JAGUAR

3·8 MARK 10 MODEL

SERVICE MANUAL

(2nd EDITION)

Jaguar Cars Limited reserve the right to make changes in design, or to make additions to or improvements upon their products without incurring any obligation to install the same on vehicles previously built.

SUPPLEMENTARY INFORMATION

Any changes which were introduced during production of the 3·8 Mk. 10 Model since the first edition of this Service Manual was published are covered in supplementary information sheets included at the end of each section. These sheets bear the letters "s" in the page number and have their own numbering sequence. Chassis and engine numbers at which these changes were introduced are also quoted and mention in the text of "early cars" refers to those bearing chassis or engine numbers prior to the numbers quoted in the supplementary information sheets.

ISSUED BY

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SECTION A

GENERAL INFORMATION

3·8 MARK 10 MODEL

Note: All references in this Manual to "right-hand side" and "left-hand side" are made assuming the person to be looking from the rear of the car or unit.

INDEX

GENERAL INFORMATION

CAR IDENTIFICATION

It is imperative that the car and engine numbers together with any prefix or suffix letters are quoted in any correspondence concerning this vehicle. If the unit in question is the gearbox or overdrive the gearbox number and any prefix or suffix letters must also be quoted. This also applies when ordering spare parts.

Car Number .. ..
Stamped on the top of the right-hand front wheel arch.

Suffix "DN" to the car number indicates that an overdrive is fitted.

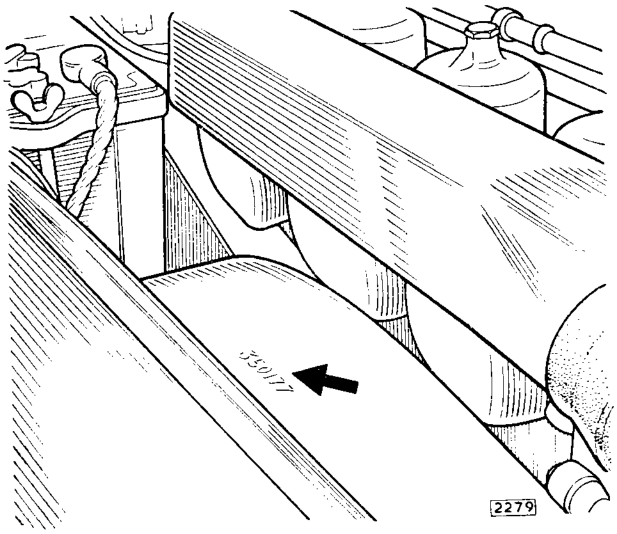

Fig. 1. Location of the car number

Engine Number .. ..
Stamped on the right-hand side of the cylinder block above the oil filter and at the front of the cylinder head casting.

/7, /8 or /9 following the engine number denotes the compression ratio.

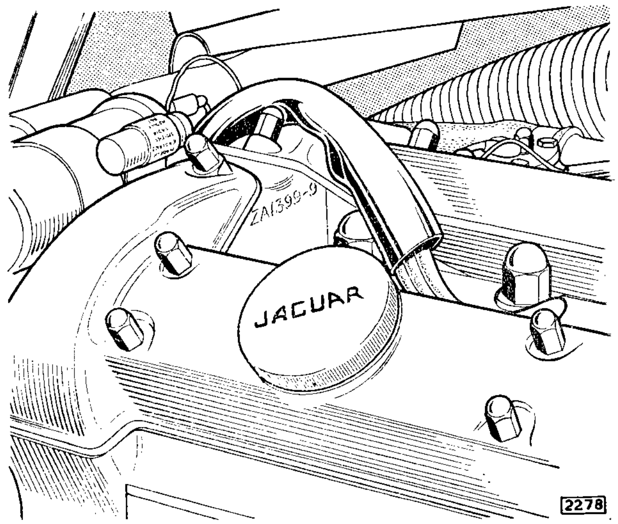

Fig. 2. Location of the engine number

Gearbox Number .. ..
Stamped on a shoulder at the left-hand rear corner of the gearbox casing and on the top cover.
Letter "N" at the end of the prefix letters indicates that an overdrive is fitted.

Body Number .. ..
Stamped on a plate attached to the right-hand bonnet lock socket box.

Key Number
Two different types of key are provided to enable the car to be left with the luggage compartment and glovebox locked on the occasions when it is required to leave the ignition key with the car.

(i) The round headed key operates the ignition switch, fuel tank filler lids and the door locks.
(ii) The rectangular headed key operates the locks for the luggage compartment lid and the glovebox.

GENERAL INFORMATION

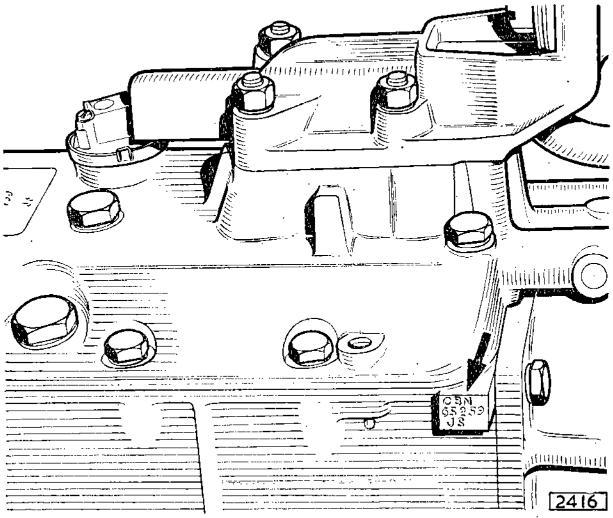

Fig. 3 Location of the gearbox number

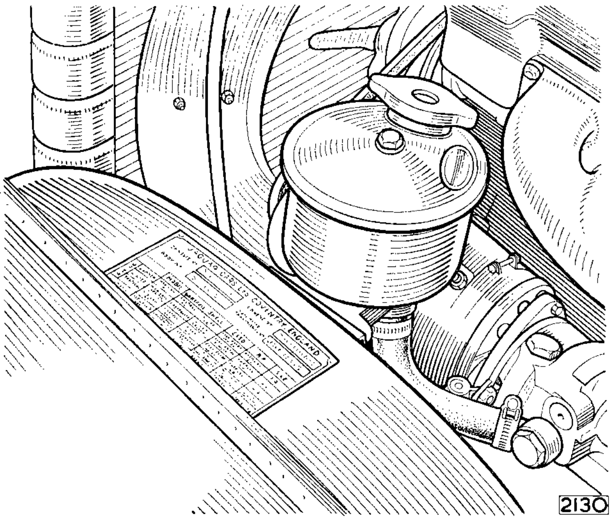

Fig. 4. The identification numbers are also stamped on a plate attached to the left-hand front wing valance

GENERAL DATA

DIMENSIONS AND WEIGHTS

Wheelbase	10′ 0″ (3·05 m.)
Track—front and rear	4′ 10″ (1·47 m.)
Overall length	16′ 10″ (5·13 m.)
Overall width	6′ 4″ (1·93 m.)
Overall height	4′ 6½″ (1·38 m.)
Ground clearance	6½″ (165 mm.)
Turning circle	37′ 0″ (11·28 m.)
Weight (dry, approximate)	35 cwt. (1778 kg.)

CAPACITIES

	Imperial	U.S.	Litres
Engine refill (including filter)	12 pints	14½ pints	6·75
Gearbox (without overdrive)	2½ ,,	3 ,,	1·5
Gearbox (with overdrive)	4 ,,	4¾ ,,	2·25
Automatic transmission unit	15 ,,	18 ,,	8·5
Rear axle	2¾ ,,	3¼ ,,	1·5
Cooling system (including heater)	24½ ,,	29½ ,,	14
Petrol tanks—left-hand	10 galls.	12 galls.	45·5
—right-hand	10 ,,	12 ,,	45·5

PERFORMANCE DATA

The following tables give the relationship between engine revolutions per minute and road speed in miles and kilometres per hour.

It is recommended that engine revolutions **in excess of 5,000 per minute** should not be exceeded for long periods. Therefore, if travelling at sustained high speed on motorways, the accelerator should be released occasionally to allow the car to overrun for a few seconds.

AXLE RATIO 3·54 : 1

ROAD SPEED		ENGINE REVOLUTIONS PER MINUTE			
Kilometres per hour	Miles per hour	First Gear 11·954	Second Gear 6·584	Third Gear 4·541	Top Gear 3·54
16	10	1563	861	594	463
32	20	3127	1722	1188	926
48	30	4690	2583	1782	1390
64	40		3444	2376	1853
80	50		4305	2970	2316
96	60		5166	3564	2779
112	70			4158	3242
128	80			4752	3705
144	90			5346	4168
160	100				4632
176	110				5094
192	120				5560

Note: The figures in the above table are corrected for the increase in tyre radius due to the effect of centrifugal force.

AXLE RATIO 3·77 : 1
(Ratio for cars fitted with an overdrive)

ROAD SPEED		ENGINE REVOLUTIONS PER MINUTE				
Kilometres per hour	Miles per hour	First Gear 12·731	Second Gear 7·012	Third Gear 4·836	Top Gear 3·77	Overdrive 2·933
16	10	1665	917	633	493	383
32	20	3330	1834	1266	986	767
48	30	4995	2751	1900	1480	1149
64	40		3668	2533	1973	1532
80	50		4586	3166	2466	1915
96	60		5503	3800	2959	2298
112	70			4432	3452	2681
128	80			5065	3945	3064
144	90				4437	3447
160	100				4930	3830
176	110				5425	4213
192	120					4596

Note: The figures in the above table are corrected for increase in tyre radius due to the effect of centrifugal force.

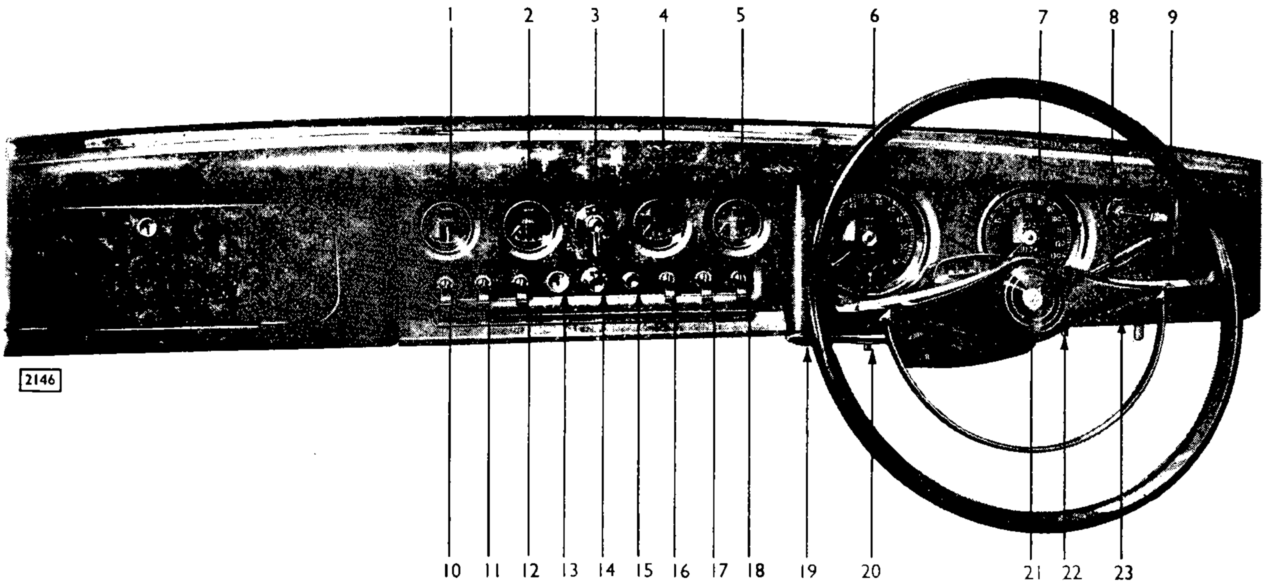

Fig. 5. Instruments and controls—Right-hand drive

1. Ammeter
2. Fuel gauge
3. Lighting switch
4. Oil pressure gauge
5. Water temperature gauge
6. Revolution counter
7. Speedometer
8. Automatic transmission selector lever or overdrive switch lever
9. Intermediate speed hold switch (if fitted)
10. Interior/map light switch
11. Panel light switch
12. Heater fan switch
13. Ignition switch
14. Cigar lighter
15. Starter switch
16. Fuel tank change-over switch
17. Windscreen wiper switch
18. Windscreen washer switch
19. Flashing direction indicator and headlight flashing switch
20. Clock adjuster
21. Horn ring
22. Speedometer trip control
23. Brake fluid level/Handbrake warning light

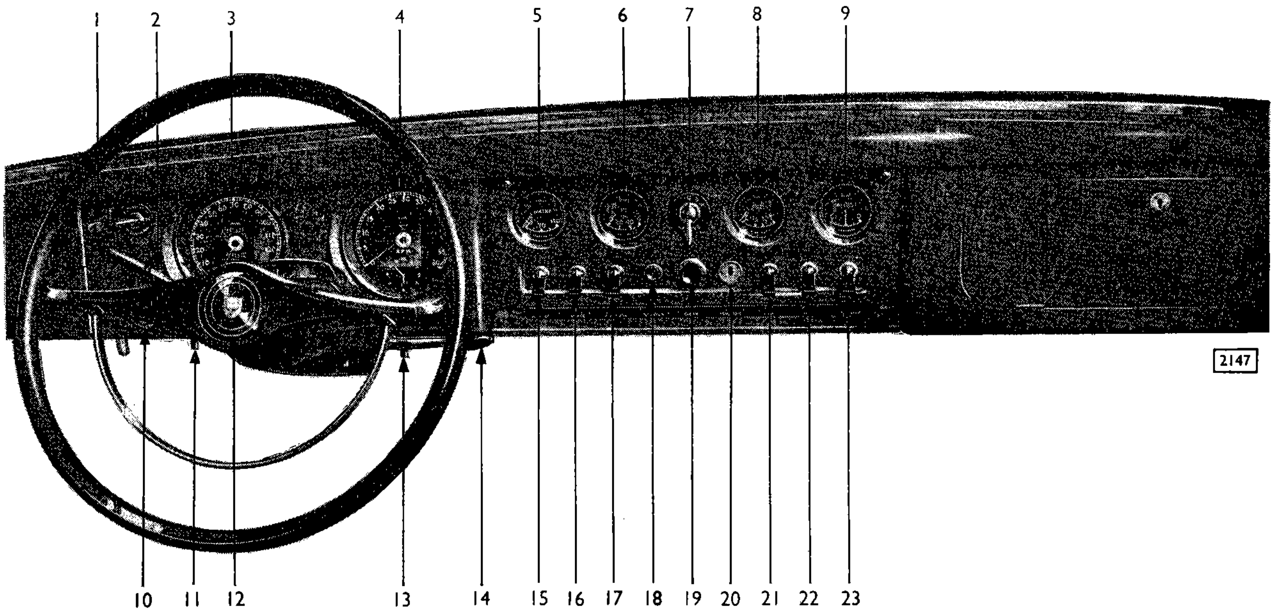

Fig. 6. Instruments and controls—Left-hand drive

1. Intermediate speed hold switch (if fitted)
2. Flashing direction indicator and headlight flashing switch
3. Speedometer
4. Revolution counter
5. Water temperature gauge
6. Oil pressure gauge
7. Lighting switch
8. Fuel gauge
9. Ammeter
10. Brake fluid level/Handbrake warning light
11. Speedometer trip control
12. Horn ring
13. Clock adjuster
14. Automatic transmission selector lever or overdrive switch lever
15. Windscreen washer switch
16. Windscreen wiper switch
17. Fuel tank change-over switch
18. Starter switch
19. Cigar lighter
20. Ignition switch
21. Heater fan switch
22. Panel light switch
23. Interior/map light switch

INSTRUMENTS

Ammeter

Records the flow of current into or out of the battery. Since compensated voltage control is incorporated, the flow of current is adjusted to the state of charge of the battery; thus when the battery is fully charged the dynamo provides only a small output and therefore little charge is registered on the ammeter, whereas when the battery is low a continuous high charge is shown.

Oil Pressure Gauge

The electrically operated pressure gauge records the oil pressure being delivered by the oil pump to the engine; it does not record the quantity of oil in the sump. The minimum pressure at 3000 r.p.m. when hot should not be less than 40 lbs. per square inch.

Note: After switching on, a period of approximately 20 seconds will elapse before the correct reading is obtained.

Water Temperature Gauge

The electrically operated water temperature gauge records the temperature of the coolant by means of a bulb screwed into the inlet manifold water jacket.

Fuel Level Gauge

Records the quantity of fuel in the supply tank in use. To obtain readings for the opposite tank operate the fuel change-over switch on the instrument panel. Readings will only be obtained when the ignition is switched "ON."

Note: Lift the switch lever for the left-hand tank, lower for the right-hand tank as shown on the switch indicator strip.

Electric Clock

The clock is built into the revolution counter instrument and is powered by the battery. The clock hands may be adjusted by pushing up the winder and rotating. Starting is accomplished in the same manner.

Revolution Counter

Records the speed of the engine in revolutions per minute.

Speedometer

Records the vehicle speed in miles per hour, total mileage and trip mileage (kilometres on certain export models). The trip figures can be set to zero by pushing the winder upwards and rotating clockwise.

Headlight Warning Light

A red warning light marked "Headlamps" situated in the speedometer, lights up when the headlights are in the full beam position and is automatically extinguished when the lights are in the dipped beam position.

Ignition Warning Light

A red warning light (marked "Ignition") situated in the speedometer lights up when the ignition is switched "on" and the engine is not running, or when the engine is running at a speed insufficient to charge the battery. The latter condition is not harmful, but always switch "off" when the engine is not running.

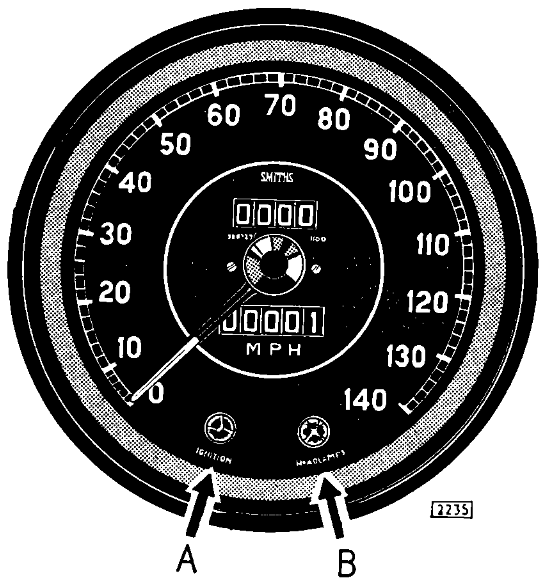

Fig. 7. Warning lights

Flashing Direction Indicators-Warning Lights

The warning lights are in the form of green arrows one at each side of the quadrant situated behind the steering wheel.

When the flashing indicators are in operation, one of the arrows lights up on the side selected.

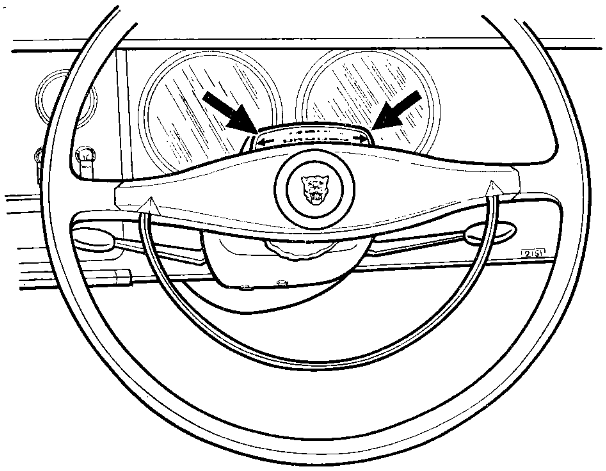

Fig. 8. Flashing direction indicator warning lights

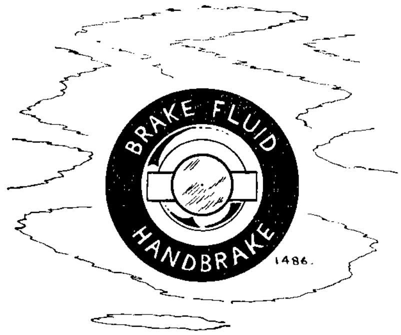

Fig. 9. Brake fluid level and handbrake warning light

Brake Fluid Level and Handbrake Warning Light

A warning light (marked "Brake Fluid—Handbrake") situated on the facia behind the steering wheel, serves to indicate if the level in the brake fluid reservoir has become low, provided the ignition is "on." As the warning light is also illuminated when the handbrake is applied, the handbrake must be fully released before it is assumed that the fluid level is low. If with the ignition "on" and the handbrake fully released the warning light is illuminated the brake fluid must be "topped up" immediately.

As the warning light is illuminated when the handbrake is applied and the ignition is "on" a two-fold purpose is served. Firstly, to avoid the possibility of driving away with the handbrake applied. Secondly, as a check that the warning light bulb has not "blown"; if on first starting up the car with the handbrake fully applied, the warning light does not become illuminated the bulb should be changed immediately.

CONTROLS AND ACCESSORIES

Accelerator Pedal

Controls the speed of the engine.

Brake Pedal

Operates the vacuum-servo assisted disc brakes on all four wheels.

Clutch Pedal

On overdrive and standard transmission cars, connects and disconnects the engine and the transmission. Never drive with the foot resting on the pedal and do not keep the pedal depressed for long periods in traffic. Never coast the car with a gear engaged and clutch depressed.

Headlight Dipper

Situated on the toe boards to the left of the clutch pedal. The switch is of the change over type and if the headlights are in the full beam position a single pressure on the control will switch the lights to the dipped beam position and they will remain so until another single pressure switches them to the full beam position again.

Gear Lever (Overdrive and Standard Transmission Models)

Centrally situated and with gear positions indicated on the control knob. To engage reverse gear first press the gear lever against the spring pressure before pushing the lever forward. Always engage neutral and release the clutch when the car is at rest.

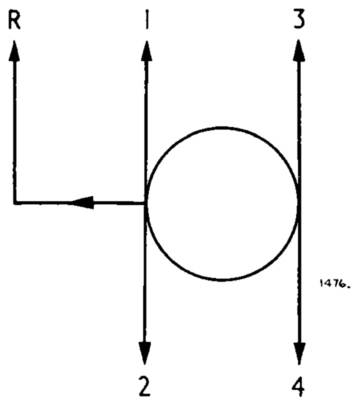

Fig. 10. Gear positions

Overdrive Switch Lever

For full instructions on the operation of the overdrive, see page 18.

Automatic Transmission Selector Lever

For full instructions on the operation of the automatic transmission, see page 19.

Handbrake Control

Positioned under the dash behind the steering wheel. The handbrake operates mechanically on the rear discs only and is provided for parking, driving away on a hill, and when at a standstill in traffic. To apply the brake, pull the lever handle outwards and the trigger will automatically engage with the ratchet. To release the handbrake turn the lever handle anticlockwise until the ratchet is disengaged and allow the control to return to the fully "off" position.

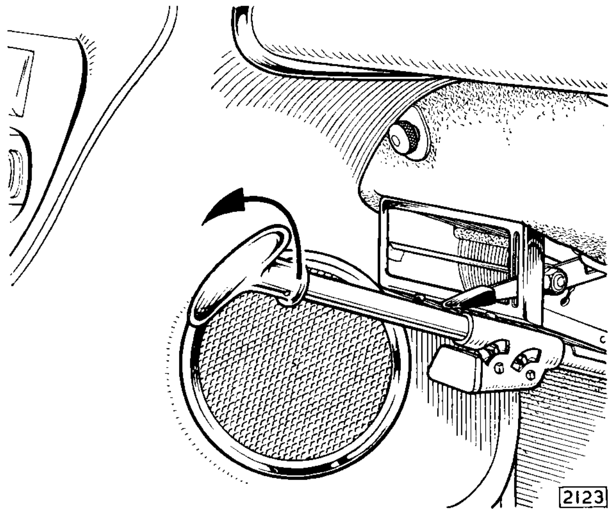

Fig. 11. Handbrake control—to release the handbrake turn the control in the direction shown

Seat Adjustment

Both the front seats are adjustable for reach. Push the lever, situated beside the inside runner, towards the centre of the car and slide into the required position. Release the lock bar and slide until the mechanism engages with a click.

The seat back is adjustable from the vertical to the full reclining position.

To adjust, lift the lever located between the seat and the propeller shaft tunnel cover and adjust the seat back to the desired position. Release the lever to lock the seat back in position.

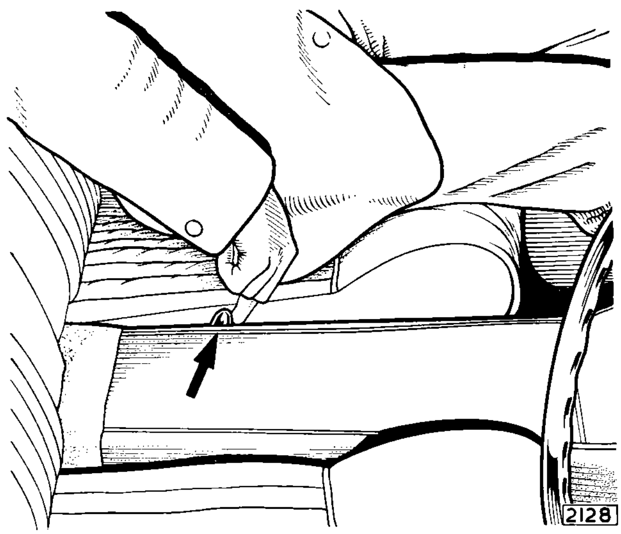

Fig. 12. Reclining seat back adjustment lever

Steering Wheel Adjustment

Rotate the knurled ring at the base of the steering wheel hub in an anti-clockwise direction when the steering wheel may be slid into the desired position. Turn the knurled ring clockwise to lock the steering wheel.

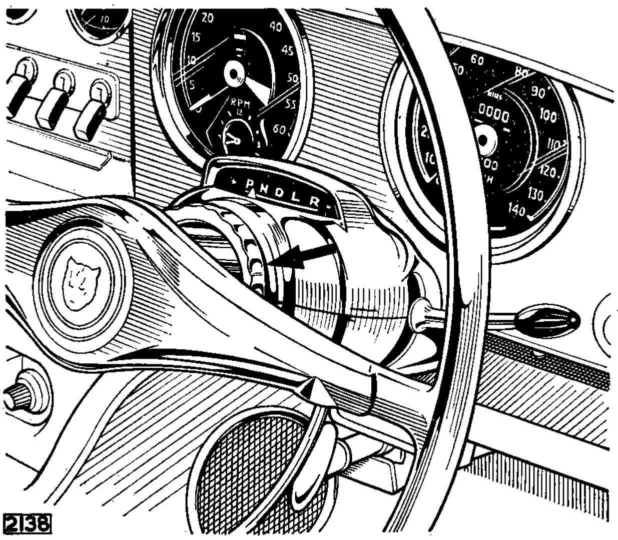

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Fig. 13. Steering wheel adjustment

Rear Door Locks

The rear doors may be opened from the outside by pressing the button incorporated in the door handle. The doors are opened from the inside by pushing the interior door handle forward.

The rear doors are locked by pulling the interior door handles rearward.

Horn

Depress the semi-circular ring attached to the steering wheel to operate the twin horns.

Ignition Switch

Inserting the key provided in the switch and turning clockwise will switch on the ignition.

Never leave the ignition on when the engine has stopped, a reminder of such circumstances is provided by the ignition warning light situated in the speedometer.

Starter Switch

Press the button (marked "Starter") with the ignition switched on, to start the engine. Release the switch immediately the engine fires and never operate the starter when the engine is running.

Front Door Locks

The front doors may be opened from the outside by pressing the button incorporated in the door handle. The doors are opened from the inside by pulling the interior handles rearward.

Both the front doors can be locked from the inside by pushing the interior handles forward and allowing them to return to their original position; this feature only applies if the doors are fully closed before operating the interior handles.

Both front doors can be locked from the outside by means of the ignition key; the locks are incorporated in the push buttons of the door handles.

To lock the right-hand door insert the key in the lock, rotate anti-clockwise as far as possible and allow the lock to return to its original position—the door is now locked. To unlock the right-hand door turn key clockwise as far as possible and allow the lock to return to its original position.

To lock the left-hand door rotate key clockwise; to unlock, rotate key anti-clockwise.

KEYLESS LOCKING is obtainable by first pushing the interior door handle fully forward and allowing it to return to its original position. If the door is now closed from the outside with the push button of the handle *fully depressed* the door will become locked.

Warning.—If the doors are to be locked by this method the ignition key should be removed beforehand (or the spare key kept on the driver's person) as the only means of unlocking the front doors is with this key.

Map/Interior Light Switch

The map and interior lights are controlled by a three position switch marked "Interior/Map". Lift the switch lever to the second position to operate the map light situated above the instrument panel. For interior lights lift the switch lever to the third position. To provide ease of entry into the car at night the interior lights are automatically switched on when any one of the doors is opened and are extinguished when the door is closed.

Lighting Switch

From "Off" can be rotated clockwise into two positions, giving in the first location, side and tail, in the second location, head, side and tail.

Panel Light Switch

Lift the switch lever (marked "Panel") to enable the instruments to be read at night and to provide illumination of the switch markings. The switch has two positions "Dim" and "Bright" to suit the driver's requirements. The panel lights will only operate when the side lights are switched on.

Flashing Direction Indicators

The "flashers" are operated by a lever behind the steering wheel. To operate the flashing direction indicators on the right-hand side of the car, move the lever clockwise; to operate the left-hand side indicators move the lever anti-clockwise. While the flashing indicators are in operation one of the warning lights in the quadrant behind the steering wheel lights up on the side selected.

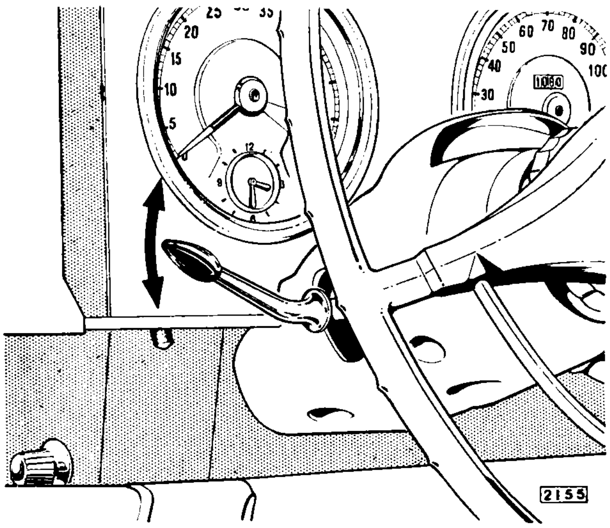


Fig. 14. Flashing direction indicator control

Headlight Flasher

To "flash" the headlights as a warning signal, lift and release the flashing indicator lever in quick succession. The headlights can be "flashed" when the lights are "off" or when they are in the dipped beam position; they will not "flash" in the main beam position.

Glovebox Light

A light in the glovebox is automatically illuminated when the lid is opened and the sidelights are "on."

Braking Lights

Twin combined tail and brake lights automatically function when the footbrake is applied.

Reversing Lights

The twin reversing lights are automatically brought into operation when reverse gear is engaged and the ignition is switched on.

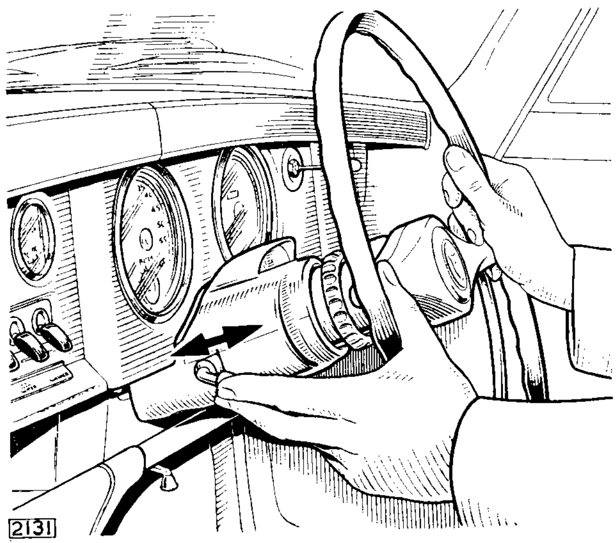


Fig. 15. Method of "flashing" the headlights

Luggage Compartment Illumination

The luggage compartment is automatically illuminated by a light when the lid is opened. The light operates only when the sidelights are switched on.

Cigar Lighter

To operate, press the holder (marked "Cigar") into the socket. On reaching the required temperature, the holder will return to the extended position. Do not hold the lighter in the "pressed in" position.

Windscreen Wipers

The wipers are controlled by a three position switch (marked "Wiper"). Lift the switch to the second position (Slow) which is recommended for all normal adverse weather conditions and snow.

For conditions of very heavy rain and for fast driving in rain lift the switch to the third position (Fast). This position should not be used in heavy snow or with a drying windscreen, that is, when the load on the motor is in excess of normal; the motor incorporates a protective cut-out switch which under conditions of excessive load cuts off the current supply until normal conditions are restored.

When the switch is placed in the "Off" position the wipers will automatically return to a position along the lower edge of the screen.

Windscreen Washer

For full instructions on the use of Windscreen Washing Equipment see Section "O."

Heating and Ventilating Equipment

For full instructions on the use of the Heating and Ventilating Equipment see Section "O."

Scuttle Ventilator

The scuttle ventilator is operated only by the Heating and Ventilating controls. See Section "O."

Bonnet Lock Control

The bonnet lock is controlled from the driving compartment. To open the bonnet pull the lever situated behind the facia on the right-hand side. This will release the bonnet which will now be retained by the safety catch. Insert the fingers under the rear edge of the bonnet and lift up the safety catch.

The bonnet is automatically retained in the fully open position by the action of the hinge torsion bars.

The bonnet is self-locking when pushed down firmly into the closed position.

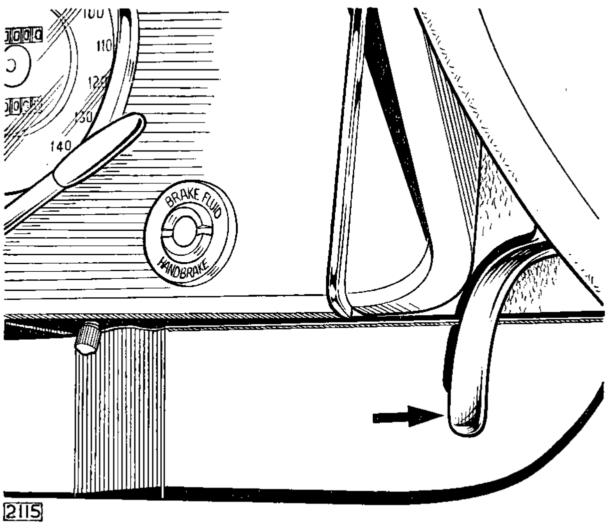


Fig. 16. Bonnet lock control

Two Pin Plug Socket

A two pin plug socket is situated under the bonnet forward of the battery. The socket may be used to "trickle charge" the battery, or to provide an inspection lamp point.

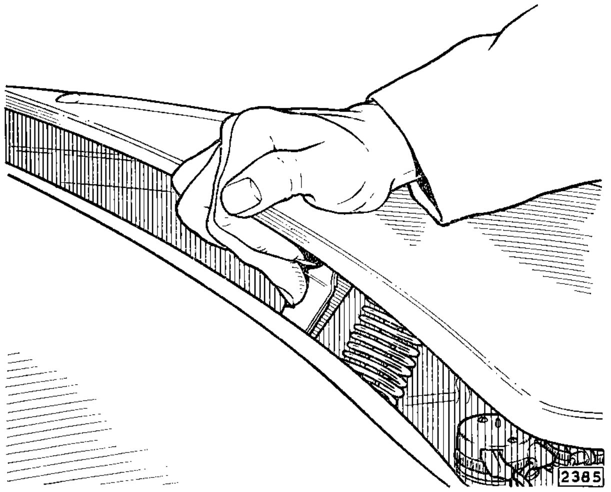


Fig. 17. Bonnet safety catch

Spare Wheel and Jacking Equipment

The spare wheel is housed in the luggage compartment. To remove the spare wheel, rotate the serrated nut securing the wheel clamp in position. Lift the clamp clear of the tyre and remove the wheel.

The jack and wheel brace are retained in clips accessible when the spare wheel is removed.

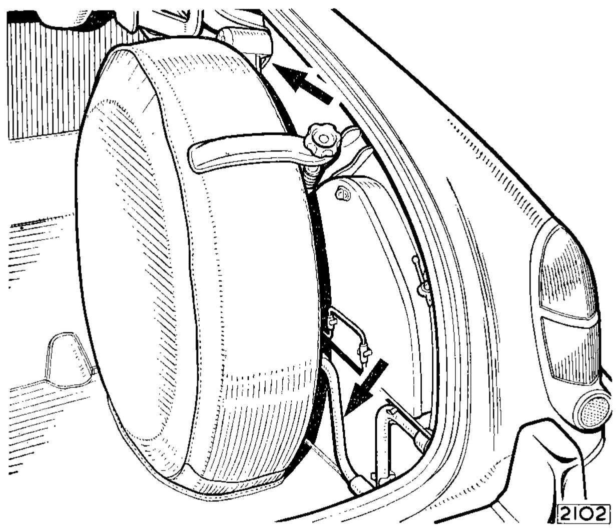


Fig. 18. The spare wheel is housed on the right-hand side of the luggage compartment and the wheel brace, jack and hand tools are secured behind the wheel

Tools

The container for the hand tools, bleeder tube, spare bulbs and sparking plug is housed in the luggage compartment behind the spare wheel.

Release the catch and withdraw the container from the retaining clips. Rotate the turnbutton to open the lid.

No Draught Ventilation

All doors are fitted with no draught ventilation windows incorporating quick locking catches.

To open the window, release the locking catch and set the window to the desired position. It will be observed that initial opening of the front window gives extraction of air from the body. When the window is opened further, air is forced into the body due to the angle of the ventilator and forward motion of the car. It should be observed that using the N.D.V. windows as extractors (that is, partially open) has, to a minor degree, the effect of demisting the windscreen.

Fuel Tank Fillers

The two fuel tank fillers are situated in recesses in the rear wings. The filler lids are fitted with locks opened by the round-headed key provided.

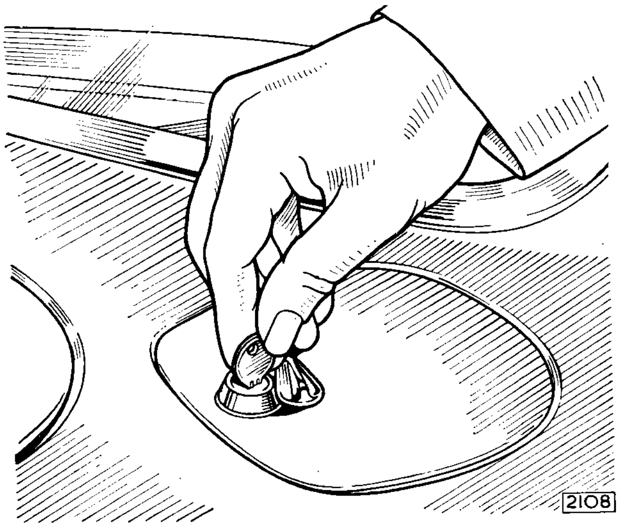


Fig. 19. Unlocking the fuel tank filler lid

Luggage Compartment

To open the luggage compartment, insert the square-headed key in the lock situated between the twin reversing lamps and unlock by rotating clockwise through half a turn. Release the catch lever located beneath the lock and raise the lid. The lid is retained in the fully open position by means of torsion bar springs.

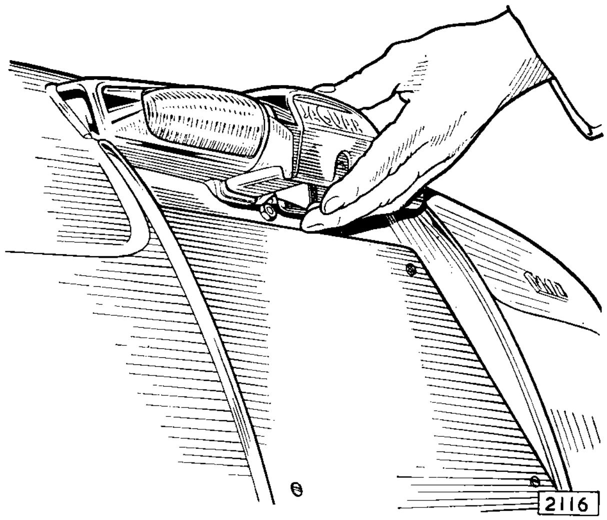


Fig. 20. Opening the luggage compartment

Interior Driving Mirror

This is of the dipping type. Move the lever, situated under the mirror, to the left for night driving to avoid being dazzled by the lights of a following car.

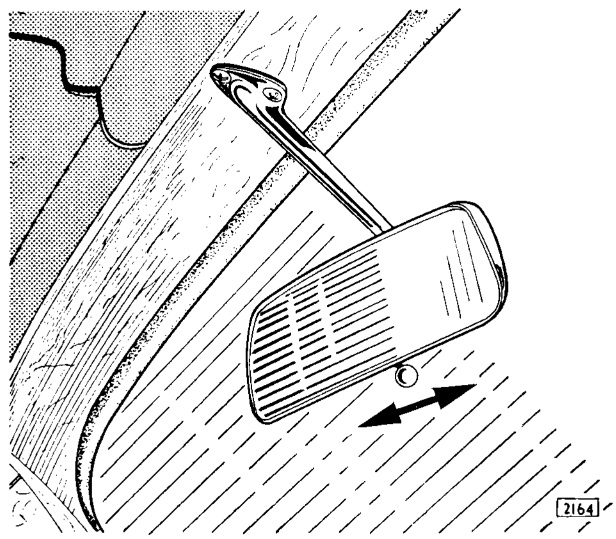


Fig. 21. Interior driving mirror dipping operation

Ash Trays

Three ash trays are provided, one being mounted centrally below the instrument panel and one mounted in the back panel of each front seat above the picnic tables.

To remove the ash trays for cleaning purposes, press down the retaining spring blade and withdraw the tray.

Wheel Changing

Whenever possible, the wheel changing should be carried out with the car standing on level ground and in all cases with the handbrake fully applied.

The spare wheel is housed in the luggage compartment; the wheel changing equipment being accessible when the spare wheel is removed.

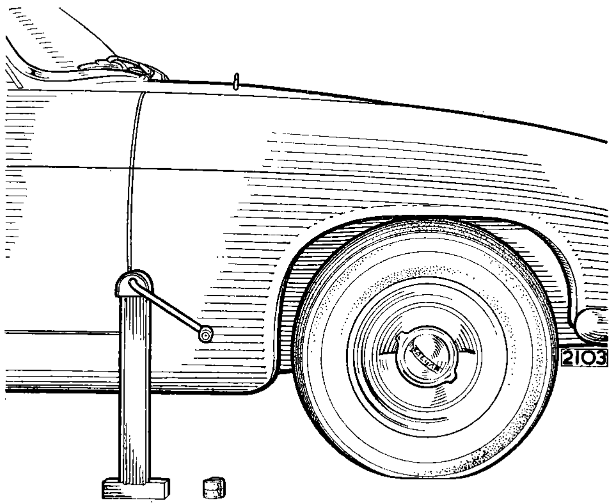


Fig. 22. The jack in position for raising the right-hand front wheel

Detach the wheel nave plate by levering off with the blade end of the wheel brace. Using the wheel brace loosen, but do not remove, the wheel nuts; all wheel nuts have right-hand threads, that is, they are unscrewed anti-clockwise. Remove the rubber plug from the jacking socket adjacent to the wheel to be removed, insert the square portion of the jack well home into the socket and rotate the handle attached to the jack clockwise. Raise the car until the wheel is clear of the ground. Remove the wheel nuts and withdraw the road wheel.

Mount the spare wheel on the fixing studs and start all five nuts on the threads by rotating clockwise. Apply the wheel brace and run up all the nuts until they are tight.

Rotate the jack handle anti-clockwise and lower the jack until the full weight of the car is on the wheel. Finally tighten all wheel nuts.

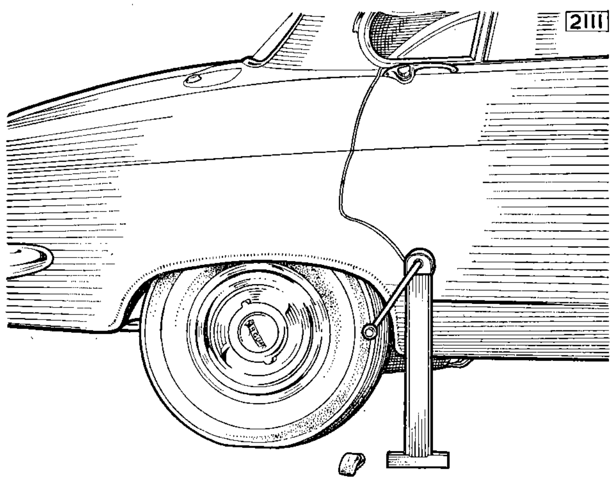


Fig. 23. The jack in position for raising the right-hand rear wheel

Fit the nave plate over two of the three mounting posts and secure by a sharp tap from the hand at a point in line with the third mounting post.

Picnic Tables

Picnic tables are provided in the back of each front seat and are opened by pulling the handles upwards and outwards until the tables assume a horizontal position.

With the tables in the opened position two angled vanity mirrors will be exposed.

SEAT BELTS

Anchorage points for seat belts are incorporated in the construction of the car as shown in Fig. 24.

Electrically Heated Backlight (Optional Extra)

An electrically heated backlight to provide demisting and defrosting is available as an optional extra.

A heating element, consisting of a fine wire mesh between the lamination of glass, is connected to the main wiring harness.

The element comes into operation when the ignition is switched on, no separate switch being provided.

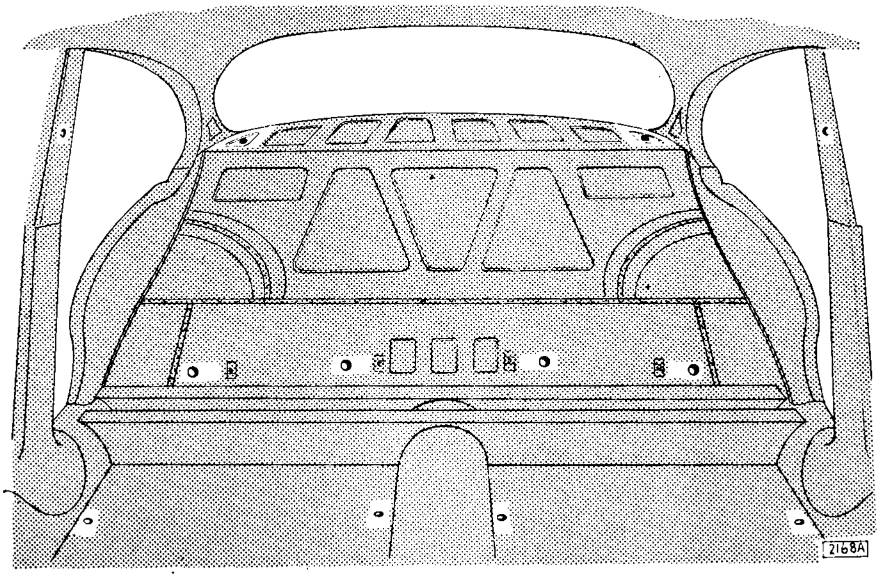


Fig. 24. Seat belt anchorage points

STARTING & DRIVING

Prior to Starting

Before starting the engine the new owner should be familiar with the location and function of the instruments and controls.

Ensure that the water level in the radiator and the oil level in the sump are correct. Check for sufficient petrol in the tank.

Place the gear lever in the neutral position and check that the handbrake is applied.

Starting from Cold

It is not necessary to use any manual choke control when starting from cold, since the auxiliary starting carburetter is entirely automatic and controls the mixture strength without assistance from the driver. The starting carburetter automatically cuts out when the temperature of the water in the cylinder head reaches 35°C. (95°F.).

When starting from cold do not depress the accelerator pedal until the engine has run for a few seconds.

Warming up

Do not operate the engine at a fast speed when first started but allow time for the engine to warm up and the oil to circulate. A thermostat is incorporated in the cooling system to assist rapid warming up. In very cold weather run the engine at 1,500 r.p.m. with the car stationary until a rise in temperature is indicated on the temperature gauge.

Driving

(*a*) Careful adherence to the "Running-in" Instructions given on the next page will be amply repaid by obtaining the best performance and utmost satisfaction from the car.

(*b*) The habit should be formed of reading the oil pressure gauge, water temperature gauge and ammeter occasionally as a check on the correct functioning of the car. Should an abnormal reading be obtained an investigation should be made immediately.

(*c*) Always start from rest in first gear. To start in a higher gear will cause excessive clutch slip and premature wear. Never drive with a foot resting on the clutch pedal and do not keep the clutch depressed for long periods in traffic.

(*d*) The synchromesh gearbox provides a synchronized change into second, third and top. When changing gear the movement should be slow and deliberate.

When changing down, a smoother gear change will be obtained if the accelerator is left depressed to provide the higher engine speed suitable to the lower gear. Always fully depress the clutch pedal when changing gear.

(*e*) Gear changing may be slightly stiff on a new car but this will disappear as the gearbox becomes "run-in."

(*f*) Always apply the footbrake progressively; fierce and sudden application is bad for the car and tyres. The handbrake is for use when parking the car, when driving away on a hill and when at a standstill in traffic.

"Running-in" Instructions

Only if the following important recommendations are observed will the high performance and continued good running, of which the Jaguar is capable, be obtained.

During the "running-in" period do not allow the engine to exceed the following speeds and particularly do not allow the engine to labour on hills; it is preferable to select a lower gear and use a higher speed rather than allow the engine to labour at low speed:—

First 1,000 miles (1,600 km.) ..	2,500 r.p.m.
From 1,000—2,000 miles (1,600—3,200 km.)	3,000 r.p.m.

Have the engine sump drained and refilled and the oil filter attended to as recommended at the free service, that is, after the first 500 miles (800 km.).

OVERDRIVE

The Laycock de Normanville overdrive unit (fitted as an optional extra) comprises a hydraulically-controlled epicyclic gear housed in a casing which is directly attached to an extension at the rear of the gearbox.

When brought into operation, the overdrive reduces the engine speed in relation to the road speed. This permits high road speeds with low engine revolutions resulting in fuel economy and reduced engine wear.

Operation

The overdrive will operate in top gear only and is brought into action by means of the lever behind the steering wheel on the right-hand side of the column. Operate the lever clockwise to engage the overdrive and anti-clockwise to bring the drive into top (4th) gear.

When the overdrive is in operation the word "Overdrive" in the quadrant behind the steering wheel becomes illuminated. When the sidelights are switched on, the light is automatically dimmed.

Use of the clutch pedal when changing into or out of overdrive is unnecessary but to ensure maximum smoothness of operation, particularly when changing down from overdrive to top gear, the accelerator pedal should be slightly depressed.

Do NOT bring the overdrive into operation at high speed with a wide throttle opening; release the accelerator momentarily when engaging overdrive.

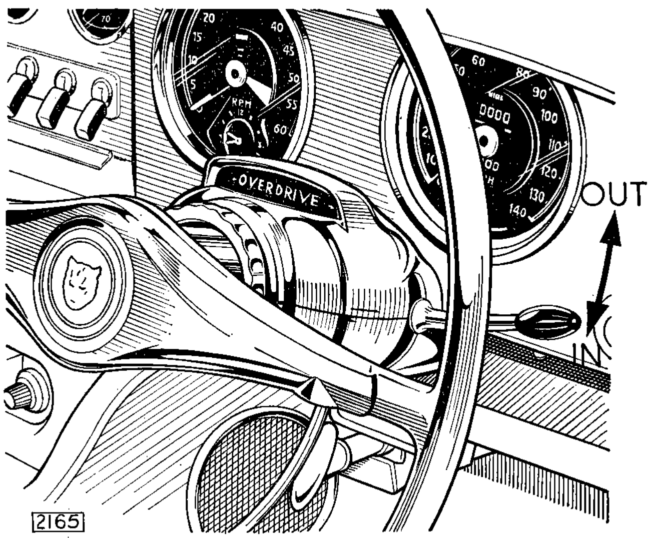


Fig. 25. Overdrive switch lever

For driving in towns, heavy traffic, or hilly country when the maximum flexibility and low speed performance is required the overdrive manual switch should be placed in the "Out" position which will bring the drive into the normal top gear ratio.

For normal driving in open country the overdrive should be brought into operation when the required cruising speed has been obtained.

AUTOMATIC TRANSMISSION

GENERAL DESCRIPTION

The transmission assembly consists of a three-element hydraulic torque converter followed by two planetary gear sets which permit the elimination of the clutch pedal and normal gear-shift lever. The planetary gear sets incorporate free-wheels and are controlled by hydraulically-operated bands and disc clutches.

The manual control lever allows selection of the following conditions:—

P (Park). A pawl is mechanically engaged with teeth on the main shaft. A hydraulic interlock prevents engagement at speeds above 5 m.p.h. (8 k.p.h.).

N (Neutral). All clutches are disengaged and there is no drive beyond the torque converter.

D (Drive). Automatic changes between the low gear and intermediate gear and between the intermediate gear and direct drive.

Changes from low to intermediate gear and intermediate to direct drive depend upon the combination of road speed and throttle position; the larger the throttle opening the higher the speed at which the change occurs. This is achieved by mechanically combining the motions of a mechanical centrifugal governor and the throttle linkage. The resultant motion operates a hydraulic valve.

Depression of the accelerator pedal beyond normal travel causes a "kick-down" change from direct to intermediate gear. Below 60 m.p.h. (96 k.p.h.) a downshift from direct to intermediate gear can be obtained by depressing the accelerator to the full throttle position short of "kick-down." No "kick-down" downshift is possible for intermediate tc low gear.

The torque converter and a gear reduction are operative in the low intermediate gears. Direct drive is obtained by coupling the engine directly to the main shaft by a disc clutch. The relevant road speeds are given in "Transmission Data" on pages viii and ix.

Manual L (Low). A low gear train and the torque converter are operative and no automatic change can occur. Manual changes between L and D may be made while the car is in motion but changes into L should be avoided at speeds above 45 m.p.h. (72 k.p.h.).

R (Reverse). A reverse-gear train and the torque converter are operative. A hydraulic interlock prevents engagement of the reverse clutch at forward speeds above 5 m.p.h. (8 k.p.h.).

Electrical connection to the starter is made only when N and P are selected. An anti-creep device traps brake fluid pressure when the car is stationary after the brakes have been applied. Opening the throttle releases the fluid.

DATA

Maximum ratio of torque converter	2·15 : 1
Low gear reduction	2·308 : 1
Intermediate gear reduction	1·435 : 1
Direct drive—no converter	1 : 1
Reverse gear reduction	2·009 : 1

AUTOMATIC GEAR CHANGES

Upshifts

	m.p.h.	k.p.h.
Low to intermediate—light throttle	10 to 13	16 to 21
Low to intermediate—full throttle	33 to 36	53 to 58
Intermediate to direct—light throttle	23 to 26	37 to 42
Intermediate to direct—full throttle	53 to 56	85 to 90
Intermediate to direct—after "kick-down"	67 to 70	108 to 113

Downshifts

		m.p.h.	k.p.h.
Direct to intermediate—closed throttle		16 to 19	26 to 31
Intermediate to low—closed throttle		3 to 7	5 to 11
Direct to intermediate—"kick-down"	Up to	60	96
Parking pawl permitted to engage	Below	5	8
Reverse gear permitted to engage	Below	5	8
Manual change from drive to low to be **avoided**	Above	45	72

DRIVING INSTRUCTIONS

The operation of the automatic transmission is controlled by the position of the selector lever which is indicated by the quadrant pointer. The quadrant is situated in front of the steering wheel and is marked P, N, D, L and R. The lever must be raised when selecting P, L or R and when moving from P to any other position.

When the ignition is switched on the letters P, N, D, L, R, in the quadrant behind the steering wheel become illuminated; when the sidelights are switched on the illumination is automatically dimmed.

To start the engine the selector lever must be in the P or N position.

P or Park provides a safe, positive lock on the rear wheels when the car is stopped. Movement of the selector lever to the P position actuates a mechanical locking device in the transmission which prevents the rear wheels from turning in either direction. For this reason, should the car be pushed from front or rear with sufficient force, the car will skid on the rear tyres. This condition is quite similar to that encountered when a car with conventional transmission is parked in gear or with the handbrake applied firmly. The fact that the engine may be started with the selector in P position is convenient when parked on an incline.

When the car is stopped on a hill and the P (Park) position is selected, the parking mechanism may become very firmly engaged due to the load on the pawl. To disengage the parking pawl under these conditions the following procedure should be adopted:—

To release transmission from P (Park) when facing UP HILL.

1. Start the engine.
2. Release the handbrake.
3. Select D and **hold** lever in this position (irrespective of the direction in which it is desired to move off).
4. Depress accelerator slowly until the car moves forward, indicating the release of the parking pawl.
5. The car is now "free" and can be driven away in the desired direction.

To release transmission from P (Park) when facing DOWN HILL.

1. Start the engine.
2. Release the handbrake.
3. Select R and **hold** lever in this position (irrespective of the direction in which it is desired to move off).
4. Depress accelerator slowly until the car moves backward, indicating the release of the parking pawl.
5. The car is now "free" and can be driven away in the desired direction.

N or Neutral position permits idling the engine without the possibility of setting the car into motion by pressure on the accelerator and may be used when starting the engine. It is inadvisable to engage neutral for coasting.

D or Drive provides the normal forward driving range and includes automatic shifting between the low, intermediate and direct drive ranges. Virtually all forward driving, accelerating and stopping can be done

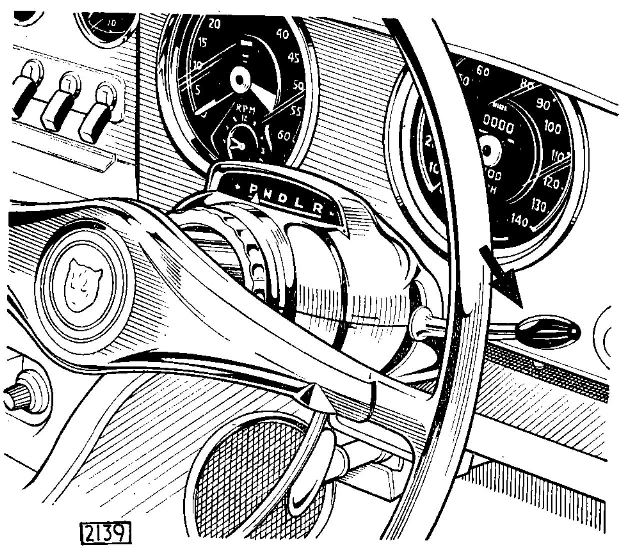


Fig. 26. Automatic transmission selector lever

with the lever in the D position. Once the engine is started and the lever is moved to D it can be left in this position for all normal driving. When accelerating, the transmission shifts automatically from low to intermediate between 10 and 36 m.p.h. (16 and 58 k.p.h.) and from intermediate to direct between 23 and 56 m.p.h. (37 and 90 k.p.h.) depending on the position of the accelerator pedal. On deceleration, it will shift automatically from direct drive to intermediate between 16 and 19 m.p.h. (26 and 31 k.p.h.) and from intermediate to low between 3 and 7 m.p.h. (5 and 11 k.p.h.).

L or Low is an emergency engine power range for use on unusually long and steep grades or for braking on descents, for extra heavy pulling, and for rocking the car out of mud, sand or snow.

R or Reverse position of the selector lever provides reverse driving range.

Intermediate Speed Hold. A switch mounted on the facia provides a means for the driver to obtain a downshift from direct to intermediate without depressing the accelerator pedal (as advised under the heading "Additional Power and Acceleration") and to retain the drive in the intermediate range. This will be found convenient for overtaking or when hill climbing.

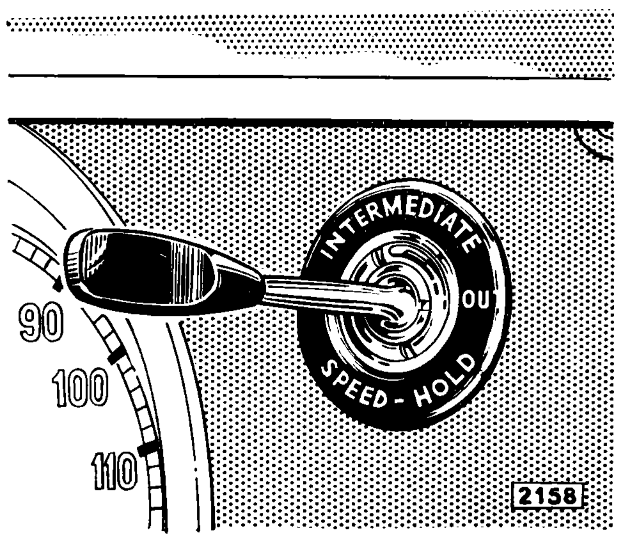


Fig. 27. Intermediate speed hold switch lever

With the switch in the "IN" position no upshift will take place between intermediate and direct drive; placing the switch lever in the "OUT" position will cause the transmission to shift to direct drive, provided the normal upshift speed has been obtained.

Warning. Do NOT allow the maximum permitted engine revolutions to be exceeded through allowing the "Intermediate Speed Hold" to remain in operation longer than necessary, or by switching in the "Hold" at speeds in excess of 75 m.p.h. (121 k.p.h.).

Additional Power and Acceleration in D range can be obtained as follows:—

(*a*) Below 45 m.p.h. (72 k.p.h.) depress the accelerator pedal to the full throttle position to effect a change into the intermediate range; the drive will continue in the intermediate range until the release of the accelerator or approximately 56 m.p.h. (90 k.p.h.) is reached.

(*b*) Between 45 m.p.h. and 60 m.p.h. (72 k.p.h. and 96 k.p.h.) depress the accelerator pedal all the way to the floorboard to effect a "kick-down" change into intermediate range; the drive will continue in the intermediate range until release of the accelerator or approximately 70 m.p.h. (113 k.p.h.) is reached.

Hard Pulling, such as encountered in deep snow, mud or other adverse driving conditions, is best accomplished in the L range.

Rocking out of Mud, Sand or Snow is accomplished with the accelerator pedal slightly depressed and held steady while making quick alternate selections of L and R ranges.

Anti-Creep is a special braking feature which prevents the car from creeping forward when stopped on level ground or slight grades, as long as the ignition key is turned on. Apply the footbrake to stop the car and then remove the foot from the brake pedal. The car will not creep forward or backward. Any movement of the accelerator pedal, or turning off the ignition key, releases the anti-creep action.

Push Starting may sometimes be necessary, as in the case of a flat battery. Turn ignition key ON, place selector lever in the N position. The car may now be pushed and when it has reached 15 to 20 m.p.h. (24 to 32 k.p.h.) move the selector lever to D or L position. **Do not tow the car to start the engine—it may overtake the tow car.**

Engine Braking, for descending long mountainous grades, is easily secured by bringing the car speed below 45 m.p.h. (72 k.p.h.) and momentarily depressing the accelerator while placing the selector lever in the L position.

Prolonged Idling is sometimes unavoidable. In such cases, as a safety precaution, move the selector lever to the P or N position.

Towing should be done with the selector lever in the N position. Car should not be towed in excess of 30 m.p.h. (48 k.p.h.).

If the car is being towed because of transmission damage, the propeller shaft should be removed or towing should be done by lifting the rear wheels from the ground. Failure to do this may result in further extensive transmission damage.

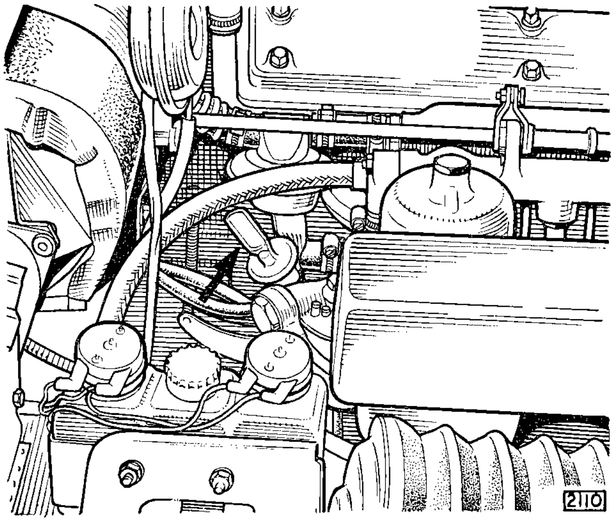


Fig. 28. Automatic transmission dipstick

MAINTENANCE

The fluid necessary for the operation of the torque converter is common with that used in the transmission. The total capacity of the transmission assembly is approximately 15 Imperial pints (18 U.S. pints; 8·5 litres), but when draining the transmission a small quantity of fluid will remain in the unit and the amount required to refill it will be that needed to bring the fluid level to the FULL mark on the dipstick as described in "Drain and Refill Transmission."

EVERY 1,250 MILES (2,000 KM.)

Check Transmission Fluid Level

1. Raise the bonnet. The dipstick will be found adjacent to the rear carburetter.

2. With the car on a level floor, set the handbrake firmly. Set the selector lever in the P position and start the engine. With the footbrake applied move the selector lever to L and raise the transmission fluid temperature by running the engine at 800 r.p.m. for 2 or 3 minutes.

3. Clean the end of the filler tube. Remove the dipstick and wipe it dry. With the foot still on the brake and the selector lever at L run the engine at its normal idling speed and check the fluid level. Add sufficient fluid to bring the level up to the "Full" mark on the dipstick. DO NOT OVERFILL. The space between the "Full" and "Low" marks on the dipstick represents approximately one pint.

EVERY 10,000 MILES (16,000 KM.)

Drain and Refill Transmission

1. Raise the bonnet. The dipstick will be found adjacent to the rear carburetter.

2. With the car on a level floor, set the handbrake firmly. Set the selector lever in the P position and start engine. With the footbrake applied move the selector lever to L and raise the transmission fluid temperature by running the engine at 800 r.p.m. for 2 or 3 minutes.

3. Stop the engine. Clean the end of the filler tube.

4. Remove the transmission oil pan drain plug. (A, Fig. 29).

5. Remove the converter housing cover plate and rotate the converter until the drain plug is in position for draining. Remove the converter drain plug. (B).

6. To facilitate draining, remove the square-headed converter pressure take-off plug (C) from the bottom of the housing attached to the left-hand side of the transmission casing.

7. After fluid has drained, refit and tighten the drain plugs in the transmission oil pan and converter. Refit the converter housing cover plate. Refit and tighten the converter pressure take-off plug.

8. Pour 10 Imperial pints (12 U.S. pints; 5·7 litres) of the recommended grade of fluid into the transmission through the filler tube.

9. Set the selector lever in the P position and start engine. With the footbrake applied move the selector lever to L and run the engine at 800 r.p.m. for 2 or 3 minutes to transfer fluid from the transmission case to the converter.

10. With the foot still on the brake and the selector lever at L run the engine at its normal idling speed and add additional fluid (approximately 5 Imperial pints; 6 U.S. pints or 2·8 litres) to bring the level up to the "Full" mark on the dipstick. DO NOT OVERFILL.

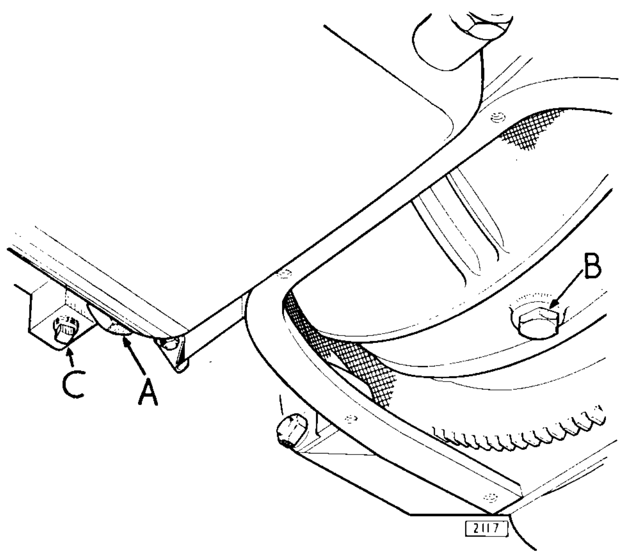


Fig. 29. Automatic transmission drain plugs (The converter housing cover plate has been removed)

SUMMARY OF MAINTENANCE

DAILY

Check radiator coolant level.
Check engine oil level.

WEEKLY

Check tyre pressures.
Check fluid level in brake and clutch master cylinder reservoirs.

MONTHLY

Check battery electrolyte level and connections.

EVERY 1,250 MILES (2,000 KM.)

Check fluid level in Automatic Transmission unit (if fitted).
Check fluid in power-assisted steering reservoir.

EVERY 2,500 MILES (4,000 KM.)

Carry out 1,250 miles service.
Drain engine sump and refill.
Clean oil filter element and renew seal.
Check gearbox oil level and top-up if necessary.
Check rear axle oil level and top up if necessary.
Lubricate steering tie-rod ball joints.
Lubricate wheel swivels.
Lubricate carburetter hydraulic piston dampers.
Lubricate rear half shaft universal joints.
Lubricate distributor and check contact points.
Clean, adjust and test sparking plugs.
Check clutch free travel and adjust if necessary.
Check handbrake cable adjustment.
Check carburetter slow running.

EVERY 5,000 MILES (8,000 KM.)

Carry out 1,250 and 2,500 miles service.
Tune carburetters.
Clean carburetter filters.
Clean fuel line filter.
Lubricate rear suspension wishbone pivot bearings.
Renew oil filter element and seal.
Examine brake friction pads for wear.
Clear drain holes in bottoms of doors.
Adjust top timing chain (if required).
Check front wheel alignment.
Carry out oil can lubrication of (a) seat runners and adjusting mechanism, (b) handbrake lever ratchet, (c) door hinges and locks, (d) boot hinges and lock, (e) bonnet hinges and catches, (f) windscreen wiper arms, (g) accelerator and carburetter linkage, (h) fuel filler cover hinges.

EVERY 10,000 MILES (16,000 KM.)

Carry out 1,250, 2,500 and 5,000 miles service.
Drain and refill gearbox (and overdrive if fitted).
Clean overdrive oil pump filter (if overdrive fitted).
Drain and refill rear axle.
Drain and refill Automatic Transmission unit (if fitted).
Dismantle front wheel bearing hubs, clean out and repack with h.m.p. grease.
Clean overdrive oil pump filter (if overdrive fitted).
Check and tighten all chassis and body nuts, screws and bolts.
Check the exhaust system for leaks.
Lubricate rear wheel hub bearings.
Renew sparking plugs.
Renew air cleaner element.
Check headlamp alignment and adjust as necessary.
Check wheel bearing end-float and adjust as necessary.

EVERY 20,000 MILES (32,000 KM.)

Carry out 1,250, 2,500, 5,000 and 10,000 miles service.
Change steering oil reservoir filter.

RECOMMENDED LUBRICANTS

Component	MOBIL	CASTROL	SHELL	ESSO	B.P.	DUCKHAM	REGENT Caltex/Texaco
Engine	Mobiloil Special*	Castrol XL 20W/50	Shell Super Oil	Esso Extra Motor Oil 10W/30 Esso Extra Motor Oil 20W/40	Super Viscostatic	Q5500* or Q20/50	Havoline 10W/30* 20W/40
Upper cylinder lubrication	Mobil Upperlube	Castrollo	Shell U.C.L. or Donax U.	Esso U.C.L.	Energol U.C.L.	Adcoid Liquid	Regent U.C.L.
Gearbox Distributor oil can points Oil can lubrication	Mobiloil A	Castrol XL	Shell X-100 30	Esso 20W/30	Energol SAE 30	NOL 30	Havoline 30
Rear axle	Mobilube GX 90	Castrol Hypoy	Spirax 90 E.P.	Esso Gear Oil G.P. 90/140	Gear oil SAE 90 E.P.	Hypoid 90	Multigear Lubricant E.P.90
Rear axle half shafts Front wheel bearings Rear wheel bearings Distributor cam	Mobil-grease MP	Castrolease LM	Retinax A	Esso Multi-purpose Grease H	Energrease L.2	LB 10	Marfak All-purpose
Steering tie-rods Wheel swivels Rear wishbone pivots	Mobil-grease MP	Castrolease Medium or LM	Retinax A	Esso Multi-purpose Grease H	Energrease L.2	LB 10	Marfak All-purpose
Automatic transmission unit Power steering system	Mobil Fluid 200	Castrol T.Q.	Shell Donax T.6	Esso Automatic Transmission Fluid	Energol Automatic Transmission Fluid Type 'A'	Nolmatic	Texamatic Fluid

* (These oils should NOT be used in worn engines requiring overhaul)

† According to availability in country of operation.

Note: 1. If an SAE 30 or 40 oil has previously been used in the engine a slight increase in oil consumption may be noticed but this will be compensated by the advantages gained.

2. **Do not** use multi-grade oil in the gearbox; use one of the recommended SAE 30 oils.

RECOMMENDED HYDRAULIC FLUIDS

Braking System and Clutch Operation

Preferred Fluid

Castrol/Girling Crimson Clutch/Brake Fluid. (S.A.E. 70 R3).

Alternative Fluids

Recognised brands of brake fluid conforming to specification S.A.E. 70 R3.

SPECIAL SERVICE TOOLS

Home distributors and dealers should obtain the Churchill special tools (i.e. tool numbers which have a prefix J, L or SL illustrated in this manual direct from Messrs. V. L. Churchill & Co. Ltd., at the address given below. Overseas distributors should order their requirements through the Spares Division, Jaguar Cars Limited, Coventry.

V. L. Churchill & Co. Ltd.,
P.O. Box No. 3,
London Road,
Daventry,
Northants

ENGINE	
Timing Chain Adjuster	J.2
Valve Spring Compressor	J.6118
Engine Lifting Plate	J.8
Crankshaft Rear Seal Sizing Tool	J.17
Valve Guide Bore Reamer	J.18
OVERDRIVE	
Hydraulic Pressure Testing Equipment	—
Freewheel Assembly Ring	L.178
Operating Piston Remover	L.300
REAR AXLE	
Multi-purpose Hand Press (used in conjunction with the following adaptors)	SL.14
Pinion Bearing Inner Race Removal/Refitting	SL.14-1
Differential Bearing Removal	SL.14-3
Differential Bearing Refitting (Universal Handle 550)	SL.550-1
Rear Hub Outer Bearing Inner Race — Remover	J.16B
Pinion Bearing Outer Race Removal/Refitting (with SL.14)	SL.14-1
Pinion Cone Setting Gauge	SL.3
Pinion Oil Seal Installation Collar	SL.4
Hub Endfloat Master Spacer	J.15
Hub Endfloat Dial Gauge	J.13
Rear Hub Extractor	J.D.1.C.
STEERING	
Power Steering Piston Assembly Sleeve	J.19
Hydraulic Pressure Gauge Set	J.10
End Cover Fitting Tool	8434
FRONT SUSPENSION	
Front Coil Spring Compressor	J.6B
REAR SUSPENSION	
Rear Spring Compressor	J.11A (use with SL.14)
Rear Wishbone Pivot Dummy Shaft	J.14 (2 off)
BRAKES	
Piston Resetting Tool	7840
Brake Servo Vacuum Gauge	J.12
Brake Servo Vacuum Gauge Adaptor	J.12 — 2
Servo Operating Lever Setting Gauge	9020

SERVICE DEPARTMENTS

Factory:

The Service Division,
Jaguar Cars Limited,
Coventry, England.
Telephone No. Allesley 2121 (P.B.X.)

London:

Messrs. Henlys Ltd.,
The Hyde,
Hendon,
London, N.W.9
Telephone No. Colindale 6565

U.S.A.:

The Technical Service Department,
Jaguar Cars Inc.,
42-50, 21st Street, Long Island City 1,
New York, U.S.A.

Canada:

The Technical Service Department,
Jaguar Cars (Canada) Ltd.,
8505 Delmeade Road, Montreal 9,
Quebec, Canada.

CONVERSION TABLES

METRIC INTO ENGLISH MEASURE

1 millimetre is approximately 1/25″, and is exactly ·03937″.
1 centimetre is approximately $\frac{3}{8}$″, and is exactly ·3937″.
1 metre is approximately $39\frac{3}{8}$″, and is exactly 39·37″ or 1·0936 yards.
1 kilometre is approximately $\frac{5}{8}$ mile, and is exactly ·6213 miles.
1 kilogramme is approximately $2\frac{1}{4}$ lbs., and is exactly 2·21 lbs.
1 litre is approximately $1\frac{3}{4}$ pints, and is exactly 1·76 pints.
To convert metres to yards, multiply by 70 and divide by 64.
To convert kilometres to miles, multiply by 5 and divide by 8 (approx.).
To convert litres to pints, multiply by 50 and divide by 88.
To convert grammes to ounces, multiply by 20 and divide by 567.
To find the cubical contents of a motor cylinder, square the diameter (or bore), multiply by 0·7854, and multiply the result by the stroke.
1 M.P.G.—0·3546 kilometres per litre or 2·84 litres per kilometre.

MILES INTO KILOMETRES

Kilo.	Miles	Kilo.	Miles	Kilo.	Miles	Kilo.	Miles	Kilo.	Miles
1	$\frac{5}{8}$	16	10	31	$19\frac{1}{4}$	46	$28\frac{5}{8}$	60	$37\frac{1}{4}$
2	$1\frac{1}{4}$	17	$10\frac{5}{8}$	32	$19\frac{7}{8}$	47	$29\frac{1}{4}$	70	$43\frac{1}{2}$
3	$1\frac{7}{8}$	18	$11\frac{1}{4}$	33	$20\frac{1}{2}$	48	$29\frac{7}{8}$	80	$49\frac{3}{4}$
4	$2\frac{1}{2}$	19	$11\frac{3}{4}$	34	$21\frac{1}{8}$	49	$30\frac{1}{2}$	90	$55\frac{7}{8}$
5	$3\frac{1}{8}$	20	$12\frac{3}{8}$	35	$21\frac{3}{4}$	50	$31\frac{1}{8}$	100	$62\frac{1}{8}$
6	$3\frac{3}{4}$	21	13	36	$22\frac{3}{8}$	51	$31\frac{3}{4}$	200	$124\frac{1}{4}$
7	$4\frac{1}{8}$	22	$13\frac{5}{8}$	37	23	52	$32\frac{1}{4}$	300	$186\frac{3}{8}$
8	5	23	$14\frac{1}{4}$	38	$23\frac{5}{8}$	53	$32\frac{7}{8}$	400	$248\frac{1}{2}$
9	$5\frac{5}{8}$	24	$14\frac{7}{8}$	39	$24\frac{1}{4}$	54	$33\frac{1}{2}$	500	$310\frac{3}{4}$
10	$6\frac{1}{4}$	25	$15\frac{1}{2}$	40	$24\frac{7}{8}$	55	$34\frac{1}{8}$	600	$372\frac{7}{8}$
11	$6\frac{7}{8}$	26	$16\frac{1}{8}$	41	$25\frac{1}{2}$	56	$34\frac{3}{4}$	700	435
12	$7\frac{1}{2}$	27	$16\frac{3}{4}$	42	$26\frac{1}{8}$	57	$35\frac{3}{8}$	800	$497\frac{1}{8}$
13	$8\frac{1}{8}$	28	$17\frac{3}{8}$	43	$26\frac{3}{4}$	58	36	900	$559\frac{1}{4}$
14	$8\frac{3}{4}$	29	18	44	$27\frac{3}{8}$	59	$36\frac{5}{8}$	1000	$621\frac{3}{8}$
15	$9\frac{3}{8}$	30	$18\frac{5}{8}$	45	28				

PINTS AND GALLONS TO LITRES

Pints	Gallons	Litres Approx.	Litres Exact	Pints	Gallons	Litres Approx.	Litres Exact
1	$\frac{1}{8}$	$\frac{1}{2}$	·57	40	5	23	22·75
2	$\frac{1}{4}$	1	1·14	48	6	27	27·30
3	$\frac{3}{8}$	$1\frac{1}{2}$	1·71	56	7	32	31·85
4	$\frac{1}{2}$	$2\frac{1}{4}$	2·27	64	8	$36\frac{1}{2}$	36·40
8	1	$4\frac{1}{2}$	4·54	72	9	41	40·95
16	2	9	9·10	80	10	$45\frac{1}{2}$	45·50
24	3	$13\frac{1}{2}$	13·65	88	11	50	50·05
32	4	18	18·20	96	12	$54\frac{1}{2}$	54·60

CONVERSION TABLES

RELATIVE VALUE OF MILLIMETRES AND INCHES

mm.	Inches	mm.	Inches	mm.	Inches	mm.	Inches
1	0·0394	26	1·0236	51	2·0079	76	2·9922
2	0·0787	27	1·0630	52	2·0473	77	3·0315
3	0·1181	28	1·1024	53	2·0866	78	3·0709
4	0·1575	29	1·1417	54	2·1260	79	3·1103
5	0·1968	30	1·1811	55	2·1654	80	3·1496
6	0·2362	31	1·2205	56	2·2047	81	3·1890
7	0·2756	32	1·2598	57	2·2441	82	3·2284
8	0·3150	33	1·2992	58	2·2835	83	3·2677
9	0·3543	34	1·3386	59	2·3288	84	3·3071
10	0·3937	35	1·3780	60	2·3622	85	3·3465
11	0·4331	36	1·4173	61	2·4016	86	3·3859
12	0·4724	37	1·4567	62	2·4410	87	3·4252
13	0·5118	38	1·4961	63	2·4803	88	3·4646
14	0·5512	39	1·5354	64	2·5197	89	3·5040
15	0·5906	40	1·5748	65	2·5591	90	3·5433
16	0·6299	41	1·6142	66	2·5984	91	3·5827
17	0·6693	42	1·6536	67	2·6378	92	3·6221
18	0·7087	43	1·6929	68	2·6772	93	3·6614
19	0·7480	44	1·7323	69	2·7166	94	3·7008
20	0·7874	45	1·7717	70	2·7559	95	3·7402
21	0·8268	46	1·8110	71	2·7953	96	3·7796
22	0·8661	47	1·8504	72	2·8347	97	3·8189
23	0·9055	48	1·8898	73	2·8740	98	3·8583
24	0·9449	49	1·9291	74	2·9134	99	3·8977
25	0·9843	50	1·9685	75	2·9528	100	3·9370

RELATIVE VALUE OF INCHES AND MILLIMETRES

Inches	0	$\frac{1}{16}$	$\frac{1}{8}$	$\frac{3}{16}$	$\frac{1}{4}$	$\frac{5}{16}$	$\frac{3}{8}$	$\frac{7}{16}$
0	0·0	1·6	3·2	4·8	6·4	7·9	9·5	11·1
1	25·4	27·0	28·6	30·2	31·7	33·3	34·9	36·5
2	50·8	52·4	54·0	55·6	57·1	58·7	60·3	61·9
3	76·2	87·8	79·4	81·0	82·5	84·1	85·7	87·3
4	101·6	103·2	104·8	106·4	108·0	109·5	111·1	112·7
5	127·0	128·6	130·2	131·8	133·4	134·9	136·5	138·1
6	152·4	154·0	155·6	157·2	158·8	160·3	161·9	163·5
Inches	$\frac{1}{2}$	$\frac{9}{16}$	$\frac{5}{8}$	$\frac{11}{16}$	$\frac{3}{4}$	$\frac{13}{16}$	$\frac{7}{8}$	$\frac{15}{16}$
0	12·7	14·3	15·9	17·5	19·1	20·6	22·2	23·8
1	38·1	39·7	41·3	42·9	44·4	46·0	47·6	49·2
2	63·5	65·1	66·7	68·3	69·8	71·4	73·0	74·6
3	88·9	90·5	92·1	93·7	95·2	96·8	98·4	100·0
4	114·3	115·9	117·5	119·1	120·7	122·2	123·8	125·4
5	139·7	141·3	142·9	144·5	146·1	147·6	149·2	150·8
6	165·1	166·7	168·3	166·9	171·5	173·0	174·6	176·2

SECTION B

ENGINE

3·8 MARK 10 MODEL

INDEX

INDEX *(continued)*

INDEX *(continued)*

ENGINE

The 3·8 Mark 10 model has the twin overhead camshaft XK type engine, fitted with an "S" type cylinder head with straight ports and $\frac{3}{8}''$ lift camshafts.

Compression Ratio	Engine Number Prefix	Colour of Cylinder Head
7 : 1, 8 : 1 or 9 : 1	ZA	Gold

Compression ratios of 7 to 1, 8 to 1 and 9 to 1 are specified for the 3·8 Mark 10 engine, the differences in compression ratio being obtained by varying the crown design of the piston.

The compression ratio of an engine is indicated by /7, /8, /9 following the engine number.

DATA

Camshaft

Number of journals	Four per shaft
Journal diameter	1·00″—·0005″ —·001″ (25·4 mm.—·013 mm.) —·025 mm.
Thrust taken	Front end
Number of bearings	Four per shaft (eight half bearings)
Type of bearing	White metal steel backed shell
Diameter clearance	·0005″ to ·002″ (·013 to ·05 mm.)
Permissible end float	·0045″ to ·008″ (·11 to ·20 mm.)
Tightening torque—Bearing cap nuts	15 lb. ft. (175 lb. ins.) (2·1 kg.m.)

Connecting Rod

Length centre to centre	$7\frac{3}{4}''$ (19·68 cm.)
Big end—Bearing type	Lead bronze, steel backed shell
Bore for big end bearing	2·233″ to 2·2335″ (56·72 to 56·73 mm.)

ENGINE

Big end—Width	$1\frac{3}{16}$″—·006″ —·008″ (30·16 mm.—·15 mm.) —·20 mm.
Big end—Diameter clearance	·0015″ to ·0033″ (·04 mm. to ·08 mm.)
Big end—side clearance	·0058″ to ·0087″ (·15 mm. to ·22 mm.)
Bore for small end bush	1·00″±·0005″ (25·4 mm.±·013 mm.)
Small end bush—Type	Phosphor bronze—steel backed
Small end—Width	$1\frac{5}{64}$″ (27·4 mm.)
Small end bush—Bore diameter	·875″+·0002″ —·0000″ (22·23 mm. +·005 mm.) —·000
Tightening torque—Con rod bolts	37 lb. ft. (450 lb. ins.) (5·1 kg.m.)

Crankshaft

Number of main bearings	Seven
Main bearing—Type	Lead bronze, steel backed shell
Journal diameter	2·750″ to 2·7505″ (69·85 to 69·86 mm.)
Journal length Front	$1\frac{11}{16}$±·005″ (42·86 mm.±·13 mm.)
Centre	$1\frac{3}{4}$″+·0005″ +·001″ (44·45 mm. +·013 mm.) +·025
Rear	$1\frac{7}{8}$″ (47·63 mm.)
Intermediate	$1\frac{7}{32}$″±·002″ (30·96 mm.±·05 mm.)

Thrust taken	Centre bearing thrust washers
Thrust washer—Thickness	·092″±·001″ and ·096″±·001″ (2·34 mm.±·025 mm. and 2·44 mm.±·025 mm.)
End clearance	·004″ to ·006″ (·10 to ·15 mm.)
Main bearing—Length	
Front, Centre, Rear	$1\frac{1}{2}$″±·005″ (38·1 mm.±·13 mm.)
Intermediate	1″±·005″ (25·4 mm.±·13 mm.)
Diameter clearance	·0025″—·0042″ (·064 to ·107 mm.)
Crankpin—Diameter	2·086″ +·0006″ —·000″ (52·98 mm. +·015 mm. —·000 mm.)
Length	$1\frac{3}{16}$″ +·0007″ —·0002″ (30·16 mm. +·018 mm. —·005 mm.)
Regrind undersize	·010″, ·020″, ·030″ and ·040″ (·25, ·51, ·76 and 1·02 mm.)
Minimum diameter for regrind	—·040″ (1·02 mm.)
Tightening torque—main bearing bolts	83 lb. ft. (1,000 lb. ins.) (11·5 kg.m.)

Cylinder Block

Material	"Brivadium" dry liners
Cylinder bores—Nominal	87 mm. +·0127 mm. —·0064 mm. (3·4252″ +·0005″ —·00025″)
Maximum rebore size	+·030″ (·76 mm.)
Bore size for fitting liners	3·561″ to 3·562″ (90·45 mm. to 90·47 mm.)

ENGINE

Outside diameter of liner	3·563″ to 3·566″ (90·50 to 90·58 mm.)
Interference fit	·001″ to ·005″ (·025 to ·13 mm.)
Overall length of liner	$6\frac{31}{32}$″ (17·7 cm.)
Outside diameter of lead-in	3·558″ to 3·560″ (90·37 to 90·42 mm.)
Size of bore honed after assembly—in cylinder block—Nominal	87 mm. (3·4252″)
Main line bore for main bearings	2·9165″ +·0005″ —·0000″ (74·08 +·013 mm.) —·000 mm.)

Cylinder Head

Type	Straight Port (Gold Top)
Material	Aluminium Alloy
Valve seat angle—Inlet	45°
—Exhaust	45°
Valve throat diameter—Inlet	$1\frac{1}{2}$″ (38·1 mm.)
—Exhaust	$1\frac{3}{8}$″ (34·9 mm.)
Tightening torque—Cylinder head nuts	54 lb. ft. (650 lb. ins) (7·5 kg.m.)
Firing order	1, 5, 3, 6, 2, 4 No. 1 cylinder being at the rear of the engine unit.

Gudgeon Pin

Type	Fully floating
Length	2·840″ to 2·845″ (72·14 to 72·26 mm.)
Inside diameter	$\frac{5}{8}$″ (15·87 mm.)
Outside diameter	·8750″ to ·8752″ (22·22 to 22·23 mm.)

Lubricating System

Oil pressure (hot)	40 lb. per sq. in. at 3,000 r.p.m.
Oil pump—Type	Eccentric rotor Roller (later cars)
—Clearance at end of lobes	·006″ maximum (·15 mm.)
—End clearance	·0025″ maximum (·06 mm.)
—Clearance between outer rotor and body	·010″ maximum (·25 mm.)

Piston and Piston Rings

Make	Brico
Type	Semi-split skirt
Piston	
Skirt clearance (*measured at bottom of skirt at 90° to gudgeon pin axis*)	·0011″ to ·0017″ (·028 to ·043 mm.)
Gudgeon pin bore	·8749″ to ·8751″ (2·223 to 2·228 mm.)

Compression Height

7 : 1 compression ratio	1·846″ to 1·841″ (46·89 to 46·76 mm.)
8 : 1 compression ratio	2·069″ to 2·064″ (52·55 to 52·42 mm.)
9 : 1 compression ratio	2·247″ to 2·242″ (57·07 to 56·94 mm.)
Piston rings—Number	
Compression	2
Oil control	1

Piston rings—Width	
Compression	0·077″ to ·0787″ (1·97 to 2·00 mm.)
Oil control	·155″ to ·156″ (3·94 to 3·96 mm.)
Piston rings—Thickness	
Compression	·124″ to ·130″ (3·15 to 3·30 mm.)
Oil control	·119″ to ·127″ (3·02 to 3·23 mm.)
Piston rings—Side clearance in groove	
Compression	·001″ to ·003″ (·03 to ·07 mm.)
Oil control	·001″ to ·003″ (·02 to ·07 mm.)
Piston rings—Gap when fitted to cylinder bore	
Compression	·015″ to ·020″ (·38 to ·51 mm.)
Oil control	·011″ to ·016″ (·28 to ·41 mm.)

Sparking Plugs

Make	Champion
Type	
7 : 1, 8 : 1 and 9 : 1 compression ratios	N.5*
Gap	·025″ (·64 mm.)

*Superseded by UN12Y

Tappets and Tappet Guides

Tappet—Material	Cast iron (chilled)
—Outside diameter	1·3738″ to 1·3742″ (34·89 to 34·91 mm.)
Diameter clearance	·0008″ to ·0019″ (·02 to ·048 mm.)

Tappet guide—Material	Austenitic iron
—Inside diameter (before reaming)	1·353″ to 1·357″ (34·37 to 34·47 mm.)
—Reaming size (when fitted to cylinder head)	1·375″ +·0007″ —·0000″ (34·925 mm. +·018 mm. —·000)
—Interference (shrink) fit in head	·003″ (·08 mm.)

Timing Chains and Sprockets

Type	Duplex
Pitch	$\frac{3}{8}$″ (9·5 mm.)
Number of pitches—Top chain	100
—Bottom chain	82
Crankshaft sprocket	21
Intermediate sprocket, outer—Teeth	28
Intermediate sprocket, inner—Teeth	20
Camshaft sprocket—Teeth	30
Idler Sprocket	21

Valve Timing

Inlet valve opens	15° B.T.D.C.
Inlet valve closes	57° A.B.D.C.
Exhaust valve opens	57° B.B.D.C.
Exhaust valve closes	15° A.T.D.C.

(with valve clearances set at ·010″ (·25 mm.))

Valves and Valve Springs

Valves—Material, Inlet	Silicon chrome steel
Exhaust	Austenitic steel
Valve head diameter, Inlet	$1\frac{3}{4}$″ ± ·002″ (44·45 mm. ± ·05 mm.)
Exhaust	$1\frac{5}{8}$″ ± ·002″ (41·28 mm. ± ·05 mm.)

ENGINE

Valve stem diameter, Inlet and Exhaust	$\frac{5}{16}$"—·0025" —·0035" (7·94 mm.—·06 mm. —·09 mm.)
Valve lift	$\frac{3}{8}$"—(9·53 mm.)
Valve clearance—Inlet	·004" (·10 mm.)
—Exhaust	·006" (·15 mm.)
Valve seat angle—Inlet	45°
—Exhaust	45°
Valve spring—Free length. Inner	1$\frac{21}{32}$" (·42 mm.)
Outer	1$\frac{15}{16}$" (49·2 mm.)
Valve spring—Fitted length. Inner	1$\frac{7}{32}$" (30·96 mm.)
Outer	1$\frac{5}{16}$" (33·34 mm.)
Valve spring—Fitted load. Inner	30·33 lb. (13·76 kg.)
Outer	48·375 lb. (21·94 kg.)
Valve spring—Solid length (max.) Inner	·810" (20·57 mm.)
Outer	·880" (22·35 mm.)
Number of free coils Inner	6
Outer	5
Diameter of wire Inner	12 SWG (·104") (2·64 mm.)
Outer	10 SWG (·128") (3·25 mm.)

Valve Guide and Valve Seat Insert

Valve guides—Material	Cast iron
Valve guide—Length, Inlet	1$\frac{13}{16}$" (46·04 mm.)
Exhaust	1$\frac{15}{16}$" (49·21 mm.)
Valve guide—Inside diameter—Inlet	$\frac{5}{16}$"—·0005" —·0015" (7·94 mm.—·013 mm. —·038 mm.)
Exhaust	$\frac{5}{16}$"±·0005" (7·94 mm.±·01 mm.)

Interference fit in head	·0005″ to ·0022″ (·013 to ·056 mm.)
Valve seat inserts—Material	Cast iron (centrifugally cast)
Inside diameter Inlet	$1\frac{1}{2}$″ $+$·003″ —·001″ (38·1 $+$·076 mm.) —·025 mm.)
Exhaust	1·379″ to 1·383″ (35·03 to 35·13 mm.)
Interference (shrink) fit in head	·003″ (·076 mm.)

FUEL REQUIREMENTS FOR 9 to 1 AND 8 to 1 COMPRESSION RATIO ENGINES

If the engine of your car is fitted with 9 to 1 compression ratio pistons (indicated by /9 after the engine number) use only Super grade fuel with a minimum octane rating of 101. (Research method). If a car is fitted with 8 to 1 compression ratio pistons (indicated by /8 after the engine number) use premium grade fuel with a minimum rating of 94. (Research method).

If, of necessity, the car has to be operated on lower octane fuel do not use full throttle otherwise detonation may occur with resultant piston trouble.

ROUTINE MAINTENANCE

DAILY

Checking the Engine Oil Level

Check the oil level with the car standing on level ground otherwise a false reading will be obtained.

Remove the dipstick and wipe it dry. Replace and withdraw the dipstick; if the oil level is on the knurled patch, with the engine hot or cold, no additional oil is required. If the engine has been run immediately prior to making an oil level check, wait one minute after switching off before checking the oil level.

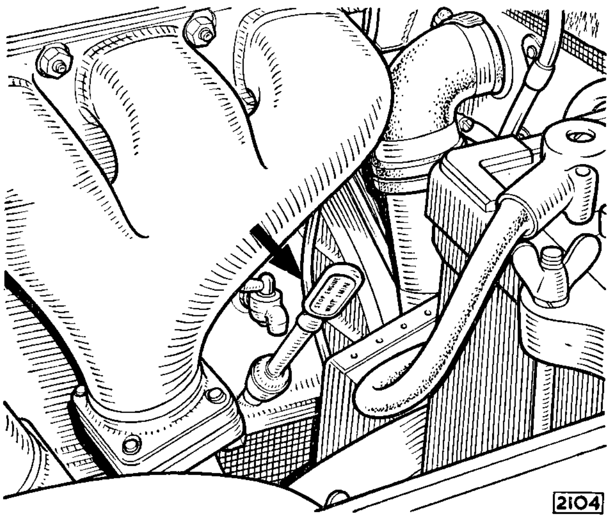


Fig. 1. The engine dipstick

Note: Almost all modern engine oils contain special additives, and whilst it is permissible to mix the recommended brands it is undesirable. If it is desired to change from one brand to another this should be done when the sump is drained, and the Oil Company's recommendation in regard to flushing procedure should be followed.

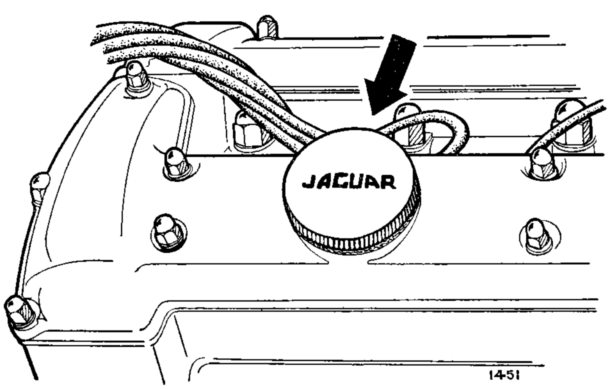


Fig. 2. The engine oil filler

EVERY 2,500 MILES (4,000 KM.)

Changing the Engine Oil

Note: Under certain adverse operating conditions, conducive to oil dilution and sludge formation, more frequent oil changing than the normal 2,500 mile (4,000 km.) period is advised. Where the car is used mainly for low-speed city driving, stop-start driving particularly in cold weather or in dusty territory the oil should be changed at least every 1,000 miles (1,600 km.).

The draining of the sump should be carried out at the end of a run when the oil is hot and therefore will flow more freely. The drain plug is situated at the right-hand rear corner of the sump. When the engine oil is changed, the oil filter which is situated on the right-hand side of the engine, must also receive attention.

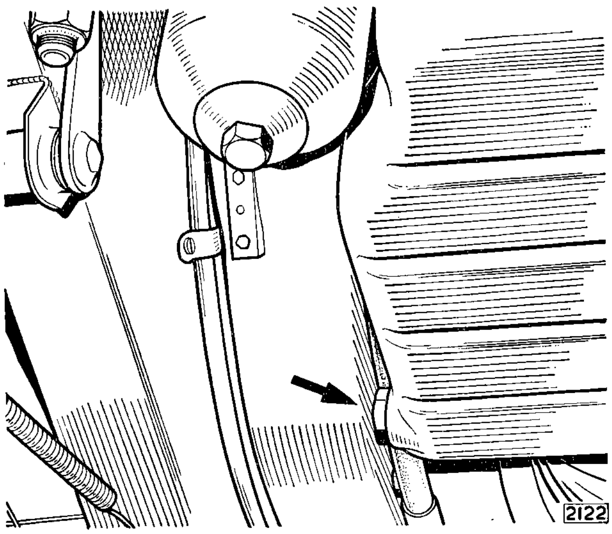


Fig. 3. The engine drain plug

Unscrew the central bolt and remove the canister and element. Thoroughly wash these parts in petrol and allow to dry out. When replacing the canister renew the circular rubber seal in the filter head. (Attention is drawn to the importance of renewing the filter element at 5,000 miles (8,000 km.) intervals).

Distributor—Lubrication

Take care to prevent oil or grease from getting on or near the contact breaker points.

Remove the moulded cap at the top of the distributor by springing back the two clips. Lift off the rotor arm and apply a few drops of engine oil around the screw (A, Fig. 5) now exposed. It is not necessary to remove the screw as it has clearance to permit the passage of oil.

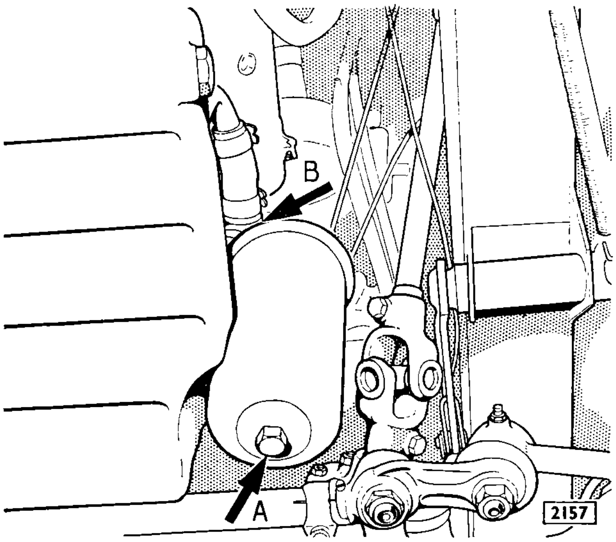


Fig. 4. The engine oil filter
A, securing bolt; B, oil pressure relief valve union

Apply **one** drop of oil to the post (B) on which the contact breaker pivots. Lightly smear the cam (C) with grease. Lubricate the centrifugal advance mechanism by injecting a few drops of engine oil through the aperture at the edge of the contact breaker base plate.

Distributor Contact Breaker Points

Check the gap between the contact points with feeler gauges when the points are fully opened by one of the cams on the distributor shaft. A combined screwdriver and feeler gauge is provided in the tool kit.

The correct gap is ·014″—·016″ (·36—·41 mm.).

If the gap is incorrect, slacken the two screws (A, Fig. 6) securing the fixed contact plate and turn the eccentric-headed adjustment screw (B) in its slot until the required gap is obtained. Tighten the securing screws and recheck the gap.

Examine the contact breaker points. If the contacts are burned or blackened, clean them with a fine carborundum stone or very fine emery cloth. Afterwards wipe away any trace of grease or metal dust with a petrol moistened cloth.

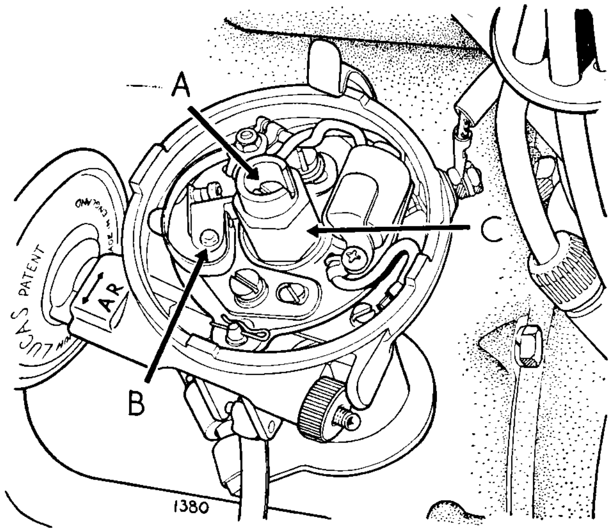
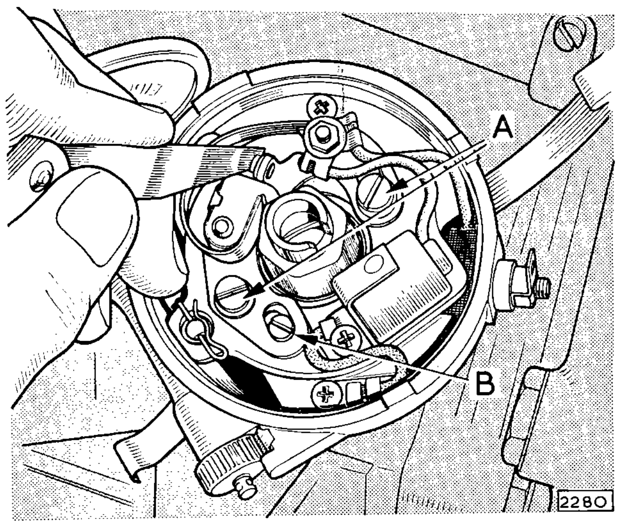


Fig. 5. Distributor lubrication points (early cars)



(*Early Cars*)

Fig. 6. Checking the gap between the distributor contact points. The screw 'A' secures the fixed contact plate; the contact gap is adjusted by means of the eccentric headed screw 'B'

Later Cars

If the gap is incorrect, slacken (very slightly) the contact plate securing screw and adjust the gap by turning a screwdriver in the slot in the contact plate, clockwise to decrease the gap and anti-clockwise to increase the gap. Tighten the securing screw and recheck the gap.

Cleaning of the contacts is made easier if the contact breaker lever carrying the moving contact is removed. To do this, remove the nut, insulating piece and connections from the post to which the end of the contact breaker spring is anchored. The contact breaker lever can now be lifted off its pivot post.

Sparking Plugs

Every 2,500 miles (4,000 km.) or more often if operating conditions demand, withdraw, clean and reset the plugs.

The only efficient way to clean sparking plugs is to have them properly serviced on machines specially designed for this purpose. These machines operate with compressed air and utilise a dry abrasive material specially graded and selected to remove harmful deposits from the plug insulator without damaging the insulator surface. In addition the majority of the machines incorporate electrical testing apparatus enabling the plugs to be pressure tested to check their electrical efficiency and gas tightness.

The gap between the points should be ·025″ (·64 mm.). When adjusting the gap always move the side wire—never bend the centre wire.

The Champion Sparking Plug Co. supply a special combination gauge and setting tool, the use of which is recommended.

Every 10,000 miles (16,000 km.) a new set of plugs of the recommended type should be fitted. To save petrol and to ensure easy starting, the plugs should be cleaned and tested regularly.

EVERY 5,000 MILES (8,000 KM.)

Fan Belt Tension

The fan belt is automatically tensioned by means of a spring loaded jockey pulley and adjustment is therefore unnecessary.

Oil Filter Element

It is most important to renew the oil filter element every 5,000 miles (8,000 km.) as after this mileage it will have become choked with impurities.

To guard against the possibility of the filter being neglected to the extent where the element becomes completely choked, a balance valve is incorporated in the filter head which allows **unfiltered** oil to by-pass

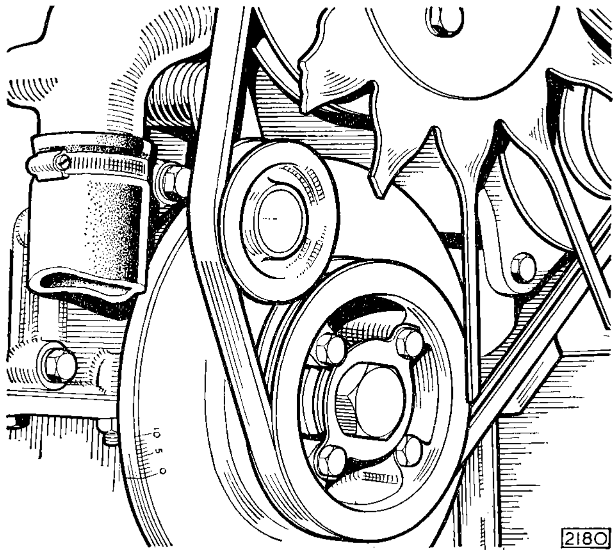


Fig. 7. The fan belt jockey pulley

the element and reach bearings. This will be accompanied by a drop in the normal oil pressure of some 10 lb. per sq. in. and if this occurs the filter element should be renewed as soon as possible.

To gain access to the element, unscrew the central bolt when the canister complete with the element can be removed. Thoroughly wash out the canister with petrol and allow to dry before inserting the new element.

When replacing the canister renew the circular rubber seal in the filter head.

Top Timing Chain Tension

If the top timing chain is audible, adjust the tension as follows:—

This operation requires the use of a special tool to enable the adjuster plate to be rotated. To gain access to the adjuster plate remove the breather housing attached to the front face of the cylinder head.

Slacken the locknut securing the serrated adjuster plate. Tension the chain by pressing the locking plunger inwards and rotating the adjuster plate in an anti-clockwise direction, using Churchill Tool No. J.2.

When correctly tensioned there should be slight flexibility on both outer sides of the chain below the camshaft sprockets, that is, the chain must not be dead tight. Release locking plunger, and securely tighten locknut. Refit the breather housing.

EVERY 10,000 MILES (16,000 KM.)

Air Cleaner

The air cleaner is of the paper element type and is situated in the right-hand wing valance accessible from inside the engine compartment.

No maintenance is necessary but the element should be renewed every 10,000 miles (16,000 km.) or more frequently in dusty territories. A clogged air cleaner element will cause heavy fuel consumption.

To gain access to the element detach the flexible hose connecting the cleaner to the air intake pipe after removing the rubber joint from the pipe and the hose clip from the air cleaner cover plate.

Turn the two quick-release screws securing the air cleaner cover plate anti-clockwise through 90° and withdraw plate with the attached element. Remove the thumb nut and retainer plate from the base of the unit and withdraw the element.

Refitting is the reverse of the removal procedure.

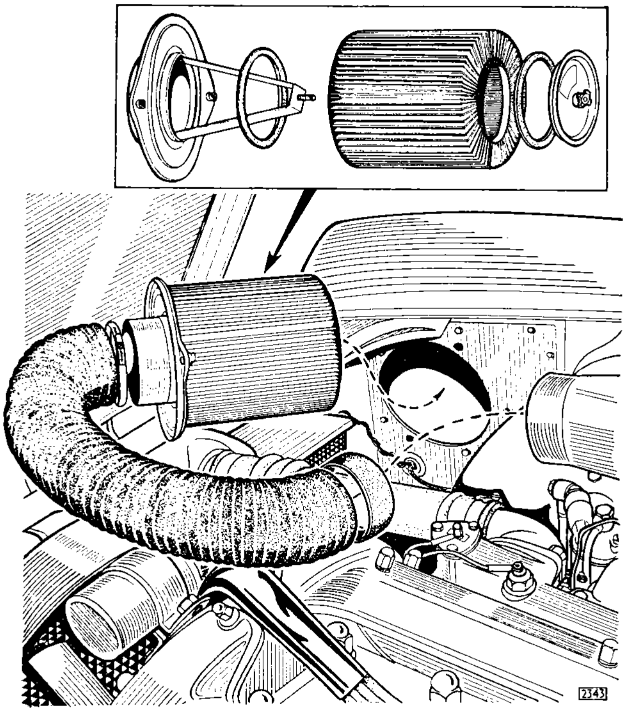


Fig. 8. Removing the air cleaner from the wing

Recommended Lubricants

	MOBIL	CASTROL	SHELL	ESSO	B.P.	DUCKHAM	REGENT Caltex/Texaco
Engine	Mobiloil Special*	Castrol XL 20W/50	Shell Super Oil	Esso Extra Motor Oil 10W/30* Esso Extra Motor Oil 20W/40*	Super Visco-static	Q20-50 or or Q5500*	Havoline 20W/40 or 10W/30*
Upper cylinder lubricant	Mobil Upperlube	Castrollo	Shell UCL or Donax U	Esso U.C.L.	U.C.L.	Adcoid Liquid	Regent U.C.L.

* These oils should NOT be used in worn engines requiring overhaul.

If an SAE 30 or 40 oil has previously been used in the engine a slight increase in oil consumption may be noticed but this will be compensated by the advantages gained.

Capacity

	Imperial	U.S.	Litres
Engine—refill (including filter)	12 pints	$14\frac{1}{2}$ pints	6·75

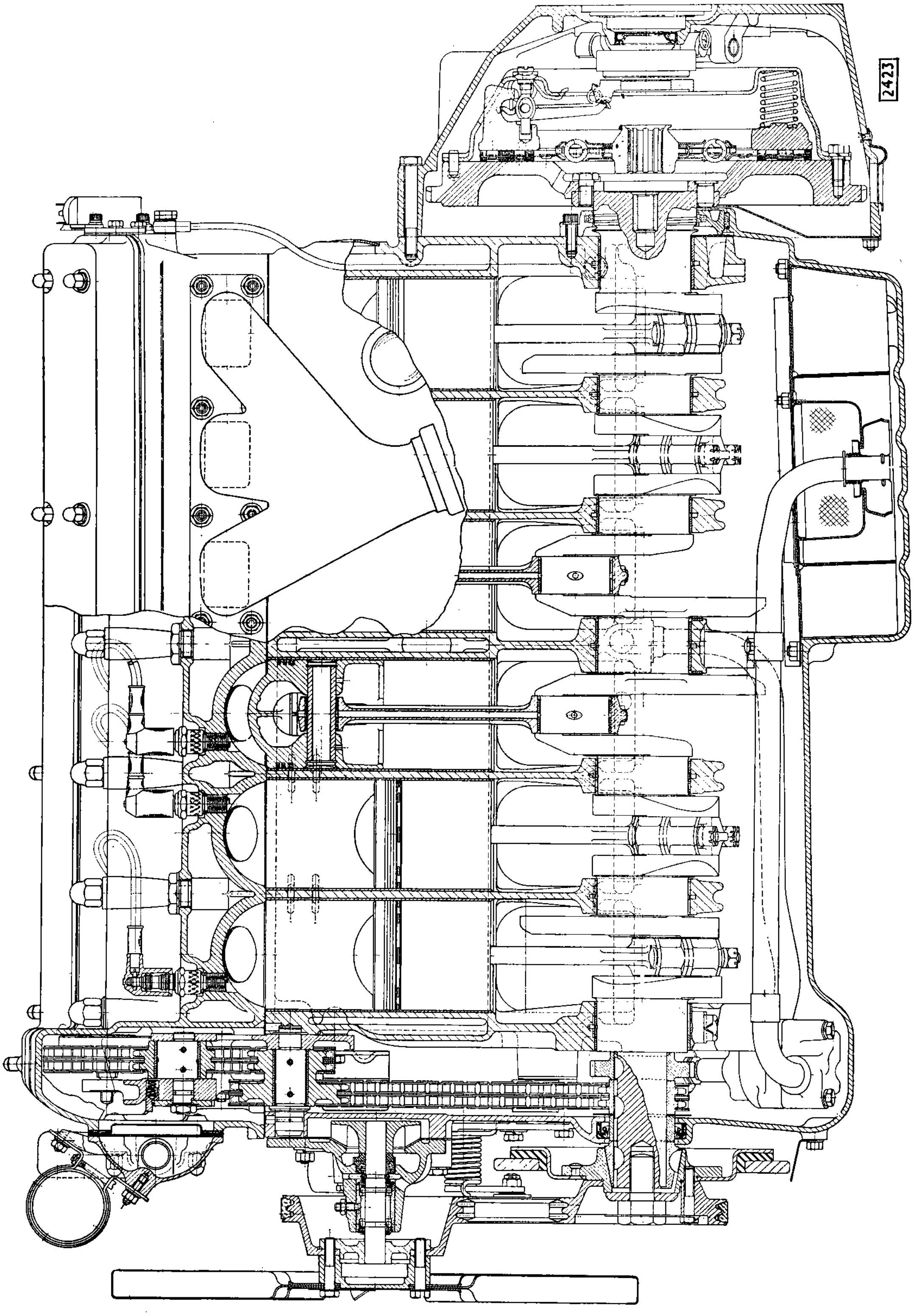


Fig. 9. Cross section view of the engine

ENGINE REMOVAL AND REFITTING

It is advisable to remove the engine from above with the car standing on the workshop floor using overhead lifting tackle and a trolley jack. If two sets of lifting tackle and engine lifting plates are available, the trolley jack may be dispensed with.

REMOVAL

Disconnect the battery.

Remove the bonnet (as described in Section N "Body").

Drain the engine sump.

Drain the cooling system by removing the radiator filler cap, turning the radiator drain tap remote control and the cylinder block drain tap. Conserve the coolant if anti-freeze is in use.

Slacken the hose clips at the upper and lower water hoses and remove the radiator and hoses as described in Section D "Cooling System."

Remove the flexible pipe at the carburetter air intake elbow, turn the two slotted fasteners on the air cleaner through 90° and withdraw the air cleaner.

Disconnect the starter cable.

Remove the cables from the coil (White to the S.W. terminal and White/Black to the C.B. terminal) and from the auxiliary starting carburetter (green and green/black).

Remove the cable (green/yellow) from the anti-creep switch (if fitted).

Remove the cable (green/blue) from the water temperature transmitter in the water jacket, and the cable (green/black) from the thermostat switch.

Remove the cable (brown/white) from the oil pressure transmitter and the cables (which may be replaced at either terminal) from the revolution counter generator.

Remove the small bolt and self-locking nut securing the intermediate throttle shaft to the main throttle shaft. Remove the rod from the rear of the intermediate shaft and withdraw the shaft.

Slacken the clips and remove two water hoses from the connections at the right-hand side of the heater unit. Disconnect the fuel feed pipe at the front union on the fuel feed line filter.

Remove the two vacuum pipes from the check valve on the heater vacuum reservoir, situated on the right-hand wing valance.

Remove the vacuum pipe which leads to the brake vacuum reservoir from the rear of the carburetter air balance pipe.

Remove the three nuts and spring washers securing the power assisted steering pump to the back of the dynamo. Withdraw the pump and secure it in a position where the pipes will not be damaged. Remove the two cables from the dynamo.

Remove the eight brass nuts securing the exhaust pipe flanges to the exhaust manifold and the nut and bolt securing the pipes to the bracket on the bell housing. Disconnect the exhaust pipes and remove the two sealing rings. Disconnect the earth strap at the left-hand rear end of the sump (on later models the strap is fitted at the left-hand front end of the sump).

From underneath the car, remove the complete steering track rod and tie rod assembly by removing the four self-locking nuts and drifting out the ball pins. Unscrew the central oil filter bolt and withdraw the oil filter canister complete with the element. Move the exhaust pipes to one side of the chassis side member where they will not be damaged.

On automatic transmission models, remove the bolt securing the selector cable trunnion to the transmission unit. Remove the nut securing the selector cable pivot pin to the selector lever. Withdraw the split pin and remove the washer securing the kick down rod to the lever on the transmission unit. Remove the cables (which may be replaced at either terminal) from the pressure switch on the right-hand side of the transmission unit. Disconnect the solenoid wires at the snap connectors (green to green and grey/purple to yellow/red). Disconnect the speedometer cable.

In the case of standard and overdrive models, remove the console and gear lever grommet. Remove the gear lever. Disconnect the speedometer drive cable at the rear of the gearbox unit. Remove the flexible hydraulic clutch pipe at the slave cylinder on the clutch housing. Allow the fluid from the system to drain into a clean container. Disconnect the overdrive switch cables from the solenoid situated underneath the overdrive unit.

Place a jack under the rear engine mounting and remove the four setscrews, spring and oval washers securing the mounting to the body. Lower the jack slowly to relieve the tension on the mounting spring.

Remove the mounting and spring ensuring that the four square packing pieces between the mounting and body are not mislaid. Unscrew the mounting pin and upper spring seat from the rear of the transmission unit. Remove the four propeller shaft securing nuts and disconnect the universal joint from the transmission unit companion flange.

Sling the engine or remove the cylinder head securing nuts, Nos. 3, 6, 8 and 9 in Fig. 18 and fit an engine lifting plate (Churchill Tool No. J.8).

Supporting the engine on the lifting tackle, insert a trolley jack under the front of the car and support the transmission unit having placed a piece of wood between the jack and the transmission unit sump (or gearbox casing).

Remove the two front engine mounting bolts, remove the self-locking nut and stepped washer from the stabiliser between the rear of the cylinder head and the bulkhead.

Lower the rear of the engine on the jack until the stabiliser bolt can be withdrawn from its mounting.

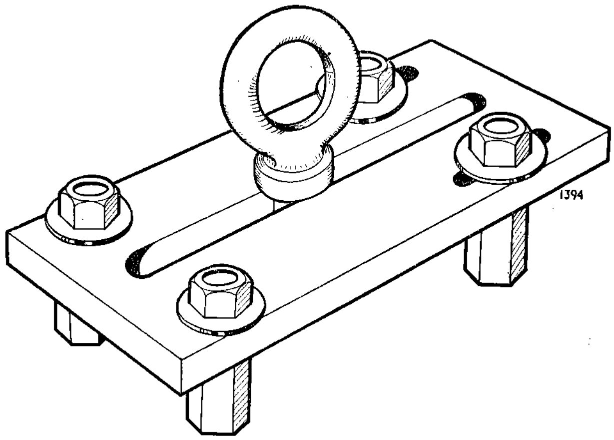


Fig. 11. The engine lifting plate (Churchill Tool Number J.8)

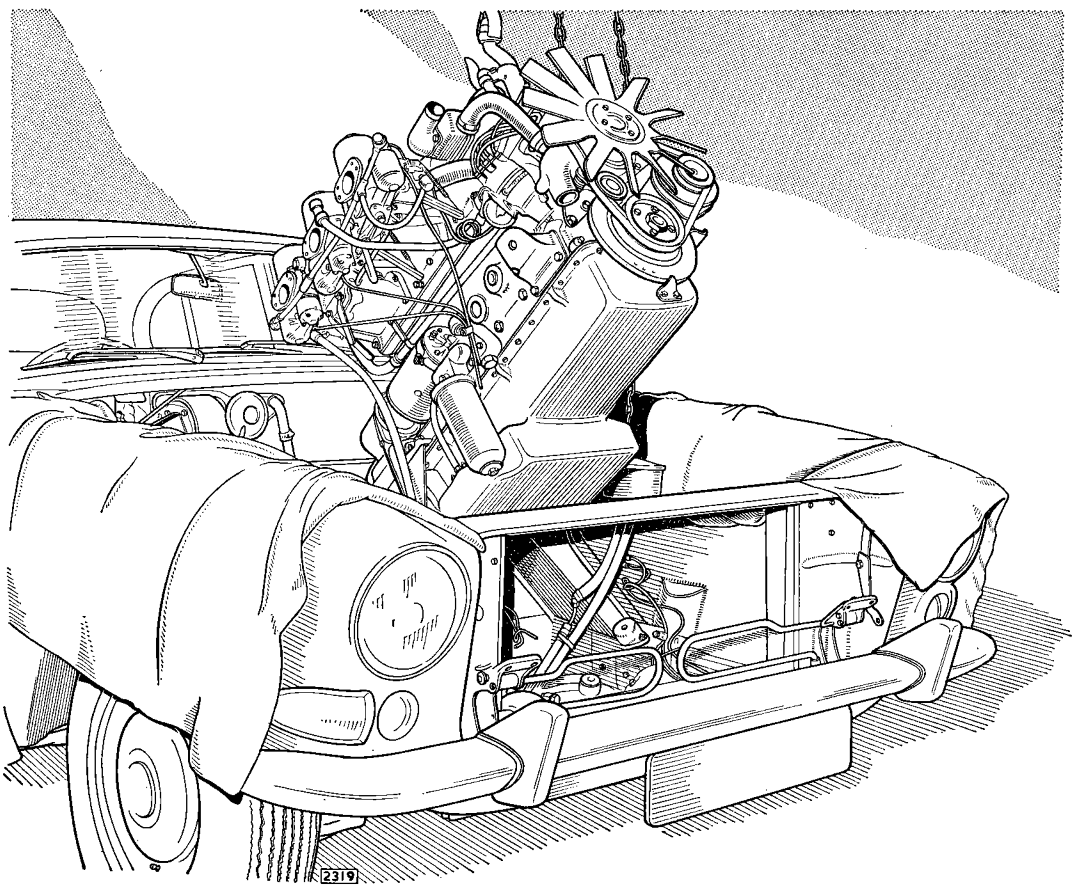


Fig. 10. Removing the engine

Raise the front of the engine on the lifting tackle, lower the rear on the jack, and withdraw the engine forwards. Ensure that the oil feed pipe to the camshafts at the rear of the cylinder head is not damaged and ensure that the ignition timing pointer at the front of the sump does not come into contact with the front body cross member.

Note: If two sets of lifting tackle and engine lifting plates are used, utilize the cylinder head studs 3, 6, 8 and 9 on Fig. 18 for the forward lifting plate and 4, 5, 7 and 10 for the rear plate.

REFITTING

Refitting is the reverse of the removal procedure, but it is important to adjust the engine stabiliser as described on page B.67.

ENGINE TO DISMANTLE

GENERAL

The following instructions apply when the engine components are removed in the following sequence with the engine unit out of the chassis. Dismantling of sub-assemblies and the removal of individual components when the engine is in the chassis frame are dealt with separately in this section.

All references made in this section to the top or bottom of the engine assume the engine to be in the normal upright position. References to the left- or right-hand side assume the engine to be upright and looking from the rear.

REMOVE STARTER

Remove the two nuts and spring washers, withdraw the horseshoe bolt bracket securing the starter to the clutch housing and remove the starter motor.

REMOVE DYNAMO

Remove the setscrew securing the dynamo link to the water pump. Slacken the two bolts securing the dynamo to the mounting bracket and press the dynamo towards the engine. Press the jockey pulley towards the engine and remove the fan belt. Release the jockey pulley, remove the dynamo mounting bolts and withdraw the dynamo.

REMOVE GEARBOX

Unscrew the four setscrews and remove the cover plate from the front face of the clutch housing.

Remove the set bolts and nuts securing the clutch housing to the engine and withdraw the gearbox unit. The gearbox must be supported during this operation in order to avoid straining the clutch driven plate and constant pinion shaft.

REMOVE DISTRIBUTOR

Slacken back the clips and remove the cover complete with high tension leads. Disconnect the white/black cable from the distributor. Slacken the clamp plate bolt and withdraw distributor. Remove the setscrew and remove the clamp plate. Note the cork seal in the recess at the top of the distributor drive hole.

REMOVE CYLINDER HEAD

Disconnect the distributor vacuum feed pipe from the front carburetter. Remove the high tension leads from the sparking plugs and lead carrier from the cylinder head studs. Remove the bolt securing the high tension lead clip to the timing cover. Remove the sparking plugs. Disconnect the camshaft oil feed pipe from the rear of the cylinder head. Remove the eleven dome nuts from each camshaft cover and lift off the covers.

Remove the four dome nuts securing the breather housing and withdraw the housing and gauze baffle. Release the tension on the camshaft chain by slackening the nut on the eccentric idler sprocket shaft, depressing the spring-loaded stop peg and rotating serrated adjuster plate clockwise. Anti-clockwise rotation of the serrated adjuster viewed from the front of the engine tightens the chain.

Break the locking wire on the two setscrews securing the camshaft sprockets to their respective camshafts.

Remove the setscrews and withdraw the sprockets from the camshafts with the chain in position. Having once disconnected the camshaft sprockets do NOT rotate the engine or camshafts.

Slacken the fourteen cylinder head dome nuts and six nuts securing the front of the cylinder head a part of a turn at a time in the order shown in Fig. 18 until

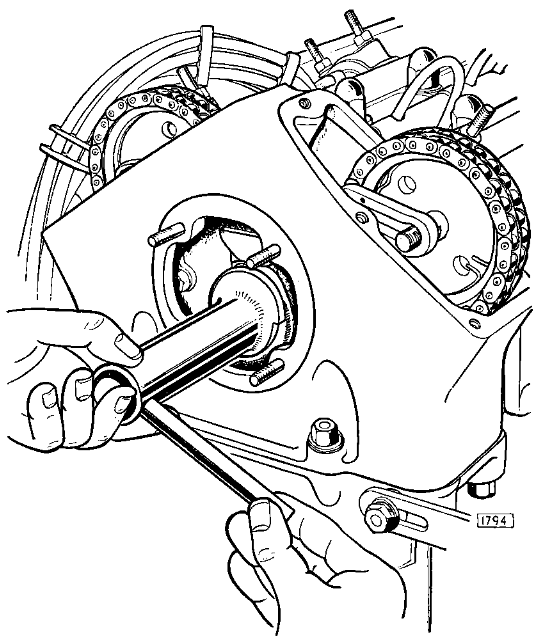


Fig. 12. Adjusting the top timing chain (Churchill Tool Number J.2)

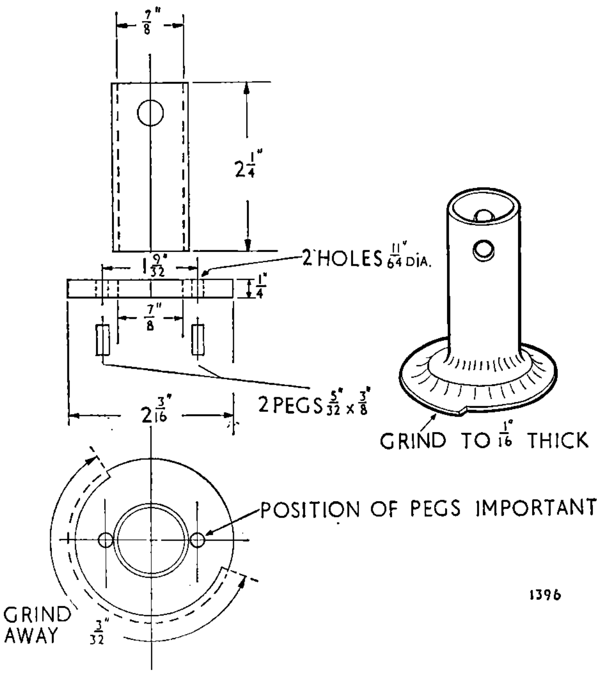


Fig. 13. The top timing chain adjusting tool

the nuts become free. Lift off the cylinder head complete with exhaust manifold and inlet manifolds. Remove and scrap the cylinder head gasket.

REMOVE CLUTCH AND FLYWHEEL

Unscrew the six setscrews securing the flange of the clutch cover to the flywheel and remove the clutch assembly. Note the balance marks "B" stamped on the clutch cover and on the edge of the flywheel.

Knock back the tabs of the locking plate securing the ten flywheel bolts. Unscrew the flywheel bolts and remove the locking plate. Remove the flywheel from the crankshaft flange by gently tapping with a rawhide mallet.

REMOVE CRANKSHAFT DAMPER

Knock back the tab washers and remove the two bolts securing the locking washer to the pulley.

Unscrew the large nut and remove the plain washer.

Insert two levers behind the damper and ease it off the split cone—a sharp tap on the end of the cone will assist removal.

REMOVE FAN

Remove the fan and fan pulley from the hub by unscrewing the four set screws fitted with shakeproof washers.

REMOVE WATER PUMP

Unscrew the bolts and three nuts, and remove the water pump from the timing cover. Note the gasket between the pump and timing cover.

REMOVE OIL FILTER

Detach the short length of flexible pipe between the oil filter head and the oil sump.

Unscrew the four bolts securing the oil filter head to the cylinder block and remove the filter head.

REMOVE SUMP

Drain the sump by removing the hexagon plug and washer from the right-hand side of the sump.

Remove the twenty-six setscrews securing the sump to the crankcase and the four nuts securing the sump to the timing cover. The sump can now be removed.

REMOVE OIL PUMP AND PIPES

Tap back the tab washers and unscrew the two bolts securing the oil feed pipe from the oil pump to the bottom face of the crankcase. Withdraw the pipe from the pump.

Remove the nut and bolt securing the oil pump inlet pipe clip to the bracket on the main bearing cap.

Remove the nut and bolt securing the oil pump inlet pipe clip in the bracket on the oil pump.

Withdraw the pipe from the pump.

Tap back the tab washers and unscrew the three bolts securing the oil pump to the front main bearing cap. The oil pump can now be withdrawn.

Remove the coupling shaft from the squared end of the distributor and oil pump drive shaft.

REMOVE PISTONS AND CONNECTING RODS

As the pistons will not pass the crankshaft it will be necessary to withdraw the pistons and connecting rods from the top.

Remove the split pins from the connecting rod bolt nuts and unscrew the nuts. Remove the connecting rod cap, noting that the corresponding cylinder numbers on the connecting rod and cap are together.

Withdraw the piston and connecting rod from the top of the cylinder block.

REMOVE TIMING COVER

Remove the two bolts securing the jockey pulley to the timing cover. Remove the remaining bolts securing the timing cover to the front face of the cylinder block. Remove the timing cover, noting that the cover is located to the cylinder block by two dowels.

REMOVE TIMING GEAR ASSEMBLY

When removing the bottom timing chain tensioner from the engine, remove the hexagon head plug and tab washer from the end of the body. Insert an Allen key into the hole until it registers in the end of the restraint cylinder. Turn the Allen key clockwise until the restraint cylinder can be felt to be fully retracted within the body. The adjuster head will then be free of the chain.

Knock back the tab washers on the two set bolts securing the chain tensioner to the cylinder block.

Withdraw the bolts and remove the tensioner together with the conical gauze filter fitted in the tensioner oil feed hole in the cylinder block, this should be cleaned in petrol.

Unscrew the four set bolts securing the front mounting bracket to the cylinder block. Release the tabs of the tab washers and remove the two screw-driver slotted setscrews from the rear mounting bracket; these setscrews also secure the intermediate timing chain damper bracket.

The timing gear can now be removed.

REMOVE DISTRIBUTOR DRIVE GEAR

Tap back the tab washer securing the distributor drive gear nut and remove the nut and washer. Tap the squared end of the distributor drive shaft through the gear, noting that the gear is keyed to the shaft. Remove the gear and thrust washer and withdraw the drive shaft.

REMOVE CRANKSHAFT

Knock back the tab washers securing the fourteen main bearing cap bolts. Unscrew the bolts and remove the main bearing caps, noting the corresponding numbers stamped on the caps and bottom face of crankcase and also the thrust washers fitted to the recesses in the centre main bearing caps.

Detach the bottom half of the crankshaft rear oil seal by unscrewing the two Allen screws. Note that the two halves are located by hollow dowels. The crankshaft may now be lifted out of the crankcase. When overhauling an engine it is advisable to replace the asbestos oil seal at the rear of the crankshaft. See Page B.35.

ENGINE TO ASSEMBLE

GENERAL

All references in this section to the top or bottom of the engine assume the engine to be upright, irrespective of the position of the unit when the reference is made. References to the left- or right-hand side assume the engine to be upright and looking from the rear.

FIT DISTRIBUTOR DRIVE SHAFT BUSH

If a new bush is to be fitted, press the bush into the bore of the lug at front of cylinder block.

Ream the bush in position to a diameter of

$$\tfrac{3}{4}'' \begin{smallmatrix} +\cdot00050'' \\ -\cdot00025'' \end{smallmatrix} \quad (19{\cdot}05 \text{ mm.} \begin{smallmatrix} +\cdot012 \text{ mm.} \\ -\cdot006 \text{ mm.} \end{smallmatrix})$$

FIT CRANKSHAFT

Fit the main bearing shells to the top half of the main line bore in the cylinder block. Lay the crank-shaft in the bearing shells. Fit the bottom half of the crankshaft rear oil seal to the top half which is bolted to the cylinder block behind the rear main bearing. The two halves are located by hollow dowels and secured with Allen screws. If the asbestos seal has been replaced, ensure that it has been well lubricated with colloidal graphite before fitting the crankshaft and lower half of the seal. The two halves of the oil seal housing are supplied only as an assembly together with the dowels and screws.

If the crankshaft rear asbestos seal has been replaced, ensure that the seal has been correctly sized and lubricated as detailed on page B.35 before fitting the crankshaft.

Fit the centre main bearing cap with a thrust washer, white metal side outward, to the recess in each side of cap. Tighten down the cap and check the crankshaft end float, which should be ·004″ to ·006″ (·10 to

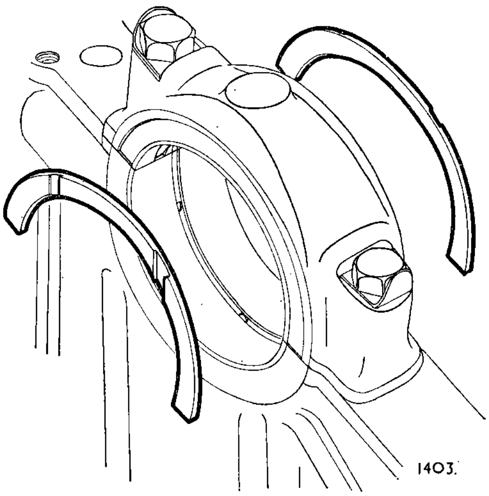


Fig. 14. The crankshaft thrust washers

·15 mm.). The thrust washers are supplied in two thicknesses, standard and ·004″ (·10 mm.) oversize and should be selected to bring the end float within permissible limits. The oversize thrust washers are stamped +·004″ (·10 mm.) on the steel face.

Fit the main bearing caps with the numbers stamped on the caps with the corresponding numbers stamped on the bottom face of the crankcase.

Fit the main bearing cap bolts and tab washers and tighten to a torque of 83 lb. ft. (11·5 kg. m.).

Test the crankshaft for free rotation.

The tab washers for the rear main bearing bolts are longer than the remainder and the plain ends should be tapped down around the bolt hole bosses.

FIT PISTONS AND CONNECTING RODS

Turn the engine on its side. Remove the connecting rod caps and fit the pistons and connecting rods to

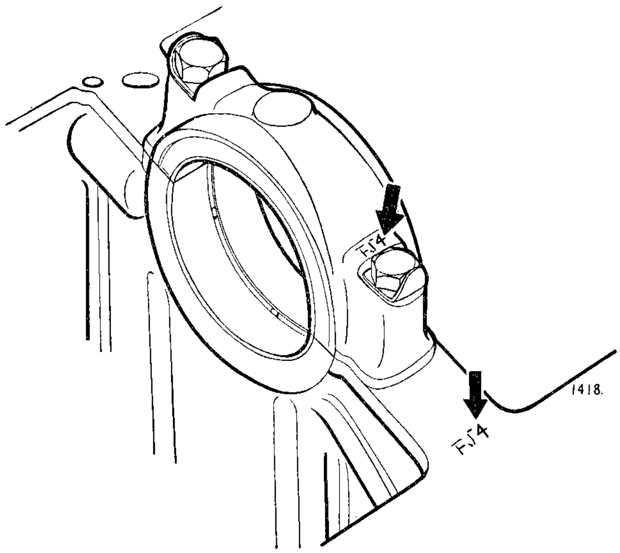


Fig. 15. Showing the corresponding numbers on the main bearing cap and the crankcase

their respective bores from the top of the cylinder block, using a suitable piston ring compressor (Churchill Tool No. 38 U3). The cylinder number is stamped on the connecting rod and cap, No. 1 cylinder being at the rear.

Note: Semi-split skirt pistons MUST be fitted with the split opposite the thrust side, that is, with the split on the left-hand or exhaust side of the engine. To facilitate correct fitting, the piston crowns are marked "Front."

Fit the connecting rod caps to the connecting rods with the corresponding numbers together. Fit the castellated nuts and tighten to a torque of 37 lb. ft. (5·1 kg. m.). Secure the nuts with split pins.

FIT CRANKSHAFT GEAR AND SPROCKET

Fit the Woodruff key to the inner slot and tap the distributor crankshaft gear into position with the widest part of the boss to the rear (see Fig. 27).

Fit the Woodruff key to the outer slot and tap the crankshaft timing gear sprocket into position. Fit the oil thrower and distance piece.

Turn the engine until Nos. 1 and 6 pistons are on T.D.C.

FIT DISTRIBUTOR AND OIL PUMP DRIVE GEAR

Ensure that the Woodruff key on the distributor drive shaft is in good condition and renew if necessary.

Place the drive shaft into position with the offset slot in the top of the shaft as shown in Fig. 16.

Withdraw the shaft slightly, maintaining the same slot position and place the thrust washer and drive gear on the end of the shaft. Press the shaft into the drive gear ensuring that the key engages the keyway correctly.

Fit the pegged tab washer with the peg in the keyway of the drive gear.

Fully tighten the nut and secure with the tab washer. Check the end float of the shaft which should be ·004″ to ·006″ (·10 to ·15 mm.).

If no clearance exists fit a new oil pump/distributor drive gear which will restore the clearance. In an emergency if a new drive gear is not available, the thrust washer may be reduced in thickness by rubbing down on a piece of emery cloth placed on a surface plate.

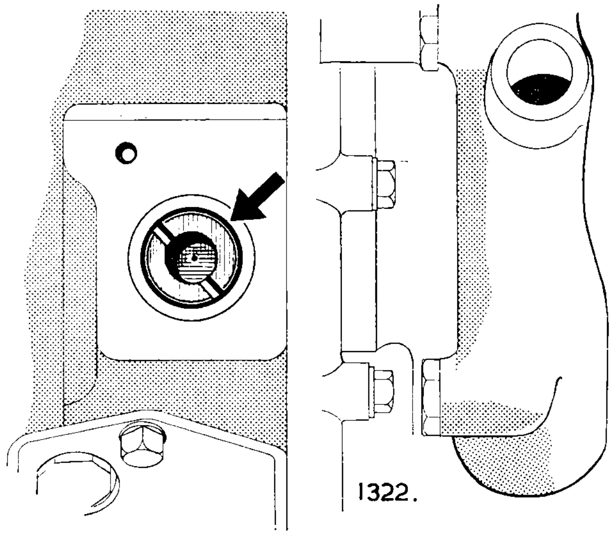


Fig. 16. Showing the position of the distributor drive shaft offset when Number 6 (front) piston is on Top Dead Centre

FIT OIL PUMP AND PIPES

Fit the coupling shaft between the squared end of the distributor drive shaft and the driving gear of the oil pump. Secure the oil pump to the front main bearing cap by the three dowel bolts and tab washers. Check that there is appreciable end-float of the short coupling shaft. Fit the oil delivery pipe from the oil pump to the bottom face of the crankcase with a new "O" ring and gasket. Fit the suction pipe with a new "O" ring at the oil pump end.

TO ASSEMBLE TIMING GEAR

Fit the eccentric shaft to the hole in the front mounting bracket. Insert the spring and locking plunger for the serrated plate to the hole in the front mounting bracket. Fit the serrated plate and secure with the shakeproof washer and nut. Fit the idler sprocket (21 teeth) to the eccentric shaft.

Fit the intermediate sprocket (20 and 28 teeth) to its shaft with the larger sprocket forward anp press the shaft through the lower central hole in the rear mounting bracket. Secure with the circlip at the rear of the bracket.

Fit the top timing chain (longer chain) to the small intermediate sprocket and the bottom timing chain (shorter chain) to the large intermediate sprocket.

Loop upper timing chain under the idler sprocket and offer up the front mounting bracket to the rear mounting bracket with the two chain dampers interposed between the brackets.

Fit the intermediate damper to the bottom of the rear mounting bracket with two screwdriver slotted setscrews and tab washers.

Pass the four securing bolts through the holes in the brackets, chain dampers and spacers noting that shakeproof washers are fitted under the bolt heads. Secure the two mounting brackets together with four stud nuts and shakeproof washers.

FIT TIMING GEAR

Turn the engine upside down. Fit the lower timing chain damper and bracket to the front face of the cylinder block with two set bolts and locking plate.

Turn the timing gear assembly upside down and offer it up to the cylinder block. Loop the bottom timing chain over the crankshaft sprocket and secure the mounting brackets to the front face of the cylinder block with the four long securing bolts and the two screwdriver slotted setscrews which also secure the intermediate timing chain damper bracket, but do not fully tighten these two setscrews until the four long securing bolts are tight.

TIMING CHAIN TENSIONER

Place the timing chain tensioner, backing plate and filter in position so that the spigot on the tensioner aligns with the hole in the cylinder block. Fit shims, as necessary, between the backing plate and cylinder block so that the timing chain runs centrally along the rubber slipper. Fit the tab washer and two securing bolts. Tighten the bolts and tap the tab washers against the bolt heads.

It is important that no attempt is made to release the locking mechanism until the adjuster has been finally mounted in the engine WITH THE TIMING CHAIN IN POSITION.

Remove the hexagon head plug and tab washer from the end of the body. Insert the Allen key into the hole until it registers in the end of the restraint cylinder. Turn the key clockwise until the tensioner head moves forward under spring pressure against the chain. Do not attempt to turn the key anti-clockwise, nor force the tensioner head into the chain by external pressure.

Refit the plug and secure with the tab washer.

FIT TIMING COVER

Fit the circular oil seal to the recess in the bottom face of timing cover, ensuring that seal is well bedded in its groove.

Fit the timing cover gasket with good quality jointing compound and secure the timing cover to the front face of the timing cover with the securing bolts noting that the jockey pulley is attached to the right-hand side of the timing cover by two of the securing bolts (see Fig. 7).

FIT OIL SUMP

Fit a new sump gasket to the bottom face of the crankcase. Fit the cork seal to the recess in the rear main bearing cap.

Fit the sump to the crankcase and secure with the twenty-six setscrews, four nuts and washers.

Note: The short setscrew must be fitted to the right-hand front corner of the sump (Fig. 41).

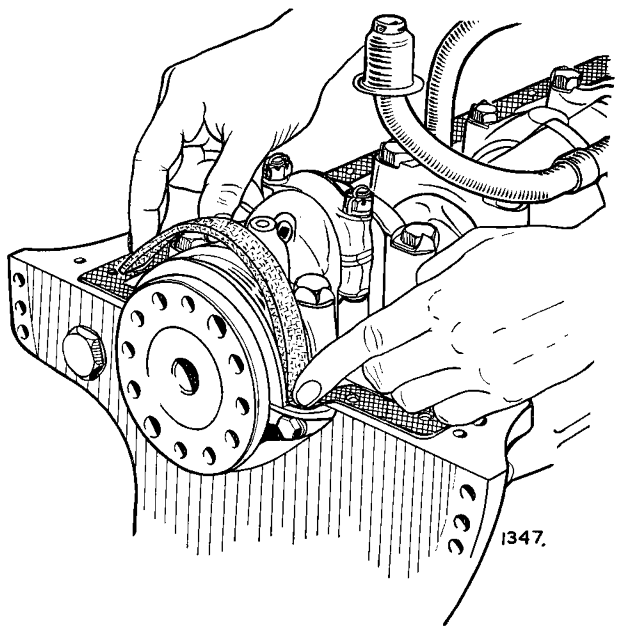


Fig. 17. Fitting the sump rear oil seal

FIT FLYWHEEL AND CLUTCH

Turn the engine upright.

Check that the crankshaft flange and the holes for the flywheel bolts and dowels are free from burrs.

Turn the engine until Nos. 1 and 6 pistons are on T.D.C. and fit the flywheel to the crankshaft flange so that the "B" stamped on the edge of the flywheel is at approximately the B.D.C. position. (This will ensure that the balance mark "B" on the flywheel is in line with the balance mark on the crankshaft which is a group of letters stamped on the crank throw just forward of the rear main journal).

Tap the two mushroom-headed dowels into position, fit the locking plate and flywheel securing setscrews. Tighten the setscrews to a torque of 67 lb. ft. (9·2 kg. m.) and secure with the locking plate tabs. Assemble the clutch driven plate to the flywheel, noting that one side of the plate is marked "Flywheel Side." Centralise the driven plate by means of a dummy shaft which fits the splined bore of the driven plate and the spigot bush in the crankshaft. (A constant pinion shaft may be used for this purpose). Fit the clutch cover assembly so that the "B" stamped adjacent to one of the dowel holes coincides with the "B" stamped on the periphery of the flywheel. Secure the clutch assembly with the six setscrews and spring washers, tightening the screws a turn at a time by diagonal selection. Remove the dummy shaft.

FIT CYLINDER HEAD

Before refitting the cylinder head it is important to observe that if the camshafts are out of phase with piston position fouling may take place between the valves and pistons. It is, therefore, essential to adhere to the following procedure before fitting the cylinder head:—

Check that the grooves in the front flanges of the camshafts are vertical to the camshaft housing face and accurately position by engaging the valve timing gauge. If it is found necessary to rotate one of the camshafts the other camshaft must either be removed or the bearing cap nuts slackened to their fullest extent to allow the valves to be released.

Turn No. 6 (front) piston to the top dead centre. The distributor drive shaft offset will be positioned as shown in Fig. 16.

Do NOT rotate the engine or camshafts until the camshaft sprockets have been connected to the camshafts. Fit the two camshaft sprockets complete with adjuster plates and circlips to the top timing chain

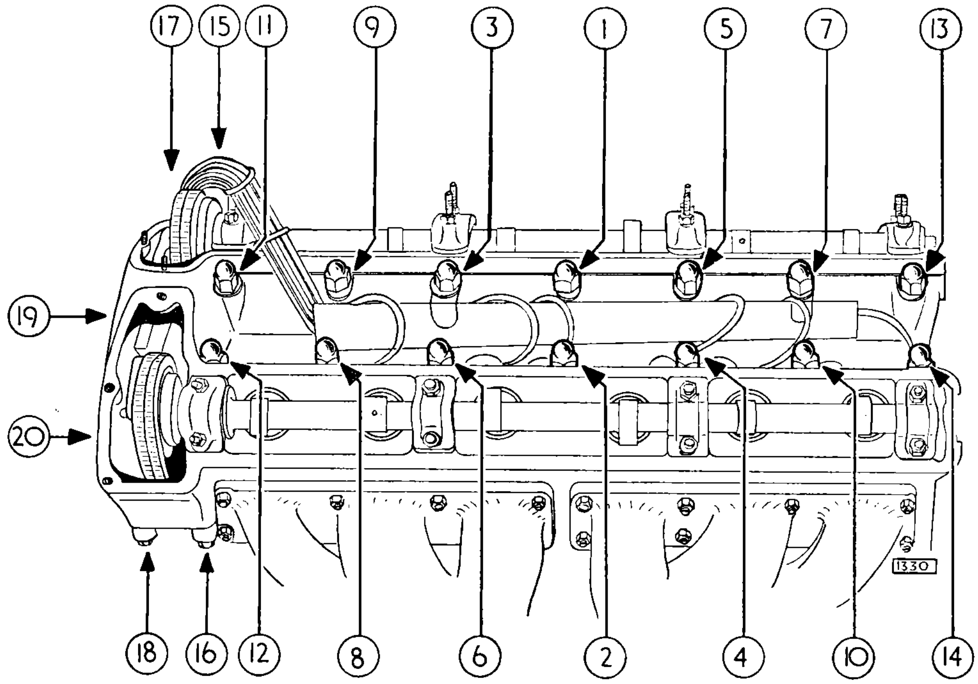


Fig. 18. Tightening sequence for the cylinder head nuts

and enter the guide pins in the slots in the front mounting bracket.

Fit the cylinder head gasket, taking care that the side marked "Top" is uppermost. Fit the cylinder head complete with manifolds to the cylinder block. Note that the second cylinder head stud from the front on the left-hand side is a dowel stud.

Fit the sparking plug lead carrier to the 3rd and 6th stud on the right-hand side. Fit plain washers to these and the two front stud positions and "D" washers to the remaining studs. Tighten the fourteen large cylinder head dome nuts a part of a turn at a time to a torque cf 54 lb. ft. (7·5 kg. m.) in the order shown in Fig. 18. Also tighten the six nuts securing the front end of the cylinder head.

VALVE TIMING

Check that the No. 6 (front) piston is exactly in the T.D.C. position.

Through the breather aperture in the front of the cylinder head slacken the lock nut securing the serrated plate.

With the camshaft sprocket on the flanges of the camshafts, tension chain by pressing locking plunger inwards and rotating serrated plate by the two holes in an anti-clockwise direction.

When correctly tensioned there should be slight flexibility on both outer sides of the chain below the camshaft sprockets, that is the chain musc not be dead tight. Release the locking plunger and securely tighten the locknut. Tap the camshaft sprockets off the flanges of the camshafts.

Accurately position the camshaft with the valve timing gauge, and check that the T.D.C. marks are in exact alignment.

Withdraw the circlips retaining the adjusting plates to the camshaft sprockets and pull the adjusting plates forward until the serrations disengage. Replace the sprockets on to the flanges of camshafts and align the two holes in the adjuster plate with the two tapped holes in each camshaft flange. Engage the serrations of the adjuster plates with the serrations in the sprockets.

Note: It is most important that the holes are in exact alignment, otherwise when the setscrews are fitted the camshafts will be moved out of position. If difficulty is experienced in aligning the holes exactly, the adjuster plates should be turned through 180°, which, due to the construction of the plate, will facilitate alignment.

Fit the circlips to the sprockets and one setscrew to the accessible hole in each adjuster plate. Turn the engine until the other two holes are accessible and fit the two remaining setscrews.

Finally, recheck the timing chain tension and timing in this order. Secure the four setscrews retaining the camshaft sprockets with new lock wire.

FIT CYLINDER HEAD OIL FEED PIPE AND OIL FILTER

Fit the cylinder head oil feed pipe from the tapped hole in the main oil gallery to the two tapped holes in the rear of the cylinder head. Secure the pipe with the three banjo bolts with a copper washer fitted to both sides of each banjo.

Fit the oil filter head to the cylinder block with the four bolts and copper washers. New gasket(s) must always be fitted between the filter and cylinder block.

Fit the short length of flexible hose between the oil filter head and the oil sump and tighten two hose clips.

FIT CRANKSHAFT DAMPER AND PULLEY

Fit a Woodruff key to the crankshaft and the split cone. Fit the split cone to the crankshaft with the widest end towards the timing cover. Fit the damper to the cone and secure with the flat washer, (chamfered side outwards) and large bolt.

FIT WATER PUMP

Fit the water pump to the timing cover with a new gasket and secure with six bolts, three nuts and spring washers. Note that the dynamo link is attached to the water pump by one of the securing bolts.

FIT DYNAMO AND FAN BELT

Place the dynamo in position on the mounting bracket and fit the two bolts and self-locking nuts. Attach the dynamo link to the water pump but leave the securing bolts at both ends of the link slack. Press both the dynamo and jockey pulley towards the engine and fit the fan belt. Pull the dynamo away from the engine as far as possible and tighten the securing bolts at either end of the dynamo link. Secure the top dynamo bolt with the self-locking nut and tighten the two lower mounting bolts.

FIT DISTRIBUTOR AND SPARKING PLUGS

Fit the cork seal to the recess at the top of the hole for the distributor. Secure the distributor clamping plate to the cylinder block with the setscrew. Slacken the clamping plate bolt.

Set the micrometer adjustment in the centre of the scale.

Enter the distributor into the cylinder block with the vacuum advance unit connection facing the cylinder block.

Rotate the rotor-arm until the driving dog engages with the distributor drive shaft.

Rotate the engine until the rotor-arm approaches the No. 6 (front) cylinder segment in the distributor cap. (Fig. 19).

Slowly rotate the engine until the ignition timing scale on the crankshaft damper is the appropriate number of degrees before the pointer on the sump.

Slowly rotate the distributor body until the points are just breaking.

Tighten the distributor plate pinch bolt.

A maximum of six clicks on the vernier adjustment from this setting, to either advance or retard, is allowed.

Fit the vacuum advance pipe from the distributor to the union on the front carburetter.

Fit the distributor cover and secure with the two spring clips. Fit the sparking plugs with new washers and attach the high tension leads.

HIGH TENSION LEAD RENEWAL

If it is necessary to renew the high tension leads the following procedure should be followed:—

Remove the plug terminals and withdraw the leads from the conduit.

Remove the distributor cap terminals and the five spacing washers.

Cut the new high tension leads to suitable length.

Fit the leads to the conduit, No. 1 lead emerges from the rear of the conduit and the other leads from holes along the conduit.

Fit the plug terminals.

Fit the two thick fibre washers, arranging the leads in the firing order (1, 5, 3, 6, 2, 4) in an anti-clockwise order, as the leads will enter the distributor cap.

Fit the three thin fibre spacers and place them equally along the leads.

Fit the distributor cap terminals.

FIT CAMSHAFT COVERS

Fit each camshaft cover to the cylinder head using a new gasket. Fit the eleven copper washers and dome nuts to the cover retaining studs but do not tighten fully.

Fit the revolution counter generator and flanged plug to the rear of right-hand and left-hand camshaft covers respectively with the rubber sealing rings seated in the recesses provided. Secure the generator and sealing plug with the setscrews and copper washers. Tighten fully the dome nuts securing the camshaft covers.

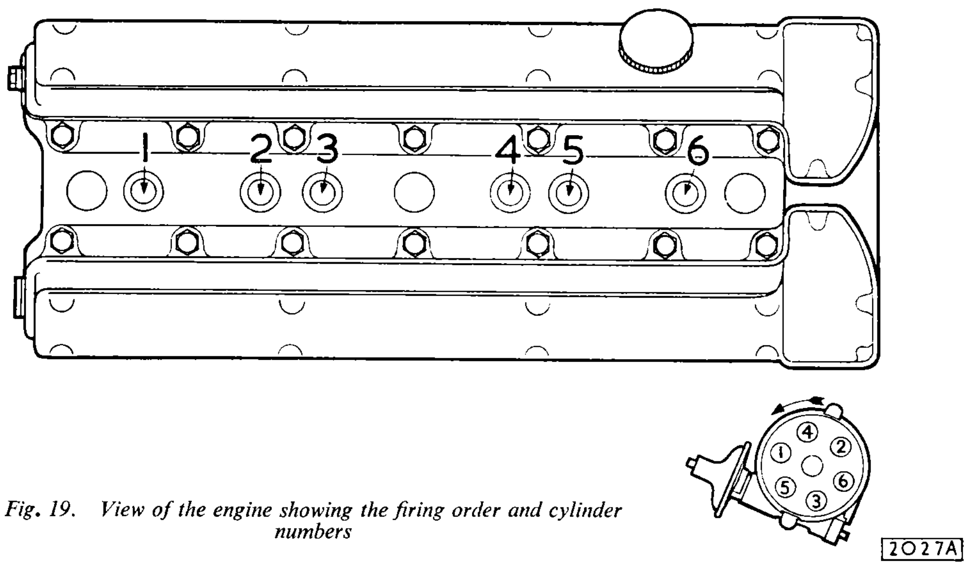


Fig. 19. View of the engine showing the firing order and cylinder numbers

FIT STARTER

Fit the starter motor to the clutch housing and secure with the horseshoe bracket, two nuts and spring washers.

FIT GEARBOX

Fit the gearbox and clutch housing to the rear of the crankcase with the setscrews and shakeproof washers.

Fit the support brackets to each side, at the bottom face of the crankcase with two bolts, nuts and spring washers, and to the clutch housing with three bolts, nuts and shakeproof washers.

DECARBONISING AND GRINDING VALVES

REMOVE CYLINDER HEAD

Remove the cylinder head as described on page B.42.

REMOVE VALVES

With the cylinder head on the bench remove the inlet manifold, and the revolution counter generator.

Remove the four bearing caps from each camshaft and lift out the camshaft (note mating marks on each bearing cap).

Remove the twelve tappets, and the adjusting pads situated between tappets and valve stems. Lay out the tappets and pads in order, to ensure that they can be replaced in their original guides.

Obtain a block of wood the approximate size of the combustion chambers and place this under the valve heads in No. 1 cylinder combustion chamber. Press down the valve collars and extract the split cotters. Remove the collars, valve springs and spring seats. Repeat for the remaining five cylinders. Valves are numbered and must be replaced in their original locations, No. 1 cylinder being at the rear, that is the flywheel end.

DECARBONISE AND GRIND VALVES

Remove all traces of carbon deposits from the combustion chambers and the induction and exhaust ports. The cylinder head is of aluminium alloy and great care should be exercised not to damage this with scrapers or sharp pointed tools. Use worn emery cloth and paraffin only. Thoroughly clean the water passages in the cylinder head. Clean the carbon deposits from the piston crowns and ensure that the top face of the cylinder block is quite clean particularly round the cylinder head studs. Remove any pitting in the valve seats, using valve seat grinding equipment. Reface the valves if necessary using valve grinding equipment; grind the valves to the seats, using a suction valve grinding tool.

Clean the sparking plugs and set gaps; if possible use approved plug cleaning and testing equipment. Clean and adjust the distributor contact breaker points.

VALVE CLEARANCE ADJUSTMENT

Thoroughly clean all traces of valve grinding compound from the cylinder head and valve gear. Assemble the valves to the cylinder head. **When checking the valve clearances the camshafts must be fitted one at a time. If one camshaft is rotated when the other camshaft is in position, fouling is likely to take place between the inlet and exhaust valves. Obtain and record all valve clearances by using a feeler gauge between the back of each cam and the appropriate valve tappet.**

Correct valve clearances are:—

Normal Touring Use

Inlet	·004″ (·10 mm.).
Exhaust	·006″ (·15 mm.).

Adjusting pads are available rising in ·001″ (·03 mm.) sizes from ·085″ to ·110″ (2·16 to 2·79 mm.) and are etched on the surface with the letter "A" to "Z", each letter indicating an increase in size of ·001″ (·03 mm.). Should any valve clearance require correction, remove the camshaft, tappet and adjusting pad. Observe the letter etched on the existing adjusting pad if visible. If the letter is not visible measure the pad with a micrometer, and should the recorded clearance for this valve have shown say ·002″ (·05 mm.) excessive clearance, select a new adjusting pad bearing a letter two lower than the original pad.

As an example, assume that No. 1 inlet valve clearance is tested and recorded as ·007″ (·18 mm.). On removal of the adjusting pad, if this is etched with the letter "D" then substitution with a pad bearing the letter "G" will correct the clearance for No. 1 inlet valve.

When fitting the camshafts prior to fitting the cylinder head to the engine it is most important that the keyway in the front bearing flange of each camshaft is perpendicular (at 90°) to the adjacent camshaft cover face (using valve timing gauge) before tightening down the camshaft bearing cap nuts.

Tighten the camshaft bearing cap nuts to a torque of 15 lb. ft. (2·0 kg. m.).

REFIT CYLINDER HEAD

Before attempting to refit the cylinder head refer to the instructions given on page B.42.

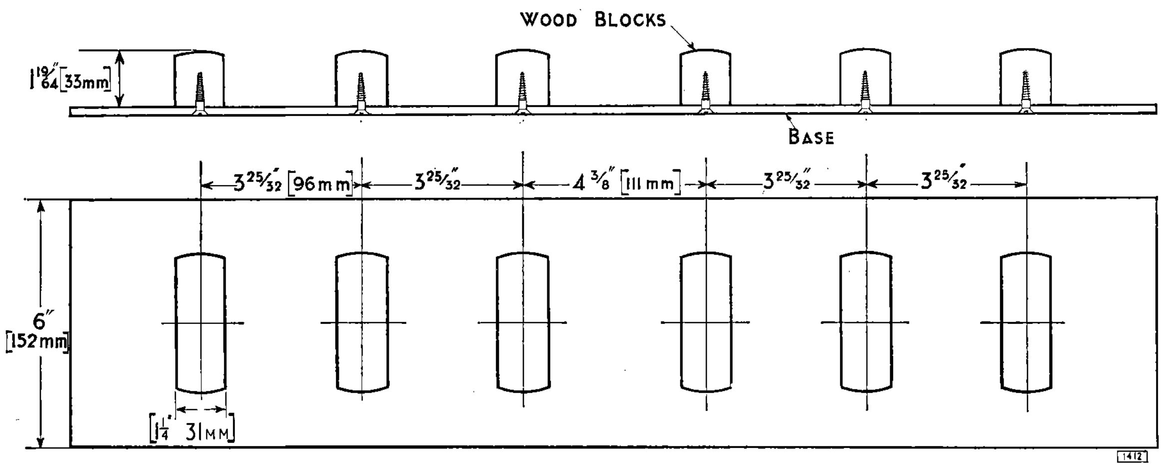


Fig. 20. Combustion chamber blocks for valve removal

COMPRESSION PRESSURES

The compression pressures for all the six cylinders should be even and should approximate to the figures given below.

If one or more compressions are weak it will most probably be due to poor valve seatings when the cylinder head must be removed and the valves and valve seats refaced and reground.

COMPRESSION PRESSURES

7 to 1 compression ratio:	125 lb. per sq. in. (8·79 kg./cm.^{2})
8 to 1 compression ratio:	155 lb. per sq. in. (10·90 kg./cm.^{2})
9 to 1 compression ratio:	180 lb. per sq. in. (12·65 kg./cm.^{2}).

Pressures must be taken with all the sparking plugs removed, carburetter throttles wide open and the engine at its normal operating temperature (70°C approximately).

Note: When taking compression pressures ensure that the ignition switch is "off"; rotate the engine by operating the push button on the starter solenoid. On cars fitted with automatic transmission it will be necessary to remove the rubber cap and the brass cover from the solenoid switch before the manual button can be operated. It is **important** that the cover and cap are replaced when all pressures have been checked.

THE CONNECTING ROD AND BEARINGS

The connecting rods are steel stampings and are provided with precision shell big-end bearings and steel backed phosphor-bronze small end bushes. A longitudinal drilling through the connecting rod provides an oil feed from the big end to the small end bush.

REMOVAL

As the pistons will not pass the crankshaft it will be necessary to withdraw the pistons and connecting rods from the top.

Proceed as follows:—

Remove Cylinder Head

Remove the cylinder head as described on page B.42.

Remove Sump

Remove the sump as described on page B.51.

Remove Piston and Connecting Rod

Remove the split pins from the connecting rod bolt nuts and unscrew the nuts. Remove the connecting rod cap, noting that the corresponding cylinder numbers on the connecting rod and cap are on the same side. Remove the connecting rod bolts and withdraw the piston and connecting rod from the top of the cylinder block.

OVERHAUL

If connecting rods have been in use for a very high mileage, or if bearing failure has been experienced, it is desirable to renew the rod(s) owing to the possibility of fatigue.

The connecting rods fitted to an engine should not vary one with another by more than 2 drams (3·5 grammes). The alignment should be checked on an approved connecting rod alignment jig. Correct any misalignment as necessary. The big end bearings are of the precision shell type and under no circumstances should they be hand scraped or the bearing caps filed.

The small ends are fitted with steel-backed phosphor-bronze bushes which are a press fit in the connecting rod. After fitting, the bush should be reamed or honed to a diameter of ·875″ to ·8752″ (22·225 to 22·23 mm.). Always use new connecting bolts and nuts at overhauls.

When a new connecting rod is to be fitted, although the small end bush is reamed to the correct dimensions, it may be necessary to hone the bush to achieve the correct gudgeon pin fit.

REFITTING

Refitting is the reverse of the removal procedure. Pistons and connecting rods must be fitted to their respective cylinders (pistons and connecting rods are stamped with their cylinder number, No. 1 being at the rear) and the same way round in the bore.

The pistons must always be fitted with split on the left-hand or exhaust side of the engine. To facilitate correct fitting the piston crowns are marked "Front," see Fig. 43.

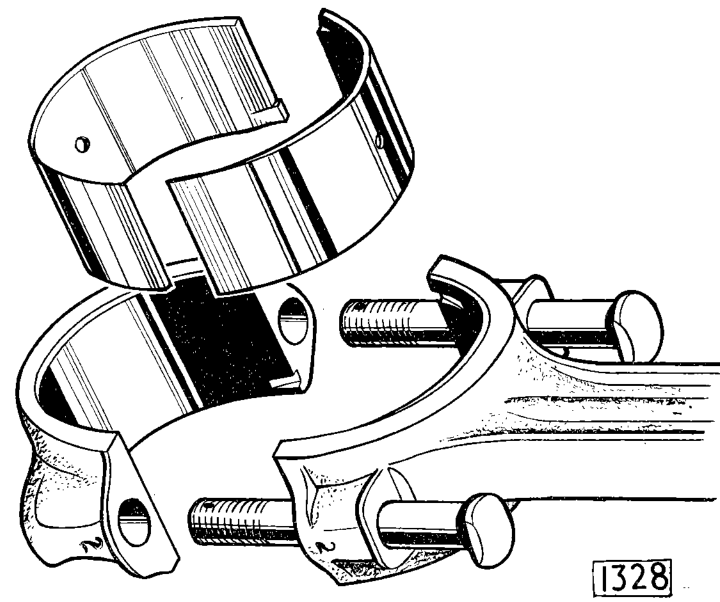


Fig. 21. The connecting rod and cap are stamped with the cylinder number

The cap must be fitted to the connecting rod so that the cylinder numbers stamped on each part are on the same side.

Tighten the connecting rod nuts to a torque of 37 lb. ft. (5·1 kg. m.).

BIG-END BEARING REPLACEMENT

The big-end bearings can be replaced without removing the engine from the car but before fitting the new bearings the crankpin must be examined for damage or for the transfer of bearing metal. The oilway in the crankshaft must also be tested for blockage.

Remove the sump as described on page 51.

Turn the engine until the big-end is approximately at the bottom dead centre position.

Remove the split pins from the connecting rod bolt nuts and unscrew the nuts. Remove the connecting rod cap, noting that the corresponding cylinder numbers on the connecting rod and cap are on the same side.

Lift the connecting rod off the crankpin and detach the bearing shell.

If all the big-end bearings are to be replaced they are most easily replaced in pairs, that is, in pairs of connecting rods having corresponding crank throws.

THE CAMSHAFTS

The camshafts are manufactured of cast iron and each shaft is supported in four white metal steel backed bearings. End float is taken on the flanges formed at each side of the front bearing. Oil is fed from the main oil gallery to the camshaft rear bearing housings through an external pipe. Oil then passes through the rear bearing into a longitudinal drilling in the camshaft; cross drillings which break into this oilway feed the three remaining bearings.

Warning: Before carrying out any work on the camshafts the following points must be observed to avoid possible fouling between (a) the inlet and exhaust valves and (b) the valves and pistons.

1. Do NOT rotate the engine or the camshafts with the camshafts sprockets disconnected. If, with the cylinder head removed from the engine, it is required to rotate a camshaft, the other camshaft must either be removed or the bearing cap nuts slackened to their fullest extent to allow the valves to be released.

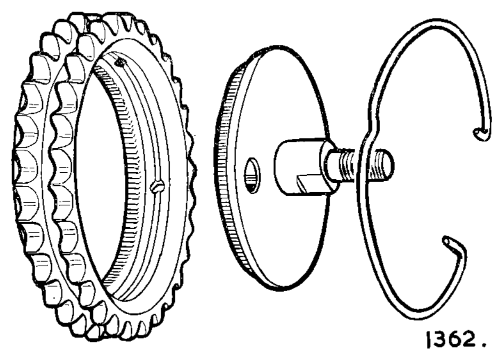


Fig. 22. Exploded view of the camshaft sprocket assembly

2. When fitting the camshafts to the cylinder head ensure that keyway in the front bearing flange of each camshaft is perpendicular (at 90°) to the adjacent camshaft cover face (use the valve timing gauge) before tightening down the camshaft bearing cap nuts.

   If this operation is being carried out with the cylinder head fitted to the engine, rotate the engine until No. 6 (front) piston is on Top Dead Centre in the firing position, that is with the distributor rotor opposite No. 6 cylinder segment, before fitting the camshafts.

REMOVAL

Remove the eleven dome nuts and copper washers securing each camshaft cover and lift off the cover.

Unscrew the three Allen setscrews attaching the revolution counter generator to the right-hand side of the cylinder head and the sealing plug from the left-hand side (note the copper washers under the heads of the setscrews). Remove the circular rubber sealing rings.

Break the wire locking the camshaft adjuster plate setscrews.

Rotate the engine until No. 6 (front) piston is approximately on Top Dead Centre on compression stroke (firing position), that is, when the keyway in the front bearing flange of each camshaft is at 90° to the adjacent cover face (see Fig. 23).

Note the positions of the **inaccessible** adjuster plate setscrews and rotate the engine until they can be removed.

Turn back the engine to the T.D.C. position with No. 6 firing and remove the two remaining setscrews.

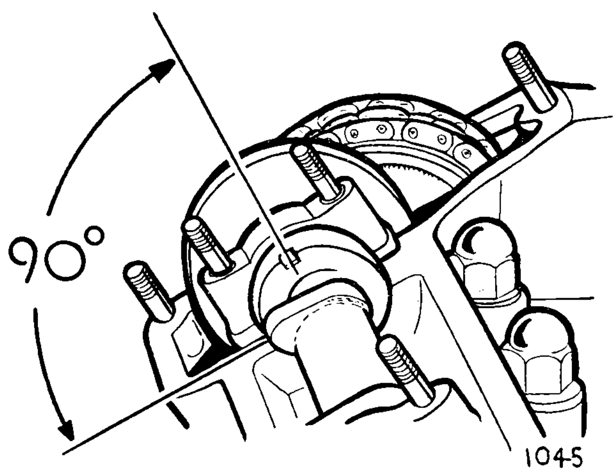


Fig. 23. When fitting a camshaft the keyway must be at 90° to the camshaft cover face

Tap the sprockets off their respective camshaft flanges. Release the eight nuts securing the bearing caps a turn at a time. Remove the nuts, spring washers and "D" washers from the bearing studs.

Remove the bearing caps, noting that the caps and cylinder head are marked with corresponding numbers. Also note that the bearing caps are located to the lower bearing housings with hollow dowels.

If the same bearing shells are to be replaced they should be refitted to their original positions.

The camshaft can now be lifted out from the cylinder head.

REFITTING

Check that No. 6 (front) piston is exactly on T.D.C. on the compression stroke (firing position), that is, with the distributor rotor opposite No. 6 cylinder segment. (Fig. 19).

Replace the shell bearings—in their original positions if the same bearings are being refitted.

Replace each camshaft with the keyways in the front bearing flange at 90° to the adjacent cover face (using the valve timing gauge).

Refit the bearing caps to their respective positions and the "D" washers, spring washers and nuts.

Tighten down the bearing caps evenly a turn at a time. Finally tighten the nuts to a torque of 15 lbs. ft. (2·0 kg. m.).

Set the valve timing as described on page B.64.

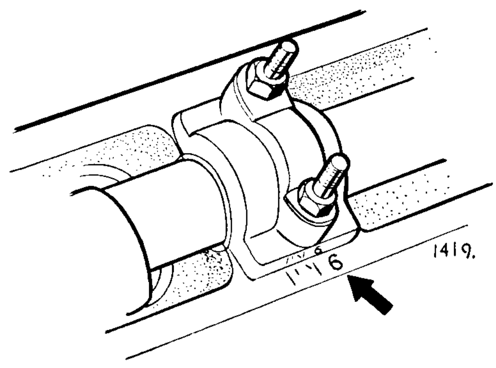


Fig. 24. Showing the corresponding numbers on the bearing cap and cylinder head

OVERHAUL

It is unlikely, except after very high mileages, to find wear in the camshafts and camshaft bearings. The camshaft bearings are of the precision shell type and under no circumstances should these be hand scraped or the bearing caps filed. Undersize bearings are **not** supplied.

THE CRANKSHAFT

The counterbalanced crankshaft is of manganese molybdenum steel and is supported in seven precision shell bearings. End thrust of the crankshaft is taken on two semi-circular white metal faced steel thrust washers fitted in recesses in the centre main bearing cap. A torsional vibration damper is fitted at the front end of the crankshaft.

Initially, the crankshaft is itself balanced both statically and dynamically and is then re-balanced as an assembly with the flywheel and clutch unit attached.

REMOVAL

Proceed as detailed under "Engine—To Dismantle" on page B.21.

OVERHAUL

Regrinding of the crankshaft journals is generally recommended when wear or ovality in excess of ·003″ (·08 mm.) is found. Factory reconditioned crankshafts are available on an exchange basis, subject to the existing crankshaft being fit for satisfactory reconditioning, with undersize main and big end bearings —·010″ (·25 mm.), —·020″ (·51 mm.), —·030″ (·76 mm.), and —·040″ (1·02 mm.).

Grinding beyond the limits of ·040″ (1·02 mm.) is not recommended and under such circumstances a new crankshaft should be obtained.

New crankshaft thrust washers should be fitted, these being in two halves located in recesses in the centre main bearing cap. Fit the main bearing cap with a thrust washer, white metal side outwards, to the recess in each side of cap. Tighten down the cap and check the crankshaft end float, which should be ·004″ to ·006″ (·10 to ·15 mm.). The thrust washers are supplied in two thicknesses, standard and ·004″ (·10 mm.) oversize and should be selected to bring the end float within the required limits. It is permissible to fit a standard size thrust washer to one side of the main bearing cap and an oversize washer to the other. Oversize thrust washers are stamped ·004″ on the steel face.

Ensure that the oil passages in the crankshaft are clear and perfectly clean before re-assembling. If the original crankshaft is to be refitted remove the Allen headed plugs in the webs (which are secured by staking) and thoroughly clean out any accumulated sludge with a high pressure jet followed by blowing out with compressed air.

After refitting the plugs, secure by staking with a blunt chisel.

REFITTING

Proceed as detailed under "Engine—To Assemble" on page B.23.

CRANKSHAFT REAR OIL SEAL

The crankshaft rear oil seal consists of a cast iron housing in two halves and an asbestos seal also in two halves, fitted to the housing. The two halves of the housing are located by hollow dowels and secured by Allen screws. The top half of the housing is secured to the cylinder block by three Allen screws and is located by two hollow dowels.

REMOVAL

Having removed the lower half of the oil seal and the crankshaft as described on page B.34 "Crankshaft Removal," remove the three Allen screws securing the upper half to the oil seal noting the hollow locating dowels at the two outer holes.

Prise out the asbestos seal from its groove and discard it.

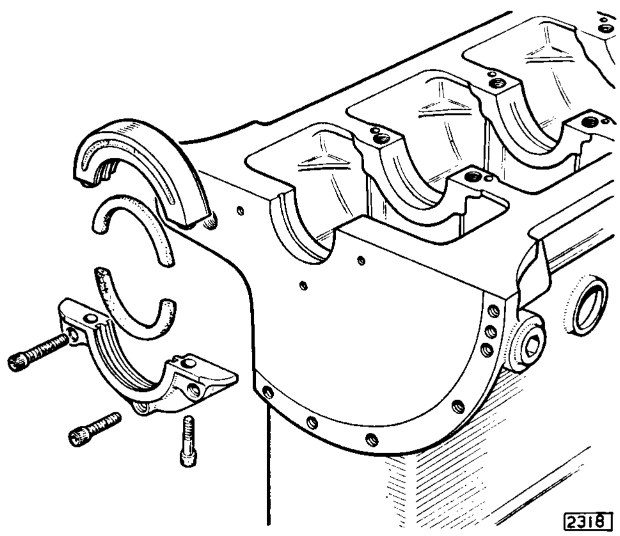


Fig. 25. Exploded view of the crankshaft rear oil seal

REPLACING THE SEAL

Take the new asbestos seals and carefully tap them on the side face to narrow the section of the seal. Fit the seals to the housing and press into the groove using a hammer handle until the seal does not protrude from the ends of the housing. Do NOT cut the ends off the seal if they protrude from the housing but continue pressing the seal into the groove until both ends are flush. Using a knife or similar tool, press all loose ends of asbestos into the ends of the groove so that they will not be trapped between the two halves of the housing when assembled.

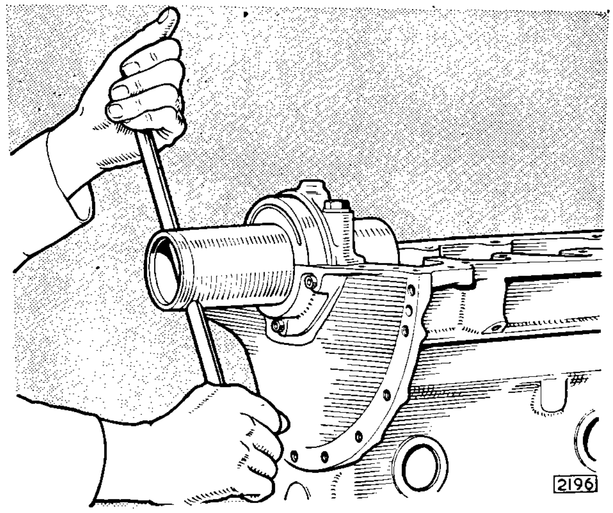


Fig. 26. Sizing the rear oil seal using the special tool (Churchill Tool Number J.17.)

REFITTING

Assemble the two halves of the rear seal and secure with the two Allen screws. Fit the rear main bearing cap to the block without the bearings and tighten to a torque of 83 lb. ft. (11·5 kg. m.). Fit the seal and housing to the cylinder block and secure with the three Allen screws. Smear a small quantity of colloidal graphite around the inner surface of the asbestos seal and insert the sizing bar (Churchill Tool No. J.17). Ensure that the pilot end of the sizing bar enters the bore of the rear main bearing then press the bar inwards and rotate at the same time until the bar is fully home. Remove the bar by pulling and twisting at the same time. Remove the three Allen screws securing the oil seal housing to the cylinder block and remove the Allen screws securing the two halves of the seal. Separate the two halves of the seal and remove the rear main bearing. The crankshaft may now be refitted as described on page B.34.

CRANKSHAFT DAMPER AND PULLEY

A torsional vibration damper is fitted at the front end of the crankshaft.

The damper consists of a malleable iron ring bonded to a thick rubber disc. An inner member also bonded to the disc is attached to a hub which is keyed to a split cone on the front extension of the crankshaft.

The crankshaft damper and pulley are balanced as an assembly, mark each part before dismantling so that they can be refitted in their original positions.

REMOVAL

It will be necessary to remove the crankshaft damper from beneath the car.

Remove the fan belt by slackening the dynamo and moving it towards the engine and pressing the jockey pulley towards the engine.

Remove the locking washer securing the damper bolt by knocking back the tabs and unscrewing the two setscrews. Remove the other two setscrews securing the crankshaft pulley to the damper and remove the pulley.

Unscrew the large damper securing bolt and remove the flat washer.

Insert two levers behind the damper and ease it off the split cone—a sharp tap on the end of the cone will assist removal.

OVERHAUL

Examine the rubber portion of the damper for signs of deterioration and if necessary fit a new one. Also examine the crankshaft pulley for signs of wear and renew if necessary. The drive should be taken on the "V" faces of the pulley; renew the pulley if a new fan belt bottoms in the "V" groove.

REFITTING

Refitting is the reverse of the removal procedure.

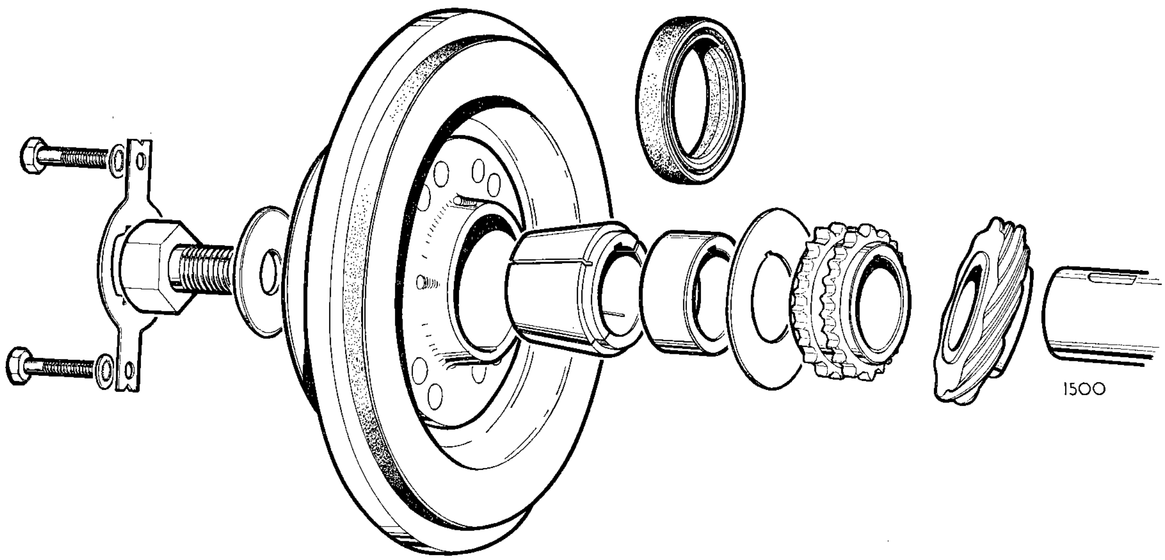


Fig. 27. The crankshaft damper and components

THE CYLINDER BLOCK

The cylinder block is of chromium iron and is integral with the crankcase. The main bearing housings are line bored and the caps are not interchangeable, corresponding numbers being stamped on the caps and the bottom face of the crankcase for identification purposes. Pressed in dry liners are fitted.

OVERHAUL

Check the top face of the cylinder block for truth. Check that the main bearing caps have not been filed and that the bores for the main bearings are in alignment. If the caps have been filed or if there is misalignment of the bearing housings the caps must be re-machined and the bearing housings line bored.

After removal of the cylinder head studs prior to reboring, check the area around the stud holes for flatness. When the edges of the stud holes are found to be raised they must be skimmed flush with the surrounding joint face, to ensure a dead flat surface on which to mount the boring equipment.

Reboring is normally recommended when the bore wear exceeds ·006″ (·15 mm.). Reboring beyond the limit of ·030″ (·76 mm.) is not recommended and when the bores will not clean out at ·030″ (·76 mm.), new liners and standard size pistons should be fitted.

The worn liners must be pressed out from below utilizing the illustrated stepped block.

Before fitting the new liner, lightly smear the cylinder walls with jointing compound to a point half way down the bore and also smear the top outer surface of the liner.

Press the new liners in from the top and lightly skim the tops of the liners flush with the top face of the cylinder block.

Bore out and hone the liners to suit the grade (or grades) of pistons to be fitted. (See piston grades on page B.53).

The following oversize pistons are available: +·010″ (·25 mm.), +·020″ (·51 mm.) and +·030″ (·76 mm.).

Following reboring the blanking plugs in the main oil gallery should be removed and the cylinder block oilways and the crankcase interior thoroughly cleaned. After cleaning, paint the crankcase interior with heat and oil resisting paint.

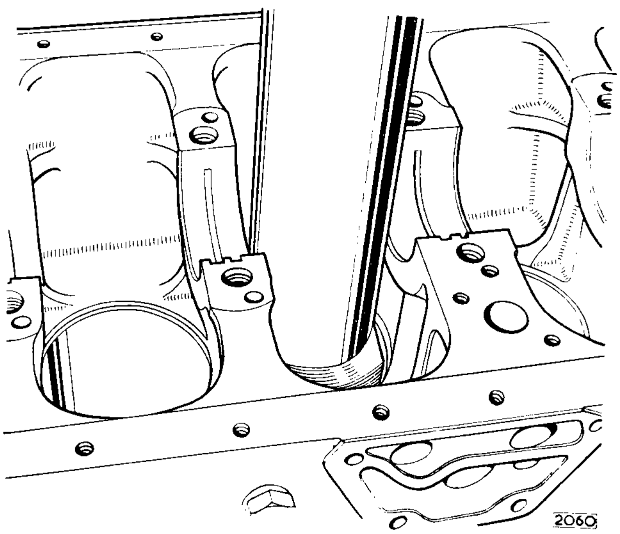


Fig. 28. Pressing out a cylinder liner using a stepped block

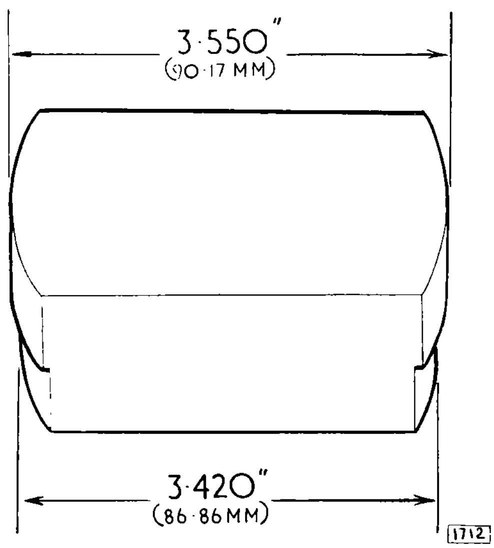


Fig. 29. Stepped block for cylinder liner removal

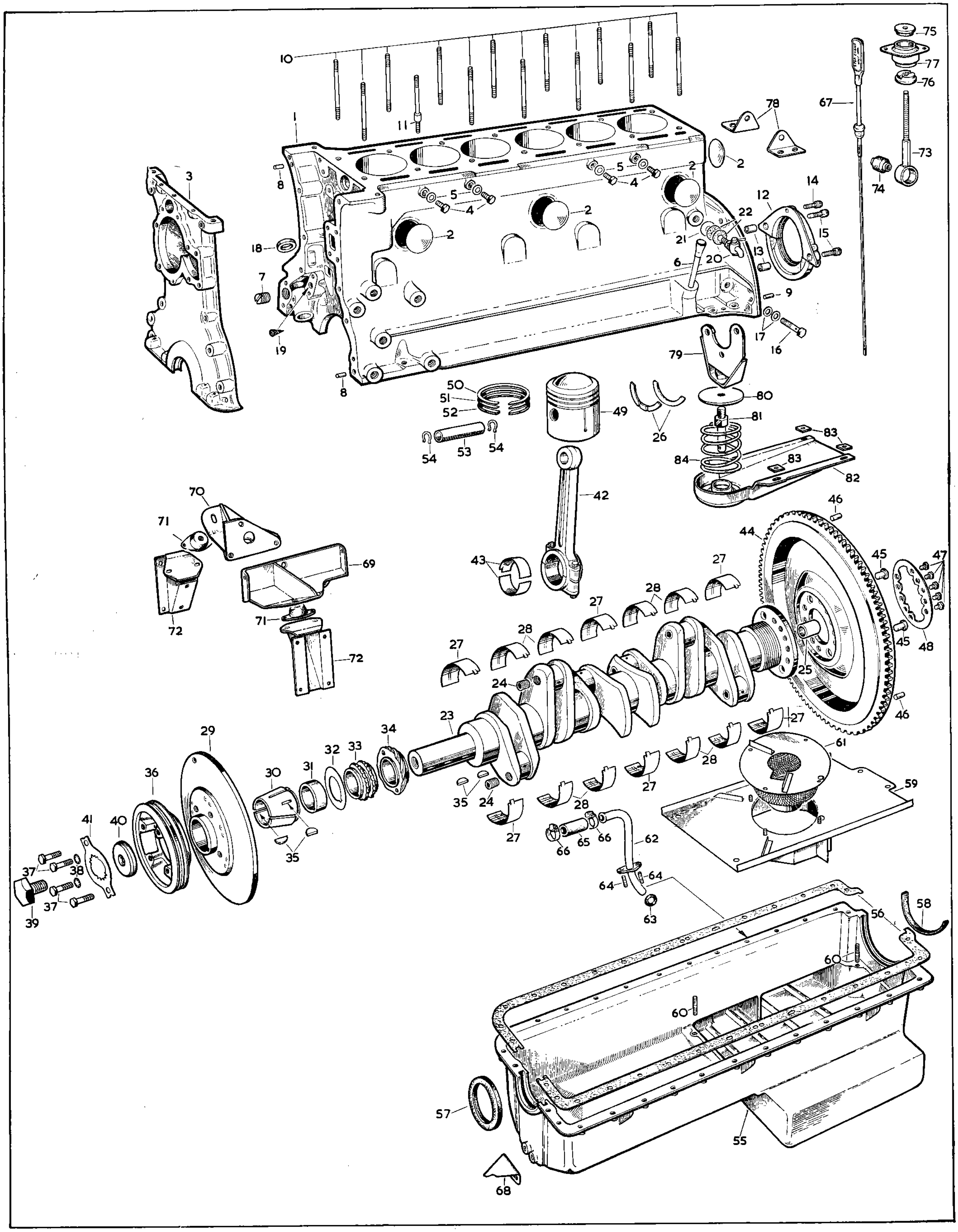


Fig. 30. Exploded view of the cylinder block assembly

1. Cylinder block
2. Core plug
3. Timing cover
4. Setscrew
5. Copper washer
6. Dipstick tube
7. Plug
8. Dowel
9. Dowel
10. Stud
11. Dowel stud
12. Cover
13. Ring dowel
14. Allen screw
15. Allen screw
16. Banjo bolt
17. Copper washer
18. Sealing ring
19. Gauze filter
20. Drain tap
21. Copper washer
22. Fibre washer
23. Crankshaft
24. Plug
25. Bush
26. Thrust washer
27. Main bearing
28. Main bearing
29. Crankshaft damper
30. Core
31. Distance piece
32. Oil thrower
33. Sprocket
34. Gear
35. Key
36. Pulley
37. Bolt
38. Shakeproof washer
39. Bolt
40. Washer
41. Tab washer
42. Connecting rod
43. Bearings
44. Flywheel
45. Dowel
46. Dowel
47. Setscrew
48. Locking plate
49. Piston
50. Compression ring
51. Compression ring
52. Scraper ring
53. Gudgeon pin
54. Circlip
55. Oil sump
56. Gasket
57. Oil seal
58. Cork seal
59. Baffle plate
60. Stud
61. Filter basket
62. Adaptor
63. "O" ring
64. Stud
65. Hose
66. Clip
67. Dipstick
68. Pointer
69. Bracket
70. Bracket
71. Engine mounting
72. Body mounting to engine
73. Link
74. Bush
75. Stepped washer
76. Stepped washer
77. Rubber mounting
78. Bracket
79. Gearbox mounting bracket
80. Washer
81. Locating stud
82. Mounting
83. Packing piece
84. Mounting spring

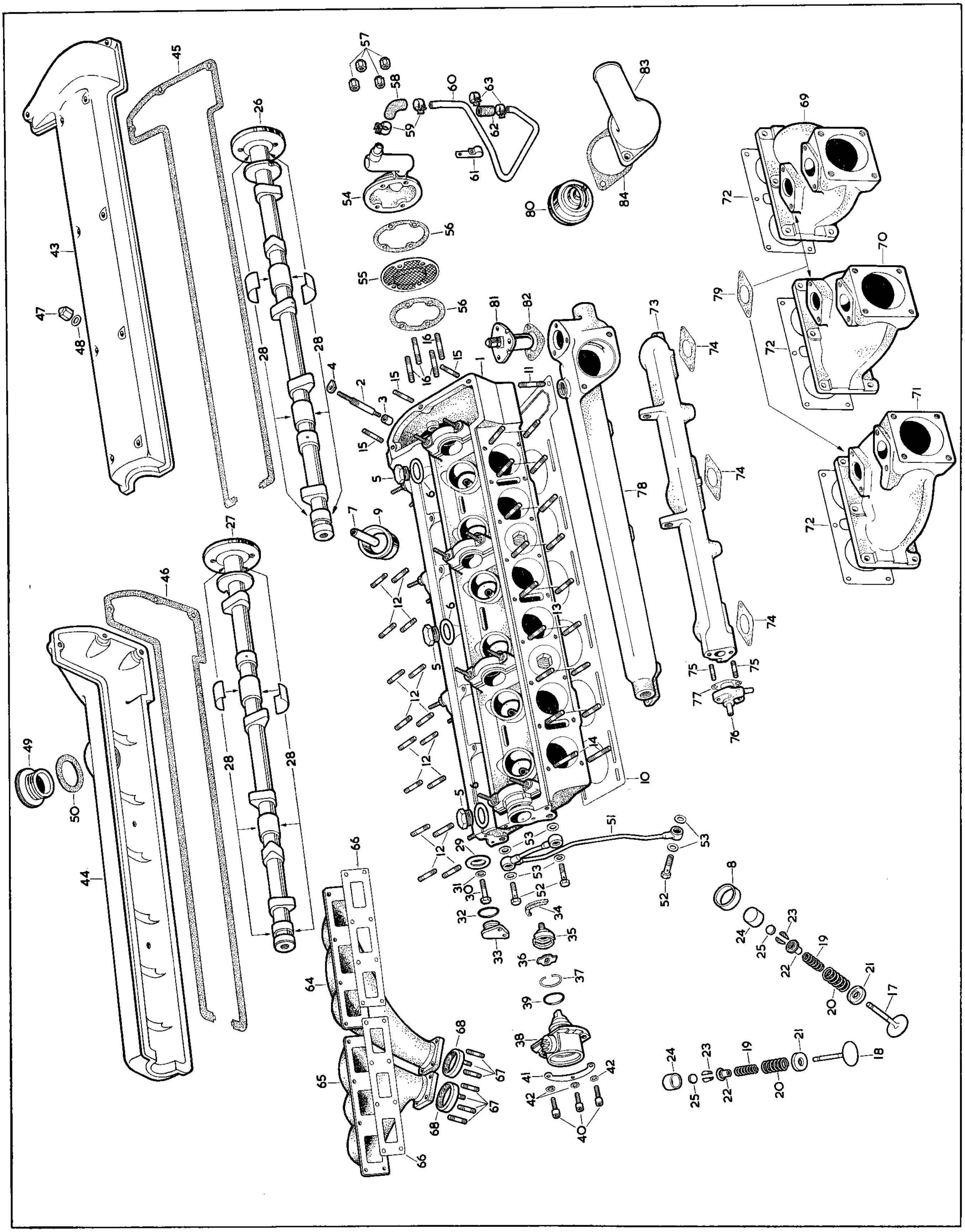


Fig. 31. Exploded view of he cylinder head assembly

1. Cylinder head
2. Stud
3. Ring washer
4. "D" washer
5. Plug
6. Copper washer
7. Valve guide
8. Valve insert
9. Tappet guide
10. Gasket
11. Stud
12. Stud
13. Stud
14. Stud
15. Stud
16. Stud
17. Inlet valve
18. Exhaust valve
19. Inner valve spring
20. Outer valve spring
21. Seat
22. Collar
23. Collar
24. Tappet
25. Adjusting pad
26. Inlet camshaft
27. Exhaust camshaft
28. Bearing
29. Oil thrower
30. Setscrew
31. Copper washer
32. Sealing ring
33. Sealing plug
34. Seal
35. Adaptor
36. Driving dog
37. Circlip
38. Generator
39. Sealing ring
40. Allen screw
41. Locking washer
42. Shakeproof washer
43. Inlet camshaft cover
44. Exhaust camshaft cover
45. Gasket
46. Gasket
47. Dome nut
48. Copper washer
49. Filler cap
50. Fibre washer
51. Oil pipe
52. Banjo bolt
53. Copper washer
54. Breather housing
55. Gauze filter
56. Gasket
57. Dome nut
58. Hose
59. Clip
60. Breather pipe
61. Clip
62. Hose
63. Clip
64. Exhaust manifold
65. Exhaust manifold
66. Gasket
67. Stud
68. Sealing ring
69. Inlet manifold
70. Inlet manifold
71. Inlet manifold
72. Gasket
73. Air balance pipe
74. Gasket
75. Stud
76. Adaptor
77. Gasket
78. Water pipe
79. Gasket
80. Thermostat
81. Thermostat automatic choke
82. Gasket
83. Elbow
84. Gasket

THE CYLINDER HEAD

The cylinder head is manufactured of aluminium alloy and has machined hemispherical combustion chambers. Cast iron valve seat inserts, tappet guides and valve guides are shrunk into the cylinder head castings.

Warning: Before carrying out any work on the cylinder head the following points should be observed to avoid possible fouling between (a) the inlet and exhaust valves, and (b) the valves and pistons.

1. Do NOT rotate the engine or the camshafts with the camshaft sprockets disconnected.

   If, with the cylinder head removed from the engine, it is required to rotate a camshaft, the other camshaft must either be removed or the bearing cap nuts slackened to their fullest extent to allow the valves to be released.

2. When fitting the camshafts to the cylinder head ensure that the keyway in the front bearing flange of each camshaft is perpendicular (at 90°) to the adjacent camshaft cover face before tightening down the camshaft bearing cap nuts. If this operation is being carried out with the cylinder head fitted to the engine, rotate the engine until No. 6 (front) piston is on Top Dead Centre in the firing position, that is with the distributor rotor opposite No. 6 cylinder segment, before fitting the camshafts.

Note: As the valves in the fully open position protrude below the cylinder head joint face, the cylinder head must not be placed joint face downwards directly on a flat surface; support the cylinder head on wooden blocks, one at each end.

REMOVAL

Drain the cooling system by turning the radiator drain tap remote control, opening the cylinder block drain tap and removing the radiator filler cap. Conserve the coolant if anti-freeze is in use.

Disconnect the battery. Remove the flexible pipe between the air cleaner and the air intake elbow. Disconnect the engine breather hose below the air intake elbow and remove the air intake elbow. Disconnect the accelerator linkage at the rear of the engine. Disconnect the fuel feed pipe at the joint below the front carburetter. Remove the cables (green/black and green) from the auxiliary starting solenoid. Remove the cable (green/yellow) from the anti-creep switch (if fitted).

Disconnect the cables (which may be replaced at either position) from the revolution counter generator at the rear of the cylinder head. Disconnect the top water hose and by-pass hose from the front of the inlet manifold water jacket. Remove the cable (green/black) at the thermostat switch.

Remove the high tension leads from the sparking plugs and the lead carrier from the cylinder head studs. Disconnect the cables (white/black and white) from the ignition coil and remove the coil. Remove the sparking plugs. Remove the cables from the retaining clips below the inlet manifold.

Disconnect the exhaust manifolds from the engine. Disconnect the two camshaft oil feed pipe unions from the rear of the cylinder head. Remove the heater pipe brackets from below the inlet manifold. Remove the carburetter overflow pipe clip from the oil filter head.

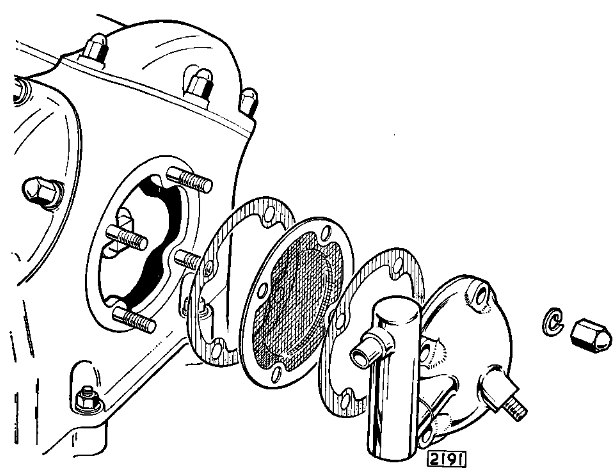


Fig. 32. Removal of the engine breather

Slacken the clips on the heater hoses at the rear of the inlet manifold water jacket and on the heater unit. Disconnect the vacuum pipe from below the heater water valve. Unscrew the nut securing the water valve and automatic transmission dipstick tube (if fitted), to the mounting bracket. Remove the water valve and hoses.

Disconnect the cable (green/blue) from the water temperature transmitter in the inlet manifold water jacket. Slacken the clips and remove the two vacuum servo pipes from the connection at the rear of the inlet manifold.

Remove the eleven dome nuts from each camshaft cover and remove the covers.

Slacken the hose clips at the engine breather housing, remove the four dome nuts securing the housing to the front of the cylinder head and withdraw the housing noting the gauze baffle and gaskets (Fig. 32).

Release the tension on the top timing chain by slackening the nut on the eccentric idler sprocket shaft, depressing the spring-loaded stop peg and rotating the serrated adjuster plate clockwise.

Break the locking wire on the two setscrews securing the camshaft sprocket to the respective camshafts.

Remove one setscrew only from each of the camshaft sprockets; rotate the engine until the two remaining setscrews are accessible and remove these two screws.

Do NOT rotate the engine or the camshafts after having disconnected the sprockets.

The two camshaft sprockets may now be slid up the support brackets.

Slacken the fourteen cylinder head dome nuts a part of a turn at a time in the order shown (Fig. 18) until the nuts become free. Remove the six nuts securing the front of the cylinder head.

Lift off the cylinder head complete with inlet manifolds. Remove and scrap the cylinder head gasket.

OVERHAUL

As the cylinder head is of aluminium alloy, great care should be exercised when carrying out overhaul work, not to damage or score the machined surfaces. When removing carbon do not use scrapers or sharply pointed tools—use worn emery cloth and paraffin only.

Check the bottom face of the cylinder head for truth.

Remove all traces of carbon and deposits from the combustion chambers and the inlet and exhaust ports and regrind the valve and seats if necessary, as described under "Decarbonising and Grinding Valves" on page B.29.

If it is required to replace the valve guides, valve seat inserts or tappet guides, only the special replacement parts must be used. The replacement parts must be shrunk into the cylinder head in accordance with the instructions given under the appropriate headings in this section.

REFITTING

Fit Cylinder Head

Before refitting the cylinder head it is important to observe that, if the camshafts are out of phase with piston position, fouling may take place between the valves and pistons. It is, therefore, essential to adhere to the following procedure before fitting the cylinder head:—

Check that the keyways in the front flanges of the camshafts are vertical to the camshaft housing face and accurately position by engaging the valve timing gauge. If it is found necessary to rotate one of the camshafts the other camshaft must either be removed or the bearing cap nuts slackened to their fullest extent to allow the valves to be released.

Turn No. 6 (front) piston to the Top Dead Centre position with the distributor rotor arm opposite No. 6 cylinder segment. (Fig. 19)

Do NOT rotate the engine or camshafts until the camshaft sprockets have been connected to the camshafts.

Fit the cylinder head gasket, taking care that the side marked "Top" is uppermost. Fit the cylinder head complete with manifolds to the cylinder block. Note that the second cylinder head stud from the front on the left-hand side is a dowel stud.

Fit the sparking plug lead carrier to the 3rd and 6th stud from the front on the right-hand side. Fit plain washers to these and the two front stud positions. Fit "D" washers to the remaining studs.

Tighten the fourteen large cylinder head dome nuts a part of a turn at a time to a torque of 54 lb. ft. (7·5 kg.m.) in the order shown in Fig. 18. Also tighten the six nuts securing the front end of the cylinder head.

Valve Timing

Check that No. 6 (front) piston is exactly in the T.D.C. position.

Through the breather aperture in the front of the cylinder head slacken the locknut securing the serrated plate.

With the camshaft sprocket on the flanges of the camshafts, tension chain by pressing locking plunger inwards and rotating serrated plate by two holes in an anti-clockwise direction.

When correctly tensioned there should be slight flexibility on both outer sides of the chain below the camshaft sprockets, that is, the chain must not be dead tight. Release the locking plunger and securely tighten the locknut. Tap the camshaft sprockets off the flanges of the camshafts.

Accurately position the camshafts with the valve timing gauge and check that the T.D.C. marks are in exact alignment.

Withdraw the circlips retaining the adjusting plates to the camshaft sprockets and pull the adjusting plates forward until the serrations disengage. Replace the sprockets on to the flanges of camshafts and align the two holes in the adjuster plate with the two tapped holes in each camshaft flange. Engage the serrations of the adjuster plates with the serrations in the sprockets.

Note: It is most important that the holes are in exact alignment, otherwise when the setscrews are fitted the camshafts will be moved out of position. If difficulty is experienced in aligning the holes exactly, the adjuster plates should be turned through 180°, which, due to the construction of the plate, will facilitate alignment.

Fit the circlips to the sprockets and one setscrew to the accessible hole in each adjuster plate. Turn the engine until the other two holes are accessible and fit the two remaining setscrews.

Finally, recheck the timing chain tension and valve timing in this order. Secure the four setscrews retaining the camshaft sprockets with new locking wire.

Fit Cylinder Head Oil feed Pipe

Fit the cylinder head oil feed pipe from the tapped hole in the main oil gallery to the two tapped holes in the rear of the cylinder head. Secure the pipe with the three banjo bolts with a new copper washer fitted to both sides of each banjo.

Fit Camshaft Covers

Fit each camshaft cover to the cylinder head using a new gasket. Fit the eleven copper washers and dome nuts to the cover retaining studs but do not tighten fully.

Fit the revolution counter generator and flanged plug to the rear of left-hand and right-hand camshaft covers respectively with the rubber sealing rings seated in the recesses provided and secure with the setscrews and copper washers. Tighten fully the dome nuts securing the camshaft covers.

Note on Refitting

When refitting the throttle linkage, note that the backing plate is offset and ensure that the backing plate assembly is aligned correctly before tightening up.

The remainder of the reassembly is the reverse of the removal procedure.

THE EXHAUST MANIFOLDS

REMOVAL

Remove the eight brass nuts and spring washers securing the exhaust pipe flanges to the exhaust manifolds.

Remove the sixteen brass nuts and spring washers securing the exhaust manifolds to the cylinder head when the manifolds can be detached.

REFITTING

Refitting is the reverse of the removal procedure. Use new gaskets between the manifolds and the cylinder head and new sealing rings between the exhaust pipe and manifold flanges.

THE FLYWHEEL

The flywheel is a steel forging and has integral starter gear teeth. The flywheel is located to the crankshaft by two mushroom-headed dowels and is secured by ten setscrews retained by a circular locking plate.

REMOVAL

Remove the engine as described on page B.19. Unscrew the four setscrews and remove the cover plate from the front face of the clutch housing.

Remove the bolts and nuts securing the clutch housing to the engine and withdraw the gearbox unit.

Unscrew the six setscrews securing the flange of clutch cover to the flywheel and remove clutch assembly. Note the balance marks "B" stamped on the clutch cover and on the periphery of the flywheel.

Knock back the tabs of locking plate securing the ten flywheel bolts. Unscrew the flywheel bolts and remove the locking plate. Remove flywheel from the crankshaft flange by gently tapping with a rawhide mallet.

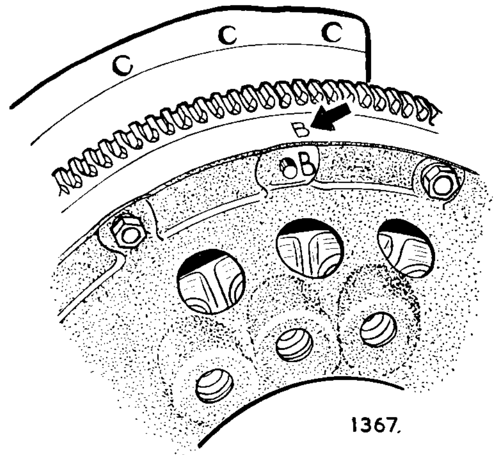


Fig. 33. Showing the balance marks 'B' on the clutch and flywheel

OVERHAUL

If the starter gear is badly worn a new flywheel should be used, since the starter gear teeth are integral with the flywheel, and in this case it will be necessary to balance the flywheel and clutch as an assembly.

If a new flywheel is being fitted, check the flywheel and clutch balance as an assembly by mounting on a mandrel and setting up on parallel knife edges. Mark the relative position of clutch and flywheel. If necessary, remove the clutch and drill $\frac{3}{8}''$ (9·5 mm.) balance holes not more than $\frac{1}{2}''$ (12·7 mm.) deep at a distance of $\frac{3}{8}''$ (9·5 mm.) from the edge of the flywheel.

REFITTING

Turn the engine upright.

Check that the crankshaft flange and the holes for the flywheel bolts and dowels are free from burrs.

Turn the engine until Nos. 1 and 6 pistons are on T.D.C. and fit the flywheel to the crankshaft flange so that the "B" stamped on the edge of the flywheel is at approximately the B.D.C. position. (This will ensure that the balance mark "B" on the flywheel is in line with the balance mark on the crankshaft which is a group of letters stamped on the crank throw just forward of the rear main journal).

Tap the two mushroom-headed dowels into position, fit the locking plate and flywheel securing setscrews. Tighten the setscrews to a torque of 67 lb.ft. (9·2 kg.m.) and secure with the locking plate tabs. Assemble the clutch driven plate to the flywheel, noting that one side of the plate is marked "Flywheel Side." Centralise the driven plate by means of a dummy shaft which fits the splined bore of the driven plate and the spigot bush in the crankshaft. (A constant pinion shaft may be used for this purpose). Fit clutch cover assembly so that the "B" stamped adjacent to one of the dowel holes coincides with the "B" stamped on the periphery of the flywheel. Secure the clutch assembly with the six setscrews and spring washers, tightening the screws a turn at a time by diagonal selection. Remove the dummy shaft.

IGNITION TIMING

Set the distributor micrometer adjustment in the centre of the scale.

Rotate the engine until the rotor-arm approaches the No. 6 (front) cylinder segment in the distributor cap. (Fig. 19).

Slowly rotate the engine until the ignition timing scale on the crankshaft damper is the appropriate number of degrees before the pointer on the sump.

Ignition Settings

Connect a 12 volt test lamp with one lead to the distributor terminal (or the CB terminal of the ignition coil) and the other to a good earth.

Slacken the distributor plate pinch bolt.

Switch on the ignition.

Slowly rotate the distributor body until the points are just breaking, that is, when the lamp lights up with the fibre heel leading the appropriate cam lobe in the normal direction of rotation.

Tighten the distributor plate pinch bolt.

A maximum of six clicks on the vernier adjustment from this setting, to either advance or retard, is allowed.

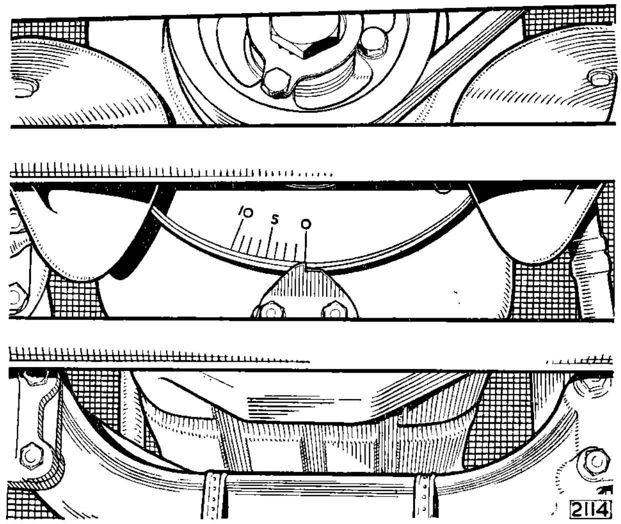


Fig. 34. Showing the timing scale marked on the crankshaft damper. The scale is marked in crankshaft degrees from 0° (Top Dead Centre) to 10° advance (before Top Dead Centre)

Static Ignition Timing

8 to 1 compression ratio ..	9° B.T.D.C.
9 to 1 compression ratio ..	10° B.T.D.C.

THE OIL FILTER

The oil filter is of the full flow type and has a renewable element. The oil from the oil pressure relief valve is returned to the engine sump by an external rubber hose. The oil pressure relief valve is retained by the outlet adaptor to which the hose to the sump is secured.

A balance valve fitted in the filter head opens at a pressure differential of 10 to 15 lb. per sq. in. (0·7 to 1·1 kg./cm.^{2}) to provide a safeguard against the possibility of the filter element becoming so choked that oil is prevented from reaching the bearings.

REMOVAL

When removing the oil filter it is advisable to catch any escaping oil in a drip tray.

With the car on a ramp disconnect the cable at the oil pressure transmitter unit and slacken the clip at the oil return hose. Remove the five bolts with plain and copper washers securing the oil filter head to the cylinder block, note the clip retaining the carburetter float chamber overflow pipes.

Remove the oil filter assembly from beneath the car, collecting the gasket between the oil filter head and the cylinder block.

REFITTING

Refitting is the reverse of the removal procedure but a new gasket must be fitted between the oil filter head and the cylinder block.

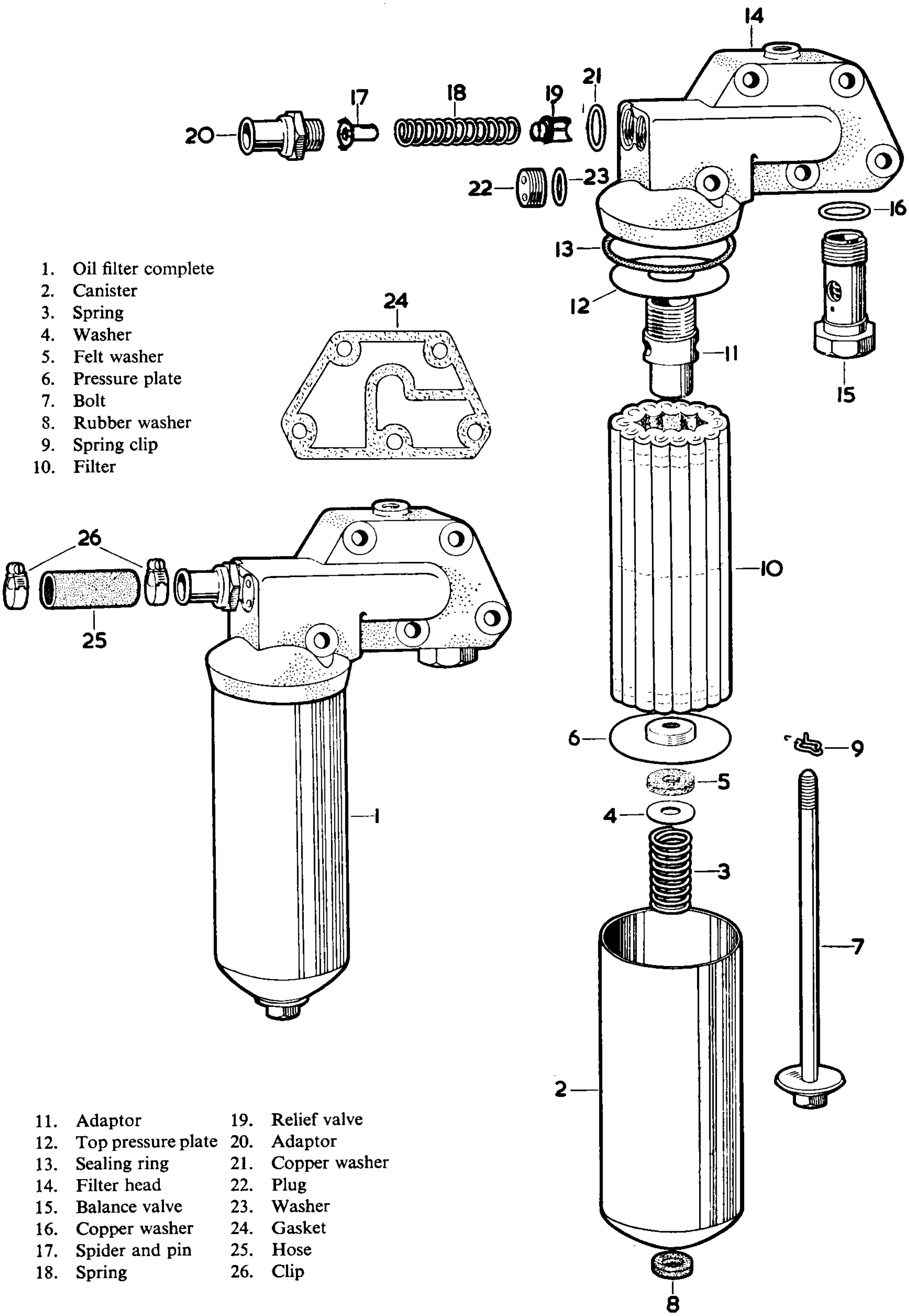
ELEMENT REPLACEMENT

It is most important to renew the oil filter element at the recommended periods as after this mileage it will have become choked with impurities.

To guard against the possibility of the filter being neglected to the extent where the element becomes completely choked, a balance valve is incorporated in the filter head which allows **unfiltered oil** to by-pass the element and reach the bearings. This will be accompanied by a drop in the normal oil pressure of some 10 lb. per sq. in. (·703 kg./cm.^{2}) and if this occurs **the filter element should be renewed as soon as possible.**

The oil filter is situated at the right-hand side of the engine and it is advisable when removing the filter canister, to catch any escaping oil. Unscrew the centre bolt and remove the canister and element from beneath the car retaining the rubber sealing ring. Empty out the oil, thoroughly wash out the canister with petrol and allow to dry before inserting a new element.

When refitting the canister, renew the rubber sealing ring. Ensure that the ring is seating correctly in the groove between the canister and the filter head before tightening the centre bolt.



1. Oil filter complete
2. Canister
3. Spring
4. Washer
5. Felt washer
6. Pressure plate
7. Bolt
8. Rubber washer
9. Spring clip
10. Filter
11. Adaptor
12. Top pressure plate
13. Sealing ring
14. Filter head
15. Balance valve
16. Copper washer
17. Spider and pin
18. Spring
19. Relief valve
20. Adaptor
21. Copper washer
22. Plug
23. Washer
24. Gasket
25. Hose
26. Clip

Fig. 35. Exploded view of the oil filter

THE INLET MANIFOLD

The inlet manifold is in three separate aluminium castings each feeding two cylinders. They are water heated by the coolant from the cylinder head through cast-in passages. A water outlet pipe attached to the inlet manifold houses the thermostat and has the top water hose and by-pass hose connected at the front end.

REMOVAL

Drain the cooling system by turning the radiator drain tap remote control, opening the cylinder block drain tap and removing the radiator filler cap. Conserve the coolant if anti-freeze is in use. Disconnect the battery, slacken the clips and disconnect the top water hose and by-pass hose from the inlet manifold water jacket. Remove the flexible air hose from between the air intake elbow and the air cleaner. Disconnect the engine breather pipe from below the air intake elbow and remove the intake noting the gaskets between the carburetter flanges and the intake. Disconnect the cable (green/blue) from the water temperature transmitter and the cable (green/black) from the thermostat switch. Disconnect the two cables (green/black and green) from the auxiliary starting carburetter and the cable (green/yellow) from the anti-creep switch (if fitted). Disconnect the flexible fuel feed pipe at the joint below the front carburetter and remove the vacuum advance pipe from the front carburetter.

Disconnect the accelerator linkage at the rear of the engine. Remove the two vacuum pipes at the rear of the air balance pipe. Remove the vacuum pipe from below the heater water tap, remove the nut securing the water tap (and automatic transmission dipstick tube (if fitted)) to the mounting bracket, disconnect the water pipe on either side of the water valve and remove the valve. Remove the bolt securing the carburetter overflow pipe clip to the oil filter head.

Remove the eighteen nuts and spring washers, the heater water tap bracket, the heater pipe brackets, cable clips and engine breather steady bracket below the manifold. Withdraw the manifold complete with the carburetters, remove and scrap the manifold gaskets. Remove the carburetters from the manifold (as described in Section C "Carburetters and Fuel System"). Remove six nuts and withdraw the water jacket, remove six nuts, unscrew the auxiliary carburetter pipe and withdraw the carburetter air balance pipe.

REFITTING

Refitting is the reverse of the removal procedure but new gaskets between the cylinder head and inlet manifold should be used.

THE OIL PUMP

The oil pump is of the eccentric rotor type and consists of five main parts:— the body, the driving spindle with the inner rotor pinned to it, the outer rotor and the cover, which is secured to the main body by four bolts, finally being secured to the engine with additional dowel bolts. The inner rotor has one lobe less than the number of internal segments in the outer rotor. The spindle centre is eccentric to that of the bore in which the outer rotor is located, thus the inner rotor is able to rotate within the outer, and causes the outer rotor to revolve. The inlet connection is positioned in the pump cover, and the outlet connection in the body. These are both connected to the ports in the pump.

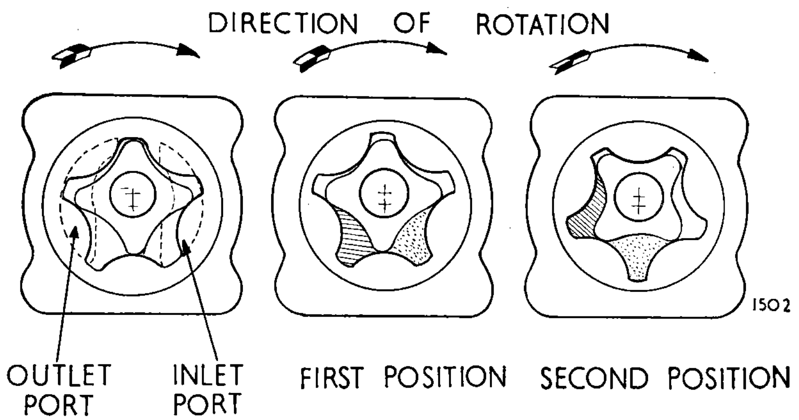


Fig. 36. Operation of rotor type oil pump

Consider the oil flow with the lobes of the inner rotor lying along the line of eccentricity. In this position oil is free to flow from the port into the space (dotted portion) between the rotors, and on the other side of the lobe (shaded portion) the oil is free to flow into the delivery port (see Fig. 36).

In the second position, the inner and outer rotors have rotated and caused the oil that was flowing from the inlet port into the space between them to be cut off from the port and transferred to the enclosed space between the ports. Similarly, the space which enclosed oil free to flow to the delivery port in the first position has decreased in size in the second position, and thus caused this oil to flow into the delivery port. The action of the pump is then a repetition of the above, oil flowing into the space between the rotors from the inlet port under atmospheric pressure and being discharged into the delivery port by reason of the space in which it is contained decreasing in size as it passes over the port.

REMOVAL

Remove the sump as directed on page B.51.

Detach the suction and delivery pipe brackets and withdraw the pipes from the oil pump.

Tap back the tab washers and remove the three dowel bolts which secure the oil pump to the front main bearing cap.

Withdraw the oil pump and collect the coupling sleeve at the top of the drive shaft.

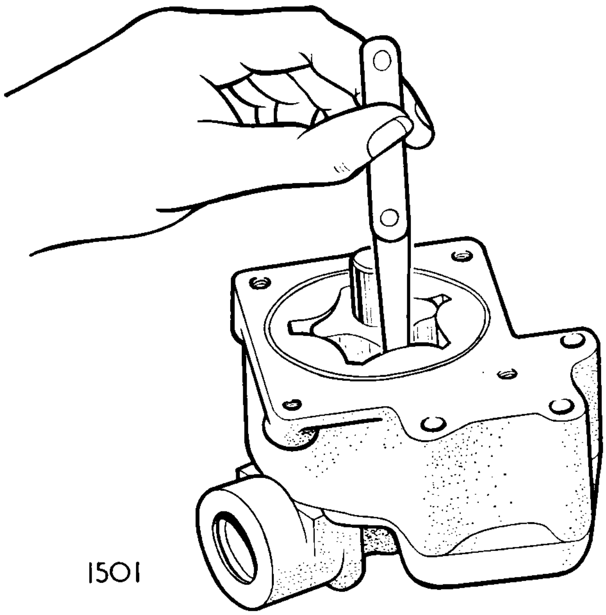


Fig. 37. Measuring the clearance between the inner and outer rotors

DISMANTLING

Unscrew the four bolts and detach the bottom cover from the oil pump.

Withdraw the inner and outer rotors from the oil pump body. The inner rotor is pinned to the drive shaft and must not be dismantled.

OVERHAUL

Check the clearance between lobes of the inner and outer rotors which should be ·006″ (·15 mm.) maximum (see Fig. 37).

Check the clearance between the outer rotor and the pump body (see Fig. 38) which should not exceed ·010″ (·25 mm.).

Check the end-float of the rotors by placing a straight

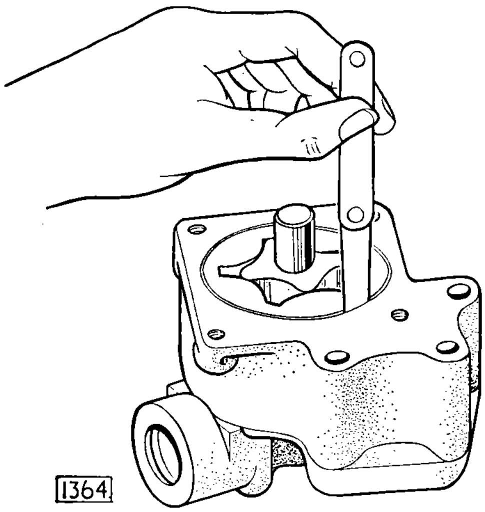


Fig. 38. Measuring the clearance between the outer rotor and the pump body

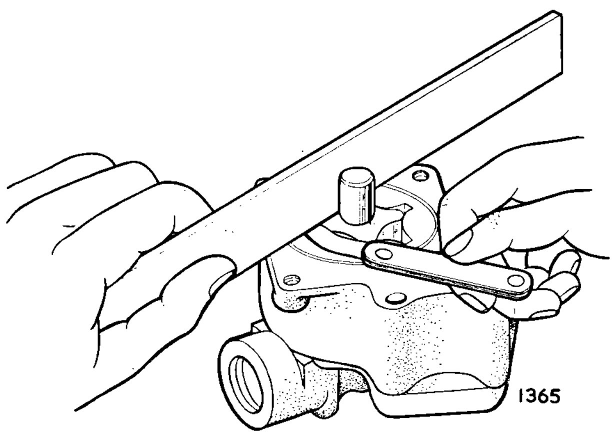
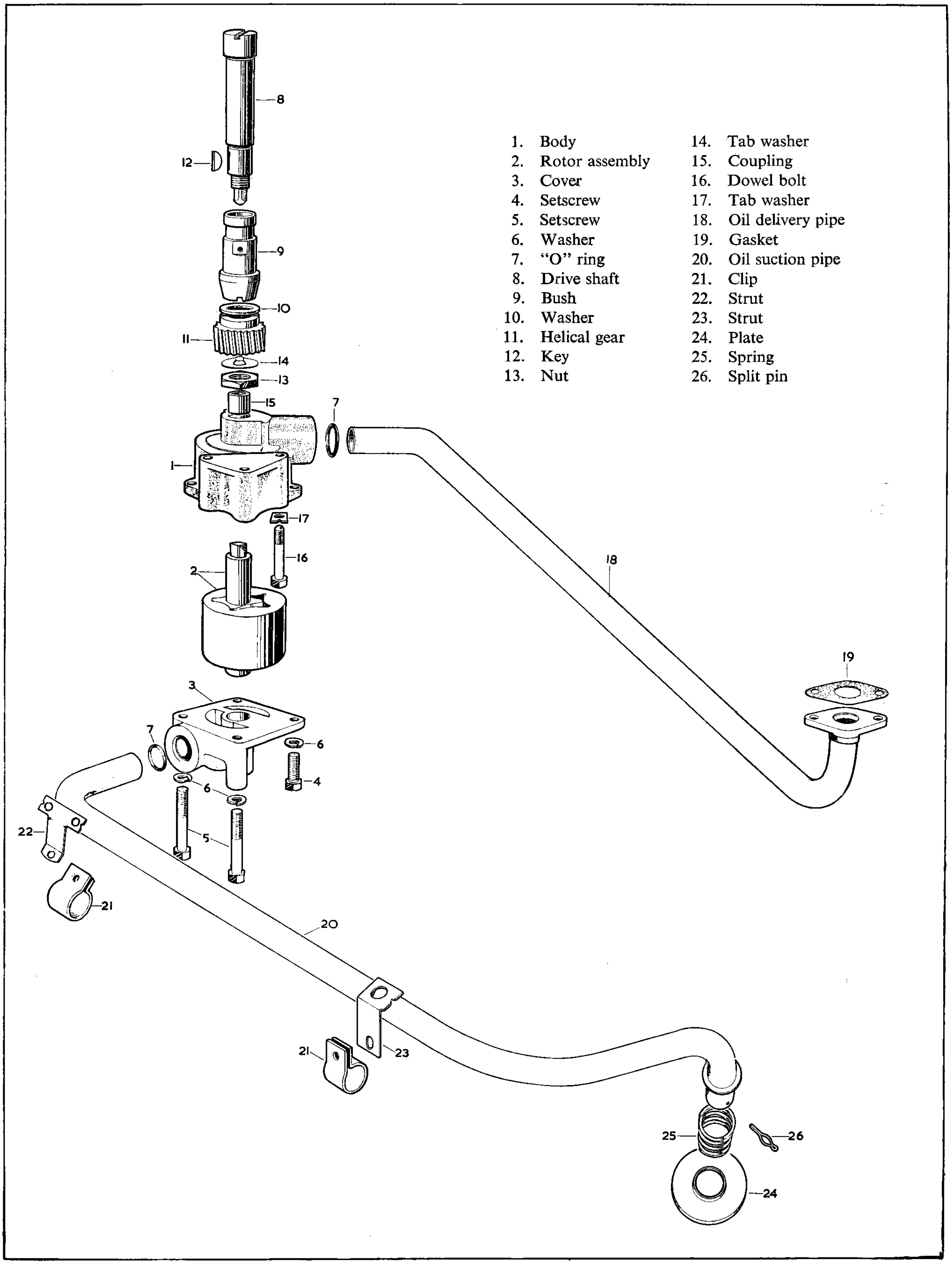


Fig. 39. Measuring the end float of the rotors



1. Body
2. Rotor assembly
3. Cover
4. Setscrew
5. Setscrew
6. Washer
7. "O" ring
8. Drive shaft
9. Bush
10. Washer
11. Helical gear
12. Key
13. Nut
14. Tab washer
15. Coupling
16. Dowel bolt
17. Tab washer
18. Oil delivery pipe
19. Gasket
20. Oil suction pipe
21. Clip
22. Strut
23. Strut
24. Plate
25. Spring
26. Split pin

Fig. 40. Exploded view of the oil pump

edge across the joint face of the body and measuring the clearance between the rotors and straight edge (see Fig. 39). This clearance should be ·0025″ (·06 mm.) and in an emergency can be restored by lapping the pump body and outer rotor on a surface plate to suit the inner rotor.

Examine the pump body and bottom cover for signs of scoring and the drive shaft bores for signs of wear; fit new parts as necessary.

Place the drive shaft in a vice fitted with soft jaws and check that the inner rotor is tight on the securing pin.

Note that the drive shaft, inner and outer rotors are supplied only as an assembly.

REASSEMBLING

Reassembly is the reverse of the dismantling procedure but it is important when fitting the outer rotor to the pump body to insert the chamfered end of the rotor foremost.

Always fit new "O" rings to the suction and delivery pipe bores.

REFITTING

Refitting is the reverse of the removal procedure.

Do not omit to fit the coupling sleeve to the squared end of the drive shaft before offering up the oil pump.

After fitting the oil pump, check that there is appreciable end-float of the coupling sleeve.

OIL SUMP

All engines are fitted with aluminium sumps. An oil return pipe is fitted between the oil filter head and the well of the sump. A gauze bowl type oil filter is attached to a baffle plate in the sump well.

REMOVAL

Remove the drain plug and drain the oil from the sump.

Remove the front suspension unit as described in Section J "Front Suspension."

Slacken the clip and disconnect the oil return hose at the oil filter head.

Unscrew the twenty-four setscrews, two bolts and four nuts securing the sump. Remove the sump from the cylinder block noting that a short setscrew is fitted at the right-hand front corner of the sump as shown in Fig. 41.

Remove the four nuts securing the baffle plate in the sump well. Withdraw the baffle plate and remove the four nuts securing the filter basket. Remove the basket and wash out with petrol.

Remove the two nuts securing the oil return pipe flange to the sump, remove the pipe, examine the "O" ring and renew if necessary.

REFITTING

Scrape off all traces of old gaskets or sealing compound from the joint faces of the sump and crankcase.

Always fit new gaskets and rear oil seal when refitting the sump. If time permits, roll the rear oil seal into a coil and retain with string for a few hours. This will facilitate the fitting of the seal to its semi-circular recess.

Ensure that the short setscrew is fitted to the right-hand front corner of the sump.

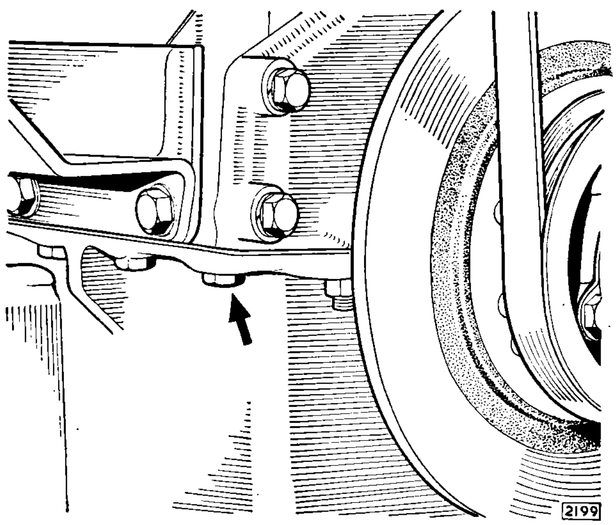


Fig. 41. Showing the location of the short setscrew

PISTONS AND GUDGEON PINS

The pistons are made from low expansion aluminium alloy and are of the semi-split skirt type.

The pistons have three rings each, two compression and one oil control. The top compression ring only is chromium plated; both the top and second compression rings have a tapered periphery.

The fully floating gudgeon pin is retained in the piston by a circlip at each end.

REMOVAL

As the pistons will not pass the crankshaft it will be necessary to withdraw the pistons and connecting rods from the top. Proceed as follows:—

Remove Cylinder Head

Remove the cylinder head as described on page B.42.

Remove Sump

Remove the sump as described on page B.51.

Remove Piston and Connecting Rod

Remove the split pins from the connecting rod bolt nuts and unscrew nuts. Remove the connecting rod cap, noting the corresponding cylinder numbers on the connecting rod and cap. Remove the connecting rod bolts and withdraw the piston and connecting rod from the top of cylinder block.

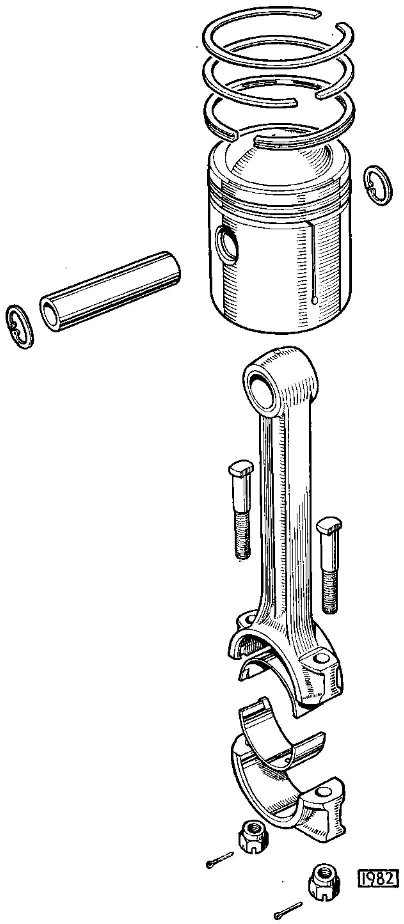


Fig. 42. Exploded view of the piston and connecting rod

OVERHAUL

Pistons are supplied complete with gudgeon pins which have been selectively assembled and are, therefore, not interchangeable one with another.

The pistons fitted to an engine should not vary one with another by more than 2 drams (3·5 grammes).

Gudgeon Pin Fitting

Gudgeon pins are a finger push fit in the piston at normal room temperature (68°F (20°C).

When actually removing or refitting the gudgeon pin, the operation should be effected by immersing the piston, gudgeon pin and connecting rod little end in a bath of hot oil. When the piston and small end have reached a sufficient temperature (230°F, 110°C), the gudgeon pin can be moved into position. Always use new circlips on assembly.

When assembling the engine, centralise the small end of the connecting rod between the gudgeon pin bosses in the piston and ensure that the connecting rod mates up with the crankshaft journal without any pressure being exerted on the rod.

Piston Grades

The following selective grades are available in standard size pistons only. When ordering standard size pistons the identification letter of the selective grade should be clearly stated. Pistons are stamped on the crown with the letter identification and the cylinder block is also stamped on the top face adjacent to the bores.

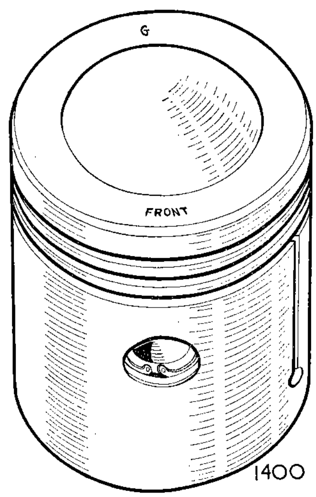


Fig. 43. Showing the markings on the piston crown

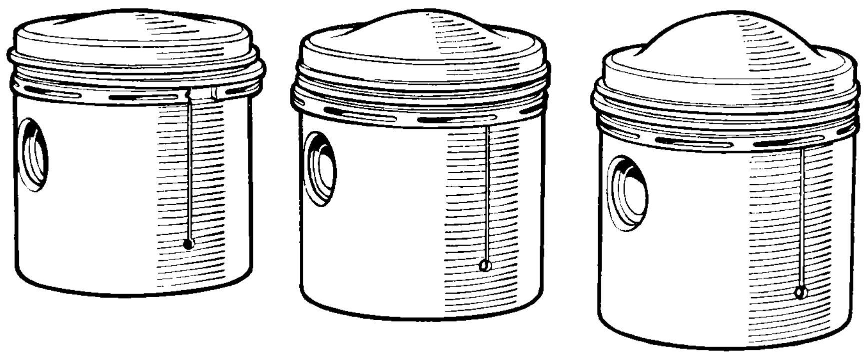


Fig. 44. Mark 10 pistons

Grade Identification Letter	
F	3·4248″ to 3·4251″ (86·990 to 86·997 mm.)
G	3·4252″ to 3·4255″ (87·000 to 87·007 mm.)
H	3·4256″ to 3·4259″ (87·010 to 87·017 mm.)
J	3·4260″ to 3·4263″ (87·020 to 87·027 mm.)
K	3·4264″ to 3·4267″ (87·030 to 87·037 mm.)

Oversize Pistons

Oversize pistons are available in the following sizes:—
+·010″ (·25 mm.), +·020″ (·51 mm.), +·030″ (·76 mm.).

There are no selective grades in oversize pistons as grading is necessary purely for factory production methods.

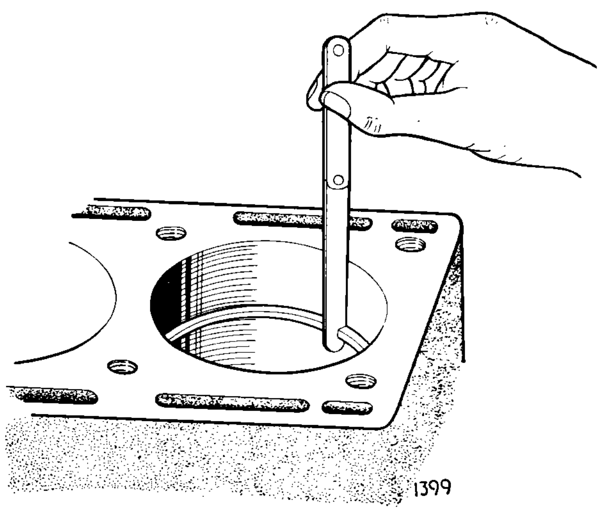


Fig. 45. Checking the piston ring gap

Piston Rings

Check the piston ring gap with the ring as far down the cylinder bore as possible. Push the ring down the bore with a piston to ensure that it is square and measure the gap with a feeler gauge. The correct gaps are as follows:—

Compression rings	·015″ to ·020″ (·38 to ·51 mm.)
Oil control rings	·011″ to ·016″ (·28 to ·41 mm.)

With the rings fitted to the piston check the side clearance in the grooves which should be ·001″ to ·003″ (·025 to ·076 mm.).

One of the compression rings is hard chrome plated and this ring must be fitted to the top groove in the piston.

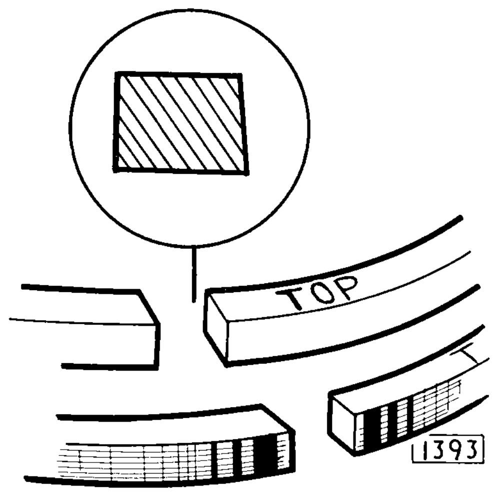


Fig. 46. Showing the identification marks on the tapered periphery compression rings

Tapered Periphery Rings

All engine units are fitted with tapered periphery piston rings in at least one position and these must be fitted the correct way up.

ENGINE

The narrowest part of the ring must be fitted uppermost; to assist in identifying the narrowest face a letter "T" or "Top" is marked on the side of the ring to be fitted uppermost.

The oil control ring is not tapered and can be fitted either way up.

REFITTING

Pistons and connecting rods must be fitted to their respective cylinders (piston and connecting rods are stamped with their cylinder number, No. 1 being at the rear) and the same way round in the bore.

The pistons must be fitted with the split on the left-hand or exhaust side of the engine. To facilitate correct fitting the piston crowns are marked "Front," see Fig. 43.

Use a piston ring clamp when entering the rings into the cylinder bore.

The cap must be fitted to the connecting rod so that the cylinder numbers stamped on each part are on the same side.

Tighten the connecting rod nuts to a torque of 37 lb. ft. (5·1 kg. m.).

SPARKING PLUGS

SERVICE PROCEDURE

To maintain peak sparking plug performance, plugs should be inspected, cleaned and re-gapped at regular intervals of 2,500 miles. Under certain fuel and operating conditions, particularly extended slow speed town driving, sparking plugs may have to be serviced at shorter intervals.

Disconnect the ignition cables from all sparking plugs.

Loosen the sparking plugs about two turns anti-clockwise using the proper sized deep-socket wrench.

Blow away the dirt from around the base of each plug.

Remove the sparking plugs and place them in a suitable holder, preferably in the order they were in the engine.

ANALYSING SERVICE CONDITIONS

Examine the gaskets to see if the sparking plugs were properly installed. If the gaskets were excessively compressed, installed on dirty seats or distorted, leakage has probably occurred during service which would tend to cause overheating of the sparking plugs. Gaskets properly installed will have flat clean surfaces. Gaskets which are approximately one-half their original thickness will be satisfactory but thinner ones should be renewed.

Examine the firing ends of the sparking plugs, noting the type of the deposits and the degree of electrode erosion. The typical conditions illustrated may indicate the use of a sparking plug with an incorrect heat range or faulty engine and ignition system operation. Remember that if sufficient voltage is not delivered to the sparking plug, no type of plug can fire the mixture in the cylinder properly.

Normal Condition

Look for powdery deposits ranging from brown to greyish tan. Electrodes may be worn slightly. These are signs of a sparking plug of the correct heat range used under **normal** conditions, that is mixed periods of high speed and low speed driving. Cleaning and re-gapping of the sparking plugs is all that is required.

Normal Condition

Watch for white to yellowish powdery deposits. This usually indicates long periods of constant speed driving or a lot of slow speed city driving. These deposits have no effect on performance if the sparking

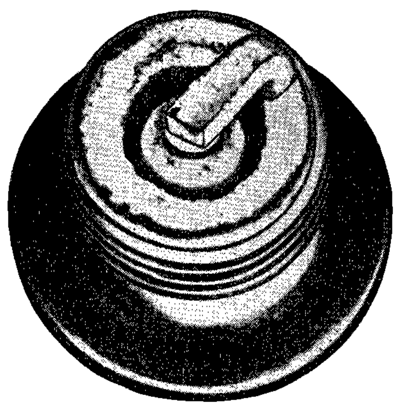


Fig. 47. Normal condition

plugs are cleaned **thoroughly** at approximately 2,500 miles intervals. Remember to "wobble" the plug during abrasive blasting in the Champion Service Unit. Then file the sparking surfaces vigorously to expose bright clean metal.

Oil Fouling

This is usually indicated by wet, sludgy deposits traceable to excessive oil entering the combustion chamber through worn cylinders, rings and pistons, excessive clearances between intake valve guides and stems, or worn and loose bearings, etc. Hotter sparking plugs may alleviate oil fouling temporarily, but in severe cases, engine overhaul is necessary.

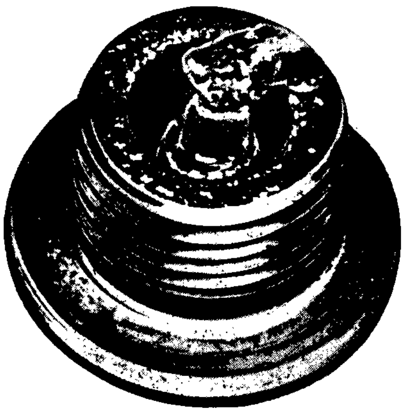


Fig. 48. Oil fouling

Petrol Fouling

This is usually indicated by dry, fluffy black deposits which result from incomplete combustion. Too rich an air-fuel mixture, excessive use of the mixture control or a faulty automatic choke can cause incomplete burning. In addition, a defective coil, contact breaker points, or ignition cable, can reduce the voltage supplied to the sparking plug and cause misfiring. If fouling is evident in only a few cylinders, sticking valves may be the cause. Excessive idling, slow speeds, or stop-and-go driving, can also keep the plug temperatures so low that normal combustion deposits are not burned off. In the latter case, hotter plugs may be installed.

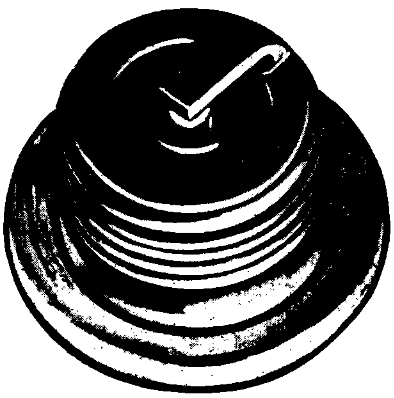


Fig. 49. Petrol fouling

Burned or Overheated Condition

This condition is usually identified by a white, burned or blistered insulator nose and badly eroded electrodes. Inefficient engine cooling and improper ignition timing can cause general overheating. Severe service, such as sustained high speed and heavy loads, can also produce abnormally high temperatures in the combustion chamber which necessitate the use of colder sparking plugs.

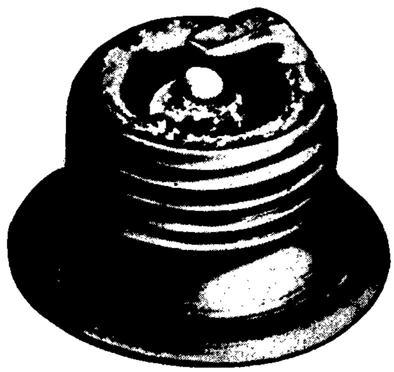


Fig. 50. Badly burned sparking plug

File the sparking surfaces of the electrodes by means of a point file. If necessary, open the gaps slightly and file vigorously enough to obtain bright, clean, parallel surfaces. For best results, hold the plug in a vice.

Reset the gaps using the bending fixture of the Champion Gap Tool. Do not apply pressure on the centre electrode as insulator fractures may result. Use the bending fixture to obtain parallel sparking surfaces for maximum gap life.

Visually inspect all sparking plugs for cracked or chipped insulators. Discard all plugs with insulator fractures.

Test the sparking ability of a used sparking plug on a comparator.

Clean the threads by means of wire hand or power-driven brush. If the latter type is used, wire size should not exceed ·005″ (·127 mm.) diameter. Do not wire brush the insulator nor the electrodes.

Clean gasket seats on the cylinder head before installing sparking plugs to assure proper seating of the sparking plug gasket. Then, using a new gasket, screw in the plug by hand finger-tight.

Note: If the sparking plug cannot be seated on its gasket by hand, clean out the cylinder head threads with a clean-out tap or with another used sparking plug having three or four vertical flutes filed in its threads.

Grease the tap well to retain chippings which may fall into the combustion chamber. Tighten the sparking plugs to a torque of 27 lb. ft. (3·73 kg. m.).

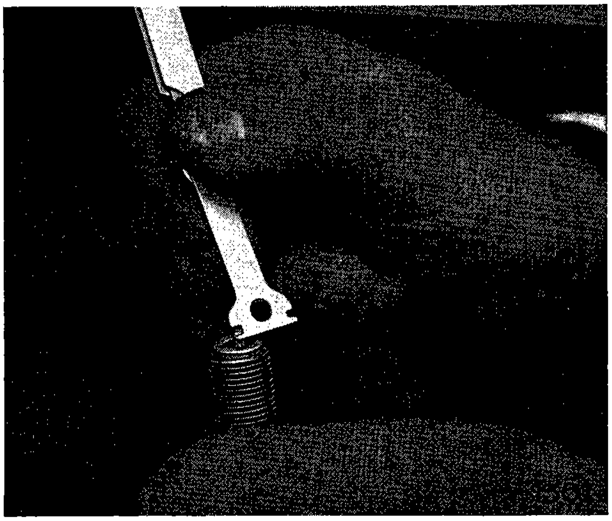


Fig. 51. Setting the gap with the special tool

STANDARD GAP SETTING

The sparking plug gap settings recommended in this Service Manual have been found to give the best overall performance under all service conditions. They are based on extensive dynamometer testing and experience on the road, and are generally a compromise between the wide gaps necessary for best idling performance and the small gaps required for the best high speed performance.

All plugs should be reset to the specified gap by bending the side electrode only, using the special tool available from the Champion Sparking Plug Company.

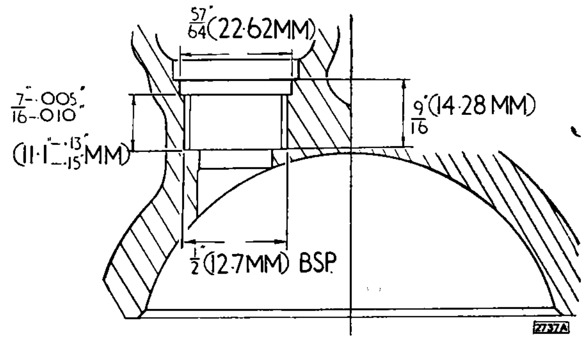


Fig. 52. Fitting dimensions for sparking plug inserts

SPARKING PLUG INSERTS

When it becomes necessary to fit a sparking plug insert in the event of a stripped thread proceed as follows:—

(a) Bore out the stripped thread to 0·75″ (19·05 mm.) diameter and tap $\frac{1}{2}$″ B.S.P.

(b) Counterbore $\frac{57}{64}$″ (22·62 mm.) diameter to accommodate the larger diameter of the insert.

(c) Fit the screwed insert ensuring that it seats firmly on the face at the bottom of the thread.

(d) Drill and ream a $\frac{1}{8}$″ (3·17 mm.) diameter hole $\frac{3}{16}$″ (4·76 mm.) deep between the side of the insert and the cylinder head as shown. Drive in the locking pin and ensure that the pin is below the surface. To secure, peen over the aluminium on the chamfered portion of the insert and also peen over the locking pin.

TAPPETS, TAPPET GUIDES AND ADJUSTING PADS

The chilled cast iron tappets are of cylindrical form and run in guides made of austenitic iron which are shrunk into the cylinder head. A steel pad for adjustment of the valve clearance is sandwiched between the underside of the tappet and top of the valve stem. The pads are available in a range of thicknesses, rising in ·001″ (·025 mm.) steps, from ·085″ to ·110″ (2·16 to 2·79 mm.) and are etched on the surface with the letter "A" to "Z," each letter indicating an increase in size of ·001″ (·025 mm.). (See page B.62).

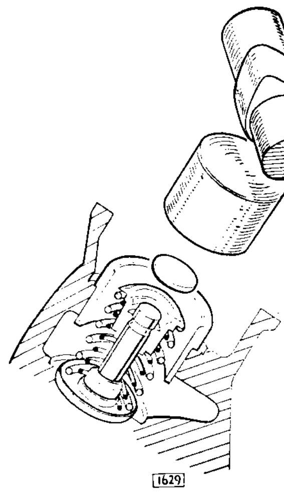


Fig. 53. Showing the tappet and adjustment pad

REMOVAL OF TAPPETS AND ADJUSTING PADS

Remove the camshafts as described on page B.33. The tappets can now be withdrawn with a suction valve grinding tool.

Remove the adjusting pads. If valve clearance adjustment is not being carried out the adjusting pads must be refitted to their original positions.

OVERHAUL

Examine the tappets and tappet guides for signs of wear. The diametrical clearance between the tappet and tappet guide should be ·0008″ to ·0019″ (·02 to ·05 mm.).

Examine the adjusting pads for signs of indentation. Renew if necessary with the appropriate size when making valve clearance adjustment on reassembly.

Tappet Guide Replacement

If it is found necessary to replace the tappet guides they must be fitted in accordance with the following instructions and only genuine factory replacement parts used.

1. Remove the old tappet guide by boring out until the guide collapses. Take care not to damage the bore for the guide in the cylinder head.
2. Carefully measure the diameter of the tappet guide bore in the cylinder head at room temperature—68°F (20°C).
3. Grind down the 1·643″ (41·73 mm.) outside diameter of tappet guide to a diameter of ·003″ (·08 mm.) larger than the tappet guide bore dimension, that is to give an interference fit of ·003″ (·08 mm.).
4. Also grind off the same amount from the "lead-in" at the bottom of tappet guide. The reduction in diameter from the adjacent diameter should be ·0032″ to ·0057″ (·08 to ·14 mm.).
5. Heat the cylinder head in an oven for half an hour from cold at a temperature of 300°F (150°C).
6. Fit the tappet guide, ensuring that the lip at top of guide beds evenly in the recess.
7. After fitting, ream tappet guide bore to a diameter of

$$1\tfrac{3}{8}'' \begin{array}{l} +\cdot 0007'' \\ -\cdot 0000'' \end{array} \left(34\cdot 925 \begin{array}{l} +\cdot 018 \text{ mm.} \\ -\cdot 000 \text{ mm.} \end{array}\right).$$

Note: It is essential that, when reamed, the tappet guide bore is concentric with the bore of the valve guide.

THE TIMING GEAR

The camshafts are driven by Duplex endless roller chains in two stages.

The first stage or bottom timing chain drives the larger wheel of a double intermediate sprocket; the second stage or top timing chain passes round the smaller wheel of the intermediate sprocket, both camshaft sprockets, and is looped below an idler sprocket.

The idler sprocket has an eccentric shaft for top timing chain tension adjustment and the bottom chain is automatically tensioned by an hydraulic tensioner bolted to the cylinder block. Rubber vibration dampers are located at convenient points around the chains.

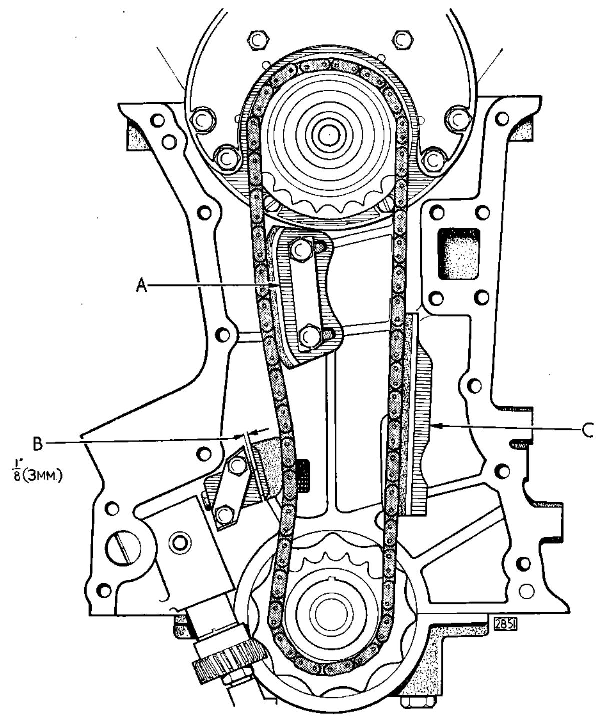


Fig. 54. When fitting a new lower timing chain, set the intermediate damper (A) in light contact with the chain when there is ⅛" (3 mm.) gap between the rubber slipper and the tensioner body. In the case of a worn chain the gap (B) will be increased to avoid fouling between the chain and the cylinder block. Set the lower damper (C) in light contact with the chain.

REMOVAL

Remove the cylinder head as described on page B.42.

Remove the radiator, cowl, header tank and cooling fan (as described in Section D "Cooling System").

Remove the damper as described on page B.36.

Withdraw the split cone.

Remove the sump as described on page B.51.

Unscrew the set bolts and nuts, and remove the water pump from the timing cover.

Note the gasket between the pump and the timing cover.

Remove the front cover as described on page B.23.

Remove the bottom timing chain tensioner as described on page B.60.

Unscrew the four setscrews securing the front mounting bracket to the cylinder block.

Remove the two screwdriver slotted setscrews securing the rear mounting bracket; these setscrews secure the intermediate damper bracket.

The timing gear assembly can now be removed.

DISMANTLING

Remove the nut and serrated washer from the front end of the idler shaft, and withdraw the plunger and spring.

Remove the four nuts securing the front mounting bracket to the rear bracket. Withdraw the front bracket from the studs.

Remove the bottom timing chain from the large intermediate sprocket.

To remove the intermediate sprockets, remove the circlip from the end of the shaft in the mounting bracket. Press the shaft out of the bracket, and withdraw the sprockets from the shaft.

OVERHAUL

If the chain shows signs of stretching or wear, new ones should be fitted. Replace any sprockets and dampers that show signs of wear.

ASSEMBLING

Fit the eccentric shaft to the hole in front mounting bracket. Insert the spring and locking plunger for the serrated plate to the hole in the front mounting bracket. Fit the serrated plate and secure with the shakeproof washer and nut. Fit the idler sprocket (21 teeth) to the eccentric shaft.

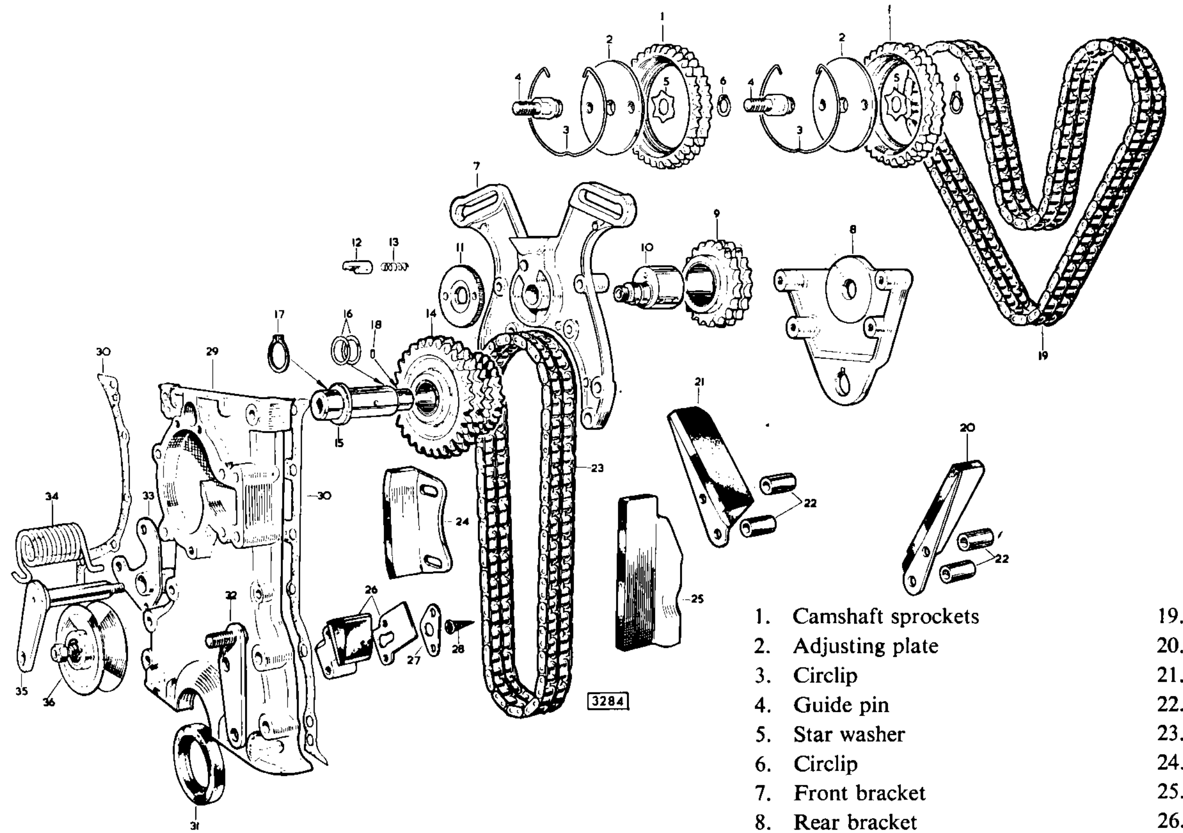


Fig. 55. Exploded view of the timing gear

1. Camshaft sprockets
2. Adjusting plate
3. Circlip
4. Guide pin
5. Star washer
6. Circlip
7. Front bracket
8. Rear bracket
9. Idler sprocket (21 teeth)
10. Eccentric shaft
11. Micro adjustment plate
12. Plunger pin
13. Spring
14. Intermediate sprocket
15. Shaft
16. Shims
17. Circlip
18. Peg
19. Upper timing chain
20. Left hand damper
21. Right hand damper
22. Distance piece
23. Lower timing chain
24. Intermediate damper
25. Vibration damper
26. Hydraulic tensioner
27. Shim
28. Filter gauze
29. Front timing cover
30. Gasket
31. Oil seal
32. Adjusting bracket
33. Fan belt tensioner bracket
34. Torsion spring
35. Jockey pulley carrier
36. Jockey pulley

Fit the intermediate sprocket (20 and 28 teeth) to its shaft with the larger sprocket forward and press the shaft through the lower central hole in the rear mounting bracket. Secure with the circlip at the rear of bracket.

Fit the top timing chain (longer chain) to the small intermediate sprocket and the bottom timing chain (shorter chain) to the large intermediate sprocket.

Loop the upper timing chain under the idler sprocket and offer up the front mounting bracket to the rear mounting bracket with the two chain dampers interposed between the brackets.

Fit the intermediate damper to the bottom of the rear mounting bracket with two screwdriver slotted setscrews and shakeproof washers.

Pass the four securing bolts through the holes in the brackets, chain dampers and spacers noting that shakeproof washers are fitted under the bolt heads. Secure the two mounting brackets together with four nuts and shakeproof washers.

REFITTING

Refitting the remainder of the assembly is the reverse of the removal procedure.

When refitting the timing chain tensioner refer to page B.60.

THE BOTTOM CHAIN TENSIONER

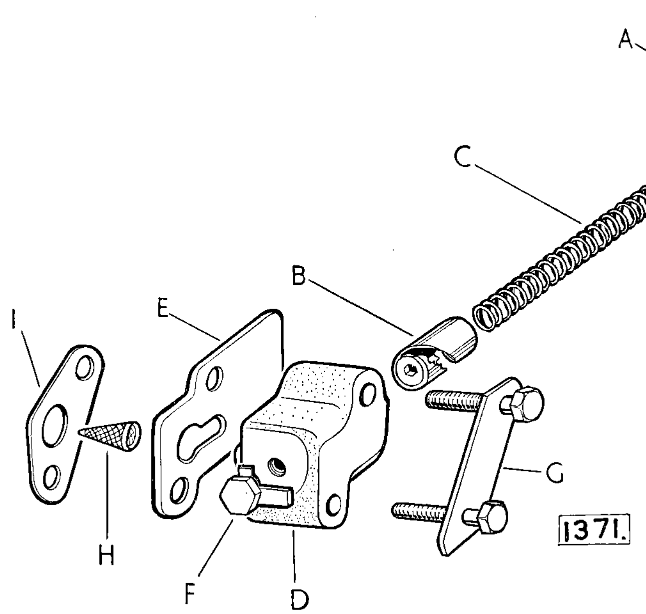
The bottom timing chain tensioner is of hydraulic type and consists of an oil resistant rubber slipper mounted on a plunger (A, Fig. 55) which bears on the outside of the chain. The light spring (C) cased by the restraint cylinder (B) and the plunger, in combination with oil pressure holds the slipper head against the chain keeping it in correct tension.

Return movement of the slipper head is prevented by the limit peg at the bottom end of the plunger bore engaging the nearest tooth in the helical slot of the restraint cylinder. The oil is introduced into the adjuster body (D) via a small drilling in the locating spigot and passing through a hole in the slipper head lubricates the chain. The backing plate (E) provides a suitable face along which the slipper head can work.

REMOVAL

Proceed as described under "Timing Gear—Removal" on page B.58 until the chain tensioner is accessible.

Remove the bottom plug which provides access to the hexagonal hole in the end of the restraint cylinder. Insert an Allen key (·125″ A/F) into this and turn the key in a *clockwise* direction until the slipper head remains in the retracted position. Remove the securing bolts and detach the adjuster. A conical filter is fitted in the oil feed hole in the cylinder block and this should be removed and cleaned in petrol.



A. Plunger
B. Restraint cylinder
C. Spring
D. Adjusting body
E. Backing plate
F. End plug and tab washer
G. Body securing bolts and tab washer
H. Gauze filter
I. Shim

Fig. 56. Exploded view of the bottom chain tensioner.

REFITTING

Fit the conical filter to the oil feed hole in the cylinder block.

Fit shims as necessary, between the backing plate and cylinder block so that the timing chain runs centrally along the rubber slipper.

Fit the tab washer and two securing bolts. Tighten the bolts and tap the tab washers against the bolt heads.

It is important that no attempt is made to release the locking mechanism until the adjuster has been finally mounted in the engine WITH THE TIMING CHAIN IN POSITION.

Remove the hexagon head plug and tab washer from the end of the body. Insert the Allen key into the hole until it registers in the end of the restraint cylinder. Turn the key clockwise until the tensioner head moves forward under spring pressure against the chain. Do not attempt to turn the key anti-clockwise, nor force the tensioner head into the chain by external pressure.

Refit the plug and secure the tab washer.

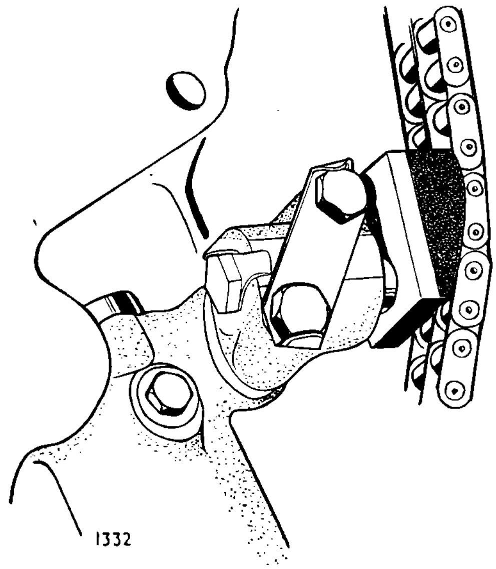


Fig. 57. Showing the bottom timing chain tensioner in position

THE VALVES AND SPRINGS

The inlet valves are of silicon chrome steel and the exhaust valves are of austenitic steel. Double coil valve springs are fitted and are retained by a valve collar with split cotters.

Warning: As the valves in the fully open position protrude below the cylinder head joint face, the cylinder head must not be placed joint face downwards directly on a flat surface; support the cylinder head on wooden blocks, one at each end.

REMOVAL

Remove the cylinder head as described on page B.42.

Remove Valves

With the cylinder head on the bench, remove the inlet manifold and the revolution counter generator.

Remove the four bearing caps from each camshaft and lift out the camshafts (note mating marks on each bearing cap).

Remove the twelve tappets and adjusting pads situated between tappets and valve stems. Lay out the tappets and pads in order, to ensure that they can be replaced in their original guides.

Obtain a block of wood the approximate size of the combustion chambers and place this under the valve heads in No. 1 cylinder combustion chamber. Press down the valve collars and extract the split cotters. Remove the collars, valve springs and spring seats. Repeat for the remaining five cylinders. Valves are numbered and must be replaced in the original locations, No. 1 cylinder being at the rear, that is, the flywheel end.

OVERHAUL

Valves

Examine the valves for pitting, burning or distortion and reface or renew the valves as necessary. Also reface the valve seats in the cylinder head and grind the valves to their seats using a suction valve tool. When refacing the valves or seat inserts do not remove more metal than is necessary to clean up the facings.

The valve seat angles are as follows:— inlet and exhaust, 45°.

Renew valves where the stem wear exceeds ·003″ (·08 mm.). The clearance of the valve stem in the guide when new is ·001″ to ·004″ (·025 to ·10 mm.).

Valve Springs

Test the valve springs for pressure, either by comparison with the figures given in the "Valve Spring Data" or by comparison with a new valve spring.

To test against a new valve spring, insert both valve springs end to end between the jaws of a vice or under a press with a flat metal plate interposed between the two springs. Apply a load to compress the springs partly and measure their comparative lengths.

When fitting valve springs to the cylinder head compress the springs using Churchill tool No. J.6118.

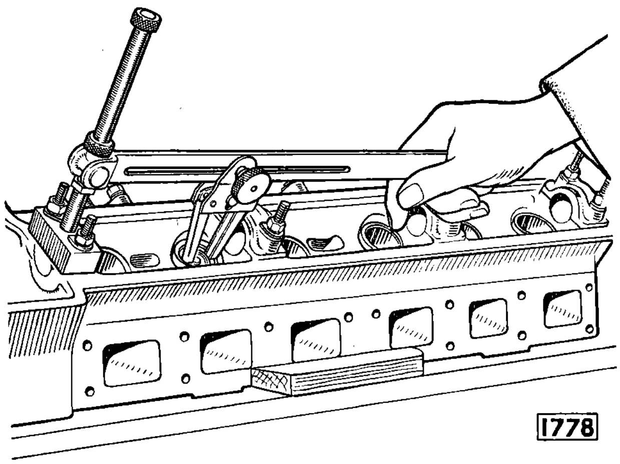


Fig. 58. Fitting the valve springs utilizing the valve spring compressing tool (Churchill Tool Number J.6118)

VALVE CLEARANCE ADJUSTMENT

When checking the valve clearances, the camshafts must be fitted one at a time. If one camshaft is rotated when the other camshaft is in position, fouling is likely to take place between the inlet and exhaust valves. Obtain and record all valve clearances by using a feeler gauge between the back of each cam and the appropriate valve tappet.

Correct valve clearances are:—

Inlet	.. .. ..	·004″ (·10 mm.)
Exhaust	.. .. ..	·006″ (·15 mm.)

Adjusting pads are available rising in ·001″ (·03 mm.) sizes from ·085″ to ·110″ (2·16 to 2·79 mm.) and are etched on the surface with the letter "A" to "Z," each letter indicating an increase in size of ·001″ (·03 mm.). Should any valve clearance require correction, remove the camshaft, tappet and adjusting pad. Observe the letter etched on the adjusting pad if visible. If the letter is not visible measure the pad with a micrometer and should the recorded clearance for this valve have shown say ·002″ (·05 mm.) excessive clearance select a new adjusting pad bearing a letter two lower than the original pad.

As an example, assume that No. 1 inlet valve clearance is tested and recorded as ·007″ (·18 mm.). On removal of the adjusting pad, if this is etched with the letter "D" then substitution with a pad bearing the letter "G" will correct the clearance for No. 1 inlet valve.

Valve Adjusting Pads

	ins.	mm.
A	·085	2·16
B	·086	2·18
C	·087	2·21
D	·088	2·23
E	·089	2·26
F	·090	2·29
G	·091	2·31
H	·092	2·34
I	·093	2·36
J	·094	2·39
K	·095	2·41
L	·096	2·44
M	·097	2·46
N	·098	2·49
O	·099	2·51
P	·100	2·54
Q	·101	2·56
R	·102	2·59
S	·103	2·62
T	·104	2·64
U	·105	2·67
V	·106	2·69
W	·107	2·72
X	·108	2·74
Y	·109	2·77
Z	·110	2·79

When fitting the camshafts prior to fitting the cylinder head to the engine it is most important that the keyway in the front bearing flange of each camshaft is perpendicular (at 90°) to the adjacent camshaft cover face before tightening down the camshaft bearing cap nuts. Tighten the camshaft bearing caps nuts to a torque of 15 lb. ft. (2·0 kg. m.).

REFITTING

Before attempting to refit the cylinder head refer to the instructions given on page B.42.

THE VALVE GUIDES

The valve guides are of cast iron and are chamfered at the upper ends. The outside diameter of the guide is reduced at the upper end to provide a "lead-in" when fitting the guide to the cylinder head. The inlet and exhaust guides are of different lengths, the inlet being the shorter of the two.

REPLACEMENT

Examine the valve guides for evidence of wear in the bore. The clearance between the valve stem and the guide when new is ·001″ to ·004″ (·025 to ·10 mm.).

If it is found necessary to replace worn valve guides they must be fitted in accordance with the following instructions and only genuine factory replacement parts used.

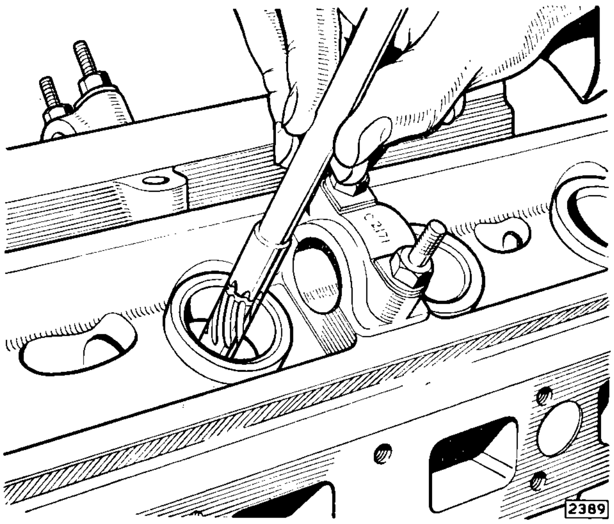


Fig. 59. Reaming the bores in the cylinder head with Churchill tool number J.18 to take service replacement valve guides

1. Press out, or drive out with a piloted drift, the old valve guide from the top of the cylinder head.
2 Ream the valve guide bore in the cylinder head to a diameter of:—

$$\cdot505'' \begin{matrix} +\cdot0005'' \\ -\cdot0002'' \end{matrix} (12\cdot83 \text{ mm.} \begin{matrix} +\cdot012 \text{ mm.}) \\ -\cdot005 \text{ mm.}) \end{matrix}$$

3. Heat the cylinder head by immersing in boiling water for 30 minutes.
4. Coat the valve guide with graphite grease and press in, or drive in with a piloted drift, from the combustion chamber end. The correct fitted position for both inlet and exhaust guides is with the top of the guide (chamfered end) $\frac{5}{16}''$ (8 mm.) above the spot facing for the valve spring seat. (See Fig. 59).

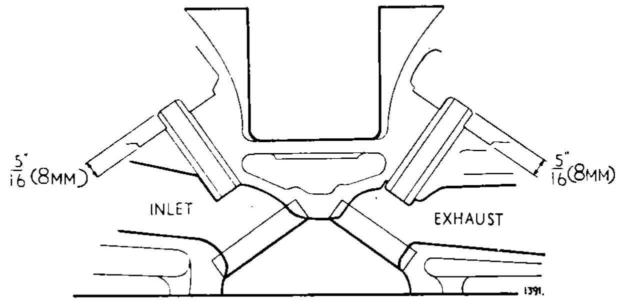


Fig. 60. Showing the fitted position of the valve guides

THE VALVE SEAT INSERTS

The valve seat inserts are centrifugally cast iron and are shrunk into the cylinder head.

REPLACEMENT

If it is found necessary to replace the valve seat inserts they must be fitted in accordance with the following instructions and only genuine factory replacement parts used.

1. Remove the old valve seat insert by boring out until the insert collapses. Take care not to damage the recess for the insert in the cylinder head.
2 Carefully measure the diameter of the insert recess in the cylinder head at room temperature 68°F (20°C).
3. Grind down outside of the insert to a diameter of ·003″ (·08 mm.) larger than the recess dimension, that is, to give an interference fit of ·003″ (·08 mm.).
4. Heat the cylinder head in an oven for one hour from cold at a temperature of 300°F (150°C).
5. Fit the insert, ensuring that it beds evenly in its recess.
6. After the valve seat insert has been fitted the following instructions should be carried out to ensure that the valve clearance can be obtained within the range of the adjusting pads, that is, ·085″ to ·110″ (2·16 to 2·79 mm.).

(*a*) Assemble the camshafts to the cylinder head. Fit the appropriate valve to the insert in question and, with the valve seat faces touching, check the distance between the top of the valve stem and the **back** of the cam. This should be ·320″ (8·13 mm.) **plus** the appropriate valve clearance. (The figure of ·320″ (8·13 mm.) includes an allowance for an adjusting pad thickness of ·095″ (2·41 mm.) to ·097″ (2·46 mm.) which will, if necessary, permit the fitting of thicker or thinner adjusting pads when making the final valve clearance adjustment).

(*b*) If the distance is greater than the figure of ·320″ (8·13 mm.), plus the appropriate valve clearance, grind the valve seat of the insert with suitable valve grinding equipment until the correct distance is obtained.

Example: Assume that the valve insert in question is an exhaust and the distance between the top of the valve stem and the back of the cam is found to be ·344″ (8·74 mm.).

Adding the exhaust valve clearance of ·006″ (·15 mm.) to ·320″ (8·13 mm.) equals ·326″ (8·28 mm.). In this case the valve seat of the insert will have to be ground down to reduce the distance between the top of valve stem and the back of the cam by ·018″ (·46 mm.) that is, ·344″ minus ·326″ (8·74 minus 8·28 mm.).

(*c*) After assembling the cylinder head, check and adjust the valve clearances in the normal manner.

VALVE TIMING

Turn the engine so that No. 6 (front) piston is exactly in the T.D.C. position on compression stroke (firing position) that is, with the distributor rotor arm opposite No. 6 cylinder segment. (See Fig. 19).

See Figs. 34 or 63 for location of T.D.C. marks.

It is important to tension the top timing chain before attempting to check or set the valve timing. Proceed as follows:—

Through the breather aperture in the front of the cylinder head slacken the locknut securing the serrated plate (Fig. 60).

Tension the chain by pressing the locking plunger inwards and rotating the serrated plate by the two holes in an anti-clockwise direction. Turn the engine each way slightly and recheck the chain tension. When correctly tensioned there should be slight flexibility on both outer sides below the camshaft sprockets, that is, the chain must not be dead tight. Release the locking plunger and securely tighten the locknut.

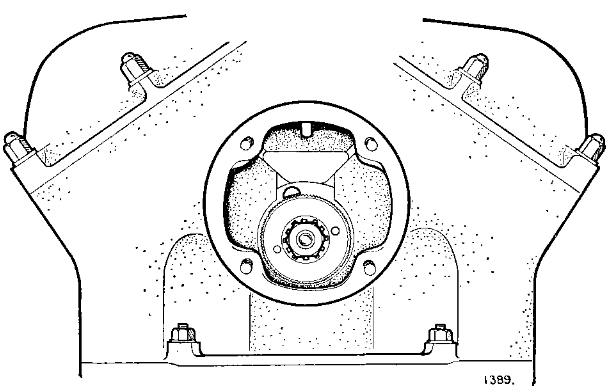


Fig. 61. Showing the serrated plate for adjustment of the top timing chain tension

Remove the locking wire from the setscrews securing the camshaft sprockets. Note the positions of the **inaccessible** setscrews and rotate the engine until they can be removed. Remove the setscrew from each

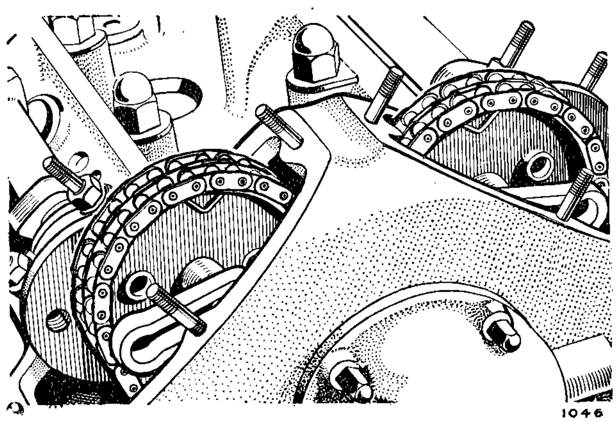


Fig. 62. Showing the camshaft sprockets disconnected from the camshafts

sprocket and turn the engine back to the T.D.C. position with the No. 6 firing and remove the remaining screws. Tap the camshaft sprockets off the flanges of the camshafts.

Accurately position the camshafts with the valve timing gauge (Part No. C.4015) and check that the T.D.C. marks are in exact alignment.

Withdraw the circlips retaining the adjusting plates to the camshaft sprockets and press the adjusting plates forward until the serrations disengage. Replace the sprockets on the flanges of camshafts and align the two holes in the adjuster plate with the two tapped holes in each camshaft flange. Engage the serrations of the adjuster plates with the serrations in the sprockets.

Note: It is most important that the holes are in exact alignment, otherwise when the setscrews are fitted, the camshafts will be moved out of position. If difficulty is experienced in aligning the holes exactly the adjuster plates should be turned through 180°, which due to the construction of the plate will facilitate alignment.

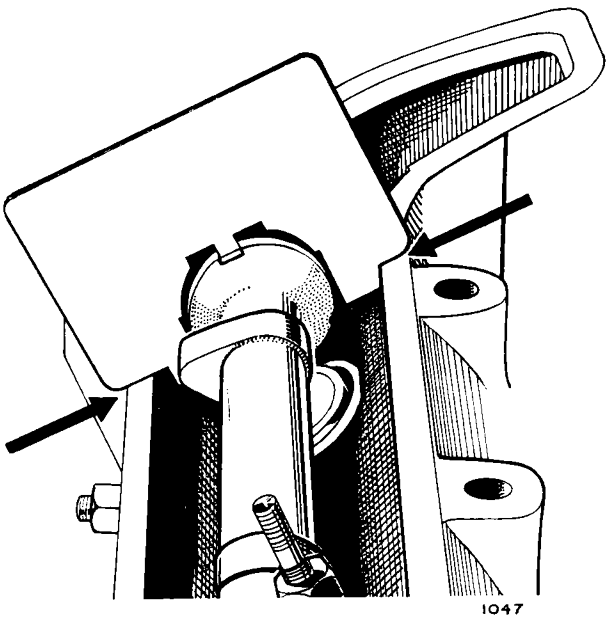


Fig. 63. The valve timing gauge in position. Ensure that the gauge is seated at the points indicated by the arrows

Fit the circlips to the sprockets and one setscrew to the accessible holes in each adjuster plate. Turn the engine until the other two holes are accessible and fit the two remaining setscrews.

Finally, recheck the timing chain tension and valve timing in this order. Secure the four setscrews for camshaft sprockets with new locking wire.

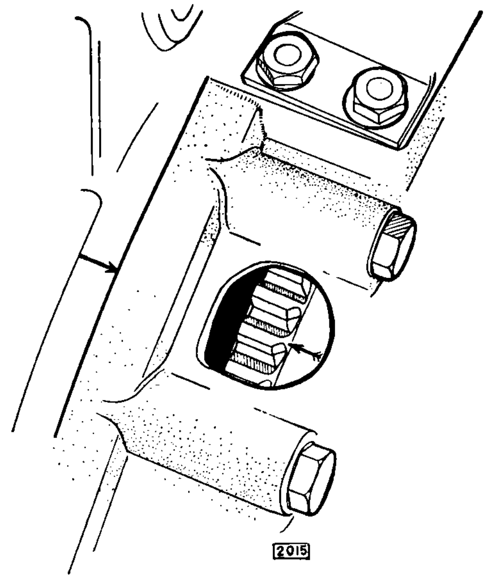


Fig. 64. Showing the location of the Top Dead Centre marks on the left-hand side of the combined engine and transmission unit

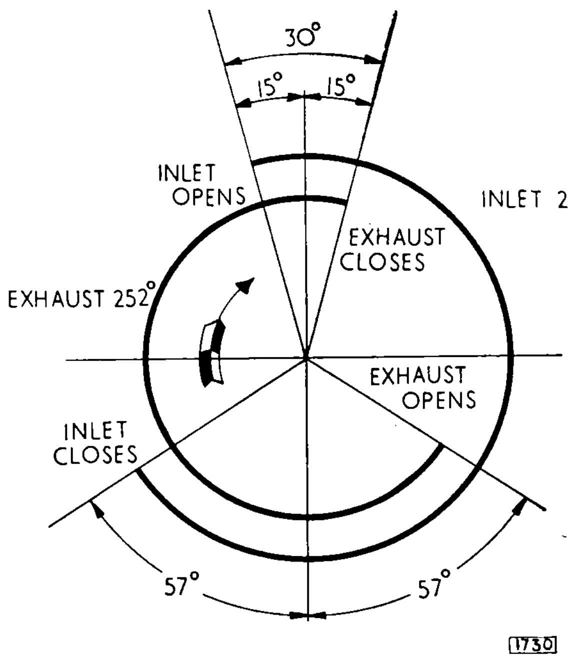


Fig. 65. The valve timing diagram

ENGINE MOUNTINGS

The engine is supported at the front on two rubber mountings which are attached to brackets on the front subframe. The rear is supported on a coil spring mounted in a channel support which is bolted to the body floor. An extension of the spring retainer passes through a rubber bush in the channel support.

FRONT ENGINE MOUNTINGS

Removal

Either place a sling around the front of the engine or attach a lifting plate to the cylinder head, as described in "Engine Removal" Page B.20. Unscrew the large set bolt and remove the spring washer, plain washer and bolt securing the front engine mounting bracket to the mounting rubber. Repeat for the other side.

Raise the engine so that the front mounting brackets are just clear of the mounting rubbers.

Remove the two bolts and self-locking nuts securing the front engine mounting to the support bracket on the body sidemembers. Repeat for the other side.

Refitting

Refitting is the reverse of the removal procedure.

REAR ENGINE MOUNTINGS

Removal

Using a jack, support the rear engine mounting. Remove the four securing setscrews, spring washers and oval washers and lower the jack slowly to release the tension on the mounting spring. Remove the mounting and mounting spring ensuring that the four square packing pieces situated between the mounting and the body are not mislaid.

Refitting

Refitting is the reverse of the removal procedure.

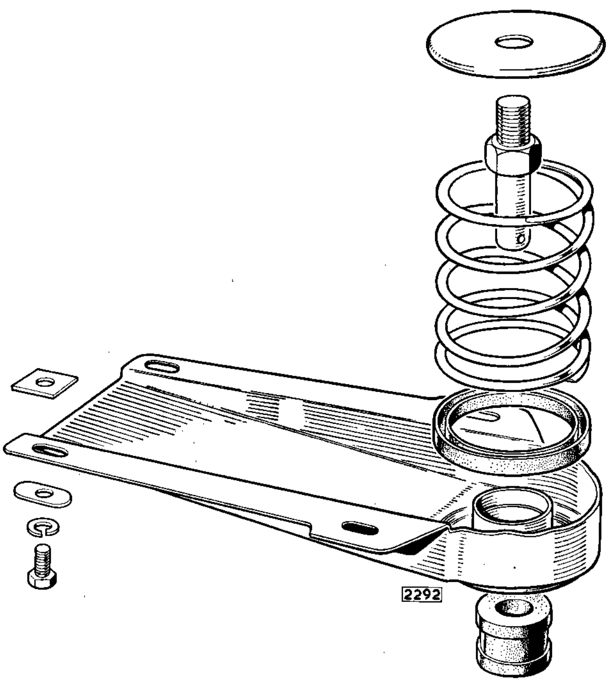


Fig. 66. The rear engine mounting

THE ENGINE STABILISER

The engine stabiliser is situated at the rear of the engine and consists of a rubber/steel mounting attached to the body which is connected to brackets on the clutch housing via a rubber bushed link pin. The link pin is threaded at its upper end and is connected to the rubber mounting by means of flanged washers and a self-locking nut.

ADJUSTMENT

It is MOST IMPORTANT that the stabiliser is assembled in the following manner, as failure to observe this procedure may cause engine vibration and/or fouling of the gearbox in its cowl, due to the engine having been pulled up on its mountings.

1. Screw the lower flanged washer (D, Fig. 66) up the stabiliser pin until the flange contacts the bottom of the stabiliser rubber mounting (C). The washer is slotted on its upper face and can be screwed up the pin by engaging a thin bladed screwdriver in the slot through the centre hole of the rubber mounting.
2. Fit the upper flanged washer (B) and tighten down with the self-locking nut (A).

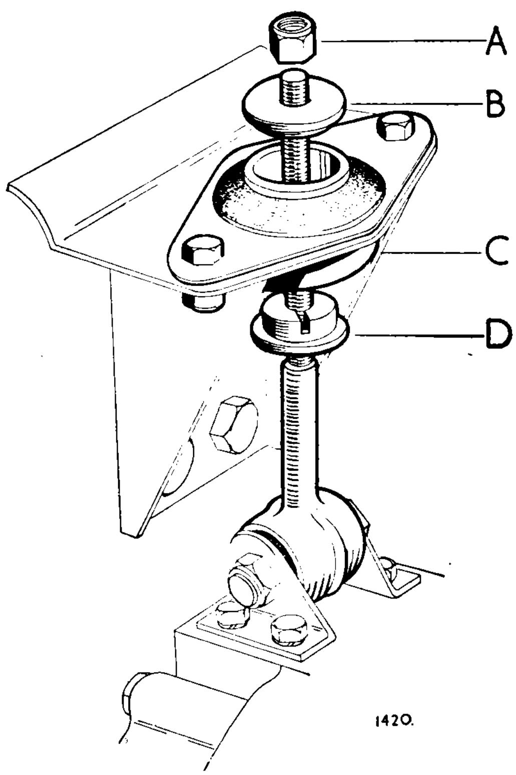


Fig. 67. The engine stabiliser

AIR CLEANER

The air cleaner which is of the paper element type is attached to the wing valance. The cleaner is attached to the air intake elbow by means of a flexible air hose. Servicing instructions are given in "Routine Maintenance" on page B.17.

REMOVAL

Detach the flexible air hose connecting the air cleaner to the air intake elbow having removed the rubber joint from the elbow and the hose clip from the air cleaner cover plate.

Turn the two quick release screws securing the air cleaner cover plate anti-clockwise through 90° and withdraw the air cleaner element. Remove the thumb nut and retainer plate from the base of the unit and withdraw the element.

REFITTING

Refitting is the reverse of the removal procedure.

SPECIAL TOOLS

Description	*Churchill Tool No.*
Timing Chain Adjuster	J.2
Engine Lifting Plate	J.8
Crankshaft Rear Oil Seal Sizing Tool	J.17
Valve Spring Compressor	J.6118
Valve Guide Reamer	J.18
Valve Timing Gauge	C.4015

MODIFIED PISTONS

Commencing Engine Number ZA 3153

Commencing at the above engine number and onwards, modified pistons are fitted. These pistons have a new top compression ring and a Maxiflex oil control ring.

The skirt panel of the piston is re-designed; seven drain holes are drilled in the chamfer below the oil control ring and a relief at the bottom of the skirt forms a sharp edge.

The upper compression ring has a 40° chamfer on the inner edge and must be fitted with the chamfer facing the top of the ring groove. The ring is marked with a "T" on the top face.

The Maxiflex ring consists of two steel rails with a spacer interposed between the two. The expander, which is fitted inside the oil control ring, should be assembled with the two lugs positioned in the hole directly above the gudgeon pin bore.

The Maxiflex oil control ring can only be used as a replacement for the earlier type if a $\frac{3}{32}''$ (2·4 mm.) hole is drilled in the bottom groove of the piston immediately above the gudgeon pin bore.

REDUCED BIG END BEARING CLEARANCES

Commencing Engine Number ZA 1054

On cars with the above engine number and onwards, new big end bearings with reduced running clearances are fitted. These bearings may be fitted in place of the previous type providing they are fitted in pairs.

The running clearance is reduced from 0·0023″—0·0039″ (0·06—0·10 mm.) to 0·0015″—0·0033″ (0·04—0·08 mm.).

SECTION C

CARBURETTERS AND FUEL SYSTEM

3·8 MARK 10 MODEL

INDEX

CARBURETTERS

THE FUEL SYSTEM

CARBURETTERS

DESCRIPTION

The 3·8 Mark 10 is fitted with triple S.U. HD.8 type carburetters. The enrichment device for starting is in the form of an auxiliary carburetter attached to the front carburetter.

The jet (19) (Fig. 1), which is fed through its lower end, is attached to a synthetic rubber diaphragm (8) by means of the jet cup (7) and jet return spring cup (14), the centre of the diaphragm being compressed between these two parts; at its outer edge it is held between the diaphragm casing (15) and the float chamber arm. The jet is controlled by the jet return spring (13) and the jet actuating lever (16), the latter having an external adjusting screw which limits the upward travel of the jet and thus controls the mixture adjustment; sciewing it in (clockwise) enriches the mixture, and unscrewing it weakens the mixtuie.

Throttle Spindle Glands

Provision is made for the use of throttle spindle glands consisting of the cork gland itself (27) (Fig. 1), a dished retaining washer (30), a spring (29) and a shroud (28). This assembly should not require servicing and can only be removed by dismantling the throttle spindle and disc.

Idling

The carburetter idles on the main jet and the mixture is conducted along the passage way (6) (Fig. 1) connecting the choke space to the other side of the throttle disc.

The quantity of the mixture passing through the passage way and, therefore, the idling speed of the engine, is controlled by the "slow-run" valve (4), the quality or relative richness of the mixture being determined by the jet adjusting screw. It follows that when idling, the throttle remains completely closed against the bore of the carburetter.

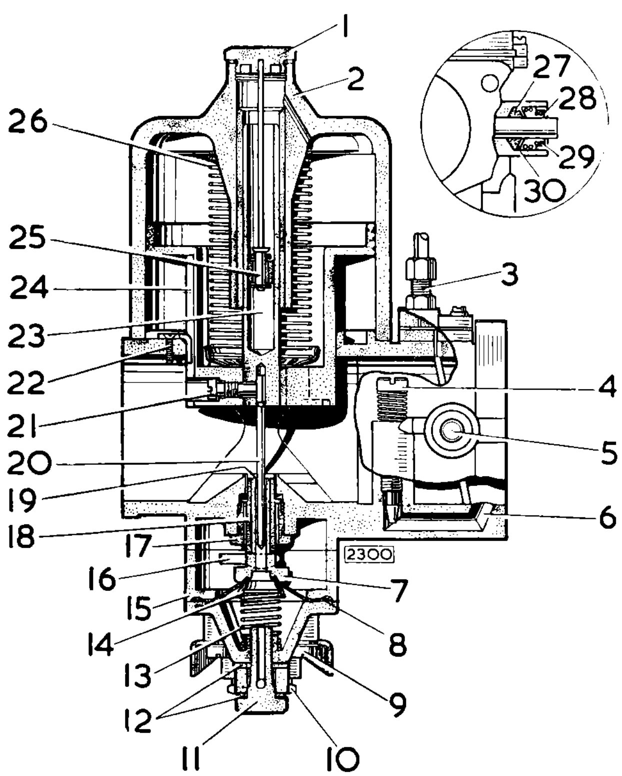


Fig. 1. Sectioned view of the HD.8 carburetter

1. Damper cap
2. Suction chamber
3. Union for vacuum advance/retard
4. Slow running volume screw
5. Throttle spindle
6. Slow run passage
7. Jet cup
8. Diaphragm
9. Float chamber securing screw
10. Banjo bolt
11. Banjo bolt
12. Fibre washers
13. Jet return spring
14. Return spring cup
15. Diaphragm casing
16. Actuating lever
17. Nut—jet bearing
18. Jet bearing
19. Jet
20. Needle
21. Needle retaining screw
22. Piston guide—retaining screw
23. Oil reservoir
24. Piston
25. Damper
26. Piston return spring
27. Throttle spindle gland
28. Shroud for spring
29. Spring
30. Washer

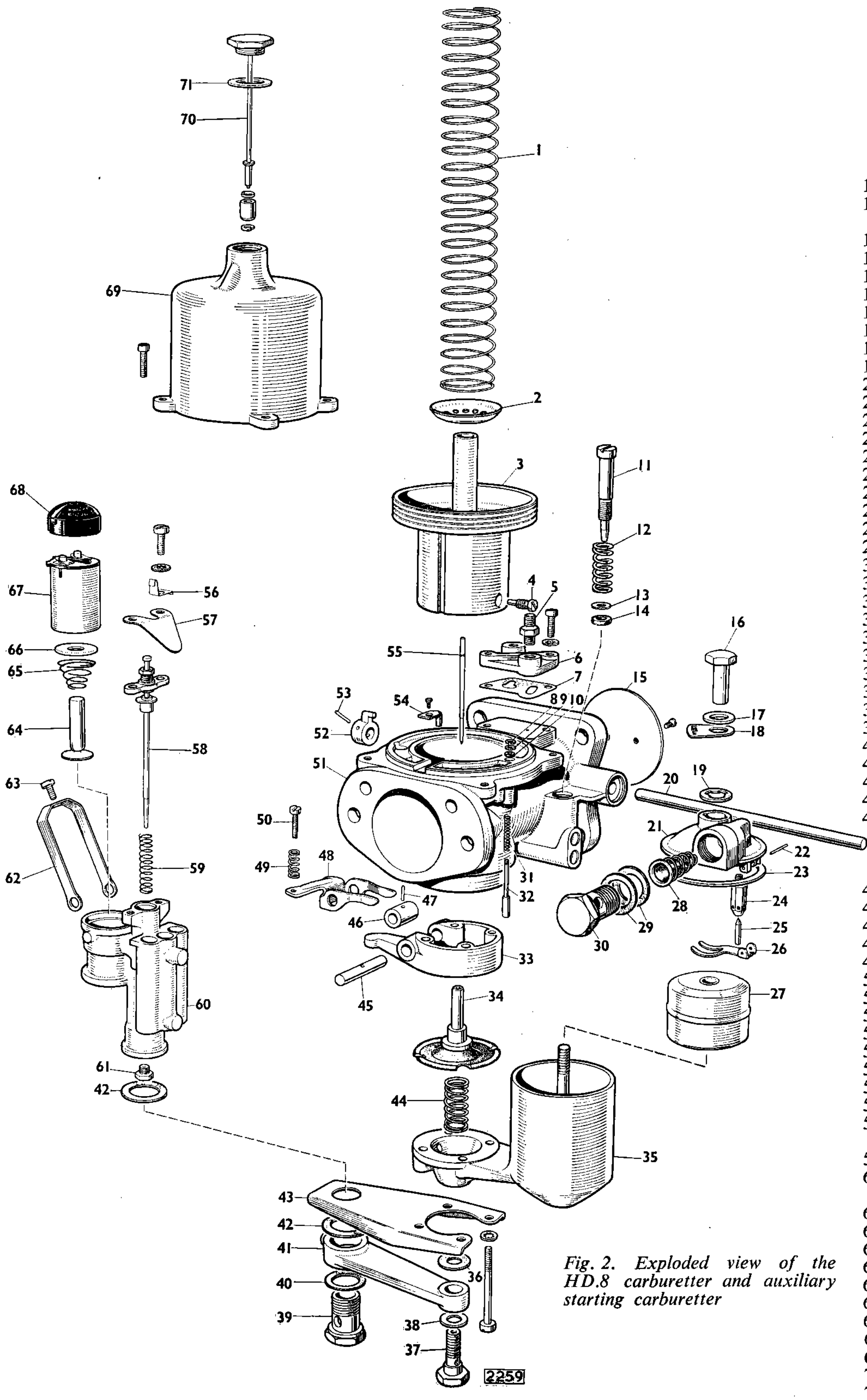


Fig. 2. Exploded view of the HD.8 carburetter and auxiliary starting carburetter

1. Spring
2. Skid washer
3. Piston
4. Retaining screw
5. Ignition union adaptor
6. Adaptor plate
7. Gasket
8. Spring washer
9. Washer
10. Nut
11. Slow running control screw
12. Spring
13. Brass washer
14. Neoprene washer
15. Throttle butterfly plate
16. Cap nut
17. Packing washer
18. Aluminium washer tag
19. Fibre serrated washer
20. Throttle spindle
21. Float chamber lid
22. Knurled pin
23. Gasket
24. Float needle seating
25. Float needle
26. Float needle lever
27. Float
28. Filter
29. Fibre washers
30. Banjo bolt
31. Spring
32. Piston lifting pin
33. Jet unit housing
34. Diaphragm
35. Float chamber
36. Fibre washer
37. Banjo bolt
38. Aluminium washer
39. Banjo bolt
40. Fibre washer
41. Connecting arm
42. Fibre washer
43. Bracket
44. Spring
45. Spindle
46. Distance piece
47. Locating pin
48. Lifting fork
49. Spring
50. Setscrew
51. Carburetter body
52. Throttle spindle stop
53. Shear pin
54. Piston guide
55. Needle
56. Spring clip
57. Dust shield
58. Auxiliary starter carburetter needle
59. Spring
60. Auxiliary starter carburetter body
61. Jet
62. Solenoid retaining clip
63. Pinch screw
64. Iron core disc valve
65. Conical spring
66. Washer
67. Solenoid
68. Solenoid cap
69. Suction chamber
70. Damper
71. Fibre washer

DATA

Type	S.U. HD 8 (triple)
Size	2″ (5·08 cm.)
Jet needle type	UM
Jet size	0·125″ (3·17 mm.)
Auxiliary starting carburetter—needle type	425/8

Note: The jet needle type is stamped on the side or top face of the parallel portion of the needle. The auxiliary starting carburetter needle is stamped with the large number (e.g. 425) on the shoulder of the needle, with the small number on the parallel portion of the needle.

ROUTINE MAINTENANCE

Warning: If it is desired to clean out the float chamber, do not use compressed air as this may cause rupture of the rubber jet diaphragm.

EVERY 2,500 MILES (4,000 KM).

Lubricate Carburetter Piston damper

Each carburetter is fitted with a hydraulic piston damper which, unless periodically replenished with oil, will cause poor acceleration and spitting back through the carburetter on rapid opening of the throttle.

To replenish with oil, unscrew the cap on top of the suction chambers and lift out the damper valve which is attached to the cap. Fill the hollow piston spindle, which can be seen down inside the bore of the suction chamber, with S.A.E.20 engine oil.

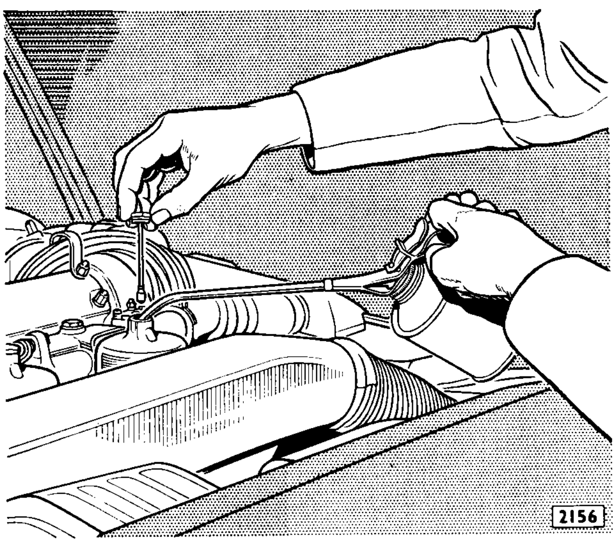


Fig. 3. Topping up the hydraulic damper

Checking Carburetter Slow Running

The idling speed of the engine should be 500 r.p.m. when the engine is at its normal working temperature.

If adjustment is required turn the three slow running volume screws (see Fig. 7) **by exactly equal amounts** until the idling speed, observed on the revolution counter instrument, is correct.

EVERY 5,000 MILES (8,000 KM.)

Tune Carburetters

(*see instructions, page* C.7)

Cleaning Carburetter Filters

Removal of the bolt securing the petrol pipe banjo union to each float chamber will expose the filters. Remove the filter and clean in petrol; do not use a cloth as particles will stick to the gauze.

When refitting, insert the filter with the spring first and ensure that the fibre washers are replaced, one to each side of the banjo union.

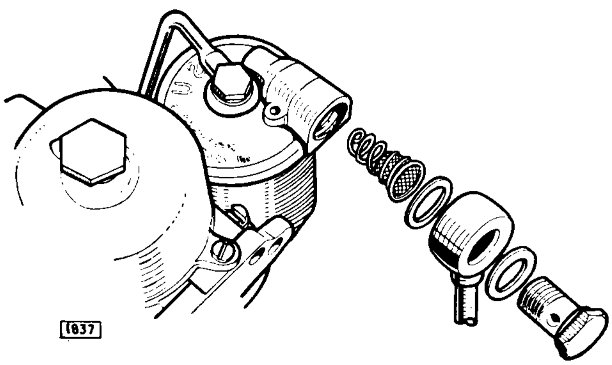


Fig. 4. Exploded view of the carburetter filter

Fuel Pump

The fuel pumps are situated in the petrol tanks, the pump with filter being submerged in the fuel. Due to the filter being self-cleaning this unit does not require periodic maintenance. If after long service the filter does become choked it can only be due to the excessive sediment in the petrol tank which should be removed and cleaned.

Fuel Feed Line Filter

The filter is attached to the right-hand wing valance and is of the glass bowl type with a flat filter gauze.

At the recommended intervals, or more frequently if the glass bowl shows signs of becoming full of sediment, slacken the locking nut, swing the retaining clip to one side and remove the bowl, sealing washer and filter gauze.

Clean the filter gauze and bowl by washing in petrol. Examine the sealing washer and if necessary fit a new one.

1. Lid
2. Gauze filter
3. Cork washer
4. Glass bowl

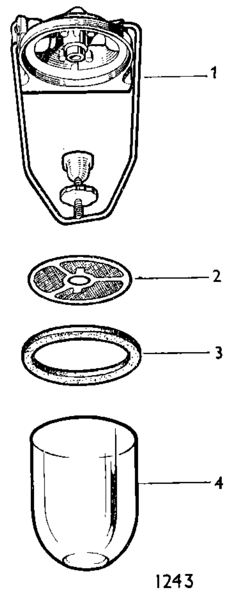


Fig. 5. Fuel feed line filter

CARBURETTERS

Since rubber "O" rings are fitted between the carburetters and manifold flanges, it is of the utmost importance that no attempt should be made to remove the carburetters from the manifolds whilst in position in the car.

The necessity of making sure the "O" rings are securely placed in the annular grooves of the aluminium packing pieces (Fig. 6) can only be checked with the carburetters and manifolds off the engine. Therefore, to remove the carburetters, proceed as follows.

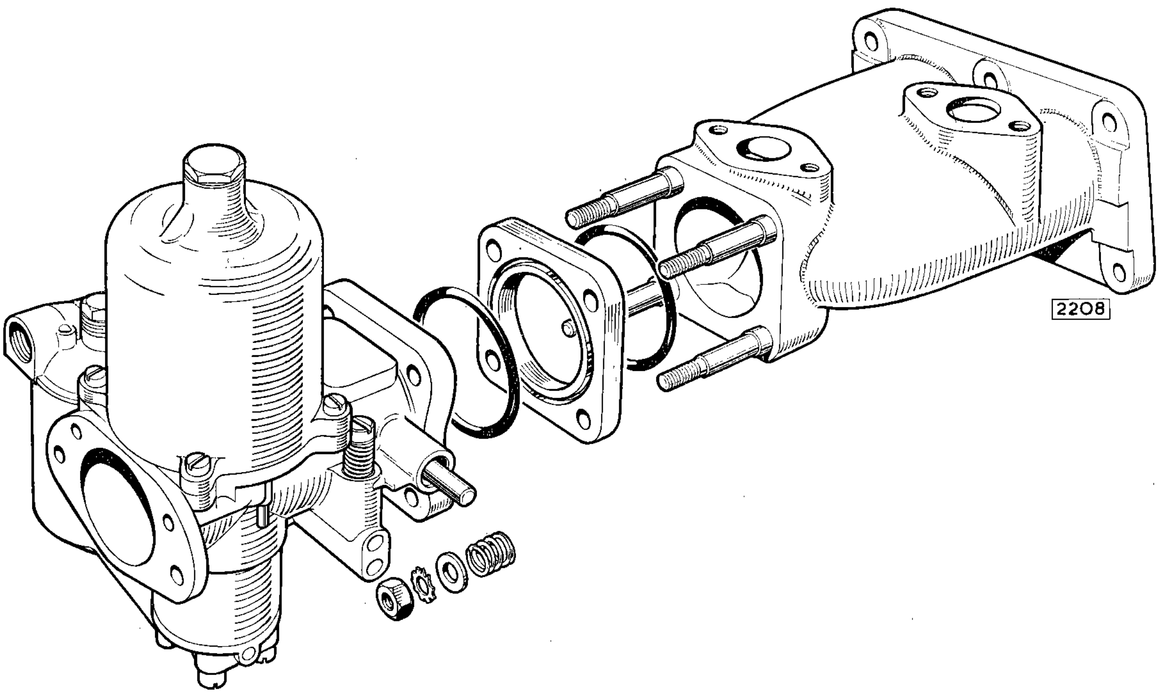


Fig. 6. Showing the carburetter to inlet manifold "O" rings

Removal

Remove the earth lead from the battery.

Drain the radiator.

Remove the air cleaner flexible hose.

Disconnect the breather pipe situated between the front and middle carburetters.

Remove the six nuts and shakeproof washers retaining the air intake box. Withdraw the air intake box and collect the three joints fitted between the intake box and carburetter flanges. Remove the three banjo bolts and six fibre washers retaining the petrol pipe.

Remove the vacuum advance pipe from the front carburetter by unscrewing the union nut.

Disconnect the throttle rod at the rear end of the inlet manifold balance pipe. Disconnect the green/blue cable at the temperature transmitter unit.

Disconnect the green/black cable at the thermostat switch and the green/black, green cables at the auxiliary starter carburetter.

Disconnect the green/yellow cable at the anti-creep switch (if fitted). Slacken the clips and disconnect the top water hose and by-pass hoses from the inlet manifold water jacket. Slacken the clips at the rear of the inlet manifold water pipe and heater unit.

Disconnect the vacuum pipe from the base of the water valve.

Remove the nut at the base of the water valve and withdraw the water valve and heater hoses.

Slacken the clips and remove the two vacuum pipes from the tee-piece at the rear of the inlet manifold balance pipe.

Remove the setscrew retaining the float chamber drain pipes to the oil filter body.

Remove the nuts and spring washers securing the inlet manifolds to the cylinder head.

Detach the heater pipe clips and cable retaining clips on the bottom manifold studs.

Withdraw the manifolds and carburetters.

Disconnect the three butterfly return springs.

Disconnect the throttle links which are clipped to throttle spindle levers.

Unscrew the union retaining the auxiliary starter carburetter induction tract.

Remove the four self-locking nuts, washers and springs from each carburetter.

Remove the throttle spring brackets and anti-creep switch.

Remove the three carburetters and note carefully the position of the two rubber "O" rings and aluminium distance piece on each manifold.

Refitting

Refitting is the reverse of the removal procedure, but note should be taken of the following points.

The "O" rings should be inspected for any signs of deterioration, that is, cuts, swelling or perishing of the rubber. The self-locking nuts should be screwed down until they meet the stud shoulder and stop turning. It should be possible to flex the carburetters up and down very slightly.

CLEANING THE SUCTION CHAMBER AND PISTON

This should be done at approximate intervals of every twelve months or if the carburetter is dismantled for any reason. After detaching, clean the main inside bore of the suction chamber and the two outside diameters of the piston with a rag moistened in fuel or thinners and then reassemble in a dry and clean condition with a few spots of thin oil on the piston rod only. Do NOT use metal polish to clean the suction chamber and piston.

CARBURETTER TUNING

Before tuning the carburetters, the sparking plug gaps and contact breaker gaps should be checked and adjusted if necessary. The distributor centrifugal advance mechanism and vacuum advance operation should be checked and ignition timing set to the figure given in Section B "Engine," with the centrifugal advance mechanism in the static position. For final road test, adjustment of not more than six clicks of the micrometer adjustment at the distributor to either advance or retard is permitted. The ignition setting is important since if retarded or advanced too far the setting of the carburetters will be affected. As the needle size is determined during engine development, tuning of the carburetters is confined to the correct idling setting.

If after tuning the carburetters, the idling setting and engine performance is not satisfactory, it will be necessary to check the cylinder compressions and the valve clearances.

Tuning

Run the engine until it has attained its normal operating temperature.

Remove the air cleaner flexible hose. Disconnect the breather pipe situated between the front and middle carburetters. Remove the six nuts and shakeproof washers retaining the air intake box. Withdraw the air intake box and collect the three joints fitted between the intake box and carburetter flanges.

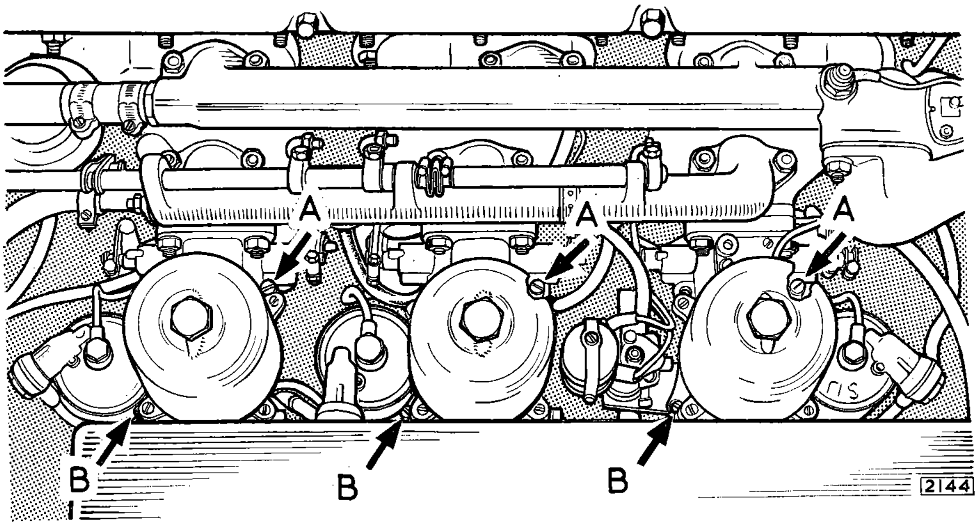


Fig. 7. "A"—Slow running volume screw "B"—Mixture adjusting screw

Slacken off the anti-creep throttle switch lever. Release the three pinch bolts securing the two piece throttle levers to the carburetter throttle spindles.

Taking one carburetter at a time close each throttle butterfly valve fully by rotating the throttle spindle in a clockwise direction looking from the front; with the throttle held closed tighten the pinch bolt keeping the two piece throttle lever in the midway position (see Fig. 8).

Repeat for the other two carburetters, then operate the accelerator linkage and observe if all the throttles are opening simultaneously by noting the movement of the full throttle stops at the left-hand side of the throttle spindles.

Note: On initial movement of the accelerator linkage there should be a limited amount of lost motion at the throttle spindles; this ensures that all the throttle butterfly valves can return to the fully closed position. Re-position the anti-creep throttle switch lever so that the switch is depressed when the throttles are closed.

Screw down the slow running volume screws (A, Fig. 7) on to their seatings and then unscrew two full turns. Remove the piston and suction chambers, ensure that the needles are correctly located in the piston, that is, with the lower edge of the groove flush with the base of the piston (see Fig. 9). Unscrew the mixture adjusting screws (B) until each jet is flush with the bridge of its carburetter. Replace the pistons and suction chambers and check that each piston falls freely on to the bridge of its carburetter (by means of the piston lifting pin). Turn down the mixture adjusting screws $2\frac{1}{2}$ turns.

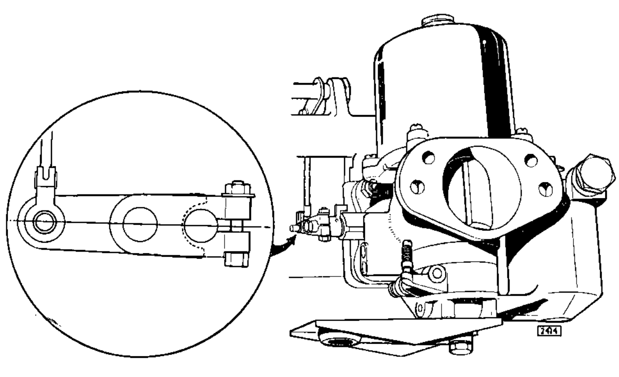


Fig. 8. Two piece throttle lever. Inset shows it in the midway position

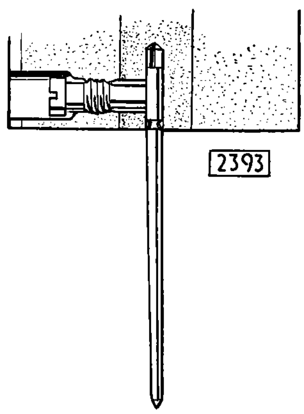


Fig. 9. Positioning the jet needle with the lower edge of the groove flush with the base of the piston

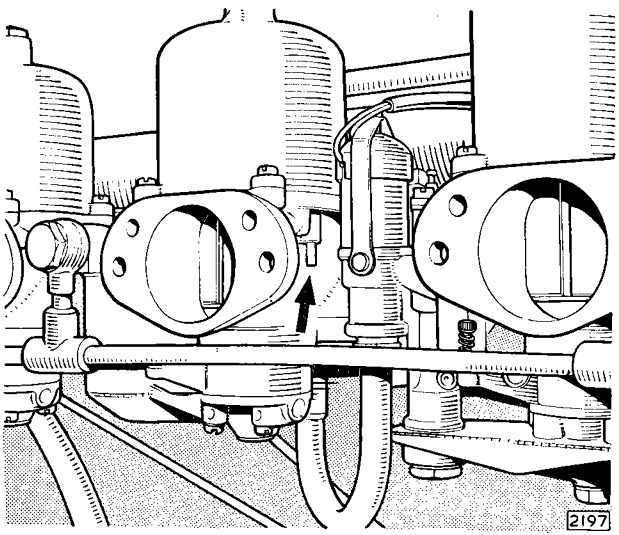


Fig. 10. The carburetter piston lifting pin; the first part of the movement is spring loaded free travel

Restart the engine and adjust to the desired idling speed of 500 r.p.m. by moving each slow running screw an equal amount. By listening to the hiss in the intakes, adjust the slow running screws until the intensity of the hiss is similar on all intakes. This will synchronise the mixture flow of the three carburetters.

When this is satisfactory the mixture should be adjusted by screwing all the mixture adjusting screws up (weaker) or down (richer) by the same amount until the fastest idling speed is obtained consistent with even firing.

As the mixture is adjusted, the engine will probably run faster and it may therefore be necessary to screw down the slow running volume screws in order to reduce the speed.

Now check the mixture strength by lifting the piston of the front carburetter by approximately $\frac{1}{32}''$ (·8 mm) when, if:

(*a*) the engine speed increases and **continues to run faster,** this indicates that the mixture is too rich.

(*b*) the engine speed immediately decreases, this indicates that the mixture is too weak.

(*c*) the engine speed **momentarily** increases very slightly, this indicates that the mixture is correct.

Repeat the operation at the remaining two carburetters and after adjustment recheck the front carburetter since the carburetters are interdependent.

When the mixture is correct, the exhaust note should be regular and even. If it is irregular, with a splashy type of misfire and colourless exhaust, the mixture is too weak. If there is a regular or rythmical type of misfire in the exhaust beat together with a blackish exhaust, then the mixture is too rich.

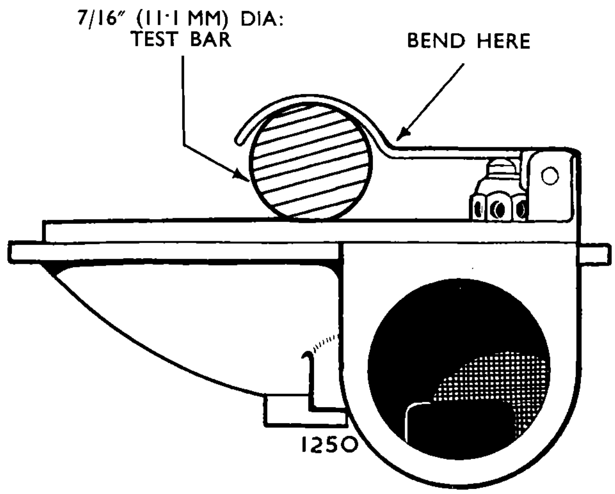


Fig. 11. Checking the float lever setting, which controls the fuel level in the float chamber

Float Chamber Fuel Level

When the fuel level setting is correct a $\frac{7}{16}''$ (11·1 mm.) test bar will just slide between the lid face and the inside curve of the float lever fork when the needle valve is in the "shut-off" position (see Fig. 11).

If the float lever fails to conform with this check figure, it must be carefully bent at the start of the fork section, in the necessary direction, for correction. Take care to keep both prongs of the fork level with each other and maintain the straight portion of the lever dead flat.

It is not advisable to alter the fuel level unless there is trouble with flooding; although too high a level can cause slow flooding, particularly when a car is left ticking over on a steep drive. It should be remembered that flooding can also be caused by grit in the fuel jamming open the needle valve, undue friction in the float gear, excessive engine vibration, or a porous float.

CENTRING THE JET

Warning: Take care not to bend the carburetter needle when carrying out this operation.

Remove the carburetter from the engine as described on page 7.

Remove the four setscrews securing the float chamber to the carburetter body. Remove the float chamber, jet housing and jet. Remove the hydraulic damper.

With a ring spanner slacken the jet locking nut approximately half a turn. Replace the jet and diaphragm assembly.

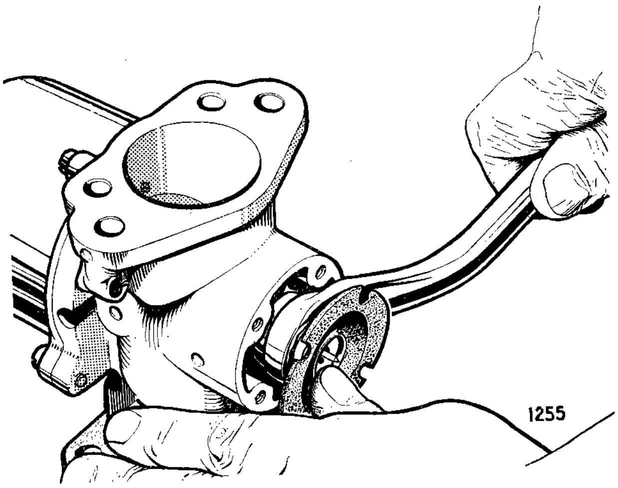


Fig. 12. Centring the jet

The jet is correctly centred when the piston falls freely and hits the jet "bridge" with a metallic click. To centre the jet, push the jet and diaphragm assembly as high as possible with the hand and with a pencil or rod gently press the piston down on to the jet bridge; centralisation will be facilitated if the side of the carburetter body is tapped lightly. Tighten the jet locking nut.

The actual centring must be carried out with the setscrew holes in the jet diaphragm and carburetter in alignment. After tightening the jet locking nut, the jet diaphragm must be kept in the same position relative to the carburetter body; the simplest way to do this is to mark one of the corresponding jet diaphragm and carburetter body setscrews holes with a soft pencil. Failure to do this may cause the centralisation to be upset.

Check that the centralisation is correct by noting if there is any difference in the sound of the piston hitting the jet bridge with the jet in its highest and lowest positions. If there is any difference in the sound, the procedure for centralising the jet will have to be repeated.

If difficulty in centring the jet is encountered after carrying out the above procedure, the jet needle can be lowered slightly in the piston to make the centralising effect more positive. The needle must, however, be restored to the normal position when checking the centralisation.

THE AUXILIARY STARTING CARBURETTER

Description

The enrichment apparatus for starting is, in effect, an auxiliary carburetting system. The main body

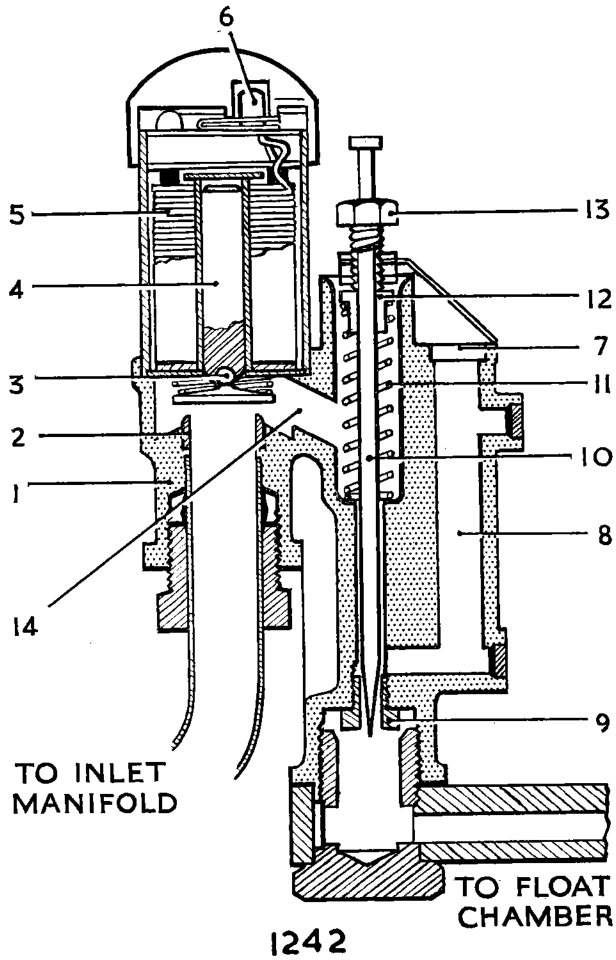


Fig. 13. Sectioned view of the auxiliary starting carburetter

casting (1, Fig. 13) containing a solenoid-operated valve and fuel metering system is a separate unit attached by means of a ducted mounting arm to the base of the front carburetter.

The auxiliary carburetter forms, therefore, a separate unit additional to the normal float chamber retained by the hollow cross-drilled bolt.

Fuel is supplied to the base of the jet (9), which is obstructed to a greater or lesser degree by the tapered slidable needle (10).

When the device is in action air is drawn from atmosphere through the air intake (7) and thence through the passage (8), being carburetted with fuel as it passes the jet (9). The mixture is thence carried upwards past the shank of the needle (10) through the passage (14) and so past the aperture provided between the valve (3) and its seating (2). From here it passes directly to the inlet manifold through an external feed pipe.

The device is brought into action by energizing the winding of the solenoid (5) from the terminals (6). The centrally located iron core (4) is thus raised magnetically, carrying with it the ball-jointed disc valve (3) against the load of the small conical spring and thus uncovering the aperture provided by the seating (2).

Considering the function of the slidable needle (10), it will be seen that this is loaded upwards in its open position by means of the light compression spring (11) which abuts against a disc (12) attached to the shank of the needle. The needle continues upwards through the vertically adjustable stop (13) and finally terminates in an enlarged head.

Depression within the space surrounding the spring (11) is directly derived from that prevailing in the induction tract, and this exerts a downward force upon the disc (12), which is provided with an adequate clearance for its surrounding bore. This tends to overcome the load of the spring (11) and to move the needle downwards, thus increasing the obstruction afforded by the tapered section which enters the jet (9).

The purpose of this device is to provide two widely different degrees of enrichment, the one corresponding to idling or light cruising conditions and the other to conditions of open throttle or full-power operation. In effect, under the former conditions the high induction depression prevailing will cause the disc (12) to be drawn downwards, drawing the tapered needle into the jet (9), while under the latter, the lower depression existing in the induction tract will permit the collar to maintain its upward position with the needle withdrawn from the jet.

The tuning elements concerned in this device are the size and degree of taper of the lower end of the needle (10), the diameter of the disc (12), the load provided by the spring (11) and the degree of movement permitted to the needle assembly, as determined by the adjustment of the stop (13).

The solenoid (5) is energized by means of a thermostatically operated switch housed in the inlet manifold water jacket. This is arranged to bring the apparatus into action at temperatures below about 30—35°C. (86—95°F).

Adjustment

The engine must be at its normal running temperature before any attempt is made to tune the auxiliary enrichment device.

As it can generally be assumed that the tapered form of the needle (10), the strength of the spring (11), and the diameter of the disc (12) have already been appropriately chosen, tuning is generally confined to the adjustment of the stop screw (13). It will be appreciated that the main purpose of this adjustment is to limit the downward movement of the needle, the head of which abuts against the upper surface of the stop screw at the lower extremity of its travel. The final downward movement of this needle determines, as has been described, the degree of enrichment provided under idling conditions with the auxiliary carburetter in operation. An appropriate guide to its correct adjustment in this respect is provided by energizing the solenoid when the engine has already attained its normal temperature. The stop screw (13) should then be so adjusted that the mixture is distinctly although not excessively rich, that is to say, until the exhaust gases are seen to be discernibly black in colour, but just short of the point where the engine commences to run with noticeable irregularity.

Anti-clockwise rotation of the stop screw will, of course, raise the needle under these conditions and increase the mixture strength, while rotation in the opposite direction will have the opposite effect. In order to energize the solenoid under conditions when

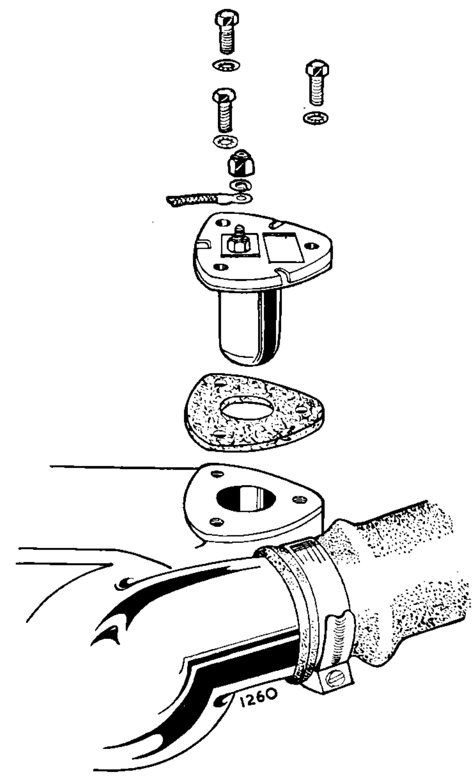


Fig. 14. Removal of the auxiliary starting carburetter thermostatic switch

the thermostatic switch will normally have broken the circuit, it is merely necessary to short-circuit the terminal of the thermostatic switch directly to earth with a screwdriver and flick open the throttles when the starting device will be heard to come into operation with a pronounced hissing noise.

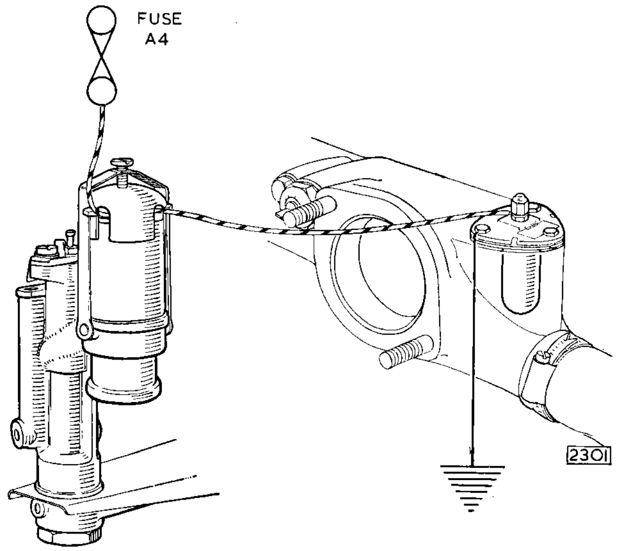


Fig. 15. Wiring circuit for the auxiliary starter carburetter to the thermostatic switch

Thermostatic Switch—Removal

The thermostatic switch which controls the operation of the auxiliary starting carburetter is situated at the front end of the inlet manifold water jacket.

Remove the electrical cable from the switch by removing the chrome plated domed nut.

If the radiator filler cap is securely tightened no appreciable amount of water will escape when the auxiliary starting carburetter switch is removed. Alternatively, a small amount of water can be drained from the radiator.

Remove the three securing setscrews and washers and withdraw the switch and the cork gasket.

Refitting

Refitting is the reverse of the removal procedure. A new cork gasket must be fitted when the switch is replaced. If any water has been drained from the radiator or has escaped during the removal of the switch, the radiator should be topped up to the correct level.

ACCELERATOR LINKAGE ADJUSTMENT (R.H. Drive)

Note: It is important to obtain the correct angle of the accelerator lever brackets for satisfactory operation of the accelerator controls.

Setting the complete accelerator linkage

1. Remove the connecting link (A, Fig. 16) (spring control rod on automatic transmission models).
2. Fit a $5\frac{3}{4}''$ (14·60 cm) template between the accelerator pedal and the toe board.
3. Slacken off the pinch bolt (B) of the lever (C) and fit a $1\frac{5}{8}''$ (4·12 m) template between the bell crank lever (C) ball end and the outer diameter of the kick down cross shaft (D). Lock up the pinch bolt on the accelerator cross shaft (B).
4. To reset the slow motion link (E), ensure that the carburetter throttle butterflies are shut. If necessary, this can be obtained by slackening off the pinch bolts on all the butterfly levers and adjusting the slow running stop eccentric to give $\frac{1}{16}''$ (1·58 mm) "offset" as shown in Fig. 16. Re-tighten the butterfly levers to the desired position; ensuring that a minimum of free play exists between the butterfly spindles and levers.
5. On automatic transmission models with the accelerator template still in position, adjust the kick down spring control rod (A) in length until it will fit the ball joints of levers (C) and (F). DO NOT forget to tighten the spring control rod lock nuts.
6. Remove the accelerator pedal to toeboard template. Depress the accelerator pedal to the full throttle position; do NOT operate the linkage by hand to obtain full throttle. Adjust the full throttle stop eccentric until it is just touching the slow motion link.

ACCELERATOR LINKAGE ADJUSTMENT (L.H. Drive)

Proceed as for R.H. Drive in paragraphs 1, 2, 3 and 4.

5. Adjust the slave bell crank fulcrum bracket (G, Fig. 17) on the left-hand bulkhead by slackening off the two mounting setscrews (H). Position the bracket so that the slave bell crank (J) is immediately in front of the fulcrum bracket upper setscrew (H).
6. Proceed as for R.H. Drive in paragraphs 5 and 6.

ACCELERATOR PEDAL STOP

Adjustment—Automatic Transmission

Slacken off the locknut and screw down the stop which is situated behind the accelerator pedal.

Depress the accelerator pedal until the spring control rod is compressed (i.e. kickdown is obtained).

Screw out the accelerator pedal stop until it is in contact with the back of the pedal. Tighten the locknut.

It may be necessary to reset the stop when the vehicle is road tested.

Adjustment—Standard and Overdrive Transmission

Slacken off the locknut and screw down the stop which is situated behind the accelerator pedal.

Depress the accelerator pedal until full throttle is reached at the carburetters. DO NOT overstress the linkage by pressing the pedal too far.

Screw out the accelerator pedal stop until it is in contact with the back of the pedal. Tighten the locknut.

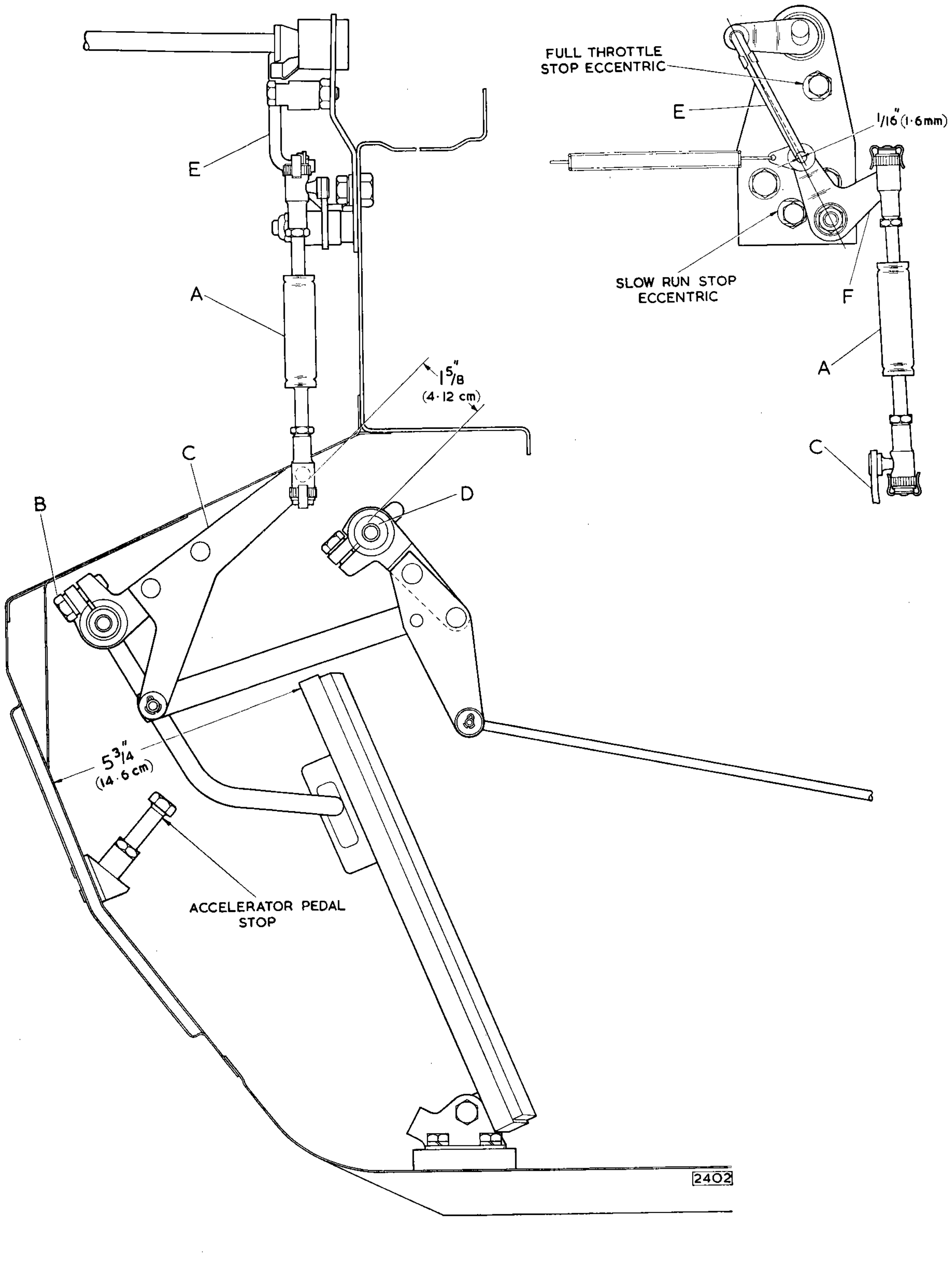


Fig. 16. Accelerator linkage—Right-hand drive

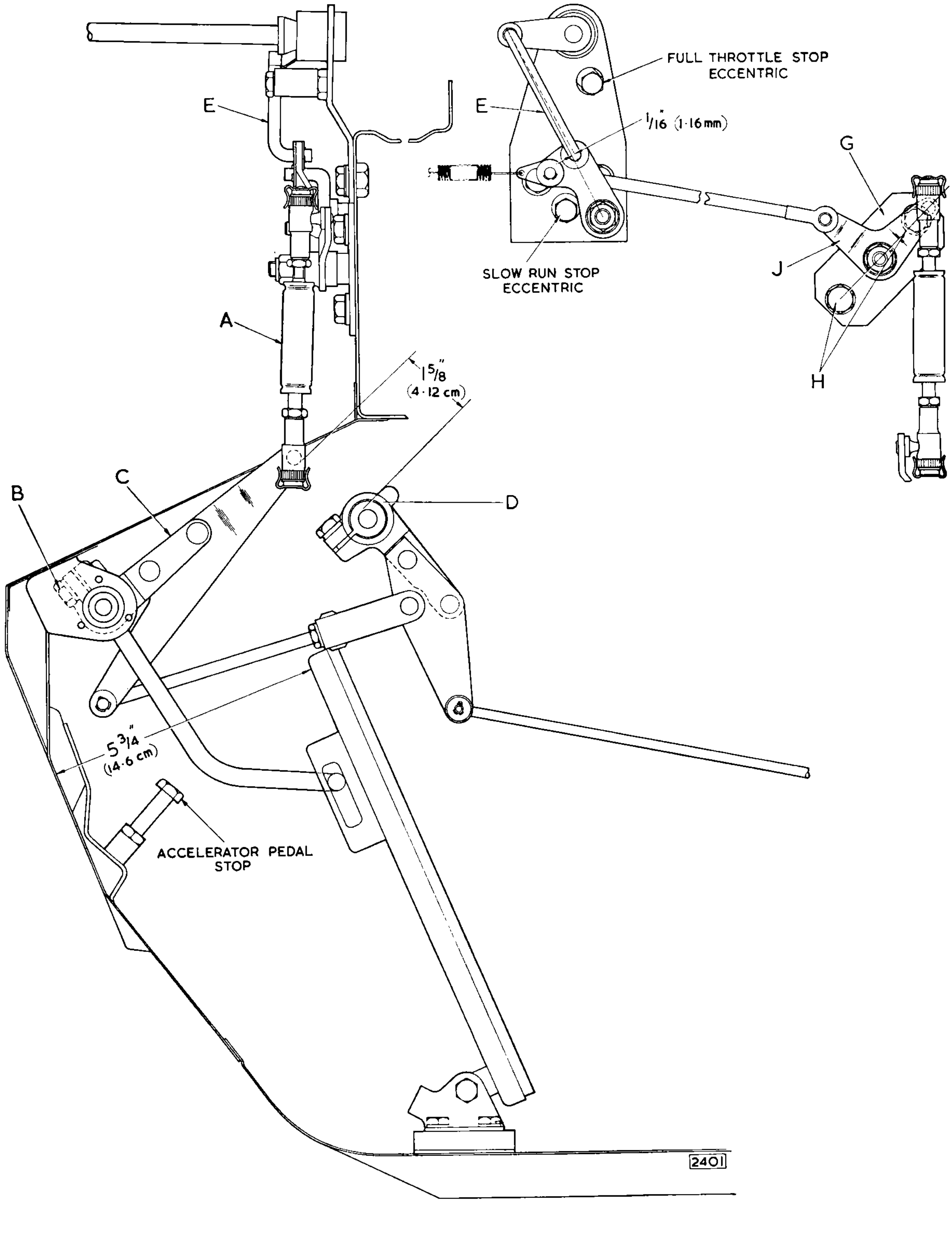


Fig. 17. Accelerator linkage—Left-hand drive

THE FUEL SYSTEM

DESCRIPTION

The fuel system consists of two separate ten gallon tanks situated in each rear wing and which contain Lucas submerged type petrol pumps incorporating a self cleaning filter. A switch is provided on the instrument panel to facilitate the change from one tank to the other (Fig. 18). The petrol gauge is connected to both tanks and records the amount of fuel in the operative tank.

FUEL PUMPS

The Lucas 2FP fuel pump is a complete unit, consisting of a cumulative type centrifugal pump driven by a permanent field electric motor. The unit is fully sealed and is mounted inside the fuel tank.

Fuel is delivered to the carburetters at a pressure of approximately 2½ lbs. per sq. in. (0·176 kg./cm²) when either pump is running.

A non-return valve in the outlet of each pump prevents fuel being fed from the operative tank to the non-operative tank (see Fig 24).

Electrically the pump is under the control of the ignition switch and will commence to operate when the ignition is switched "ON."

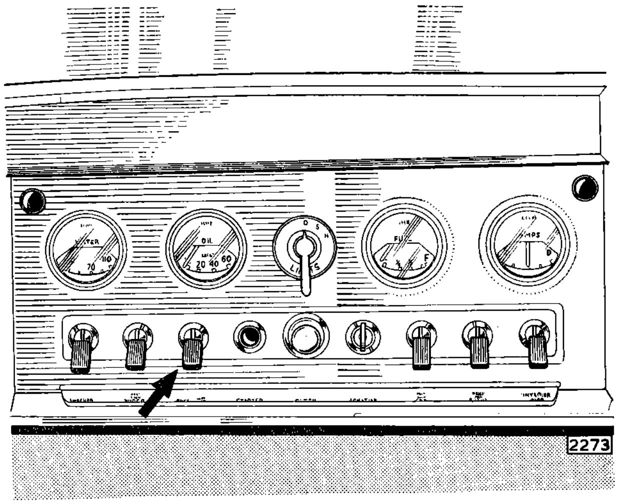


Fig. 18. Position of fuel tank change over switch (L.H. Drive)

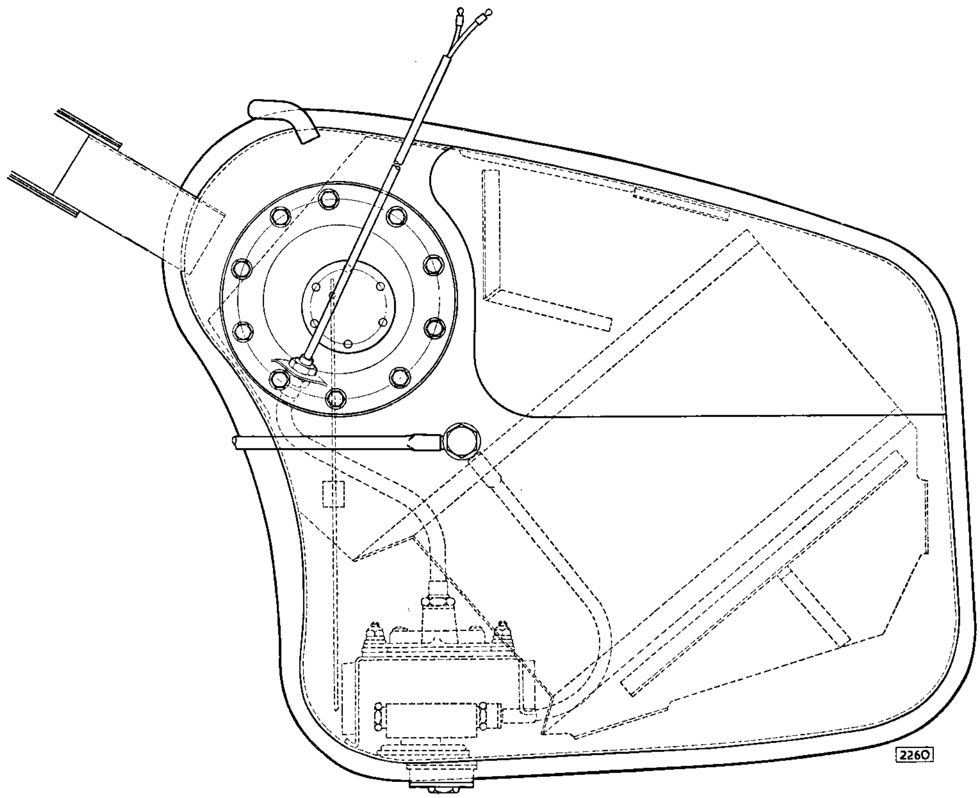


Fig. 19. Position of the fuel pump in the tank

A 5 amp fuse, located behind the instrument panel in the fuse pack, is incorporated in the electrical circuit as a safety measure in the event of a fault developing in a pump or connections and it is essential if a fuse blows to replace it with one of the same value. Under no circumstances should a higher rated fuse be fitted.

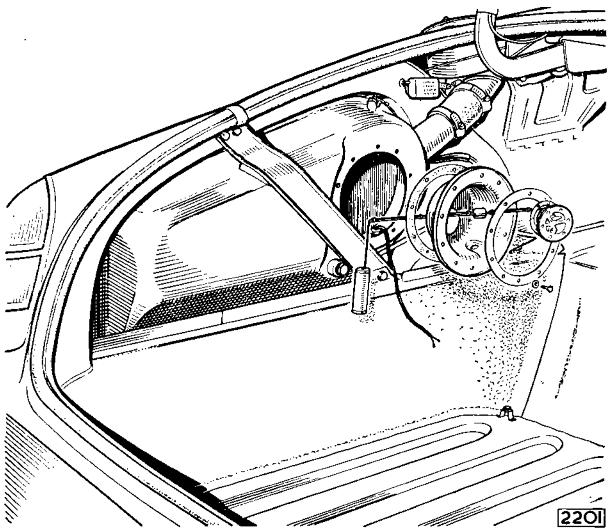


Fig. 20. Showing the cover plate and fuel tank gauge unit removed

Removal

Disconnect the positive battery terminal. Remove eight self-tapping screws and trim panel covering the petrol tank. In the case of the right-hand tank, it will be necessary to remove the spare wheel and tool kit. Drain the petrol tank by removing the drain plug situated underneath the car. Disconnect the petrol pump cable, noting that like colours are connected.

A. Cable terminals
B. Commutator brushes
C. Impeller
D. Relief valve
E. Gauze flame trap
F. Armature
G. Anti-static earthing washer

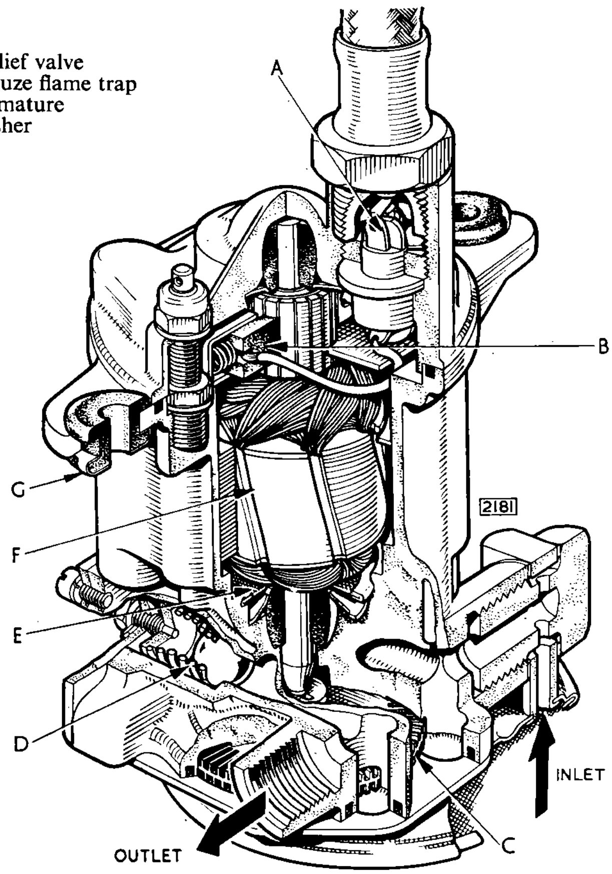


Fig. 21. Sectioned view of the Lucas fuel pump

Remove the brass nut securing the pump cable to the petrol tank cover plate. Remove the ten setscrews, washers and stiffener plate retaining the cover plate in position. To facilitate reassembly, mark the position of the cover plate in relation to the petrol tank as the setscrews are unequally spaced. Remove the cover plate complete with petrol gauge unit and take care not to damage the petrol gauge float. Remove the delivery pipe union from inside the tank noting the position of fibre and cork washers.

Remove the two self-locking nuts and brass washers retaining the petrol pump. Remove the petrol pump taking care not to damage the filter gauze attached to the pump unit.

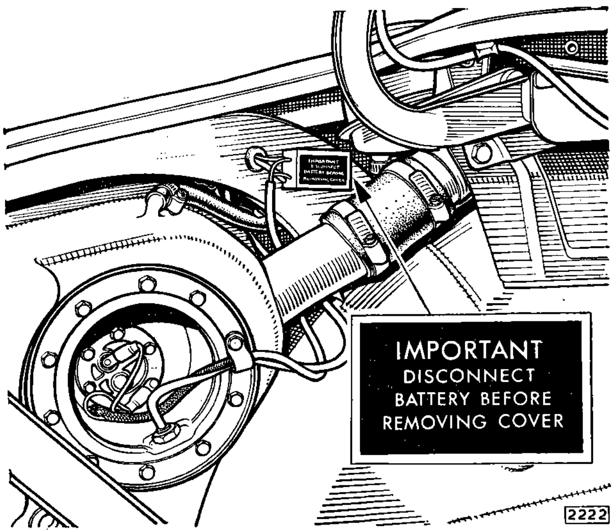


Fig. 22. Location of the fuse pack

Refitting

Refitting is the reverse of the removal procedure, but care must be taken when refitting the pump to the tank to ensure that the cork washer on the inner petrol pump to tank union is replaced.

Note: A star washer is provided on one of the petrol proof grommets on the mounting lugs. This washer provides an earthing path from the pump to the mounting bracket via the fixing bolt, so preventing the build up of electrostatic charges on the pump unit. **It is extremely important that the earthing washer is in position when a replacement pump is fitted.**

Ensure that the drain plug and cover place cork washer are in good condition and renew if necessary.

SERVICING INSTRUCTIONS

Complaint—Fuel Starvation

(i) Check the level of the fuel in the tanks. Replenish if necessary.

(ii) Check the fuse, located behind the instrument panel. If after replacement the fuse blows again, check for a short circuit in (*a*) feed cables or (*b*) pump units.
Replace unit or repair cable as required.

(iii) If the fuse has not blown, check cable connectors contained in rubber anti-flash blocks located in the spare wheel compartment, by which the pumps are connected to the battery supply.
Check voltage and current available at the terminal ends with the ignition switched "ON" by using a first grade voltmeter and an ammeter. The voltage should be 12 volts and the current should not exceed 1·8 amperes.

(iv) If no voltage is shown, check that the fault is not due to a broken or an intermittent connection in the switch, feed or earth. Repair as necessary.

(v) If no current or an excessive current measurement is shown, this will be indicative that the pump being tested is faulty.
Fit a replacement pump unit.

Complaint—Fuel Flooding

First check that the needle valves in the carburetters are clean and unworn. If these are satisfactory, check the delivery pressure by connecting a pressure gauge to the fuel line at the petrol pump end.

With a voltage of 12 volts applied to either pump this pressure should be $2\frac{1}{2}$—$2\frac{3}{4}$ lbs./sq. in. (·176—·183 kg./cm^2) with the system closed.

If it is higher than $2\frac{3}{4}$ lbs./sq. in. (183 kg./cm^2) the setting of the relief valve (a screw and locknut on the pump cover plate) should be adjusted to reduce the pressure to $2\frac{3}{4}$ lbs./sq. in. (·183 kg./cm^2).

Adjustment of the Relief Valve

A suitable rig for this purpose can be made by employing a container deep enough to receive the pump and containing sufficient paraffin to cover the inlet filter. Position the pump in the container on two small wooden packing blocks, which will ensure that the filter unit is clear of the bottom. Connect an O —5 p.s.i. gauge to the outlet union and connect the pump supply cables to a 12 volt source (BLACK to positive). Switch on, and set the delivery pressure to $2\frac{1}{2}$—$2\frac{3}{4}$

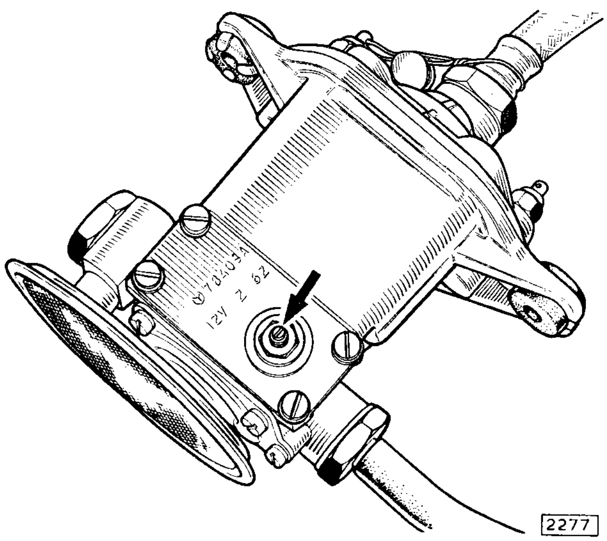


Fig. 23. Pump pressure adjusting screw

lbs./sq. in. (·176—·183 kg./cm^2) by means of the adjusting screw on the pump cover plate (see Fig. 23), turning clockwise to increase and anti-clockwise to decrease. Secure the selected position of the screw with the locknut.

Non-Return Valves

As previously stated, each pump is provided with a non-return valve in the delivery union (see Fig. 24), preventing fuel being pumped from one tank to the other. This valve takes the form of a flat rubber seal which blanks off the pump delivery port. A light backing spring allows the seal to be lifted off its seating by the pump delivery pressure during normal operation.

In the unlikely event of failure of a non-return valve, indication will be given by a rise in fuel level in the non-operative tank which if unchecked may lead

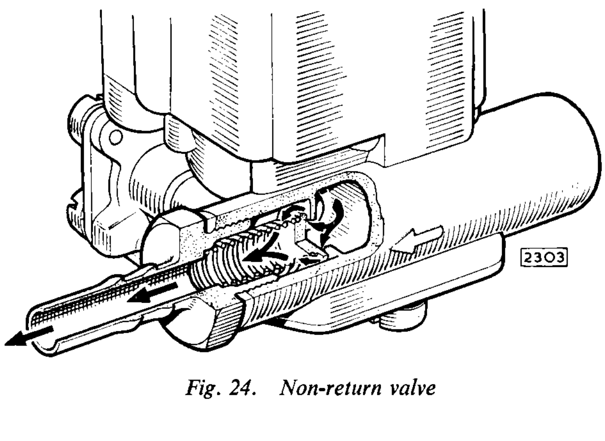


Fig. 24. Non-return valve

to fuel spillage through the tank overflow. Removal of the pump for examination of the non-return valve will be necessary (see fuel pump removal).

Note: When testing the fuel pump for fuel pressure, the **black** cable on the pump must always be connected to the **positive** battery terminal.

WARNING

When bench testing a fuel pump, EXTINGUISH all naked lights or flames in the vicinity and do not allow the cables to spark when making connections. To obviate this connect a switch in the test cable circuit and switch "OFF" when connecting the pump to the battery.

FUEL TANKS

Removal

Disconnect the battery positive terminal. Drain the tank by removing the drain plug situated underneath the car. (See Fig. 25). Remove the eight self-tapping screws and trim panel covering the petrol tank, In the case of the right-hand tank it will be necessary to remove the spare wheel and tool kit.

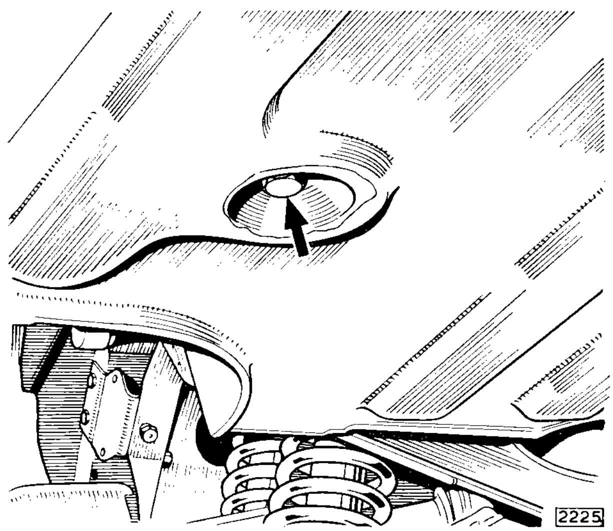


Fig. 25. Location of the fuel tank drain plug

Remove the four setscrews and washers securing the diagonal tank locating bracket in position. Remove the fuel pump cables from the terminal block, noting that like colours are connected. Remove the fuel pipe banjo bolt (33) and fibre washers (34) from the side of the tank. Remove the fuel gauge wires. Slacken the filler pipe clips (20) and push the rubber pipe (19) up the filler neck.

1. Right-hand fuel tank
2. Fuel level indicator
3. Gasket
4. Cover plate
5. Gasket
6. Stiffener plate
7. Drain plug
8. Washer
9. Left-hand fuel tank
10. Fuel level indicator
11. Left-hand cover plate
12. Tank and spare wheel retaining strap
13. Left-hand tank retaining strap
14. Rubber locating pad under retaining strap
15. Rubber locating pad
16. Rubber locating pad
17. Rubber locating pad
18. Rubber locating pad
19. Fuel filler rubber hose
20. Hose clips
21. Hose
22. Clips
23. Overflow pipe
24. Clip
25. Grommet
26. Fuel pump
27. Nylon pipe
28. Union
29. Banjo
30. Fibre washer
31. Cork washer
32. Fuel pipe
33. Banjo
34. Fibre washer
35. Cork washer
36. Grommet
37. Retaining clip
38. Retaining clip
39. Spring body clip
40. Filter bowl
41. Filter bowl lid
42. Cork washer
43. Gauze filter
44. Glass bowl
45. Bowl retaining clip
46. Banjo
47. Fibre washers
48. Fuel filter to carburetter fuel pipe
49. Banjo
50. Fibre washers

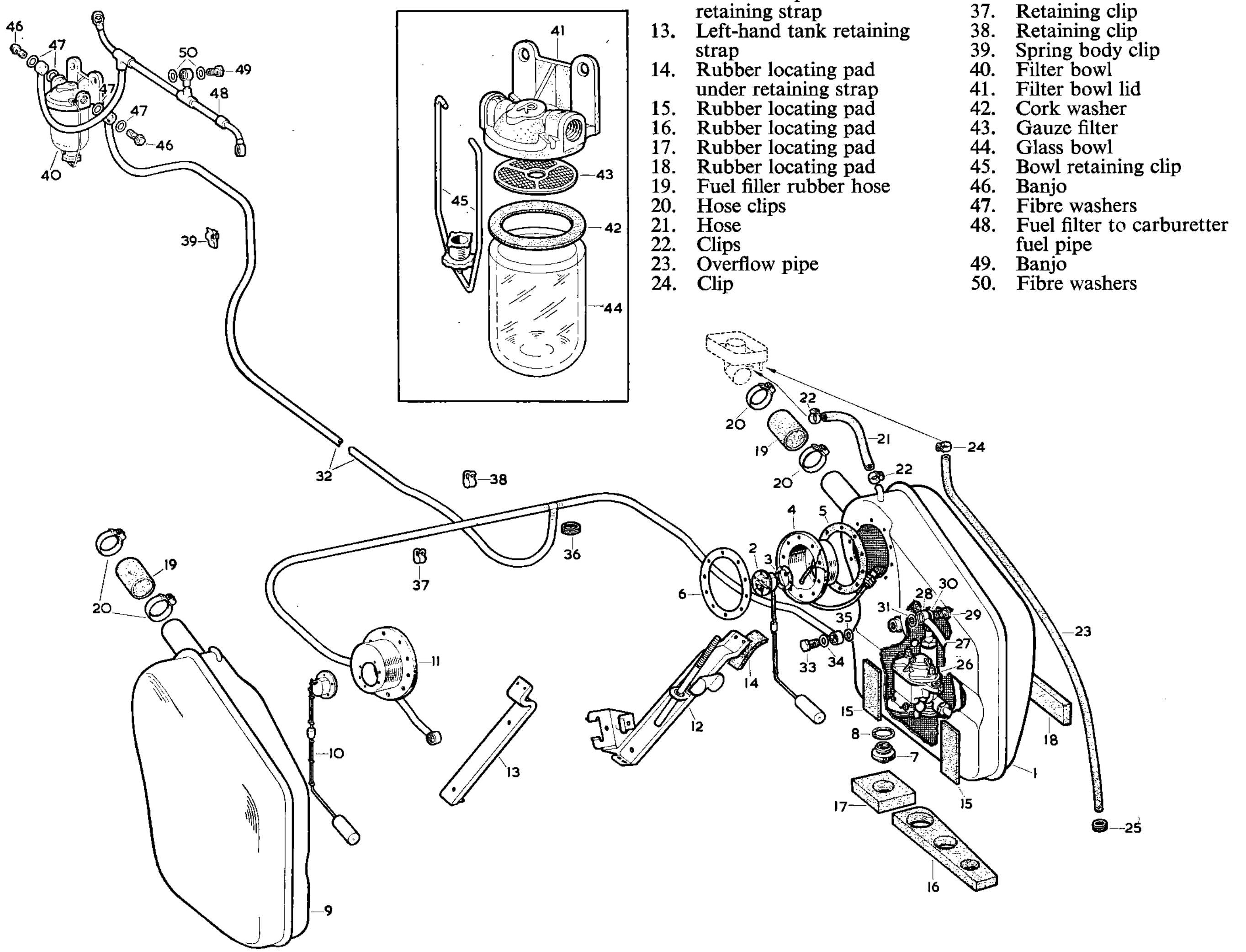


Fig. 26. Exploded view of the fuel system

Slacken the breather clip (23) and remove breather pipe. Withdraw the fuel tank.

Refitting

Refitting is the reverse of the removal procedure. Replace the fuel gauge cables with the white and green cable to the terminal marked "W" and the green and black to the terminal marked "T". The black cable should be fitted to the earth terminal on the element housing.

Note: To ensure that the cable connectors are correctly attached to the blade terminals on the fuel gauge tank unit, slide back the insulating sleeve from the cable connector to expose the terminal end. Push home fully onto the blade and slide the insulating sleeve forward to cover the joint.

FUEL TANK GAUGE UNITS

Removal

Disconnect the battery positive terminal.

Remove the trim panel and eight self-tapping screws, to expose the fuel tank gauge unit. Disconnect the three cables. Remove the six setscrews and twelve copper washers attaching the unit to the fuel tank. The seal can be broken by a sharp tap on one side of the unit. Withdraw the unit, taking care not to damage the float arm.

Refitting

The existing gasket should be scraped away from the boss on the fuel tank, taking care that none falls into the tank. Apply a suitable sealing compound to both sides of the new gasket, which should be positioned on the fuel tank boss with the holes in line. Insert the element into the tank so that the float is towards the rear of the car. Replace the six screws and twelve washers and tighten securely. Attach the white and green cable to the terminal marked "W", and the green and black cable to the terminal marked "T".

Note: To ensure that the cable connectors are correctly attached to the blade terminals on the fuel tank unit, slide back the insulating sleeve from the cable connector to expose terminal end. Push the connector home fully on to the blade and slide the insulating sleeve forward to cover the joint.

Attach the earth wire connector to the terminal at the element housing and refit the trim panel. Reconnect the battery positive terminal.

MODIFIED PETROL TANK AND NYLON BREATHER TUBE

	R.H. Drive	L.H. Drive
Commencing Chassis Numbers	303534	352306

Commencing at the above chassis numbers, a nylon breather tube is fitted in place of the metal tube previously used. A piece of Bundy tube $4\frac{1}{2}''$ (11·4 cm.) long is inserted in the end of the nylon tube to protrude through an aperture in the boot floor.

This nylon breather tube is not interchangeable with the previous type as a threaded union is used in the tank.

MODIFIED PETROL FILLER BOX DRAIN TUBE

	R.H. Drive	L.H. Drive
Commencing Chassis Numbers	303132	352160

From the above chassis numbers and onwards, a revised petrol filler box drain tube is fitted. This tube passes through the boot floor in front of the petrol tank and is not interchangeable with the original type fitted.

INTRODUCTION OF BAFFLES IN PETROL TANK VENT PIPES

	R.H. Drive	L.H. Drive
Commencing Chassis Numbers	305914	353131

Commencing at the above chassis numbers, a pink coloured polyurethane sponge baffle is inserted in the vent pipe of each petrol tank.

The baffles allow adequate breathing to the petrol tanks and also prevent petrol flowing out of the vent pipes under hard acceleration with the tanks full.

To fit the baffle, remove the vent pipes from the tanks. Insert a baffle in each pipe. Squeeze the pipe with a pair of pliers (using soft material between the jaws of the pliers to prevent damage to the pipe) in the middle of the "U" bend immediately above the vent pipe to the tank union.

Place an air line to the end of the nylon vent pipe and blow the baffle round until it reaches the squeezed portion of the tube. The baffle should be at the highest point of the vent pipe.

Refit the vent pipes to the petrol tanks.

MODIFIED PETROL TANKS AND PIPES

	R.H. Drive	L.H. Drive
Commencing Chassis Number	306784	353292 & 353261

Commencing at the above chassis numbers, revised petrol tanks and pipes are introduced. A modified petrol gauge tank unit is fitted to a flat cover plate which is bolted over the elongated hole in the side of each tank. This replaces the previous gauge unit fitted to a cover plate with a central depression.

The petrol pump assemblies no longer incorporate non-return valves as a non-return valve assembly is now included in the "T" piece located at the front of the luggage compartment (see Fig. 27) which connects the feed pipes from the two tanks. The nylon piping has been replaced by Bundy pipe throughout the fuel system. From the pipe assemblies the feed pipes are re-routed to emerge from the front vertical faces of each tank and the electrical cables leave the tanks on the top face adjacent to the breather connections.

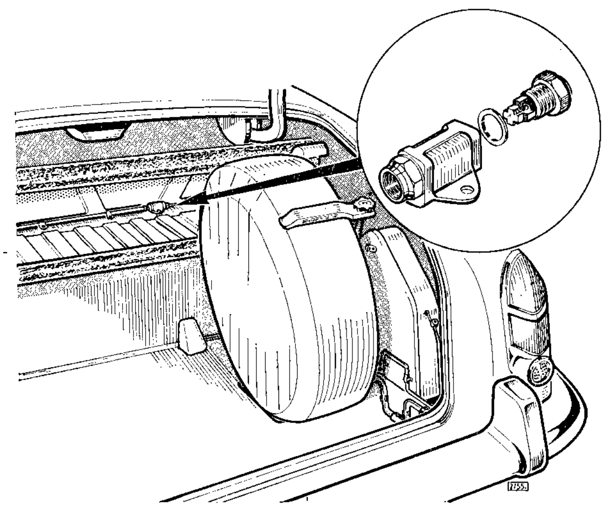


Fig. 27.

INTRODUCTION OF "DELRIN" FLOAT CHAMBER NEEDLE

Commencing Engine Number ZA 9860

Commencing at the above engine number, S.U. carburetters are fitted with a "Delrin" needle valve. This needle has a body of white plastic material and incorporates a spring loaded pin; the object of this pin is to overcome needle "flutter" due to engine "rock" when idling, causing slow flooding with consequent rough slow running or stalling.

In conjunction with the introduction of this new type of needle, the seat, float lever fork and float chamber lid are also modified.

The new type of float chamber lid assembly is interchangeable with the previous type as a complete assembly. The new type needle and seat can be used to replace the previous type provided the original lever fork is retained. The old type needle and seat must **not** be fitted to the new type float chamber lid. The lever forks are **not** interchangeable and must be kept to their respective lids.

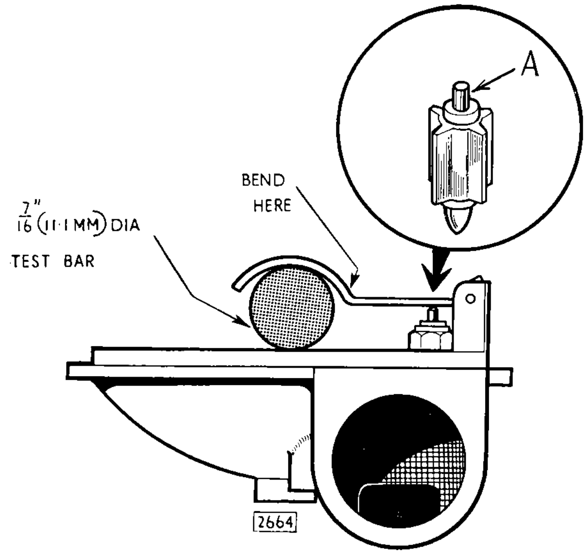


Fig. 28.

SECTION D

COOLING SYSTEM

3·8 MARK 10 MODEL

INDEX

COOLING SYSTEM

Water circulation is assisted by an impeller type pump mounted on the front cover of the engine, the system being pressurised and thermostatically controlled. Water is circulated fıom the right-hand side of the cross-flow radiator by the water pump and flows through the cylinder block and cylinder head water passages to the radiator header tank via the inlet manifold water jacket. A fan, mounted on the spindle of the water pump, draws in air through the radiator block.

DATA

	Imperial pints	U.S. pints	Litres
Total capacity—including heater	24½	29½	14
Coolant pump—type		Centrifugal	
—drive		Belt	
Coolant pump belt—angle of "V"		40°	
Coolant pump to engine speed ratio		0·9 : 1	
Cooling system control		Thermostat	
Thermostat Data		See page D7	
Radiator type		Cross flow	
Fan—number of blades		12	
Radiator cap:			
Make and type		A.C.—relief valve	
Release pressure		9 lbs. per sq. in. (0·633 kg./cm.^{2})	
Release depression		1 lb. (0·452 kg.)	

ROUTINE MAINTENANCE

DAILY

Checking Radiator Water Level

Every day, check the level of the water in the radiator and, if necessary, top up to the bottom of the filler neck.

Use water that is as soft as is procurable; hard water produces scale which in time will affect the cooling efficiency of the system.

PERIODICALLY

Care of the Cooling System

The entire cooling system should occasionally be flushed out to remove sediment. To do this, open the radiator block and cylinder block drain taps and insert a water hose into the radiator filler neck. Allow the water to flow through the system, with the engine running at a fast idle speed (1,000 r.p.m.) to cause circulation, until the water runs clear.

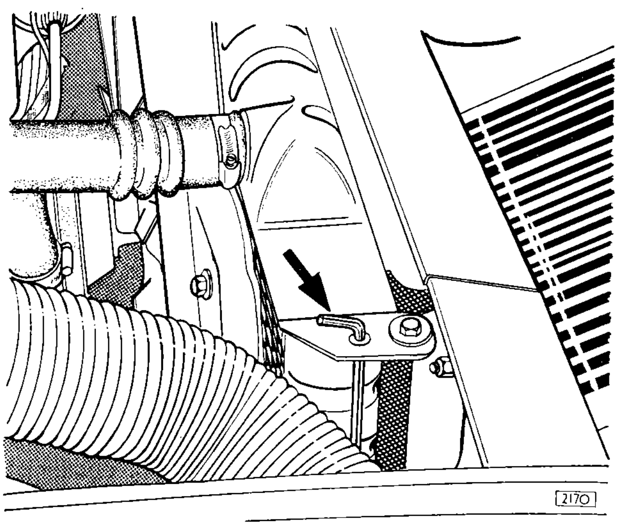


Fig. 1. Radiator drain tap

Since deposits in the water will in time cause fouling of the surfaces of the cooling system with consequent impaired efficiency it is desirable to retard this tendency as much as possible by using water that is as nearly neutral (soft) as is available. One of the approved brands of water inhibitor may be used with advantage to obviate the creation of deposits in the system.

When **refilling the cooling system,** open the heater water valve by pressing in the "HOT" button on the heater control panel (later cars "HEAT" button). Start the engine and check the radiator water level. Top up the radiator if necessary, after running the engine for a short time.

FROST PRECAUTIONS

Anti-Freeze—Important

During the winter months it is strongly recommended that an anti-freeze compound with an inhibited Ethylene Glycol base is used in the proportions laid down by the anti-freeze manufacturers. It should be remembered that if anti-freeze is not used it is possible, owing to the action of the thermostat, for the radiator to "freeze up" whilst the car is being driven, even though the water in the radiator was not frozen when the engine was started.

Before adding anti-freeze solution the cooling system should be cleaned by flushing.

The cylinder head gasket must be in good condition and the cylinder head nuts pulled down correctly, since if the solution leaks into the crankcase a mixture will be formed with the engine oil which is likely to cause blockage of the oil ways with consequent damage to working parts. Check the tightness of all water hose connections, water pump and manifold joints. To ensure satisfactory mixing, measure the recommended proportions of water and anti-freeze solution in a separate container and fill the system from this container, rather than add the solution direct to the cooling system.

When filling the cooling system, open the heater control tap by placing the temperature control on the console in the "HOT" position (later cars "HEAT" button). Check the radiator water level after running the engine and top up if necessary. If topping up is necessary during the period in which anti-freeze solution is in use, this topping up must be carried out using anti-freeze solution or the degree of protection provided may be lost. Topping up with water will dilute the mixture possibly to an extent where damage by frost will occur.

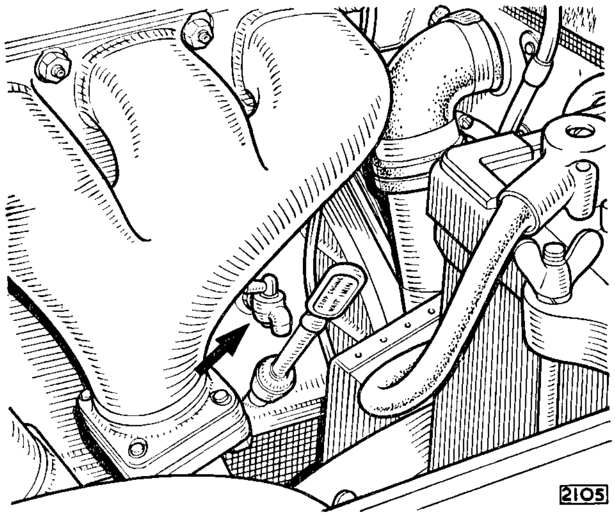


Fig. 2. Cylinder block drain tap

Engine Heater

Provision is made on the right-hand side of the cylinder block for the fitment of an American standard engine heater element No. 7, manufactured by James B. Carter Ltd., Electrical, Heating and Manufacturing Division, Winnipeg, Manitoba, Canada, or George Bray & Co. Ltd., Leicester Place, Blackman Lane, Leeds 2, England.

RADIATOR

The radiator is of the cross-flow type and is pressurised by means of a filler cap. The filler cap incorporates a pressure relief valve which is designed to hold a pressure of up to nine pounds per square inch (0·633 kg./cm.^{2}) above atmospheric pressure inside the system. When the pressure rises above nine pounds the spring loaded valve lifts off its seat and the excess pressure escapes via the overflow pipe. As the water temperature falls again a small valve incorporated in the centre of the pressure valve unit opens and restores atmospheric pressure, should a depression be caused by a fall in the temperature of the water.

By raising the pressure inside the cooling system the boiling point of the water is raised, thus reducing the risk of water loss from boiling.

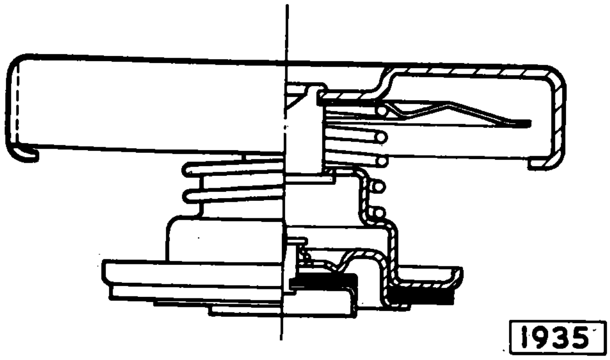


Fig. 3. Sectioned view of the radiator filler cap

Removal

Release the radiator cap and drain the radiator and cylinder block.

Slacken the hose clips securing the water hose from the cylinder head to the top of the radiator. Slacken the hose clips securing the water hose from the water pump to the bottom of the radiator.

Remove the two self-locking nuts and washers securing the top of the radiator.

Remove the two self-locking nuts and washers securing the bottom of the radiator to the sub frame. Collect the mounting rubbers.

Remove the radiator carefully making sure that the fan blades do not foul the radiator matrix.

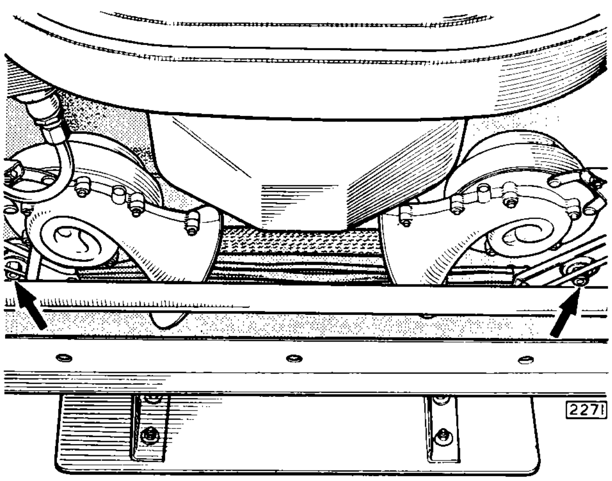


Fig. 4. Radiator lower securing nuts

Refitting

Refitting is the reverse of the removal procedure, but care must be taken in ensuring that the mounting rubbers are in position on the mounting studs.

RADIATOR COWL

Removal

Drain enough water from the header tank of the radiator to facilitate the removal of the top hose. Remove the two self-locking nuts, washers and overflow pipe clip securing the cowl to the top of the radiator. Remove the four setscrews, nuts and washers securing the two halves of the cowl together. Remove the upper half of the radiator cowl. Remove the two self-locking nuts, washers and overflow pipe clip securing the lower half of the cowl. Remove the lower half of the cowl.

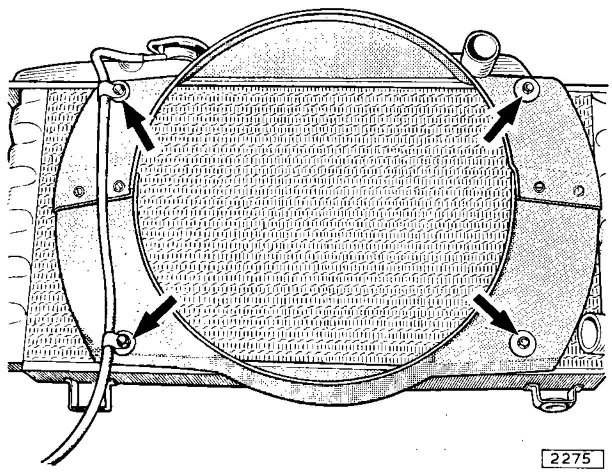


Fig. 5. Radiator cowl securing nuts

Refitting

Refitting is the reverse of the removal procedure.

FAN

Removal

Remove the upper half of the radiator cowl as described above.

Slacken the dynamo adjusting link bolt and the two dynamo bolts and nuts underneath the dynamo. Release the fan belt tension by pushing the fan belt jockey pulley in towards the engine. Remove the fan belt.

Before removing the setscrews securing the fan to the hub, mark the position of the semi-circular balance piece(s) relative to the fan and fan hub. On initial assembly the ends of the balance piece(s) and fan are marked with a centre punch and a small hole is drilled through the balance piece(s), hub and fan to assist reassembly. The fan, distance piece and pulley are also stamped with the letter "O" which are placed in line. Remove the fan from the hub by unscrewing the four setscrews fitted with shakeproof washers.

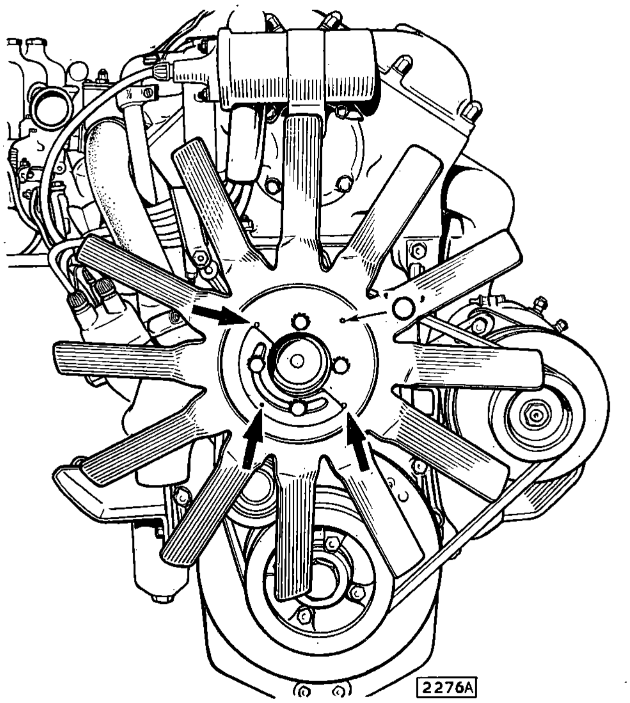


Fig. 6. When refitting, the letter "O" stamped on the fan, distance piece and pulley should be in line. The arrows indicate the locating marks for the balance piece(s)

Refitting

Refitting is the reverse of the removal procedure, but attention should be paid to the removal notes in order to preserve the balance of the assembly.

If it becomes necessary to replace any part of the assembly then it should be rebalanced as shown in Fig. 7. Static balancing is effected by varying the position of the semi-circular balance piece(s) which are retained by setscrews securing the fan to the hub. These should be arranged so that the fan remains at rest in any position. After re-balancing, the ends of the balance piece(s) and the fan should be marked with a centre punch, a small hole drilled through the balance piece(s), hub and fan and the old hole filled in with solder.

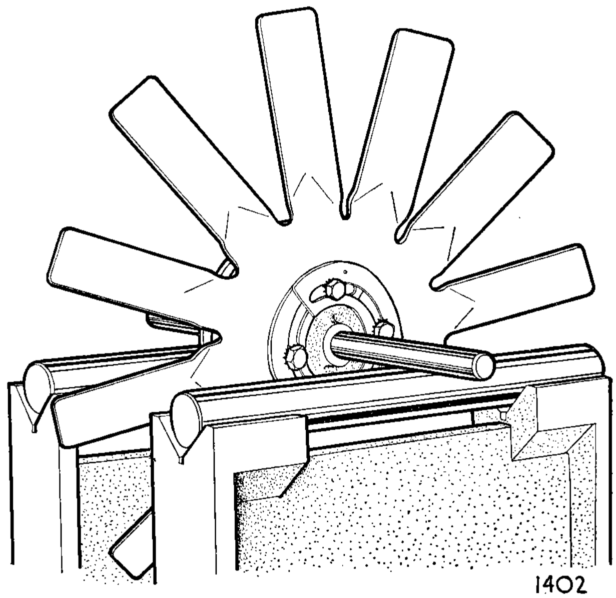


Fig. 7. Balancing the fan assembly

FAN BELT

Removal

Remove the upper half of the radiator cowl as described under "Radiator Cowl Removal."

Slacken the dynamo adjusting link bolt and the two dynamo bolts and nuts underneath the dynamo. Release the fan belt tension by pushing the fan belt jockey pulley in towards the engine. Remove the fan belt.

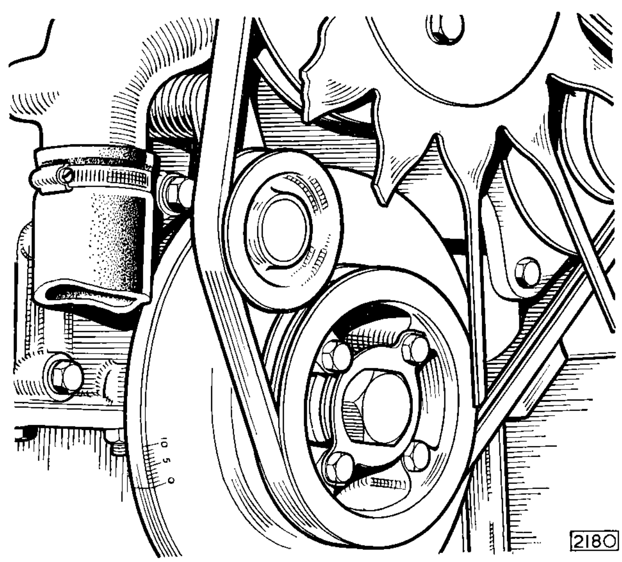


Fig. 8. Automatic fan belt tensioner

Refitting

Refitting is the reverse of the removal procedure, but it is important that the belt is not stretched over the pulleys by any means other than by hand. If a tool is used to lever the belt on or off, the endless cords in the belt may be broken. Ensure that there is no slack in the fan belt when tightening the dynamo. The jockey pulley will provide any tension required as the fan belt stretches. Check that the fan belt is located in the double groove of the pulleys.

THERMOSTAT

This is a valve incorporated in the cooling system which restricts the flow of coolant through the radiator until the engine has reached its operating temperature, thus providing rapid warming up of the engine and in cold weather an early supply of warm air to the interior of the car via the heater. When the engine temperature rises to a pre-determined figure (see "Thermostat Data") the thermostat valve commences to open and allows the water to circulate through the radiator. The flow of water increases as the temperature rises until the valve is fully open. Included in the system is a water by-pass utilizing a slot in the thermostat housing integral with the water outlet pipe; this allows the coolant to by-pass the radiator until the thermostat opening temperature is attained.

Removal

Drain sufficient water from the system to allow the level to fall below the thermostat by operating the drain tap situated at the bottom left-hand side of the radiator block. Slacken the hose clip and remove the top water hose from the elbow pipe on the thermostat housing. Remove the two nuts and spring washers securing the water outlet elbow and remove the elbow. Lift out the thermostat, noting the gasket between the elbow pipe and thermostat housing.

Checking

Thoroughly clean the thermostat and check that the small hole in the valve is clear. Check the thermostat for correct operation by immersing in a container of cold water together with a thermometer and stirrer. Heat the water, keeping it well stirred and observe if the characteristics of the thermostat are in agreement with the data given under "Thermostat Temperatures."

Refitting

Refitting is the reverse of the removal procedure.

Always fit a new gasket between the elbow pipe and the thermostat housing. Ensure that the recess in the thermostat housing and all machined faces are clean.

Thermostat Data

Start Operating Temperature	Fully Open Temperature	Remarks
159° F. (70·5° C.)	168° F. (75·5° C.)	
174° F. (78·8° C.)	183° F. (83·7° C.)	High setting for extreme winter conditions.

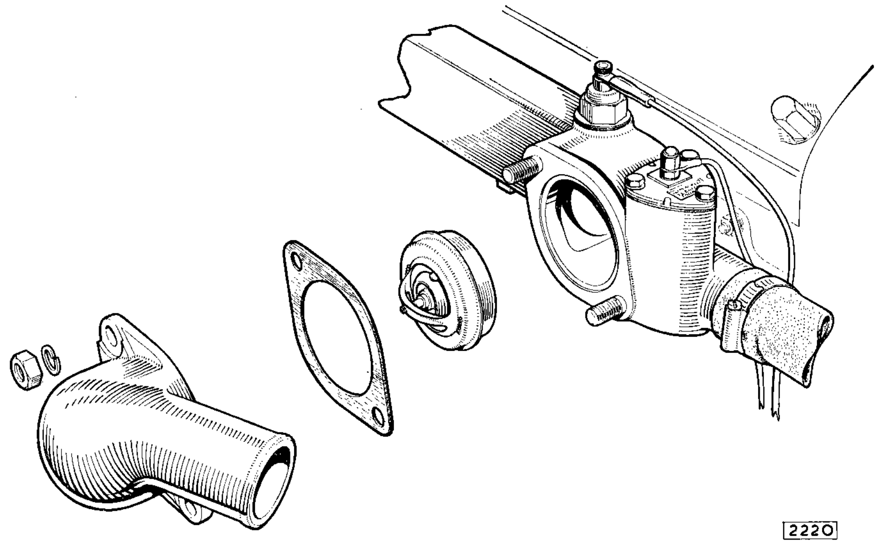


Fig. 9. Exploded view of the thermostat and housing

WATER PUMP

The water pump (Fig. 10) is of the centrifugal vane impeller type, the impeller being mounted on a steel spindle which in turn runs in a double row of ball bearings. These are sealed at their ends to exclude all dirt and to retain the lubricant. The main seal on the pump spindle is located in the pump housing by a metal cover and the carbon face maintains a constant pressure on the impeller by means of a thrust spring inside the seal. A hole drilled in the top of the casting acts as an air vent and lead into an annular groove in the casting into which stray water is directed by means of a rubber thrower on the pump spindle. A drain hole at the bottom of the groove leads away any water and prevents seepage into the bearing.

Removal

Drain the cooling system.

Detach the top hose, heater hose and bottom radiator hose.

Remove the two self-locking nuts, washers and overflow pipe bracket securing the upper half of the fan cowl in position.

Remove the four setscrews, washers and nuts and remove the upper half of the fan cowl.

Remove the fan belt by slackening off the dynamo and relieving the tension of the jockey pulley. Remove the fan as already described under "Fan Removal" making sure that the balance pieces are marked for their relative position to assist in the reassembly. Remove water pump pulley and adaptor.

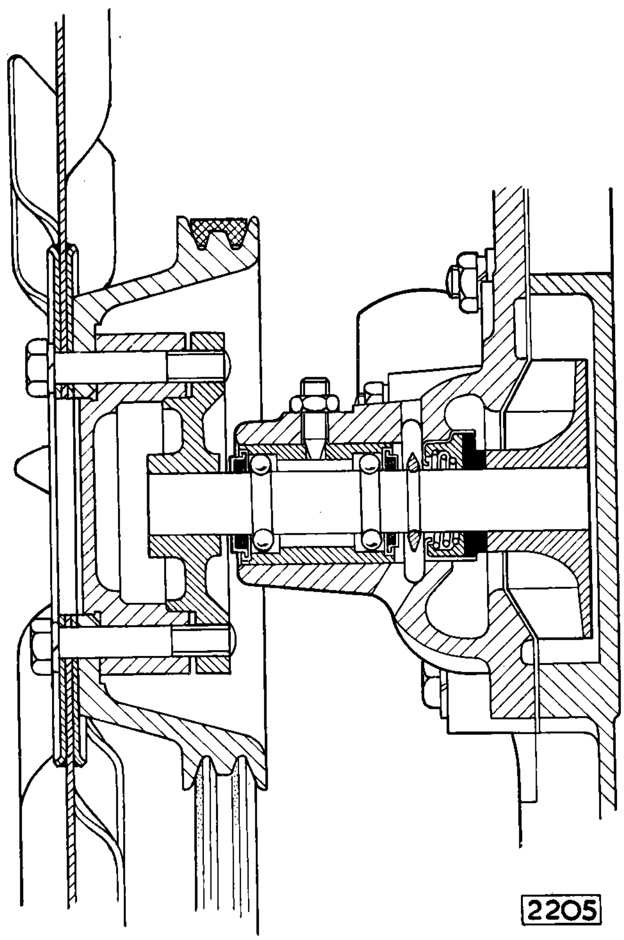


Fig. 10. Sectioned view of the water pump

Unscrew the six set bolts, three nuts and spring washers securing the water pump to the engine timing chain cover.

Note the gasket between the pump and timing cover. Withdraw the water pump.

Dismantling

Remove the water pump pulley hub by means of a suitable extractor as shown in Fig. 11. Slacken the locknut and remove Allen head locating screw.

Remove the spindle and impeller assembly from the pump casting. This assembly must not be pushed out by means of the shaft or the bearing will be damaged. A tube measuring $1\frac{3}{32}$" (27·77 mm.) outside diameter and $\frac{31}{32}$" (24·61 mm.) inside diameter must be used to push out the assembly from the front of the pump.

Press out the spindle from the impeller as shown in Fig. 12 and remove the seal and rubber thrower. The spindle and bearing assembly cannot be dismantled any further.

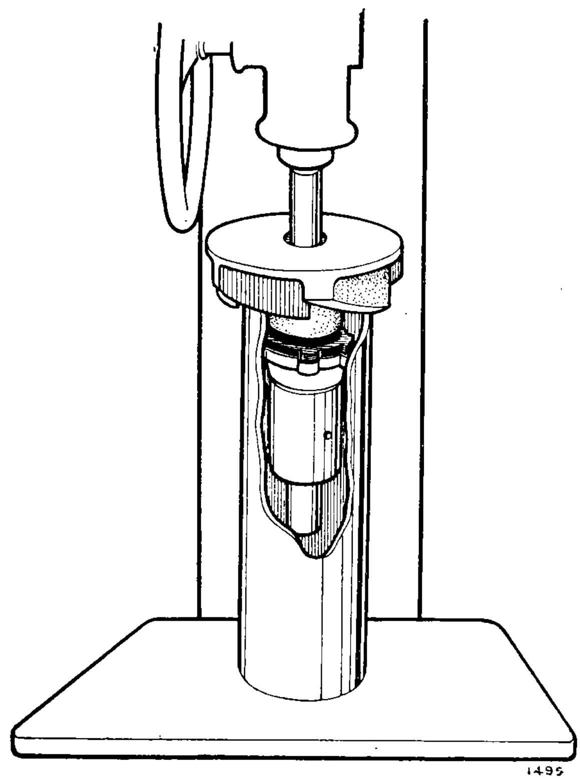


Fig. 12. Removing the water pump impeller from the pump spindle

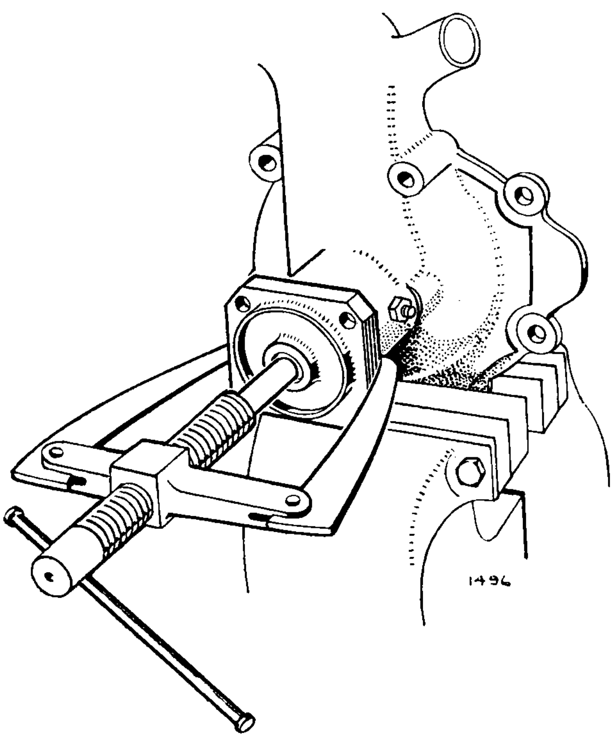


Fig. 11. Withdrawing the fan hub from the spindle

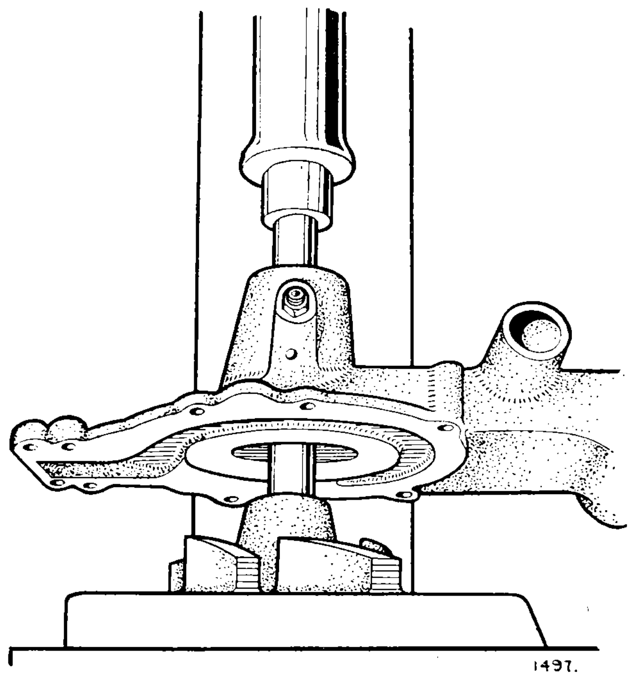
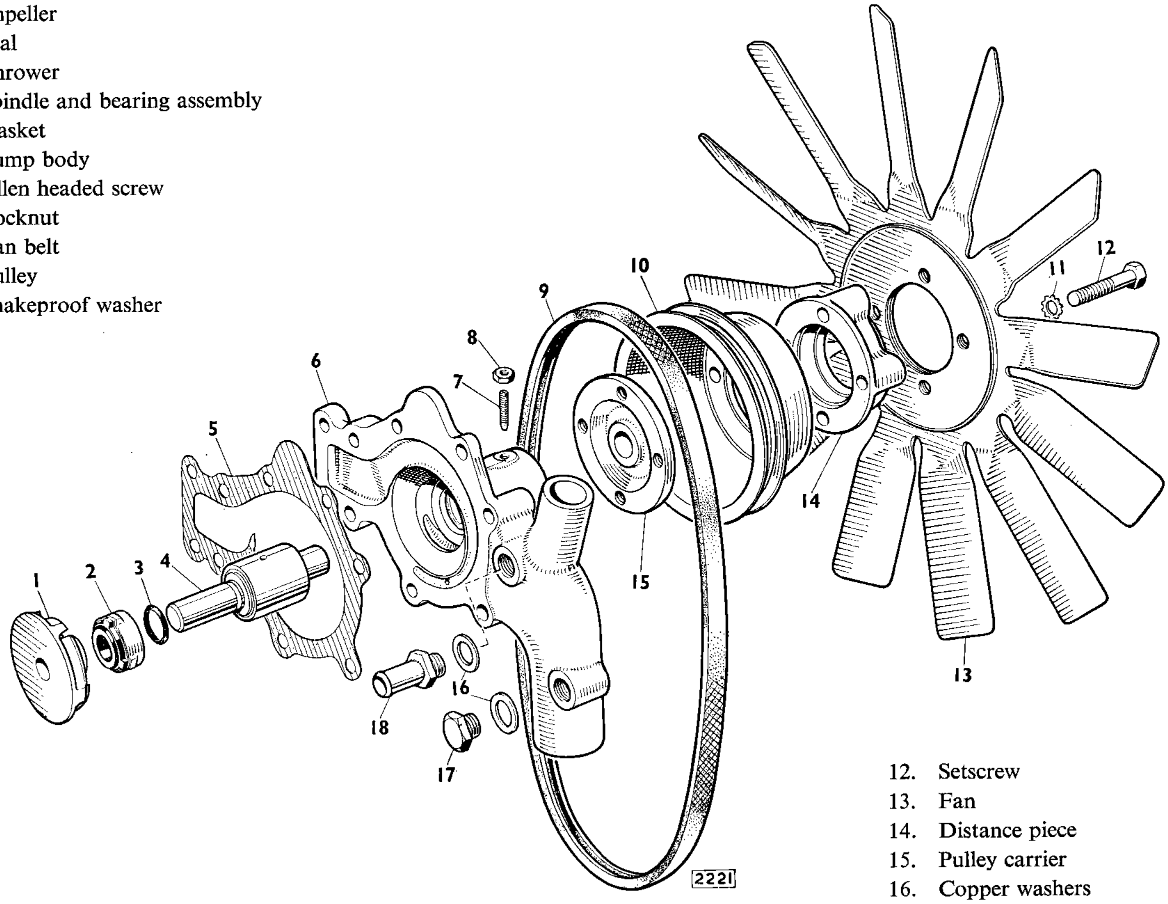


Fig. 13. Fitting the impeller

1. Impeller
2. Seal
3. Thrower
4. Spindle and bearing assembly
5. Gasket
6. Pump body
7. Allen headed screw
8. Locknut
9. Fan belt
10. Pulley
11. Shakeproof washer



12. Setscrew
13. Fan
14. Distance piece
15. Pulley carrier
16. Copper washers
17. Blanking plug
18. Adaptor for heater return pipe

Fig. 14. Exploded view of the water pump

Checking

Thoroughly clean all parts of the pump (except the spindle and bearing assembly) in a suitable cleaning solvent.

Note: The bearing is a permanently sealed and lubricated assembly and therefore must not be washed in the solvent.

Inspect the bearing for excessive end play and remove any burrs, rust or scale from the shaft with fine emery paper, taking the precaution of covering the bearing with a cloth, to prevent emery dust from entering the bearing. If there are any signs of wear or corrosion in the bearing bore or on the face in front of the impeller, the housing should be renewed.

Reassembly

Install the shaft and bearing assembly into the pump body from the rear and line up the location hole in the bearing with the tapped hole in the body. Fit locating screw and locknut. Place the rubber thrower in its groove on the spindle in front of the seal. Coat the outside of the brass seal housing with a suitable water resistant jointing compound and fit into the recess in the pump casting. Push the seal into its housing with the carbon face towards the rear of the pump. Ensure that the seal is seated properly.

Press on the impeller as shown in Fig. 13 until the rear face of the impeller is flush with the end of the spindle. In a similar manner press the water pump pulley on to the spindle until it is flush with the end.

Refitting

Refitting is the reverse of the removal procedure although care should be taken to renew the water pump to timing cover gasket, lightly smearing with grease before fitting. Refit the fan belt as described on page D.7.

WATER TEMPERATURE GAUGE

The indicator head is attached to the instrument panel and operates on a thermal principle using a bi-metal strip surrounded by a heater winding. The transmitter unit is mounted in the inlet manifold water jacket adjacent to the thermostat. For the full description and fault analysis of this instrument refer to Section P "Electrical and Instruments."

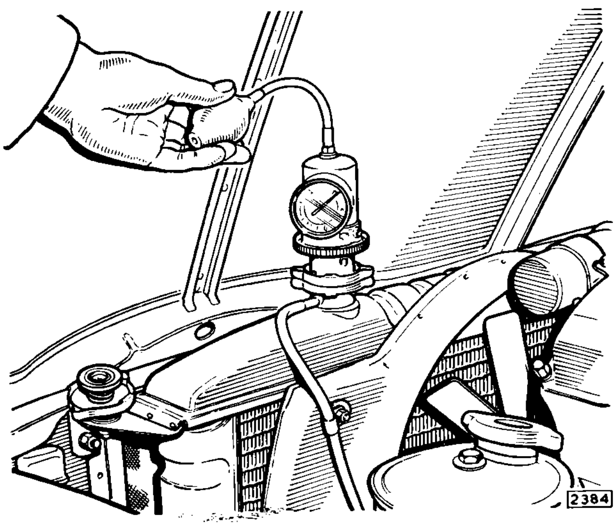


Fig. 15. Pressure testing the cooling system

PRESSURE TESTING RADIATOR CAP AND COOLING SYSTEM

The radiator cap and cooling system can be pressure tested and checked for leaks with the aid of the AC-Delco Cooling System Tester RCT—1 (See Figs. 15 and 16). This equipment is obtainable from AC-Delco Division of General Motors Limited, Dunstable, Beds.

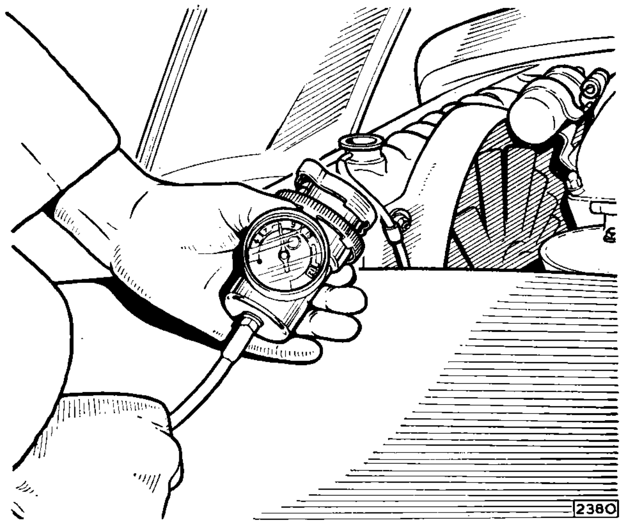


Fig. 16. Pressure testing the radiator cap

INTRODUCTION OF "QUICK-LIFT" THERMOSTAT

Commencing Engine Number ZA 3123

Commencing at the above engine number, a new thermostat is introduced to give a "quick-lift" operation. This thermostat is interchangeable with the previous type fitted.

Jaguar Part No.	Start Opening Temp.	Fully Open Temp.	Remarks
C.20766	159F (70·5C)	168F (75·5C)	
C.20766/1	174F (78·8C)	183F (83·7C)	High setting for extreme winter conditions

INTRODUCTION OF MODIFIED RADIATOR

	R.H. Drive	*L.H. Drive*
Commencing Chassis Numbers	307363 plus 307230, 1, 2	353359

Commencing at the above chassis numbers, the radiator block and certain other parts of the cooling system are revised to obviate air locks when filling the system and to increase cooling efficiency.

The new assembly has a separate header tank bolted to the top of the tube and fin radiator block and connected to the left hand side tank with a short rubber hose. A short small diameter hose from the top of the right hand side tank is also connected to the header tank. This acts as a vent pipe allowing any air returned from the engine to escape into the header tank.

The water from the by-pass outlet pipe now returns to the pump via the left hand side tank, drawing the coolant from the heater return pipe (which now runs above the inlet manifolds). Any air in this water escapes to the header tank on entering the left hand side tank via the connecting hose. A further drain plug is provided in the bottom return pipe: the drain tap arrangement of the previous type of radiator remaining as before.

The water pump is modified in that the inlet to which the by-pass hose was connected is tapped and plugged. The hole for the return pipe connection is also plugged, the adaptor being deleted. The heater end of this return pipe is right-angled and, being positioned above the manifolds, the short vertical pipe and rubber elbow are no longer required to connect it to the heater.

To facilitate the fitting of the bottom return pipe, new horns are fitted one above the other on the left hand (near) side of the car. The wiring harness has also been modified to suit this arrangement.

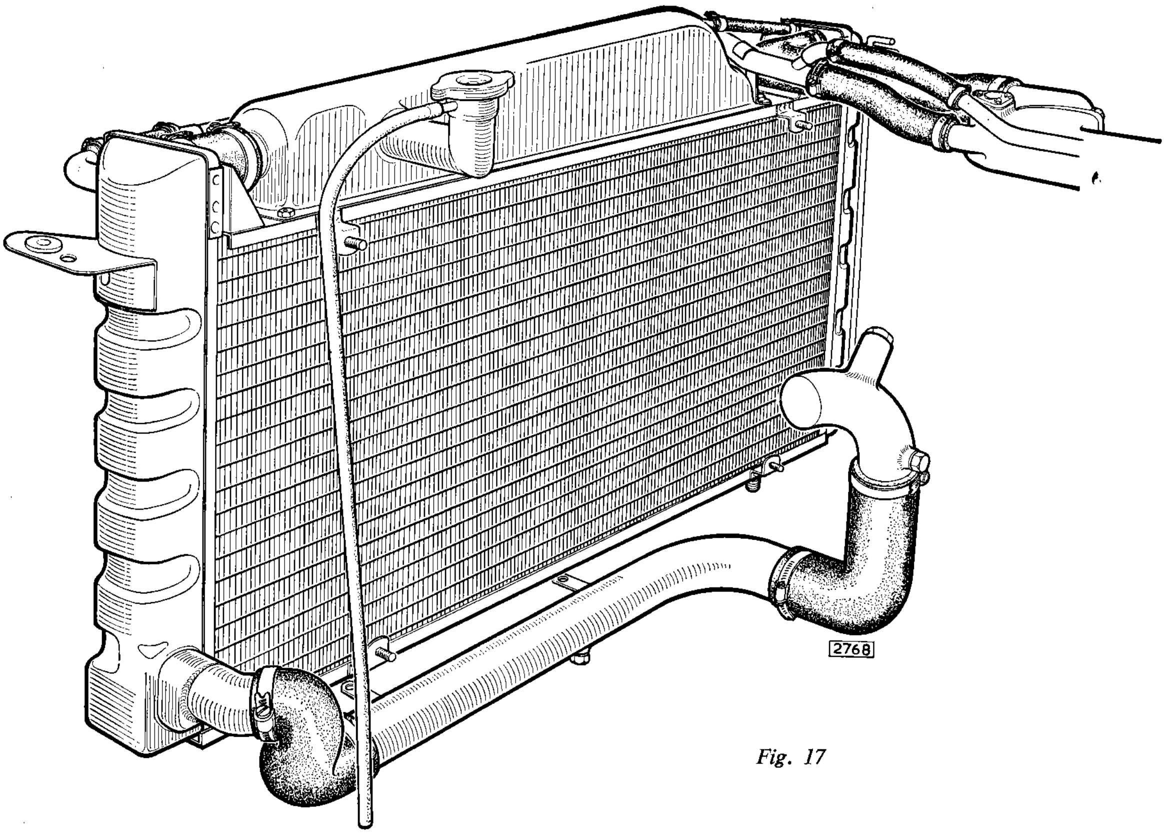


Fig. 17

SECTION E

CLUTCH

3·8 MARK 10 MODEL

INDEX

INDEX *(Continued)*

CLUTCH

DESCRIPTION

The clutch is of the single dry plate type and consists of a spring loaded driven plate assembly, a cover assembly and a graphite release bearing. The operating mechanism consists of a pendant-type foot pedal, coupled by a push rod to an independent master cylinder. This is connected by piping and a flexible hose to a slave cylinder mounted on the clutch housing. Depressing the clutch pedal moves the piston in the master cylinder and imparts thrust to the slave cylinder piston which in turn, operates the graphite release bearing by means of a push rod and operating fork. The bearing is forced against the clutch release lever plate which causes the release levers to withdraw the pressure plate and thus release the clutch driven plate.

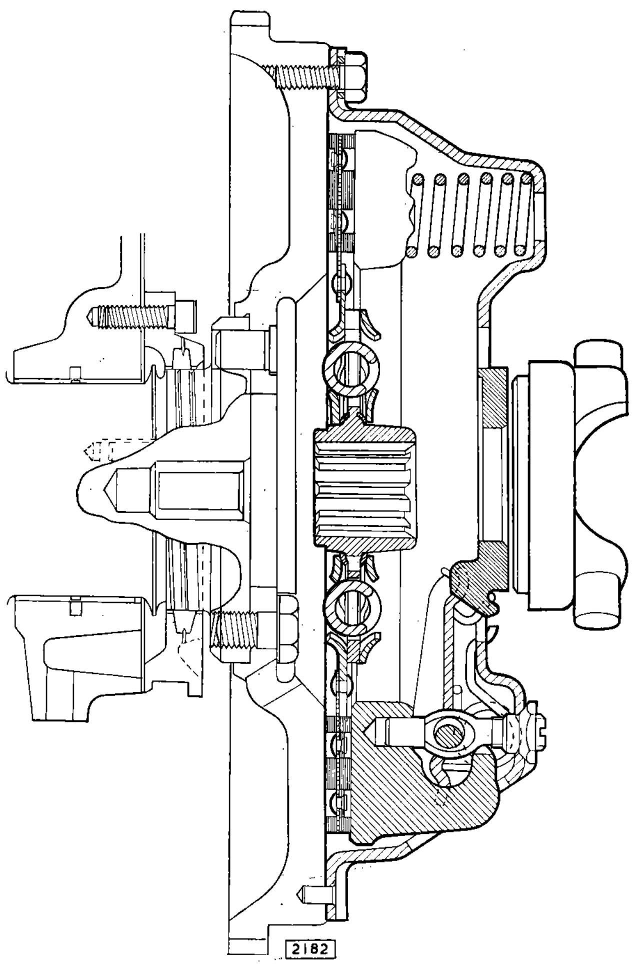


Fig. 1. Sectional view of clutch

DATA

Make	Borg and Beck
Model	10 A6—G
Outside diameter	9·84″—9·87″ (231 mm.—232 mm.)
Inside diameter	6 12″—6·13″ (153 mm.—154 mm.)
Type-	Single dry plate
Clutch release bearing	Graphite
Operation	Hydraulic
Clutch thrust springs—number	12
—colour	Violet
—free length	2·68″ (68 mm.)
Driven plate—type	Borglite
—facings	Wound yarn
Driven plate damper springs—number	6
—colour	Brown/Cream
Clutch master cylinder—bore	$\frac{3}{4}$″ (19·05 mm.)
—stroke	$1\frac{1}{4}$″ (3·175 cm.)
Clutch slave cylinder—bore	$\frac{7}{8}$″ (22·22 mm.)

ROUTINE MAINTENANCE

WEEKLY

Check Fluid Level

The clutch is operated hydraulically from a master cylinder situated at the rear of the engine compartment on the driver's side of the car. The hydraulic fluid is stored in a reservoir also situated on the driver's side of the car and it is important that the level does not fall below the line marked "Fluid Level."

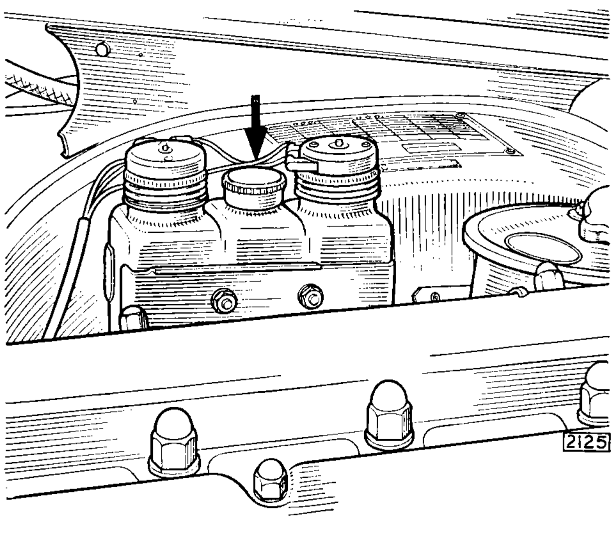


Fig. 2. Clutch fluid reservoir—left-hand drive

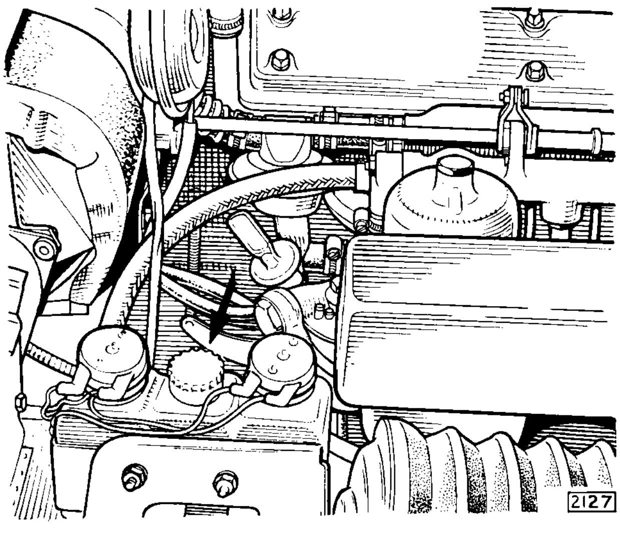


Fig. 3. Clutch fluid reservoir—right-hand drive

EVERY 2,500 MILES (4,000 KM.)

Clutch Free Travel

There should be $\frac{1}{16}$" (1·5 mm.) free travel measured on the operating rod between the slave cylinder and clutch withdrawal lever.

Pull the withdrawal lever rearward and allow it to return. Adjustment is effected by slackening the lock-nut and turning the operating rod.

Screwing the rod into the knuckle joint will increase the free travel; screwing the rod out will decrease the free travel. Always replace the return spring after adjustment.

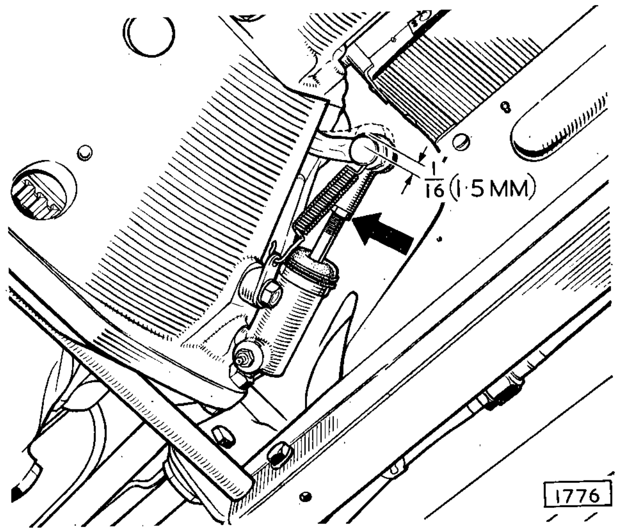


Fig. 4. Adjustment of the clutch free travel is effected on the rod between the clutch slave cylinder and withdrawal lever

Recommended Hydraulic Fluids

Preferred Fluid

Castrol/Girling Crimson Clutch/Brake Fluid.

Alternative Fluids

In countries where Castrol/Girling Crimson is unobtainable use only a recognised brake fluid guaranteed to conform to the S.A.E. specification 70 R.3.

In the event of deterioration of the rubber seals and hoses due to the use of incorrect fluid, all the seals and hoses must be replaced and the system thoroughly flushed and refilled with one of the above fluids. (See "Flushing the System").

HYDRAULIC SYSTEM—GENERAL INSTRUCTIONS

Should it be found necessary to dismantle any part of the clutch system (that is, master cylinder or slave cylinder), the operation must be carried out under conditions of scrupulous cleanliness. Clean the mud and grease off the unit before removal from the vehicle and dismantle on a bench covered with a sheet of clean paper. Do not swill a complete unit, after removal from the vehicle, in paraffin, petrol or trichlorethylene as this would ruin the rubber parts and, on dismantling, give a misleading impression of their original condition. Do not handle the internal parts, particularly rubbers, with dirty hands. Place all metal parts in a tray of clean brake fluid to soak; afterwards dry off with a clean fluffless cloth, and lay out in order on a sheet of clean paper. Rubber parts should be carefully examined and if there is any sign of swelling or perishing they should be renewed; in any case it is usually good policy to renew **all** rubbers. The main castings may be swilled in any of the normal cleaning fluids but all traces of the cleaner must be dried out before assembly.

All internal parts should be dipped in clean brake fluid and assembled wet, as the fluid acts as a lubricant. When assembling the rubber parts use the fingers only.

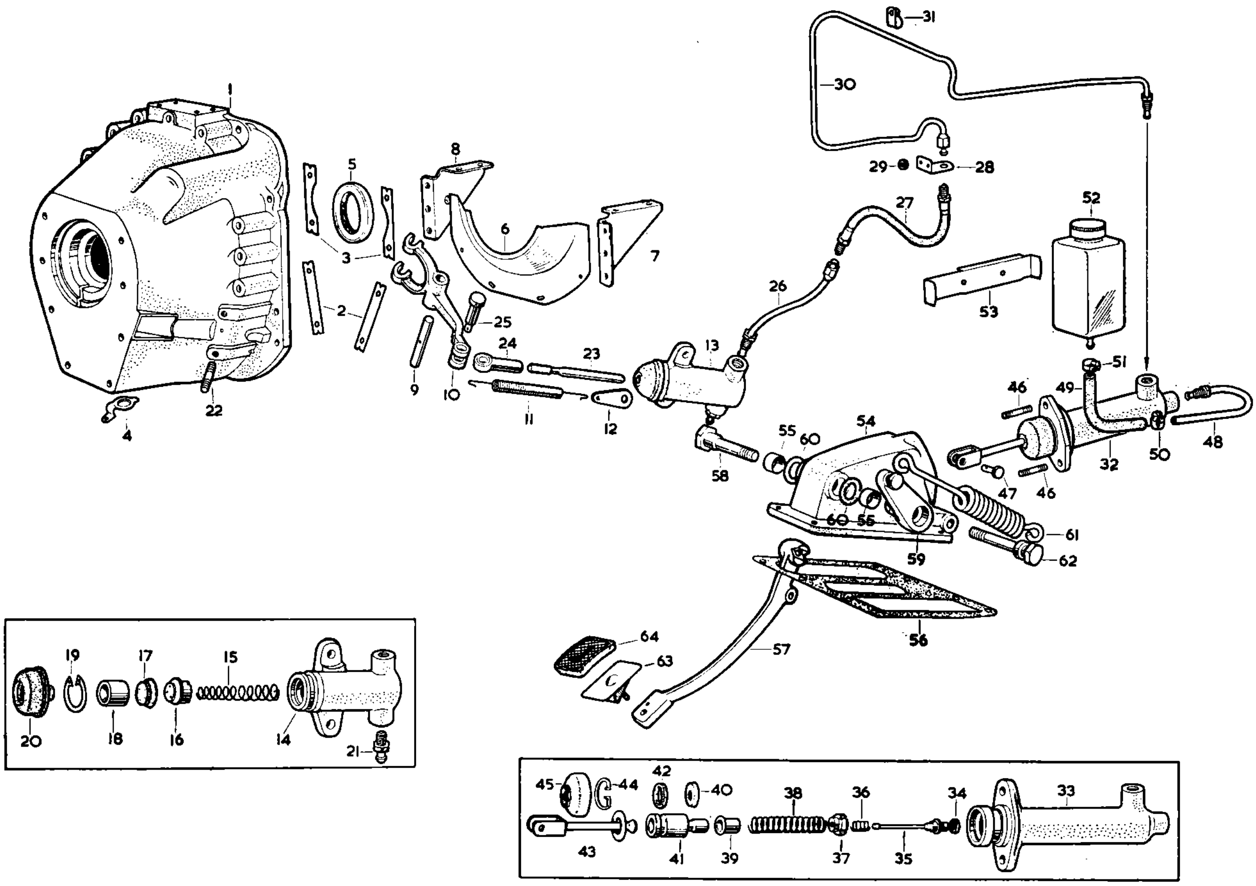


Fig. 5. Clutch operating system

1. Clutch housing
2. Locking plate
3. Locking plate
4. Timing aperture cover
5. Oil seal
6. Cover plate
7. Support bracket
8. Support bracket
9. Shaft
10. Operating fork
11. Return spring
12. Anchor plate
13. Slave cylinder
14. Slave cylinder body
15. Spring
16. Cup filler
17. Seal
18. Piston
19. Circlip
20. Rubber dust cover
21. Bleeder screw
22. Stud
23. Operating rod
24. Adjuster assembly
25. Pivot pin
26. Hydraulic pipe
27. Flexible hydraulic pipe
28. Bracket
29. Distance piece
30. Hydraulic pipe
31. Clip
32. Master cylinder
33. Master cylinder body
34. Seal
35. Valve
36. Spring
37. Spring support
38. Main spring
39. Spring support
40. Cup seal
41. Piston
42. Static seal
43. Push rod
44. Circlip
45. Dust cover
46. Stud
47. Clevis pin
48. Hydraulic pipe
49. Flexible pipe
50. Hose clip
51. Hose clip
52. Reservoir
53. Mounting bracket
54. Clutch pedal housing
55. Bush
56. Gasket
57. Pedal
58. Fulcrum pin
59. Anchor lever
60. Fibre washer
61. Return spring
62. Anchor pin
63. Pedal pad
64. Pedal pad cover

BLEEDING THE SYSTEM

"Bleeding" the clutch hydraulic system (expelling air) is not a routine maintenance operation and should only be necessary when a portion of the hydraulic system has been disconnected or if the level of the fluid in the reservoir has been allowed to fall. The presence of air in the hydraulic system may result in difficulty in engaging gear owing to the clutch not disengaging fully.

The procedure is as follows:—

Fill up the master cylinder reservoir with brake fluid exercising great care to prevent the entry of dirt. Attach a rubber bleed tube to the nipple on the slave cylinder on the right-hand side of the clutch housing and allow the tube to hang in a clean glass jar partly filled with brake fluid. Unscrew the nipple one complete turn. Depress the clutch pedal slowly, **tighten the bleed nipple before the pedal reaches the end of its travel** and allow the pedal to return unassisted.

Repeat the above procedure, closing the bleed nipple at each stroke, until the fluid issuing from the tube is entirely free of air, care being taken that the reservoir is replenished **frequently** during this operation, for should the level be allowed to drop appreciably air will enter the system.

On completion, top up the master cylinder reservoir to the line marked "Fluid Level."

Do not on any account use the fluid which has been bled through the system to replenish the reservoir as it will have become aerated. Always use fresh fluid straight from the tin.

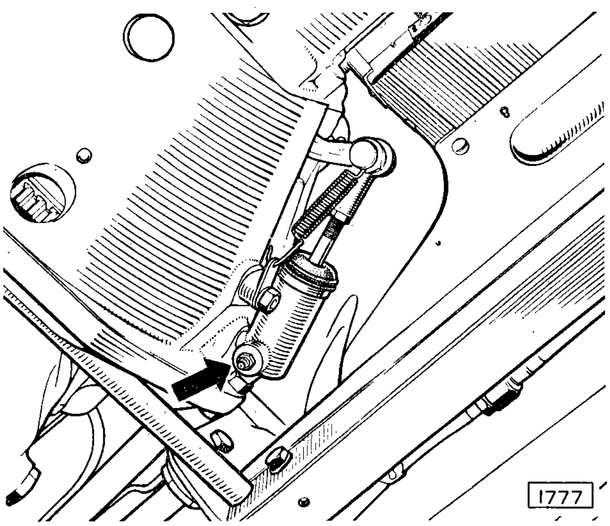


Fig. 6. Position of clutch bleed nipple

FLUSHING THE SYSTEM

Should the fluid in the system become thick or "gummy" after many years in service, or after a vehicle has been laid up for some considerable time, the system should be drained, flushed and re-filled. It is recommended that this should be carried out once every five years.

Pump all fluid out of the hydraulic system through the bleeder screw of the clutch slave cylinder. To the bleed screw on the slave cylinder connect one end of a rubber tube, and allow the other end to fall into a container, slacken the screw one complete turn and pump the clutch pedal by depressing it quickly and allowing it to return without assistance; repeat, with a pause in between each operation, until no more fluid is expelled. Discard the fluid extracted.

Fill the supply tank with industrial methylated spirit and flush the system as described above. Keep the supply tank replenished until at least a quart of spirit has passed through the bleed screw.

Remove the master cylinder and pour off any remaining spirit. Refit the master cylinder, re-fill with clean brake fluid and "bleed" the system.

Note: If the system has been contaminated by the use of mineral oil, etc., the above process will not prove effective. It is recommended that the various units, including the pipe lines, be dismantled and thoroughly cleaned and that all rubber parts, including flexible hoses should be renewed. The contaminated fluid should be destroyed immediately.

REMOVAL AND REFITTING A FLEXIBLE HOSE

In some cases, the cause of a faulty clutch may be traced to a choked flexible hose. Do not attempt to clear the obstruction by any means except air pressure, otherwise the hose may be damaged. If the obstruction cannot be cleared the hose must be replaced by a new one.

Removal

To renew a flexible hose, adopt the following procedure:—

Unscrew the tube nut from the hose union, then unscrew the locknut and withdraw the hose from the bracket. Disconnect the hose at the other end.

Refitting

When refitting a hose, first ensure that it is not twisted or "kinked" (this is MOST IMPORTANT) then pass the hose union through the bracket and, whilst holding the union with a spanner to prevent the hose from turning, fit the locknut and the shakeproof washer; connect up the pipe by screwing on the tube-nut.

THE MASTER CYLINDER

The master cylinder is mechanically linked to the clutch pedal and provides the hydraulic pressure necessary to operate the clutch. The components of the master cylinder are contained within the bore of a body which at its closed end has two 90° opposed integral pipe connection bosses. Integrally formed around the opposite end of the cylinder is a flange provided with two holes for the master cylinder attachment bolts. In the unloaded condition a spring loaded piston, carrying two seals (see Fig. 7) is held against the underside of a circlip retained dished washer at the head of the cylinder. A hemispherically ended push-rod seats in a similarly formed recess at the head of the piston. A fork end on the outer end of the push-rod provides for attachment to the pedal. A rubber dust excluder, the lip of which seats in a groove, shrouds the head of the master cylinder to prevent the intrusion of foreign matter.

A cylindrical spring support locates around the inner end of the piston and a small drilling in the end of the support is engaged by the stem of a valve. The larger diameter head of the valve locates in a central blind bore in the piston. The valve passes through the bore of a vented spring support and interposed between the spring support and an integral flange formed on the valve is a small coiled spring. A lipped rubber seal registers in a groove around the end of the valve. This assembly forms a recuperation valve which controls fluid flow to and from the reservoir.

When the foot pedal is in the OFF position the master cylinder is fully extended and the valve is held clear of the base of the cylinder by the action of the main spring. In this condition the master cylinder is in fluid communication with the reservoir, thus permitting recuperation of any fluid loss sustained, particularly during the bleeding operation.

When a load is applied to the foot pedal the piston moves down the cylinder against the compression of the main spring. Immediately this movement is in excess of the valve clearance the valve closes under the influence of its spring and isolates the reservoir. Further loading of the pedal results in the discharge of fluid under pressure from the outlet connection, via the pipe lines to the clutch slave cylinder.

Removal of the load from the pedal reverses the sequence, the action of the main spring returns the master cylinder to the extended position.

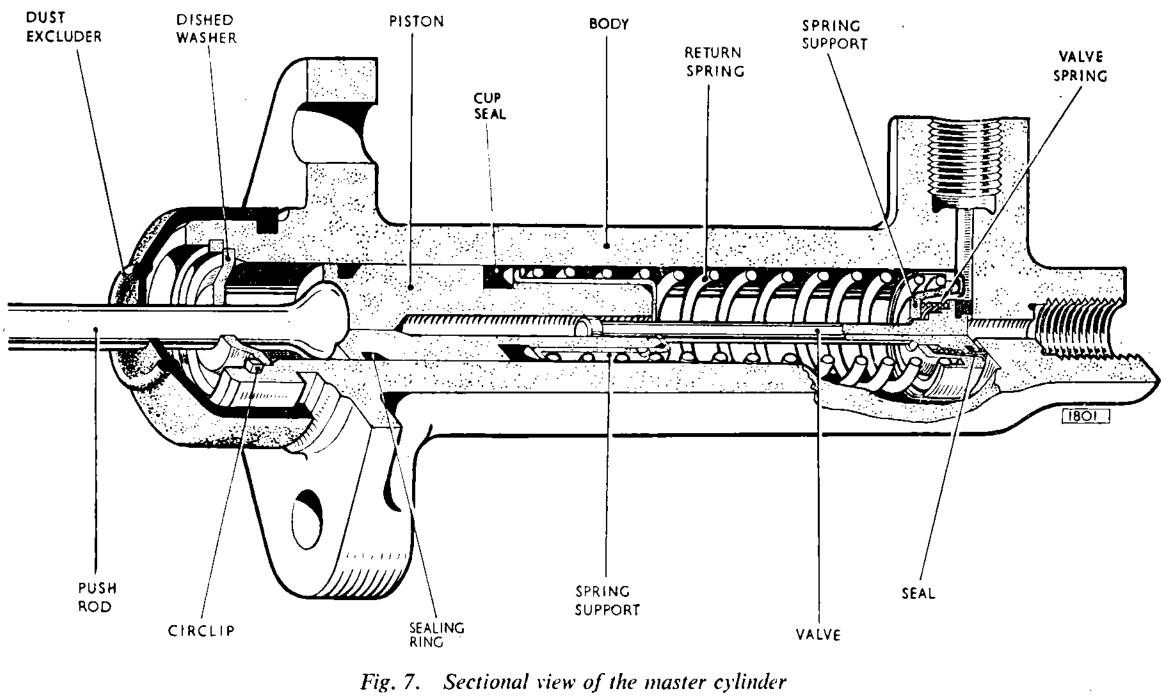


Fig. 7. Sectional view of the master cylinder

Removal

Drain the clutch reservoir and detach the inlet and outlet pipes from the clutch master cylinder, by unscrewing the two union nuts. Detach the master cylinder push-rod from the clutch pedal from inside the car by removing the split pin and withdrawing the clevis pin. Remove the clutch master cylinder from the housing situated inside the engine compartment by removing two nuts.

Renewing the Master Cylinder Seals

Ease the dust excluder clear of the head of the master cylinder.

With suitable pliers remove the circlip; this will release the push rod complete with dished washer.

Withdraw the piston and remove both seals.

Withdraw the valve assembly complete with springs and supports. Remove the seal from the end of the valve.

Lubricate the new seals and the bore of the cylinder with brake fluid, fit the seal to the end of the valve ensuring that the lip registers in the groove. Fit the seals in their grooves around the piston.

Insert the piston into the spring support, ensuring that the head of the valve engages the piston bore.

Lubricate the piston with Castrol Rubber Grease H. 95/59 and slide the complete assembly into the cylinder body taking particular care not to damage or twist the seals. The use of a fitting sleeve is advised.

Position the push-rod and depress the piston sufficiently to allow the dished washer to seat on the shoulder at the head of the cylinder. Fit the circlip and check that it fully engages the groove.

Fill the dust excluder with clean Castrol H.95/59 Rubber Grease.

Reseat the dust excluder around the head of the master cylinder.

Master Cylinder Push-rod—Free Travel

To ensure that this piston returns to the fully extended position clearance is provided between the enlarged head of the push-rod, the piston and dished washer. As this washer also forms the return stop for the clutch pedal, no means of adjustment is necessary.

Refitting

Secure the master cylinder to the vehicle by fitting the fixing nuts at the flange. Connect the pipes to the inlet and outlet connections, the push rod to the pedal, and bleed the system. Check for leaks by depressing the clutch pedal once or twice and examining all hydraulic connections.

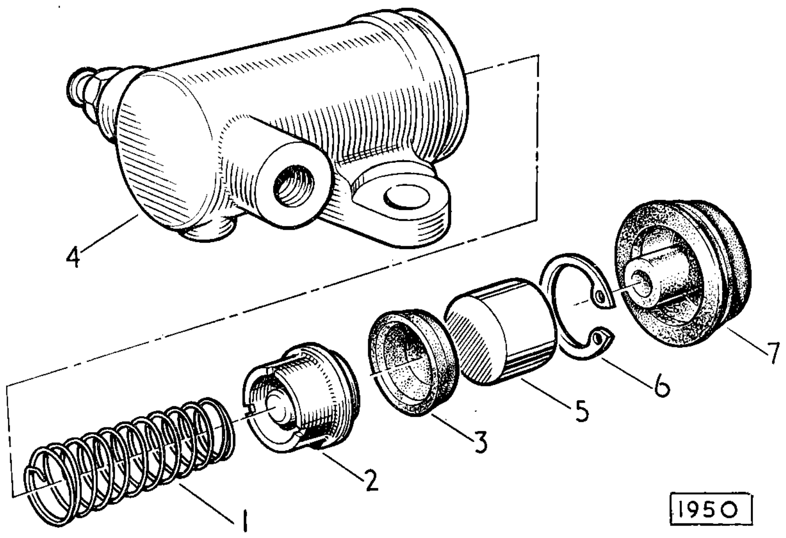


Fig. 8. Exploded view of the clutch slave cylinder

THE SLAVE CYLINDER

The clutch slave cylinder consists of a body (4 Fig. 8) which incorporates two threaded connections and is bored to accommodate a piston (5) against the inner face of which a rubber cup (3) is loaded by a cup filler (2) and a spring (1); the travel of the piston is limited by a circlip (6) fitted in a groove at the end of the bore. A rubber boot (7) through which a push-rod passes, is fitted on to the body to prevent the intrusion of dirt or moisture.

One of the connections in the body receives a pipe from the clutch master cylinder, whilst the other is fitted with a bleeder screw.

Removal

To remove from the vehicle, disconnect the pipe, detach the rubber boot from the body and remove the fixing screws; leave the push-rod attached to the vehicle. If the boot is not being renewed it may be left on the push-rod.

Dismantling

Remove the circlip (6) from the end of the bore and apply a **low** air pressure to the open connection to expel the piston (5) and the other parts; remove the bleeder screw.

Assembling

Prior to assembly, smear all internal parts and the bore of the body with Rubberlube.

Fit the spring (1) in the cup filler (2) and insert these parts, spring uppermost, into the bore of the body (4). Follow up with the cup (3), lip leading, taking care not to turn back or buckle the lip; then insert the piston (5), flat face innermost, and fit the circlip (6) into the groove at the end of the bore.

Refitting

Fit the rubber boot (7) on the push-rod, if removed previously, and offer up the slave cylinder to the vehicle, with the push-rod entering the bore. Secure the cylinder with the fixing screws and stretch the large end of the boot into the groove on the body. Fit into their respective connections the bleeder screw and the pipe from the clutch master cylinder.

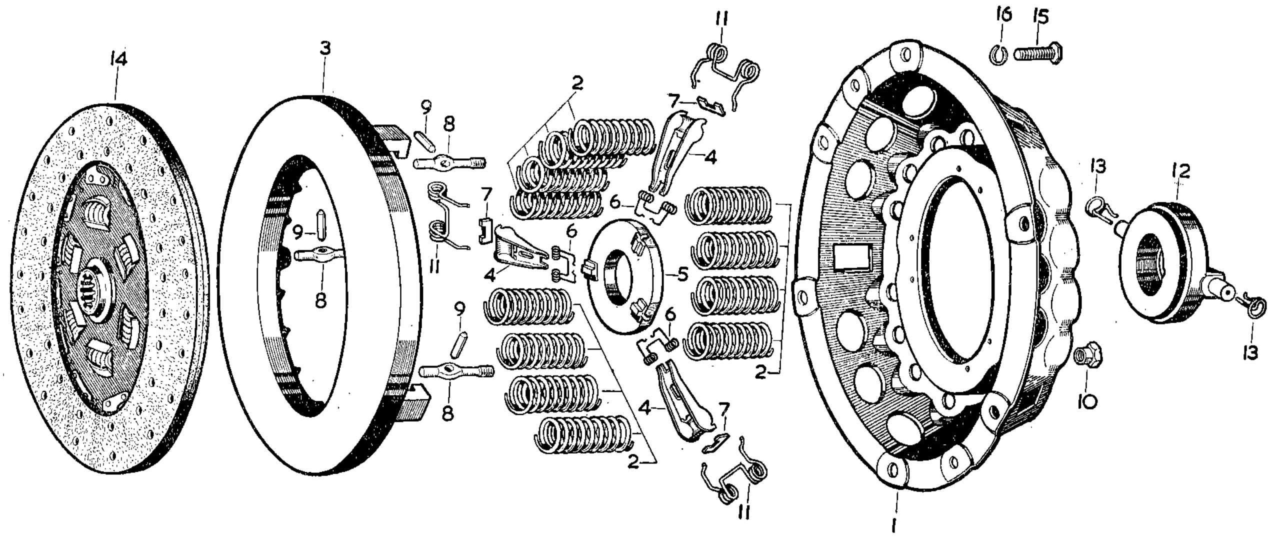
"Bleed" the clutch as described on page 8.

THE CLUTCH UNIT

The driven plate assembly (14, Fig. 9) is of the flexible centre type, in which a splined hub is indirectly attached to a disc and transmits the power and overrun through a number of coil springs held in position by shrouds.

The cover assembly consists of a pressed steel cover (1) and a cast iron pressure plate (3) loaded by thrust springs (2). Mounted on the pressure plate are release levers (4), which pivot on floating pins (9), retained by eye bolts (8). Adjustment nuts (10) are screwed on to the eye bolts and secured by staking. Struts (7) are interposed between lugs on the pressure plate and the outer end of the release levers. Anti-rattle springs (11) restrain the release levers and retainer springs (6) connect the release lever plate (5) to the levers.

The graphite release bearing (12) is shrunk into a bearing cup which is mounted on the throw-out forks and held by the release bearing retainer springs (13).



1. Cover
2. Thrust spring
3. Pressure plate
4. Release lever
5. Release lever plate
6. Release lever retainer
7. Release lever strut
8. Release lever eyebolt
9. Eyebolt pin
10. Adjustment nut
11. Anti-rattle spring
12. Release bearing and cup assembly
13. Release bearing retainer
14. Driven plate assembly
15. Securing bolt
16. Spring washer

Fig. 9. Exploded view of the clutch assembly

GENERAL INSTRUCTIONS

When overhauling the clutch the following instructions should be noted and carried out:—

Clutch Cover Assembly

Before dismantling the clutch, suitably mark the following parts so that they can be reassembled in the same relative positions to each other to preserve the balance and adjustment; clutch cover, lugs on the pressure plate and the release levers.

When reassembling make sure that the markings coincide and, if new parts have been fitted which would affect the adjustment, carefully set the release levers (see page 15).

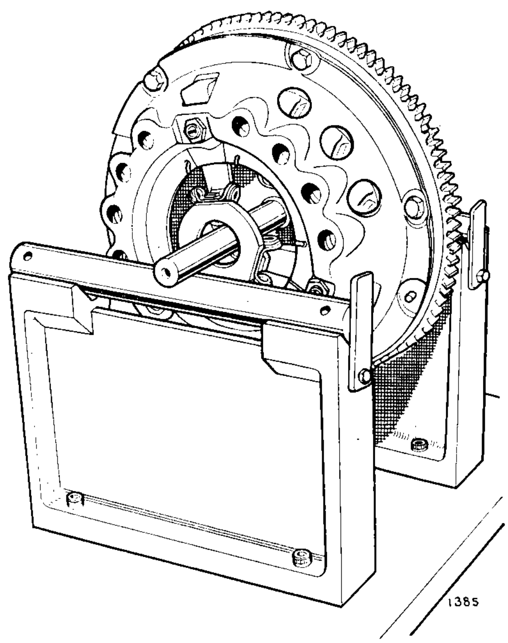


Fig. 10. Clutch and flywheel balance

If a new pressure plate has been fitted, it is essential that the complete cover assembly should be re-balanced, for which reason it is not a practical proposition where special equipment is not available.

Before assembly, thoroughly clean all parts and renew those which show appreciable wear. A very slight smear of grease such as Lockheed Expander Lubricant or Duckham's Keenol K.O.12 should be applied to the release lever pins, contact faces of the struts, eyebolts seats in the clutch cover, drive lug sides on the pressure plate and the plain end of the eyebolts.

Release Bearing

If the graphite release bearing ring is badly worn it should be replaced by a complete bearing assembly.

CONDITION OF CLUTCH FACINGS

The possibility of further use of the friction facings of the clutch is sometimes raised, because they have a polished appearance after considerable service. It is natural to assume that a rough surface will give a higher fractional value against slipping, but this is not correct.

Since the introduction of non-metallic facings of the moulded asbestos type, in service, a polished surface is a common experience, but it must not be confused with a glazed surface which is sometimes encountered due to the conditions discussed below.

The ideal smooth or polished condition will provide a normal contact, but a glazed surface may be due to a film or a condition introduced, which entirely alters the frictional value of the facings. These two conditions might be simply illustrated by the comparison between a polished wood, and a varnished surface. In the former the contact is still made by the original material, whereas in the latter instance, a film of dried varnish is interposed between the contact surfaces.

The following notes are issued with a view to giving useful information on this subject:—

(*a*) After the clutch has been in use for some little time, under perfect conditions (that is, with the clutch facings working on true and polished or ground surfaces of correct material, without the presence of oil, and with only that amount of slip which the clutch provides for under normal conditions) then the surface of the facings assumes a high polish, through which the grain of the material can be clearly seen. This polished facing is of mid-brown colour and is then in a perfect condition.

(*b*) Should oil in small quantities gain access to the clutch in such a manner as to come in contact with the facings it will burn off, due to the heat generated by slip which occurs under normal starting conditions. The burning off of this small amount of lubricant, has the effect of gradually darkening the facings, but, provided the polish on the facings remains such that the grain of the material can be clearly distinguished, it has very little effect on clutch performance.

(*c*) Should increased quantities of oil or grease obtain access to the facings, one or two conditions, or a combination of the two, may arise, depending upon the nature of oil, etc.

1. The oil may burn off and leave on the surface facings a carbon deposit which assumes a high glaze and causes slip. This is a very definite, though very thin deposit, and in general it hides the grain of the material.
2. The oil may partially burn and leave a resinous deposit on the facings, which frequently produces a fierce clutch, and may also cause a "spinning" clutch due to a tendency of the facings to adhere to the flywheel or pressure plate face.
3. There may be a combination of (1) and (2) conditions, which is likely to produce a judder during clutch engagement.

(*d*) Still greater quantities of oil produce a black soaked appearance of the facings, and the effect may be slip, fierceness, or judder in engagement, etc., according to the conditions. If the conditions under (*c*) or (*d*) are experienced, the clutch driven plate should be replaced by one fitted with new facings, the cause of the presence of the oil removed and the clutch and flywheel face thoroughly cleaned.

ALIGNMENT

Faulty alignment will cause excessive wear of the splines in the hub of the driven plate, and eventually fracture the steel disc around the hub centre as a result of "swash action" produced by axial movement of the splined shaft.

PEDAL ADJUSTMENT

This adjustment is most important and the instructions given should be carefully followed; faulty adjustment falls under two headings:—

(*a*) Insufficient free (or unloaded) pedal travel may cause a partly slipping clutch condition which becomes aggravated as additional wear takes place on the facings, and this can result in a slipping clutch leading to burning out unless corrected. Over-travel of effective pedal movement only imposes undue internal strain and causes excessive bearing wear.

(*b*) Too much free pedal movement results in inadequate release movement of the bearing and may produce a spinning plate condition that is, dragging clutch rendering clean changes impossible.

REMOVAL

To remove the clutch, the engine and gearbox must first be removed (refer to Section B "Engine").

Slacken the clutch mounting screws a turn at a time by diagonal selection until the thrust spring pressure is released. Remove the setscrews and withdraw the complete clutch assembly from the flywheel. Remove the driven plate assembly and take care to maintain the driven plate faces in a clean condition. Observe that the clutch and flywheel are balanced as an assembly. This location is indicated by balance marks "B" stamped on the clutch and flywheel (Fig. 21).

DISMANTLING

Before dismantling, mark all the major components.

To dismantle the clutch, either bolt the assembly to the baseplate of the Churchill fixture, to a spare flywheel, or place the clutch on the bed of a press with blocks under the pressure plate in such a manner that the cover is free to move downwards when pressure is applied.

Having compressed the clutch in one of these various ways, unscrew the nuts (Fig. 11), (considerable torque is initially necessary in order to break off the squeezed-in portion of each nut), and slowly release the clamping pressure. Lift the cover and the thrust springs off the pressure plate and remove the release lever mechanism. Fig. 12 shows the method whereby the strut is disen-

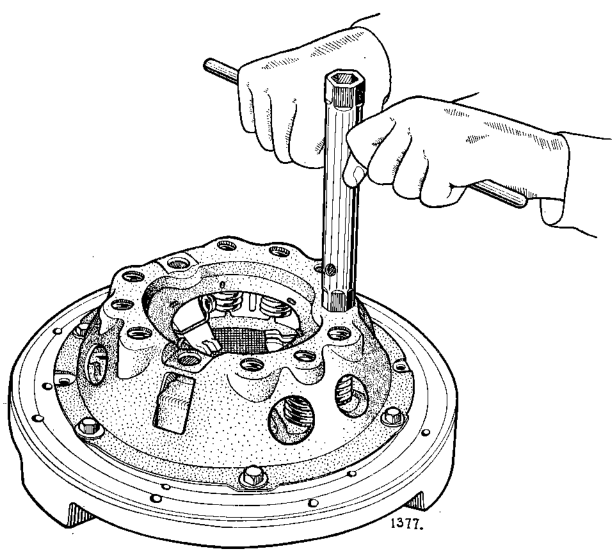


Fig. 11. Removal of the adjustment nuts

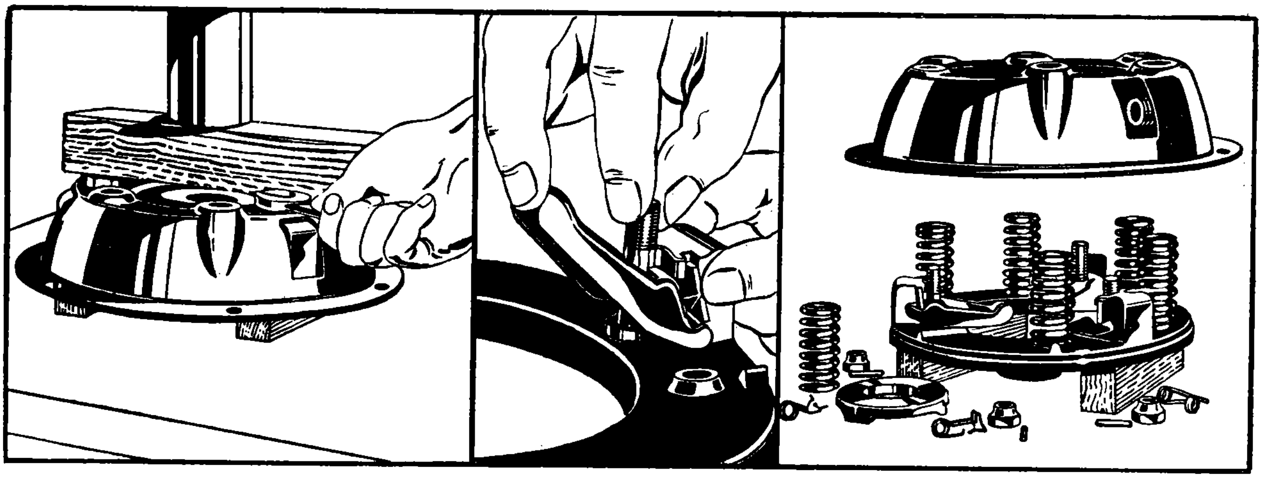


Fig. 12. Dismantling the clutch assembly using a ram press

gaged from the lever, after which the threaded end of the eye-bolt and the inner end of the lever are held as close together as possible to enable the shank of the eyebolt to clear the hole in the pressure plate.

ASSEMBLING

It is essential that all major components be returned to their original positions if the balance of the assembly is to be preserved.

Fit a pin (9, Fig. 9) into an eyebolt (8) and locate the parts within a release lever (4). Hold the threaded end of the eyebolt and the inner end of the lever as close together as possible and, with the other hand, engage the strut (7) within the slots in a lug on the pressure plate, with the other end of the strut push outwards towards the periphery of the plate. Offer up the lever assembly, first engaging the eyebolt shank within the hole in the plate, then locate the strut within the groove in the lever. Fit the remaining levers in the same way, not forgetting to lubricate all contact faces.

Place the pressure plate on the baseplate of the Churchill fixture, on a spare flywheel, or on blocks on the bed of a press and position the thrust springs (2) on the bosses of the plate. Having arranged all the springs, and ensuring that the anti-rattle springs (11) are fixed within the cover, rest the cover on the springs, carefully aligning the pressure plate lugs with the cover slots. If the Churchill fixture or a spare flywheel is being used, move the clutch to align the holes in the cover flange with the tapped holes in the flywheel or baseplate and then clamp the cover down with the fixing screws, turning them a little at a time to avoid distortion. If a press is being used, arrange a block across the cover and compress the assembly. Then screw the adjusting nuts (10) into an approximately correct position.

The release levers must now be set to the correct height, adopting any of three methods elsewhere described after which the adjusting nuts should be locked by punching them into the eyebolt slots. After setting the levers, fit the release lever plate.

ADJUSTING THE RELEASE LEVERS

To ensure satisfactory operation, correct adjustment of the release levers is essential. In service, the original adjustment made by the makers never needs attention and re-adjustment is only necessary if the clutch has been dismantled.

To facilitate adjustment of the release levers the gauge plates once produced by the clutch manufacturer can be utilized. As numerous Traders still possess these plates details as to their identification are given on Page 19.

An alternative method of lever adjustment is to use the universal fixture known as the No. 99 manufactured by V. L. Churchill & Co. Ltd., which caters for the 6¼″—11″ clutch.

Finally, where neither a gauge plate nor Churchill tool is available the levers may be set using the actual driven plate as a gauge and these three methods are described as follows:—

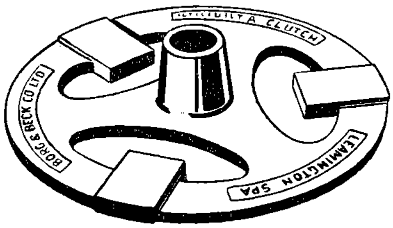


Fig. 13. The gauge plate

(1) Using a Borg & Beck gauge plate (Fig. 14)

(*a*) Mount the clutch on the actual or a spare flywheel (1, Fig. 14) or alternatively clamp it down to a flat surface, with the gauge plate (4) occupying the position normally taken by the driven plate. The ground lands of the gauge plate should each be located under a release lever (5).

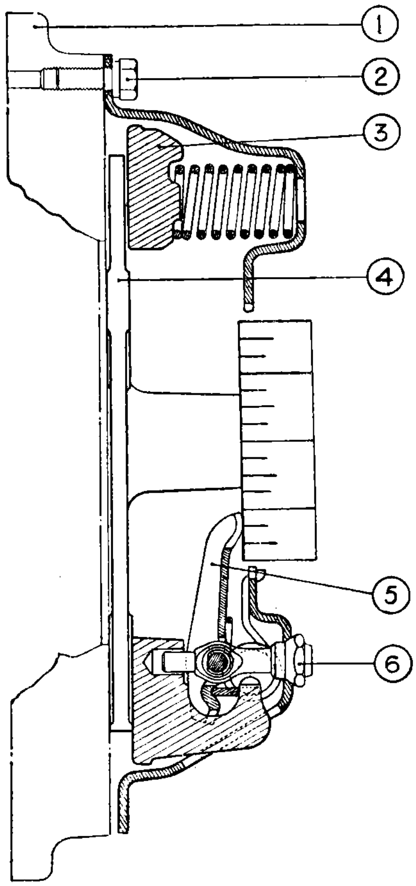


Fig. 14. Release lever adjustment

(*b*) Adjust the levers by turning the eyebolt nuts (6) until the levers are just in contact with a short straight edge resting upon the boss of the gauge plate.

(*c*) Having made a preliminary setting some attempt must be made to operate the clutch several times in order to settle the mechanism. Normally, this operation can be carried out in a drilling machine or light press having a suitable adaptor, arranged to bear upon the lever tips.

(*d*) Carry out a further check and re-adjust if necessary.

(2) Using the Churchill Fixture

This tool, which is illustrated in Fig. 15 provides for the accurate adjustment of the levers; additionally, it affords a convenient fixture upon which to dismantle and assemble the unit. A device is included to operate the clutch and thereby to settle the working parts after assembly. To use the tool, adopt the following procedure, which also indicates the additional operations when dismantling and assembling the clutch.

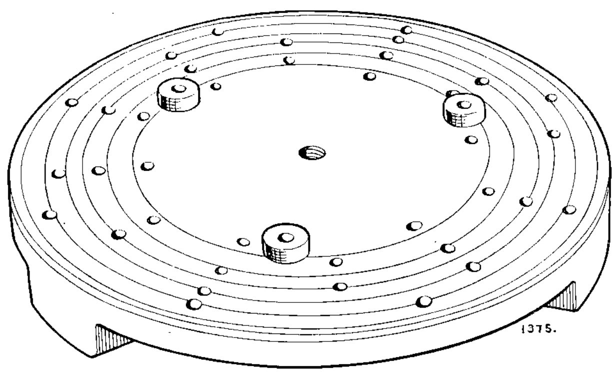


Fig. 15. The special base plate for clutch adjustment

Remove from the box the gauge finger, the pillar and the actuator, as shown in Fig. 16 and consult the code card to determine the reference of the adaptor and the spacers appropriate to the clutch which is being serviced.

Rest the base plate on a flat surface, wipe it clean and place the spacers upon it in the positions quoted on the code card, as in Fig. 15. Place the clutch on the spacers, aligning it with the appropriate tapped holes in the base, arranging it so that the release levers are as close to the spacers as possible.

Screw the actuator into the centre hole in the base plate and press the handle down to clamp the clutch. Then screw the set bolts provided firmly into the trapped holes in the baseplate using a speed brace; remove the actuator.

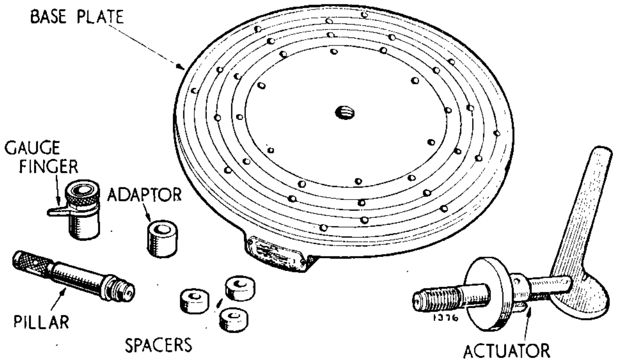


Fig. 16. The base plate and accessories

Remove the adjusting nuts (Fig. 11) and gradually unscrew the set bolts to relieve the load of the thrust springs (Fig. 17). Lift the cover off the clutch and carry out whatever additional dismantling may be desired.

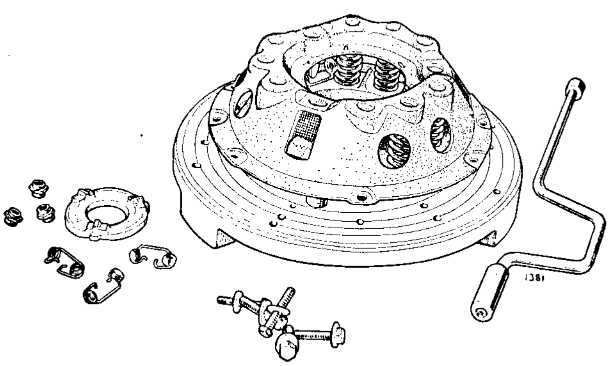


Fig. 17. Removing the clutch cover

After carrying out the necessary servicing of the clutch components, reassemble the parts on the clutch pressure plate, place the cover upon it and transfer the assembly to the base plate, resting on the spacers and aligned correctly.

Carefully bolt the cover to the base plate and screw the adjusting nuts on to the eyebolts until flush with the tops of the latter. Screw the actuator into the base (Fig. 18) and pump the handle a dozen times to settle the clutch mechanism. Remove the actuator. Screw the pillar firmly into the base and place upon it the appropriate adaptor, recessed face downwards, and the gauge finger.

Turn the adjusting nuts until the finger just touches the release levers, pressing downwards on the finger assembly to ensure that it is bearing squarely on the adaptor (Fig. 19).

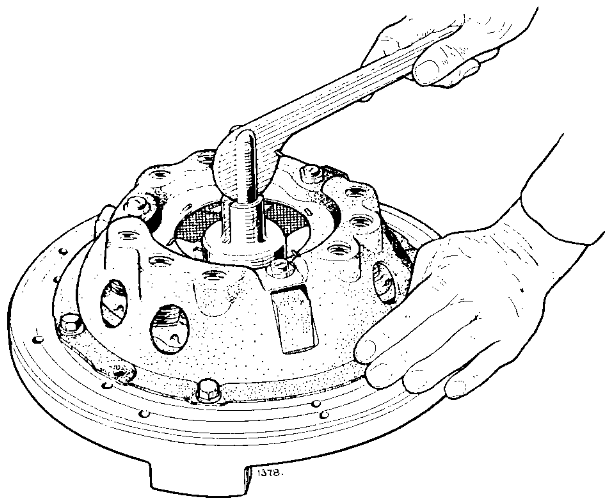


Fig. 18. Screwing the actuator into the base plate

Remove the finger adaptor and pillar, replace the actuator and operate the clutch a further dozen times. Replace the pillar and check the lever setting, making any final correction.

Finally, lock the adjusting nuts. The cylindrical portion of the nut must be peened into the slot in the eyebolt, using a blunt chisel and hammer.

(3) Using the Actual Driven Plate

This method of setting the levers is not highly accurate and should only be resorted to when neither a gauge plate nor Churchill Fixture is available. The drawback to this method lies in the fact that although the driven plate is produced to close limits, it is difficult to ensure absolute

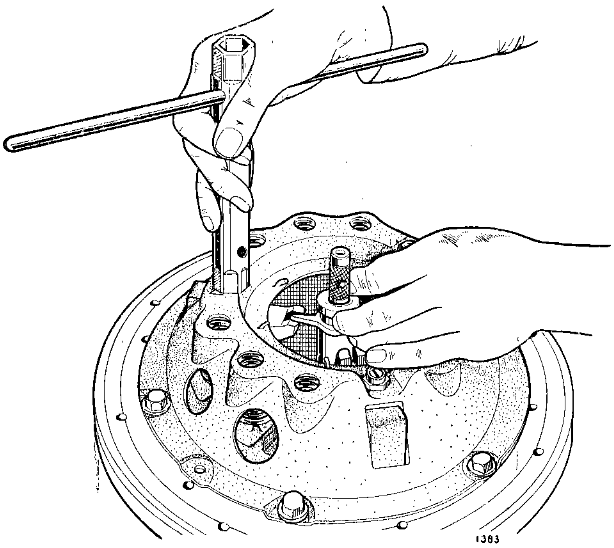


Fig. 19. Using finger assembly to adjust the release levers

parallelism. Although the error in the plate is small, it is magnified some five-fold at the lever tip due to the lever ratio.

The method to be adopted is as follows:—

(*a*) Mount the clutch on the flywheel with the driven plate in its normal position or clamp the assembly to any flat surface having a hole within it to accommodate the boss of the driven plate.

(*b*) Consult the chart on page 19 to ascertain the height of the lever tip from the flywheel and adjust the levers until this dimension is achieved.

(*c*) Having made a preliminary setting slacken the clamping pressure, turn the driven plate through a right angle, re-clamp the cover and check the levers again as a safeguard against any lack of truth in the driven plate.

REFITTING

Place the driven plate on the flywheel taking care that the larger part of the splined hub faces the gearbox. Centralise the plate on the flywheel by means of the dummy shaft (a constant pinion shaft may be used for this purpose, Fig. 20). Secure the cover assembly with the six setscrews and spring washers, tightening the screws a turn at a time by diagonal selection. Ensure that the "B" stamped adjacent to one of the dowel holes coincides with the "B" stamped on the periphery of the flywheel (Fig. 21). Do not remove the dummy shaft until all the setscrews are securely tightened, otherwise the driven plate will come off centre and difficulty will be met in engaging the constant pinion shaft into the bush in the rear end of the crankshaft.

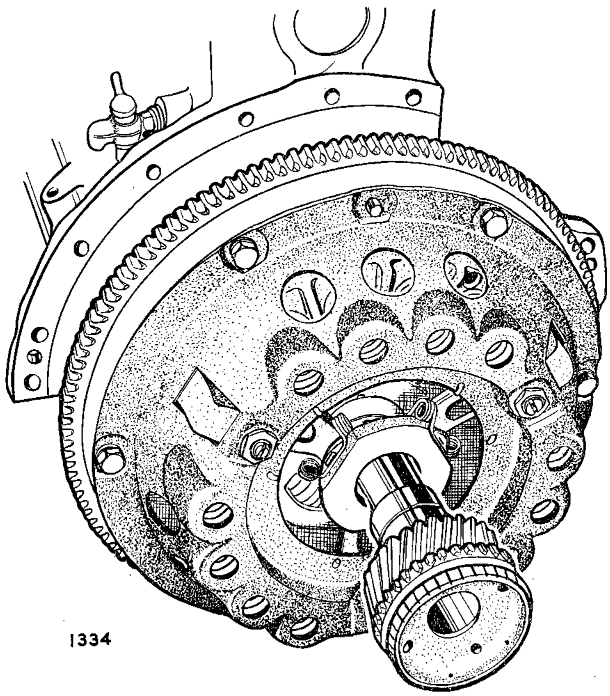


Fig. 20. Centralising the driven plate

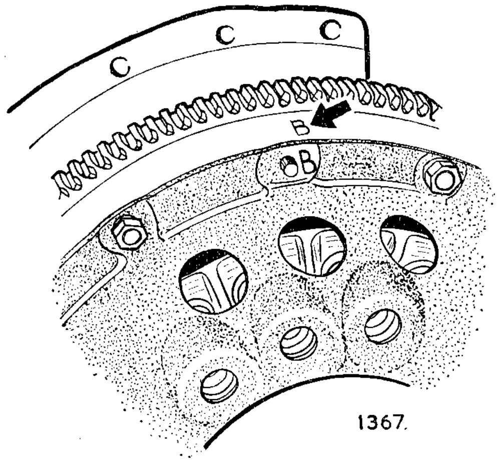


Fig. 21. Balance marks on the clutch and flywheel

DATA FOR CLUTCH LEVER TIP SETTING

Clutch Model	Driven Plate	Gauge Plate Part No.	Lever tip height from flywheel face Dimension "A"	Gauge Plate Land Thickness Dimension "C"	Gauge Plate Dia.	Remarks
10″	Borglite	CG14322	1·955″ (49·65 mm.)	0·330″ (8·381 mm.)	8·375″ (212·7mm.)	Dimension "A" 2·45″ (62·23mm.) if taken with Release Lever Plate in position.

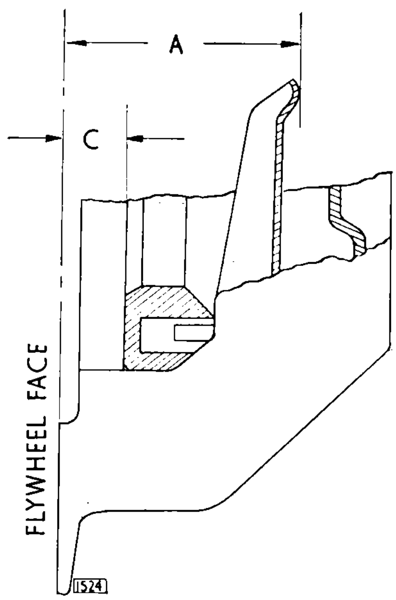


Fig. 22. Dimensions for clutch lever tip setting

FAULT FINDING

SYMPTOM	CAUSE	REMEDY
Drag or Spin	(a) Oil or grease on the driven plate facings	Fit new facings and eliminate cause of foreign presence
	(b) Misalignment between the engine and splined clutch shaft	Check over and correct the alignment
	(c) Air in clutch system	"Bleed" system
	(d) Bad external leak between the clutch master cylinder and the slave cylinder	Renew pipe and unions
	(e) Excessive clearance between the release bearing and the release lever plate	Adjust to $\frac{1}{16}''$ (1·58 mm.) clearance
	(f) Warped or damaged pressure plate or clutch cover	Renew defective part
	(g) Driven plate hub binding on splined shaft	Clean up splines and lubricate with small quantity of high melting point grease such as Duckham's Keenol
	(h) Distorted driven plate due to the weight of the gearbox being allowed to hang on clutch plate during assembly	Fit new driven plate assembly using a jack to take overhanging weight of the gearbox
	(i) Broken facings of driven plate	Fit new facings, or replace plate
	(j) Dirt or foreign matter in the clutch	Dismantle clutch from flywheel and clean the unit, see that all working parts are free CAUTION: Never use petrol or paraffin for cleaning out clutch
Fierceness or Snatch	(a) Oil or grease on driven plate facings	Fit new facings and ensure isolation of clutch from possible ingress of oil or grease
	(b) Misalignment	Check over and correct alignment
	(c) Worn out driven plate facings	New facings required
Slip	(a) Oil or grease on driven plate facings	Fit new facings and eliminate cause of foreign presence
	(b) Failure to adjust at clutch slave cylinder to compensate for loss of release bearing clearance consequent upon wear of the driven plate facings $\frac{1}{16}''$ (1·58 mm.) clearance is necessary between the release bearing and the release lever plate)	Adjust push rod as necessary
	(c) Seized piston in clutch slave cylinder	Renew parts as necessary
	(d) Master cylinder piston sticking	Free off the piston

FAULT FINDING *(Continued)*

SYMPTOM	CAUSE	REMEDY
Judder	(a) Oil, grease or foreign matter on driven plate facings	Fit new facings or driven plate and eliminate cause of foreign presence
	(b) Misalignment	Check over and correct alignment
	(c) Pressure plate out of parallel with flywheel face in excess of the permissible tolerance	Re-adjust levers in plane, and, if necessary, fit new eyebolts
	(d) Contact area of friction facings not evenly distributed. Note that friction facing surface will not show 100% contact until the clutch has been in use for some time, but the contact actually showing should be evenly distributed round the friction facings	This may be due to distortion, if so fit new driven plate assembly
	(e) Bent splined shaft or buckled driven plate	Fit new shaft or driven plate assembly
Rattle	(a) Damaged driven plate, broken springs, etc. (b) Worn parts in release mechanism (c) Excessive backlash in transmission (d) Wear in transmission bearings (e) Bent or worn splined shaft (f) Graphite release bearing loose on throw out fork	Fit new parts as necessary
Tick or Knock	Hub splines worn due to misalignment	Check and correct alignment then fit new driven plate
Fracture of Driven Plate	(a) Misalignment distorts the plate and causes it to break or tear round the hub or at segment necks	Check and correct alignment and introduce new driven plate
	(b) If the gearbox during assembly be allowed to hang with the shaft in the hub, the driven plate may be distorted, leading to drag, metal fatigue and breakage	Fit new driven plate assembly and ensure satisfactory re-assembly
Abnormal Facing Wear	Usually produced by overloading and by excessive clutch slip when starting	In the hands of the operator

SECTION F

GEARBOX AND OVERDRIVE

3·8 MARK 10 MODEL

INDEX

INDEX *(continued)*

GEARBOX AND OVERDRIVE

The gearbox is of the four-speed type with synchromesh on the second, third and top gears; these gears are of single helical form and are in constant mesh. The first and reverse gears have spur teeth which slide into mesh.

The overdrive (fitted as an optional extra) is of the Laycock de Normanville type and is dealt with separately at the end of this section.

GEARBOX

	Gearbox Ratios	Overall Ratios (Standard model)	Overall Ratios (Overdrive model)
Gearbox prefix*	GZ	—	—
Gearbox suffix	JS	—	—
First and reverse	3·377 : 1	11·954 : 1	12·731 : 1
Second	1·86 : 1	6·584 : 1	7·012 : 1
Third	1·283 : 1	4·541 : 1	4·836 : 1
Top	1 : 1	3·54 : 1	3·77 : 1
Overdrive	·778 : 1	—	2·933 : 1
Axle ratio		3·54 : 1	3·77 : 1

* The letter "N" at the end of the prefix letters "GZ" indicates that a gearbox mainshaft suitable for the attachment of an overdrive is fitted.

Ordering Spare Parts

It is essential when ordering spare parts for an individual gearbox, to quote the prefix and suffix letters in addition to the gearbox number.

The gearbox number is stamped on a lug situated at the left-hand rear corner of the gearbox casing and on the top cover.

DATA

Second gear end-float on mainshaft—·002″ to ·004″ (·05 to ·10 mm.)
Third gear end-float on mainshaft—·002″ to ·004″ (·05 to ·10 mm.)
Layshaft end-float on countershaft—·002″ to ·004″ (·05 to ·10 mm.)

ROUTINE MAINTENANCE

EVERY 2,500 MILES (4,000 KM.)

Gearbox Oil Level

Check the level of the oil in the gearbox with the car standing on level ground.

A combined level and filler plug is fitted on the left-hand side of the gearbox. Clean off any dirt from around the plug before removing it.

The level of the oil should be to the bottom of the filler and level plug hole.

Overdrive Oil Level—Important

The oil for the lubrication and operation of the overdrive unit is fed from the gearbox casing and therefore checking the gearbox oil level will also check the level of oil in the overdrive unit, but as this unit is hydraulically controlled extra attention should be paid to exercising absolute cleanliness when replenishing with oil. It is also important that the oil level is not allowed to fall appreciably otherwise the operation of the overdrive may be affected.

EVERY 10,000 MILES (16,000 KM.)

Changing the Gearbox Oil

The draining of the gearbox should be carried out at the end of a run when the oil is hot and therefore will flow more freely. The magnetic drain plug is situated at the front end of the gearbox casing.

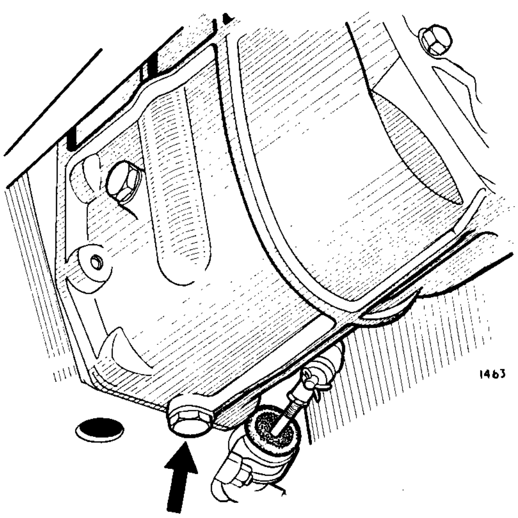


Fig. 1. Gearbox drain plug

After all the oil has drained, clean and replace the magnetic drain plug and refill the gearbox with the recommended grade of oil through the combined filler and level plug hole situated on the left-hand side of the gearbox casing; the level should be to the bottom of the hole.

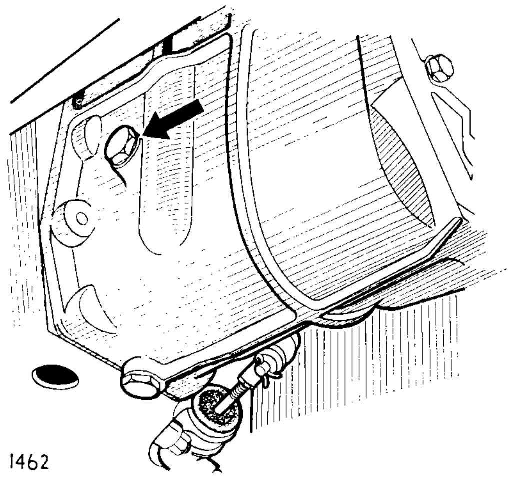


Fig. 2. Gearbox filler and level plug

Overdrive—Oil Changing

The oil for the overdrive unit is common with that in the gearbox but draining the gearbox casing will not drain the oil from the overdrive unit. A brass drain plug is provided in the base of the overdrive unit and when draining the gearbox this plug should also be removed.

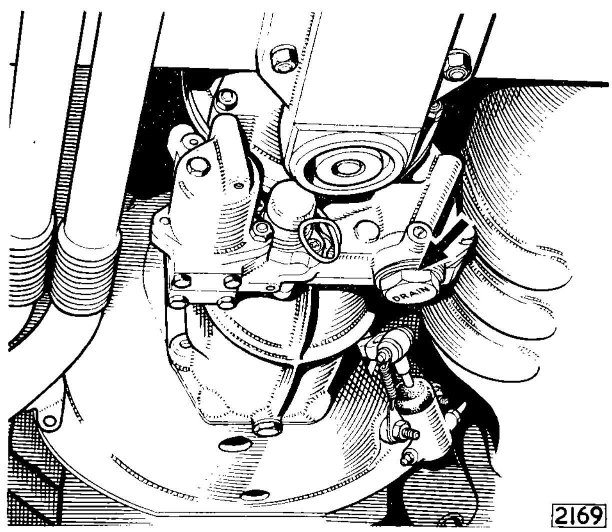


Fig. 3. Overdrive drain plug

Whilst this drain plug is removed, the overdrive filter should be cleaned. This filter is accessible through the drain plug hole and is retained by a spring. Thoroughly wash the filter gauze and allow to dry. When refitting the filter, ensure that the closed end is uppermost.

A magnetic washer is situated in the brass drain plug and should be cleaned before refitting.

Refill the gearbox and overdrive with oil through the gearbox filler and level plug hole. **Recheck the level after the car has been run** as a certain amount of oil will be retained in the hydraulic system of the overdrive.

Particular attention should be paid to maintaining absolute cleanliness when filling the gearbox and overdrive with oil as any foreign matter that enters may seriously affect the operation of the overdrive.

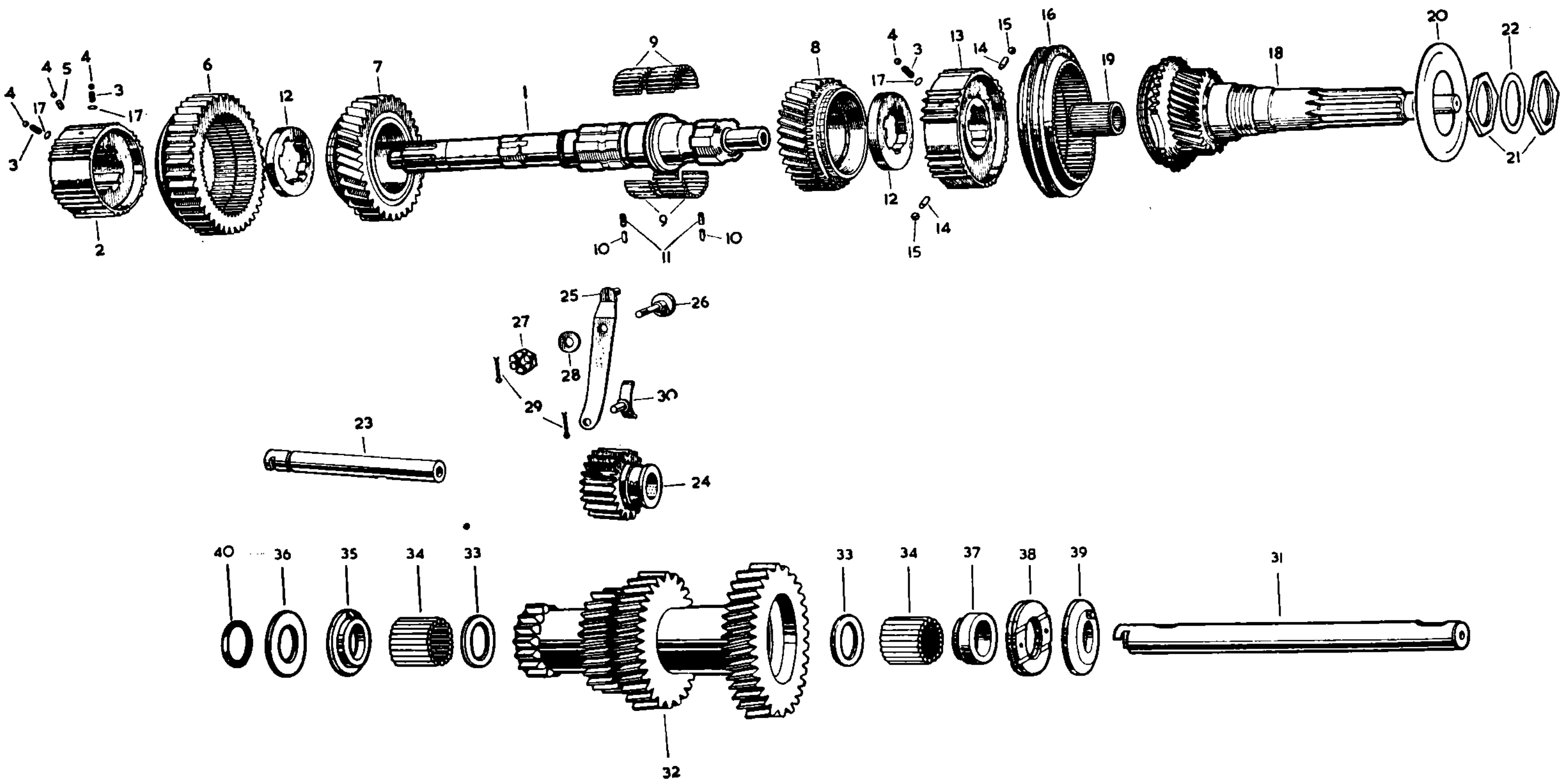
Note: ANTI-FRICTION ADDITIVES SHOULD NOT BE USED.

Recommended Lubricants

Mobil	**Castrol**	**Shell**	**Esso**	**B.P.**	**Duckham**	**Regent** Caltex/Texaco
Mobiloil A	Castrol XL	X100 30	Esso Extra Motor Oil 20W/30	Energol 30	NOL 30	Havoline 30

Gearbox and Overdrive Oil Capacity

Type	**Imp. Pints**	**U.S. Pints**	**Litres**
Gearbox only	2½	3	1·5
Gearbox overdrive	4	4¾	2·25



1. Mainshaft
2. 2nd speed synchronising sleeve
3. Spring
4. Ball
5. Plunger
6. 1st Gear
7. 2nd Gear
8. 3rd Gear
9. Needle roller
10. Plunger
11. Spring
12. Thrust washer
13. Synchro sleeve
14. Plunger
15. Ball
16. Operating sleeve
17. Shim
18. Constant pinion shaft
19. Roller bearing
20. Oil thrower
21. Locknut
22. Tab washer
23. Reverse spindle
24. Reverse gear
25. Lever
26. Fulcrum shaft
27. Slotted nut
28. Washer
29. Split pin
30. Reverse slipper
31. Countershaft
32. Layshaft cluster
33. Retaining ring
34. Needle roller
35. Thrust washer assembly
36. Thrust washer
37. Retaining ring
38. Thrust washer
39. Thrust washer assembly
40. Sealing ring

Fig. 4. Gear train

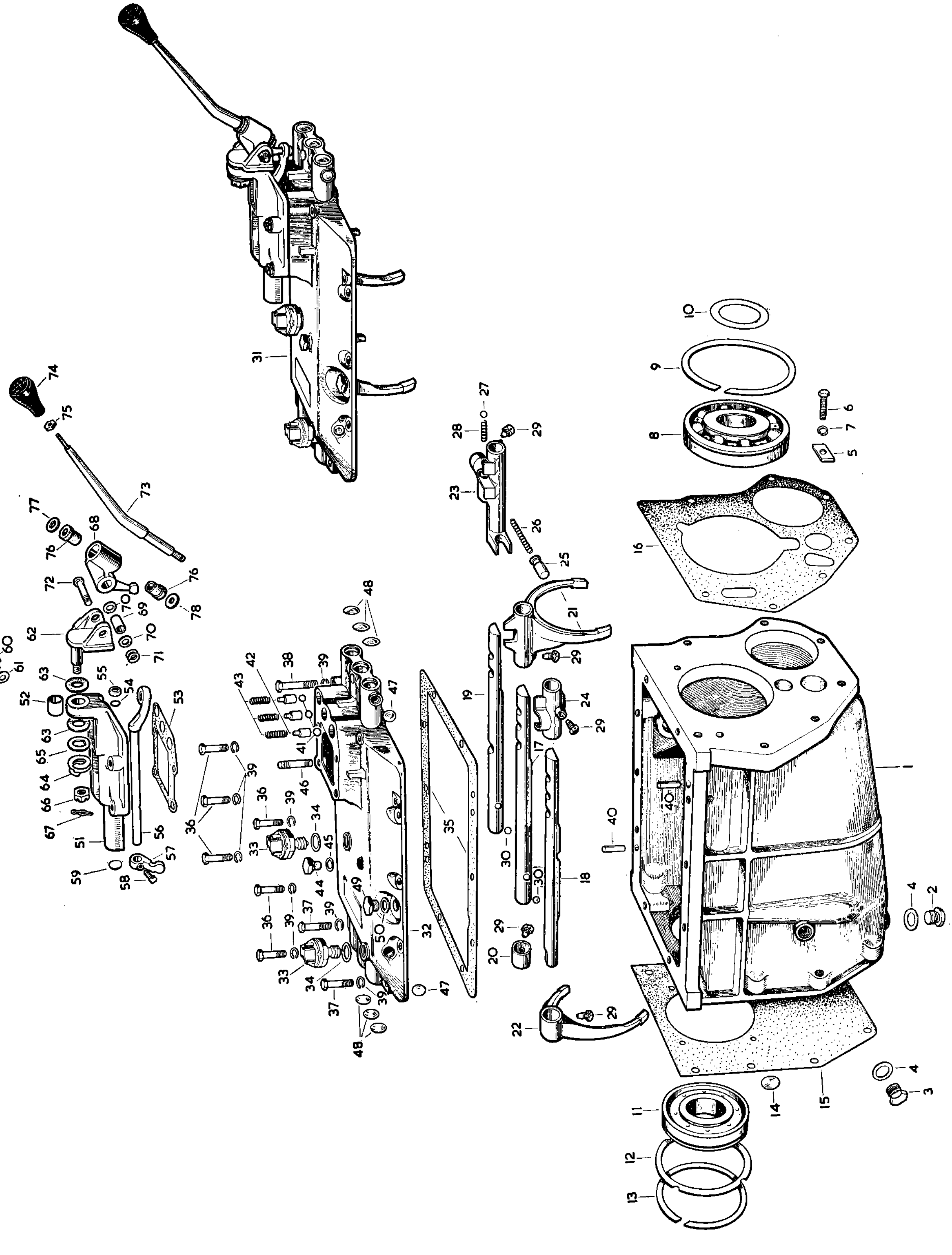


Fig. 5. Exploded view of the gearbox casing and top cover

1. Gearbox case
2. Drain plug
3. Level plug
4. Fibre washer
5. Locking plate
6. Setscrew
7. Spring washer
8. Ball race
9. Circlip
10. Shim
11. Ball race
12. Collar
13. Circlip
14. Fibre washer
15. Gasket (front)
16. Gasket (rear)
17. 1st/2nd striking rod
18. 3rd/Top striking rod
19. Reverse striking rod
20. Striking rod stop
21. Change speed fork (1st and 2nd)
22. Change speed fork (3rd and Top)
23. Change speed fork (Reverse)
24. Selector
25. Plunger
26. Spring
27. Locking bolt
28. Spring
29. Dowel locating screw
30. Interlock ball
31. Top cover assembly
32. Top cover
33. Reverse light and Overdrive switches
34. Gasket
35. Gasket
36. Bolt
37. Bolt
38. Bolt
39. Spring washer
40. Dowel
41. Ball
42. Plunger
43. Spring
44. Sealing plug
45. Fibre washer
46. Stud
47. Welch washer
48. Welch washer
49. Plug
50. Fibre washer
51. Change speed lever housing
52. Pivot jaw bush
53. Gasket
54. 'O' ring
55. Retaining cap
56. Remote control shaft
57. Selector finger
58. Dowel screw
59. Welch washer
60. Breather
61. Fibre washer
62. Pivot jaw housing
63. Fibre washer
64. Coil spring washer
65. 'D' washer
66. Slotted nut
67. Split pin
68. Selector lever
69. Bush
70. Fibre washer
71. Coil spring washer
72. Pivot pin
73. Change speed lever
74. Change speed lever knob
75. Nut
76. Rubber bush
77. Washer
78. Washer

GEARBOX — TO REMOVE AND REFIT

In order to remove the gearbox it is necessary to remove the gearbox and engine as an assembly as described in Section B "Engine."

GEARBOX — TO DISMANTLE

Drain the gearbox by removing plug and fibre washer situated at base of the casing. Place gearbox in neutral and remove the ten setscrews with spring washers securing the top cover. Lift off top cover noting that this is located by two dowels fitted in the gearbox case. Remove and scrap the gasket.

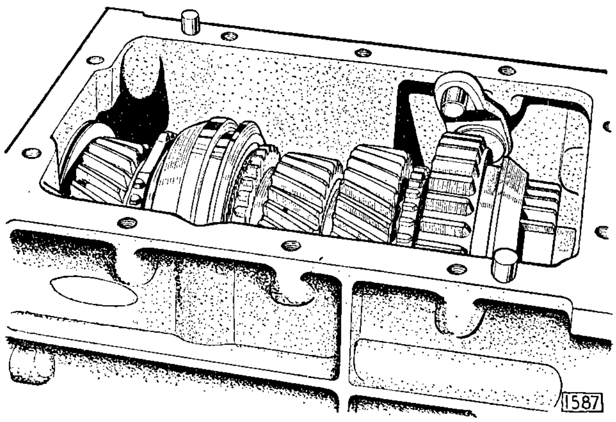


Fig. 6. The top cover removed showing the layout of the mainshaft gears

Remove the clutch slave cylinder from the clutch housing. Detach the spring clips and remove the clutch release bearing. Release the locknut and remove the Allen headed screw securing the clutch fork to shaft. Withdraw shaft downwards and remove fork. From inside the clutch housing remove the locking wire from the two bolts and tap back the tabs on the locking washers. Unscrew the eight bolts and remove the clutch housing.

Remove the speedometer cable drive attachment from the speedometer driven gear by rotating the knurled thumb nut in an anti-clockwise direction. Remove the locking screw retaining the speedometer driven gear bush in the end cover. Withdraw the driven gear and bearing.

Remove the fibre blank from the front end of the layshaft.

Engage top and first gear. Extract the split pin, remove the nut and plain washer retaining the universal joint flange to the mainshaft and withdraw the flange from the splines on the shaft.

On non-overdrive gearboxes remove the seven setscrews securing the rear end cover to the gearbox casing. (Do not disturb the layshaft/reverse idler locking plate). Withdraw the end cover complete with shafts, at the same time inserting a dummy countershaft into the countershaft bore at the front of the gearbox casing. The dummy shaft and countershaft must be kept in contact until the countershaft is clear of the casing.

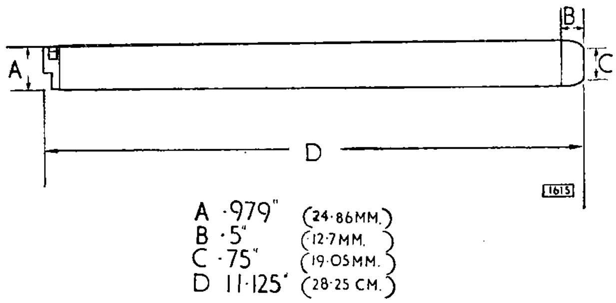


Fig. 7. The dummy countershaft

Withdraw the speedo drive gear. Withdraw the dummy countershaft allowing the layshaft gear unit to drop into the bottom of the casing.

On gearboxes equipped with an overdrive, remove the circlip, plain washer and shims from behind the gearbox rear bearing.

Rotate the constant pinion shaft until the two cutaway portions of the driving gear are facing the top and bottom of the casing. Tap the mainshaft to the front to knock the constant pinion shaft with ball bearing forward out of the case (see Fig. 8). Remove the constant pinion shaft and withdraw the roller bearing from the shaft spigot. Continue to tap mainshaft forward until free of the rear bearing. Tap lhe bearing rearward out of the casing.

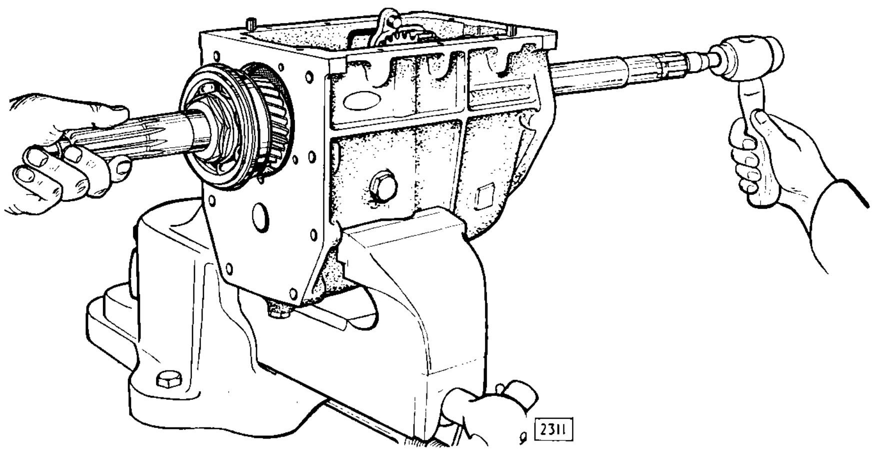


Fig. 8. The constant pinion shaft is removed by tapping the mainshaft forward

Push the reverse gear forward out of engagement to clear the mainshaft first speed gear. Lift the front end of the mainshaft upwards and remove complete with all mainshaft gears forward out of the casing leaving the layshaft in the bottom of the casing (see Fig. 9).

Draw reverse wheel rearwards as far as it will go to clear layshaft first speed gear. Lift out layshaft gear unit observing inner and outer thrust washers fitted at each end of the gears. Take care not to lose any needles which are located at each end of the gear unit.

Push reverse gear back into the case and remove through top. Note bush which is a press fit in reverse gear.

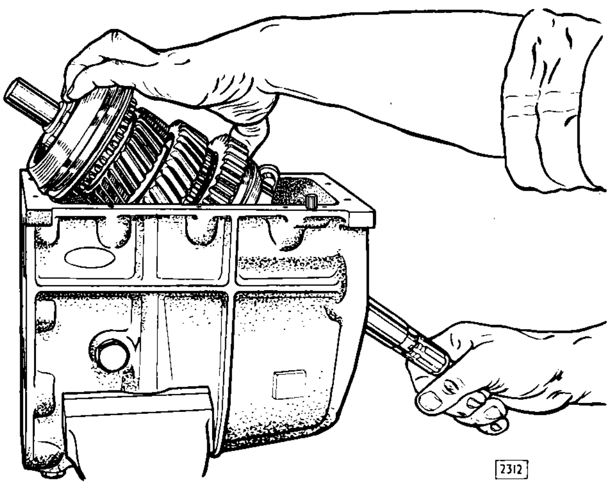


Fig. 9. Removing the mainshaft from the gearbox casing

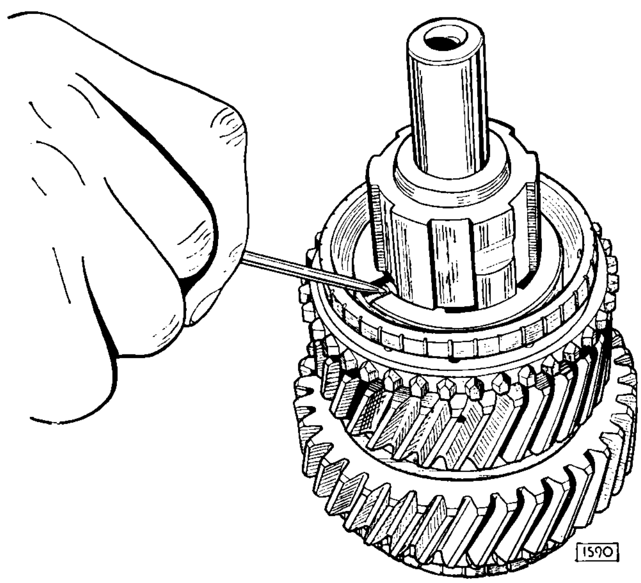


Fig. 10. Depressing the 3rd speed thrust washer locking plunger

DISMANTLING THE MAINSHAFT

Withdraw the top/third gear operating and synchronising sleeves forward off the shaft. Press the operating sleeve off the synchronising sleeve and remove the six synchronising balls and springs. Remove the interlock plungers and balls from the synchro sleeve.

Withdraw the second gear synchronising sleeve complete with first speed gear rearwards off the shaft. Press the first speed gear off the synchronising sleeve and remove the six synchronising balls and springs.

Remove the interlock ball and plunger from the synchro sleeve.

Press in the plunger locking the third speed gear thrust washer (see Fig. 10) and rotate washer until splines line up, when washer can be withdrawn. Remove the washer forward off shaft followed by third speed gear, taking care not to lose any needles which will emerge as the gear is removed. Remove the spring and plunger.

Press in the plunger locking the second speed gear thrust washer (see Fig. 11) and rotate washer until splines line up, when washer can be withdrawn. Remove the washer rearwards off shaft followed by second speed gear, taking care not to lose any needles which will emerge as the gear is removed. Remove the spring and plunger.

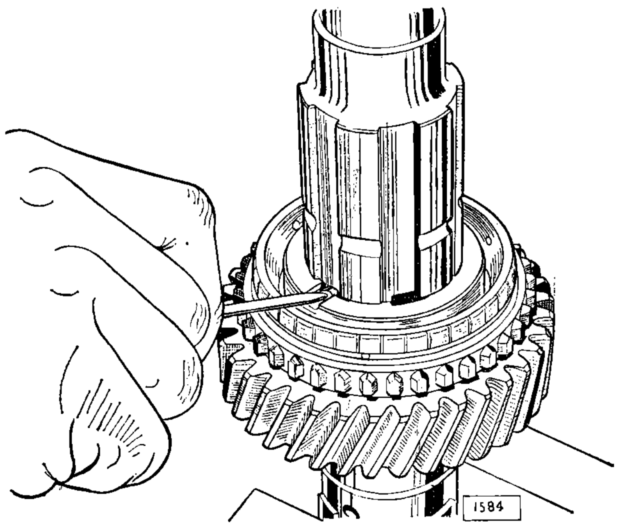


Fig. 11. Depressing the 2nd speed thrust washer plunger

DISMANTLING THE CONSTANT PINION SHAFT

Knock back tab washer securing locknuts and remove locknuts (right-hand thread). Withdraw the bearing from the shaft and remove the oil thrower.

GEARBOX — TO REASSEMBLE

CHECKING LAYSHAFT END-FLOAT

Check the clearance between bronze thrust washer and the casing at rear of layshaft (see Fig. 12). The end-float should be ·002″ to ·004″ (·05 to ·10 mm.). Thrust washers are available in thicknesses of ·152″, ·156″, ·159″, ·162″ and ·164″ (3·86, 3·96, 4·04, 4·11 and 4·17 mm.) to provide a means of adjusting the end-float.

Note: The gearbox must not be gripped in a vice when checking the end float otherwise a false reading will be obtained.

Remove dummy countershaft and insert a thin rod in its place.

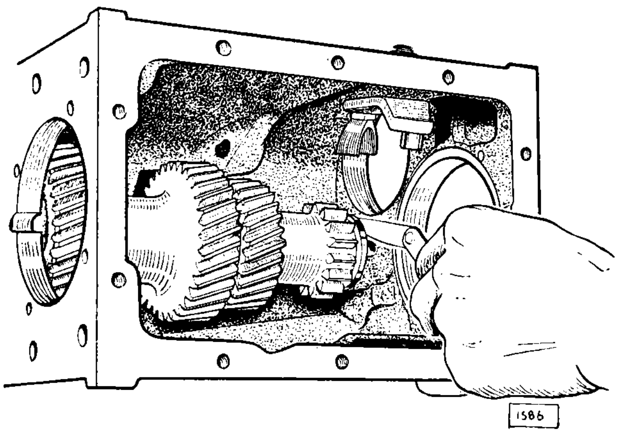


Fig. 12. Checking the layshaft end float

Place bushed reverse gear in slipper and draw gear rearwards as far as possible to give clearance for fitting layshaft gear unit.

ASSEMBLING THE MAINSHAFT

Fit the needle rollers (41 off) behind the shoulder on the mainshaft and slide the second speed gear, synchronising cone to rear, on to rollers. Apply grease to the needle rollers to facilitate assembly. Fit the second speed thrust washer spring and plunger into plunger hole. Slide thrust washer up shaft and over

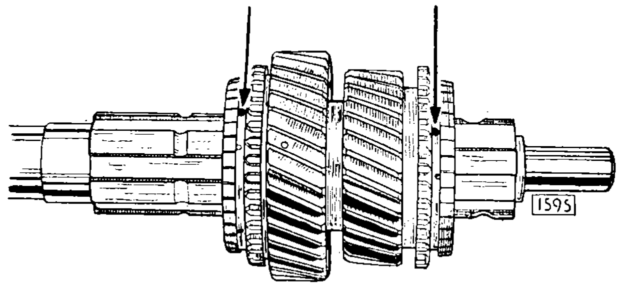


Fig. 13. Showing the holes through which the thrust washer locking plungers are depressed

splines. Align large hole in synchro cone and with a steel pin compress plunger and rotate thrust washer into locked position with cutaway in line with plunger. Check the end-float of the second gear on the mainshaft by inserting a feeler gauge between the thrust washer and the shoulder on the mainshaft. The clearance should be ·002″ to ·004″ (·05 to ·10 mm.). Thrust washers are available in the following thicknesses to enable the end-float to be adjusted:

·471″/·472″—(11·96/11·99 mm.)

·473″/·474″—(12·01/12·03 mm.)

·475″/·476″—(12·06/12·09 mm.)

Fit the needle rollers (41 off) in front of the shoulder on the mainshaft and slide the third speed gear, synchronising cone to front, on to rollers. Apply grease to the needle rollers to facilitate assembly. Fit the third speed thrust washer spring and plunger into plunger hole. Slide thrust washer down shaft and over splines. Align large hole in synchro cone and with a steel pin compress plunger and rotate thrust washer into locked position with cutaway in line with plunger. Check the end-float of the third gear on the mainshaft by inserting a feeler gauge between the thrust washer and the shoulder on the mainshaft. The clearance should be ·002″ to ·004″ (·05 to ·10 mm.). Thrust washers are available in the following thicknesses to enable the end-float to be adjusted:

·471″/·472″—(11·96/11·99 mm.)

·473″/·474″—(12.01/12·03 mm.)

·475″/·476″—(12·06/12·09 mm.)

ASSEMBLING THE 2nd GEAR SYNCHRO ASSEMBLY

Fit the springs and balls (and shims if fitted) to the six blind holes in the synchro sleeve. Fit the 1st speed gear to the 2nd speed synchronising sleeve with the relieved tooth of the internal splines in the gear in line with the stop in the sleeve (see Fig. 14). Compress the springs by means of a hose clip or by inserting the assembly endwise in a vice and slowly closing the jaws. Slide the operating sleeve over the synchronising sleeve until the balls can be heard and felt to engage the neutral position groove.

It should require 62 to 68 lbs. (28 to 31 kg.) pressure to disengage the synchronising sleeve from the neutral position in the operating sleeve. In the absence of the necessary equipment to check this pressure, grip the operating sleeve in the palms of the hands and press the synchronising sleeve with the fingers until it disengages from the neutral position; it should require firm finger pressure before disengaging. Shims can be fitted underneath the springs to adjust the pressure of the balls against the operating sleeve.

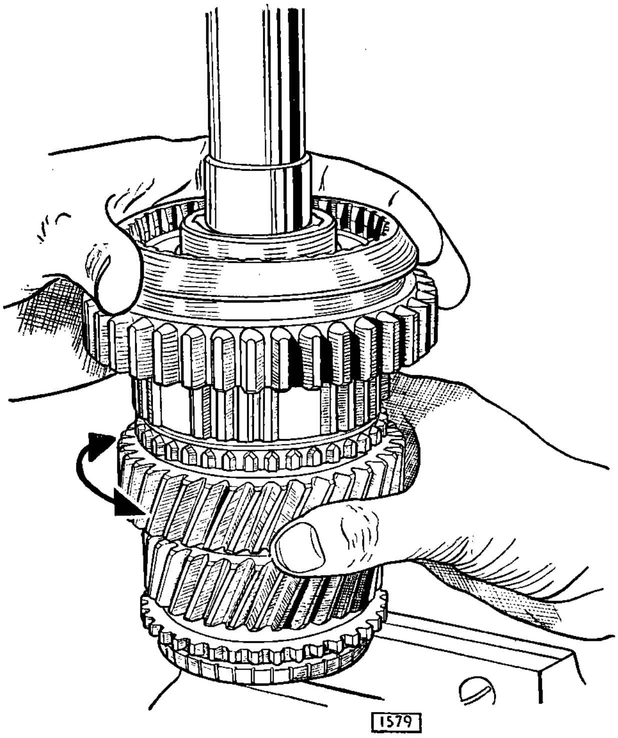


Fig. 15. With the 1st gear engaged and slight downward pressure on the synchro-assembly the 2nd gear assembly should be free to rotate

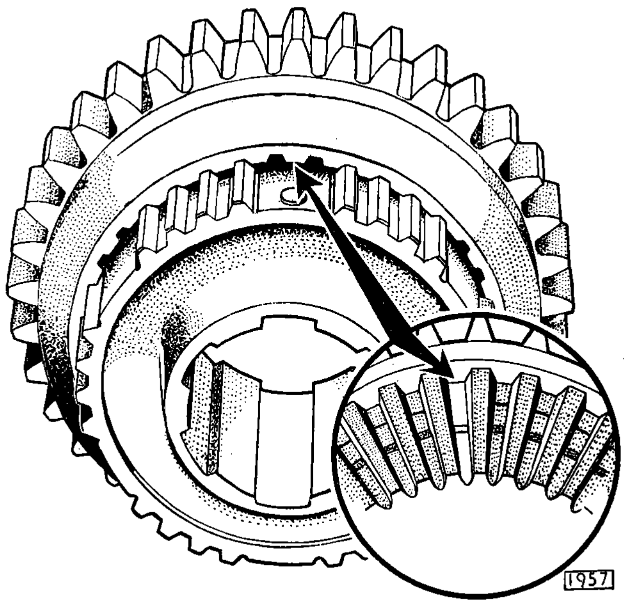


Fig. 14. When fitting the 1st speed gear to the 2nd speed synchro-sleeve the relieved tooth on the internal splines must be in line with the stop pin in the sleeve

FITTING THE 2nd GEAR ASSEMBLY TO THE MAINSHAFT

Fit the 1st speed gear/2nd speed synchro assembly to the mainshaft (any spline) and check that the synchro sleeve slides freely on the mainshaft, when the ball and plunger is not fitted. If it does not, try the sleeve on different splines on the mainshaft and check for burrs at the end of the splines.

Remove the synchro assembly from the mainshaft, fit the ball and plunger and refit to the same spline on the mainshaft.

Check the interlock plunger as follows:—

Slide the outer operating sleeve into the first gear position as shown in Fig. 15.

With slight downward pressure on the synchro assembly the 2nd speed gear should rotate freely without any tendency for the synchro cones to rub.

If the synchro cones are felt to rub, a longer plunger should be fitted to the synchro sleeve. Plungers are available in the following lengths:—

·490″, ·495″, and ·500″ (12·4, 12·52 and 12·65 mm.).

ASSEMBLING THE 3rd/TOP SYNCHRO ASSEMBLY

Fit the springs and balls (and shims if fitted) to the six blind holes in the inner synchronising sleeve. Fit the wide chamfer end of the operating sleeve to the large boss end of inner synchronising sleeve (see Fig. 16) with the two relieved teeth in operating sleeve in line with the two ball and plunger holes in the synchronising sleeve (see Fig. 17). Compress the springs by means of a hose clip or by inserting the assembly endwise in a vice and slowly closing the jaws. Slide the operating sleeve over the synchronising sleeve until the balls can be heard and felt to engage the neutral position groove.

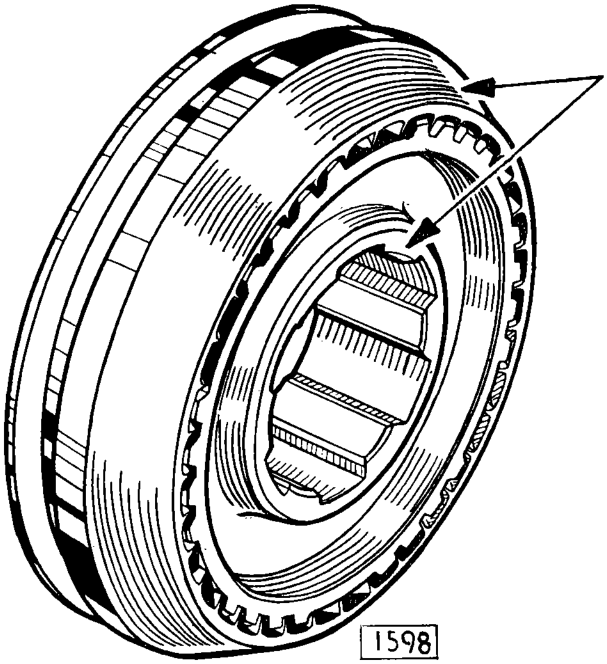


Fig. 16. The wide chamfer end of the operating sleeve must be fitted to the same side as the large boss on the synchro sleeve

It should require 52 to 58 lbs. (24 to 26 kg.) pressure to disengage the synchronising sleeve from the neutral position in the operating sleeve. In the absence of the necessary equipment to check this pressure, grip the operating sleeve in the palms of the hands and press the synchronising sleeve with the fingers until it disengages from the neutral position; it should require firm finger pressure before disengaging. Shims can be fitted underneath the springs and balls to adjust the pressure of the balls against the operating sleeve.

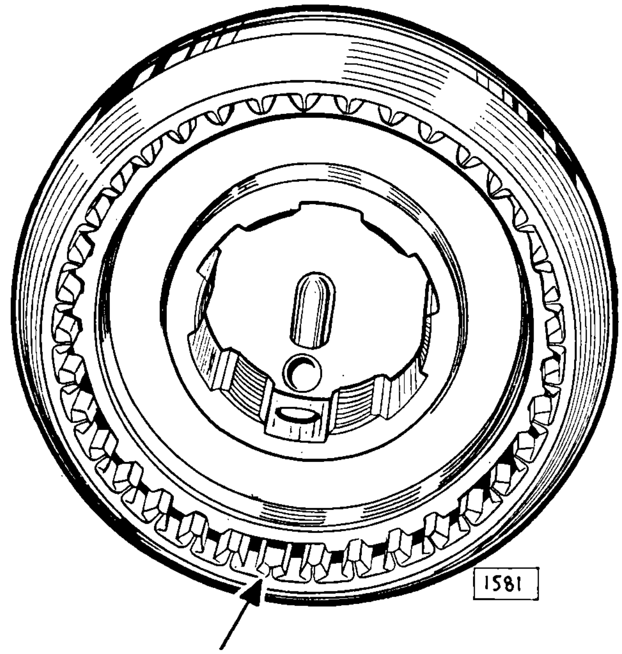


Fig. 17. The relieved tooth in the operating sleeve must be n line with the interlock holes in the synchro sleeve

FITTING THE 3rd/TOP SYNCHRO ASSEMBLY TO THE MAINSHAFT

Fit the interlock balls and plungers, balls first, to the holes in the synchronising sleeve.

When fitting the 3rd speed/top gear synchro assembly to the mainshaft note the following points:—

(*a*) There are two transverse grooves on the mainshaft splines which take the 3rd/top synchro assembly and the relieved tooth at the wide chamfer end of the outer operating sleeve must be in line with the **foremost** groove in the mainshaft (Fig. 18). Failure to observe this procedure will result in the locking plungers engaging the wrong grooves thereby preventing full engagement of top and third gears.

(*b*) The wide chamfer end of the outer operating sleeve must be facing forward, that is, towards the constant pinion shaft end of the gearbox.

The inner sleeve must slide freely on the mainshaft, when the balls and plungers are not fitted. If it does not, check for burrs at the ends of the splines.

Fit the two balls and plungers to the holes in the inner synchro sleeve and refit the synchro assembly to the mainshaft observing points "*a*" and "*b*" above.

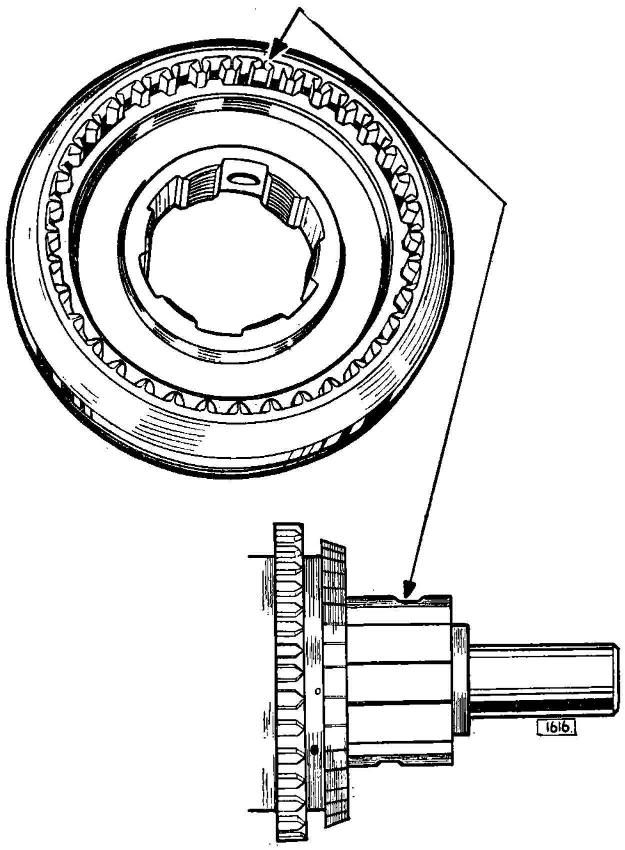


Fig. 18. The relieved tooth at the wide chamfer end of the outer operating sleeve must be in line with the foremost groove in the mainshaft

Check the interlock plungers as follows:—

Slide the 3rd/top operating sleeve over the 3rd speed gear dogs as shown in Fig. 19. With the 3rd gear engaged lift and lower the synchro assembly; it should be possible to move the assembly approximately $\frac{3}{32}''$ (2·5 mm.) without any drag being felt. If it is found that the synchro assembly does not move freely a shorter 3rd speed plunger should be fitted; looking at the wide chamfer end of the outer operating sleeve this is the plunger that is not opposite the relieved tooth in the operating sleeve.

Plungers are available in the following lengths:— 490″, ·495″ and ·500″ (12·4, 12·52 and 12·65 mm.).

Next slide the operating sleeve into the top gear position as shown in Fig. 20.

Lift and lower the synchro assembly; it should be possible to move the assembly approximately $\frac{3}{16}''$ (4·5 mm.) without any drag being felt. Also with slight downward pressure exerted on the synchro assembly the 3rd speed gear should be free to rotate without any tendency for the synchro cones to rub.

If it is found that the synchro assembly does not move freely a shorter top gear plunger should be fitted. If the 3rd gear synchro cones are felt to rub a longer top gear plunger should be fitted; looking at the wide chamfer end of the outer operating sleeve, the top gear plunger is one in line with the relieved tooth in the operating sleeve.

Plungers are available in the following lengths:— ·490″, ·495″ and ·500″ (12·4, 12·52 and 12·65 mm.).

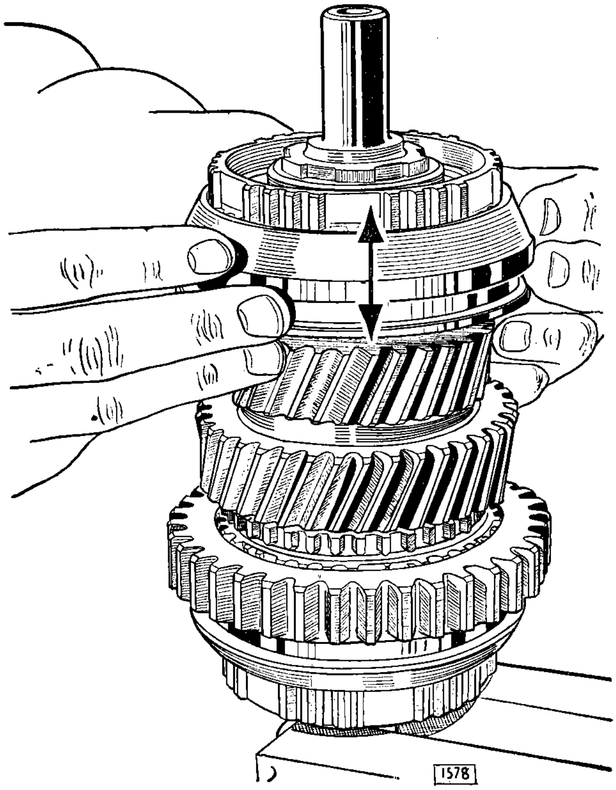


Fig. 19. Checking the 3rd speed interlock plunger with the 3rd speed engaged there should be approximately $\frac{3}{32}''$ (2.5 mm) movement without drag

ASSEMBLING THE CONSTANT PINION SHAFT

Fit the oil thrower followed by ball bearing on to shaft with circlip and collar fitted to outer track of bearing. Screw on nut (right-hand thread) and fit tab washer and locknut. Fit the roller race into the shaft spigot bore.

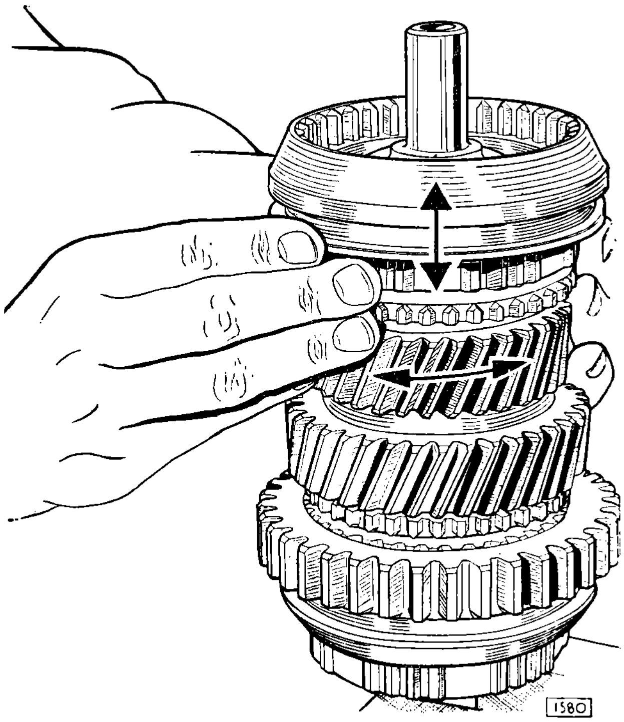


Fig. 20. Checking the 4th (top) interlock plunger. With the top gear engaged there should be approximately $\frac{3}{16}$" (4.76 mm) axial movement without any drag. With the top gear still engaged and with a slight downward pressure exerted on the synchro assembly the 3rd speed gear should be free to rotate

ASSEMBLING THE GEARS TO THE CASING

Enter the mainshaft through the top of the casing and pass to the rear through bearing hole in case. Fit a new gasket to the front face of casing. Offer up the constant pinion shaft at the front of the case with cutaway portions of toothed driving member facing the top and bottom of the casing. Tap the constant pinion shaft to the rear until the collar and circlip on the bearing butt against the casing. Holding the constant pinion shaft in position tap in the rear bearing complete with circlip.

Lift the layshaft cluster into mesh with the thin rod and insert a dummy countershaft through the countershaft bore in front face of the casing (see Fig. 21).

Engage top and first gears. Fit the Woodruff key and speedo drive gear to the mainshaft. Fit the tab washer and locknut and secure. Place gearbox in neutral.

Fit the clutch operating fork and insert shaft. Fit the locking screw and locknut. Fit the release bearing and spring clips. Engage slave cylinder with operating rod and slide on to studs. Fit the spring anchor plate to lower stud and secure with the nuts. Fit the return spring.

FITTING THE TOP COVER

Fit a new gasket on to top face of case. Offer up the top cover, noting that this is located by two dowels and secure in position with ten setscrews and spring washers. (Two long screws at rear and two short screws at front.) Fit the gearbox drain plug and fibre washer.

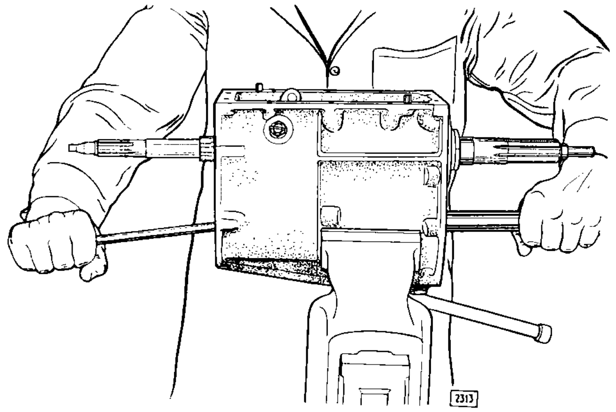


Fig. 21. Lifting the layshaft into mesh and inserting the dummy countershaft

FITTING THE EXTENSION

Fit a new gasket to the rear face of the gearbox casing. Offer up the rear end cover complete with counter and reverse shafts and tap into position, driving the dummy countershaft forward out of the casing. Secure the rear cover with seven setscrews and spring washers.

Fit a new fibre washer at the front end of the countershaft. Fit the speedo driven gear and bearing to the rear cover.

Refit the speedometer cable drive attachment to the speedometer driven gear. Care must be taken to ensure that the square drive shaft protruding from the unit has entered into the gearbox drive correctly before tightening the nut.

FITTING THE CLUTCH HOUSING

Fit a new oil seal into the clutch housing, lip of oil seal facing the gearbox.

Fit the clutch housing and secure with the eight bolts and three tab washers and locking wire.

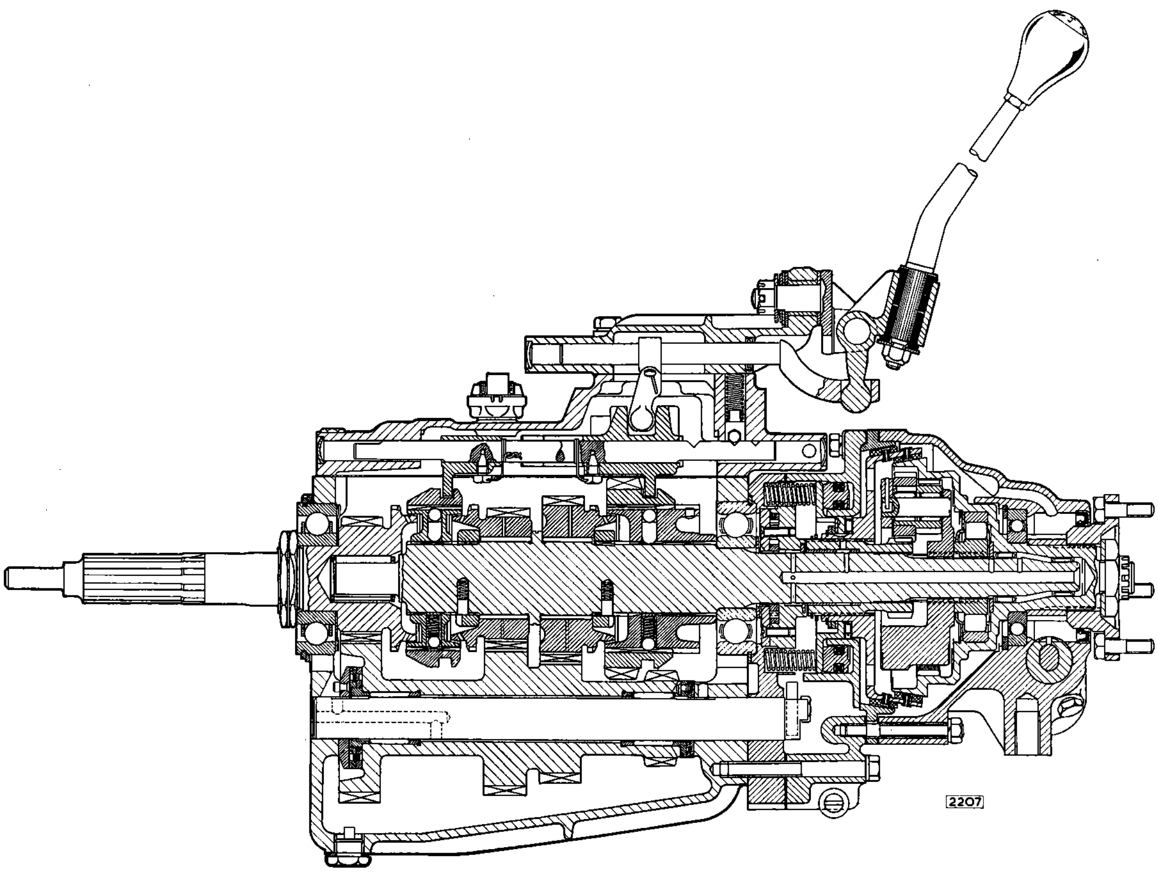


Fig. 22. Sectioned view of the gearbox and overdrive

OVERDRIVE

OPERATION

The Laycock de Normanville overdrive unit (fitted as an optional extra) comprises a hydraulically controlled epicyclic gear housed in a casing which is directly attached to an extension at the rear of the gearbox.

When brought into operation, the overdrive reduces the engine speed in relation to the road speed. This permits high road speeds with low engine revolutions resulting in fuel economy and reduced engine wear.

The gearbox driven (or input) shaft is extended and carries at its end the inner member of a uni-directional clutch. The outer member of this clutch is carried in the combined annulus and output shaft. Also mounted on the input shaft are the planet carrier and a freely rotatable sunwheel. Splined to a forward extension of the sunwheel and sliding thereon is a cone clutch member, the inner lining of which engages the outside of the annulus, while the outer lining engages a cast-iron brake ring sandwiched between the front and rear parts of the unit housing.

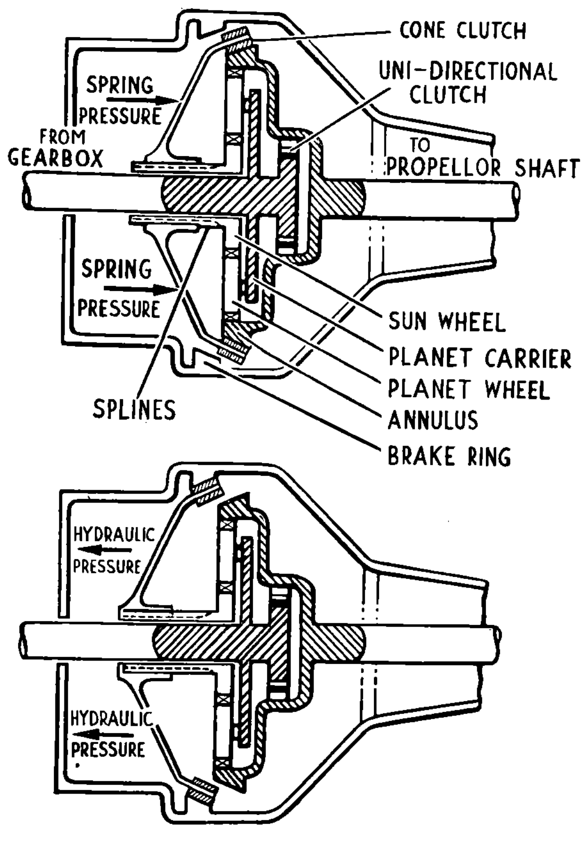


Fig. 23. Principle of operation

A number of compression springs are used to hold the cone clutch in contact with the annulus, locking the sunwheel to the latter so that the entire gear train rotates as a solid unit, giving direct drive. In this condition the drive is taken through the uni-directional clutch, the cone clutch taking overrun and reverse torque since without it there would be a free-wheel condition.

The spring pressure can be overcome through the medium of an annular piston working in a cylinder formed in the unit housing, supplied with oil under pressure from the overdrive pump. This hydraulic pressure causes the cone clutch to engage the stationary brake ring and bring the sunwheel to rest, allowing the annulus to overrun the uni-directional clutch and give an increased speed to the output shaft i.e. "overdrive."

When changing from overdrive to direct gear, if the accelerator pedal is released, as in change-down for engine braking, the cone clutch being oil immersed, takes up smoothly. If the accelerator pedal is not released when contact between the cone clutch and brake ring is broken, the unit still operates momentarily in its overdrive ratio since engine speed and road speed remain unchanged. But the load on the engine is released and it begins to accelerate, speeding up the sunwheel from rest, until, just at the instant when its speed synchronises with the speed of the annulus, the whole unit revolves solidly and the uni-directional clutch takes up the drive once more. The movement of the cone clutch is deliberately slowed down so that the uni-directional clutch is driving before the cone clutch contacts, ensuring a perfectly self synchronised change.

CONSTRUCTION

The driven shaft of the synchromesh gearbox is extended to carry first the oil pump driving gear, then the sunwheel of the epicyclic gear carried on a Clevite bush, and beyond this the shaft is splined to take the planet carrier and uni-directional clutch. The end of the shaft is reduced and carried in two Torrington bearings in the output shaft. The latter is supported in the rear housing by a ball bearing. The clutch member slides on the splines of the sunwheel extension to contact either the annulus or a cast iron brake ring

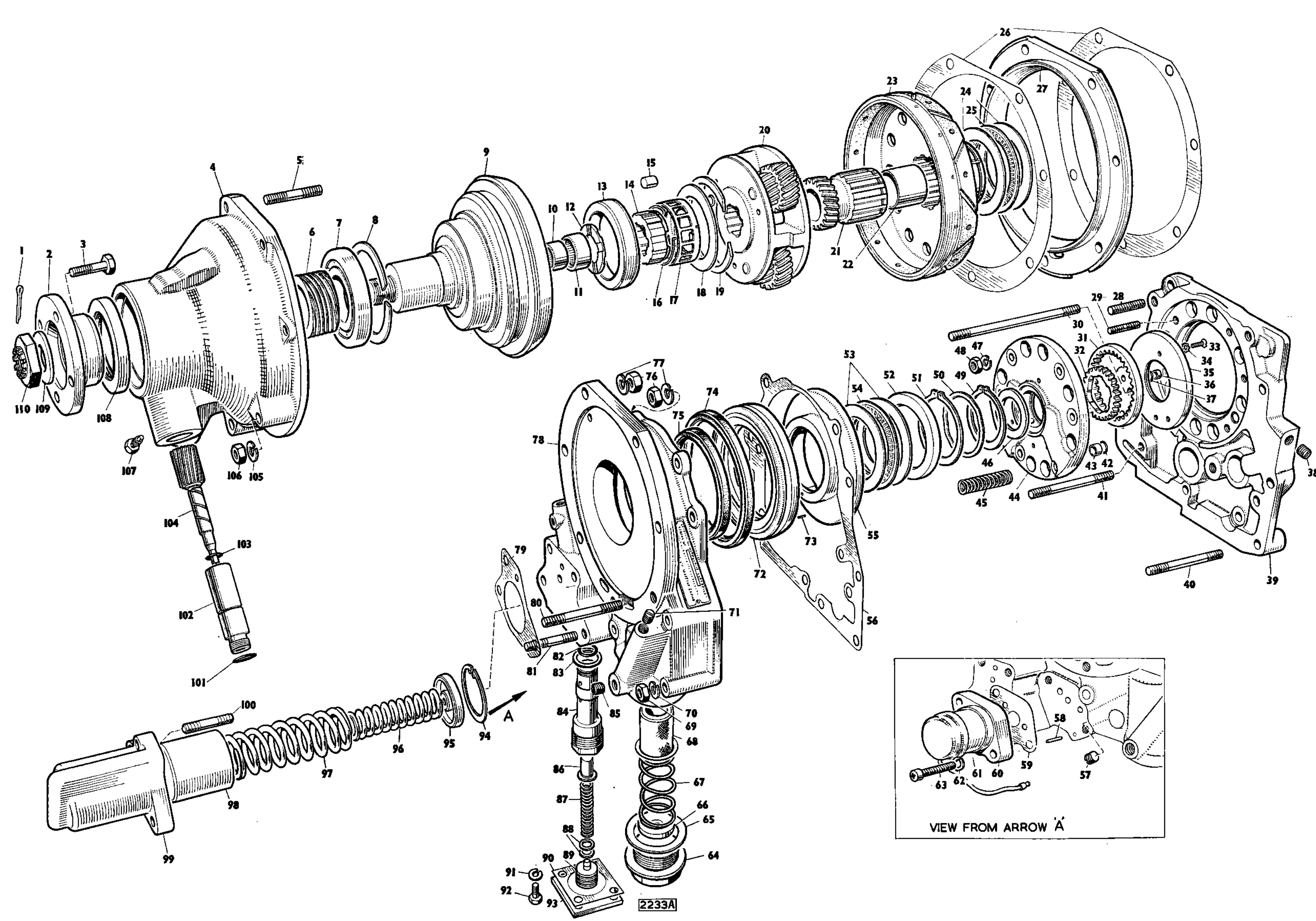


Fig. 24. Exploded view of the overdrive

1. Split pin
2. Flange
3. Bolt
4. Rear casing
5. Stud
6. Speedometer driving gear
7. Ball bearing
8. Circlip
9. Annulus
10. Needle roller bearing (small)
11. Needle roller bearing (large)
12. Thrust washer
13. Roller outer member
14. Inner member for uni-directional clutch
15. Roller
16. Spring ring
17. Cage for the uni-directional clutch
18. Retaining washer
19. Spring ring
20. Planetary carrier assembly
21. Sunwheel assembly
22. Bush
23. Sliding member
24. Thrust washers
25. Thrust bearing
26. Gasket
27. Brake ring
28. Stud
29. Stud
30. Stud
31. Oil pump annular position
32. Oil pump pinion gear
33. Countersunk screw
34. Shakeproof washer
35. Oil pump cover plate
36. Oil transfer tube (inlet)
37. "O" ring
38. Blanking plug
39. Adaptor plate
40. Stud
41. Stud
42. "O" ring
43. Oil transfer tube (outlet)
44. Oil pump
45. Thrust spring
46. Thrust washer
47. Spring washer
48. Nut
49. Circlip
50. Wavy washer
51. Circlip
52. Thick thrust washer
53. Thrust washers
54. Thrust bearing
55. Thrust housing
56. Gasket
57. Blanking plug
58. Dowel
59. Gasket
60. Solenoid base
61. Solenoid
62. Spring washer
63. Philips head setscrew
64. Drain plug
65. Fibre washer
66. Magnet
67. Spring
68. Gauze filter
69. Nut
70. Spring washer
71. Blanking plug
72. Annular operating piston
73. Dowel (Early cars only)
74. Sealing ring (outer)
75. Sealing ring (inner)
76. Nut
77. Spring washer
78. Front casing
79. Gasket
80. Stud
81. Stud
82. "O" ring
83. Copper washer
84. Relief valve
85. Blanking plug
86. Upper piston
87. Spring
88. Shims
89. Lower piston
90. Gasket
91. Spring washer
92. Bolt
93. Cover plate
94. Circlip
95. Locating plate
96. Inner spring
97. Outer spring
98. Dashpot piston
99. Dashpot
100. Stud
101. "O" ring
102. Speedometer gear housing
103. "O" ring
104. Speedometer driven gear
105. Spring washer
106. Nut
107. Retaining bolt
108. Oil seal
109. Washer
110. Slotted nut

forming part of the unit housing. To the hub of the clutch member is secured a thrust plate which thrusts through the Torrington race in direct drive or the rear race when in overdrive. A number of compression springs, located in counter bores in the adaptor plate, bear against the face of the thrust ring. Through them the clutch member is held against the annulus. The springs prevent free-wheeling on over-run, and are of sufficient strength to handle reverse torque with assistance from the sunwheel, which has a circlip at its forward end, bearing against the end of the cone clutch member, and applying a thrust load due to the helix angle of the gear teeth. The annular piston which bears against the thrust ring is connected to the crescent type pump via the relief valve. This pump delivers pressure via oilways to the small piston of the relief valve, forcing the piston against the relief valve spring until 20–25 lbs./sq. in. (1·40–1·76 kg./cm.^{2}) pressure is reached when a relief hole is uncovered. When the solenoid valve is operated, other oilways are uncovered to allow the oil pressure to move the larger relief valve piston against the other end of the relief valve spring, compressing it further, the hydraulic pressure then has to increase to 205–215 lbs./sq. in. (14·41–15·11 kg./cm.^{2}) before the small piston will again reach its bleed off position. As the larger relief valve piston moves to its stop the rise in hydraulic pressure causes the operating piston to move the sliding member across to the brake ring. The hydraulic pressure at this moment is about 90 lbs./sq. in. (6·32 kg./cm.^{2}). Immediately the sliding member contacts the brake ring the dash pot piston is forced up the bore of the dashpot against the springs until a pressure of 150 lbs./sq. in. (10·55 kg./cm.^{2}) is reached when the piston comes up against a stop. As a consequence there is an immediate rise of pressure up to 205–215 lbs./sq. in. (14·41–15·11 kg./cm.^{2}) when the small relief valve piston reaches its bleed off position. The effect of the operation of this hydraulic system is to move the sliding member gently yet firmly into the brake ring and thereafter to have a gradual pressure rise and enable the unit to go into overdrive at the torque being transmitted from the engine, thereby giving smooth engagement at all engine torques. The residual pressure of 20–25 lbs./sq. in. (1·40–1·76 kg./cm.^{2}) has the effect of opposing the clutch return springs and thus, when going out of overdrive under over-run conditions it cushions the sliding member on to the annulus and gives a smooth engagement.

The spill oil from the relief valve is led through drilled passages to an annular groove in the pump body on the gearbox driven shaft. Radial holes in the shaft collect the oil and deliver it along an axial drilling to other radial holes in the shaft from which it is fed to the sunwheel, thrust bearing, thrust washer and needle bearings.

When the solenoid is de-energised the oil supply from the pump to the base of the relief valve is cut off allowing the relief valve spring to overcome the larger piston and reducing the oil pressure developed by the small piston to 20–25 lbs./sq. in. (1·40–1·76 kg./cm.^{2}). As the operating piston and dashpot return to the direct drive position the oil is discharged through the relief valve and the oil from the large relief valve piston is discharged via oilways and the solenoid to the sump.

The planet pinions are of compound design, the larger diameter engaging the sunwheel and the smaller diameter the annulus. Gear teeth are helical, the helix angle of each pair of mating gears arranged to give an almost complete balance of end thrust. The end thrust of the sunwheel in forward drive is taken by a bronze washer in the oil pump, and on over-run the end thrust is taken on the cone clutch member through a circlip and wavy washer which acts as a cushioning device. As previously mentioned, the thrust in reverse is also taken in the same way and adds to the spring load. The sunwheel and pinions are cyanide case-hardened and the annulus heat treated. The pinions have needle roller bearings and run on case-hardened pins.

The outer ring of the uni-directional clutch is pressed into the annulus member. The clutch itself is of the caged roller type, loaded by a clock-type spring made of round wire.

The hydraulic system is supplied with oil by a crescent type oil pump driven by the main shaft and the assembly is housed in the adaptor plate. Oil is drawn through the filter in the main case via oilways to the pump.

OPERATING INSTRUCTIONS

When brought into operation, the overdrive reduces the engine speed in relation to the road speed. This permits high road speeds with low engine revolutions resulting in fuel economy and reduced engine wear.

Operation

The overdrive will operate in top gear only and is brought into action by means of the lever behind the steering wheel on the right-hand side of the column. Operate the lever clockwise to engage the overdrive and anti-clockwise to bring the drive into top (4th) gear.

When the overdrive is in operation the word "Overdrive" in the quadrant behind the steering wheel becomes illuminated. When the sidelights are switched on, the light is automatically dimmed.

Use of the clutch pedal when changing into or out of overdrive is unnecessary but to ensure maximum smoothness of operation, particularly when changing down from overdrive to top gear, the accelerator pedal should be slightly depressed.

Do NOT bring the overdrive into operation at high speed with a wide throttle opening; release the accelerator momentarily when engaging overdrive.

For driving in towns, heavy traffic, or hilly country when the maximum flexibility and low speed performance is required the overdrive manual switch should be placed in the "Out" position which will bring the drive into the normal top gear ratio.

For normal driving in open country the overdrive should be brought into operation when the required cruising speed has been obtained.

The following table gives the relationship between engine revolutions per minute to road speed in miles and kilometres per hour for top gear and overdrive top gears:

AXLE RATIO 3·77 : 1

(Ratio for cars fitted with an overdrive)

Road Speed		Engine Revolutions Per Minute	
Kilometres per hour	Miles per hour	Top Gear 3·77	Overdrive 2·933
16	10	493	383
32	20	986	767
48	30	1480	1149
64	40	1973	1532
80	50	2466	1915
96	60	2959	2298
112	70	3452	2681
128	80	3945	3064
144	90	4437	3447
160	100	4930	3830
176	110	5425	4213
192	120		4596

Note: The figures in the above table are corrected for increase in tyre radius due to the effect of centrifugal force.

If trouble should arise necessitating dismantling of the unit, it will be necessary to remove the overdrive unit from the car. The engine, gearbox and overdrive are removed together. The removal instructions are as given on page 24. Remove the gearbox and clutch housing from the engine.

DISMANTLING AND REASSEMBLING

REMOVING THE OVERDRIVE FROM THE GEARBOX

The overdrive is separated from the gearbox at the joint between the adaptor plate and the overdrive front casing, these being attached by nine studs.

Slacken the nuts by equal amounts to release the compression of the clutch return springs.

Remove the nuts and withdraw the front and tail cases complete; the adaptor plate and pump assembly remaining on the gearbox.

Remove the eight clutch return springs from their recesses in the pump body. The pump assembly can then be removed as a unit by removing the six retaining nuts. (To dismantle see below).

DISMANTLING THE OVERDRIVE

Remove circlip and spring washer from sunwheel. The larger circlip on the sliding member can now be removed together with the thrust washers and thrust bearing housing.

Remove the six nuts securing the front to rear casing and separate them. Tap off the brake ring which is spigotted into the two cases. Lift out the planet carrier assembly and sunwheel. Remove the clutch sliding member complete with needle thrust bearing. Take out the spring clip and retaining washer of the uni-directional clutch, then the inner member, the rollers, cage and thrust washer.

To remove the annulus, first withdraw the speedo driven gear, then take off the coupling flange at the rear of the unit; the speedo driving gear can now be taken out. Press out the annulus, the bearing staying in position retained by its circlip.

Remove circlip, tap out bearing and finally the oil seal.

Note: It is advisable to renew the annulus bearing after the above dismantling. The annular operating piston can be removed from the front case by means of a special extractor tool which locates in the two tapped holes.

INSPECTION

Each part should be thoroughly inspected after the unit is dismantled and cleaned to ensure what parts should be replaced. It is important to appreciate the difference between parts which are worn sufficiently to affect the operation of the unit and those which are merely "worn in."

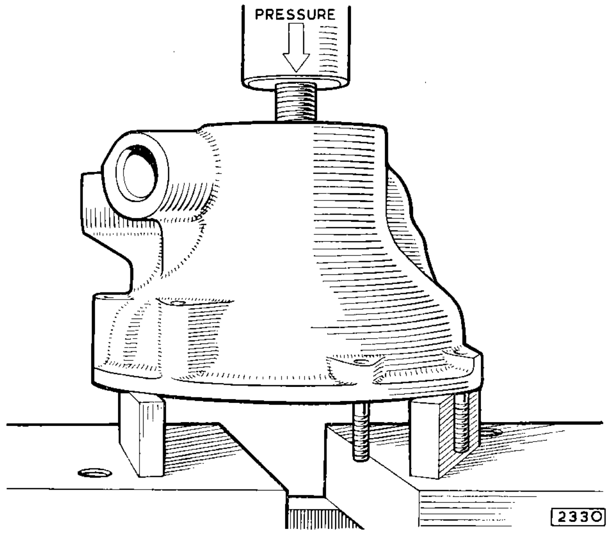


Fig. 25. Pressing the annulus out of the casing

Inspect the adaptor and front casings for cracks, damage, etc. Examine the operating piston and bore, and relief valve and its bore for scores and wear. Ensure the rubber seals on the operating piston and relief valve are in good condition, check for leaks from the plugged ends of oil passages. Examine the clutch sliding member assembly. Ensure the clutch linings are not burnt or worn. Ensure that the needle thrust bearing is in good condition. See that the sliding member slides easily on the splines of the sunwheel.

Inspect the clutch return springs for distortion.

Inspect the teeth of the gear train for damage. (Whilst it is possible to replace the needle roller sets in the planet gears, it is not practice in service to fit new bushes in the sunwheel as these are bored to the pitch line of the teeth).

Inspect the thrust washers and bearing.

Inspect the uni-directional clutch. See that the rollers are not chipped and that the inner and outer members of the clutch are free from damage, and that the outer member is tight in the annulus. Ensure that the spring is free from distortion.

If it is not necessary to remove the annulus, check that there is no roughness when the annulus is rotated slowly. Check condition of the two needle roller bearings in the bore of the annulus.

Inspect the mainshaft and see that the oilways are open and clean. Ensure that the three rubber "O" rings and transfer tubes on the inlet and outlet ports of the pump body are in good condition.

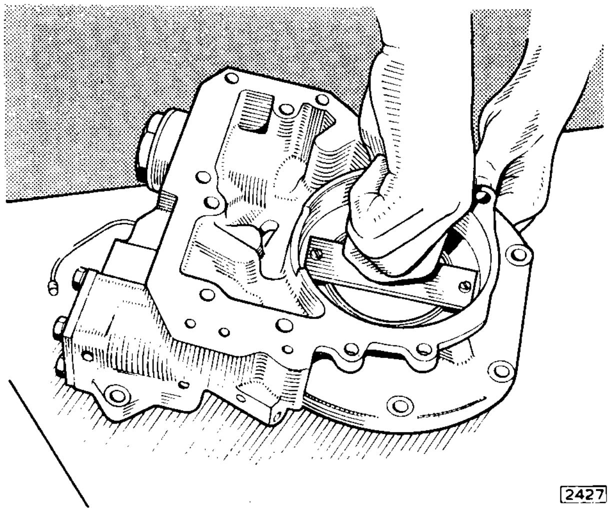


Fig. 26. Extracting the hydraulic piston with Special Tool No. L.300

Examine the dashpot piston, bore and springs for damage or excess wear.

REASSEMBLING THE OVERDRIVE

The unit can be reassembled after all the parts have been thoroughly cleaned and checked to ensure that none are damaged or worn.

Rear Casing

Press the bearing into the rear casing and fit the retaining circlip. Replace the oil seal, then supporting the annulus, press the bearing and rear case on to the annulus using assembly tube which locates on inner race of bearing. Place speedometer driving gear on to the annulus and after fitting propshaft bolts, press on flange, replace washer and using torque spanner, tighten nut to 140 lb./ft. minimum until split hole is aligned but do not exceed 170 lb./ft. The speedometer driven gear can now be replaced.

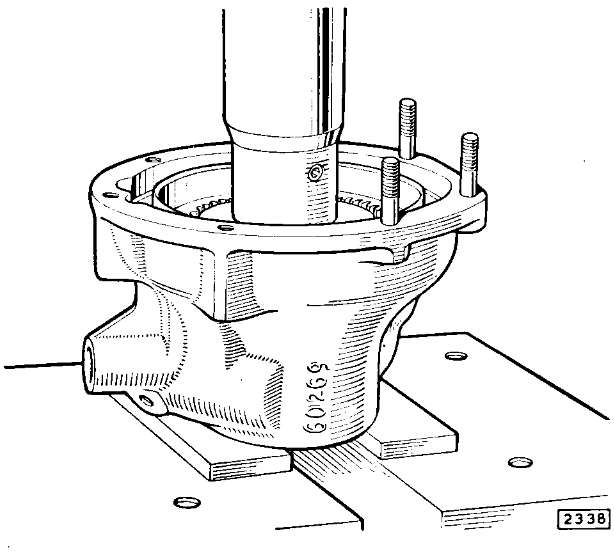


Fig. 27. Pressing the annulus back into the casing

Replace the thrust washer and uni-directional clutch inner member with its rollers and cage. Before fitting the rollers, ensure that the inner member is located on the two spigots of the cage. Fit the spring with the inner end located in the inner member and the outer end located in the cage. It will be necessary to apply a slight downward pressure on the inner member when fitting the rollers in position. To facilitate the assembly of the rollers, a special tool (L178) is available. It is most important for the spring to be fitted correctly so that the cage urges the rollers up the ramps on the inner member. When the clutch is in position, replace the retaining washer and spring ring.

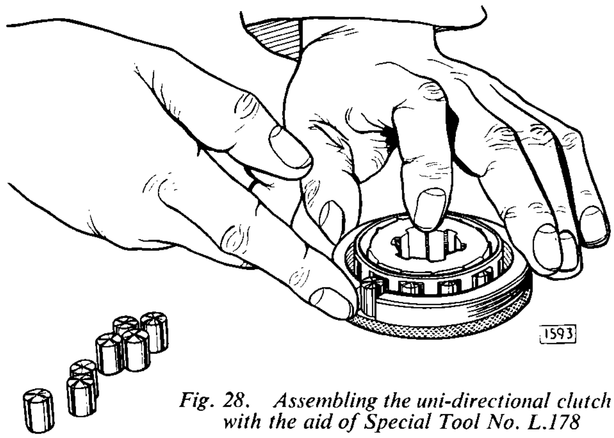


Fig. 28. Assembling the uni-directional clutch with the aid of Special Tool No. L.178

Fit the sunwheel into the planet carrier with the marked teeth of the planets radially outwards as shown in Fig. 30 and with the assembly in this position offer it up to the annulus.

The clutch sliding member assembly complete with needle roller thrust bearing and its two thrust washers can now be fitted on to the sunwheel, care being taken to mate the splines so that **the oil transfer holes are in alignment.**

Assemble the brake ring to the rear casing using the correct gasket. Position an identical gasket on the front face of brake ring noting relative position of oil transfer cut-outs. The front and rear cases can now be assembled together. Fully tighten the six nuts by turning by equal amounts.

Replace the annular operating piston, thrust washer, thrust bearing, thrust washer the thick thrust washer.

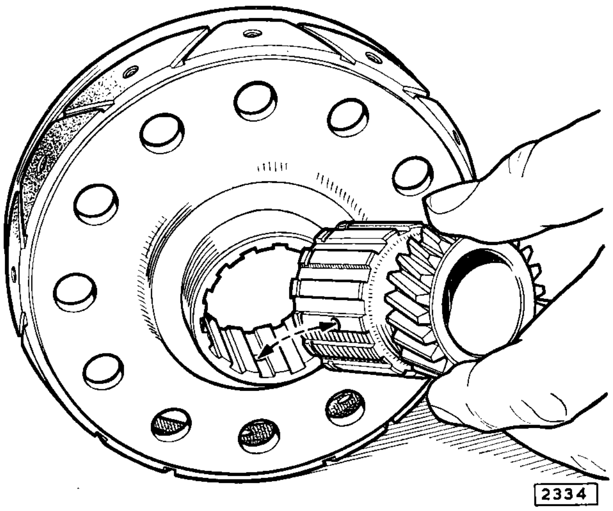


Fig. 29. Alignment of the cone clutch and sliding member

The larger circlip can now be fitted to the clutch sliding member. Refit the corrugated spring washer and sun-wheel circlip.

Important: When assembled there should be ·003″ to ·006″ (·07 to ·15 mm) clearance between the thick thrust washer and the large circlip. This will enable the thrust housing to be rotated by hand. During operation this will allow the thrust housing to remain stationary as the cone clutch revolves.
The thick thrust washer is available in varying sizes to enable the correct clearance to be obtained.

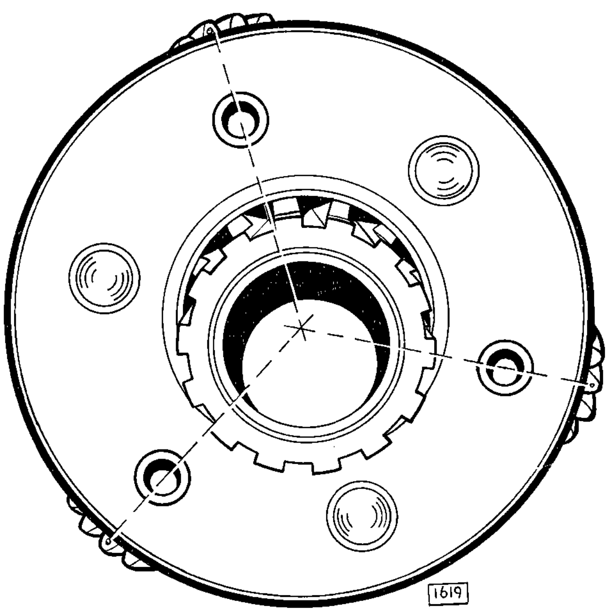


Fig. 30. Assembly of the planet gears—note the positions of the marked teeth

PUMP

Position the 3 "O" rings and transfer tubes in pump body holding in position by a small amount of grease.

Place pump on adaptor plate studs and turn mainshaft to locate splines. Secure body by tightening the six nuts equally.

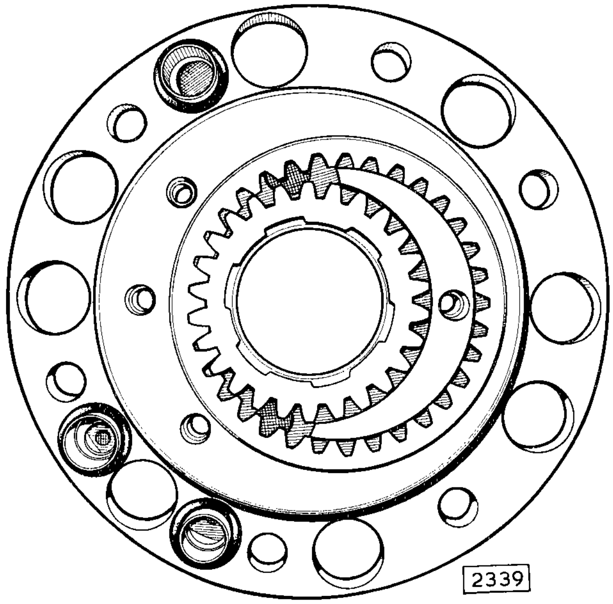


Fig. 31. Rear view of the oil pump showing the relative positions of the three rubber "O" rings and spigots

REFITTING THE OVERDRIVE TO THE GEARBOX

Fit spring ring to mainshaft.

Ensure that the splines in the uni-directional clutch and planet carrier are in alignment. These splines are visible at the bottom of the bore in the overdrive unit and the uni-directional clutch splines can be turned anti-clockwise into alignment. The dummy mainshaft as shown in Fig. 32 should be used to check that the splines are correctly positioned.

Ensure that the eight clutch return springs are located in the drilled holes in the pump body.

Fit new gasket on adaptor plate.

Position the gearbox, engage a gear then enter the main shaft into the overdrive unit. Turn the constant pinion shaft until the splines engage.

Fit the nine nuts and tighten by equal amounts. If any undue tightness occurs whilst tightening these nuts, remove the overdrive and re-check the alignment of the splines.

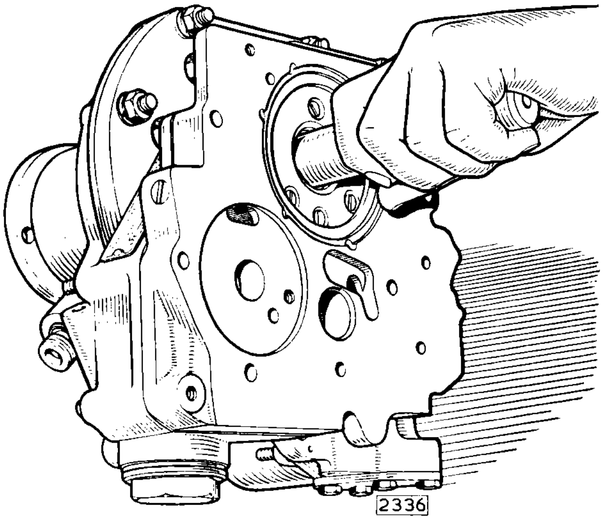


Fig. 32. Aligning the splines

THE RELIEF VALVE

Access to the relief valve is gained through a cover plate on the base of the front casing. To remove, proceed as follows:—

Remove drain plug and drain off oil.

Remove the cover plate which is secured by four $\frac{1}{4}$" (6·35 mm.) diameter bolts.

The lower piston and spring can now be withdrawn (note shims which if fitted are located on dowel of piston).

Unscrew the relief valve body and remove.

Remove the smaller piston by pushing down bore of body.

Reassembly is the reverse of the above operations. Ensure that the soft copper washer between the valve body and maincase is correctly located and nipped up tightly.

THE DASHPOT

The dashpot is located on the left-hand side of the front casing. To dismantle proceed as follows:—

Remove the drain plug and drain off oil.

Remove the nuts from the three $\frac{5}{16}$" (7·93 mm.) studs which secure the dashpot assembly.

DO NOT attempt to remove the circlip before compressing dashpot springs.

Remove stud from dashpot assembly.

Fix dashpot in press locating across the two flanges and packing piece as shown in Fig. 33 in order to ensure correct alignment.

Compress the dashpot springs sufficiently to remove the circlip.

Release the spring pressure slowly. The retaining washer, springs, packing washer and piston can now be removed.

Reassembly is the reverse of the above operation. Care should be taken not to over-compress the springs when refitting circlip.

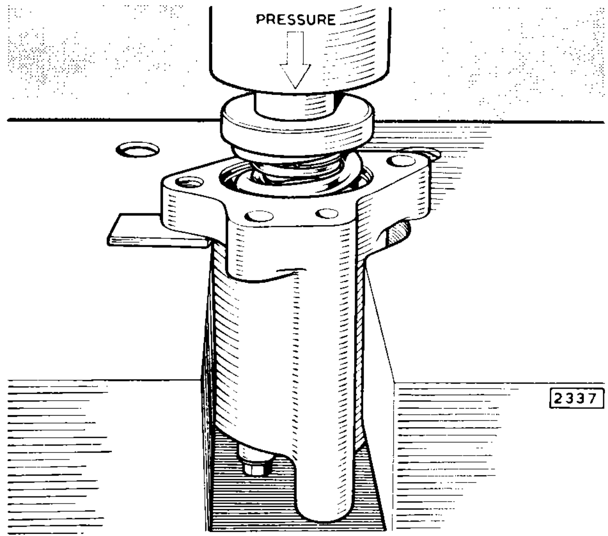


Fig. 33. Assembling the dashpot piston with the aid of an hydraulic press. Note the packing piece under the left-hand stud hole

ROTARY SOLENOID VALVE

Remove drain plug and drain off oil.

Unscrew the two setscrews and remove unit complete.

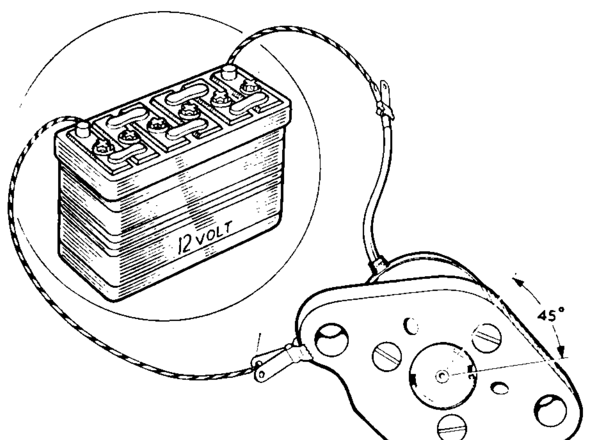


Fig. 34. Energising the solenoid

THE PUMP

As the pump is mounted on the mainshaft and is housed in the adaptor plate, the overdrive unit has to be removed from the gearbox to gain access to the pump. To remove the pump assembly, remove the six $\frac{1}{4}''$ (6·35 mm.) retaining nuts.

To dismantle, proceed as follows:—

Remove the four $\frac{3}{16}''$ (4·76 mm.) countersunk headed screws securing the pump cover plate, remove the plate and lift out the annular and pinion gears.

Assembly is the reverse of the above operation taking care to ensure all parts are perfectly clean. If it is found necessary to replace the bronze thrust washer in the housing, tap out the old one and press new one down to its location.

After assembly turn gears and test for free rotation.

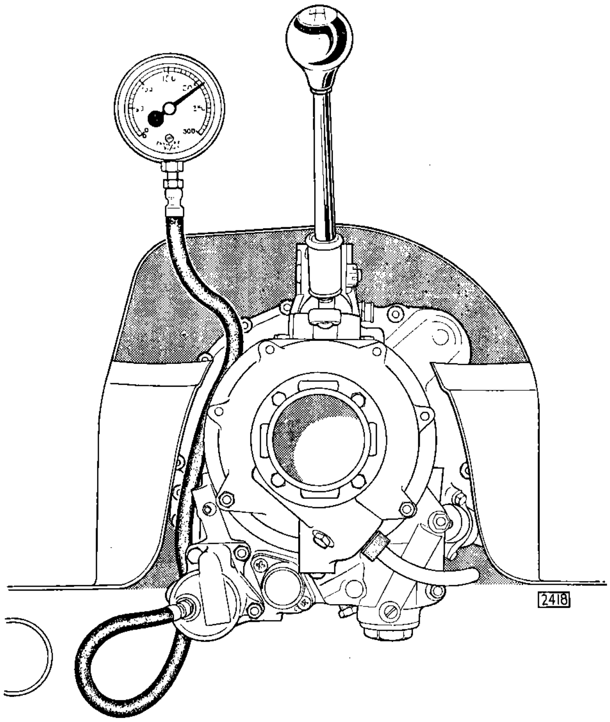


Fig. 35. Checking the hydraulic pressure

HYDRAULIC PRESSURE

The normal residual oil pressure in direct drive (top gear) is 20–25 lbs./sq. in. (1·40–1·76 kg./cm.²). This

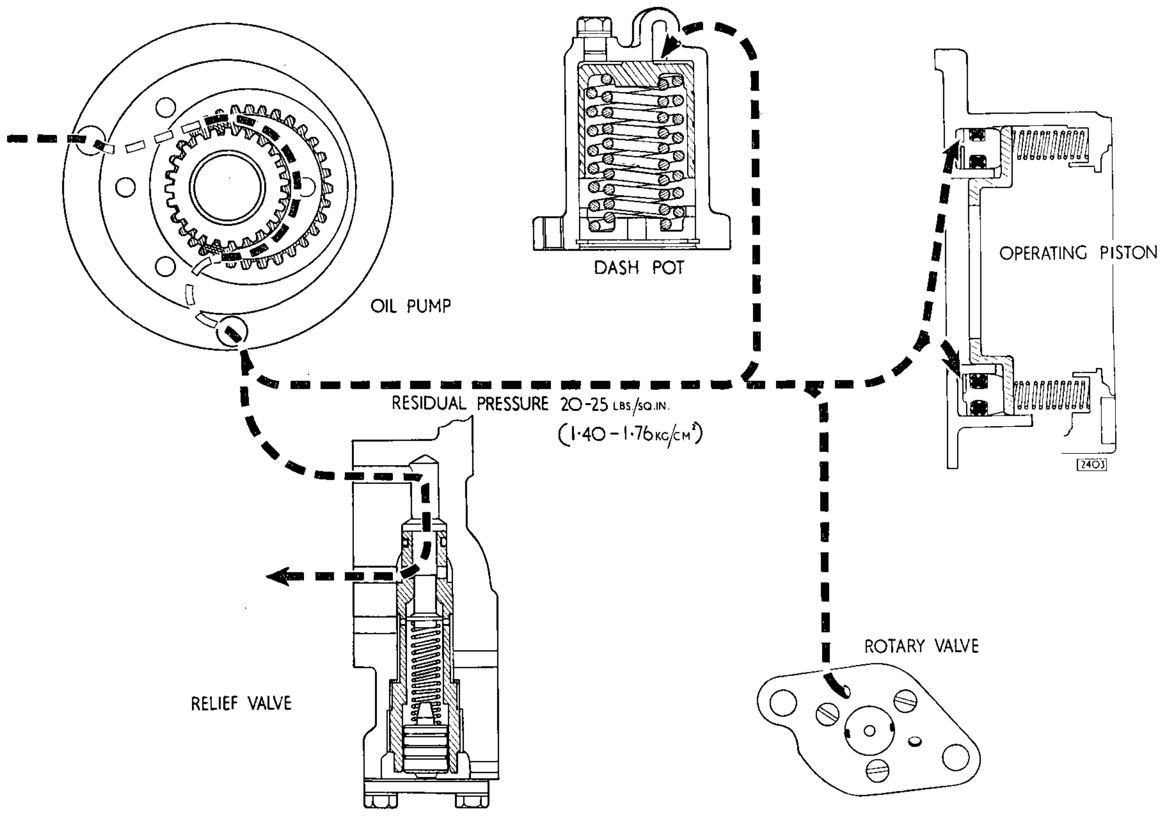


Fig. 36. Residual pressure in the hydraulic system. Overdrive not in operation

pressure is increased to 205–215 lbs./sq. in. (14·41–15·11 kg./cm.^{2}) when the overdrive is engaged. To test the hydraulic pressure, a gauge reading from 0–300 lbs./sq. in. (0–21·09 kg./cm.^{2}) should be used in conjunction with a hose and adaptor. The adaptor is inserted in the tapped hole normally occupied by the blanking plug in the end of the dashpot (see Fig. 35).

The overdrive is actuated by a solenoid which is connected to a rotary valve. The solenoid is connected to a manual switch mounted in the facia panel and a top gear switch mounted on the gearbox cover which will only close when top gear is selected.

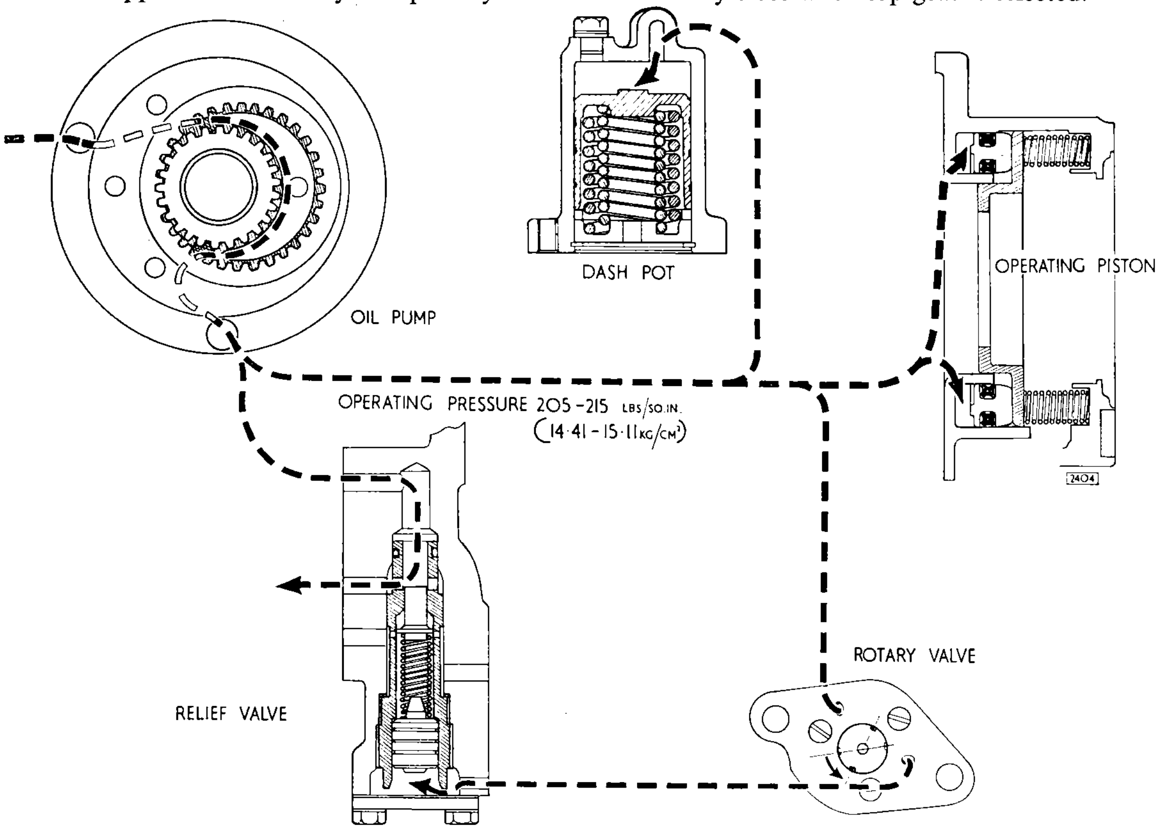


Fig. 37 Operating pressure in the hydraulic system. Overdrive in operation.

THE ELECTRICALLY OPERATED CONTROL SYSTEM

WIRING CIRCUIT

The circuit consists of a control switch connected in series between the top gear switch and the solenoid. An illumination bulb and resistance is also incorporated in the circuit. The resistance dims the illumination bulb when the lights are turned on at night (see Fig. 38).

ROTARY SOLENOID VALVE

The solenoid operating the rotary valve is attached to the rear of the overdrive unit and when current is passed to the solenoid it rotates the valve anti-clockwise through 45°. Oilways are then uncovered to allow the oil pressure to move the larger relief valve piston against the spring thus increasing the pressure at which the smaller relief valve will reach its "bleed off" position.

ADJUSTMENT

If the solenoid plunger nut has been disturbed it will be necessary to re-adjust the solenoid plunger as follows:—

Remove the solenoid valve cover plate and note the position of the solenoid lever. Remove the small screw and fibre washer situated in the side of the valve body.

Insert the shank of a No. 33 drill or a steel rod 0·133″ (3·39 mm.) diameter into the hole and move the solenoid lever until the drill shank registers with the setting hole in the lever. ("A" Fig. 38).

Remove the split pin and adjust the position of the nut "B" on the plunger "C" until, when the plunger is pushed in, the nut just contacts the lever.

Remove the No. 33 drill or steel rod and check the setting of the lever by energising the solenoid and incorporating an ammeter in series.

Verify that the holes are in alignment and the correct consumption does not exceed 1 ampere with the solenoid energised. If the ammeter shows a reading of 15–20 amperes, the solenoid plunger is not moving far enough to open the contacts and switch from the closing to the holding coil. Therefore, it will be necessary to re-adjust the setting of the lever otherwise the solenoid will quickly burn out.

Refit the split pin and refit the cover plate.

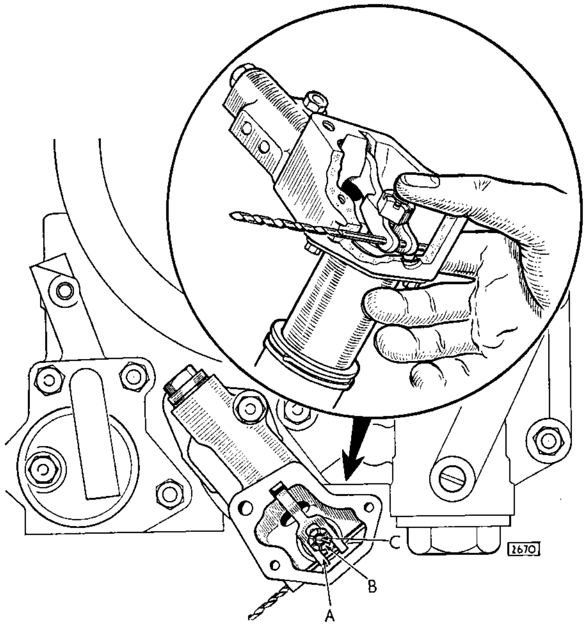


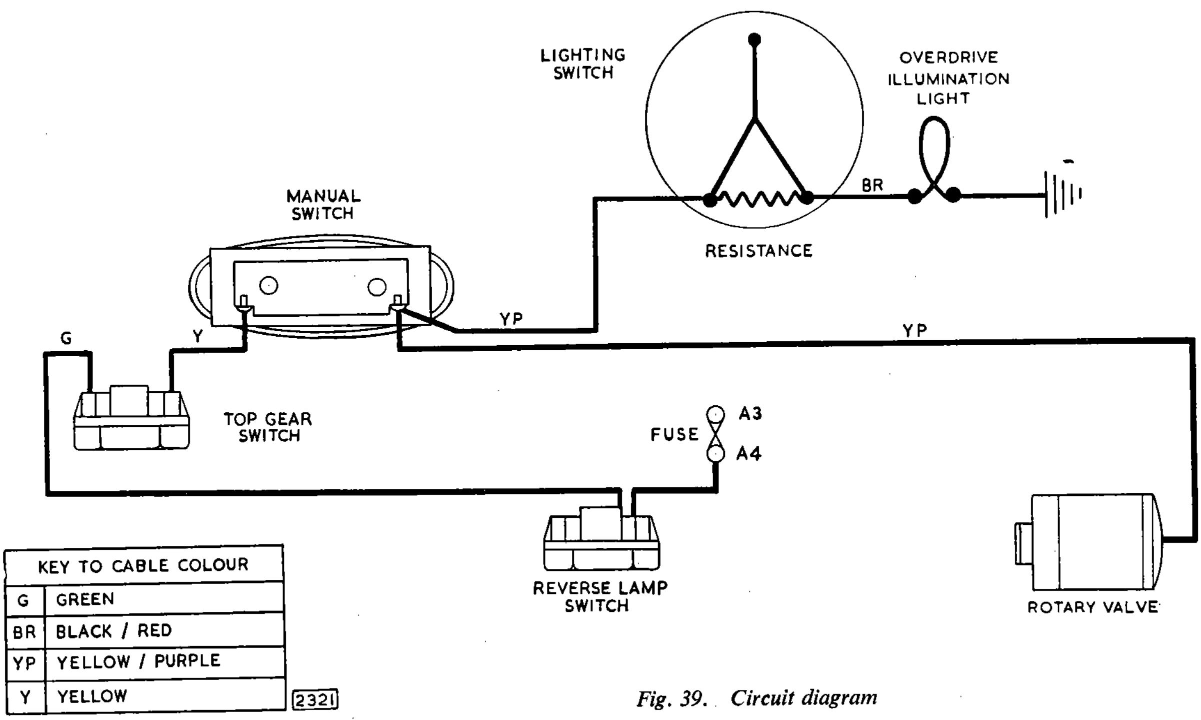
Fig. 38. Solenoid adjustment

FAULT FINDING

When an overdrive unit does not operate properly it is advisable first to check the level of oil and, if below the low level mark, top up with fresh oil and test the unit again before making any further investigations.

Faulty units should be checked for defects in the order listed on page F.30.

Should the electrical control not operate the electrical circuits should be checked from the diagram.



KEY TO CABLE COLOUR	
G	GREEN
BR	BLACK / RED
YP	YELLOW / PURPLE
Y	YELLOW

Fig. 39. Circuit diagram

OVERDRIVE DOES NOT ENGAGE

1. Insufficient oil in gearbox.
2. Pump not working due to choked filter.
3. Solenoid valve not operating.
4. Low pressure due to faulty relief valve.
5. Low pressure due to leak on suction side of pump.

CLUTCH SLIP IN OVERDRIVE

1. Insufficient oil in gearbox.
2. Partially choked pump filter.
3. Low oil pressure due to faulty relief valve.
4. Slow build-up in pressure—due to faulty relief valve or numbers 2, 5 and 7.
5. Leak on suction side of pump due to faulty pump "O" ring or maincase gasket.
6. Worn or glazed clutch lining.
7. Worn pump gear.

OVERDRIVE DOES NOT RELEASE

Important: If the overdrive does not release, do NOT reverse the car, otherwise extensive damage may be caused.

1. Fault on electrical control.
2. Sticking solenoid valve.
3. Sticking relief valve.
4. Sticking clutch.

SPECIAL TOOLS

Part No.	Description
L.178	Freewheel Assembly Ring
L.185	Dummy Drive Shaft
—	Hydraulic Test Equipment
L.300	Overdrive Operating Piston Remover

SECTION FF

AUTOMATIC TRANSMISSION

3·8 MARK 10 MODEL

INDEX

AUTOMATIC TRANSMISSION

FOREWORD

This section deals principally with the setting of the linkages and controls of automatic transmission models.

The dismantling, testing and servicing of the automatic transmission unit is dealt with in a separate publication—"Service Manual for the Jaguar Automatic Transmission."

DESCRIPTION

The automatic transmission assembly consists of a three-element hydraulic torque converter followed by two planetary gear sets which permit the elimination of the clutch pedal and normal gear lever. The planetary gear sets incorporate freewheels and are controlled by hydraulically operated bands and disc clutches.

Anti-Creep System

The anti-creep system is a special braking feature which prevents the car from creeping forward when stopped on level ground or slight grades, provided the ignition is switched on. Apply the footbrake to stop the car and then remove the foot from the brake pedal. The car will not creep forwards or backwards. Any movement of the accelerator pedal, or turning off the ignition key releases the anti-creep action.

The system (see Fig. 7) consists of a solenoid valve which holds brake pressure on the rear wheel brakes whenever the anti-creep circuit is closed.

A pressure control switch operated by the transmission rear pump pressure is used to open the anti-creep circuit when the car is moving forward and to close the circuit when the car is stationary or moving in reverse. Also a switch is incorporated in the throttle linkage which opens and closes the anti-creep circuit as the accelerator is depressed or released.

With the ignition switched ON, the accelerator released, (anti-creep throttle switch closed) and the car stationary, (pressure control switch closed) the anti-creep circuit is completed and the solenoid valve is energised. When the brakes are applied under these conditions the anti-creep solenoid valve will retain hydraulic pressure at the rear wheel brakes to prevent creeping.

DATA

Maximum torque ratio of converter	2·15 : 1
Low gear reduction	2·308 : 1
Intermediate gear reduction	1·435 : 1
Direct drive—no converter	1 : 1
Reverse gear reduction	2·009 : 1
Rear axle ratio	3·54 : 1

AUTOMATIC GEAR CHANGES

Upshifts

	m.p.h.	k.p.h.
Low to intermediate—light throttle	10—13	16—21
Low to intermediate—full throttle	33—36	53—58
Intermediate to direct—light throttle	23—26	37—42

		m.p.h.	k.p.h.
Intermediate to direct—full throttle		53—56	85—90
Intermediate to direct—after "kick-down"		67—70	108—113

Downshifts

Direct to intermediate—closed throttle		16—19	26—31
Intermediate to low—closed throttle		3—7	5—11
Direct to intermediate—"kick-down" Up to		60	96
Parking pawl permitted to engage	Below	5	8
Reverse gear permitted to engage	Below	5	8
Manual change from drive to low to be avoided	Above	45	72

ROUTINE MAINTENANCE

The fluid necessary for the operation of the torque converter is common with that used in the transmission. The total capacity of the transmission assembly is approximately 15 Imperial pints (18 U.S. pints; 8·5 litres), but when draining the transmission a small quantity of fluid will remain in the unit and the amount required to refill it will be that needed to bring the level to the FULL mark on the dipstick as described in "Drain and Refill Transmission."

EVERY 1,250 MILES (2,000 KM.)

Check Transmission Fluid Level

1. Raise the bonnet. The dipstick will be found adjacent to the rear carburetter.
2. With the car on a level floor, set the handbrake firmly. Set the selector lever in the P position and start the engine. With the footbrake applied, move the selector lever to L and raise the transmission fluid temperature by running the engine at 800 r.p.m. for 2 or 3 minutes.
3. Clean the end of the filler tube. Remove the dipstick and wipe it dry. With the foot still on the brake and the selector lever at L run the engine at its normal idling speed and check the fluid level. Add sufficient fluid to bring the level up to the "Full" mark on the dipstick. DO NOT OVERFILL. The space between the "Full" and "Low" marks on the dipstick represents approximately one pint.

EVERY 10,000 MILES (16,000 KM.)

Drain and Refill Transmission

1. Raise the bonnet. The dipstick will be found adjacent to the rear carburetter.
2. With the car on a level floor, set the handbrake firmly. Set the selector lever in the P position and start engine. With the footbrake applied move the selector lever to L and raise the transmission fluid temperature by running the engine at 800 r.p.m. for 2 or 3 minutes.
3. Stop the engine. Clean the end of the filler tube.
4. Remove the transmission oil pan drain plug (A, Fig. 1).
5. Remove the converter housing cover plate and rotate the converter until the drain plug is in position for draining. Remove the converter drain plug (B).
6. To facilitate draining, remove the square-headed converter pressure take-off plug (C) from the bottom of the housing attached to the left-hand side of the transmission casing.

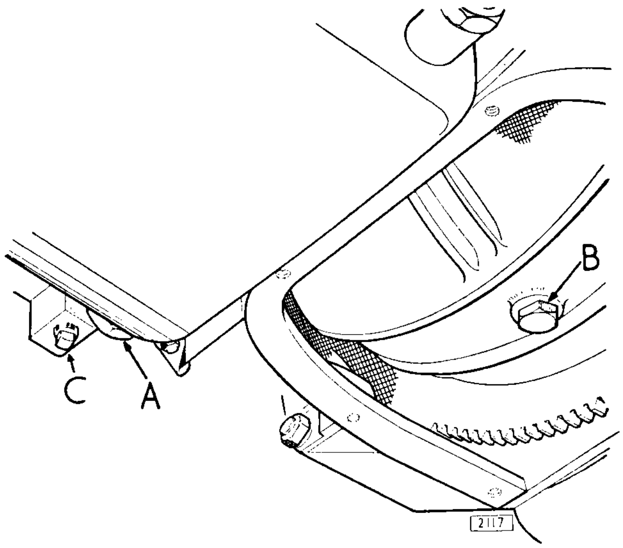


Fig. 1. Automatic transmission drain plugs (the converter housing cover plate has been removed)

7. After fluid has drained, refit and tighten the drain plugs in the transmission oil pan and converter. Refill the converter housing cover plate. Refit and tighten the converter pressure take-off plug.
8. Pour 10 Imperial pints (12 U.S. pints; 5·7 litres) of the recommended grade of fluid into the transmission through the filler tube.
9. Set the selector lever in the P position and start engine. With the footbrake applied move the selector lever to L and run the engine at 800 r.p.m. for 2 or 3 minutes to transfer fluid from the transmission case to the converter.
10. With the foot still on the brake and the selector lever at L run the engine at its normal idling speed and add additional fluid (approximately 5 Imperial pints; 6 U.S. pints or 2·8 litres) to bring the level up to the "full" mark on the dipstick. DO NOT OVERFILL.

Recommended Lubricants

Mobil	**Castrol**	**Shell**	**Esso**	**B.P.**	**Duckham**	**Regent** Caltex/Texaco
Mobil Fluid 200	Castrol TQ	Shell Donax T.6	Esso Automatic Transmission Fluid	Energol Automatic Transmission Fluid type A	Nolmatic	Texamatic Fluid

OPERATION

The transmission assembly consists of a three-element hydraulic torque converter followed by two planetary gear sets which permit the elimination of the clutch pedal and normal gear-shift lever. The planetary gear sets incorporate free-wheels and are controlled by hydraulically-operated band and disc clutches.

The manual control lever allows selection of the following conditions:—

P (Park). A pawl is mechanically engaged with teeth on the main shaft. A hydraulic interlock prevents engagement at speeds above 5 m.p.h. (8 k.p.h.).

N (Neutral). All clutches are disengaged and there is no drive beyond the torque converter.

D (Drive). Automatic changes between the low gear and intermediate gear and between the intermediate gear and direct drive.

Changes from low to intermediate gear and intermediate to direct drive depend upon the combination of road speed and throttle position; the larger the throttle opening the higher the speed at which the change occurs. This is achieved by mechanically combining the motions of a mechanical centrifugal governor and the throttle linkage. The resultant motion operates a hydraulic valve.

Depression of the accelerator pedal beyond normal travel causes a "kick-down" change from direct to intermediate gear. Below 60 m.p.h. (96 k.p.h.) a downshift from direct to intermediate gear can be obtained by depressing the accelerator to the full throttle position short of "kick-down." No "kick-down" downshift is possible for intermediate to low gear.

The torque converter and a gear reduction are operative in the low intermediate gears. Direct drive is obtained by coupling the engine directly to the main shaft by a disc clutch. The relevant road speeds are given in "Transmission Data" on pages viii and ix.

Manual L (Low). A low gear train and the torque converter are operative and no automatic change can occur. Manual changes between L and D may be made while the car is in motion but changes into L should be avoided at speeds above 45 m.p.h. (72 k.p.h.).

R (Reverse). A reverse-gear train and the torque converter are operative. A hydraulic interlock prevents engagement of the reverse clutch at forward speeds above 5 m.p.h. (8 k.p.h.).

Electrical connection to the starter is made only when N and P are selected. An anti-creep device traps brake fluid pressure when the car is stationary after the brakes have been applied. Opening the throttle releases the fluid.

Selector

The operation of the automatic transmission is controlled by the position of the selector lever which is indicated by the quadrant pointer. The quadrant is situated in front of the steering wheel and is marked P, N, D, L and R. The lever must be raised when selecting P, L or R and when moving from P to any other position.

When the ignition is switched on the letters P, N, D, L, R, in the quadrant behind the steering wheel become illuminated; when the sidelights are switched on the illumination is automatically dimmed.

To start the engine the selector lever must be in the P or N position.

P or Park provides a safe, positive lock on the rear wheels when the car is stopped. Movement of the selector lever to the P position actuates a mechanical locking device in the transmission which prevents the rear wheels from turning in either direction. For this reason, should the car be pushed from front or rear with sufficient force, the car will skid on the rear tyres. This condition is quite similar to that encountered when a car with conventional transmission is parked in gear or with the handbrake applied firmly. The fact that the engine may be started with the selector in P position is convenient when parked on an incline.

When the car is stopped on a hill and the P (Park) position is selected, the parking mechanism may become very firmly engaged due to the load on the pawl. To disengage the parking pawl under these conditions the following procedure should be adopted:

To release transmission from P (Park) when facing UP HILL.

1. Start the engine.
2. Release the handbrake.
3. Select D and **hold** lever in this position (irrespective of the direction in which it is desired to move off).
4. Depress accelerator slowly until the car moves forward, indicating the release of the parking pawl.
5. The car is now "free" and can be driven away in the desired direction.

To release transmission from P (Park) when facing DOWN HILL.

1. Start the engine.
2. Release the handbrake.
3. Select R and **hold** lever in this position (irrespective of the direction in which it is desired to move off).
4. Depress accelerator slowly until the car moves backward, indicating the release of the parking pawl.
5. The car is now "free" and can be driven away in the desired direction.

N or Neutral position permits idling the engine without the possibility of setting the car into motion by pressure on the accelerator and may be used when starting the engine. It is inadvisable to engage neutral for coasting.

D or Drive provides the normal forward driving range and includes automatic shifting between the low, intermediate and direct drive ranges. Virtually all forward driving, accelerating and stopping can be done with the lever in the D position. Once the engine is started and the lever is moved to D it can be left in this position for all normal driving. When accelerating, the transmission shifts automatically from low to intermediate between 10 and 36 m.p.h. (16 and 58 k.p.h.) and from intermediate to direct between 23 and 56 m.p.h. (37 and 90 k.p.h.) depending on the position of the accelerator pedal. On deceleration, it will shift automatically from direct drive to intermediate between 16 and 19 m.p.h. (26 and 31 k.p.h.) and from intermediate to low between 3 and 7 m.p.h. (5 and 11 k.p.h.).

L or Low is an emergency engine power range for use on unusually long and steep grades or for braking on descents, for extra heavy pulling, and for rocking the car out of mud, sand or snow.

R or Reverse position of the selector lever provides reverse driving range.

Intermediate Speed Hold. A switch mounted on the facia provides a means for the driver to obtain a downshift from direct to intermediate without depressing the accelerator pedal (as advised under the heading "Additional Power and Acceleration") and to retain the drive in the intermediate range. This will be found convenient for overtaking or when hill climbing.

With the switch in the "IN" position no upshift will take place between intermediate and direct drive; placing the switch lever in the "OUT" position will cause the transmission to shift to direct drive, provided the normal upshift speed has been obtained.

Warning. Do NOT allow the maximum permitted engine revolutions to be exceeded through allowing the "Intermediate Speed Hold" to remain in operation longer than necessary, or by switching in the "Hold" at speeds in excess of 75 m.p.h. (121 k.p.h.).

Additional Power and Acceleration in D range can be obtained as follows:—

(*a*) Below 45 m.p.h. (72 k.p.h.) depress the accelerator pedal to the full throttle position to effect a change into the intermediate range; the drive will continue in the intermediate range until the release of the accelerator or approximately 56 m.p.h. (90 k.p.h.) is reached.

(*b*) Between 45 m.p.h. and 60 m.p.h. (72 k.p.h. and 96 k.p.h.) depress the accelerator pedal all the way to the floorboard to effect a "kickdown" change into intermediate range; the drive will continue in the intermediate range until release of the accelerator or approximately 70 m.p.h. (113 k.p.h.) is reached.

Hard Pulling, such as encountered in deep snow, mud or other adverse driving conditions, is best accomplished in the L range.

Rocking out of Mud, Sand or Snow is accomplished with the accelerator pedal slightly depressed and held steady while making quick alternate selections of L and R ranges.

Push Starting may sometimes be necessary, as in the case of a flat battery. Turn ignition key ON, place selector lever in the N position. The car may now be pushed and when it has reached 15 to 20 m.p.h (24 to 32 k.p.h.) move the selector lever to D or L position. **Do not tow the car to start the engine—it may overtake the tow car.**

Engine Braking, for descending long mountainous grades, is easily secured by bringing the car speed below 45 m.p.h. (72 k.p.h.) and momentarily depressing the accelerator while placing the selector lever in the L position.

Prolonged Idling is sometimes unavoidable. In such cases, as a safety precaution, move the selector lever to the P or N position.

Towing should be done with the selector lever in the N position. Car should not be towed in excess of 30 m.p.h. (48 k.p.h.).

SERVICE ADJUSTMENTS

ACCELERATOR TO GOVERNOR LEVER ADJUSTMENT

Before making any adjustment to the accelerator pedal to governor lever linkage (see Fig. 3), the points enumerated under the sub-heading "Carburetter Idling Speed" should be checked and, if necessary, adjusted.

Disconnect the control rod from the governor control lever (note that the control ball pin is installed in the **inner** of the two holes).

Carburetter Idling Speed

1. Slacken the locknut retaining the anti-creep throttle switch (see Fig. 6) and screw the switch downwards out of operation.

2. Adjust the idling speed of the engine to 500 r.p.m. by rotating the three throttle adjusting screws by exactly equal amounts.

3. Reset the anti-creep throttle switch as described on page FF.10.

Adjusting the Governor Lever

With the control rod to the governor lever disconnected:—

1. Depress the accelerator pedal to the full throttle position at the carburetters (DO NOT depress the pedal sufficiently hard to overcome the "kick-down" overtravel spring in the vertical link situated on the right-hand side of the bulkhead for right-hand drive cars and vice versa for left-hand drive cars).
2. Turn the governor lever to the full throttle position, that is, the position where solid resistance is felt before overcoming the cam detent (see Fig. 3).
3. With the accelerator pedal and governor lever in these positions, adjust the length of the governor lever control rod at the large knurled nut. The ball pin should slip easily into the **inner** hole of the governor lever.
4. Check the kickdown operation on road test.

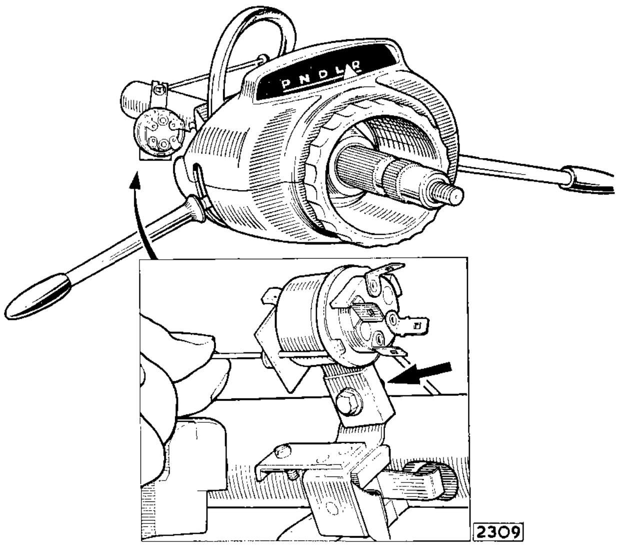


Fig. 2. Setting the starter/reverse inhibitor switch

STARTER CUT OUT AND REVERSE LIGHT SWITCH

The combined starter cutout and reverse light switch is attached to a bracket situated at the bottom of the manual selector control rod (see Fig. 2).

The switch is operated by a centrally pivoted arm which is attached to the selector rod.

The starter cut out serves to close the starter motor operating circuit only when the manual selector lever

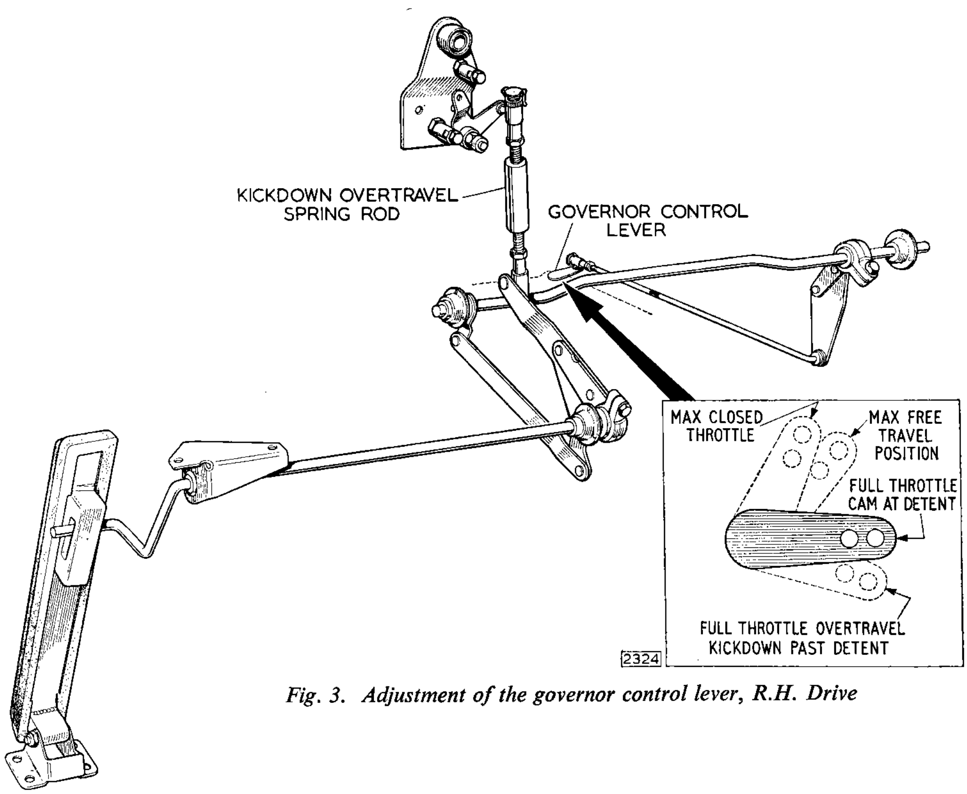


Fig. 3. Adjustment of the governor control lever, R.H. Drive

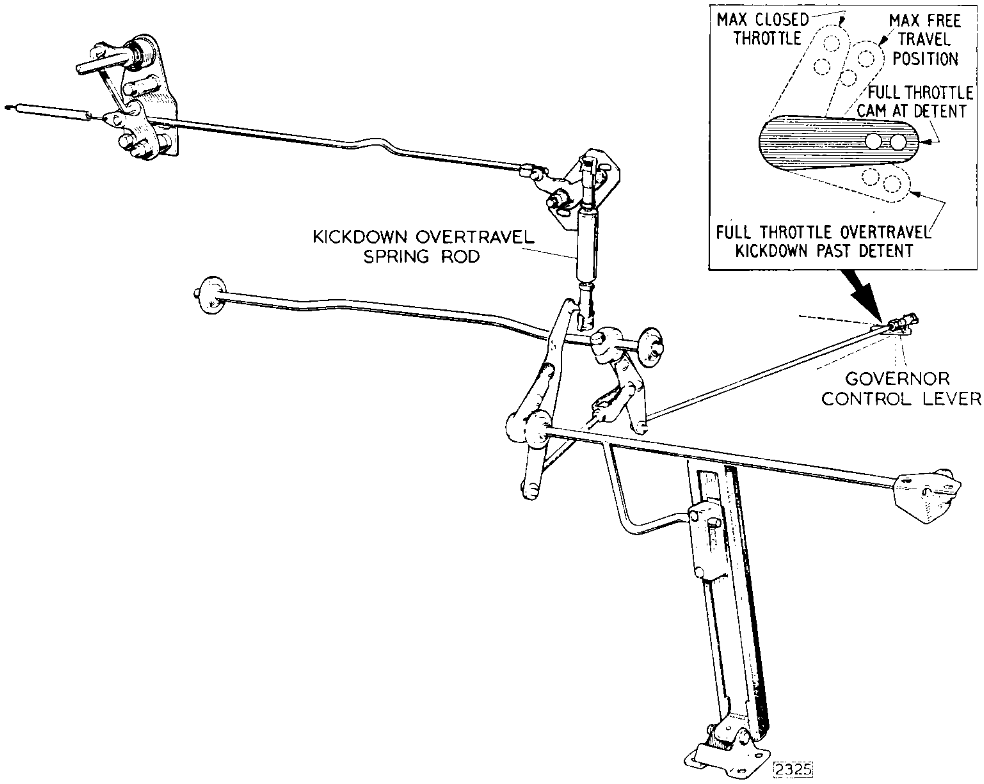


Fig. 4. Adjustment of the governor control lever, L.H. Drive

is in the P or N (Park or Neutral) position. This ensures that the engine cannot be started when the tıansmission is in any of the driving ranges.

The reverse light switch serves to close the reversing light circuit when the manual selector lever is in the R (Reverse) position and the ignition switch is ON.

Adjustment

To ensure correct operation of the starter cut out and reverse light inhibitor switch, it is **most important** that the following instructions be adhered to:—

Slacken the starter/reverse light switch securing bolt. Move the gear selector lever until the gear indicator is halfway between the L and R (Low and Reverse) positions. Rotate the starter/reverse light switch until the hole in the lever is in line with the hole in the switch base plate. Place a piece of wire through the two holes and tighten the nut securing the switch to the upper steering column (see Fig. 2). Remove the wire.

MANUAL SELECTOR CABLE ADJUSTMENT

Adjustment of the cable should only be necessary if the cable has been removed from the car. The exhaust system will have to be removed to provide access to the selector valve lever.

1. Place the selector valve lever in the D position, that is, the centre of the five positions that can be obtained (see inset Fig. 5).
2. Pass the outer cable through the transmission mounted locating bracket. Secure the cable to the selector valve lever. It is **most important** that the cable runs in a straight line to the selector valve lever.
3. Measure the distance "A" between the inner and outer cables at the top end as shown in Fig. 5. The dimension "A" on R.H. drive cars should be $4\frac{3}{4}''$ (12·06 cm.) and L.H drive cars $3\frac{11}{16}''$ (9·36 cm.).
4. Carry out any necessary adjustment on the lower end of the cable. Lock up the collet on the lower ball joint.
5. Place the gear selector lever in D position. The upper ball joint should now be in line with the hole in the selector lever control rod.
6. Connect the cable ball joint to the control rod, and check the operation of the transmission in the five positions of the manual selector lever quadrant.

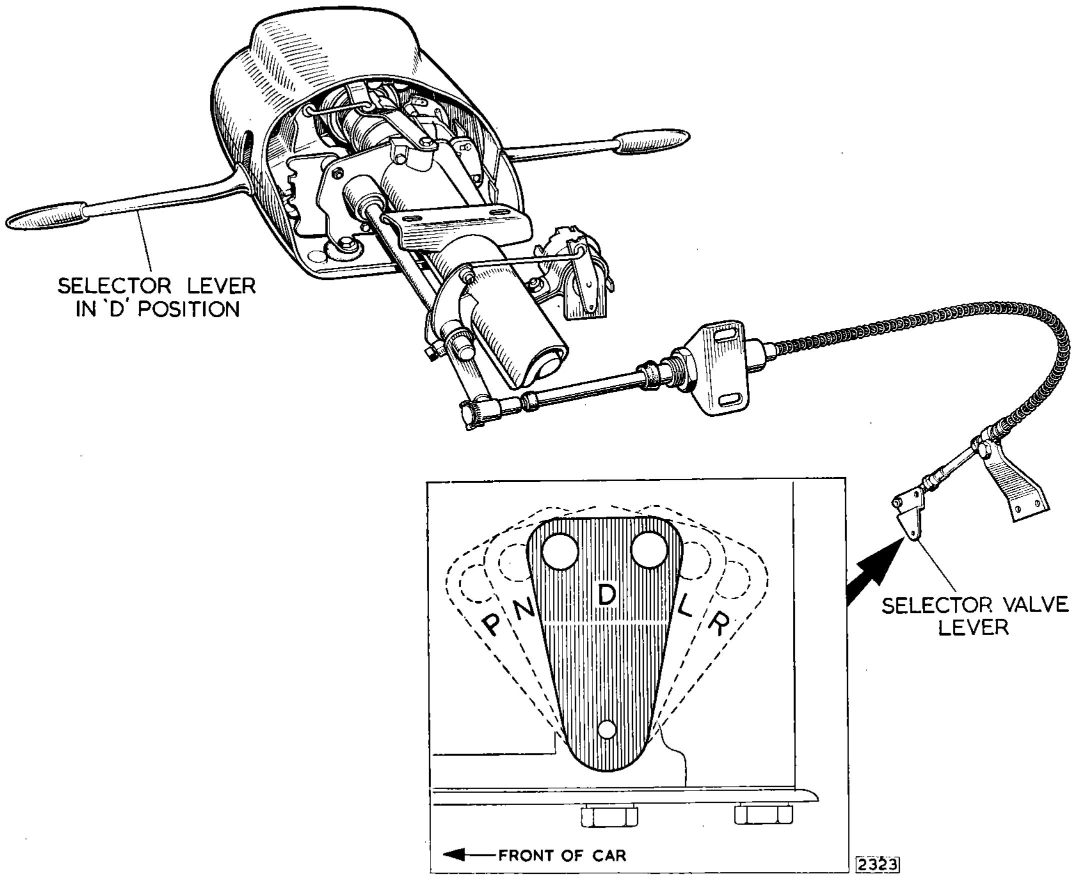


Fig. 5. Adjustment of the manual selector cable

"ANTI-CREEP" THROTTLE SWITCH ADJUSTMENT

The "anti-creep" throttle switch is attached to a bracket situated forward of the front carburetter. For a full description of the system, see page 3.

To adjust the switch, carry out the following procedure:—

Slacken the locknut securing the anti-creep throttle switch to its bracket, and screw the switch downwards so that the plunger in the centre of the switch is not in contact with the operating lever.

Ensure that the throttle adjusting screws are on their stops and check the idling speed of the engine which should be 500 r.p.m. If it is necessary to adjust the idling speed, rotate the three throttle adjusting screws by exactly equal amounts.

Adjust the position of the switch in the bracket so that the plunger in the centre of the switch is FULLY DEPRESSED by the operating lever with the carburetter throttles in the normal idling position. Tighten the locknut.

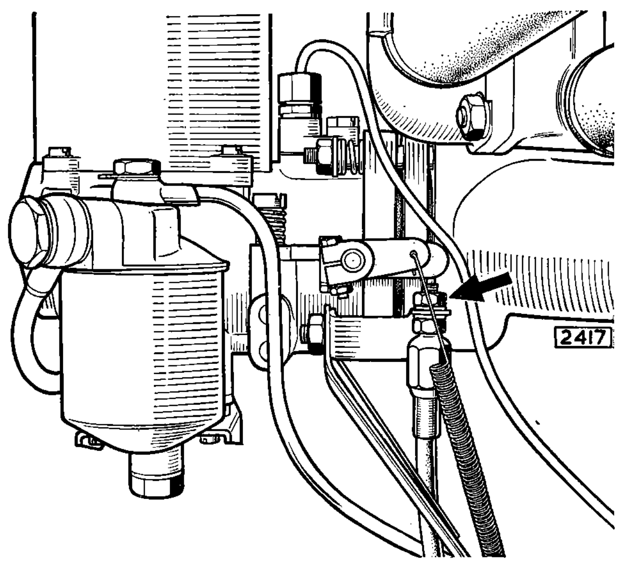


Fig. 6. Anti-creep throttle switch

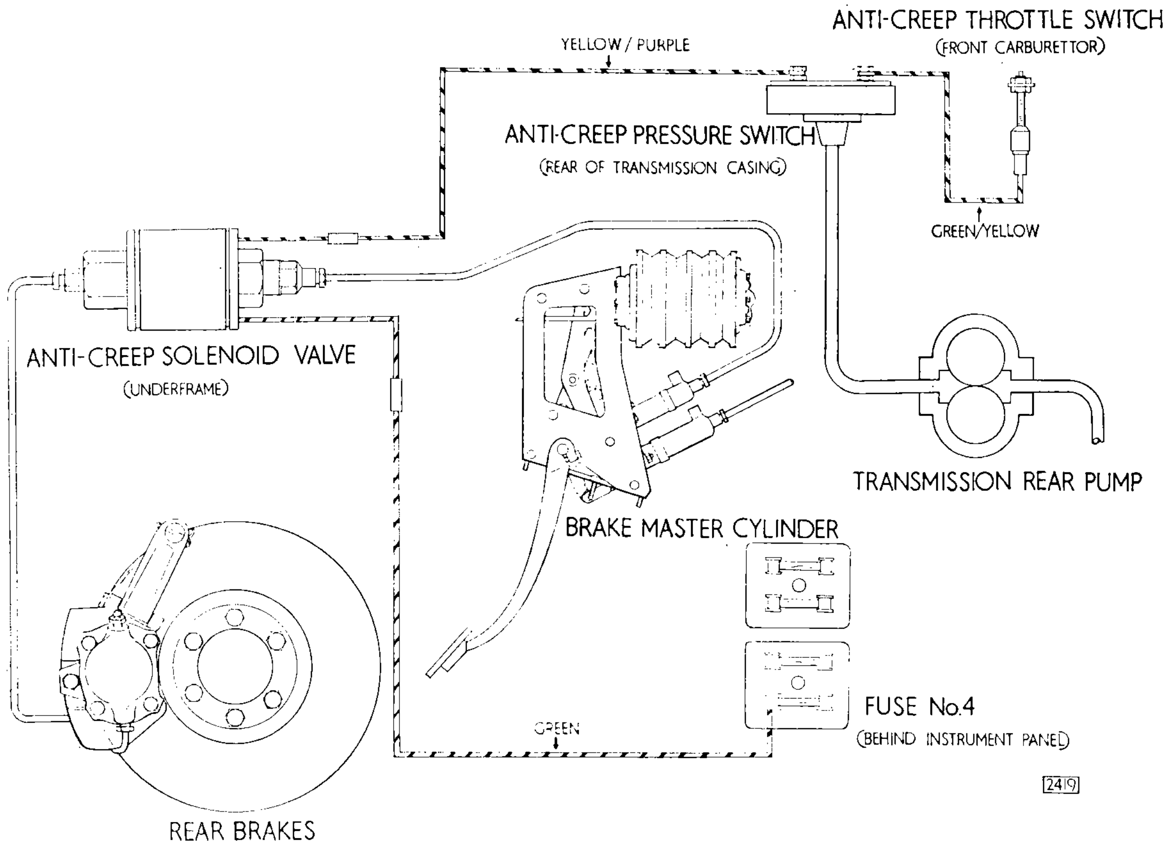


Fig. 7. Anti-creep system

To test the "anti-creep" system, carry out the following procedure:—

1. Drive the car at approximately 10 m.p.h. (16·09 k.p.h.) with the hand control selector lever in D position, and quickly apply then immediately release the brakes. Do not touch the accelerator pedal. The anti-creep pressure switch should open the anti-creep circuit so that the car rolls freely with no evidence of brake drag after the brake pedal is released.
2. While driving the car on level ground, release the accelerator pedal and apply the brakes, bringing the car to a complete stop. The car should not creep forward until the accelerator is depressed.
3. With the car standing still on level ground, the engine idling, the selector lever in one of the driving positions and the anti-creep system preventing the car from creeping, touch the accelerator pedal lightly and release it. This action should release the anti-creep system and the car should creep slowly from a standstill.

SECTION G

PROPELLER SHAFTS

3·8 MARK 10 MODEL

INDEX

PROPELLER SHAFTS

DESCRIPTION

A divided propeller shaft of the open type is fitted, the rear end of the front shaft being supported in a rubber mounted ball bearing. The rear shaft has a universal joint at each end and a sliding spline encased in a rubber gaiter.

DATA

Dimension "A"	**Front Shaft**
Standard and Overdrive Model	$25\frac{3}{16}''$ (63·97 cm.)
Automatic Transmission Model	$26\frac{3}{4}''$ (67·94 cm.)

Note: The rear propeller shaft is the same length for all models.

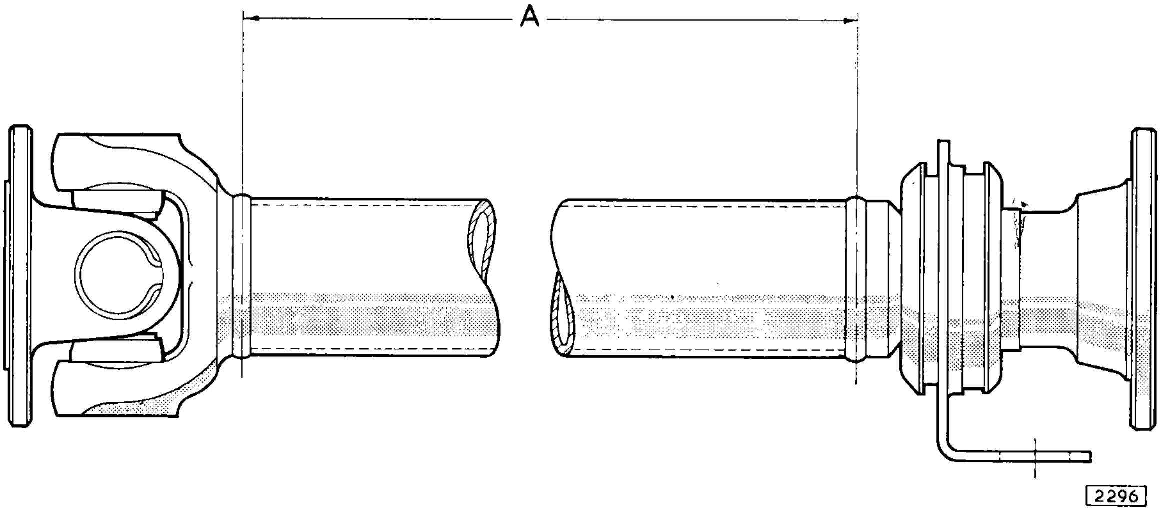


Fig. 1. Propeller shaft lengths

ROUTINE MAINTENANCE

The propeller shaft universal joints, sliding spline and the centre bearing are pre-packed with grease, therefore no periodic maintenance is required. Replenishment with grease is necessary only when the propeller shafts are overhauled.

Recommended Lubricants

Mobil	**Castrol**	**Shell**	**Esso**	**B.P.**	**Duckham**	**Regent** Caltex/Texaco
Mobilgrease MP	Castrolease LM	Retinax A	Esso Multi-purpose Grease H	Energrease L.2	LB.10	Marfak All-Purpose

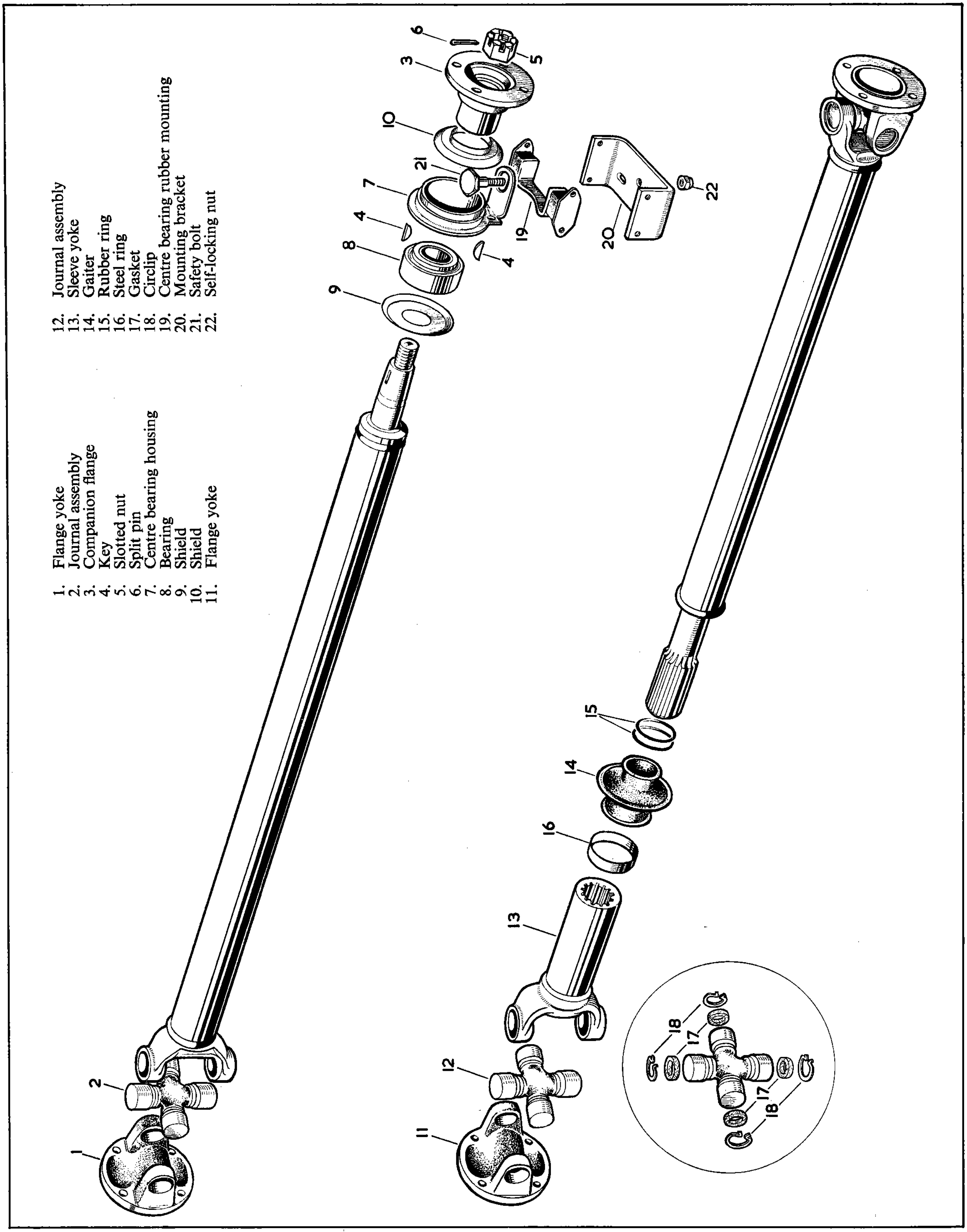


Fig. 2. Exploded view of the propeller shafts

FRONT PROPELLER SHAFT

Removal

Position a jack under the rear engine mounting and raise it until contact is just made with the rear engine mounting bracket.

Mark the position of the rear mounting bracket in relation to the floor to facilitate reassembly.

Remove the four bolts, shakeproof washers and plain washers.

Lower the jack with great care until the coil spring is free.

Collect the four steel packing pieces located between the rear mounting bracket and floor.

Remove the four self-locking nuts from the front propeller shaft to gearbox flange.

Remove the four self-locking nuts from the rear flange of the front propeller shaft.

Compress the rear propeller shaft on the splines and lower the front end.

Remove the two self-locking nuts and washers from the front propeller shaft centre bearing bracket.

Disengage the centre bearing bracket from the body, and note the number of washers between the bearing bracket and tunnel floor.

Withdraw the front propeller shaft towards the back of the car.

Refitting

Refitting is the reverse of the removal procedure. Propeller shaft flanges must be clean and locate with the spigot on the opposite flange.

REAR PROPELLER SHAFT

Removal

Remove the four self-locking nuts attaching the rear propeller shaft to the front propeller shaft.

Remove the four self-locking nuts attaching the propeller shaft to the rear axle assembly.

Compress the sliding splines and remove the propeller shaft.

Refitting

Refitting is the reverse of the removal procedure. It is important to have clean propeller shaft flange faces and make sure that the spigot on one flange locates with the spigot on the other flange.

CENTRE BEARING

The centre bearing consists of a ball bearing pressed into a housing which has a plate attached; this assembly is mounted on the tail of the front propeller shaft with a dust shield interposed between the housing and shaft tubing. The bearing is retained on the shaft by

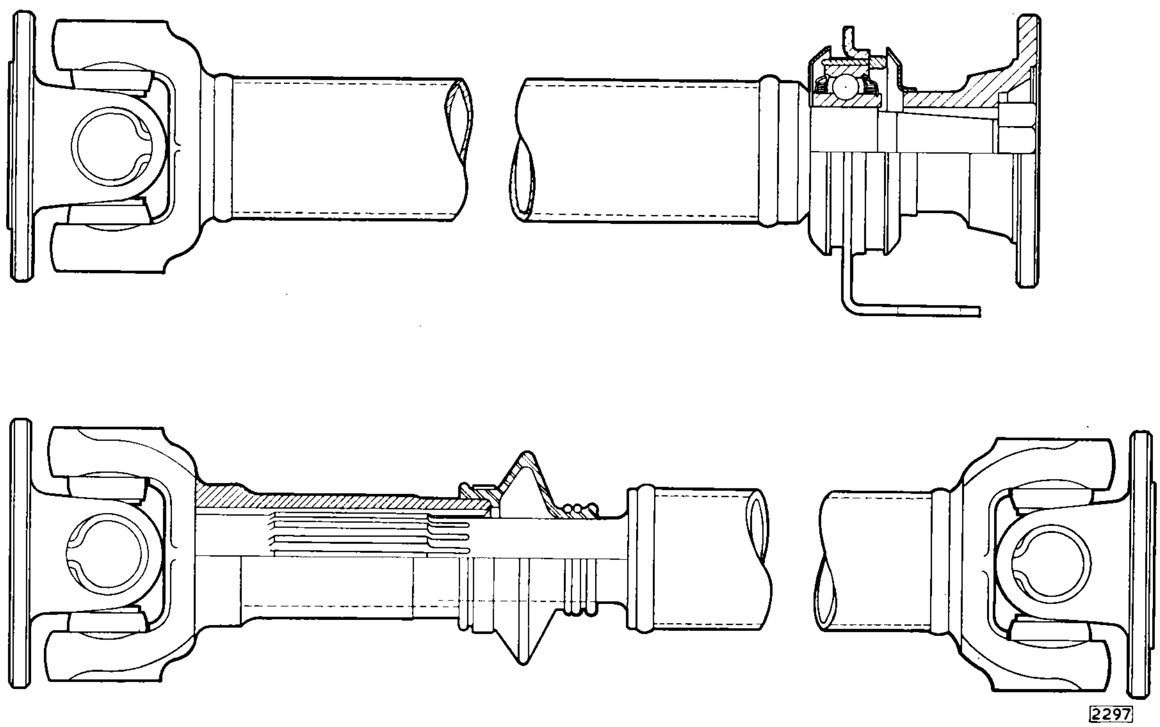


Fig. 3. Front propeller shaft showing centre bearing (Upper illustration), *Rear propeller shaft* (Lower illustration)

a flange coupling which is bolted to the companion flange on the rear propeller shaft.

Removal

Remove the front propeller shaft complete with the centre bearing as described on page G.6.

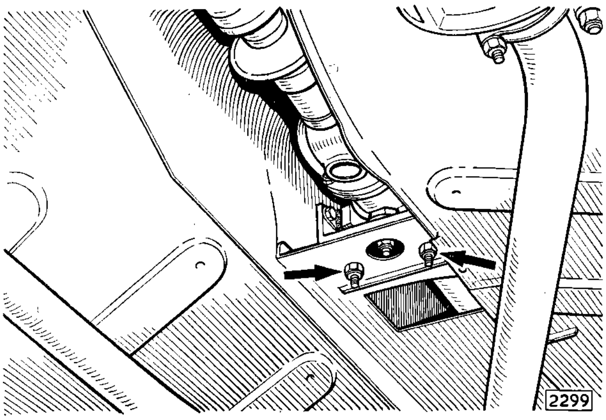


Fig. 4. Showing the centre bearing bracket securing bolts

Dismantling

The flange coupling is retained on the front propeller shaft by two Woodruff keys and is secured by a castellated nut and split pin.

Remove the split pin and castellated nut.

Draw off the flange coupling and remove the Woodruff keys. Remove the outer dust cover.

Drive the shaft through the bearing and housing and press the bearing out of the housing.

Remove the two self-locking nuts and bolts securing the body mounting bracket to the propeller shaft bearer plate.

Remove the four setbolts and shakeproof washers securing the mounting rubbers to the body mounting bracket.

Withdraw the mounting rubbers from the body mounting bracket.

Reassembly

Reassembly is the reverse of the dismantling procedure.

Refitting

Refitting is the reverse of the removal procedure. Note the procedure detailed under the heading "Divided Propeller Shaft Alignment."

DIVIDED PROPELLER SHAFT ALIGNMENT

The alignment of the divided propeller shaft is most important and if removal of the engine or front propeller shaft has taken place, the following checks should be made on replacement. Failure to do so may result in transmission judder when taking up the drive from a standing start.

Note: Before carrying out any checking or rectification work.

(*a*) Ensure that the engine stabilizer at the rear of the cylinder head is disconnected. To disconnect the engine stabilizer, remove the self-locking nut and flanged washer from the top of the stabilizer. Screw the lower washer down the centre pin by engaging a thin bladed screwdriver in the slot in the washer through the centre hole of the rubber mounting.

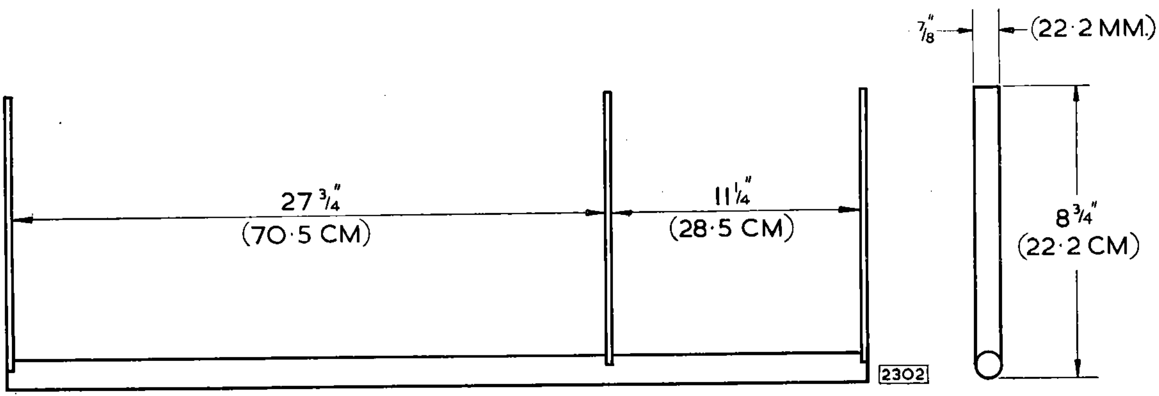


Fig. 5. The propeller shaft alignment jig

(*b*) Check that the rear engine mounting spring is not distorted. Note that the holes in the rear engine mounting cradle are slotted.

Checking the Alignment—in the Horizontal Plane

To check the alignment it is advisable to make up a simple checking jig as shown in Fig. 5. The jig consists of 3 pieces of flat bar 8″ × 1″ × $\frac{3}{16}$″ (20·5 × 2·5 × 4·75 cm.) which are welded exactly in line to a piece of tube 1½″ (38·1 mm.) outer diameter at the distances shown in the illustration.

Offer up the jig to the front and rear propeller shafts as illustrated in Fig. 8, to check the propshafts in the horizontal plane. All three legs should contact the propeller shafts.

Remedy

If any adjustment is necessary, add or subtract shim washers between the centre bearing bracket and propeller shaft tunnel (see Fig. 7). Add shims to raise and remove to lower the centre bearing.

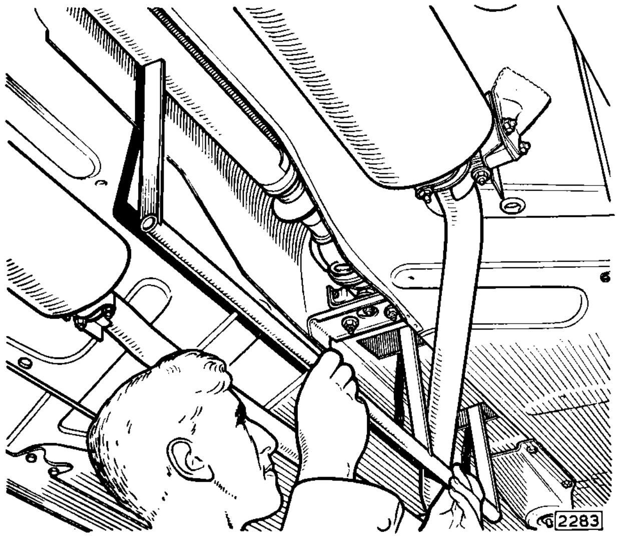


Fig. 6. Checking the vertical alignment

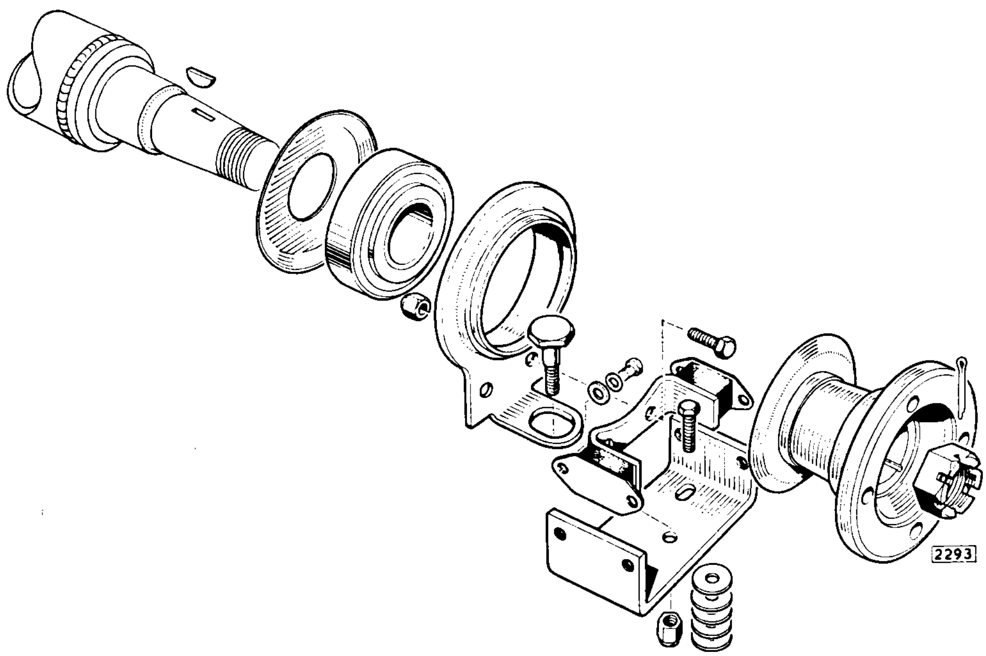


Fig. 7. Exploded view of the centre bearing

Checking the Alignment—in the Vertical Plane

Using the jig already mentioned under "Checking the Alignment—in the Horizontal Plane," place it in contact with the sides of the front and rear propeller shafts (see Fig. 6).

An alternative method of checking the alignment is to use three plumb bobs and sight along three cords. Two cords should be positioned at the front and rear of the propeller shaft tube and the remaining cord at the rear end of the rear propeller shaft tube.

Remedy

Alignment of the propeller shafts is carried out at the centre bearing bracket by the two elongated holes through which the setscrews pass to secure the bracket to the body floor. The position of the centre bearing bracket can then be adjusted to allow the propeller shafts to be aligned.

Adjustment of Engine Stabilizer

After having carried out the above procedure adjust the stabilizer as follows:—

1. Screw the lower flanged washer up the stabilizer pin **until the flange contacts the bottom of the stabilizer rubber mounting.** The washer is slotted on its upper face and can be screwed up the pin by engaging a thin bladed screwdriver in the slot through the centre hole of the rubber mounting.
2. Fit the upper flanged washer and tighten down with the self-locking nut.

Failure to observe the above procedure may cause engine vibration and/or fouling of the gearbox in its cowl owing to the engine being pulled up on its mountings.

THE UNIVERSAL JOINTS

Examine and Check for Wear

The parts most likely to show signs of wear after long usage are the bearing races and spider journals. Should looseness in the fit of these parts, load markings or distortion be observed they should be renewed as a unit as worn needle bearings used with a new spider journal or new needle bearings with a worn spider journal will wear more rapidly, making another replacement necessary in a short time.

It is essential that the bearing races are a light drive fit in the yoke trunnion.

In the rare event of wear having taken place in the yoke cross holes, the holes will have become oval and the yokes must be removed.

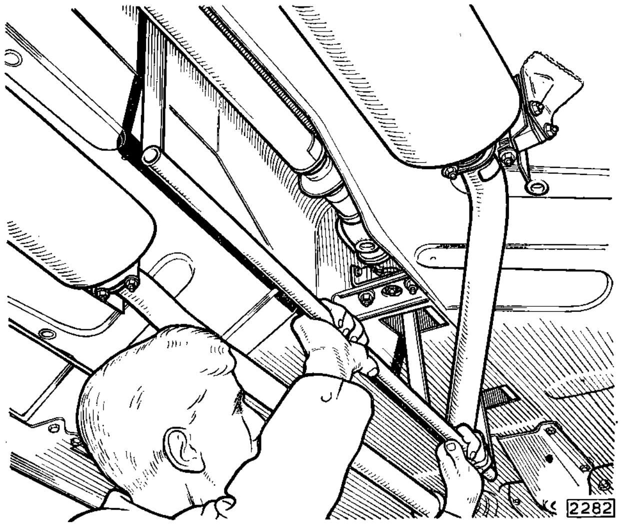


Fig. 8. Checking the horizontal alignment

In the case of wear of the cross holes in a fixed yoke, which is part of the tubular shaft, only in cases of emergency should these be replaced. They should normally be replaced by a complete assembly.

The other parts likely to show signs of wear are the splined sleeve yoke and splined shaft. A total of ·004″ (·1 mm.) circumferential movement, measured on the outside diameter of the spline, should not be exceeded. If wear has taken place above this limit the complete propeller shaft should be replaced.

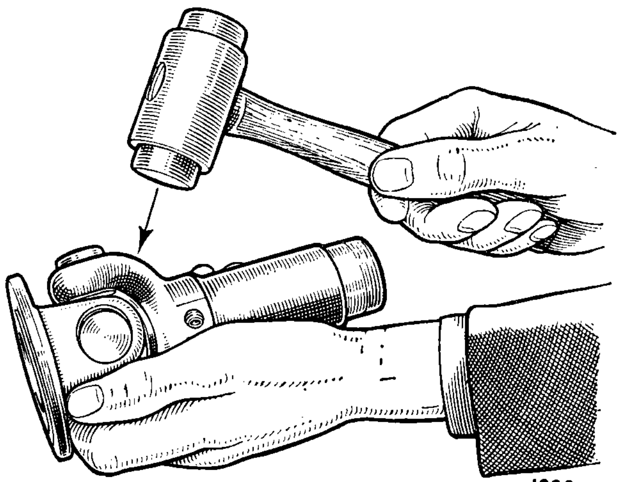


Fig. 9. Tapping the yoke to remove the bearing

Dismantling

To remove the sliding joint from the splined shaft, unscrew the dust cap and pull back the cork washer.

Clean the paint and dirt from the rings and top of bearing races. Remove all the snap rings by pinching together with a pair of pliers and prising out with a screwdriver. If a ring does not snap out of its groove readily, lightly tap end of bearing brace to relieve the pressure against the ring.

Hold the joint in the hand and with a soft nosed hammer tap the yoke lug as shown in Fig. 9.

The top bearing will gradually emerge and can finally be removed with the fingers (see Fig. 10).

If necessary, tap the bearing race from inside with a small diameter bar, taking care not to damage the bearing race (see Fig. 11).

Repeat this operation for the opposite bearing. The splined sleeve yoke or flange yoke can now be removed. Rest the two exposed trunnions on wood or lead blocks, then tap yoke with a soft nosed hammer to remove the two remaining bearing races. Wash all parts in petrol.

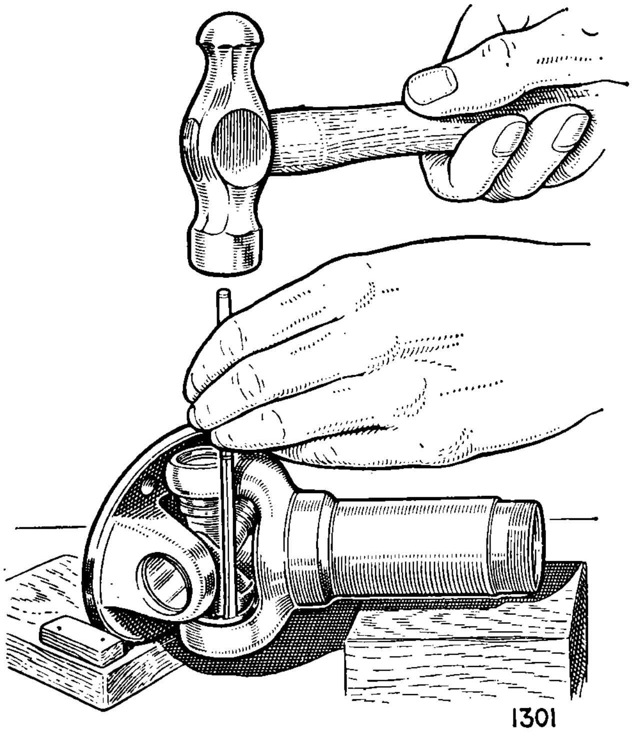


Fig. 11. Tapping out a bearing with a small diameter bar

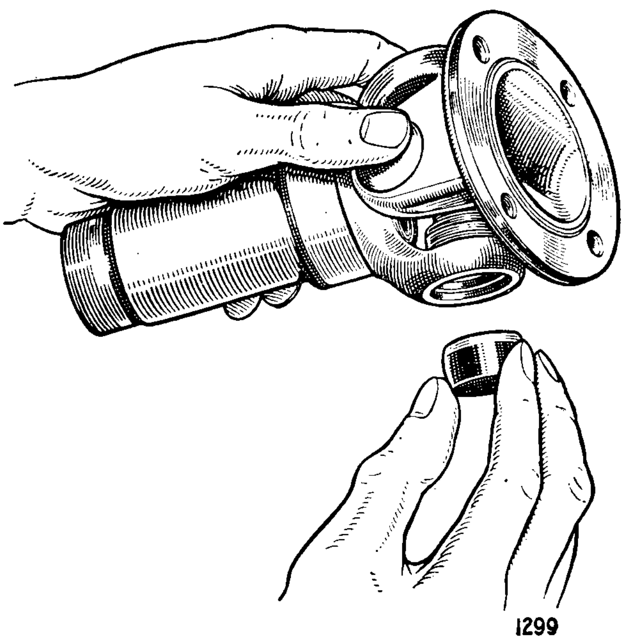


Fig. 10. Withdrawing the bearing from the universal joint

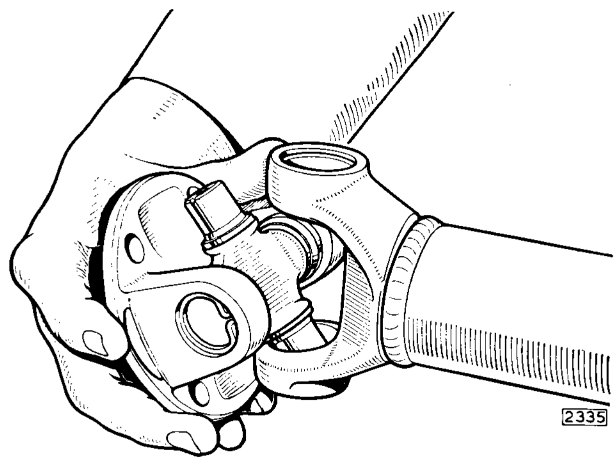


Fig. 12. Separating the universal joint yokes

Assembling

Insert the journal cross into the flange yoke, tilting it to engage in the yoke bores.

Fill each bearing bush one-third full with grease of the type recommended.

Fit one of the bearing races in the yoke bore, and using a soft, round drift about $\frac{1}{32}''$ (·8 mm.) smaller in diameter than bearing diameter, tap it into the yoke bore. Fit a circlip and ensure it is correctly located in the groove.

Assemble the opposite bearing into the yoke bore introducing the bearing from the bottom. Repeat this operation for the other two bearings, and fit new circlips.

Wipe off any superfluous grease from the last unassembled peg prior to fitting the last race.

Proceed to fit the unit package assembly at the other end in a similar manner.

Ensure that all the circlips are sitting correctly in their respective grooves. Check the races are bearing against the circlip. Check for free movement of the journals.

Important

When replacing the sliding joint it must be refitted with its fixed yoke in line with the fixed yoke at the end of the propeller shaft tube. Arrows are stamped on the two parts to facilitate alignment. (See Fig. 13).

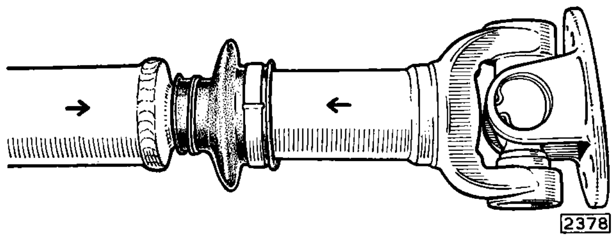


Fig. 13. Showing the arrows on the sliding joint and drive shaft

SECTION H

REAR AXLE

3·8 MARK 10 MODEL

INDEX

INDEX *(continued)*

REAR AXLE

DESCRIPTION

The rear axle unit (Fig. 1) is of the Salisbury 4.HU type. It is mounted independently from the hubs and road wheels and is fitted with the Thornton "Powr-Lok" differential unit. Short drive shafts with universal joints at each end are coupled to the axle output shafts. These output shafts also provide a mounting for the discs of the inboard mounted disc brakes.

The axle gear ratio is stamped on a tag attached to the assembly by one of the rear cover screws. The axle serial number is stamped on the underside of the gear carrier housing.

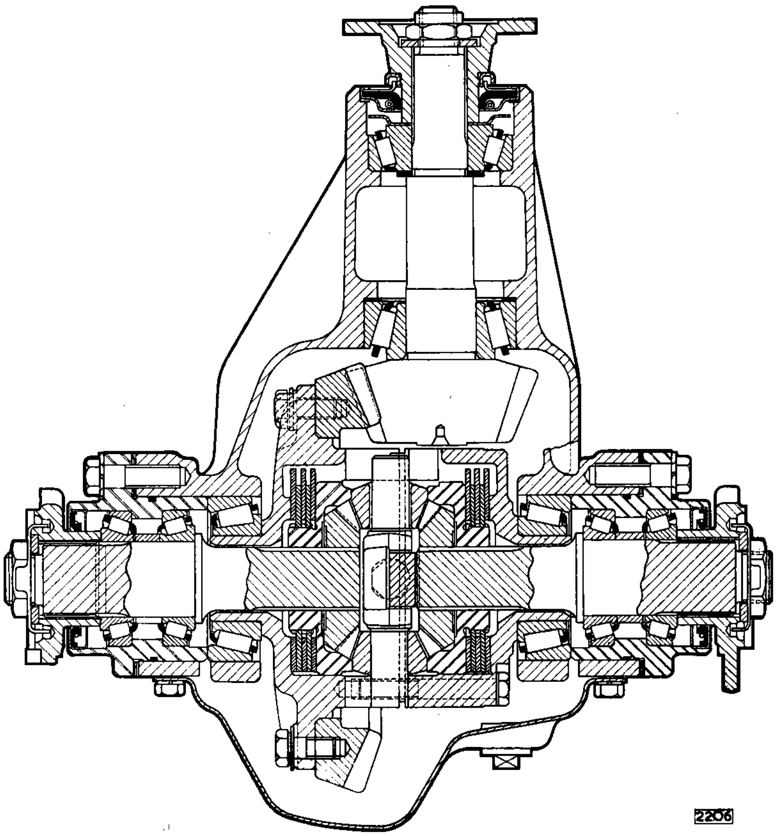


Fig. 1. Sectioned view of the rear axle unit

DATA

Output Shaft End Float	·001″ to ·003″ (·02 to ·07 mm.)
Differential Bearing Preload	·006″ to 010″ (·15 to ·25 mm.) total shim allowance
Pinion Bearing Preload	8 to 12 lbs. in. (·09 to ·14 kg. m.)
Backlash	As etched on drive gear—minimum ·004″ (·10 mm.)
Tightening Torque	
—Drive Gear Bolts	70 to 80 lbs. ft. (9·7 to 11·1 kg. m.)
—Differential Bearing Cap Bolts	60 to 65 lbs. ft. (8·3 to 9·0 kg m.)
—Pinion Nut	120 to 130 lbs. ft. (16·6 to 18·0 kg. m.)
Thornton "Powr-Lok" Differential Bolts	40 to 45 lbs. ft. (5·5 to 6·2 kg. m.)

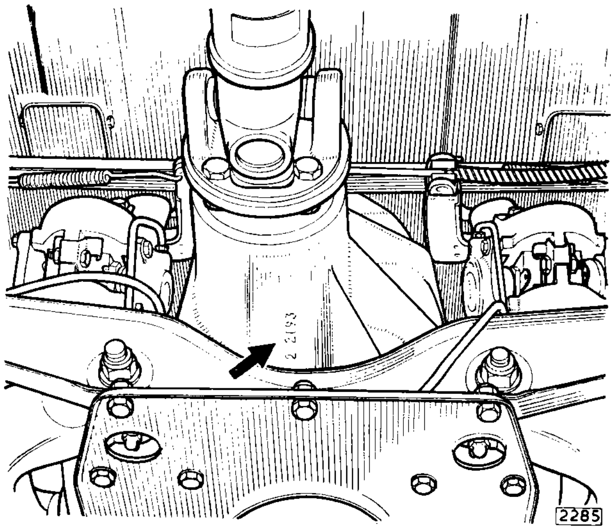


Fig. 2. Location of the axle serial number

Axle Ratios

Standard model	3·54 : 1 (46 × 13)
Automatic transmission model	3·54 : 1 (46 × 13)
Overdrive model	3·77 : 1 (49 × 13)

Reconditioning Scheme (Great Britain only)

Although full servicing instructions for the rear axle are given in this section it is recommended that, wherever possible, advantage is taken of the factory reconditioning scheme particularly in view of the intricate adjustments and the number of special tools required.

Reconditioned axles are supplied on an exchange basis and comprise an axle complete less half shafts, hubs and brake details; rear axles for overhaul should therefore be returned in this condition.

Recommended Lubricants

Component	Mobil	Castrol	Shell	Esso	B.P.	Duckham	Regent Caltex/ Texaco
Rear Axle	Mobilube GX 90	Castrol Hypoy	Spirax 90 EP	Esso Gear Oil GP 90/140	Gear Oil EP 90	Hypoid 90	Multigear Lubricant EP 90
Rear wheel bearings	Mobilgrease MP	Castrolease LM	Retinax A	Esso Multi-purpose Grease H	Energrease L2	LB10	Marfak All purpose

Capacities

Imperial pints	U.S. pints	Litres
2¾	3¼	1·5

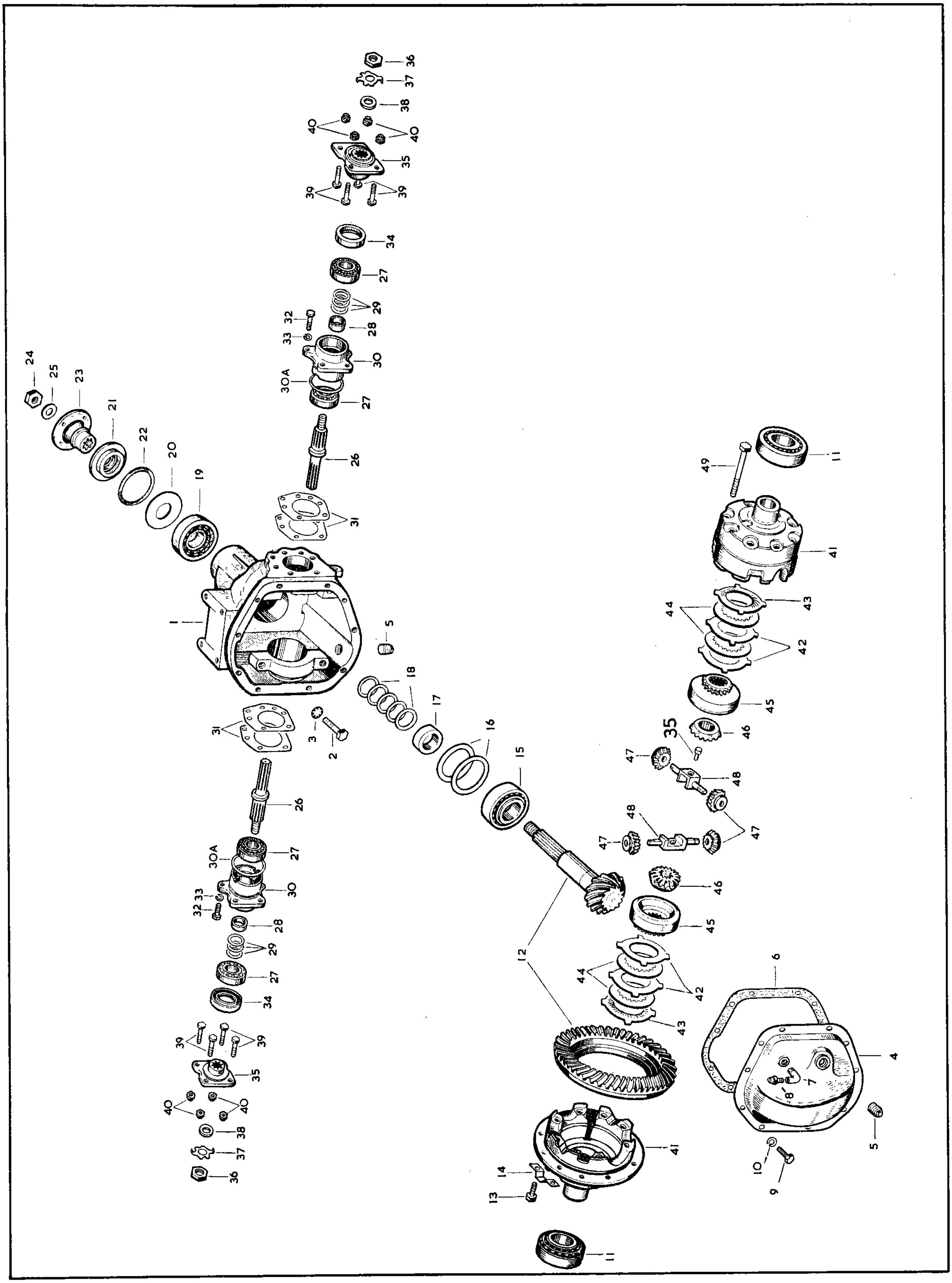


Fig. 3. Exploded view of the axle unit

1. Final drive unit casing
2. Setscrew
3. Lockwasher
4. Cover plate
5. Filler and drain plugs
6. Gasket
7. Elbow
8. Breather
9. Setscrew
10. Spring washer
11. Roller bearing
12. Crownwheel and pinion
13. Setscrew
14. Lock strap
15. Roller bearing
16. Shim
17. Distance washer
18. Shim
19. Roller bearing
20. Oil slinger
21. Oil seal
22. Pinion seal gasket
23. Companion flange assembly
24. Nut
25. Washer
26. Drive shaft
27. Roller bearing
28. Spacing collar
29. Shim
30. Bearing housing

30a. 'O' ring

31. Shim
32. Bolt
33. Lockwasher
34. Oil seal
35. Drive shaft flange
36. Nut
37. Tab washer
38. Special washer
39. Bolt
40. Self-locking nut
41. Differential case
42. Friction plates (flat)
43. Friction plate (dished)
44. Friction disc
45. Side gear ring
46. Side gear
47. Pinion mate gear
48. Shaft
49. Bolt

ROUTINE MAINTENANCE

EVERY 2,500 MILES (4,000 km)

Checking Rear Axle Oil Level

Check the level of the oil in the rear axle with the car standing on level ground.

A combined filler and level plug is fitted in the rear of the axle casing accessible from underneath the car. Clean off any dirt from around the plug before removing it.

The level of the oil should be to the bottom of the filler and level plug hole; use only HYPOID oil of the correct grade and since different brands may not mix satisfactorily, draining and refilling is preferable to replenishing if the brand of oil in the axle is unknown.

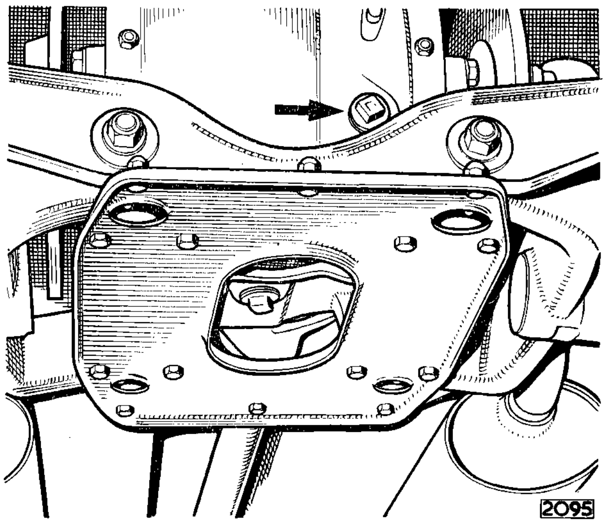


Fig. 4. Rear axle level and filler plug

Rear Axle Half Shafts

The two rear axle half shafts are fitted with needle roller bearing universal joints which should be lubricated with the recommended grade of grease through the nipples provided. One nipple is situated at each joint.

Later cars are fitted with rear axle half shafts having "sealed for life" universal joints which require no periodic lubrication.

EVERY 10,000 MILES (16,000 km)

Rear Wheel Bearings

A hole in the hub bearing housing for lubrication of the wheel bearings is accessible after removal of the wheel. Clean off the area around the dust cap to ensure that no dirt enters the hub. Prise out the cap and inject the recommended grade of grease through the hole until no more will enter. If a pressure gun is used take care not to build-up pressure in the hub as the grease may escape past the oil seal. Refit the dust cap.

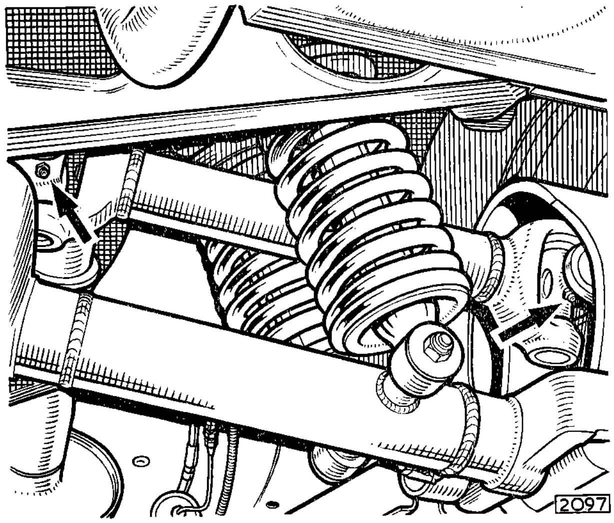


Fig. 5. Half-shaft universal joint grease nipples

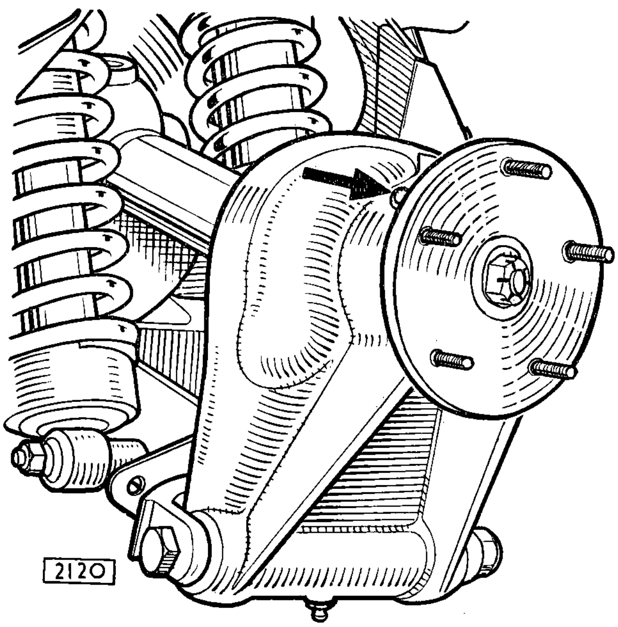


Fig. 6. Rear wheel hub bearing grease cap

Changing the Rear Axle Oil

The draining of the rear axle should be carried out at the end of a run when the oil is hot and will therefore flow more freely. The drain plug is situated in the base of the differential casing.

After the oil has drained, replace the drain plug and refill the rear axle with the recommended grade of oil after removal of the combined filler and level plug situated in rear cover.

The level of the oil should be to the bottom of the filler and level plug hole when the car is standing on level ground.

Use only HYPOID oil of the correct grade.

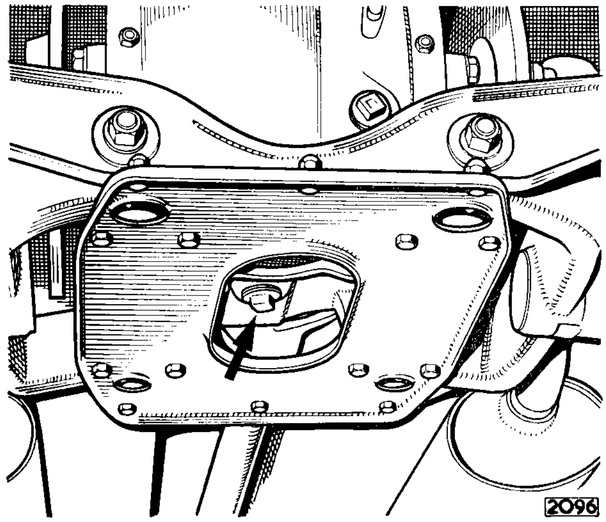


Fig. 7. Rear axle drain plug

THE AXLE UNIT

REMOVAL

The following removal and refitting operations are described assuming the rear suspension is removed from the car. If it is possible for the operations to be carried out with the rear suspension in position on the car the fact will be noted in the text.

Remove the rear suspension assembly from the car (as described in section K "Rear Suspension"). Invert the suspension assembly on a bench and remove the 14 bolts securing the tie plate. Remove the tie plate and disconnect the four hydraulic damper and spring units. Remove the four self-locking nuts securing the half shaft universal joint to the brake disc and axle output shaft flange. Owing to heat dissipation from the brake disc, it is most important that the locknuts fitted on the output shaft flange studs are of the metal and not nylon self-locking type. Withdraw the half shaft from the bolts noting the number of camber shims. Remove one self-locking nut from the inner wishbone fulcrum shaft and drift out the shaft. Remove the hub, halfshaft, wishbone and radius arm assembly and repeat the procedure at the other side. Disconnect the hydraulic feed pipes at the brake calipers. Turn the suspension assembly over and remove the locking wire from the four differential

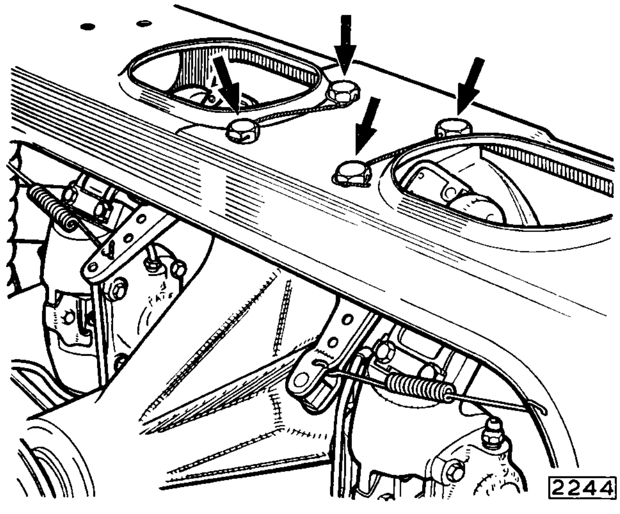


Fig. 8. Showing the top axle casing mounting bolts

carrier mounting bolts. Unscrew the mounting bolts and remove the cross beam from the differential carrier by tilting forward over the nose of the pinion.

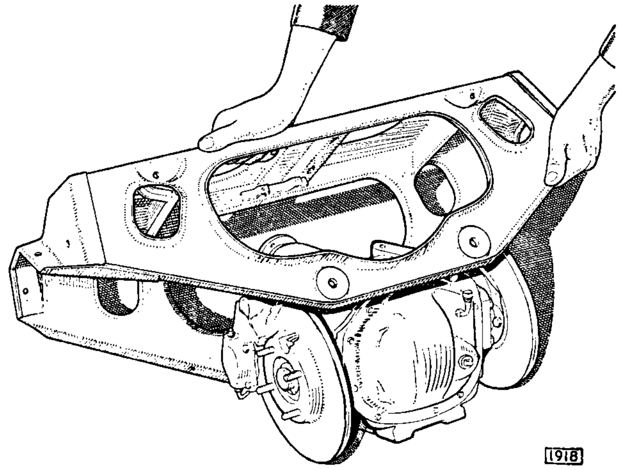


Fig. 9. Removing the cross beam from the axle unit

REFITTING

Refitting is the reverse of the removal procedure, it should be noted however, that the inner wishbone fulcrum shaft self-locking nut should be tightened to a torque of 55 lbs. ft. (7·6 kg. m.). The four differential carrier mounting bolts on the top of the cross beam should be tightened to a torque of 75 lbs. ft. (10·4 kg. m.).

THE REAR HUBS

REMOVAL

It is not necessary to remove the rear suspension unit from the car to carry out this operation.

Jack up and support the rear end of the car and remove the appropriate road wheel. Withdraw the split pin and remove the castellated nut and washer from the halfshaft. Using the extractor, Special Tool No. J.D.1C as shown in Fig. 10, withdraw the hub and hub carrier assembly from the splined end of the halfshaft retaining the inner oil seal track and end float spacer. Remove the lower wishbone outer fulcrum shaft (as described in Section K "Rear Suspension") and remove the hub and hub carrier assembly.

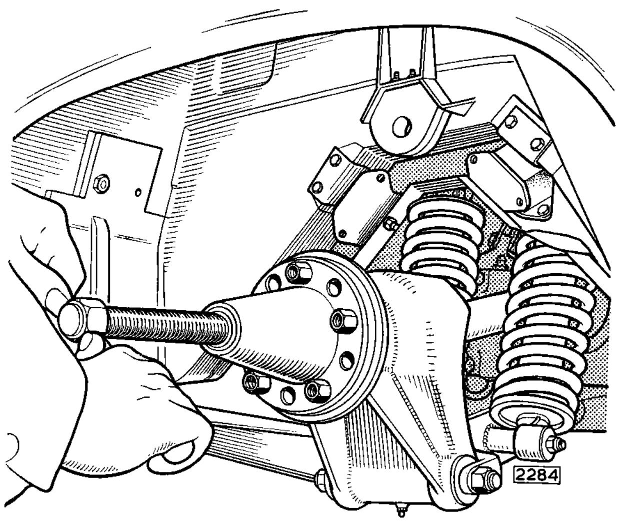


Fig. 10. Removing the rear hub with the aid of the extractor (Churchill Tool No. J.D.I.C.)

Note: Since it is necessary to press the hub assembly onto the halfshaft before refitting to the rear suspension assembly, remove the halfshaft as follows. Remove the front hydraulic damper and spring unit (as described in Section K "Rear Suspension"). Remove the four steel type self-locking nuts securing the halfshaft inner universal joint to the axle shaft output flange and brake disc. Withdraw the halfshaft from the bolts noting the number of camber shims fitted.

DISMANTLING

Invert the hub carrier so that the inner hub bearing is at the top and press out the hub (Fig. 11) with the outer bearing inner race and the outer oil seal track in place, discarding the outer oil seal. Remove the three setscrews and withdraw the water deflector. Prise out the inner oil seal and remove the inner bearing inner race. Drift out the outer races of the inner and

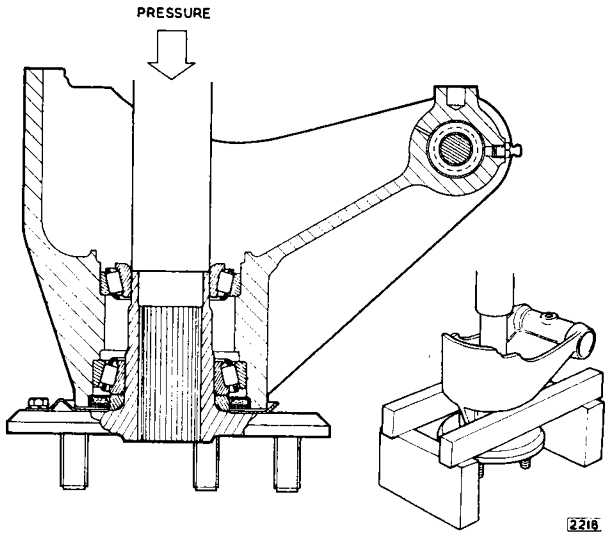


Fig. 11. Pressing the hub from the hub carrier

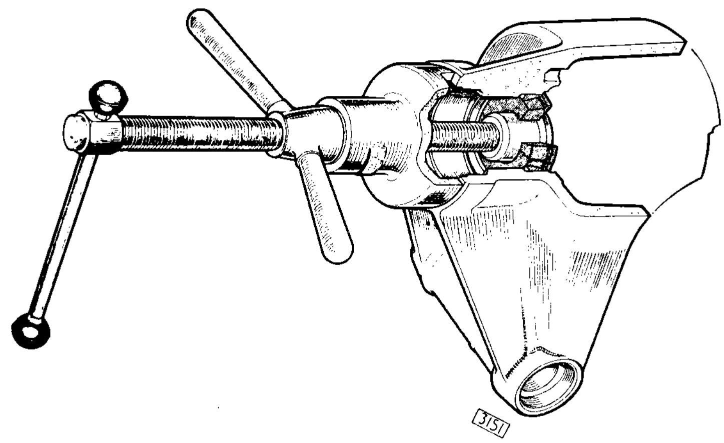


Fig. 13. Replacing the hub bearing outer races using Churchill Tool No. J.20A with adaptors J.20 A-1

outer bearings if necessary. Withdraw the outer bearing inner race with a suitable extractor.

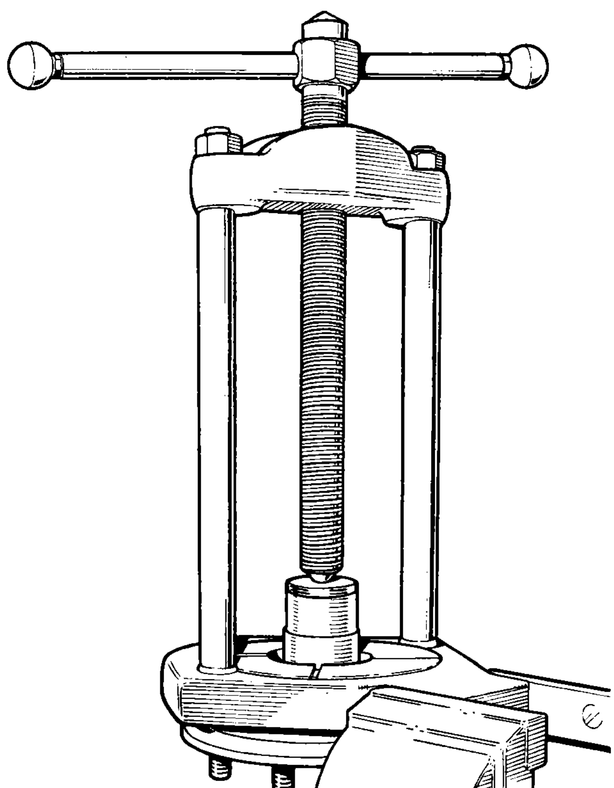


Fig. 12. Removing the inner race from the hub using Churchill Tool No. SL.14 with adaptor SL.14-7

ASSEMBLING

If new bearings are to be fitted, press new inner and outer bearing outer races into the hub carrier ensuring that they seat correctly in their recesses.

With the hub carrier held so that the outer bearing will be at the top, place the outer bearing inner race in

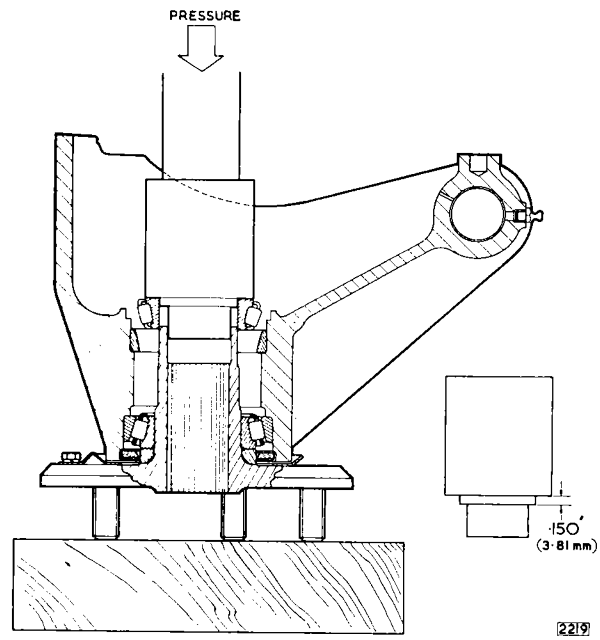


Fig. 14. Pressing in the hub inner bearing inner race using the master spacer (Churchill Tool No. J.15)

position and press the outer oil seal into its recess. Fit the water deflector and press the hub with the outer oil seal track in position into the outer bearing inner race until the hub is fully home.

Hub Bearing End Float

Hold the hub and hub carrier vertically in a hand press with the inner end of the hub uppermost. Place the inner bearing inner race on the hub, fit the master spacer (Special Tool No. J.15) into the race and press the race onto the hub (Fig. 14) until the master spacer contacts the hub. This will ensure a certain amount of end float. Remove the hub and hub carrier from the hand press and secure in a vice in order to measure the end float. With the inner end of the hub uppermost, and the master spacer in position as before, fit a dial gauge (Special Tool No. J.13) to the hub as shown in Fig. 15. Tap the hub carrier downwards, zero the dial gauge and using two screwdrivers or similar levers between the hub and hub carrier, move the hub carrier upwards to its fullest extent. Note the reading on the dial gauge. Having determined the measured end float, a spacer must be fitted in place of the special

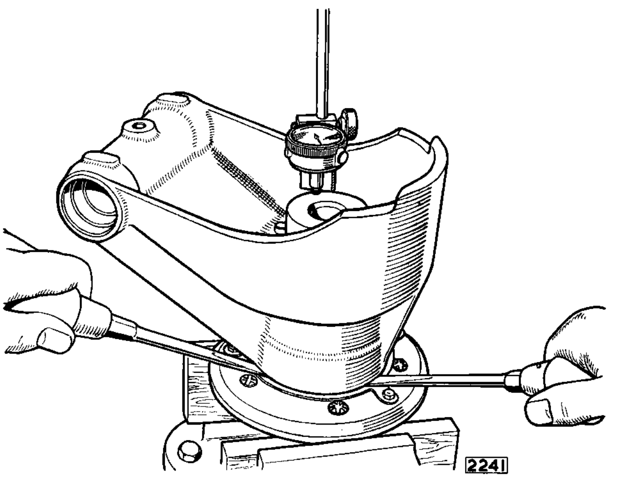


Fig. 15. Checking the hub bearing end float with a dial tester indicator (Churchill Tool No. J.13)

collar to give an end float of ·002″—·006″ (·051—·152 mm). Spacers are supplied in thicknesses of ·109″—·151″ (2·77—3·87 mm.) in steps of ·003″ (·076 mm.) as shown in the following table:

Spacer Letter	Thickness inches	mm.
A	·109	2·77
B	·112	2·85
C	·115	2·92
D	·118	3·00
E	·121	3·07
F	·124	3·15
G	·127	3·23
H	·130	3·30
J	·133	3·38
K	·136	3·45
L	·139	3·53
M	·142	3·61
P	·145	3·68
Q	·148	3·75
R	·151	3·87

For example, assume the end float measured to be ·025″ (·64 mm.). Subtract the nominal end float of ·004″ (·10 mm.) from the measured end float giving ·021″ (·53 mm.). Since the Master Spacer is ·150″ (3·81 mm.) thick, the thickness of the spacer to be fitted will be ·150″—·021″ i.e. ·129″ (3·28 mm.). The nearest spacer is ·130″ (3·30 mm.) so a letter H spacer should be fitted.

When the hub assembly and halfshaft have been refitted to the rear suspension the end float should be checked using the dial indicator as shown in Fig. 17.

Fitting the Hub Assembly to the Halfshaft

To fit the hub assembly to the halfshaft it will be necessary to use a hand-press (see Fig. 16). Ensure

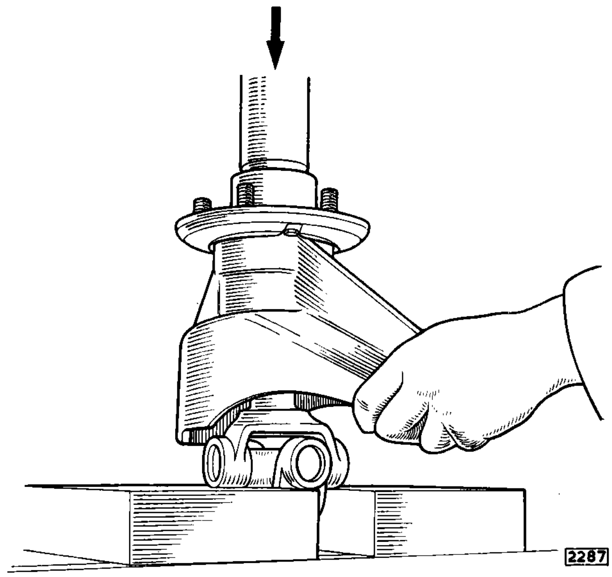


Fig. 16. Fitting the hub to the halfshaft using a press

that both the splines of the halfshaft and the hub are free of grease by using a suitable solvent. Place the inner oil seal track and end float spacer on the half-shaft. Apply a drop or two of "Loctite" (available in 10 c.c. bottles, Part No. 9035) to the halfshaft splines for about an inch from the threaded end using a small paint brush to ensure even spreading. Only use "Loctite" sparingly as no additional benefit will be achieved by using large amounts. Introduce the half-shaft into the hub and engage the splines. Place the assembly on the hand-press and press the hub onto the halfshaft. Fit the washer and castellated nut, tighten to 140 lbs. ft. (19·3 kg. m.) torque and fit the split pin.

Note: To obtain the best results from the "Loctite" sealant, the joint should be allowed to set for 4 to 12 hours, that is, this period should be allowed to elapse before the car is run.

REFITTING

The hub assembly and halfshaft are refitted to the rear suspension as described under "Halfshaft Re-fitting."

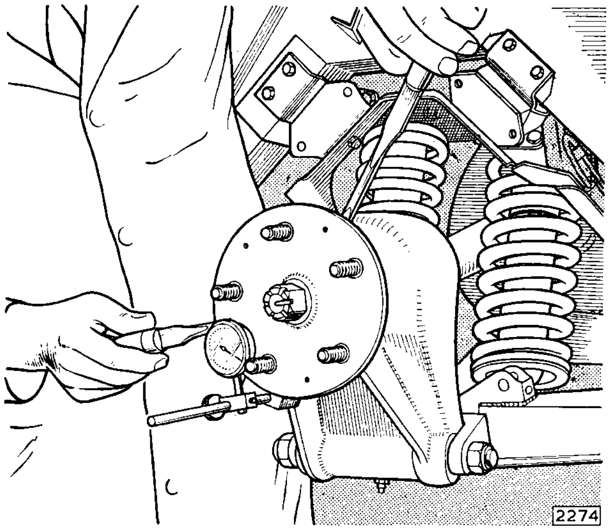


Fig. 17. Checking the hub bearing end float when in position (Churchill Tool No. J.13)

THE HALFSHAFTS

REMOVAL

Proceed as described under Rear Hub Removal until the hub assembly can be withdrawn. Remove the front hydraulic damper and spring unit (as described in Section K "Rear Suspension"). Remove the four steel type self-locking nuts securing the halfshaft inner universal joint to the axle output shaft flange and brake disc. Withdraw the halfshaft from the bolts noting the number of camber shims fitted.

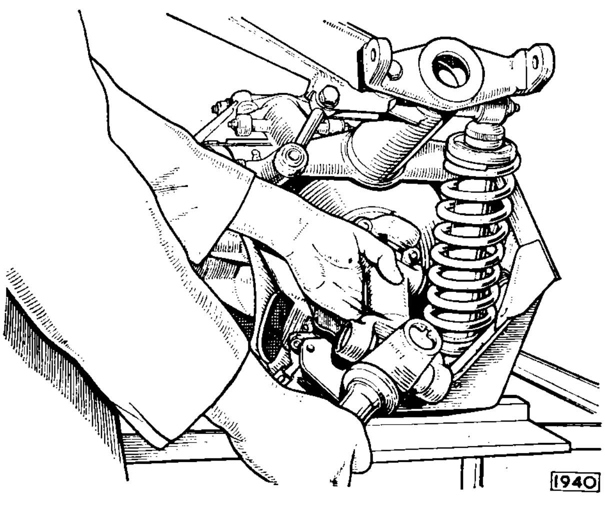


Fig. 18. Withdrawing the halfshaft

REFITTING

Refit the hub assembly to the halfshaft as described in the Rear Hub section and proceed as follows.

Replace the camber shims and place the halfshaft and hub into position with the halfshaft inner universal joint over the four bolts. Fit the four steel-type self-locking nuts and tighten up. Refit the front hydraulic damper and spring unit (as described in Section K "Rear Suspension"). Refit the lower wishbone outer fulcrum shaft (as described in Section K "Rear Suspension"). If the halfshaft has been renewed, it will be necessary to refer to Section K "Rear Suspension" for checking the wheel camber.

THE UNIVERSAL JOINTS

Examine and Check for Wear

The part most likely to show wear after long usage are the bearing races and spider journals. Should looseness in the fit of these parts, load markings or distortion be observed, they should be renewed as a unit, as worn needle bearings used with a new spider journal or new needle bearings with a worn spider journal will wear more rapidly, making another replacement necessary in a short time.

It is essential that the bearing races are a light drive fit in the yoke trunnion.

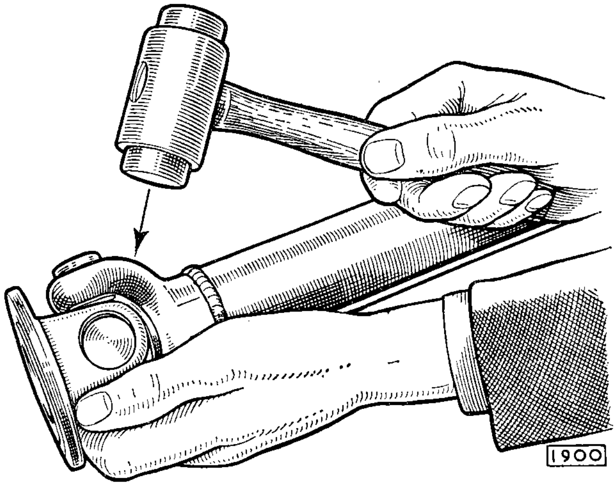


Fig. 19. Tapping the yoke to remove the bearing

In the rare event of wear having taken place in the yoke cross holes, the holes will have become oval and the yokes must be replaced.

UNIVERSAL JOINTS (Later Cars)

Later cars are fitted with rear half shaft universal joints with improved sealing for the needle roller bearings. This seal takes the form of a rubber gaiter which fits into an angular recess in the needle bearing housing.

	R.H. Drive	*L.H. Drive*
Commencing chassis number	307612	353412

On cars with the above chassis numbers and onwards, shrouds are fitted over the half shaft universal joints.

Dismantling

Clean the paint and dirt from the rings and top of bearing races. Remove all the snap rings by pinching together with a pair of pliers and prising out with a screwdriver. If a ring does not snap out of its groove readily lightly tap the end of the bearing race to relieve the pressure against the ring.

Hold the joint in the hand and with a soft nosed hammer tap the yoke lug as shown in Fig. 19.

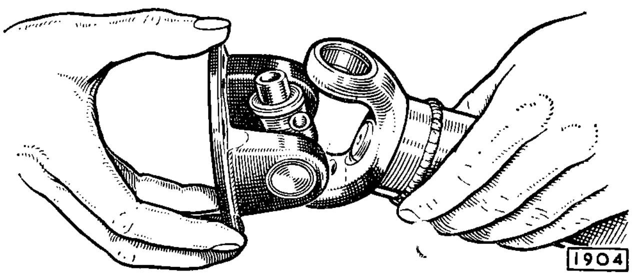


Fig. 20. Separating the universal joint yokes

The bearing will gradually emerge and can finally be removed with the fingers (see Fig. 21).

If necessary tap the bearing race from inside with a small diameter bar taking care not to damage the bearing race (see Fig. 22).

Repeat the operation for the opposite bearing.

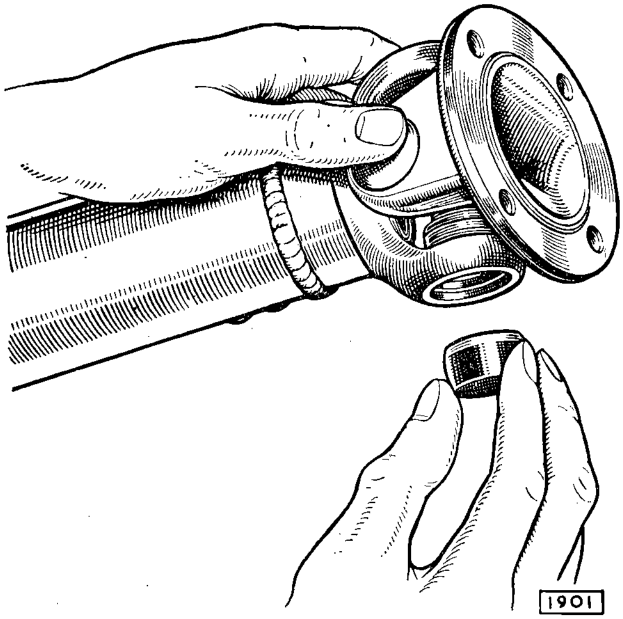


Fig. 21. Withdrawing the bearing from the universal joint

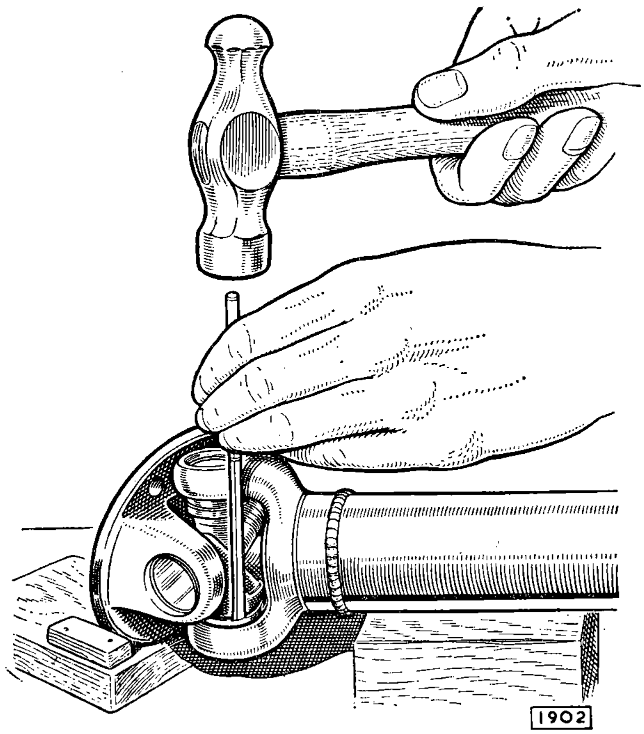


Fig. 22. Tapping out a bearing with a small diameter bar

The flange yoke can now be removed. Rest the two exposed trunnions on wood or lead blocks, then tap the yoke with a soft nosed hammer to remove the two remaining bearing races. Wash all parts in petrol.

Assembling

Insert the journal in the yoke holes and using a soft round drift with a flat face $\frac{1}{32}''$ (·8 mm.) smaller in diameter than the hole in the yoke, tap the bearings into position. Repeat this operation for the other three bearings. Fit new snap rings and ensure that they are correctly located in their grooves. If the joint appears to bind, tap lightly with a wooden mallet to relieve any pressure of the bearings on the end of the journal.

Should any difficulty be encountered when assembling the needle rollers in the housing, smear the wall of the race with vaseline. It is advisable to install new cork gaskets and gasket retainers on the spider assembly using a tubular drift.

THE DIFFERENTIAL UNIT

The Thornton "Powr-Lok" limited slip differential is fitted as standard.

Warning

When a car is equipped with a Thornton "Powr-Lok" differential the engine must NOT be run with the car in gear and one wheel off the ground otherwise, owing to the action of the differential, the car may drive itself off the jack or stand.

If it is desired to turn the transmission by running the engine with the car in gear **both** wheels must be jacked up clear of the ground.

DESCRIPTION

The limited slip differential has two pinion shafts with two mates to each shaft. The pinion shafts are mounted at right angles to each other but do not make contact at their intersection. Double ramps with flat surfaces at each end of the pinion shafts, mate with similar ramps in the differential case. Clearance in the differential case permits slight peripheral movement at the ends of the pinion shafts.

When a driving force is applied to the differential case, the pinion shafts, pinion mates and differential side gears splined to the axle shafts, rotate as a unit. Resistance to turning at the wheel forces the pinion shafts to slide up the differential case ramps, pushing the pinion shafts and side gears apart. As the pinion shafts move apart they apply load to the clutch plates thus restricting turning between the axle shafts and the differential case. Both axle shafts have now become clutched to the differential case to a varying degree dependent upon the amount of torque transmitted. This in effect locks the axle shafts to the differential case, in the normal straight ahead driving position, which reduces spinning of either rear wheel should it leave the road or encounter poor traction such as ice, snow, sand, loose gravel or oil patches.

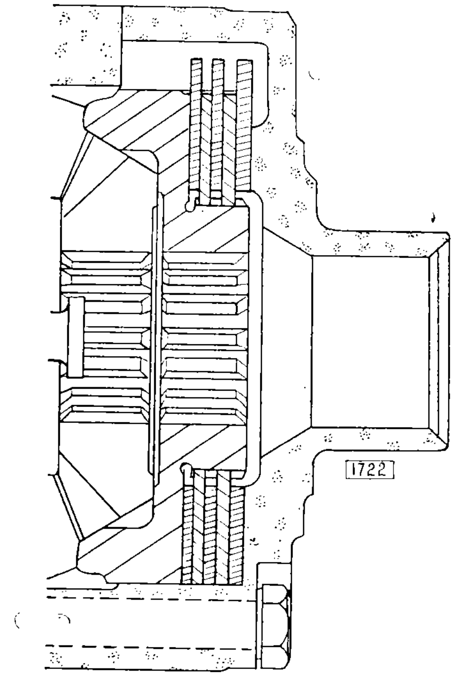


Fig. 23. Sectioned view showing the friction discs and plates

Due to the lateral movement of the pinion shafts in the differential case, a little more backlash may be apparent in a limited slip rear axle. Slight chatter may also occur when one wheel is on a slippery surface, this is due to surge torque.

PRINCIPLE OF OPERATION

The conventional differential divides the load equally between both driving wheels. In this connection, it should be remembered that the conventional differential will always drive the wheel which is easiest to turn. This is a definite disadvantage under adverse conditions of driving where the traction of one wheel is limited.

The main purpose of the limited slip differential is to overcome this limit-action. Many times the torque

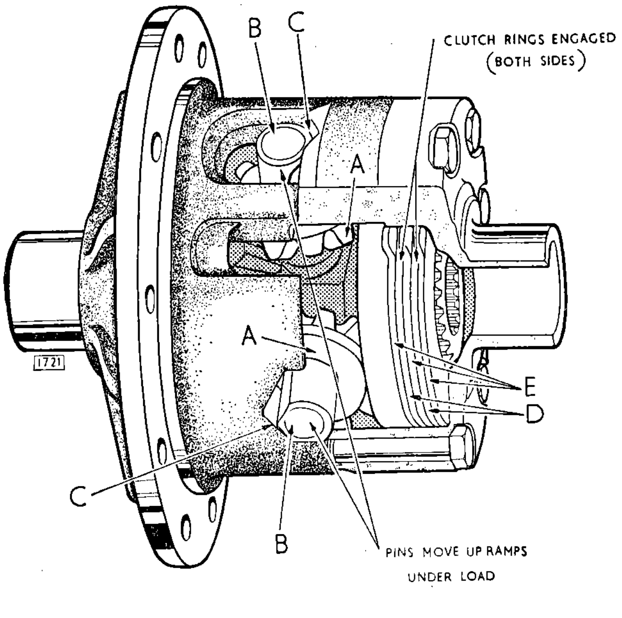


Fig. 24

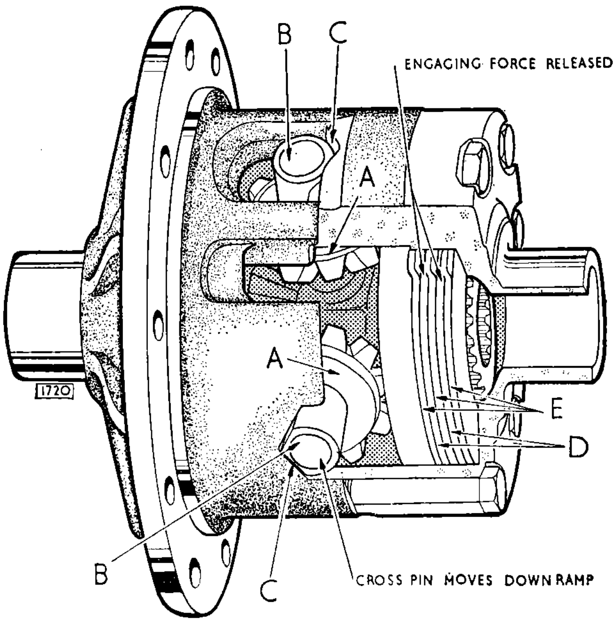


Fig. 25

of the slipping wheel is provided to the driving wheel, thus permitting improved operation under all conditions of driving. The torque is transmitted from the differential case to the cross pins and differential pinions to the side gears in the same manner as torque is applied in the conventional differential.

The driving forces moves the cross pins B, Fig. 24, up the ramp of the cam surfaces C, applying a load to the clutch rings D and restricts turning of the differential through the friction clutches E. This provides a torque ratio between the axle shafts which is based on the amount of friction in the differential and the amount of load that is being applied to the differential.

When turning a corner, this process is in effect partially reversed. The differential gears become a planetary set, with the gear on the inside of the curve becoming the fixed gear of the planetary. The outer gear of the planetary over-runs as the outside wheel on the curve has a further distance to travel. With the outer gear over-running and the inner gear fixed, the pinion mates A, Fig. 25, are caused to rotate, but inasmuch as they are restricted by the fixed gear, they first must move pinion mate shafts B back down the cam surface C relieving the thrust loads on the plate clutches E. Thus when turning the corner, the differential, for all practical purposes, is similar to a conventional differential and the wheels are free to rotate at different speeds.

On straight driving, the clutches are engaged and thus prevent momentary spinning of the wheels when leaving the road or when encountering poor traction. In turning a corner, the load is relieved from the clutch surface so that wear is reduced to a minimum.

Power Flow in Forward Driving

Under normal starting and operating conditions the torque or power flow in both the limited slip and conventional type differential is transmitted equally to each axle shaft and wheel. However, when sudden patches of ice, loose gravel or oil are encountered, the limited slip differential will not permit the wheel with the lesser traction to spin, gain momentum and swerve the car when a dry surface is regained.

Power Flow in Turns

In turning, the limited slip differential gives normal differential action and permits the outer wheel to turn faster than the inner wheel. At the same time the differential applies the major driving force to the inside rear wheel, improving stability and cornering.

Power Flow with Poor Traction

When traction conditions under the rear wheels are dissimilar, the driving force with an ordinary differential is limited by the wheel with the poorer traction. Typically, in this situation, the wheel with the poorer traction spins and the vehicle remains immobile. The limited slip differential enables the wheel with the better traction to apply the major driving force to the road.

Action on Rough Roads

Bumps do not adversely affect wheel action when wheels are controlled by the limited slip differential. The free wheel does not spin and gain momentum. There is no sudden wheel stoppage to cause car swerve or tyre scuffing and wheel hop is reduced.

THE OUTPUT SHAFTS

Removal

Remove the brake caliper and disc as described under "Removing the Differential Assembly from the Carrier."

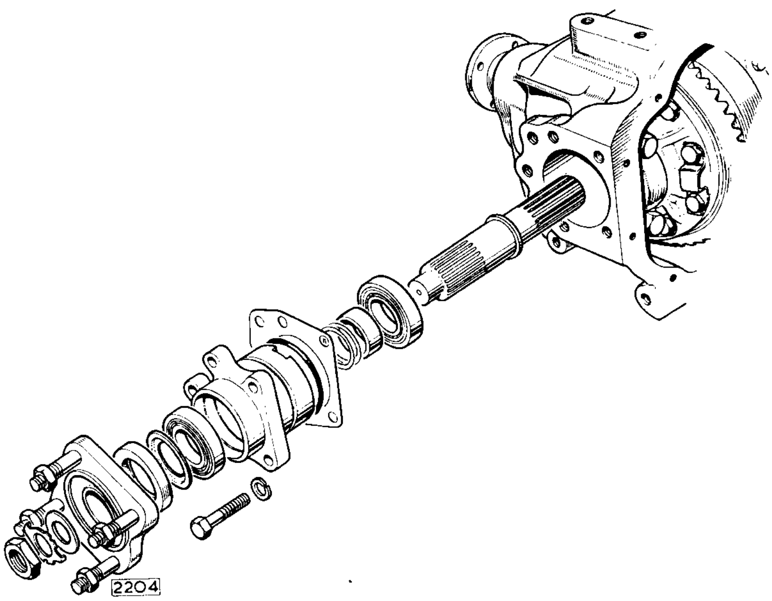


Fig. 26. Exploded view of an output shaft assembly

Unscerw and remove the five bolts securing the output shaft bearing housings, bearings and adjustment shims, noting the number of pre-load shims.

Dismantling

Unlock the tab washer and remove the nut, tab washer and plain washer. Press the output shaft with the inner bearing inner race, spacing sleeve and endfloat shims in position through the flange and bearing housing. If it is necessary to replace the bearings, remove the endfloat shims and spacing collar, and using a suitable extractor withdraw the inner bearing inner race from the shaft. Drift out the inner bearing outer race and using a suitable sized tube on the outer race, press out the complete outer bearing and the oil seal. If it is necessary to reset the output shaft endfloat, withdraw the oil seal and the outer bearing inner race.

Assembling

Press in the new inner and outer bearing outer races ensuring that they are fully home in the recesses. The races must be fitted so that the bearings will be opposed. Press the inner bearing inner race on to the shaft ensuring that it is fully home against the shoulder and that the race is fitted the correct way round. Fit the spacing sleeve and the endfloat shims. Fit the output shaft into the bearing housing and place the outer bearing inner race on the shaft from the opposite end. Do not fit the oil seal at this stage. Fit the output shaft flange with the plain washer and a new tab washer, fit the nut and tighten.

Check the endfloat with a dial gauge, this should be ·001″—·003″ (·025—·076 mm.). Should adjustment be necessary remove the flange nut, tab and plain washers and withdraw the flange and outer bearing inner race. Add or remove shims to obtain the correct clearance. Adding shims increases the endfloat and removing shims decreases it. When the correct endfloat is obtained replace the outer bearing inner race and press a new oil seal into position, flush with the casing and with the lip inwards. Refit the flange and the plain tab washers ensuring that the two tags on the tab washer locate in the holes on the flange. Tighten the nut and turn one or more tabs up securing the nut. Ensure that these tabs lie as flat on the nut as possible.

Refitting

See "Drive Gear Mesh Adjustment and Differential Bearing Preload Setting," page H.23.

REMOVING THE DIFFERENTIAL ASSEMBLY FROM THE CARRIER

Remove the axle as described on page H.9.

Knock up the locking tabs and unscrew the brake caliper mounting bolts.

Remove the caliper noting the number of small round shims between the caliper and the shims and differential carrier. Remove the brake disc.

Drain the lubricant from the gear carrier and remove the gear carrier rear cover. Flush out the unit thoroughly so that the parts can be carefully inspected.

Unscrew the five bolts securing the output shaft bearing housing. Withdraw the output shaft, bearing housing, bearings and adjustment shims noting the number of preload shims.

Repeat for the other drive shaft. Remove the two bolts holding each differential bearing cap and withdraw the differential unit.

Pinion Removal

Remove the pinion nut and washer. Withdraw the universal joint companion flange with a suitable puller. PRESS the pinion out of the outer bearing. It is important that the pinion should be pressed out, not driven out, to prevent damage to the outer bearing.

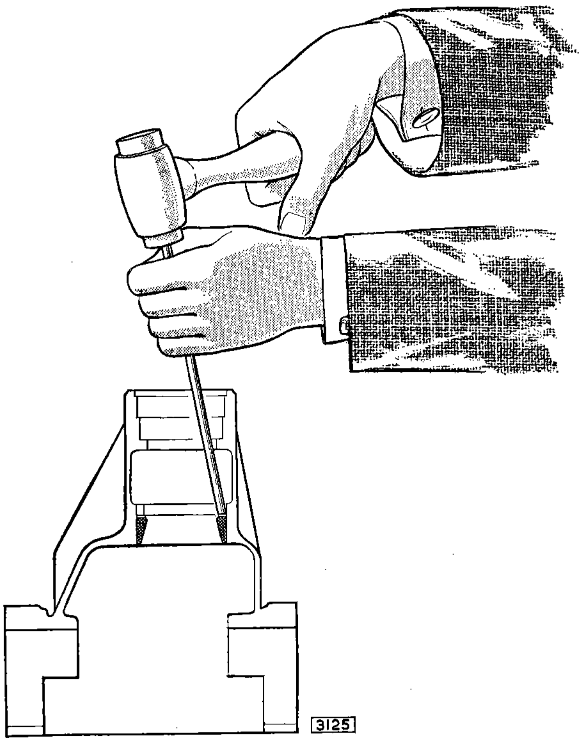


Fig. 27 Driving out the pinion bearing outer race.

The pinion having been pressed from its outer bearing may now be removed from the differential casing.

Note: Keep all shims intact.

Remove the pinion oil seal together with the oil slinger and outer bearing cone. Examine the outer bearing for wear and, if replacement is required, it is possible to drive out the cup, the shoulder locating the bearing being recessed to facilitate this operation. Remove the pinion inner bearing outer race as shown in Fig. 27 if the bearing requires replacement or adjustment of the pinion setting is to be undertaken. Take care of the shims fitted between the bearing cup and the

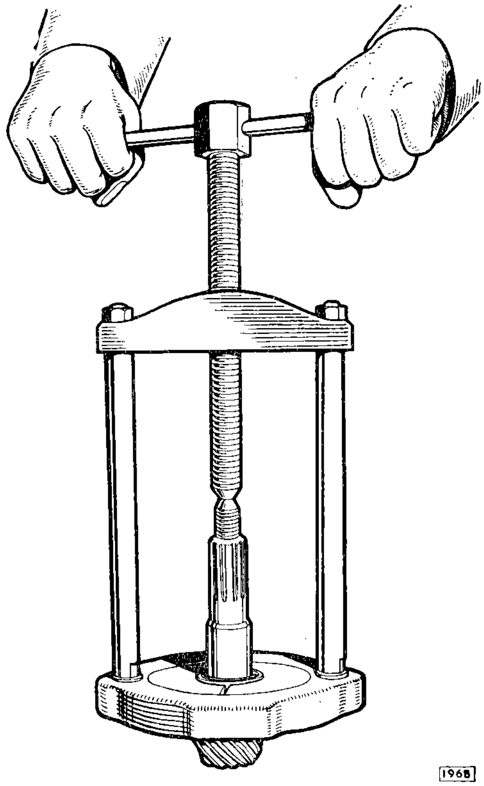


Fig. 28. Withdraw the pinion inner bearing race using Churchill Tool No. SL.14 with adaptor SL. 14-3.

housing abutment face. If the inner bearing is to be replaced it may be driven out but the correct service tool should be used when the bearing is removed in order to carry out pinion setting adjustment.

DISMANTLING THE DIFFERENTIAL UNIT

Knock back the locking tabs from the drive gear securing setscrews. Remove the securing setscrews and tap the drive gear from the differential case with a rawhide mallet.

In the absence of any mating or aligning marks as shown in Fig. 32, scribe a line across the two half casings to facilitate assembly.

Remove the eight bolts (9, Fig. 31) securing the two halves of the differential casing.

Split the casing and remove the clutch discs (3) and plates (2 and 4) from one side.

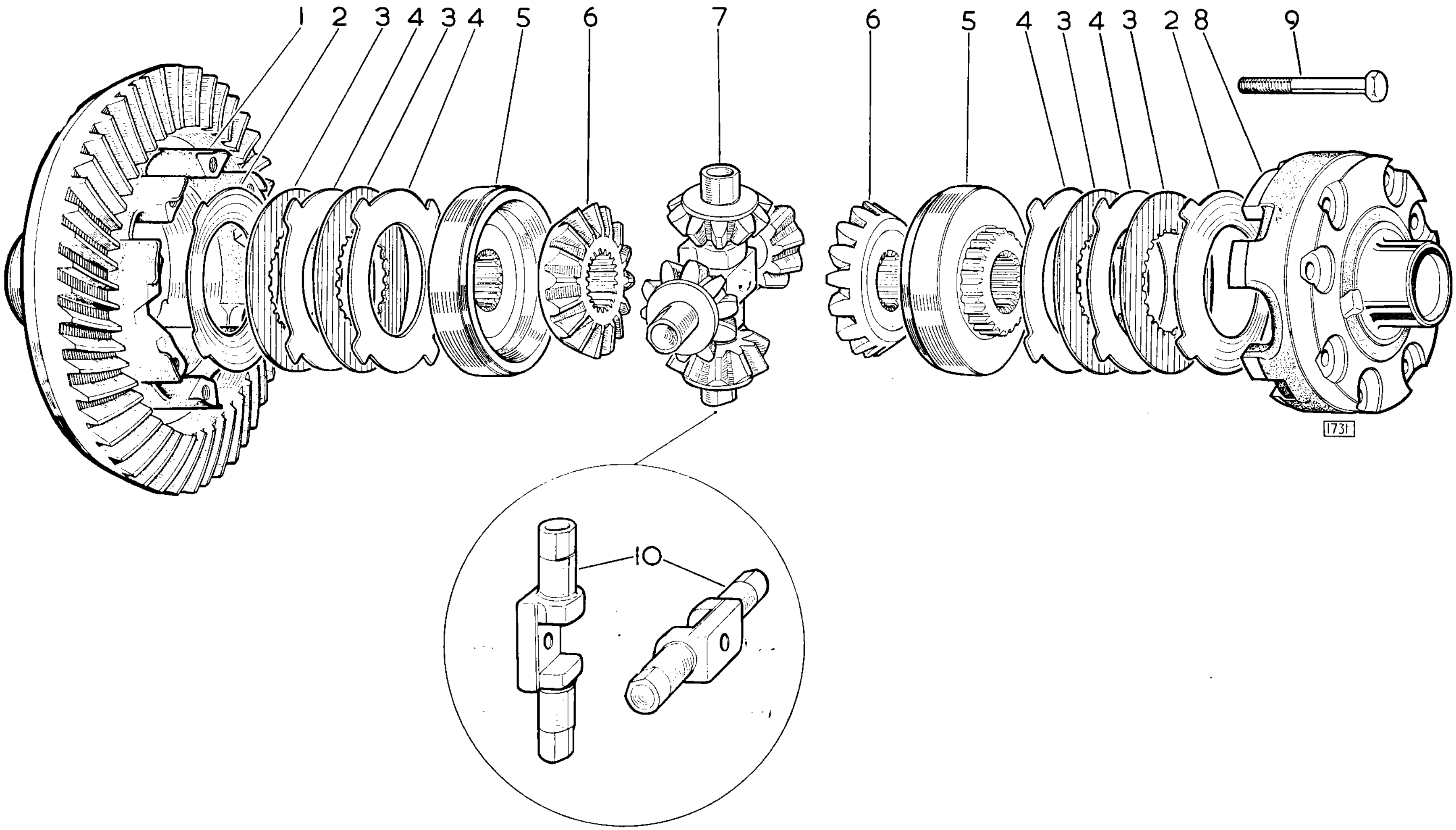
Remove the differential side gear ring (5).

Remove the pinion side gear (6) and the pinion mate cross shafts (7) complete with the pinion mate gears.

Separate the cross shafts (10).

Remove the remaining side gear and the side gear ring.

Extract the remaining clutch discs and plates.



1. Differential casing—flange half.
2. Dished clutch friction plate.
3. Clutch friction disc.
4. Clutch friction plate.
5. Side gear ring.
6. Bevel side gear.
7. Bevel pinion mate gear.
8. Differential case—button half.
9. Differential case—bolt.
10. Pinion mate cross shaft.

Fig. 29. Exploded view of the Thornton "Powr-Lok" Differential

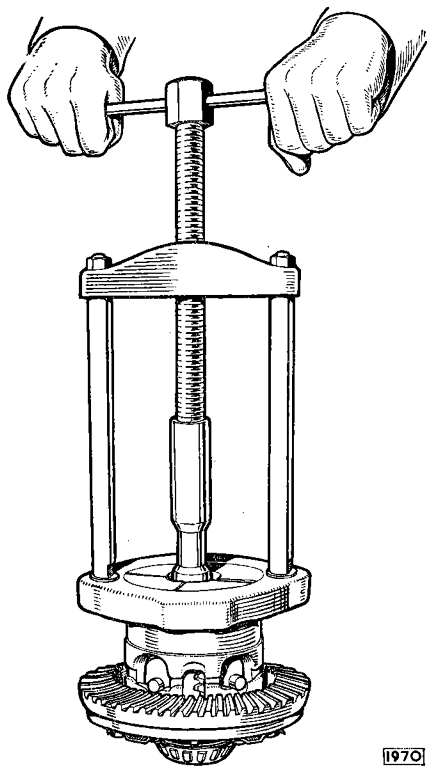


Fig. 30. Withdrawing a differential bearing using Churchill Tool No. SL.14 with adaptor SL.14-3

ASSEMBLING THE DIFFERENTIAL UNIT

Refit the clutch plates and discs alternately into the flange of the casing.

Fit the two "Belleville" clutch plates (i.e. curved plates) so that the convex side is against the diff. casing (see Fig. 29).

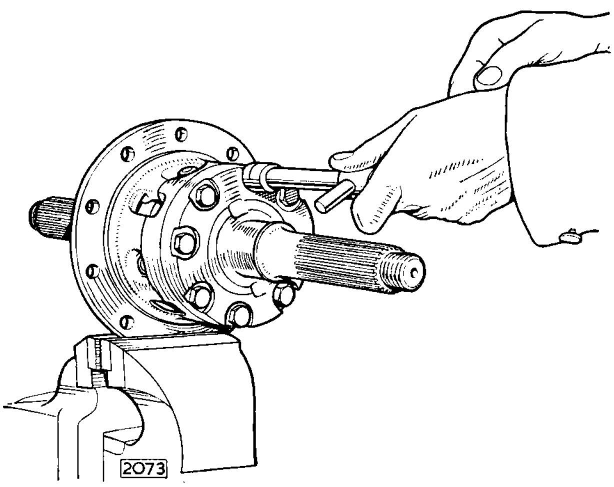


Fig. 31. Tightening the differential casing bolts with the output shaft in position

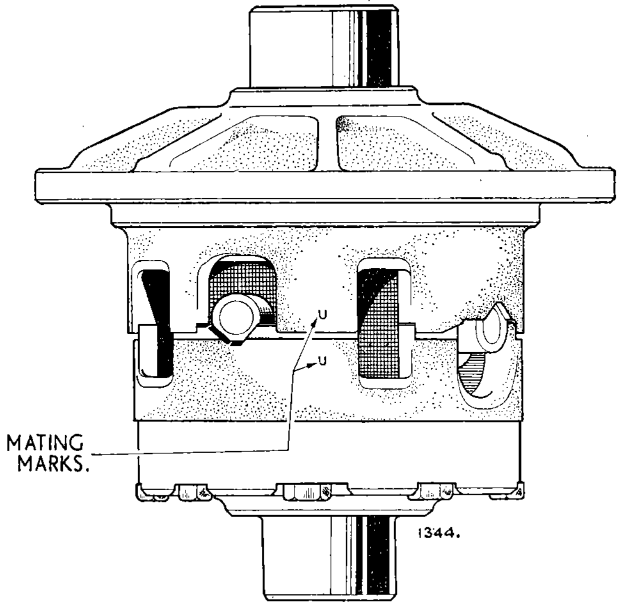


Fig. 32. Alignment marks on the differential casing

Fit the side gear ring so that the serrations on the gear mesh with the serrations in the two clutch discs.

Place one of the side gears into the recess of the side gear ring so the splines in both align.

Fit the cross shafts together.

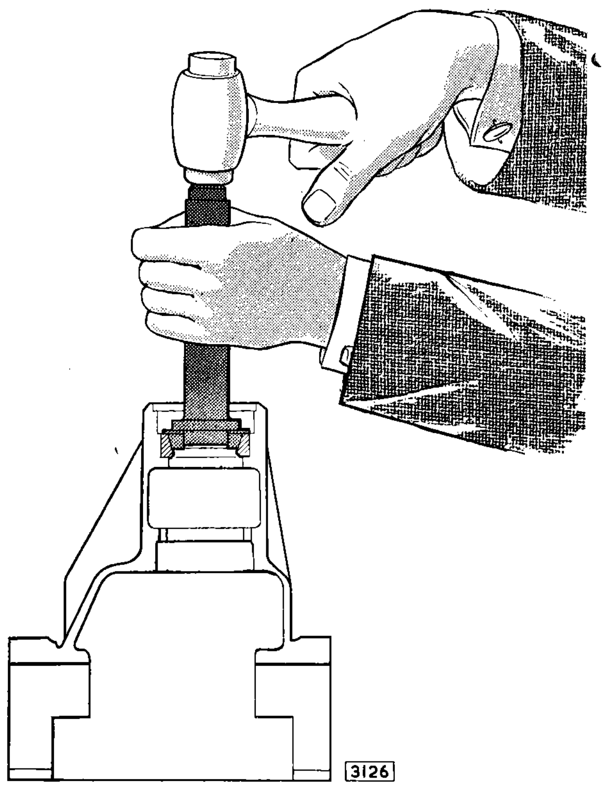


Fig. 33. Replacing the pinion outer bearing outer race using Churchill Tool No. 550 with adaptor SL.550-4.

A. Pinion Drop	1·5″ (38·1 mm.)
B. Zero Cone Setting	2·625″ (66·67 mm.)
C. Mounting Distance	4·312″ (108·52 mm.)
D. Centre Line to Bearing Housing	5·495″ (139·57 mm.) to 5·505″ (139·83 mm.)

Refit the pinion mate cross shafts complete with pinion mate gears ensuring that the ramps on the shafts coincide with the mating ramps in the differential case.

Assemble the remaining side gear and side gear ring so the splines in both align.

Refit the remaining clutch plates and discs to the side gear ring.

Offer up the button half of the differential case to the flange half in accordance with the identification

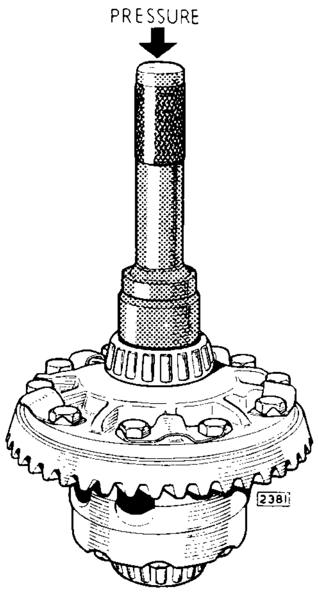


Fig. 34. Replacing the differential bearing using Churchill Tool No. 550 with adaptor SL.550-1

marks and position the tongues of the clutch friction plates so they align with the grooves in the differential case. Assemble the button half to the flange half of the differential case with eight bolts but do not tighten at this juncture.

Check the alignment of the splines in the side gear rings and side gears by inserting two output shafts, then tighten the eight bolts to a torque of 40–45 lbs. ft. (5·5 to 6·2 kg. m.) while the output shafts are in position. Failure to observe this instruction, particularly with the differential unit having the dished clutch

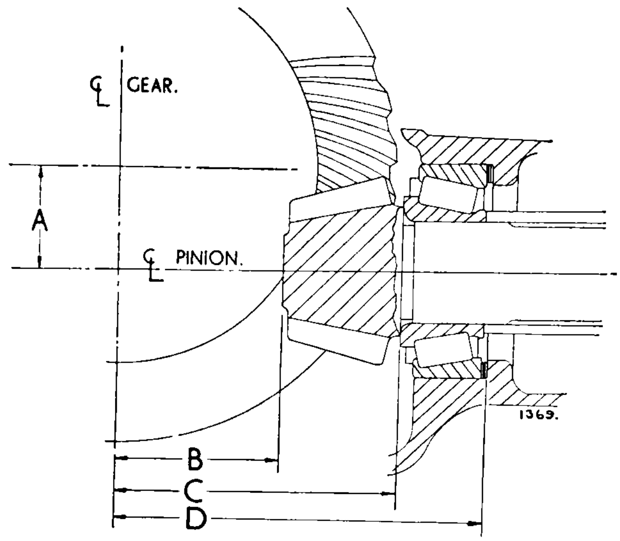


Fig. 35. Pinion setting distances

friction plates, will render it difficult or impossible to enter the output shafts after the eight bolts have been tightened.

Refit the drive gear to the differential case, having first ensured that the locating faces are not damaged, by aligning the bolt holes on the gear and case and tapping the gear into position with a rawhide mallet. Fit the securing setscrews using NEW locking straps and tighten to a torque of 70 to 80 lbs. ft. (9·7 to 11·1 kg. m.) knock up the tabs around the heads of the setscrews.

Checking for Wear

With one output shaft and the drive pinion locked, the other output shaft must not turn radially more than ¾″ (19 mm.) measured on a 6″ (152 mm.) radius.

PINION ADJUSTMENT

Refit the pinion outer bearing outer race using Tool No. 550 with the adaptor SL. 550-4. Refit the pinion inner bearing outer race (as shown in Fig. 33) with the original shims in position between the outer race and its abutment shoulder.

Press the inner bearing inner race onto the pinion using a hand press and a length of tube. Ensure that the tube contacts only the inner portion of the race and not the roller retainer. Place the pinion into position, turn the gear carrier over and support the pinion with a suitable block of wood. Fit the original outer bearing shims to the pinion shank so that they seat on the shoulder of the shank.

Fit the outer bearing inner race, companion flange, washer and nut only, omitting the oil slinger and oil seal assembly and tighten the nut.

It will now be necessary to check the pinion cone setting as follows:—

Pinion Cone Setting

The correct pinion cone setting is marked on the ground end of the pinion as shown on the inset in Fig. 36. The serial number of the matched drive gear and pinion assembly is marked above the cone setting, it is most important that similarly marked drive gears and pinions are kept in their matched sets as each pair is lapped together at the factory. The letters on the left and right of the pinion should be disregarded.

Hold the gear carrier so that the ground end of the pinion is uppermost. Take the pinion cone setting gauge (Tool No. SL 3 PCS and remove the magnetic keeper from the gauge post. Using the setting block on a surface plate as shown in Fig. 36, set the dial test gauge to zero on the 4 HA Setting. Place the dial gauge post on the end of the pinion as shown in Fig. 36, so that the plunger of the dial gauge registers in the differential bearing bore. Check the pinion cone setting by moving the gauge plunger in the differential bore; the actual reading being the minimum obtained. If the cone setting is correct, the reading on the dial gauge will be the same as the figure marked on the pinion end. For example, if the setting marked on the pinion is –2 then the reading on the dial gauge must also be –2.

If the pinion setting is incorrect, it will be necessary to remove the pinion assembly (as described on page H.18) and remove the pinion inner bearing outer race. Withdraw the shim pack and add or remove shims as necessary. Adding shims to the pack will decrease the gauge reading, that is, increase the number on the gauge if negative (–) and decrease the number if positive (+); removing shims will increase the reading; shims are available in ·003″, ·005″ and ·010″ (·076, ·127 and ·254 mm.) thicknesses.

Example, assume the required pinion cone setting distance (marked on the pinion end) to be –2, if on checking with the dial gauge, the reading is –7 it will be necessary to remove a ·005″ ·127 mm.) thick shim in order to reduce the gauge reading to –2.

Replace the inner bearing outer race, fit the pinion and check the cone setting as described before.

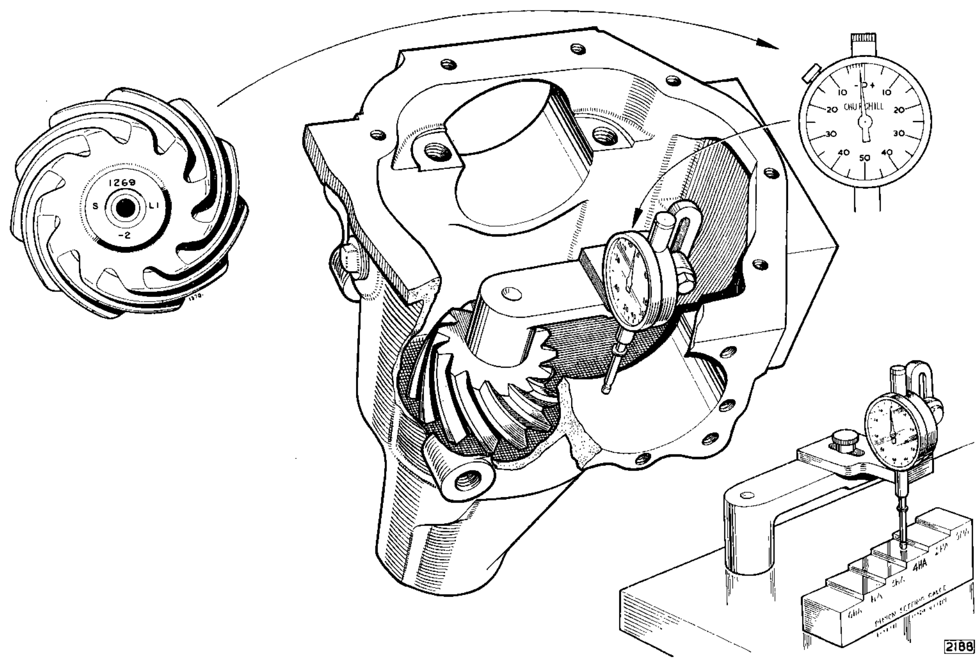


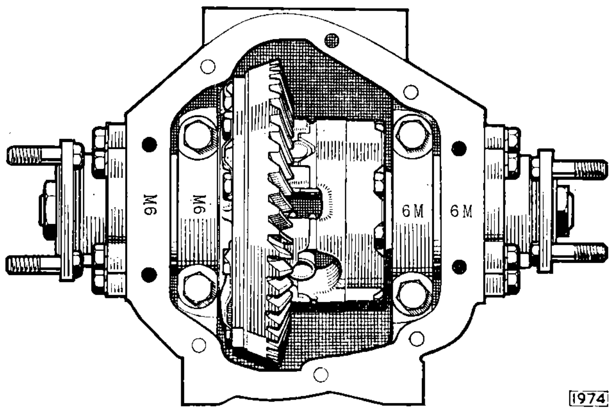
Fig. 36. Checking the pinion cone setting using Churchill Tool No. SL.3 PCS. Also illustrated are the pinion setting marks located on the end of the pinion

When the correct pinion setting has been obtained, check the pinion bearing preload. There should be no end play in the pinion and a slight resistance to turning should be felt. The correct pinion bearing preload is given as a torque figure under "Data" on page H.21. Inadequate preload will result in pinion deflection under load whilst excessive preload will lead to pitting and failure of the bearings.

To adjust the preload, add or remove shims at the shim pack between the outer bearing inner race and the shoulder on the pinion shank. Removing shims will increase the preload and adding shims will decrease the preload; shims are available in thicknesses of ·003", ·005", ·010" and ·030" (·076, ·127, ·254 and ·762 mm). It is most important that the shims behind the inner bearing outer race which control the pinion cone setting are not disturbed when setting the preload.

DIFFERENTIAL BEARING PRELOAD AND DRIVE GEAR ADJUSTMENT

With the pinion (less the oil seal and oil slinger) installed in the differential carrier, fit the differential assembly. Fit the differential bearing caps noting that the numerals marked on the bearing caps and the end



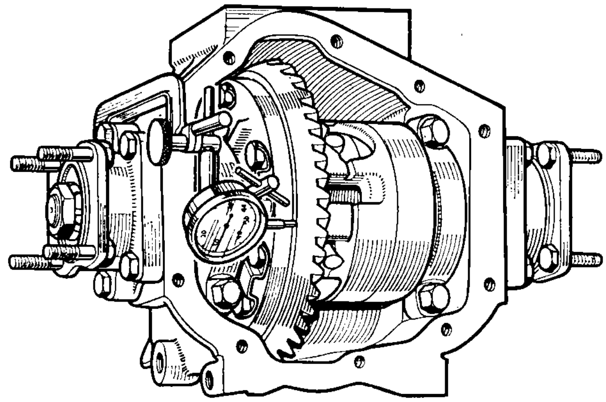
1974

Fig. 37. Differential bearing cap markings

cover face correspond as shown in Fig. 37. Fit the cap bolts and tighten to a torque of 60 to 65 lbs. ft. (8·3 to 9·0 kg. m.).

Drive Gear Runout

Mount a dial indicator on the gear carrier with the plunger of the gauge against the back face of the drive gear as shown in Fig. 38. Turn the drive gear by hand and check the run-out on the back face which should not exceed ·005" (·13 mm.). If the run-out exceeds this figure, the differential assembly should be removed,



1975A

Fig. 38. Checking the drive gear run-out

the drive gear withdrawn from the assembly and the locating surfaces on the drive gear and differential casing cleaned and burrs removed.

Drive Gear Mesh Adjustment and Differential Bearing Preload Setting

Install the drive shafts without any shims between the drive shaft bearing housing and the differential carrier. Note the condition of the "O" ring on the bearing housing and renew if necessary. Fit three bolts evenly spaced around each bearing housing. Set up a dial indicator on the differential carrier with the plunger of the gauge against one of the drive gear teeth as nearly in line with the direction of tooth travel as possible (as shown in Fig. 39). Move the drive gear by hand to check the backlash; the correct backlash will be etched on the sloping face of the drive gear. If the backlash reading is incorrect, move the drive gear towards or away from the pinion as necessary until the correct backlash reading is obtained. To move the drive gear in the required direction, it will be necessary to tighten the bolts in the drive shaft housing on one side of the differential carrier and slacken the bolts on the other side.

When the correct backlash has been obtained, measure the gap between the drive shaft bearing housing and the differential carrier on each side using a set of feeler gauges. Note the gap, having first checked around the circumference of the housing to ensure that the gap is even. Make up a shim pack to fill the gap on each side but subtract ·003" (·076 mm.) from the pack to give the correct preload on the differential bearings. The shims are available in

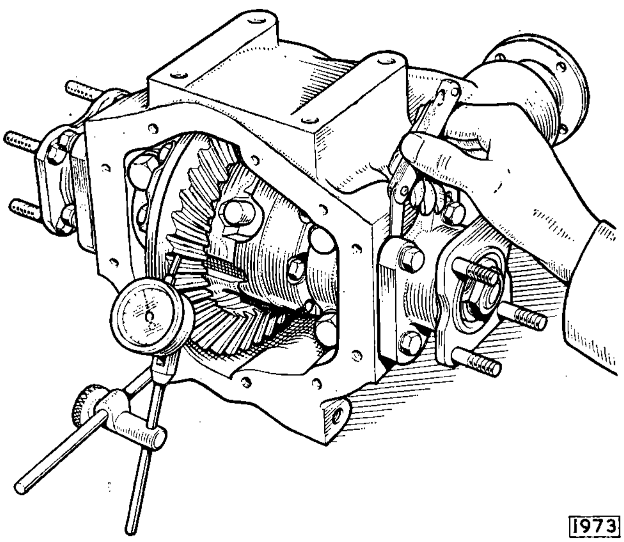


Fig. 39. Checking the backlash and the drive gear location

thicknesses of ·003″, ·005″, ·010″ and ·030″ (·076, ·127, ·254 and ·762 mm.).

For example; Assume that the backlash etched on the drive gear is ·007″ (·178 mm.), when this figure has been obtained as described previously, the gap on one side is ·054″ (1·37 mm.) and ·046″ (1·17 mm.) on the other, then the amount of shims to be fitted will be ·054″ – ·003″, that is, ·051″ (1·30 mm.) and ·046 – ·003″, that is, ·043″ (1·09 mm.) to the other side.

Finally, fit the output shafts with the shims in position to the differential carrier, fit the five bolts to each housing and tighten up. The drive gear mesh adjustment should now be checked as described in "Tooth Contact" on page H.25.

FINAL ASSEMBLY

Remove the pinion flange nut, washer and the companion flange, and fit the oil slinger. Place the oil seal gasket into position in the oil seal recess, then fit the oil seal so that the lip of the seal faces inwards and the dust excluder flange is uppermost. Fit the installation collar Tool No. SL 4 and tighten down the pinion nut and washer to drive the assembly home as shown in Fig. 40. Remove the installation collar, fit the companion flange, washer and pinion nut and tighten to a torque of 120 to 130 lbs. ft. (16·6 to 18·0 kg. m.).

Fit the differential carrier rear cover gasket, renewing if necessary, fit the rear cover and secure with setscrews and spring washers. Do not omit to refit the "Powr-Lok" (P.L.) and axle ratio tags which are also secured by the cover setscrews for identification purposes. Check that the drain plug is tightened and fill the axle with one of the recommended lubricants specified on page H.5. Replace the filler plug, check the tightness of the cover setscrews and check the complete unit for oil leaks.

Refit the brake discs and calipers, centralising the calipers by means of the adjusting shims (as described in Section L "Brakes"). Fit new tab washers to the mounting bolts, tighten the bolts to a torque of 55 lbs. ft. (7·6 kg. m.) and secure the bolt heads with the tab washers.

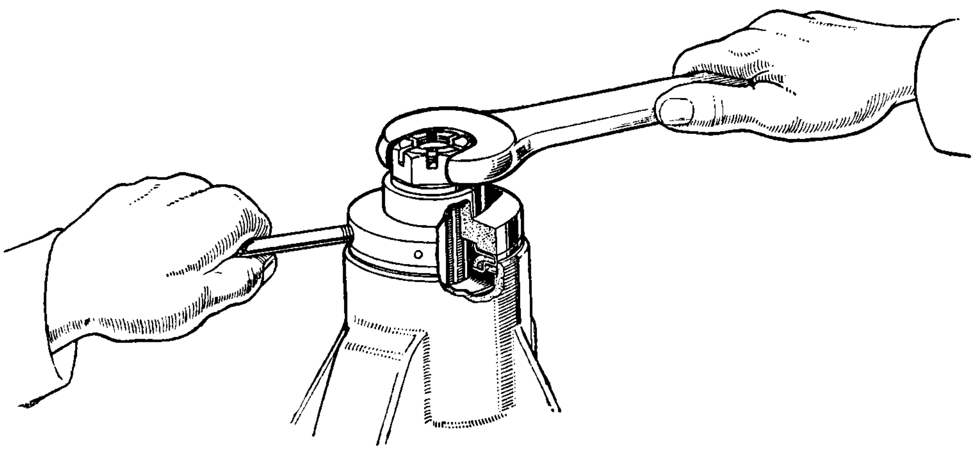


Fig. 40. Fitting the pinion oil seal using Churchill Tool No. SL.4

TOOTH CONTACT

After setting the backlash to the required figure, use a small brush to paint eight or ten of the drive gear teeth with a stiff mixture of marking raddle, used sparingly, or engineers blue may be used if preferred. Move the painted gear teeth in mesh with the pinion until a good impression of the tooth contact is obtained. The resulting impression should be similar to Fig. A in Fig. 41.

The illustrations referred to in this section are those shown in Fig. 41 which indicates the tooth bearing impression as seen on the drive gear.

The HEEL is the large or outer end of the tooth.

The TOE is the small or inner end of the tooth.

The FACE top or addendum is the upper portion of the tooth profile.

The FLANK or dedendum is the lower portion of the tooth profile.

The DRIVE side of the drive gear tooth is CONVEX.

The COAST side of the drive gear tooth is CONCAVE.

(a) Ideal Contact

Fig. A shows the ideal tooth bearing impression on the drive and coast sides of the gear teeth. The area of contac is evenly distributed over the working depth of the tooth profile and is located nearer to the toe (small end) than the heel (large end). This type of contact permits the tooth bearing to spread towards the heel under operating conditions when allowance must be made for deflection.

(b) High Tooth Contact

In Fig. B it will be observed that the tooth contact is heavy on the drive gear face or addendum, that is, high tooth contact. To rectify this condition, move the pinion deeper into mesh, that is, reduce the pinion inner race setting distance, by adding shims between the pinion inner bearing outer race and the housing and adding the same thickness of preload shims between the pinion bearing spacer, or the shoulder of the pinion shank and outer bearing inner race. This correction has a tendency to move the tooth bearing towards the toe on drive and heel on coast, and it may therefore be necessary after making this change to adjust the drive gear as described in paragraphs (d) and (e).

(c) Low Tooth Contact

In Fig. C it will be observed that the tooth contact is heavy on the drive gear flank or dedendum, that is, low tooth contact. This is the opposite condition from that shown in (b) and is therefore corrected by moving the pinion out of mesh, that is, increase the pinion inner race setting distance by removing shims from between the pinion inner bearing outer race and housing, and removing the same thickness of preload shims from between the pinion bearing spacer or the shoulder on the pinion shank and the outer bearing inner race. The correction has a tendency to move the tooth bearing towards the heel on drive and toe on coast, and it may therefore be necessary after making this change to adjust the drive gear as described in (d) and (e).

(d) Toe Contact

Fig. D shows an example of toe contact which occurs when the bearing is concentrated at the small end of the tooth. To rectify this condition, move the drive gear out of mesh, that is, increase backlash, by transferring shims to the drive gear side of the differential from the opposite end.

(e) Heel Contact

Fig. E shows an example of heel contact which is indicated by the concentration of the bearing at the large end of the tooth. To rectify this condition move the drive gear closer into mesh, that is reduce backlash, by removing shims from the drive gear side of the differential and adding an equal thickness of shims to the opposite side.

Note: It is most important to remember when making this adjustment to correct a heel bearing that sufficient backlash for satisfactory operation must be maintained. If there is insufficient backlash the gears will at least be noisy and have a greatly reduced life, whilst scoring of the tooth profile and breakage may result. Therefore, always maintain a minimum backlash requirement of ·004″ (·10 mm.).

Backlash

When adjusting backlash always move the drive gear as adjustment of this member has more direct influence on backlash, it being necessary to move the pinion considerably to alter the backlash a small amount—·005″ (·13 mm.) movement on pinion will generally alter backlash ·001″ (·025 mm.).

Drive Gear and Pinion Movement

Moving the drive gear out of the mesh moves the tooth contact towards the heel and raises it slightly towards the top of the tooth.

Moving the pinion out of the mesh raises the tooth contact on the face of the tooth and slightly towards the heel on drive, and towards the toe on coast.

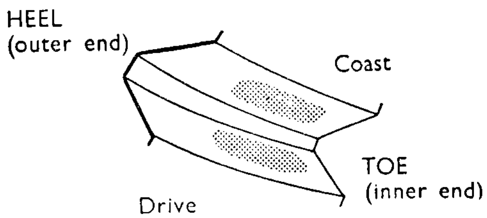
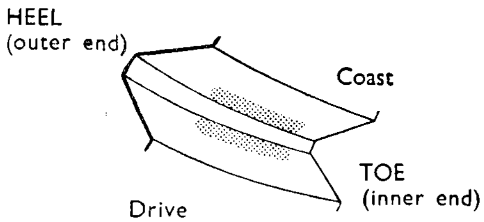
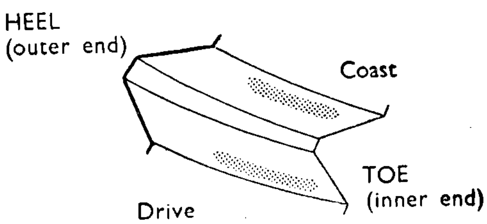
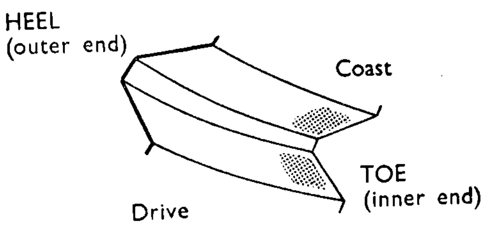
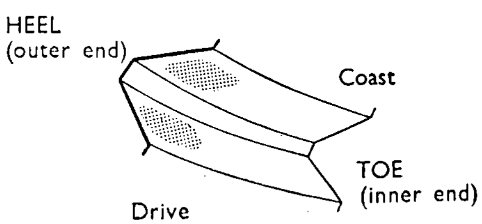
<table>
<tr><th></th><th>TOOTH CONTACT
(DRIVE GEAR)</th><th>CONDITION</th><th>REMEDY</th></tr>
<tr><td>A</td><td>
</td><td>IDEAL TOOTH CONTACT
Evenly spread over profile, nearer toe than heel.</td><td>$\frac{\text{o}}{\text{o}}$</td></tr>
<tr><td>B</td><td>
</td><td>HIGH TOOTH CONTACT
Heavy on the top of the drive gear tooth profile.</td><td>Move the DRIVE PINION DEEPER INTO MESH.
i.e., REDUCE the pinion cone setting.</td></tr>
<tr><td>C</td><td>
</td><td>LOW TOOTH CONTACT
Heavy in the root of the drive gear tooth profile.</td><td>Move the DRIVE PINION OUT OF MESH.
i.e., INCREASE the pinion cone setting.</td></tr>
<tr><td>D</td><td>
</td><td>TOE CONTACT
Hard on the small end of the drive gear tooth.</td><td>Move the DRIVE GEAR OUT OF MESH.
i.e., INCREASE backlash.</td></tr>
<tr><td>E</td><td>
</td><td>HEEL CONTACT
Hard on the large end of the drive gear tooth.</td><td>Move the DRIVE GEAR INTO MESH.
i.e., DECREASE backlash but maintain minimum backlash as given in "Data"</td></tr>
</table>

Fig. 41. Tooth contact indication (Contact markings on the drive gear)

SPECIAL TOOLS

Description	Tool Number
Multi-purpose hand press	SL.14
Used in conjunction with the following adaptors:—	
Pinion Bearing Inner Races	
Removing / Replacing } adaptor	SL.14-1
Differential Bearing	
Removing adaptor	SL.14-3
Differential Bearing	
Replacing—Universal Handle	550
Used with adaptor	SL.550-1
Main tool and Ring	J.20A
Used in conjunction with the following adaptor:—	
Pinion Bearing Outer Races	
Removing / Replacing } adaptor	SL.550-4
Hub Bearing Outer Race Removing/Replacing Adaptors	J.20A-1
Hub Endfloat Master Spacer	J.15
Hub Endfloat Dial Gauge	J.13
Pinion Cone Setting Gauge	SL.3
Rear Hub Extractor	JD.1.C
Rear Hub Outer Bearing Inner Race Removing Adaptor	J.16B (use with SL.14)
Pinion Oil Seal Installation Collar	SL.4

SECTION I

STEERING

3·8 MARK 10 MODEL

INDEX

INDEX *(continued)*

STEERING

DESCRIPTION

The power-assisted steering system consists of a Hobourn-Eaton roller type pump driven off the rear of the dynamo shaft, an oil reservoir with a replaceable filter element and an hydraulically assisted worm and re-circulating ball type steering box.

These parts are connected by flexible hoses as follows:—

Reservoir to inlet side of pump.

Outlet side of pump to inlet pipe connection attached to the steering box.

Outlet at top of steering box to reservoir.

The pump supplies a continuous flow of oil through the system while the engine is running and the steering is in the straight ahead position. Pressure is only created in the system when the steering column is rotated and is proportional to the effort applied to the steering wheel.

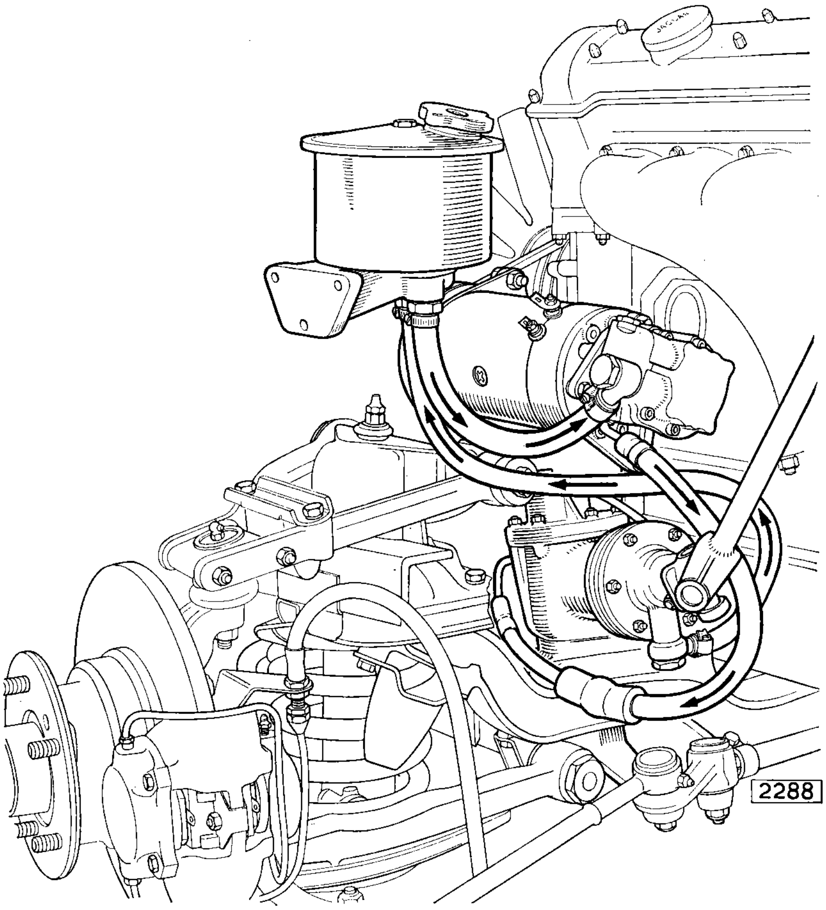


Fig. 1. Layout of the power-assisted steering system

The Steering Unit

The steering box is of the re-circulating ball worm and nut type in which hydraulic assistance is applied to a piston forming part of the nut (D, Fig. 2). The piston works within a cast iron cylinder pressed into the aluminium steering box casing, hydraulic pressure being admitted to one side or other of the piston, depending on which steering lock is applied.

Admission of oil to the appropriate pressure chamber is controlled by a selector valve (J) co-axially mounted within the hollow rear end of the wormshaft (M). The valve extends rearwards, through the steering box top cover, and forms the input shaft to which the lower end of the steering column is directly connected.

Rotary movement of the valve relative to the wormshaft opens and closes ports in the wormshaft and thus directs oil to the side of the piston in operation for the steering lock required.

When steering wheel effort is at a minimum, centralisation of the valve within the wormshaft is effected by the action of an interlock ball (H) which is loaded by a coil spring (N) located at the bottom of the valve. The interlock ball operates in specially shaped mating holes in the valve and wormshaft.

To obtain a high mechanical efficiency the internal sealing in the box is obtained by the use of sealing sleeves instead of rubber "O" rings.

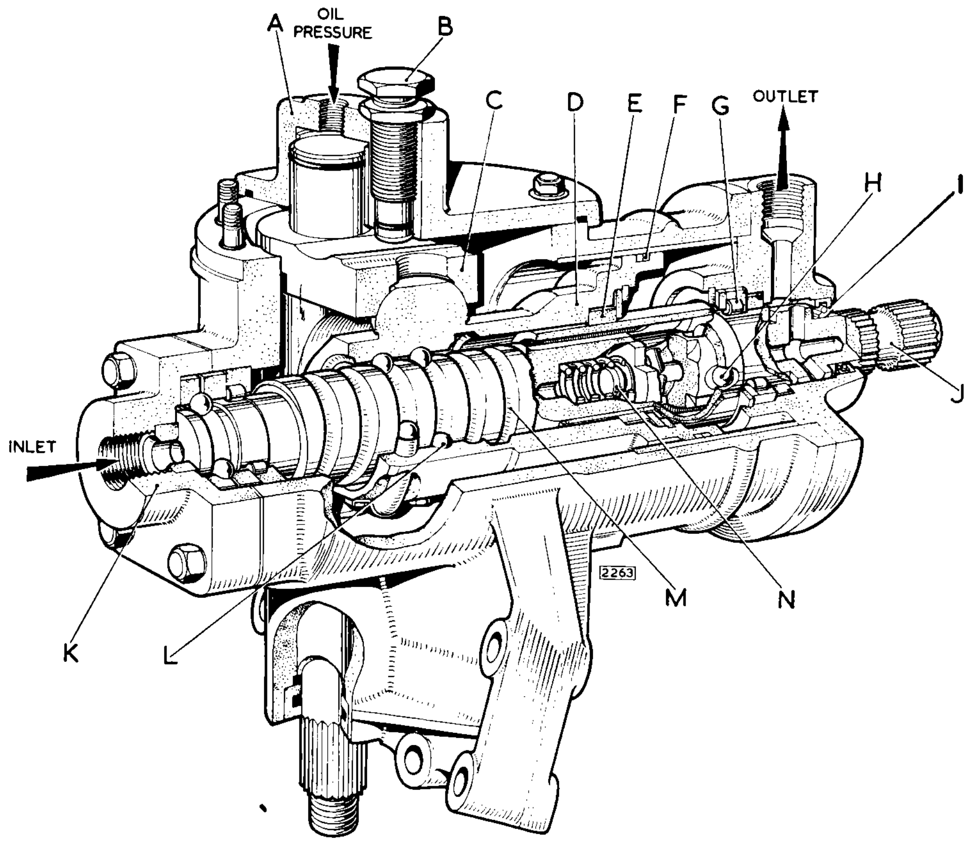


Fig. 2. Sectional view of the power-assisted steering unit

The Valve

The valve is of cylindrical form and has a central longitudinal passage which is closed at each end. An interrupted flange formed on the outside of the valve working between stops on the wormshaft, limits the rotary movement of the valve within the wormshaft. This prevents overloading of the valve and permits normal steering in the event of the hydraulic assistance not being available. At each side of the valve symmetrical oil feed grooves and ports are machined, the port drillings communicating with the central passage (see Fig. 3).

Note: A limited amount of axial movement of the valve (input shaft) may be noticed when turning the steering but this movement is quite normal.

The Rocker Shaft

The rocker shaft is of the normal pre-loaded type with an adjustable spherical headed bolt running in contact with the rocker shaft. A groove is machined in the rocker shaft which allows the rocker shaft to rise when on either lock.

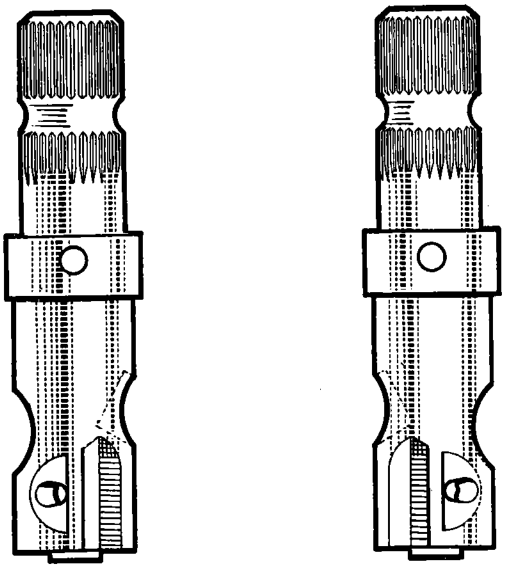


Fig. 3. Showing the oil feed groove and port at each side of the valve

DATA

Steering Unit

Make	Burman
Type	Hydraulically assisted worm and re-circulating ball
Steering gear ratio (mean)	18·9 : 1
Number of turns—lock to lock	4¼
Turning circle	37′ (11·27 m.)

Oil Pump

Make	Hobourn-Eaton
Type	Roller
Location	Rear of generator
Operating pressure (wheels against stops, engine at 1000 r.p.m.)	1000 lbs. per sq. in. (70·3 kg./cm^2)

ROUTINE MAINTENANCE

EVERY 1,250 MILES (2,000 KM.)

Checking the Reservoir Oil Level

The oil reservoir is attached to the left-hand wing valance. It is important that absolute cleanliness is observed when replenishing with oil as any foreign matter that enters may affect the hydraulic system. Clean the area around the filler cap and then remove the cap by turning anti-clockwise.

Check the level of oil and top up if necessary with the recommended grade. The level of oil must be just above the filter element located in the reservoir.

Important: If the oil level is allowed to fall appreciably, the power assistance to the steering will be affected.

EVERY 2,500 MILES (4,000 KM.)

Steering Tie Rods

Lubricate the ball joints at the ends of the two steering tie rods with the recommended lubricant. The tie rods are situated at the rear of the front suspension cross member. When carrying out this operation examine the rubber seals at the ends of the ball housings to see if they have become displaced or split. In this event they should be repositioned or replaced, as any dirt or water that enters the ball joint will cause premature wear.

Do not over-lubricate the ball joints to the extent where grease escapes from the rubber seals.

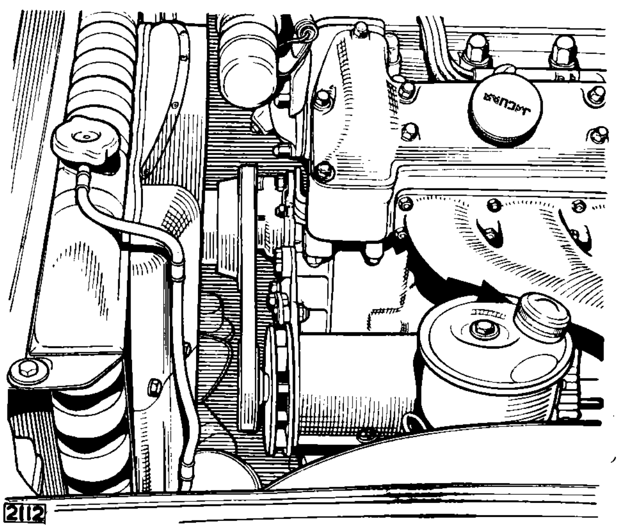


Fig. 4. The hydraulic fluid reservoir

Wheel Swivels

Lubricate the nipples (four per car) fitted to the top and bottom of the wheel swivels.

The nipples are accessible from underneath the front of the car.

EVERY 5,000 MILES (8,000 KM.)

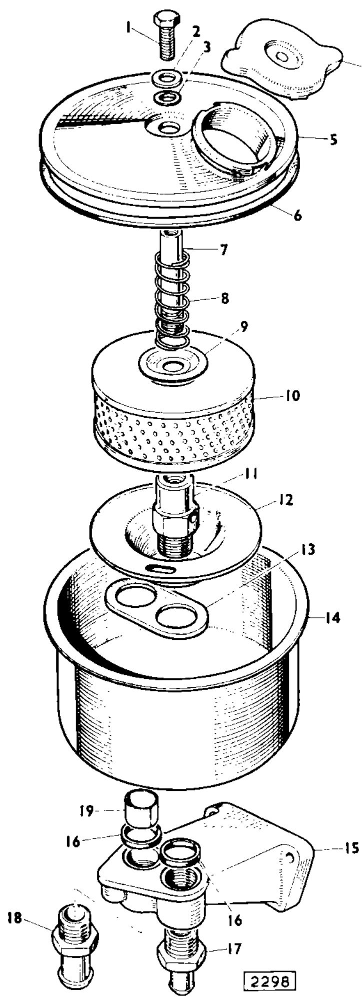
Front Wheel Alignment

Check the front wheel alignment as described on page I.17.

EVERY 20,000 MILES (32,000 KM.)

Oil Reservoir Filter

At the recommended intervals, renew the paper filter element in the oil reservoir.



1. Securing bolt
2. Washer
3. Gasket
4. Reservoir cap
5. Reservoir cover
6. Sealing ring
7. Stud
8. Spring
9. Filter cap
10. Filter element
11. Mounting stud
12. Support
13. Reinforcement plate
14. Reservoir
15. Mounting bracket
16. Seal
17. Adaptor
18. Adaptor
19. Seal retainer

Fig. 5. Exploded view of the oil reservoir

Unscrew the bolt securing the oil reservoir top cover. Lift off the top cover and collect the spring and retainer plate. The filter element can now be lifted out from the reservoir.

When fitting the new element ensure that it is located in the support plate at the bottom of the reservoir. Refit the retainer plate, spring and top cover. Tighten the central bolt.

Steering Idler Housing

The idler housing is pre-packed with grease which only requires replenishing if the idler assembly is dismantled for overhaul.

Recommended Lubricants

	Mobil	Castrol	Shell	Esso	B.P.	Duckham	Regent Caltex/ Texaco
Steering reservoir	Mobil Fluid 200	Castrol T.Q.	Shell Donax T6	Esso Automatic Transmission Fluid	Energol Automatic Transmission Fluid Type 'A'	Nolmatic	Texamatic Fluid
Steering idler housing Wheel Swivels Steering tie rods	Mobilgrease MP	Castrolease LM	Retinax A	Esso Multi-purpose Grease H	Energrease L.2	LB 10	Marfak All-purpose

OPERATION

(a) Steering in straight ahead position

Oil direct from the pump enters the steering box via the bottom end cover (K, Fig. 2) and passes up through a longitudinal hole in the wormshaft; the valve being in its central position permits free flow of oil through the steering box to the outlet in the top cover. In this condition the oil is at low pressure and no thrust is applied to the piston.

(b) Steering on lock

Rotation of the steering wheel causes the valve to move relative to the wormshaft by an amount proportional to the effort applied to the steering wheel; the amount is determined by the resistance of the road wheels to turning. On either side of the worm a milled slot communicates with the oil feed grooves in the valves; the larger milled slot controls the flow to the chamber above the piston, and the smaller slot, together with a longitudinal groove controls the flow to the chamber below the piston. A sleeve pressed on to the outside of the worm and valve assembly effects a seal between the upper and lower chambers and also acts as a retainer for the interlock ball.

The relative movement of the valve to wormshaft restricts or completely closes the return port in the valve, which causes pressure to build up in the chamber on the side of the piston on which it is required to exert hydraulic pressure. Immediately steering wheel movement ceases and the car is held on a constant lock, the valve tends to centralise in the wormshaft by the combined action of the valve spring and interlock ball and the reduction in resistance to turning of the wormshaft due to the hydraulic assistance being applied to the main nut piston. A state of balance then exists between the effort at the steering wheel and the normal self-centring action of the front road wheels. On returning to the straight ahead position the hydraulic condition described in paragraph **(a)** is restored.

THE STEERING UNIT

REMOVAL

Remove the bolt securing the reservoir return hose banjo to the top end cover of the steering unit and drain the oil into a clean container. Undo the union securing the hose from the pump to the feed pipe adaptor on the lower end of the steering box.

Remove the retaining clip, clamp ring and plastic thrust-bearing retaining the inner column situated at the lower end of the upper steering column; (see Fig. 17). The inner column cannot be removed until the above procedure is carried out.

Remove the pinch bolt retaining the upper steering column to the universal joint and rubber coupling on the lower column and pull back the steering wheel until the splines clear the retaining jaw. Detach the universal joint from the steering box and remove the lower column.

Refitting will be simplified if, before removal of the lower column, the steering wheel and road wheels are set in the straight ahead position. If these are then left undisturbed during the dismantling operations refitting can be carried out without any further adjustment of steering wheel or indicator cancelling device.

Remove the self-locking nut securing the track rod end to the drop arm. Drift out the track rod end from the drop arm in which it is a taper fit.

Remove the two setscrews, one long bolt and spacer securing the steering unit to the front suspension cross beam when the unit can be removed.

Note: It may be necessary to remove the oil filter body to enable the track rod end to be drifted out.

DISMANTLING

Tap back the tab washer and unscrew the nut (30, Fig. 6) and with a suitable extractor withdraw the drop arm (29) from the rocker shaft. With the steering box held in a vice by the mounting boss and a suitable tray placed underneath it to catch the oil, remove the feed pipe assembly from the lower end cover and rocker shaft cover. Remove the six nuts securing the rocker shaft cover to the steering box.

Turn the input shaft in an ANTI-CLOCKWISE DIRECTION AS FAR AS POSSIBLE, for R.H. Drive and CLOCKWISE for L.H. Drive cars.

The rocker shaft cover may now be removed by gently tapping the lower end of the rocker shaft which will also disengage the socket in the rocker arm from the ball end on the nut.

Important: It is most important that the rocker shaft arm is in the uppermost position in the steering box otherwise the transfer tube in the main nut will be damaged when the rocker shaft is tapped upwards.

Empty out the oil from the box into the tray.

Remove the six nuts securing the top end cover and withdraw complete with the roller race assembly. Collect the twenty-four loose rollers.

Remove the four nuts securing the bottom cover (12) and withdraw the cover and outer ball race. The eleven loose balls may be released by pushing on the inner column.

Remove the inner ball race and roller race complete with twenty-one rollers.

Withdraw the worm and nut from the top of the steering box.

Unwind the main nut from the wormshaft and collect the thirty-six recirculating balls.

Note: Eighteen of these balls are exactly $\frac{9}{32}''$ (7·14 mm.) diameter while the other eighteen are undersize by approximately 0·0007″ (·017 mm.). The smaller balls are black in colour on assembly and it is MOST IMPORTANT that they should be alternately assembled with the larger balls.

From the upper end cover and roller race assembly, remove the circlip and washer. The roller race can then be tapped out of position against a piece of wood. If this does not dislodge the roller race, immerse the end cover in boiling water and repeat the treatment. The sealing sleeve and "O" ring will come out with the roller race and the oil seal may now be pushed out.

From the main nut assembly remove the piston rings; do not stretch too far or breakage will occur.

ASSEMBLING

When assembling the steering unit it is advisable, owing to the high pressure (1,000 lbs. per sq. in. (70 kg. per sq. cm.), existing in the system to renew all the rubber "O" ring seals and the lip seal.

1. Steering box
2. Stud
3. Stud
4. 'O' ring
5. Dowel
6. Stud
7. 'O' ring
8. Roller outer race
9. Rollers
10. Outer ball races
11. Balls
12. Bottom end plate
12A. Seal.
13. Shims
14. Worm and nut
15. Piston rings
16. Balls (small)
17. Balls (large)
18. Packing piece
19. 'O' ring
20. Outer race
21. Rollers
22. Washer
23. Circlip
24. Top cover
25. Oil seal
26. 'O' ring
27. Rocker shaft
28. 'O' rings
29. Drop arm
30. Nut
31. Tab washer
32. 'O' ring
33. 'O' ring
34. Rocker shaft cover
35. Adjusting nut
36. Locknut
37. 'O' ring
38. Feed pipe
39. Connection for feed pipe
40. Copper washers
41. Banjo bolt
42. Copper washers
43. Dust seal

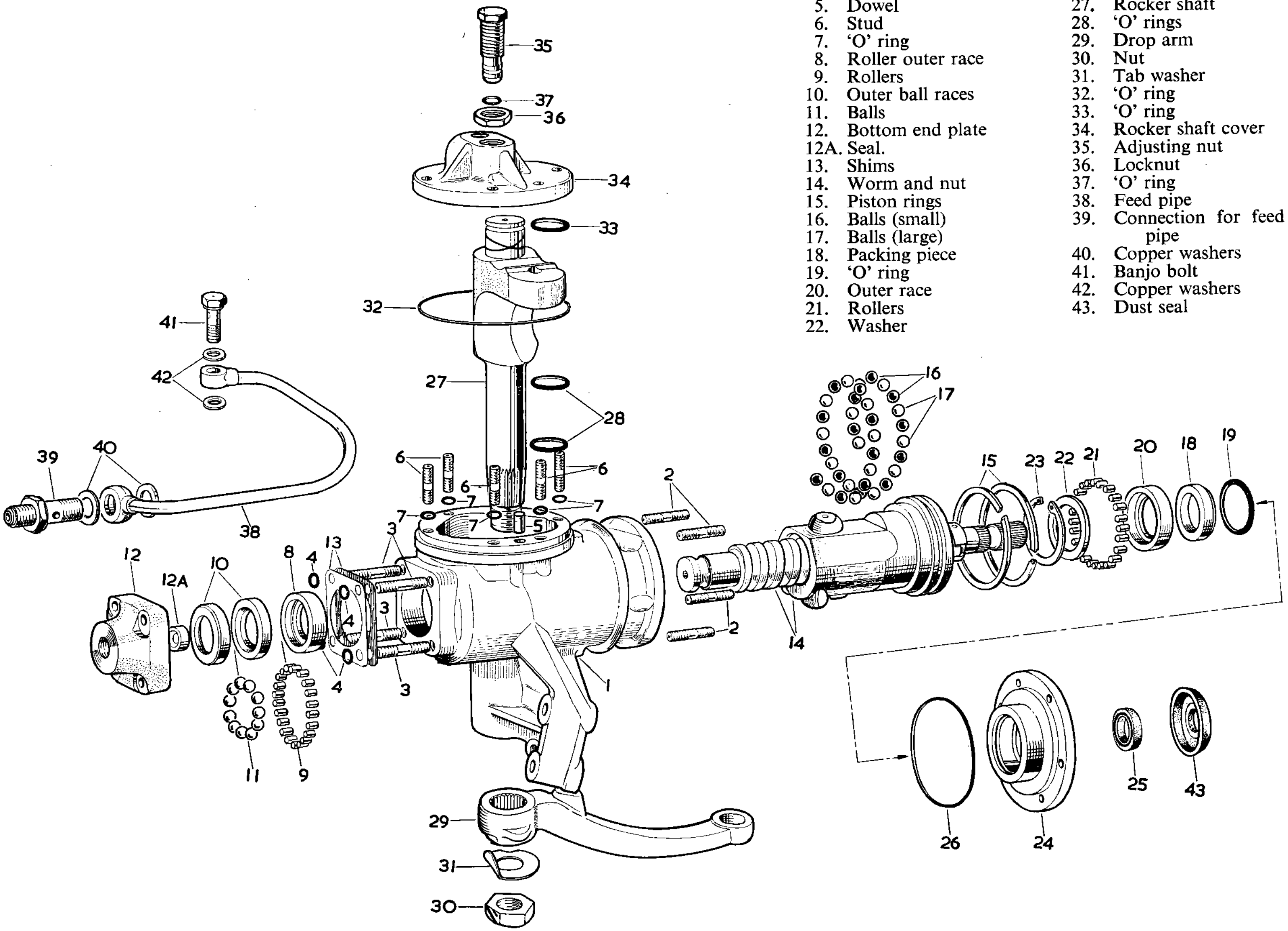


Fig. 6. Exploded view of the steering unit (right-hand drive illustrated)

Assemble the pistons rings into groove on main nut.

Assemble the thirty-six balls into the main nut making sure that they are placed alternately, large and small, around the grooves. (See note on page I.9 under "Dismantling").

Screw the worm and valve assembly into the nut, taking care not to dislodge any balls from the nut.

Position the piston rings in the groove on the main nut so that the ring gaps are opposed at 180°. Insert the rocker shaft and worm nut assembly into the box with the aid of a piston ring compression sleeve, Tool No. J19 (see "Special Tools," page I.27). It will be necessary to turn the rocker shaft until it is facing the upper end of the steering box to facilitate the lining up of the ball on the nut assembly with the socket in the rocker arm.

Remove the piston ring compression sleeve and fit the roller race complete with twenty-one rollers and the inner ball race to the lower end of the worm shaft. Tap the inner ball race and roller race into the bottom of the box and fit the eleven steel balls round the worm shaft (with petroleum jelly) and press the shaft up into the box until the balls locate on the inner ball race. Fit the outer ball race, end plate and shims so that the worm assembly rotates freely without end float.

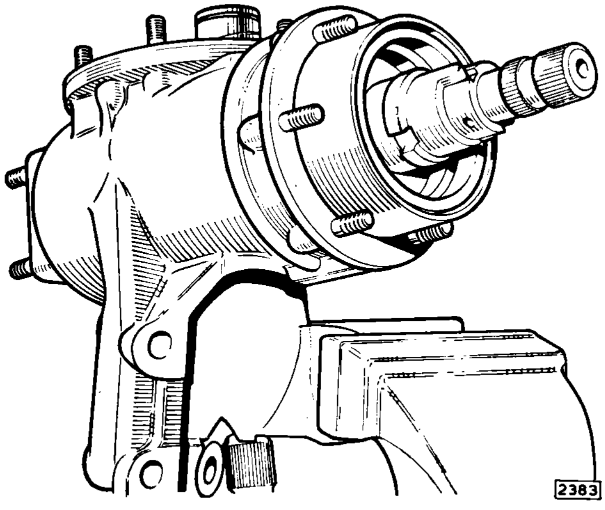


Fig. 7. Showing the special tool for compressing the piston rings (Tool No. J.19)

Then remove ·0025″ (0·63 mm.) thick shim to obtain the correct axial preload. Always tighten down the cover evenly.

The Top End Cover

Press the oil seal into recess in the end cover with the spring showing towards the inside of the box.

Fit the "O" ring and sealing sleeve to the top end cover and push in the roller race. Insert the twenty-four rollers and pack them with petroleum jelly.

Fit the washer and circlip.

Fit the "O" ring to the spigot on the end cover and fit the cover using Tool No. 8343 to protect the oil seal as the top end cover is pushed over the serrations on the valve (see Fig. 8). Fit the top end cover with the oil outlet facing downwards. If a service tool is not available, wrap the valve serrations in tape.

Remove the tool when the cover is right home and tighten down evenly.

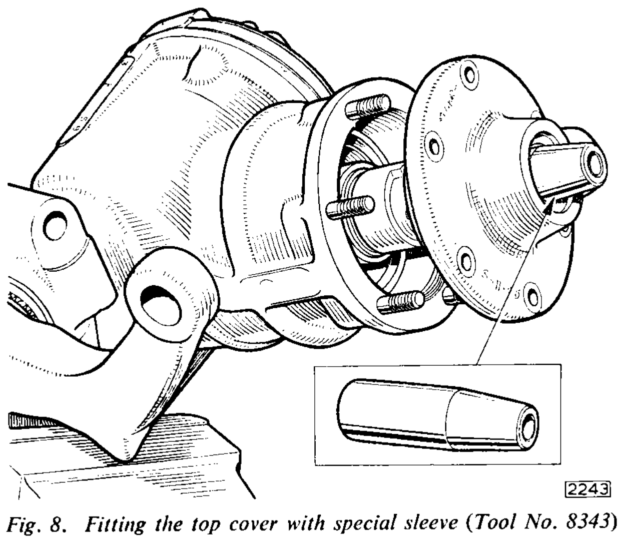


Fig. 8. Fitting the top cover with special sleeve (Tool No. 8343)

The Rocker Shaft Cover

Assemble the cover complete with the rocker shaft adjuster bolt and locknut and fit the cover making sure that the "O" rings are in place on the steering box studs. Locate the cover on the dowel and tap securely home. Bolt down the cover evenly.

Rocker Shaft Adjustment

The rocker shaft rises and falls slightly in travelling to either lock and it is necessary that the adjustment for the end float should be carried out with the front wheels in the "straight-ahead" position. The rocker shaft should be at right angles to a line passing down the centre of the box, that is, in the midway position which can be found by counting the number of revolutions required at the input shaft to turn the steering arm from one lock to the other and halving the total. This procedure will of course only be necessary when the box is out of the car and the top cover is in place.

Turn the adjuster bolt in a clockwise direction until it is felt to bear upon the rocker shaft. Tighten the locknut and rotate the input shaft back and forth about the midway position to check that the adjuster bolt is not binding on the rocker shaft. The steering unit is so designed that there is approximately ·002″ to ·003″ end float when on right- or left-hand lock. As a final check, rotate the input shaft from one lock to the other to ensure that the rocker shaft is not binding.

To Complete Assembly

(*a*) Fit the drop arm, ensuring that lines on rocker shaft and drop arm are in alignment.
(*b*) Fit the nut and secure with new lock washer.
(*c*) Fit the pipe between the bottom cover and the rocker shaft cover with a new copper washer on each side of the banjo connections.

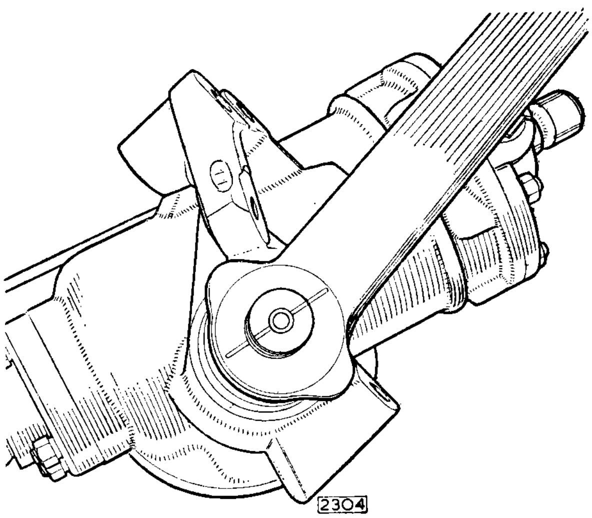


Fig. 9. Showing the alignment of the drop arm/rocker shaft marks

Refitting

Refitting is the reverse of the removal procedure but special attention must be given to the following points.

Replace the spacer between the steering unit and cross beam. Refit the steering column plastic thrust bearing and clamp ring to retain the inner column in position.

Whilst reconnecting the upper steering column to the universal joint on the lower column care must be taken to ensure that the horn contact (34) does not catch the horn slip ring (42) on the inner column. The contact may be prised up with a screwdriver whilst the column is brought into position.

Should the road wheels or steering wheel have become disturbed during the removal operation, then these must be set in the straight ahead position before connecting the lower column jaw to the input shaft. Check that the indicators cancel evenly on each side of the straight ahead position. An adjustment can be made by removing the switch cover, turning the steering wheel until the adjustment screws on the trigger are visible, slackening the screws and moving the trigger in the required direction. Should the adjustment screws be already hard up against the ends of the slots then the adjustment must be made by re-positioning the lower column jaw in relation to the input shaft of the steering box.

Bleed the system as described on page I.13.

Adjust the lock stops as described on page I.17.

REPLACEMENT OF TOP END COVER OIL SEAL

Remove the steering unit as described on page 9.

Remove the six nuts securing the upper end cover and carefully withdraw the end cover and roller race assembly. Remove the circlip and washer and collect the twenty-four loose rollers. The roller race can then be tapped out of position against a piece of wood. If this does not dislodge the roller race immerse the end cover in boiling water and repeat the treatment. The sealing sleeve and "O" ring will now come out with the roller race and the oil seal may be pushed out.

Press the oil seal into the recess in the end cover with the spring showing towards the inside of the box.

Fit the new "O" ring and sealing sleeve to the top end cover and push in the roller race (if necessary, immerse cover in boiling water).

Fit the twenty-four loose rollers with petroleum jelly. Fit the washer and circlip.

Fit "O" ring to the spigot on the end cover and fit the end cover using Tool No. 8343 to protect the oil seal as the top cover is slid over the serrations on the valve input shaft (see Fig. 8). Fit the cover with the oil outlet facing downwards. (If a service tool is not available, wrap the valve serrations in tape).

Remove the tool when the cover is right home and tighten down evenly.

Bleed the system as described on page I.13.

THE RESERVOIR

Dismantling, Inspection and Reassembling

Remove the pump inlet hose from beneath the reservoir and allow the oil to drain into a clean container.

Thoroughly clean the exterior of the reservoir assembly.

Remove the screw, cover, spring and spring seat. Then remove the filter element.

(Loosen the screw and remove the reservoir cover and filter).

Examine the filter and renew if damaged.

Place the filter on the reservoir stud.

Install the reservoir cover and a new gasket and secure it with the screw.

Caution: Check to ensure that the cover is installed flush with the reservoir body.

BLEEDING THE SYSTEM

The system requires bleeding only when any part of the steering system has been disconnected. The procedure is as follows:—

1. Fill the reservoir to the top of the filter element with the recommended grade of oil.
2. Start the engine and allow to idle. While the engine is idling pour more oil into the reservoir until the level reaches to the top of the filter element. Check the hose connections for leaks.
3. Increase the engine speed to 1,000 r.p.m. and turn the wheels in each direction five or six times.
4. Re-check for leaks and oil level in reservoir after road test.

THE PRESSURE PUMP

The pressure pump which provides hydraulic pressure in the system is a Hobourn-Eaton unit of the roller type and incorporates a combined flow and relief valve (Fig. 10). The pump is attached to the rear of the dynamo and is driven from the dynamo shaft by means of a rubber coupling.

OPERATION

Pressure from the pump is caused by six rollers in slots in a circular carrier, keyed to the pump drive shaft. These rollers circulate inside an eccentrically mounted cam ring. Owing to the eccentricity, the gap between each pair of rollers widens and narrows during the cycle, drawing oil from the inlet side of the pump and forcing it to the flow control valve.

When the pump comes into operation, and oil flow commences, a drop in pressure caused by the primary orifice (A, Dia. 1, Fig. 10) occurs. Oil at this lower pressure passes through the secondary orifice (B) and enters the chamber containing spring (D) (Condition

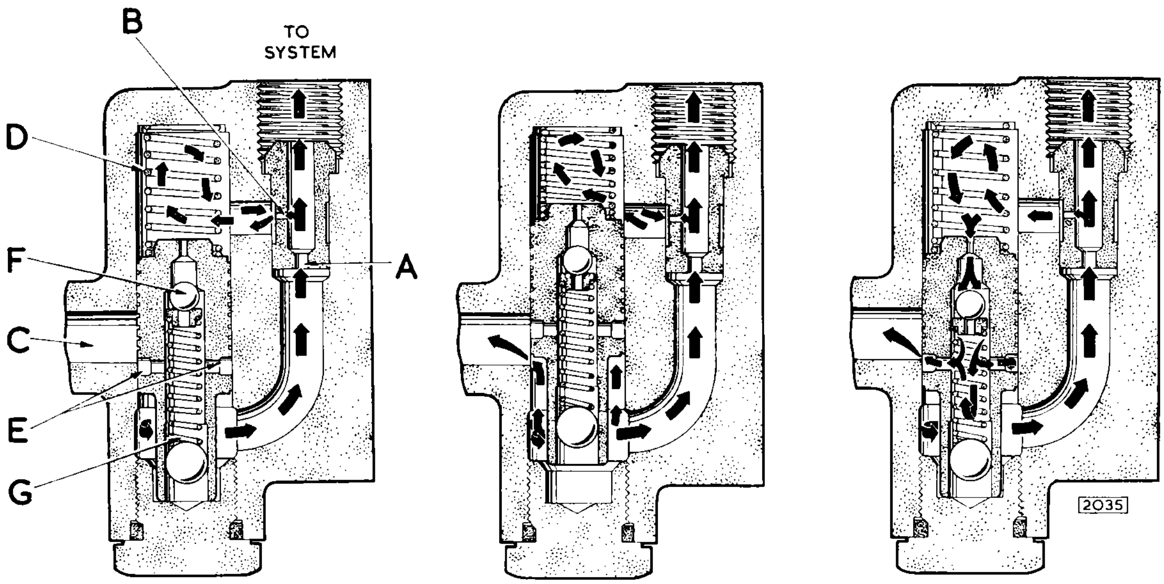


DIAGRAM I. DIAGRAM 2. DIAGRAM 3.

Fig. 10. Diagram showing the operation of the combined flow and relief valve

in Dia. 1). This pressure difference increases with the oil flow causing the control valve to move against the spring (D) and when a pre-determined flow has been reached, the valve uncovers the by-pass hole (C) leading to the intake side of the system.

Any further increase in flow causes the by-pass hole to be uncovered further and thus a constant flow is maintained (Condition in Dia. 2).

Should the line pressure become excessive, the ball (F) in the valve moves against the spring (G) and oil flow from the chamber containing spring (D) by-passes through the annular holes (E) (Condition in Dia. 3).

When this occurs, a further pressure drop caused by the secondary orifice (B) causes the valve to move up to its normal by-pass position irrespective of the oil flow conditions. As soon as the line pressure drops the ball valve closes and the pressure difference is restored bringing the constant oil flow back to normal.

REMOVAL

Disconnect the hoses at the pump unions and place the hose ends in a raised position to prevent oil drainage. Alternatively, allow the oil to drain into a clean container.

Remove the nuts and lock washers securing the pump to the dynamo and remove the pump. If the flexible coupling comes away with the pump, withdraw the coupling from the slot in the pump shaft.

DISMANTLING, INSPECTION AND ASSEMBLY

Note: Thoroughly clean the exterior of the pump ensuring that dirt does not enter the inlet and outlet holes.

Hold the pump in a vice, using soft jaws.

Remove the adaptor screw (25, Fig. 11), fibre washer (24), adaptor (23) and gasket (22).

Remove the six screws securing the cover (19) to the pump body (4).

Remove the pump from the vice, remove the cover from the pump body vertically to prevent the loss of parts.

Remove the sealing rings (9 and 12) from the grooves in the pump body. Remove the thrust washer (18) from the bearing hole in the cover.

Remove the snap ring (16) from the drive shaft (15) and withdraw the six rollers (14) and roller carrier (13).

Remove the drive pin (15a) and withdraw the drive shaft from the pump body.

Remove the cam (11) from the cam locking peg (10).

Drift the oil seal (2) from the body if worn or damaged ensuring that the drive shaft bushing is not damaged.

Remove the valve cap (8), valve seal (7) and flow control valve (6) and flow control spring (5).

Caution: Place the parts where they will not be damaged.

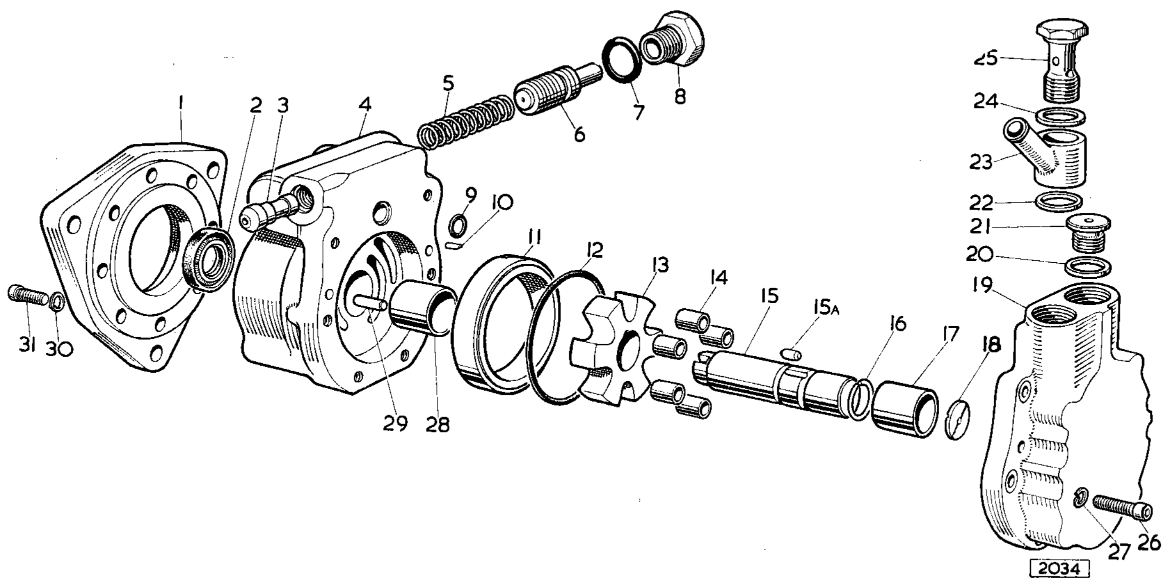


Fig. 11. Exploded view of the oil pump

Wash all parts in a suitable solvent and dry with a lint-free cloth or compressed air.

Check the pump body and cover for wear and replace either part if the faces or bushes are scored or worn.

Grease the lip of a new oil seal and assemble the seal with the lip towards the roller assembly. An arbor press is generally employed with a $1\frac{7}{32}''$ (30·95 mm.) diameter piece of steel bar used as a piloting tool. Press the seal in until it is fully home but ensure that the seal is not squashed.

Refit the cam locking peg. Inspect the cam for wear and replace if worn or damaged. Refit the cam with the slot over the locking peg. Ensure that the cam is seated correctly.

Insert the drive shaft from the seal side of the body, ensuring that there are no sharp edges on the shaft to damage the oil seal lip.

Refit the drive pin to the shaft and having inspected the roller carrier, fit it into position as shown in Fig. 12. Ensure that the correct face of the carrier slots are driving the rollers. Refit the snap ring.

Inspect the rollers, paying particular attention to the finish on the ends. Replace if scored, damaged or out of round, refit the rollers.

Check the end float of the carrier and rollers in the pump body using feeler gauges and a straight edge across the cam surface. If the end float exceeds ·002″

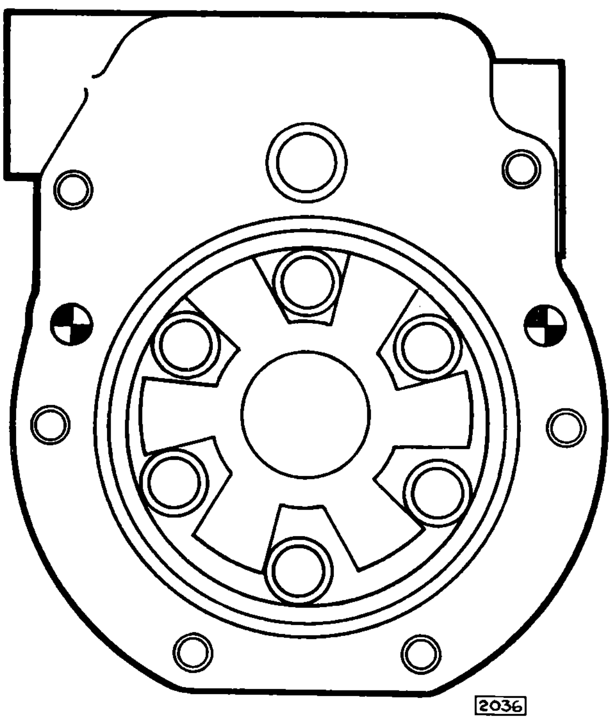


Fig. 12. The roller carrier and rollers in position

(·051 mm.) the rollers and carrier should be replaced.

Refit the flow control spring in the valve bore. The spring should be replaced if the tension is not between 8–9 lbs. (3·63–4·08 kg.) at 0·82″ (20·8 mm.).

Refit the valve in the pump body with the exposed ball bearing end entering last. Ensure that the valve is not sticking. Refit the cap sealing ring and tighten the cap to 30–35 lbs. ft. (4·15–4·84 kg. m.).

Fit new sealing rings to the pump body joint face. Fit the thrust washer to the cover and refit the pump cover to the body, secure with the six cover screws and tighten evenly to a torque of 18 lbs. ft. (2·49 kg. m.).

Important: Check the drive shaft rotation for freedom after tightening the cover screws. There must be no binding.

Fit a new rubber gasket at the adaptor on the cover. Refit the adaptor, adaptor bolt and fibre washer. The plug in the top of the cover housing is used only for sealing purposes and if removed, care should be taken to ensure that an airtight seal is obtained when the plug is replaced.

REFITTING

To install, place the flexible coupling assembly in the slot on the dynamo shaft. Align the slot in the pump driving shaft with the driving tongue on the flexible coupling and push the pump home on to the mounting studs. Secure with nuts and spring washers. Connect the pressure and intake hoses to the pump.

Bleed the system as described on page I.13.

FAULT FINDING

1. High Steering Effort

(*a*) Attach the pressure gauge to the union at the base of the steering box.

Make up a block of hard wood $2\frac{1}{4}'' \times 2\frac{1}{4}''$ (5·75 × 5·75 mm.).

With the steering in the straight ahead position, insert the block of wood between the lower wishbone fulcrum tube bracket and either the steering drop arm or idler lever (depending on which lock is being checked).

Run the engine at 1,000 r.p.m. and turn the steering hard against the block of wood when the pressure gauge should register 1,000 lbs./sq. in. (70·3 kg./sq. cm.). If the pump is not delivering oil under pressure, it may be due to one of the following causes:—

following causes:—

(i) Low oil level. Add oil as necessary.

(ii) Drive belt slippage. Adjust and tighten. Not excessively.

(iii) Stuck valves, dirt wedges in valves. Remove valves from pump and check for free operation.

(iv) Valving surfaces scored by abrasive matter. Replace all scored or worn parts. Clearance of relief valve should not exceed ·0015″ (·038 mm.).

(v) Worm pumping elements. End clearance should not exceed ·0025″ (·063 mm.).

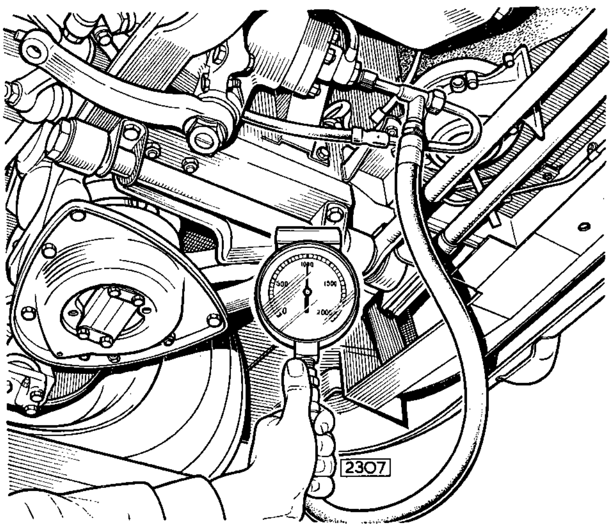


Fig. 13. Checking the pressure with the gauge (Tool No. J.10)

2. Noise (the installation is noisy at engine idling speed).

(*a*) Look for hoses rubbing against the chassis or body metal; isolate hoses.

(*b*) This may be caused by entrapped air in the system.

(i) Check reservoir to pump inlet connections for leaks.

(ii) Bleed the system.

(iii) Refill reservoir to correct level.

(*c*) Inspect oil seal; lips may have been damaged due to faulty installation; replace oil seal.

(*d*) Flow control valve stuck closed, excessive internal pressure build up causing noise.

Free up valve. If necessary use crocus cloth to remove burrs in bore and on valve.

(*e*) Some noise may be expected when wheels are against stops. This is caused by the relief valve. It is undesirable to hold wheels in this position.

(*f*) When the oil level is low on a cold morning start, some noise may be caused by funneling of the oil, allowing air to enter the system. This will stop when the oil heats.

3. Oil Leaks

(*a*) Shaft seal leakage. Replace oil seal.

(*b*) Reservoir gasket. If leakage is indicated by excessive oil around reservoir, replace gasket.

(*c*) Oil flowing out of air vent may indicate a clogged filter. Replace the element.

STEERING IDLER ASSEMBLY

Removal

Remove the self-locking nut and washer securing the track rod end to the idler lever. Drift out the track rod end from the idler lever in which it is a taper fit.

Remove the two setscrews and one long bolt attaching the steering idler bracket to the front suspension cross beam when the steering idler assembly can be detached.

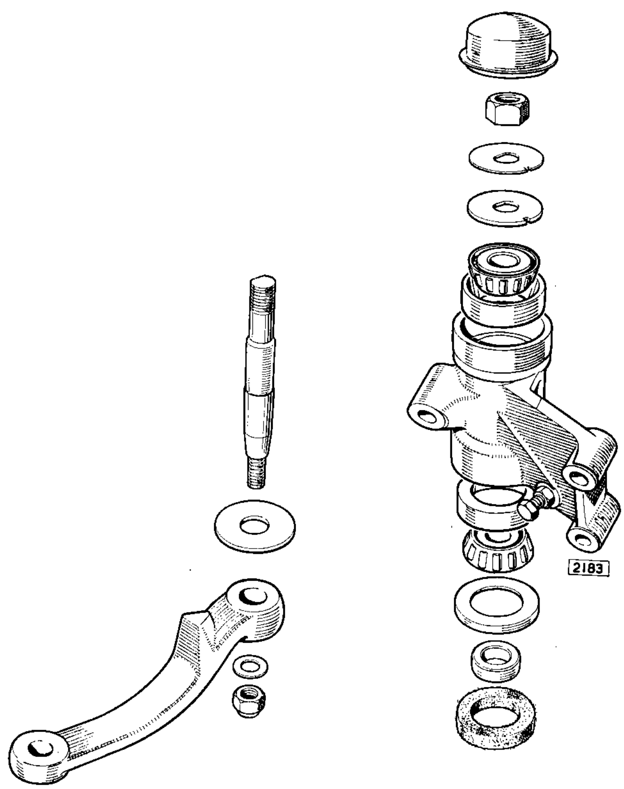


Fig. 14. Exploded view of the idler assembly

Dismantling

Prise out the dust cap from the top of the idler bracket.

Tap back the tab washer and unscrew the nut at the top of the idler shaft.

The idler arm and shaft can now be withdrawn and the washers, felt seal, etc., removed. Remove the inner races of the taper roller bearings.

Assembling

Thoroughly clean out the inner races of the taper roller races and the idler housing. Repack the housing and bearings with one of the recommended greases.

Fit the lower bearing, distance piece, seal retainer and a new felt seal.

Place the large washer over the idler shaft and pass the shaft upwards into the housing.

Fit the upper bearing, "D" washer, tab washer and nut. Tighten the nut to a torque of 5 lbs. ft. If a torque wrench is not available tighten the nut until rotation of the idler shaft by the idler arm feels "sticky" and then slacken back the nut one flat; lock the nut by means of the tab washer and refit the dust cap.

Refitting

Refitting is the reverse of the removal procedure but it is important to ensure that the idler lever is in the straight ahead position before fitting the track rod end to the lever.

Reset the lock stop as described on page I.17. Fig. 15.

LOCK STOP ADJUSTMENT

The lock stop bolts are screwed into the idler lever bracket and steering box respectively and are retained in position by locknuts.

Normally, the lock stop bolts should not require adjustment but if attention is found to be necessary, the adjustment should be carried out in the following manner.

Slacken the locknuts and screw in the lock stop bolts as far as possible. Turn the steering unit until there is $\frac{1}{8}''$ clearance between the track rod eye of the steering drop arm and the rear end of the lower wishbone fulcrum shaft. Screw out the lock stop bolt until the head contacts the abutment on the idler lever and drop arm, and tighten the locknut. Repeat for the other lock.

FRONT WHEEL ALIGNMENT

Check that the car is full of petrol, oil and water. If not, additional weight must be added to compensate for, say, a low level of petrol (the weight of 10 gallons of petrol is approximately 80 lbs.—36·0 kg.).

Ensure that the tyre pressures are correct and that the car is standing on a level surface.

With the wheels in the straight ahead position check the alignment of the front wheels with an approved track setting gauge.

The front wheel alignment should be:—$\frac{1}{16}''$ (1·59 mm.) to $\frac{1}{8}''$ (3·18 mm.) "toe-in" (measured at the wheel rim).

Re-check the alignment after pushing the car forward until the wheels have turned half a revolution (180°).

If adjustment is required slacken the clamp bolt at each end of the central track rod and rotate the rod in the required direction until the alignment of the front wheels is correct. Tighten the clamp bolts and re-check the alignment.

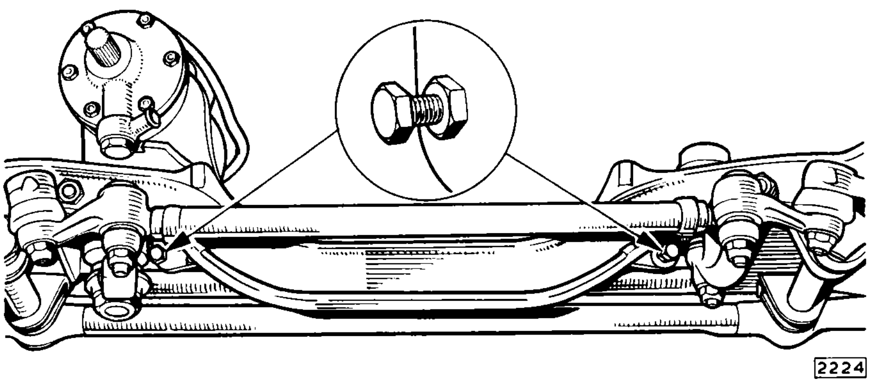


Fig. 15. Positions of the steering lock stops

STEERING ARM

Removal

Raise the car by placing a jack under the front suspension cross member and remove the road wheel.

Remove the self-locking nut and plain washer securing the tie rod to the steering arm. Drift out the tie rod ball pin from the steering arm in which it is a taper fit.

Unscrew the centre self-locking nut securing the stub axle shafts and steering arm to the carrier and remove the wired bolt attaching the end of the steering arm to the carrier. The steering arm can now be removed.

Refitting

Refitting is the reverse of the removal procedure. Use new locking wire to secure the steering arm attachment bolt.

TIE ROD

The tie rod ball joints cannot be dismantled and if worn a complete tie rod assembly must be fitted.

Removal

Remove the self-locking nuts and plain washers securing the tie rod to the steering arm and track rod end.

Tap the tie rod ball pins out of the steering arm and track rod end in which they are a taper fit.

Refitting

Refitting is the reverse of the removal procedure.

TRACK ROD

The track rod ends incorporate rubber/steel bonded bushes. If the bushes show signs of deterioration they should be replaced.

Removal

Remove the self-locking nuts and washers from the inner ball joint of each tie rod. Tap the ball pin out of each track rod end in which they are a taper fit.

Remove the self-locking nuts and washers securing the track rod ends to the drop arm and idler lever.

Tap the track rod ends out of the drop arm and idler lever in which they are a taper fit.

Dismantling

To remove the track rod ends, slacken the clamp at each end of the centre tube; unscrew each end from the tube noting that one end has a left-hand thread and the other a right-hand thread.

Assembling

When refitting the track rod ends to the centre tube, screw in each end **an equal number of turns.** The final setting of the track rod length must be carried out after the track rod has been refitted, as described under the heading "Front Wheel Alignment."

STEERING WHEEL

Removal

Remove the back cover which is clipped on to the horn ring. Undo the three screws securing the horn ring to the steering wheel and remove the horn ring. Undo the locknut (33, Fig. 16) and the nut (31) securing the steering wheel to the inner column. Withdraw the steering wheel and collect the two halves of the split cone (29).

Refitting

Hold the split cones in place in the grooves of the inner column shaft, making sure that the narrowest part of the cone is towards the top of the column. With the other hand slide the steering wheel on to the column shaft splines so that the two spokes are horizontal when the road wheels are pointing straight ahead. Push the steering wheel fully home on to the split cone. Fit the plain washer, the securing nut and the locknut. Refit the horn ring and cover.

STEERING COLUMN

Removal

Disconnect the battery.

Remove the two knurled nuts fitted on either side of the console adjacent to the scuttle.

Remove the knurled nuts situated at the rear of console and withdraw the console.

Remove the two drive screws situated on either side of the parcel tray.

Remove the two set bolts found directly above the console and retaining the parcel tray in position. Withdraw the complete parcel tray.

Disconnect the wires from the flashing indicator/headlamp flashing switch at the snap connectors.

If an overdrive is fitted, disconnect the wires from the overdrive switch at the snap connectors.

Disconnect the wires from the illuminated indicator nacelle at the snap connectors.

If the car is fitted with automatic transmission, unscrew the ratchet adjustment on the ball joint and lift out the ball.

If the car is fitted with a combined ignition switch and steering column lock, disconnect the white and the brown and white cables from the column switch.

1. Lower steering column assembly
2. End yoke
3. Journal assembly
4. Socket
5. Nylon roller
6. Circlip
7. Gaiter
8. Clip
9. Clip
10. Outer tube assembly
11. Felt bearing
12. Felt bearing
13. Retaining washer
14. Spring clip
15. Inner column

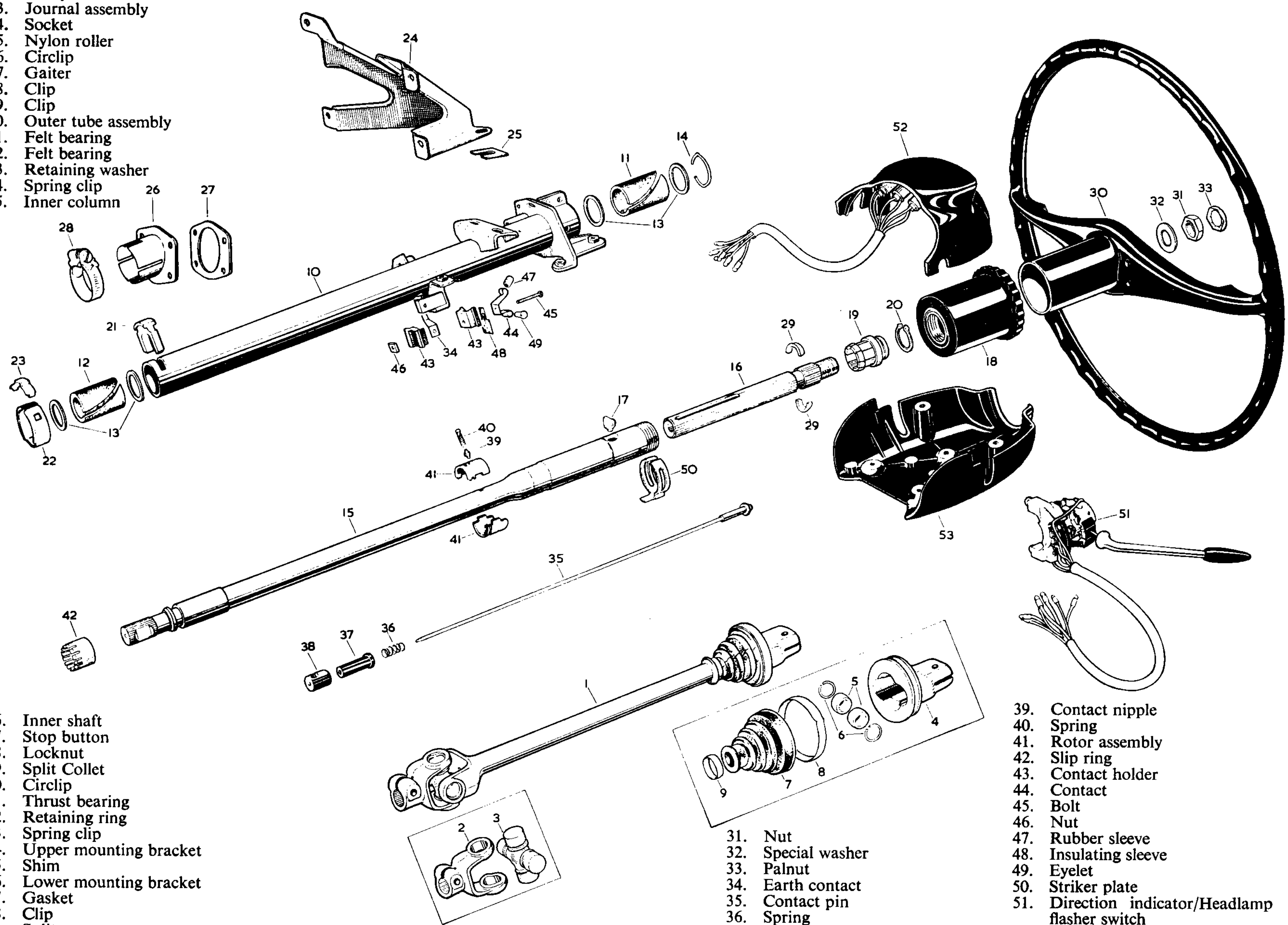


Fig. 16. Exploded view of the steering column

16. Inner shaft
17. Stop button
18. Locknut
19. Split Collet
20. Circlip
21. Thrust bearing
22. Retaining ring
23. Spring clip
24. Upper mounting bracket
25. Shim
26. Lower mounting bracket
27. Gasket
28. Clip
29. Split cone
30. Steering wheel
31. Nut
32. Special washer
33. Palnut
34. Earth contact
35. Contact pin
36. Spring
37. Insulating bush (upper)
38. Insulating bush (lower)
39. Contact nipple
40. Spring
41. Rotor assembly
42. Slip ring
43. Contact holder
44. Contact
45. Bolt
46. Nut
47. Rubber sleeve
48. Insulating sleeve
49. Eyelet
50. Striker plate
51. Direction indicator/Headlamp flasher switch
52. Upper switch cover assembly
53. Lower switch cover assembly

Disconnect the wires at the back of the starter/ reverse inhibitor switch.

Remove the set bolt securing the inhibitor switch to the steering column.

Pull out the horn wire at the contact found immediately below the bottom half of the nacelle.

Unscrew the hose clip securing the bottom of the steering column to the mounting bracket.

Remove the pinch bolt securing the inner column to the top universal joint on the lower steering column.

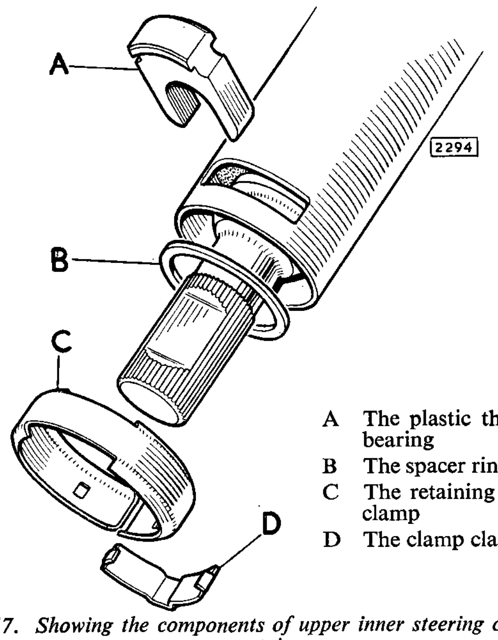
Remove the two bolts and washers securing the upper steering column to the body.

Collect the packing pieces between the upper column bracket and body.

Remove the claw and retaining clamp situated at the lower end of the upper column. Withdraw the plastic thrust bearing and collect the spacer ring found between the inner and outer column.

Withdraw the steering column.

Note: If the car is fitted with a combined ignition steering column lock, the switch cannot be removed from the inner column.



A The plastic thrust bearing
B The spacer ring
C The retaining clamp
D The clamp claw

Fig. 17. Showing the components of upper inner steering column retainer

Dismantling

Remove the cover which is clipped to the horn ring and covers the horn contact points.

Remove the three screws and spring washers securing the horn ring to the steering wheel.

Unscrew the locknut (33, Fig. 16), nut (31) and plain washer (32) securing the steering wheel (30) to the shaft (16) inside the inner column (15).

Withdraw the steering wheel and collect the split cone (29).

Unscrew the steering wheel locking nut (18) and remove.

Remove the two screws and plain washers securing the top half of the nacelle (52) to the bottom half.

Remove the three screws and plain washers securing the bottom half of the nacelle (53) to the upper steering column.

Withdraw the horn contact rod.

Remove the rubber insulating collar.

Remove the two screws, serrated and plain washers securing the flashing indicators striker ring (50) in position.

Unscrew the centre button (17) retaining the inner column (16) in position.

Prise up the horn earth contact and withdraw the inner column.

If the car is fitted with a combined ignition steering column lock, turn the switch to the Drive position to enable the inner column to be withdrawn.

Remove the circlip and withdraw the collet from the lock nut.

Remove the two bolts, nuts, shakeproof washers and spacers securing the quadrant selector to the outer column bracket.

Prise up slightly the horn pick up ring (42) serrations.

Slide off the horn pick up ring and remove the top and bottom half of the rubber rotor (41).

Pinch together one of the ends of the starter/reverse inhibitor switch control rod and withdraw the washer and control rod.

Remove the inhibitor switch/automatic transmission bracket locating screw.

Withdraw the bracket from the automatic transmission control rod.

Remove the two screws and serrated washers securing the flashing indicator switch to the outer column.

If the car is fitted with automatic transmission unclip the circlip and slide it and the washer along the automatic transmission control rod.

If the car is fitted with an overdrive remove the two nuts, bolts and serrated washers securing the overdrive switch to the outer column.

Remove the bolt, plain and serrated washers securing the quadrant selector pointer to the outer column bracket.

Withdraw the automatic transmission control rod from the bushes.

Remove the nut and bolt securing the earth contact (34).

Remove the nut (46) and bolt (45) securing the two rubber contact holders (43), fibre insulating strip (48) and contact (44).

Remove the spring clip (14) and washers (13) securing the bearings (11 and 12) in the outer steering column (10).

Assembling

Replace the two washers (13) and spring clip (14) securing the upper bearing (11) in the outer steering column (10).

Repeat the procedure when refitting the lower bearing.

Replace the two rubber contact holders (43) in the bracket.

The large contact (44) which touches the horn pick up ring should face towards the top of the outer column.

Pass the bolt (45) through the contact (44), fibre insulating strip (48) and secure with the nut (46).

Replace the earth contact (34) and secure it to the outer column with a nut and bolt.

Refit the selector quadrant and secure it to the outer column bracket by two nuts, bolts, spacers and washers. The spacers are to fit between the selector quadrant and the bracket.

Pass the control rod through the top bush on the outer column. Slide the plain washer and circlip over the control rod and insert through the lower bush on the outer column. Align the flat on the control rod with the hole for the securing screw on the inhibitor switch/automatic transmission control bracket.

Refit the starter/reverse inhibitor switch control rod and washers. Open the split ends of the control rod.

Refit the quadrant selector pointer to the bracket on

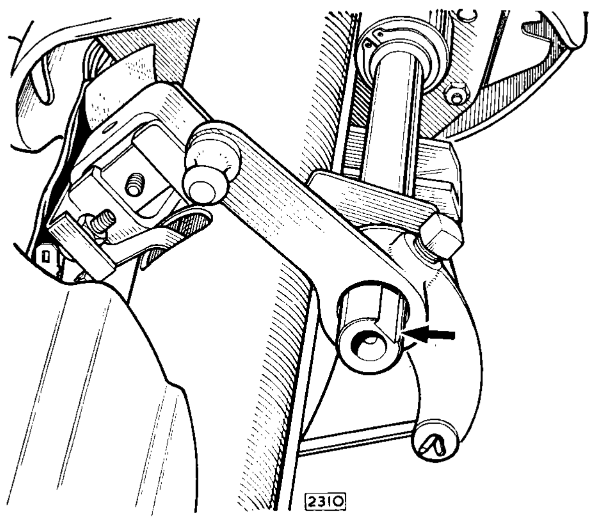


Fig. 18. Aligning the flat on the control rod with the setscrew in the transmission control bracket

Refit the two screws and serrated washers securing the flashing indicator switch to the outer column.

If the car is fitted with an overdrive secure the overdrive switch to the outer column bracket with two bolts, nuts and serrated washers.

Fit the two halves of the rubber rotor (41) and slide the horn pick up ring (42) over both halves of the rotor with the serrations in the pick up ring towards the bottom of the column.

Gently knock the serrations into the groove in the rubber rotors until the horn pick up ring is secure.

Slide the inner shaft (16) into the inner column (15) so that the slot in the shaft serrations aligns with the centre button hole in the inner column.

Screw the centre button (17) into position until the inner shaft binds on the button.

Slacken off the button until the inner shaft moves freely.

The striker ring (50) should be fitted with the striker peg towards the bottom of the column and the opposite side to the inner shaft retaining button.

Turn the inner column until the striker retaining bolts are in the vertical position.

Set the striker peg so that it is just below the horizontal axis position.

Refit the two screws, serrated and plain washers securing the flashing indicator striker ring in position. the outer column and secure finger tight with a nut, bolt and serrated washer.

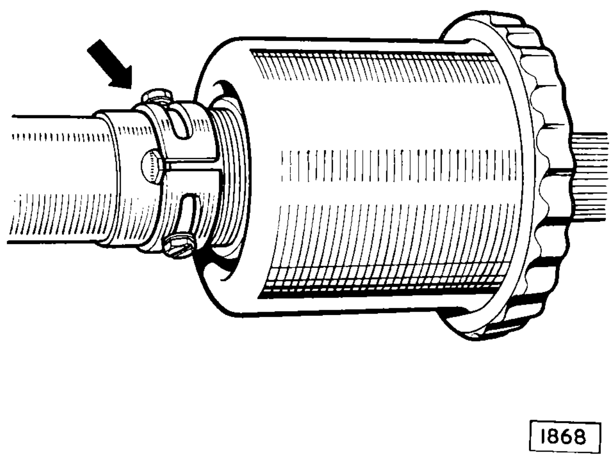
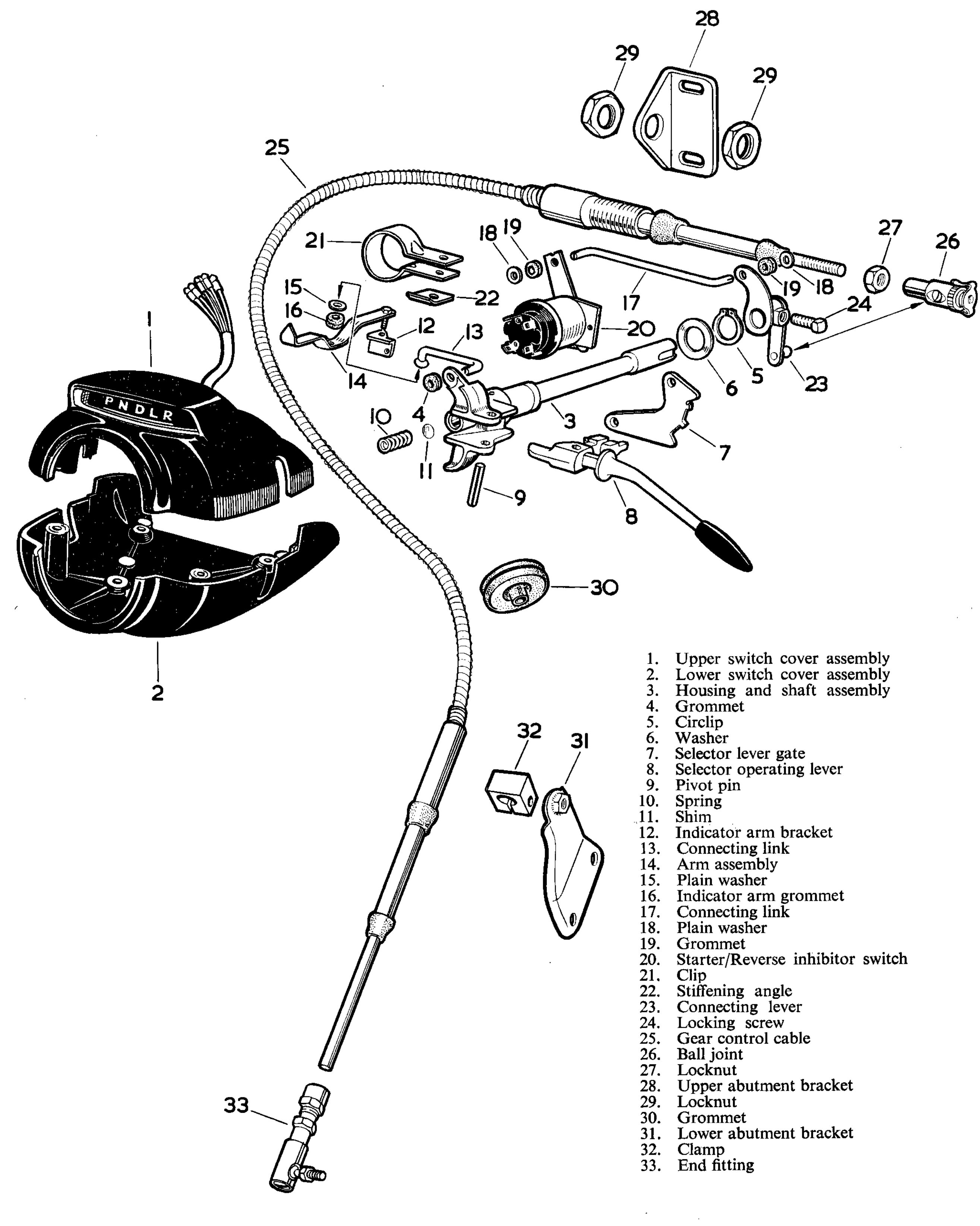


Fig. 19. Centralizing the flashing indicator striker peg

Slide the inner column (15) into the outer column (10). Care should be taken to avoid damaging the earth contact (34) on the outer column.

Place the bottom half of the nacelle (53) on to the outer column (10) and secure with three screws and washers.



1. Upper switch cover assembly
2. Lower switch cover assembly
3. Housing and shaft assembly
4. Grommet
5. Circlip
6. Washer
7. Selector lever gate
8. Selector operating lever
9. Pivot pin
10. Spring
11. Shim
12. Indicator arm bracket
13. Connecting link
14. Arm assembly
15. Plain washer
16. Indicator arm grommet
17. Connecting link
18. Plain washer
19. Grommet
20. Starter/Reverse inhibitor switch
21. Clip
22. Stiffening angle
23. Connecting lever
24. Locking screw
25. Gear control cable
26. Ball joint
27. Locknut
28. Upper abutment bracket
29. Locknut
30. Grommet
31. Lower abutment bracket
32. Clamp
33. End fitting

Fig. 20. Exploded view of the automatic transmission control

Refit the top half of the nacelle (52) and secure with two screws and washers.

If the car is fitted with automatic transmission move the hand control to the "D" position in the selector quadrant and move the pointer along the elongated slot in the outer column bracket until the pointer coincides with the "D" on the nacelle.

Tighten the nut and bolt securing the pointer.

Refit the split collet and circlip to the steering column locknut.

Refitting

Ensure that the front road wheels are in the straight ahead position.

Offer up the steering column to the mounting points.

Ensure that the striker ring (50) on the inner column (15) is between the two cancelling arms on the flashing indicator switch.

Engage the splines of the upper steering column with the splines on the lower steering column universal joint.

Refit the two nuts and washers securing the upper steering column top mounting bracket to the body.

Refit the pinch bolt securing the inner column to the top universal joint on the lower steering column.

Tighten the jubilee clip securing the upper steering column to the lower mounting bracket.

Replace the plastic thrust bearing and retaining clamp in the upper column.

Fit a new claw and secure, pinching the raised portion with a pair of pincers.

On automatic transmission cars, refit the ratchet adjustment to the ball joint on the control rod bracket.

To ensure correct operation of the reverse light and starter cut-out inhibitor switch it is important that the following instructions be adhered to:

On all automatic transmission cars slacken the starter/reverse light inhibitor switch securing bolt. Move the gear selector lever until the gear indicator is in between the "L and R" position. Move the starter/reverse light inhibitor switch until the hole in the lever is in line with the hole in the switch base plate. Place a piece of wire through the two holes and tighten the nut securing the switch to the upper steering column (see Fig. 21). Remove the wire.

Fit the three illumination bulbs at the back of the nacelle.

Fit the top half of the nacelle and secure to the bottom half with two screws and washers.

If an overdrive switch is fitted connect the wires from the overdrive switch to the snap connectors.

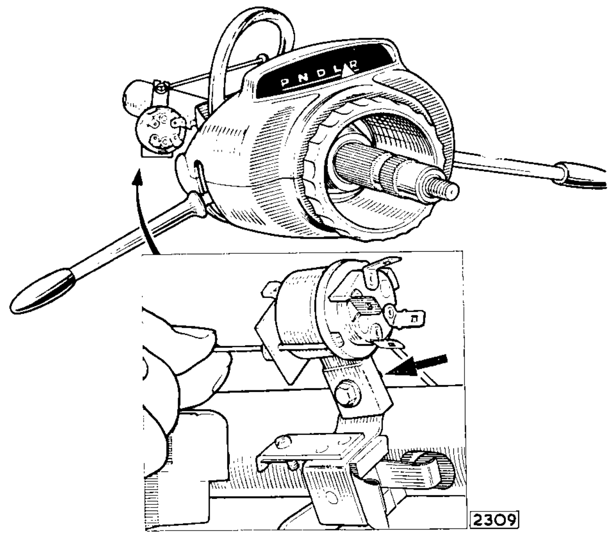


Fig. 21. Setting the starter/reverse inhibitor switch

Refit the wires from the flashing indicator/headlamp flashing switch to the snap connector.

Screw the steering wheel locking nut (18) into position on the inner column (15).

Place the split cone (29) into the groove on the inner shaft (16) with the tapered end towards the top of the shaft.

Fit the steering wheel (30) on to the inner shaft with the two holes on the steering wheel centre boss towards the top.

Refit the plain washer (32), nut (31) and locknut (33).

Ensure that the horn button contact rod makes good contact with the horn ring pick up.

Clip the horn ring contact cover into position on the horn ring.

Replace the horn contact wire, starter/reverse inhibitor switch wires and the gear selector panel wires.

Refit the parcel tray and secure with four drive screws and two set bolts.

Replace the console and secure with the four knurled nuts.

LOWER STEERING COLUMN

Removal

Remove the upper steering column as described in the foregoing paragraphs.

Remove the pinch bolt retaining the universal joint to the steering box shaft when the lower column can be removed.

Refitting

Refitting is the reverse of the removal procedure.

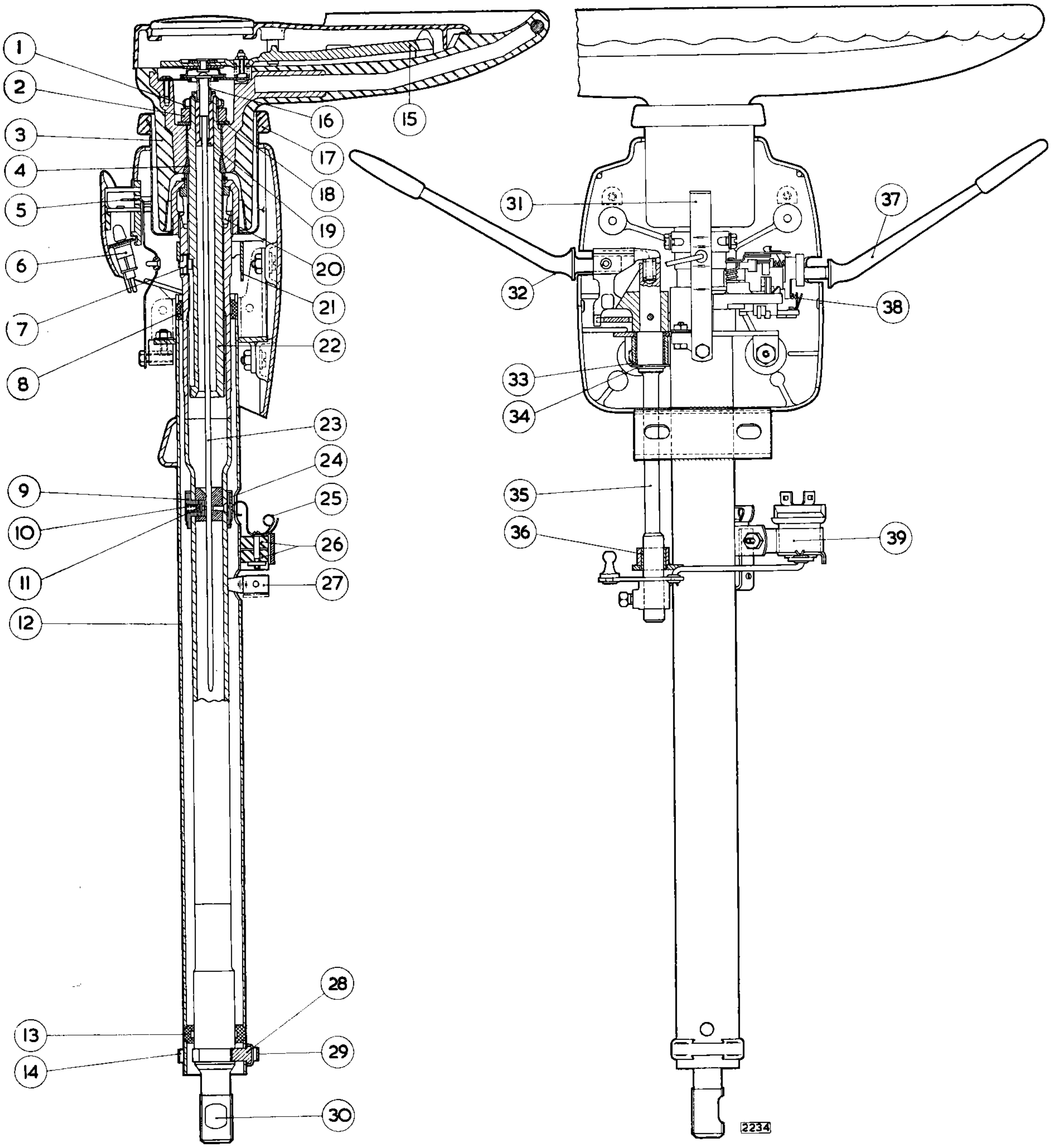


Fig. 22. Sectioned view of the upper steering column

1. Tabwasher
2. Nut
3. Steering wheel
4. Split cone
5. Indicator
6. Bulb socket
7. Stop button
8. Retaining washer
9. Rotor (bottom half)
10. Spring
11. Horn slip ring
12. Outer tube
13. Bearing (Felt or Vulkollan)
14. Retaining clamp
15. Horn ring
16. Horn ring contact
17. Locknut
18. Plain washer
19. Bush
20. Split collet
21. Striker
22. Inner column
23. Contact rod
24. Rotor (top half)
25. Contact
26. Contact holder
27. Earth contact
28. Plastic thrust bearing
29. Clamp claw
30. Pinchbolt location
31. Indicator
32. Gear selector lever
33. Bush
34. Circlip
35. Selector rod
36. Bearing bush
37. Headlamp flasher and flashing indicator operating lever
38. Headlamp flasher contacts
39. Reverse and starter inhibitor switch

ACCIDENTAL DAMAGE

The following dimensional drawings are provided to assist in assessing accidental damage. A component suspected of being damaged should be removed from the car, cleaned off, and the dimensions checked and compared with those given in the appropriate illustration.

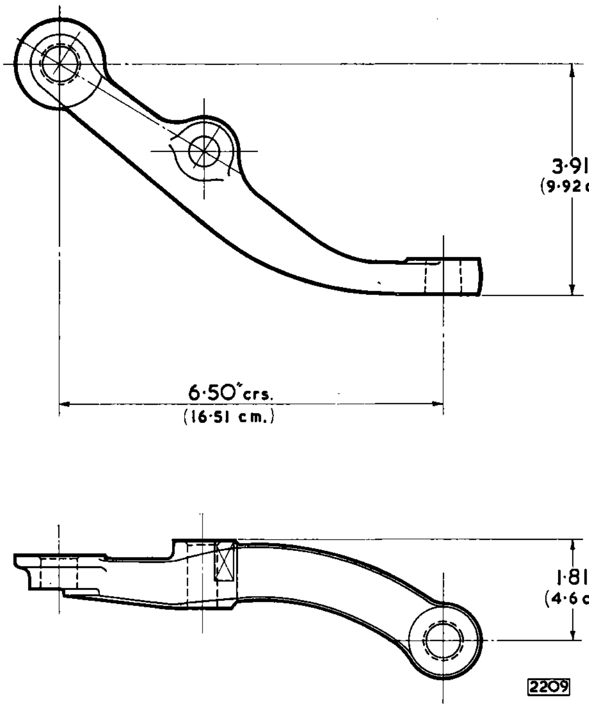


Fig. 23. The steering arm

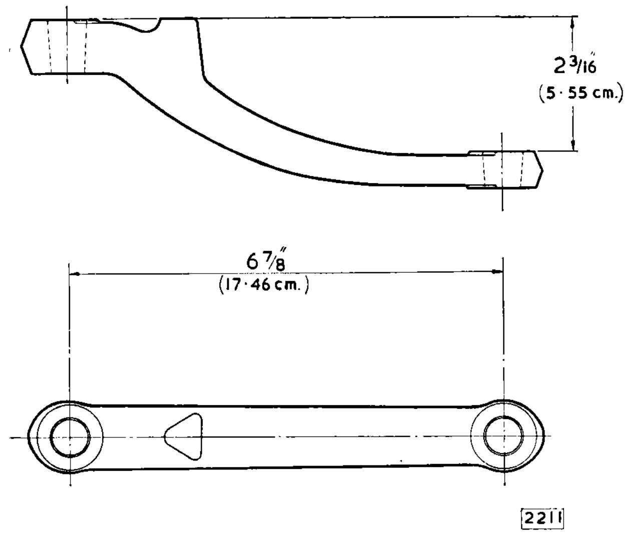


Fig. 24. The idler lever

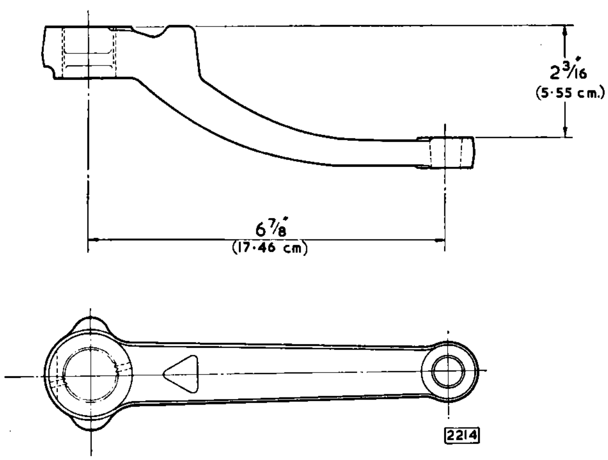


Fig. 25. The steering drop arm

SPECIAL TOOLS

Description	Tool Number
Main Nut piston ring compressor sleeve ..	J.19
Hydraulic pressure gauge	J.10
End cover fitting tool	8343

INTRODUCTION OF BLEED POINT ON POWER ASSISTED STEERING UNIT

	R.H. Drive	*L.H. Drive*
Commencing Chassis No.	303738	352573

Commencing at the above chassis numbers, a bleed point is fitted in the top cover of the power steering box.

If a lumpy feeling on one particular lock is experienced, it will be necessary to slacken the plug half a turn to release air from the unit whilst the engine is running. Always tighten the bleed screw securely after bleeding.

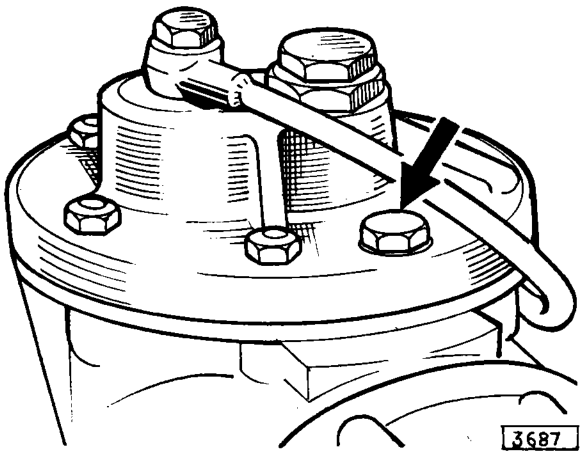


Fig. 26. Power steering bleed point

STEERING COLUMN LOCK (Optional Extra)

	R.H. Drive	*L.H. Drive*
Commencing Chassis No.	301225	351545

Commencing at the above chassis numbers, the upper steering column is modified to enable the "Waso-Verkon" combined ignition switch/steering column lock to be fitted.

Description

The combined ignition switch/steering column lock replaces the normal ignition switch located on the instrument panel.

The switch/lock unit is mounted on an extension arm attached to the steering column below the steering wheel. The key has three positions—Drive (Fahrt), Garage (Garage) and Stop (Halt). The fourth position, Start, is not used.

Operation

Drive (Fahrt)

This is the normal driving position. The key cannot be withdrawn in this position and the ignition is "ON".

Garage (Garage)

This is the normal stop position. The key can be withdrawn leaving the car capable of being steered with the ignition "OFF".

Stop (Halt)

This is the locked stop position. The key can be removed leaving the steering locked and the ignition "OFF". The key can only be removed after depressing the chromium plated bar situated on the right hand side of the key-hole. To unlock the steering, insert the key and turn to Garage or Drive position.

Fitting the Steering Column Lock

Disconnect the battery.

On automatic transmission cars only, remove the steering wheel and upper steering column as detailed on page I.18. Remove the control rod and mechanism to facilitate fitting the lock.

On standard and overdrive transmission cars it is only necessary to lower the upper end of the column by removing the clamping bolt.

Fit the lock to the steering column but do not tighten the clamp bolts.

Check that the switch/lock assembly is correctly aligned in the lower cover cut-out. Insert the key and turn to the "Stop" (Halt) position. Remove the key and check that the lock bolt is entering the register holes in the outer and inner columns and that the steering is locked. Tighten the clamp bolts evenly until the heads sheer off.

It is important that the correct operation of the lock is ensured before the clamp bolts are fully tightened. After the heads have been sheered off the lock cannot be removed.

Refit the steering column as detailed on page I.23.

Modify the wiring as follows:—
Lower the instrument panel and disconnect the brown and white cable from the small terminal of the ammeter and tape back into the harness. Disconnect the brown and white cable from the ignition switch and tape back into the harness.

Connect the long brown and white cable to the vacant small terminal on the ammeter. The lead is approximately 2′ 6″ (76·2 cm.) long with a P.V.C. sleeve. Tape into the harness until the point is reached where the main harness is taken through the bulkhead.

Connect the single white cable with the black P.V.C. sleeve to the vacant terminal on fuse No. 6 or 7.

Tape the steering lock connector to the harness on the steering column and connect to the lock switch as follows:—

Connect the white cable to terminal No. 15. Connect the brown and white cable to terminal No. 30. Remove the terminal from the switch cable ends and strip the cables $\frac{3}{8}$″ (9·5 mm.) before connecting to the switch.

Close the instrument panel. Reconnect the battery and check the operation of the switch/lock.

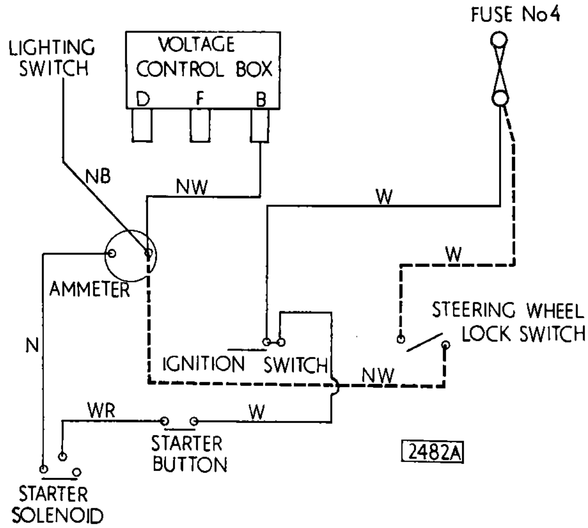


Fig. 27. Wiring diagram of Steering Lock/Ignition switch assembly

SECTION J

FRONT SUSPENSION

3·8 MARK 10 MODEL

INDEX

INDEX *(continued)*

FRONT SUSPENSION

DESCRIPTION

The front suspension assembly consists of a forged steel cross beam with fabricated pressed steel "turrets" bolted to either end to which are attached the wishbones, stub axle carriers and coil spring and damper units. The power-assisted steering unit, idler assembly, track rod and tie rods are also attached to the cross beam. The lower wishbone fulcrum shafts which are attached to the underside of the turret assemblies are tied together at their front ends by means of a bar running transversely across the assembly.

The coil springs are housed in the "turrets" at either end of the forged cross beam, and are retained at the lower end by seat pans bolted to the lower wishbone.

Each coil spring is controlled by a direct acting hydraulic damper mounted in the centre of the spring. The top end of the damper is attached to the turret and the lower end of the damper is bolted to a mounting bracket which is in turn attached to the coil spring seat pan.

The upper wishbone levers are of forged steel and are mounted at the fulcrum shaft end on rubber/steel bonded bushes. The outer ends of the wishbone levers are bolted to the upper wishbone ball joint which is in turn attached to the stub axle carrier.

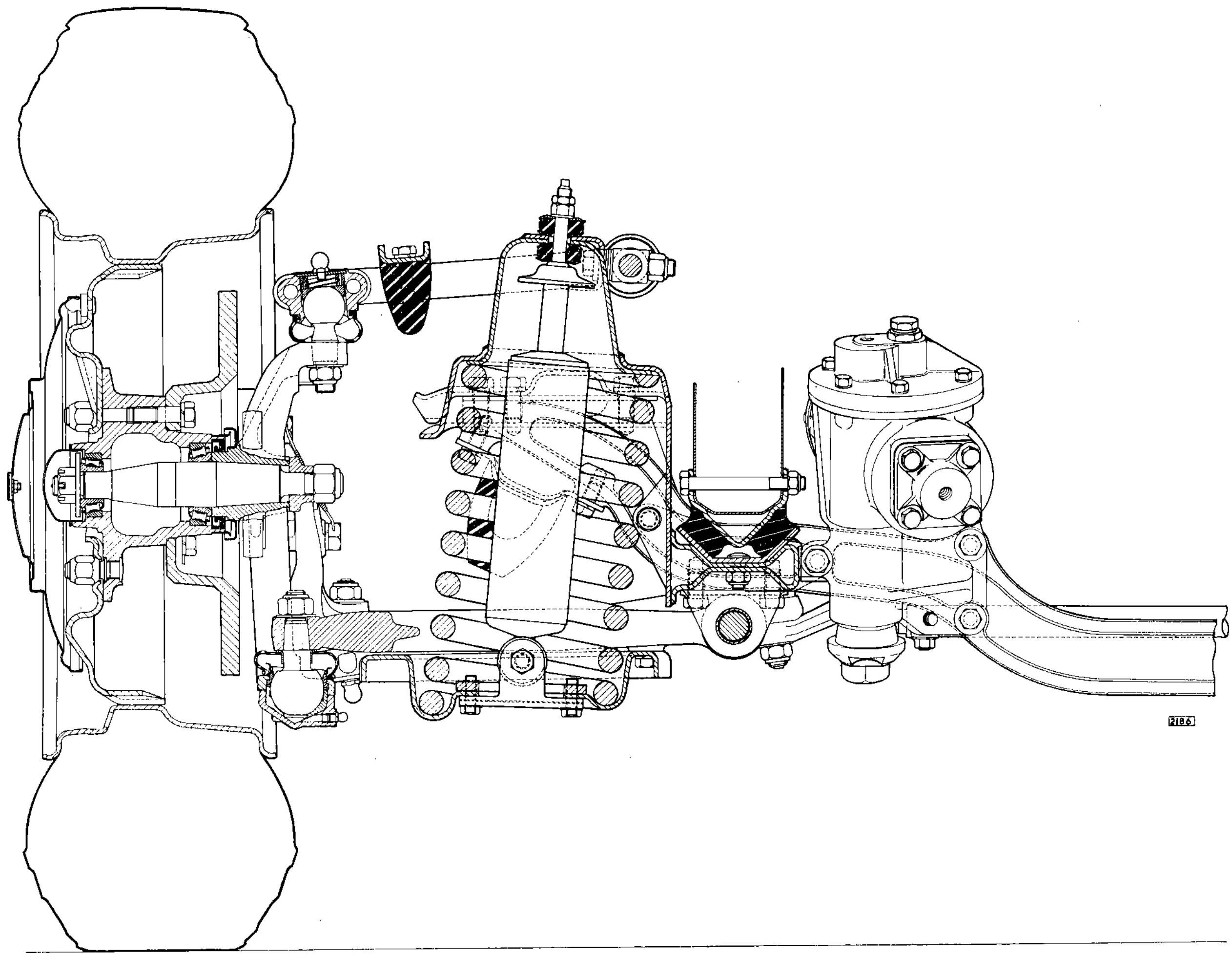


Fig. 1. Sectioned view of the front suspension

The lower wishbone is a one piece forging, the inner ends of which are mounted on rubber/steel bonded bushes. The outer end of the lower wishbone is bolted to the lower ball joint which in turn is attached to the stub axle carrier.

The wheel hub is supported on two tapered roller bearings the inner races of which fit on a shaft located in a tapered hole bored in the stub axle carrier.

An anti-roll bar fitted between the two lower wishbones, is attached to the chassis side members by rubber insulated brackets.

The front suspension assembly is attached to the body underframe at four points. The lower wishbone fulcrum shafts which are attached to the turret assemblies are attached in turn to the front ends of the chassis side members by means of flat rubber/steel bonded mountings. The rear end of the suspension assembly is attached to the chassis side members by means of two "V" shaped rubber/steel bonded mountings.

DATA

Type	Independent—Coil Spring
Dampers	Telescopic hydraulic
Castor Angle	$0° \pm \frac{1}{2}°$
Camber Angle	$\frac{1}{2}° \pm \frac{1}{2}°$ positive
Swivel Inclination	$3\frac{3}{4}°$

ROUTINE MAINTENANCE

The front suspension wishbone levers and anti-roll bar are supported in rubber bushes which do not require attention.

Hydraulic Dampers

The hydraulic dampers are of the telescopic type and no replacement with fluid is necessary or provided for.

EVERY 2,500 MILES (4,000 KM.)

Wheel Swivels

Lubricate the nipples (four per car) fitted to the top and bottom of the wheel swivels.

The nipples are accessible from underneath the front of the car.

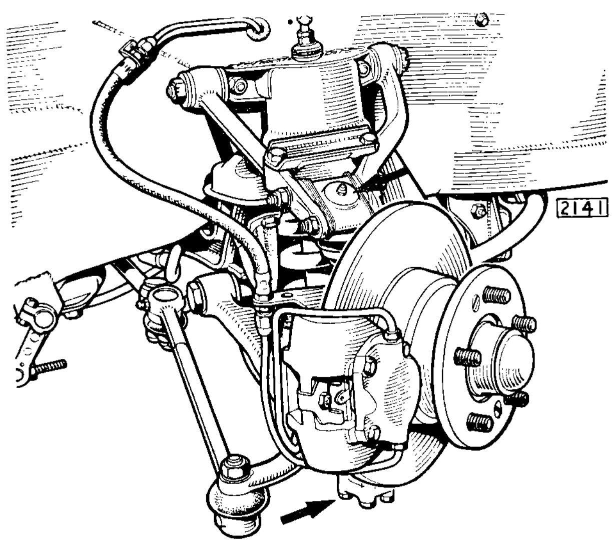


Fig. 2. The steering swivel grease nipples

EVERY 10,000 MILES (16,000 KM.)

Wheel Bearings

No grease nipples are fitted to the front wheel hubs and therefore it is necessary, at the recommended intervals, to dismantle the front wheel hubs, thoroughly clean out and repack the taper roller bearings with one of the recommended high melting point greases.

Do NOT pack the hub with grease but apply a coating to the inside of the hub between the outer races of the bearings. Apply a light coat of grease to the stub axle shaft; do not fill the hub end cap.

When the hub has been refitted, adjust the bearing end float as described on page J.12.

RECOMMENDED LUBRICANTS

Component	Mobil	Castrol	Shell	Esso	B.P.	Duckham	Regent Caltex/Texaco
Wheel Bearings	Mobilgrease MP	Castrolease LM	Retinax A	Esso Multi-purpose Grease H	Energrease L2	LB.10	Marfak All-purpose
Wheel Swivels	Mobilgrease MP	Castrolease LM	Retinax A	Esso Multi-purpose Grease H	Energrease L2	LB.10	Marfak All-purpose

FRONT SUSPENSION ASSEMBLY

Removal

Jack up under the front suspension cross-member until the road wheels are clear of the ground. Remove the road wheels.

Support the weight of the car under the front jacking sockets by means of blocks not less than 16″ (40 cm.) in height, leaving the jack in position under the front cross-member.

Remove the four self-locking nuts securing the front suspension rear mountings to the chassis side members.

Remove the four bolts, washers and self-locking nuts securing the front mountings to the brackets at the front ends of the chassis side members.

Disconnect the two anti-roll bar mountings from the body underframe members.

Disconnect the flexible bıake hoses at the brackets on the body.

Disconnect the two hoses at the power-assisted steering box, and allow the fluid to drain into a clean container.

Remove the clamping bolt securing the steering column universal joint to the steering box shaft.

Lower the front suspension cross-member assembly on the jack until the front suspension assembly can be drawn forward.

Refitting

When refitting the front suspension cross-member assembly ensure that the brake discs are in the straight

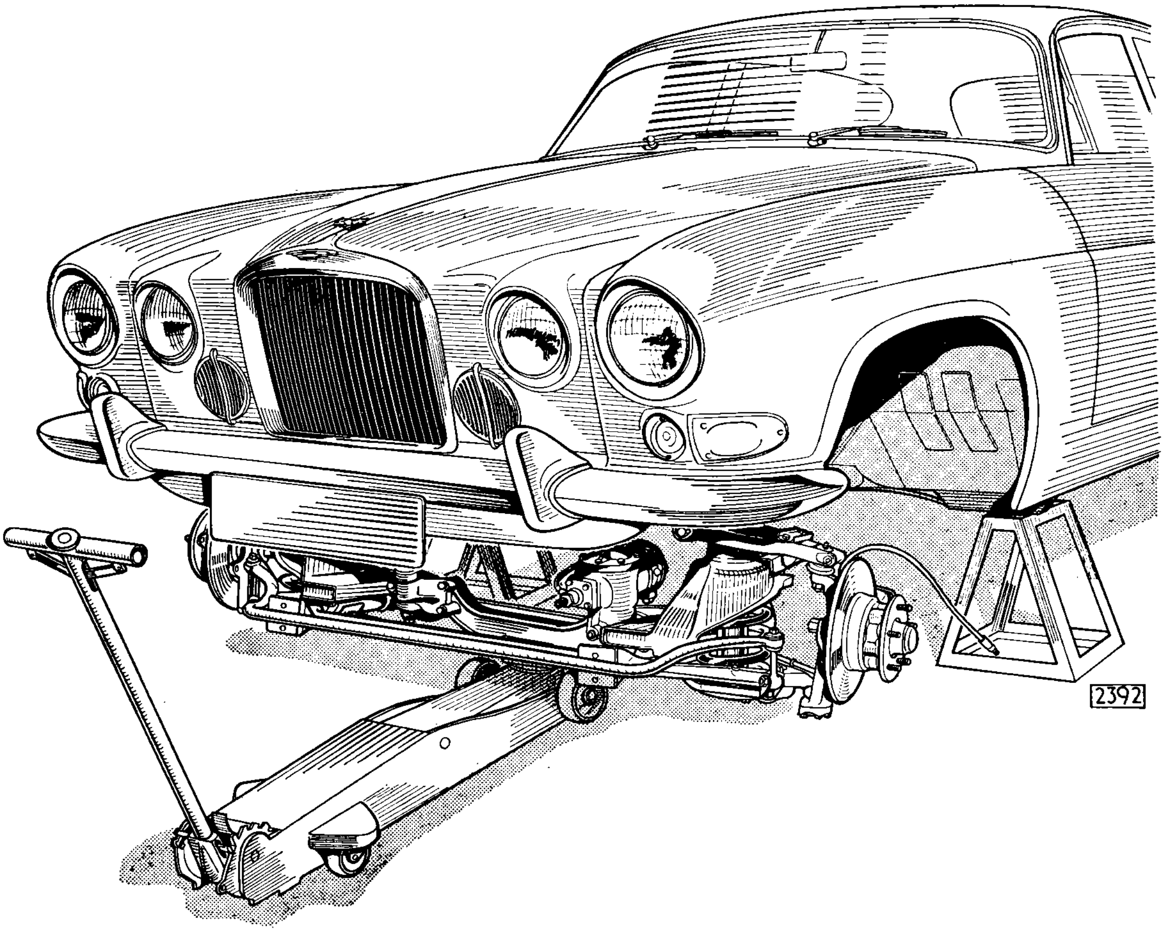


Fig. 3. Removal of the front suspension

ahead position and that the steering wheel spokes are in the three and nine o'clock positions with the horn ring at the bottom.

After the front suspension assembly has been completely refitted it will be necessary to "bleed" the brake hydraulic system as described in Section L—"Brakes."

It is advisable to bleed the power-assisted steering system as detailed in Section I "Steering."

HYDRAULIC DAMPERS

The telescopic hydraulic dampers are of the sealed type with no provision for adjustment or "topping up" with fluid. Therefore, in the event of a damper being unserviceable a replacement must be fitted.

Before fitting a damper to a car it is advisable to carry out the following procedure to "bleed" any air from the pressure chamber that may have accumulated due to the damper having been stored in a horizontal position. Hold the damper in its normal vertical position with the shroud uppermost and make several short strokes (not extending more than halfway) until there is no lost motion and finish by extending the damper to its full length once or twice. Do not extend the damper fully until several short strokes have been made first. After the operation of "bleeding" the hydraulic dampers should be kept in their normal upright position until they are fitted to the car.

Removal

Removal of the hydraulic dampers will be facilitated if the wishbones are kept approximately horizontal by placing either a piece of 2″ × 2″ × 8″ (5·1 × 5·1 × 20·3 c/m.) angle iron or a piece of wood of the same dimensions between the top wishbone and the fabricated turret (as shown in Fig. 5). The wishbones may

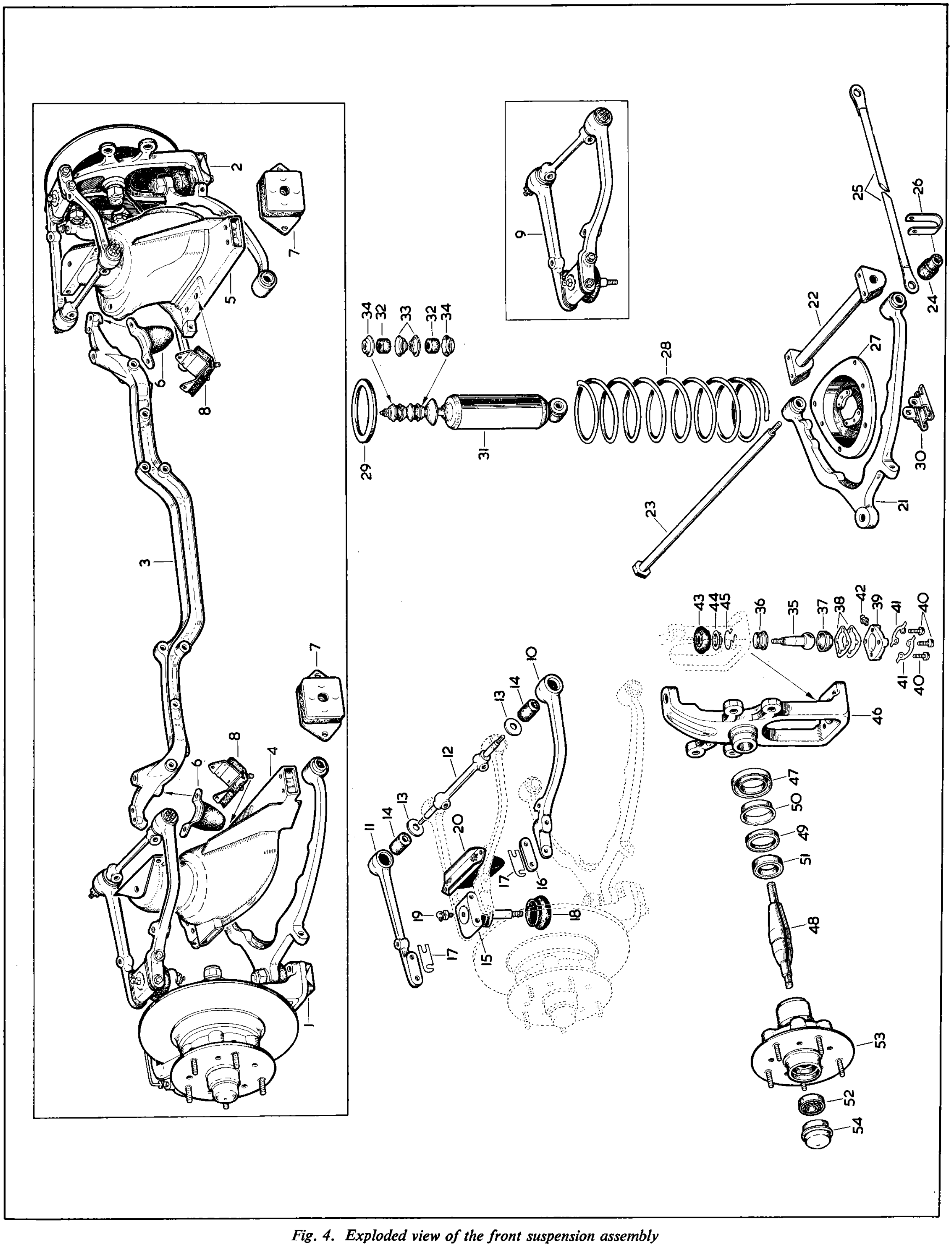


Fig. 4. Exploded view of the front suspension assembly

1. Front suspension assembly R.H.
2. Front suspension assembly L.H.
3. Front suspension beam
4. Suspension bracket assembly R.H.
5. Suspension bracket assembly L.H.
6. Bump stop
7. Front rubber mounting
8. 'V' rubber mounting (rear)
9. Upper wishbone assembly R.H.
10. Upper wishbone lever (front)
11. Upper wishbone lever (rear)
12. Fulcrum shaft
13. Distance washer
14. Rubber bush
15. Ball joint assembly
16. Distance piece
17. Shim
18. Gaiter
19. Grease nipple
20. Rebound stop
21. Lower wishbone R.H.
22. Fulcrum tube and bracket
23. Fulcrum shaft
24. Safety bush
25. Cross tube
26. Check strap
27. Coil spring seat
28. Coil spring
29. Packing ring
30. Lower damper mounting bracket
31. Hydraulic damper
32. Rubber buffer
33. Inner washer
34. Outer washer
35. Ball pin
36. Spigot
37. Ball pin socket
38. Shim
39. Cap
40. Bolt
41. Tab washer
42. Grease nipple
43. Rubber gaiter
44. Gaiter retainer
45. Clip
46. Stub axle carrier
47. Water deflector
48. Stub axle shaft
49. Oil seal
50. Water deflector
51. Inner bearing
52. Outer bearing
53. Front hub
54. Hub cap

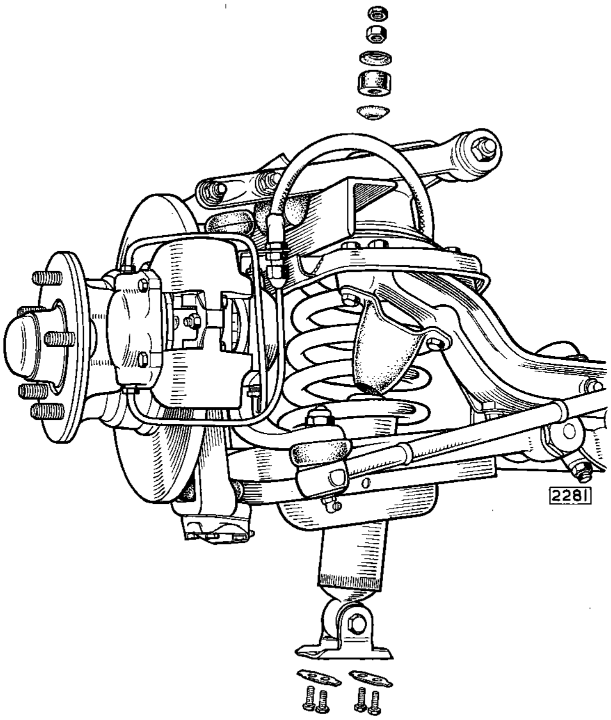


Fig. 5. Removing the shock absorber

also be kept horizontal by supporting the outer end of the lower wishbone and partly lowering the jack to compress the road spring.

Jack up the car under the front suspension cross member until the wheels are clear of the ground and remove the road wheel.

Remove the locknut and securing nut from the damper top mounting and withdraw the outer washer, rubber buffer and inner washer, noting the difference between the inner and outer washers.

Knock back the tabs securing the heads of the four setscrews which attach the damper lower mounting bracket to the coil spring seat. Remove the four setscrews and withdraw the hydraulic damper.

Refitting

Refitting is the reverse of the removal procedure.

COIL SPRINGS

The coil springs are marked with coloured paint strips (which may be covered by tape) to denote springs of the same static load. It is, therefore, important that the two front springs fitted to a car are of the same colour code.

Removal

Remove the hydraulic damper as described on page J.7.

Insert a suitable compressor (Tool No. J.6.A) through the centre of the spring and compress the spring sufficiently to relieve the load on the spring seat pan screws.

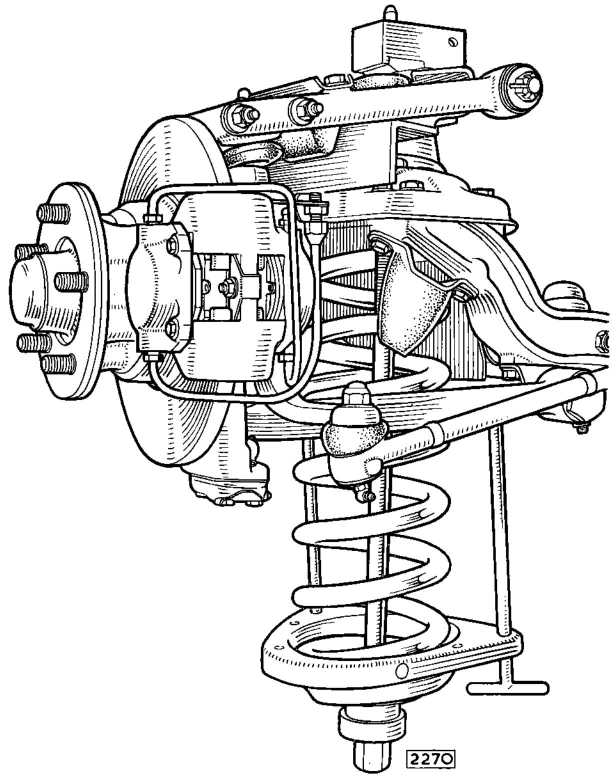


Fig. 6. Removing the coil spring using special Tool J.6.A

Remove the three self-locking nuts and bolts securing the anti-roll bar bracket to the lower wishbone and spring seat pan and detach the bracket. Remove the four setscrews and spring washers which secure the seat pan to the lower wishbone.

Release the coil spring compressor until the load of the spring is completely relieved. Completely unscrew the compressor and withdraw the coil spring and seat pan.

Refitting

Refitting is the reverse of the removal procedure.

Alignment of the seat pan holes with the tapped holes in the lower wishbone will be facilitated if 8″ (20 cm.) long pilot studs (threaded $\frac{3}{8}$″ UNF) are used as shown in Fig. 6.

Coil Spring Packing Pieces

Packing pieces may be fitted above the coil springs of some cars, their purpose being to accommodate manufacturing variations in the springs which are graded into three groups and identified by a colour patch on the middle coil.

Colour Code of spring	Thickness of packing
Red	¼" (6·4 mm.)
Yellow	⅛" (3·2 mm.)
Purple	None fitted

WHEEL HUBS

Removal

Firmly apply the handbrake, jack up the front of the car and remove the road wheel. Disconnect the brake fluid feed pipe at the caliper.

Break the locking wire and remove the bolts securing the brake caliper to the stub axle carrier. Remove the caliper from the carrier noting the shims fitted at the mounting points for centralisation of the caliper on the brake disc.

Prise off the hub end cap and remove the split pin retaining the hub nut. Remove the slotted nut and plain washer from the end of the stub axle shaft. The hub may now be withdrawn by hand. Remove the four setscrews and spring washers securing the brake disc, withdraw the disc ensuring that the inner water deflector is not damaged.

Dismantling

Extract the oil seal from the inner end of the hub. Withdraw the inner races of the taper roller bearings; if new bearings are to be fitted, the outer races may be drifted out, grooves being provided in the abutment shoulders of the hub. Do not disturb the inner water deflector on the hub or the outer deflector on the stub axle carrier.

Refitting

Refitting is the reverse of the removal procedure but it will be necessary to re-lubricate the bearings as detailed in "Routine Maintenance" at the beginning of this section and adjust the end float of the hub bearings as described under the next heading.

Refit the brake caliper, ensuring it is correctly aligned and bleed the brake hydraulic system as detailed in Section L "Braking System".

Bearing end-float adjustment

The correct end-float of the wheel bearings is ·003" to ·005· (·07 mm. to ·13 mm.). It is particularly important that the end-float does not exceed ·005" (·13 mm.) otherwise the brakes may tend to drag and not function correctly.

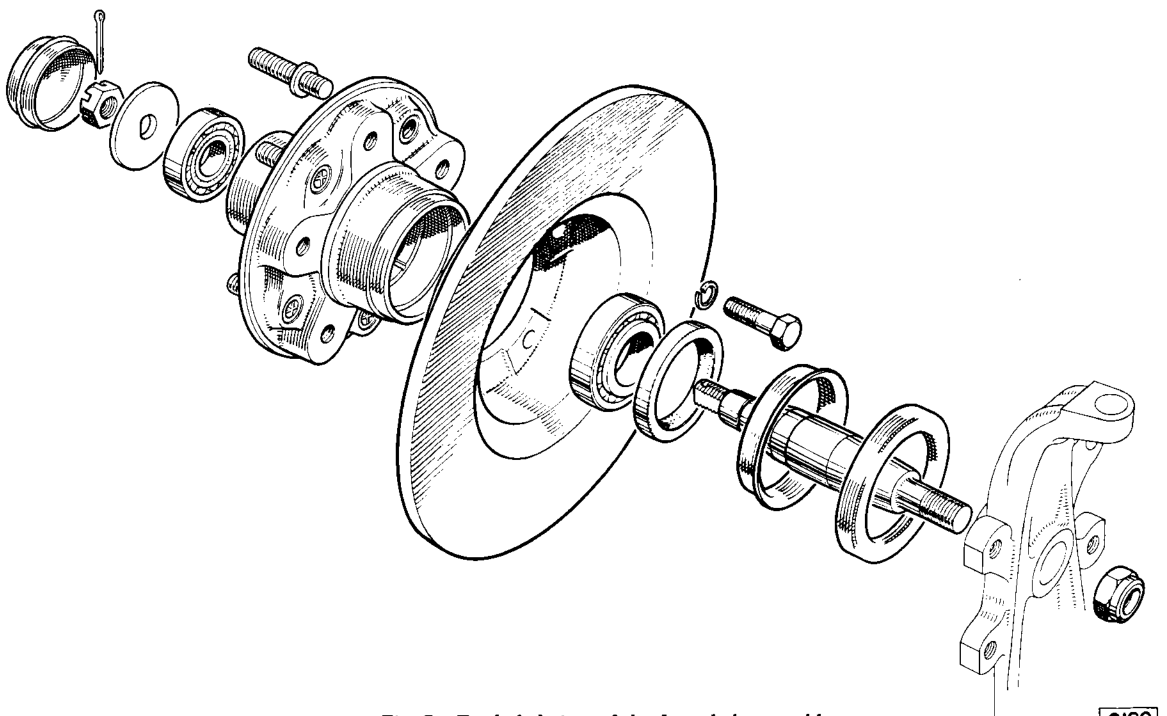


Fig. 7. Exploded view of the front hub assembly

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The wheel bearing end-float can be measured with a dial indicator gauge, mounted with the plunger against the end of the hub. If a gauge is not available proceed as follows:—

Tighten the hub nut until there is no end-float, that is when rotation of the hub feels slightly "sticky".

Slacken back the hub nut between one and two flats depending on the position of the split pin hole relative to the slots in the nut.

Temporarily attach the road wheel and check that the wheel spins freely.

If satisfactory, fit a new split pin and turn over the ends.

STUB AXLE CARRIERS

Removal

Jack up the suspension under the lower wishbone lever and remove the road wheel.

Disconnect the brake hydraulic fluid feed pipe from the caliper. Break the locking wire, remove the mounting bolts and withdraw the caliper noting the shims fitted at the mounting points. Remove the wheel hub complete with the brake disc as described under "Wheel hub removal" page J.11.

Remove the self-locking nut and plain washer securing the upper ball joint to the stub axle carrier. Drift out the ball pin from the stub axle carrier in which it is a taper fit.

Remove the self-locking nut and plain washer securing the lower ball joint to the wishbone. Drift out the ball pin from the lower wishbone, in which it is a taper fit and remove the stub axle carrier.

Refitting

Refitting is the reverse of the removal procedure. Bleed the brake hydraulic system as described in Section L "Brakes."

LOWER WISHBONE

Removal

Jack the car up under the front cross beam and remove the road wheel.

Remove the coil spring as described on page J.10.

Remove the stub axle carrier as described on page J.12.

Remove the two bolts and self-locking nuts securing the front suspension front mounting to the chassis. Remove the self-locking nut at the front of the lower wishbone fulcrum shaft and withdraw the front mounting and rubber bush. Drift out the fulcrum shaft, supporting the transverse tie rod. The wishbone may now be withdrawn from below.

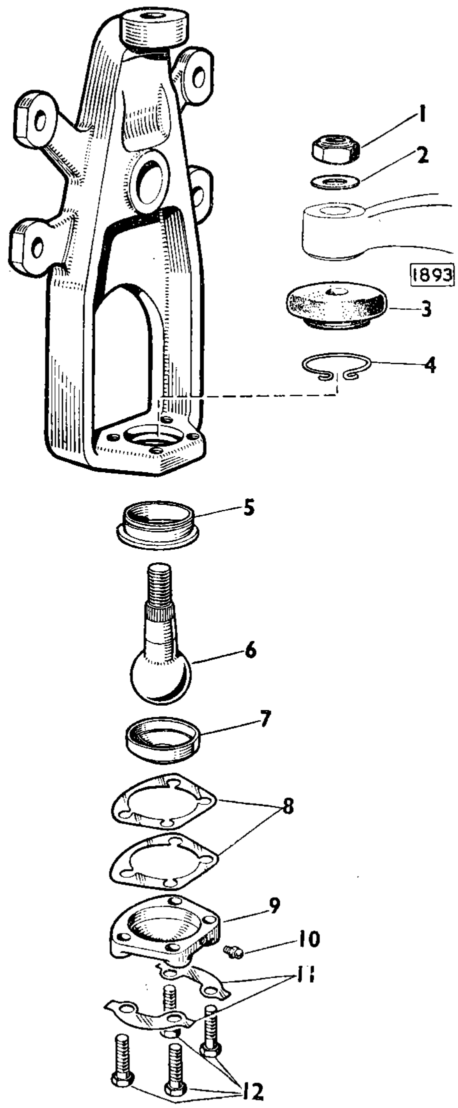


Fig. 8. Exploded view of the lower wishbone ball joint

1. Nut.
2. Washer.
3. Rubber gaiter.
4. Circlip.
5. Spigot.
6. Ball pin.
7. Socket.
8. Shims.
9. Ball pin cap.
10. Grease nipple.
11. Tab washers.
12. Setscrews.

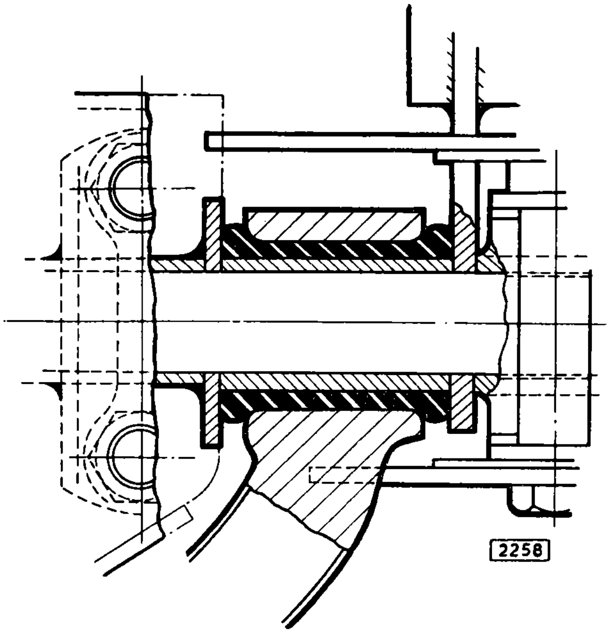


Fig. 9. Section through the lower rubber suspension bush

Fitting the Rubber/Steel Bushes

Drift out or press out the bush from the wishbone eye. Press the new bush into the eye, ensuring that the bush projects from each side by an equal amount. Fitting of the bush will be facilitated if a lubricant, made up of twelve parts of water to one part of liquid soap, is used.

Refitting

Refitting is the reverse of the removal procedure. When refitting the fulcrum shaft, the car should be in the normal riding position before the self-locking nut at the front of the shaft is tightened and the front mounting is refitted. Omitting to carry out this procedure will result in undue torsional loading of the bushes with possible premature failure.

LOWER WISHBONE BALL JOINT

Removal

Remove the stub axle carrier complete with the lower wishbone ball joint as described on page J.12.

Dismantling

Release the wire clip and remove the rubber gaiter. Withdraw the retainer from the top of the ball pin.

Tap back the tab washers and unscrew the four setscrews securing the ball pin cap to the stub axle carrier.

Remove the cap, shims, ball pin socket, spigot and ball pin.

Later cars have a plastic ring securing the rubber gaiter to the ball pin spigot with a further insert between the ball pin spigot and gaiter.

Reassembling

Reassembling is the reverse of the dismantling procedure but, if necessary, re-shim the ball joint to obtain the correct clearance of ·004″—·006″ (·10 mm.—·15 mm.).

Note: Shims should not be removed to take up excessive wear in the ball pin and socket; if these parts are badly worn, replacements should be fitted.

Adjustment of the ball joint

The correct clearance of the ball pin in its sockets is ·004″—·006″ (·10 mm.—·15 mm.). Shims for adjustment of the ball joint are available in ·002″ (·05 mm.) and ·004″ (·10 mm.) thicknesses.

To adjust the ball pin clearance to the correct figure, remove shims one by one until, with ball cap fully tightened, the ball is tight in its sockets. Fit shims to the value of ·004″—·006″ (·10 mm.—·15 mm.) which should enable the shank of the ball pin to be moved by hand.

Refitting

Refit the stub axle carrier complete with the lower wishbone ball joint as described on page J.13.

UPPER WISHBONE

Removal

Jack the suspension up under the lower wishbone lever and remove the road wheel.

Remove the two bolts, plain washers and self-locking nuts securing the ball joint to the upper wishbone levers. Note the relative positions of the packing piece and the shims as these control the camber angle. Alternatively, remove the self-locking nut and drift the ball joint from the stub axle carrier in which it is a taper fit. Tie up the stub axle carrier to the suspension so that the flexible brake hose does not become extended.

Remove the two bolts and self-locking nuts which secure the upper wishbone fulcrum shaft to the suspension turret. Note the relative positions of the shims as these control the camber angle. Remove the upper wishbone assembly.

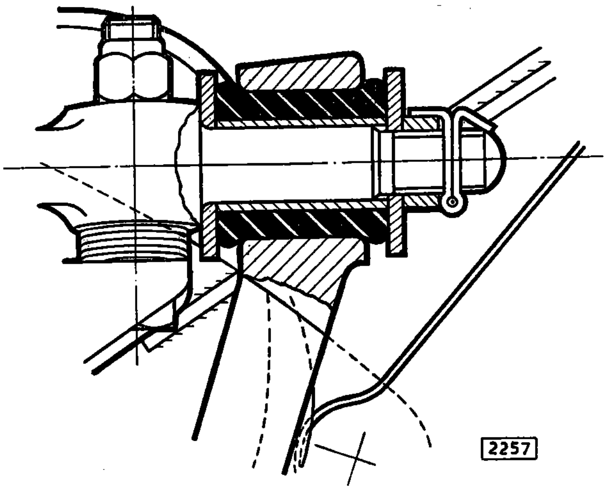


Fig. 10. Section through the upper rubber suspension bush

Dismantling

Remove the two setscrews and spring washers securing the rebound stop rubber to the upper wishbone levers.

Withdraw the split pins and remove the slotted nuts and plain washers which secure the wishbone levers to the fulcrum shaft. Remove the wishbone levers from the fulcrum shaft.

Fitting the Rubber/Steel Bushes

Drift out or press out the bush from the wishbone eye. Press the new bush into the eye, ensuring that the bush projects from each side by an equal amount. Fitting of the bush will be facilitated if a lubricant, made up of twelve parts of water to one part of liquid soap, is used.

Reassembling

The reassembly of the upper wishbone assembly is the reverse of the dismantling procedure but the slotted nuts securing the wishbone levers to the fulcrum shaft must not be tightened until the upper wishbone assembly has been refitted and the full weight of the car is on the suspension. Omitting to carry out the procedure will result in undue torsional loading of the rubber bushes with possible premature failure.

Refitting

Refitting is the reverse of the removal procedure.

UPPER WISHBONE BALL JOINT

The upper wishbone ball joint cannot be dismantled and, if worn, the complete assembly must be replaced.

Removal

Jack up the car under the lower wishbone and remove the road wheel.

Remove the two bolts, self-locking nuts and plain washers securing the ball joint to the upper wishbone levers. Note the relative positions of the packing piece and shims as these control the castor angle.

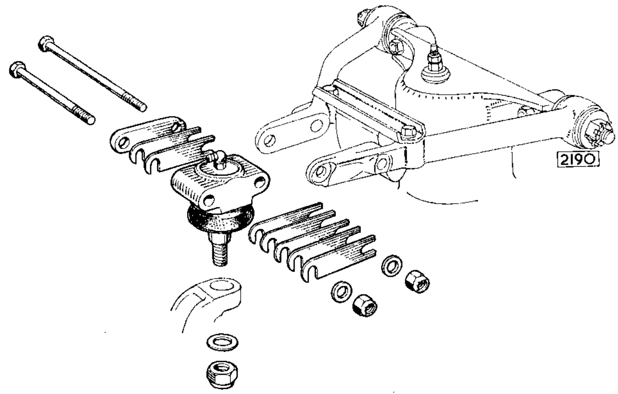


Fig. 11. Exploded view of upper ball joint and castor adjustment shims.

Remove the self-locking nut and plain washer which secure the ball joint to the stub axle carrier.

The ball joint can now be drifted out of the stub axle carrier in which it is a taper fit.

Note: When carrying out the above operation do not allow the flexible brake hose to become extended; tie up the stub axle carrier to the cross-member turret.

Refitting

Refitting is the reverse of the removal procedure. Ensure that the packing piece and shims are refitted in their original positions otherwise the castor angle will be upset.

CASTOR ANGLE ADJUSTMENT

Check that the car is full of petrol, oil and water. If not, additional weight must be added to compensate for say, a low level of petrol (the weight of 10 gallons of petrol is approximately 80 lbs—36·0 kg.).

Ensure that the tyre pressures are correct and that the car is standing on a level surface.

Using an approved gauge, check the castor angle.

Castor Angle . . . . .$0° \pm \frac{1}{2}°$

Note: The two front wheels must be within a $\frac{1}{2}°$ of each other.

Adjustment is effected by either transposing the shims from the rear of the upper wishbone ball joint to the front, or transposing the packing piece and shim(s).

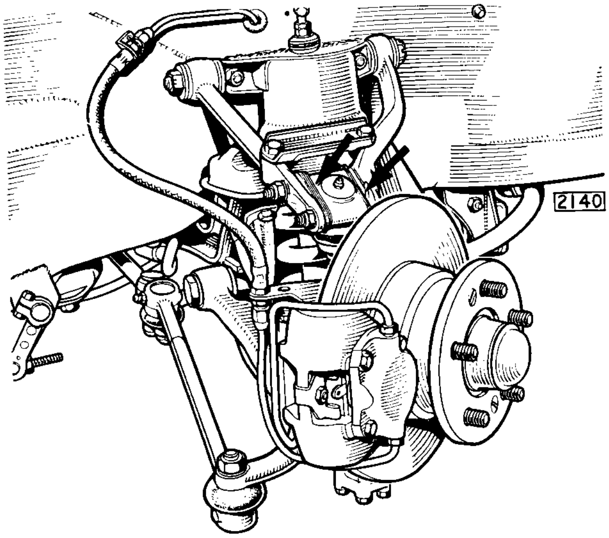


Fig. 12. Castor angle adjustment

To decrease negative castor or increase positive castor transpose shims from the rear to the front; the holes in the shims are slotted and therefore it will only be necessary to slacken the two bolts securing the upper wishbone members to enable the shims to be removed.

CAMBER ANGLE ADJUSTMENT

Check that the car is full of petrol, oil and water. If not, additional weight must be added to compensate for, say, a low level in petrol (the weight of 10 gallons of petrol is approximately 80 lbs.—36·0 kg.).

Ensure that the tyre pressures are correct and that the car is standing on a level surface.

Camber Angle $\frac{1}{2}° \pm \frac{1}{2}°$ positive.

Note: The camber angle for each wheel must not vary by more than $\frac{1}{2}°$.

Line up the front wheel bearing checked parallel to the centre line of the car. Using an approved gauge, check the camber angle. Rotate the wheel being checked through 180° and re-check.

Adjustment is effected by removing or adding shims at the top wishbone fulcrum shaft mountings. The holes in the shims are not slotted and it will be necessary to remove the bolt securing the fulcrum shaft to enable the shims to be removed, after supporting the lower wishbone at the outer mounting point. Inserting shims decreases positive camber; removing shims decreases negative camber or increases positive camber. Remove or add an equal thickness of shims from each position otherwise the castor angle will be affected. Shims for the adjustment of camber are of $\frac{1}{16}''$ (1·6 mm.) thickness and it should be noted that $\frac{1}{16}''$ (1·6 mm.) of shimming will alter the camber angle by approximately $\frac{1}{4}°$.

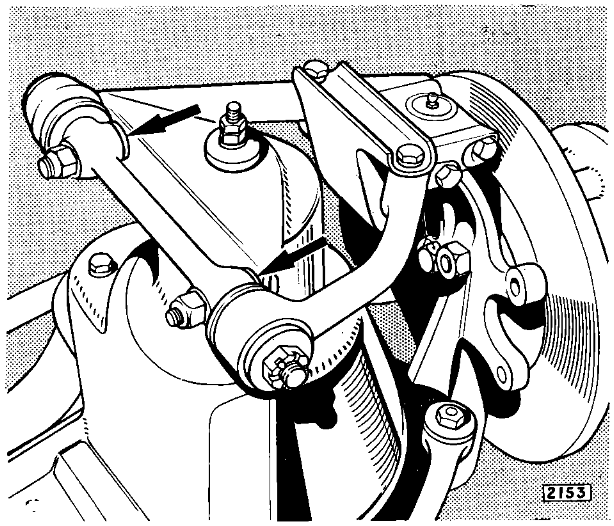


Fig. 13. Camber angle adjustment

Note: It is most important that there are always an equal number of shims at each mounting bolt on a particular side.

ANTI-ROLL BAR

Removal

Raise the front of the car so that work may be carried out underneath. Remove the four setscrews and spring washers securing the anti-roll bar support brackets to the front of the chassis side members. Remove the support brackets and the keeper plates which are fitted between the anti-roll bar bracket rubbers and the chassis.

Remove the bolt and self-locking nut securing the anti-roll bar link arm to the bracket on the coil spring seat. Repeat for the other side.

To separate the anti-roll bar from the link arms, remove the self-locking nuts, upper cup washers and rubbers. Care should be taken to replace the tubular spacer when refitting.

The anti-roll bar bracket rubbers are split to enable them to be removed.

Fitting the Link Arm Bush

Drift out or press out the bush from the link arm eye.

Press the new bush into the eye, ensuring that the bush projects from each side by an equal amount. Fitting of the bush will be facilitated if a lubricant, made up of twelve parts of water to one part of liquid soap, is used.

Refitting

Refitting is the reverse of the removal procedure. It is important when attaching the support brackets to the chassis side members, to have the full weight of the car on the road wheels.

ACCIDENTAL DAMAGE

The following dimensional drawings are provided to assist in assessing accidental damage. A component suspected of being damaged should be removed from the car, cleaned off, and the dimensions checked and compared with those given in the appropriate illustration.

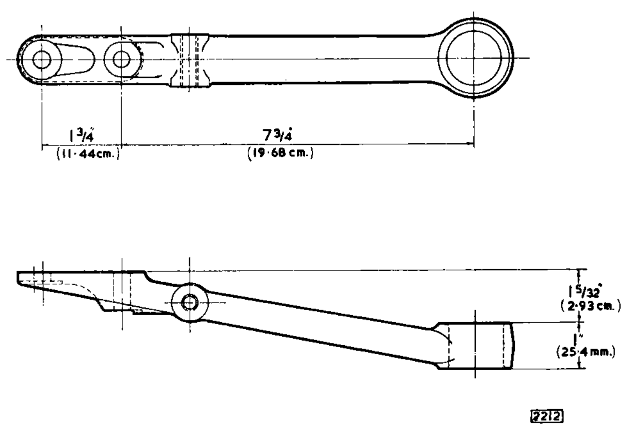


Fig. 14. The upper wishbone lever—rear

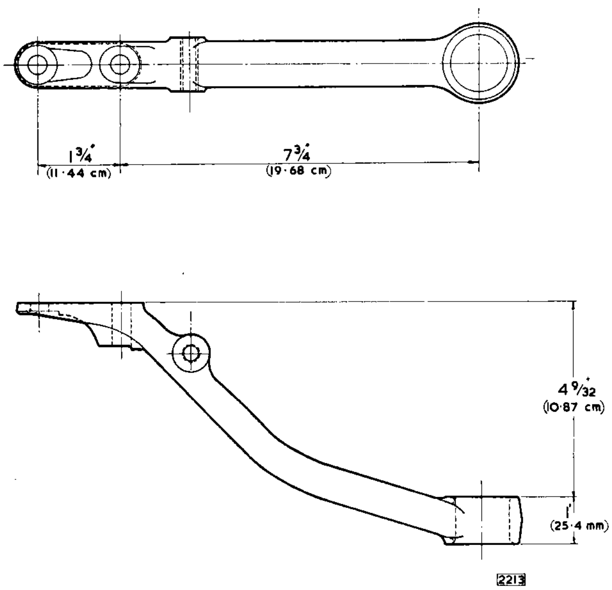


Fig. 15. The upper wishbone lever—front

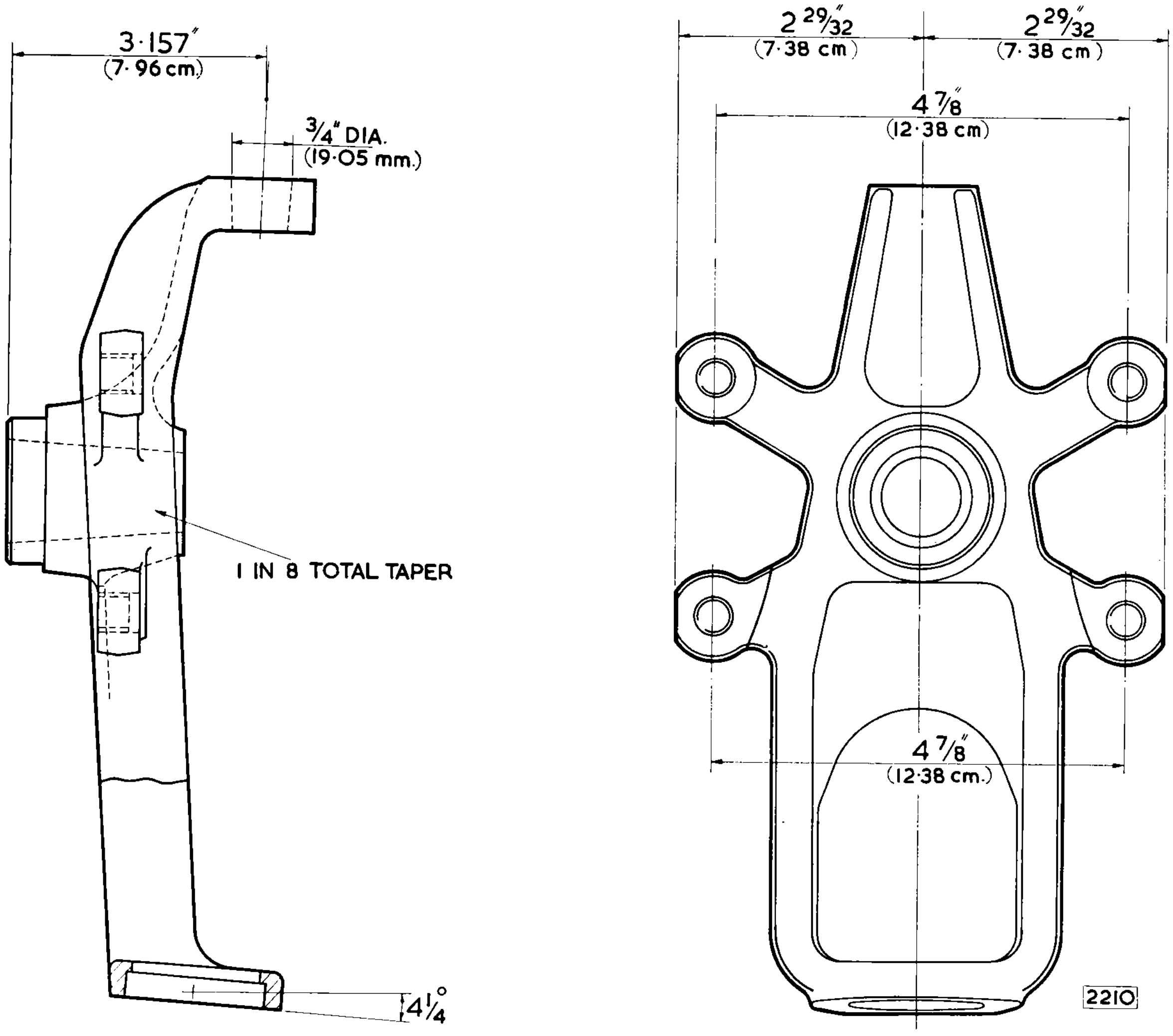


Fig. 16. The stub axle carrier

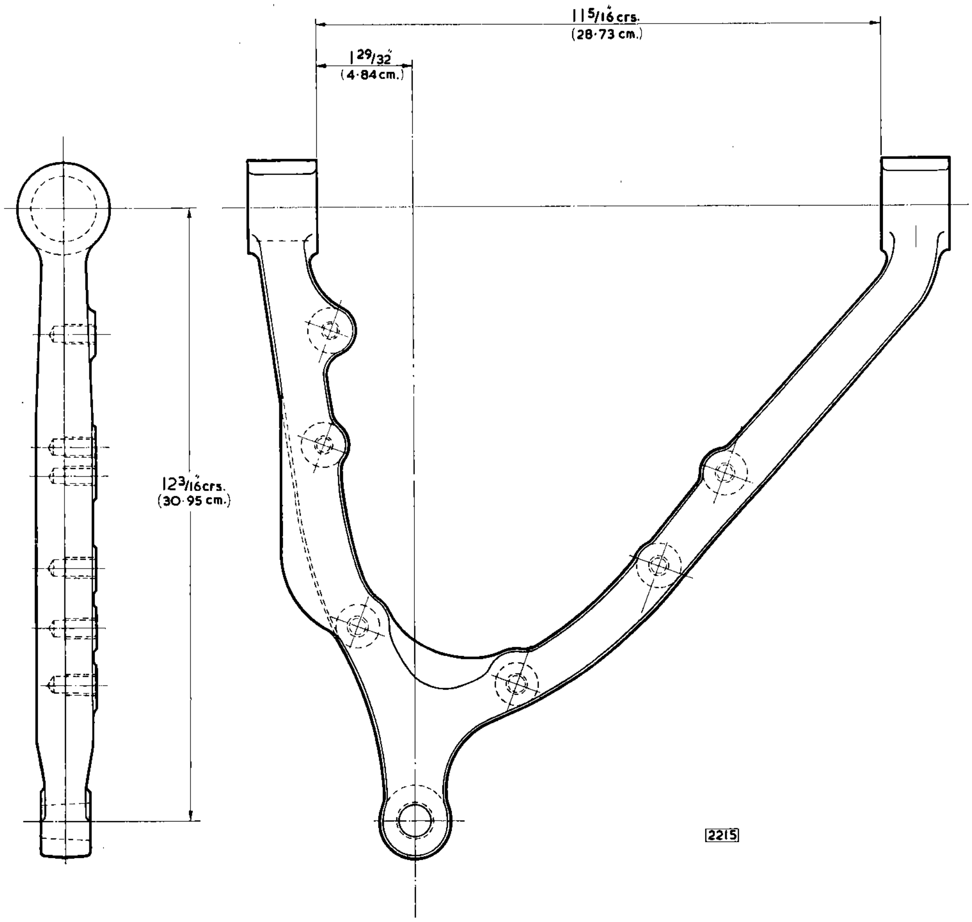


Fig. 17. The lower wishbone

SPECIAL TOOLS

Description	Tool No.
Front Coil Spring Compressor	J.6.B

SECTION K

REAR SUSPENSION

3·8 MARK 10 MODEL

INDEX

REAR SUSPENSION

Description

The rear wheels are located in a transverse plane by two tubular links of which the top link is the half shafts universally jointed at each end. The lower link is pivoted at the wheel carrier and at the crossbeam adjacent to the differential casing. To provide maximum rigidity in a longitudinal plane the pivot bearings at both ends of the lower link are widely spaced. The suspension medium is provided by four coil springs enclosing telescopic hydraulic dampers, two being mounted on either side of the differential casing. The complete assembly is carried in a fabricated steel crossbeam. The crossbeam is attached to the body by four "Vee" rubber blocks and is located by radius arms. The radius arm pivots are rubber bushes mounted on each side of the car between the lower link and a mounting point on the body structure.

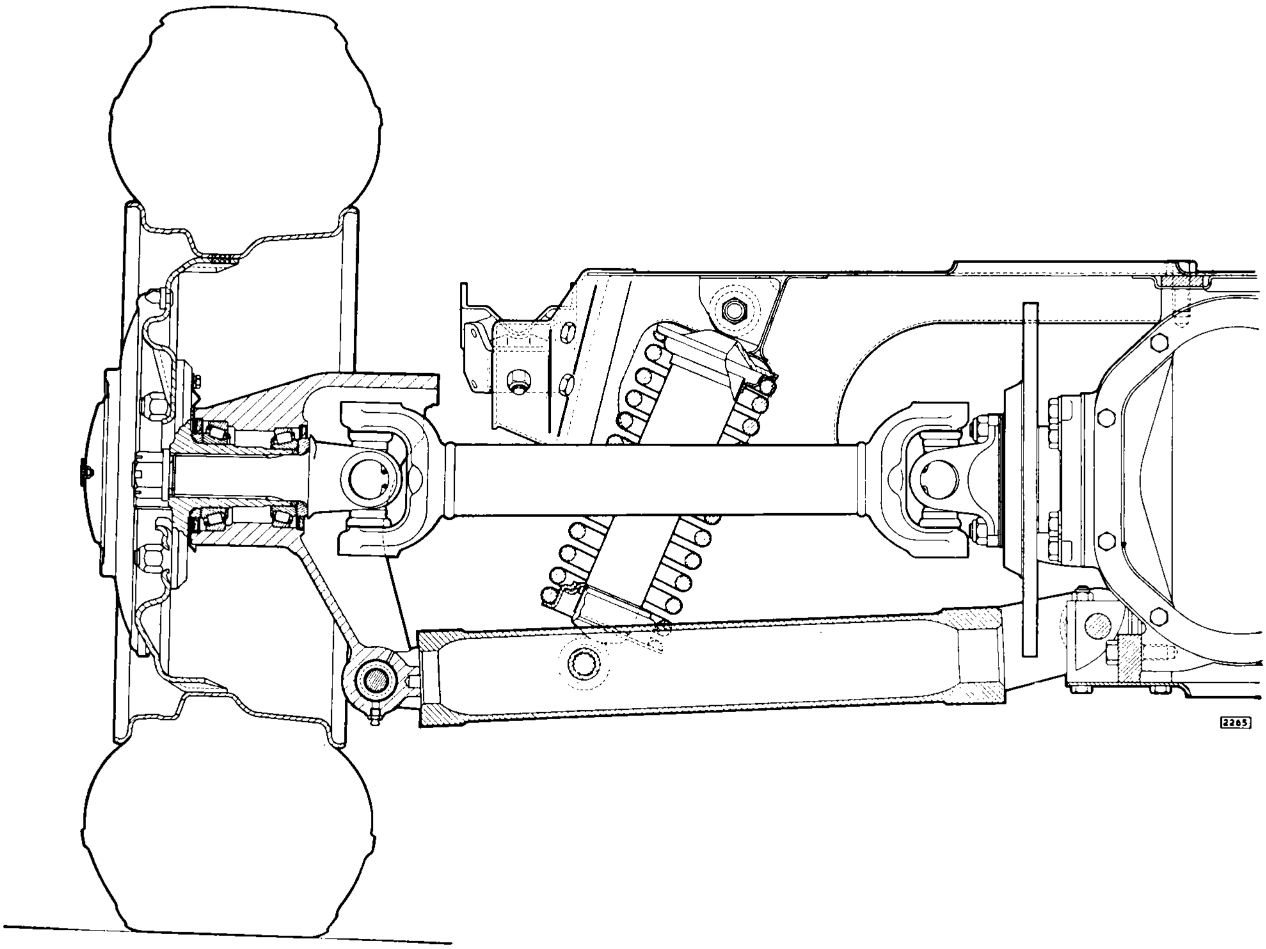


Fig. 1. Sectioned view of rear suspension

REAR SUSPENSION

DATA

	1st Type	2nd Type	3rd Type
Rear Road Spring			
Free length (approx)	12·725″ (32·32 cm.)	13·35″ (33·91 cm.)	12·525″ (31·82 cm.)
Identification colour	White	Green	Yellow
Number of coils (approx.)	12		$10\frac{1}{4}$
Wire diameter		·475″ (12·06 mm.)	
Dampers		Telescopic	
Road Wheel Movement from mid laden position			
Full bump		$3\frac{3}{4}$″ (9·52 cm.)	
Full rebound		$3\frac{3}{4}$″ (9·52 cm.)	
Track		58″ (147·32 cm.)	
Rear Wheel Camber		$\frac{3}{4}° \pm \frac{1}{4}°$ negative	

*Fitted with an aluminium spacer between each spring seat and split retainer.

ROUTINE MAINTENANCE

EVERY 5,000 MILES (8,000 KM.)

Wishbones

Lubricate the wishbone lever pivots. Three grease nipples are provided on each wishbone, see Fig. 2.

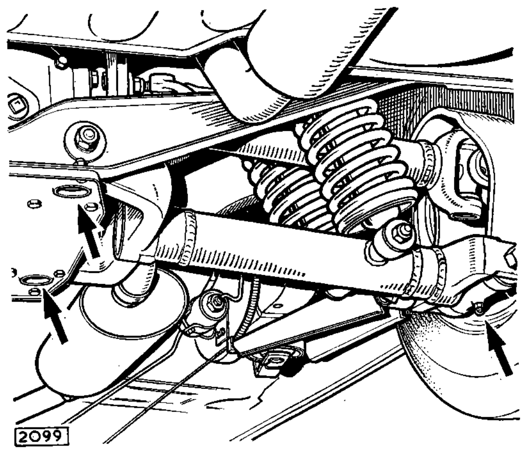


Fig. 2. Inner and outer pivot bearing grease nipples

Recommended Lubricants

	Mobil	Castrol	Shell	Esso	B.P.	Duckham	Regent Caltex/Texaco
Wishbone Pivots	Mobilgrease MP	Castrolease LM	Retinax A	Esso Multi-purpose Grease H	Energrease L2	LB10	Marfak All-purpose

Removal

Slacken the two clamp bolts which secure the muffler boxes to the rear silencers.

Remove the four nuts and washers retaining the muffler mounting rubbers to the underside of the car.

Withdraw the mufflers.

Remove the locking wire from the radius arm safety strap and securing bolt.

Unscrew the two bolts securing the safety strap to the body floor.

Remove the radius arm securing bolt and spring washer and remove the safety strap.

Withdraw the radius arm from the mounting post on the body.

Place a stout piece of wood approximately 9″ × 9″ × 1″ (22·8 cm. × 22·8 cm. × 25·4 mm.) between the rear suspension tie plate and the jack.

Jack up the rear of the car and place two chassis stands of equal height under the body forward of the radius arm mounting posts. Place blocks of wood between the chassis stands and the body to avoid damage.

Remove the rear road wheels.

Disconnect the flexible brake pipe at the connection on the body.

Remove the split pin, washer and clevis pin securing the handbrake cable to the handbrake caliper actuating levers mounted on the suspension cross beam.

Slacken the locknut and screw the outer handbrake cable screw out of the adjuster block.

Remove the four bolts and self-locking nuts securing the mounting rubbers at the front of the cross beam to the body frame. Remove the six self-locking nuts and four bolts securing the rear mounting rubbers to the cross beam.

Remove the four self-locking nuts and bolts securing the propeller shaft to the differential pinion flange.

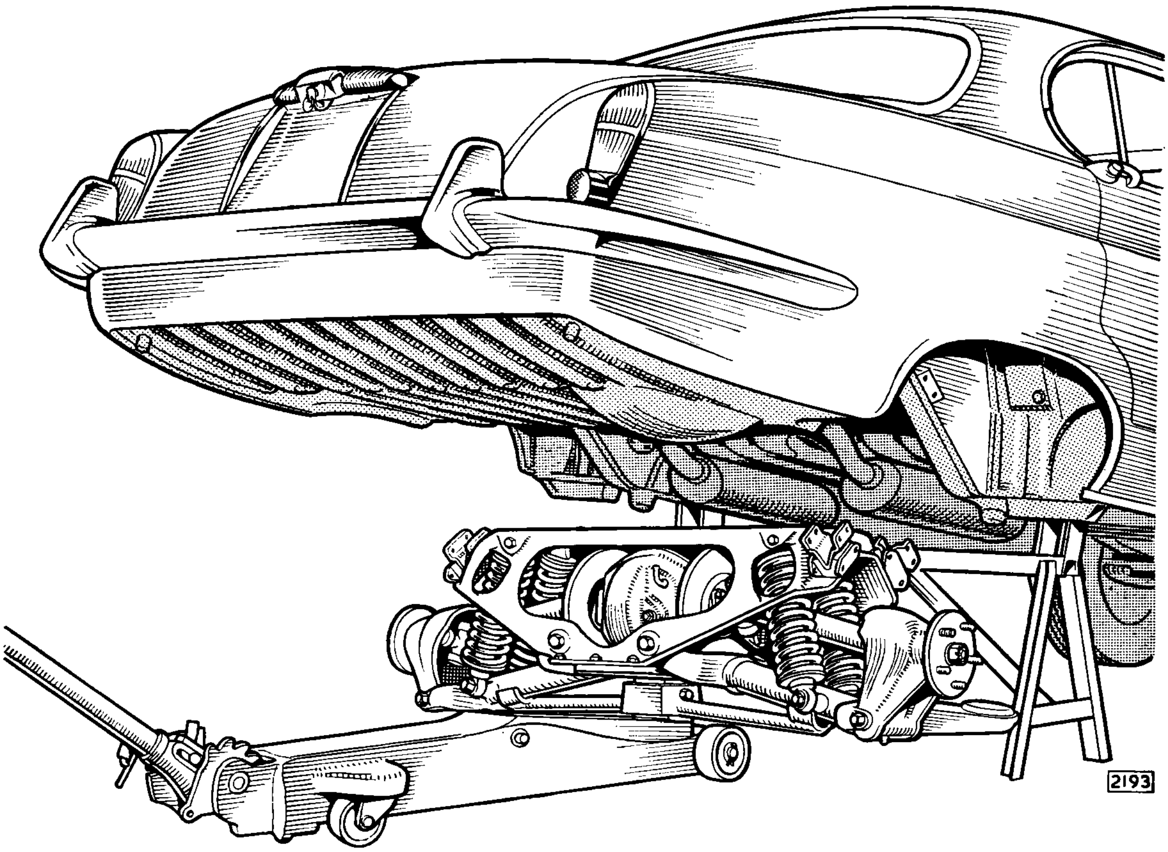


Fig. 3. Removal of the rear suspension assembly from the car

Lower the rear suspension unit on the jack and withdraw the unit from under the car as shown in Fig. 3.

Refitting

Refitting is the reverse of the removal procedure.
Check all mounting rubbers for deterioration.
Bleed the braking system as described in Section L. "Brakes."

If the radius arms have been removed the rear suspension should be at the normal riding height before tightening the radius arm securing nuts on the rear suspension wishbone. Refit the radius arms as described on page K.7.

IMPORTANT

The following removal and refitting operations are described assuming the rear suspension is removed from the car. If it is possible for the operations to be carried out with the rear suspension in position on the car the fact will be noted in the text.

ROAD SPRING AND HYDRAULIC DAMPER ASSEMBLY

Removal

The road spring and hydraulic damper assembly may be removed from the car with the rear suspension assembly in position.

Remove the two self-locking nuts and washers securing the two hydraulic dampers to the wishbone.

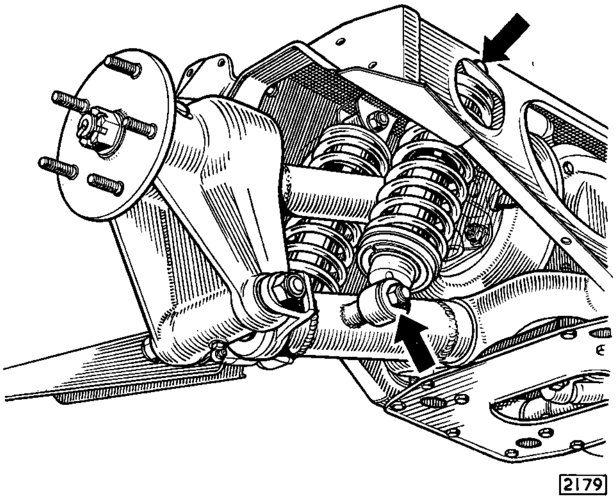


Fig. 4. Hydraulic damper mounting points

Support the appropriate wishbone and drift out the hydraulic damper mounting pin, Fig. 5.

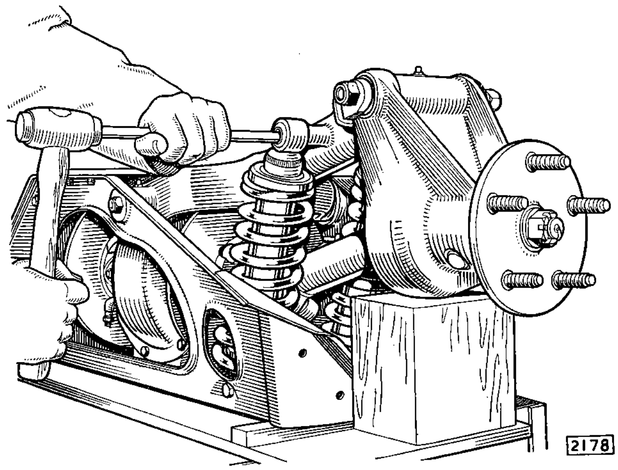


Fig. 5. Drifting out the hydraulic damper mounting pin

Remove the self-locking nut and bolt securing each hydraulic damper to the cross beam.

Withdraw the hydraulic damper and road spring assembly.

Refitting

Refitting is the reverse of the removal procedure.

HYDRAULIC DAMPERS

The telescopic hydraulic dampers are of the sealed type with no provision for adjustment or "topping-up" with fluid. Therefore, in the event of a damper becoming unserviceable a replacement must be fitted.

Before fitting a damper to a car it is advisable to carry out the following procedure to "bleed" any air from the pressure chamber that may have accumulated due to the damper having been stored in the horizontal position. Hold the damper in its normal vertical position with the shroud uppermost and make several short strokes (not extending more than half way) until there is no lost motion. Finish by extending the damper to its full length once or twice. Do not extend the damper fully until several short strokes have been made first. After the operation of "bleeding," the hydraulic dampers should be kept in their normal upright position until they are fitted to the car.

Removal

Remove the road spring and hydraulic damper as described on page K.6.

Utilizing a suitable press, Fig. 6, compress the road spring until the split collet can be removed from under the road spring retaining pad.

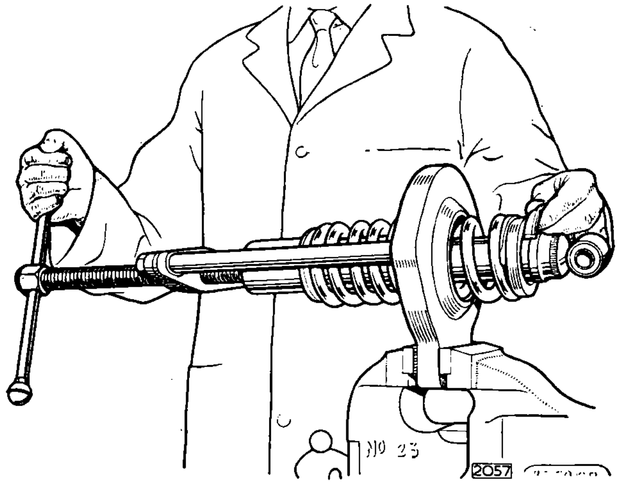


Fig. 6. Removing the rear road spring from the hydraulic damper with Churchill tool J.11A in conjunction with SL.14

Carefully release the pressure on the road spring and withdraw the hydraulic damper.

On early cars an aluminium pad was fitted to either end of the spring. The pad fitted to the shrouded end of the damper was recessed to receive the shroud.

Refitting

Compress the road spring, utilizing Churchill tool No. J.11A and SL.14, sufficiently to allow the hydraulic damper to be passed through the road spring and spring pad and split collet placed into position, see Fig. 6. Ensure that the split collet and spring pad are seating correctly. Release the pressure on the road spring.

On early cars fit the machined recessed aluminium pad to the shrouded end of the damper. Compress the road spring and pass the damper through the spring and fit the other aluminium pad and secure with the split collet. Release the pressure on the road spring.

Refit the road spring and hydraulic damper assembly as described on page K.6.

RADIUS ARM

Removal

Remove the locking wire from the radius arm safety strap and securing bolt.

Unscrew the two bolts securing the safety strap to the body floor.

Remove the radius arm securing bolt and spring washer and remove the safety strap.

Withdraw the radius arm from the mounting post on the body.

Remove one of the self-locking nuts securing the hub bearing assembly fulcrum shaft to the wishbone.

Drift out the fulcrum shaft from the wishbone and hub assembly as described on page K.10.

Remove the self-locking nut and bolt securing the radius arm to the wishbone and remove the radius arm.

Examine the radius arm mounting rubbers for deterioration.

Refitting

Refitting is the reverse of the removal procedure.

When replacing the large radius arm body mounting rubber, the two holes should be in the longitudinal position in the radius arm as shown in Fig. 7.

The rubbers on the wishbone mounted end of the radius arm can be pressed out. Ensure that the rubbers are refitted with an equal amount of space showing on each side of the radius arm.

When refitting the hub bearing assembly shaft refer to page K.13.

Refit the safety strap into position, refit the spring washer and radius arm securing bolt.

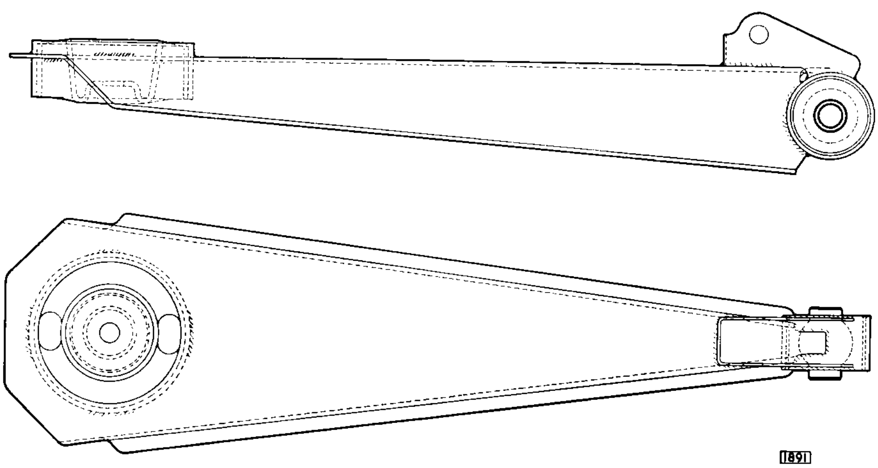


Fig. 7. Showing the position of the mounting rubbers in the radius arm

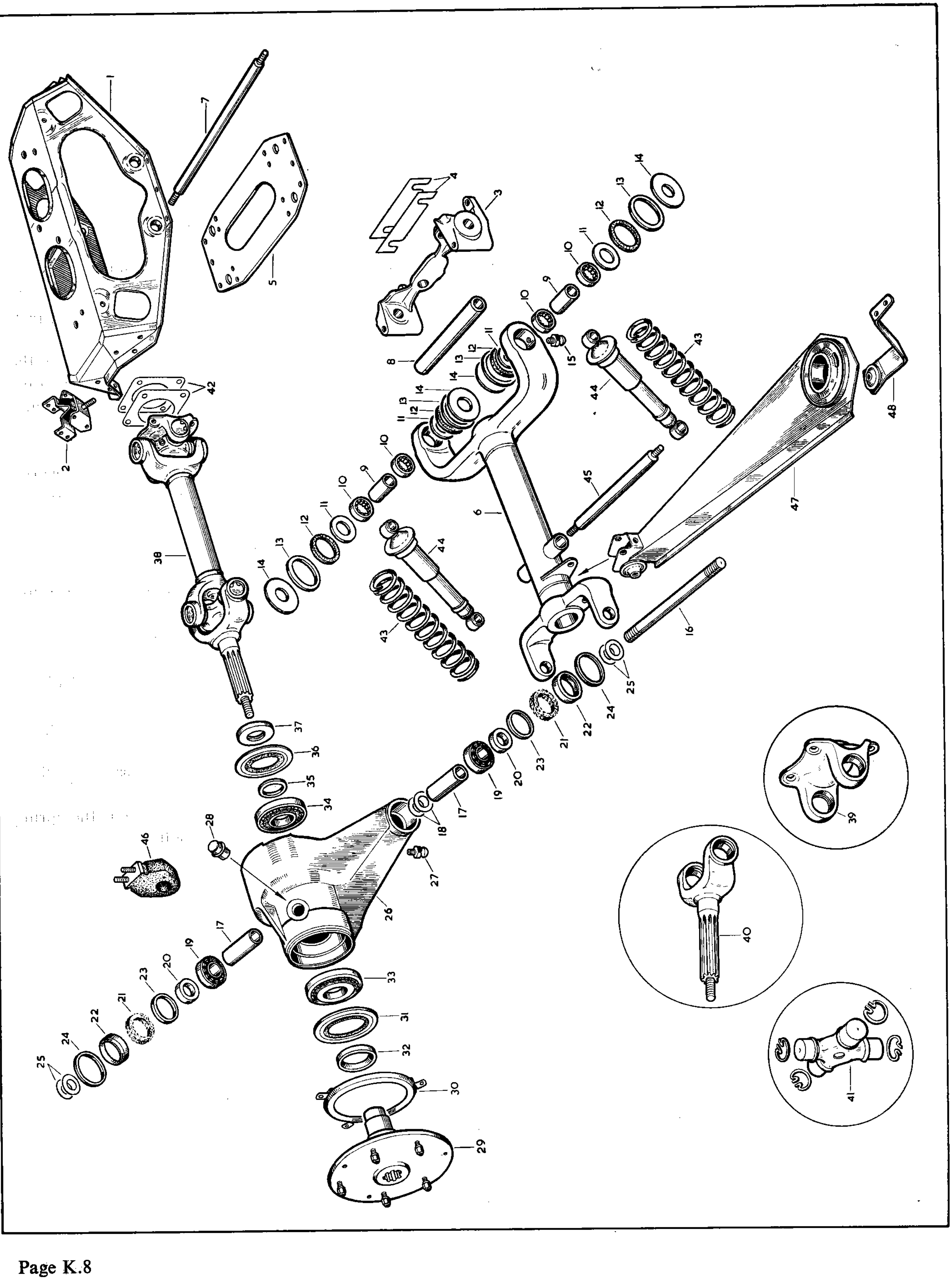


Fig. 8. Exploded view of rear suspension assembly

1. Rear suspension cross member.
2. Rubber mounting.
3. Inner fulcrum mounting bracket.
4. Shims.
5. Tie plate.
6. Wishbone.
7. Inner fulcrum shaft.
8. Distance tube.
9. Bearing tube.
10. Needle bearings.
11. Inner thrust washer.
12. Sealing ring.
13. Sealing ring retainer.
14. Outer thrust washer.
15. Grease nipple.
16. Outer fulcrum shaft.
17. Distance tube.
18. Shims.
19. Bearing.
20. Oil seal track.
21. Felt seal.
22. Oil seal.
23. Oil seal retainer.
24. Oil seal retainer.
25. Shims.
26. Hub carrier.
27. Grease nipple.
28. Grease retaining cap.
29. Hub.
30. Water deflector.
31. Oil seal.
32. Oil seal track.
33. Outer bearing.
34. Outer bearing.
35. Spacer.
36. Oil seal.
37. Oil seal track.
38. Half shaft.
39. Flange yoke.
40. Splined yoke.
41. Journal assembly.
42. Shims.
43. Coil spring.
44. Hydraulic damper.
45. Mounting pin.
46. Bump stop.
47. Radius arm.
48. Retaining strap.

Refit the two bolts and nuts securing the safety strap to the body.

Tighten the radius arm securing bolt to 46 lb.ft. (6·36 kg.m.) and pass the locking wire through the hole in the head of the bolt and secure round the safety strap.

WISHBONE

Removal

Remove the hydraulic dampers from the appropriate wishbone as described on page K.6.

Remove the six self-locking nuts and bolts securing the tie plate to the cross beam.

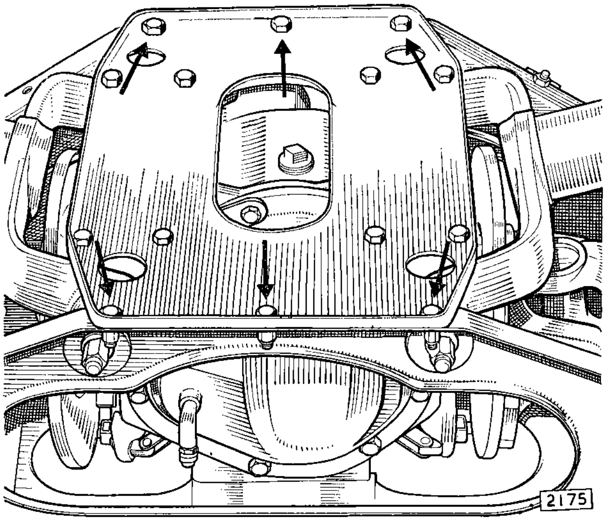


Fig. 9. Showing the six bolts which secure the tie plate to the cross beam

Remove the eight self-locking nuts and bolts securing the tie plate to the inner fulcrum wishbone mounting brackets and remove the tie plate.

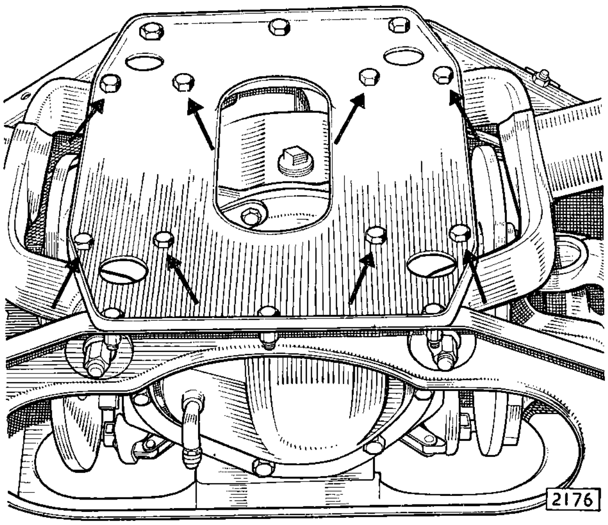


Fig. 10. Showing the eight bolts which secure the tie plate to the inner fulcrum mounting bracket

Remove one of the self-locking nuts securing the hub bearing assembly fulcrum shaft to the wishbone and drift out the fulcrum shaft, see Fig. 5.

Separate the hub carrier from the wishbone. If any shims are fitted between the wishbone and hub assembly note the amount and position of the shims as it is essential to replace the exact amount in the correct position. To facilitate refitting slide a dummy fulcrum shaft Churchill tool No. J.14 through the hub carrier.

Place a piece of sticky tape over each of the hub carrier assembly oil seal tracks to prevent them becoming displaced.

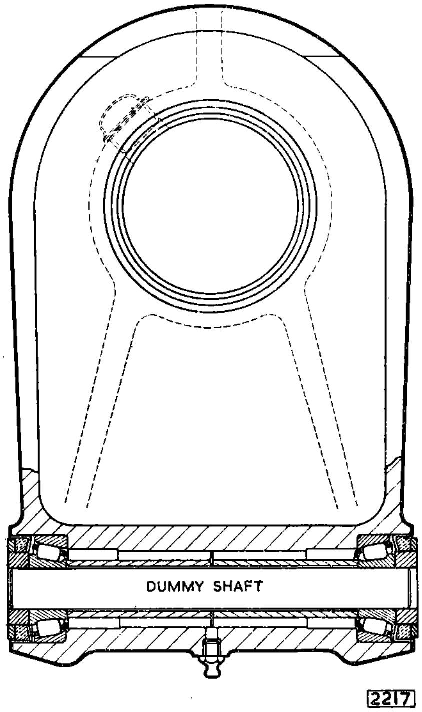


Fig. 11. Showing the dummy shaft in position in the hub carrier

Remove the self-locking nut securing the radius arm to the wishbone. Withdraw the special thin headed bolt and remove the radius arm from the wishbone.

Remove the self-locking nut securing the wishbone fulcrum shaft to the cross beam.

Drift the inner fulcrum shaft out of the wishbone and inner fulcrum mounting bracket.

Withdraw the wishbone assembly and collect the four outer thrust washers, inner thrust washers, oil seals and oil retainers.

Examine the oil seals for deterioration.

Remove the two bearing tubes.

There is no need to remove the spacer fitted between the inner fulcrum mounting bracket unless the mounting bracket is to be replaced. To remove the spacer, tap out of position. To remove the needle rollers gently tap the needle cages out of the wishbone using a suitable drift. Remove the needle roller spacer.

Refitting

If the needle rollers have been removed from the larger fork of the wishbone lever press one roller cage into position, with the engraving on the roller cage facing outwards.

Insert the roller spacing tube and press in the other roller cage.

Repeat for the other side.

Insert the bearing tubes. Smear the four outer thrust washers, inner thrust washers, oil seals and oil seal retainers with grease and place into position on the wishbone, see Fig. 12.

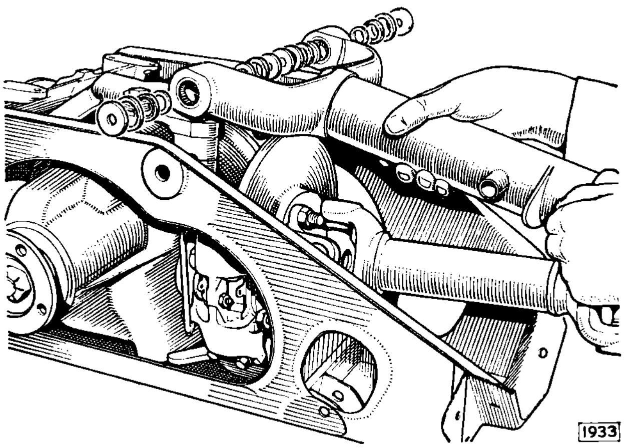


Fig. 12. Showing the wishbone inner fork and components

Offer up the wishbone to the inner fulcrum mounting bracket with the radius arm mounting bracket towards the front of the car. Align the holes and spacers. Press a dummy shaft Churchill tool No. J.14 through each side of the cross beam and wishbone.

The dummy shafts locate the wishbone, thrust washers, cross beam and inner fulcrum mounting bracket and facilitate refitting of the fulcrum shaft.

Smear the fulcrum shaft with grease and gently tap the shaft through the cross beam, wishbone and inner fulcrum mounting bracket. As the fulcrum shaft is tapped into position the short dummy shafts will be displaced from the opposite side. It will be found advantageous to keep a slight amount of pressure exerted on the dummy shafts as they emerge from the cross beam. This will reduce the tendency for the dummy shafts to be knocked out of position and allow

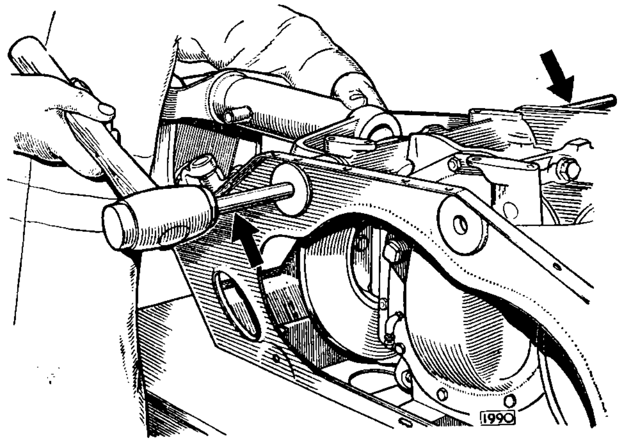


Fig. 13. Tapping the dummy shafts into position at the wishbone inner fulcrum

a spacer or thrust washer to be displaced. If a washer or spacer becomes displaced it will be necessary to remove the fulcrum shaft, dummy shafts and wishbone and then repeat the operation.

When the fulcrum shaft is in position tighten the two self locking nuts to 55 lbs. ft. (7·60 kg.m.) with a torque wrench.

Refit the eight bolts and self-locking nuts securing the tie plate to the inner fulcrum wishbone mounting bracket.

Refit the six bolts and self-locking nuts securing the tie plate to the cross beam.

Refit the radius arm to the wishbone as described on page K.7.

Remove the two pieces of sticky tape holding the oil seal tracks in position.

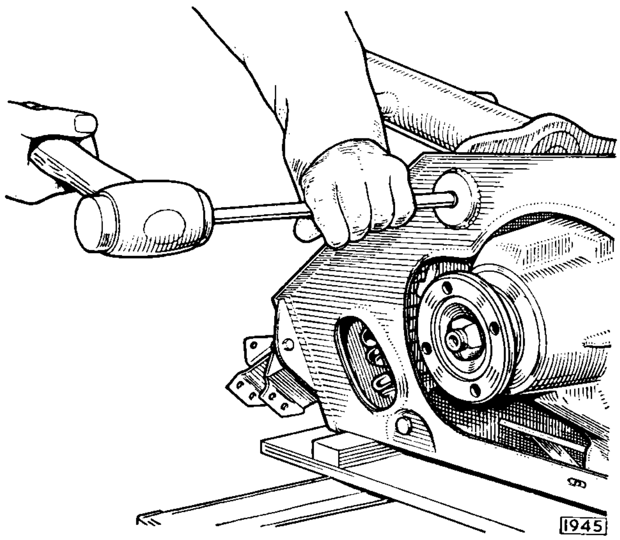


Fig. 14. Drifting the inner fulcrum shaft into position and displacing the dummy shafts

Offer up the wishbone to the hub assembly.

Using a dummy shaft, Churchill tool No. J.14, line up the wishbone hub assembly oil seal tracks and spacers. Smear the fulcrum shaft with grease and gently tap the fulcrum shaft into position and displace the dummy shaft.

It will be found advantageous to apply a small amount of pressure on the dummy bar against the fulcrum shaft to prevent the bar being knocked out of position and allowing a spacer to be displaced. If a spacer is displaced it may be necessary to repeat the operation.

Slide the fulcrum shaft through the wishbone and hub carrier. Using feeler gauges check the amount of clearance between the hub carrier and the wishbone lever, see Fig. 18. If necessary fit sufficient shims between the hub carrier and the wishbone to centralize the hub carrier. Tighten the nuts on the fulcrum shaft to 55 lbs. ft. (7·60 kg.m.).

Check the rear suspension camber angle as described on page K.14.

Refit the hydraulic dampers as described on page K.7.

Refit the rear suspension as described on page K.6.

Re-lubricate the wishbone fulcrum shafts as described in "Routine Maintenance" at the beginning of this section.

WISHBONE OUTER PIVOT

Removal

Support the hub carrier and wishbone.

Remove one of the self-locking nuts securing the outer fulcrum shaft.

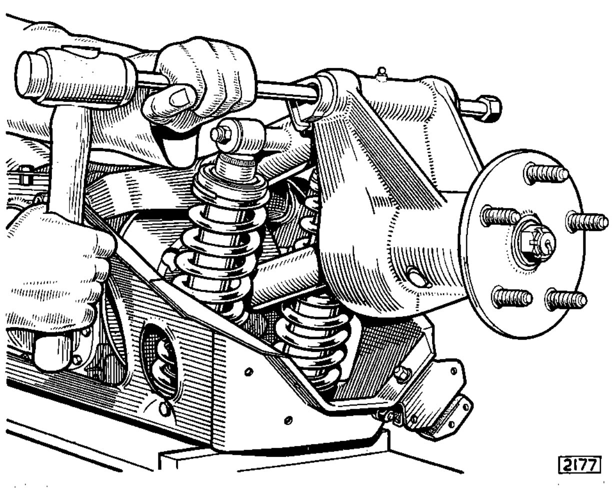


Fig. 15. Drifting out the wishbone outer fulcrum shaft

Drift out the fulcrum shaft, Fig. 15, and collect the shims, if any, between the hub carrier and the wishbone.

Separate the hub carrier and wishbone.

Dismantling

Remove the oil seal track and prise out the oil seals.

Remove the inner races of the tapered roller bearings by tapping out with the aid of a drift in the grooves provided.

Remove the spacers and shims.

Reassembly

Refit the inner races for the tapered roller bearings.

Fit the spacers and a known quantity of shims, this is necessary to obtain the correct bearing adjustment as described in the following paragraphs.

Fit the tapered roller bearings and oil seal tracks.

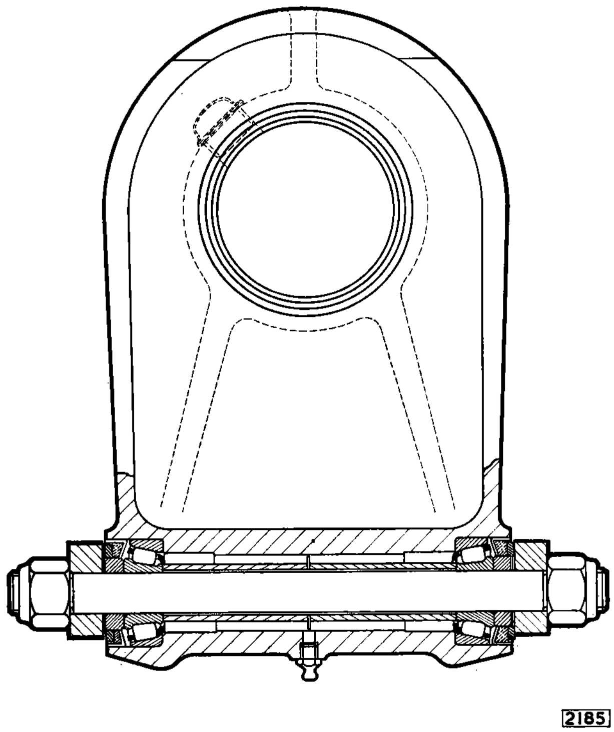


Fig. 16. Section through hub carrier and wishbone showing outer fulcrum shaft in position

Bearing Adjustment

If it is necessary to adjust the tapered roller bearings it will be necessary to extract the hub from the rear axle half shaft as described in Section H "Rear Axle."

Bearing adjustment is effected by shims fitted between the two fulcrum shaft spacer tubes. The correct bearing adjustment is ·000″—·002″ (·00 mm.—·05 mm.) pre-load.

Shims are available in sizes of ·004″ (·101 mm.) and ·007″ (·17 mm.) thick and 1⅛″ (28·67 mm.) diameter.

A simple jig should be made consisting of a piece of plate steel approximately 7″ × 4″ × ⅜″ (17·7 cm. × 10·1 cm. × 9·5 mm.). Drill and tap a hole suitable to receive the outer fulcrum shaft. Place the steel plate in a vice and screw the fulcrum shaft into the plate and slide an oil seal track onto the shaft. Place the assembly into position on the fulcrum shaft minus the oil seals and with an excess of shims between the spacers. Place an inner wishbone fork outer thrust washer onto the fulcrum shaft so that it abuts the oil seal track. Fill the remaining space on the shaft with washers and secure with a nut. Tighten the nut to 55 lbs. ft. (7·60 kg.m.).

Press the hub carrier assembly towards the steel plate using a slight twisting motion to settle the rollers onto the bearing surface. Maintain a steady pressure against the hub carrier and using a feeler gauge measure the amount of clearance between the large diameter washer and the machined face of the hub carrier.

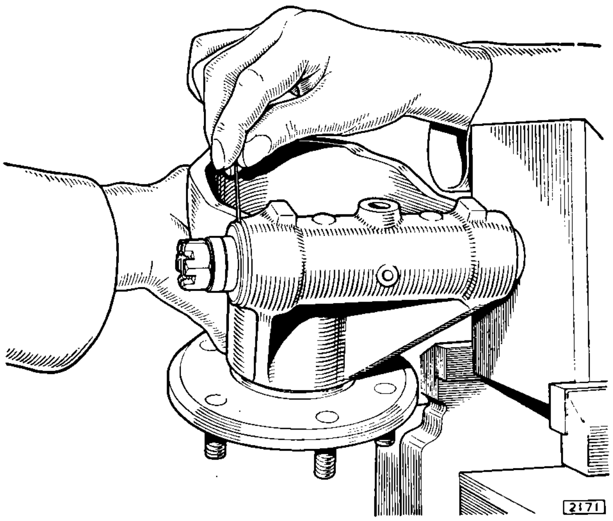


Fig. 17. Measuring the amount of clearance between the hub carrier and large washer to determine the end float in the bearings

Pull the hub carrier assembly towards the large diameter washer slightly rotating the carrier to settle the rollers onto the bearing surface. Maintain a steady pressure against the hub carrier and using feeler gauges measure the amount of clearance between the large diameter washer and the machined face of the hub carrier.

Subtract the one measurement from the other which gives the amount of end float present in the bearings.

Remove sufficient shims to obtain a reading of ·000″—·002″ (·00 mm.—·05 mm.) preload.

Example:—

Correct preload ·000″—·002″ (·00 mm.—·05 mm.)

Mean ·001″ (·02 mm.)

Assume the bearing end-float to be ·010″ (·35 mm.).

Therefore ·010″ + ·001″ = ·011″ (·25 mm. + ·02 mm. = ·27 mm.) to be removed to give correct preload.

Refit the hub carrier to the half shaft as described in Section H "Rear Axle."

Fit new oil seals with the lips inwards and place the fulcrum shaft into position in the hub carrier.

Offer up the hub carrier to the wishbone. Chase the dummy shaft through the wishbone with the fulcrum shaft.

Using feeler gauges measure the gap between the oil seal track and the wishbone. Shims of ·004″ (·101 mm.) thickness by 1⅛″ (22·2 mm.) diameter should be used.

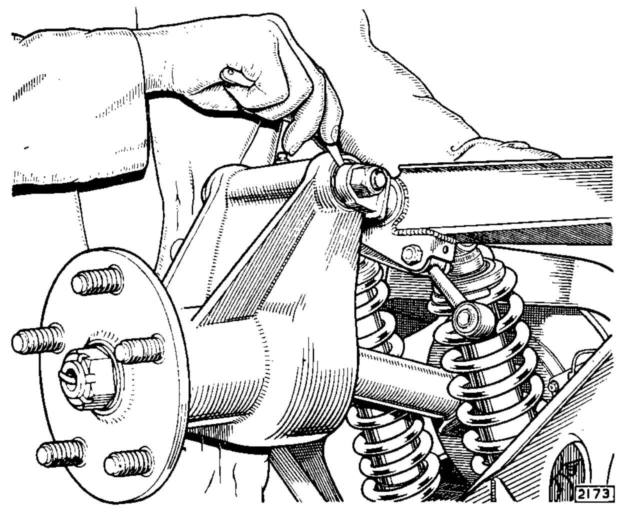


Fig. 18. Using feeler gauges to measure the clearance between the hub carrier oil seal tracks and wishbone fork

Repeat for the other end and shim as necessary to centralize the hub carrier in the wishbone fork. The above procedure is to prevent the wishbone fork ends from closing inwards. Tighten the nuts on the fulcrum shaft to 55 lbs. ft. (7·60 kg.m.).

Refitting

To facilitate refitting, slide a dummy shaft Churchill tool No. J.14 through the hub carrier before offering up the wishbone to the hub carrier.

Refitting is the reverse of the removal procedure.

Re-lubricate the bearings as described in "Routine Maintenance" at the beginning of the section.

INNER FULCRUM WISHBONE MOUNTING BRACKET

Removal

Remove the eight bolts and self-locking nuts securing the tie plate to the inner fulcrum wishbone mounting bracket.

Remove the six bolts and self-locking nuts securing the tie plate to the cross beam.

Remove one self-locking nut and drift out the inner fulcrum shaft.

Withdraw the forks of the wishbone from between the cross beam and inner fulcrum wishbone mounting bracket.

Collect the oil seal retainers, oil seals, inner and outer thrust washers and bearing tubes.

Remove the lock wire from the two setscrews which secure the inner fulcrum wishbone mounting bracket to the differential unit.

Remove the spacer between the inner fulcrum mounting bracket.

Remove the two setscrews and note the amount of shims between the bracket and the differential.

Remove the inner fulcrum wishbone mounting bracket.

Refitting

When refitting the inner fulcrum wishbone mounting bracket, replace the same amount of shims between the differential casing and the bracket.

Shims are available in sizes of ·005″ (·127 mm.) and ·007″ (·177 mm.) thickness.

Hold the inner fulcrum wishbone mounting bracket in position between the cross beam.

Insert the fulcrum shaft through the cross beam and bracket. Screw the inner fulcrum bracket securing setscrews in two or three threads, enough to locate the bracket.

Insert the required amount of shims and tighten the two setscrews securing the inner fulcrum wishbone mounting bracket to the differential casing. Secure the two setscrews with locking wire.

Tap the spacer, fitted between the inner fulcrum mounting bracket lugs, into position.

Withdraw the inner fulcrum shaft from the cross beam and fulcrum bracket.

Offer up the wishbone to the inner fulcrum mounting bracket complete with bearing tubes, needle roller bearing and spacers, inner and outer thrust washers, oil seals and oil seal retainers. Ensure that the radius arm mounting bracket is towards the front of the car.

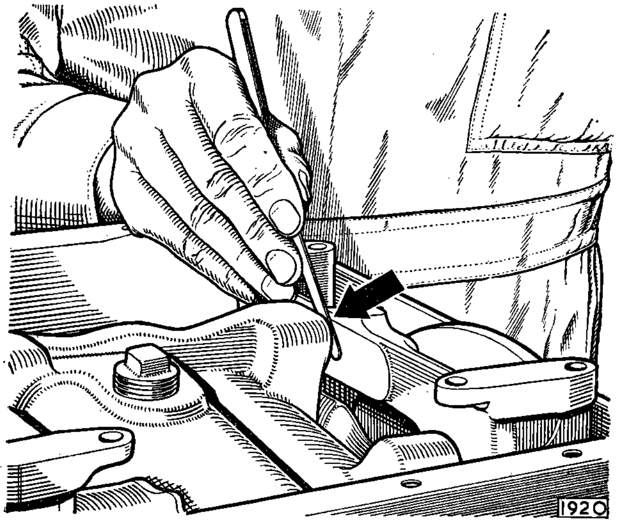


Fig. 19. Measuring the clearance between the inner fulcrum mounting bracket and the differential casing

Align the holes and spacers. Press a dummy shaft through each side of the cross beam and wishbone. The dummy shafts locate the wishbone, spacers, cross beam and inner fulcrum mounting bracket and facilitate refitting of the fulcrum shaft.

Smear the fulcrum shaft with grease and gently tap the shaft through the cross beam, wishbone and inner fulcrum mounting bracket. As the fulcrum is tapped into position the short dummy shafts will be displaced from the opposite side. It will be found advantageous to keep a slight amount of pressure exerted on the dummy shafts as they emerge from the cross beam. This will reduce the tendency for the dummy shafts to be knocked out of position and allow a spacer or thrust washer to be displaced. If a washer or spacer becomes displaced it will be necessary to remove the fulcrum shaft, dummy shafts and wishbone and then repeat the operation.

When the fulcrum shaft is in position tighten the two self locking nuts to 55 lbs. ft. (7·60 kg.m.) with a torque wrench.

Refit the eight bolts and self-locking nuts securing the tie plate to the inner fulcrum wishbone mounting bracket.

Refit the six bolts and self-locking nuts securing the tie plate to the cross beam.

Refit the rear suspension unit as described on page K.6.

REAR WHEEL CAMBER ANGLE—ADJUSTMENT

To check the camber angle of the rear suspension it is necessary for the car's wheels to be on a flat

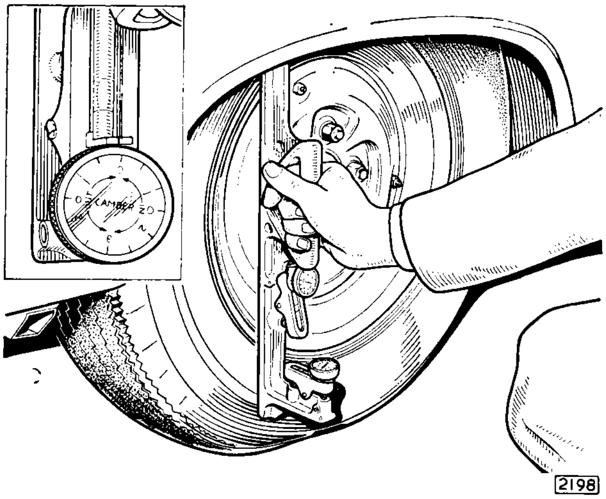


Fig. 20. Checking the rear wheel camber angle

surface and for the tyre pressures to be correct.

Check that the level of the oil and water is correct, the petrol tank full and the spare wheel is in position. If not, additional weight must be added to compensate for, say, a low level of petrol. The weight of 10 gallons of petrol is approximately 80 lbs. (3·60 kg.).

Roll the car backwards and forwards until the road wheels have rotated at least six times; this procedure is to settle the suspension in the loaded condition. Measure the distance from the ground to the inner and outer pivots A and B on the rear suspension, see Fig. 21. The difference between the two measurements should be $2\frac{13}{32}''$ (6·11 cm.).

Check the camber of the rear wheels, using a recommended gauge, by placing the gauge against each rear tyre in turn as shown in Fig. 20.

The correct reading is $\frac{3}{4}° \pm \frac{1}{4}°$ negative.

If the reading is incorrect it will be necessary to add or subtract shims between the half shaft and the brake disc. One shim ·020″ (·05 mm.) will alter the rear camber angle by approximately $\frac{1}{4}°$.

Jack up the car on the appropriate side and remove the rear road wheel.

Remove the self-locking nut and washer securing the forward road spring and hydraulic damper assembly to the wishbone mounting pin. Drift the mounting

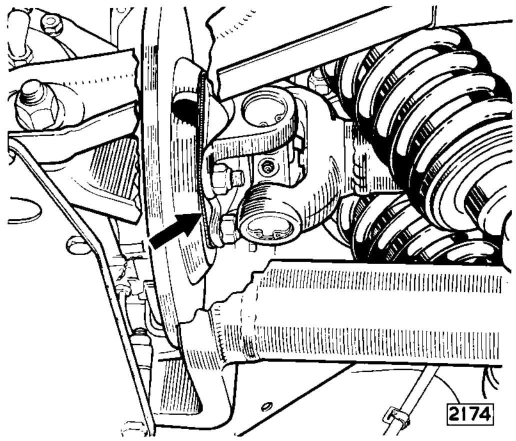


Fig. 21. The rear wheel camber angle is adjusted by means of shims indicated by the arrow

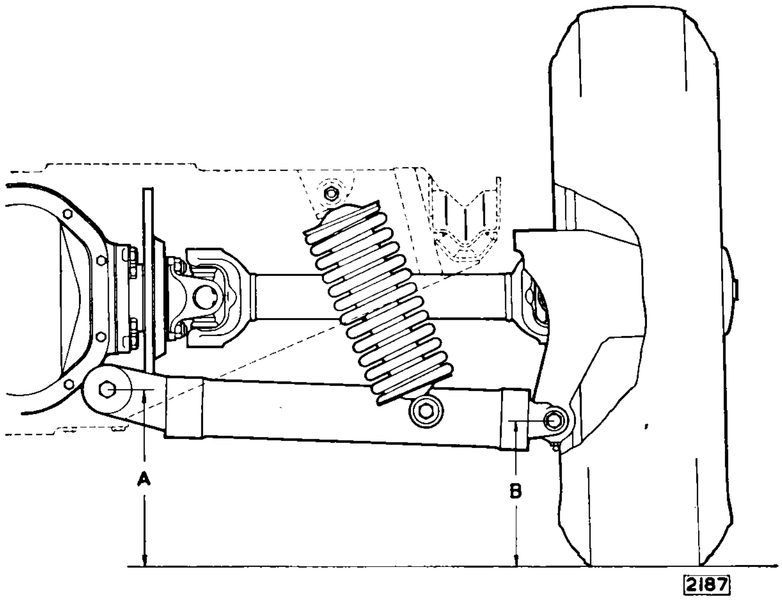


Fig. 22. When checking the rear wheel camber angle A minus B must be $2\frac{13}{32}''$ (6·11 cm.)

pin through the wishbone until the assembly is free from the pin.

Remove the self-locking nut and bolt securing the top of the road spring and hydraulic damper assembly to the cross beam and remove the assembly.

Unscrew the four self-locking nuts securing the half shaft and the camber shims to the brake disc. Pull the hub and half shaft away from the shims sufficiently to clear the disc mounting studs. Remove or add shims as necessary.

Offer up the half shaft to the four disc mounting studs and secure with four self-locking nuts. Offer up the forward road spring and hydraulic damper assembly to the cross beam and secure with a bolt and self locking nut.

Align the hydraulic damper and road spring assembly bottom mounting with the mounting pin in the wishbone and drift the pin through the assembly. Replace the plain washer and secure with a self-locking nut.

Replace the rear road wheel. Move the car backwards and forwards until the road wheels have rotated at least six times.

Check the measurement variation between the inner and outer pivots, see Fig. 22 which should be $2\frac{13}{32}''$ (6·11 cm.) and recheck the camber angle.

ACCIDENTAL DAMAGE

The following dimensional drawings are provided to assist in assessing accidental damage. A component suspected of being damaged should be removed from the car, cleaned off, the dimensions checked and compared with those given in the appropriate illustration.

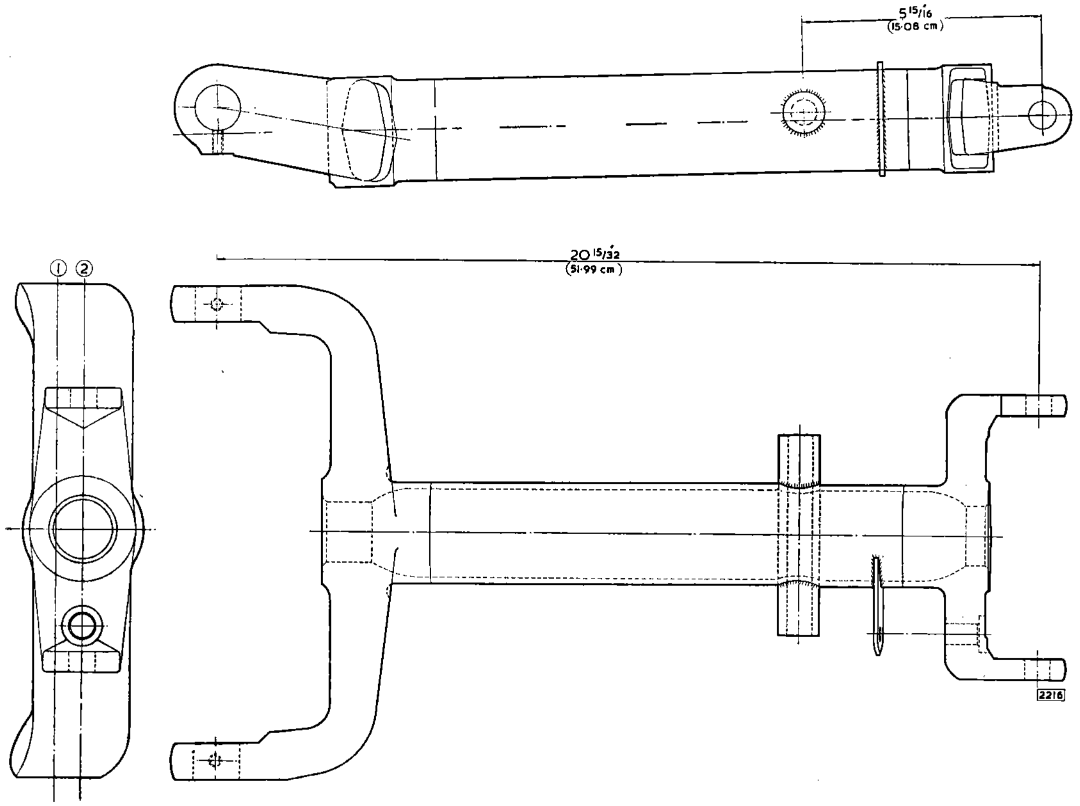


Fig. 23. The wishbone

SPECIAL TOOLS

DESCRIPTION		TOOL NO.
Shock Absorber/Spring Unit Dismantling Tool	Use with SL.14.	J.11 A
Rear Wishbone Pivot Dummy Shaft		J.14 (2 off per set)

SECTION L

BRAKES

3·8 MARK 10 MODEL

INDEX

INDEX *(continued)*

THE BRAKING SYSTEM

DESCRIPTION

The front wheel brake units are comprised of a hub mounted disc rotating with the wheel and a braking unit rigidly attached to each suspension member. The rear brake units are mounted inboard adjacent to the differential case. The braking unit is rigidly attached to the differential case. The brake unit consists of a caliper which straddles the disc and houses a pair of rectangular friction pad assemblies, each comprising a pad and a securing plate. These assemblies locate between a keep plate bolted to the caliper bridge and two support plates accommodated in slots in the caliper jaw. Cylinder blocks bolted to the outer faces of the caliper accommodate piston assemblies which are keyed to the friction pad assemblies. A spigot formed on the outer face of each piston locates in the bore of a backing plate with an integral boss grooved to accommodate the collar of a flexible rubber dust seal. The outer rim of the seal engages a groove around the block face and so protects the assembly from intrusion of moisture and foreign matter. A piston seal is located in a groove at the outer end of the piston.

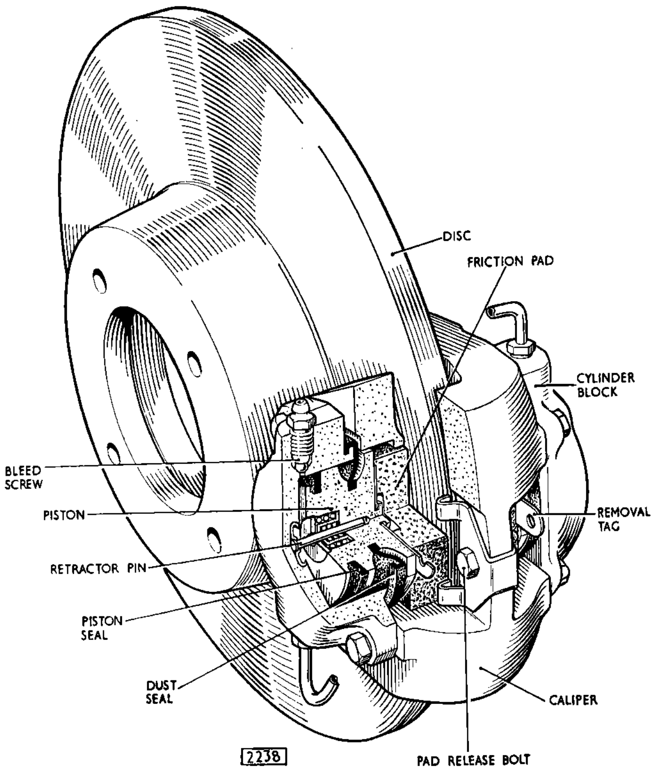


Fig. 1. Sectioned view of a front disc brake

DATA

Make	Dunlop
Type	Bridge type caliper with quick change pads
Brake disc diameter—front	$10\frac{3}{4}$" (27·31 cm.)
rear	10" (25·4 cm.)

Master cylinders—bore diameter	$\frac{5}{8}$″ (15·87 mm.)
Master cylinder stroke (upper—rear brakes)	1·075″ (2·73 cm.)
(lower—front brakes)	1·45″ (3·68 cm.)
Front brake cylinder bore diameter—early cars	$2\frac{1}{8}$″ (5·39 cm.)
—later cars *	$2\frac{1}{4}$″ (5·71 cm.)
Rear brake cylinder bore diameter—early cars	$1\frac{5}{8}$″ (4·12 cm.)
—later cars *	$1\frac{11}{16}$″ (4·58 cm.)
Main friction pad material—early cars	Mintex M.33
—later cars	Mintex M.59
Handbrake friction pad material	Mintex M.34
Servo unit type	Vacuum bellows type

* From chassis numbers 300471 R.H. Drive and 350973 L.H. Drive.

Retractor Operation

The retractor unit (see Fig. 2) comprises the retractor pin pressed into the cylinder block and the retractor bush, washer, return spring and spring retainer peened into the piston.

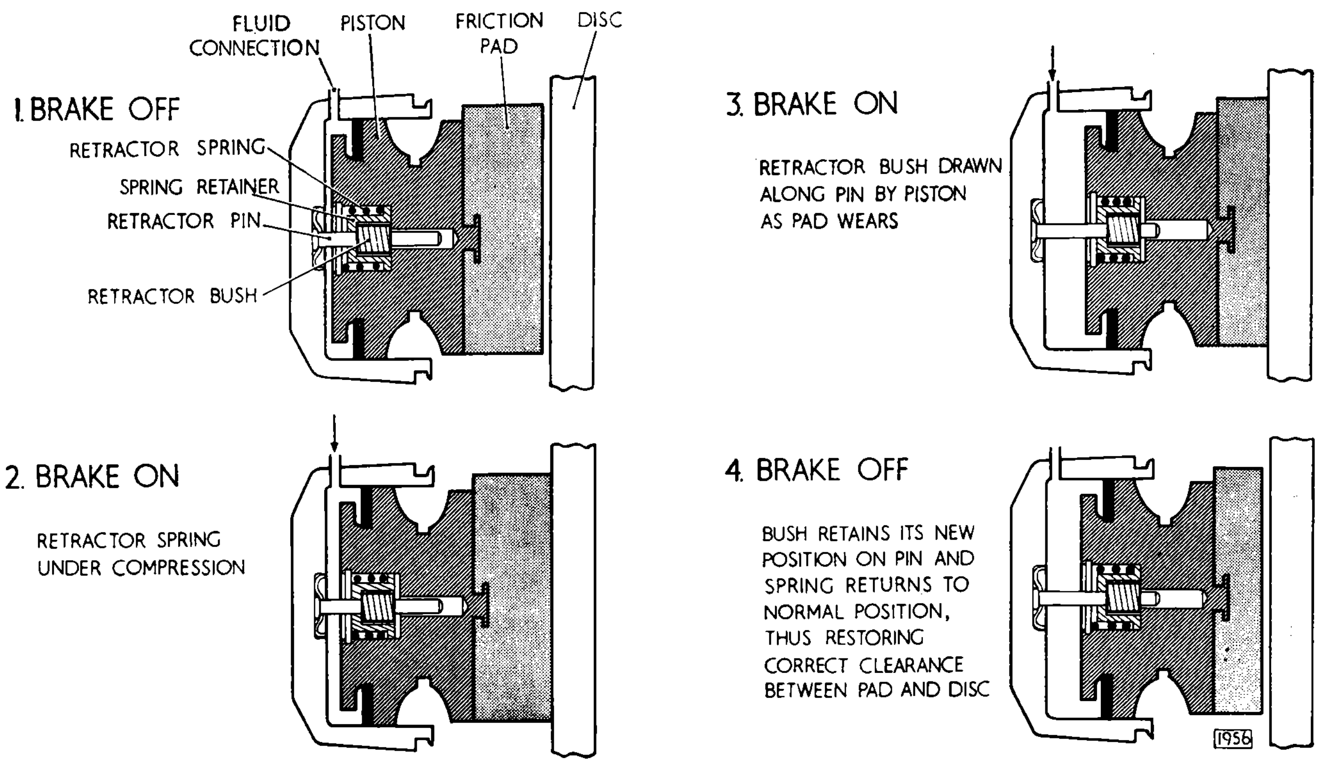


Fig. 2. Operation of the self adjusting mechanism

When the brakes are applied the piston moves the friction pad towards the disc. The retractor bush grips the pin holding the spring retainer and the return spring against the washer. The piston in moving the distance between the pad and disc compresses the return spring and when the brakes are released the return spring expands maintaining an equal clearance between the pad and disc.

When the pad wears and has not made contact with the disc by the time that the washer has fully compressed the return spring, the washer will move the retractor bush down the pin until the pad contacts the disc. The retractor bush stops in this new position and when the brakes are released the return spring expands allowing the pads to maintain the normal "brakes off" clearance of approximately ·008″—·010″ (·20—·25 mm.) as before.

Handbrakes

The self-adjusting handbrakes are attached to the rear brake caliper bodies but form an independent mechanically operated system carrying its own friction pads. The handbrakes are self-adjusting to compensate for friction pad wear and automatically provide the necessary clearance between the brake discs and the friction pads.

ROUTINE MAINTENANCE

WEEKLY

Brake Fluid Level

The two fluid reservoirs for the hydraulic brakes are attached to the engine bulkhead on the driver's side of the car.

The front reservoir supplies the front brakes and the rear reservoir supplies the rear brakes. The clutch reservoir (if fitted) is situated between the two brake reservoirs.

At the recommended intervals check the level of the fluid in the reservoirs and top up if necessary to the level mark above the fixing strap marked "Fluid Level" using only the correct specification of brake fluid.

DO NOT overfill.

The level can be plainly seen through the plastic reservoir container.

First disconnect the two electric cables from the "snap-on" terminals. Unscrew the filler cap and top up if necessary to the recommended level. Insert the combined filler cap and float slowly into the reservoir to allow for displacement of fluid and screw down the cap. Wipe off any fluid from the top of the cap and connect the cables to either of the two terminals.

Note: A further indication that the fluid level is becoming low is provided by an indicator pin situated between the two terminals.

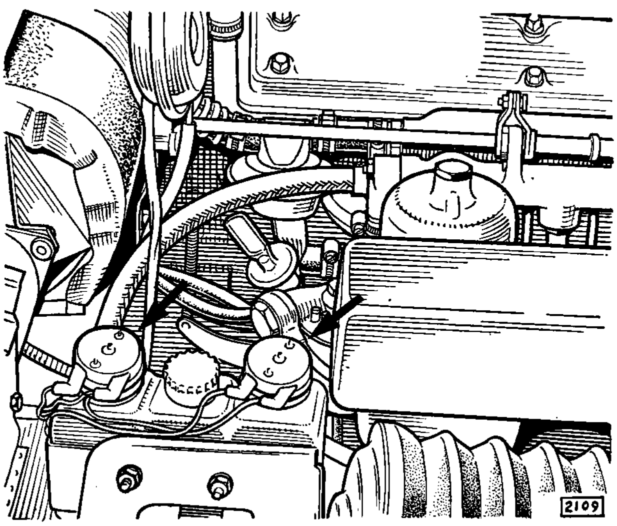


Fig. 3. Fluid reservoir—right-hand drive

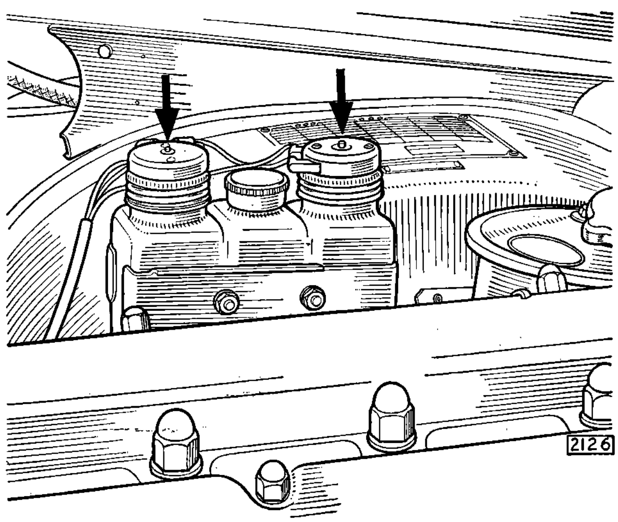


Fig. 4. Fluid reservoir—left-hand drive

First press down the pin and allow it to return to its normal position; if the pin can then be lifted with the thumb and forefinger, the reservoir requires topping-up immediately.

Brake Fluid Level Warning Light

A warning light (marked "Brake Fluid—Handbrake") situated on the facia behind the steering wheel, serves to indicate if the level in one or both of the brake fluid reservoirs has become low, provided the ignition is "on." As the warning light is also illuminated when

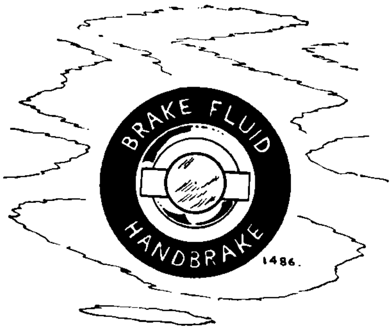


Fig. 5. Brake fluid/Handbrake warning light

the handbrake is applied, the handbrake must be fully released before it is assumed that the fluid level is low. If with the ignition "on" and the handbrake fully released the warning light is illuminated the brake fluid must be "topped-up" immediately.

As the warning light is illuminated when the handbrake is applied and the ignition is "on" a two-fold purpose is served. Firstly, to avoid the possibility of driving away with the handbrake applied. Secondly, as a check that the warning light bulb has not "blown"; if on first starting up the car with the handbrake fully applied, the warning light does not become illuminated the bulb should be changed immediately.

Note: If it is found that the fluid level falls rapidly indicating a leak from the system, the car should be taken immediately to the nearest Jaguar Dealer for examination.

EVERY 2,500 MILES (4,000 KM.)

Footbrake Adjustment

Both the front wheel and rear wheel brakes are so designed that no manual adjustment to compensate for brake friction pad wear is necessary as this automatically takes place when the the footbrake is applied.

Handbrakes

The self-adjusting handbrakes are attached to the rear caliper bodies but form an independent mechanically actuated system carrying its own friction pads. The handbrakes are self-adjusting to compensate for friction pad wear and automatically provide the necessary clearance between the brake discs and the friction pads.

Handbrake Cable Adjustment

The handbrake cable adjustment linkage (Fig. 6) is situated at the rear of the front suspension assembly on the driver's side of the car.

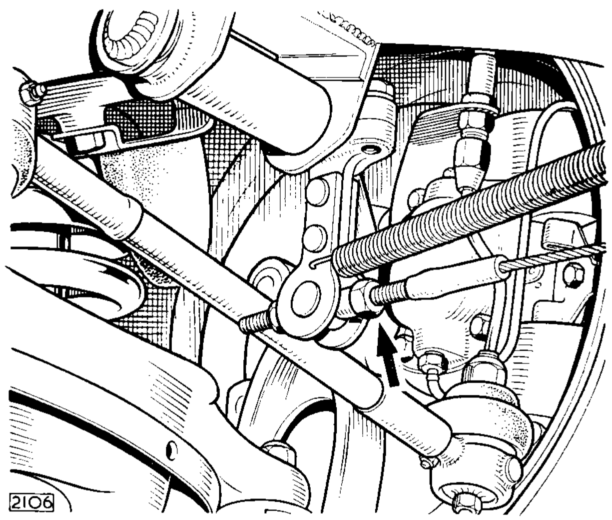


Fig. 6. Handbrake cable adjustment

Fully release the handbrake control in the car and slacken the locknut at the rear of the adjustment linkage. Ensure that levers at the calipers are in the "fully off" position by pressing toward the caliper and adjust the length of the cable to a point just short of where the caliper levers start to move; no attempt should be made to place the cable under tension otherwise the handbrake may bind.

EVERY 5,000 MILES (8,000 KM.)

Friction Pads—Examination for Wear

At the recommended intervals, or if a loss of braking efficiency is noticed, the brake friction pads (2 per brake) should be examined for wear; the ends of the pads can be easily observed through the apertures in the brake caliper. When the friction pads have worn down to a thickness of approximately $\frac{1}{4}''$ (7 mm.) they need renewing.

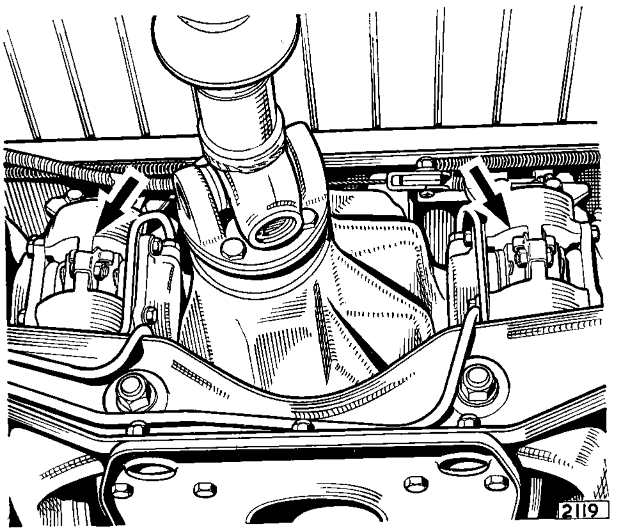


Fig. 7. Location of the rear brake calipers

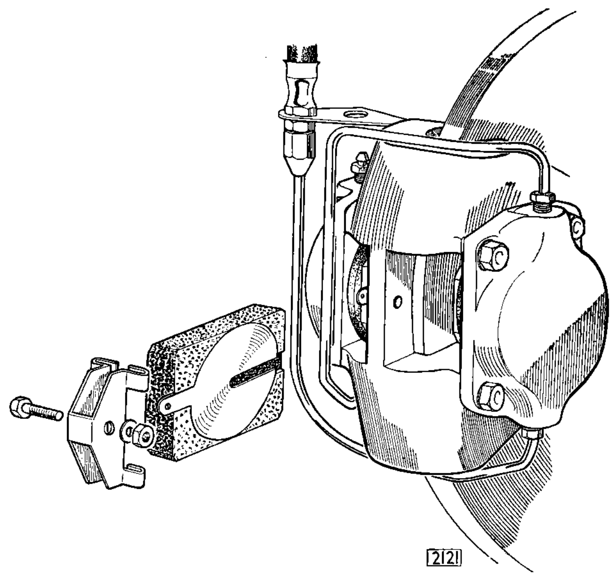


Fig. 8. Friction pad removal

Friction Pads—Renewal

To remove the friction pads, unscrew the nut from the bolt attaching the friction pad retainer to the caliper and extract the bolt. Withdraw the pad retainer.

Insert a hooked implement through the hole in the metal tag attached to the friction pad and withdraw the pad by pulling on the tag.

To enable the new friction pads to be fitted it will be necessary to force the pistons back into the cylinder blocks by means of the special tool (Part No. 7840) See Fig. 22.

When all the new friction pads have been fitted, top up the supply tank to the recommended level.

Insert the new friction pads into the caliper ensuring that the slot in the metal plate attached to each pad engages with the button in the centre of the piston.

Finally, refit the friction pad retainer and secure with the bolt and nut. Apply the footbrake a few times to operate the self-adjusting mechanism, so that normal travel of the pedal is obtained.

RECOMMENDED BRAKE FLUIDS

Preferred Fluid

Castrol/Girling Crimson Brake/Clutch Fluid.

Alternative Brake Fluids

Recognised brands of brake fluid conforming to Specification S.A.E. 70 R3.

In the event of deterioration of the rubber seals and hoses due to the use of an incorrect fluid, all the seals and hoses must be replaced and the system thoroughly flushed and refilled with the above fluid.

THE BRAKING SYSTEM

BLEEDING THE BRAKE SYSTEM

The following procedure should be adopted either for initial priming of the system or to bleed in service if air has been permitted to enter the system. This latter condition may occur if connections are not maintained, properly tightened, or if the master cylinder periodic level check is neglected. During the bleeding operation it is important that the level in the reservoir is kept topped up to avoid drawing air into the system. It is recommended that new fluid be used for this purpose.

Check that all connections are tightened and all bleed screws closed. Fill the reservoir with brake fluid of the correct specification. Attach the bleeder tube to the bleed screw on the near side rear brake and immerse the open end of the tube in a small quantity of brake fluid contained in a clean glass jar. Slacken the bleed screw and operate the brake pedal slowly backwards and forwards through its full stroke until fluid pumped into the jar is reasonably free from air bubbles. Keep the pedal depressed and close the bleed screw. Release the pedal.

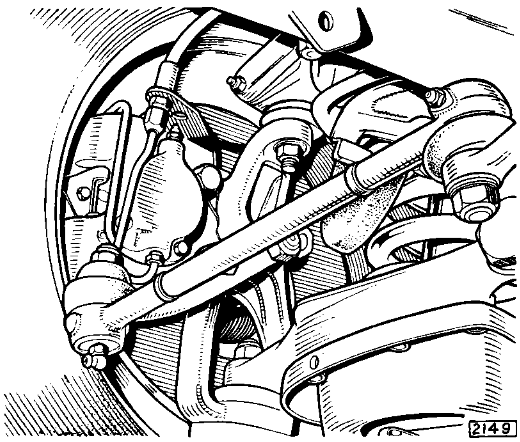


Fig. 9. Location of the bleed nipple

Repeat for the offside rear brake.

Repeat for each of the front brakes.

Repeat the complete bleeding sequence until the brake fluid pumped into the jar is completely free from air bubbles.

Lock all bleed screws and finally regulate the fluid level in the reservoir. Apply a normal working load on the brake pedal for a period of two or three minutes and examine the entire system for leaks.

BRAKE OVERHAUL—PRECAUTIONS

The complete brake system is designed to require the minimum of attention and providing the hydraulic fluid in the reservoir is not allowed to fall below the recommended level no defects should normally occur. Fluid loss must be supplemented by periodically topping up the reservoir with fluid of the same specification as that in the system.

The inclusion of air in a system of this type will be indicated by sluggish response of the brakes and spongy action of the brake pedal. This condition may be due to air induction at a loose joint or at a reservoir in which the fluid has been allowed to fall to a very low level. These defects must be immediately remedied and the complete system bled. Similarly, bleeding the system is equally essential following any servicing operation involving the disconnecting of part or whole of the hydraulic system.

The following instructions detail the procedure for renewal of component parts and for complete overhaul of the disc brakes, handbrakes and master cylinders. The units should be thoroughly cleaned externally before dismantling. Brake fluid should be used for cleaning internal components, and, except where otherwise stated in these notes, the use of petrol, paraffin or chemical grease solvents should be avoided as they may be detrimental to the rubber components. Throughout the dismantling and assembling operation it is essential that the work bench be maintained in a clean condition and that the components are not handled with dirty or greasy hands. The precision parts should be handled with extreme care and should be carefully placed away from tools or other equipment likely to cause damage. After cleaning, all components should be dried with lint-free rag.

When it is not the intention to renew the rubber components, they must be carefully examined for serviceability. There must be no evidence of defects such as perishing, excessive swelling, cutting or twisting, and where doubt exists comparison with new parts may prove to be of some assistance in making an assessment of their condition. The flexible pipes must show no signs of deterioration or damage and the bores should be cleaned with a jet of compressed air. No attempt should be made to clear blockage by probing as this may result in damage to the lining and serious restriction to fluid flow. Partially or totally blocked flexible pipes should always be renewed. When removing or refitting a flexible pipe, the end sleeve hexagon (A, Fig. 10) should be held with the appropriate spanner to prevent the pipe from twisting. A twisted pipe will prove detrimental to efficient brake operation.

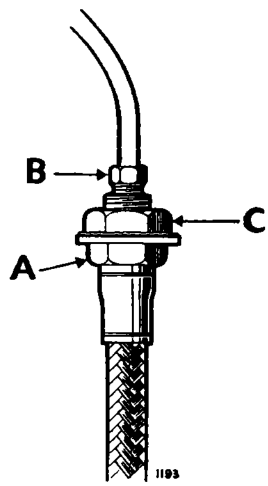


Fig. 10, Flexible hose connection. Hold hexagon "A" with a spanner when removing or refitting locknut "C"

THE BRAKE PEDAL BOX ASSEMBLY

Removal

Remove the servo vacuum pipe from the connection at the rear of the servo unit.

Remove the four self-tapping screws and cover plate situated on the top of the pedal box frame.

Right-hand Drive

Disconnect the Lucar connectors at the brake fluid reservoirs.

Remove the air intake box as described in the carburetter Section "C".

Remove the brake fluid pipes from both master cylinders. (Upper master cylinder to rear brakes. Lower master cylinder to front brakes). Plug the holes and pipe ends.

Pull back the trim under the pedal box in the car.

Remove the six nuts and shakeproof washers from the studs at the base of the pedal box assembly.

Remove the small nut and shakeproof washer securing the rear of the pedal box cover.

Remove the cover.

Remove the two self-tapping screws locating the plastic cover situated between the pedal box and gearbox tunnel member.

Remove the brake pedal pad.

Remove the brake pedal box and servo unit from the car.

The servo unit can now be separated from the pedal box by removing the four nuts and shakeproof washers.

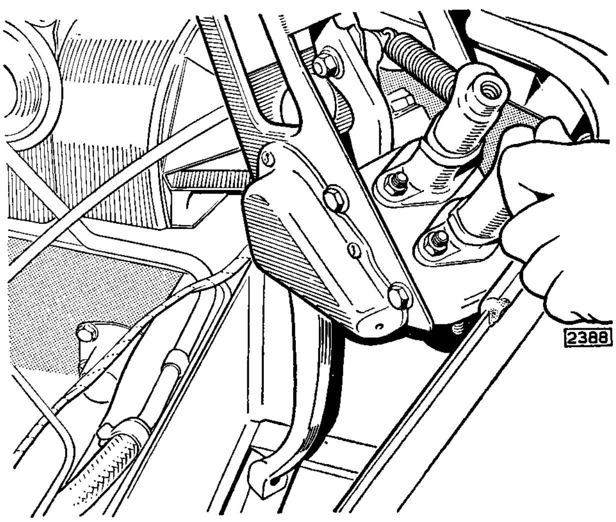


Fig. 11. Removing the pedal box

Left-hand Drive

Remove four nuts and shakeproof washers retaining the servo and withdraw the unit forward.

Remove the outlet pipes from the master cylinders and plug the holes.

Remove the pipes from the reservoirs and plug the holes and other pipe ends.

Pull back the trim under the pedal box in the car interior.

Remove the six nuts and shakeproof washers at the base of the pedal box.

Remove the small nut and shakeproof washer located at the back of the pedal box cover.

Remove the cover.

Remove two self-tapping screws securing the plastic cover on the pedal box to the frame.

Remove the brake pedal pad.

Withdraw the pedal box assembly.

Dismantling the Brake Linkage

Having removed the brake linkage assembly from the car as described above, if it is necessary to dismantle the assembly, proceed as follows.

Remove the plastic cover (4, Fig. 12) over the brake pedal splines.

Remove the return spring from between the operating lever (9) and the vacuum servo support bracket (3).

Unscrew six setscrews, remove the shakeproof washers and withdraw the servo support bracket from the pedal housing (25).

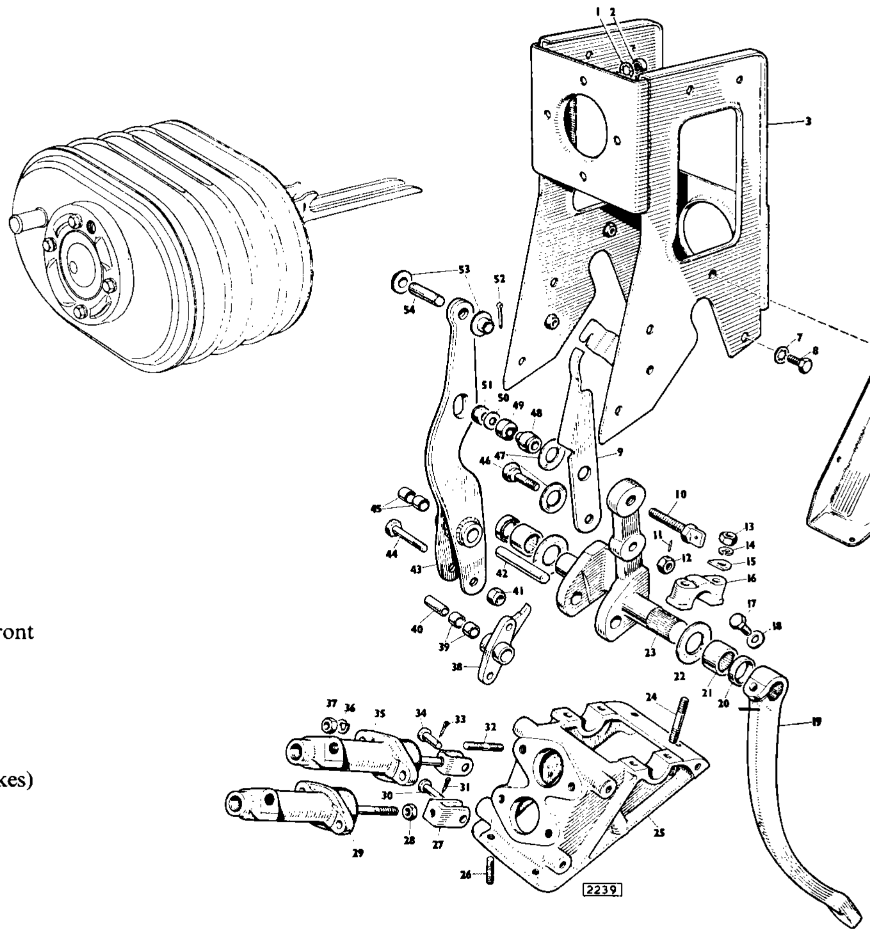
Slacken the locknut on the push-rod of the lower master cylinder (29) and unscrew the push-rod from its fork end (27). Remove the two securing nuts and spring washers and withdraw the lower master cylinder.

Discard the split pin and withdraw the clevis pin from the forkend on the push-rod of the upper master cylinder (35). Remove the two securing nuts and spring washers and withdraw the upper master cylinder.

Remove the two nuts, spring washers and "D" washers securing each bearing cap and withdraw the caps (16). Remove the brake power lever and operating lever assembly from the pedal housing.

Remove the dust seal (20) on each pivot shaft noting that the lip of the seal faces **inwards.** Withdraw the two roller races noting that the flat end faces inwards. Remove the two fibre washers (22) noting that the chamfer on the inside diameter also faces inwards.

Remove the brake power lever (43) from the assembly by lifting out the pivot pin (42) securing the power lever to the pedal shaft (23) and withdrawing the lever.



1. Shakeproof washer
2. Nut
3. Servo support bracket
4. Plastic pedal cover
5. Shakeproof washer
6. Setscrew
7. Shakeproof washer
8. Bolt
9. Operating lever
10. Special bolt
11. Pin
12. Locknut
13. Nut
14. Spring washer
15. "D" washer
16. Bearing cap
17. Pinch bolt
18. Washer
19. Brake pedal
20. Dust seal
21. Needle roller bearing
22. Fibre washer
23. Pedal shaft
24. Stud
25. Pedal housing
26. Stud
27. Fork end
28. Locknut
29. Lower master cylinder (front brakes)
30. Clevis pin
31. Split pin
32. Stud
33. Split pin
34. Clevis pin
35. Upper master cylinder (rear brakes)
36. Spring washer
37. Nut
38. Balance link
39. Bushes
40. Spacer
41. Locknut
42. Pivot pin
43. Power lever
44. Bolt
45. Bushes
46. Eccentric bolt
47. Dished washers
48. Spacer
49. Rubber collar
50. Washer
51. Locknut
52. Split pin
53. Nylon collar
54. Pin

Fig. 12. Exploded view of the brake pedal box assembly

If it is required to renew the special impregnated plastic bearings (45), remove the old bearings and press in new bearings, the outside faces of which should be flush with the outer ends of the bearing housing.

Remove the bolt and self-locking nut securing the balance link (38) to the power lever. Withdraw the balance link, remove the tubular spacer (40) and if required, drift out the special impregnated bearings (39) and press in new ones, the outside faces of which should be flush with the outer ends of the bearing housing.

Remove the eccentric adjusting bolt (46) by withdrawing the pin locking the securing nut, removing the nut and withdrawing the bolt and dished washer (47). Note that the concave face of the dished washer faces towards the operating lever.

Remove the self-locking nut (51), plain washer (50), rubber collar (49), spacer (48) and dished washer (47) the operating lever may now be removed. If it is necessary to remove the special bolt (10) note that the bolt should be entered from the side with the countersink. Note that the concave face of the dished washer faces towards the operating lever.

Reassembly

Reassembly is the reverse of the dismantling procedure, ensure that all pivots in the linkage are free and that all components are assembled the correct way round.

When fitting the brake pedal to the pedal shaft, ensure that the pedal pad face is at right angles (90°)

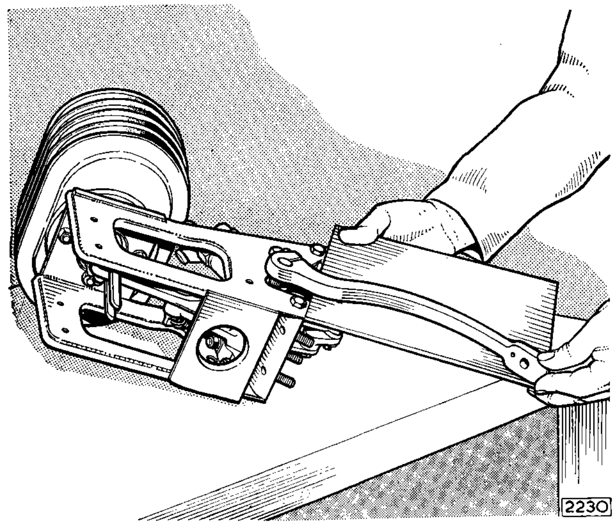


Fig. 13. Fitting the pedal using a gauge

to the mounting face of the pedal housing by using a suitable piece of wood or cardboard as shown in Fig. 13.

Before refitting the servo unit support bracket to the pedal housing the operating lever must be set as follows.

Setting the Operating Lever

Hold the operating lever against the power lever (as shown in Fig. 14) so that the rubber collar is fully compressed. Remove the split pin and nylon collar from the power lever and fit the perspex gauge (Special Tool No. 9020) as shown in Fig. 14. The eccentric adjusting nut should be turned until the

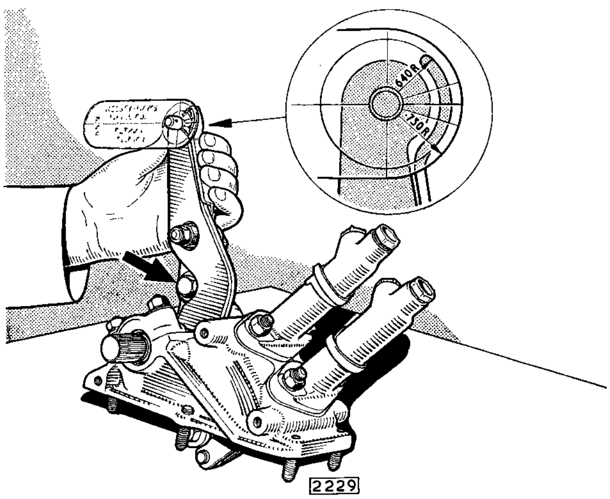


Fig. 14. Checking the servo operating lever setting using special tool No. 9020

outside curve of the operating lever becomes exactly aligned with the ·640 R line on the gauge. The other marks on the gauge should be disregarded.

Refitting

Refitting is the reverse of the removal procedure. Ensure that all linkages are quite free and smooth to operate.

Special attention must be given to the lining up of the forks on the servo with the pin on the operating lever. The pin must seat into the forks correctly before tightening the servo mounting bolts.

Failure to carry out the above will result in the brakes hanging on after application.

THE MASTER CYLINDERS

The master cylinders are mechanically linked to the footbrake pedal and, at a ratio proportional to the load applied, provide the hydraulic pressure necessary to operate the brakes. The components of the master cylinders are contained within the bore of a body which at its closed end has two integral pipe connection bosses. Integrally formed around the opposite end of the cylinder is a flange provided with two holes for the master cylinder attachment bolts. In the unloaded condition a spring loaded piston, carrying two seals (see Fig. 15) is held against the underside of a circlip retained dished washer at the head of the cylinder. A hemispherically ended push-rod seats in a similarly formed recess at the head of the piston. A fork end on the outer end of the push-rod provides for attachment to the pedal. A rubber dust excluder, the lip of which seats in a groove, shrouds the head of the master cylinder to prevent the intrusion of foreign matter.

A cylindrical spring support locates around the inner end of the piston and a small drilling in the end of the support is engaged by the stem of a valve. The larger diameter head of the valve locates in a central blind bore in the piston. The valve passes through the bore of a vented spring support and interposed between the spring support and an integral flange formed on the valve is a small coiled spring. A lipped rubber seal registers in a groove around the end of the valve. This assembly forms a recuperation valve which controls fluid flow to and from the reservoir.

When the foot pedal is in the OFF position the master cylinder is fully extended and the valve is held clear of the base of the cylinder by the action of the main spring. In this condition the master cylinder is in fluid communication with the reservoir, thus

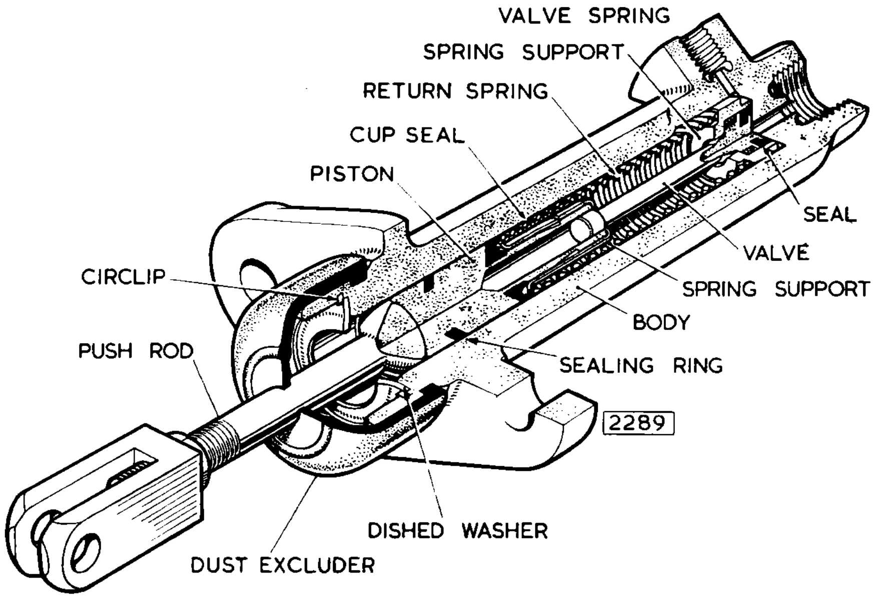


Fig. 15. Sectioned view of the lower master cylinder (front brakes)

permitting recuperation of any fluid loss sustained, particularly during the bleeding operation of the brake system.

When a load is applied to the foot pedal the piston moves down the cylinder against the compression of the main spring. Immediately this movement is in excess of the valve clearance the valve closes under the influence of its spring and isolates the reservoir. Further loading of the pedal results in the discharge of fluid under pressure from the outlet connection, via the pipe lines to the brake system.

Removal of the load from the pedal reverses the sequence, the action of the main spring returns the master cylinder to the extended position.

Removal

Remove the pedal box and brake linkage assembly from the car as described on page L.9.

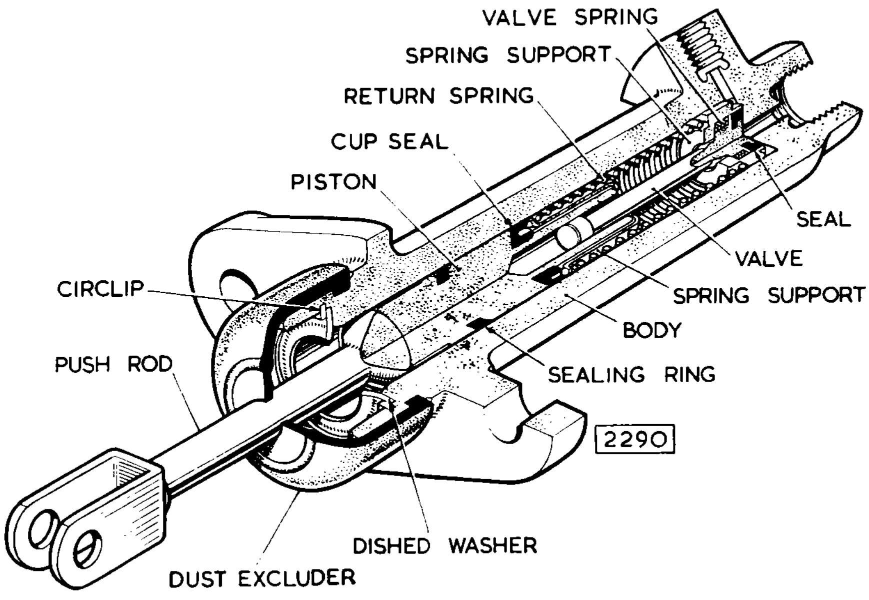


Fig. 16. Sectioned view of the upper master cylinder (rear brakes)

Slacken the locknut on the push-rod of the lower master cylinder and unscrew the push-rod from the fork end. Remove the two securing nuts and spring washers and withdraw the master cylinder from the pedal housing.

Discard the split pin and withdraw the clevis pin from the fork end on the push-rod of the upper master cylinder. Remove the two securing nuts and spring washers and withdraw the upper master cylinder.

Renewing the Master Cylinder Seals

Ease the dust excluder clear of the head of the master cylinder.

With suitable pliers remove the circlip; this will release the push-rod complete with the dished washer.

Withdraw the piston and valve assembly. Remove the sealing ring and the cup seal from the piston body.

Using a screwdriver, lift the tongue in the spring support clear of the groove in the piston body. Remove the valve, return spring and spring support from the piston. Withdraw the valve assembly and remove the seal from the end of the valve.

Lubricate the new seals and the bore of the cylinder with brake fluid, fit the seal to the end of the valve ensuring that the lip registers in the groove. Fit the seals in their grooves in the piston. It is recommended that the tubular spring support is also renewed before carrying out reassembly.

Insert the valve head into the slotted hole in the tubular spring support. Insert the piston into the other end of the spring support and centralise the valve head in the piston bore.

Press the tongue of the spring support into the groove of the piston.

Lubricate the piston with Castrol Rubber Grease H.95/59.

Insert the piston and valve assembly into the cylinder taking care not to twist or damage the seals. The use of the fitting sleeve supplied with the master cylinder reconditioning kit is recommended.

Position the push-rod and depress the piston sufficiently to allow the dished washer to seat on the shoulder at the head of the cylinder. Fit the circlip and check that it fully engages the groove.

Fill the dust excluder with clean Castrol Rubber Grease H.95/59.

Reseat the dust excluder around the end of the master cylinder.

Important: While the two brake master cylinders are basically similar in design most of the internal parts are not interchangeable and therefore, if both brake master cylinders are to be overhauled it is recommended that they should be dismantled and re-assembled individually.

Refitting

Refitting the master cylinders is the reverse of the removal procedure, the push-rod of the lower master cylinder should be set as described below and the braking system bled as described on page L.8.

Master Cylinder Push-rod Adjustment

Remove the dash casing and plate. Ensure that the brake pedal power lever is in the "fully off" position, by noting that the cross pin seats snugly in the forks. Slacken the locknut on the push-rod of the lower master cylinder and holding the cross pin of the power lever into the forks, screw the push-rod **into** the yoke to a point just short of where the cross pin starts to move away from the forks. Screw the push-rod **out** of the yoke $\frac{1}{3}$ of a turn, that is, two flats of the locknut and tighten up the nut. Depress the brake pedal lever slightly and check that there is free movement at the balance link.

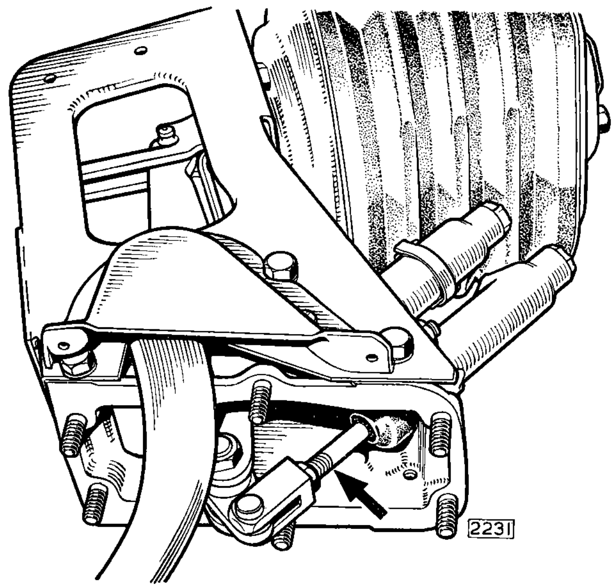


Fig. 17. Location of the lower master cylinder push-rod

FRONT CALIPERS

Removal

In order to remove the front calipers, jack up the car and remove the road wheel. Disconnect the

1. Body
2. Recuperating seal
3. Spring
4. Spring support
5. Valve
6. Main spring
7. Main spring support
8. Piston cup seal
9. Piston
10. Static piston seal
11. Dished washer
12. Push-rod retaining circlip
13. Dust excluder
14. Push-rod
15. Locknut
16. Fork end

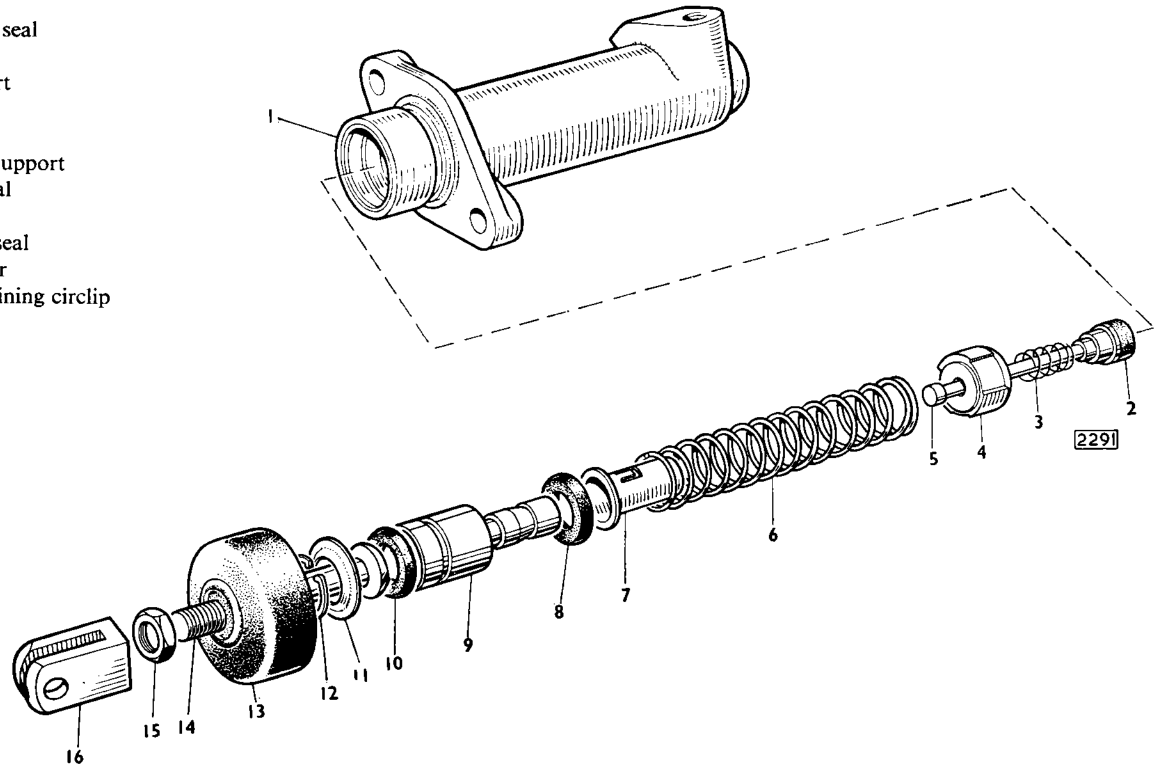


Fig. 18. Exploded view of a master cylinder

fluid feed pipe and plug the hole in the caliper. Discard the locking wire from the mounting bolts. Remove the caliper, noting the number of round shims fitted.

Refitting

Locate the caliper body (complete with the cylinder assemblies) in position and secure with two bolts.

Check the gap between each side of the caliper and the disc, both at the top and bottom of the caliper. The difference should not exceed ·010″ (·25 mm.) and round shims may be fitted between the caliper and the mounting plate to centralise the caliper body. Lock-wire the mounting bolts.

If not already fitted, fit the bridge pipe connecting the two cylinder assemblies. Connect the supply pipe to the cylinder body and ensure that it is correctly secured.

Bleed the brakes as described on page L.8.

REAR CALIPERS

Removal

The rear suspension unit must be removed in order to withdraw the rear calipers.

Proceed as described in Section K "Rear Suspension" and support the suspension unit under its centre.

Withdraw the split pin, remove the clevis pin joining the handbrake inner cable to the operating lever at the caliper and withdraw the outer cable from the trunnion on the other lever.

Remove the operating lever return springs at each caliper.

Remove the hydraulic feed pipe at the caliper and plug the hole to prevent the ingress of dirt.

Remove the friction pads from the caliper as described on page L.18.

Remove the front hydraulic damper and road spring unit (as described in Section K "Rear Suspension") and remove the four self-locking nuts from the halfshaft inner universal joint.

Withdraw the joint from the bolts and allow the hub carrier to move outwards—support the carrier in this position.

Note the number of camber shims between the universal joint flange and the brake disc.

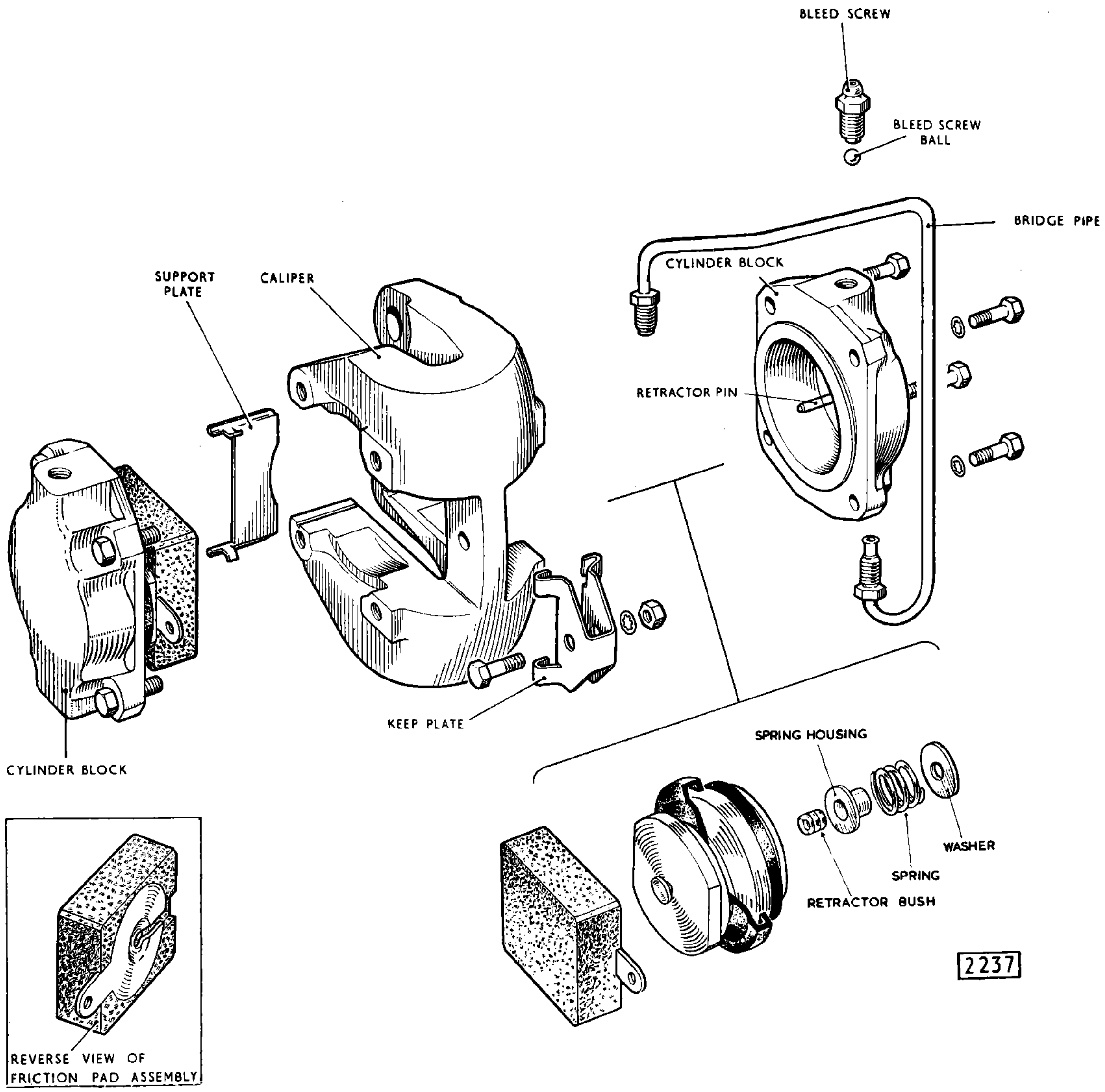


Fig. 19. Exploded view of a front brake caliper assembly

Knock back the locking tabs and remove the pivot bolts securing the handbrake pad carriers to the caliper and the retractor plate. Withdraw the handbrake pad carriers from the aperture at the rear of the cross member.

Remove the keep plate on the caliper and using a hooked implement withdraw both brake pads.

Rotate the disc until the holes in the disc line up with the caliper mounting bolts.

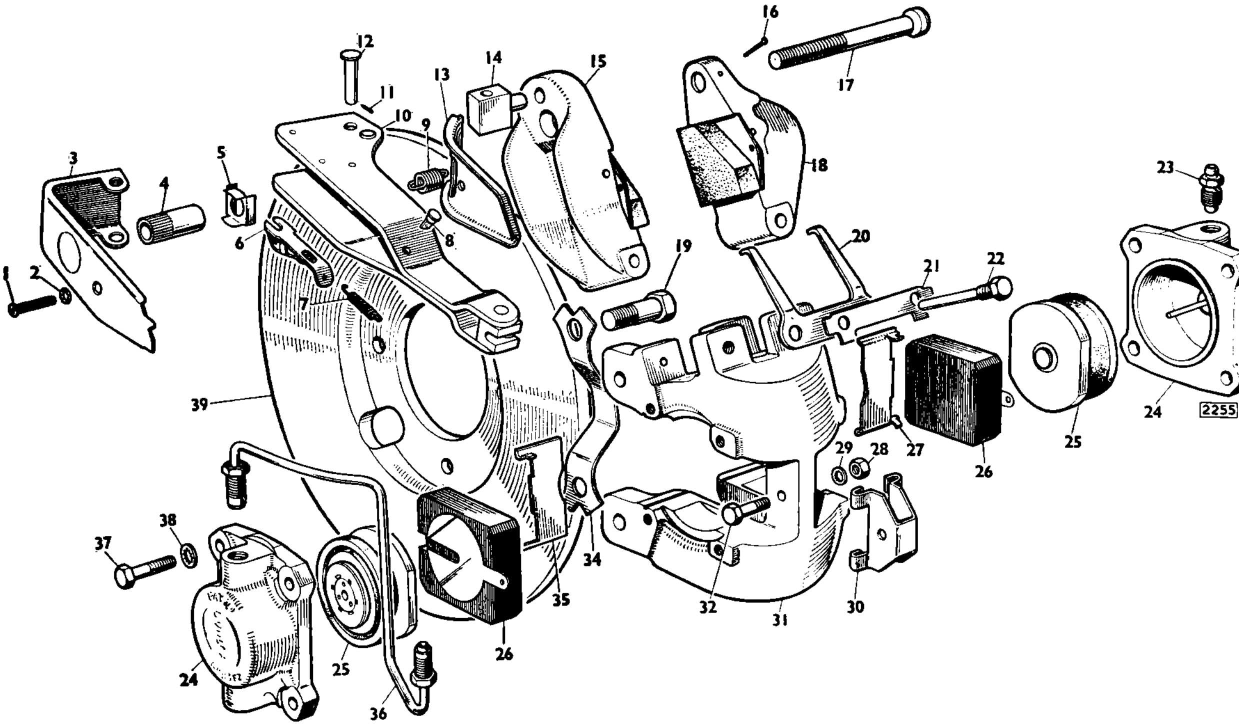
Knock back the locking tabs and remove the mounting bolts.

Note the number of small circular shims fitted to the caliper mounting bolts between the caliper and the axle casing (Fig. 21).

The caliper can now be removed from the aperture at the front of the cross member.

Refitting

Refitting is the reverse of the removal procedure. The correct number of camber shims should be fitted.



1. Setscrew
2. Shakeproof washer
3. Protection plate
4. Ratchet nut
5. Friction spring
6. Pawl
7. Spring
8. Anchor pin
9. Spring
10. Operating lever assembly
11. Split pin
12. Clevis pin
13. Inner protection cover
14. Pivot seat
15. Pad carrier
16. Split pin
17. Bolt (adjuster)
18. Pad carrier
19. Caliper retaining bolt
20. Retraction plate
21. Tab washer
22. Bolt
23. Bleed nipple
24. Cylinder assembly
25. Piston
26. Friction pad
27. Support plate
28. Nut
29. Shakeproof washer
30. Retaining plate
31. Caliper
32. Retaining plate bolt
34. Tab washer
35. Support plate
36. Bridge plate
37. Bolt
38. Shakeproof washer
39. Brake disc

Fig. 20. Exploded view of a rear brake caliper assembly and handbrake mechanism

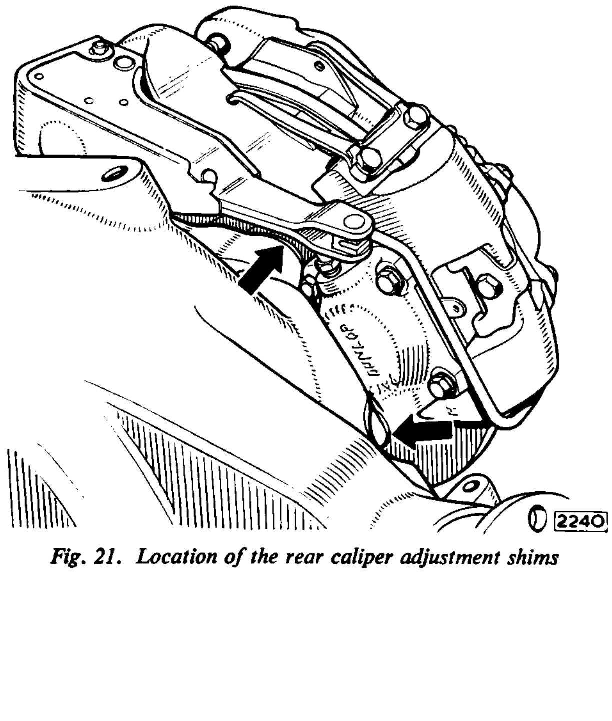


Fig. 21. Location of the rear caliper adjustment shims

When the halfshaft has been refitted check the caliper for centralisation as described in refitting the front calipers. Fit the fluid supply pipe and the bridge pipe if necessary. Bleed the braking system (as described on page 8).

THE FRONT BRAKE DISCS

Removal

Jack up the car and remove the road wheel. Disconnect the flexible hydraulic pipe from the frame connection and plug the connector to prevent ingress of dirt and loss of fluid.

Discard the locking wire and remove the two caliper mounting bolts noting the number of round shims fitted between the caliper and mounting plate. Remove the caliper.

Remove the hub (as described in Section J "Front Suspension").

Remove the five setscrews and spring washers securing the disc to the hub and remove the disc.

Refitting

Refitting is the reverse of the removal procedure. The hub bearing endfloat should be set (as described in Section J "Front Suspension") and the caliper fitted and centralised as described previously (page L.16). Reconnect the brakes and bleed the braking system (as described on Page L.8).

THE REAR BRAKE DISCS

Removal

Remove the rear suspension unit (as described in Section K "Rear Suspension").

Invert the suspension and remove the two hydraulic damper and road spring units (as described in Section K "Rear Suspension").

Remove the four steel type self-locking nuts securing the halfshaft inner universal joint and brake disc to the axle output shaft flange.

Withdraw the halfshaft from the bolts, noting the number of camber shims between the universal joint and the brake disc.

Remove the handbrake operating lever return spring at each caliper.

Knock back the tabs and unscrew the two pivot bolts securing the hand brake pad carriers to the caliper. Remove the pivot bolts and the retractor plate (Fig. 20).

Withdraw the handbrake pad carriers from the aperture at the rear of the cross members.

Knock back the tabs at the caliper mounting bolts.

Remove the keeper plate on the caliper and using a hooked implement, withdraw both brake pads.

Disconnect the brake fluid feed pipe at the caliper.

Unscrew the mounting bolts through the access holes in the brake disc.

Withdraw the bolts, noting the number and position of the round caliper centralizing shims.

Withdraw the caliper through the aperture at the front of the cross member.

Tap the halfshaft universal joint and brake disc securing bolts back as far as possible.

Lift the lower wishbone, hub carrier and halfshaft assembly upwards until the brake disc can be withdrawn from the mounting bolts.

Refitting

Refitting the brake discs is the reverse of the removal procedure. The securing bolts must be knocked back against the drive shaft flange when the new disc has been fitted.

Care must be taken to refit the caliper centralizing shims in the same position. The centralization of the caliper should be checked (as described in "Refitting the Calipers") when the halfshaft has been refitted.

Refit the rear suspension (as described in Section K "Rear Suspension").

Bleed the brakes as described on page L.8.

BRAKE DISC "RUN-OUT"

Check the brake discs for "run-out" by clamping a dial test indicator to the stub axle carrier for the front discs and the cross member for the rear discs. Clamp the indicator so that the button bears on the face of the disc. "Run-out" should not exceed ·006″ (·15 mm.) gauge reading. Manufacturing tolerances on the disc should maintain this truth and in the event of "run-out" exceeding this value, the components should be examined for damage.

Note: It is most important that the endfloat of the front hubs and the rear axle output shafts is within the stated limits otherwise the brakes may not function correctly.

The front hub endfloat adjustment is described in Section J "Front Suspension." The endfloat adjustment of the rear axle output shafts is described in Section H "Rear Axle."

RENEWING THE FRICTION PADS

Brake adjustment is automatic during the wearing life of the pads. The pads should be checked for wear every 5,000 miles (8,000 km.) by visual observation and measurement; when wear has reduced the pads to the minimum permissible thickness of ¼″ (7 mm.) the pad assemblies (complete with securing plates) must be renewed. If checking is neglected the need to renew the pads will be indicated by a loss of brake efficiency. The friction pads fitted have been selected as a result of intensive development, and it is essential at all times to use only factory approved material. To fit the new friction pad assemblies proceed as follows:

Remove the nut, washer and bolt securing the keep plate and withdraw the plate.

With a suitable hooked implement engaged in the hole in the lug of the securing plate withdraw the defective pad assemblies.

Thoroughly clean the backing plate, dust seal and the surrounding area of the caliper.

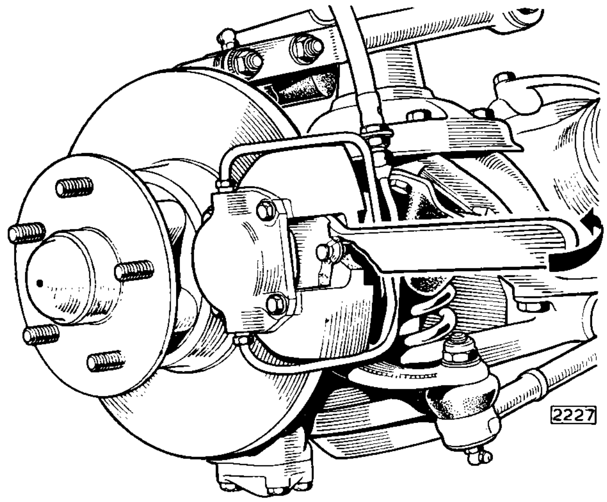


Fig. 22. Pressing the caliper piston back using special tool No. 7840

With the aid of the special tool (Part No. 7840), press in the piston assemblies to the base of the cylinder bores as shown in Fig. 22.

Note: Before doing this, it is advisable to half empty the brake supply tank, otherwise forcing back the friction pads will eject fluid from the tank with possible damage to the paintwork. When all the new friction pads have been fitted, top up the supply tank to the recommended level.

Insert the forked end of the piston resetting lever into the space between the caliper bridge and one of the piston backing plates, with the fork astride the projecting piston spigot and its convex face bearing on the piston backing plate. Locate the spigot end of the lever pin in the keep plate bolt hole in the bridge. Pivot the lever about the pin to force the piston to the base of its cylinder. Insert the new friction pad assembly.

Replace the keep plate and secure it with the bolt, washer and nut.

RENEWING THE BRAKE PISTON SEALS

Remove the caliper.

Withdraw the brake pads as described under "Renewing the Friction Pads."

Disconnect and blank off the supply pipe and remove the bridge pipe.

Remove the bolts securing the cylinder blocks to the caliper and withdraw the cylinder blocks. Thoroughly clean the blocks externally before proceeding with further dismantling.

Disengage the dust seal from the groove around the cylinder block face.

Connect the cylinder block to a source of fluid supply and apply pressure to eject the piston assembly.

Using a blunt screwdriver carefully push out and remove the piston seal and the dust seal. It is impossible to strip the piston down further.

Check that the piston and cylinder bore are thoroughly clean and show no signs of damage.

When replacing the piston and dust seals, first lightly lubricate with brake fluid, then place on the piston using the fingers only. Locate the retractor pin in the retractor bush in the piston, then with even pressure press the piston assembly into the cylinder bore. During this operation ensure the piston assembly is in correct alignment in relation to the cylinder bore and that the piston seal does not become twisted or trapped as it enters. Engage the outer rim of the dust seal in the groove around the cylinder block face. Ensure that the two support plates are in position.

Reassemble the cylinder blocks to the caliper. Fit the bridge pipes, ensuring that they are correctly positioned. Connect the supply pipe and bleed the hydraulic system (as described on page L.8).

THE HANDBRAKE

OPERATION

The self-adjusting handbrakes are attached to the rear brake caliper bodies but form an independent mechanically actuated system carrying its own friction pads. The handbrakes are self-adjusting to compensate for friction pad wear and automatically provide the necessary clearance between the brake discs and the friction pads.

When the handbrake lever in the car is operated, the operating lever (A, Fig. 23) is moved away from the friction pad carrier (B) and draws the friction pads (F) together. Under normal conditions, when the lever is released the pawl (C) in the adjusting mechanism returns to its normal position, thus the normal running clearance between the brake disc and the friction pads is maintained.

In the event of there being increased clearance, the pawl will turn the ratchet nut (D) on the bolt thread drawing the adjuster bolt (E) inwards and bringing the friction pads closer to the brake disc until the normal running clearance is restored.

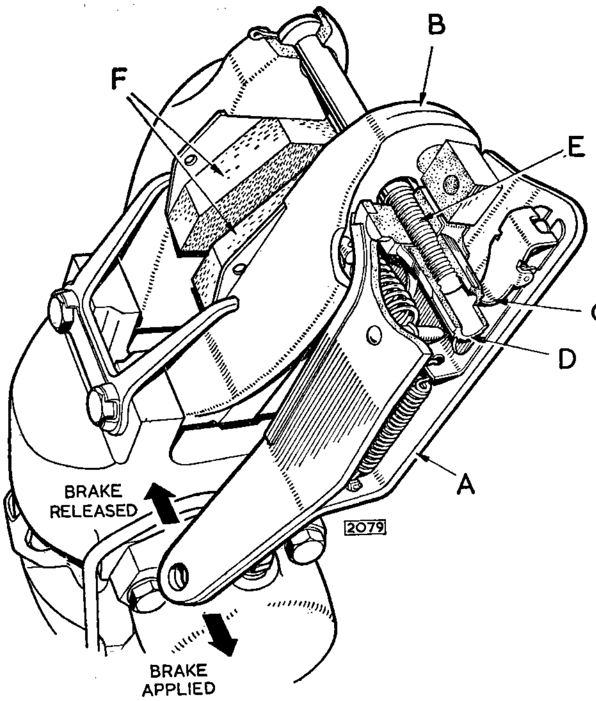


Fig. 23. Sectioned view of the handbrake mechanism

FRICTION PAD CARRIERS—REMOVAL

With the car on a ramp, disconnect the handbrake cable from the operating levers on the handbrake mechanisms as follows.

Remove the split pin, withdraw the clevis pin and disconnect the fork end on one lever and withdraw the outer cable from the trunnion on the other lever.

Lift the locking tabs and remove the pivot bolts and retraction plate. Remove the friction pad carriers by moving them rearwards around the disc and withdrawing from the rear of the rear suspension assembly. Repeat for the second handbrake.

DISMANTLING

Remove the cover securing bolt, discard the split pin and withdraw the pivot clevis pin. Remove the dust cover and remove the split pin from the screwdriver slot in the adjusting bolt. Unscrew the adjusting bolt from the ratchet nut and withdraw the nut and bolt. Detach the pawl return spring and withdraw the pawl over the locating dowel. Detach the operating lever return spring and remove the operating lever and lower cover plate.

ASSEMBLING

Assembly is the reverse of the dismantling procedure.

FRICTION PAD CARRIERS—REFITTING

Refitting is the reverse of the removal procedure but the handbrake should be set as follows:—

Ensure that the handbrake pivot bolts are slack.

Remove the split pin from the head of the adjuster bolt and slacken the bolt until there is approximately $\frac{1}{4}$" (6·35 mm.) free movement between the head and outer pad carrier.

Pull the inner and outer pad carriers away from the disc bending the brass retraction fingers until there is $\frac{1}{16}$" (1·6 mm.) clearance between each pad and the disc.

Take up the free movement at the adjuster bolt by tightening until the bolthead is in light contact with the outer pad carrier seating.

Fit a new split pin to lock the adjuster bolt.

Pull and release the handbrake lever repeatedly until the ratchet ceases to operate, which will indicate that the correct adjustment has been obtained.

With the handbrake applied reasonably hard, tighten the pivot bolts and secure with the tab washer.

Note: It is ESSENTIAL that the brass retraction fingers are in good condition, i.e. not badly distorted. The ends which fit into the pad carriers must be inserted fully into the holes to avoid the possibility of twisting the fingers.

Reconnect the handbrake compensator linkage to the operating levers and check the cable adjustment as follows:—

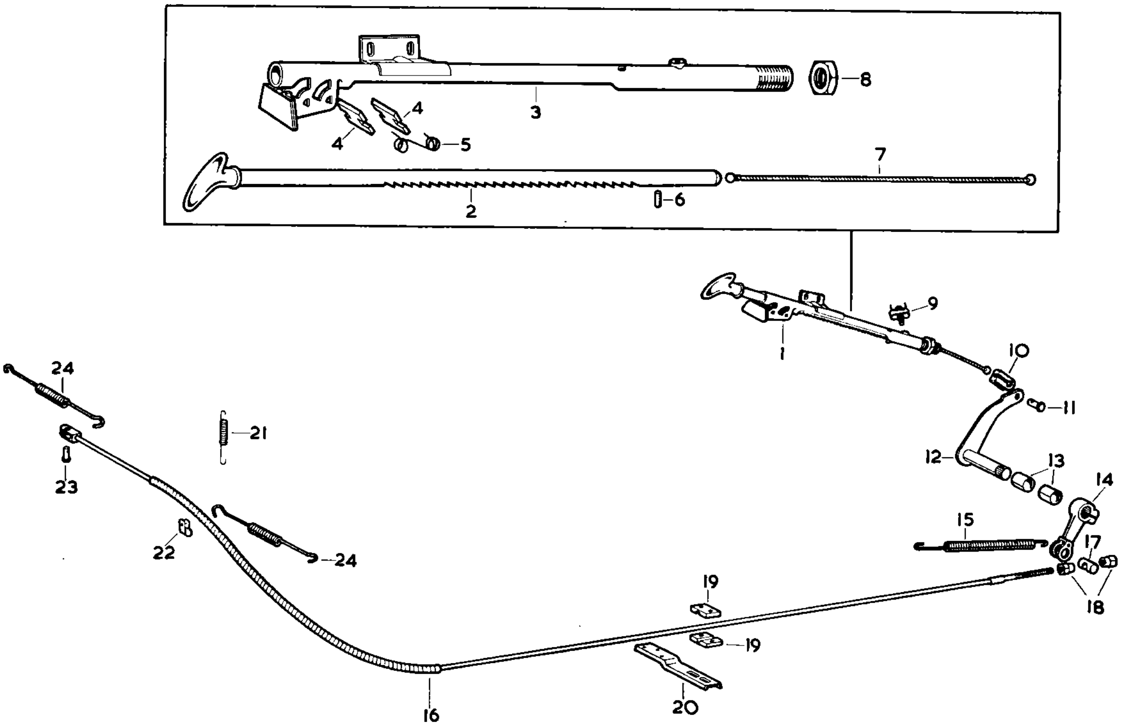
HANDBRAKE CABLE ADJUSTMENT

The handbrake cable adjustment linkage (Fig. 6) is situated to the rear of the front suspension assembly on the driver's side of the car.

Fully release the handbrake control in the car and slacken the locknut at the rear of the adjustment linkage. Ensure that levers at the calipers are in the "fully off" position by pressing toward the caliper and adjust the length of the cable to a point just short of where the caliper levers start to move; no attempt should be made to place the cable under tension otherwise the handbrake may bind.

HANDBRAKE FRICTION PADS—RENEWING

With the friction pad carriers removed, withdraw the old pads by slackening the nuts in the outer face of each carrier and utilizing a hooked tool in the hole of each pad securing plate. Fit new pads, short face upwards, ensuring that each pad locates the head of the retaining bolt. Fit new retraction fingers and



1. Handbrake assembly	7. Primary cable	13. Bushes	19. Nylon cable guides
2. Handle and rod assembly	8. Nut	14. Connecting lever	20. Bracket
3. Handbrake housing	9. Warning light switch	15. Return spring	21. Spring
4. Pawl	10. Fork end	16. Main cable	22. Clip
5. Pawl spring	11. Clevis pin	17. Trunnion	23. Clevis pin
6. Guide pin	12. Intermediate lever and shaft	18. Adjusting nuts	24. Return spring

Fig. 24. Exploded view of the handbrake mechanism

assemble the carrier to the main calipers, leaving the pivot bolts slack.

Pull and release the handbrake lever repeatedly until the ratchet ceases to operate, which will indicate that the correct adjustment has been obtained.

With the handbrake applied reasonably hard, tighten the pivot bolts and secure the tab washer.

Note: It is recommended that new retraction fingers are fitted when replacing the handbrake pads, but they should on no account be bent to suit the calipers.

Reconnect the handbrake compensator linkage to the operating levers and check the handbrake cable adjustment.

HANDBRAKE CABLE—REMOVAL

From under the car, remove the rear end of the handbrake cable from the operating levers on the handbrake mechanism as follows. Remove the split pin, withdraw the clevis pin and disconnect the fork end at one operating lever and withdraw the outer cable end from the trunnion on the other lever.

Remove the pinch bolt and withdraw the forward end of the outer cable from the trunnion adjacent to the rear suspension radius arm mounting post. Remove the two small bolts and self-locking nuts securing the top half of the nylon intermediate cable support. Disconnect the front end of the cable from the cross shaft linkage on the chassis side member, adjacent to the rear of the front road wheel by removing the front brass nut.

Withdraw the main handbrake cable.

REFITTING

Refitting is the reverse of the removal procedure and the cable should be adjusted as described previously.

HANDBRAKE CONTROL—REMOVAL

Remove the split pin and withdraw the clevis pin securing the primary cable fork end to the cross shaft lever, noting the three spacing washers. Remove the fork end from the cable by means of the slotted hole.

Pull back the carpet and felt on the side of the transmission tunnel at the upper end of the handbrake control. Remove the two setscrews securing the handbrake control to the transmission tunnel adjacent to the rear of the heater outlet.

Pull back the carpets at the lower end of the handbrake control and slacken the nut on the control. Remove the nut in the engine compartment securing the lower end of the handbrake control. Remove the two cables from the handbrake warning light switch and withdraw the handbrake control and primary cable from inside the car.

REFITTING

Refitting is the reverse of the removal procedure.

THE BRAKE FLUID LEVEL AND HANDBRAKE WARNING LIGHT

Description

The brake fluid level and handbrake warning light, situated in the side facia panel, will indicate after the ignition has been switched on whether the brake fluid in the reservoir is at a low level or the handbrake has not reached the fully off position. This is effected by three switches, one in the top of each of the fluid reservoirs and a third on the handbrake control, being in circuit with a single warning lamp which is included in the ignition circuit.

When the ignition is switched on and while the handbrake remains applied, the warning light will glow but will become extinguished when the handbrake is fully released with the brake fluid in the reservoir at a high level.

Should the warning light continue to glow after the handbrake has been fully released, it indicates that the brake fluid in the reservoir is at a very low level and the cause must be immediately determined and eliminated. Should the brake fluid be at a high level, the cause of the handbrake remaining on must be investigated.

HANDBRAKE WARNING LIGHT SWITCH—SETTING

The handbrake warning light switch is situated at the lower end of the handbrake control. When the handbrake is fully released, the plunger of the switch is depressed and the handbrake warning light is extinguished.

Should it be necessary to reset the handbrake warning light switch proceed as follows:—

Remove the handbrake control and primary cable (as described in "Handbrake Control—Removal").

Slacken off the lock-nut and unscrew the warning light switch. Ensure that the handbrake control is in the "fully off" position and screw the switch fully in. Unscrew the switch half a turn and line up with the handbrake tube, tighten the locknut and refit the handbrake control.

BELLOWS TYPE VACUUM SERVO

DESCRIPTION

The vacuum servo unit consists of an air/vacuum bellows which expands or contracts as the air pressure is varied by the introduction of vacuum or atmosphere. The unit is mounted at one end on a bracket over the pedal linkage and the valves are incorporated in a valve housing at the other end. When the pedal is depressed, the operating lever moves away from the servo unit, the air valve is closed, the vacuum valve opened and air is evacuated from the bellows by the depression in the inlet manifold. This in turn exerts a push on the power lever in proportion to the pedal pressure applied by the driver; it thus provides the power assistance to the driver in depressing the pedal and applying the brakes. It is, therefore, a "pedal-assistance" type of unit operating in conjunction with the conventional hydraulic system.

Lifting the pedal pressure closes the vacuum valve and opens the air valve so destroying the vacuum and releasing the brakes. If the pedal pressure is partially applied and then held both air and vacuum valves are closed and the vacuum remains constant until the pedal is further depressed or released completely. This is known as the poised position.

In the event of no assistance as with the loss of vacuum, the hydraulic brakes can still be applied in the normal manner.

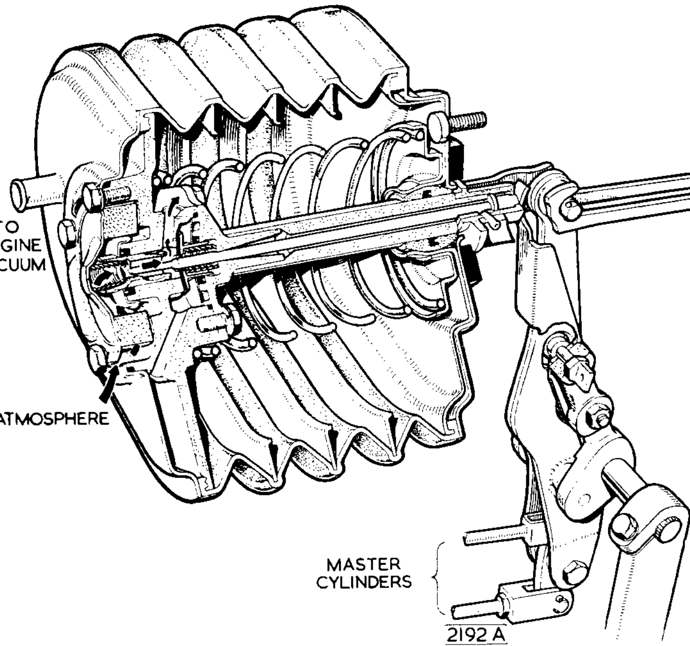


Fig. 25. Servo operation—"Brakes Off" position

OPERATION

1. **Brakes are in the "off" position.** The bellows are fully extended and filled with air admitted through the air filter and air valve which is held open by the valve operating rod. The vacuum valve is held closed by its spring, sealing the bellows from the vacuum supply. It will be noted, however, that vacuum is being applied at all times against the vacuum valve so that any opening of the valve will immediately begin to exhaust air from the bellows.

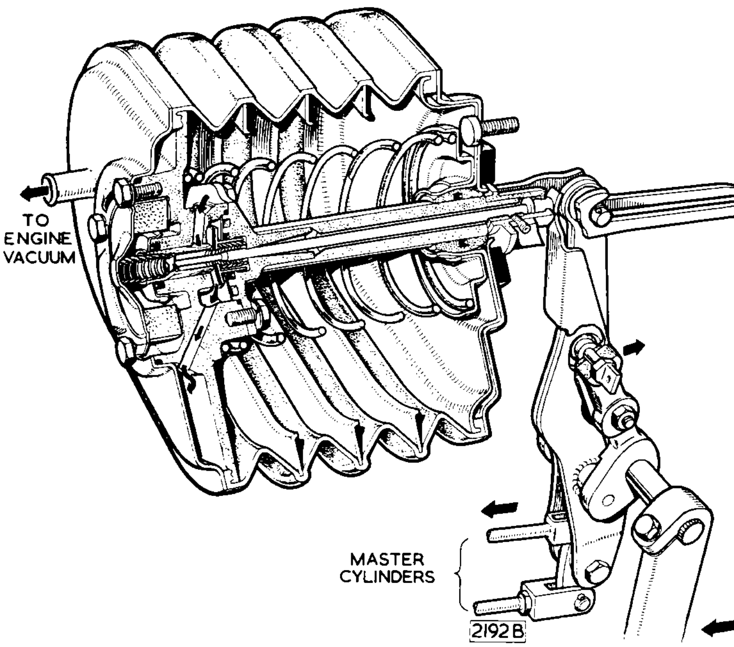


Fig. 26. Servo operation—Applying the brakes

2. **Applying the brakes.** When the brakes are applied, the operating lever moves away from the valve operating rod which allows the air valve spring to close the air valve against the vacuum valve. Continued movement permits the air valve spring to overcome the vacuum valve spring and the vacuum valve opens. Vacuum is admitted to the bellows causing them to contract. By means of the forks, contraction of the bellows is transmitted via the brake power lever to the brake master cylinders in the form of mechanical assistance. The contracting movement of the bellows moves the bottom of the valve operating rod towards the brake operating lever; thus the continuing exhaust of air from the bellows will only occur with greater pressure of the brake pedal.

   When pedal pressure is held, both valves immediately close and the servo remains poised until pressure is again increased or released.

3. **Brakes fully applied.** When the brakes are fully applied, and the servo is giving maximum assistance, any added pedal pressure results in still greater increase of pressure to the master cylinder. This is achieved through the combination of the pedal and power lever acting as one through the eccentric, fully compressing the rubber collar as shown in the diagram. The full assistance of the servo unit is maintained during this increase.

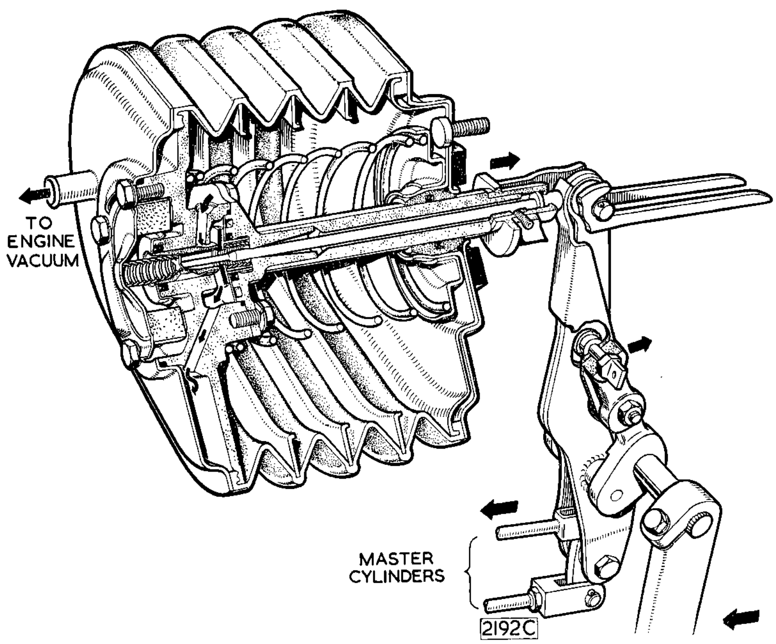


Fig. 27. Servo operation—Brakes fully applied

4. **Releasing the brake.** When the brakes are released, the operating lever moves the valve operating rod and thus the air valve against the action of the air valve spring. This opens the air valve and closes the vacuum valve, air again enters the bellows causing them to expand. At any point during the release the driver may hold the brakes and the unit will immediately become poised. On complete release the servo regains the position shown in Fig. 25.

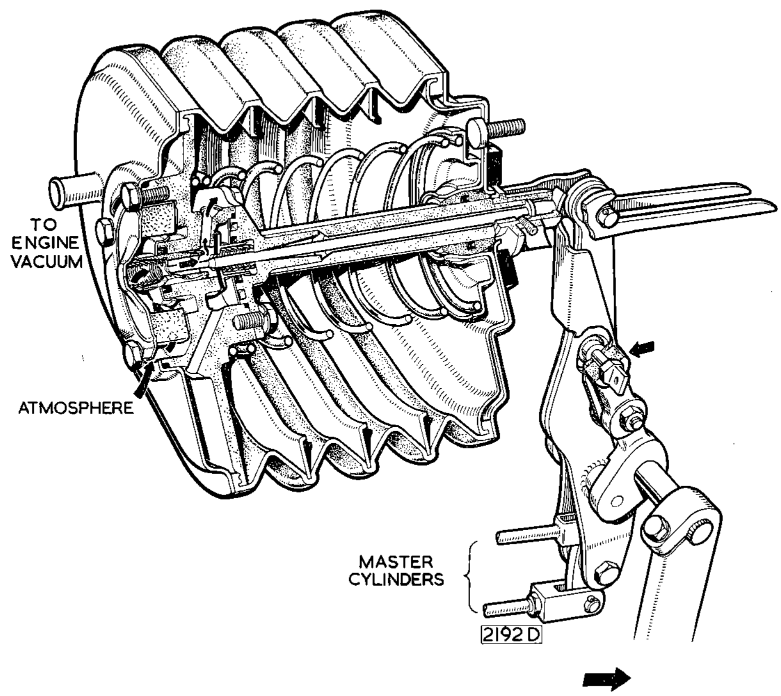
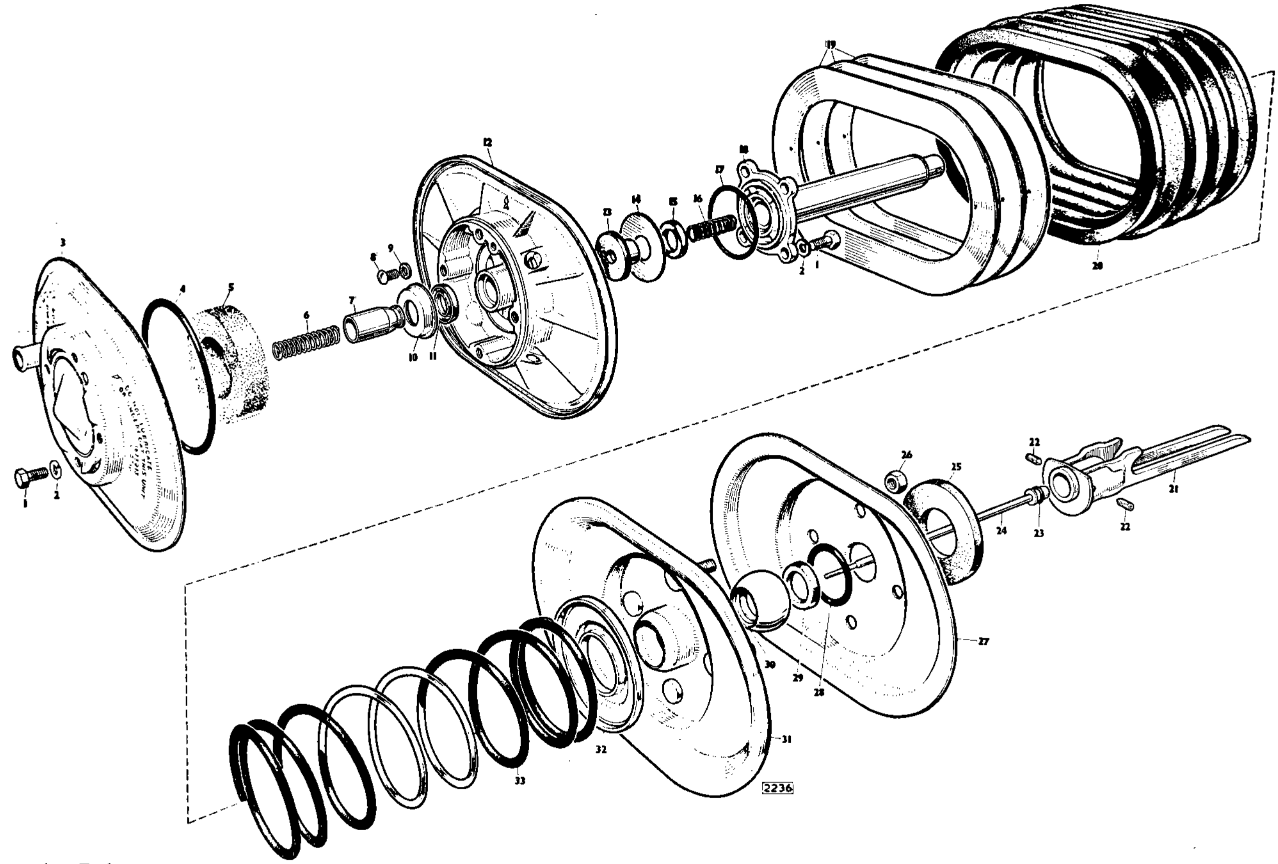


Fig. 28. Servo operation—Releasing the brakes



1. Bolt
2. Spring washer
3. Valve housing cover
4. Valve housing to cover plate "O" ring
5. Air cleaner
6. Air valve spring
7. Air valve
8. Setscrew
9. Washer
10. Seal retainer
11. Air valve seal
12. Valve housing
13. Vacuum valve
14. Vacuum valve retainer
15. Vacuum valve seal
16. Vacuum valve spring
17. Guide sleeve to valve housing "O" ring
18. Guide sleeve
19. Bellows support
20. Bellows
21. Forks
22. Setscrew
23. Valve rod "O" ring
24. Valve operating rod
25. Rubber washer
26. Nut
27. Outer mounting plate
28. Guide sleeve bearing to outer mounting plate "O" ring
29. Sleeve seal
30. Guide sleeve bearing
31. Inner mounting plate
32. Spring retainer
33. Return spring

Fig. 29. Exploded view of the vacuum servo

DISMANTLING

Having removed the servo unit from the pedal box assembly (as described under "Pedal Box Assembly—Removal" page L.9), proceed as follows:—

Stand the unit on the bench with the forks uppermost. Compress the bellows by hand and using a $\frac{3}{32}$" (2·38m.) hexagon wrench unscrew the two setscrews retaining the forks (22) until the forks may be removed. When removing the forks, ensure that the valve operating rod (24) is not bent or damaged.

Withdraw the valve operating rod, and remove and scrap the "O" ring (23) which will be found either on the nylon button or inside the bore of the forks. Remove the rubber washer (25). Unscrew the four nuts securing the outer mounting plate (27) and withdraw the plate. If it is necessary to prise the mounting plate from the bellows, ensure that the bellows are not damaged in any way; on reassembly there must be an air tight seal between the mounting plate and the bellows.

Compress the bellows by hand and remove and scrap the "O" ring (28) between the guide sleeve bearing (30) and the outer mounting plate. Remove the guide sleeve bearing and prise out and scrap the sleeve seal (29) from inside the bearing.

Holding the inner mounting plate (31) down, fold back the lip of the bellows. Carefully release the tension on the return spring (33) and remove the mounting plate. Withdraw the return spring and spring retainer (32).

Place the unit on its side and remove the four securing setscrews and the valve housing cover (3). If it is necessary to prise the cover from the bellows, ensure that the bellows are not damaged in any way; on reassembly there must be an air tight seal between the cover and the bellows. Do not remove the inspection screw. (8). Remove and scrap the "O" ring between the valve housing (12) and cover. Withdraw the air valve spring (6), air cleaner (5) and air valve (7).

Remove the bellows from the valve housing (12), remove the three bellows supports (19) if the bellows are to be renewed.

Remove the four setscrews securing the guide sleeve assembly (18) holding the guide sleeve down against the vacuum valve spring while the securing setscrews are removed. Remove the guide sleeve assembly, remove and scrap the vacuum valve seal (15) and the "O" ring (17) between the valve housing and guide sleeve.

Remove the vacuum valve spring (16), vacuum valve retainer (14) and vacuum valve assembly (13) from the valve housing. Invert the valve housing, and remove and scrap the air valve seal by prising the seal out from its housing with a sharp instrument.

Important: The guide sleeve bearing (30) is filled with a mineral oil lubricant and therefore should not be cleaned with a solvent.
Clean the bellows if necessary by removing the support rings and washing in a mild soap and water solution. Rinse in clean water and dry with compressed air. Ensure that all other parts are clean and dry before reassembly.
Renew the following parts whether they show wear or not.

Description	**Fig. No. 29**
Valve housing to cover plate "O" ring	Item 4
Guide sleeve bearing seal	Item 29
Guide sleeve bearing to mounting plate "O" ring	Item 28
Vacuum valve assembly	Item 13
Vacuum valve seal	Item 15
Air valve seal	Item 11
Valve operating rod "O" ring	Item 23
Guide sleeve to valve housing "O" ring	Item 17

ASSEMBLING

Fit the new air valve seal (11, Fig. 29) into its housing in the valve housing casting (12), ensuring that the lips face **outwards.**

Invert the valve housing and fit the new vacuum valve assembly (13) and vacuum valve retainer (14) ensuring that it seats correctly. Place the vacuum valve spring (16) into the centre of the vacuum valve.

Fit the new vacuum valve seal to the guide sleeve assembly, ensuring that the lips are not kinked or damaged and that the lips are facing **inwards.** Fit the new guide sleeve to valve housing "O" ring to the guide sleeve.

Position the guide sleeve assembly over the vacuum valve spring and line up the countersunk holes near the end of the guide sleeve assembly parallel with the longer centre line of the valve housing. (This is most important, if the holes are misaligned, the forks (21) will not be in the correct position when assembly is complete).

Fit the guide sleeve assembly to the valve housing and secure with four setscrews and spring washers.

If the bellows (20) have been renewed, fit the supports (19) and ensure that they are correctly lined up and positioned.

Fit the lip of the bellows over the valve housing and guide sleeve assembly, ensuring that one of the arrows on the bellows is lined up with the arrow on the valve housing. Smear the outside of the air valve (7) with a small amount of **silicone** grease and fit the valve, small end first into the housing. Check the free movement of the valve by pressing in against the vacuum valve spring.

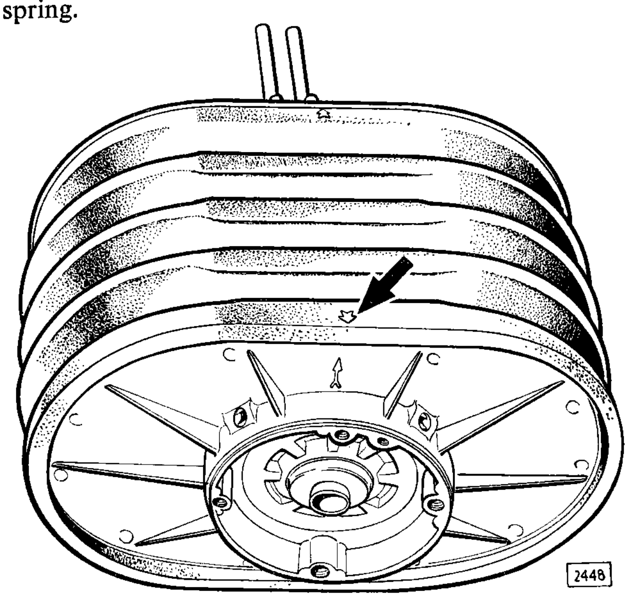


Fig. 30. Aligning the valve housing to the bellows

Fit the air cleaner (5) and place the new valve housing to cover plate "O" ring (4) on the valve housing hub. Fit the air valve spring (6) into the air valve and fit the cover plate, ensuring that the spring seats centrally and the notch in the edge of the cover plate lines up with the arrow on the valve housing casting. Secure the plate with four setscrews and spring washers.

Invert the assembly, smear the guide sleeve with silicone grease and install the return spring (33) and retainer (32) ensuring that the spring is positioned correctly on the guide sleeve assembly.

Fit the inner mounting plate (31) over the spring retainer lining up the arrows on the plate with those on the bellows. Fit the lip of the bellows over the mounting plate ensuring that it is fitted evenly all round.

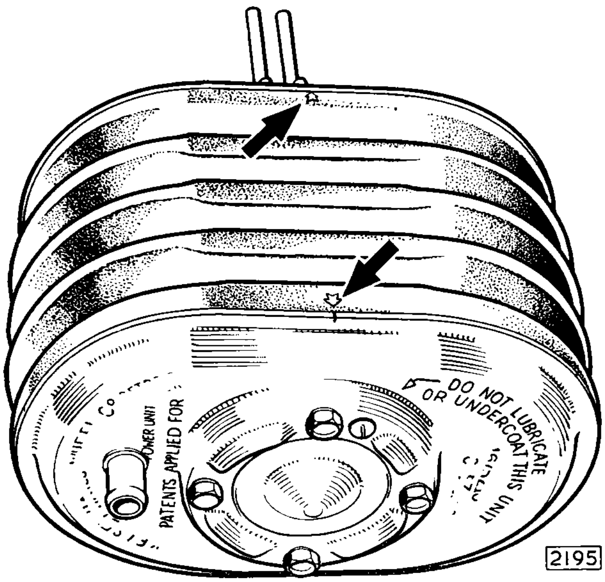


Fig. 31. Aligning the bellows with the grooves in the cover plates

Fit the new guide sleeve bearing seal (29) to the groove in the bearing (30) making sure that the seal is seating correctly. Smear the inside and outside of the bearing with silicone grease. Hold the bellows down and fit the guide sleeve bearing to the guide sleeve; the lips of the seal within the bearing must face **outwards** when the bearing is fitted. Release the bellows and allow the bearing to slide up the guide sleeve.

Fit the new guide sleeve bearing to mounting plate "O" ring (28) and fit the outer mounting plate (27) lining up the notches on the plate with the arrows on the bellows. Secure the outer mounting plate with the four nuts. Do not tighten fully.

Fit the new valve operating rod "O" ring (23) to the nylon button on the rod (24) and fit the operating rod into the hub of the forks (21) using a twisting action as the "O" ring enters the bore. Ensure that the rod is fully inserted.

Fit the rubber washer (25) on the mounting plate and fit the forks and valve operating rod assembly by carefully inserting the rod into the bore of the guide sleeve. Press the hub of the forks down onto the shoulder of the guide sleeve.

Compress the bellows by hand, line up the setscrews in the fork hub with the countersunk holes in the guide sleeve and using a $\frac{3}{32}''$ (2·38 mm.) hexagon wrench tighten the setscrews alternately.

Use a rod to align the forks with the appropriate two mounting studs and tighten down the four mounting nuts evenly.

When the unit is assembled, test the air valve by pressing down the nylon button with the flat of a screw-driver. Two definite stages of movement should be felt and the valve should snap back readily.

FAULT FINDING

Symptom: Brake action sticky or pedal fails to return

Cause (1) Improper adjustment of pedal linkage and master cylinder push-rod or brake operating lever (9, Fig. 12) is bent.

Remedy: Readjust the pedal linkage and push-rod. Reset the operating lever as described on page L.21.

Cause (2): Weak or damaged return spring.

Remedy: Replace the spring.

Cause (3): One or more of the pedal linkage pivot pins binding.

Remedy: Check the pedal linkage for free movement, relieve and lubricate as necessary.

Cause (4): Broken, damaged or weakened servo unit return spring (33, Fig. 29).

Remedy: Replace the return spring.

Symptom: Brakes do not release properly

Cause (1): Pedal is not returning to the full unapplied position.

Remedy: See remedies for the complaint "Brake action sticky or pedal fails to return" page 27.

Cause (2): Seal (29, Fig. 29) in guide sleeve bearing (30) may be binding on the guide sleeve.

Remedy: Dismantle the unit (as described on page L.25) and replace the guide sleeve seal.

Cause (3): Master cylinder push-rod incorrectly adjusted.

Remedy: Adjust the push-rod as described on page L.14.

Cause (4): Air filter (5) in the servo unit is clogged or obstructed.

Remedy: Replace the air filter.

Cause (5): Damaged or defective master cylinder or caliper cylinders.

Remedy: See the servicing procedures under the appropriate headings in this section.

Symptom: Unit does not boost

Before proceeding to service this complaint, it is necessary to discover whether the servo unit is in fact operating. This may be done as follows:

With the engine stopped, operate the brake pedal several times until all vacuum has been eliminated from the system. Apply the brakes and while holding the foot on the brakes, start the engine. If the servo unit is operating, the brake pedal will move forward slightly when the power exerted by the engine vacuum is added to the foot pressure already on the pedal. If the servo unit is not operating, no reaction at the pedal will be noticed.

If the servo unit is not operating, proceed as follows:

Cause (1): Bent, broken or obstructed vacuum hose line from the engine inlet manifold to the check valve or a faulty check valve.

Remedy: Replace hose or check valve as necessary.

Cause (2): Blocked vacuum passage in valve housing (12, Fig. 29).

Remedy: Dismantle the servo unit (as described on page L.25) and clean out the vacuum passage.

Cause (3): Air valve spring (6, Fig. 29) weak or broken.

Remedy: Remove valve housing (3) cover plate and replace the spring.

Cause (4): The vacuum valve (13, Fig. 29) is not moving freely in the bore in the guide sleeve assembly (18) because of a weak vacuum valve spring (16) or a dry vacuum valve seal (15).

Remedy: Dismantle the servo unit (as described on page L.25) and replace the spring or lubricate the seal.

Cause (5): Valve operating rod (24, Fig. 29) is bent or binding.

Remedy: Free or replace as necessary.

Cause (6): Leak in the bellows or at the joints between the valve housing and bellows or the outer mounting plate and bellows.

Remedy: Dismantle the unit (as described on page L.25) and check the bellows for leaks. When reassembling, ensure that the bellows lips at either end are securely clamped all round, this is **most important.**

If the test shows that the unit is operating but there is **no boost**—proceed as follows:

Cause (1): Incorrect adjustment of the pedal linkage or the brake operating lever (9, Fig. 12) is bent.

Remedy: Adjust the pedal linkage or reset the operating lever as described on page L.12.

Cause (2): The inspection screw (8, Fig. 29) and washer are loose or missing.

Remedy: Replace as necessary and tighten securely.

Symptom: Brakes grab

Cause (1): One or more of the pedal linkage pivot pins are binding.

Remedy: Check for free operation, relieve and lubricate as necessary.

Cause (2): The rubber seals in the servo unit are binding.

Remedy: Dismantle the servo unit (as described on page L.25) and replace all the seals listed on page L.26.

Cause (3): Grease or brake fluid on brakes pads.

Remedy: Service the brake calipers as described on page L.14.

Symptom: Spongy pedal

Cause: This symptom is not related to the servo unit or system but indicates air in the hydraulic system.

Remedy: Bleed the hydraulic system thoroughly as described on page L.8.

Symptom: Pedal travel too great

Cause (1): Air in hydraulic system.

Remedy: Bleed the system as described on page L.8.

Cause (2): Master cylinder push-rod incorrectly adjusted.

Remedy: Adjust the push-rod as described on page L.14.

Symptom: Pedal chatter

Cause (1): Brake operating lever is out of adjustment or bent.

Remedy: Adjust the lever as described on page L.12.

Cause (2): Master cylinder push-rod is out of adjustment.

Remedy: Adjust the push-rod as described on page L.14.

Cause (3): Brake operating lever rubber pivot collar (49, Fig. 12) is damaged or missing.

Remedy: Replace the collar.

Cause (4): The seal (29, Fig. 29) in the guide sleeve bearing (30) is binding badly on the guide sleeve.

Remedy: Dismantle the unit (as described on page L.25) and renew the seal.

Checking the servo unit for vacuum

The servo unit may be checked for correct vacuum reading without removing it from the car. Remove the inspection screw and washer (8, Fig. 29) and connect a vacuum gauge (Special Tool No. J.12 and adaptor J.12–2) reading 0–30 inches (0–76·2 cm.) of mercury as shown in Fig. 32. Start the engine and apply the brake pedal. Increase the engine revs. and release the pedal, as the engine revs. drop, check the gauge which should read approximately 20 inches (50·8 cm.) of mercury. If no or only partial vacuum is recorded, it will be necessary to remove the pedal box and brake linkage assembly (as described on page L.10) and set the operating lever with the setting gauge (Special Tool No. 9020) as described on page L.12.

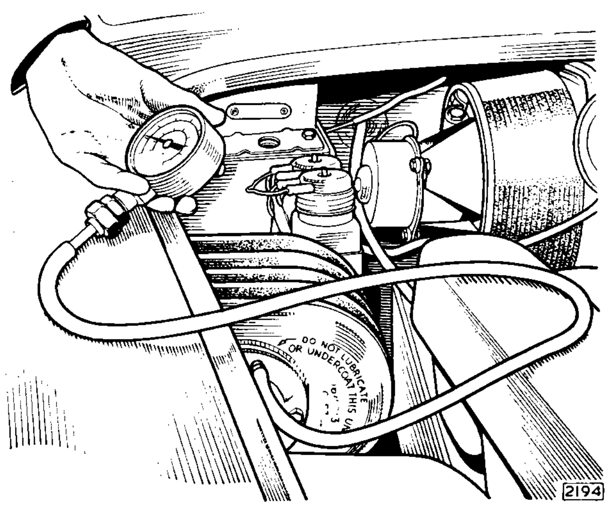


Fig. 32. Checking the vacuum on the servo unit using special tool No. J.12 and adaptor J.12-2

Check that with the engine running and the brake pedal released there is no gauge reading.

Note: Always release the brake pedal and re-apply when re-checking the vacuum gauge reading.

THE VACUUM RESERVOIR AND CHECK VALVE

The vacuum reservoir is incorporated in the vacuum system between the inlet manifold and the vacuum servo unit. It is located in the right-hand wing adjacent to the bulkhead. Its purpose is to provide a reserve of vacuum in the event of braking being required when the engine has stalled. For this purpose a vacuum check valve in the form of a tee-piece is fitted in the pipe system. Included in the inlet port of the check valve is a rubber spring loaded valve, when there is a depression in the inlet manifold the valve is drawn off its seat against the spring loading thus the interior of the reservoir becomes exhausted. When the depression in the reservoir becomes equal to that of the inlet manifold the valve spring will return the valve to its seat thus maintaining the highest possible degree of vacuum in the reservoir.

Removal

To remove the vacuum reservoir on left-hand drive cars, it will be necessary to unscrew the two butterfly nuts securing the battery clamp, remove the clamp and withdraw the battery.

Slacken the clip securing the vacuum hose to the reservoir and disconnect the hose. Remove the three nuts and bolts securing the reservoir to the wing and withdraw the reservoir.

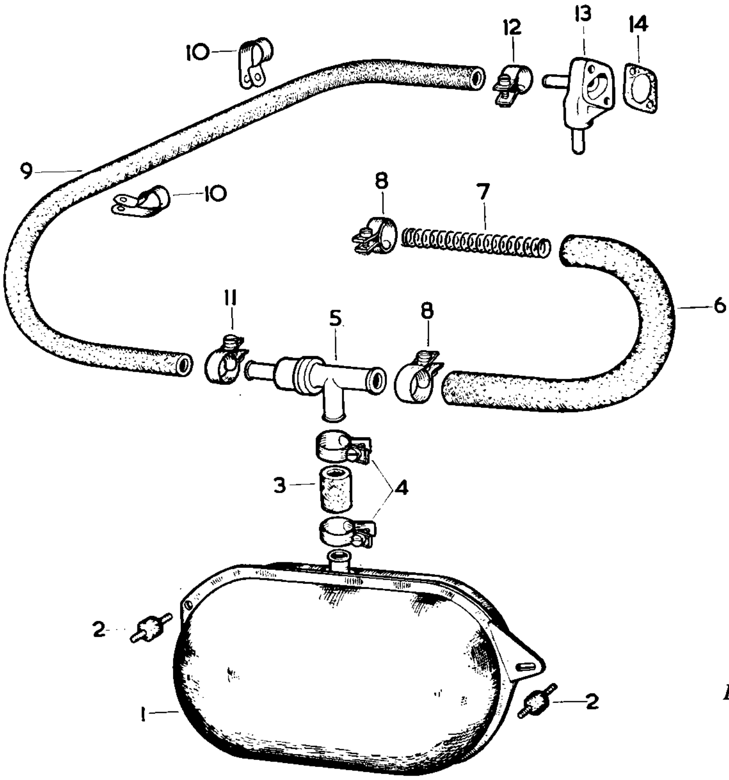
To remove the vacuum reservoir on right-hand drive cars, it will be necessary to remove the brake vacuum servo and pedal box assembly (as described on page L.9).

Refitting

Refitting is the reverse of the removal procedure.

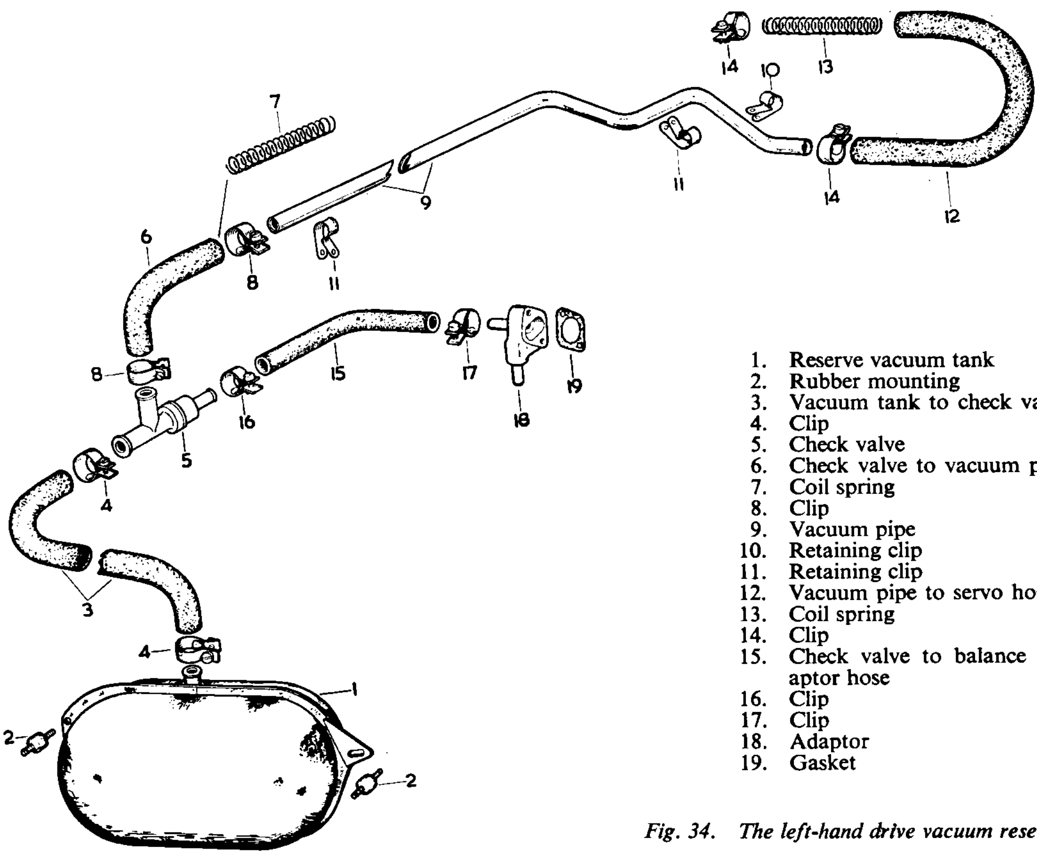
SPECIAL TOOLS

Description	Tool Number
Brake Servo Vacuum Gauge	J.12
Brake Servo Vacuum Gauge Adaptor	J.12–2
Piston Setting Tool	7840
Operating Lever Setting Gauge	9020



1. Reserve vacuum tank
2. Rubber mounting
3. Hose
4. Clip
5. Check valve
6. Check valve to servo hose
7. Coil spring
8. Clip
9. Check valve to air balance pipe hose
10. Retaining clip
11. Clip
12. Clip
13. Adaptor
14. Gasket

Fig. 33. The right-hand drive vacuum reservoir system



1. Reserve vacuum tank
2. Rubber mounting
3. Vacuum tank to check valve hose
4. Clip
5. Check valve
6. Check valve to vacuum pipe hose
7. Coil spring
8. Clip
9. Vacuum pipe
10. Retaining clip
11. Retaining clip
12. Vacuum pipe to servo hose
13. Coil spring
14. Clip
15. Check valve to balance pipe adaptor hose
16. Clip
17. Clip
18. Adaptor
19. Gasket

Fig. 34. The left-hand drive vacuum reservoir system

INTRODUCTION OF THICKER $\frac{1}{2}''$ BRAKE DISCS

	R.H. Drive	*L.H. Drive*
Commencing Chassis Nos.		
Automatic Transmission	302914	352060
Overdrive Transmission	302938	352067

Commencing at the above chassis numbers, the thickness of the rear brake discs is increased from $\frac{3}{8}''$ (9·5 mm.) to $\frac{1}{2}''$ (12·7 mm.). This necessitates new brake calipers and the caliper mounting has been modified to include an adaptor plate between the caliper and the final drive casing, the casing having been modified to suit.

INTRODUCTION OF MINTEX M 59 FRICTION PADS

	R.H. Drive	*L.H. Drive*
Commencing Chassis Nos.	302914	352051

Commencing at the above chassis numbers, Mintex M.59 brake pads are fitted in place of Mintex M.33 pads.

The M.59 pads are identified by stripes of brown and white paint on the end face. The M.33 pads being identified by red and white stripes.

M.59 pads can be used to replace M.33 pads provided they are fitted in car sets (8 off).

SECTION M

WHEELS & TYRES

3·8 MARK 10 MODEL

INDEX

WHEELS AND TYRES

DESCRIPTION

Dunlop Road Speed RS.5 Tyres and tubes are fitted to the disc wheels as standard equipment.

DATA

Road Wheels

Type	Pressed steel disc
Fixing	Five studs and nuts
Rim Section	$5\frac{1}{2}$ J
Rim diameter	14″ (345·6 mm.)

Tyres

Make	Dunlop
Type	Conventional tyre and tube (RS.5)
Size	7·50 × 14″ (190·5 × 345·6 mm.)

Inflation Pressures

	Front lbs/sq. ins.	Rear lbs/sq. ins.	
Normal motoring up to 100 m.p.h. (160 k.p.h.)	28	25	Not more than three persons in car.
		28	Full complement of passengers.
For sustained high speed or use of maximum performance	32	30	Not more than three persons in car.
		32	Full complement of passengers.

Note: Pressures should be checked when the tyres are cold, such as after standing overnight, and not when they have attained normal running temperatures.

	Front lbs/sq. ins.	Rear lbs/sq. ins.	
Normal motoring up to 100 m.p.h. (160 k.p.h.)	30 (2·1 kg./cm.^{2})	27 (1·9 kg./cm.^{2})	Not more than three persons in car.
	32 (2·25 kg./cm.^{2})	34 (2·4 kg./cm.^{2})	Full complement of passengers.
For sustained high speed or use of maximum performance	36 (2·5 kg./cm.^{2})	33 (2·3 kg./cm.^{2})	Not more than three persons in car.
	38 (2·65 kg./cm^2)	40 (2·8 kg./cm.^{2})	Full complement of passengers

Note: If S.P. tyres are used to replace RS.5 tyres, they must be fitted in car sets.

TYRES—GENERAL INFORMATION

Dunlop RS.5 tyres have been specially designed for cars with the high speed range of the Jaguar 3·8 Mark 10 class.

When replacing worn or damaged tyres and tubes it is essential that tyres with exactly the same characteristics are fitted.

Due to the high speed performance capabilities of the Jaguar 3·8 Mark 10 it is important that only repair of damaged or punctured tyres should be undertaken by a tyre repair specialist.

All tyres which are suspect in any way should be submitted to the tyre manufacturers for their examination and report. The importance of maintaining **all** tyres in perfect condition cannot be too highly stressed.

CONSTRUCTION OF THE TYRE

One of the principal functions of the tyres fitted to a car is to eliminate high frequency vibrations. They do this by virtue of the fact that the unsprung mass of each tyre—the part of the tyre in contact with the ground—is very small.

Tyres must be flexible and responsive. They must also be strong and tough to contain the air pressure, resist damage, give long mileage, transmit driving and braking forces, and at the same time provide road grip, stability and good steering properties.

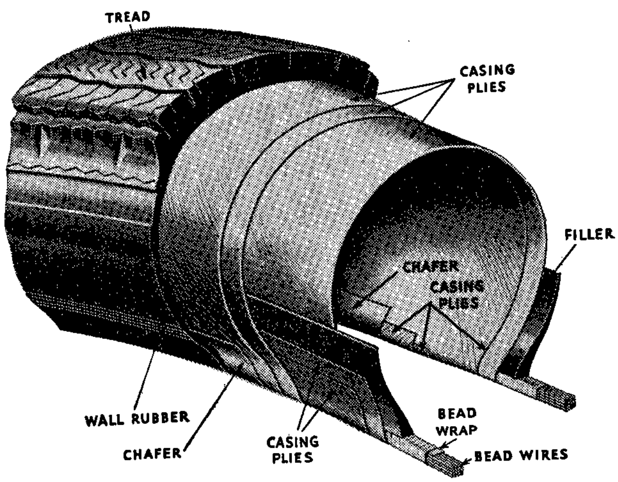


Fig. 1. Construction of the RS.5 tyre

Strength and resistance to wear are achieved by building the casing from several plies of cord fabric, secured at the rim position by wire bead cores, and adding a tough rubber tread. (Fig. 1).

Part of the work done in deflecting the tyres on a moving car is converted into heat within the tyres. Rubber and fabric are poor conductors and internal heat is not easily dissipated. Excessive temperature weakens the tyre structure and reduces the resistance of the tread to abrasion by the road surface.

Heat generation, comfort, stability, power consumption, rate of tread wear, steering properties and other factors affecting the performance of the tyres and car are associated with the degree of tyre deflection. All tyres are designed to run at predetermined deflections, depending upon their size and purpose.

Correct inflation pressures are given on page 3.

By following the recommendations the owner will obtain the best results from both the tyres and the car.

Removal and Fitting of Tyres

The wheels fitted to the 3·8 Mark 10 model have rims with a "Hump" bead seat (See Fig. 2) and need special care in fitting and removing for which the correct methods are as follows.

Removing

Free each bead from its taper seating in the usual way. Note that the bead on the hump side of the rim will have to be pushed away from the flange further than usual before it is free.

To facilitate lifting the beads over the rim flanges, lubricate the tyre beads and levers with a thin vegetable oil soap solution, or Dunlop Tyre Bead Lubricant, Code TBL/1.

Lift the beads, one at a time, over the narrower bead ledge which is on the outside of the wheel rim.

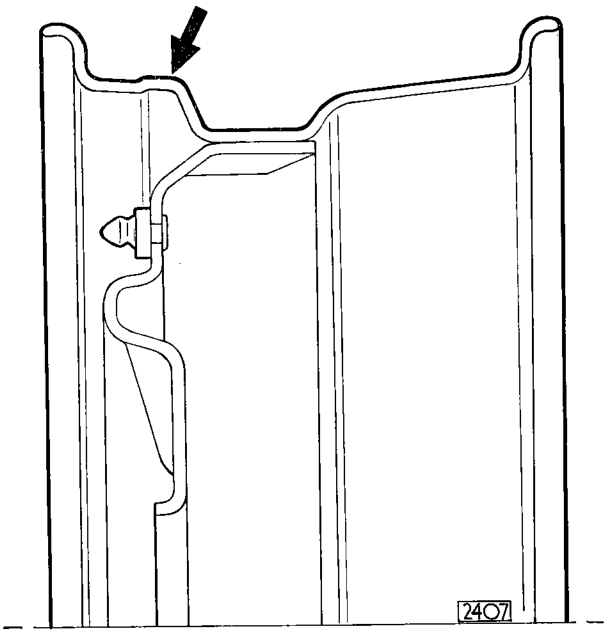


Fig. 2. Cross-section of the wheel rim showing the position of the "hump"

Fitting

If the rim is dirty or rusty, clean both rim flanges and bead seats with emery cloth or steel wool.

Lubricate tyre beads, rim flanges, rim bead ledges and levers with a suitable solution as already mentioned in Tyre Removal.

Both beads must be fitted over the narrow ledge side or outside of the wheel rim. The narrower ledge should be facing upwards if fitting is accomplished with the wheel lying flat.

Inflating

When inflating the tyre, be sure that valve core is in the valve and DO NOT EXCEED 40 POUNDS AIR PRESSURE as there is a risk of breaking the bead wires. If it is found that the beads will not seat properly, deflate, lubricate and centralise tyre before re-inflating. When the tyre bead does not seat properly at the second attempt, the wheel rim circumference is suspect and should be checked with a rim gauge, if available, or replaced with a new wheel.

After the beads have seated properly, reduce pressure to the recommended operating pressure.

Note: Lock the wheel down when using the mounting machine and do not stand over the tyre when inflating it. Check the tyre pressure frequently to be absolutely sure that the pressure never exceeds 40 pounds per sq. in. It is advisable to use an extension pressure gauge with a clip-on chuck and stand well back for maximum safety.

Fig. 3. Correct position of the inner tube to outer cover to facilitate wheel balance

Inflation Pressures

It is important to maintain the tyre pressures at the correct figures, incorrect pressures will affect the steering, riding comfort, and tyre wear.

Effect of Temperature

Air expands with heating and therefore tyre pressures increase as the tyres warm up. Pressures increase more in hot weather than in cold weather and as a result of high speed. These factors are taken into account when designing the tyre and when determining recommended inflation pressures.

Pressures in warm tyres should not be reduced to standard pressures for cold tyres. "Bleeding" the tyres increases their deflections and causes their temperatures to climb still higher. The tyres will be underinflated when they have cooled.

Always ensure that the valve caps are fitted as they prevent the ingress of dirt and form a secondary seal to the valve core.

Nylon Tyres

Nylon tyres may develop a temporary fla after standing for some time and cooling off, following a long run during which high temperatures have been reached.

These flat spots can be run out quite quickly but it may usually be necessary to approach the speeds and temperatures which have led to the flatting. For example, flats on tyres which have developed after a long fast run will be difficult to remove if the car is then used for local motoring especially if the weather has become colder and wetter.

Before balancing nylon tyres, it is essential to ensure that these flats have been completely run out, otherwise a false balance reading will be obtained.

Tyre Examination

Examine tyres periodically for flints, nails, etc., which may have become embedded in the tread. These should be removed with a blunt screwdriver or a similar instrument.

WHEEL ALIGNMENT AND ITS ASSOCIATION WITH ROAD CAMBER

It is very important that correct wheel alignment should be maintained. Misalignment causes a tyre tread to be scrubbed off laterally because the natural direction of the wheel differs from that of the car.

An upstanding sharp "fin" on the edge of each pattern rib is a sure sign of misalignment and it is possible to determine from the position of the "fins" whether the wheels are toeing in or toeing out.

"Fins" on the inside edges of the pattern ribs—nearest to the car—and particularly on the near side tyre indicate toe in. "Fins" on the outside edges, particularly on the offside tyre, indicate toe out.

With minor misalignment, the evidence is less noticeable and sharp pattern edges may be caused by road camber even when wheel alignment is correct. In such cases it is better to make sure by checking with an alignment gauge.

Road camber effects the direction of the car by imposing a side thrust and if left to follow its natural course the car will drift towards the near side. This is instinctively corrected by steering towards the road centre.

As a result the car runs crab-wise, diagrammatically illustrated in an exaggerated form in Fig. 4. The diagram shows why near side tyres are very sensitive to too much toe in and offside tyres to toe out. It also shows why sharp "fins" appear on one tyre but not

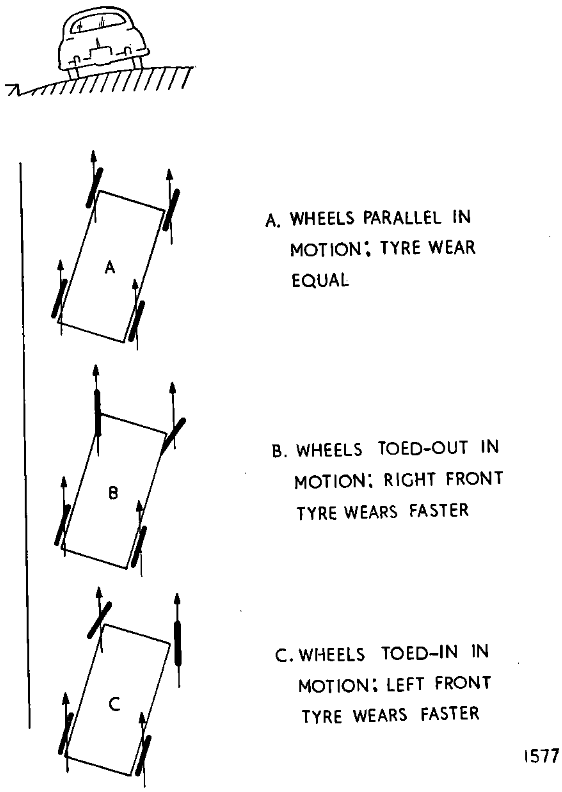


Fig. 4. Exaggerated diagram of the way in which road camber affects a car's progress

on the other and why the direction of misalignment can be determined by noting the position of the "fins." Severe misalignment produces clear evidence on both tyres.

The front wheels on a moving car should be parallel. Tyre wear can be affected noticeably by quite small variations from this condition. It will be noted from the diagram that even with parallel wheels the car is still out of line with its direction of movement, but there is less tendency for the wear to be concentrated on any one tyre.

The near side front tyre sometimes persists in wearing faster and more unevenly than the other tyres even when the mechanical condition of the car and tyre maintenance are satisfactory. The more severe the average road camber the more marked will this tendency be. This is an additional reason for the regular interchanging of tyres.

Precautions When Measuring Wheel Alignment

1. The car should have come to rest from a forward movement. This ensures as far as possible that the wheels are in their natural running positions.
2. It is preferable for alignment to be checked with the car laden.
3. With conventional base-bar tyre alignment gauges, measurements in front of and behind the wheel centres should be taken at the same points on the tyres or rim flanges. This is achieved by marking the tyres where the first reading is taken and moving the car forwards approximately half a road wheel revolution before taking the second reading at the same points. With the Dunlop Optical Gauge, two or three readings should be taken with the car moved forwards to different positions—180° road wheel turn for two readings and 120° for three readings. An average figure should then be calculated.

   Wheels and tyres vary laterally within their manufacturing tolerances, or as the result of service, and alignment figures obtained without moving the car are unreliable.

TYRE AND WHEEL BALANCE

Static Balance

In the interests of smooth riding, precise steering and the avoidance of high speed "tramp" or "wheel hop" all Dunlop tyres are balance checked to predetermined limits.

To ensure the best degree of tyre balance, the covers are marked with a white spot on one bead, and this indicates the lightest part of the cover. Tubes are marked on the base with coloured spots at the heaviest point. By fitting the tyre so that the mark on the cover bead exactly coincides with the marks on the tube, a high degree of tyre balance is achieved (Fig. 3). When using tubes which do not have the coloured spots, it is usually advantageous to fit the covers so that the white spots are at the valve position.

The original degree of balance is not necessarily maintained and it may be affected by uneven tread wear, by cover and tube repairs, by tyre removal and refitting or by wheel damage and eccentricity. The car may also become more sensitive to unbalance due to normal wear of moving parts.

If roughness or high speed steering troubles develop, and mechanical investigation fails to disclose a possible cause, wheel and tyre balance should be suspected.

A Tyre Balancing Machine is marketed by the Dunlop Company to enable Service Stations to deal with such cases.

Warning

If balancing equipment is used which dynamically balances the road wheels on the car, the following precaution should be observed.

In the case of the rear wheels, always jack **both** wheels off the ground otherwise damage may be caused to the differential.

This is doubly important in the case of the Mark 10 which is fitted with a Thornton "Powr-Lok" differential as in addition to possible damage to the differential the car may drive itself off the jack or stand.

Dynamic Balance

Static unbalance can be measured when the tyre and wheel assembly is stationary. There is another form known as dynamic unbalance which can be detected only when the assembly is revolving.

There may be no heavy spot, that is, there may be no natural tendency for the assembly to rotate about its centre due to gravity, but the weight may be unevenly distributed each side of the tyre centre line. Laterally eccentric wheels give the same effect. During rotation the off set weight distribution sets up a rotating couple which tends to steer the wheel to right and left alternately.

Dynamic unbalance of tyre and wheel assemblies can be measured on the Dunlop Tyre Balancing Machine and suitable corrections made when cars show sensitivity to this form of unbalance. Where it is clear that a damaged wheel is the primary cause of severe unbalance it is advisable for the wheel to be replaced.

TYRE REPLACEMENT AND WHEEL INTERCHANGING

When replacement of the rear tyres becomes necessary, fit new tyres to the existing rear wheels and, after balancing, fit these wheels to the front wheel positions on the car, fitting the existing front wheel and tyre assemblies (which should have useful tread life left) to the rear wheel positions on the car.

If at the time this operation is carried out the tyre of the spare wheel is in new condition, it can be fitted to one of the front wheel positions in preference to replacing one of the original rear tyres, which wheel and tyre can then become the spare.

Note: Due to the change in the steering characteristics which can be introduced by fitting to the front wheel positions wheels and tyres which have been used on the rear wheel positions, interchanging of part worn tyres from rear to front wheel positions is not recommended.

SECTION N

BODY AND EXHAUST SYSTEM

3·8 MARK 10 MODEL

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BODY

INDEX *(continued)*

INDEX *(continued)*

INDEX *(continued)*

BODY AND EXHAUST SYSTEM

BODY

SIDE FACIA PANEL

Removal

Disconnect the positive lead on the battery. Remove the two nuts and washers securing the curved side panels to the side facia panel and the glove box. Extract the two screws securing the side panels to the body at the base of the screen pillars. The screw heads are accessible after opening the door and lifting the door trim welt locally. Remove both side panels (see Fig. 1).

Remove both screen pillar cappings by withdrawing the screws from the bottom fixing brackets, now exposed, inserting a thin bladed instrument between the capping and the screen pillar, pressing in the top spring clip fastener, and gently prising away the capping.

Release the four nuts securing the screen rail to the two outer and the two inner slotted attachment brackets (Fig. 1).

Disconnect the two cables attached to the map light and remove the screen rail.

Remove the two thumb screws securing the centre panel to the body and allow the panel to rest in the horizontal position.

Release the steering wheel locknut and pull the steering wheel outwards to the full extent.

Remove the two setscrews and washers securing the top half of the flasher switch cover to the steering column and detach the cover.

Disconnect the speedometer drive cable from the rear of the speedometer.

Disconnect the flasher warning light and the automatic transmission (or overdrive) indicator panel illumination bulb cables from the snap connectors located behind the facia panel above the steering column and withdraw the cables through the clip attached to the panel.

Remove the automatic transmission speed hold switch (when fitted) from the facia panel by removing the chrome ring nut and withdrawing the switch through the panel.

Remove the three slotted setscrews and lock washers retaining the side facia to the centre instrument panel support bracket.

Remove the nut, lock washer and plain washer securing the panel outer attachment bracket to the body and detach the side facia panel (see Fig. 1).

Disconnect the panel light and clock cables at the snap connector.

Withdraw the ignition and main beam warning light bulb holders.

Disconnect the "Lucar" connectors from the revolution counter and the brake fluid warning light.

Disconnect the earth wires from the speedometer and the revolution counter.

Remove the side facia panel.

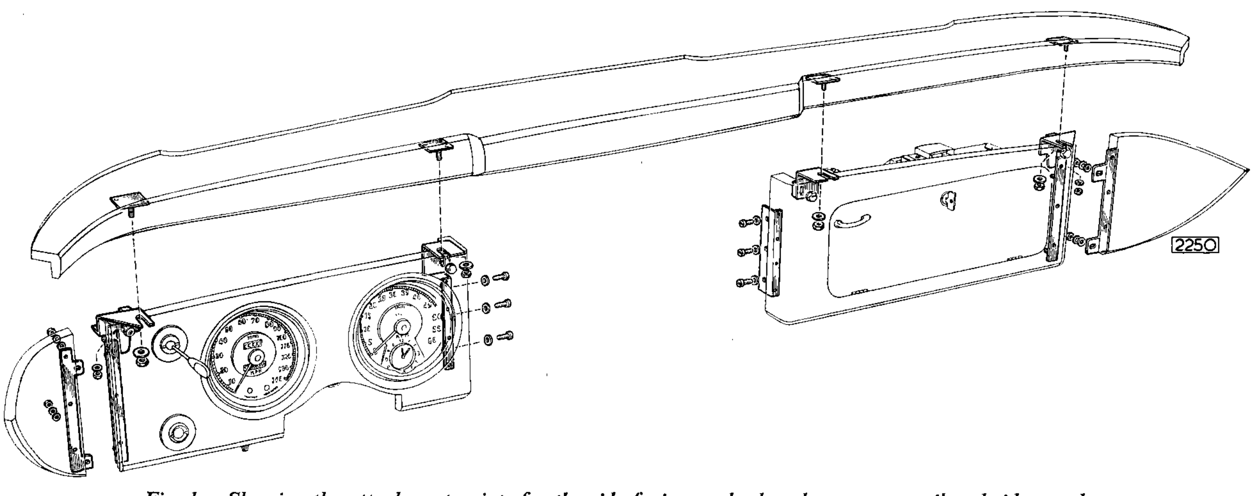


Fig. 1. Showing the attachment points for the side facia panel, glove box, screen rail and side panels

Refitting

Refitting is the reverse of the removal procedure. On cars equipped with automatic transmission, ensure that the three cables connected to the flasher warning and indicator panel illumination lights do not foul the indicator pointer when the gear control is operated.

THE GLOVE BOX

Removal

Disconnect the positive lead from the battery.

Remove the curved side panels, screen pillar cappings and screen rail as detailed under "Side Facia Panel."

Remove the two thumb screws securing the centre instrument panel to the body and allow the panel to rest in the horizontal position.

Remove the three slotted setscrews and lock washers retaining the glove box to the centre instrument panel support bracket.

Remove the nut, lock washer and plain washer securing the glove box outer attachment bracket to the body and detach the glove box (see Fig. 1).

Disconnect the "Lucar" connectors from the glove box illumination lamp and earth connections.

Withdraw the glove box.

Refitting

Refitting is the reverse of the removal procedure.

SCREEN RAIL

Removal

The screen rail cannot be removed until both curved side panels and screen pillar cappings have been detached as detailed under "Side Facia Panel."

Release the four nuts, serrated and plain washers securing the screen rail to the two inner and two outer attachment brackets (see Fig. 1).

Disconnect the two cables attached to the map light and remove the screen rail.

Refitting

Refitting is the reverse of the removal procedure.

BONNET

Removal

To open the bonnet, pull the lever situated behind the facia on the right-hand side. This will release the bonnet which will now be retained by the safety catch. Insert the fingers under the rear edge of the bonnet and lift up the safety catch.

The bonnet is automatically retained in the fully open position by the action of the hinge torsion bars.

Disconnect the two inner head lamps at the snap connector junctions and withdraw the cables through the front panel grommets.

The left-hand lamp connectors are located under the wing valance; the right-hand lamp connectors being accessible after removing the air cleaner element.

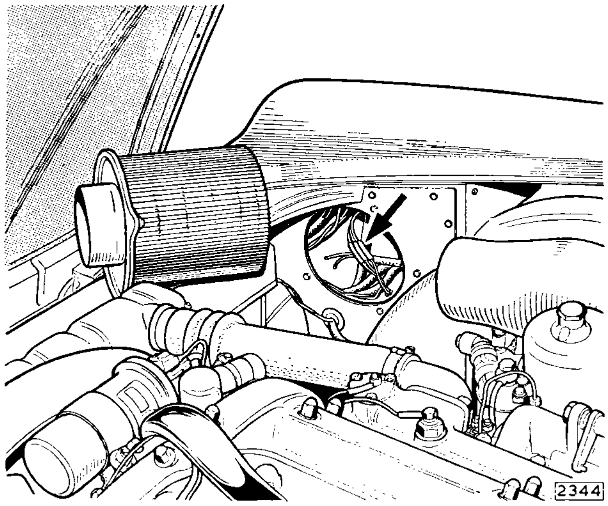


Fig. 2. The right-hand lamp connectors

Detach the flexible hose connecting the cleaner to the air intake pipe.

Turn the two quick-release screws securing the air cleaner cover plate anti-clockwise through 90° and withdraw plate with the attached element.

Mark the position of the hinge brackets on the bonnet to facilitate refitting.

Remove the self-locking nuts from the two bonnet stay pivot pins, withdraw the pins and collect the double coil spring washers located between the stays and the bonnet.

Support the bonnet in the open position after the pivot pins have been removed.

Remove the two setscrews, plain and lock washers securing the bonnet to each hinge and lift off the bonnet (see Fig. 3).

Refitting

Refitting is the reverse of the removal procedure.

Position the hinges to the marks made on the bonnet before removal.

BONNET HINGE ASSEMBLY

Removal

Remove the bonnet as detailed under "Bonnet."

Withdraw the four setscrews, plain and lock washers securing each hinge to the body and remove the

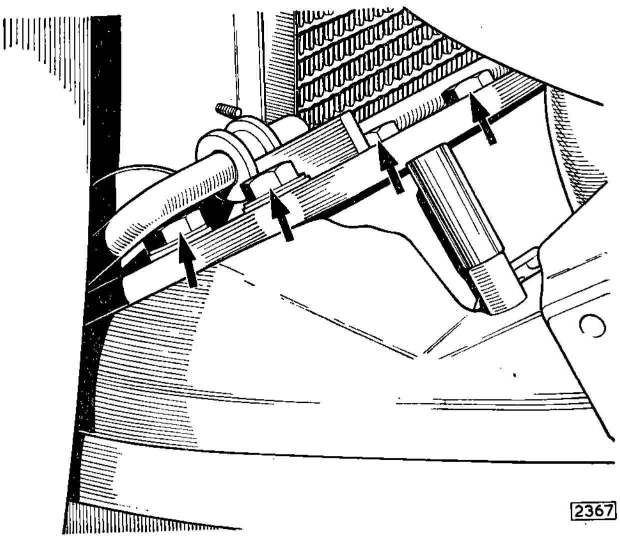


Fig. 3. The bonnet hinge and securing points

assembly. Mark the position of the hinge brackets on the body before removing (see Fig. 3).

Refitting

Refitting is the reverse of the removal procedure.

If new hinges have been fitted it will be necessary to re-align the bonnet to the body. Elongated holes are provided in the hinge mountings to facilitate adjustment (see Fig. 3).

BONNET LOCK

Two bonnet locks are provided, the left-hand lock being operated by a link cable connected to the right-hand lock, while the right-hand lock is connected directly by means of a rod to the bonnet release lever.

Removal of the Right-Hand Lock

Remove the self-locking nut securing the operating rod to the release lever. Pull the lever outwards clear of the rod and withdraw the rubber bush from the rod.

Disconnect the operating cable from the left-hand lock and release the outer flex from the securing clips.

Remove the two setscrews securing the right-hand lock to the lock bracket (see Fig. 4).

Lower and remove the lock, withdrawing the operating rod through the grommet in the bulkhead.

Refitting the Right-Hand Lock

Refitting is the reverse of the removal procedure. Lightly grease the lock mechanism before refitting.

Adjust the right-hand lock operating rod nut to ensure that full locking movement of the catch plate is obtained.

Adjust the left-hand lock operating cable to ensure that the full movement of both locks is equal.

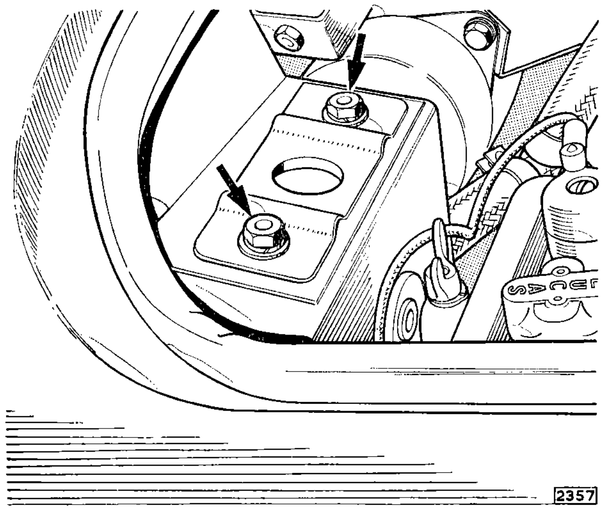


Fig. 4. The right-hand bonnet lock

Removal of the Left-Hand Lock

Disconnect the operating cable by releasing the inner cable locking setscrew and withdrawing the inner cable and outer flex (see Fig. 5).

Remove the two setscrews securing the lock to the lock racket and withdraw the lock.

Refitting the Left-Hand Lock

Refitting is the reverse of the removal procedure. Lightly grease the lock mechanism before fitting.

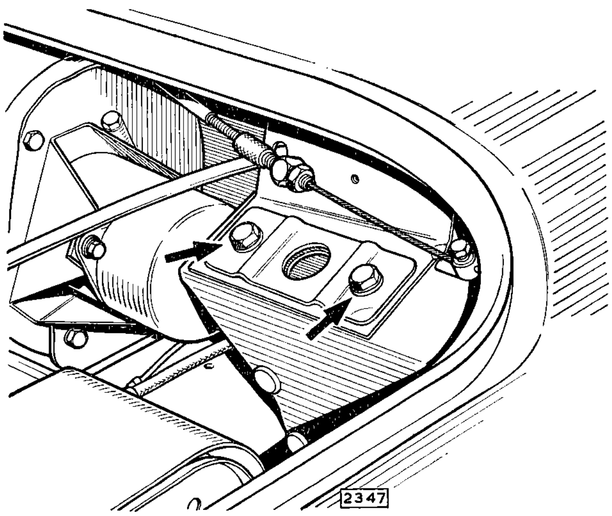


Fig. 5. The left-hand bonnet lock

Adjust the lock operating cable to ensure that the full movement of the lock is obtained and movement is equal to the right-hand lock.

Removing the Bonnet Release Lever

Remove the self-locking nut from the operating rod. Applying a slight pressure press the pivot pin through the spring steel locking nut and withdraw from the bracket.

Remove the lever and collect the two brass shim washers.

Refitting the Bonnet Release Lever

Refitting is the reverse of the removal procedure. Lightly coat the pin with grease before refitting, and press home the spring steel nut.

Refit the nut to the operating rod and adjust to obtain full locking movement of the bonnet locks.

Removing the Bonnet Lock Striker Pegs

To remove slacken the locknut at the top of the peg. Insert a screwdriver into the slot in the peg and unscrew complete with locknut, two washers and spring. Refitting is the reverse of the removal procedure.

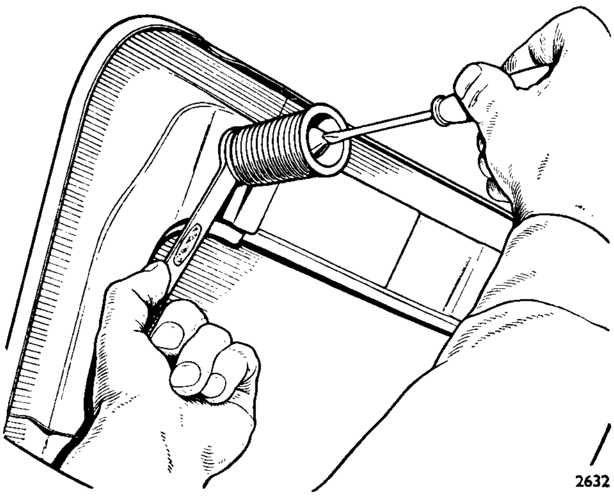


Fig. 6. The bonnet lock striker peg adjustment

Adjustment of the Striker Pegs

Slacken the locknut and rotate one of the pegs with a screwdriver, until there is approximately $\frac{1}{16}''$ (1·5mm.) movement between the catch plate and the peg.

This is to ensure that the catch plate will fully engage with the peg.

Tighten the locknut and repeat the operation to the opposite peg (see Fig. 6).

CHROME STRIP ON BONNET

Removal

Remove the eight nuts, plain and lock washers accessible when the bonnet is raised.

Refitting

Refitting is the reverse of the removal procedure. Adjust the strip to line up with the mascot before finally tightening the nuts.

MASCOT

Removal

Raise the bonnet and remove the two nuts, plain and lock washers securing the mascot to the bonnet. Note the cup washer fitted to the front stud fixing.

Refitting

Refitting is the reverse of the removal procedure. Adjust the mascot to line up with the centre strip and radiator grille surround before finally tightening the nuts.

RADIATOR GRILLE AND SURROUND

Removal

Open the bonnet.

Remove the setscrew, cup washer and lock washer securing the radiator grille top extension to the bonnet. The setscrew is accessible through a hol in the underside of the bonnet.

Remove the two nuts, plain and lock washers from the surround top fixing, two setscrews, plain and lock washers from the side fixing and three nuts, plain and

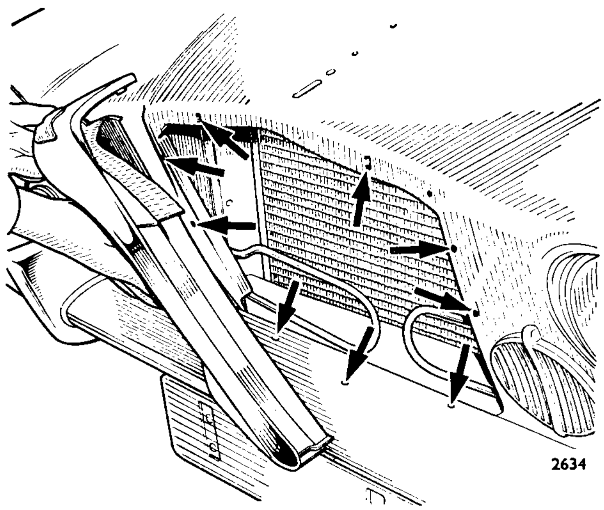


Fig. 7. Radiator grille removal

lock washers securing the surround at the bottom of the bonnet closing plate.

Remove the surround.

To detach the radiator grille, remove the four setscrews at the top and four setscrews, domed nuts and washers at the bottom mountings and detach the grille.

Refitting

Refitting is the reverse of the removal procedure. Adjust the radiator grille top extension to line up with the mascot and bonnet strip before finally tightening the setscrews and nuts.

LUGGAGE COMPARTMENT LID AND HINGES

Removal

Raise the luggage compartment lid. Remove the twenty-nine screws retaining the trim board casings and detach the casings. Disconnect the electrical connections to the reverse lamp and detach the earth wire.

Remove the clip and plastic strap from the left-hand hinge and withdraw the cable harness and grommet from the panel.

Mark the positions of the hinges on the lid, remove the two setscrews securing each hinge bracket and detach the luggage compartment lid.

Mark the positions of the hinges on the body.

Remove the setscrew, nut, washer and central clip securing the right and left-hand torsion bars together. Remove the four setscrews, nuts and washers retaining each hinge to the body and detach the hinges.

Refitting

Refitting is the reverse of the removal procedure.

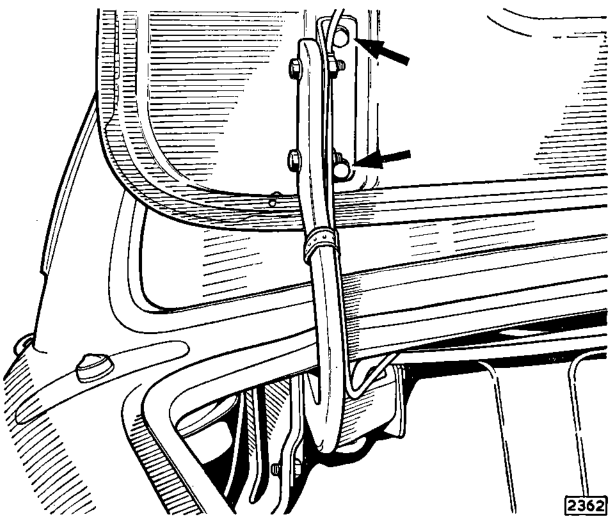


Fig. 8. The luggage compartment lid hinges

LUGGAGE COMPARTMENT LOCKS

Removal

Remove the two hairpin spring clips securing the right and left-hand outer links to the lock strikers and withdraw the links from the pivot pins.

Remove the hairpin spring clip securing the central link to the lock assembly and detach the link from the pivot pin.

Remove the four setscrews and washers securing the link carrier plate to the luggage compartment lid.

Feed the link assembly to the right and withdraw the left-hand link, feed the assembly to the left-hand and remove. (See Fig. 9).

Remove the four setscrews, plain and lock washers and withdraw the lock assembly.

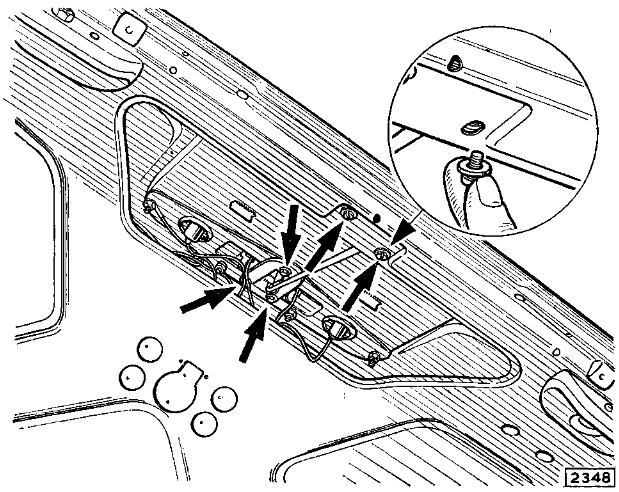


Fig. 9. The luggage compartment locks

Remove the four setscrews, plain and lock washers securing each lock striker assembly to the lid and detach the strikers.

Refitting

Refitting is the reverse of the removal procedure. Do not tighten the link carrier plate setscrews until the lock strikers have been adjusted. Lightly grease all moving parts before refitting.

Adjusting the Locks

Reconnect the links to the lock assembly and the lock strikers. Place the lock strikers in the locked position. Utilizing the slotted holes on the lid mounting, adjust the link carrier plate up or down as required until the lock strikers release when the lock button is depressed. Retaining this vertical position, move the carrier plate to the right or left as necessary to equalize the release of the two lock strikers. Tighten the retaining setscrews.

Adjust the lock striker pegs until the locks operate correctly and do not rattle. Tighten the striker peg retaining screws.

PETROL FILLER LIDS

Removal

The removal sequence is identical for both right-hand and left-hand lids.

Remove the return spring. Unscrew the two setscrews and washers securing the lid and hinge to the inner wall of the petrol filler cap compartment. Remove the two setscrews securing the lid to the hinge (see Fig. 10).

Refitting

Refitting is the reverse of the removal procedure. When refitting the lid tighten the setscrews finger tight only in the elongated holes, then align the lid to fit into the recess of the body panel. Tighten the setscrews securely.

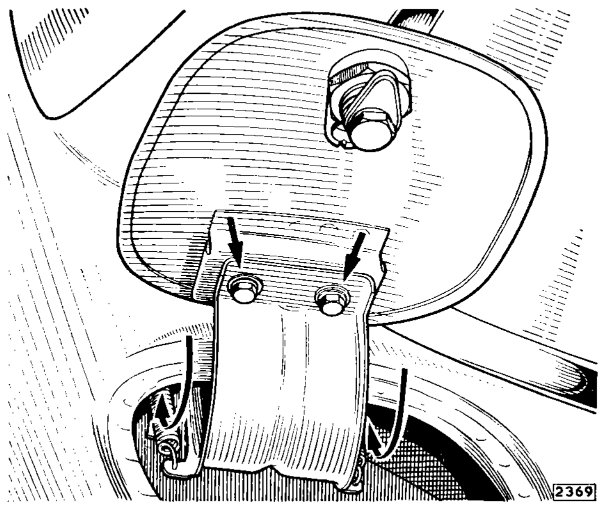


Fig. 10. Removal of the fuel filler lid

FRONT BUMPER

Removal

Remove the two bolts, nuts, plain and lock washers securing the front bumper to the side brackets and the two bolts, nuts, plain and lock washers securing the bumper to the inner brackets.

Withdraw the bumper (see Fig. 11).

Refitting

Refitting is the reverse of the removal procedure.

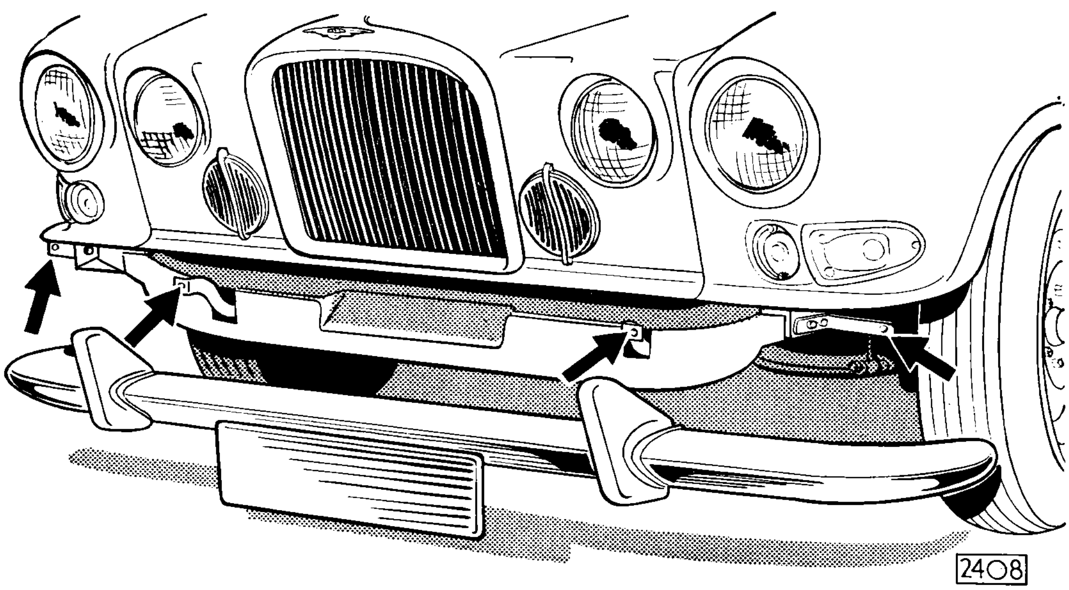


Fig. 11. Showing the mounting points for the front bumper

FRONT BUMPER OVER-RIDERS

Removal

Remove the nut, plain and lock washers and the setscrew, plain and lock washer securing each over-rider to the front bumper.

Remove the over-rider and beading.

Refitting

Refitting is the reverse of the removal procedure. Replace the beading between the over-riders and the bumper when reassembling.

REAR BUMPER

Removal

Remove the four setscrews, plain and lock washers securing the bumper to the side mounting brackets and the four setscrews, plain and lock washers securing the bumper to the inner brackets.

Withdraw the bumper (see Fig. 12).

Refitting

Refitting is the reverse of the removal procedure.

REAR BUMPER OVER-RIDERS

Removal

Remove the nut, plain and lock washer and the setscrew, plain and lock washer securing each over-rider to the rear bumper.

Remove the over-rider and beading.

Refitting

Refitting is the reverse of the removal procedure. Replace the beading between the over-riders and the bumper when reassembling.

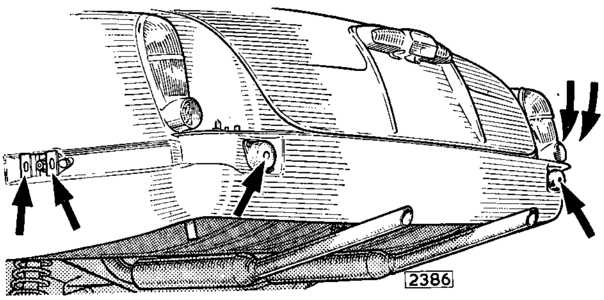


Fig. 12. Showing the mounting points for the rear bumper

WINDSCREEN

Removal

Prise off the two centre chrome clips securing the ends of the chrome finisher encircling the windscreen.

Prise off the chrome finisher from the windscreen rubber. Extract one end of the rubber insert and withdraw completely.

Run a thin bladed tool around the windscreen to break the seal between the rubber and the windscreen aperture flange.

Strike the glass with the flat of the hand from inside the car, starting at one corner and working towards the bottom.

Repeat this process around the complete windscreen and withdraw the glass.

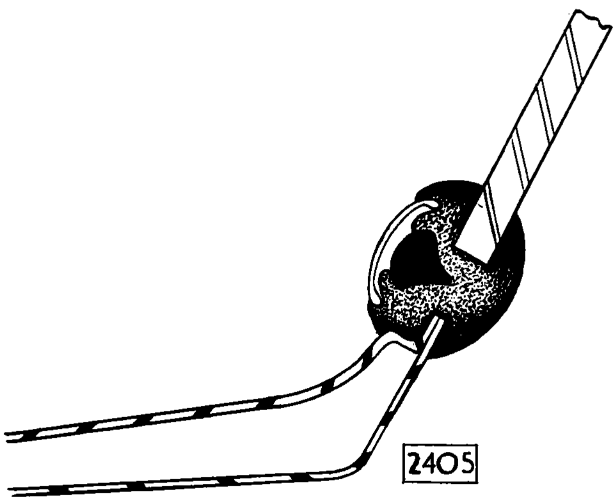


Fig. 13. Section through the windscreen glass and rubber

Refitting

Remove the old sealer from the windscreen flange. Examine the windscreen rubber for cuts. If the old windscreen was of the toughened glass type it is recommended that the rubber should be replaced. This is because small particles of glass may have become impregnated in the rubber and could break the screen again. If, however, the windscieen was not broken by a projectile the windscreen aperture flange should be examined for a bump in the metal. If this is found, the bump should be filed away otherwise the glass may break again.

The rubber should be attached to the aperture with the flat side of the rubber towards the rear. Coat the glass channel in the rubber surround with a soap solution to provide lubrication between the glass and rubber when refitting.

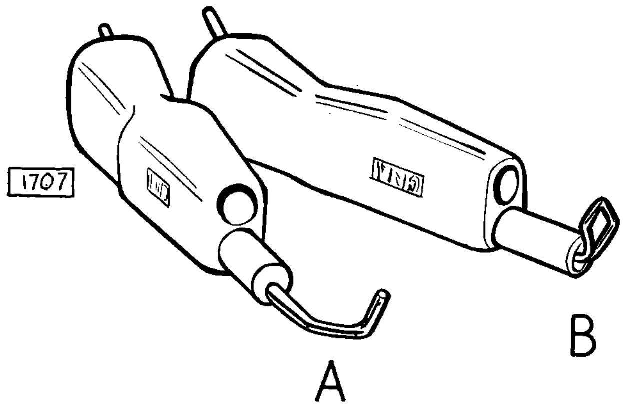


Fig. 14. The two special tools used when refitting the windscreen

Using the special tool (A, Fig. 14) insert the screen into the rubber along the bottom edge first. It is important that the glass should be fitted equally. DO NOT fit one end and then try to fit the other.

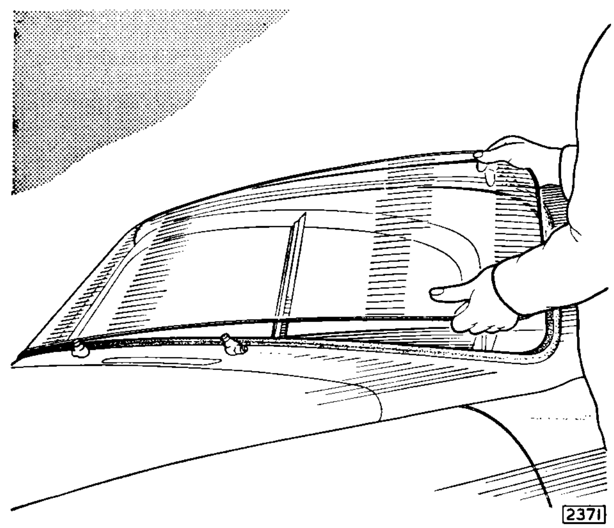


Fig. 15. Removing the windscreen

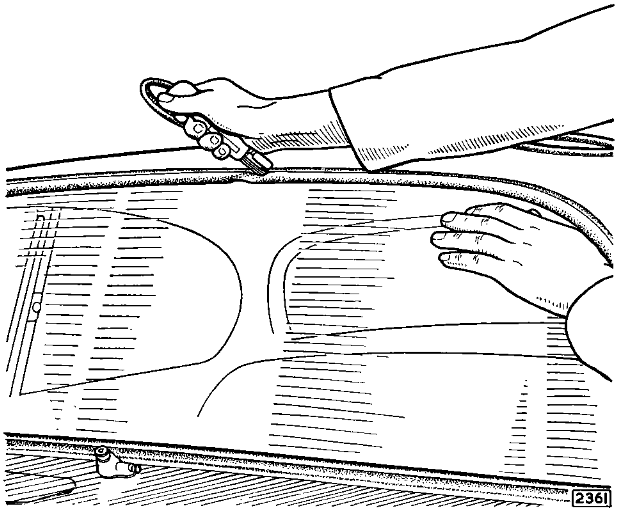


Fig. 16. Using the special tool ("B", Fig. 14) when inserting the rubber sealing strip in the windscreen rubber

Using the special tool (B, Fig. 14) insert the rubber sealing strip with the round wide edge to the outside.

Using a pressure gun filled with a sealing compound, and fitted with a copper nozzle (so that the glass will not be scratched) apply the nozzle of the gun between the metal body flange and the rubber and fill with sealing compound. Repeat the operation between the glass and the rubber. Remove any excess sealing compound with a cloth soaked in white spirit. DO NOT USE THINNERS as this will damage the paintwork.

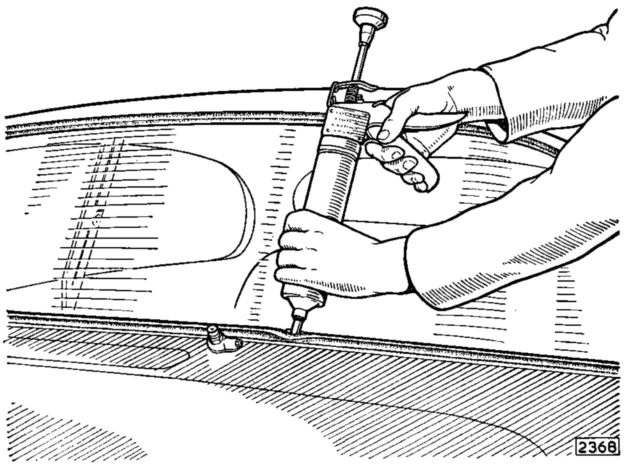


Fig. 17. Using a gun to inject sealing compound between the surround rubber and the glass

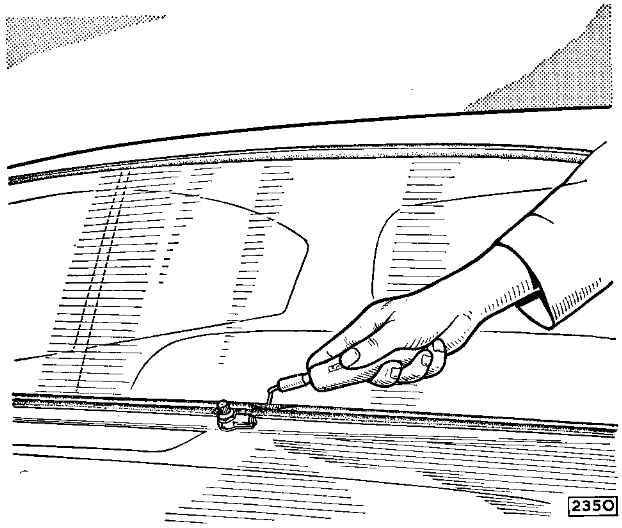


Fig. 18. Lipping the sealing rubber over the chrome strip with the special tool ("A", Fig. 14)

Fit the chrome strip on top of the rubber and bend to suit contour if necessary. Coat the inside of the chrome strip with Bostik 1251 and allow to become tacky. Place the chrome strip on the rubber and with the hook (A, Fig. 14) lip the rubber over the top of the finisher. Fit the two centre chrome clips and lip the rubber over the edges of the clips.

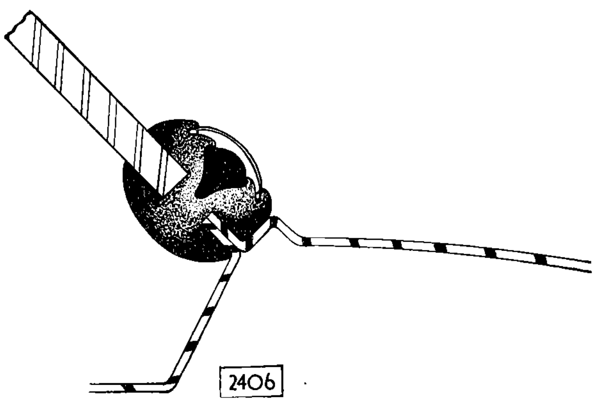


Fig. 19. Section through the rear glass and rubber

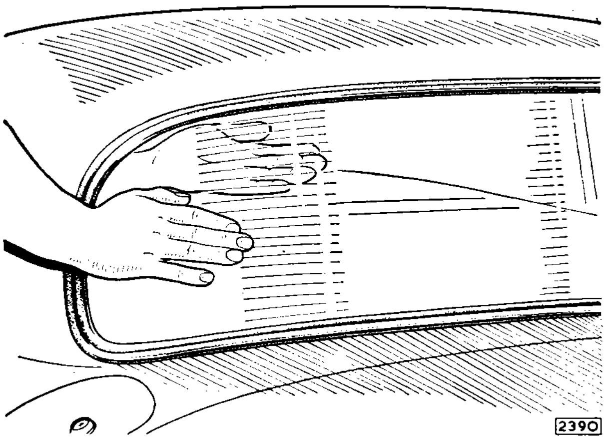


Fig. 20. Removal of the rear glass

REAR GLASS

The procedure for removing and refitting the rear glass is identical to that used for the windscreen.

If the car is fitted with a heated backlight (optional extra) disconnect the electrical cables inside the luggage compartment before removal of glass.

FRONT DOOR AND HINGES

Removal

Remove the door trim casing as detailed under "Front and Rear Door Trim Casings" page N.17.

Remove the clear plastic sheet from the front section of the door.

Insert a thin bladed screwdriver between the door frame and the small casing attached to the door upper closing panel and prise off the casing which is secured by two spring clips.

Pull the casing covering away from the door to expose the top hinge cover plate. Withdraw the five cross headed drive screws and remove the cover plate.

Remove the split pin and clevis pin from the check strap bracket.

Important: Care must be taken when the check strap has been disconnected to ensure that the door opening is restrained and the leading edge of the door is not allowed to contact the body panel. Failure to observe this may result in damage to the body panel and paintwork.

Note: On cars equipped with the electrically operated windows, it will be necessary to withdraw the motor cables as follows:

Remove the two clips securing the cables to the door inner panel.

Disconnect the three snap connectors.

Remove the three setscrews securing the cable guide tube to the door closing panel and withdraw the cables and tube from the door.

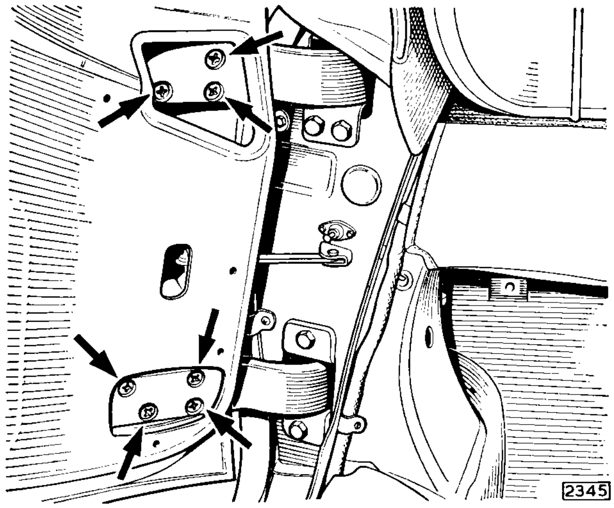


Fig. 21. Showing the front door hinge mounting points

Mark the position of the two hinges on the door.

Remove the four cross headed setscrews securing each hinge to the door and lift the door away from the hinges.

To remove the hinges from the door pillar, mark the position of the two hinges on the door pillar. Disconnect the door opening torsion spring lever by removing the split pin and withdrawing the clevis pin from the bottom hinge. Remove the three setscrews and lock washers from the top hinge and the two setscrews and lock washers from the bottom hinge. Withdraw the hinges from the pillar.

Note: The hinges cannot be removed from the pillar until the door has been removed.

Refitting

Refitting is the reverse of the removal procedure.

Refit the door casing as detailed under "Front and Rear Door Trim Casings" page N.17.

REAR DOOR AND HINGES

Removal

Remove the centre pillar capping by inserting a thin bladed screwdriver between the capping and the pillar pressing in the two spring clips fasteners and gently prising the capping away. Care must be taken not to damage the polished woodwork.

Remove the trim welts from the pillar by pulling away from the flange fixing.

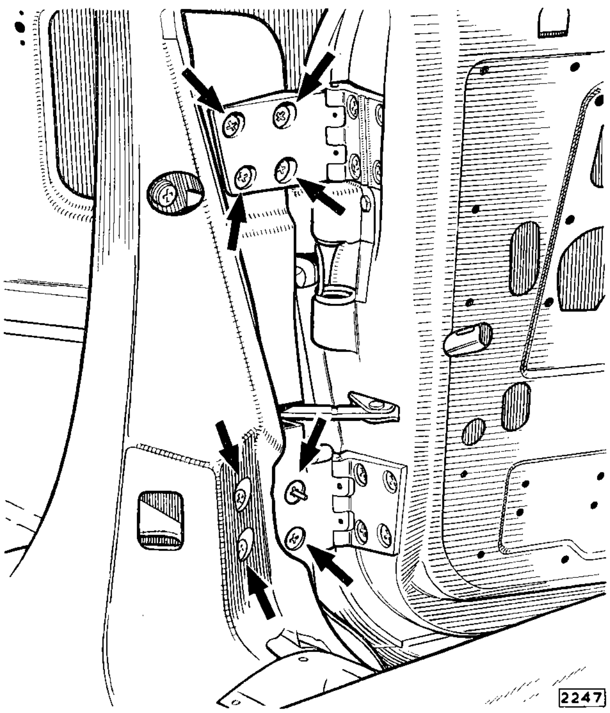


Fig. 22. Showing the rear door hinge mounting points

Lift the centre pillar lower trim casing where stuck to the pillar, locate and remove three drive screws and detach the trim casing. Locate and disconnect the door pillar switch cable at the snap connector.

Mark the position of the top hinge on the body.

Note: On cars equipped with the electrically operated windows, it will be necessary to withdraw the motor cables as follows.

Remove the door trim casing as detailed under "Front and Rear Door Trim Casings" page N.17.

Remove the two clips securing the cables to the door inner panel.

Disconnect the four snap connectors.

Detach the rubber door link by prising away the three plastic stud fixings from the door closing panel and withdraw the cables from the door.

Remove the split pin and clevis pin from the check strap bracket.

Important: Care must be taken when the check strap has been disconnected to ensure that the door opening is restrained and the panel of the door is not allowed to contact the rear edge of the front door. Failure to observe this may result in damage to the door panel and paintwork.

Remove the four cross headed setscrews securing each hinge to the body.

Note: The top outer screw on the bottom hinge functions as a door pillar switch.
To remove, press in the pin and extract as an ordinary screw.

Remove the door.

To remove the hinges from the door, mark the position of the two hinges on the door and extract the four cross headed screws from each hinge.

Refitting

Refitting is the reverse of the removal procedure.

Refit the door casing as detailed under "Front and Rear Door Casings" page N.17.

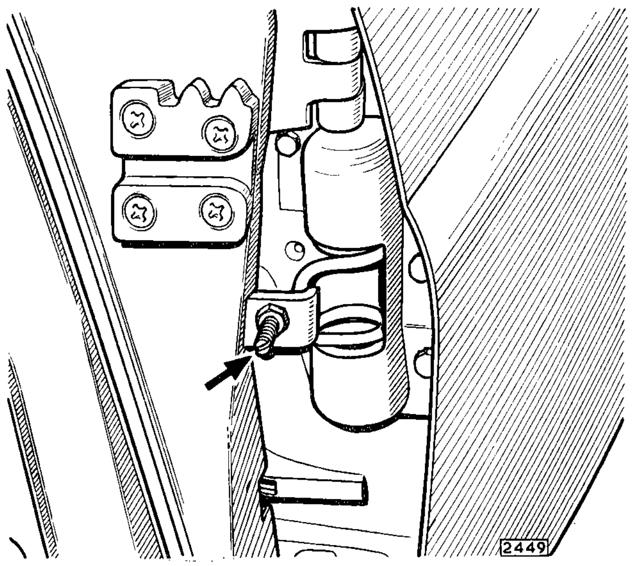


Fig. 23. Showing the location of the rear door torsion spring adjuster screw

Adjusting the Door Torsion Spring

To adjust the door opening torsion spring, open the front door to gain access to the adjuster. Release the adjuster locknut, insert a screwdriver in the slot in the screw and turn clockwise to increase and anti-clockwise to decrease the spring tension.

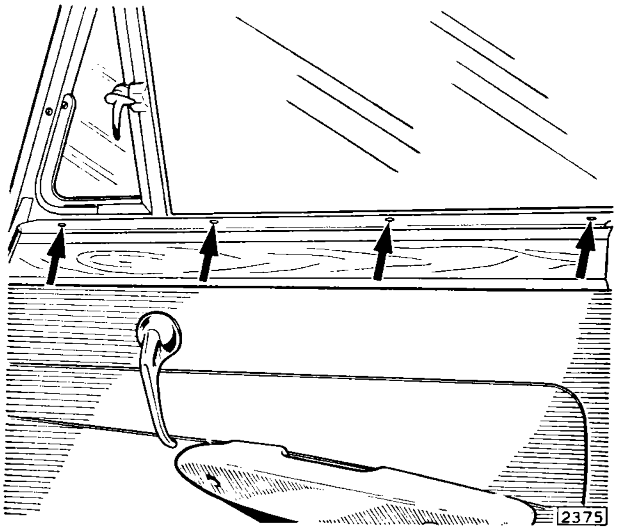


Fig. 24. Showing the screws securing the wood capping to the waist rail

FRONT AND REAR DOOR TRIM CASINGS

Removal

Remove the four chrome screws and washers securing the wood capping to the waist rail.

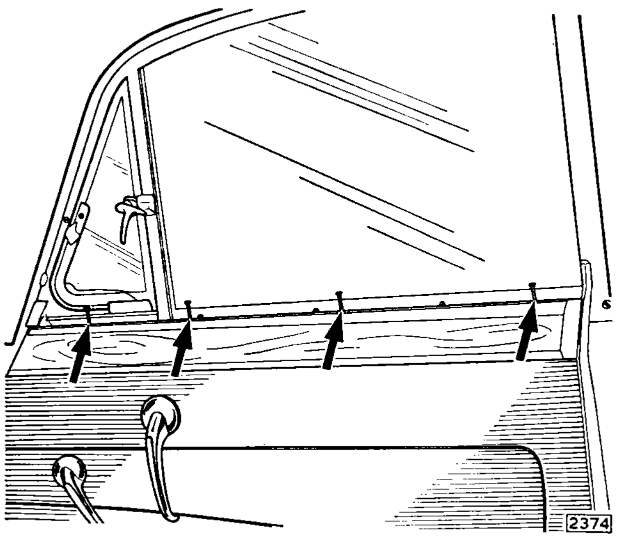


Fig. 25. Showing the screws securing the waist rail to the door frame

Remove the four screws securing the waist rail to the door frame and detach the rail.

The covering for the door casing is attached to the door frame at the bottom of the window aperture with

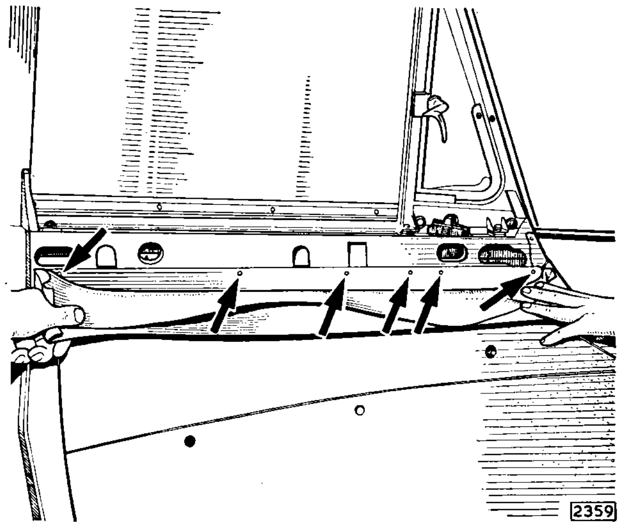


Fig. 26. Showing the screws securing the top of the door trim casing

upholstery solution. Pull the covering away from the door frame.

Remove the six drive screws now exposed securing the door casing to the door frame.

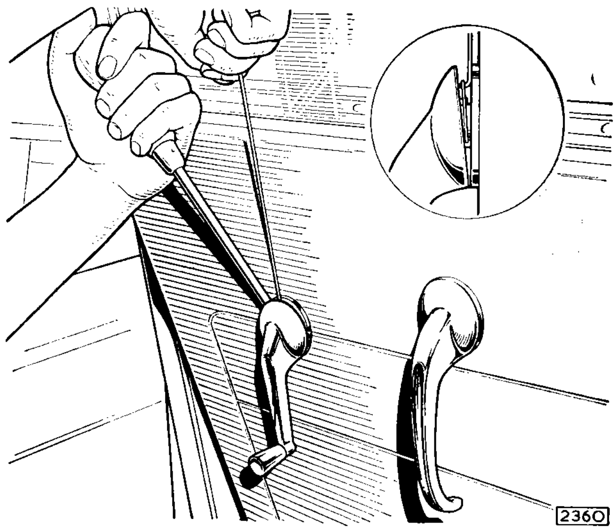


Fig. 27. Removing the window regulator handle

Remove the two setscrews securing the arm rest to the door and detach the arm rest.

Insert a thin bladed screwdriver between the interior door lock handle and inner ring and prise apart. Insert a draw wire with a small formed hook end between the handle and the ring and locate the hook in the handle retaining spring clip loop (see Fig. 27).

Withdraw the retaining spring clip.

The draw wire should be made from piano or spring steel wire with a 1" (25·4 mm.) diameter loop formed at the opposite end to the hook for holding purposes.

Withdraw the door handle from the splined lock shaft.

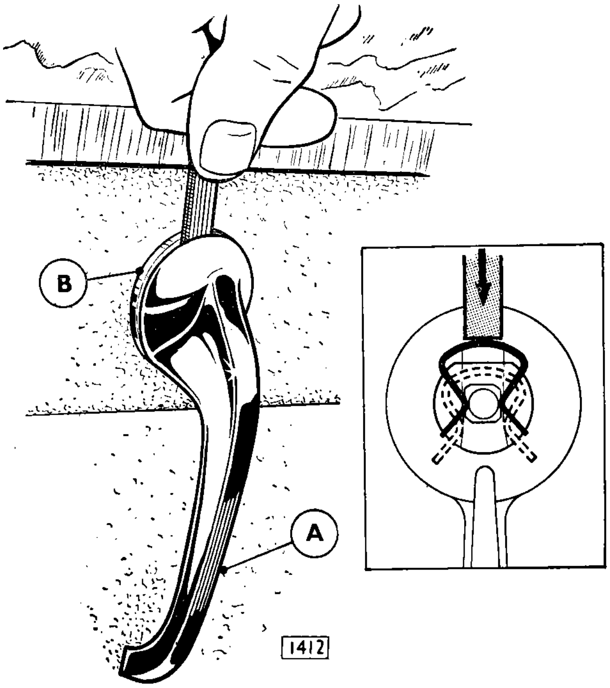


Fig. 28. An alternative method of removing the regulator handle

As an alternative method for releasing the spring clip insert a flat strip of steel about $\frac{1}{16}$" (1·6 mm.) thick between the handle (A) and the inner ring (B) as illustrated in Fig. 28.

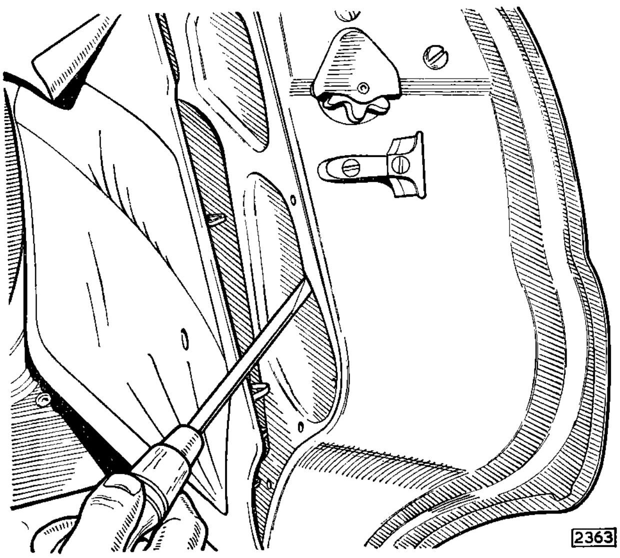


Fig. 29. Removing the door trim casing

Press downwards sufficiently to disengage the spring clip from the groove in the splined handle spindle and retain it in this position to enable the handle to be removed.

Remove the window regulator handle, secured in the same way as the door lock handle.

Insert a thin bladed screwdriver between the door casing and the door frame. Prise off the casing which is secured by sixteen clips on the front door and thirteen clips on the rear door. Remove the felt pads from the regulator shafts.

To remove the small trim casing attached to the front door upper closing panel, lift away the trim covering where stuck to the door panel and prise off the casing which is secured by two clips.

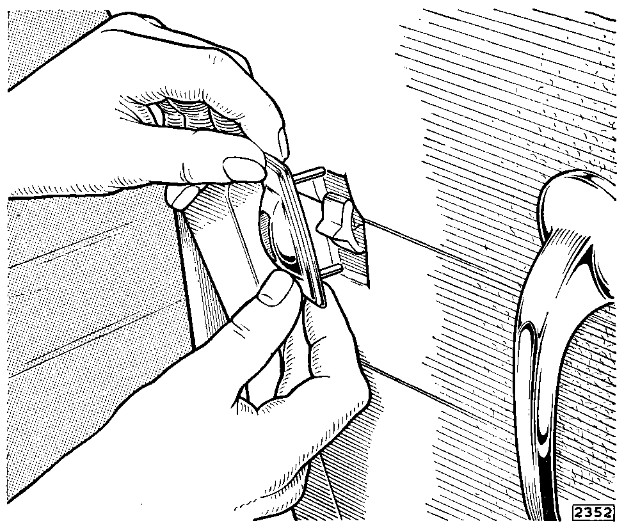


Fig. 30. Removing the rear door switch escutcheon (electrically operated windows)

When the electrically operated window system is fitted to the car, the window regulator handles are omitted, being replaced on the rear window only by an electrical switch. To remove the switch escutcheon before removing the door casing, insert a thin bladed screwdriver between the escutcheon and the casing and gently prise the escutcheon away.

Refitting

Refitting is the reverse of the removal procedure.

When refitting the window regulator and door lock handles, reassemble the spring clips to the handles with the loop uppermost before attaching to the splined shafts.

Fully close the window and fit the regulator handle with the knob vertically below the escutcheon. Feed the handle onto the correct spline and tap fully home

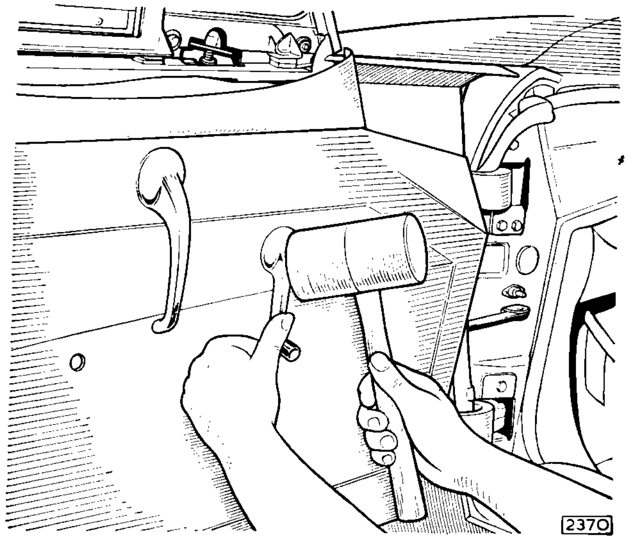


Fig. 31. Refitting the regulator handle

with a soft faced hammer. Ensure that the inner ring is fitted to the handle before attaching to the shaft.

The door lock handle is fitted in a similar manner.

FRONT DOOR WINDOW FRAME AND GLASS

Removal

Remove the door trim casing as detailed under "Front and Rear Door Trim Casings" page N.17.

Pull off the clear plastic sheet found attached to the door frame with upholstery solution.

Remove the five round headed setscrews and washers securing the window frame to the top of the door frame.

Note and collect all the packing pieces under these screws. Care must be taken to replace the same number of packing pieces under their respective screws when refitting the frame.

Remove the drive screw securing the window frame to the rear top corner of the door.

Remove the two setscrews and washers securing the two legs of the window frame to the door. Collect the fibre packing washers when withdrawing the screws.

Withdraw the window frame.

Collect the small rubber sealing pad fitted to the rear of the window frame and the door top panel.

Raise the glass and withdraw from the regulator arms.

Remove the weather strip from the door frame by withdrawing six drive screws and lifting away the chrome bearing and rubber seal.

If the glass is to be renewed, remove the channel and discard the sealing compound.

Refitting

Fit the regulator arm channel to the glass, if previously removed, renewing the sealing compound.

Fit a new rubber seal to the weather strip chrome beading if damaged and refit the strip to the door securing with the six drive screws. Bed the two ends of the chrome beading in a glass sealing compound before securing to the door for a length of approximately 3" (76·2 mm.).

Place the glass into position on the regulator arms and slide the glass into position between the door frame.

Insert the window frame into the door and enter the glass into the window frame channel.

Refit all screws, bolts, nuts and packing pieces.

Tighten finger tight only and refit the small rubber sealing pad to the frame rear.

Close the door and check the clearance of the frame with the screen pillar. Adjust the window frame to a clearance of $\frac{1}{4}$" (6·4 mm.) maximum.

Fully tighten all the mounting points and check that the glass moves freely in the frame channels.

Seal the entry point of the frame rear leg into the door frame with sealing compound.

Clean off any surplus sealing compound and refit the plastic sheeting.

Refit the door casing as detailed under "Front and Rear Door Casings" page N.17.

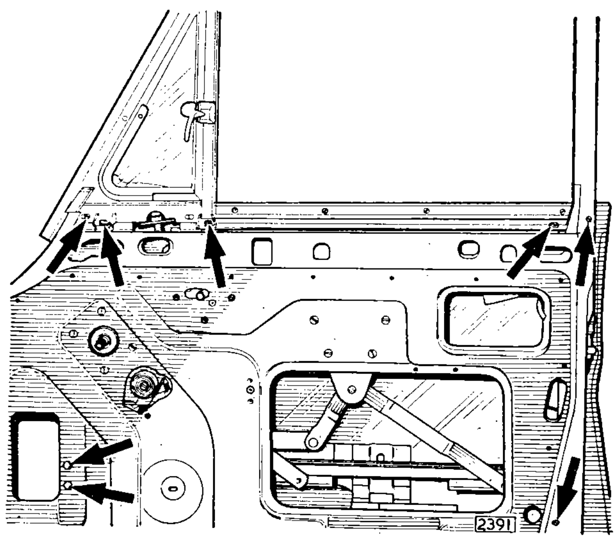


Fig. 32. The front window frame securing screws

REAR DOOR WINDOW FRAME AND GLASS

Removal

Remove the door trim casing as detailed under "Front and Rear Door Casings" page N.17.

Pull off the clear plastic sheet.

Remove the three round-headed setscrews and washers securing the window frame to the top of the door frame.

Remove the countersunk bolt and chrome cap nut securing the frame front to the door panel.

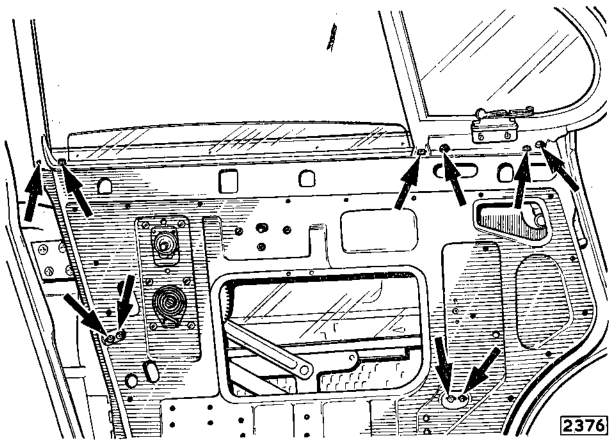


Fig. 33. The rear window frame securing screws

Release the two slotted screws accessible through holes in the door panel below the N.D.V. light.

Raise the window.

Remove the two bolts, nuts and washers securing the front and rear legs to the door frame.

Collect all packing pieces. Care must be taken to replace the same number of packing pieces under their respective screws when refitting the frame.

Withdraw the window frame. Collect the small rubber pad fitted between the front of the window frame and the door panel top.

Raise the glass and withdraw from the regulator arms.

Remove the weather strip from the door frame by withdrawing six drive screws and lifting away the chrome beading and rubber seal.

If the glass is to be removed, remove the channel and discard the sealing compound.

Refitting

Fit the regulator arm channel to the glass, if previously removed, renewing the sealing compound.

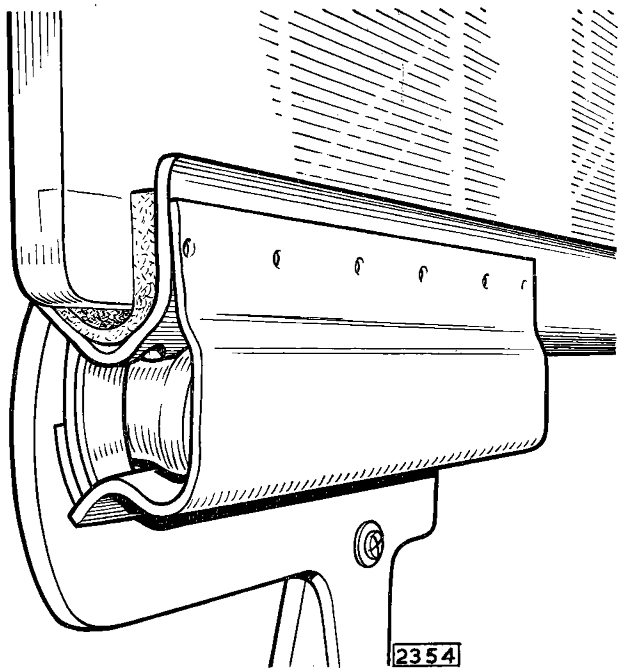


Fig. 34. Showing the window regulator arm and channel

Fit a new rubber seal to the weather strip chrome beading if damaged, and refit the strip to the door securing with the six drive screws. Bed the two ends of the chrome beading in a glass sealing compound before securing to the door for a length of approximately 3″ (76·2 mm.).

Place the glass into position on the regulator arms and slide the glass into position between the door frame.

Insert the window frame into the door, noting that the two screws and washers located under the N.D.V. light register correctly with the slotted holes in the window frame. Refit all screws, bolts, nuts and packing pieces. Tighten finger tight only and refit the small rubber pad to the frame front.

Close the door and check the clearance of the frame with the centre pillar. Adjust the window frame to a clearance of $\frac{1}{4}$″ (6·4 mm.) maximum. Check that rear door frame is parallel with front door frame with both doors closed.

Fully tighten all the mounting points and check that the glass moves freely in the frame channels. Refit the plastic sheeting.

Refit the door casing as detailed under "Front and Rear Door Casings" Page N.17.

FRONT NO DRAUGHT VENTILATOR

Removal

Remove the trim casing from the front door as detailed under "Front and Rear Door Trim Casings". Page N.17.

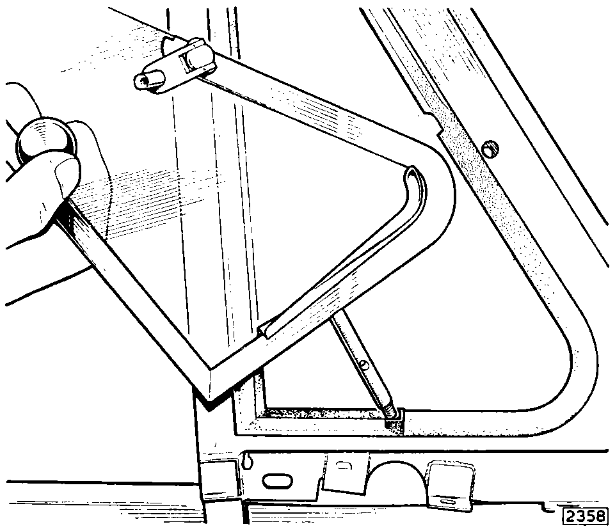


Fig. 35. Removing the front N.D.V. light from frame

The no draught ventilator adjustment and securing mechanism is visible through a small aperture in the door frame.

Remove the locknut, nut and washer securing the spring against the quadrant and withdraw the quadrant.

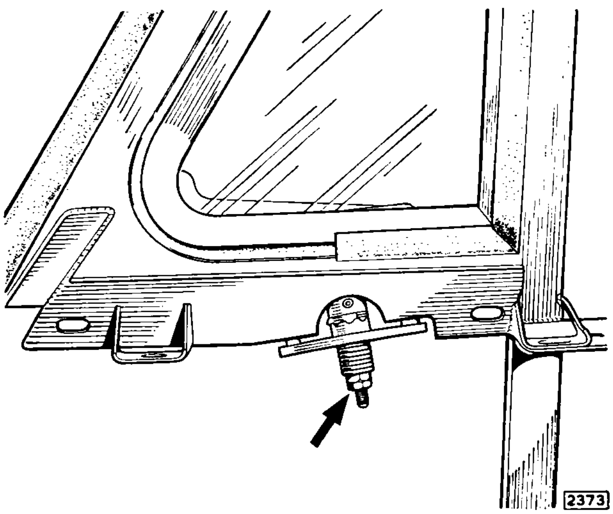


Fig. 36. The front N.D.V. light adjustment

Remove the pin and segment on the N.D.V. post.

Remove the countersunk screw securing the hinge to the door frame.

Open the N.D.V. and withdraw from the window frame.

Refitting

Refitting is the reverse of the removal procedure.

Adjust the quadrant spring tension so that the N.D.V. light will remain in any of the open positions selected without backlash.

REAR NO DRAUGHT VENTILATOR

Removal

Remove the nut, screw and fibre washer securing the rear N.D.V. bracket to the catch arm which operates the N.D.V.

Open the ventilator, remove the five countersunk screws securing the N.D.V. hinge to the window frame and withdraw the light.

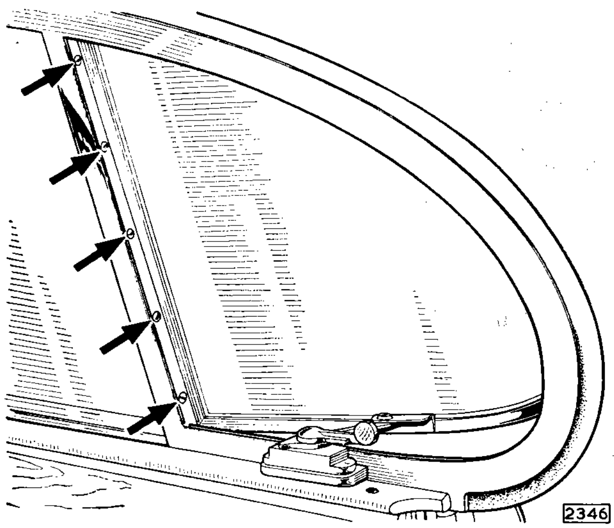


Fig. 37. Removing the rear N.D.V. light

Refitting

Refitting is the reverse of the removal procedure.

FRONT WINDOW REGULATOR
(Manually Operated)

Removal

Remove the door trim casing as detailed under "Front and Rear Door Trim Casings" page N.17.

Pull off the clear plastic sheet and remove the felt placed over the window regulator spindle.

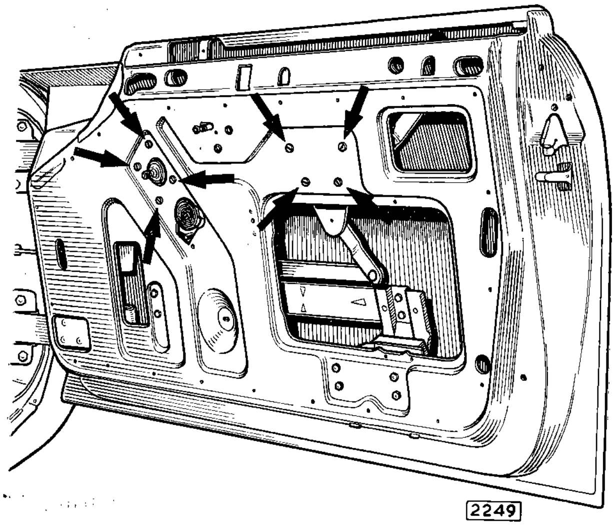


Fig. 38. Showing the screws securing the front window winding mechanism to the door frame

Remove the window frame and glass as detailed under "Front and Rear Door Window Frames" page N.17.

Remove the four screws and lock washers securing the window regulator to the door frame.

Remove the four screws and lock washers securing the window regulator spring to the door.

Withdraw the mechanism from the door frame.

Refitting

Refitting is the reverse of the removal procedure.

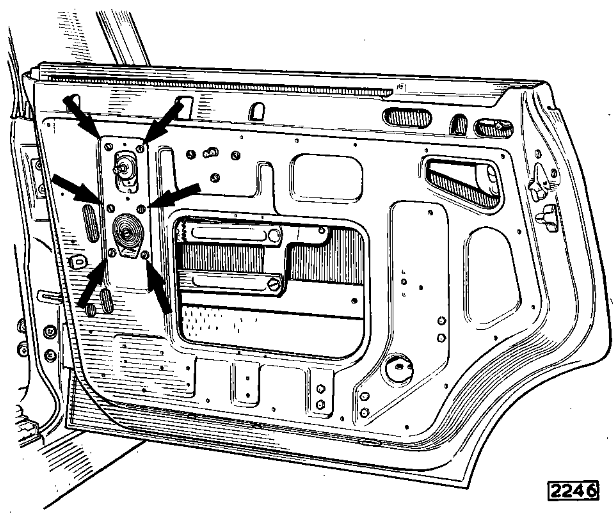


Fig. 39. Showing the screws securing the rear window winding mechanism to the door frame

REAR WINDOW REGULATOR (Manually Operated)

Removal

Remove the door trim casing as detailed under "Front and Rear Door Trim Casings" page N.17.

Remove the felt placed over the regulator spindle and pull off the clear plastic sheet.

Remove the window frame and glass as detailed under "Front and Rear Door Window Frames" page N.17.

Remove the six screws and lock washers securing the regulator mechanism to the door frame and withdraw the mechanism.

Refitting

Refitting is the reverse of the removal procedure.

FRONT WINDOW REGULATOR (Electrically Operated)

Refer to Section P "Electrical and Instruments" for the removal and refitting procedure.

REAR WINDOW REGULATOR (Electrically Operated)

Refer to Section P "Electrical and Instruments" for the removal and refitting procedure.

FRONT SEATS AND SEAT RUNNERS

Removal

Remove the cushion.

Slide the seat fully rearwards.

Remove the two setscrews and washer securing the front of the seat runners to the body floor and collect the two distance pieces located between the runner and the floor.

Slide the seat forwards and remove the setscrew securing the inner runner and the nut and bolt securing the outer runner to the floor. Collect the two distance pieces.

Disconnect the two slide springs and push the seat slide forward exposing the setscrews securing the rear of the seat slides to the seat.

Remove the bolts, nuts and washers.

Push the seat slides to the rear and remove the front securing bolts, nuts and washers.

Note: The outer slides are secured by setscrews and washers only.
Collect the distance pieces between the slides and the seat frame.

To remove the seat back rest, extract the split pins and withdraw the four clevis pins securing the back rest to the seat frame pivots and locking mechanism. Collect the washers from the clevis pins. To remove the locking bars, turn the release handle to release the locking catch and withdraw the locking bars.

To remove the handle, insert a screwdriver between the handle and spring cap and press the cap inwards. This will expose the retaining pin which should be tapped out. The handle and spring cap can now be removed.

Refitting

Refitting the seat back rest and locking mechanism is the reverse of the removal procedure.

When refitting the seat and seat slides care must be taken to ensure that the distance pieces are replaced exactly as removed.

REAR SEAT AND SQUAB

Removal

Lift the rear cushion upwards, withdraw forwards and remove.

Remove the three setscrews, nuts serrated and lock washers securing the bottom of the rear seat squabs to the back of the seat pan.

Lift the squabs to disengage the three top hook fixings and remove.

Refitting

Refitting is the reverse of the removal procedure.

POLISHED WOOD CAPPINGS

Removal of Centre Pillar Capping

Insert a thin bladed screwdriver between the capping and the pillar, press in the two spring clip fasteners and gently prise the capping away. Care must be taken not to damage the polished woodwork with the screwdriver blade.

On cars equipped with safety belts, remove the chrome bolt securing the belt fixing to the pillar before prising the capping away.

Refitting

Enter the spring clips into the holes in the pillar and tap the capping smartly with the hand.

Removal of the Screen Capping

The screen capping is divided into two separate halves.

Remove the interior mirror by withdrawing the three fixing screws.

Remove the three screws and washers securing the right and left-hand cappings and detach cappings.

Refitting is the reverse of the removal procedure.

Removal of the Screen Pillar Capping

Remove the two nuts and washers securing the curved side panels to the side facia panel or the glove-box. Extract the two screws securing the side panels to the body at the base of the screen pillars. The screw heads are accessible after opening the door and lifting the door trim welt locally.

Remove the side panel.

Remove the two screws now exposed from the screen pillar bottom fixing brackets, insert a thin bladed screwdriver between the capping and the screen pillar, press in the top spring clip fastener and gently prise away the capping.

Refitting is the reverse of the removal procedure.

Removal of the Rear Quarter Cant Rail

Press in the rear squab adjacent to the rear quarter cant rail and remove the screw now exposed, securing the rear quarter casing. Insert a thin bladed screw-driver behind the casing and prise off the casing.

Remove the screw securing the cant rail tail plate.

Insert the screwdriver between the cant rail and the body at the top end, press in the spring clip and gently prise away the capping.

Refitting is the reverse of the removal procedure.

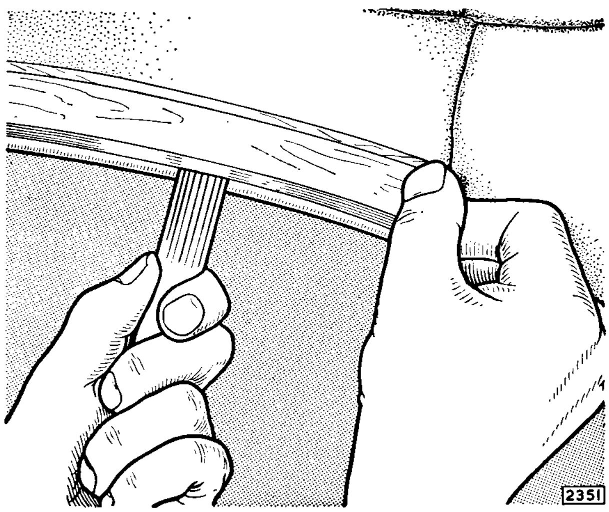


Fig. 40. Showing the method of pressing in the spring clips securing the wood cappings

Removal of the Rear Cant Rail

Remove the rear quarter cant rail as described above.

Slide the rear cant rail to the rear, insert a thin bladed screwdriver between the rail and the body, press in the four spring clips and gently prise away the cant rail.

Note: On some cars the rail may also be secured by a woodscrew accessible after lifting the door aperture sealing rubber adjacent to the centre pillar.

Refitting is the reverse of the removal procedure.

Removal of the Courtesy Light and Capping

Remove the rear quarter cant rail as described above.

Remove the rear cant rail securing screw (if fitted) and slide the rail to the rear to clear the courtesy light capping.

Slide the capping to the rear, insert a screwdriver between the capping and the body, press in the two spring clips and gently prise away the capping.

Disconnect the two cables from the light unit.

To remove the courtesy light from the capping, pull off the light cover, and withdraw the two screws securing the lamp to the block.

Removal of the Front Cant Rail

Remove the rear quarter cant rail as described previously.

Remove the rear cant rail securing screw (if fitted) and slide the rail to the rear.

Slide the courtesy light capping to the rear to clear the front cant rail.

Slide the front cant rail to the rear, insert the thin bladed screwdriver between the rail and the body, press in the three spring clips, and gently prise away the cant rail.

Note: On some cars, the rail may also be secured by a wood screw accessible after lifting the door aperture sealing rubber adjacent to the centre pillar.

TRANSMISSION TUNNEL COVER AND CONSOLE

Removal

Remove the two chrome thumb nuts securing the console to the front mounting studs located under the parcel shelf.

Remove the two chrome nuts securing the console to the propeller shaft tunnel at the rear.

Raise the rear of the console and detach the front end from the parcel tray location.

Withdraw the console and remove the rubber tubes from the heater control panel.

Mark and identify each rubber tube to the three heater control panel connections.

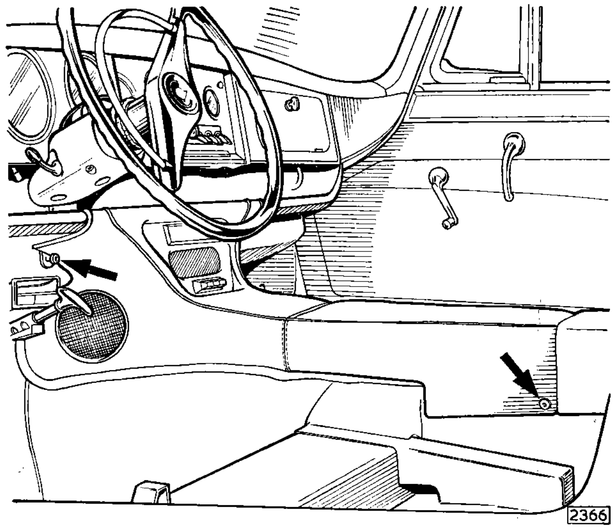


Fig. 41. The transmission tunnel cover securing points

It is **ESSENTIAL** when reconnecting that the tubes be refitted exactly as removed.

On radio equipped cars, disconnect the positive battery terminal and remove the radio facia panel with attached radio control lead before removing the console.

Remove the ash tray and by inserting the fingers in the aperture withdraw the facia away from the four spring/stud mountings. Disconnect the aerial and loud speaker terminal plugs and the power feed terminal.

On cars equipped with the electrically operated windows, disconnect the positive battery terminal, insert a screwdriver under the rear edge of the 4 switch facia panel attached to the console, lift clear of the spring/stud mounting and withdraw rearwards away from the clip fixing. Feed the facia through the aperture when removing the console. Care must be taken not to damage the polished wooden facia when removing or refitting.

Refitting

Refitting is the reverse of the removal procedure.

PARCEL TRAY

Removal

Remove the transmission tunnel cover and console as detailed above.

Remove the two setscrews, plain and lock washers securing the parcel tray to the bulkhead and located behind the centre instrument panel.

Remove the two screws securing each attachment bracket to the right and left-hand side of the body.

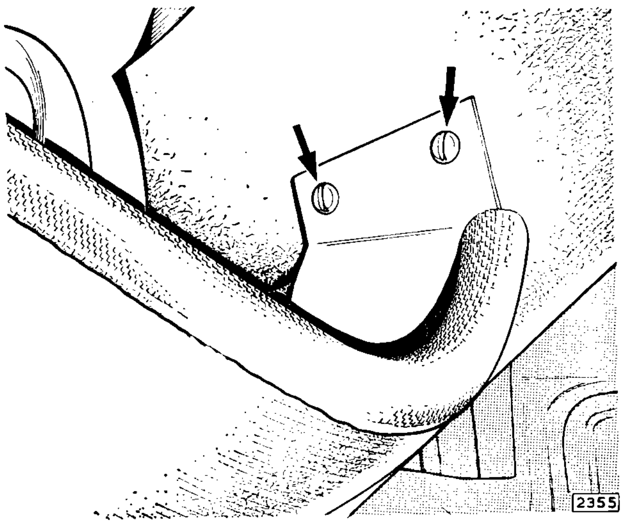


Fig. 42. *The parcel tray securing points*

Lower the parcel shelf and withdraw away from the facia.

On cars equipped with radio, remove the loudspeaker balance control switch by withdrawing the knob from the spindle, removing the securing nut and withdrawing the switch through the panel. Care must be taken not to lose the spring clip located in the switch knob.

When refitting, ensure that the spring clip in the knob registers with the flat on the switch spindle.

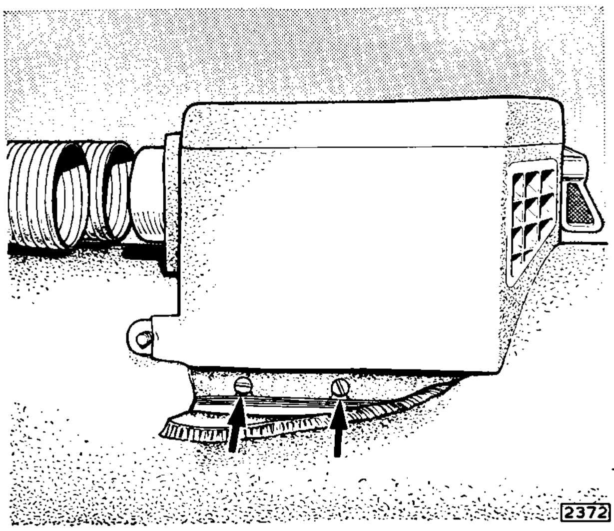


Fig. 43. The rear heater duct control securing points

REAR HEATER DUCT CONTROL

Removal

Remove two drive screws and detach the cover.

Detach the two flexible pipes from the duct orifice.

Lift the carpet, where cut, below the rear duct assembly, remove the four drive screws and detach the complete duct unit.

To detach the operating spring, remove the duct unit, open the shutter, turn the spring through 90° and lift the spring hooks away from the pivot holes in the shutter and the body.

Refitting

Refitting is the reverse of the removal procedure.

DOOR LOCK MECHANISM

REMOVAL OF LOCK MECHANISM

Remove the door trim casing as detailed under "Front and Rear Door Trim Casings" Page N.17.

Pull off the clear plastic sheet found attached to the door frame with upholstery solution.

Raise the window to the full extent and release the spring clip holding the bottom of the outside handle connecting link (E or Ea) Fig. 49 to the dowel (F) on the intermediate lever. This is accessible through an aperture in the inner door panel. Remove the spring clip (G) and the waved washer fitted between the connecting link (H) and the remote control link.

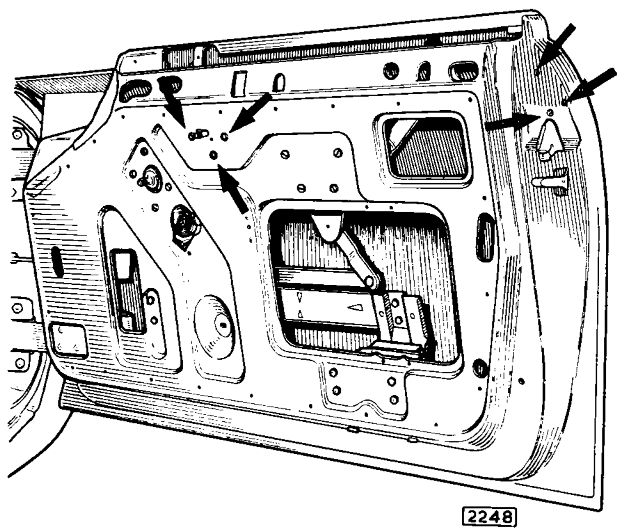


Fig. 44. Showing the front door lock mounting points

Removing the Remote Control Unit

Remove the three setscrews (I), lock and plain washers securing the remote control unit to the door panel.

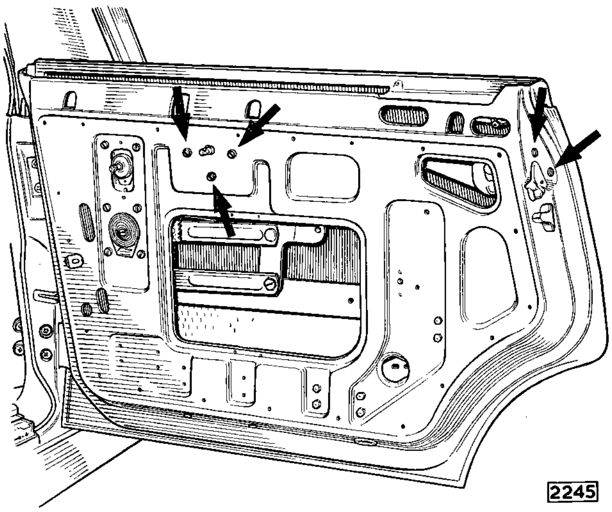


Fig. 45. Showing the rear door lock mounting points

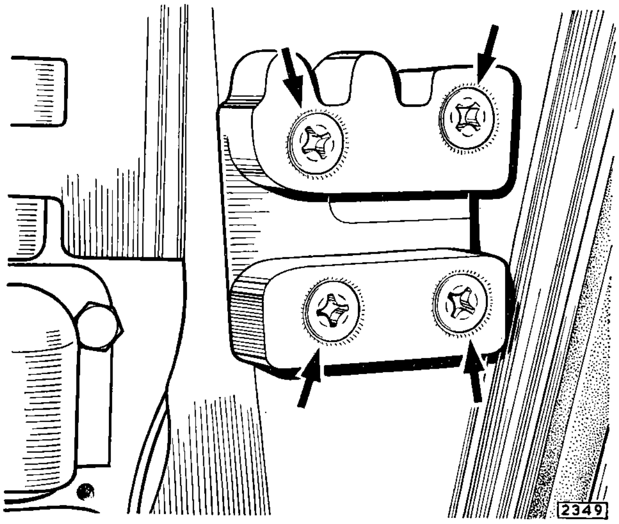


Fig. 46. Location of the door striker plate securing screws

Press the control inwards to clear the spindle from the door panel and remove from the door via the large aperture.

Note: On the front it is necessary to remove the lower glass channel bolt with plain and lockwashers and packing pieces to enable the control to be pressed in sufficiently to clear the spindle.

Removing the Lock Unit

Remove the two countersunk screws (J) which pass through the dovetail and the three setscrews with lock and plain washers (K) (two on the rear doors) from the door shut face. Remove the lock through the aperture in the door panel.

Removing the Outside Handle Base Plate Assembly

This is retained from inside the door by two setscrews (L) and lockwashers.

Removing the Outside Handle

This should not be removed unless it is necessary to fit a replacement handle and is retained in position by the two nuts (N) and (O) and lockwashers.

On the front doors it will be necessary to remove the window frame and glass as detailed on page N.19 but on the rear doors the window frame only should be removed as detailed on page N.20 and the glass wound down to its lowest point.

Removing the Striker Unit

Do not disturb the three fixing screws (M) unless it is necessary to make adjustments or fit a replacement.

REFITTING THE LOCK MECHANISM

Refitting the Lock Unit

The lock is inserted through the upper aperture in the inner door panel and passed between the window channel and the outer door panel, if the window channel has not been previously removed, so that the rotor and dovetail locating studs project through their respective apertures in the shut face of the door.

The dovetail (F) is then placed in position and retained with the two countersunk screws (J). The three screws (K) with lockwashers (two on the rear doors) are fitted through the shut face.

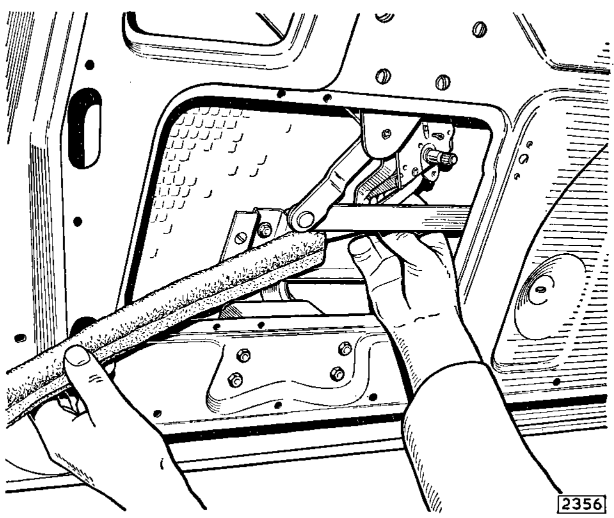


Fig. 47. The front door lock being placed in position

Refitting the Remote Control Unit

The remote controls must always be fitted in the locked position. In the case of the front doors the controls are supplied pinned in the locked position as shown at (Q) ready for fitting.

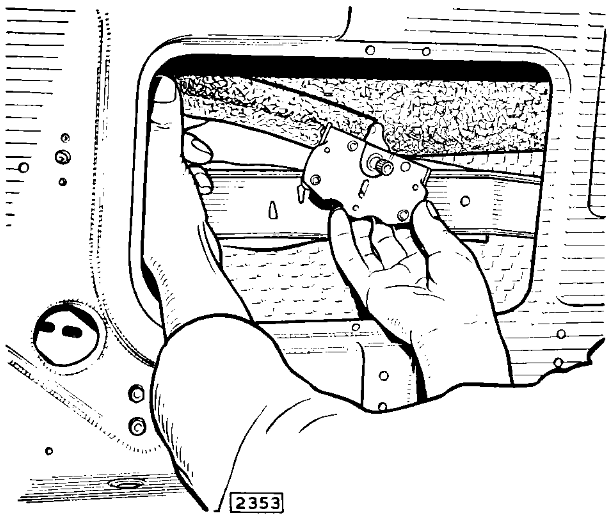


Fig. 48. The rear door lock being placed in position

Locate the remote control inside the door via the large aperture so that the spindle and the split pin on the front doors project through the door inner panel.

Fit the connecting link to the stud on the lock lever (H) with the waved washer interposed and fit the spring clip (G).

Fit the three setscrews (I) with the plain and lock-washers.

Do not tighten the setscrews at this stage.

Aligning the Lock Assembly

The assembly is aligned by sliding the remote control towards the lock, the holes in the inner door panel being elongated for this purpose. The lock lever (H) should then be in contact with the stop (R) on the lock as illustrated and the three securing screws (I) can then be tightened.

Refitting the Outside Handle Base Plate Assembly

The base plate assemblies are stamped L.H. (left-hand) or R.H. (right-hand).

The appropriate assembly should be held in position inside the door panel and the clearance between the push button plunger (S) and the lock contactor (T) checked through the aperture in the inner door panel. The clearance should be $\frac{1}{32}$" (·79 mm.).

To adjust release the locknut (U), screw the plunger screw (S) in or out as required and re-tighten the locknut.

Before finally fitting the assembly, the appropriate connecting link (E) (Ea on rear doors) should be attached to the dowel on the plunger operating lever (V) and retained by the spring clips.

The base plate assembly is secured from inside the door by two setscrews (L) which pass into the back of the outside handle.

Connecting the Push Button Mechanism

First ensure that the remote control is set in the locked position. On the front doors this is retained by the split pin (Q) as illustrated.

To compensate for variations in fitting the links (E and Ea) are provided with three holes at the bottom end. It will be observed that one of these can be aligned with the dowel (F) in the intermediate lever. The link is automatically retained by a spring clip.

At this stage, remove the split pin (Q) from the remote control on the front doors in order that the locking operation can be checked as follows:

Depress the push button, the plunger (S) should clear the lock contactor (T).

Conversely, when the remote control is set in the unlocked position, the plunger should pass squarely behind the lock contactor, coming into contact with it when the push button is operated.

Fitting and Adjusting the Striker Unit

Attach the striker loosely by means of its four screws (M) which pass through the door pillar into an adjustable tapping plate.

Positioning is carried out by trial and error until the door can be closed easily but without rattling and no lifting or dropping of the door is apparent. Ensure that the securing screws are finally tightened.

Important: The striker must be retained in the horizontal plane relative to the door axis.

Master Check for Correct Alignment

Fit an inside handle vertically downwards on the remote control spindle. This is simply pressed on, being automatically retained by the internal spring.

Front Doors

Turn the inside handle *forward.* It will automatically return to the central position when released. Close the door while holding the push button in the *fully depressed* position. The door will remain locked although the push button may be *freely depressed.*

Insert the key in the slot in the push button and turn in the appropriate direction. Push button control will then be restored and the door can be opened.

After turning the key ,will automatically return to the *horizontal* position when it can be removed.

Important: The key must be removed from the locking device before closing a door in the locked position.

Rear Doors

Turn the inside handle forward into the locked position where it will be automatically retained.

Close the door; it will then be locked although the push button may be freely depressed.

To unlock, the inside handle is returned to the central position when push button control is restored.

LUBRICATION

Before fitting the door casing, ensure that any moving parts are adequately greased. After assembly introduce a few drops of thin machine oil around the rotor and into the private lock key slots. These items should be lubricated once a month.

Important: The private cylinder lock cylinders must not under any circumstances be lubricated with grease.

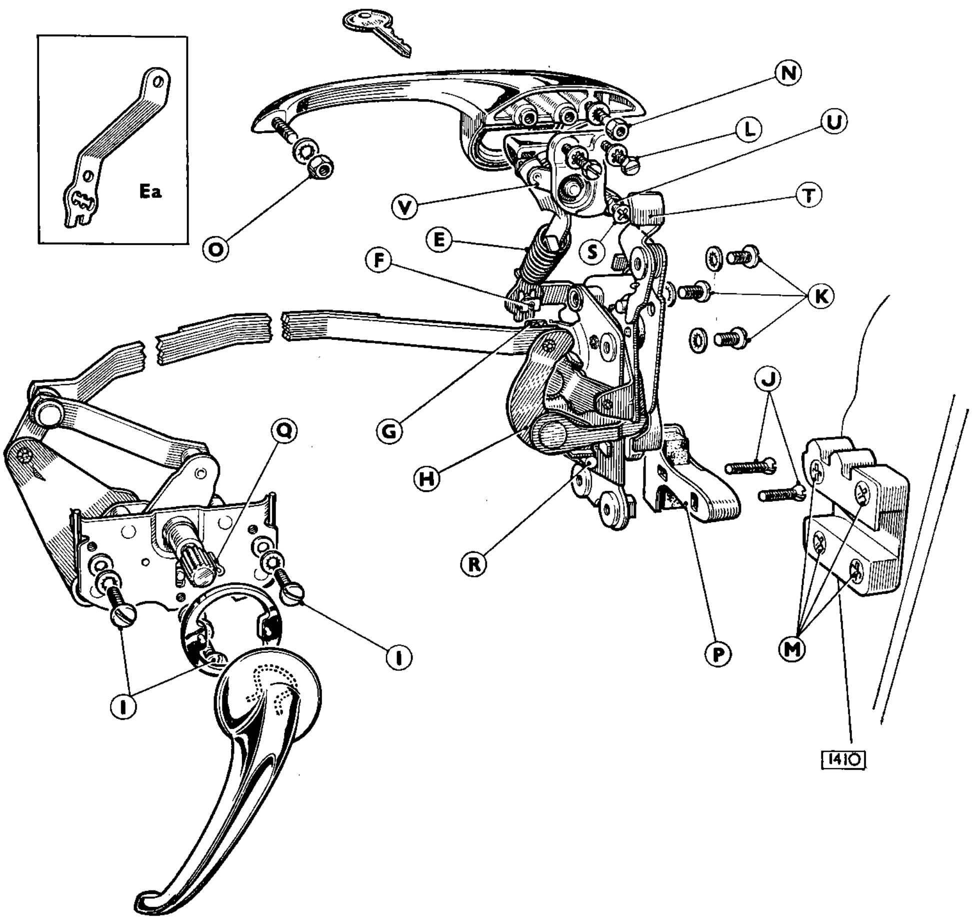


Fig. 49. Exploded view of the door lock mechanism

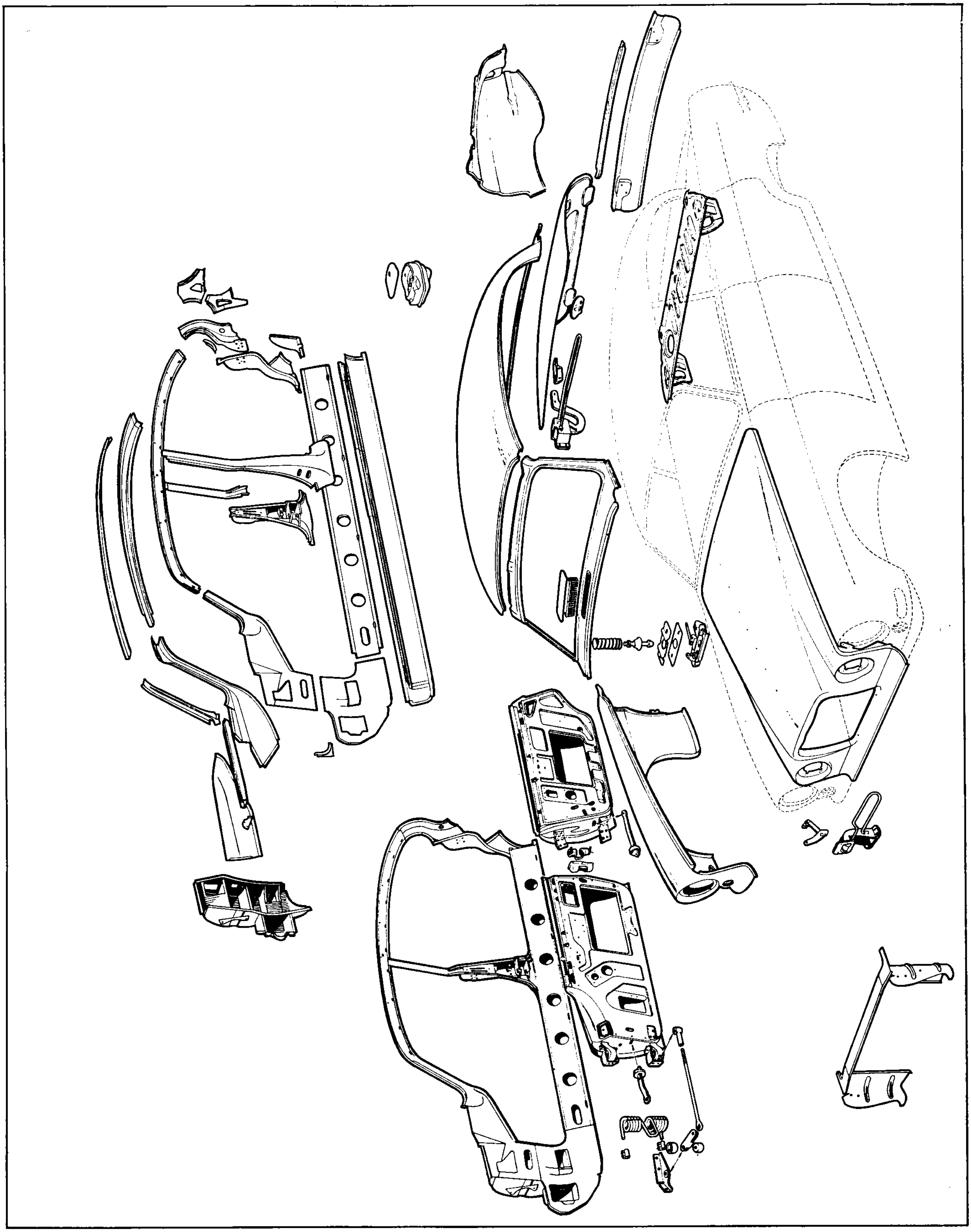


Fig. 50. Exploded view of the body panels

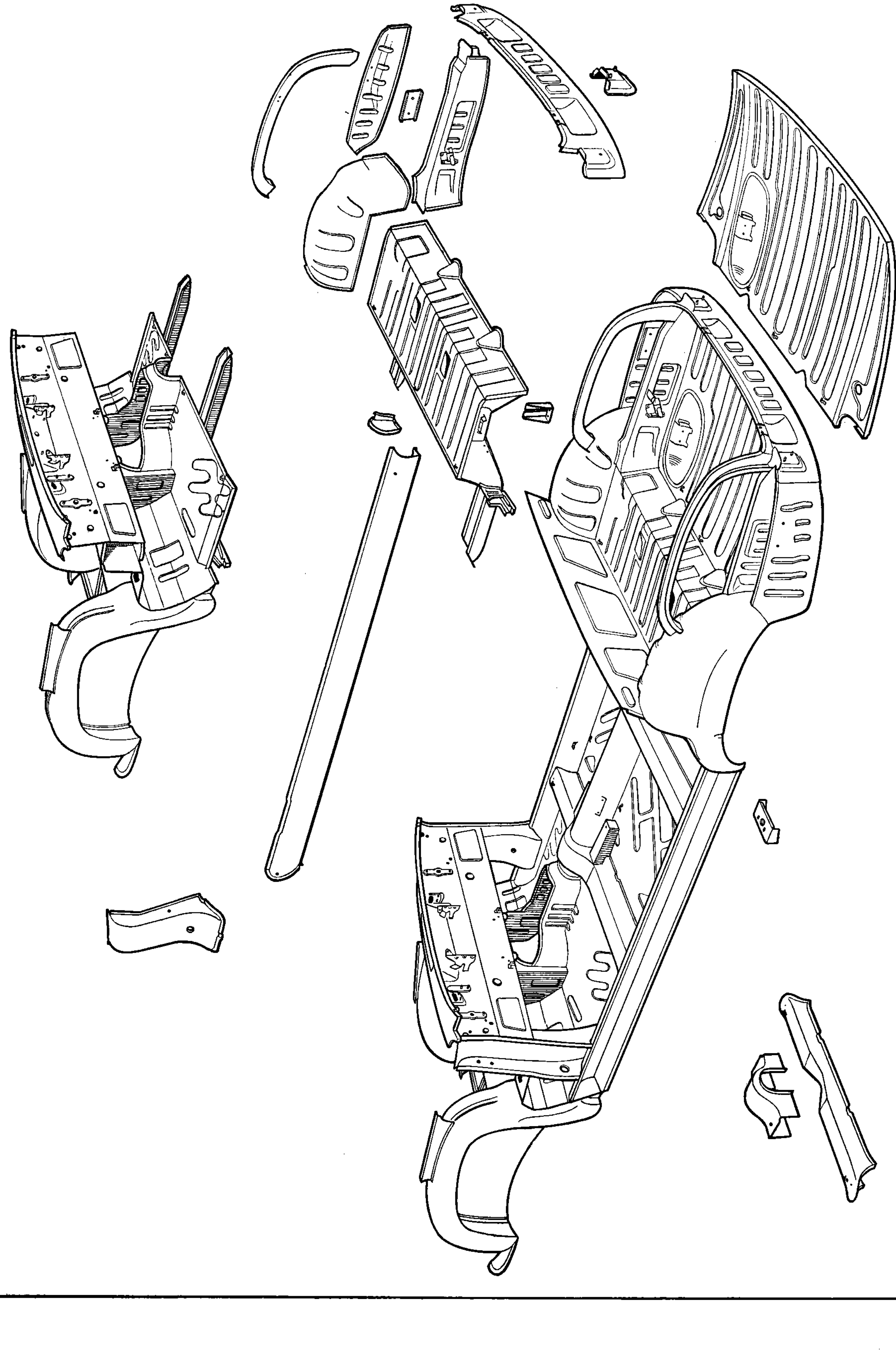


Fig. 51. Exploded view of the underframe components

ACCIDENTAL DAMAGE

The repair of integral construction bodies varies in some degree, depending on the extent of the damage, to that of separate body and chassis construction.

Superficial damage can be effected in a similar manner to that employed on "all steel" bodies which is familiar to all body repairers.

Repairs to rectify extensive damage affecting the main members of the underframe must be carried out so that when the repair is completed the main mounting points for the engine, front and rear suspensions, etc., are in correct relation to each other.

When checking for or rectifying distortion in the main underframe members, reference should be made to the diagrams in the section headed "Checking Body Underframe Alignment" which gives the important dimensions to be observed.

Replacement Body Panels

Where the existing panels or members are badly damaged and it is not possible to effect a satisfactory repair in position, the affected panels will have to be cut out and replacement panels welded in their place.

It will frequently be found advantageous to use only a part of a given panel so that the welded joint can be made in a more accessible position. Great care must, of course, be taken when cutting the mating portions of the panel to ensure that perfect matching is obtained.

For example, if damage to a front wing is confined to the forward end a simpler and quicker repair can be effected by cutting the front wing off between the wheel aperture and the wing valance. If the replacement front wing is then cut to match, a simple butt weld can be made and after cleaning down with a sanding disc and filling with plumber's lead the joint should be invisible.

Any unused portions of replacement panels should be retained as it will often be found that they can be used for some future repair job.

Where a replacement panel to be fitted forms part of an aperture such as for a door or the luggage boot lid, an undamaged door or lid should be temporarily hinged on position and used as a template to assist location while the replacement panel is clamped and welded in position.

Similarly, an undamaged radiator grille can be used as a template to accurately form the aperture when fitting a replacement front wing or wings.

Before any dismantling takes place after accidental damage a check of the underframe alignment should be carried out.

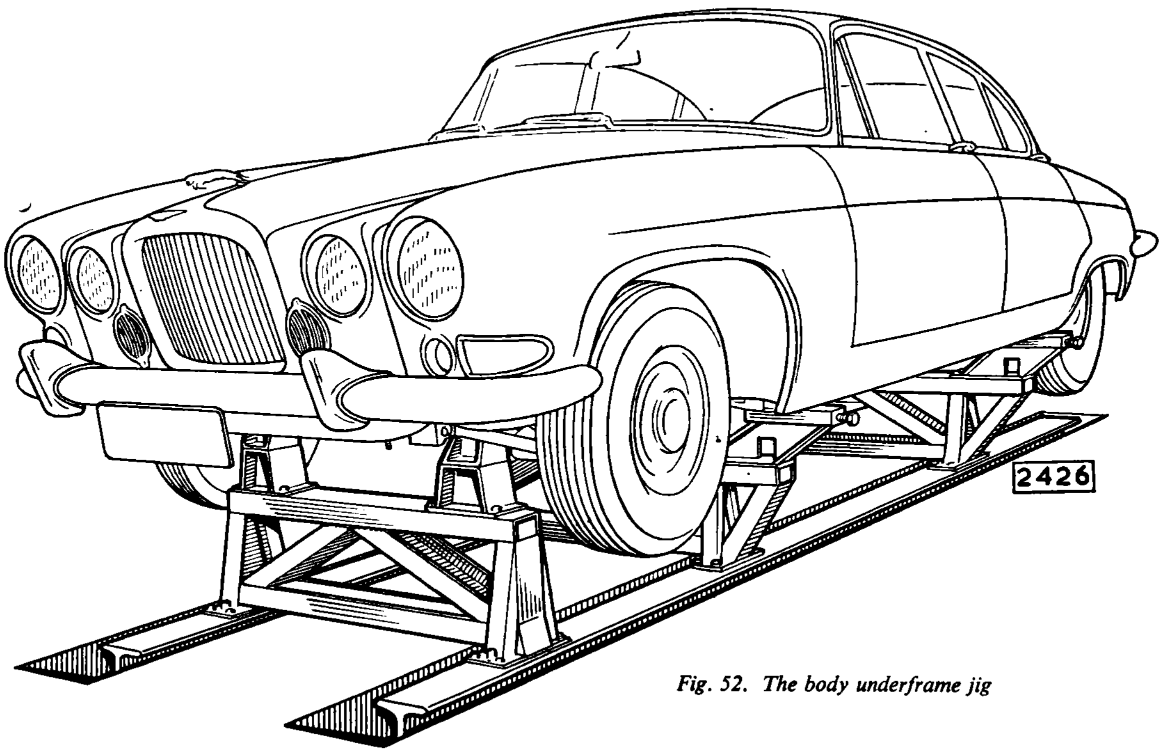


Fig. 52. The body underframe jig

CHECKING BODY UNDERFRAME ALIGNMENT

Checking for Distortion in the Horizontal Plane

The plan view of the body on page N.33 provides the important dimensions for checking for distortion in the underframe. These dimensions can be measured actually on the underside of the body or by dropping perpendiculars from the points indicated by means of a plumb-bob on to a clean and level floor. If the latter method is adopted the area directly below each point should be chalked over and the position at which the plumb-bob touches the floor marked with a pencilled cross.

Checking for Distortion in the Vertical Plane

For checking the underframe for distortion in the vertical plane the side elevation gives the details of the important dimensions from a datum line.

If the relative distance between two points **above** the datum line is required one dimension should be subtracted from the other.

If the relative distance between a point above the datum line and the straight section of the chassis side member is required, add the dimension "U" —$5\frac{1}{32}$" (12·78 cm.)—to the dimension above the datum line.

If it is required to check the dimensions from ground level, raise up the car at the front and rear and insert four blocks or stands of exactly equal height between the ground and the straight section of the chassis side members. **Do not allow the weight of the car to rest on the blocks, use them only as test pieces.**

The distance from the ground to any given check point will be: height of blocks + "U" ($5\frac{1}{32}$" 12·78 cm.) + distance from datum line to check point.

KEY TO ALIGNMENT DIAGRAM

Symbol	Measurement taken from	Dimension	
		Up to chassis No. 300980 R.H. Dr. 351387 L.H. Dr.	From chassis No. 300981 R.H. Dr. 351388 L.H. Dr.
A	Datum line to centre of tube in chassis side member for front suspension cross member mounting	$1\frac{1}{16}$" (2·7 cm.)	$1\frac{1}{16}$" (2·7 cm.)
B	Front of jacking tube to front face of sub-frame cross member	$49\frac{35}{64}$" (125·84 cm.)	$49\frac{35}{64}$" (125·84 cm.)
C	Datum line to bottom face of front jacking tube	$5\frac{17}{64}$" (13·37 cm.)	$5\frac{17}{64}$" (13·37 cm.)
D	Datum line to bottom face of rear jacking tube	$5\frac{17}{64}$" (13·37 cm.)	$5\frac{17}{64}$" (13·37 cm.)
E	Centre line of tube for front suspension cross member mounting to centre line of lower front tube of rear suspension frame mounting	$115\frac{11}{16}$" (293·84 cm.)	$114\frac{5}{8}$" (291·14 cm.)
F	Centre of front wheel to centre of rear wheel	120" (304·8 cm.)	120" (304·8 cm.)
G	Centre line of radius arm body mounting bracket to centre line of lower front tube of rear suspension frame mounting	$13\frac{19}{64}$" (33·77 cm.)	$12\frac{15}{64}$" (31·07 cm.)

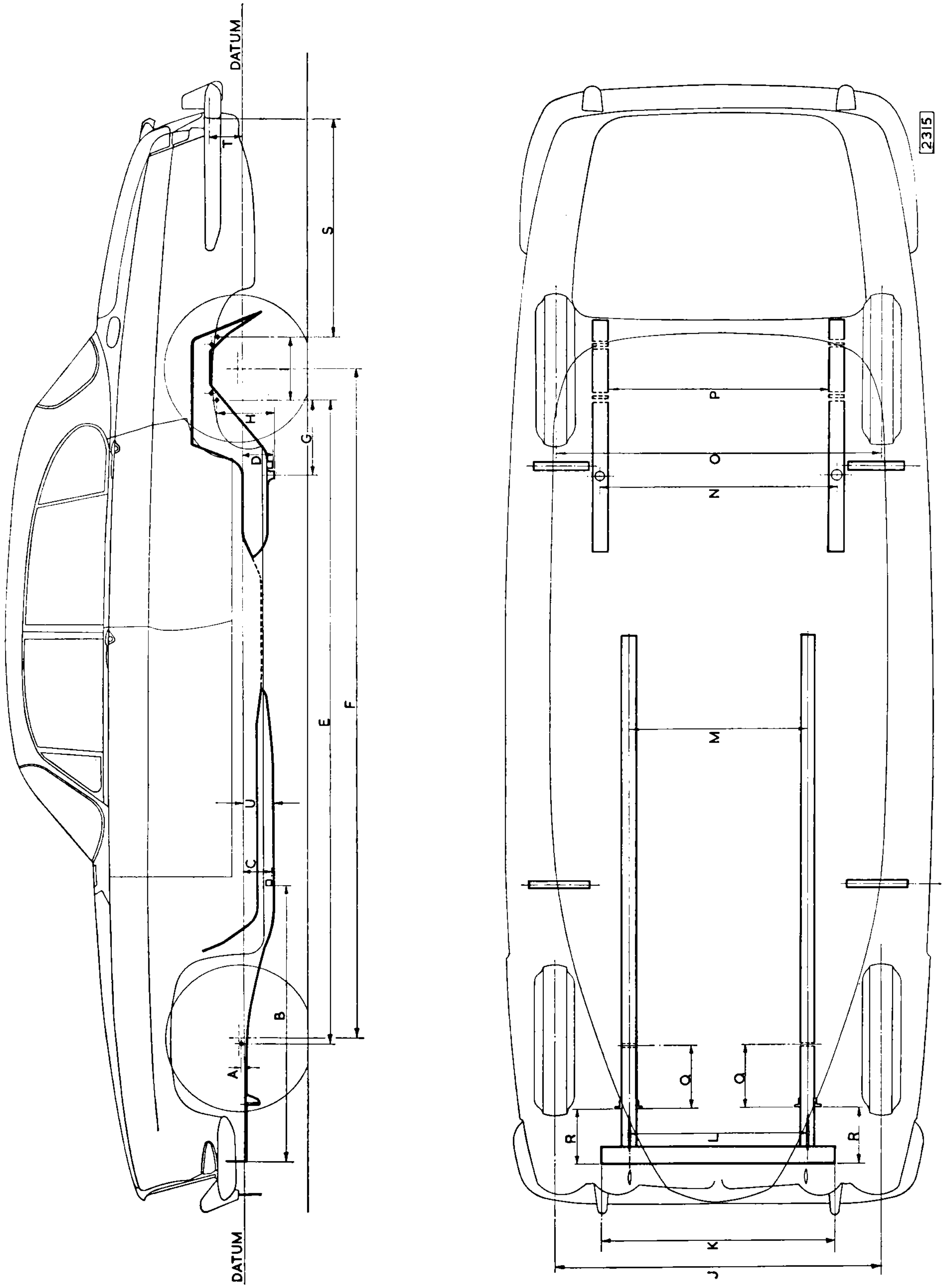


Fig. 53. The underframe alignment diagram

KEY TO ALIGNMENT DIAGRAM—*(continued)*

Symbol	Measurement taken from	Dimension	
		Up to chassis No. 300980 R.H. Dr. 351387 L.H. Dr.	From chassis No. 300981 R.H. Dr. 351388 L.H. Dr.
H	Bottom of radius arm body mounting bracket to centre line of lower front tube of rear suspension frame mounting	$10\frac{3}{64}''$ (25·51 cm.)	$10\frac{7}{64}''$ (25·67 cm.)
I	Centre line of lower front tube to lower rear tube of rear suspension frame mounting	$11\frac{1}{8}''$ (28·25 cm.)	$11\frac{1}{4}''$ (28·57 cm.)
J	Front track	$58\frac{3}{4}''$ (149·22 cm.)	$58\frac{3}{4}''$ (149·22 cm.)
K	Outer ends of front cross member	$55\frac{1}{2}''$ (140·97 cm.)	$55\frac{1}{2}''$ (140·97 cm.)
L	Centre lines of front chassis side members at front	$26\frac{5}{8}''$ (67·62 cm.)	$26\frac{5}{8}''$ (67·62 cm.)
M	Centre lines of front chassis side members at rear	$26\frac{5}{8}''$ (67·62 cm.)	$26\frac{5}{8}''$ (67·62 cm.)
N	Centre lines of radius arm body mounting	$41\frac{7}{8}''$ (106·36 cm.)	$41\frac{7}{8}''$ (106·36 cm.)
O	Rear track	$58\frac{21}{32}''$ (148·98 cm.)	$58\frac{21}{32}''$ (148·98 cm.)
P	Inner faces of rear chassis side members	$38\frac{7}{8}''$ (98·74 cm.)	$38\frac{7}{8}''$ (98·74 cm.)
Q	Forward face of front suspension cross member mounting bracket to tube in chassis side member for front suspension cross member mounting	$11\frac{1}{4}''$ (28·57 cm.)	$11\frac{1}{4}''$ (28·57 cm.)
R	Forward face of front suspension cross member mounting bracket to front face chassis cross member	$9\frac{1}{2}''$ (24·13 cm.)	$9\frac{1}{2}''$ (24·13 cm.)
S	Lower rear tube of rear suspension frame mounting to rear bumper mounting face	$38\frac{55}{64}''$ (98·70 cm.)	$39\frac{51}{64}''$ (108·08 cm.)
T	Datum line to centre line of rear bumper mounting bolt hole	$6\frac{3}{32}''$ (15·47 cm.)	$6\frac{3}{32}''$ (15·47 cm.)
U	Datum line to underside of straight section of chassis side member	$5\frac{1}{32}''$ (12·78 cm.)	$5\frac{1}{32}''$ (12·78 cm.)

WELDING METHODS

The following are the principal methods of welding used in the assembly of the body and underframe panels. The instructions given below for breaking the different types of welds should be adhered to when removing a damaged panel as this will facilitate the assembly of the new panel.

Spot Welding

This type of welding is used for the jointing of two or more overlapping panels and consists of passing electric current of high amperage through the panels by means of two copper electrodes.

This results in complete fusion of the metal between the electrodes forming a "spot" weld which is frequently repeated along the length of the panels to be joined. Spot welds can easily be recognised by slight indentation of the metal.

Lap joints on the outer body panels which are spot welded together are usually lead filled and in this case it will be necessary to direct the flame of an oxy-acetylene torch on to the lead so that the filling can be melted and wiped off by means of a piece of cloth.

Breaking Spot Welds

Spot welds cannot be broken satisfactorily other than by drilling; any attempt to separate the panels by using a chisel will result in the tearing of the metal in the vicinity of the spot welds.

Use a $\frac{3}{16}$" (4·7 cm.) diameter drill and carefully drill out each weld. There is no necessity to drill completely through both panels; if the "spot" is drilled out of one of the panels the weld can be completely broken by inserting a thin sharp chisel between the two panels and tapping lightly with a hammer.

Where possible, drill the spot welds completely out of the panel that is to be left in position on the body. This will allow the new panel to be joined to the mating panel on the body by gas welding through the holes in the overlapping flange. (This does not apply if spot welding equipment is available).

If this is not possible, and the holes have to be drilled out in the damaged panel, new holes can be drilled in the replacement panel and the same type of weld effected.

Gas Welding

This type of welding is carried out by means of oxy-acetylene equipment and is used for the jointing of overlapping panels or the butt welding of the edges of two panels.

Breaking Gas Welds

Gas welds may be broken either by means of a sharp chisel or by cutting through with a hacksaw; welding can be removed by grinding with a pointed emery wheel.

EXHAUST SYSTEM

EXHAUST SYSTEM

The following is the procedure for removing the complete exhaust system working from the rear. If it is required to remove the tailpipes or silencers proceed as far as is necessary.

Removal

Remove the two bolts, nuts and washers securing each tail pipe rubber mounting clip to the luggage compartment floor. Withdraw the mounting from the pin attachment on the tail pipe.

Release the clip(s) securing the tail pipe(s) to the rear silencer(s) and remove the pipe(s).

Release the rear silencer front clip(s) and remove the silencer(s).

Release the rear clips on the front silencer, remove the two bolts, nuts and washers securing each rubber mounting to the body and withdraw the intermediate pipe(s).

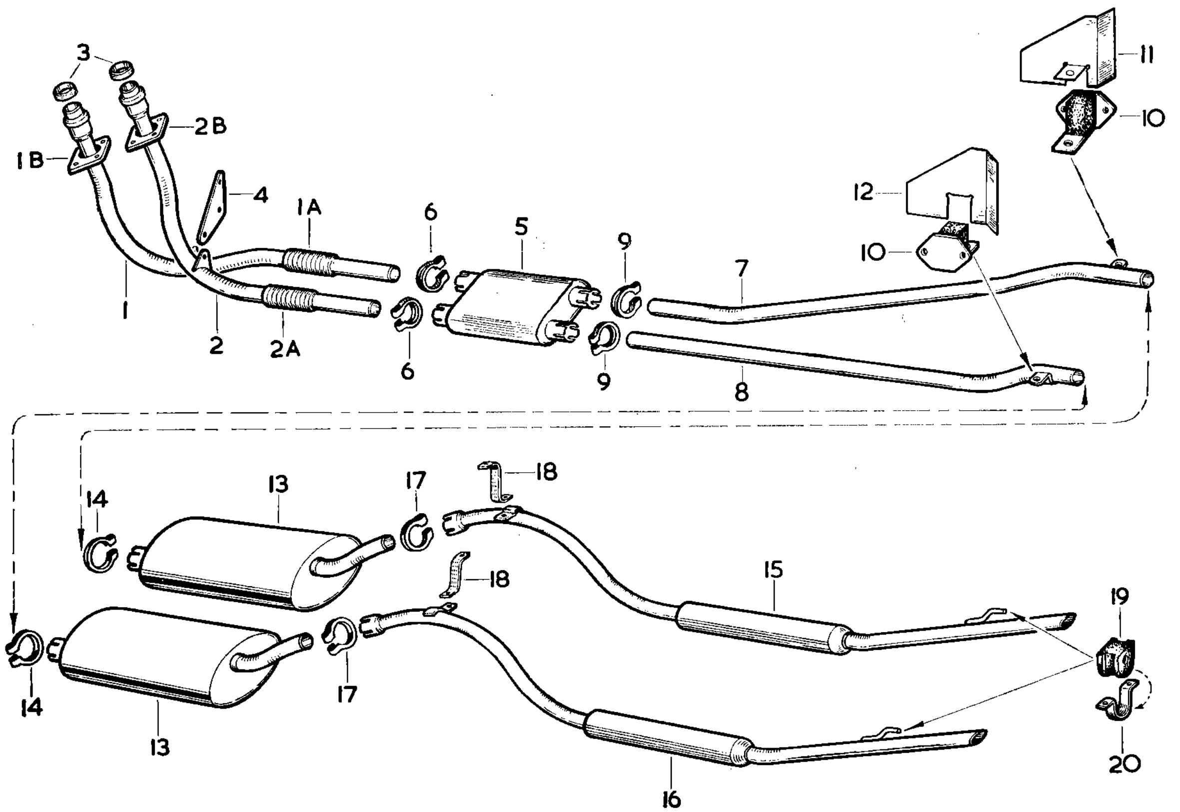
Release the front silencer front clips and withdraw the silencer from the down pipes.

Remove the four nuts and washers securing each down pipe to the exhaust manifold and remove the down pipes.

Refitting

Renew the sealing rings when refitting the down pipes to the exhaust manifold.

Care must be taken to refit the heat shields when replacing the intermediate pipe rubber mounting. Refitting is the reverse of the removal procedure. Renew rear mounting rubber if worn.



1. Front down pipe assembly
1a. Flexible pipe
1b. Flange for down pipe
2. Rear down pipe assembly
2a. Flexible pipe
2b. Flange for down pipe
3. Sealing Ring
4. Down pipe suspension bracket
5. Front silencer assembly
6. Clip
7. Intermediate pipe assembly (Right-Hand)
8. Intermediate pipe assembly (Left-Hand)
9. Clip
10. Rubber mounting
11. Heat shield (R.H. Rubber mounting)
12. Heat shield (L.H. Rubber mounting)
13. Main silencer assembly
14. Clip
15. Tail pipe and rear silencer assembly (Right-Hand)
16. Tail pipe and rear silencer assembly (Left-Hand)
17. Clip
18. Suspension strap
19. Rubber mounting (tail pipe)
20. Bracket for rubber mounting

Fig. 54. The exhaust system components

HEADLINING

	R.H. Drive	*L.H. Drive*
Commencing Chassis Nos.	307781	353456

Commencing at the above chassis numbers all MK 10 cars are fitted with a redesigned headlining. The headlining is now bonded to a fibreglass board and not directly to the roof as was the previous practice. This headlining may be used to replace the previous type if necessary.

Removal

Remove the front seat and seat runners as detailed on page N.22.

Remove the rear seat and squab as detailed on page N.23. Remove the polished wood cappings as described on page N.23-24.

Withdraw the self-tapping screws securing the trim roll and screen visors to the flange above the windshield. Remove the trim roll.

Withdraw the two screws securing the loop pull strap on either side above the rear seat. Remove the trim fillets running along the side of the cant rail by removing the spring clips.

Remove the screws securing the trim roll side flanges.

Withdraw the trim roll chrome finishers and trim roll at the rear of the roof and at the top of the back light.

Partially remove the back light head lining and remove the nine screws securing the trim panel.

Remove the trim panel behind the rear seat squab and trim panel backlight surround.

Withdraw the drive screws securing the metal flanges above the rear light.

Remove the existing headlining. Ensure that the cant rail flanges are free from discarded pieces of headlining material.

Fitting the New Headlining

Feed the headlining through the front door of the car opposite the steering wheel with the widest part to the rear of the car. Great care should be taken to avoid scuffing the leather covering on the console. Any undue pressure on the fibreglass-backed headlining may cause a crack which will scrap it.

Offer up the headlining to the left hand cant rail flange and carefully slide the headlining behind it.

Slide the headlining behind the flange above the windscreen. Offer up the headlining to the right hand cant rail flange and using flat hand pressure only in the middle of the headlining at the front, press the lining behind the flange. Fit the rear edge and secure with metal flanges which are held by drive screws. Refit the back light trim panel surround and secure with nine drive screws. Stick the top edge of the headlining above the back light with adhesive making sure there are no wrinkles.

Refit the trim fillets and polished wood cappings. Refit the front and rear seats by reversing the removal procedure.

Modification to Spare Wheel Well

If SP or SP.41 tyres are fitted to a car originally fitted with RS.5 tyres it will be necessary to carry out the following modification to enable the wider section SP tyre to be fitted as a spare to the luggage compartment without fouling the lid.

With the spare wheel removed, it will be seen that there is a bracket welded on one side of the depression in the luggage compartment floor which takes the spare wheel. With a round-headed mallet, knock this bracket down until it conforms roughly to the remainder of the well.

Refit the spare wheel and check to ensure that it does not foul the boot lid.

SECTION O

HEATING & WINDSCREEN WASHING EQUIPMENT

3·8 MARK 10 MODEL

INDEX

CAR HEATING AND VENTILATING SYSTEM

INDEX *(continued)*

HEATING AND WINDSCREEN WASHING EQUIPMENT

CAR HEATING AND VENTILATION SYSTEM (EARLY TYPE)

The car heating and ventilation system consists of a combined heating element and twin two-speed electrically driven fan assembly.

Air from the heating and ventilation system is directed:—

(*a*) To the front of the car through outlets (one on the driver's side and one on the passenger's side) below the parcel shelf.

(*b*) To the rear of the car through an outlet situated on the propeller shaft tunnel cover between the two front seats.

(*c*) To nozzles at the base of the windscreen to provide demisting and defrosting.

Fresh air is introduced into the car by pressing the appropriate air temperature button and switching on the fan if required (see also air distribution).

HEATER CONTROLS

The heater controls, marked OFF, HOT and COLD, are situated on the console just below the ashtray (see Fig. 1). These controls operate the air intake vent on the scuttle, the water valve adjacent to the cylinder head and the flaps which direct the air either through or past the heating element. All three controls are cross linked so that when one button is pressed, the other buttons are released.

Off

When the OFF button is pressed, the air intake vent is closed and no fresh air is available.

Cold

When the COLD button is pressed, the air intake vent is opened by means of the vacuum system and

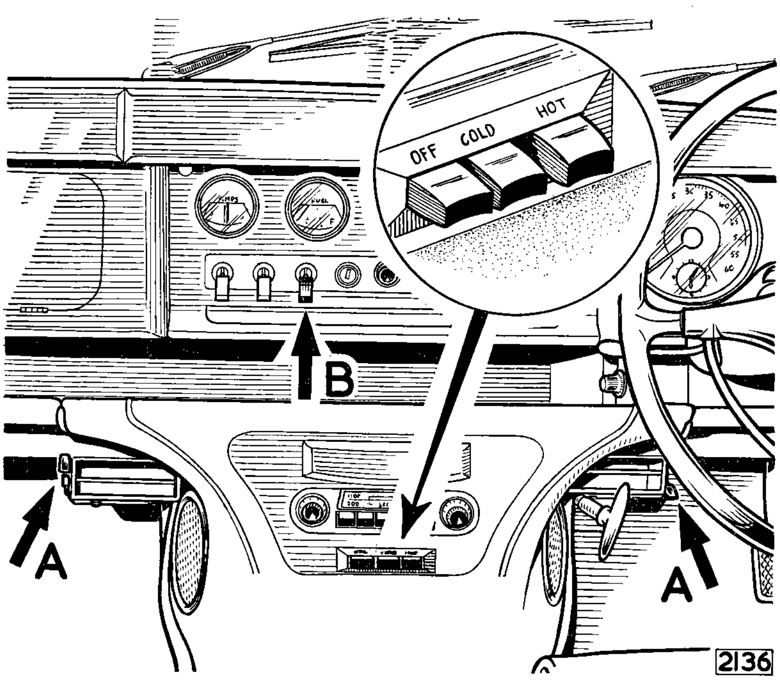


Fig. 1. Heating and ventilating controls (Early type)
A. Front outlets. B. Fan switch

fresh air by-passes the heater unit and is directed to the outlets in the car.

Hot

When the HOT button is pressed, the air intake vent is opened, the water valve opens and supplies hot water to the heating unit and air is directed through the heating unit to the outlets in the car.

THE FAN SWITCH

The fans for the heating and ventilation system increase the flow of air through the system and are controlled by a three-position switch (marked "FAN") on the instrument panel (see Fig. 1).

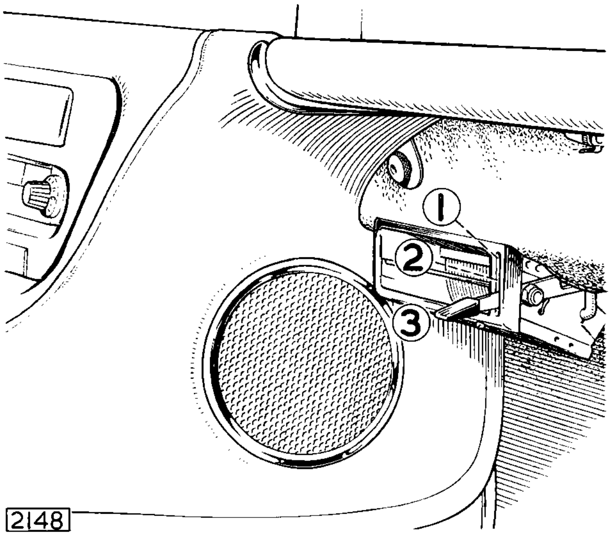


Fig. 2. Front outlet—Position 1. Air directed upwards. Position 2. Air shut off. Position 3. Air directed downwards

Lift the switch to the second position for slow speed and to the third position for high speed, whichever is required.

Operation of the fan is required mainly when the car is stationary or running at a slow speed. At road speeds in excess of 40 m.p.h. it will be found possible to dispense with the fan due to air being forced into the system via the intake. This will provide enough fresh air for normal operating conditions.

AIR DISTRIBUTION

The proportion of air directed to the car or to the windscreen can be controlled by the positions of the front and rear air outlet controls.

The demisting outlets operate whenever the system is working. To obtain a maximum amount of air at

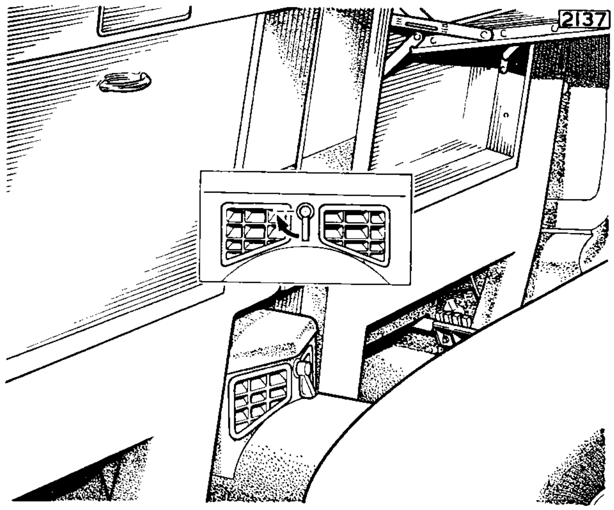


Fig. 3. Rear outlet. The inset shows the operation of the control lever

the windscreen, both the front outlets and the rear outlet control must be closed.

The two front outlets are fitted with direction controls. In the centre position the air is completely shut off, in the "up" position air is directed to the chest and in the "down" position air is directed to the feet.

The knob at the rear outlet either turns the air supply "on" or "off"; turning the knob clockwise opens the outlet.

VACUUM SERVO SYSTEM

Description

The vacuum system which operates the air temperature controls, includes a vacuum supply tank situated on the right-hand wing valance under the carburetters. The vacuum supply tank will provide approximately six complete operations when the ignition is switched off. If either the "COLD" or "HOT" buttons are in the depressed position when the ignition is switched off, the air vent will automatically close itself after five or six minutes and will open again when the engine is restarted.

The vacuum supply tank obtains its vacuum from the inlet manifold to which it is connected by a heavy duty hose at the rear of the inlet manifold air balance pipe. A small diameter rubber tube from the non-return valve leads direct to the air temperature control panel situated on the console.

The two forward facing servos operating the heater flaps are joined at a tee-piece connected to the vacuum pipe from the heater water tap (which is also vacuum operated). The tee-piece is connected to the air

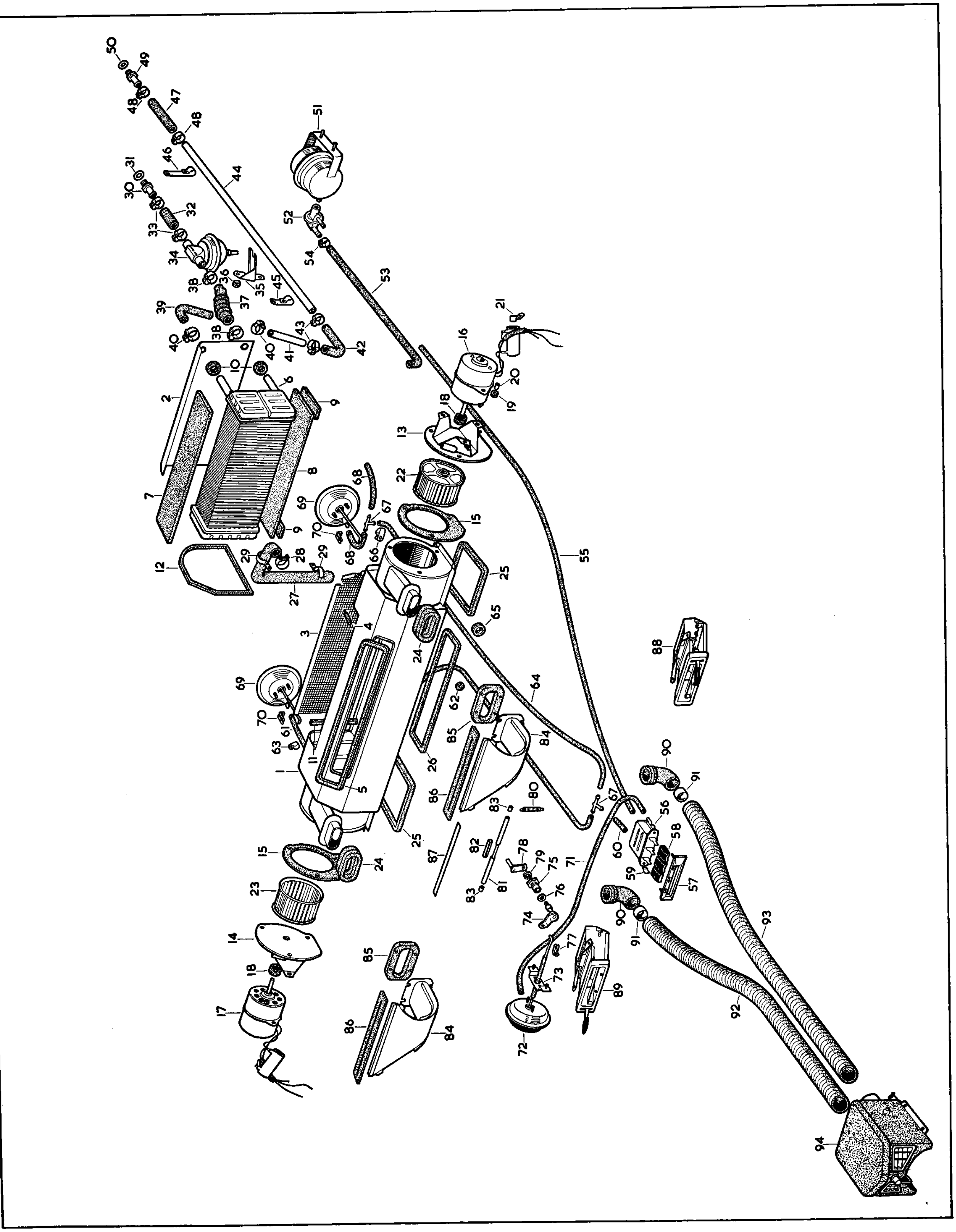


Fig. 4. Exploded view of heater components

1. Heater unit
2. Front cover
3. Gauze cover
4. Return spring
5. Air intake seal
6. Water radiator
7. Radiator seal (top)
8. Radiator seal (bottom)
9. Radiator seal (ends)
10. Radiator inlet/outer pipe seals
11. Air control flap seal
12. Air control flap cowl seal
13. Mounting plate for heater motor (R.H.)
14. Mounting plate for heater motor (L.H.)
15. Heater motor mounting plate to volute seal
16. Heater motor (R.H.)
17. Heater motor (L.H.)
18. Heater motor to mounting plate seal
19. Grommet
20. Distance tube
21. Bracket
22. Fan (R.H.)
23. Fan (L.H.)
24. Demister outlet seal
25. Heater unit to dash seal
26. Heater unit seal
27. Drain tube
28. Clip
29. Retaining clip
30. Adaptor
31. Copper washer
32. Adaptor to water valve hose
33. Clip
34. Water valve
35. Bracket
36. Distance piece
37. Convolute hose
38. Clip
39. Elbow hose
40. Clip
41. Rear return pipe
42. Elbow hose
43. Clip
44. Front return pipe
45. Clip
46. Clip
47. Return pipe to adaptor hose
48. Clip
49. Adaptor
50. Copper washer
51. Reserve vacuum tank
52. Check valve
53. Vacuum hose
54. Clip
55. Vacuum hose
56. Vacuum control box
57. Escutcheon
58. Heater control knob
59. Clip
60. Vacuum hose connecting contro box to lower 'T' piece
61. Vacuum hose from 'T' piece to L.H. vacuum diaphragm
62. Grommet
63. Retaining clip
64. Vacuum hose from lower to upper tee piece
65. Grommet
66. Retaining clip
67. 'T' piece
68. Vacuum hose from upper 'T' piece to R.H. vacuum diaphragm
69. Heater flap servo
70. Servo rod retaining clip
71. Vacuum hose from scuttle vent servo to control box
72. Scuttle vent servo
73. Servo mounting bracket
74. Servo lever
75. Adaptor
76. Fibre washer
77. Clip
78. Vent lever
79. Felt washer
80. Return spring
81. Tie rod
82. Nylon sleeve
83. Spacing tube
84. Demister nozzle
85. Seal between facia and nozzle
86. Seal between nozzle and screen rail
87. Sealing strip support
88. Heater outlet (R.H.)
89. Heater outlet (L.H.)
90. Rubber elbow
91. Tube
92. L.H. rear heater hose
93. R.H. rear heater hose
94. Air distribution box

temperature control panel. The air intake vent on the scuttle is vacuum operated by a servo which is independently connected to the air temperature control panel.

COLD WEATHER

To obtain fresh air heating, demisting and defrosting:

(*a*) Press the air temperature button marked HOT.
(*b*) Switch the fan ON at the desired speed.
(*c*) Open the front outlets and the rear outlet as desired.

To obtain rapid demisting and defrosting:

(*a*) Press the air temperature button marked HOT.
(*b*) Switch the fan ON at the FAST position.
(*c*) Close the front outlets and the rear outlets.

HOT WEATHER

To obtain ventilation and demisting:

(*a*) Depress the air temperature button marked COLD.
(*b*) Switch the fan ON at the desired speed.
(*c*) Open the front outlets and the rear outlet as desired.

To obtain rapid demisting:

(*a*) Depress the air temperature button marked COLD.
(*b*) Switch the fan ON at the FAST position.
(*c*) Close the front outlets and the rear outlet.

HEATER UNIT

Removal

Drain the radiator and cylinder block.

Disconnect the earth lead from the battery terminal.

Slacken off the clips and remove the convolute hose between the heater water valve and heater unit and plain hose between the heater and the return pipe.

Remove the vacuum pipes connected to the two forward facing heater servo units.

Disconnect the cables at each fan motor noting that like colours are joined.

Disconnect the cables from the rev. counter generator located at the rear of the right-hand camshaft cover.

Remove the three Allen setscrews retaining the rev. counter generator, noting the shakeproof washers and plain washers under the Allen screws. Remove the circular rubber sealing ring.

Remove the eleven dome nuts and copper washers from each camshaft cover and lift off the cover (protecting the camshaft and oil galleries by covering with a clean cloth). Remove the self-tapping screws, brackets and servo to vacuum tank pipe.

Remove the setbolts, one mounted either side of the heater unit passing diagonally through the fan motor mounting brackets.

Withdraw the heater unit complete with fan motors.

Refitting

Refitting of the heater is the reverse of the removal procedure, but care should be taken in seeing that the sealing strips are in position, and the demister spigots are properly located in the dash.

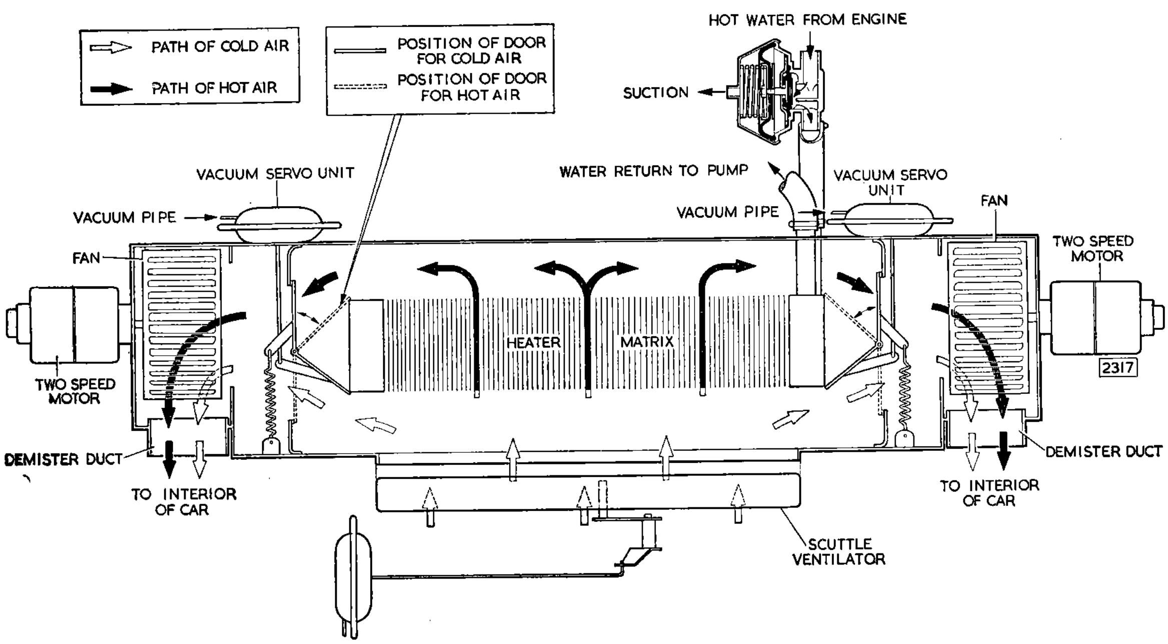


Fig. 5. Operation of the heater unit

HEATER MATRIX

Removal

Remove the self-tapping screws, brackets and servo pipe. Carefully prise off the felt covering the front of the heater unit.

Remove fourteen self-tapping screws revealed securing the cover plate.

Remove the cover plate and withdraw the matrix.

Refitting

Refitting is the reverse of the removal procedure. When re-positioning the material over the cover plate, use a rubber adhesive.

VACUUM SUPPLY TANK

Removal

Pull off the small rubber tube at the vacuum supply tank non-return valve.

Slacken off the clip securing the large rubber hose to the vacuum tank.

Remove the two nuts and washers found under the offside front wing securing the vacuum supply tank to the wing valance.

Withdraw the vacuum supply tank.

Note: If difficulty is found in reaching the clip retaining the hose to the vacuum tank, it is permissible to remove the hose from the rear end of the balance pipe.

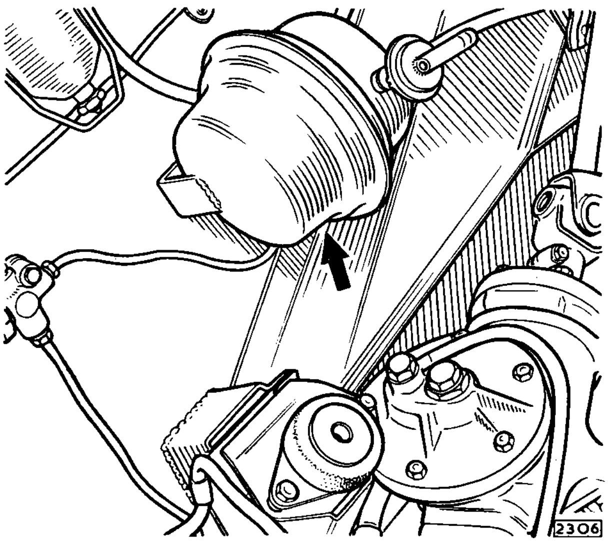


Fig. 6. The vacuum supply tank

Refitting

Refitting is the reverse of the removal procedure.

VACUUM SERVO UNIT (Operating the Scuttle Ventilator)

The servo unit is located behind the facia between the glove compartment and the instrument panel.

Removal

Detach the earth lead from the battery.

Remove the ignition key and cigar lighter.

Remove the thumb screws retaining the instrument panel in position and allow to hinge down.

Remove the three self-tapping screws situated on the left-hand foremost position of the instrument panel recess.

Remove the two setscrews visible under the top rail of the facia immediately above the glove compartment. Remove the two nuts and washers located on the left-hand side of the glove compartment behind the facia.

Disconnect the two electrical cables from the glove box illumination light at the terminal block.

Withdraw the left-hand facia complete with the glove compartment.

Remove the two nuts and earth wire securing the servo unit to the left-hand side of the instrument panel recess. (See Fig. 7).

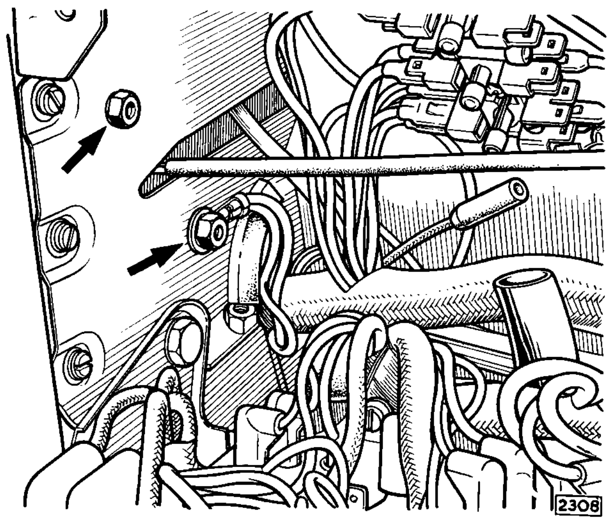


Fig. 7. Showing the two nuts which secure the scuttle vent servo unit

Disconnect the clip retaining the servo unit pull-rod to the scuttle ventilator bell crank lever.

Withdraw the servo unit and disconnect the vacuum tube.

Note: With regard to left-hand drive cars, the servo unit will be found in a similar position on the right-hand side of the vehicle.

Refitting

When refitting the servo unit, it is important to check that the vacuum pipe is not trapped between the servo unit body and the facia panel as the latter is being replaced.

VACUUM SERVO UNIT (Operating the HOT/COLD Heater Flaps)

Removal

Disconnect one of the battery terminals.

Disconnect the two wires from the fan at the snap connectors.

Slacken the three setscrews securing the fan motor and mounting bracket to the heater unit.

Withdraw the motor complete with fan, note plastic foam joint between fan motor mounting and heater unit.

Disconnect vacuum servo suction pipe.

Disconnect the servo return spring.

With the aid of a flexible shaft socket, remove the two nuts, shakeproof washers and plain washers retaining the servo unit in position.

Remove the clip retaining the servo pull-rod to the heater flap.

Remove the vacuum servo unit.

Refitting

Refitting is the reverse of the removal procedure. Care should be taken in refitting the spring as an over-stretched spring will not fully close the vent, and therefore seriously impairing the efficiency of the heater.

FAN MOTOR

Removal

Disconnect one of the battery terminals.

Disconnect the two wires from the fan at the snap connectors.

Slacken the three setscrews securing the fan motor and mounting bracket to the heater unit.

Withdraw the motor complete with the fan.

Remove the fan by slackening off the locking in the centre of the fan.

Slacken off the three setscrews retaining the fan motor to the mounting bracket.

Refitting

Refitting is the reverse of the removal procedure. When reassembling the fan to the motor spindle, check that there is at least an $\frac{1}{8}''$ clearance between the fan and the fan motor mounting bracket, and that the fan is running true on the spindle.

HEATER WATER CONTROL VALVE

Removal

Drain the water from the radiator.

Remove the rubber suction pipe from beneath the water control valve.

Slacken off the clips retaining the water hoses.

Remove the nut and washer situated underneath the water control valve and securing it to the cylinder head bracket and gearbox dipstick bracket.

Remove the water control valve.

It is not possible to strip the valve down any further as it is a sealed unit. Therefore, if it is faulty, it will have to be replaced as a complete unit.

Refitting

When refitting the water control valve, it is always advisable to replace the two small water hoses with new ones. Check that the arrow on the valve is pointing toward the bulkhead, this being the direction of the water flow. (See Fig. 8).

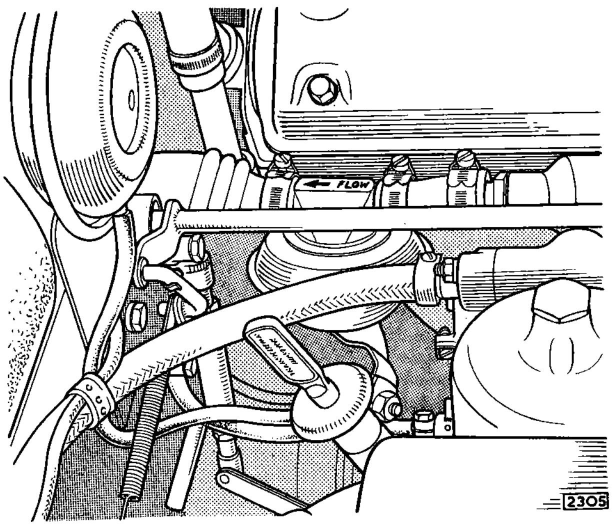


Fig. 8. Showing the location of the water control valve

FAN SWITCH

Removal

Disconnect one of the battery terminals.

Remove the two thumb screws securing the instrument panel to the facia.

Remove the three "Lucar" connectors at the rear of the fan switch.

Unscrew the chrome bezel securing the fan switch to the instrument panel taking care not to scratch the polished face of the instrument panel. It is suggested that a box spanner is used for this operation.

Refitting

Refitting is the reverse of the removal procedure.

AIR TEMPERATURE CONTROL PANEL

Removal

Remove the ashtray.

Remove the console panel complete by putting the hand in the ashtray aperture and pulling the panel out (panel is held in by spring clips).

Mark the position of the vacuum pipes to each connection of the air temperature control panel (see Fig. 9).

Remove the vacuum pipes.

Unscrew the two nuts and shakeproof washers retaining the air temperature control panel to the back of the console.

Refitting

Refitting is the reverse of the removal procedure.

Note: The control panel has no interchangeable parts and therefore no attempt should be made to strip the unit.

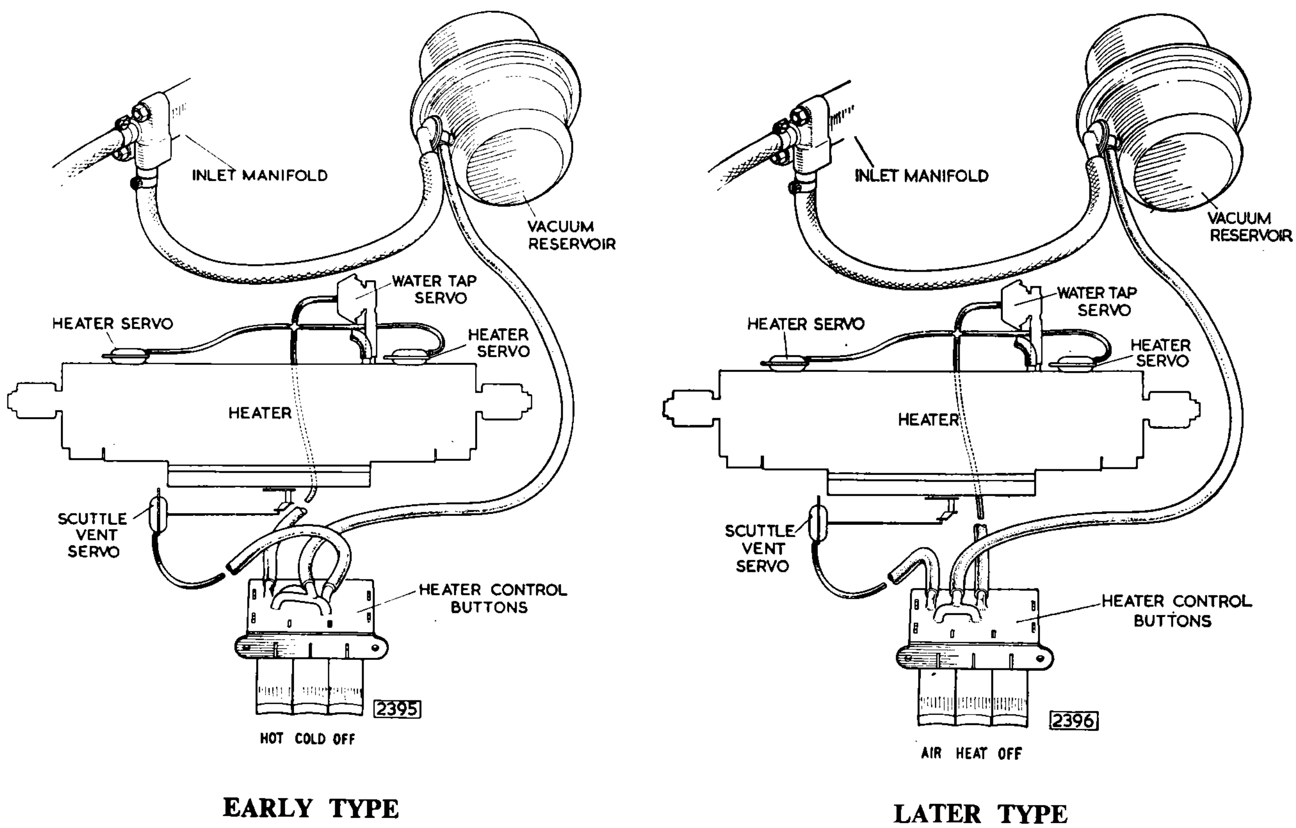


Fig. 9. Layout of heater vacuum system

CAR HEATING AND VENTILATING SYSTEM (LATER TYPE)

From chassis Nos. 300318 R.H. Drive and 350684 L.H. Drive, the operation of the vacuum operated heater controls are altered but the construction and layout is identical with the earlier type.

HEATER CONTROLS

The heater control buttons marked "OFF, HEAT and AIR" are situated below the radio panel, Fig. 10. The "Heat" button operates the water valve and flaps which control the flow of air through the heating element. The "Air" button operates the scuttle ventilator. Operation of the "Off" button automatically cancels the "Heat" and "Air" buttons. The "Heat" button also cancels the "Air" button. If it is desired to have the "Heat" and "Air" in operation at the same time, the "Heat" button must be pressed first (see Fig. 10).

Off

When the "Off" button is pressed the system is inoperative, that is, the scuttle ventilator and water valve are shut.

Heat

To obtain hot or warm air in the car, press the "Heat" button which will open the water valve to supply hot water to the heating element and move the heater flaps to the hot position. Allow the engine to reach normal operating temperature (particularly in cold weather) enabling hot water to circulate through the heater prior to admitting fresh air into the system by pressing the "Air" button which opens the scuttle ventilator.

Air

If fresh air is required, press the "Air" button only and the scuttle vent will open, directing air to the outlets in the car. With the controls in this position air will by-pass the heating element. The fan can be switched on if it is desired to increase the air circulation.

VACUUM SYSTEM

The vacuum system is exactly the same in construction as already described for the early type system apart from the reversal of the connections behind the control buttons.

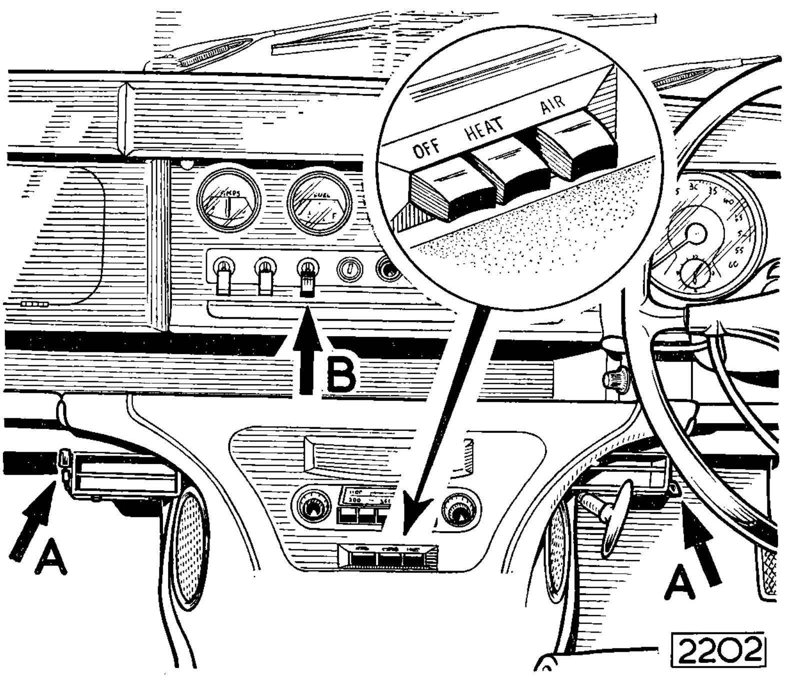


Fig. 10. Heating and ventilating controls (Later type)
A. Front outlets. B. Fan switch

COLD WEATHER

To obtain heating, demisting and defrosting:

(*a*) Depress the button marked HEAT and allow a short period to elapse to permit the heater to warm up.
(*b*) Depress the AIR button.
(*c*) Switch the fan ON at the desired speed.
(*d*) Open the front and rear outlets as desired.

To obtain rapid demisting and defrosting:

(*a*) Depress the button marked HEAT and allow a short period to elapse to permit the heater to warm up.
(*b*) Depress the AIR button.
(*c*) Switch the fan ON at the FAST position.
(*d*) Close the front and rear outlets.

HOT WEATHER

To obtain ventilation and demisting:

(*a*) Depress the button marked AIR.
(*b*) Switch the fan ON at the desired speed.
(*c*) Open the front outlets and rear outlet as desired.

To obtain rapid demisting:

(*a*) Depress the button marked AIR.
(*b*) Switch the fan ON at the FAST position.
(*c*) Close the front outlets and rear outlet.

The vacuum pipe from the scuttle vent is now coupled to the right-hand intake on the heater control panel whilst the vacuum pipe from the water valve and servo operated heater flaps is connected to the left-hand side.

Note: It is advisable when leaving the car in frosty weather to close the scuttle vent by pressing the "off" button.

Removal and refitting of all parts of the heater unit are as described in the earlier section.

WINDSCREEN WASHING EQUIPMENT

The windscreen washer is electrically operated and comprises a glass water container mounted in the engine compartment adjacent to the left-hand side of the radiator (Fig. 11). The container is connected by tubing to two jets located in the windscreen wiper spindle housings. Water is delivered to the jets by an electrically driven pump incorporated in the water container.

OPERATION

The windscreen washer should be used in conjunction with the windscreen wipers to remove foreign matter that settles on the windscreen.

Lift the switch lever (marked "Washer") and release immediately when the washer should operate at once and continue to function for approximately seven seconds. Allow a lapse of time before operating the switch for a second time.

WARNING

If the washer does not function immediately check that there is water in the container.

The motor will be damaged if the switch is held closed for more than one or two seconds if the water in the container is frozen.

The washer should not be used under freezing conditions as the fine jets of water spread over the windscreen by the blades will tend to freeze up.

In the summer the washer should be used freely to remove insects before they dry and harden on the screen.

FILLING-UP

The water should be absolutely CLEAN. If possible use SOFT water for filling the container, but if this is not obtainable and hard water has to be used, frequent operation and occasional attention to the nozzle outlet holes will be amply repaid in preventing the formation of unwelcome deposits.

The correct water level is up to the bottom of the container neck. Do not overfill, or unnecessary splashing may result. Always replace the rubber filler cover correctly after filling, pressing it fully home.

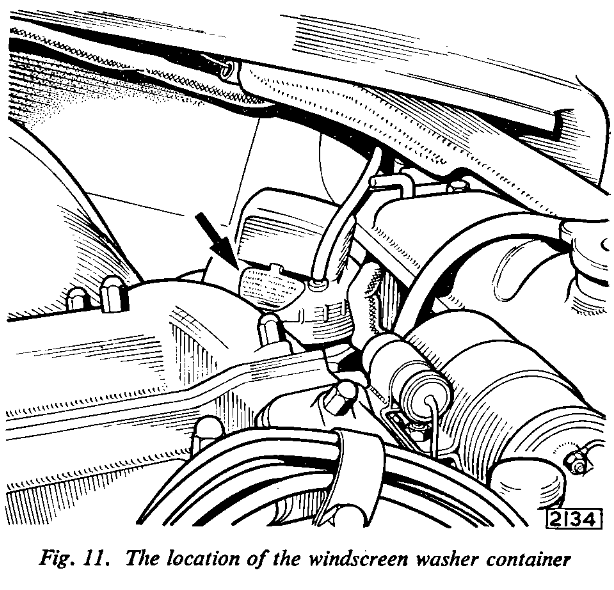


Fig. 11. The location of the windscreen washer container

It is not possible to empty the container completely with the pump. **Refilling is necessary when the water level has fallen so that the top of the auxiliary reservoir is uncovered.** About 30 full operations will be obtained from one filling.

When using the washer, an indication of the need to refill the container is given by the behaviour of the unit. The time taken for the auxiliary reservoir to refill increases as the water level in the container falls.

As soon as the water level has fallen to the top of the auxiliary reservoir, the amount of water delivered to the windscreen will decrease with successive operations and the time the unit runs will, in proportion, become less.

If the water level is allowed to fall still further, until it is down to the bottom of the auxiliary reservoir, the automatic action will cease and water will be delivered to the windscreen only as long as the switch is operated. This will continue until the water level has fallen to the inlet orifices, when the pump will be above the water level and no water will be available for delivery to the windscreen.

Do not continue to operate the switch after the available water has been used up, otherwise damage may be caused to the unit.

Refilling the container will restore normal operation of the unit.

COLD WEATHER

To avoid damage by frost, add denatured alcohol (methylated spirits) as follows:

The underside of the rubber filler cover will be found to form a measure. Two measures of denatured alcohol should be added per container of water. USE NO OTHER ADDITIVES WHATSOEVER.

ADJUSTING THE JETS

With a screwdriver turn each nozzle in the jet holder until the jets of water strike the windscreen in the area swept by the wiper blades. It may be necessary to adjust the nozzles slightly after a trial on the road due to the jets of water being deflected by the air stream.

JET NOZZLES

Cleaning

To clear a blocked jet nozzle completely unscrew the nozzle from the jet holder. Clear the small orifices with a thin piece of wire or blow out with compressed air; operate the washer with the nozzle removed. Allow the water to flush through the jet holder and then replace the nozzle.

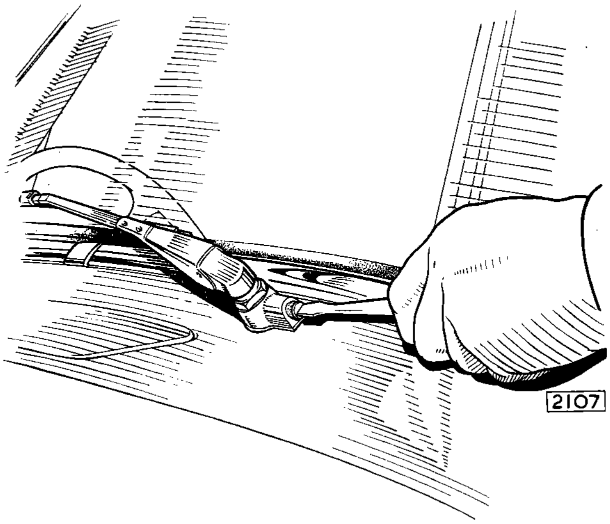


Fig. 12. Adjusting the windscreen washer jets

LUBRICATION

If, after lengthy service, the motor is found to be running slowly, unscrew the moulded cover from the container and apply one or two drops only of thin machine oil to the felt pad situated in the gap between the cover and the motor unit. Do not over-lubricate or excess oil may find its way into the water container when the cover is refitted, with consequent smearing of the windscreen.

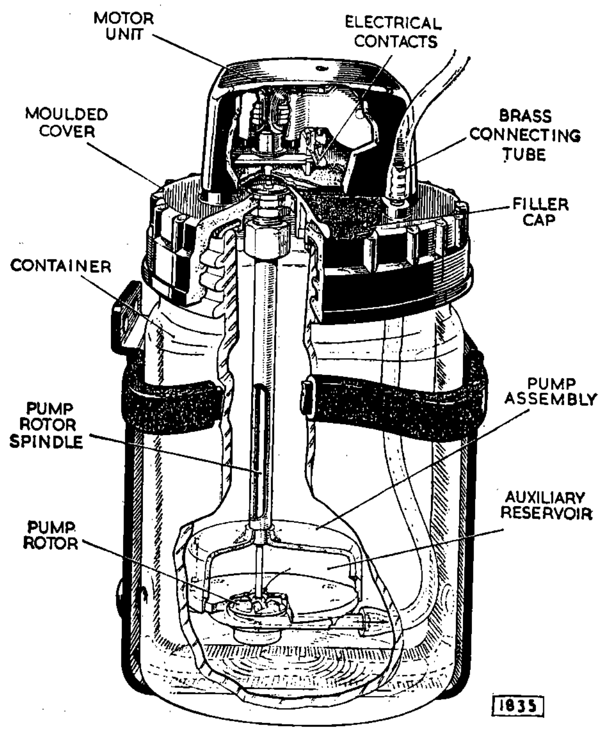


Fig. 13. The windscreen washer water container

SECTION P

ELECTRICAL AND INSTRUMENTS

3·8 MARK 10 MODEL

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Battery

Distributor

Flasher Units

Fuse Unit

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Starter Motor

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Instruments *(continued)*

ELECTRICAL AND INSTRUMENTS

BATTERY

The Lucas FRV11A battery is of the semi-linkless type, the short cell inter-connectors being partially exposed to enable testing of the individual cells to be carried out with a heavy discharge tester.

DATA

Battery type	FRV11A
Voltage	12
Number of plates per cell	11
Capacity at 10-hour rate ..	60 ampere hours
Capacity at 20-hour rate ..	67 ampere hours

ROUTINE MAINTENANCE

Wipe away any foreign matter or moisture from the top of the battery, and ensure that the connections and the fixings are clean and tight.

About once a month, or more frequently in hot weather, examine the level of the electrolyte in the cells. If necessary add distilled water to bring the electrolyte just level with the separator guards, which can be seen when the vent plugs are removed.

The use of a Lucas battery filler will be found helpful in this topping-up process, as it ensures that the correct electrolyte level is obtained automatically and also prevents distilled water from being spilled over the battery top.

Distilled water should always be used for topping-up. In an emergency however, clean soft rain water collected in an earthenware container may be used.

Note: Never use a naked light when examining a battery, as the mixture of oxygen and hydrogen given off by the battery when on charge, and to a lesser extent when standing idle, can be dangerously explosive.

REMOVAL

Unscrew the two wing nuts retaining the battery retaining clamp; remove the fixing rods and strap. Disconnect the terminals and lift out the battery from the cradle.

REFITTING

Refitting is the reverse of the removal procedure. Before refitting the cable connectors, clean the terminals and coat with petroleum jelly.

PERSISTENT LOW STATE OF CHARGE

First consider the conditions under which the battery is used. If the battery is subjected to long periods of discharge without suitable opportunities for recharging, a low state of charge can be expected. A fault in the generator or regulator, or neglect of the battery during a period of low or zero mileage may also be responsible for the trouble.

Vent Plugs

See that the ventilating holes in each vent plug are clear.

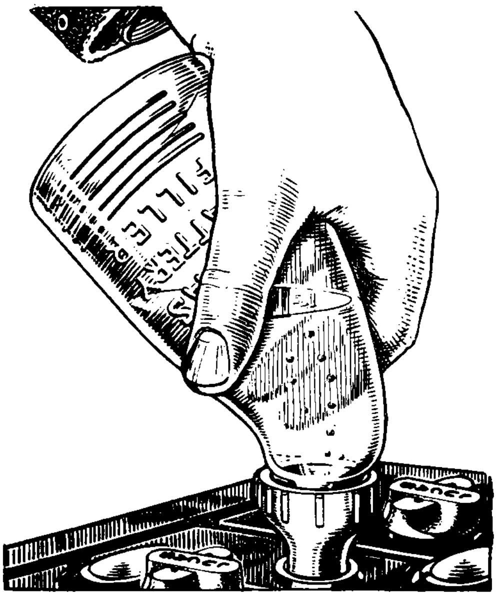


Fig. 1. Lucas battery filler

Level of Electrolyte

The surface of the electrolyte should be just level with the tops of the separator guards. If necessary, top up with distilled water. Any loss of acid from spilling or spraying (as opposed to the normal loss of **water** by evaporation) should be made good by dilute acid of the same specific gravity as that already in the cell.

Cleanliness

See that the top of the battery is free from dirt or moisture which might provide a discharge path. Ensure that the battery connections are clean and tight.

Hydrometer Tests

Measure the specific gravity of the acid in each cell in turn with a hydrometer. To avoid misleading readings, do not take hydrometer readings immediately after topping-up.

The readings given by each cell should be approximately the same. If one cell differs appreciably from the others, an internal fault in the cell is indicated.

The appearance of the electrolyte drawn into the hydrometer when taking a reading gives a useful indication of the state of the plates. If the electrolyte is very dirty, or contains small particles in suspension, it is possible that the plates are in a bad condition.

The specific gravity of the electrolyte varies with the temperature, therefore, for convenience in comparing specific gravities, this is always corrected to 60°F., which is adopted as a reference temperature. The method of correction is as follows:—

For every 5°F. below 60°F. deduct ·002 from the observed reading to obtain the true specific gravity at 60°F.

For every 5°F. above 60°F. add ·002 to the observed reading to obtain the true specific gravity at 60°F.

The temperature must be that indicated by a thermometer actually immersed in the electrolyte, and not the air temperature.

Compare the specific gravity of the electrolyte with the values given in the table and so ascertain the state of charge of the battery.

If the battery is in a discharged state, it should be recharged, either on the vehicle by a period of day-time running or on the bench from an external supply, as described under "Recharging from an External Supply."

Discharge Test

A heavy discharge tester consists of a voltmeter, 2 or 3 volts full scale, across which is connected a shunt resistance capable of carrying a current of 150–160 amperes. It is important to use only a suitably rated instrument. Pointed prongs are provided for making contact with the inter-cell connectors.

Press the contact prongs against the exposed positive and negative terminals of each cell. A good cell will maintain a reading of 1·2–1·5 volts, depending on the state of charge, for 10 seconds. If, however, the reading rapidly falls off, the cell is probably faulty and a new plate assembly may have to be fitted.

RECHARGING FROM AN EXTERNAL SUPPLY

If the battery tests indicate that the battery is merely discharged, and is otherwise in a good condition, it should be recharged, either on the vehicle by a period of day-time running or on the bench from an external supply.

If the latter, the battery should be charged at 6 amperes unti lthe specific gravity and voltage show no increase over three successive hourly readings. During the charge the electrolyte must be kept level with the tops of the separator guards by the addition of distilled water.

A battery that shows a general falling-off in efficiency common to all cells, will often respond to the process known as "cycling." This process consists of fully charging the battery as described above and then discharging it by connecting to a lamp board, or other load, taking a current of 5 amperes. The battery should be capable of providing this current for at

State	Home and climates with shade temperature ordinarily below 80°F (26·6°C). Specific gravity of electrolyte (corrected to 60°F)	Climates with shade temperature frequently over 80°F (26·6°C). Specific gravity of electrolyte (corrected to 60°F)
Fully charged	1·270—1·290	1·210—1·230
About half discharged	1·190—1·210	1·130—1·150
Completely discharged	1·110—1·130	1·050—1·070

least 7 hours before it is fully discharged, as indicated by the voltage of each cell falling to 1·8. If the battery discharges in a shorter time, repeat the "cycle" of charge and discharge.

PREPARING NEW UNFILLED, UNCHARGED BATTERIES FOR SERVICE

Preparation of Electrolyte

Batteries should not be filled with acid until required for initial charging.

Electrolyte of the specific gravity required is prepared by mixing distilled water and concentrated sulphuric acid, usually of 1·835 specific gravity. The mixing must be carried out either in a lead-lined tank or in a suitable glass or earthenware vessel. Slowly add the acid to the water, stirring with a glass rod. **Never add the water to the acid,** as the resulting chemical reaction causes violent and dangerous spurting of the concentrated acid. The correct specific gravity for the filling acid and approximate proportions of acid and water are indicated in the following table:—

Specific Gravity of Filling Acid (corrected to 60°F)	
Home and Climates with shade temperature ordinarily below 80°F (26·6°C) 1·270 Add 1 part by volume of acid (1·835 S.G.) to 2·8 parts of distilled water to mix this electrolyte	Climates with shade temperatures frequently above 80°F (26·6°C) 1·210 Add 1 part by volume of acid (1·835 S.G.) to 4 parts of distilled water to mix this electrolyte
Quantity of electrolyte required per cell 1¼ pints approximately (720 cc.)	

Heat is produced by the mixture of acid and water, and the electrolyte should be allowed to cool before taking hydrometer readings—unless a thermometer is used to measure the actual temperature, and a correction applied to the reading before pouring the electrolyte into the battery.

Filling the Battery

The temperature of the acid, battery and filling-in must not be below 32°F.

Carefully break the seals in the filling holes and fill each cell to the level of the separator guard with electrolyte of the appropriate specific gravity. Allow the battery to stand for twelve hours, in order to dissipate the heat generated by the chemical action of the acid on the plates and separators. Restore levels by adding more acid of the same specific gravity and then proceed with the initial charge.

Initial Charge Rate

Charge at a rate of 4 amps until the voltage and specific gravity readings show no increase over five successive hourly readings. This may take up to 80 hours, depending on the length of time the battery has been stored before charging.

Keep the current constant by varying the series resistance of the circuit or the generator output.

This charge should not be broken by long rest periods. If, however, the temperature of any cell rises above the permissible maximum (that is, 100°F. for batteries filled with 1·270 S.G. acids, 120°F. for those with 1·210 S.G. acid), the charge must be interrupted until the temperature has fallen at least 10°F., below that figure. Throughout the charge, the electrolyte must be kept level with the top of the separator guards by the addition of acid solution of the same specific gravity as the original filling-in acid, until the specific gravity and voltage readings have remained constant for five successive hourly readings. If the charge is continued beyond that point, top up with distilled water.

At the end of the charge carefully check the specific gravity in each cell to ensure that, when corrected to 60°F., it lies within the specified fully-charged limits. If any cell requires adjustment, some of the electrolyte must be siphoned off and replaced either by distilled water or by acid of the strength originally used for filling-in, depending on whether the specific gravity is too high or too low. Continue the charge for an hour or so to ensure adequate mixing of the electrolyte and again check the specific gravity readings. If necessary, repeat the adjustment process until the desired reading is obtained in each cell. Finally, allow the battery to cool, and siphon off any electrolyte above the tops of the separator guards.

PREPARING NEW "DRY-CHARGED" BATTERIES FOR SERVICE

Filling the Cells

Carefully break the seals in the filling holes and fill each cell with correct specific gravity acid as shown in the table on page P.8 to the top of the separator guards in one operation. The temperatures of the filling room, battery and acid should be maintained at between 60°F. and 100°F. If the battery has been stored in a cool place, it should be allowed to warm up to room temperature before filling.

Freshening Charge

Batteries filled in this way are up to 90% charged and capable of giving a starting discharge one hour after filling. When time permits, however, a short freshening charge will ensure that the battery is fully charged.

Such a freshening charge should be 5 amperes for not more than 4 hours.

During the charge the electrolyte must be kept level with the top of the separators by the addition of distilled water. Check the specific gravity of the electrolyte at the end of the charge; if 1·270 acid was used to fill the battery, the specific gravity should now be between 1·270 and 1·290; if 1·210 acid, between 1·210 and 1·230.

Maintenance in Service

After filling, a dry-charged battery needs only the attention normally given to all lead-acid type batteries.

DISTRIBUTOR

REMOVAL

Spring back the clips and remove the distributor cap.

Disconnect the low tension wire from the distributor.

Disconnect the vacuum pipe by unscrewing the union nut at the vacuum advance unit.

Remove distributor clamping plate retaining set-screw and withdraw distributor.

REFITTING

If the distributor clamping plate pinch bolt has not been slackened during removal of distributor refitting will be the reverse of the removal procedure. Enter the distributor into the cylinder block with the vacuum advance unit connection facing the cylinder block.

Rotate the rotor arm until the driving dog engages with the distributor drive shaft.

If the distributor clamping plate pinch bolt has been slackened during removal of distributor it will be necessary to reset the ignition timing as follows:—

Ignition Timing

Set the micrometer adjustment in the centre of the scale.

Connect the low tension wire to the terminal on the distributor body.

Enter the distributor into the cylinder block with the vacuum advance unit connection facing the cylinder block.

Rotate the rotor arm until the driving dog engages with the distributor drive shaft.

Rotate the engine until the rotor arm approaches the No. 6 (front) cylinder segment in the distributor cap.

Slowly rotate the engine until the ignition timing scale on the crankshaft damper is the appropriate number of degrees before the pointer on the sump. (See Data).

Connect a 12 volt test lamp with one lead to the distributor terminal (or the CB terminal of the ignition coil) and the other to a good earth.

Slowly rotate the distributor body until the points are just breaking, that is, when the lamp lights up.

Tighten the distributor plate pinch bolt.

A maximum of six clicks on the vernier adjustment from this setting, to either advance or retard, is allowed.

ROUTINE MAINTENANCE

Distributor Contact Breaker Points

Every 2,500 miles (4,000 km.), (500 miles (800 km.) with new contact set), check the gap between the contact points with feeler gauges when the points are fully opened by one of the cams on the distributor shaft. A combined screwdriver and feeler gauge is provided in the tool kit.

The correct gap is ·014″—·016″ (·36—·41 mm.).

If the gap is incorrect, slacken the two screws securing the fixed contact plate and turn the eccentric-headed adjustment screw in its slot until the required gap is obtained. Tighten the securing screws and recheck the gap. (Fig. 3).

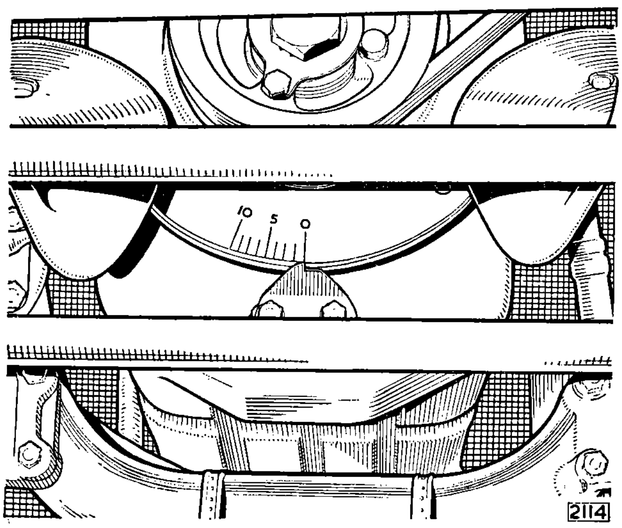


Fig. 2. Ignition timing scale on crankshaft damper

Later Cars

If the gap is incorrect, slacken (very slightly) the contact plate securing screw and adjust the gap by turning a screwdriver in the slot in the contact plate (clockwise to decrease the gap and anti-clockwise to increase the gap). Tighten the securing screw and recheck the gap.

Lubrication—Every 2,500 miles (4,000 km.)

Remove the moulded cover and withdraw the rotor arm. A tight rotor arm can be withdrawn by using a suitable pair of levers carefully applied at opposite points below the rotor moulding—never against the metal electrode.

Important: Do not allow oil or grease on or near the contacts when carrying out the following lubrication.

Cam Bearing

To lubricate the cam bearing, inject a few drops of thin machine oil into the rotor arm spindle (Fig. 3). Do not remove or slacken the screw located inside the spindle—a space is provided beneath the screwhead to allow the lubricant to reach the cam bearing.

Pivot Post

Place a drop of clean engine oil on the tip of the pivot post (see Fig. 3).

Cam

Lightly smear the faces of the cam (Fig. 3) with Mobilgrease No. 2 or with clean engine oil.

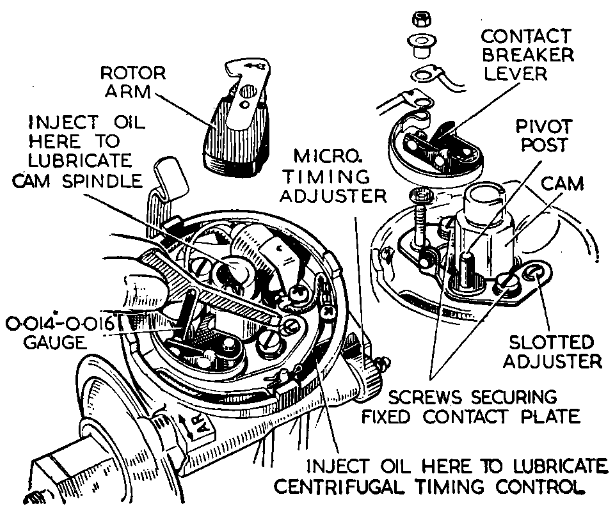


Fig. 3. Checking distributor gap and lubrication points (early cars)

Centrifugal Timing Control

Inject a few drops of thin machine oil through a convenient aperture in the contact breaker base plate.

Cleaning

Clean the moulded cover inside and outside with a soft dry cloth. Pay particular attention to spaces between the terminals. Check that the small carbon brush inside the moulding can move freely in its holder.

Whilst the rotor arm is removed, examine the contact breaker. Rough, burned or blackened contacts can be cleaned with fine carborundum stone or emery cloth. After cleaning remove any grease or metallic dust with a petrol moistened cloth.

Contact cleaning is facilitated by removing the lever to which the moving contact is attached. To do this, remove the nut, insulating piece and electrical connections from the post to which the contact breaker spring is anchored. The contact breaker lever can then be lifted off the pivot post and the spring from the anchor post.

After cleaning and trimming the contacts, smear the pivot post (Fig. 3) with Ragosine Molybdenised Non-creep Oil or with Mobilgrease No. 2. Reassemble the contact breaker and check the setting.

Refit the rotor·arm, carefully locating its moulded projection in the spindle keyway and pushing it on as far as it will go.

DATA

Ignition Distributor Type	DMBZ.6A
8 to 1 Compression Ratio	40828A
9 to 1 Compression Ratio	40828A
Cam dwell angle	32°- 38° (with contact breaker heel bedded and contacts set to the correct gap)
Contact breaker gap	0·014"—0·016" (0·36—0·41 mm.)
Contact breaker spring tension (measured at free contact)	18—24 ozs. (512—682 gms.)

Refit the moulded cover and spring the two side clips into position.

IGNITION TIMING

8 to 1 Compression Ratio	9° BTDC
9 to 1 Compression Ratio	10° BTDC

SERVICING

Dismantling

When dismantling, note carefully the position in which the various components are fitted in order to simplify their reassembly.

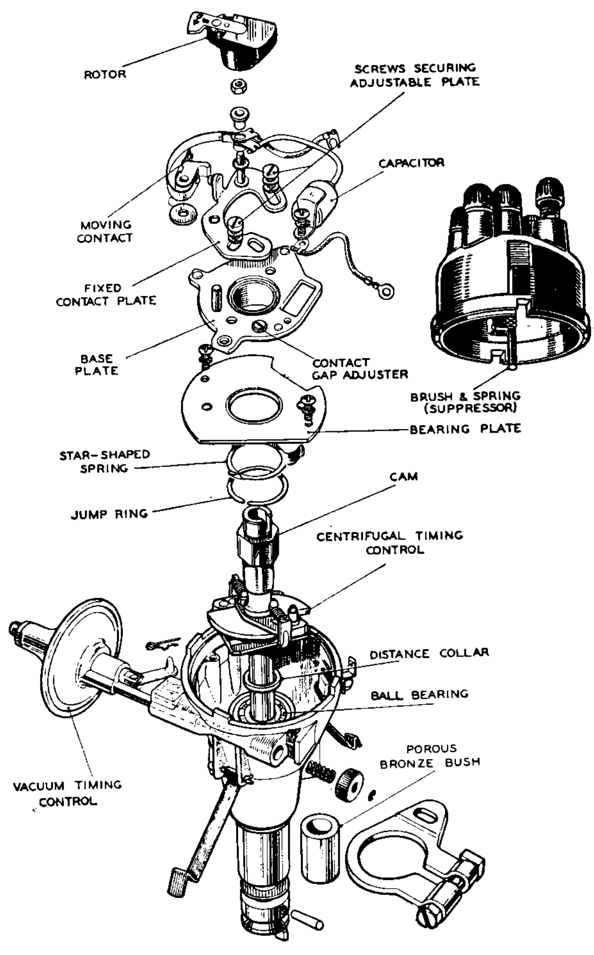


Fig. 4. Exploded view of the distributor (early cars).

Bearing Replacement

The ball bearing at the upper end of the shank can be removed with a shouldered mandrel locating on the inner journal of the bearing.

When fitting a new ball bearing, the shouldered mandrel must locate on both inner and outer journals of the bearing.

The bearing bush at the lower end of the shank can be driven out with a suitable punch.

A bearing bush may be prepared for fitting by allowing it to stand completely immersed in medium viscosity (S.A.E. 30—40) engine oil for at least 24 hours. In cases of extreme urgency, this period of soaking may be shortened by heating the oil to 100°C. for 2 hours and then allowing to cool before removing the bush.

The bush is pressed into the shank with a shouldered mandrel. The mandrel should be hardened and polished and approximately 0·0005″ greater in diameter than the distributor shaft. To prevent subsequent withdrawal of the bush with the mandrel, a stripping washer should be fitted between the shoulder of the mandrel and the bush.

Under no circumstances should the bush be over-bored by reaming or by any other means, since this will impair the porosity and therefore the lubricating quality of the bush.

Reassembly

When reassembling, Ragosine molybdenised non-creep oil or (failing this) clean engine oil, should be smeared on the shaft and, more lightly, on the contact breaker bearing plate.

IGNITION DISTRIBUTOR TEST DATA (DMBZ6A)

			VACUUM TIMING ADVANCE TESTS The distributor must be run immediately below the speed at which the centrifugal advance begins to function to obviate the possibility of an incorrect reading being registered.				CENTRIFUGAL TIMING ADVANCE TESTS Mount distributor in centrifugal advance test rig and set to spark at zero degrees at 100 r.p.m.				
Distributor Type	Lucas Service Number	Lucas Vacuum Unit Number	Vacuum in inches of mercury and advance in degrees: Inches	Degrees	No advance in timing below-ins. of mercury	Lucas Advance Springs Number	Accelerate to-RPM and note advance in degrees: RPM	Degrees	Decelerate to-RPM and note advance in degrees: RPM	Degrees	No advance in timing below-RPM
DMBZ 6A	40828A	54412348	20 13 9 7½ 6	7—9 6—8½ 2½—5½ 0—3 0—½	4½	54414898/S	2.300	8½—10½	1,800 1,250 800 650 500	8½—10½ 6½—8½ 5—7 2—4 0—1	400

Auto advance weights Lucas number 410033/S. One inch of mercury = 0·0345 kg/cm²

FLASHER UNITS

The flasher unit is housed in a cylindrical container plugged into a base block which is a part of the main wiring harness, and is attached to the bulkhead behind the instrument panel on the driver's side.

The electrical contact is made by means of three blades, extending from the base of the unit. These blades are offset to prevent any possibility of a wrong connection being made.

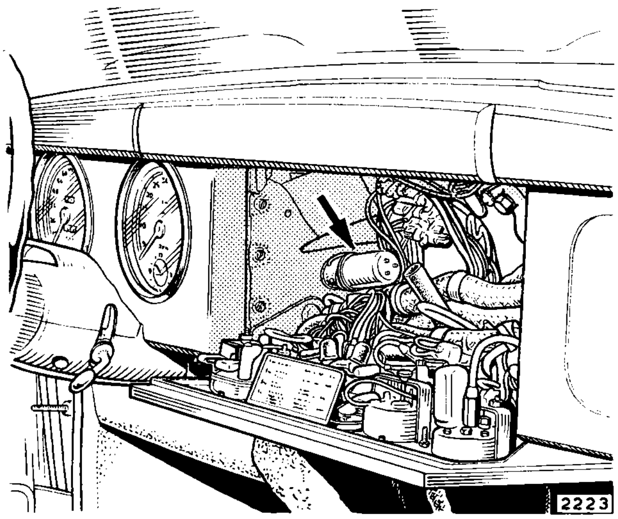


Fig. 5. Showing the position of the flasher unit behind instrument panel

The automatic operation of the flasher lamps is controlled by means of a switch, contained in the flasher unit, being operated automatically by the alternative heating and cooling of an actuating wire; also incorporated is a small relay to flash the indicator warning lights when the system is functioning correctly. Failure of either of these lights to flash will indicate a fault.

In the event of trouble occurring the following procedure should be followed:—

(i) Check bulbs for broken filaments.

(ii) Refer to the wiring diagram and check all flasher circuit connections.

(iii) Switch on the ignition and check with a voltmeter that flasher unit terminal "B" is at 12 volts, with respect to earth.

(iv) Connect together flasher unit terminals "B" and "L" and operate the direction indicator switch. If the flasher lamps now light the flasher unit is defective and must be replaced.

(v) If after the above checks the bulb still does not light a fault is indicated in the flasher switch which is best checked by substitution.

Note: It is important that only bulbs of the correct wattage rating (that is, 21 watts) are used in the flasher lamps.

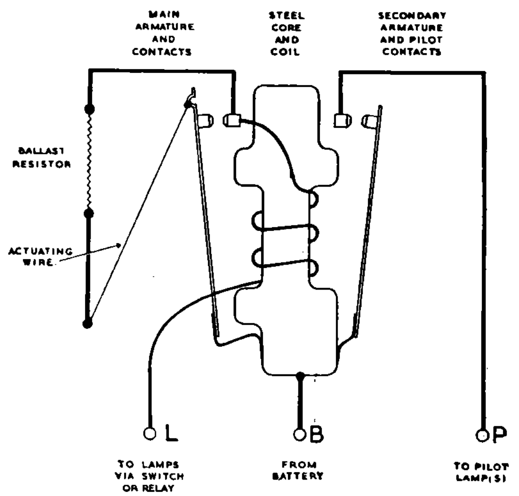


Fig. 6. Flasher unit circuit diagram

FUSE UNITS

Four fuse units (Model 4FJ), carrying a total of eight live fuses and eight spares, are incorporated in the electrical system and are located behind the instrument panel. Two units each carry two 35 ampere live fuses and two spares. The remaining units carry one 50 ampere live fuse with a spare, and one 5 ampere live fuse with a spare.

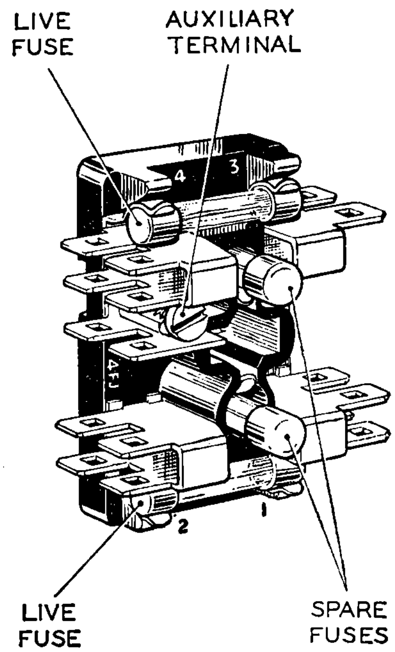


Fig. 7. The 4J fuse unit

It is essential that a "blown" fuse be replaced by one of the metal-ended glass cartridge type containing a slip of coloured paper to denote the rating in amperes (see chart below) to indicate (by scorching) when a fuse has blown.

Access to the fuses is obtained by removing the two instrument panel retaining screws (top left-hand and right hand corners). The instrument panel will then hinge downwards exposing the fuses and the fuse indicator panel. The circuits controlled by individual fuses are shown on the indicator panel.

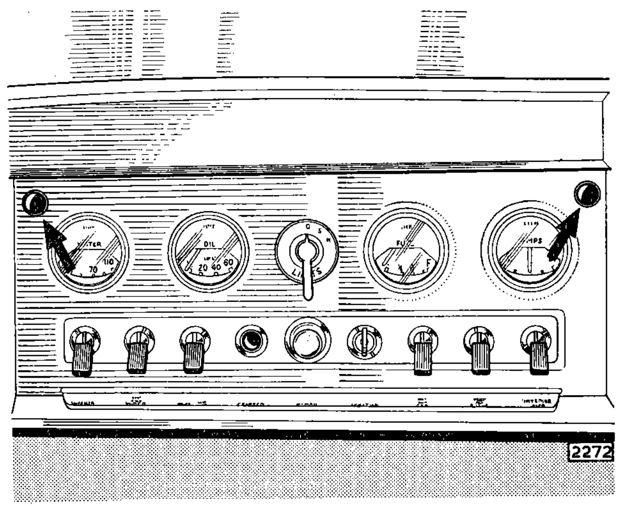


Fig. 8. Showing instrument panel removal screws

Only one end of the spare fuse is visible and they are retained in position by a small spring clip. Always replace the spare fuse as soon as possible.

Fuse Rating (amperes)	**Identity Colours**
5	Red printing on Yellow paper.
35	Black printing on White paper.
50	Purple printing on Yellow paper.

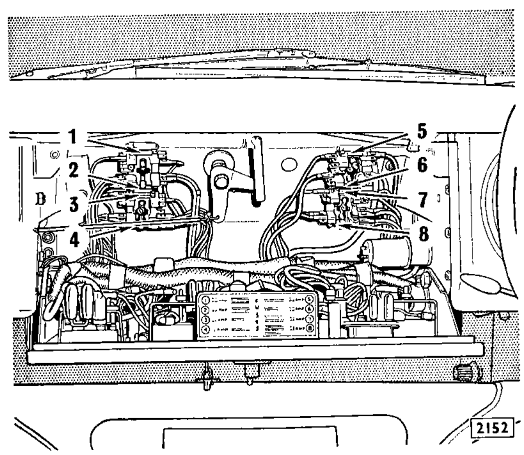


Fig. 9. Location of fuses

GENERATOR — MODEL C48

GENERAL

The generator is a shunt-wound two-pole two-brush machine, arranged to work on conjunction with a current-voltage control unit. A fan, integral with the driving pulley, draws cooling air through the generator, inlet and outlet holes being provided in the end bracket of the unit.

Ball race bearings are provided at each end of the armature. At the commutator end the bearing outer race is a sliding fit in the commutator end bracket while the inner race is a press fit onto the armature shaft. The drive-end bearing is secured with a die-cast retaining plate and four countersunk screws, the end of the screws being caulked over on to the outer face of the bracket.

ROUTINE MAINTENANCE

Inspection of Brushgear

Every 24,000 miles (38,000 km.) the generator should be removed from the engine and the brushgear checked as described under "Servicing—Testing in position" paragraph vi.

REMOVAL

Disconnect the cables from the two terminals at the rear of the generator noting that they are of different sizes.

Disconnect the hoses at the unions on the pump assembly (attached to the rear of the generator) and place the hoses in a raised position to prevent drainage of the oil. Alternatively, allow the oil to drain into a clean container.

Remove the nut and bolt securing the adjusting link to the generator.

Remove the generator belt by pushing the spring loaded jockey pulley inwards and lifting the belt over the generator pulley.

Remove the two nuts and bolts securing the generator to the mounting bracket when the generator can be lifted out.

REFITTING

Refitting is the reverse of the removal procedure. When replacing the generator belt, hold the spring loaded jockey pulley in towards the block and only release when the belt is sitting securely in the twin "vee" tracks.

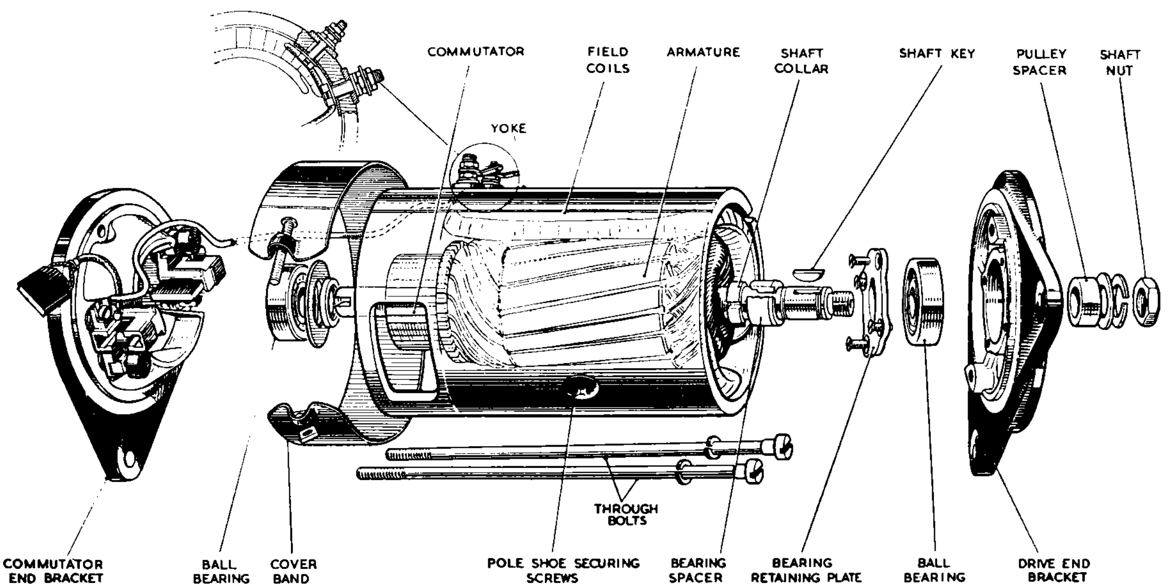


Fig. 10. Exploded view of generator

PERFORMANCE DATA

Cutting-in speed ..	850 (max.) r.p.m. at 13 generator volts
Maximum output ..	35 amps. at 1,650 (max.) r.p.m. at 13·5 generator volts (on resistance load of 0·385 ohm)
Field resistance ..	6·0 ohms

SERVICING

Testing in position to locate fault in charging circuit

In the event of a fault in the charging circuit, adopt the following procedure to locate the cause of trouble.

(i) Check that the generator and the control box are connected correctly. The larger generator terminal must be connected to control box terminal "D" and the smaller generator terminal to control box terminal "F."

(ii) Disconnect the cables from the generator terminals and connect the two terminals with a short length of wire.

(iii) Start the engine and set to run at normal idling speed.

(iv) Clip the negative lead of a moving-coil voltmeter, calibrated 0–20 volts, to one generator terminal and the other lead to a good earthing point on the yoke.

(v) Gradually increase the engine speed, when the voltmeter reading should rise rapidly and without fluctuation. Do not allow the voltmeter reading to reach 20 volts and do not race the engine in an attempt to increase the voltage. It is sufficient to run the generator up to a speed of 1,000 r.p.m. If the voltage does not rise rapidly and without fluctuation the unit must be dismantled for internal examination, see "To Dismantle." Excessive sparking at the commutator in the above test indicates a defective armature which should be replaced.

(vi) Remove the cover band and examine the brushes and commutator. Hold back each brush spring and move the brush by pulling gently on its flexible connector. If the movement is sluggish, remove the brush from its holder and ease the sides by gently polishing on a smooth file. Always refit a brush in its original position. Brushes must be replaced when worn to $\frac{11}{32}''$ (8·73 mm.) in length.

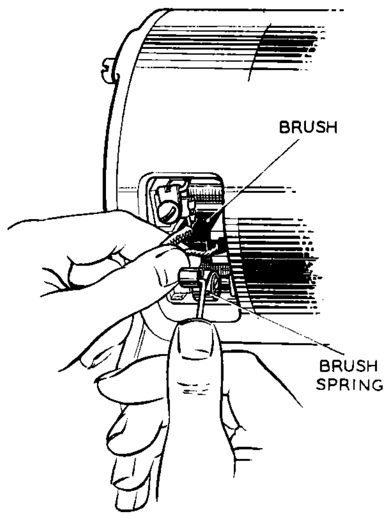


Fig. 11. Checking the brush gear

Test the brush spring tension with a spring balance. The spring force on a new brush should be 25 oz. (720 grms.), and on a brush worn to its minimum length 16 oz. (460 grms.)—both values being measured radially to the commutator. Fit new springs if the tension is low.

If the commutator is blackened or dirty, clean it by holding a petrol-moistened cloth against it while the engine is turned slowly by hand. Re-test the generator as in (vi); if there is still no reading on the voltmeter, there is an internal fault and the complete unit, if a spare is available, should be replaced. Otherwise the unit must be dismantled (see "To Dismantle") for internal examination.

(vii) If the generator is in good order, remove the link from between the terminals and restore the original connections, taking care to connect the larger generator terminal to control box terminal "D" and the smaller generator terminal to control box terminal "F."

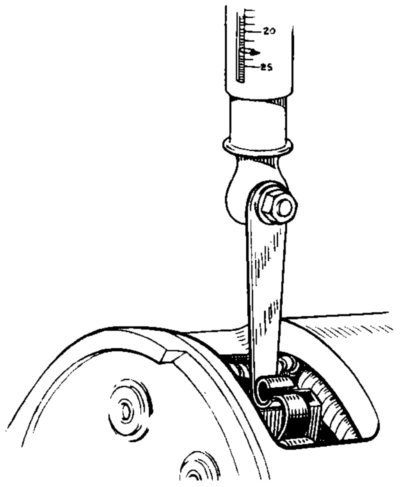


Fig. 12. Testing the brush spring tension

To Dismantle

(i) Take off the driving pulley.
(ii) Remove the cover band, hold back the brush springs and remove the brushes from their holders.
(iii) Unscrew and withdraw the two through bolts.
(iv) The commutator end bracket can be withdrawn from the generator yoke, after removing the "D" terminal.
(v) The driving end bracket together with the armature can now be lifted out of the yoke.
(vi) The driving end bracket need not be separated from the shaft unless the bearing is suspected and requires examination, or the armature is to be replaced; in this event the armature should be removed from the end bracket by means of a hand press.

Assembly is the reverse of the dismantling procedure.

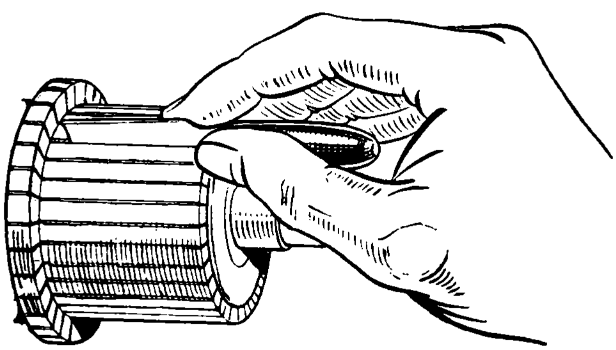


Fig. 13. Undercutting the commutator insulation

Commutator

A commutator in good condition will be smooth and free from pits or burned spots. Clean the commutator with a petrol-moistened cloth. If this is ineffective, carefully polish with a strip of fine glass paper while rotating the armature. To remedy a badly worn commutator, mount the armature, with or without drive end bracket, in a lathe, rotate at high speed and take a light cut with a very sharp tool. Do not remove more metal than is necessary. Polish the commutator with very fine glass paper. Undercut the insulators between the segments to a depth of $\frac{1}{32}$" (·8 mm.) with a hacksaw blade ground to the thickness of the insulator.

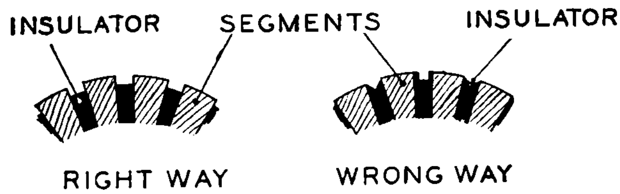


Fig. 14. Showing the correct and incorrect way of undercutting the commutator insulation

Armature

The testing of the armature winding requires the use of a volt-drop test and growler. If these are not available, the armature should be checked by substitution. No attempt should be made to machine the armature core or to true a distorted armature shaft.

To remove the armature shaft from the drive end bracket and bearing, support the bearing retaining plate firmly and press the shaft out of the drive end bracket. When fitting the new armature, support the inner journal of the ball bearing whilst pressing the armature shaft firmly home.

Field Coils

Measure the resistance of the field coils, without removing them from the generator yoke, by means of an ohm meter connected between the field terminal and yoke. The ohm meter should read 6·0 ohms. If an ohm meter is not available connect a 12 volt D.C. supply with an ammeter in series between the field terminal and generator yoke. The ammeter reading should be approximately 2 amperes.

No reading on the ammeter, or an infinite ohm meter reading, indicates an open circuit in the field winding. If the current reading is much more than 2 amperes, or the ohm meter reading much below 6 ohms, it is an indication that the insulation of one of the field coils has broken down.

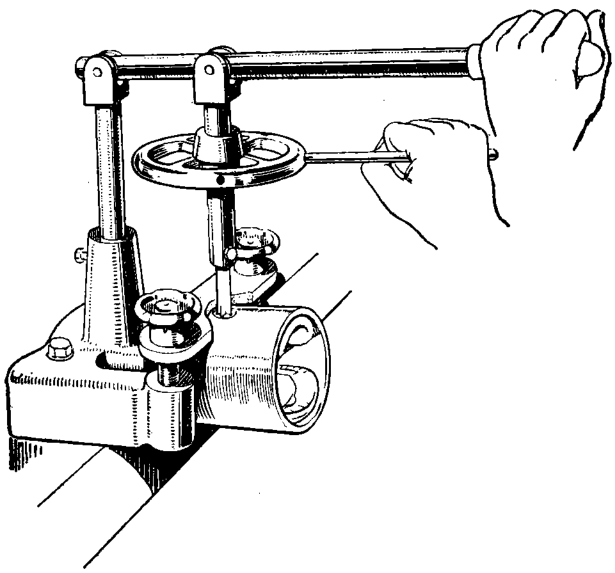


Fig. 15. Tightening the pole shoe retaining screw

In either case, unless a substitute generator is available, the field coils must be replaced. To do this, carry out the procedure outlined below, using a wheel-operated screwdriver.

(i) Remove the field coil terminal from the yoke, and unsolder the field coil connections.

(ii) Remove the insulation piece which is provided to prevent the junction of the field coils from contacting with the yoke.

(iii) Mark the yoke and pole shoes so that the latter can be refitted in their original positions.

(iv) Unscrew the two pole shoe retaining screws by means of the wheel-operated screwdriver.

(v) Draw the pole shoes and coils out of the yoke and lift off the coils.

(vi) Fit the new field coils over the pole shoes and place them in position inside the yoke. Take care to ensure that the taping of the field coils is not trapped between the pole shoes and the yoke.

(vii) Locate the pole shoes and field coils by lightly tightening the fixing screws.

(viii) Fully tighten the screws by means of the wheel-operated screwdriver.

(ix) Replace the insulation piece between the field coil connections and the yoke.

(x) Resolder the field coil connections to the field coil terminal and refit to the yoke.

Bearings

It is extremely unlikely that bearing wear, sufficient to necessitate replacement, will be found to occur during the normal life of the generator. If, however, such wear is found to have taken place, the bearing must be replaced.

The ball bearing at the driving end is replaced as follows:—

(i) Withdraw the screws which secure the bearing retaining plate to the end bracket and remove the plate.

(ii) Press the bearing out of the end bracket.

(iii) Before fitting the replacement bearing see that it is clean and pack it with high melting point grease.

(iv) Locate the bearing in the housing and press it home.

(v) Refit the bearing retaining plate.

The ball bearing at the commutator end is replaced as follows:—

Withdraw the bearing from the armature shaft by means of a hand press or extractor. The inner race of the replacement bearing must be supported during fitment.

HORNS

(MODEL WT 618U)

The horns are situated at the front and on either side of the engine compartment immediately below the radiator.

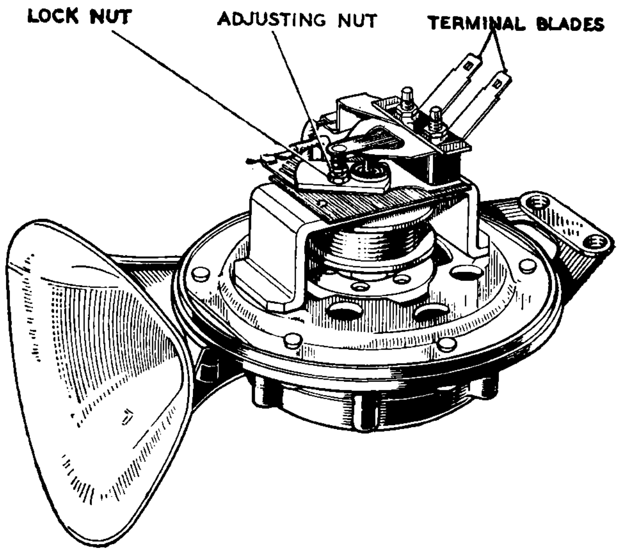


Fig. 16. Horn adjustment screw

Removal

Remove the battery earth terminal.

Pull off the two "Lucar" cable connections at the horn terminals.

Remove the two mounting bolts, nuts, washers and earth wire from each horn.

Withdraw the horns.

Adjustment

Adjustment is effected after removal of the domed cover by means of a fixed contact screw.

Connect an 0–20 first grade moving coil ammeter in series with a horn. Release the contact locknut and adjust the contact until the horn will pass $13\frac{1}{2}$–$15\frac{1}{2}$ amperes at 12 volts. Retighten the locknut and check.

Refit the domed cover.

Refitting

Refitting is the reverse of the removal procedure. Care should be taken in ensuring a good contact between the earth strap and horn bracket on the left-hand horn.

Note: It is important to keep the horn mounting bolts tight and to maintain rigid the mountings of any units fitted near the horns. Electrical connections and cable should be checked occasionally and rectified as necessary.

LAMPS

LIGHT BULBS

LIGHT	LUCAS BULB No.	VOLTS	WATTS	APPLICATION
Outer Headlight (Main and dip beams)	Sealed Beam Unit	12	60/45	Home and R.H.D. Export
	Sealed Beam Unit	12	50/40	S. America & Middle East
	Sealed Beam Unit	12	37·5/50	U.S.A.
	410	12	45/40	Belgium, Holland, Sweden, Austria, Italy & Germany
	411	12	45/40 (Yellow)	France
Inner Headlight (Main beam only)	Sealed Beam Unit	12	37·5	Home and R.H.D. Export, Austria, U.S.A. & Germany
	Sealed Beam Unit	12	37·5 (Yellow)	France
	410	12	45	Italy
Side light	989	12	6	
Front and Rear Flashing indicators	382	12	21	
Rear/Brake	380	12	6/21	
Number Plate	989	12	6	
Reversing lights	382	12	21	
Interior Lights—pillar	989	12	6	
Interior Lights—rear	254	12	6	
Glovebox illumination	254	12	6	
Map light	989	12	6	
Luggage Compartment illumination	989	12	6	
Instrument illumination, Headlight Warning, Ignition Warning, Handbrake/Fluid Warning	987	12	2·2	
Switch indicator strip, Flasher Warning Overdrive indicator Automatic Transmission indicator	281	12	2	

HEADLIGHTS

Description

The 3·8 Mark 10 Model is fitted with the four headlight system, the standard light units fitted are of the sealed beam type having aiming pads mounted into the lenses. These pads are for use with an approved mechanical aimer (such as the Lucas Lev-L-Lite).

To obtain the best possible results from the headlights, it is essential that they are correctly adjusted. The alignment of the headlight beam is set correctly before the car leaves the factory but if for any reason adjustment becomes necessary and an approved beam setter is not available the following procedure should be carried out.

HEADLIGHT BEAM SETTING

Place the car on a level surface in front of a wall or board. Mark out the vertical and horizontal centre lines of both inner and outer headlight units on the wall or board and position the car 25 feet (7·6 m.) away from, and square to, the surface.

Inner headlight beam setting (all cars)

Switch the headlights on in the full beam position and blank off the outer headlights. Set the inner headlights to the position shown in Fig. 18.

Outer headlight beam setting (vertical dip units)

With the headlights switched on in the dip position, set the outer headlight beams to the position shown in Fig. 19.

Outer headlight beam setting (right-hand drive cars excluding vertical dip units)

With the headlights switched on in the dip position, set the outer headlight beams to the position shown in Fig. 20.

Outer headlight beam setting (left-hand drive cars excluding vertical dip units)

With the headlights switched on in the dip position, set the outer headlight beams to the position shown in Fig. 21.

Adjusting the Headlight Beam

Remove the headlight surround by unscrewing the retaining screw and springing the surround away from the bottom clip fixings.

The setting of the outer beams is adjusted by two screws, one being located at the top centre and the other at the centre left-hand side. The top screw is for vertical adjustment, that is, to raise or lower the beam; turn the screw anti-clockwise to lower the beam and clockwise to raise the beam. The side screw is for lateral adjustment, that is, to turn the beam to left or right. To move the beam to the right turn the screw clockwise and to move the beam to the left, turn the screw anti-clockwise.

The setting of the two inner beams is adjusted by two screws diagonally opposite each other. The upper screw is for vertical adjustment, turn the screw clockwise to move the beam to the right and anti-clockwise to move the beam to the left.

Note: Cars for some countries are fitted with similar light units in the inner and outer positions. The adjustment of the beam on these outer lights is the same as that described above for the inner headlights.

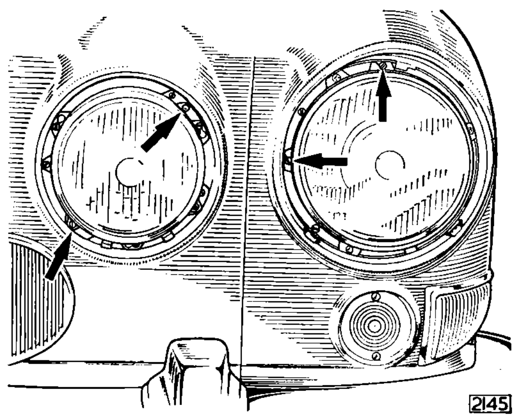


Fig. 17. The inner and outer headlight beam setting screws

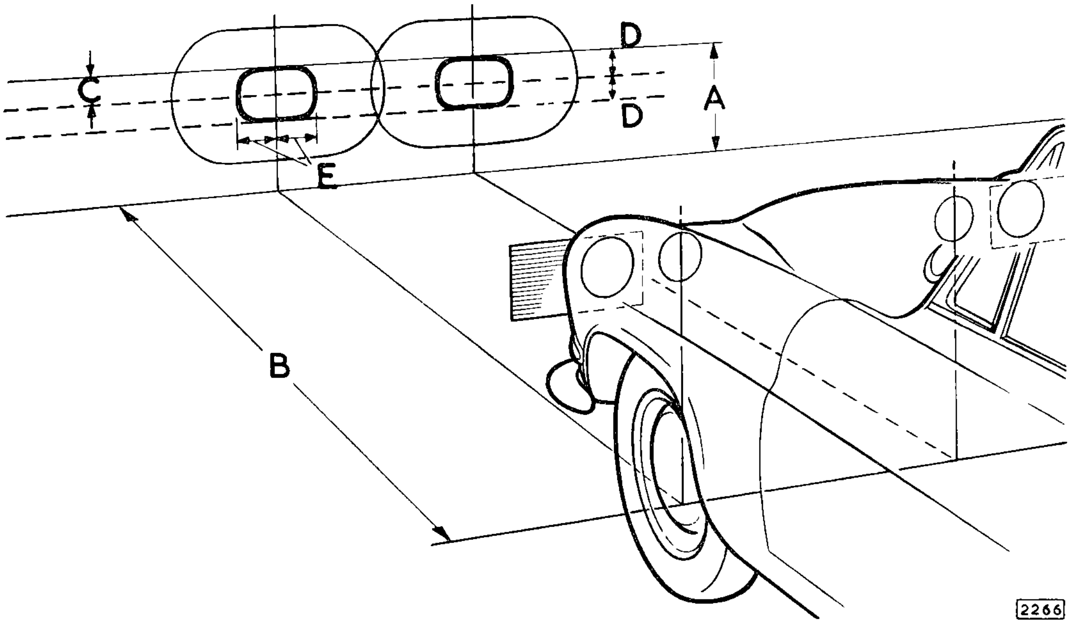


Fig. 18. Inner headlight beam setting

"*A*" *Height of horizontal centre line of lamps from the ground*
"*B*" *Setting distance of car from wall—25 feet (7·6 m.)*
"*C*" *Centre of "Hot Spot" below horizontal centre line—2″ (50·78 mm.)*
"*D*" *Vertical drift limits ±2″ (50·78 mm.)*
"*E*" *Horizontal drift limits ±6″ (15·24 cm.)*

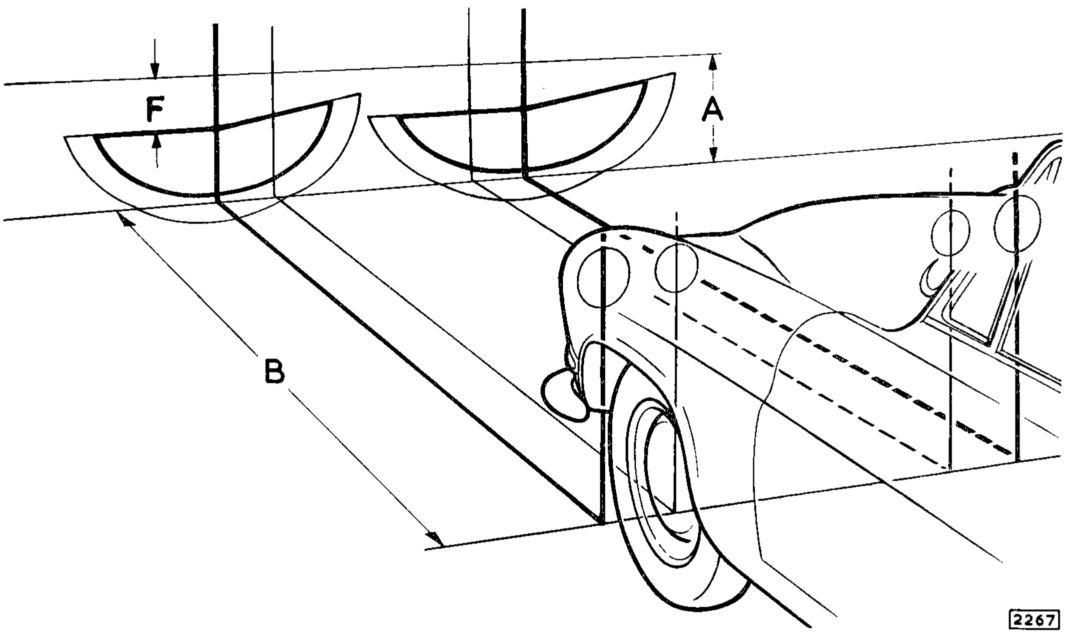


Fig. 19. Outer headlight beam setting—vertical dip

"*A*" *Height of horizontal centre line of lamp from the ground*
"*B*" *Setting distance of car from wall—25 feet (7·6 m.)*
"*F*" *3″ (76·2 mm.)*

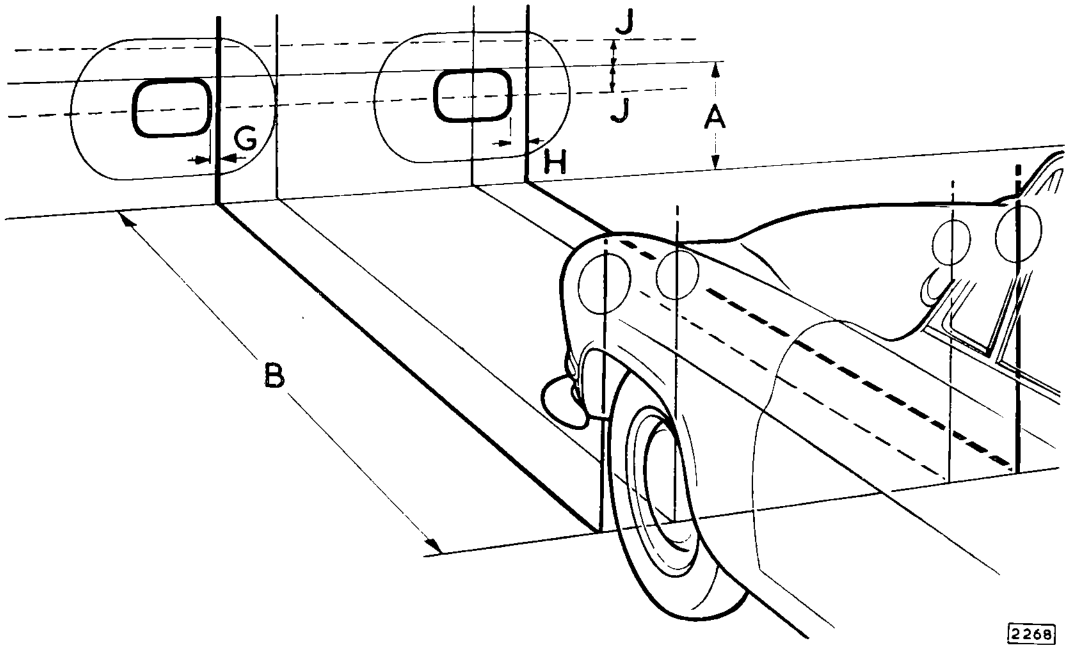


Fig. 20. Outer headlight beam setting (right-hand drive cars)

"A" *Height of horizontal centre line of lamp from the ground*
"B" *Setting distance of car from wall—25 feet (7·6 m.)*
"G" *Lateral aim of high intensity zone—2" (50·78 mm.)*
"H" *Horizontal drift limits—centre line of lamp to 6" (15·24 cm.)—left*
"J-J" *Vertical drift limits ±2" (50·78 mm.)*

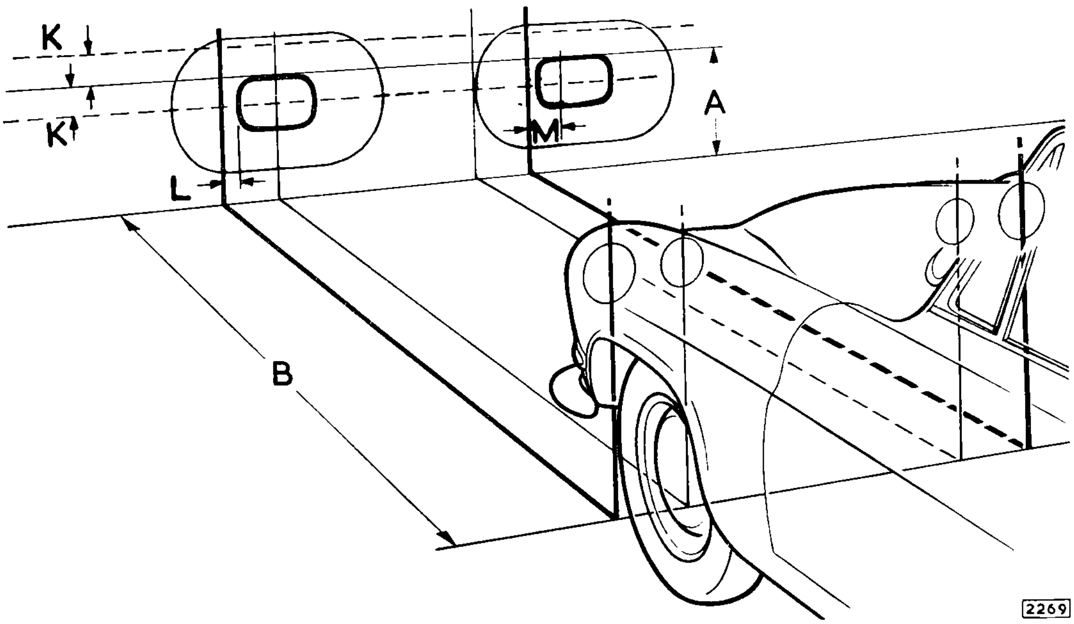


Fig. 21. Outer headlight beam setting (left-hand drive cars)

"A" *Height of horizontal centre line of lamp from the ground*
"B" *Setting distance of car from wall—25 feet (7·6 m.)*
"K-K" *Vertical drift limits—±2" (50·78 mm.)*
"L" *Lateral aim of high intensity zone—2" (50·78 mm.)*
"M" *Horizontal drift limits—Centre line of lamp to 6" (15·24 cm.)—right*

Outer Headlight Replacement

Remove the top retainer screw and withdraw the headlight embellisher noting the two retaining lugs at the lower edge. Remove the three cross headed screws and the headlight unit retaining rim. Withdraw the headlight unit and unplug the socket from the rear of the unit. The headlight may now be replaced with a unit of the correct type (see Page 22).

On cars fitted with non-sealed beam headlights proceed as described above until the headlight unit is withdrawn, release the bulb retaining spring clips and withdraw the bulb. Replace with a bulb of the correct type (see Page 23). When reassembling note that a groove in the bulb plate must register with a raised portion of the bulb retainer.

Note: Do not turn the two slotted screws or the setting of the headlights will be upset.

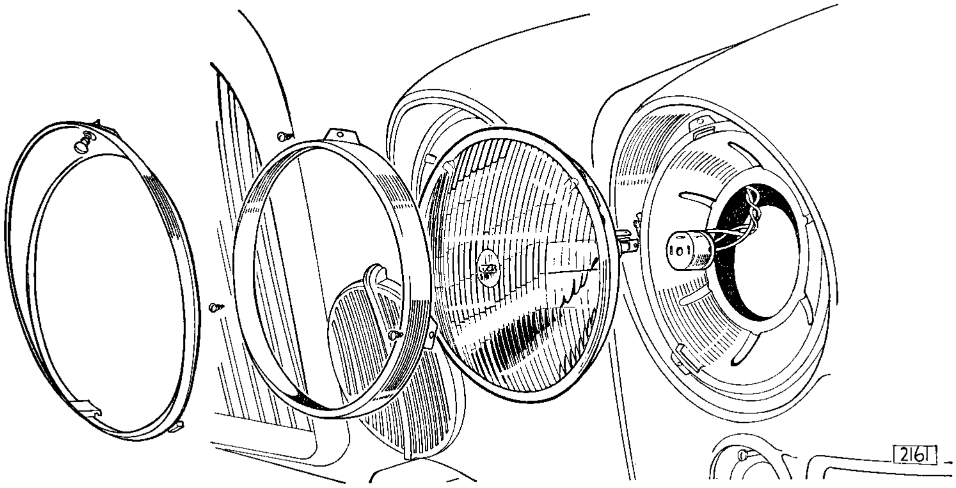


Fig. 22. The outer headlight unit removal

Inner Headlight—Replacement

The procedure for replacing the inner headlight unit or bulb is the same as that described in "Outer Headlight—Replacement." However, when removing the headlight unit retaining rim, it is not necessary to remove the three cross headed screws, these should be slackened and the rim turned anti-clockwise until it can be withdrawn.

Note: Do not turn the two slotted screws or the setting of the headlight will be upset.

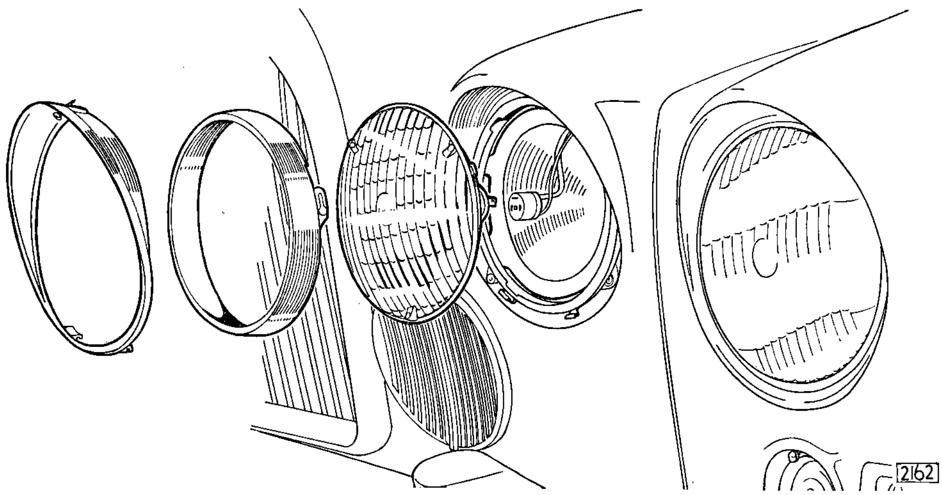


Fig. 23. The inner headlight unit removal

Sidelight Bulb—Replacement

Remove the two screws retaining the light embellisher. Withdraw the embellisher and light unit, remove the bulb holder from the rear of the unit. The bulb may then be removed by pressing in and turning anti-clockwise.

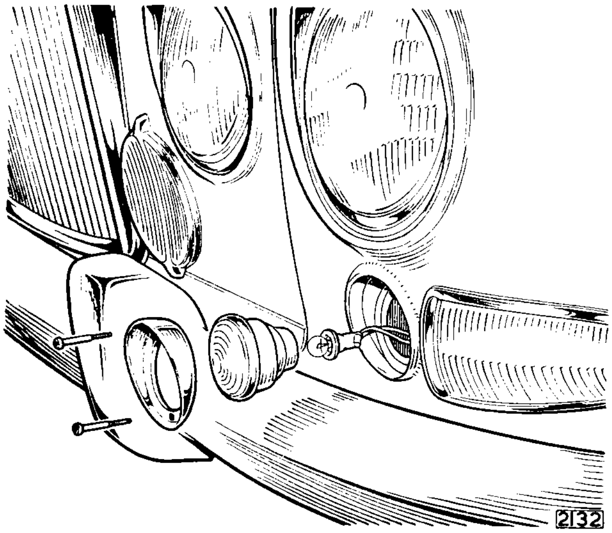


Fig. 24. Side light bulb removal

Front Flasher Bulb—Replacement

Remove the screw retaining the light glass and disconnect the glass at the three tags under the chrome surround. The bulb may then be removed by pressing in and turning anti-clockwise.

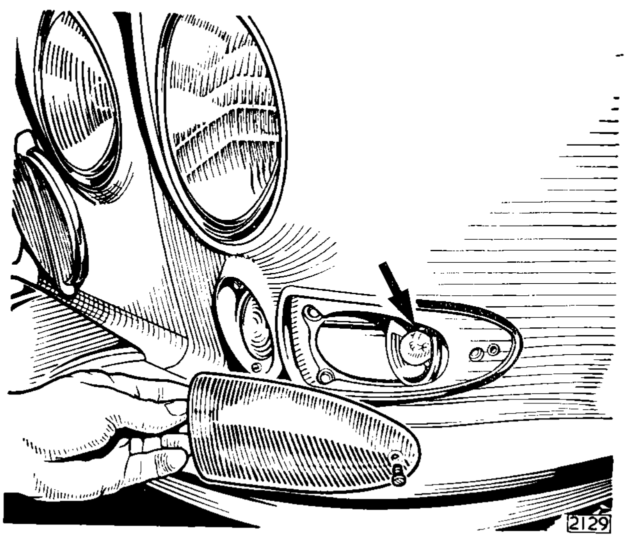


Fig. 25. Front flasher bulb removal

Rear Flasher Bulb—Replacement

Remove the screws securing the appropriate luggage compartment casing and withdraw the upper bulb holder from the rear of the light assembly. The bulb may then be removed by pressing in and turning anti-clockwise.

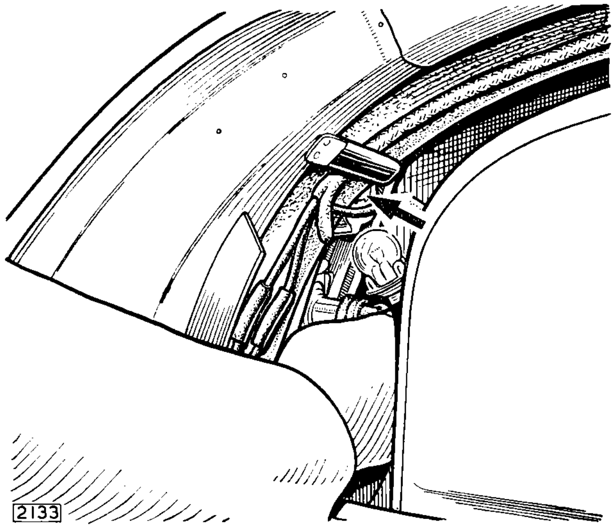


Fig. 26. Rear flasher bulb removal

Rear/Brake Light Bulb—Replacement

Proceed as for Rear Flasher Bulb but withdraw the lower bulb holder. When fitting a replacement bulb note that the pins are offset.

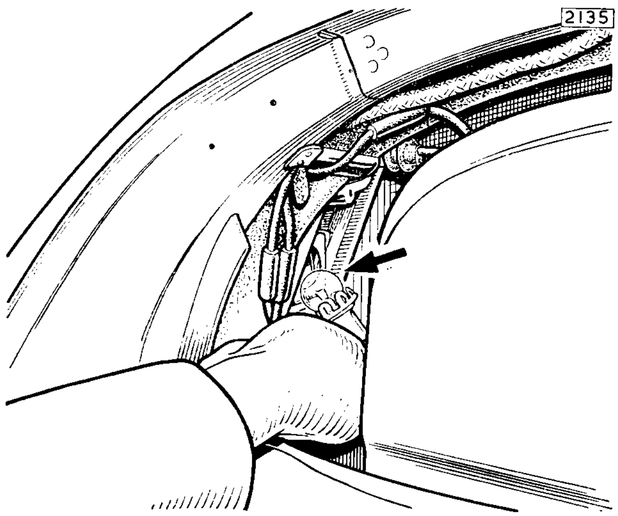


Fig. 27. Rear/brake bulb removal

Number Plate Light Bulb—Replacement

Remove sufficient screws securing the luggage compartment lid casing to allow access to the bulb holders. The number plate bulb holders are the two in the centre of the group. Press the tag in, lift and withdraw the holder. The bulb may then be removed by pressing in and turning anti-clockwise.

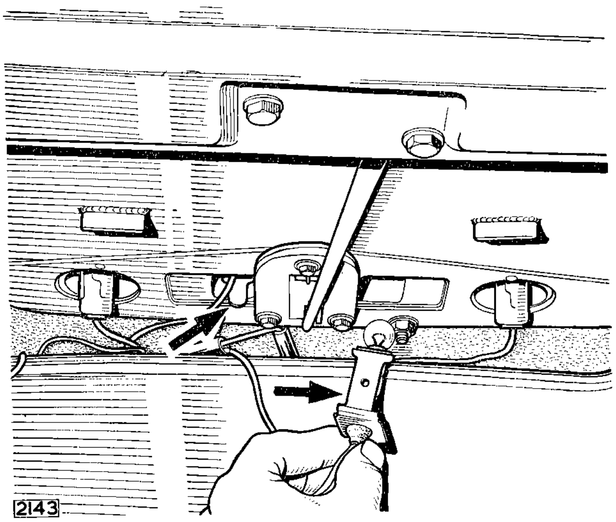


Fig. 28. Number plate bulb removal

Reversing Light Bulb—Replacement

Proceed as for the number plate light bulb. The reversing light bulb holders are those on the outsides of the group.

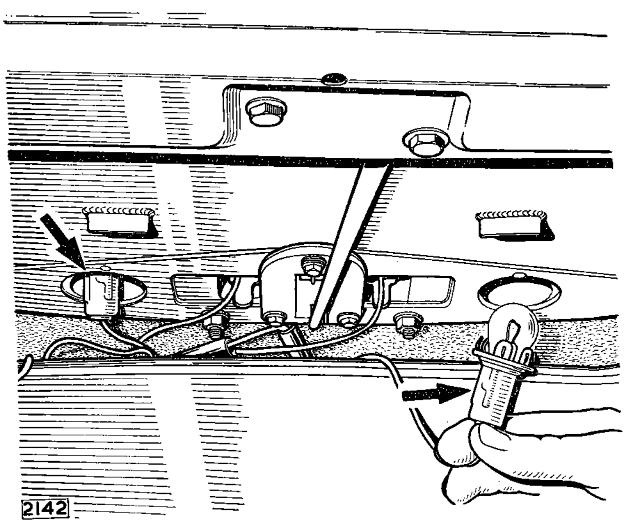


Fig. 29. Reverse lamp bulb removal

Interior Light Bulbs—Replacement

Using care to avoid breakages, prise the cover from the appropriate interior light noting the stud fixings. Remove the bulb by pressing in and turning through 90°. Replace the bulb with one of the correct value by pressing the bulb into the holder and turning until the notches inside the holder are located. Replace the cover by pressing onto the securing studs.

Glovebox Light Bulb—Replacement

Open the glove box lid and remove the mauve glass from its holder. Care should be taken when removing this glass to avoid breakages. Remove the bulb from between the two contacts and replace with a bulb of the correct value. Replace the glass.

Flashing Indicator Bulb—Replacement

Disconnect the earth lead at the battery.

Detach the switch cover from above the steering column by withdrawing the two most sunken screws from below. Withdraw one or both flasher indicator warning light bulb holders from the outer sockets of the upper switch cover. Remove the bulb from the holder by applying inward pressure and rotating through 90° in either direction. The bulb is replaced by inserting into the bulb holder and rotating through 90° until the notches inside the bulb holder are located. Replacing the bulb holder and upper switch cover is the reverse of the removal procedure.

Overdrive/Automatic Selector Bulb—Replacement

Disconnect the earth cable at the battery. Detach the upper switch cover from the steering column by removing the two most sunken screws from below. Remove the bulb holder from the centre socket in the switch cover. Remove the bulb from the holder by pressing in and turning through 90° in either direction. The bulb is replaced by inserting into the bulb holder and turning until the notches inside the bulb holder are located. Replacing the bulb holder and upper switch cover is the reverse of the removal procedure.

Map Light Bulb—Replacement

Remove the bulb which is situated under the centre of the screen rail and in front of the instrument panel. Removal is effected by pressing the bulb inwards, rotating slightly and withdrawing outwards.

Replace the bulb by a reversal of the above procedure.

Indicator Strip Bulbs—Replacement

Three bulbs are provided along the bottom rear edge of the instrument panel. Withdraw the bulbs by pulling out from the sockets provided in the rear panel.

Replace the appropriate bulb with one of the correct value.

CURRENT VOLTAGE REGULATOR

MODEL RB 340

GENERAL

Preliminary Checking of Charging Circuit

Before disturbing any electrical adjustments, examine as described below to ensure that the fault does not lie outside the control box:—

(i) Check the battery by substitution or with an hydrometer and a heavy discharge (150–160A) tester.

(ii) Inspect the generator driving belt. This should just be taut enough to drive without slipping.

(iii) Check the generator by substitution or by withdrawing the cables from the generator terminals and, using a suitable "jumper lead," linking large generator terminal "D" to small terminal "F" and connecting a voltmeter between this link and earth and then running the generator up to about 1,000 r.p.m., when a rising voltage should be shown.

(iv) Inspect the wiring of the charging circuit and carry out continuity tests between the generator, control box and, when fitted, the ammeter.

(v) Check earth connections, particularly that of the control box.

(vi) In the event of reported undercharging, ascertain that this is not due to low mileage.

Note: Should the control box fail to respond correctly to any adjustment given in the following instructions, it should be examined at a Lucas Service Depot or by an official Lucas Agent.

VOLTAGE REGULATOR

Open Circuit Settings

Ambient Temperature	Voltage
10°C (50°F)	14·9–15·5
20°C (68°F)	14·7–15·3
30°C (86°F)	14·5–15·1
40°C (104°F)	14·3–14·9

Method of Adjustment

Checking and adjusting should be completed as rapidly as possible to avoid errors due to heating of the operating coil.

(i) Withdraw the cable from control box terminal blades "B."

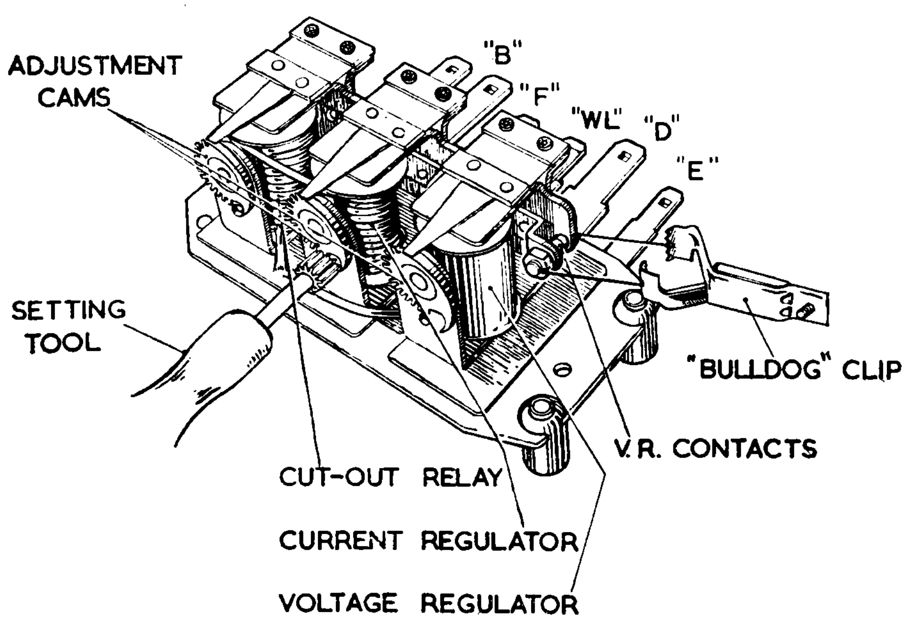


Fig. 30. The cam adjuster on the RB.340 control box

(ii) Connect a first-grade 0–20 moving-coil voltmeter between control box terminal "D" and a good earthing point.

Note: A convenient method of making this connection is to withdraw the ignition warning light feed from control box terminal "WL" and to clip the voltmeter lead of appropriate polarity to the small terminal blade thus exposed—this terminal being electrically common with terminal "D."

(iii) Start the engine and run the generator at 1,500 r.p.m.

(iv) Observe the voltmeter pointer.

The voltmeter reading should be steady and lie between the appropriate limits (see "Open Circuit Settings"), according to the temperature. An unsteady reading may be due to unclean contacts. If the reading is steady but occurs outside the appropriate limits, an adjustment must be made. In this event, continue as follows:—

(v) Stop the engine and remove the control box cover.

(vi) Re-start the engine and run the generator at 1,500 r.p.m. (900 engine r.p.m.).

(vii) Using a suitable tool, turn the voltage adjustment cam until the correct setting is obtained—turning the tool clockwise to raise the setting or anti-clockwise to lower it.

(viii) Check the setting by stopping the engine and then again raising the generator speed to 1,500 r.p.m.

(ix) Restore the original connections and refit the cover.

CURRENT REGULATOR

On-Load Setting

The current regulator on-load setting is equal to the maximum rated output of the generator, which is 34 amperes.

Method of Adjustment

The generator must be made to develop its maximum rated output, whatever the state of charge of the battery might be at the time of setting. The voltage regulator must therefore be rendered inoperative, and this is the function of the bulldog clip used in (ii) below in keeping the voltage regulator contacts together.

(i) Remove the control box cover.

(ii) Using a bulldog clip, short out the contacts of the voltage regulator.

(iii) Withdraw the cables from control box terminal blades "B."

(iv) Using a suitable "jumper lead," connect the cables removed in (iii) to the load side of a first-grade 0–40A moving coil ammeter.

(v) Connect the other side of the ammeter to one of the control box terminal blades "B."

Note: It is important to ensure that terminal "B" carries only this one connection. All other load connections (including the ignition coil feed) must be made to the battery side of the ammeter.

(vi) Switch on all lights, to ensure that the generator develops its full rated output.

(vii) Start the engine and run the generator at 4,000 r.p.m. (2,400 engine r.p.m.).

(viii) Observe the ammeter pointer.

The ammeter pointer should be steady and indicate a current of 33–35 amperes. An unsteady reading may be due to unclean contacts. If the reading is too high or too low, an adjustment must be made. In this event, continue as follows:—

(ix) Using a suitable tool, turn the current adjustment cam until the correct setting is obtained—turning the tool clockwise to raise the setting or anti-clockwise to lower it.

(x) Switch off the engine and restore the original connections.

(xi) Refit the control box cover.

CUT-OUT RELAY

Electrical Settings

(i)	Cut-in Voltage	12·6–13·4.
(ii)	Drop-off Voltage	9·3–11·2.

Method of Cut-in Adjustment

Checking and adjusting should be completed as rapidly as possible to avoid errors due to heating of the operating coil.

(i) Connect a first-grade 0–20 moving-coil voltmeter between control box terminal "D" and a good earthing point, referring to the note in "Voltage Regulator—Method of Adjustment" (ii).

(ii) Switch on an electrical load, such as the head-lamps.

(iii) Start the engine and slowly increase its speed.

(iv) Observe the voltmeter pointer.

The voltage should rise steadily and then drop slightly at the instant of contact closure. The cut-in voltage is that which is indicated immediately before the pointer drops back. It should occur between the limits given in "Electrical

Settings" (i) above. If the cut-in occurs outside those limits, an adjustment must be made. In this event, reduce generator speed to below cut-in value and continue as follows:—

(v) Remove the control box cover.

(vi) Using a suitable tool, turn the cut-out relay adjustment cam a small amount in the appropriate direction—turning the tool clockwise to raise the setting or anti-clockwise to lower it.

(vii) Repeat the above checking procedure until the correct setting is obtained.

(viii) Switch off the engine, restore the original connections and refit the cover.

Method of Drop-off Adjustment

(i) Withdraw the cables from control box terminal blades "B."

(ii) Connect a first-grade 0–20 moving-coil voltmeter between control box terminal "B" and earth.

(iii) Start the engine and run up to approximately 3,000 r.p.m. (1800 engine r.p.m.).

(iv) Slowly decelerate and observe the voltmeter pointer.

Opening of the contacts, indicated by the voltmeter pointer dropping to zero, should occur between the limits given in "Electrical Settings" (ii). If the drop-off occurs outside these limits, an adjustment must be made. In this event, continue as follows:—

(v) Stop the engine and remove the control box cover.

(vi) Adjust the drop-off voltage by carefully bending the fixed contact bracket. Reducing the contact gap will raise the drop-off voltage; increasing the gap will lower the drop-off voltage.

(vii) Retest and, if necessary, readjust until the correct drop-off setting is obtained.

Note: This should result in a contact "follow through" or blade deflection of 0·010″–0·020″.

(viii) Restore the original connections and refit the cover.

ADJUSTMENT OF AIR GAP SETTINGS

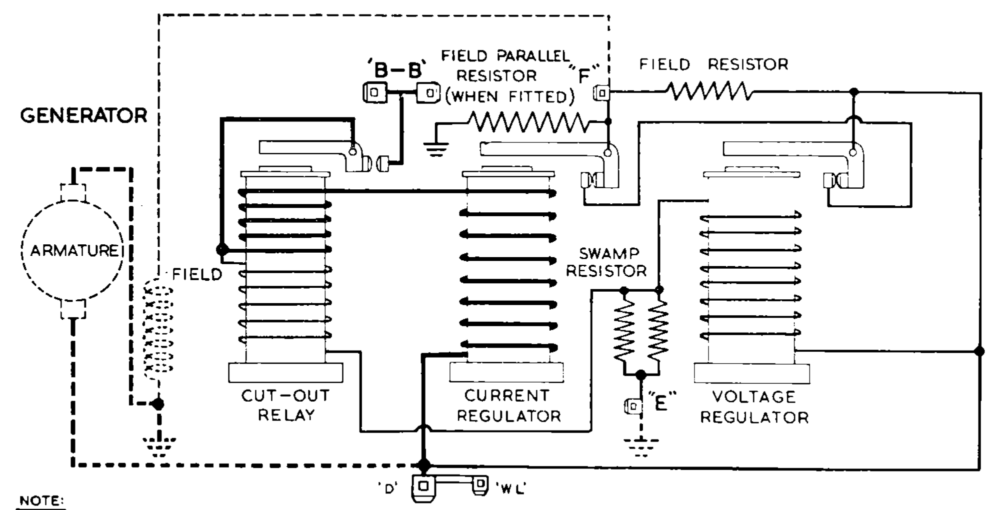
Air gap settings are accurately adjusted during production of the control box and should require no further attention. If the original adjustments have been disturbed, it will be necessary to reset as described below.

Armature-to-Bobbin Core Gaps of Voltage and Current Regulators

(i) Using a suitable tool, turn the adjustment cam to the point giving maximum lift to the armature tensioning spring, i.e. by turning the tool to the fullest extent anti-clockwise.

(ii) Slacken the adjustable contact locking nut and screw back the adjustment contact.

EXTERNAL CONNECTIONS SHOWN IN BROKEN LINE



NOTE:
UNTIL EARLY IN 1962, THE VR AND CR MAGNET FRAMES WERE LINKED BY A CONNECTOR THROUGH WHICH (IN THE CONTACTS CLOSED POSITION) THE FIELD CURRENT PASSED, VIA THE C.O. AND C.R. SERIES WINDINGS, TO TERMINAL 'D'.

Fig. 31. Circuit diagram of the RB.340 control box

(iii) Insert a flat steel feeler gauge of 0·045″ thickness between the armature and the copper separation on the core face, taking care not to turn up or damage the copper shim. The gauge should be inserted as far back as the two rivet heads on the underside of the armature.
(iv) Retaining the gauge in position and pressing squarely down on the armature, screw in the adjustable contact until it just touches the armature contact.
(v) Retighten the locking nut and withdraw the gauge.
(vi) Carry out the electrical setting procedure.

Contact "follow-through" and Armature-to-Bobbin Core Gap of Cut-out Relay

(i) Press the armature squarely down against the copper separation on the core face.
(ii) Adjust the fixed contact bracket to give a "follow-through" or blade deflection of the moving contact of 0·010″– 0·020″.
(iii) Release the armature.
(iv) Adjust the armature back stop to give a core gap of 0·035″– 0·045″.
(v) Check the cut-in and drop-off voltage settings.

CLEANING CONTACTS

Regulator Contacts

To clean the voltage or current regulator contacts, use fine carborundum stone or silicon carbide paper followed by methylated spirits (denatured alcohol).

Cut-out Relay Contacts

To clean the cut-out relay contacts, use a strip of fine glass paper—never carborundum stone or emery cloth.

STARTER MOTOR

GENERAL

The electric starting motor is a four-pole, four-brush machine having an extended shaft which carries the engine engagement gear, or starter drive as it is more usually named. The diameter of the yoke is $4\frac{1}{2}$″.

The starting motor is of similar construction to the generator except that heavier copper wire is used in the construction of the armature and field coils. The field coils are series parallel connected between the field terminal and the insulated pair of brushes.

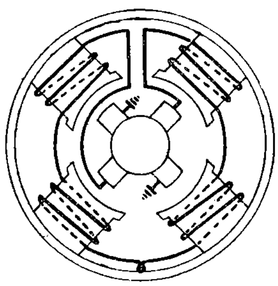


Fig. 32. Internal connections of the starter motor

REMOVAL

Detach the earth lead from the battery. Disconnect the cable from the terminal at the end of the starter motor.

Release the clips and detach the two rubber hose pipes from the brake servo vacuum situated on the bulkhead above the starter motor (Note hose pipe connections for later fitting).

Remove the four nuts and washers retaining vacuum tank to bulkhead and remove tank.

Remove the two nuts from the rear ends of the starter motor securing bolts. Support starter motor from below by hand and withdraw both bolts.

Withdraw starter motor through chassis frame.

REFITTING

Refitting is the reverse of the removal procedure. Care must be taken when reconnecting to ensure that the vacuum tank hoses are fitted to the correct unions. Refer to Section L "Brakes" before making connections.

ROUTINE MAINTENANCE

The only maintenance normally required by the starting motor is the occasional checking of brush-gear and commutator. About every 10,000 miles, remove the

3. PERFORMANCE DATA

Model	M 45 G
Lock Torque	22 lbs. ft. with 430–450 amperes at 7·8–7·4 volts
Torque at 1,000 r.p.m.	8·3 lbs. ft. with 200–220 amperes at 10·2–9·8 volts
Light running current	45 amperes at 5,800–6,800 r.p.m.

metal band cover. Check that the brushes move freely in their holders by holding back the brush springs and pulling gently on the flexible connectors. If a brush is inclined to stick, remove it from its holder and clean its sides with a petrol-moistened cloth. Be careful to replace brushes in their original positions in order to retain "bedding." Brushes which have worn so that they will not "bed" properly on the commutator or have worn less than $\frac{5}{16}$" (7·9 mm.) in length must be renewed.

The commutator should be clean, free from oil or dirt and should have a polished appearance. If it is dirty, clean it by pressing a fine dry cloth against it while the starter is turned by hand by means of a spanner applied to the squared extension of the shaft. Access to the squared shaft is gained by removing the thimble-shaped metal cover. If the commutator is very dirty moisten the cloth with petrol.

SERVICING

Testing in Position

Check that the battery is fully charged and terminals are clean and tight. Recharge if necessary.

(i) Switch on the lamps and operate the starter control. If the lights go dim, but the starter motor is not heard to operate, an indication is given that the current is flowing through the starting motor windings but that the armature is not rotating for some reason; possibly the pinion is meshing permanently with the geared ring on the flywheel. In this case the starting motor must be removed from the engine for examination.

(ii) Should the lamps retain their full brilliance when the starter switch is operated, check the circuit for continuity from battery to starting motor via the starter switch, and examine the connections at these units. If the supply voltage is found to be applied to the starting motor when the switch is operated, an internal fault in the motor is indicated and the unit must be removed from the engine for examination.

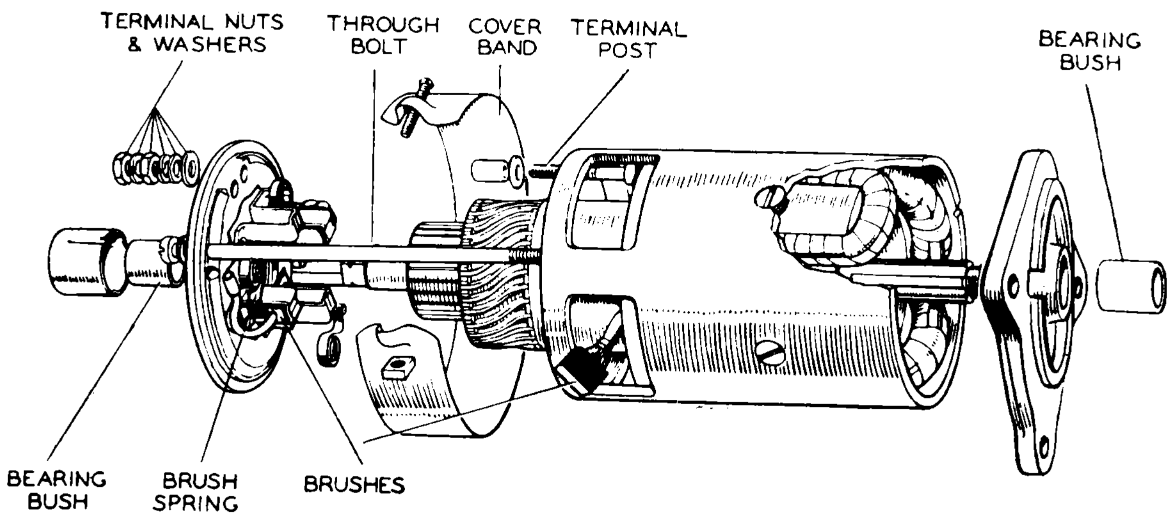


Fig. 33. Exploded view of the starter motor

(iii) Sluggish or slow action of the starting motor is usually due to a loose connection causing a high resistance in the motor circuit. Check as described above.

(iv) If the motor is heard to operate, but does not crank the engine, indication is given of damage to the drive.

Bench Testing and Examination of Brushgear and Commutator

(i) Remove the starting motor from the engine, as described on page P.30.

(ii) After removing the starting motor from the engine secure the body in a vice and test by connecting it with heavy gauge cables to a battery of the appropriate voltage. One cable must be connected to the starter terminal and the other held against the body or end bracket. Under these light road conditions, the starter should run at a very high speed (see Paragraph 3) without excessive noise and without excessive sparking at the commutator.

(iii) If the operation of the starting motor is unsatisfactory, remove the cover band and examine the brushes and commutator. Hold back each of the brush springs and move the brush by pulling gently on its flexible connector. If the movement is sluggish, remove the brush from its holder and ease the sides by lightly polishing on a smooth file. Always replace brushes in their original positions.

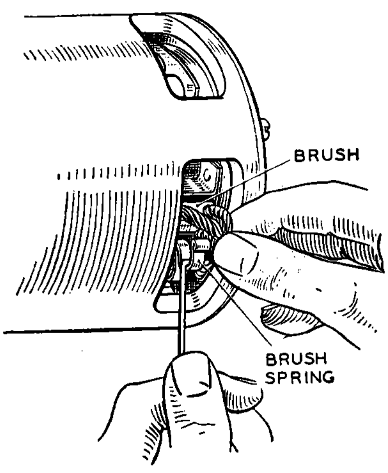


Fig. 34. Checking the brush gear

If the brushes are worn so that they will not bear on the commutator, or if the brush flexible is exposed on the running face, they must be replaced.

Check the tension of the brush springs with a spring scale. The correct tension is 30–40 ozs. New springs should be fitted if the tension is low.

If the commutator is blackened or dirty, clean it by holding a petrol-moistened cloth against it while the armature is rotated.

(iv) Re-test the starter as described under (ii). If the operation is still unsatisfactory, the unit can be dismantled for detailed inspection and testing as follows:—

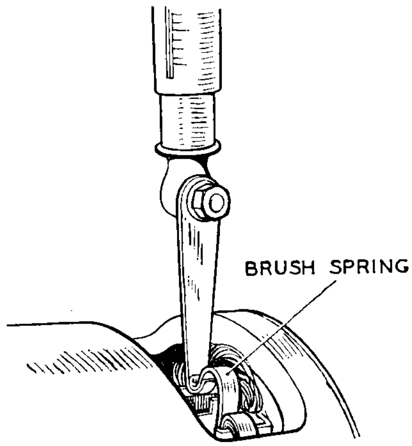


Fig. 35. Testing the brush spring tension

TO DISMANTLE

(i) Remove the cover band, hold back the brush springs and lift the brushes from their holders.

(ii) Remove the nuts from the terminal post which protrudes from the commutator end bracket.

(iii) Unscrew the two through bolts from the commutator end bracket. Remove the commutator end bracket from the yoke.

(iv) Remove the driving end bracket complete with armature and drive from the starting motor yoke. If it is necessary to remove the armature from the driving end bracket, it can be done by means of a hand press after the drive has been dismantled.

Replacement of Brushes

If the brushes are worn to less than $\frac{5}{16}$" (7·9 mm.) in length, they must be replaced.

Two of the brushes are connected to terminal eyelets attached to the brush boxes on the commutator end bracket and two are connected to the field coils.

The flexible connectors must be removed by unsoldering and the connectors of the new brushes secured in their place by soldering. The new brushes are preformed so that the bedding to the commutator is unnecessary.

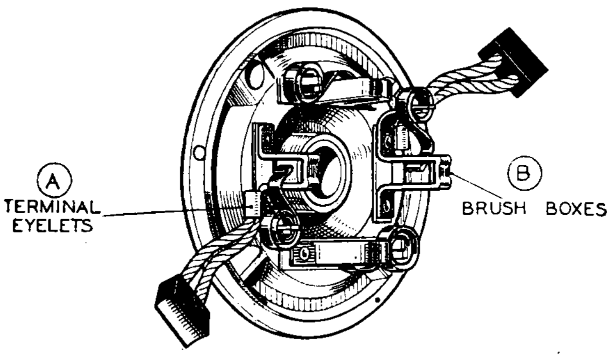


Fig. 36. Commutator end bracket brush connections

Commutator

A commutator in good condition will be smooth and free from pits and burned spots. Clean the commutator with a petrol-moistened cloth. If this is ineffective, carefully polish with a strip of fine glass paper, while rotating the armature. To remedy a badly worn commutator, dismantle the starter drive and remove the armature from the end bracket. Now mount the armature in a lathe, rotate at a high speed and take a light cut with a very sharp tool. Do not remove any more metal than is necessary. Finally polish with very fine glass paper.

The insulators between the commutator segments MUST NOT BE UNDERCUT.

Armature

Examination of the armature may reveal the cause of failure, e.g., conductors lifted from the commutator due to the starter motor being engaged while the engine is running and causing the armature to be rotated at an excessive speed. A damaged armature must always be replaced—no attempts should be made to machine the armature core or to true a distorted armature shaft.

Field Coils

(i) Test the field coils for continuity by connecting a 12-volt test lamp between the starting motor terminal and to each field brush in turn.

(ii) Lighting of the lamp does not necessarily mean that the field coils are in order, as it is possible that one of them may be earthed to a pole-shoe or to the yoke. This may be checked with a 110-volt test lamp, the test leads being connected between the starting motor terminal and a clean part of the yoke. If the lamp lights, defective insulation of the field coils or of the terminal post is indicated. In this event, see that the insulating band is in position and examine the field coils and terminal connections for any obvious point of contact with the yoke. If from the above tests the coils are shown to be open-circuited or earthed and the point of contact cannot be readily located and rectified, either the complete starting motor or the field coils must be replaced. If the field coils are to be replaced, follow the procedure outlined below, using a wheel-operated screwdriver.

Remove the insulation piece which is provided to prevent the intercoil connectors from contacting with the yoke.

Mark the yoke and pole shoes so that the latter can be refitted in their original positions. Unscrew the four pole shoe retaining screws with the wheel-operated screwdriver.

Draw the pole shoes and coils out of the yoke and lift off the coils. Fit the new field coils over the pole shoes and place them in position inside the yoke.

Take care to ensure that the taping of the field coils is not trapped between the pole shoes and the yoke.

Locate the pole shoes and field coils by lightly tightening the fixing screw. Fully tighten the screws with the wheel-operated screwdriver. Replace the insulation piece between the field coil connections and the yoke.

Bearings

Bearings which are worn to such an extent that they will allow excessive side-play of the armature shaft must be replaced. To replace the bearing bushes proceed as follows:—

(i) Press the bearing bush out of the end bracket.

(ii) Press the new bearing bush into the end bracket using a shouldered, highly polished mandrel of the same diameter as the shaft which is to fit in the bearing. Porous bronze bushes must not be opened out after fitting, or the porosity of the bush may be impaired.

Note: Before fitting a new porous bronze bearing bush it must be completely immersed for 24 hours in clean thin engine oil.

REASSEMBLY

The reassembly of the starting motor is a reversal of the dismantling procedure.

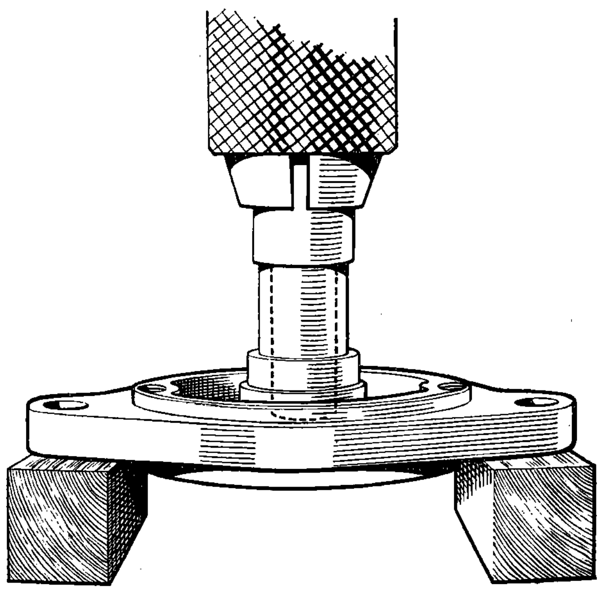


Fig. 37. Method of fitting bush

STARTER DRIVE

GENERAL

The pinion is mounted on a threaded sleeve which is carried on splines on the armature shaft, the sleeve being arranged so that it can move along the shaft against a compression spring so as to reduce the shock loading at the moment engagement takes place.

When the starter switch is operated, the shaft and screwed sleeve rotate, and owing to the inertia of the pinion the screwed sleeve turns inside the pinion causing the latter to move along the sleeve into engagement with the flywheel ring. The starter will then turn the engine.

As soon as the engine fires and commences to run under its own power, the flywheel will be driven faster by the engine than by the starter. This will cause the pinion to be screwed back along the sleeve and so thrown out of mesh with the flywheel teeth. In this manner the drive safeguards the starter against damage due to being driven at high speeds by the engine.

A pinion restraining spring is fitted over the starter shaft to prevent the pinion being vibrated into contact with the flywheel when the engine is running.

ROUTINE MAINTENANCE

If any difficulty is experienced with the starting motor not meshing correctly with the flywheel, it may be that the drive requires cleaning. The pinion should move freely on the screwed sleeve; if there is any dirt or other foreign matter on the sleeve it must be washed off with paraffin.

In the event of the pinion becoming jammed in mesh with the flywheel, it can usually be freed by turning the starter motor armature by means of a spanner applied to the shaft extension at the commutator end.

This is accessible by removing the cap which is a push fit.

DISMANTLING AND REASSEMBLY

Having removed the armature as described in the section dealing with starting motors the drive can be dismantled as follows:—

Remove the split pin (A) from the shaft nut (B) at the end of the starter drive. Hold the squared starter shaft extension at the commutator end by means of a spanner and unscrew shaft nut (B). Lift off the main spring (C), washer (D), screwed sleeve with pinion (E), collar (F), pinion restraining spring (G) and restraining spring sleeve (H).

Note: If either the screwed sleeve or pinion are worn or damaged they must be replaced as a pair, not separately.

The reassembly of the drive is a reversal of the dismantling procedure.

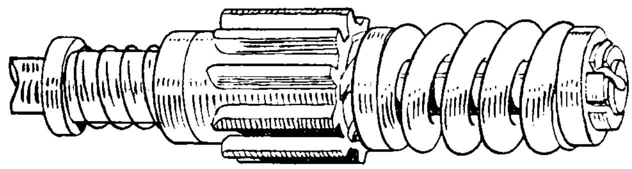


Fig. 38. Showing the starter drive assembled

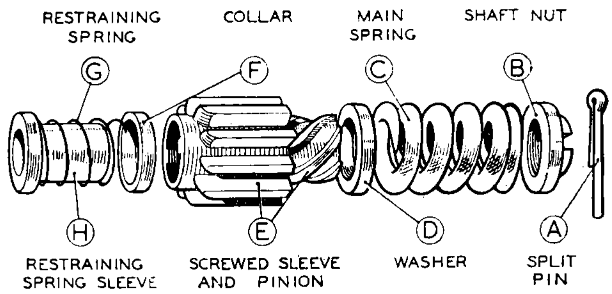


Fig. 39. Exploded view of the starter drive assembly

WINDSCREEN WIPER

DESCRIPTION

The windscreen wiper assembly consists of a two-speed, thermostatically protected motor coupled by a cable rack drive to two scuttle mounted wheel boxes. The cable rack comprises a flexible inner core of steel wire wound with a wire helix. A reciprocating motion is imparted to the rack by a connection rod in the motor gearbox and transmitted to the wiper arm spindles by engagement of the rack with a gear in each wheelbox.

The wipers are self parking and are controlled by a switch on the instrument panel, giving Park, Slow and Fast speed operation. The fast speed is intended for use when driving fast through heavy rain or light snow. It should NOT be used with heavy snow or a drying windscreen.

If overloaded, the motor windings will overheat and cause the thermostat to trip and isolate the motor from the supply. Possible causes include: Packed snow or ice on the screen, over-frictional or oil-contaminated blades, damaged drive mechanism or spindle units. Provided the obstruction or other cause of excessive heating is removed, normal working resumes automatically when the temperature falls to a safe level.

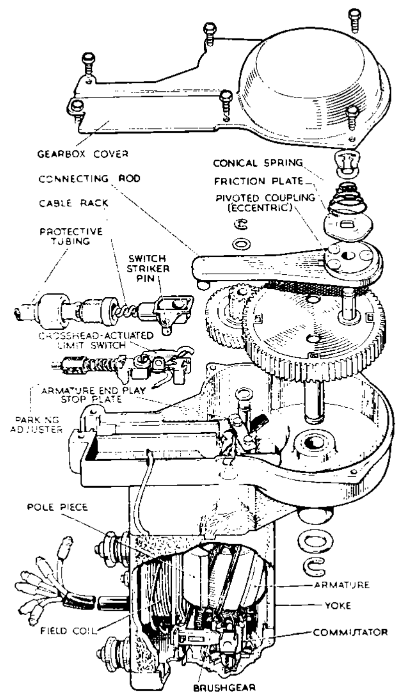


Fig. 40. Exploded view of the windscreen wiper motor

DATA

	Slow	Fast
Wiping Speeds	44–48 Cycles/minute	58–68 Cycles/minute
Current Consumption ..	3·4 amperes (max.)	2·6 amperes (max.)
Resistance of Field Coil ..	8·0–9·5 ohms	
Value of Field Resistor ..	9·5–11·0 ohms	
Armature End Play	0·003″– 0·008″ (0·07–0·20 mm.)	
Wheelbox End Play	0·003″ (0·076 mm.) max.	

MAINTENANCE

Efficient wiping is dependent upon having a clean windscreen and wiper blades in good condition.

Use methylated spirits (denatured alcohol) to remove oil, tar spots and other stains from the windscreen.

Silicone and wax polishes should not be used for this purpose.

Worn or perished wiper blades are readily removed for replacement.

When necessary, adjustment to the self-parking mechanism can be made by turning the knurled nut located near the cable rack outlet on the wiper motor. Turn the nut only one or two serrations at a time, and test the effect of each setting before proceeding.

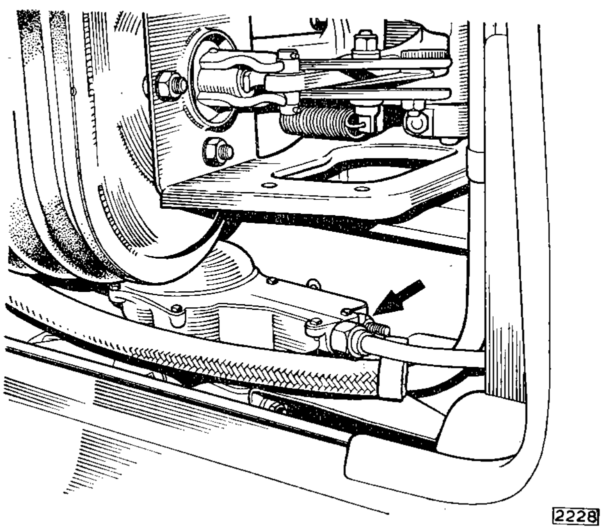


Fig. 41. The windscreen wiper parking adjuster screw

REMOVAL OF WIPER MOTOR AND CABLE

Withdraw the wiper arms from the spindles. Disconnect the earth cable at the battery.

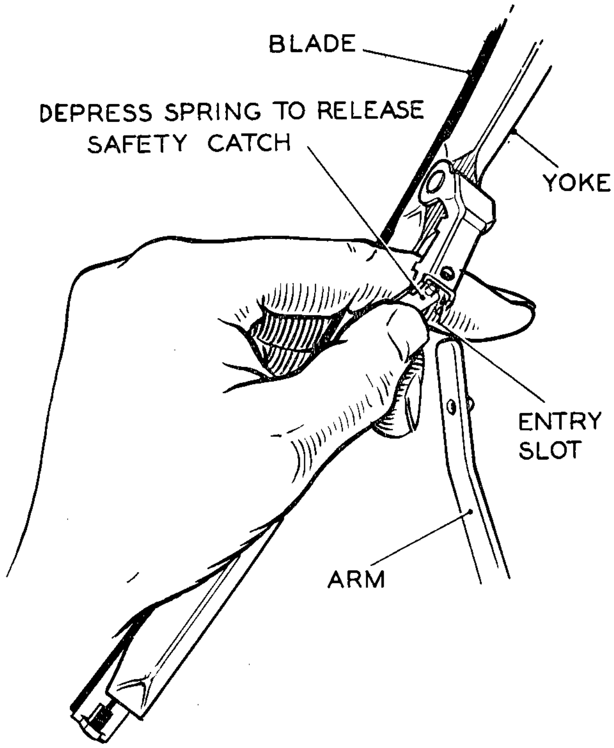


Fig. 42. Wiper blade to arm attachment

Unscrew the large nut connecting the cable guide to the wiper motor.

Remove the setscrew and nut securing the earth wire and cable clip to the motor mounting bracket.

Disconnect the cable harness attached to the motor at the snap connectors noting the cable colours.

Remove the four nuts and washers securing the motor to the mounting bracket attached to the bulkhead adjacent to the left-hand front wing.

Detach the motor and withdraw the rack from the wheel boxes.

Note: On right-hand drive cars it will be necessary to remove the battery to gain access to the wiper motor.

Disconnecting the Cable

Remove the six small set bolts from the wiper motor gearbox cover.

Lift off the cover, remove the circlip from the post in the gearwheel.

Remove the washer, conical spring, friction plate and connecting link from the post. Lift out the connecting rod from the crosshead.

Lift out the cable ferrule from the gear casing.

REFITTING

Refitting is the reverse of the removal procedure.

REMOVAL OF WHEELBOXES

Remove the side facia panel as described on page P.51.

Remove the glove box as described on page P.50.

Withdraw both wiper arms from the spindles.

From outside the car, unscrew the large nuts securing the wheelboxes to the scuttle.

Detach the clear plastic screen washer tubing from the tube connections inside the car. Remove the chrome distance pieces with attached tube connection and the rubber seals.

Detach the demister ducts by removing the four nuts and washers from each unit.

Remove the backplates from the wheelboxes by removing the four nuts and shakeproof washers.

Pull the cable away from the worm wheels and slide off the spacer tubing.

From inside the car withdraw the wheelboxes and spacers.

REFITTING

Refitting is the reverse of the removal procedure. When refitting, ensure that the flared end of the tube from the wiper motor to the left-hand wheelbox is securely held in the wheelbox and registers in the slot provided in the backplate.

FAULT DIAGNOSIS

Poor performance can be electrical or mechanical in origin and not necessarily due to a faulty motor, for example:—

Low voltage at the motor due to poor connections or to a discharged battery;

Cable rack binding in protective tubing;

Excessive loading on the wiper blades;

Wheelboxes loose, out of alignment or spindles binding in the bearing housing.

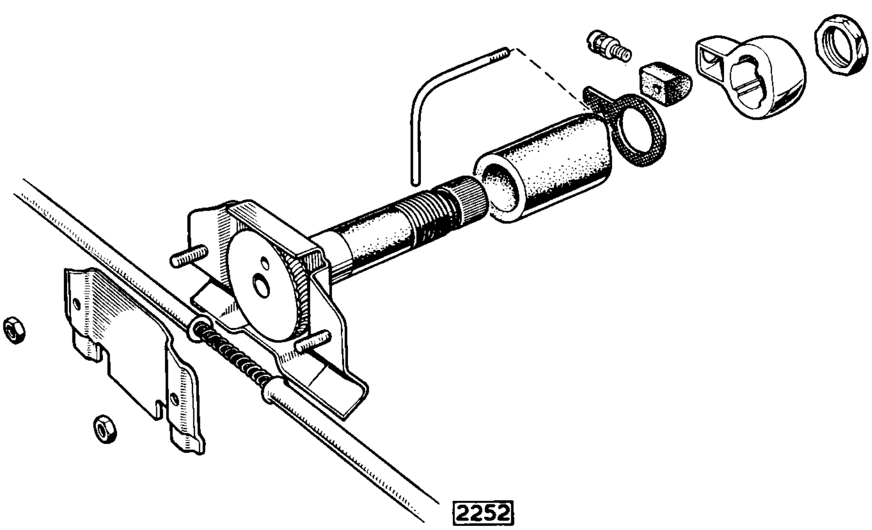


Fig. 43. Exploded view of the wheel box assembly

TESTING

Unless the origin of the fault is apparent, proceed as follows to determine the cause of failure.

Measuring Supply Voltage

Using a first grade moving coil voltmeter, measure the voltage between the motor supply terminal (to which the green cable is connected) and a good earthing point. This should be 11·5 volts with wiper working normally. If the reading is low, check the battery, switch (by substitution), cabling and connections.

To Check the "Fast" Speed Current

Using a fully charged 12-volt battery and two test leads, connect the "GREEN" cable on the wiper motor to the "Negative" battery terminal. Join the "YELLOW" and "RED" cables together and connect to the "Positive" battery terminal. Connect the "BLUE" and "WHITE" cables together. Check the cycles per minute of the wiper spindle.

To Check the "Slow" Speed Current

Connect the "GREEN" cable to the "Negative" battery terminal. Join the "BROWN" and "RED" cables together and connect to the "Positive" battery terminal. Connect the "BLUE" and "WHITE" cables together. Check the cycles per minute of the wiper spindle.

Measuring the Light Running Current

The light running current must not exceed 3·0–3·7 amperes at slow speed of 44–48 c.p.m./or r.p.m. of the output motor shaft; also 2·2–2·9 amperes at fast speed 58–68 c.p.m./or r.p.m. of output motor shaft.

If the current is in excess of these figures, change the wiper motor. See DATA chart for other information.

Checking Cable Rack and Tubing

The maximum permissible force to move the cable rack in its protective tubing is 6 pounds with the wiper arms, blades and motor disconnected. The measurement can be made by hooking a spring balance in the hole in the cross-head (into which a pin on the connecting rod is normally located) and withdrawing the rack with the balance.

Binding of the rack can be due to kinked or flattened tubing or to faulty installation. Minor faults can be cleared with a suitable tested mandrel sold specifically for checking wiper installations. Badly kinked or flattened tubing must be renewed. Any bends of less than 9″ radius must be reformed.

It is ESSENTIAL that all the flared ends of the tubing are registered in the slots provided in the wheel box plates before tightening the wheel box cover plate securing nuts.

The cable rack should be well lubricated with Duckhams HBB grease.

Checking Wheelboxes

Check the wheelboxes for misalignment or looseness and rectify as required.

Renew seized wheelboxes.

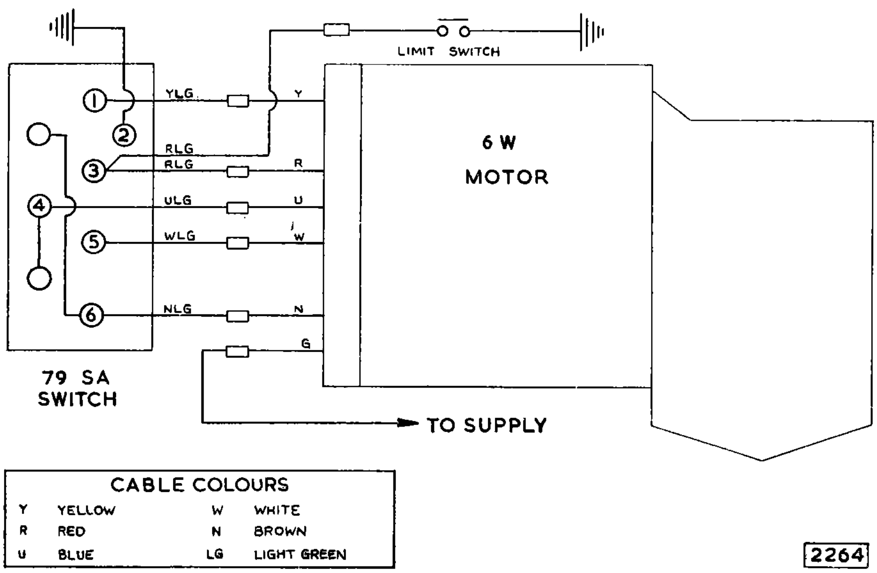


Fig. 44. Wiring connections—Switch to wiper motor

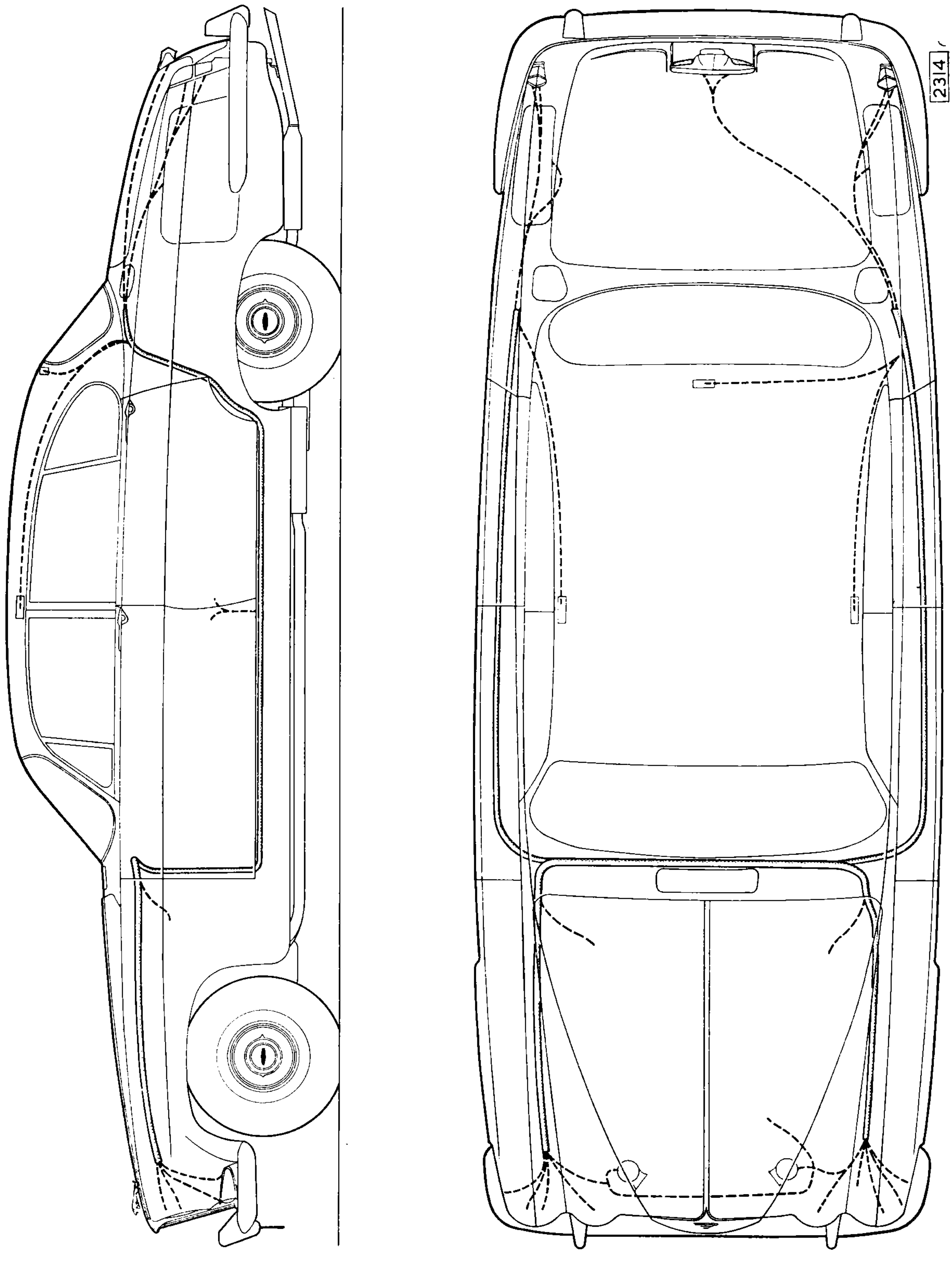


Fig. 45. Layout of the wiring harness

ELECTRICALLY-OPERATED WINDOWS

GENERAL

This system (fitted as an optional extra) enables the window regulators to be operated by means of press-button switches which control reversible electric motors mounted in each door panel and actuate the lifting and lowering mechanism.

Six control switches are employed, two for the use of passengers in the rear of the car controlling the rear windows, and four for the driver's use, giving control over all four windows and overriding the rear passengers' switches. The driver's control switches each incorporate two switching sequences; the first is a normally-closed on-off switch isolating the power supply to the rear window switches, and this operates fractionally ahead of a single-pole changeover switch controlling the direction of motor rotation.

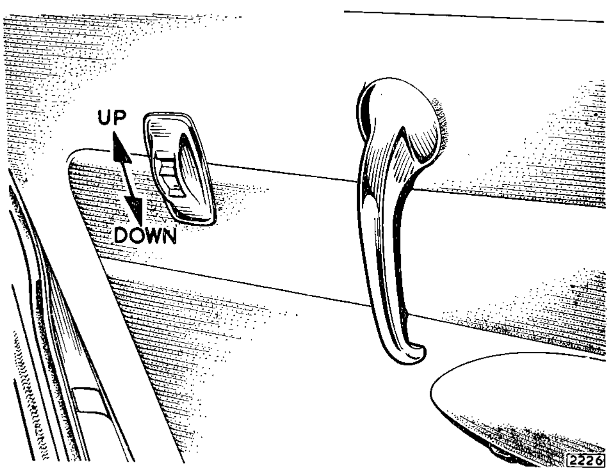


Fig. 46. Rear passenger's window regulator switch

The system is operative only when the ignition is switched on, when the closing of a heavy-duty relay (Model 9RA) connects the window lift circuit direct to the battery (via the solenoid starter switch).

A thermostatic circuit breaker protects the motor windings from damage should the motors be stalled with the current on, as for example with the control switch not released although the window is fully open or fully closed, or if the regulating mechanism is out of adjustment or requires lubrication. It also protects the wiring should fault current be flowing for any reason in any part of the circuit.

In the system fitted to the initial 3·8 Mark 10 cars, the circuit breaker is a double unit, one half protecting the motors and wiring on the right-hand side of the car, the other half the left-hand. In the event of stall or fault current flowing, the circuit breaker will operate to break the circuit after a few seconds (depending on the current value and ambient temperature and will then reset itself after a time interval), allowing current to flow until the circuit breaker again operates. This cycle will be repeated as long as the switch remains closed or the fault exists, with the ignition switched on.

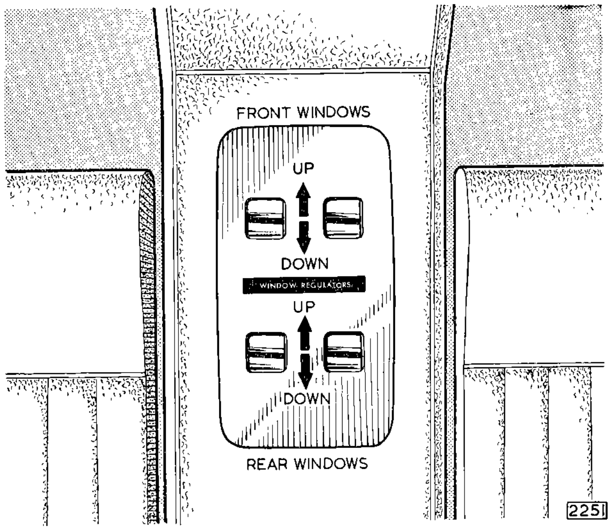


Fig. 47. The driver's control switches

In the system subsequently fitted, a refinement is added to this protection device. A single circuit breaker is employed in conjunction with a second relay (Model 6RA) having normally closed contacts. In the event of stall or fault current flowing in the circumstances described above, the circuit breaker will operate. Current will then flow through the relay winding (rated at 65 milliamps) thus opening the relay contacts. So long as the switch remains closed or the fault exists, the relay will be energised, preventing further operation of the motors. When the switch is released, or the fault rectified, the relay is de-energised and the contacts re-closed, so restoring the system to normal. It should be noted, however, that since by operating the driver's window control switch the remainder of the circuit is isolated, the driver may still use the system to control his own window provided that the cause of the trouble is in one or all of the passengers' windows.

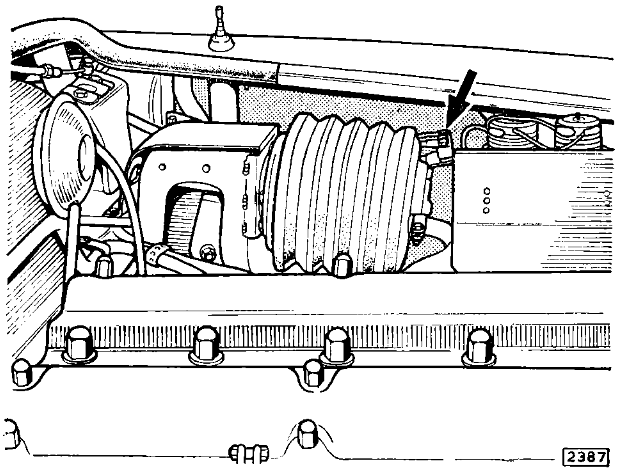


Fig. 48. *Location of circuit breaker*

Note: In the event of a window not closing when the switch is operated, it can be wound up with the aid of a special screwbrace which is retained in the luggage compartment next to the wheel brace. The screwbrace should be inserted in an aperture provided in the bottom edge of the door and engaged with a slot in the regulator mechanism. The window can now be wound up to the closed position.

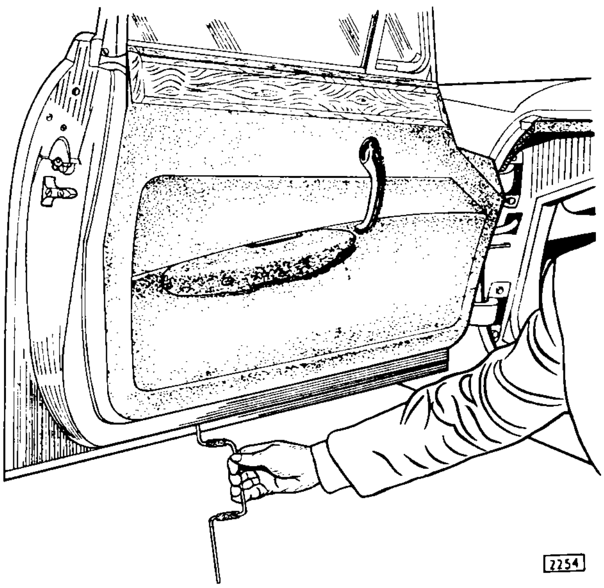


Fig. 49. Using the screwbrace to raise the window

REMOVING AND REFITTING THE WINDOW REGULATORS

Removal of Door Casing

Remove the four screws from the wood capping at the top of the door panel.

Remove the four screws revealed securing the wood facia rail on the door panel (note the amount of packing strips underneath the facia rail brackets).

Lift up the leather cloth which is affixed to the top of the door frame.

Remove the six self-tapping screws revealed in the top of the casing.

Remove the interior door handle by pushing the escutcheon inwards and extracting the spring retainer clip.

Remove the two screws securing the arm rest.

Remove the door casing by pulling away from the door frame and releasing the spring clips.

Remove the polythene sheet covering the inner door frame.

Removal of Window Regulator

If it becomes necessary to remove the motor or any other part of the regulator mechanism for maintenance or replacement, the complete regulator must be taken out of the door first as follows:—

Lower the window to the full open position and remove the self-tapping screw (1) Fig. 50, securing the regulator motor support bracket (2) to the window sill fold in the outer door panel.

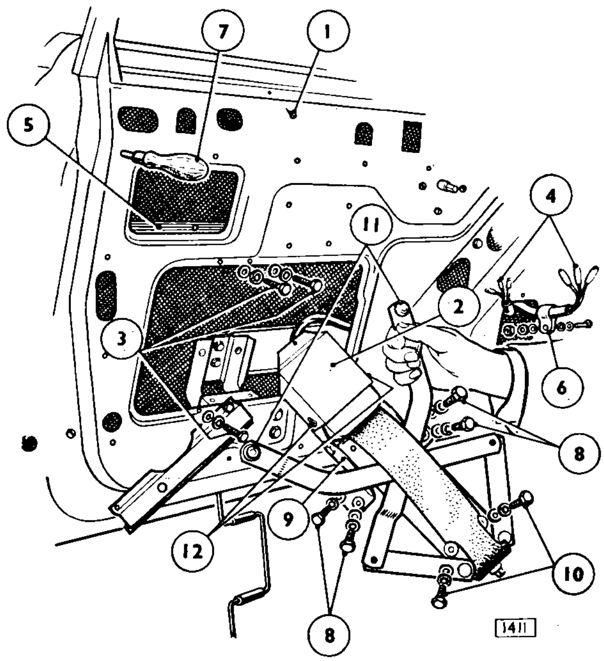


Fig. 50. Removing the regulator

Important: Raise the window to approximately one inch from the closed position.

Remove three of the four bolts and nuts (3) with their plain and shakeproof washers retaining the arm rest support bracket to the inner door panel and swing the bracket downwards out of the way as illustrated.

Disconnect the three cables (4) at the snap connectors situated in the aperture of the door frame and remove the three clips and screws (6) securing the cables to the door frame as illustrated.

Note: Before attempting to release the regulator the glass must be retained in the raised position by inserting a small screwdriver or similar tool through one of the upper door casing clip holes in the door frame as shown in (7).

Remove the four setscrews (8) plain and lockwashers securing the upper regulator bracket (9) to the top mounting rail (5) inside the door.

Remove the two setscrews (10) plain and lockwashers securing the regulator backplate to the bottom mounting bracket.

Important: To ensure that the slotted bottom of the lifting screw (25), Fig. 53, clears the outer door panel and is parallel with the glass, spacing washers are fitted on some doors between the regulator backplate and the bottom mounting bracket. The position of these must be noted for reassembly.

To remove the regulator slide the lower half towards the back of the car when removing from the left-hand doors and slide the regulator forward when removing from the right-hand doors.

This action will disengage one of the window lifting arms; the other arm is removed from the window channel by sliding the regulator in the opposite direction. The release slot is in the middle of the glass channel.

Note the position of the window lifting arms. Remove the regulator complete with the side mounting brackets and the motor with the motor support as illustrated in Fig. 50.

Important: Do NOT disturb the top mounting rail, the bottom mounting bracket or the glass run channels as these are accurately set during production.

Refitting the Regulator

If the window frames have been removed or disturbed for any reason, it will be necessary to carry out the following checks before refitting the regulator.

Check that the window frame is correctly aligned with the door, that is, the frame must contact the draught excluder at all points. Distance washers can be fitted between the bottom frame and the inner panel of the door and the mounting holes in the inner door panel can be enlarged to achieve this condition.

It is ESSENTIAL that the glass is absolutely free in the window frame. With the regulator removed from the door, the glass must fall from the top to the bottom of the frame under its own weight.

Position the regulator arms by rotating the bottom of the lifting screw with a screwdriver so that the brass pin on which the arms pivot is $1\frac{5}{8}''$ (4·12 cm.) from the top bush plate (see Fig. 51).

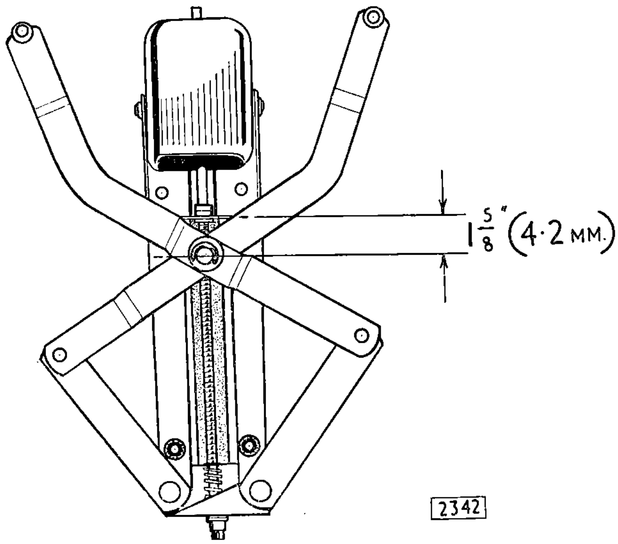


Fig. 51. Showing the setting dimension for the regulator arms

On right-hand doors first enter the left-hand regulator arm into the glazing channel and vice versa.

Temporarily secure the regulator to the mounting points (B, Fig. 52) and connect the cables to the motor.

Ensure that all the regulator bracket securing bolts (A, Fig. 52) are slack.

Having refitted the regulator and cables it is essential to test the operation of the glass and the amount of current required to drive the motor as follows:—

Connect an accurate 0–50 ammeter in series with the brown and purple cable connected to the 9 RA relay (terminal C2) situated under the left-hand wing adjacent to the control box.

Reconnect the battery and start the engine.

Operate the control, lower the glass inch by inch until it is at the lowermost position.

Allow the regulator to find its natural position and tighten the bolts or fit packing between the lower bracket and inner face of door as necessary.

Raise the window and check the current used.

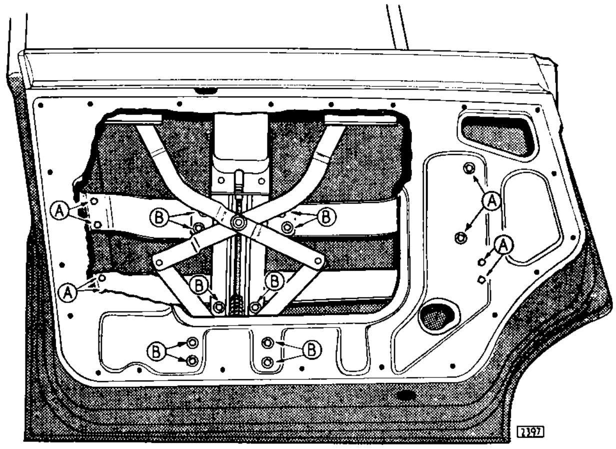


Fig. 52. Refitting the regulator

With the engine running the regulator must not use more than 17 amps. when closing the window. It is desirable to use as little current as possible.

If more than 17 amps. is used when operating the window it may be necessary to elongate the holes in the lower regulator mounting bracket so that the motor spindle can be positioned exactly at right angles to the bottom edge of the window glass.

Removing the Motor

Remove the two setscrews (12) Fig. 53 and plain washers securing the motor to the support brackets. Detach the motor support and raise the motor sufficiently to release the driving shaft (14) from the end coupling (15) and the dowels from the locating holes (16). This will also release the top of the paper oil shield (17) which should be bent downwards out of the way.

Refitting the Motor

Place the paper oil shield in position and engage the two motor dowels in the rubber bushed locating holes in the bottom motor support brackets.

The driving shaft (14), coupling (15) and the lifting screw (25) are "D" shaped to ensure instant and positive engagement.

Place the support (2) over motor and secure with two screws (12) and washers.

Note: To enable the motor support to be positioned inside the door the screws should not be tightened at this stage.

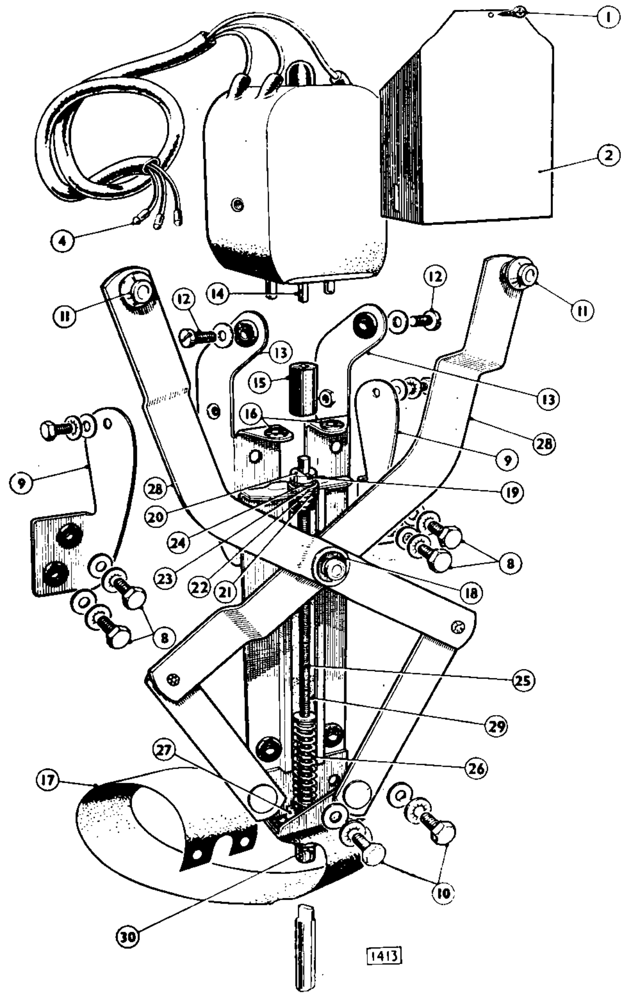


Fig. 53. Exploded view of the window regulator

Replacing the Lifting Screw

Release the circlip (18) and washer. Collect the three plastic washers (when fitted) one immediately above, one between and one below the lifting arms.

Knock the cross pin (19) out of the top thrust collar (20). Note the sequence of assembly for refitting the flexible bush (21), the bearing bush (22), hardened washer (23), thrust bearing (24) and finally the collar and thrust pin.

The lifting screw (25) is unscrewed from the bottom until the lifting nut is released. The screw and bottom bearing assembly can then be removed.

Important: If the bottom bearing assembly is replaced a single washer, plastic coated on one side, is used in place of the hardened washer (23) and the thrust washer (24) used on the top bearing. The washer must be assembled so that its coated side is in contact with the bottom thrust collar.

Note: If a new lifting screw is to be fitted the hole for the bottom cross pin must be drilled in position. End float should be between ·005″ (·127 mm.) and ·015″ (·381 mm.).

Replacing the Lifting Nut

To remove the nut the buffer spring (26) with its nylon top bush, must be taken off first to allow the nut to slide to the bottom of its channel when it can be removed. The spring is held in position at the bottom by a retaining clip (27) riveted to the regulator backplate.

FAULT LOCATION

In the event of the system not operating satisfactorily it will be necessary—because of the interdependability of the mechanisms associated with each window—to note the symptoms and locate the source of the trouble by a process of elimination with the aid of the wiring diagram.

The following notes are given for guidance:

It is important that the supply voltage for testing must be a minimum of 12 volts. If, for some reason, the engine cannot be running at above generator cut-in speed during testing, an external battery supply must be used.

System Employed on Early Cars

(i) Complete failure of system.

This will usually indicate that the battery supply is not connected to the system. Check by means of a voltmeter connected between 9RA relay terminal C2 and earth; with the ignition switched on, the meter should register battery voltage. If not, check wiring from ignition switch to relay terminal W2 and from terminal W1 to earth. Also from feed on starter solenoid switch to relay terminal C1. If wiring is in order, check relay by substitution.

(ii) Failure of both windows on one side, those on the other side operating satisfactorily.

This will normally indicate that the battery supply is not passing through the appropriate half of the circuit breaker, or is not reaching the front window control switch on the affected side. Check with voltmeter at the switch terminal, and if no reading is given, check at the appropriate circuit breaker terminal. If the circuit breaker appears to be permanently open circuit, fit a replacement unit.

If the voltmeter shows the supply through the circuit breaker to be alternately available and non-available, with an interval between each, an indication is given that current is being drawn by either a motor remaining switched on but stalled, or a fault to earth in the wiring, causing the circuit breaker alternately to break and make the circuit. Check all switches on the affected side to ensure that they are in fact off, and make point-to-point check of wiring, paying particular attention to snap connectors.

(iii) Failure of one window only.

Check if voltage appears at the switch terminal connection to the motor when the switch is operated. If not, make point-to-point check with voltmeter along circuit to non-operative mechanism, paying particular attention to snap connectors. If voltage is present at switch terminal, check wiring from switch to motor and motor to earth. Provided that the window mechanism is free to operate, an open circuit in the motor itself is indicated in these circumstances and a replacement unit should be fitted.

If voltage is present at the switch input terminal but not at the appropriate switch output terminal when the switch is operated, check switch by substitution.

If voltage is present at the motor switch terminal when the ignition is first switched on, but fails to zero after a few seconds, and the window does not move, this indicates that stall current is being drawn by the motor causing the circuit breaker to open. Check window mechanism for freeness in operation.

System Employed on Later Cars

(i) Complete failure of system

Proceed as under paragraph (i) "System Employed on Early Cars." If voltage is indicated as far as terminal C2 on 6RA relay, disconnect the cables at the circuit breaker to driver's window control switch and to relay terminal W1, and check at terminal C3. No reading indicates relay contacts permanently open, and a new relay should be fitted. (The functioning of the relay winding can be checked by disconnecting external connections from relay terminals C3, C2 and W1. There should now be direct continuity between C3 and C2. With 12 volts applied between C2 and W1, the relay should operate to open the contacts and break the continuity between C3 and C2). If reading is shown at C3, next check at circuit breaker terminal normally connected to driver's window control switch. No reading indicates circuit breaker permanently open circuit, and it should be replaced. Reconnect cables from control switch and relay terminal W1 and C3 at circuit breaker.

If normal supply voltage is available at the circuit breaker, check for loose, broken or earth-fault cable connection from circuit breaker to driver's window control switch. If normal supply voltage is available, the only other fault which could produce this symptom is a faulty switch not disconnecting the driver's window motor, which consequently passes stall current and causes the protective circuit described under "General Description" to operate. Check switch operation.

(ii) Driver's window operates normally, but none or one of remainder operates.

If operation of the driver's control switch causes the driver's window to operate normally, but none or one only of the remainder do so, the cause of the trouble may be due to a sticking switch or an earth fault in the rest of the circuit causing the protective circuit to function. Operation of the driver's window control switch has the effect of isolating the remainder of the system, allowing the driver's window motor to operate individually.

Depending upon the situation of the fault, however, it might be possible to localise it more closely. With the driver's window control switch off, operate the rear window master control switch on the same side. By doing so, the corresponding rear passenger control switch will be isolated, and if the rear window now operates normally, a faulty rear passenger switch or feed wire can be suspected. Such a fault will also prevent both windows on the opposite side from operating.

If no operation results, next operate the switch controlling the front window on the opposite side. If this window now operates, an indication is given that the fault is associated with the rear window circuit on that side which has now been isolated by the front control switch. Release the front control switch and operate the rear window master control switch, thereby isolating the rear passenger control switch. If the rear window operates normally, a faulty rear passenger switch or feed wire can be suspected. Such a fault will prevent the front window and the rear window on the opposite side from operating.

(iii) Failure of one window only.

Proceed as for paragraph (iii) under "System employed on early cars."

DATA

Motor (Model 4GM)

Current consumption 12·5 amps. approximately at armature speed of 3,500±200 r.p.m. with torque of 25 oz. in. Cold stall current 32–37 amps. at 12 volts (not to be allowed to flow for longer than 5 seconds without circuit breaker in use). Light running current not to exceed 4½ amps. at 13·5 volts. Brush pressure 160 grams.

Relay (Model 9RA)

Cut-in voltage 6·0–9·0 volts. Drop-off voltage 2·0 volts (min.). Coil resistance 130±10 ohms.

Relay (Model 6RA)

Cut-in voltage 8·5–10 volts. Drop-off voltage 6·0 volts (max.). Coil resistance 76±5 ohms.

Circuit Breaker (Models 4CB and 3CB)

Under stall current conditions, the circuit breaker must operate in less than 5 seconds, and reset in less than 10 seconds. These figures apply to the first operation of the circuit breaker and with an ambient temperature of 20°C. For subsequent operations, and with the circuit breaker in situ on the car and therefore at a higher ambient temperature, the circuit breaker will operate sooner and take longer to reset.

DRIVER'S CONTROL SWITCHES

Removal

Disconnect the battery.

Prise up the switch panel from the rear with a wide, blunt instrument taking care not to mark the wood veneer.

Lift out the panel and remove seven self-tapping screws retaining the wood capping to the switch panel.

Remove the two screws and wires and remove the required switch.

Refitting

Refitting is the reverse of the removal procedure.

REAR PASSENGER'S CONTROL SWITCHES

Removal

Remove the rear door casing as detailed in the Body Section N.

Remove the switch from the door panel and disconnect the wires.

Refitting

Refitting is the reverse of the removal procedure.

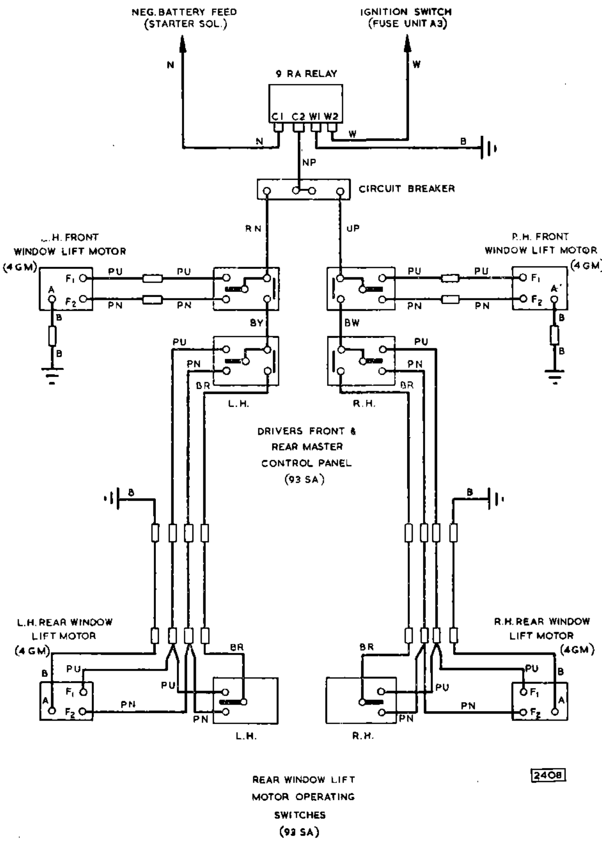


Fig. 54. The electric window circuit for cars up to chassis numbers 301359 R.H. Drive and 351596 L.H. Drive.

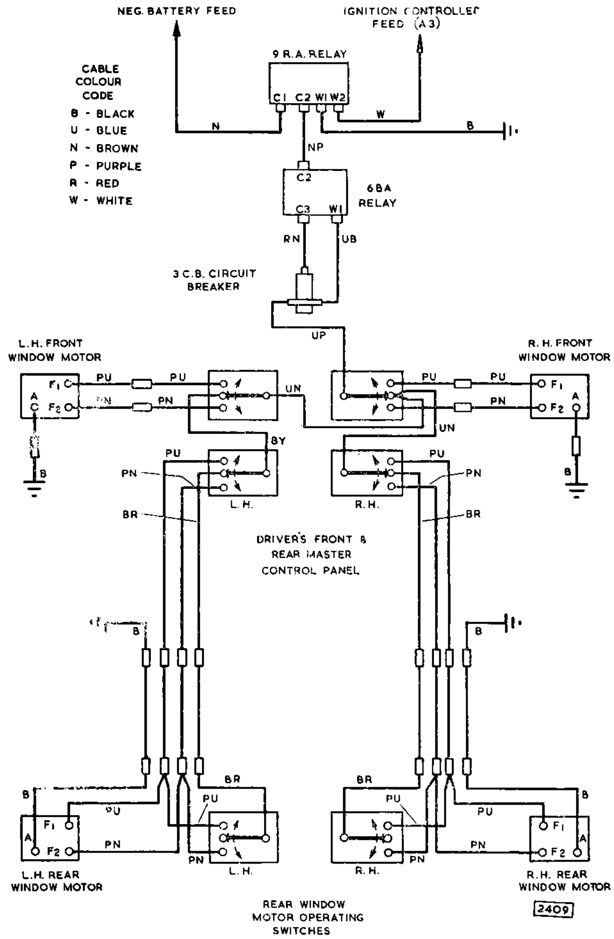


Fig. 55. The electric window circuit for cars after chassis numbers 301359 R.H. Drive and 351596 L.H. Drive.

MISCELLANEOUS

INTERMEDIATE SPEED HOLD SWITCH (Automatic Transmission)

Removal

Disconnect the earth lead at the battery. Remove the intermediate speed hold switch from the rear of the panel by unscrewing the retaining ring, collecting the escutcheon and removing the two cables.

Refitting

Refitting is the reverse of the removal procedure.

ELECTRIC CLOCK

Removal

Detach the earth lead from the battery. Remove the revolution counter from the instrument panel as detailed under "Revolution Counter and Clock Removal." Detach the clock from the rear face of the revolution counter by removing the two nuts. The flexible setting drive can be removed by slackening the knurled nut. Disconnect the cable at the snap connector.

Adjustment

Adjustment is effected by means of a small screw surrounded by a semi-circular scale located at the back of the instrument.

If the clock is gaining turn the screw towards the minus (—) sign; if the clock is losing turn the screw towards the positive (+) sign.

Note: The action of resetting the hands automatically restarts the clock.

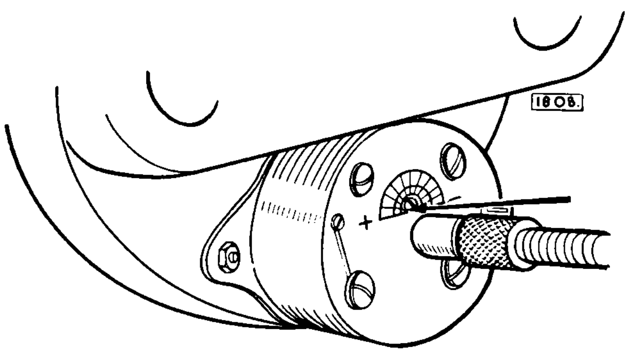


Fig. 56. Adjustment screw for clock

Refitting

Refitting is the reverse of the removal procedure.

BRAKE FLUID AND HANDBRAKE WARNING LIGHT

Renewing the Bulb

Unscrew the bezel of the lamp, exercising care to control the run of the spring loaded bulb beneath. Feed the bulb into the spring-loaded bulb holder, ensure that the red transparent window is retained in the bezel by a small circlip, position the designation plate on the bulb holder and screw on the bezel.

FLASHING INDICATOR CONTROL

Removal

Disconnect the earth lead at the battery. Detach the upper and lower switch covers from around the steering column by removing the two sunken screws and three screws from below. Disconnect the seven cable harness at the snap connectors at the left-hand side of the steering column. Detach the flasher indicator control from the left-hand side of the steering column by withdrawing two horizontally positioned screws from the right-hand side.

Refitting

Refitting is the reverse of the removal procedure. Insert the wires into the connectors so that similar coloured wires are opposite each other.

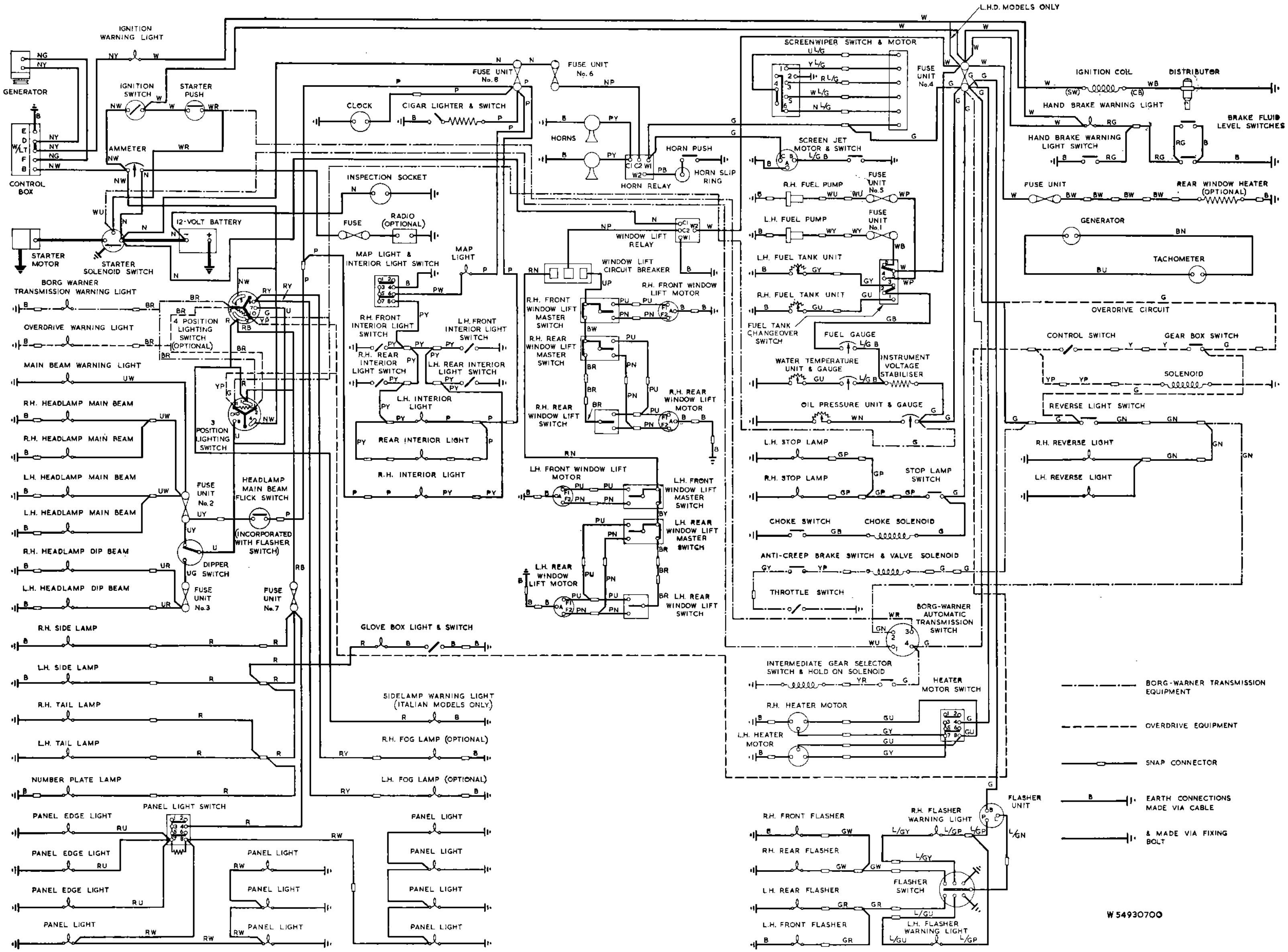
OVERDRIVE SWITCH

Removal

Disconnect the earth cable at the battery. Detach the upper switch cover from the steering column by removing the two most sunken screws from below. Disconnect the two cables at the snap connectors, remove the nut securing the switch to the mounting bracket and withdraw the switch.

Refitting

Refitting is the reverse of the removal procedure but ensure that the switch lever is horizontal in the "out" position when tightening the securing nut.

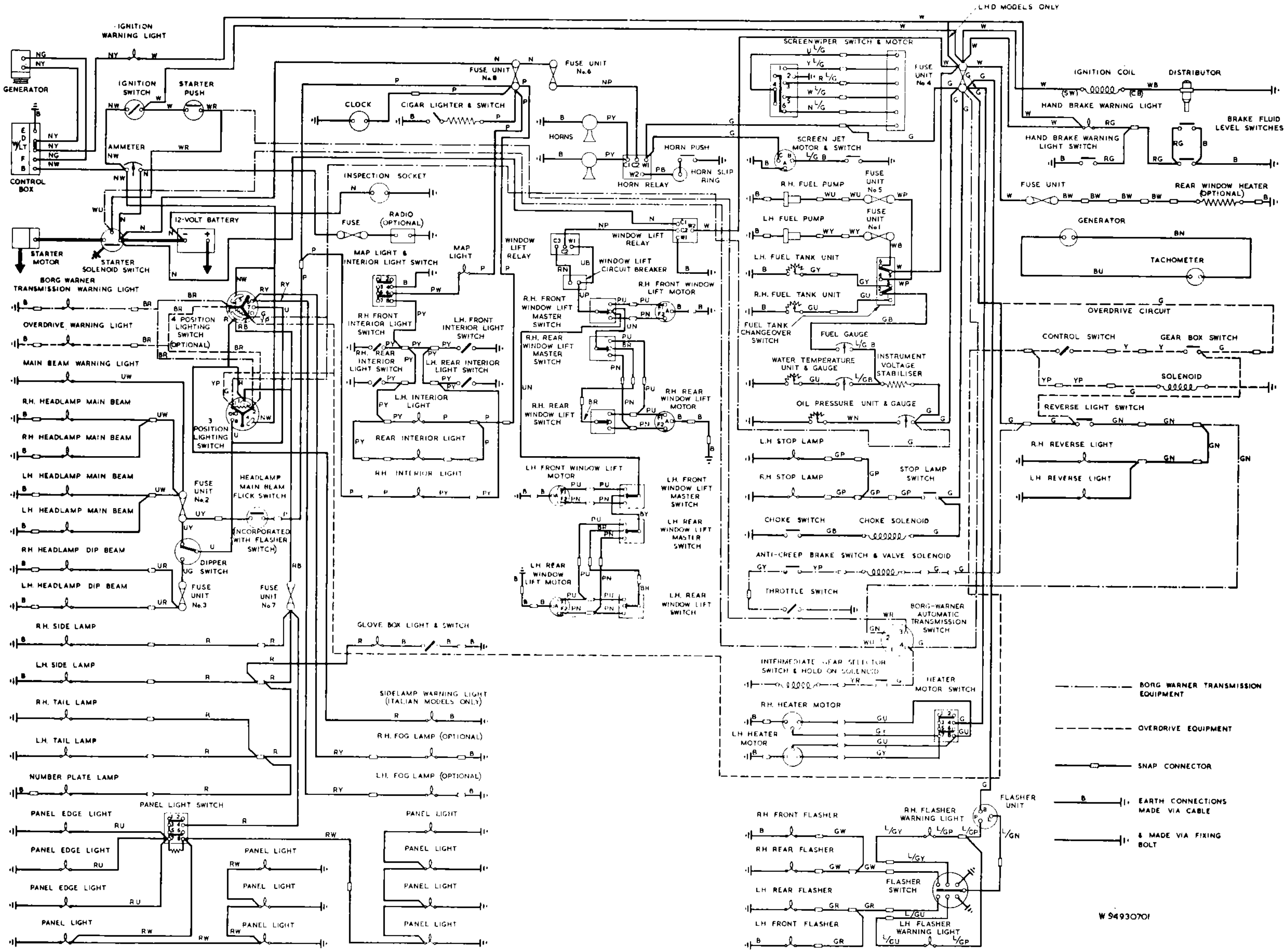


CABLE COLOUR CODE

B—BLACK	N—BROWN	P—PURPLE	S—SLATE	Y—YELLOW	L—LIGHT
U—BLUE	R—RED	G—GREEN	W—WHITE	D—DARK	M—MEDIUM

When a cable has two colour code letters, the first denotes the main colour and the second denotes the tracer colour.

Fig. 57. The wiring diagram for cars up to chassis numbers 301359 R.H. Drive and 351596 L.H. Drive



CABLE COLOUR CODE

B—BLACK	N—BROWN	P—PURPLE	S—SLATE	Y—YELLOW	L—LIGHT
U—BLUE	R—RED	G—GREEN	W—WHITE	D—DARK	M—MEDIUM

When a cable has two colour code letters, the first denotes the main colour and the second denotes the tracer colour.

THE INSTRUMENTS

SCREEN RAIL

Removal

The screen rail cannot be removed until both curved side panels and screen pillar cappings have been detached as detailed under "Side Facia Panel."

Release the four nuts, serrated and plain washers securing the screen rail to the two inner and two outer attachment brackets (see Fig. 59).

Disconnect the two cables attached to the map light and remove the screen rail.

Refitting

Refitting is the reverse of the removal procedure.

THE INSTRUMENT PANEL

Opening

Detach the earth lead from the battery.

Remove the ignition key and cigar lighter for safe keeping. Hinge the centre instrument panel downwards on its bottom edge, after withdrawing the thumb screws situated in each top corner.

Removal

The instrument panel can be removed completely by detaching the earth lead from the battery, identifying and removing the leads from the instruments, cigar lighter and switches, removing the electrical harness and clips from the instrument panel and withdrawing the two hinge pivot bolts from the instrument panel support brackets.

Refitting

Refitting is the reverse of the removal procedure, but particular attention must be given to the following point:

That the leads are refitted in accordance with their colour coding, utilizing the wiring diagram as a reference.

Closing

Closing is the reverse of the opening procedure, but particular attention must be given to the following points:

(i) That the leads are replaced in accordance with their colour coding, utilizing the wiring diagram as a reference.

(ii) That the clips securing the main harness to the instrument panel will in no way foul any of the switch or instrument terminals, otherwise a direct short will occur when the battery is connected.

THE GLOVE BOX

Removal

Disconnect the positive lead from the battery.

Remove the curved side panels, screen pillar cappings and screen rail as detailed under "Side Facia Panel."

Remove the two thumb screws securing the centre instrument panel to the body and allow the panel to rest in the horizontal position.

Remove the three slotted setscrews and lock washers

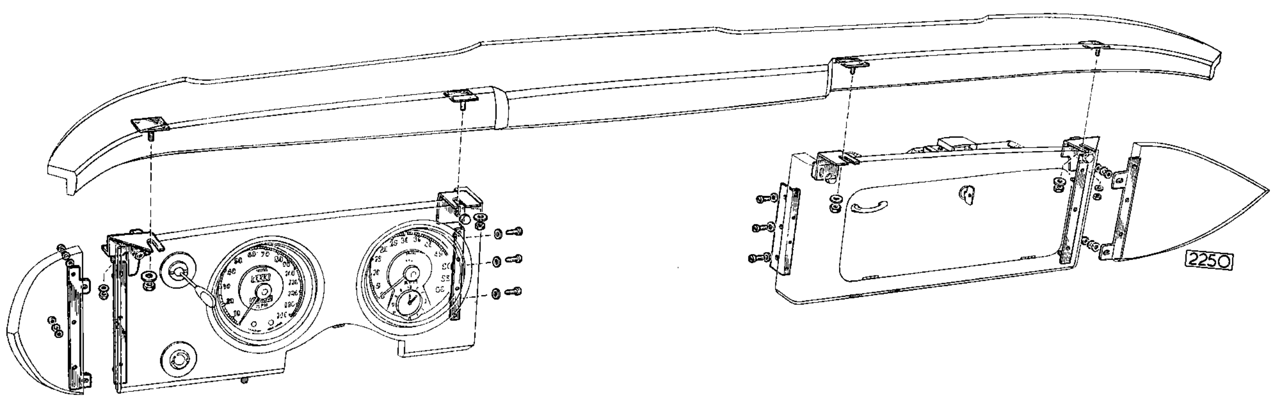


Fig. 59. The screen rail, glove box and side facia attachment points

retaining the glove box to the centre instrument panel support bracket.

Remove the nut, lock washer and plain washer securing the glove box outer attachment bracket to the body and detach the glove box (see Fig. 59).

Disconnect the "Lucar" connectors from the glove box illumination lamp and earth connections.

Withdraw the glove box.

Refitting

Refitting is the reverse of the removal procedure.

SIDE FACIA PANEL

Removal

Disconnect the positive lead on the battery. Remove the two nuts and washers securing the curved side panels to the side facia panel and the glove box. Extract the two screws securing the side panels to the body at the base of the screen pillars. The screw heads are accessible after opening the door and lifting the door trim welt locally.

Remove both side panels (see Fig. 59).

Remove both screen pillar cappings by withdrawing the screws from the bottom fixing brackets, now exposed, inserting a thin bladed instrument between the capping and the screen pillar, pressing in the top spring clip fastener, and gently prising away the capping.

Release the four nuts securing the screen rail to the two outer and the two inner slotted attachment brackets (Fig. 59).

Disconnect the two cables attached to the map light and remove the screen rail.

Remove the two thumb screws securing the centre panel to the body and allow the panel to rest in the horizontal position.

Release the steering wheel locknut and pull the steering wheel outwards to the full extent.

Remove the two setscrews and washers securing the top half of the flasher switch cover to the steering column and detach the cover.

Disconnect the speedometer drive cable from the rear of the speedometer.

Disconnect the flasher warning light and the automatic transmission (or overdrive) indicator panel illumination bulb cables from the snap connectors located behind the facia panel above the steering column and withdraw the cables through the clip attached to the panel.

Remove the automatic transmission speed hold switch (when fitted) from the facia panel by removing the chrome ring nut and withdrawing the switch through the panel.

Remove the three slotted setscrews and lock washers retaining the side facia to the centre instrument panel support bracket.

Remove the nut, lock washer and plain washer securing the panel outer attachment bracket to the body and detach the side facia panel (see Fig. 59).

Disconnect the panel light and clock cables at the snap connector.

Withdraw the ignition and main beam warning light bulb holders.

Disconnect the "Lucar" connectors from the revolution counter and the brake fluid warning light.

Disconnect the earth wires from the speedometer and the revolution counter.

Remove the side facia panel.

Refitting

Refitting is the reverse of the removal procedure. On cars equipped with automatic transmission, ensure that the three cables connected to the flasher warning and indicator panel illumination lights do not foul the indicator pointer when the gear control is operated.

SPEEDOMETER

Removal

Detach the earth lead from the battery and raise the steering wheel to the highest position.

Remove the upper half of the steering column nacelle.

Detach the speedometer from the facia board by removing the two knurled nuts, earth lead and two retaining pieces, then withdraw the flexible drive from the centre of the instrument by slackening the knurled sleeve. Withdraw the speedometer from the facia board, identifying and removing the two warning lights and two instrument illumination lights from the hidden face of the instrument. Remove the flexible trip odometer setting drive from the rear of the speedometer by slackening the knurled sleeve.

Refitting

Refitting is the reverse of the removal procedure. Replace the headlamp warning light in the right-hand aperture at the back of the instrument. Replace the ignition warning light in the left-hand aperture.

REVOLUTION COUNTER AND CLOCK

The revolution counter and clock are of the electrical type and the electrical leads to both are included in the car harness. The clock is mounted in the bottom of the revolution counter indicator head and to effect its removal, it is necessary to remove both speedometer and revolution counter from the side facia panel. The revolution counter consists of an A.C. generator fitted to the rear end of the camshaft with an indicator head mounted in the side facia panel, both units have Lucar tags of equal size.

Removal

Remove the speedometer from the side facia panel as previously detailed, this will give the necessary working clearance. Detach the revolution counter from the facia board by removing two knurled nuts, earth lead and retaining pieces, then withdraw the revolution counter by removing the two centre leads and two instrument illumination bulbs from the hidden face of the instrument and from the clock at the snap connector. Detach the flexible clock setting drive by slackening the knurled sleeve and remove the clock from the revolution counter by removing two nuts.

Refitting

Refitting is the reverse of the removal procedure.

Refit the leads in accordance to their colour coding, utilizing the winning diagram as a reference.

Testing operation of Revolution Counter

Utilizing an A.C. voltmeter check the current across the terminals of the generator at the rear of the right hand camshaft while the engine is running; as a rough guide it can be assumed that there is one volt output per 100 r.p.m. When electrical current is evident, check the continuity of the two leads by attaching the terminals to the generator and connecting the voltmeter to the opposite ends of the cables after removal from revolution counter. If when running engine continuity is evident, it can be assumed that the instrument is unserviceable and must be exchanged.

THE REVOLUTION COUNTER DRIVE

The revolution counter drive takes the form of a small A.C. electrical generator fitted at the rear R.H. end of the cylinder head where its tongued driving spindle engages a slotted adaptor screwed in the rear end of the inlet camshaft. Leads included in the electrical harness of the car connect with the Lucar tabs pointing upward in the body of the generator and with similar tabs at the rear of the instrument lead in the side facia panel. The Lucar tabs are of the same size and the leads can be fitted either way round.

Removal

Open the engine compartment and detach the earth lead from the battery. Remove the electrical harness from the two Lucar tabs on the A.C. generator on the rear R.H. end of the cylinder head. Detach the A.C. generator from the rear R.H. end of the cylinder head by withdrawing three Allen screws and a plate washer, remove the generator in a rearward direction and note the position of the tongued driving spindle.

Refitting

Refitting is the reverse of the removal procedure but particular attention must be given to the following point:

That the tongued driving spindle is positioned in the same attitude as it was when it was removed; whenever difficulty is experienced in engaging the tongued spindle do not apply any force but remove the generator, ascertain the position of the slot in the camshaft with a mirror and set the tongued drive in a similar position.

REMOVAL OF THE INSTRUMENT PANEL COMPONENTS

Detach the earth lead from the battery.

Remove the ignition key and cigar lighter for safe keeping. Hinge the centre instrument panel downwards on its bottom edge, after withdrawing the thumb screws situated in each top corner.

Ignition Switch

Identify and remove the ignition switch cables. Withdraw the ignition switch from the rear of the instrument panel by removing the chrome ring. The lock barrel can be withdrawn by inserting a thin rod through a hole in the body of the switch.

Refitting is the reverse of the removal procedure but particular attention should be given to the following points.

The number of the ignition key is the same as that stamped on the lock barrel. The flat on the thread of the lock barrel is positioned towards the right-hand side of the panel.

Cigar Lighter Element

Withdraw the cigar lighter and ensure that it is cold. Place the unit in the palm of the hand, knob first, and hold the sleeve downward against the pressure of the spring. Unscrew the lighter element and fit a replacement. It is important **not** to omit the spring as it ejects the lighter unit when it attains the correct temperature.

Cigar Lighter Unit

Withdraw the cigar lighter. Identify and remove the cables from the cigar lighter housing. Remove the nut, shakeproof washer and blade terminal from the centre of the unit. Unscrew the outer casing at the rear of the panel and withdraw the inner section of the cigar lighter unit.

Refitting is the reverse of the removal procedure.

Starter Push Button

Remove the cables from the push button. Withdraw the push button through the face of the instrument panel by removing the nut, washer and spring washer at the rear of the instrument panel.

Refitting is the reverse of the removal procedure.

Head and Side Light Switch

Remove the light switch control lever from the face of the instrument panel by depressing the plunger in the right-hand side.

Identify and remove the leads from the light switch.

Remove the three nuts, shakeproof washers, washers and blade terminal from the switch mounting posts. Withdraw the light switch. The designation plate can be removed from the instrument panel face by detaching the nut on the rear of the panel.

Refitting is the reverse of the removal procedure. Re-position the designation plate on the instrument panel by allowing a flat on the threaded barrel to locate a flat in the panel.

The light switch control lever is pressed onto the light switch so that the plunger locates with a drilling in the hub of the control lever.

Tumbler Switches

Identify and remove the leads from the Lucar tags on the body of the switch. Withdraw the tumbler switch from the rear of the instrument panel by holding the switch lever in a horizontal position and removing the screwed chromium ring from the face of the instrument panel.

Refitting is the reverse of the removal procedure. The flat face of the switch lever should be facing downwards.

Ammeter and Oil Pressure Gauges

Withdraw the illumination bulb holder from the rear of the gauge. Remove the cables from the Lucas connectors and terminals. Remove the two knurled nuts and "U" clamp. Withdraw the gauge through the front face of the instrument panel.

When refitting the gauges, check that the "U" clamp does not foul any terminals or the bulb holder.

Fuel and Water Temperature Gauges

Removal and refitting of these gauges is similar to the ammeter and oil pressure gauges. But in this case, the "U" clamp is retained by one knurled nut.

The removal and replacement of the fuel gauge tank unit and water temperature transmitter unit are detailed in the "Fuel System" and "Cooling System" sections respectively.

Voltage Regulator (Fuel and Water Temperature Gauges)

Remove the cables (noting their respective positions) from the voltage regulator situated in the left-hand corner of the instrument panel. Withdraw the voltage regulator by removing one nut, shakeproof washer and blade terminal.

When refitting the voltage regulator, ensure that a good earth is made between the regulator and panel.

Switch Indicator Strip

Remove the indicator strip, chrome finisher and light filter from the bottom edge of the instrument panel by withdrawing the four screws.

Refitting

Refitting is the reverse of the removal procedure.

THE BI-METAL RESISTANCE INSTRUMENTATION

Engine Temperature, Fuel Tank and Oil Pressure Gauges

DESCRIPTION

The Bi-metal Resistance Instrumentation for engine temperature, petrol tank contents and engine oil pressure consists of a gauge unit fitted in the instrument panel, a transmitter unit fitted in the engine unit or petrol tanks and connected together to the battery, the oil pressure gauge being an exception, through a common voltage regulator. The purpose of the latter is to ensure a constant power supply at a predetermined voltage thus avoiding errors due to a low battery voltage. In the instance of the oil pressure gauge this is not quite so critical to supply voltage.

In all systems the gauge unit operates on the thermal principle utilizing a heater winding wound on a bi-metal strip, while the transmitter units of the engine temperature and petrol tank contents gauge are of the resistance type but in both instances the system is voltage sensitive. The transmitter unit of the oil pressure gauge is of the thermal pressure principle utilizing a heater winding wound on a bi-metal strip having contact at one end with the second contact mounted on a diaphragm which is sensitive to engine oil pressure.

OPERATION OF THE ENGINE TEMPERATURE GAUGE

The transmitter unit of the engine temperature gauge is fitted in the water outlet pipe of the engine unit and is a variable resistance and consists of a temperature sensitive resistance element contained in a brass bulb. The resistance element is a semi-conductor which has a high negative temperature co-efficient of resistance and its electrical resistance decreases rapidly with an increase in its temperature. As the temperature of the engine unit rises the resistance of the semi-conductor decreases and increases the flow of current through the transmitter similarly a decrease in engine temperature reduces the flow of current.

The gauge unit fitted in the instrument panel consists of a heater winding, connected at one end to the transmitter unit and at the second end to the "I" terminal of the voltage regulator, wound on a bi-metal strip which is linked to the indicator needle. The heater winding and bi-metal strip assembly is sensitive to the changes in voltage received from the transmitter unit causing the heater winding to heat or cool in the bi-metal strip, resulting in the deflection of the indicator needle over the scale provided. The calibration of the scale is such that the movement of the indicator needle over it is relative to the temperature of the transmitter unit bulb and therefore the temperature of the engine unit.

OPERATION OF THE FUEL TANK GAUGE

The transmitter units of the petrol gauge are fitted in the petrol tanks and is a variable resistance actuated by a float, the arm of which carries a contact travelling across a resistance housed in the transmitter body. The float arm takes up a position relative to the level of petrol in the tank being used and thus varies the amount of current passing through the indicator unit.

The gauge unit in the instrument panel consists of a heater winding, connected at one end to the transmitter units and at the other to the "I" terminal of the voltage regulator, wound on a bi-metal strip which is linked to the indicator needle. The heater winding and bi-metal strip assembly is sensitive to the changes in voltage received from the position of the transmitter float, causing the heater winding to heat or cool the bi-metal strip, resulting in the deflection of the indicator needle over the scale provided. The calibration of the scale is such that the movement of the indicator needle over it is relative to the position of the transmitter float actuated by the level of the contents in the petrol tank.

Exaggerated indicator needle movement due to petrol swirl in either tank is considerably reduced as there is a delay before current changes from the transmitter unit can heat or cool the bi-metal and heater winding assembly in the indicator unit, which in fact causes the deflection of the needle. Similarly the indicator needle will take a few moments to register the contents of the petrol tank being used when the ignition is first switched on.

OPERATION OF THE OIL PRESSURE GAUGE

The transmitter unit of the oil pressure gauge, fitted in the head of the engine oil filter, is a voltage compensated pressure unit and consists of a diaphragm, a bi-metal strip with a heater winding wound thereon, a resistance and a pair of contacts. One contact is attached to the diaphragm while the second is mounted on one end of the bi-metal strip, the second end of

ANALYSIS OF THE ENGINE TEMPERATURE AND PETROL TANK GAUGE FAULTS

NOTE: THE INSTRUMENT PANEL GAUGES MUST NEVER BE CHECKED BY SHORT-CIRCUITING THE TRANSMITTER UNITS TO EARTH

Symptom	Unit Possibly at Fault	Action
Instrument panel gauge showing a "zero" reading	Voltage regulator	Check that output voltage at terminal 'I' is 10 volts
	Instrument panel gauge	Check for continuity between the gauge terminals with the leads disconnected.
	Transmitter unit in petrol tank or engine unit.	Check for continuity between the terminal and the case with lead disconnected.
	Wiring	Check for continuity between the gauge, the transmitter and the voltage regulator, also that the transmitter unit is earthed.
Instrument panel gauge showing a high/low reading when ignition switched on	Voltage regulator	Check output voltage at terminal 'I' is 10 volts.
	Instrument panel gauge	Check by substituting another instrument panel gauge.
	Transmitter unit in petrol tank or engine	Check by substituting another transmitter unit in petrol tank or engine unit.
	Wiring	Check for leak to earth.
Instrument panel gauge showing a high reading and overheating	Voltage regulator	Check output voltage at terminal 'I' is 10 volts.
	Wiring	Check for short circuits on wiring to each transmitter unit.
Instrument panel gauge showing an intermittent reading	Voltage regulator	Check by substituting another voltage regulator.
	Instrument panel gauge	Check by substituting another instrument panel gauge.
	Transmitter unit in petrol tank or engine unit	Check by substituting another transmitter unit in petrol tank or engine unit.
	Wiring	Check terminals for security, earthing and wiring continuity.

which is connected through the resistance and the gauge unit to the battery supply; the heater winding is also connected to the battery supply but not through the resistance. Engine oil pressure will close the contacts causing current to flow through the gauge unit, bi-metal strip and contacts to earth resulting in the heating of the heater winding which will, after a time, open the contacts.

The gauge unit fitted in the instrument panel consists of a winding, connected at one end to the battery supply and at the second to the transmitter unit wound on to a bi-metal strip which is linked to an indicating needle. The heater winding and bi-metal strip assembly is sensitive to the continuity changes received from the thermal pressure unit, fitted in the engine oil filter, causing the heater winding to heat or cool the bi-metal strip resulting in the deflection of the indicating needle over the scale provided.

The changes in continuity of current from the transmitter unit will vary according to the amount of oil pressure for, as the latter rises, the outward moving diaphragm contact limits the return travel of the bi-metal strip contact thus allowing a longer continuity period. This results in a greater heating of the heater winding in the gauge unit and increased deflection of the indicating needle over the scale showing a greater oil pressure.

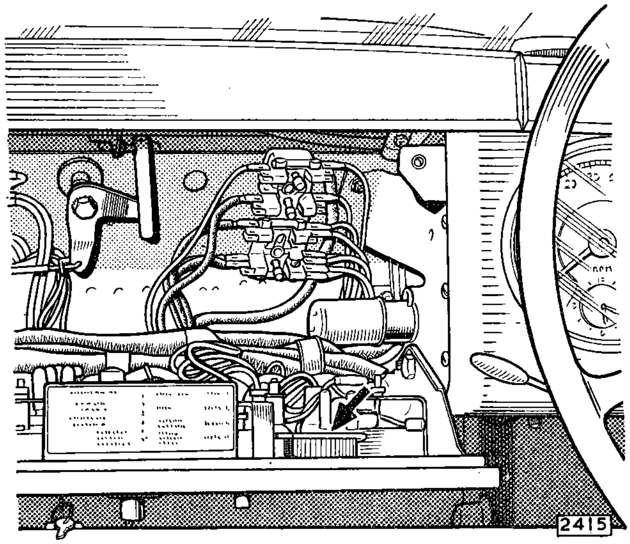


Fig. 60. Showing the location of the voltage regulator unit

The opening and closing of the transmitter unit contacts is continuous thus the temperature of the heater winding in the gauge unit is kept within close limits and the calibration of the scale is such that the movement of the indicating needle over it is relative to the opening of the transmitter unit contacts and therefore the oil pressure of the engine is recorded.

ANALYSIS OF THE OIL PRESSURE GAUGE FAULTS

Symptom	Unit Possibly at Fault	Action
Instrument panel gauge showing a "zero" reading	Wiring	Check for continuity between the gauge and the transmitter unit and that the latter is earthed.
	Instrument panel gauge	Check for continuity between the gauge terminals with leads disconnected. If satisfactory replace the transmitter unit.
Instrument panel gauge showing a reading with ignition switched on but engine not running	Transmitter unit on oil filter head	Check by substituting another transmitter unit.
Instrument panel gauge showing a high reading and overheating	Transmitter unit on oil filter head	Check by substituting another transmitter unit.
Instrument panel gauge showing a below "zero" reading with ignition switched off	Instrument panel gauge	Check by substituting another instrument panel gauge.

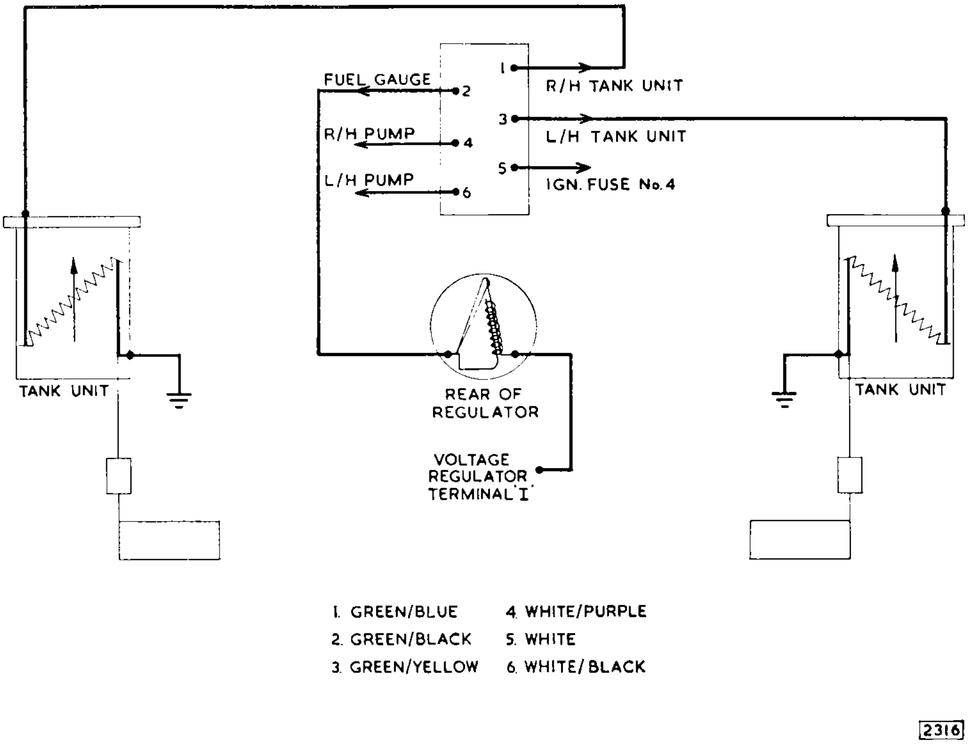


Fig. 61. The fuel gauge circuit

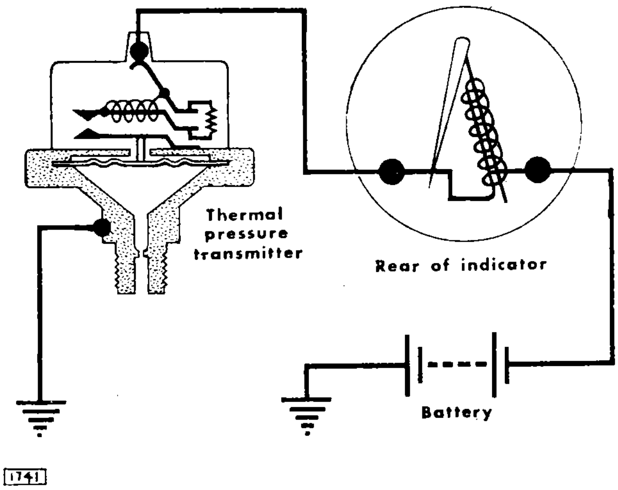


Fig. 62. The oil pressure gauge circuit

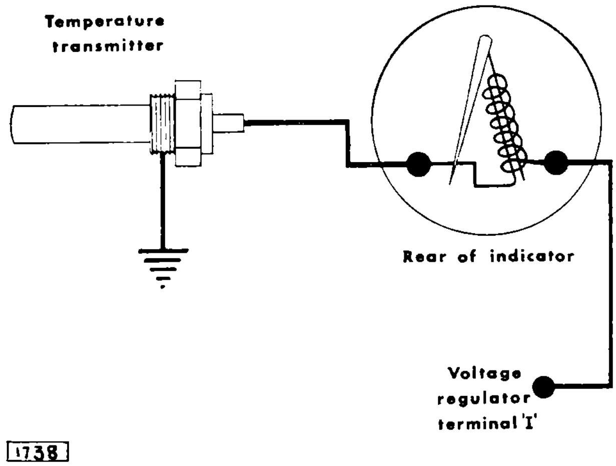


Fig. 63. The water temperature gauge circuit

THE SPEEDOMETER DRIVE CABLE

Removal

Disconnect the flexible drive cable and remove the speedometer from the side instrument facia as previously detailed. Detach the flexible drive cable from the right-angle drive attachment on the gearbox and release it from the retaining clips.

Refitting

Refitting is the reverse of the removal procedure but particular attention must be given to the following points:—

(i) That the run of the flexible drive cable is without any sharp bends.

(ii) That the securing clips are so shaped that they only hold the cable in position without crushing it.

SPEEDOMETER CABLE

General Instructions

Flexible cable condition to a great extent affects performance of speedometers. Poor installation or damage to the flexible drive will show up as apparent faults. It is most important that the flexible drive should be correctly fitted and maintained as illustrated in the following diagrams.

1. **Smooth Run**
   Run of flexible drive must be smooth. Minimum bend radius 6″. No bend within 2″ of connections.

2. **Securing**
   Avoid sharp bends at clips. If necessary change their positions. Do not allow flexible drive to flap freely. Clip at suitable points.

3. **Securing**
   Avoid crushing flexible drive by over-tightening clip.

4. **Connection**
   Ensure tightness of outer flex connections. They should be finger tight only. It may be necessary to clean thoroughly the point of drive before the connection can be screwed completely home.

5. **Connection of Inner Flexible Shaft**
   Where possible slightly withdraw inner flex and connect outer first. Then slide inner into engagement.

6. **Removal of Inner Shaft**
   Most inner flexes can be removed by disconnecting instrument end and pulling out flex. Broken inner flex will have to be withdrawn from both ends.

7. **Examination of Inner Flexible Shaft**
   Check for kinked inner flexible shaft by rolling on clean flat surface. Kinks will be seen and felt.

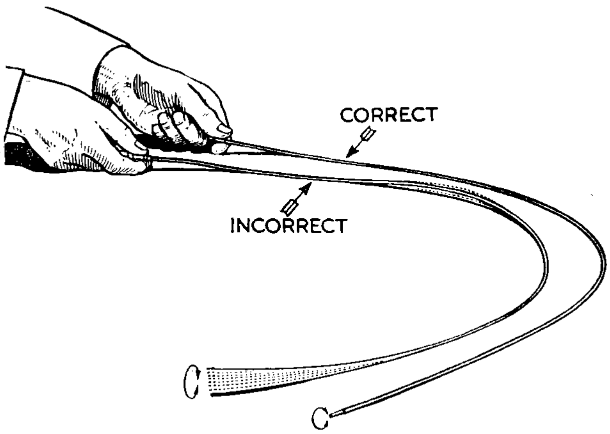


Fig. 64. Checking the inner flex for kinks

8. **Lubrication Every 10,000 Miles**
   Withdraw inner flexible drive (see paragraph 6). Place blob of grease on end of outer cable and insert flex through it, carrying grease inside. Use Esso T.S.D. 119 or equivalent. Do NOT use oil.

9. **Excessive Lubrication**
   Avoid excessive lubrication. If oil appears in flexible drive, suspect faulty oil-seal at point of drive.

10. **Inner Shaft Projection**
    Check $\frac{3}{8}$″ projection of inner flex beyond outer casing at instrument end. This ensures correct engagement in instrument and point of drive.

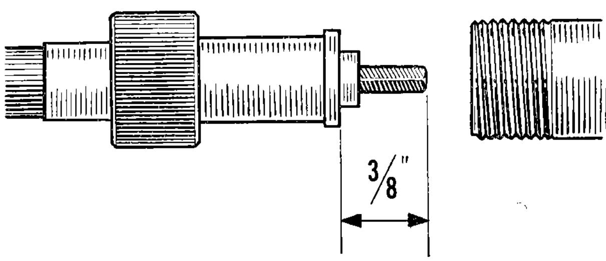


Fig. 65. Amount the inner flex must protrude

11. **Concentric Rotation**
Check that inner flex rotates in centre of outer cable.

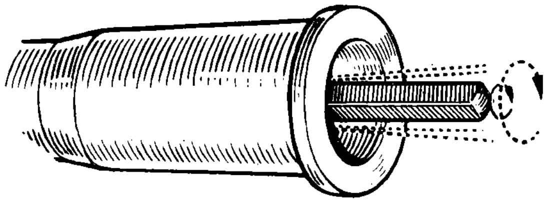


Fig. 66. Checking the inner flex for "run-out"

12. **Damaged Inner Shaft**
Examine inner flex ends for wear or other damage. Before fitting new flex ensure instrument main spindle is free.

13. **Damage Drive End Connections**
Examine point of drive for damage or slip on gears in gearbox.

14. **Ensuring Correct Drive Fitted**
When ordering, state Make, Year and Model of vehicle. State also length of drive required when alternatives are shown.

SPEEDOMETERS—GENERAL INSTRUCTIONS

Speedometer performance is dependent on the flexible drive, and apparent faults in the instrument may be due to some failure of the drive. Before returning a speedometer for service, the flexible drive should be checked, as described in the previous paragraphs. The following diagrams show you how to check the instrument performance.

15. **Instrument Not Operating**
Flexible drive not properly connected (see paragraph 5). Broken or damaged inner flexible shaft or fault at point of drive (see paragraphs 12 and 13), in which case remove and replace flex (see paragraphs 6 and 8) or rectify point of drive fault. Insufficient engagement of inner shaft (see paragraph 10). Defective instrument—return for service.

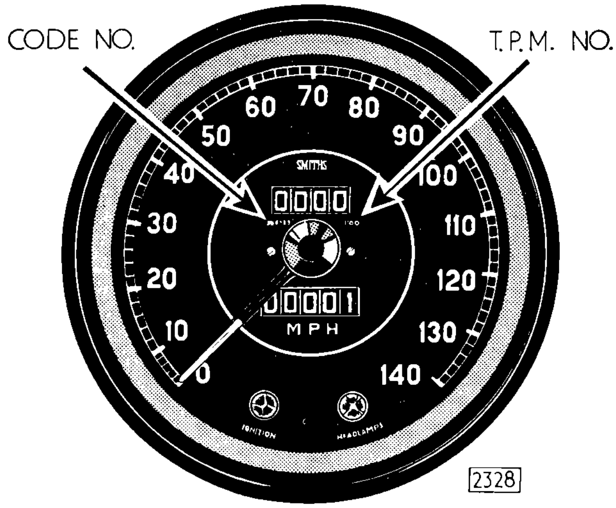


Fig. 67. The code number and turns per mile on the speedometer instrument

16. **Instrument Inaccurate**
Incorrect speedometer fitted. Check code number.

17. **Speedometer Inaccurate**
Check tyre pressures. Inaccuracy can be caused by badly worn tyres. Non-standard tyres fitted, apply to Smiths for specially calibrated instrument.

18. **Speedometer Inaccurate**
Rear axle non-standard. Drive ratio in vehicle gearbox non-standard. A rapid and simple check is obtained by entering in the formula the figures found in the test (see paragraph 19).

$$\frac{1680\,N}{R} = \text{T.P.M. No.}$$

Where N = Number of turns made by the inner shaft for 6 turns of rear wheel and R = Radius of rear wheel in inches measured from centre of hub to ground.

Example

Cardboard pointer on inner shaft (see 19) rotates $9\frac{1}{8}$ times as vehicle is pushed forward 6 turns of rear wheel. Rear wheel radius $12\frac{1}{4}''$.

Flex turns per mile:

$$\frac{1680 \times 9\frac{1}{8}}{12\frac{1}{4}} = \frac{15330}{12\frac{1}{4}} = 1251 = \text{T.P.M. No.}$$

19. **Gearing Test**
Disconnect flexible drive from speedometer. With the gears in neutral, count the number of turns of the inner shaft for six turns of the rear wheels when the vehicle is pushed forward in a straight line. Measure rolling radius of rear wheels —centre of hub to ground. Apply figures in formula (see paragraph 18).

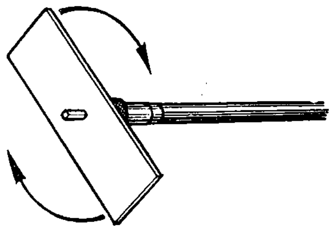


Fig. 68. Cardboard counter on the inner flex for checking the number of turns

20. **Correct Speedometer**
Number illustrated should correspond within 25 either way with the number obtained from paragraphs 18 and 19. If it does not, apply to Smiths for specially calibrated instrument, giving details of test and vehicle.

21. **Pointer Waver**
Oiled up instrument. Replace oil seal if necessary, clean and lubricate flexible drive (see paragraph 8). Return instrument for replacement.

22. **Pointer Waver**
Inner flexible shaft not engaging fully. Check 10, then try 4. Also check 12.

23. **Pointer Waver**
Kinked or crushed flexible drive. Check 7 and 3. For withdrawal of inner shaft see paragraph 6. Bends of too small radius in flexible drive, check 1.

24. **Pointer Waver**
If 21, 22 and 23 show no sign of trouble, instrument is probably defective. Return for replacement.

25. **Noisy Installation**
Tapping noises. Check 5 and 2. Flexible drive damaged. Check 7 and 12 (also see paragraph 6), check lubrication is sufficient. Check 10 and 11.

26. **Noisy Installation**
General high noise level. Withdraw inner shaft (see paragraph 6) and reconnect outer flex. If noise continues at lower level then source of noise is in vehicle point of drive. Fitting new P.V.C. covered flexible drive with nylon bush on inner shaft and instrument with rubber mounted movement should overcome this trouble.

27. **Noisy Installation**
Regular ticking in time with speedometer decimal distance counter. Return speedometer for replacement.

28. **Noisy Installation**
Loud screeching noise more prevalent in cold weather, return instrument for replacement.

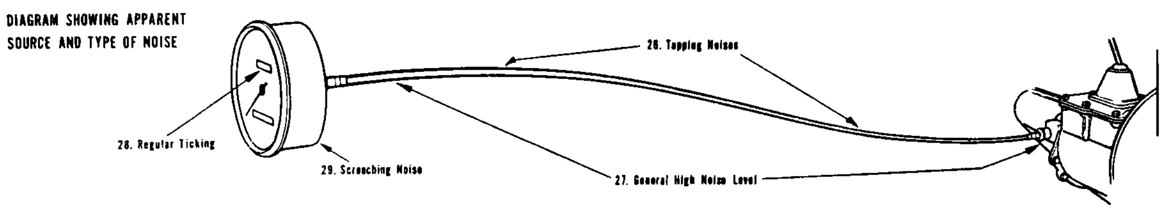


Fig. 69. Diagram showing the apparent source and type of noise

DISTRIBUTOR (22D6)

Lucas 22D6 distributors replacing the DMBZ6A distributors previously fitted have the same test data figures as those stated on page P.12.

The method of adjusting the contact breaker points does however, differ.

Remove the distributor cap.

Slacken, very slightly, the contact plate securing screw (2 Fig. 70) and adjust the gap by turning a screw-driver in the nick in the counter plate and the slot (3 Fig. 70) in the base plate. Turn clockwise to decrease the gap and anti-clockwise to increase the gap.

Tighten the securing screw and re-check the gap.

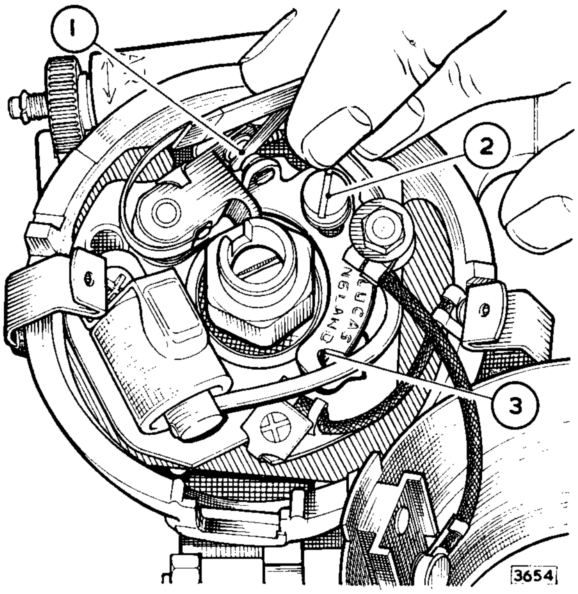


Fig. 70. (1) Contact breaker points. (2) Securing screw. (3) Slot in contact plate

HORNS (Model 9H)

	R.H. Drive	L.H. Drive
Commencing Chassis Nos.	307363	353359

DESCRIPTION

The Lucas 9H horns are mounted on a common bracket behind the radiator on the left hand side of the car.

The horn circuit operates through a Lucas 6RA relay, the contacts C1 and C2 closing when the relay coil is energised by depressing the semi-circular horn ring attached to the steering wheel, or by pressing the centre button.

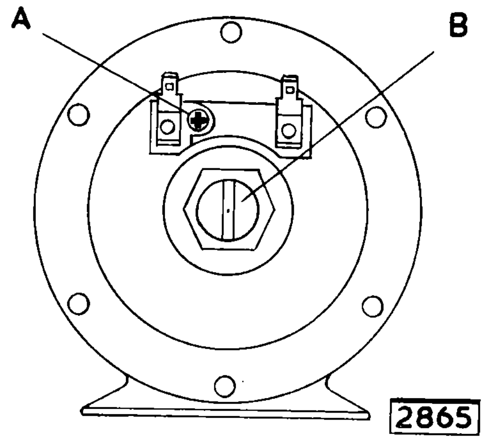


Fig. 71. Lucas 9 H horn.
A—Contact breaker adjustment screw.
B—Slotted centre core (do not disturb).

MAINTENANCE—CIRCUIT CHECKING

In the event of the horn(s) failing to sound or performance becoming uncertain, check that the fault is not due to external causes before any adjustments are made.

Check as follows and rectify as necessary.

(a) Battery condition.

(b) Loose or broken connections in the horn circuit. Test with voltmeter at cable terminals.

(c) Loose fixing bolts. It is important to keep the horn mountings tight and to maintain rigid the mountings of any units fitted near the horns.

(d) Faulty relay. Check by substitution after verifying that current is available at terminal C2 (cable colour brown and blue) and terminal W1 (green).

(e) Check that fuse 3 (35 amp.) and fuse 5 (50 amp.) have not blown.

Note: Horns will not operate until the ignition is switched on.

ADJUSTMENT

The horns cannot be conveniently adjusted in position, remove and mount securely on the test fixture.

A small serrated adjustment screw is provided to take wear of moving parts only in the horn and is located adjacent to the horn terminals. Turning this screw does not alter the pitch of the note.

Connect a 0–25 moving coil ammeter in series with the horn supply feed. The ammeter should be protected from overload by connecting an ON-OFF switch in parallel with its terminals.

Keep this switch ON except while taking readings, that is when the horn is sounding.

Turn the adjustment screw anti-clockwise until the horn just fails to sound.

Turn the screw clockwise until the horn operates within the specified current limits of 6·5–7·0 amps.

ELECTRICALLY-HEATED BACKLIGHT

DESCRIPTION

An electrically-heated back light to provide demisting or defrosting is fitted as an optional extra.

OPERATION

The heating element, consisting of a fine wire mesh between the laminations of the glass, is connected to the main wiring harness.

The element comes into operation when the ignition is switched on, no separate switch being provided.

The current consumption is approximately 5 amperes.

A 15 ampere fuse contained in a plastic holder, located in a clip behind the instrument is provided in the circuit as a safety precaution.

FITTING INSTRUCTIONS

Remove the fitted back light as detailed in Section N—Page N.15 (Body and Exhaust System).

Remove the rear seat and squab as detailed in Section N—Page N.23.

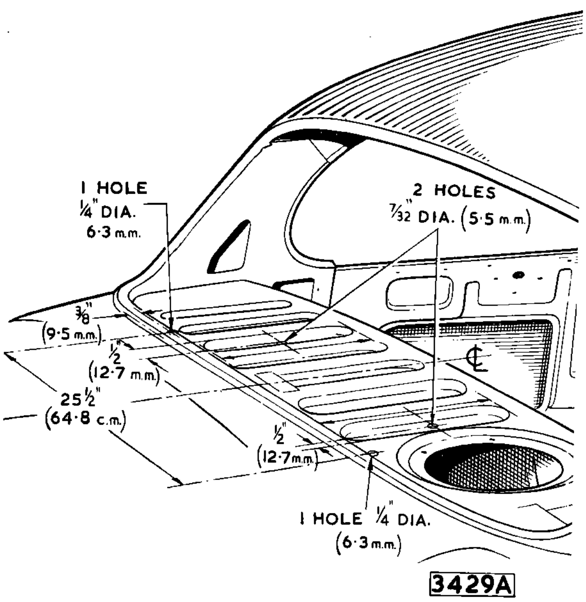


Fig. 72. Drilling instructions for the electrically-heated backlight

Lift up the rear parcel tray trimming where secured by solution to the rear squab panel and remove the two drive screws now exposed securing the trim board. Pull the board away from the retaining clips at the rear edge.

Drill two $\frac{1}{4}''$ (6·4 mm.) holes in the parcel tray $12\frac{3}{4}''$ (32·4 cm.) from either side of the centre line of the tray and $\frac{3}{8}''$ (9·5 mm.) from the rear edge. (See Fig. 72) and fit the two small grommets. Drill two $\frac{7}{32}''$ (5·6 mm.) holes as also shown in Fig. 72.

Fit the heated back light as detailed in Section N—Page N.15.

Feed the two cables attached to the back light through the grommets, ensure that the cables pass through the felt on the underside of the parcel tray panel.

Pull away the luggage compartment bulkhead trimming locally at the centre top edge and locate the two cables, black and black/white, incorporated in the harness and temporarily secured in a harness clip on the bulkhead.

Connect the two cables to the leads from the back light, noting the cable colours.

Clip the cables to the underside of the parcel tray with the two clips provided utilizing the $\frac{7}{32}''$ (5·6 mm.) holes previously drilled.

Refit the parcel tray trim board, squab and seat cushion.

Disconnect the battery.

Remove the picnic tray and lower the centre instrument panel.

Withdraw the two screws retaining the left-hand fuse blocks in position, insert the fuse carrier clip plate, with attached clip behind the fuse blocks and refit the screws.

Clip in the fuse holder.

Connect the white cable to the vacant A3 terminal on the fuse block along with the existing white cables.

Connect the black/white cable from the fuse holder to the equivalent cable already situated in the existing body harness.

Refit the instrument panel and picnic tray.

Reconnect the battery, switch on the ignition and test through.

FAULT DIAGNOSIS

Check that the fuse has not blown. Replace if necessary by one of the correct value.

Check the back-light element by disconnecting the cable connectors in luggage compartment and re-connecting the back light cables to a 12 volt battery with a 0–20 moving coil ammeter in series.

If no reading is apparent on the meter replace the back light glass as detailed in Section N—Page N.15 (Body and Exhaust System).

If a reading is shown on the meter check the feed cable connections in the luggage compartment for continuity with a voltmeter. Insert the fuse and switch on the ignition before checking.

INTRODUCTION OF LINE FUSE

Commencing Chassis Nos.	*R.H. Drive*	*L.H. Drive*
Automatic Transmission	308244	353519
Overdrive Transmission	308320	353520

Commencing at the above chassis numbers, an 8 amp. in-line fuse has been introduced in the intermediate speed hold switch (automatic transmission) circuit and the control switch circuit (overdrive transmission).

The fuse holder is retained in a spring clip located behind the curved side facia panel on the steering wheel side.

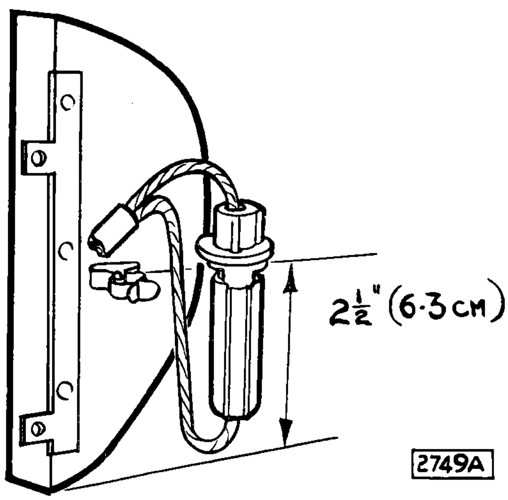


Fig. 73. Showing the position of the clip for the in-line fuse holder

Earlier cars may be modified, the necessary parts being obtainable from the Spares Division, Jaguar Cars Ltd.

Proceed as follows:—

(a) Disconnect the battery.

(b) Remove the curved side facia panel on the steering wheel side. The panel is retained by two No. 10 U.N.F. nuts behind the panel and one drive screw accessible at the base of the screen pillar behind the door sealing welt.

(c) Secure the chromium plate clip with the screw to the curved side panel as shown in Fig. 73.

(d) Remove the ring nut securing the intermediate speed hold switch (automatic transmission models) to the side facia panel and push the switch forward.

(e) Pull the switch down below the panel and modify the connections as follows:—

Automatic Transmission Models

Disconnect the twin green cables connected by a common eyelet to the switch and cut off the eyelet. Strip the insulation from each cable for a length of ⅜" (9·5 mm.) and solder on the two nipples.

Connect both green cables into the double connector tube located on the fuse connector harness.

Connect the eyelet on the connector harness to the vacant terminal on the switch. (See circuit diagram).

Refit the switch to the side facia panel and refit the curved facia panel.

Clip the fuse holder into the spring clip previously fitted.

Reconnect the battery and test the circuit by operation.

Overdrive Transmission Models

Disconnect the yellow cable attached to the switch at the connector tube located behind the side facia panel and connect to the yellow cable with the single connector contained in the fuse connector harness.

Connect the yellow cable with the white indent to the vacant single connector tube on the main harness. (See circuit diagram).

Refit the switch to the side facia panel and refit the curved side facia panel.

Clip the fuse holder into the spring clip previously fitted.

Reconnect the battery and test the circuit by operation.

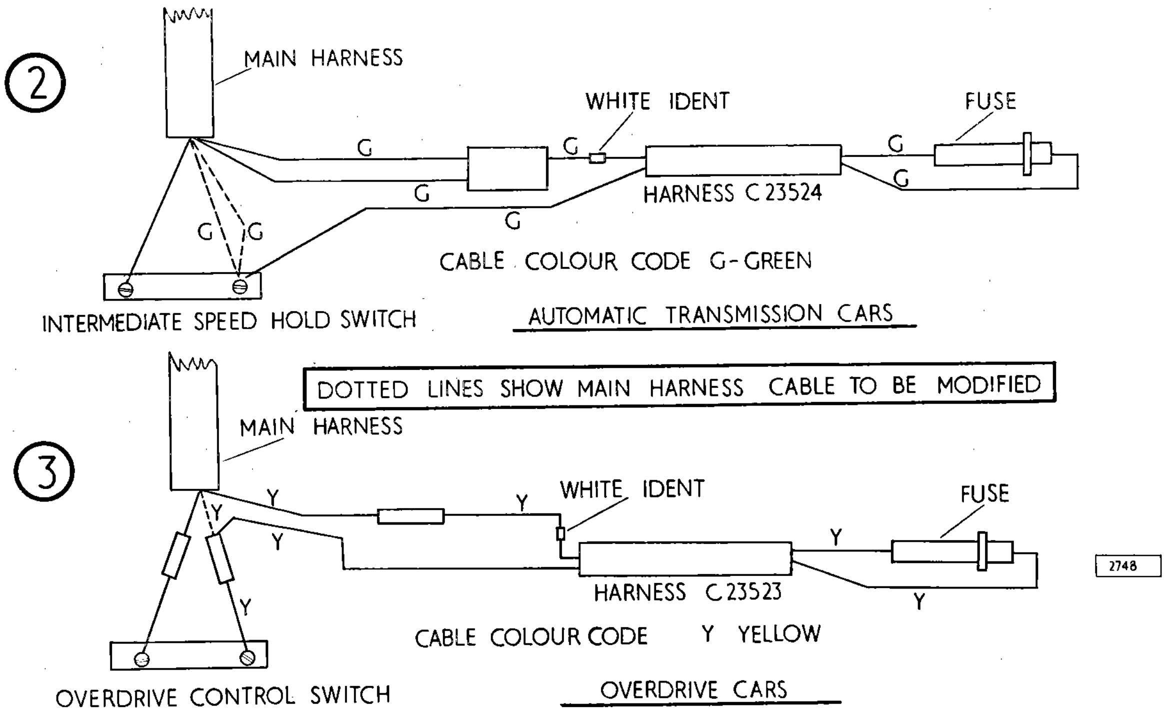


Fig. 74. Circuit diagrams

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