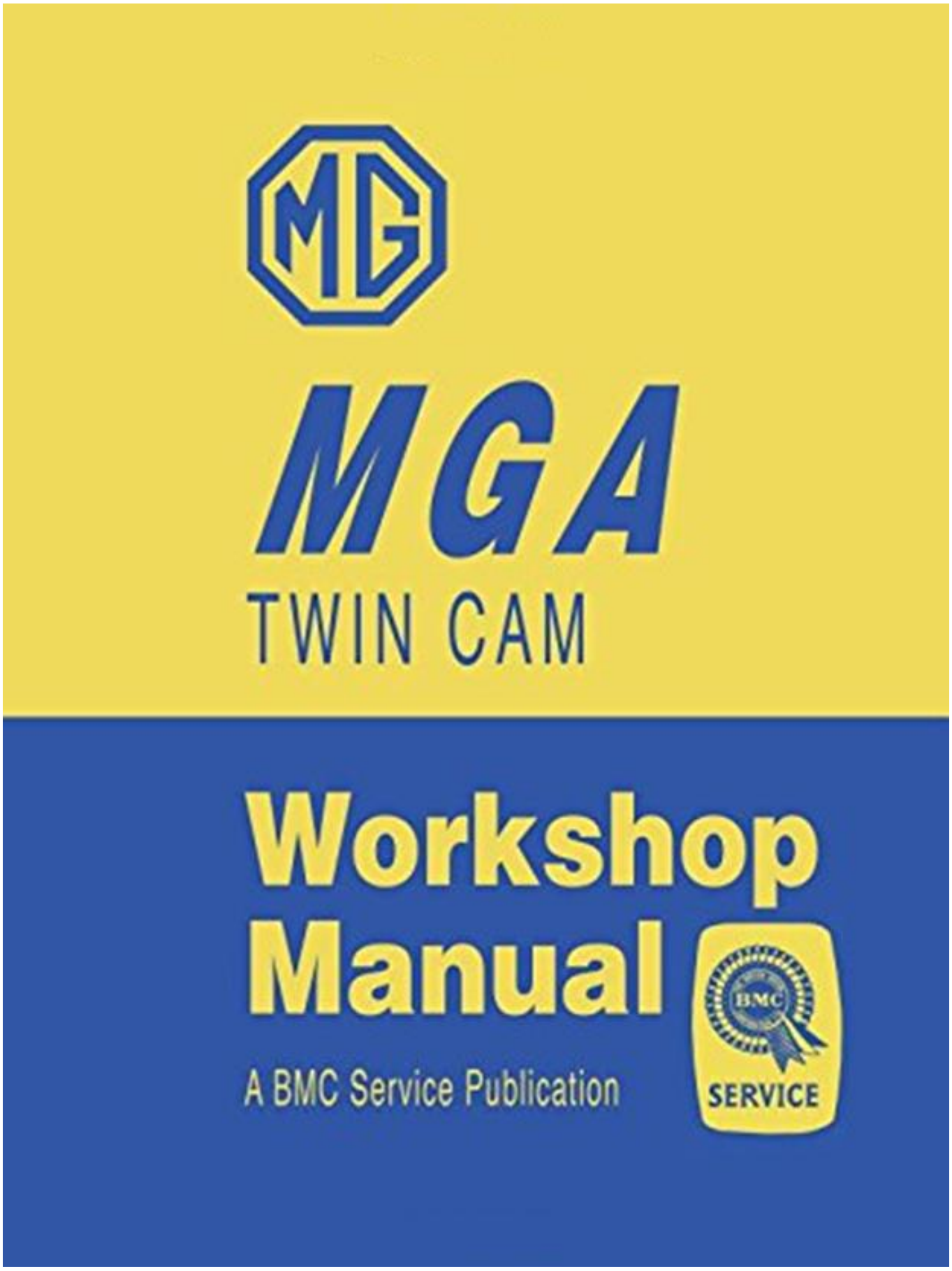

The

MG

Series MGA Twin Cam

WORKSHOP MANUAL

NOTE
Refer to the end of the appropriate Section for the latest instructions when carrying out work on the vehicle.
Additional copies of this publication (Part No. AKD926B) can only be obtained from an M.G. Distributor.

Issued by
THE M.G. CAR COMPANY LIMITED
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INTRODUCTION

This Manual has been prepared to provide the service operator with the necessary information for the maintenance and repair of the M.G. (Series MGA Twin Cam).

The Manual also serves as a ready-reference book for service supervision and covers items of procedure for the guidance of both the fully qualified and the less-experienced mechanic.

UNIT ARRANGEMENT

In the Manual the complete vehicle is divided into Sections each of which deals with an assembly or major component and carries a reference letter.

NUMBERING OF PAGES AND ILLUSTRATIONS

The pages and illustrations are numbered consecutively within each Section

SERVICE TOOLS

Use of the correct tools contributes to an efficient, economic, and profitable repair. References have therefore been made to such tools throughout the Manual.

The MGA Twin Cam factory demonstrator pauses for a publicity shot at the Plough at Clifton Hampden.

CONTENTS

GENERAL INFORMATION

CONTROLS

Hand brake

The hand brake lever is located alongside the driver's seat and operates the rear wheel brakes only.

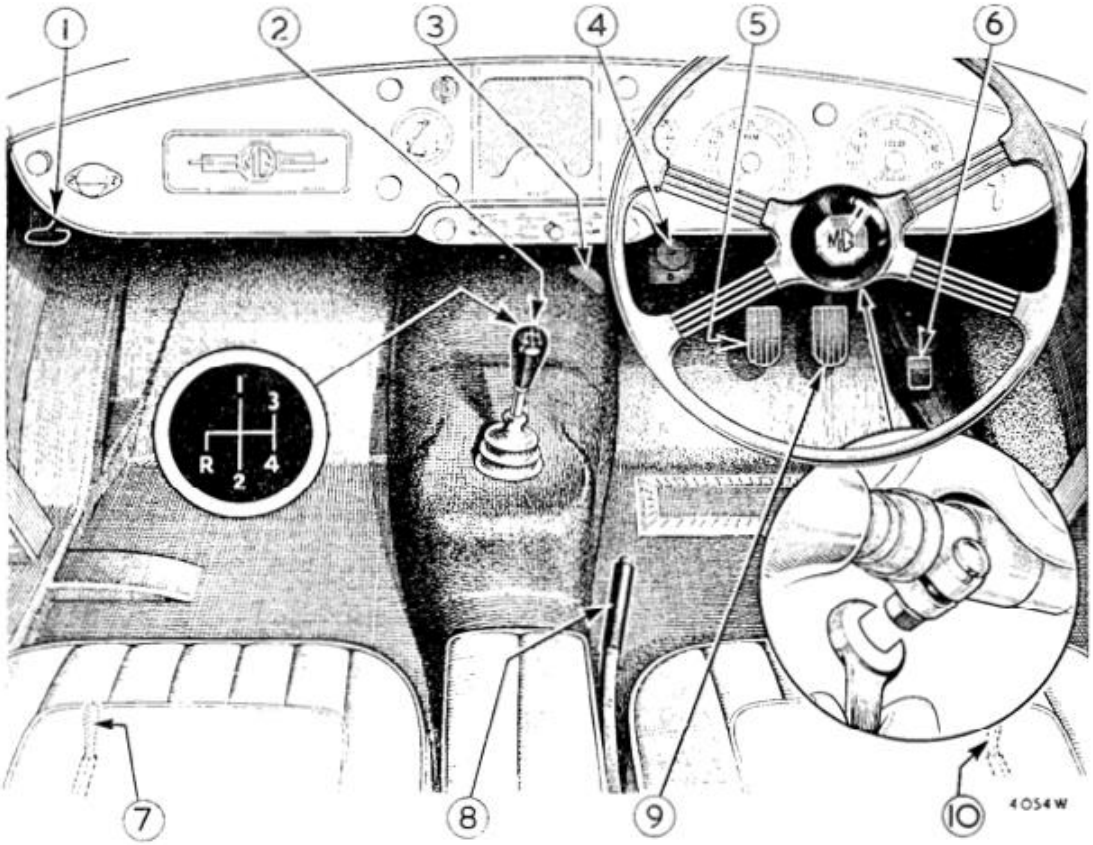
To operate, pull up the lever and press the knob in the end with the thumb to lock the lever in position.

To release the brakes, pull upwards on the lever to automatically release the lock and then push downwards.

Always apply the hand brake when parking.

Brake pedal

The pedal operates the hydraulic brakes on all four wheels and will also operate the twin stop warning lamps when the ignition is switched on.



The location of the driving controls

1. Bonnet release.
2. Gear lever.
3. Gearbox oil filler plug.
4. Headlamp dip switch.
5. Clutch pedal.
6. Accelerator.
7. Seat lock,
8. Hand brake lever.
9. Foot brake.
10. Seat lock.

Gear lever

The four forward gears and the reverse gear are engaged by moving the lever to the positions indicated in the illustration.

To engage the reverse gear, move the lever to the left of the neutral position until resistance is felt, apply side pressure to the lever to overcome the resistance and then pull it backwards to engage the gear. Synchromesh engagement is provided on second, third and fourth gears.

Seat adjustment

A lever is provided at the front of each seat and this must be pressed outwards to release the catches and allow the seat to slide.

Steering column adjustment

This enables the steering wheel to be placed in the most comfortable driving position after slackening a clamp bolt below the wheel hub.

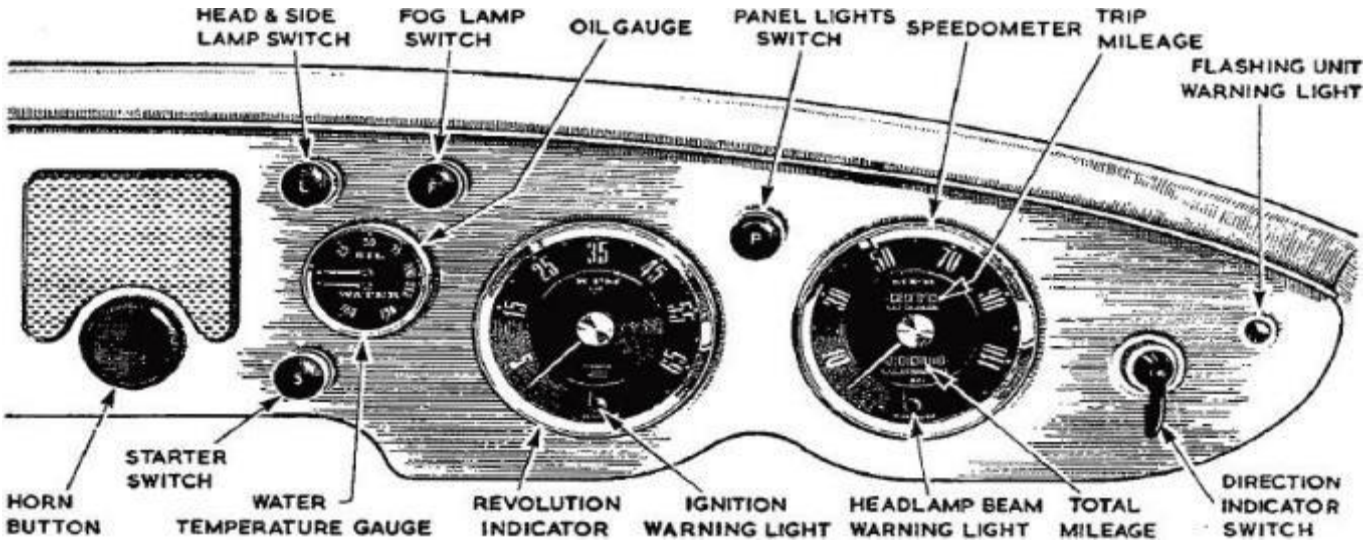
Headlamp beam dip switch

This is situated on the left of the clutch pedal and is foot operated. The switch will dip the headlamp beams on one depression and raise them on the next.

Bonnet lock release

The bonnet is hinged at the rear and the lock is released by pulling on the ring below the instrument panel on the extreme left-hand side of the car. The bonnet is still held by the safety catch, which must be released before the bonnet can be raised. To re-lock the bonnet in the fully closed position after opening, press downwards on the front of the bonnet until the lock is heard to engage.

INSTRUMENT PANEL



The right-hand side of the instrument panel (R.H.D.)

1. Headlamp and sidelamp switch
6. Trip mileage
11. Revolution indicator..

2. Fog lamp switch.
7. Flasher warning light
12. Ignition warning light..
3. Oil gauge
8. Horn button.
13. Headlamp beam warning light,.
4. Panel light switch
9. Starter switch
14. Total mileage..
5. Speedometer
10. Water temperature gauge

Speedometer

The speedometer also records the trip and total distances. The trip recorder is reset to zero by pushing upwards the knob below the instrument and turning it anti-clockwise.

Main beam warning light

The warning light at the bottom of the speedometer dial glows red when the headlamp main beams are in use, as a reminder to dip the beams when approaching other traffic.

Engine revolution indicator

This dial is calibrated in hundreds of revolutions per minute. Normal use of the engine will not require speeds over 5,000 RPM. and great care must be taken if the needle does approach the amber sector of the dial, which commences at 5,500 RPM. Under favourable conditions the needle may be allowed to enter the amber sector but under no circumstances must it enter the red sector.

Ignition warning light

The warning light at the bottom of the revolution indicator dial glows red when the ignition is switched on and will go out again when the engine is started, and its speed is increased sufficiently for the dynamo to charge the battery. Should the light glow at all engine speeds, the dynamo is not charging the battery.

Oil pressure gauge

The pressure of the oil should be between 30 lb./sq. in. and 80 lb./sq. in. (2.1 kg. /cm ^{2} and 5.6 kg. /cm.^{2}) under normal running conditions. Approximately 10 lb./sq. in. (.7 kg. /cm.^{2}) should be shown when the engine is idling.

Water temperature gauge

The temperature of the cooling water leaving the cylinder head is indicated by this gauge and should be approximately 160° F. when the engine is running normally.

Starter switch

Pull out the knob marked 'S' to operate the starter motor. The switch must be pushed in immediately the engine starts.

Lamp switch

To switch on the sidelamps, tail-lamps, and number-plate illumination lamp pull out the knob marked `L'.

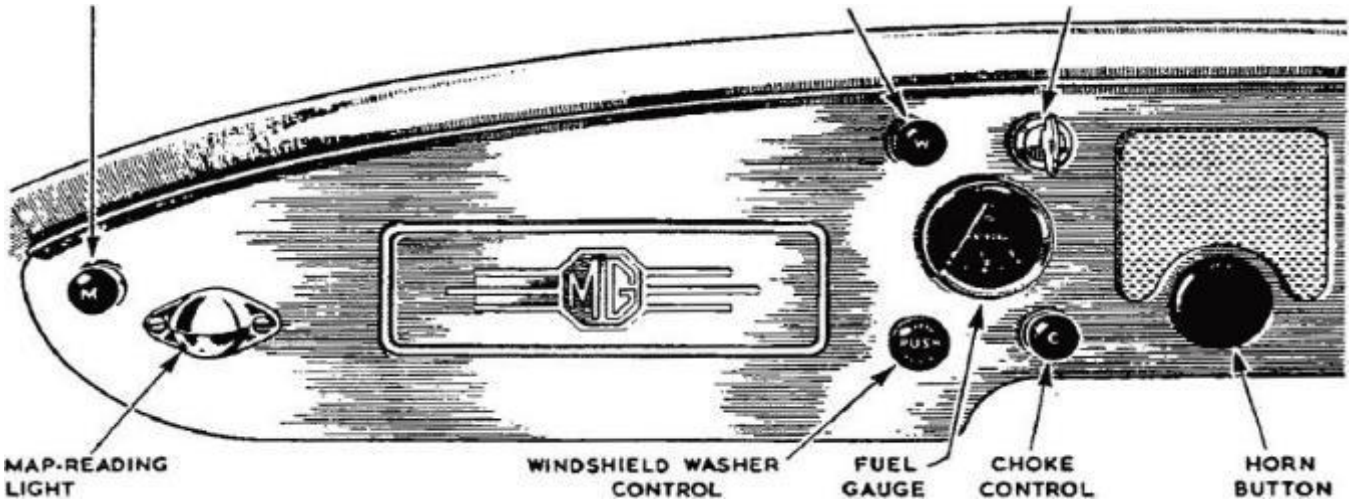
Turn the knob clockwise and pull out again to switch on the headlamps.

See **Headlamp beam dip switch'** and **'Main beam warning light'.**

Fog lamp switch

A fog lamp is not fitted as standard equipment, but the switch marked 'F' on the instrument panel is

connected to the battery and is ready for use when a fog lamp is connected to it. Pull out the knob to switch on the fog lamp.



The left-hand side of the Instrument panel (R.H.D.)

1. Map-reading light switch
2. Windshield wiper switch
3. Ignition switch
4. Map-reading light
5. Windshield washer control
6. Fuel gauge
7. Choke control.
8. Horn button.

Panel lamp switch

To illuminate the instruments, turn the control knob clockwise. The first movement of the knob will switch on the lamps and further turning to the right will dim the lamps. The panel lamps will only operate when the sidelamps are also switched on.

Direction indicator switch

The lever-type switch on the outer edge of the panel controls the flashing indicator unit. The unit will operate only while the ignition is switched on and flashes the sidelamp and tail lamp, on the side of the car to which the switch lever is moved, until it is automatically switched off. While the flashing unit is switched on, the warning light next to the switch will show green.

Fuel gauge

This operates only when the ignition is switched on.

Choke or mixture control

To enrich the mixture and assist starting when the engine is cold, pull out the knob marked 'C' and lock it in position by turning it anti-clockwise. Turn the knob clockwise and push it inwards to the normal running position as soon as the engine is warm enough to run without the rich mixture. Never allow the engine to run for any length of time with the knob pulled out.

Ignition switch

The fuel pump and gauge are brought into action by this switch, which is also the master switch for the windshield wipers and direction indicators.

Windshield wiper switch

The windshield wipers are self-parking and operate only when the ignition is switched on. Pull out the control 'W' to set the wiper blades in motion. Push in the knob to switch off the motor and park the blades.

Map-reading lamp

The map-reading lamp is controlled by the adjacent knob, which must be pulled out to switch on the light. The lamp will only operate while the sidelamps are switched on.

Windshield washer

When windshield-washing equipment is fitted it is operated by the knob marked 'Push' below the fuel gauge

HEATING AND DEMISTING EQUIPMENT

The 2.75-kw. heating and demisting unit is fitted as an extra to standard equipment (see Section S.9).

Fresh air is ducted from the radiator grille to the heating element and blower motor mounted below the Bonnet. Water from the engine cooling system is used to heat the element.

Warmed air issues from the toeboard or the windshield demisting vents according to the position of the controls mounted below the instrument panel

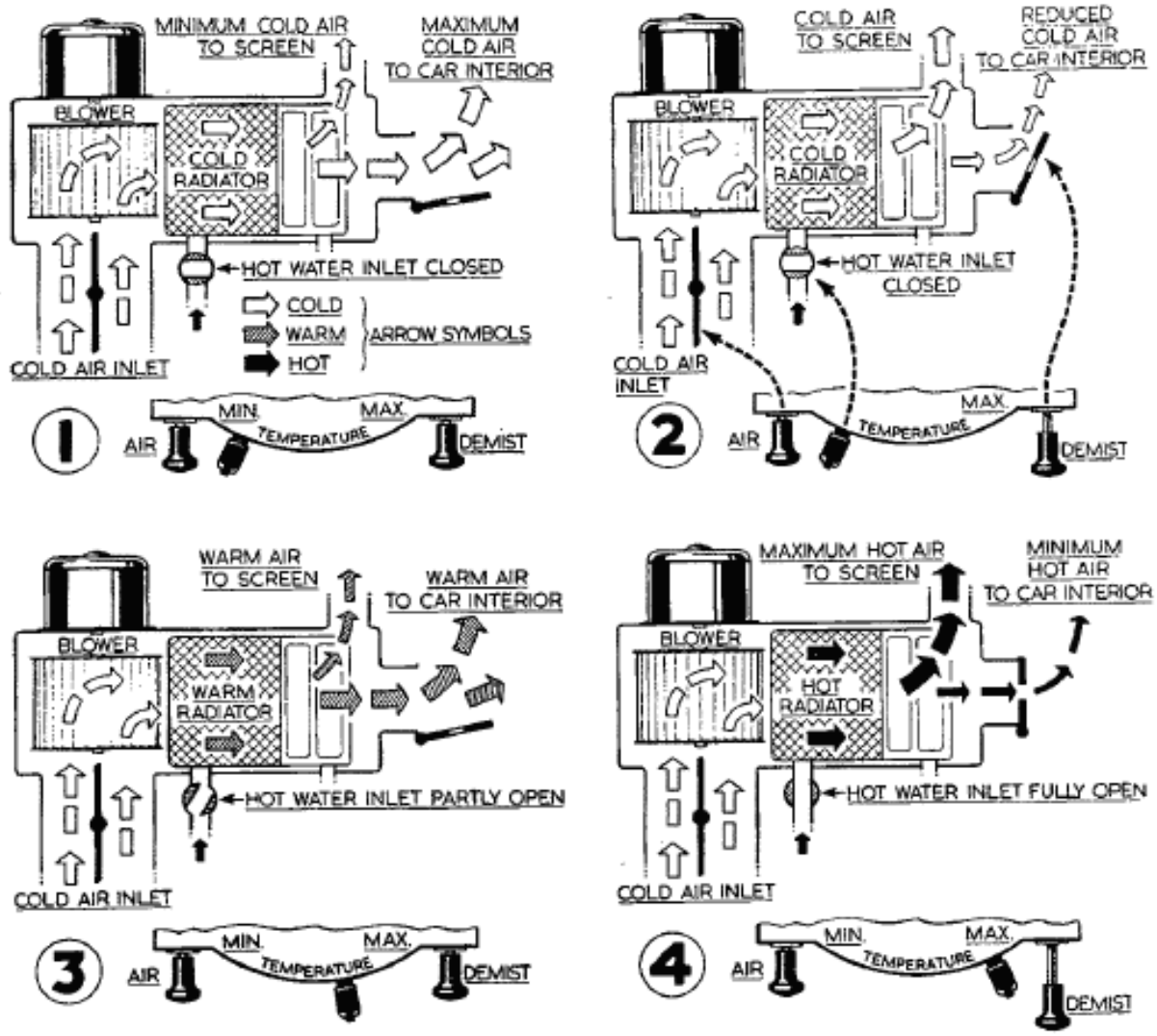
Air

The left-hand knob controls the air supply. When the knob is pushed in the air duct is open and air at atmospheric temperature will enter the car when it is in motion and will issue from the toeboard or demisting vents.

While the control is pushed in it may be turned clockwise to switch on the blower motor, if the ignition is switched on also, and this will increase the flow of air into the car unit and may be used to give a supply of air when the car is stationary.

If the blower motor is switched off by the air control, the knob can be pulled outwards to close the air duct and prevent fresh air entering the car from the toeboard or windshield vents. The blower cannot be switched on while the knob is pulled out.

NOTE: -The heating and demisting equipment control panel fitted to some cars has the blower motor operating switch incorporated in the temperature control lever. These control panels may be identified by the temperature lever knob, which is round and marked Pull out the knob to switch on the blower motor. The left-hand control on these panels will regulate the air supply only



The circulation of the air through the heater unit with the controls positioned as recommended on Heater operation

Demist

The right-hand knob on the heater unit control panel operates a shutter in the panel above the gearbox cover When the control is pushed into the normal position the shutter is open and most of the air from the unit will enter the car at the toeboard while some will issue from the vents below the windshield. As the knob is pulled out the shutter closes, and more air is delivered to the car from the demisting vents, giving the maximum supply of air to the windshield. This is the demist position of the control if the blower is switched on and also die defrost position if the heater is operating.

Temperature

The temperature lever operates the water valve on the engine. When the lever is in the left-hand Position the hot water supply is cut off and air entering the car through the unit will not be heated. As the lever is moved to the right the water supply is increased and the maximum temperature is obtained.

As a general guide, here are some of the more frequently required positions:

1. No additional ventilation or heating. Pull out the air control, push the temperature control to the left.
2. Hot weather. Push in the air and demist controls. Move the temperature control to the left. To

increase the supply of air switch on the blower motor.

3. Warm weather. Set the controls as for hot weather. To increase the supply of air switch on the blower motor. To prevent mist forming on the windshield pull out the demist control partially.
4. Cold weather. Place the air control in its normal position. Place the temperature lever according to the degree of heating required. Switch on the blower to increase the air supply. (If demisting is required pull out the demist control).
5. Severe cold. Move the temperature control to the right for maximum heating and pull out the demist control fully to give a maximum supply of hot air to the screen. Switch on the blower motor to increase the air flow.

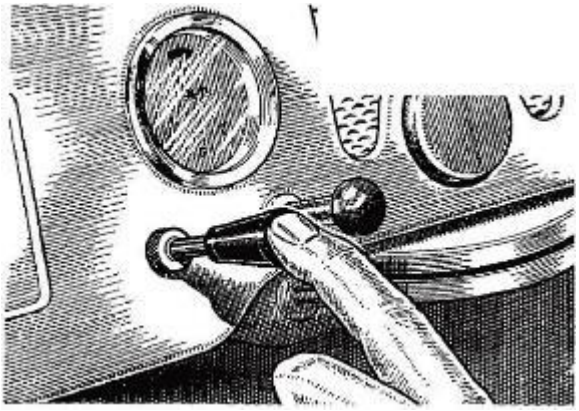
WINDSHIELD WASHER

The washing equipment supplied as an optional fitting is operated by pumping the knob on the instrument panel. As the knob moves towards the panel a jet of cleaning fluid is ejected onto the windshield from nozzles on the scuttle.

Set the windshield wipers in motion before operating the cleaning jets.

Fluid for the windshield is stored in an unbreakable bottle clipped to the engine bulkhead. When refilling with fluid, lift the bottle from its clip and unscrew the cap.

Operating the windshield washer



FOLDING THE HOOD

Never fold the hood if it is wet or damp; wait until it is dry.

1. Release the hood from the pillars at the top of the windshield by unscrewing the wing bolts
2. Release the rear bottom edge of the hood from the three buttons and the turnbuckle at each side. Pull on the centre knob of each button to release them from their attachment pins.
3. Raise the front of the hood slightly to release the tension in the canvas and pull to the rear the bottom of the hood where it is attached to the tonneau panel to release it from the two anchor brackets on the panel.
4. Tip the seats forward, unfasten the sidescreen container, and turn it over onto the tonneau panel to expose the hood stowage compartment.
5. Leave the rear window panel suspended over the tonneau panel and collapse the hood into the stowage compartment, pulling the canvas clear of the hood irons and folding it forward over the front hood rail.
6. Fold the rear window forward over the hood, pulling out the spare canvas at each side and folding it neatly over the front of the window.
7. Push the hood into the stowage compartment and turn the sidescreen container forward to cover the hood
8. Remove the sidescreen and stow them in the container pockets with the cranked bracket of each screen at opposite ends and facing towards the rear.
9. Secure the sidescreen container over the folded hood with the six buttons (three on each side).
10. Tighten the sidescreen clamping nut on each door to prevent its possible loss.

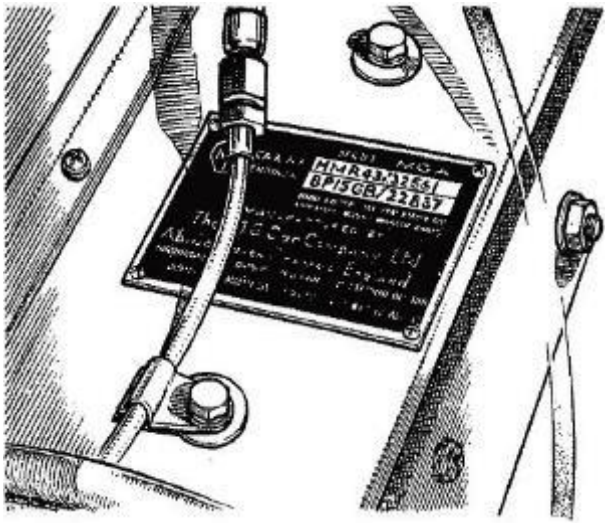
OPTIONAL FITTINGS

The following items of equipment are available as optional fittings:

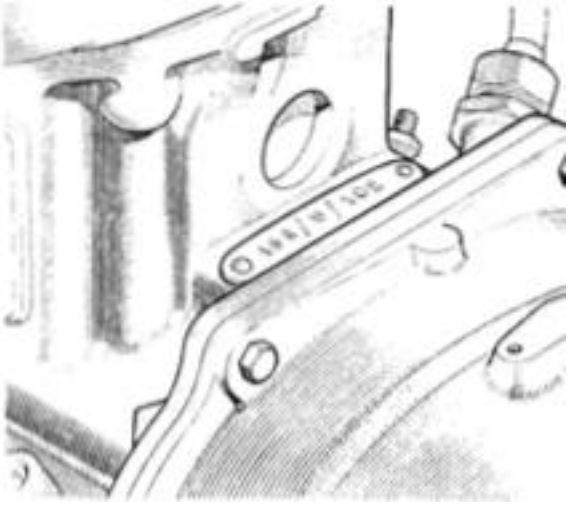
Tonneau cover.
Radiator blind.
Heating and demisting equipment.
Twin horns.
Fog lamps.
Cigar lighter.
H.M.V. car radio *(*provision has been made for easy installation).
Windshield washer.
Detachable hard-top.
Sliding windows.
Competition windshield assembly
Luggage carrier
Wing driving mirror.
Cold air ventilation kit.
Ashtray.
Badge bar.
Sun visors *(*Coupé only).
Adjustable telescopic steering column.
Competition de-luxe seats.
Close-ratio gearbox.

SERIAL NUMBERS

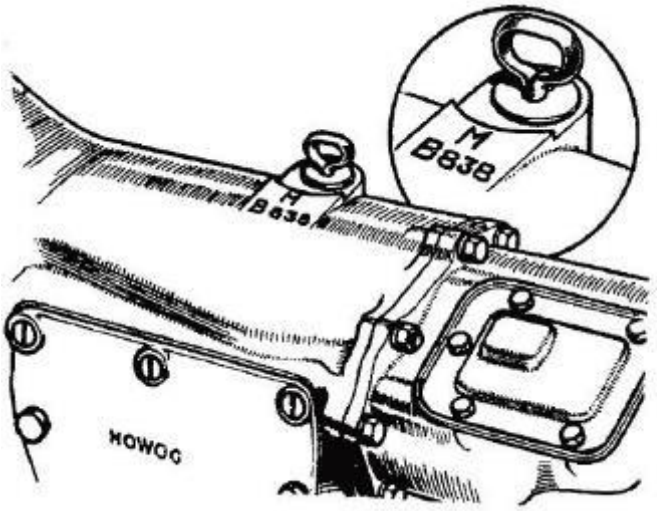
The major components of the vehicle have serial numbers, and these will be found in the positions illustrated on pages General Information 6 and 7. When in communication with the Company or your Dealer always quote the engine number and car number complete with prefixes. The registration number is of no assistance and is not required. Write your name and address clearly.



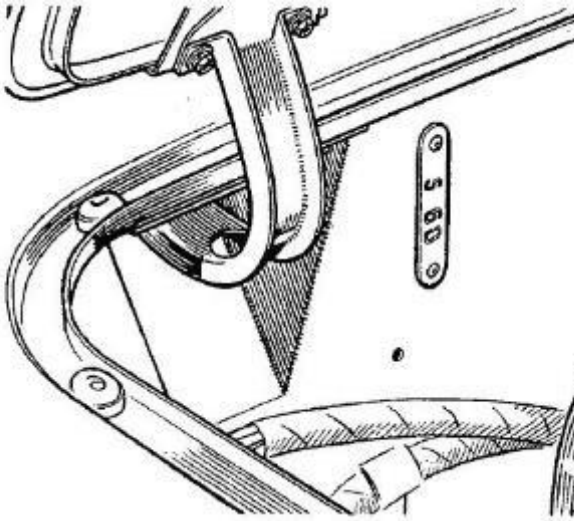
Chassis Number. This is stamped on the identification plate and should be quoted with its prefix. The plate is secured to the top left-hand side of the dash panel



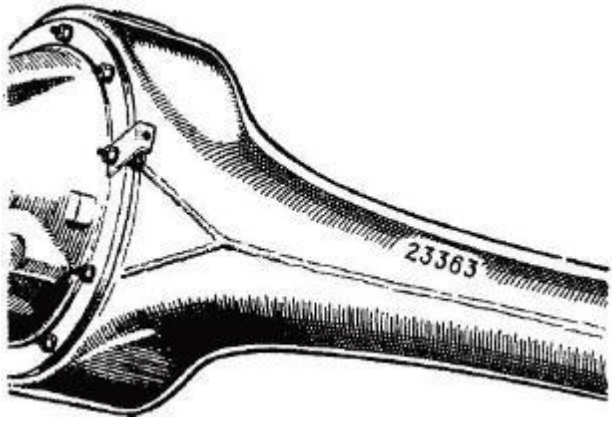
Engine Number. Stamped on a plate at the rear of the engine behind the cylinder block



Gearbox Number. Stamped on top of the gearbox casing adjacent to the dipstick



Body Number. Stamped on a plate secured to the right-hand side of the dash panel



Rear Axle Number. Stamped on the front of the left-hand rear axle tube

POWER UNIT SERIAL NUMBER CODING

The engine number and later engines comprises a series of letters and numbers, presenting in code the capacity, make, and type of unit, gearbox and ancillaries fitted, and the type of compression together with the serial number of the unit.

1st PREFIX GROUP—Cubic capacity, make, and type

1st Prefix number

8-803 c.c.

9-950 c.c.

12--1200 c.c.

15-1500 c.c.

16-1600 c.c.

22-2200 c.c.

25-2500 c.c.

26-2600 c.c.

1st Prefix letter

A—Austin

B—B.M.C. Industrials

G—M.G.

H—Miscellaneous special

J—Commercial

M—Morris

R—Riley

W—Wolseley

2nd Prefix letter A—Z used for the variations of engine type

2nd PREFIX GROUP—Gearbox and ancillaries

A—Automatic gearbox

M—Manumatic clutch

N—Steering-column gear change gearbox

0—Overdrive (Borg-Warner)

P—Police specification

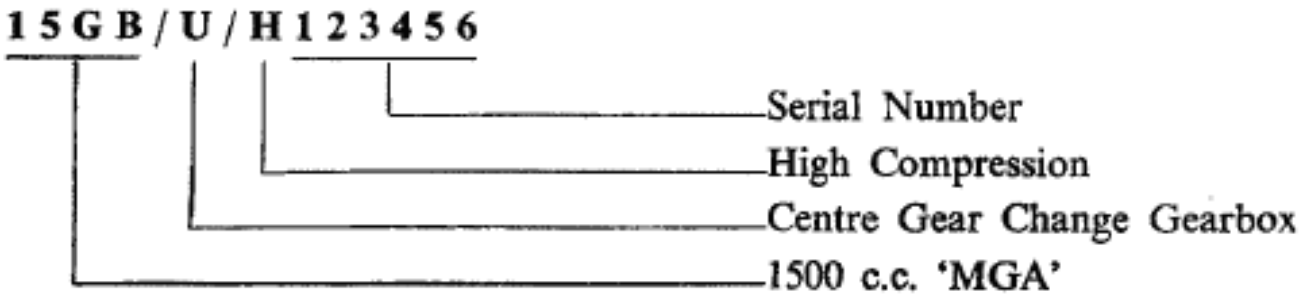
U—Centre gear change gearbox

3rd GROUP—Compression and serial number

H—High compression and serial number of unit

L— Low compression and serial number of unit

CODE EXAMPLE



IDENTIFICATION OF UNIFIED SCREW THREADS

The general standardization of Unified screw threads makes it necessary to identify all nuts, bolts, and set screws with these threads in order to ensure their being matched with correspondingly threaded components and the fitting of correct replacements.

Identification has been standardized and is effected in the following manner:

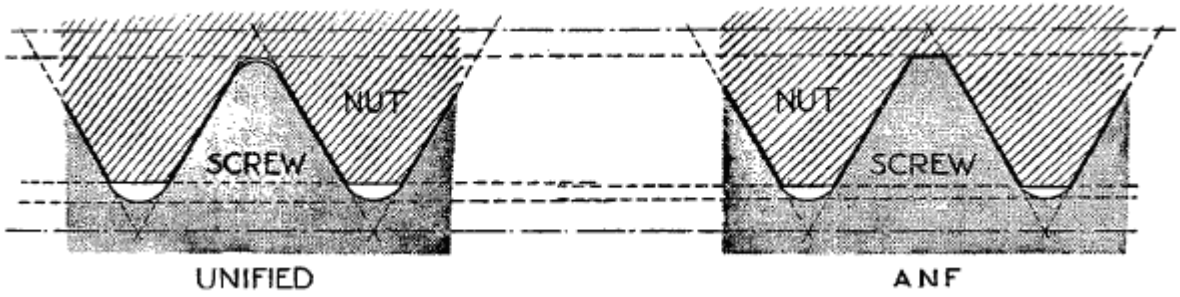
Nuts. By a circular groove turned on the end face of the nut or by connected circles stamped on one flat of the hexagon.

Bolts and set screws. By a circular depression turned on the head or by connected circles stamped on one flat of the hexagon.

Wheel and nuts. By a notch cut in all the corners of the hexagon.

It is of the utmost importance that any nuts, bolts, or set screws marked with the above identifications are used only in conjunction with associated components having Unified threads and that only replacement parts with Unified threads are used, as these are *not* interchangeable with Whitworth, B.S.F., or Metric threads.

The Unified thread is, however, interchangeable with the American National Fine (A.N.F.) thread for all practical purposes.



This illustration of the Unified thread and the A.N.F. thread to the same scale indicates their close relationship

Spanners. It is to be noted that all A.N.F.- and Unified-threaded nuts and hexagon-headed bolts are made to the standard American hexagon sizes and that spanners of the appropriate size must be used when tightening or loosening them.

KEY TO SPANNER SIZES (Nominal widths between jaws)

Diameter of screw thread (inches)	¼"	5/16"	⅜"	7/16"	½"	9/16"	⅝"	¾"	⅞"	1"
For B.S.F. screws and nuts	·448	·529	·604	·705	·825	·925	1·016	1·207	1·309	1·489
For A.N.F. screws and nuts	·440	·504	·566	·629	·755	·880	·944	1·132	1·320	1·508
For Unified screws	·440	·504	·566	**·630**	·755	**·817**	·943	1·132	1·321	1·509
For Unified nuts (normal)	·440	·504	·566	**·692**	·755	**·880**	·943	1·132	1·321	1·509
For Unified nuts (heavy)	—	—	—	—	—	—	**1·069**	**1·258**	**1·446**	—

KEY TO SPANNER SIZES (Nominal widths between jaws)

NOTE. —In the case of some Unified-threaded components the size of the hexagon for the nut is different from that of the bolt. Where this occurs the spanner size is shown in heavy type in the above tabl

PART NAME ALTERNATIVES

	M.G. part name	*Alternatives*
ENGINE	Gudgeon pin	Piston pin. Small-end pin. Wrist pin
	Scraper ring	Oil control ring
	Core plug	Expansion plug. Welch plug. Sealing disc
	Oil sump	Oil pan. Oil reservoir.
CONTROLS	Mixture control	Choke. Strangler
GEARBOX	Gear lever	Shift lever
	Change speed fork	Shift fork. Selector fork.
	First motion shaft	Clutch shaft. First reduction pinion. Main drive pinion. Drive gear
	Layshaft	Countershaft
AXLE	Crown wheel	Ring gear. Spiral drive gear.
	Bevel pinion	Small pinion. Spiral drive pinion
	U' bolts	Spring clips
	Axle shaft	Half-shaft. Hub driving shaft. Jack driving shaft
	Differential gear	Sun wheel
	Differential pinion	Planet wheel
STEERING	Swivel pin	Pivot pin. Steering pin. King pin
	Stub axle	Swivel axle.
	Track-rod	Cross-tube
	Draglink	Side-tube. Steering connecting rod

ELECTRICAL	Dynamo	Generator
	Control box	Voltage regulator. Cut-out. Voltage control
	Silencer	Muffler
BODY	Bonnet	Hood
	Wing	Fender, Mudguard

COMMUNICATING WITH THE COMPANY

For all Home trade inquiries the address is:

THE M.G. CAR COMPANY LIMITED

Abingdon, Berkshire.

Telephone: Abingdon 251-2–3–4.

Telegrams: Emgee, Abingdon.

For all Overseas inquiries the address is:

NUFFIELD EXPORTS LIMITED

Cowley, Oxford, England.

Telephone: Oxford, England, 7*773*3.

*Tele*x: 83133, Morex, Oxford, England.

Cables: Morex, Oxford, England.

CLAIMS UNDER WARRANTY

Claims for the replacement of material or parts under Warranty must always be submitted to the supplying Distributor or Dealer, or, when this is not possible, to the nearest Distributor or Dealer, informing them of the vendor's name and address.

FUEL REQUIREMENTS

Where optimum performance is required, fuels having an octane rating of between 99 and 101 are suitable, and for normal touring conditions fuel having an octane rating of between 95 and 98 are suitable. Fuels down to 90 octane rating may be used provided the contact breaker points are checked for correct gap (.015 in.) and the ignition timing set to between 29 and 3° A.T.D.C.

Fuels below 90 octane **must not** be used,

RUNNING-IN SPEEDS

The treatment given to a new car will have an important bearing on its subsequent life, and engine speeds during this early period must be limited. The following instructions should be strictly adhered to.

During the first 500 miles (800 km.)

DO NOT exceed 45 m.p.h. *(*72 km.p.h.).

DO NOT operate at full throttle in any gear.

DO NOT allow the engine to labour in any gear.

CAR NUMBER IDENTIFICATION CODE

Car number identification of the MGA Twin Cam consists of two letters and one figure followed by the chassis number.

The coding is as follows:

YD1 (Ch. No.) Right-hand drive (Home)	
YD2 (Ch. No.) Right-hand drive (Export)	2-seater
YD3 (Ch. No.) Left-hand drive	
YM1 (Ch. No.) Right-hand drive (Home)	Coupé
YM2 (Ch. No.) Right-hand drive (Export)	
YM3 (Ch. No.) Left-hand drive	

FROST PRECAUTIONS

If the car is not stored in a warmed building, steps must be taken to prevent the cooling water from freezing during frosty weather. As a precautionary measure when frost is anticipated an anti-freezing solution must be used in the cooling system. The heater unit fitted to the M.G. (Series MGA) cannot be drained completely by the cooling system drain taps and the use of anti-freeze is essential and this model in freezing weather.

The cooling system is of the sealed type and relatively high temperatures are developed in the radiator upper tank. For this reason, anti-freeze solutions having an alcohol base are unsuitable owing to their high evaporation rate producing a rapid loss of coolant and consequent interruption of circulation.

Only anti-freeze of the ethylene glycol type incorporating the correct type of corrosion inhibitor is suitable and owners are recommended to use Bluecol, Shell, Esso Anti-freeze, or any other anti-freeze conforming to Specification B.S.3151 or B.S.3152.

The recommended quantities of anti-freeze for different degrees of frost resistance are:

15° frost (17° F. or -8° C.)	1 pint (0.57 litre, 1.2 U.S. pints)
25° frost (7° F. or -14° C.)	1 ½ pints (0.85 litre, 1.8 U.S. pints)
35° frost (-3° F. or -19° C.)	2 ½ pints (1.42 litres, 3 U.S. pints)

Where temperatures below 0° F. or -18° C. are likely to be encountered a solution of at least 25 per cent of anti-freeze must be used to ensure immunity from trouble. Consult your local Dealer on this matter.

First decide what degree of frost protection is required before adding anti-freeze to the radiator.

Make sure that the cooling system is watertight and examine all joints, replacing any defective rubber hose with a new one.

Before introducing anti-freeze mixture to the radiator, it is advisable to clean out the cooling system thoroughly by draining out the water and swilling out the water passages with a hose inserted in the radiator filler, keeping the drain taps open.

Avoid excessive topping up, otherwise there is a risk of losing valuable anti-freeze due to expansion of the solution. Only top up when the cooling system is at its normal running temperature.

Generally speaking, anti-freeze is not injurious to cellulose paint, provided it is wiped off in reasonable time. It must not, however, be allowed to remain on the paintwork.

Radiator anti-freeze should not be used in windshield-washing equipment.

B.M.C. SEAT BELTS

The body of the car incorporates anchorage points to facilitate the fitting of B.M.C. seat belts.

To use the seat belt, position the buckle tongue and the long belt approximately in the centre of the belt and ensure that the upper part of the belt passes over the shoulder; pass the tongue across the body. Adjust the short belt until the buckle is located just in front of the hip and push the tongue into the buckle until it clicks in the locked position. Finally, adjust the long belt until the user is held firmly but comfortably in the seat.

To release the seat belt, lift up the buckle lever. After releasing the seat belt the long belt must be stowed in such a way as to give clear access to the doors.

MAINTENANCE ATTENTION

500 miles (800 km.) free service

During the early life of the car, soon after it has completed 500 miles (800 km.), you are entitled to have it inspected free of charge by the M.G. Dealer from whom you purchased it, or, if this should not be convenient, by any other M.G. Dealer by arrangement.

This attention given during the critical period in the life of the car makes all the difference to its subsequent life and performance.

This service includes:

1. Engine

Tighten cylinder head and manifold nuts to recommended pressures.

Check tightness of camshaft bearing cap nuts to recommended pressures.

Check valve clearances, and reset if necessary.

Tighten fan belt if necessary. Check all water connections, and tighten clips if necessary.

Examine and clean carburetters, and reset slow running adjustment if necessary.

2. Ignition

Examine sparking plugs and distributor points, and adjust if necessary.

Check working of automatic ignition control and, if necessary, reset ignition timing.

3. Clutch

Check clutch pedal for free movement, and bleed if necessary.

Check fluid level in master cylinder, and top up if necessary.

4. Steering

Check front wheel alignment and steering connections; adjust if necessary.

5. Brakes

Check braking system functionally, and bleed lines if necessary.

Check fluid level in master cylinder, and top up if necessary.

6. Hydraulic dampers

Inspect hydraulic dampers for leaks.

Examine oil levels, and top up if necessary.

Check mounting bolts for tightness,

7. Body

Check doors for ease in opening and closing. If necessary, lightly smear all dovetails and striking plates with a suitable lubricant.

8. Electrical

Check electrical system functionally.

Examine battery and top up to correct level with distilled water.

Clean and tighten terminals.

9. General

Check tightness of universal joint nuts, spring clips, and wing (fender) bolts.

10. Lubrication

Drain oil from engine, gearbox, and rear axle, and refill.

Oil and grease all points of car.

11. Wheels and tyres

Test tyres for correct pressure.

Check tightness of wheel nuts.

Regular servicing, as proved by presentation of completed voucher counterfoils, could well enhance the value of your vehicle in the eyes of a prospective purchaser.

ALL MATERIALS CHARGEABLE TO THE CUSTOMER

Daily.

Inspect oil level in crankcase. Top up if necessary.

See that the radiator is full of water.

Weekly. Test tyre pressures. (See 'GENERAL DATA'.)

1,000 miles (1600 km.) service

1. Engine

Top up carburetter piston dashpots.

Lubricate carburetter controls.

Top up radiator header tank.

2. Clutch

Check level of fluid in the hydraulic clutch master cylinder.

3. Brakes

Make visual inspection of brake lines and pipes.

Check level of fluid in hydraulic brake master cylinder.

4. Hydraulic dampers

Examine all hydraulic dampers for leaks.

5. Electrical

Check battery cell specific gravity readings and top up to correct level.

6. Lubrication

Top up engine, gearbox, and rear axle oil levels.

Lubricate all nipples (except steering rack and pinion and water pump).

7. Wheels and tyres

Check tyre pressures.

Check wheel nuts for tightness.

2,000 miles (3200 km.) service

Carry out the **1,000 miles (1600 km.) service.**

3,000 miles (4800 km.) service

1. Engine

Top up carburetter piston dashpots.

Lubricate carburetter controls.

Top up radiator header tank.

Check dynamo drive belt tension.

Clean and re-oil air cleaner elements.

2. Ignition

Check automatic ignition control, lubricating distributor drive shaft and cam and advance mechanism.

Check distributor contact points, and adjust if necessary. Clean and adjust sparking plugs.

3. Clutch

Check level of fluid in the hydraulic clutch master cylinder.

4. Brakes

Make visual inspection of brake lines and pipes.

Check level of fluid in the hydraulic brake master cylinder.

5. Hydraulic dampers

Examine all hydraulic dampers for leaks.

6. Body

Lubricate door hinges, bonnet lock, and operating
mechanism.

7. Electrical

Check battery cell specific gravity readings and top up to correct level.

8. Lubrication

Change engine oil.

Top up gearbox and rear axle oil levels.

Lubricate all nipples (except steering rack and pinion and water pump).

9. Wheels and tyres

Check tyre pressures.

Change road wheels round diagonally, including spare, to regularize tyre wear.

4,000 miles (8000 km.) service

Carry out the **1,000 miles (1600 km.) service.**

5,000 miles (6400 km.) service

Carry out the **1,000 miles (1600 km.) service**.

6,000 miles (9600 km.) service

1. Engine

Top up carburetter piston dashpots.

Lubricate carburetter controls.

Top up radiator header tank.

Check dynamo drive belt tension.

Lubricate water pump sparingly.

Clean and re-oil air cleaner elements.

Clean carburetter and fuel pump filters,

2. Ignition

Check automatic ignition control, lubricating distributor drive shaft and cam and advance mechanism.

Check distributor contact points, and adjust if necessary. Clean and adjust sparking plugs.

3. Clutch

Check level of fluid in the hydraulic clutch master cylinder.

4. Brakes

Make visual inspection of brake lines and pipes.

Check level of fluid in the hydraulic brake master cylinder.

5. Hydraulic dampers

Examine all hydraulic dampers for leaks and check fluid level in front dampers.

6. General

Tighten rear road spring seat bolts.

7. Body

Check, and tighten if necessary, door hinges and striker plate securing screws.

Lubricate door hinges, bonnet lock, and operating mechanism.

8. Electrical

Check battery cell specific gravity readings and top up to correct level.

9. Lubrication

Change oil in engine, gearbox, and rear axle.

Fit new oil filter element.

Lubricate all nipples (except steering rack and pinion).

Repack front hub caps with grease.

10. Wheels and tyres

Check tyre pressures.

Check wheel alignment.

Change road wheels round diagonally, including spare, to regularize tyre wear.

11. Test

Road-test car and report.

7,000 miles (11200 km.) service

Carry out the **1,000 miles (1600 km.) service.**

8,000 miles (12800 km.) service

Carry out the **1,000 miles (1600 km.) service.**

9,000 miles (14400 km.) service

Carry out the **3,000 miles (4800 km.) service**

10,000 miles (16000 km.) service

Carry out the **1,000 miles (1600 km.) service.**

11,000 miles (17600 km.) service

Carry out the **1,000 miles (1600 km.) service.**

12,000 miles (19200 km.) service

1. Engine

Remove carburetter suction chambers and pistons, clean, reassemble, and top up.

Remove carburetter float-chambers, empty sediment, and refit.

Lubricate carburetter controls.

Check valve clearances, and adjust if necessary.

Clean and re-oil air cleaner elements.

Check dynamo drive belt tension.

Lubricate water pump sparingly.

Clean carburetters and fuel pump filters.

2. Ignition

Check automatic ignition control, lubricating distributor drive shaft and cam and advance mechanism.
Check distributor contact points, and adjust if necessary.
Fit new sparking plugs.

3. Clutch

Check level of fluid in the hydraulic clutch master cylinder.

4. Steering

Check steering and suspension moving parts for wear.

5. Brakes

Make visual inspection of brake lines and pipes.
Check level of fluid in the hydraulic brake master cylinder.

6. Hydraulic dampers

Examine all hydraulic dampers for leaks, and top up if necessary.

7. Radiator

Drain, flush out, and refill radiator header tank.

8. General

Tighten rear road spring seat bolts.

9. Body

Check door hinges and striker plate securing screws, and tighten if necessary.
Lubricate door hinges, bonnet lock, and operating mechanism.

10. Electrical

Check battery cell specific gravity readings and top up to correct level.
Lubricate trafficators. Lubricate dynamo bearing.

11. Lubrication

Drain engine oil, flush out with flushing oil, and refill with engine oil.

Change oil in gearbox and rear axle.

Fit new oil filter element. Lubricate steering rack and pinion.

Lubricate all nipples.

Repack front hub caps with grease.

Lubricate speedometer and tachometer cables

12. Wheels and tyres

Check tyre pressures.

Check wheel alignment.

Change road wheels round diagonally, including spare, to regularize tyre wear.

13. Headlamps

Check headlamp beam setting, and reset if necessary.

14. Test

Road-test car and report.

24,000 miles (38400 km.) service

Carry out the **12,000 miles (19200 km.) service**, with the following addition:

11. Lubrication

Remove engine sump and pick-up strainer, clean, and reassemble, filling with fresh oil.

SECTION A THE ENGINE

GENERAL DESCRIPTION

The M.G. (Series MGA) twin-overhead-camshaft engine is built in unit construction with an 8 in. (20.3 cm.) Borg & Beck clutch.

The valves, which are fitted with bucket-type tappets, are inclined at an included angle of 80° in the detachable aluminium-alloy cylinder head and are directly operated by the chain-driven camshafts. The valve clearances are adjusted by means of hardened-steel shims, which are supplied in a range of sizes. The shims are inserted between the top of the valve stem and the underside of the tappets. Each camshaft runs in three renewable white-metal bearings and is driven by a fin. pitch duplex roller chain from a half-speed shaft situated in the left-hand side of the cylinder block. The drive is taken from the crankshaft to the half-speed shaft through a pair of reducing gears. The tachometer, oil pump, and distributor are driven from the half-speed shaft.

Two idler sprockets are employed with the camshaft chain, one permanently located and the other mounted on a fulcrum arm, the position of which can be adjusted by means of a manually operated chain tensioner.

The aluminium-alloy pistons carry three compression rings and one slotted oil control ring. The gudgeon pins are of the fully floating pattern and the connecting rods are fitted with renewable lead-indium- or lead-tin-plated bearings. Three renewable bearings, also of lead-indium or lead-tin, support the forged-steel counterbalanced crankshaft. The thrust is taken by special washers at the centre main bearing. The renewable-element full-flow filter is secured by its centre-bolt to the right-hand side of the cylinder block.

A centrifugal water pump fitted with a fan is driven by the dynamo belt.

The two semi-downdraught H6 S.U. carburetters are supplied with fuel by a large-capacity S.U. electric pump.

LUBRICATION SYSTEM

An eccentric-type oil pump inside the crankcase is driven from the half-speed shaft by a short vertical shaft. Oil is drawn into the pump through a gauze strainer and is delivered through crankcase drillings to a non-adjustable plunger-type relief valve located at the rear of the engine on the left-hand side. From the relief valve the oil passes through an internal drilling across the rear of the block and through an external oil pipe to the main oil filter. The filter bowl is filled with oil at full pressure which passes through the element into the annular space around the centre-bolt and from there into the main oil gallery: drillings supply oil to the main, big-end, and half-speed shaft bearings.

Oil is fed to the camshaft bearings from the main oil gallery through an external pipe. The timing gears are sprayed with oil from a small drilling in an oil distributor pillar attached to the engine front plate. Oil is also taken through pipes from this distributor pillar to the timing chain idler sprocket bearing and the chain adjuster sprocket pivot bearing.

A.1 DRAINING THE SUMP

The sump on new and reconditioned engines must be drained and then filled with new oil after the first 500 miles (800 km.) and at intervals of every 3,000 miles (4800 km.). The hexagon-headed drain plug is at the rear of the sump on the right-hand side. The sump should be drained when the engine is hot as the oil will flow more readily; allow to drain for at least 10 minutes before the drain plug is replaced.

The capacity of the sump is given in the "GENERAL DATA section.

A.2 OIL PRESSURE

Under normal running conditions the oil pressure should not drop below 30 lb./sq. in. (2.1 kg. /cm.) on the gauge at normal road speeds, whilst approximately 10 lb./sq. in. (.7 kg. /cm.) should be shown when the engine is idling. New engines with new oil will give considerably higher readings at low speeds.

Should there be a noticeable drop in pressure, the following points should be checked:

1. That there is a good supply of the correct grade of oil in the engine sump.
2. That the strainer in the sump is clean and not choked with sludge.
3. That the bearings, to which oil is fed under pressure, have the correct working clearances.

   Should the bearings be worn and the clearances excessive, the oil will escape more readily from the sides of the bearings, particularly when the oil is warm and becomes more fluid. This will cause a drop in pressure on the gauge as compared with that shown when the bearings are in good order.

The automatic relief valve in the lubrication system deals with any excessive oil pressure when starting from cold. When hot the pressure drops as the oil becomes more fluid.

Should the oil filter become blocked, two relief valves in the filter blow off to enable the oil to by-pass the filter and pass direct into the main gallery.

Continuous cold running and unnecessary use of the mixture control are often the cause of serious oil dilution by fuel, with a consequent drop in pressure.

Particular attention is called to the recommended change of oil every 3,000 miles (5000 km.).

A.3 OIL PRESSURE RELIEF VALVE

The non-adjustable oil pressure relief valve is situated at the rear of the left-hand side of the cylinder block and is held in position by a domed hexagon nut sealed by two fibre washers. The relief valve spring maintains a valve cup against a seating machined in the block.

The valve should be examined to ensure that the cup is seating correctly, and that the relief spring has not lost its tension. The latter can be checked by measuring the length of the spring. To give the correct relief pressure of 50 lb. sq. in. (3.52 kg. /cm.) this should not be less than 3 in. (7.6 cm.). Fit a new cup and spring if necessary.

A.4 WATER PUMP

The water pump is of the centrifugal impeller type and is mounted on a common spindle with the fan. The pump and fan assembly, together with the cast-aluminium inlet pipe, is attached to the front of the timing case by three studs and one bolt around the pump casing and one bolt on the inlet pipe, and may be withdrawn and serviced as detailed in Sections C.7 and C.8.

If the gasket is damaged as the pump body is withdrawn from the timing case, ensure that all traces of it are removed before a new gasket is fitted and the pump replaced.

A.5 CARBURETTERS

Removal

Disconnect the fuel supply pipe and the flexible connecting pipe at the rear carburetter union.

Remove the two set screws and spring washers securing each air cleaner and remove the air cleaners. Remove the split pin and flat washer and release the mixture cable and clevis pin from the mixture control linkage and release the mixture outer cable abutment complete with bracket.

Remove the split pin from the jet lever interconnecting link to separate the two jet levers. Detach the throttle return spring and release the throttle cable.

Unscrew the union nut and disconnect the ignition vacuum control pipe from the front carburetter.

Remove the nut and flat washer on top of each float-chamber to release the vent pipes.

Remove the four nuts, spring washers, and plain washers securing each carburetter flange and withdraw the carburetters. The throttle cable abutment bracket and throttle return spring bracket will also be withdrawn.

Replacement

Replacement is a reversal of the above instructions.

Do not attempt to remove the carburetters and induction manifold as an Assembly. The induction manifold is secured by two studs inside the intakes and cannot be released until the carburetters are removed (Fig. A.1).

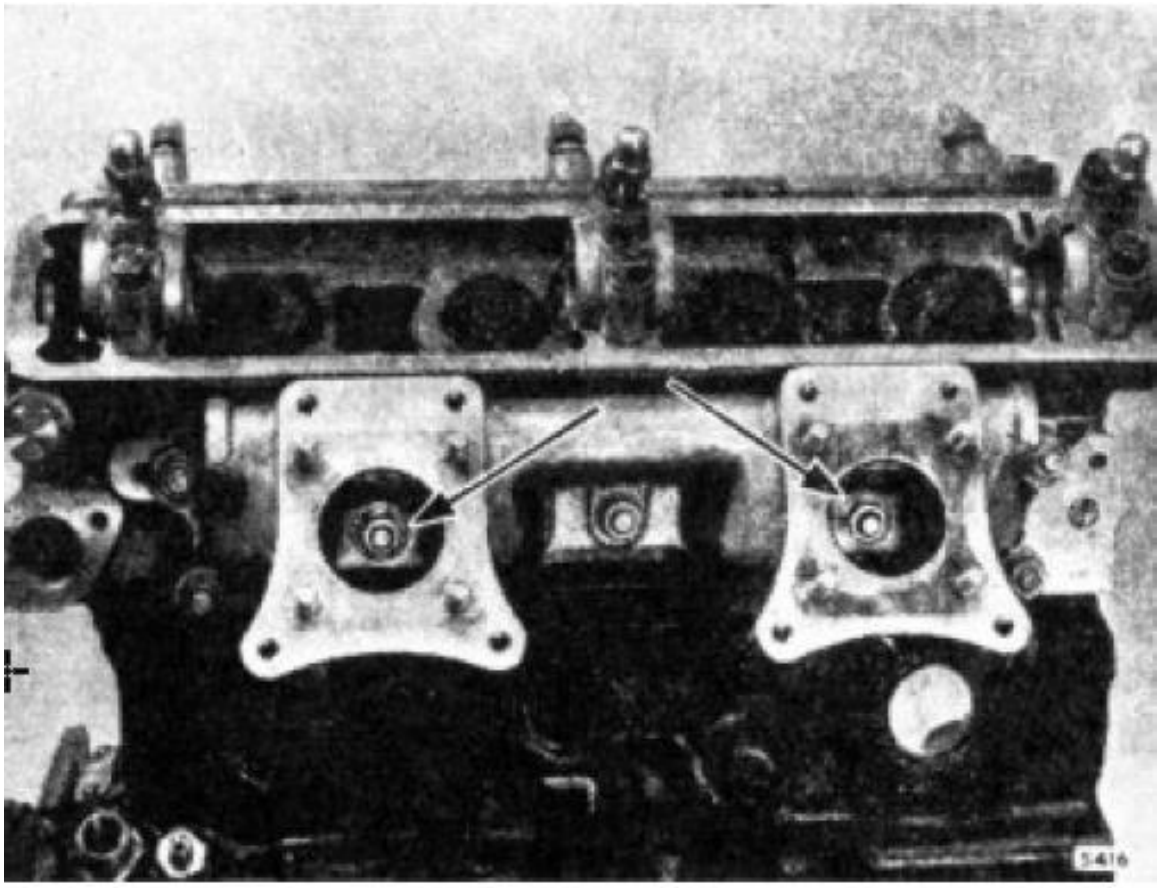


Fig. A.1 Two of the manifold securing nuts (arrowed) are fitted inside the intakes

A.6 INLET MANIFOLD

Removal

Remove the air cleaners and carburetters as detailed in Section A.5.

Seven studs secure the inlet manifold to the cylinder head. Remove the nuts, spring washers, and flat washers, noting that two studs pass through the manifold, the nuts being located inside the intakes (see Fig. A.1).

Replacement

Replacement of the manifold is a reversal of these instructions. A new gasket should be used.

A.7 HEADER TANK

Removal

Remove the heater air intake pipe.

Slacken the hose clips between the thermostat housing cover and the header tank.

Remove the two set screws, spring washers, and plain washers securing the header tank mounting bracket at the rear of the tank. Release the overflow pipe at the rubber connection to the filler neck and lift out the header tank.

Replacement

Replacement is a reversal of the above instructions.

A.8 THERMOSTAT HOUSING

Removal

Remove the heater air intake pipe, thermostat cover, and header tank as detailed in Section A.7.

Slacken the heater water pipe union nut and release the pipe from the thermostat housing. Release the thermal transmitter bulb olive nut and withdraw the thermal transmitter. Release the hose clip securing the hose between the thermostat housing and cylinder head.

Remove the three bolts, nuts, and spring washers securing the thermostat housing to the front engine plate. Push the housing into a position which will enable the clip on the by-pass hose to be slackened.

The thermostat housing can now be removed.

Replacement

Replacement is a reversal of the above instructions.

A.9 EXHAUST MANIFOLDS

Removal

Drain the cooling system. Remove the header tank as detailed in Section A.7 and the thermostat housing as described in Section A.8. Remove the heater water intake pipe if fitted. Remove the six nuts and washers connecting the exhaust pipes to the manifolds. Release the exhaust pipe bracket from the gearbox mounting plate. Remove the nuts and washers securing the exhaust manifold to the cylinder head and withdraw the manifolds.

Replacement

Replacement is a reversal of the above instructions. A new gasket should be used.

A.10 CAMSHAFT DRIVING SPROCKETS

Disconnecting

When the camshafts or cylinder head are removed it is necessary to first disconnect the camshaft driving sprockets from the driving flanges on the camshafts. Proceed as follows.

Remove the three set screws, spring washers, and plain washers securing the front end of each camshaft cover and the three domed nuts and copper washers along the top of the covers. Lift off the camshaft covers. Mark the camshaft sprockets and the driving flanges so that the sprockets may be replaced in their original positions on assembly.

Slacken the timing chain tensioner adjusting screw right off.

Remove the locking wire from the two set screws securing each camshaft driving sprocket to the camshaft flange and slacken the screws. Slacken the two nuts securing the camshaft sprocket support plate to the timing chain cover. Pull the camshaft sprocket and support spindle away from the

camshaft flange and engage the thread on the spindle with the support plate (see Fig. A.2). Remove the driving sprocket set screws completely.

Reconnecting

When reassembling the driving sprockets to the camshaft, line up the marks (made on removal) on the flanges before fitting the sprocket Securing screws. Rewire the screws after final tightening.

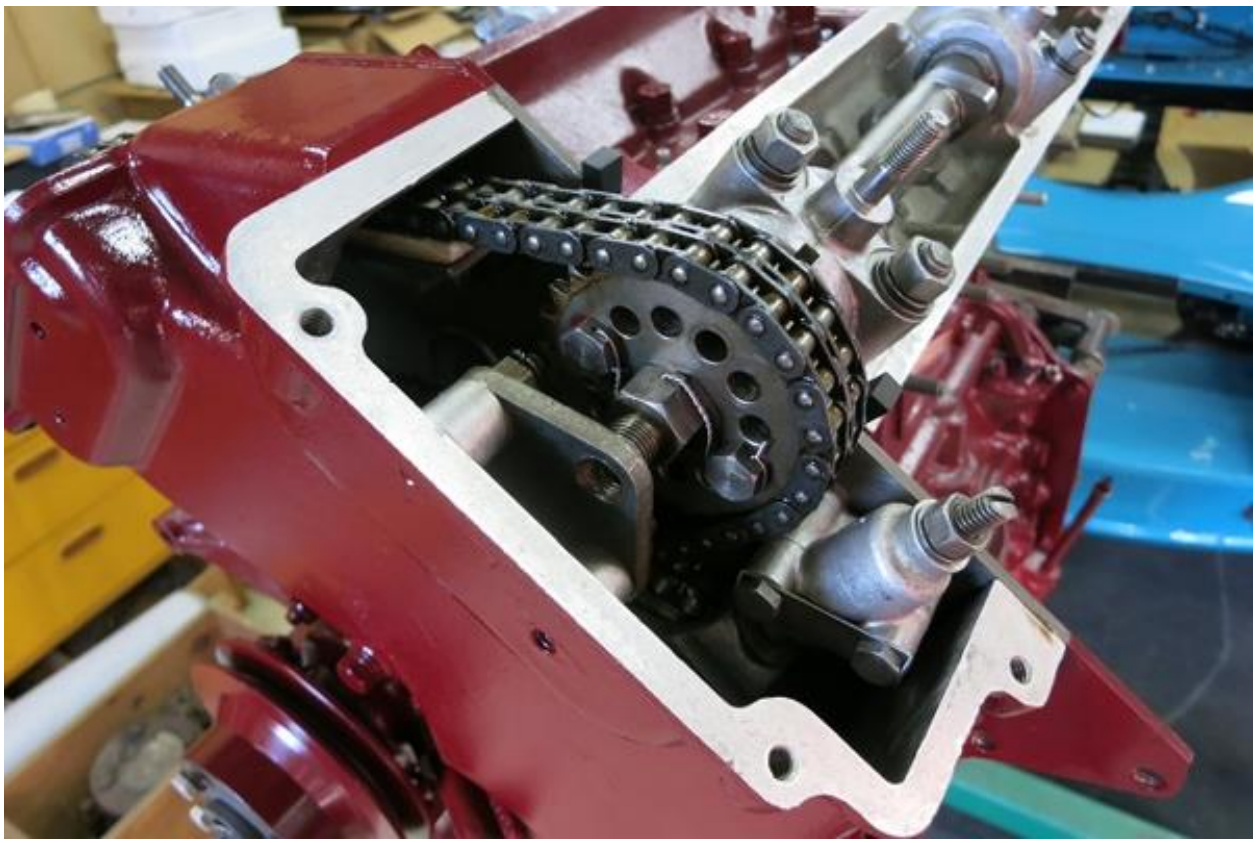
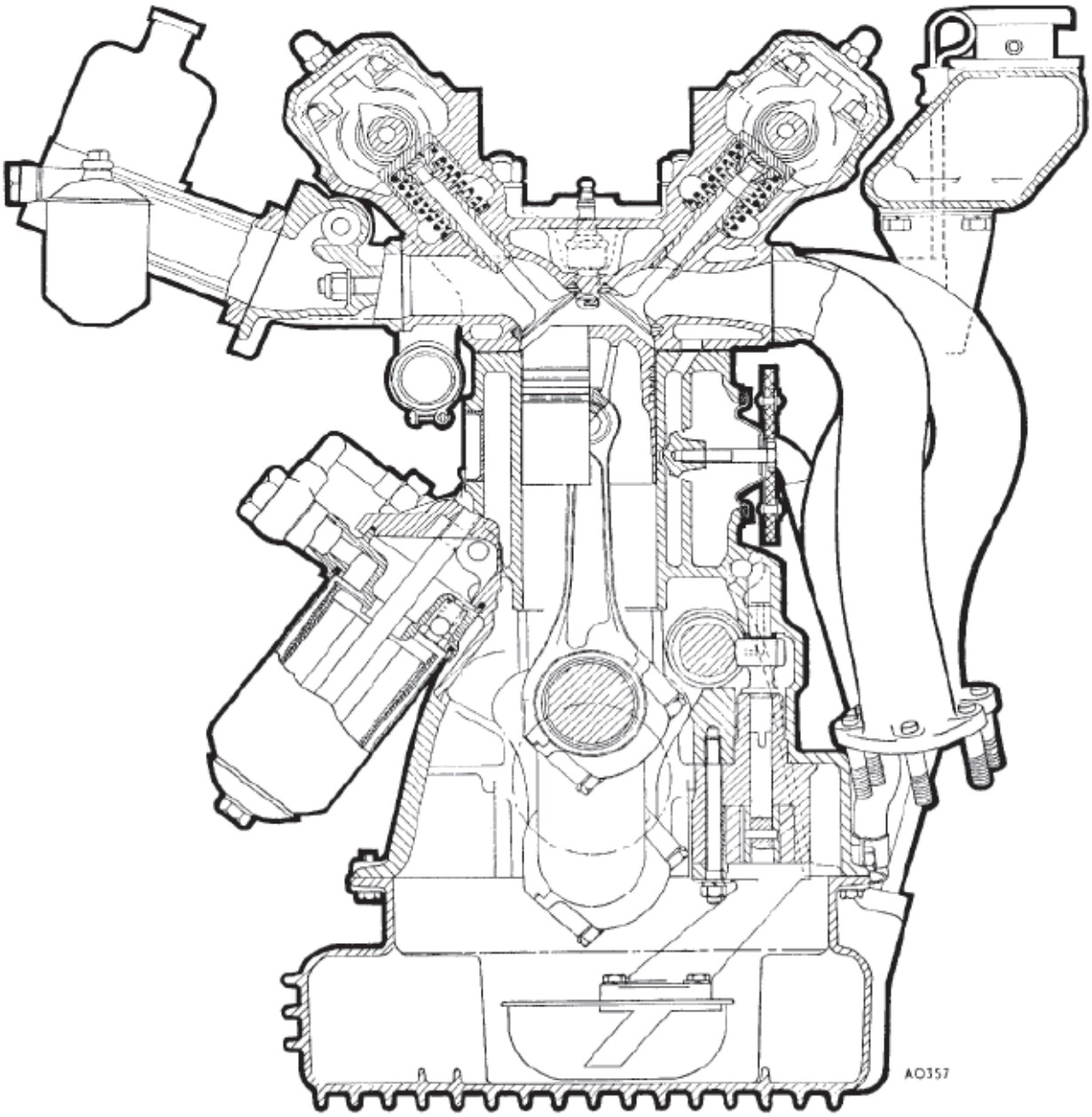


Fig. A.2 The sprocket support spindle thread engaged in the support plate

(Transverse Section) THE M.G. Series MGA (Twin Cam) ENGINE



A.11 CAMSHAFTS

Remove the camshaft covers and disconnect the camshaft driving sprockets (see Section A.10). Slacken the camshaft bearing cap nuts a turn at a time to allow the camshaft to rise evenly on the studs. Commence at the rear bearing and work towards the front. If this is not done the camshaft thrust flange may cause damage to its housing or the camshaft may suffer distortion or breakage.

Before replacing the camshaft set the crankshaft to 90° B.T.D.C. on No. 1 cylinder to obviate an open valve fouling a piston crown. Position the camshaft with the timing slots in the cap and shaft approximately in line. Tighten the bearing cap nuts a turn at a time, commencing with the front bearing, to fit the camshaft evenly and to prevent the thrust flange fouling the thrust slot. Finally tighten the nuts to the torque loading figures given in "GENERAL DATA'.

The camshaft bearing caps are marked, and care must be taken to replace them in their correct positions. After assembly check and adjust the valve timing (Section A.19).

Replacement

When refitting the cylinder head, it is advisable to use a new gasket. The seals fitted between the front camshaft bearings and the engine front plate should be examined and renewed if necessary.

Tighten the cylinder head nuts in the correct sequence (see Fig. A.3), using a torque Wrench. The torque wrench settings are given in the 'GENERAL DATA' section.

Reassembly continues in the reverse order to the dismantling procedure. After final tightening of the cylinder head nuts check the valve clearances and adjust if necessary (see Section A.18).

A.12 CAMSHAFT BEARINGS

Each camshaft runs in three non-adjustable white-metal shell bearings.

To renew the bearings, disconnect the camshaft driving sprockets and remove the camshafts (see Section A.11) when the bearings may be extracted.

Care should be exercised to see that the bearing journals, etc., are thoroughly cleaned before installing new bearings. No scraping is required, as the bearings are machined during manufacture to give the correct diametrical clearance.

A.13 CYLINDER HEAD

Removal

Drain the cooling system and remove the header tank, thermostat housing, and exhaust manifolds as detailed in Section A.9. Remove the air cleaners and carburetters as described in Section A.5. Unscrew the cylinder head oil feed pipe at the right-hand rear of the head.

Remove the two bolts, spring washers, and plain washers securing the cylinder head water intake pipe at the rear of the head.

Detach the high-tension cables and remove the sparking plugs, taking care not to damage the porcelain insulators.

Remove the camshaft covers and disconnect the camshafts from their driving sprockets (see Section A.10).

Remove the 10 cylinder head retaining nuts and the cylinder head. When lifting the head, a direct pull should be given to withdraw it evenly up the studs.

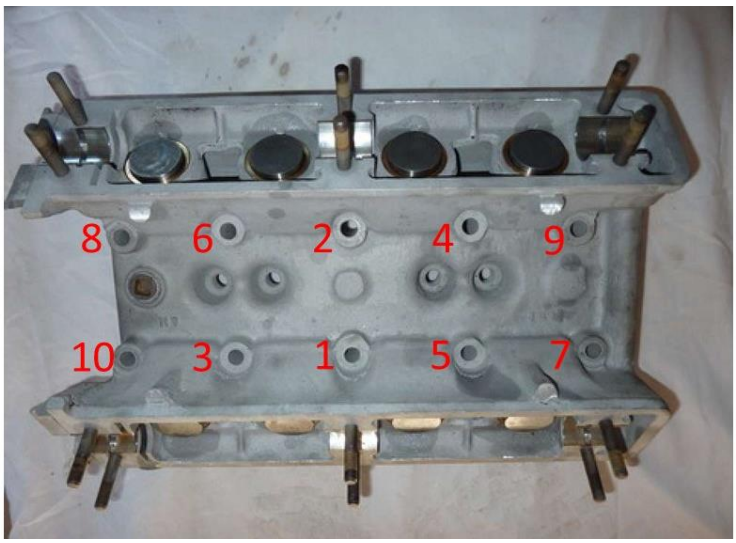


Fig. A.3 The correct order of tightening and slackening the cylinder head nuts

A.14 DECARBONIZING

Remove the cylinder head as described in Section A.13.

Withdraw the valves as described in Section A.15.

Remove the cylinder head gasket and plug the waterways with a clean rag.

If special equipment is not available for decarbonizing it will be necessary to scrape the carbon deposit from the piston crowns and cylinder head, using a blunt scraper.

A ring of carbon should be left round the periphery of the piston crown and the rim of carbon round the top of the cylinder bore should not be touched. To facilitate this an old piston ring can be sprung into the bore so that it rests on top of the piston.

The cylinder head is next given attention. The sparking plugs must be removed, cleaned, and adjusted. Clean off the carbon deposit from the valve stems, valve ports, and combustion spaces of the cylinder head. Remove all traces of carbon dust with compressed air or by the vigorous use of a tyre pump and then thoroughly clean with paraffin (kerosene) and dry off.

Fit a new cylinder head gasket.

A.15 VALVES

Removal

Remove the cylinder head (Section A.13) and remove the camshafts (Section A.11).

Withdraw the tappets with a valve grinding suction tool and remove the tappet adjusting shims (see Fig. A.5). Keep the tappets, adjusting shims, and valves in their relative positions to ensure replacement in their original locations.

Compress the valve springs with a suitable compressor and remove the two valve retainers. Release the valve springs and remove the compressor, the valve spring cup, the inner and outer valve springs, and the valve spring thrust washer.

Withdraw the valve from the guide.

Refitting

To replace the valves, place each valve in its guide and replace the thrust washer, the valve springs, and the valve spring cup.

Compress the valve springs with the compressor and refit the valve spring retainers. Remove the compressor and refit the tappet adjustment shim and the tappet. The valve clearances should be checked and adjusted after final assembly (see Section A.18).

A.16 VALVE GUIDES

Removal

Disconnect the camshaft driving sprockets and remove the cylinder head as detailed in Section A.13. Remove the appropriate camshaft, valve, and springs as in Section A.15.

The valve guides are shouldered and can therefore only be removed by driving through from the combustion chambers.

Rest the camshaft cover joint face of the cylinder head on a smooth wooden block of sufficient thickness to keep the camshaft bearing cap studs clear of the press table (see Fig. A.4) and drive the valve guide through from the combustion chamber with a suitably sized drift. This should take the form of a hardened-steel punch 9/16 in. (14 mm.) in diameter and not less than 4 in. (10 cm.) in length, with a locating spigot 5/16 in. (8 mm.) diameter machined on one end for a length of 1 in. (2.5 cm.) to engage the bore of the guide.

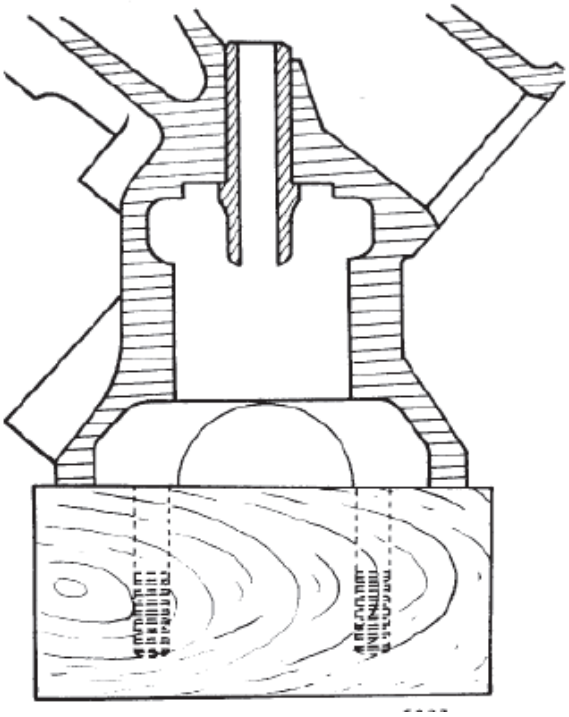


Fig. A.4 The camshaft housing (sectioned) positioned on a wooden block for valve guide removal

Replacement

When fitting new valve guides they should be pressed in from the top of the cylinder head until the flange registers on the bottom of the valve spring recess.

A.17 VALVES AND SEATINGS

Grinding and testing

Remove the valves as in Section A.15.

Each valve must be cleaned thoroughly and carefully examined for pitting. Valves in a pitted condition should be refaced with a suitable grinder or new valves should be fitted.

If valve seats show signs of pitting or unevenness they should be trued using a suitable grinder or special cutter. When using a cutter care must be exercised to remove only as little metal as is necessary to ensure a true surface.

When grinding a valve onto its seating the valve face should be smeared lightly with fine- or medium-grade carborundum paste and then lapped in with a suction grinder (special tool 18G29). Avoid the use of excessive quantities of grinding paste and see that it remains in the region of the valve seating only.

A light coil spring placed under the valve head will assist considerably in the process of grinding. The valve should be ground to its seat with a semi-rotary motion and occasionally allowed to rise by the pressure of the light coil spring. This assists in spreading the paste evenly over the valve face and seat. It is necessary to carry out the grinding operation until a dull, even, matt surface, free from blemish, is produced on the valve seat and valve face.

On completion the valve seat and ports should be cleaned thoroughly with a rag soaked in paraffin (kerosene), dried, and then thoroughly cleaned by compressed air. The valves should be washed in paraffin (kerosene) and all traces of grinding paste removed.

After replacing the valves test them by pouring a small quantity of paraffin (kerosene) through the ports. If there is any leakage of paraffin (kerosene) past the valve seating's the valve should be removed and examined and, if necessary, reground.

A.18 TAPPET CLEARANCES

If the engine is to give its best performance and the valves are to retain their maximum life it is essential to maintain the correct tappet clearances. Accordingly, it is recommended that the clearance be checked at regular intervals and any necessary adjustments made.

The clearance figure for both inlet and exhaust valves is shown in the "GENERAL DATA' section. The engine is designed to operate with this clearance and no departure from it is permissible.

The valve clearances are adjusted by means of hardened steel shims interposed between the underside of each tappet and the top of the valve stem.

Turn the engine and check the clearance of each tappet with a feeler gauge. Care must be taken to ensure that the clearance is measured on the back of the cam, i.e. opposite the peak. Take note of the clearance figures.

To adjust the tappet clearances, disconnect the camshaft driving sprockets (Section A.10) and remove the camshafts. Withdraw one of the tappets which requires adjustment, using a valve grinding suction tool (see Fig. A.5), and remove the shim. Insert a new shim of suitable thickness to correct the valve clearance and replace the tappet. Correct the other valve clearances in a similar manner and replace the camshafts.

Re-check the valve clearances after finally tightening the camshaft bearing nuts and carry out any further adjustments if necessary.

Variations in the tappet clearances have a marked influence upon the valve timing and it is therefore advisable to check the timing (see Section A.19) after adjusting the tappets.

The shims are available in 16 sizes and the thickness of a shim is indicated by a stamped number.

The numbers, with corresponding sizes, are detailed in the table below:

Number on shim	Size
1	.086 in. (2.182 mm.)
2	.088 in. (2.233 mm.)
3	.090 in. (2.284 mm.)
4	.092 in. (2.335 mm.)
5	.094 in. (2.386 mm.)
6	.096 in. (2.437 mm.)
7	.098 in. (2.488 mm.)
8	.100 in. (2.540 mm.)
9	.102 in. (2.591 mm.)
10	.104 in. (2.642 mm.)
11	.106 in. (2.693 mm.)
12	.108 in. (2.744 mm.)
13	.110 in. (2.795 mm.)
14	.112 in. (2.846 mm.)

15	.114 in. (2.897 mm.)
16	.116 in. (2.948 mm.)

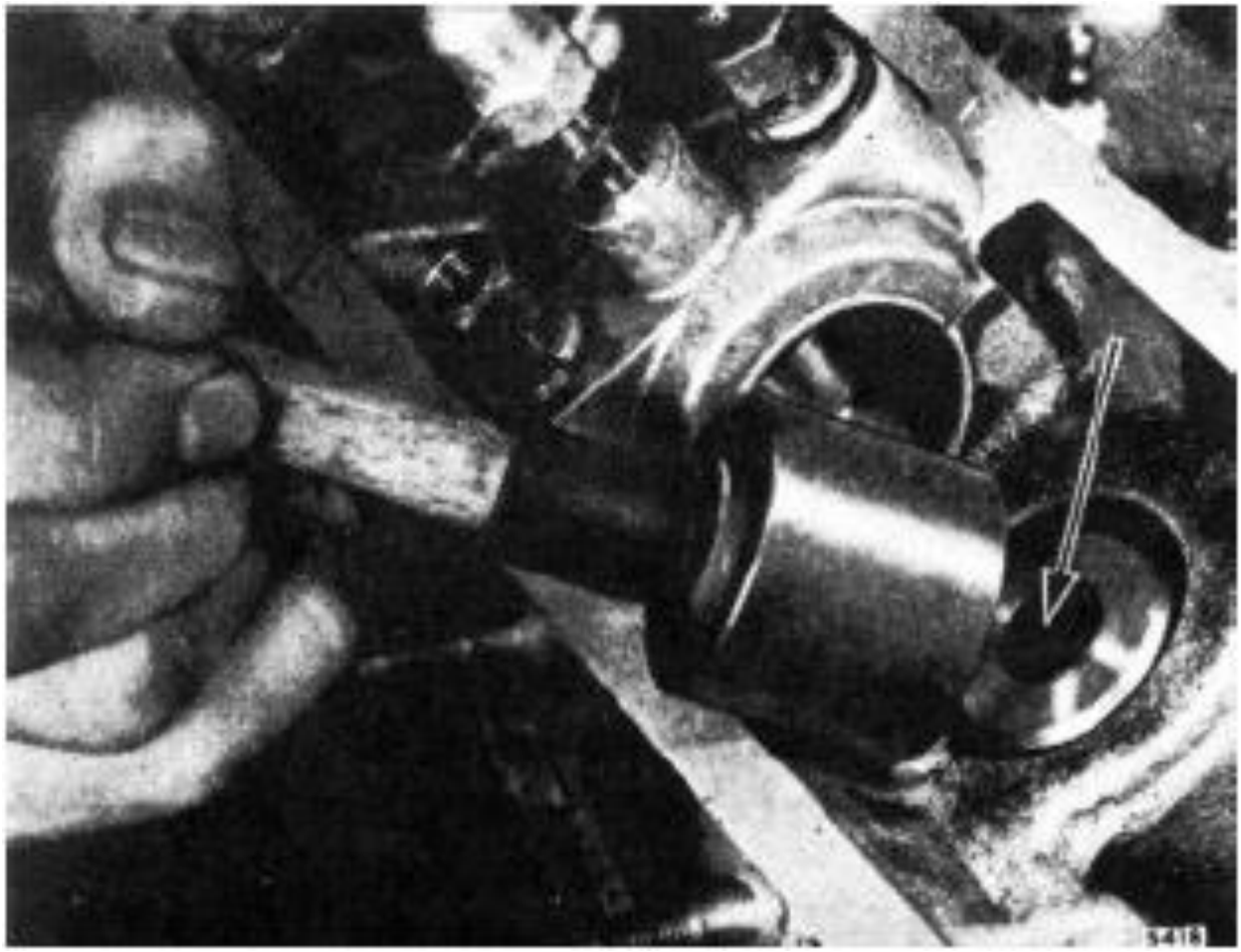


Fig. A.5 Withdrawing a tappet with a valve grinding suction tool. The adjusting shim is indicated by the arrow

A.19 VALVE TIMING-CHECKING AND ADJUSTING

Excessive stretch in the timing chain or variations in the tappet clearances will have a considerable effect on the valve timing and cause the performance of the car to suffer. The valve timing should therefore be checked at regular intervals and adjusted if necessary.

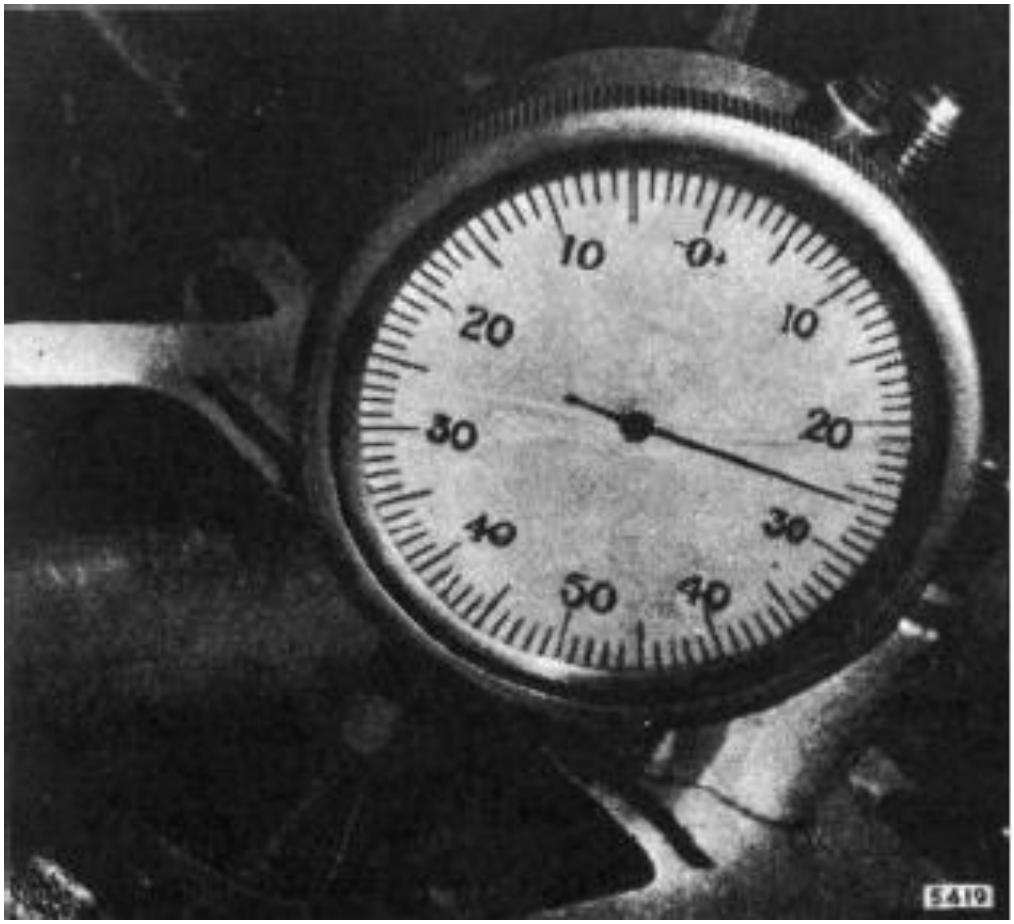


Fig. A.6 The use of a dial indicator to check the valve timing. The indicator needle has moved in an anti-clockwise direction, showing a total tappet displacement of .074 in. (1.882 mm.) in this example

Proceed as follows.

Remove the camshaft covers and check the tappet clearances as detailed in Section A.18; adjust them if necessary.

Mount a dial indicator to a suitable fixed point on the cylinder head with the indicator foot resting on No. 1 inlet valve tappet. Make certain that the cam is clear of the tappet and set the dial indicator to 'O'. Turn the engine until No. 1 piston is at T.D.C. with the valves rocking (i.e. No. 4 piston at T.D.C. on compression stroke) and line up the notch in the crankshaft pulley with the projection in the timing cover (see Fig. A.7).

If the timing of the inlet camshaft is correct the dial indicator will show that the tappet has moved between .072 and .083 in. (1.831 and 2.108 mm.) (see Fig. A.6).

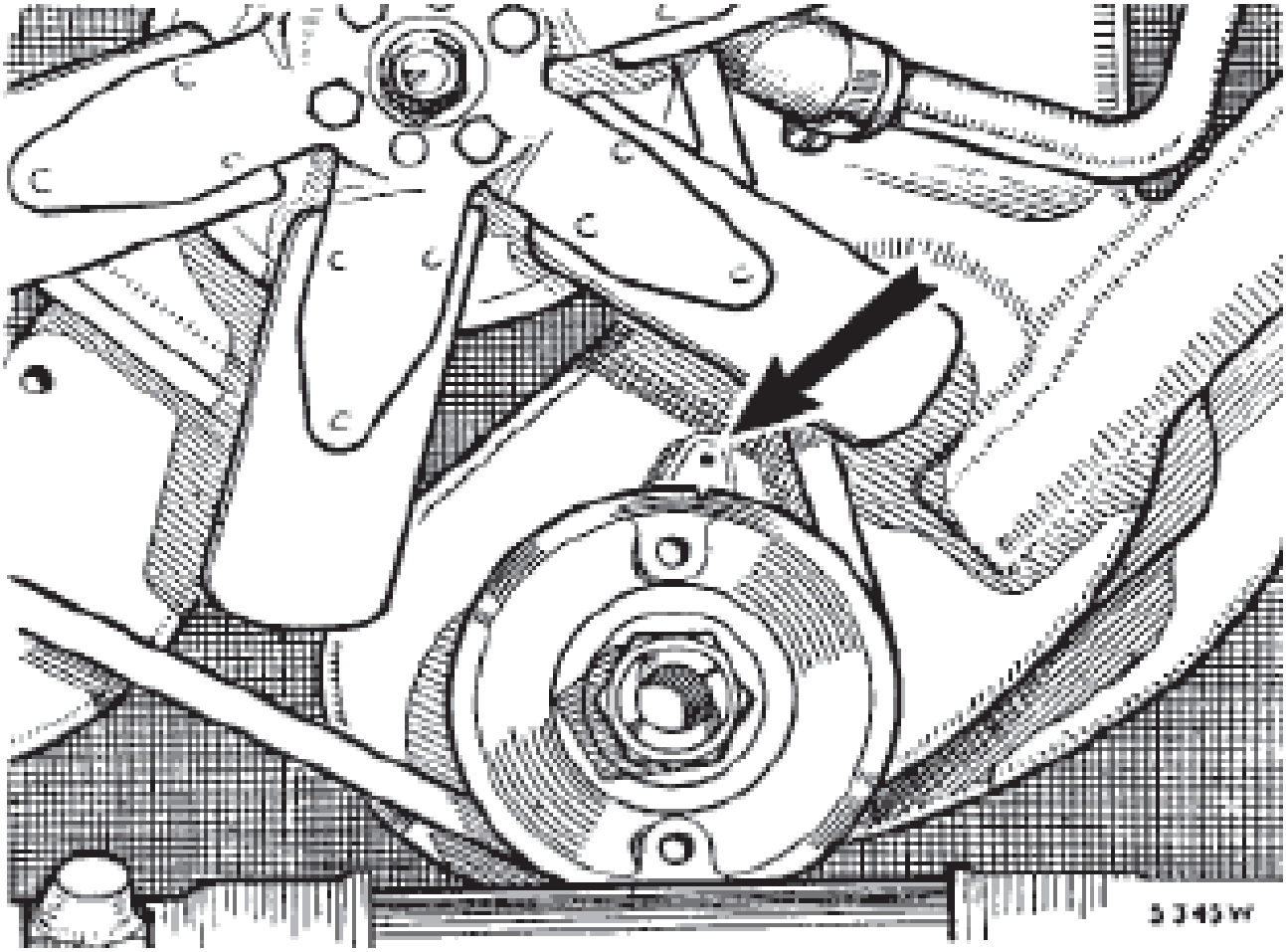


Fig. A.7 When the groove in the crankshaft pulley coincides with the small projection on the timing case Nos. 1 and 4 pistons are at T.D.C

Transfer the dial indicator to No. 1 exhaust tappet without moving the engine from T.D.C. and set the dial indicator to '0'. Turn the engine until the tappet has risen fully (until the cam is clear of the tappet) and check the displacement. This should be within the tolerance shown above for the inlet tappet.

If the timing is incorrect it can be reset in the following manner.

Remove the timing chain cover as detailed in Section A.21. Knock back the tab washer on the chain adjuster securing bolts and remove the chain adjuster. Swing the adjuster sprocket fork clear of the timing chain.

Turn the camshafts until the slots in the inner flanges line up with the slots in the front camshaft bearing housings. If the timing chain has been removed make certain that the pistons are half-way down the bores, otherwise there is danger of the valves fouling the piston crowns as the camshafts are turned. Lock both camshafts, using the tool described in Section A.35 (service tool 186551).

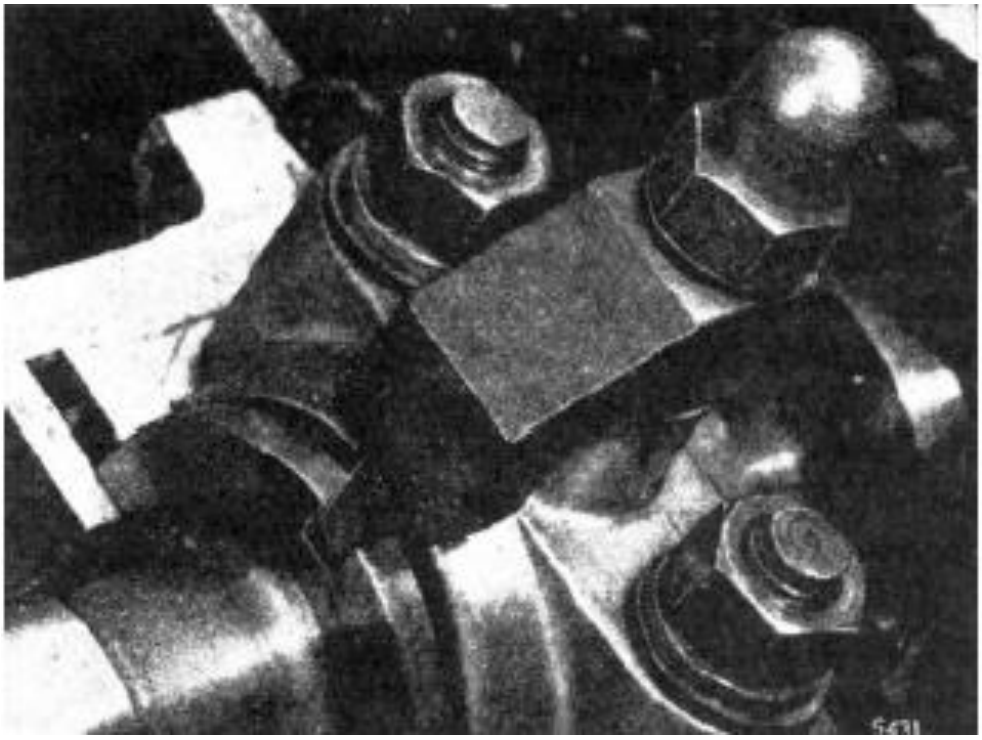


Fig. A.8 The camshaft locking tool (18G551) in use. See Section A.35 for dimensions

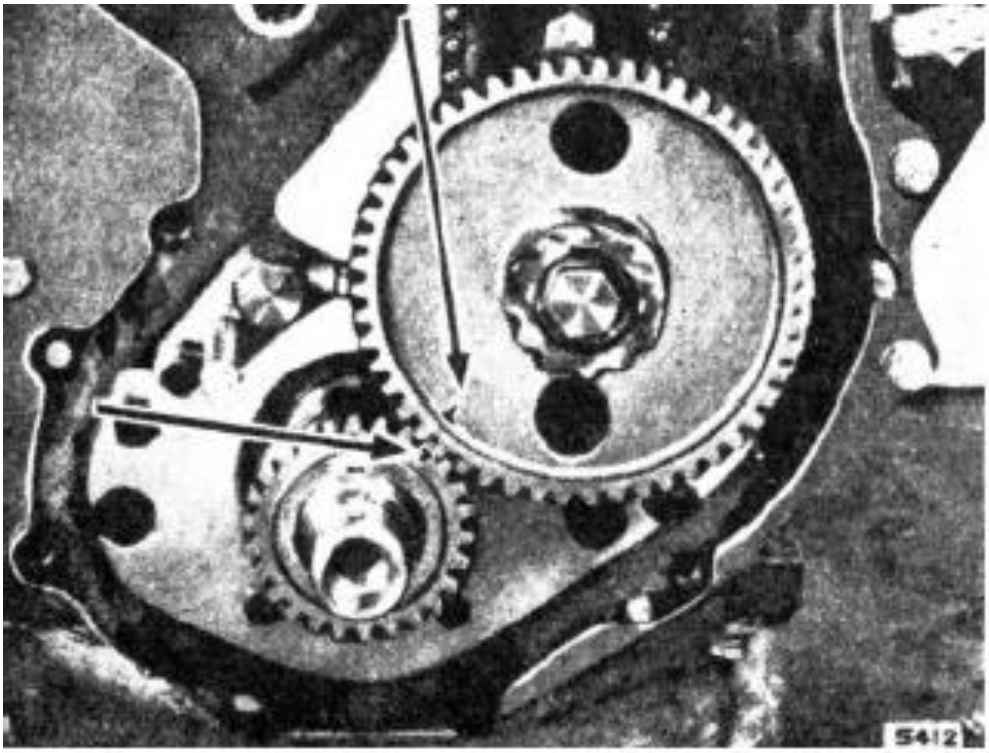


Fig. A.9 When replacing the timing gears the 'T' markings must be in line as shown

Check that the 'T' markings on the crankshaft and half-speed shaft gears are in their correct relationship (see Fig. A.9) and that No. I piston is at T.D.C.

Remove the camshaft sprocket securing screws and slacken the sprocket support spindles.

Turn the inlet camshaft sprocket in a clockwise direction to pull the timing chain tight between the half-speed shaft sprocket and the inlet camshaft sprocket. If two opposite holes in the sprocket do not line up exactly with the tapped holes in the camshaft flange it will be necessary to use the Vernier arrangement provided by the holes in the camshaft sprocket.

Lift the chain away from the sprocket and turn the sprocket to select a pair of holes which will line up exactly with the tapped holes in the camshaft flange **when the chain is tight**.

When the correct holes have been selected fit the Sprocket securing screws and tighten the support spindle.

Adjust the timing of the exhaust camshaft in a similar manner to that adopted for the inlet camshaft, ensuring that the **chain tension between the exhaust, inlet, and half-speed shaft sprockets is retained.**

Fit the exhaust sprocket screws and tighten the support spindle.

Swing the sprocket adjuster fork to its correct position and replace the chain tensioner.

Adjust the chain tension as detailed in Section A.20.

Finally, check the valve timing, using the dial indicator as described at the beginning of this section. If the readings are slightly outside the tolerance given it will usually be found that advancing or retarding one hole will correct it. Rewire the sprocket securing screws and fit the timing chain cover and camshaft covers.

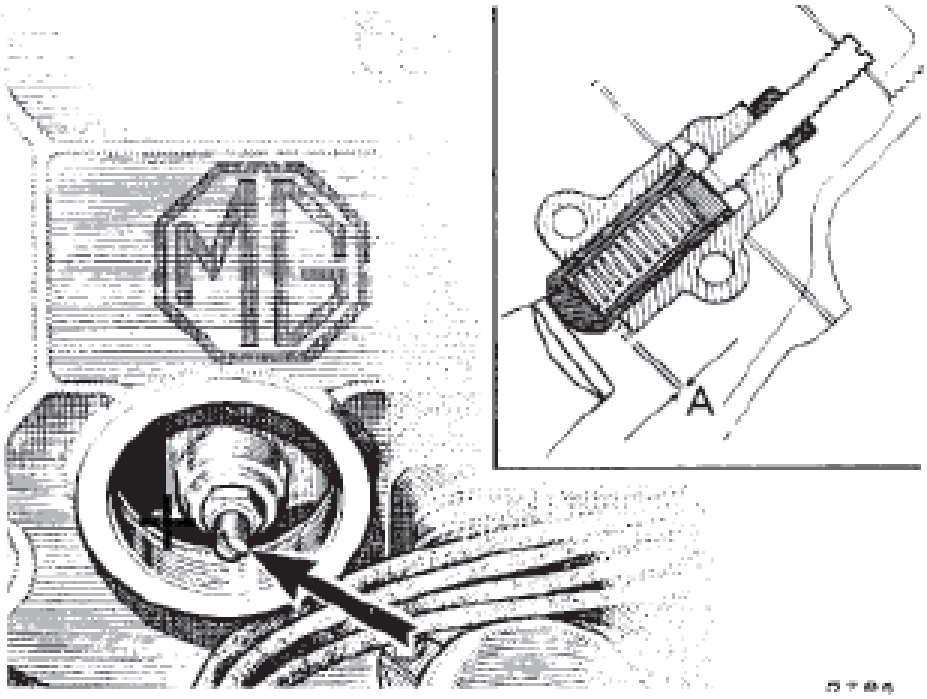
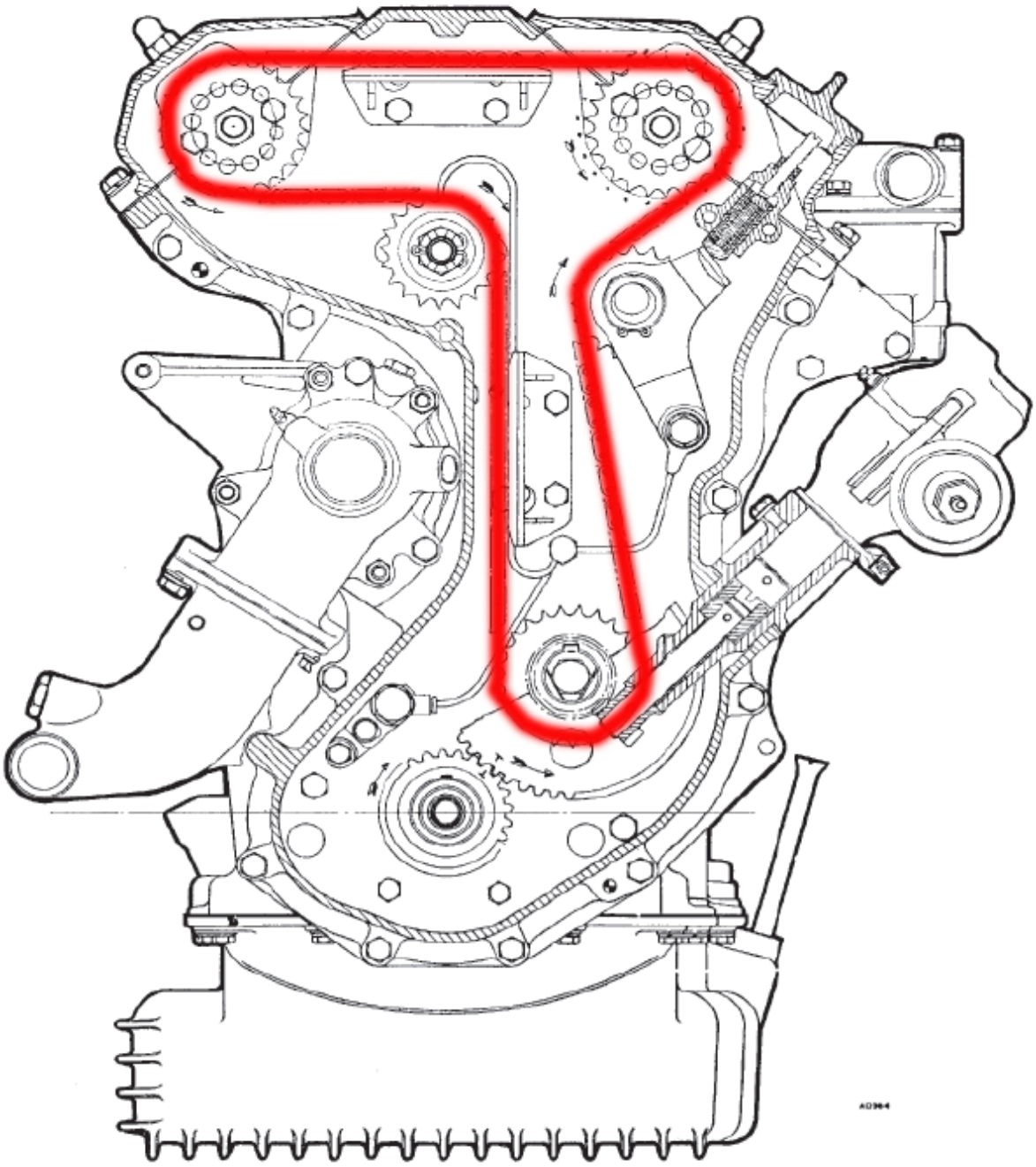


Fig. A.10 The timing chain adjuster screw is located beneath the engine oil filler cap. A clearance of in. (-80 mm.) should be maintained at (A) (see Section 4.20) to prevent the inner sleeve bottoming and the spring becoming inoperative

A.20 TIMING CHAIN-ADJUSTING

The amount of free play in the timing chain is controlled by means of a manually operated chain tensioner.



Remove the oil filler cap at the front of the exhaust camshaft cover to gain access to the adjuster screw and locknut. Release the locknut and carefully turn the adjuster screw in a clockwise direction until a change in resistance is felt. Turn the screw back (anti-clockwise) three-quarters of a turn to obtain the required clearance of 1/32 in. (.80 mm.) (see Fig. A.10).

If the threads in the housing are worn or damaged, a new chain adjuster (Part No. AEH27) must be fitted.

A.21 TIMING CHAIN COVER

Removal

Drain the cooling system and remove the radiator as detailed in Section C.4.

Slacken the clamp bolt on the steering column top universal joint and remove the four nuts and bolts

securing the steering rack to the frame. The steering rack may now be pulled forward clear of the crankshaft pulley.

Remove the water pump and by-pass pipe (see Section A.4) and the distributor and distributor drive gear and housing. Remove the camshaft covers.

Bend back the tab washer on the starting dog nut and remove the nut with a suitable tool (such as service tool 18G98). Withdraw the crankshaft pulley.

Remove the set screws, bolts, nuts, and washers securing the timing chain cover to the front mounting plate. The timing chain cover may now be withdrawn.

If the gasket or the crankshaft oil seal shows signs of damage it should be renewed.

Replacement

Replacement of the timing chain cover is a reversal of the above instructions. Refer to Section A.31 for instructions covering the replacement of the distributor drive gear.

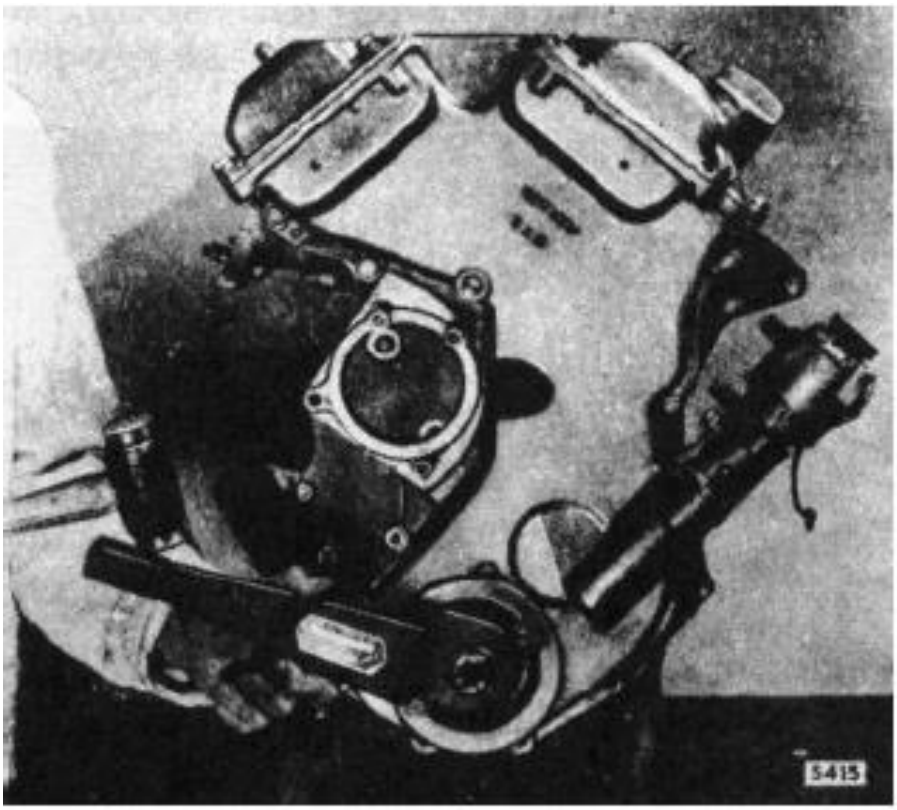


Fig. A.11 Removal of the starting dog nut, using service tool

A.22 TIMING CHAIN

Removal

Disconnect the battery.

Drain the cooling system and remove the radiator as detailed in Section C.4.

Remove the water pump and by-pass pipe (Section A.4), the distributor drive gear and housing, and the camshaft covers. Remove the timing chain cover as detailed in Section A.21.

Knock back the tab washer on the chain adjuster securing bolts and remove the chain adjuster. Swing the adjuster sprocket fork clear of the timing chain. Remove the locking wire from the camshaft driving sprocket securing screws and remove the sprockets.

Remove the bolt, locking washer, and distance pieces securing the half-speed shaft gear and the

distributor drive gear and withdraw the gears. Both gears are located on Woodruff keys. The timing chain may now be removed.

Replacement

When replacing the half-speed shaft driving gear the 'T' markings must be lined up as shown in Fig. A.9. After replacing the timing chain, the valve timing should be checked, and adjusted if necessary as detailed in Section A.19.

Refit the distributor drive gear by the method described in Section A.31.

Reset the timing chain tension adjustment after final assembly (see Section A.20). If a new chain has been fitted the tension should be checked again after initial running to take up the stretch.

A.23 ENGINE FRONT PLATE

Removal

Remove the power unit (see Section A.24). Remove the water pump and by-pass pipe (Section A.4), the distributor drive gear and housing, and the camshaft covers.

Remove the timing chain cover (Section A.21) and the timing chain (Section A.22).

Remove the timing chain driving sprocket from the half-speed shaft, take out the three set screws and shake proof washers, and remove the half-speed shaft locating washer and shims.

Remove the securing bolt and the oil pipe banjo bolt from the oil feed pillar.

Remove the engine mounting brackets.

Remove the set screws and spring washers securing the engine front plate to the cylinder block and remove the plate.

Replacement

Replacement is a reversal of these instructions.

A.24 POWER UNIT

Removal

Remove both seats and frames. Remove all the floor covering from the toeboards, floorboards, and gearbox cover and remove the toeboards, floorboards, and propeller shaft cover.

Release the hand brake cable adjuster nut and remove the hand brake cable from the relay lever. Mark the propeller shaft and gearbox flanges and disconnect the propeller shaft from the gearbox. Remove the gear lever knob, rubber draught excluder, and gearbox remote control cover. Remove the screws securing the gearbox cover to the frame and the four nuts, bolts, and spring washers securing the left-hand sides of the cross-brace plates to the gearbox cover. The gearbox cover is removed by springing out its rear end to allow the cross-brace plates to be pulled past the propeller shaft.

Disconnect the speedometer drive cable from the gearbox.

Remove the two set screws securing the clutch slave cylinder to the gearbox casing and remove the cylinder. The clutch cylinder push-rod can be left attached to the clutch operating fork.

Drain the oil from the engine and gearbox and remove the gearbox remote control assembly from the gearbox extension. Detach the bonnet from the bonnet hinges. Drain the radiator and cylinder block. Remove the radiator as described in Section C.4. Remove the air cleaners and carburetters as detailed in Section A.S. Remove the heater air intake pipe, header tank, and thermostat housing cover.

Unscrew the union nut on the heater water intake pipe and remove the pipe from the thermostat housing Remove the thermal transmitter bulb from the thermostat housing

Disconnect the tachometer drive cable from the rear of the cylinder block. Release the exhaust pipes from the exhaust manifolds and from the steady bracket on the engine rear mounting plate.

Slacken the exhaust pipe clamp bolt at the joint between the front and rear pipes and remove the front pipe from the vehicle.

Disconnect the flexible oil gauge pipe from the union at the rear of the cylinder block on the right-hand side. Disconnect the cables from the dynamo, ignition coil, distributor, and starter motor.

Remove the bolts from the clamps at the base and top of the steering-column and the nut, bolt, and spring washer from the rear end of the steering-column universal joint. Withdraw the steering-column.

Remove the dipper switch mounting bracket. Release the petrol pipe clip from the steering-column dust seal retainer plate. Withdraw the throttle cable.

Remove the nine set screws and washers from the toe board support plate and remove the plate.

Remove the four bolts, nuts, and spring washers securing the mounting plates on each side of the engine.

Place a rope sling around the power unit and attach the lifting tackle. Arrange the sling so that the unit may be lifted slightly and moved forward and finally lifted from the frame at a sharp angle with the front considerably higher than the rear.

Take the weight of the unit and remove the nut, bolt, and spring washer to release the gearbox from the mounting bracket on the frame cross-member.

The power unit is now free to be manoeuvred from the chassis.

Replacement

Replacement is a reversal of these instructions. Refill the engine and gearbox with oil to Ref. A (Section P).

A.25 SUMP AND OIL PUMP STRAINER

Removal

Drain the oil from the engine sump.

Remove the bolts and withdraw the sump from the crankcase.

To remove the oil strainer, remove the three bolts securing it to the pump cover.

Clean out the sump and strainer with paraffin (kerosene) and a stiff brush; never use rag.

Replacement

When refitting the sump to the engine give particular attention to the gasket. If the gasket is in good condition and has not been damaged during removal of the sump it may be used again, but it is always advisable to fit a new one. Before fitting a new gasket remove all traces of the old one from the sump and crankcase faces. Smear the face of the crankcase joint with grease and fit the gasket. Lift the sump into position on the crankcase, insert the securing bolts, and tighten them evenly.

A.26 MAIN AND BIG-END BEARINGS

Unless the bearing journals are badly worn the big-end bearings may be renewed without removing the crankshaft. To renew the main bearings, it is necessary to withdraw the crankshaft as detailed in Section A.33. Liners are used both for the main and the big-end bearings, which are of the shimless type and therefore non-adjustable.

Big-end bearings

Drain the engine oil and remove the sump as in Section A.25.

As the bearings are of the shimless type it is essential that no attempt should be made to adjust bearings which are worn. Always fit new bearings in place of worn parts. If the crankshaft journals are

found to be in a worn condition it is advisable to fit a new crankshaft, complete with main and big-end bearings, as supplied by the Factory

Both the big-end and main bearing liners are located in position in the bearing housings by a small tag on one side of each half-bearing; it should be noted that the bearings are fitted so that the tags come on the same joint edge of the bearing housing although on opposite corners.

To detach the big-end bearings bend down the locking strips so that the bolts may be removed. Remove the connecting rod caps and extract the bearings. Care should be exercised to see that the bearing journals, etc., are thoroughly cleaned before installing new bearings. No scraping is required, as the bearings are machined to give the correct diametrical clearance (see "GENERAL DATA').

Main bearings

Remove the engine from the car and remove the clutch and flywheel (Section A.32) and the gearbox mounting plate. Remove the sump, oil strainer, timing chain cover, timing chain, and engine front plate (Section A.23).

Remove the self-locking nuts securing the main bearing caps to the cylinder block.

Note that a thrust washer is fitted one each side of the centre main bearing to take the crankshaft end-thrust. These thrust washers each consist of two semi-circular halves, one half having a lug which is located in a recess in the detachable half of the bearing and the other being plain.

When fitting new bearings, no scraping is required as the bearings are machined to give the correct diametrical clearance (see "GENERAL DATA').

In the case of a "run" bearing it is always essential to clean out thoroughly all the oilways in the crankshaft and block, wash out the engine sump with paraffin (kerosene), and clean the oil pump and sump strainer to ensure that no particles of metal are left anywhere in the lubricating system. Replace each main bearing and cap, replacing the thrust washers in their correct positions at the centre main bearing with the oil grooves away from the bearing. Refit the locking strip or locking plates to each bearing cap and bend them to lock the bolts after tightening.

[See Addendum for additional information.]

A.27 PISTONS AND CONNECTING RODS

Removal

Remove the cylinder head as in Section A.13. Drain and remove the sump and oil strainer as in Section A.25.

The pistons and connecting rods must be withdrawn from the top of the cylinder block.

Unlock and remove the big-end bolts and remove the bearing caps. Release the connecting rod from the crankshaft.

Withdraw the piston and connecting rod from the top of the cylinder block and refit the bearing cap. The big end bearing caps are offset, and the caps on the big-ends in Nos. 1 and 3 cylinders are interchangeable when new, as are those for Nos. 2 and 4 cylinders. When used parts are replaced after dismantling it is essential that they should be fitted in their original positions. In order to ensure this, mark the caps and connecting rods on their sides which are fitted together with the number of the cylinder from which each was taken.

<

Fig. A.12 A connecting rod bearing. Note the bearing locating tab

Dismantling

Remove the two circlips securing each gudgeon pin in its piston and press the gudgeon pin out. Mark the gudgeon pins and pistons for reassembly to their original positions and to their original connecting rods.

Check the gudgeon pin and the connecting rod little end bearings for wear with the dimension given in the "GENERAL DATA' section. If the bush is worn it should be removed and a new bush fitted, A light press is most suitable for this operation.

Reassembly

When pressing in the new bush ensure that the oil hole in the bush is in line with the oil hole in the connecting rod.

Replacement bushes must be finish-reamed to size after pressing into the connecting rod (see the 'GENERAL DATA' section for the correct dimensions). The piston gudgeon pin bosses must not be reamed as oversize gudgeon pins are not supplied.

Assemble the pistons to the connecting rods by inserting the gudgeon pins, which should be a hard hand-push fit at a room temperature of 68° F. (20° C.). Secure each gudgeon pin in position with the two circlips, ensuring that they fit well into their grooves.

Replacement

Replacement of the piston and connecting rod is a direct reversal of the above, but the piston ring gaps should be set at 180° to each other.

If the piston rings have been removed from the piston they must be replaced as detailed in Section A.28.

It is essential that the connecting rod and piston assemblies should be replaced in their own bores and fitted the same way around, i.e. with the big-end cap facing the half-speed shaft side of the engine.

Refit the big-end bearings in their original positions.

A.28 PISTON RINGS

If no special piston ring expander is available use a piece of thin steel such as a smoothly ground hacksaw blade or a disused .020 in. (-50 mm.) feeler gauge.

Raise one end of the ring out of its groove. Insert the steel strip between the ring and the piston. Rotate the strip around the piston, applying slight upward pressure to the raised portion of the ring until it rests on the land above the ring grooves. It can then be eased off the piston.

Do not remove or replace the rings over the piston skirt, but always over the top of the piston.

Before fitting new rings clean the grooves in the piston to remove any carbon deposit. Care must be taken not to remove any metal or side-play between the ring and the groove will result, with consequent excessive oil consumption and loss of gas-tightness.

When refitting the rings note that the second and third compression rings are tapered and marked with the letter 'T' (top) for correct reassembly.

New rings must be tested in the cylinder bore to ensure that the ends do not butt together. The best way to do this is to insert the piston approximately 1 in. (2-54 cm.) into the cylinder bore and push the ring down onto the top of the piston and hold it there in order to keep the ring square with the bore. The correct ring gap is 008 to 013 in. (-20 to 33 mm.).

[See Addendum for additional information.]

A.29 HALF-SPEED SHAFT

Removal

Disconnect the battery.

Drain the cooling system and remove the radiator as detailed in Section C.4.

Remove the water pump and by-pass pipe (Section A.4), the distributor drive gear and housing, and the camshaft covers. Remove the timing chain cover (Section A.21) and the timing chain (Section A. 22).

Draw off the timing chain driving sprocket with a suitable drawer. Remove the sump, oil pump, and oil pump drive shaft (sec Section A.31).

Take out the three set screws and shake proof washers which secure the half-speed shaft locating plate and withdraw the half-speed shaft. Note that shims are fitted behind the locating plate to control the half-speed shaft end-float.

If the half-speed shaft bearing clearances are excessive new bearings should be fitted. Ensure that the oil holes in the bearings line up with the oil passages in the cylinder block. The bearings must be reamed to give the correct diametrical clearance (see "GENERAL DATA').

Replacement

Replacement of the half-speed shaft is a reversal of the above procedure. Adjust the half-speed shaft end-float if necessary by increasing or decreasing the thickness of the shims fitted behind the half-speed shaft locating plate. See "GENERAL DATA" for the correct end-float measurement.

A.30 DISTRIBUTOR DRIVE GEAR

Fitting

Turn the engine until No. 4 piston is at T.D.C. on its compression stroke. When the valves on No. 1 cylinder are 'rocking' i.e. exhaust just closing and inlet just opening) No. 4 piston is at the top of its compression stroke. If the engine is set so that the notch in the crankshaft pulley is in line with the projection in the timing chain cover the piston is exactly at T.D.C., giving the correct ignition setting (see Fig. A.7).

Turn the drive gear to the position shown in Fig. A.13. The driving slot will be horizontal with the large offset uppermost.

As the gear engages the half-speed shaft the slot will turn in an anti-clockwise direction until it is in the two o'clock position,

Secure the drive gear housing with the two nuts, spring washers, and flat washers. Refit the distributor, referring to Section B.7 for retiming instructions if the distributor clamp plate has been released.

A.31 OIL PUMP

Remove the sump and oil pump strainer (see Section A.25).

Two bolts secure the oil pump cover and three studs secure the pump to the crankcase.

Unscrew the stud puts and remove the pump and drive shaft.

When refitting the pump use a new joint washer.

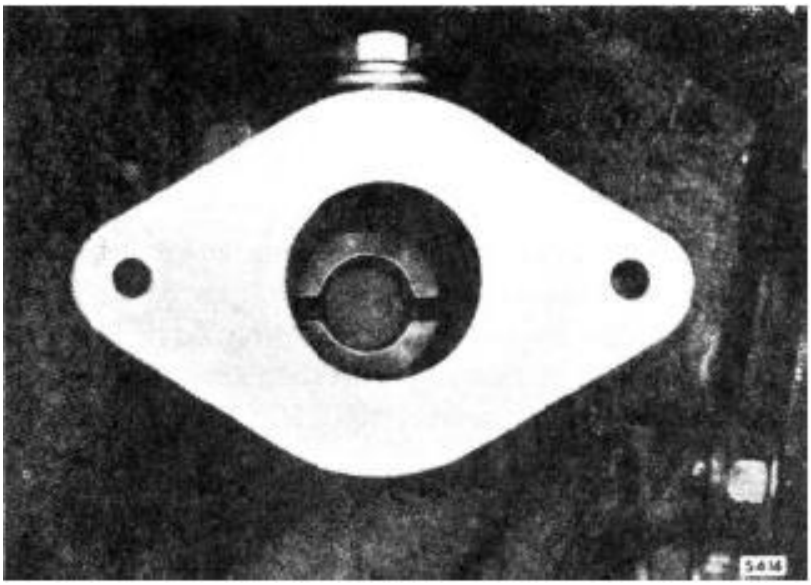


Fig. A.13 Replacing the distributor drive gear. The slot is horizontal with the large offset uppermost

Dismantling and reassembling

The oil pump cover is attached to the body of the pump by two bolts and spring washers, and when these are removed the oil pump cover, the outer rotor, and the combined oil pump shaft and inner rotor may be extracted.

NOTE. If a new or reconditioned oil pump is being fitted it is necessary to remove the half-speed shaft (see Section A.29) to enable a check of the pump gear end-float and "free spin' to be made. After removing the half-speed shaft mount the pump with drive gear and thrust washer in position and tighten down to the correct torque figure (275 lb. in.). Check that the shaft rotates freely and that the end-float is not excessive. The oil pump must be assembled in the dry condition, but lubrication should be used on the oil pump driving gear spindle in the cylinder block, Refit the half-speed shaft, etc., as detailed in Section A.29.

A.32 FLYWHEEL

Remove the power unit (see Section A.24). Remove the gearbox from the gearbox mounting plate. Mark the clutch and flywheel to allow the two components to be reassembled in their original positions. Remove the six set screws securing the clutch to the flywheel and remove the clutch.

Mark the flywheel and crankshaft flange. Unlock and remove the six nuts and three lock plates which secure the flywheel to the crankshaft mounting flange and remove the flywheel.

Replacement of the flywheel is a reversal of the above instructions. Take care to fit the flywheel and clutch in their original locations by lining up the marks made when dismantling, otherwise engine vibration will result.

To release the special flywheel bolts the engine sump and rear main bearing cap must be removed.

A.33 CRANKSHAFT

Removal

Remove the engine from the car and remove the clutch and flywheel (Section A.32) and the gearbox mounting plate.

Remove the sump, oil strainer, timing chain cover, timing chain, and engine front plate (Section A.23).

Remove the big-end bearing cap and then take off the main bearing caps (see Section A.26).

Mark the big-end bearing cap and bearing to ensure that it is reassembled to the correct journal, taking care, in the case of the bearings, that they are not damaged or distorted when marking. Punches should not be used for this purpose.

Lift the crankshaft out of the bearings.

Replacement

Replacement of the crankshaft is a reversal of the above operations. If the oil seal fitted in the rear main bearing cap shows any signs of damage it should be renewed.

Before replacing the crankshaft thoroughly clean out all oilways.

A.34 CAMSHAFT LOCKING TOOL

To set the valve timing accurately it is necessary to lock both camshafts in the correct timing position as described in Section A.19. A suitable tool is illustrated in Fig. A.14 and two will be required, one for each camshaft.

A.35 FLYWHEEL STARTER RINGS

To remove the old starter ring from the flywheel flange split the ring gear with a cold chisel, taking care not to damage the flywheel. Make certain that the bore of the new ring and its mating surface on the flywheel are free from burns and perfectly clean.

To fit the new ring, it must be heated to a temperature of 300 to 400° C. (572 to 752° F.) indicated by a light blue surface colour. If this temperature is exceeded the temper of the teeth will be affected. The use of a thermostatically controlled furnace is recommended. Place the heated ring on the flywheel with the lead of the ring teeth uppermost. The expansion will allow the ring to be fitted without force by pressing or tapping it lightly until the ring is hard against its register.

This operation should be followed by natural cooling, when the 'shrink fit' will be permanently established and no further treatment required.

A.36 CONNECTING ROD ASSEMBLIES

Each connecting rod assembly has a standard weight of 1 lb. 15 oz. 6 dr. (889.47 gm.) but may vary above or below this weight approximately plus or minus 1 oz. (28.35 gm.).

Complete sets of connecting rod assemblies for replacement should all be of identical weight (as in case of production), but, where one of a set is changed, it is essential that the replacement connecting rod does not differ from the others by more than 3 dr. (5.32 gm.).

To facilitate identification, assemblies now being produced, if not to standard weight, will be stamped as follows:

+1, +2, etc., to indicate drams **above** standard. 1, 2, etc., to indicate drams **below** standard.

Only six weights of rod, right-hand and left-hand (12 in all), are serviced and the table shows how these sizes cater for all contingencies.

NOTE. This table must be strictly adhered to if correct replacements are to be ensured.

To replace	Use only
Standard: +1, +2, +3, +4, +5	+2
+6, +7, +8, +9, +10	+7
+11, +12, +13, +14, +15, +16	+13
1, 2, 3, 4, 5	2
6, 7, 8, 9, 10	7
11, 12, 13, 14, 15, 16	13

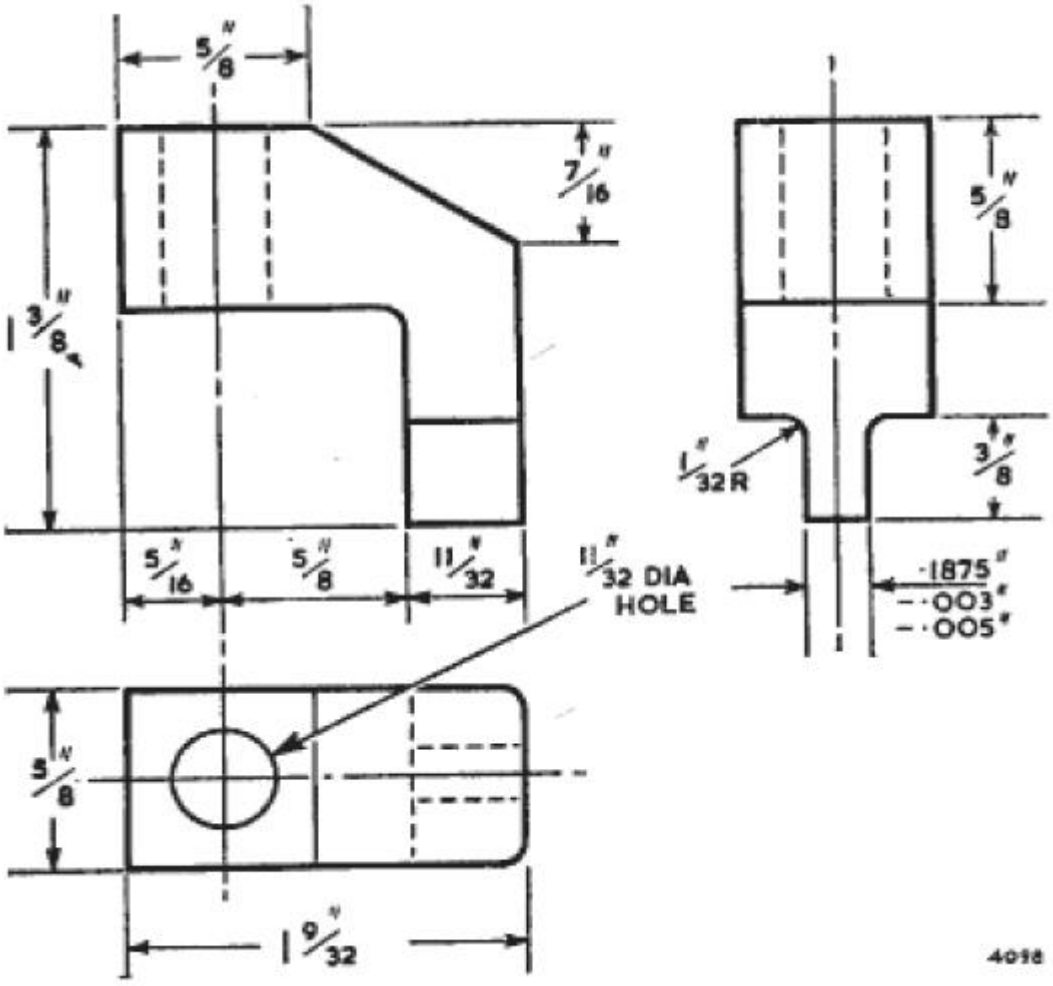


Fig. A.14 A camshaft locking tool

A.37 MODIFIED ENGINE MOUNTING

Commencing at Chassis No. MGA528, a packing plate (Part No. AHH5896), together with longer set screws (Part No. HZS0506), is fitted under the engine mounting on the left-hand side only.

This packing plate is introduced to give an increased clearance between the starting dog (on the crankshaft pulley) and the steering-rack housing.

The modification can be fitted to chassis prior to the one given above.

A.38 MODIFIED HALF-SPEED SHAFT AND OIL PUMP DRIVING SPINDLE

In cases of excessive wear on the oil pump driving spindle and half-speed shaft skew gearing, a modified shaft (Part No. AEH619) and spindle (Part No. AEH620) may be fitted. The number of teeth on the oil pump driving spindle has been increased from 10 to 11 and on the half-speed shaft from 9 to 10.

This modification was incorporated from Engine No. 315 and on Engine No. 313. The new components can be fitted on earlier engines if they are both fitted at the same time.

A.39 MODIFIED PISTONS AND RINGS

To improve oil consumption, twin-segment scraper rings (Part No. AEH615) were introduced at Engine No. 446 and twin-segment scraper rings fitted with expander rings (Part No. AEH672) at Engine No. 2057. These rings are interchangeable with the micro-land scraper rings previously fitted.

To overcome any tendency to piston noise, piston assemblies (Part No. AEH640) incorporating new top rings (Part No. AEH649) were fitted at Engine No. 606.

Piston assemblies, complete with twin-scraper rings, expander rings, and the new top rings, are available under Part No. AEH673 and may be interchanged in sets of four with those originally fitted.

A.40 MODIFIED CRANKCASE BREATHER PIPE

A new crankcase breather pipe was introduced at Engine No. 657. The purpose of this modification is to overcome any possibility of oil leakage from the engine breather onto the exhaust system, thus causing fumes to enter the car.

Fitting the modified breather pipe (Part No. AEH628) necessitates the use of a new clip (Part No. 1G1309) and a longer clutch bell housing bolt (Part No. HBZ0511) in substitution for the clip and bolt which previously secured the original breather pipe to the crankcase.

Fit the breather pipe to the vent pipe on the engine rear side cover, slide the clip over the end of the pipe, fasten the clip to the gearbox mounting plate with the longer bolt specified, and secure with the existing nut and spring washer.

A.41 MODIFIED TAPPETS

To increase the tappet contact area with the cylinder head and eliminate the possibility of tappet fracture the length of the tappets has been increased by 25 in. (-635 mm.) to 1.5 in. (38-1 mm.).

This modification was introduced at Engine No. 1087. The new tappets (Part No. AEH651) may be fitted to earlier engines in complete sets of eight.

Commencing at Engine No. 1587, tappet bushes have been fitted to the cylinder head to reduce tappet wear to a minimum. Each bush is locked in the head with a screwed plug

A.42 MODIFIED TIMING COVER GASKET

To obviate complete dismantling of the timing gear each time a new timing cover gasket is fitted, a gasket that is partially cut to provide four sections has been produced under Part No. AEH377.

The gasket may be fitted in the same way as the previous gasket, or alternatively any one or more of the four sections may be detached and used separately.

A.43 ALTERNATIVE PISTONS

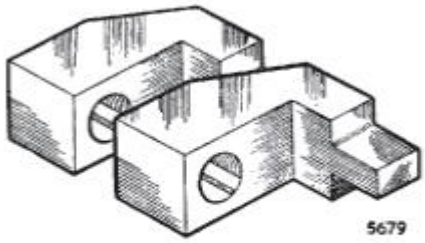
A domed-top piston giving a compression ratio of 83: has been introduced for standard use, the piston

is available under Part No. AEH690 and must be operated with a static ignition setting of 8o B.T.D.C.

Pistons to Part No. AEH681 giving a compression ratio of 9.9:1 are still available, but their use should be confined to competition work with 100-octane fuel only. The static ignition setting for 9.9:1 compression ratio pistons remains at T.D.C.

[See Addendum for more information on Reconditioned Engines]

SERVICE TOOLS



18G551

18G551. Camshaft Timing Keys

Supplied in pairs to lock the camshafts in position when adjusting the valve timing.

18G27. Handle

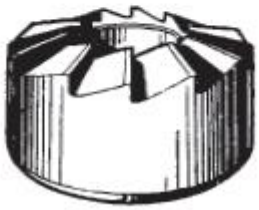
A standardized type of handle for use with a wide range of cutters, including those below.

18G174D. Pilot

For use with all the cutters listed below.

18G28 and 18G174

18G28A and 18G174A



18G28B and 18G174B

18G28. Valve Seat Finishing Cutter-Inlet

18G28A. Valve Seat Glaze Breaker-Inlet

18G28B. Valve Seat Narrowing Cutter-Top-Inlet

18G174. Valve Seat Finishing Cutter--Exhaust

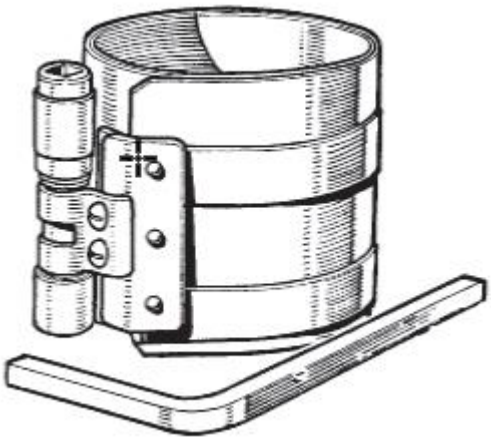
18G174A. Valve Seat Glaze Breaker--Exhaust

18G174B. Valve Seat Narrowing Cutter-- Top-Exhaust

The use of these cutting tools will save lengthy and wasteful grinding in when the valve seats are pitted. The narrowing cutters will enable the width of the valve seats to be maintained at their original dimensions.

18G29. Valve Grinding-in Tool

This suction-type tool has a rubber handle of convenient length to enable it to be rotated backwards and forwards between the palms of the hands when grinding the valves into the seats. The detachable rubber suction pads 18G29A may be obtained separately.



18G55A. Piston Ring Compressor

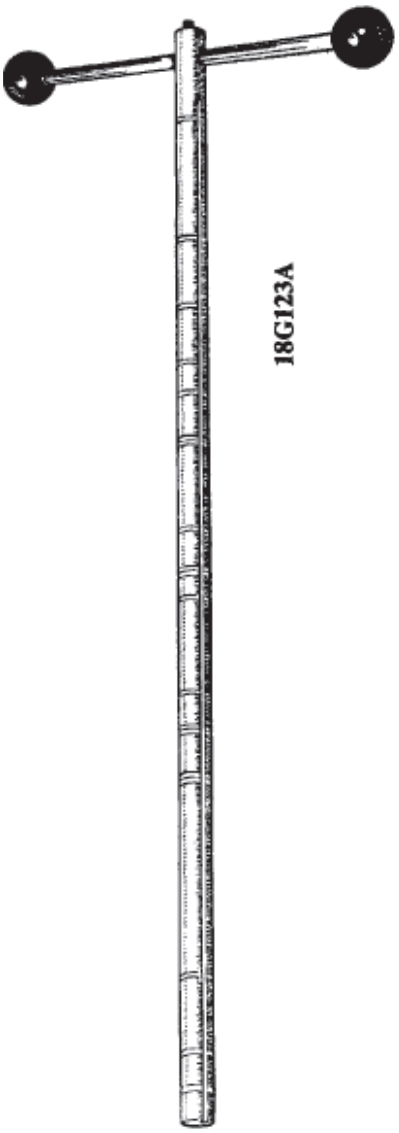
A clamping device to compress the piston rings enabling the operator to insert the piston assembly into the cylinder bore with the minimum of pressure, thus preventing damage to the piston and the piston rings.

18G69. Oil Pump Relief Valve Grinding-in Tool

This tool is designed for the removal and grinding in of the oil relief valve. Tightening the knurled set screw will expand the rubber plunger, which ensures that the tool is a tight fit when inserted into the hollow oil relief valve.

18G98. Starting Dog Nut Spanner

A shock-type spanner designed to remove and replace the starting dog without having to lock the crankshaft by improvised means, which invariably damages the engine components



18G123A. Camshaft* Liner Reamer (basic tool)

This tool is essential when reconditioning cylinder blocks, otherwise half-speed shaft liners cannot be reamed in true and in consequence the clearance between the half-speed shaft journal and the liner will be incorrect.

The cutters and pilots for use with this basic tool are supplied separately.

18G123E. Camshaft* Liner Reamer Cutter-Front

18G123B. Camshaft* Liner Reamer Cutter-Rear

18G123L. Camshaft Liner Reamer Pilot-Front

18G123AB. Camshaft* Liner Reamer Pilot—Centre

18G123AC. Camshaft* Liner Reamer Pilot-Rear

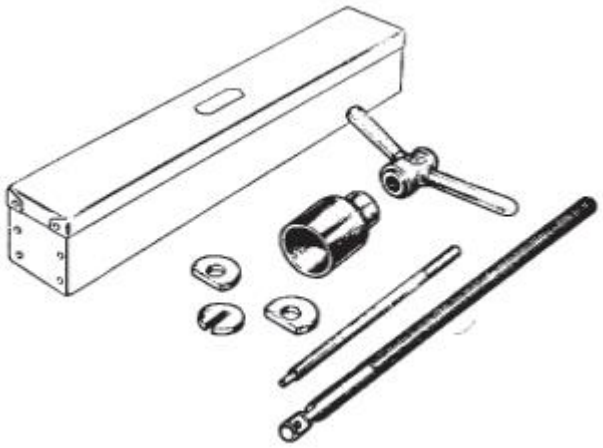
The above cutters and pilots are required for use with basic tool 18G123A to line-ream the front and rear half-speed shaft liners.

186123F.Camshaft Liner Reamer Cutter-Centre

18G123T.Camshaft* Liner Reamer Pilot-Front

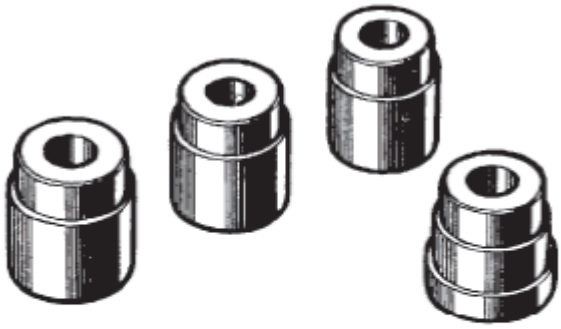
18G123AD. Camshaft Liner Reamer Pilot-Rear

* For use on the half-speed shaft bearings only--not on camshafts (see Section A.12).



18G124A. Camshaft* Liner Remover and Replacer

(basic tool) Half-speed shaft liners can be removed and replaced accurately and without the damage invariably associated with the use of improvised drifts. Adaptors for use with this basic tool are supplied separately.



18G124F
18G124C
18G124B

18G124H

18G124F. Camshaft Liner Remover Adaptor-Front

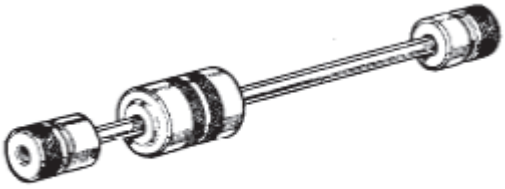
18G124C. Camshaft* Liner Remover Adaptor-Centre

18G124B. Camshaft* Liner Remover Adaptor-Rear

18G124H. Camshaft* Liner Remover Adaptor

The adaptors 18G124F, 18G124C and 18G124B are used in conjunction with the basic tool 18G124A to remove old and worn liners and to pilot new liners into position. Adaptor 18G124H is a pilot to be inserted into the front bearing when the centre liner is being removed or replaced.

* For use on the half-speed shaft bearings only-not on camshafts (see Section A.12).



18G284

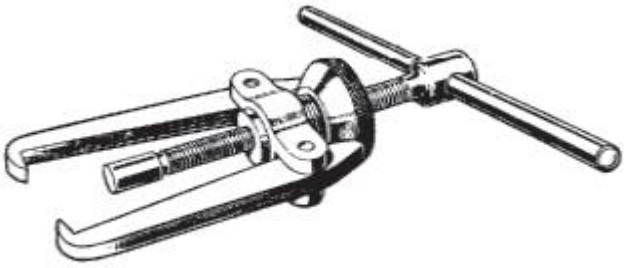
18G284. Impulse Extractor-UNF. (basic tool)

This extractor with the adaptor positioned in the screwed end will remove the most difficult main bearing cap quickly and without damage.

18G284A

18G284A. Main Bearing Cap Removal Adaptor

For use with impulse extractor 18G284.



18G309

18G309. Extractor

For use when removing the half-speed shaft sprocket, distributor drive gear, and crankshaft gear.

Addendum:

From time to time there were additions, deletions, and corrections to the Workshop Manual. The following notes will detail some of these changes. Notice that when certain Sections were added or deleted the Section numbers could change.

Section A.26 - last paragraph: Issues 1 and 2 of the Manual had an error noting that crankshaft thrust washers, should be installed with oil grooves TOWARD the bearing. This copy (Issue 3) has corrected this error, noting the thrust washers should be installed with oil grooves AWAY from the bearing (toward the rotating flange of the crankshaft). Refer to Confidential Service Memorandum MG-416.

Section A.29 - from prior issues: This section was printed in prior issues but was not included in Issue 3:

Section A.44 - from prior issues: This section was printed in prior issues but was not included in Issue 3:

SECTION B THE IGNITION SYSTEM

DESCRIPTION

The distributor is mounted at the front of the engine on the left-hand side and is driven from the front of the half-speed shaft.

The automatic advance device is housed in the distributor unit, and it consists of a centrifugally and vacuum operated mechanism by means of which the ignition is advanced in proportion to the engine speed and load. The combined effects of the centrifugally and vacuum operated timing controls give added efficiency over the full operating range of the engine, with a corresponding economy in fuel consumption. A micrometer adjustment is fitted by means of which fine alterations to the timing can be made to allow for changes in running conditions, e.g. state of carbonization, change of fuel, etc.

Like the rest of the electrical equipment, it is wired on the positive earth system, which results in longer sparking plug life.

A completely sealed, metallized paper capacitor is fitted to the distributor. This has the property of being self-healing in the event of a breakdown, so that trouble arising from this source should be very infrequent.

The high-tension pick-up brush in the distributor cover is of composite construction, the top portion consisting of a resistive compound and the lower of softer carbon to prevent wear taking place on the rotor electrode.

The resistive portion of the brush is in circuit between the coil and distributor and gives a measure of radio interference suppression. Under no circumstances must a short, non-resistive brush be used as a replacement for one of the longer, resistive type.

B.1 LOCATING THE CAUSE OF UNEVEN FIRING

Start the engine and set it to run at a fairly fast idling speed.

Short-circuit each plug in turn by pulling the insulator sleeve up the cable and placing a hammer head or the blade of a screwdriver with a wooden or insulated handle between the terminal and the cylinder head. No difference in the engine performance will be noted when short-circuiting the plug in the defective cylinder. Shorting the other plugs will make uneven running more pronounced.

Having located the cylinder which is at fault, stop the engine and remove the cable from the terminal of the sparking plug. Restart the engine and hold the end of the cable about is in. (4-8 mm.) from the cylinder head.

If the sparking is strong and regular, the fault probably lies in the sparking plug. Remove the plug, clean it, and adjust the gap to the correct setting (see "GENERAL DATA'), or alternatively fit a new plug.

If there is no spark or if it is weak and irregular, examine the cable from the sparking plug to the distributor. After a long period of service, the insulation may be cracked or perished, in which case the cable should be renewed.

Finally, examine the distributor moulded cap, wipe the inside and outside with a clean dry cloth, see that the carbon brush moves freely in its holder, and examine the moulding closely for signs of breakdown, After long service it may become tracked-that is, a conducting path may have formed between two or more of the electrodes or between one of the electrodes and some part of the distributor in contact with the cap. Evidence of a tracked cap is shown by the presence of a thin, black line. A replacement distributor cap must be fitted in place of one that has become tracked.

B.2 TESTING THE LOW-TENSION CIRCUIT

Spring back the securing clips on the distributor and remove the moulded cap and rotor. If the rotor is a tight fit it can be levered off carefully with a screwdriver.

Check that the contacts are clean and free from pits, burns, oil, or grease. Turn the engine and check that the contacts are opening and closing correctly, and that the clearance is correct when the contacts are fully opened.

Correct the gap if necessary to between .014 and .016 in. (.35 and .40 mm.).

Disconnect the cable at the contact breaker terminal of the coil and at the low-tension terminal of the distributor and connect a test lamp between these terminals. If the lamp lights when the contacts close and goes out when the contacts open the low-tension circuit is in order. Should the lamp fail to light, the contacts are dirty or there is a broken or loose connection in the low-tension wiring. The procedure for isolating the fault is detailed in Section B.3.

B.3 LOCATING A LOW-TENSION CIRCUIT FAULT

Having determined, by testing as described in Section B.2, that the fault lies in the low-tension circuit, switch on the ignition and turn the engine until the contact breaker points are fully opened.

Refer to the wiring diagram and check the circuit with a voltmeter (0–20 volts) as follows.

NOTE. If the circuit is in order the reading on the voltmeter should be approximately 12 volts.

1. Battery to starter switch terminal. Connect the volt meter to the starter switch terminal and to earth. No reading indicates a faulty cable or loose connections.
2. Starter switch to control box terminal 'A' (brown lead). Connect a voltmeter to the control box terminal 'A' and to earth. No reading indicates a faulty cable or loose connections.
3. Control box terminal 'A1'. Connect a voltmeter to the control box terminal *Al' and to earth. No reading indicates a fault in the series winding of the control box.
4. Control box terminal 'Al' to terminal on ignition switch (brown with blue lead). Connect a voltmeter to the ignition switch terminal and to earth. No reading indicates a faulty cable or loose connections.
5. Ignition switch. Connect a voltmeter to the second ignition switch terminal (white lead) and to earth. No reading indicates a fault in the ignition switch.
6. Ignition switch to fuse box terminal 'A3' (white lead). Connect the voltmeter to the fuse box terminal "A3" and to earth. No reading indicates a faulty cable or loose connections.
7. Fusebox terminal "A3' to ignition coil terminal "SW" (white lead). Connect a voltmeter to the ignition coil terminal "SW* and to earth. No reading indicates a faulty cable or loose connections.
8. Ignition coil. Connect a voltmeter to the ignition terminal 'CB' (white with black lead) and to earth. No reading indicates a fault in the primary winding of the coil and a new coil must be fitted.
9. Ignition coil to distributor (white with black lead). Connect a voltmeter to the distributor low-tension terminal and to earth. No reading indicates a faulty cable or loose connections.
10. Contact breaker and capacitor. Connect the volt meter across the breaker points. No reading indicates a fault in the capacitor.

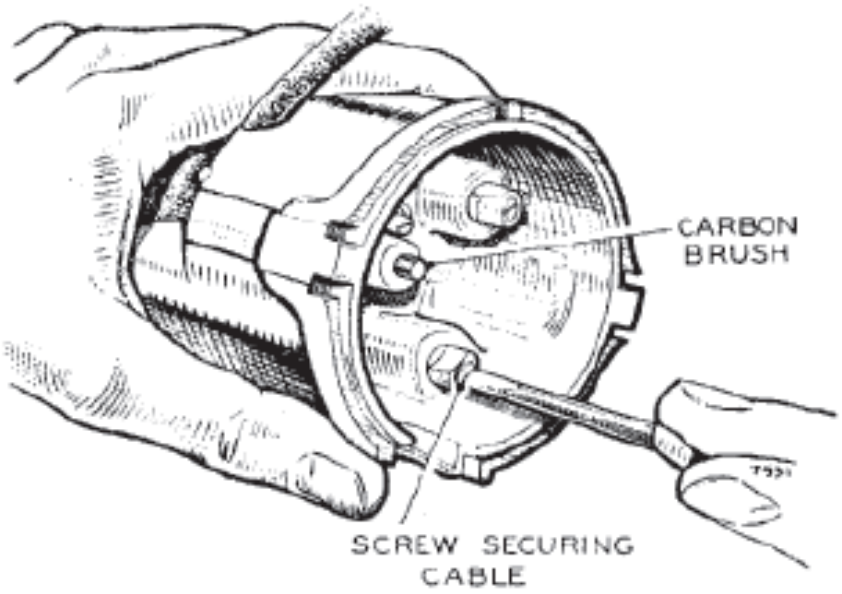


Fig. B.1 The method of connecting H.T. leads MGA (Twin Cam)

B.4 HIGH-TENSION CABLES

The high-tension cables must be examined carefully and any which have the insulation cracked, perished, or damaged in any way must be renewed.

To fit the cables to the terminal of the ignition coil thread the knurled moulded terminal nut over the lead, bare the end of the cable for about 4 in. (6 mm.), thread the wire through the brass washer removed from the original cable, and bend back the strands over the washer. Finally, screw the terminal into the coil.

To make the connections to the terminals in the distributor moulded cap, first remove the cap and slacken the screws on the inside of the moulding till they are clear of the cables. Cut the new cables off to the required length, push them completely home, and tighten the securing screws.

The cables from the distributor to the sparking plugs must be connected in the correct firing order, which is 1, 3, 4, 2. Secure them firmly to the connectors.

B.5 CONTACT BREAKER

The distributor has a pre-tilted contact breaker unit. The moving contact breaker plate is balanced on two nylon studs and the angle through which the plate may be tilted is controlled by a stud riveted to the moving contact breaker plate locating in a slot in the base plate. The plate carrying the fixed contact is secured by one screw only.

After the first 500 miles (800 km.) and subsequently every 6,000 miles (9600 km.) check the contact breaker as follows:

1. Rotate the crankshaft until the contact breaker points are fully opened and check the gap with a gauge having a thickness of .014 to .016 in. (.35 to .40 mm.). If the gap is correct the gauge should be a sliding fit. Do not alter the setting unless the gap varies considerably from the gauge thickness.
   To adjust the setting keep the engine in the position which gives maximum opening of the contacts, then slacken the fixed contact plate securing screw and adjust the contact gap by inserting a screwdriver in the notched hole and turning clockwise to reduce the gap and anticlockwise to increase it. Tighten the securing screw.
2. If the contacts are dirty or pitted they must be cleaned by polishing them with a fine carborundum stone and afterwards wiping them with a cloth moistened with petrol (gasoline).

The moving contact can be removed from its mounting to assist cleaning. Check and adjust the contact breaker setting after cleaning the contacts.

3. Check that the moving arm is free on its pivot. If it is sluggish, remove the arm and polish the pivot pin with a strip of fine emery-cloth. Afterwards clean off all trace of emery dust and apply a spot of clean engine oil to the top of the pivot. The contact breaker spring tension should be between 20 and 24 oz. (567 and 680 gm.) measured at the contacts.

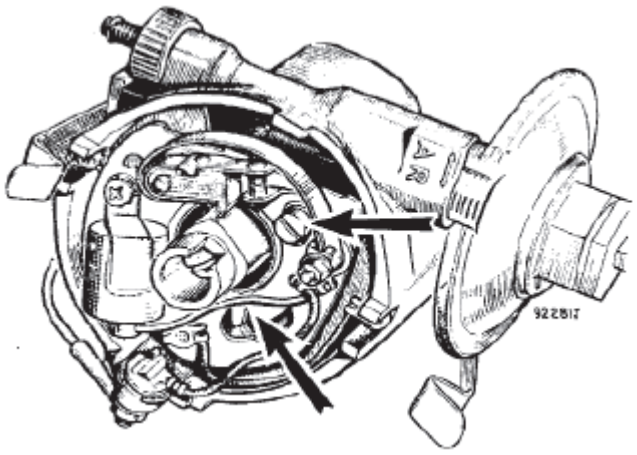


Fig. B.2 The arrows indicate the fixed contact plate securing screw and the adjusting notch

B.6 REMOVING AND REPLACING THE DISTRIBUTOR

The distributor can be removed and replaced without interfering with the ignition timing, provided the clamp plate pinch-bolt is not disturbed.

To facilitate the replacement of the distributor, remove the distributor cover and turn the engine over until the rotor arm is in a position pointing to the segment for No. 4 cylinder plug lead to provide a datum for replacement.

Disconnect the low-tension lead from the terminal on the distributor. Disconnect the suction advance pipe at the union on the distributor.

Extract the two bolts securing the distributor clamp plate to the distributor housing and withdraw the distributor.

To replace the distributor insert it into the distributor housing until the driving dog rests on the distributor drive shaft. The rotor arm should then be rotated slowly until the driving dog lugs engage with the drive shaft slots, both of which are offset to ensure correct replacement. Turn the distributor body to align the clamping plate holes with those in the housing. The remainder of the assembly is now in the reverse order to that of removal.

NOTE: Provided that the crankshaft has not been turned, the rotor arm will be opposite the segment for No.4 plug lead. The high-tension leads can then be replaced on their respective plug terminals in the order of firing, i.e. 1,3, 4, 2, remembering that the distributor rotation is anticlockwise when viewed from above.

B.7 STATIC IGNITION TIMING

The ignition timing must be set to satisfy the requirements of the grade of fuel used. (See "GENERAL INFORMATION'.)

After timing the ignition, it is essential that the distributor advance mechanism be checked as described in Section B.13.

To set the distributor proceed as follows:

1. Turn the crankshaft in the direction of rotation until No. 4 piston is at T.D.C. on its compression stroke. This can best be effected by turning the engine and observing the valves. When the valves are 'rocking' (i.e. exhaust just closing and inlet just opening) on No. 1 cylinder No. 4 piston is approximately at T.D.C. on its compression stroke. If the engine is now rotated until the notch in the rear flange of the crankshaft pulley is in line with the small projection on the timing chain case the piston is exactly at T.D.C. (see Fig. B.3).
2. Set the contact breaker points to .014 to .016 in. (.35 to .40 mm.) when in their position of maximum opening.
3. Insert the distributor into its housing, and engage the drive dog lugs with the drive shaft slots (both of which are offset) by slowly rotating the rotor arm.
4. Screw in the two bolts securing the distributor clamp plate to the distributor housing but do not tighten them. Failure to leave these bolts slack will cause misalignment of the distributor resulting in excessive wear of the drive gears.
5. Position the distributor so that the vacuum control unit side of the body is uppermost with the unit diaphragm to the rear.
6. Rotate the distributor body anti-clockwise until the points are fully closed. Then slowly rotate it in a clockwise direction until the points just commence to open. Secure the distributor body in this position by tightening up the clamp plate pinch-bolt and nut, give the engine a few turns to allow alignment of the gears to take place, and then fully tighten the two clamp plate bolts. Check that the rotor arm is opposite the correct segment for the cylinder which is at the top of its compression stroke.
   IMPORTANT.—To obtain an accurate setting an electrical method should be used to determine the actual position at which the points break, and the following method can be used:
   With the low-tension lead connected to the distributor, turn on the ignition switch and connect a 12-volt lamp in parallel with the contact breaker points (i.e. one lead from the distributor low-tension terminal and the other to earth) and turn the distributor as detailed in paragraph 6 until the lamp lights, which indicates that the points have just opened.
7. After locking the distributor, re-check the timing.

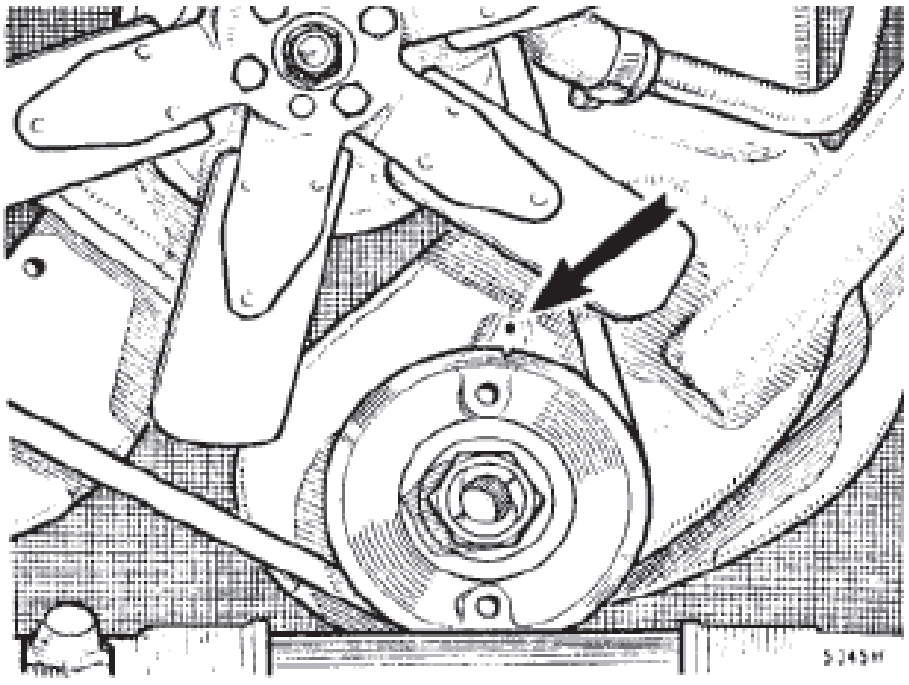


Fig. B.3 When the groove in the crankshaft pulley coincides with the small projection on the riming

case Nos. 1 and 4 pistons are at T.D.C.

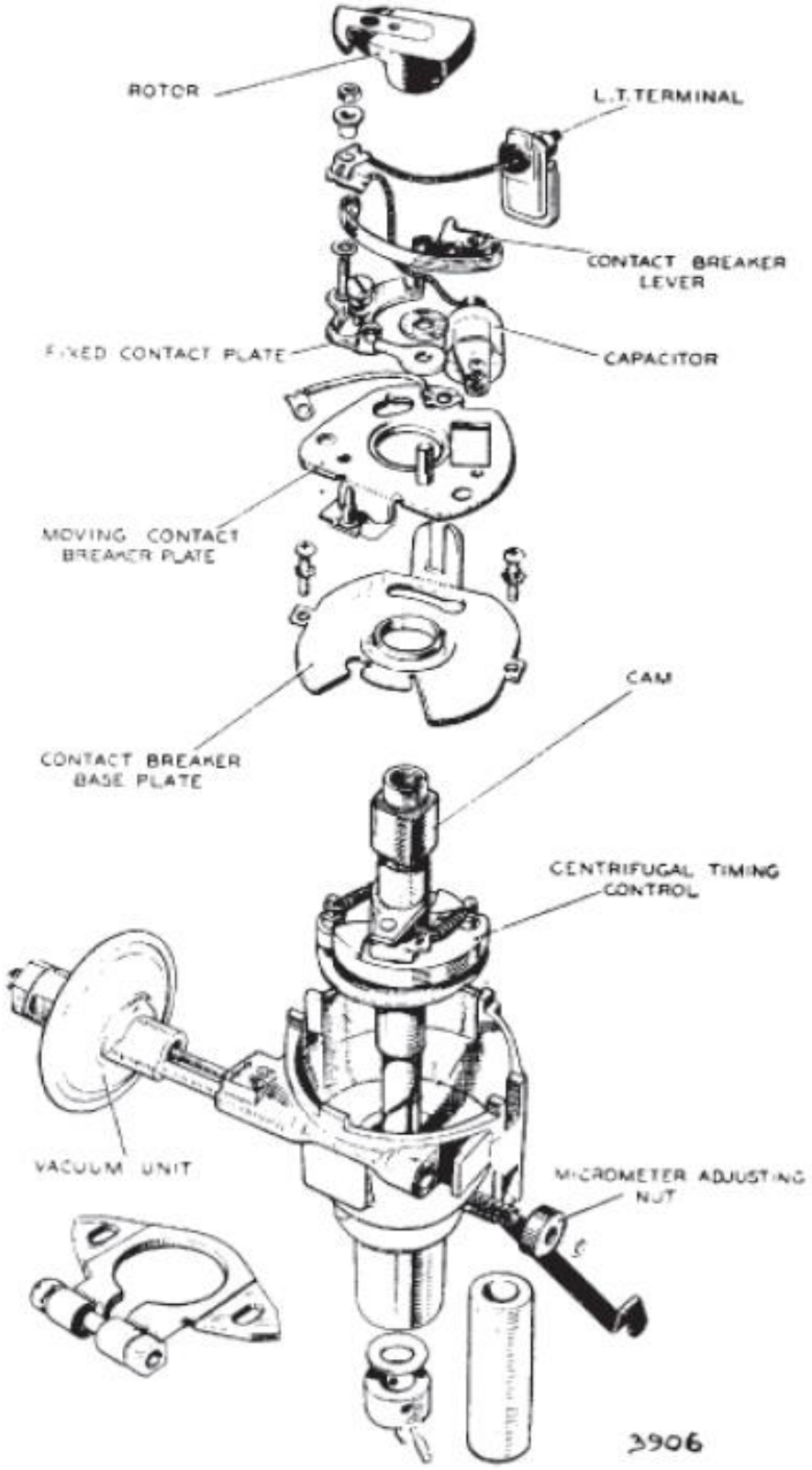


Fig. B.4 The components parts of the DM2.P4 distributor

B.8 DISMANTLING THE DISTRIBUTOR

The contact breaker plate may be removed as an assembly to give access to the centrifugal weights without completely dismantling the distributor. To do this remove the rotor arm and withdraw the slotted nylon low-tension terminal post from the distributor body.

Take out the two screws which secure the plate assembly to the distributor body, ease up the plate, and unhook the flexible actuating link connected to the contact breaker plate.

The following procedure is necessary if the distributor is to be completely stripped. Before dismantling, note the positions in which the various components are fitted in order that they may be replaced correctly.

1. Spring back the clips and remove the moulded cap.
2. (Lift the rotor off the top of the spindle. If it is a tight fit it must be levered off carefully with a screwdriver.
3. Remove the nut and washer from the moving contact anchor pin. Withdraw the insulating sleeve from the capacitor lead and low-tension lead connectors, noting the order in which they are fitted. Lift the moving contact from the pivot pin and remove the large insulating washer from the anchor pin.
4. Take out the screw, spring, and flat washer securing the fixed contact plate and remove the plate.
5. Remove the securing screw and the capacitor. (6) Extract the two screws securing the base plate to the distributor body, noting that one also secures the earthing lead, and lift out the base plate.
6. Unhook the flexible actuating link connecting the diaphragm in the vacuum unit with the moving contact breaker plate.
   IMPORTANT.-Note the relative position of the rotor arm drive slot in the cam spindle and the offset drive dog at the driving end of the spindle to ensure that the timing is not 180° out when the cam spindle is engaged with the centrifugal weights during assembly.
7. Take out the cam retaining screw and remove the cam spindle.
8. Take out the centrifugal weights. These may be lifted out as two assemblies, each complete with a spring and toggle.
9. To release the suction advance unit, remove the circlip, adjusting nut, and spring. Withdraw the unit. Take care not to lose the adjusting nut lock spring clip.
10. To release the spindle from the body, drive out the parallel driving pin passing through the collar of the driving tongue member at the lower end of the spindle.

B.9 CAPACITOR

A 2-microfarad metallized capacitor is fitted and the eyelet on the cable connected to the contact breaker terminal post is squared and slotted to prevent it twisting round and short-circuiting against the distributor.

The best method of testing the capacitor is by substitution. Disconnect the original capacitor and connect a new one between the low-tension terminal of the distributor and earth.

B.10 REASSEMBLING THE DISTRIBUTOR

Reassembly is a direct reversal of the dismantling procedure given in Section B.8, although careful attention must be given to the following points.

1. As they are assembled, the components of the automatic advance mechanism, the distributor shaft, and the portion of the shaft on which the cam fits must be lubricated with thin, clean engine oil to Ref. D.
2. Turn the vacuum control adjusting nut until it is in the half-way position when replacing the control unit.
3. When engaging the cam driving pins with the centrifugal weights make sure that they are

in the original position. When seen from above, the small offset of the driving dog must be on the right and the driving slot for the rotor arm must be in the six o'clock position.

4. Adjust the contact breaker to give a maximum opening of .014 to .016 in. (.35 to .40 mm.).

B.11 COIL

The coil does not require any attention beyond seeing that the terminal connections and the coil mounting bolts are tight, and that the exterior is kept clean and dry, particularly between the terminals.

B.12 SPARKING PLUGS

Inspect, clean, adjust, and renew sparking plugs at the recommended mileage intervals (see "MAINTENANCE ATTENTION).

When sparking plugs are removed from the engine their gaskets should be removed with them and replaced on the plugs, which should be placed in a suitable holder. It is advisable to identify each plug with the number of the cylinder from which it was removed so that any faults revealed on examination can be traced back to the cylinder concerned.

When examining the plugs place a new plug of the same type beside the others to afford a ready comparison of the relative condition of the used plugs.

Examine for signs of oil fouling. This will be indicated by a wet, shiny, black deposit on the insulator. This is caused by oil pumping due to worn cylinders and pistons or gummed-up or broken rings. Under such conditions oil from the cylinder walls is forced up past the ring on the suction stroke of the piston and is eventually deposited on the plugs.

A permanent remedy for this cannot be effected, the only cure being the fitting of a new piston and rings, or in extreme cases a re-bore may be necessary.

Next examine the plugs for signs of petrol (gasoline) fouling. This is indicated by a dry, fluffy, black deposit which is usually caused by over-rich carburation, although ignition system defects such as a run-down battery, faulty distributor, coil or condenser defects, or a broken or worn-out cable may be additional causes. If the plugs appear to be suitable for further use proceed to clean and test them.

First remove the plug gaskets and examine them for condition. A large proportion of the heat of the plug is normally dissipated to the cylinder head through the gasket between the plug and the head. Plugs not screwed down tightly can easily become overheated so that they operate out of their proper heat range, producing pre-ignition, short plug life, and "pinking'. On the other hand, it is unnecessary and unwise to tighten up the plugs too much. What is required is a reasonably good seal between the plug and the cylinder head and the use of a torque Wrench is recommended to tighten the plugs to a figure of 30 lb. ft. (4.15 kg. m.).

If the plugs require cleaning it is preferable to make use of a proper plug cleaner of the type recommended by the plug manufacturers, and the makers instructions for using the cleaner should be followed carefully.

Occasionally a blistered insulator or a badly burnt electrode may be noticed when examining the plugs.

If the plug is of the type normally recommended for the engine and it was correctly installed (down tightly on the gasket), this condition may have been brought about by a very lean mixture or an overheated engine. There is, however, a possibility that a plug of another type is required, but as a rule the recommended plug should be adhered to

After cleaning carefully, examine the plugs for cracked insulators and wear of the insulator nose due to excessive previous cleaning. In such cases the plugs have passed their useful life, and new plugs should be installed.

Examine the insulator for deposits underneath the side electrode which have possibly accumulated and which act as a 'hot-spot" in service.

After cleaning the plugs in a special cleaner blow all surplus abrasive out of the body recesses, and off the plug threads, by means of an air blast. Next examine the threads for carbon. Any deposits can be removed, and the threads cleaned with a wire brush. A wire buffing wheel may also be utilized, but reasonable care must be used in both methods in order not to injure the electrodes or the tip of the insulator. The thread section of the plug body is often neglected when cleaning the plugs, because it is not generally realized that, like the gaskets, the threads are a means of heat dissipation and that when they are coated with carbon the flow of the heat from the plug is retarded, producing overheating. This simple procedure will also ensure absence of binding on the threads on replacement and also obviate unnecessary use of the plug spanner.

When replacing a plug always screw it down by hand as far as possible and use the torque Wrench for final tightening only. Whenever possible, use a socket to avoid possible fracture of the insulator.

Examine the electrodes for the correct gap (see "GENERAL DATA'). Avoid an incorrect reading in the case of badly pitted electrodes**.**

Remember that electrode corrosion and the development of oxides at the gap area vitally affects the sparking efficiency. The special cleaner can remove the oxides and deposits from the insulator, but the cleaner stream does not always reach this area with full effect owing to its location and cannot necessarily deal with corrosion effectively as this sometimes requires too strong a blast for proper removal.

When plugs appear worthy of further use it is good practice to dress the gap area on both centre and side electrodes with a small file before resetting them to the correct gap. The intense heat, pressure, explosion shock, and electrical and chemical action to which the plugs are submitted during miles of service are so intense that the molecular structure of the metal points is eventually affected. Plugs then reach a worn-out condition and resetting the points can no longer serve a good purpose. When points are badly burnt it is indicative that the plug has worn to such an extent that its further use is undesirable and wasteful.

Before replacing the plug in the engine, test it for correct functioning under air pressure in a plug tester, following out the instructions issued by the makers of the plug tester. Generally speaking, a plug may be considered satisfactory for further service if it sparks continuously under a pressure of 100lb./sq.in. (7 kg. /cm.) with the gap between the points set at -022 in. (-56 mm.). It is essential that the plug point should be reset to the recommended gap before the plug is refitted to the engine (see "GENERAL DATA)

While the plug is under pressure in the tester it should be inspected for leakage by applying oil round the terminal. Leakage is indicated by the production of air bubbles, the intensity of which will serve to indicate the degree of leakage. The leakage gases have a 'blowtorch' effect when the engine is running which rapidly raises the temperature of the plug to above its designed heat range, thus producing overheating, preignition, and rapid electrode destruction.

The top half of the insulator is frequently responsible for poor plug performance due to the following faults: splashes, accumulation of dirt and dust, cracked insulators caused by a slipping spanner, over tightness of the terminals.

Examine for a cracked insulator at the shoulder and the terminal post and remove any accumulations of dirt and dust.

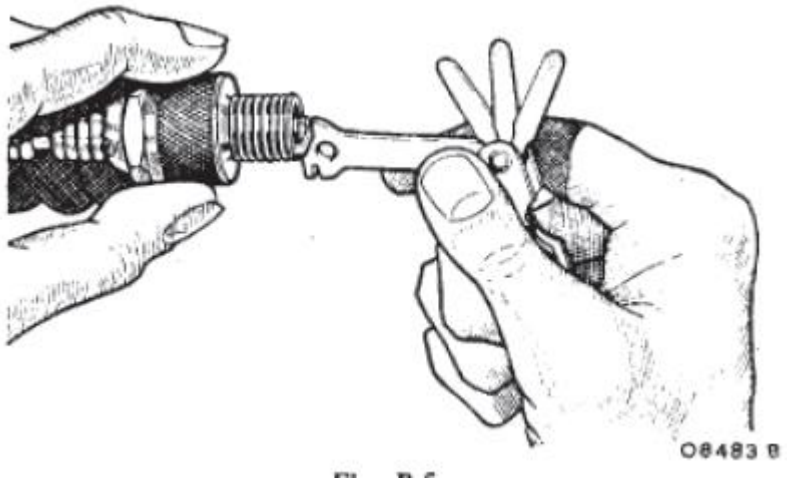


Fig. B.5 Adjusting the plug gap with the Champion setting tool

B.13 NEW-TYPE DISTRIBUTOR

A new distributor (Part No. AEJ41), having a roller weight mechanism with a positive stop (to prevent over advance) and no vacuum advance mechanism, has been introduced. When this distributor is fitted, the vacuum advance pipe must be removed, and the union blanked off with blanking plug (Part No. AEH1289).

Instructions for timing the distributor are given in Section B.7.

Before fitting a new distributor, the distributor drive shaft gears must be checked for backlash as described in Section B.14.

B.14 CHECKING DISTRIBUTOR DRIVE SHAFT BACKLASH

When fitting a new distributor, it is most important that there should be no excessive backlash in the distributor drive shaft gears. The backlash is checked as follows:

(1) Fabricate a pointer as shown in Fig. B.6 and secure it to a disused rotor arm with a nut and bolt.

(2) Remove the header tank hose to give access to the distributor.

(3) Lock the automatic advance mechanism by removing the cam retaining screw and refitting it with a washer underneath its head. The washer may be made from a piece of wire .030 in. (.76 mm.) diameter and 14 in. (28.57 mm.) long formed into a circle.

(4) Fit the rotor and pointer to the distributor and ensure that the rotor is tight on the spindle.

(5) Rotate the crankshaft until the pointer is over the flange of the camshaft cover (Fig. B.6).

(6) Turn the pointer by hand in an anti-clockwise direction and mark the limit of its travel on the camshaft cover flange; then turn the pointer clockwise, and again mark the limit of its travel. (8) If the distance between the two limits exceeds5/16 in. (8 mm.) the distributor drive gears must be renewed before a new distributor is fitted.

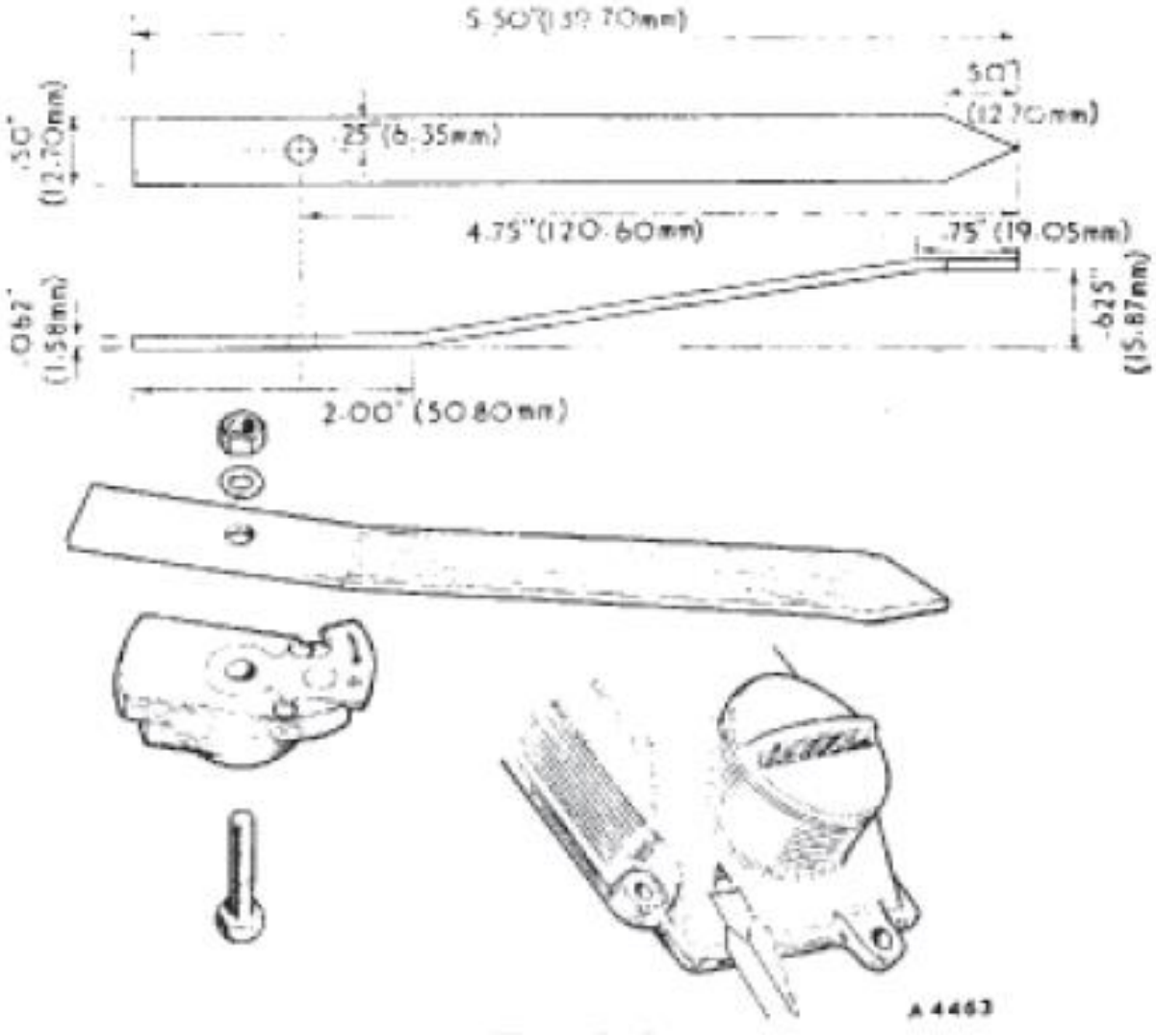


Fig. B.6 Checking the distributor drive shaft backlash

While the plug is under pressure in the tester it should be inspected for leakage by applying oil round the terminal. Leakage is indicated by the production of air bubbles, the intensity of which will serve to indicate the degree of leakage. The leakage gases have a 'blowtorch' effect when the engine is running which rapidly raises the temperature of the plug, raising it above its designed heat range, thus producing overheating, preignition, and rapid electrode destruction.

The top half of the insulator is frequently responsible for poor plug performance due to the following faults: splashes, accumulation of dirt and dust, cracked insulators caused by a slipping spanner, over tightness of the terminals.

Examine for a cracked insulator at the shoulder and the terminal post and remove any accumulations of dirt and dust.

B.15 CHECKING THE IGNITION TIMING

To prevent any excessive ignition advance, the vacuum advance pipe must be permanently disconnected, and the manifold union blanked off with blanking plug (Part No. AUC1289). The vacuum union on the distributor must be left open to atmosphere and the micrometer scale permanently set to zero.

To ensure that the ignition timing is correct throughout the speed range of the engine, the distributor advance mechanism must be checked with a stroboscopic timing light and the results checked against the following table.

Crankshaft RPM.,	2,000	3,000	4,000	5,000
Maximum advance.	24°	26°	26°	26°

If the advance figures are exceeded, the static ignition setting may be retarded to a maximum of 3° A.T.D.C. Check the new setting against the table.

If the advance is still outside the limits, renew the distributor and re-check the setting

If the advance is still not within limits, renew the distributor drive gears (Part Nos. AEH450 and AEH 500).

B.16 NEW-TYPE DISTRIBUTOR

A new distributor (Part No. AE541), having a roller weight mechanism with a positive stop (to prevent over advance) and no vacuum advance mechanism, has been introduced. When this distributor is fitted, the vacuum advance pipe must be removed and the carburetter union blanked off with blanking plug (Part No. AEH1289).

This distributor has been fitted to engines having the following Serial Nos.:

2011 2040 2200 to 2206

2028 2041 2209 to 2219

2038 2188 2222 onwards

Instructions for timing the distributor are given in Section B.7

NOTICE: -- This is page B.8 from the earlier Issue 2 of the MG Series Twin Cam Workshop Manual. Section B.13 here gives instructions for setting ignition timing with the earlier distributor (vacuum advance model). For that model it was deemed important to set the maximum spark advance at higher engine speed using a strobe light.

There is a Confidential Service Memorandum MG301, 24 February 1960, dictating dealer change to the later model distributor for all Twin Cams. However, most cars never had the distributor changed, so the earlier release page including the technique for timing the earlier model is included here.

SECTION C THE COOLING SYSTEM

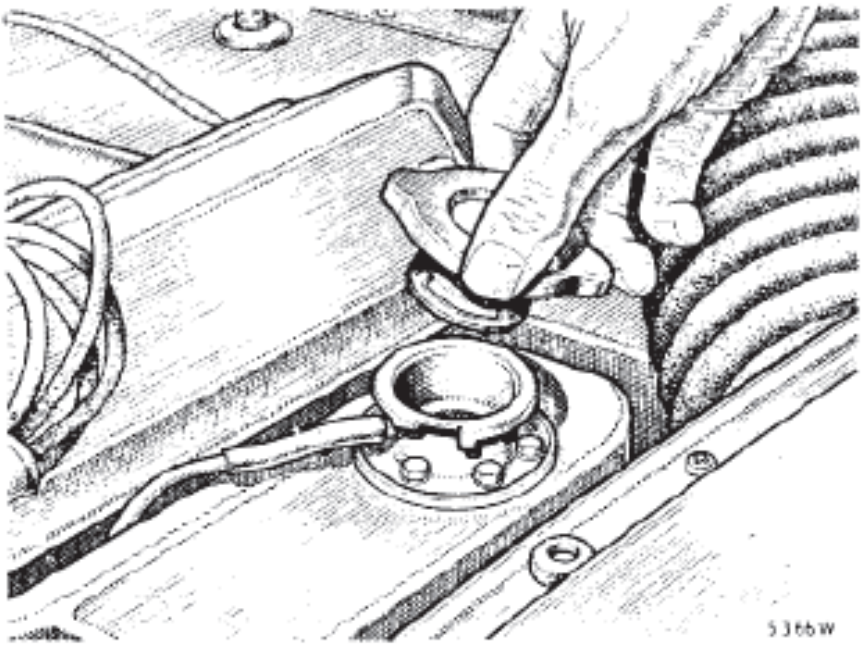


Fig. C.1 The cooling system header tank is positioned above the exhaust manifold on the left-hand side of the engine. Remove the cap slowly if the engine is hot

DESCRIPTION

The cooling system is sealed, and the water circulation is assisted by a pump attached to the front of the engine and driven by a belt from the crankshaft. The water circulates from the base of the radiator and passes around the cylinder head to the separate header tank mounted above the exhaust manifold before reaching the radiator. The cylinder block is cooled by thermosiphon action. From the header tank the water passes down the radiator core to the base tank of the radiator. Air is drawn through the radiator by a fan attached to the water pump pulley.

The thermostat is set to open between 50 and 55° C.

IMPORTANT. -Never use a muff on the radiator grille to protect the cooling system in cold weather as this would seal the carburetter and heater unit air supply. The radiator must be protected by a blind such as the type available as an optional extra fitting.

C.1 REMOVING THE FILLER CAP

The cooling system is under appreciable pressure while the engine is hot after a run, and the header tank filler cap must be removed very carefully or left in position until the water has cooled.

If it is necessary to remove the filler cap when the engine is hot it is absolutely essential to remove it gradually, and the filler spout is provided with a specially shaped cam to enable this to be done easily.

Unscrew the cap slowly till the retaining tongues are felt to engage the small lobes on the end of the filler spout cam, and wait until the pressure in the system is fully released before finally removing the cap.

It is advisable to protect the hand against escaping steam while removing the cap

C.2 DRAINING THE COOLING SYSTEM

Remove the header tank filler cap.

Open the two drain taps. One is fitted on the righthand side of the base of the radiator and the other at the rear of the cylinder block on the right-hand side.

NOTE. -If anti-freeze mixture is being used it should be drained into a suitable container and carefully preserved for replacement.

C3 FILLING THE COOLING SYSTEM

Close the radiator and cylinder block drain taps.

Ensure that the water hose clips are tightened.

Fill up the system through the filler in the header tank until the coolant level is approximately 1/4 in. (6.3 mm.) below the bottom of the filler neck.

When possible, rain-water should be used in the system.

Avoid overfilling to prevent loss of anti-freeze due to expansion

Screw the filler cap firmly into position.

The cooling system is unsuitable for use with antifreeze mixtures having an alcohol base, owing to the high temperatures attained. Only anti-freeze mixtures of the ethylene glycol or glycerine type should be employed. (See Section C.6.)

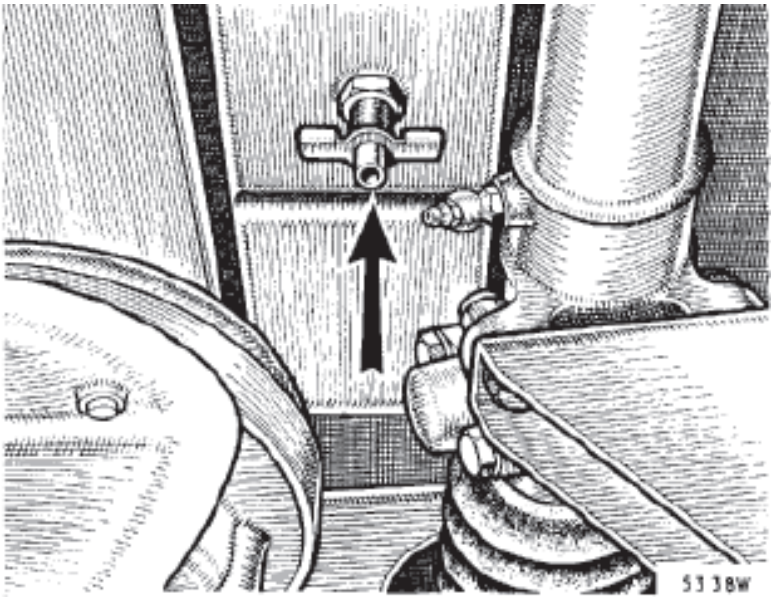


Fig. C.2 The radiator drain tap is positioned beneath the radiator on the right-hand side

C.4 REMOVING AND REPLACING THE RADIATOR

Drain the coolant from the system as in Section C.2.

Release the clips on the top and bottom water hoses and detach the hoses from their connections.

Remove the three bolts securing each side of the radiator to the body and lift out the radiator.

Replace the radiator core by reversing the above procedure, noting that there is a packing strip between the radiator flanges and the body.

Close the drain taps, refill the cooling system, and check for leaks.

C.5 DYNAMO AND FAN BELT ADJUSTMENT

The adjustment of the dynamo and fan belt tension is affected by slackening slightly the two bolts on

which the dynamo pivots, and releasing the bolt securing it to the slotted link and the nut securing the slotted link to the engine. Raise the dynamo bodily until the belt tension is correct. Tighten up the bolts with the dynamo in this position.

NOTE. - A gentle hand pull only must be exerted on the dynamo, or the belt tension will be excessive and undue strain thrown on the dynamo bearings.

To check the belt tension, rotate the fan blades. If the dynamo pulley slips inside the fan belt the tension is insufficient. When the tension is correct it should be possible to move the belt from side to side to the extent of 1 in. (2.5 cm.) at the centre of the longest belt run.

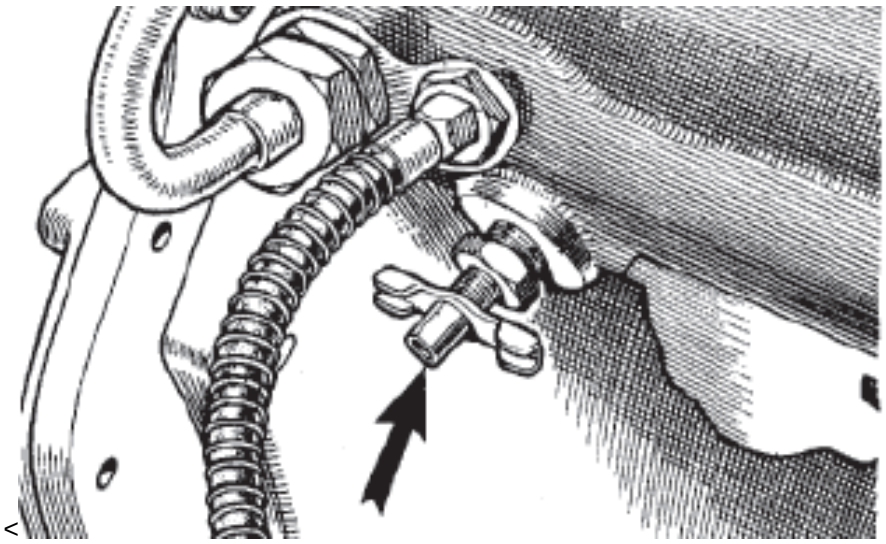


Fig. C.3 The cylinder block drain tap is situated on the righthand side of the engine. To drain the coolant, turn the tap in an anti-clockwise direction

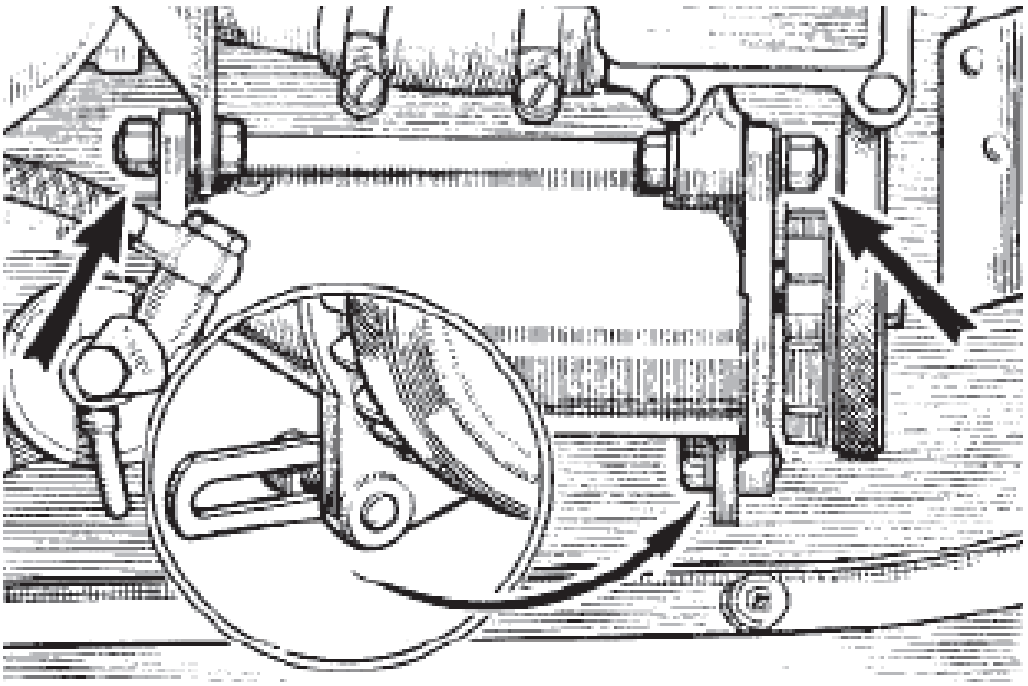


Fig. C.4 The dynamo mounting bolts which must be slackened for belt tension adjustment

C.6 COLD WEATHER PRECAUTIONS

As the cooling system is sealed, relatively high temperatures are developed in the header tank. For this reason, anti-freeze solutions having an alcohol base are unsuitable owing to their high evaporation rate producing rapid loss of coolant and a consequent interruption of the circulation of coolant. -

Only anti-freeze of the ethylene glycol or glycerine type is suitable for use in the cooling system.

The correct quantities of anti-freeze for different degrees of frost resistance are given in the "GENERAL DATA' section.

Before introducing anti-freeze mixture to the radiator, it is advisable to clean out the cooling system thoroughly by swilling out the passages with a hose inserted in the filler neck, keeping the drain taps open. Only top up when the cooling system is at its normal running temperature, to avoid losing anti-freeze due to expansion.

Make sure that the cooling system is watertight and examine all joints, replacing any defective rubber hose with new.

C7 REMOVING THE WATER PUMP,

The water pump is attached to the front of the timing case by three studs and one bolt around the pump casing. A further bolt secures the cast aluminium inlet pipe.

To remove the water pump it is first necessary to drain the water from the cooling system by opening the two drain taps as described in Section C.2, at the same time remembering to keep the coolant liquid for re-use if it contains anti-freeze mixture.

Release the clips on the top and bottom water hoses and detach the hoses from their connections.

Remove the three bolts at each side securing the radiator core to the body and lift out the radiator.

Disconnect the dynamo leads, remove the dynamo attachment bolts, and take off the dynamo and fan belt.

Remove the bolt and the three nuts from the studs securing the pump body to the timing case, also the bolt holding the aluminium inlet pipe. Release the clips on the water outlet and by-pass hoses. The pump and fan assembly together with the inlet pipe can then be withdrawn.

Replacement of the assembly is a reversal of the above procedure, but care must be taken to see that the joint gasket between the pump body and the timing case is in good condition.

C.8 DISMANTLING AND REASSEMBLING THE WATER PUMP

When the fan and water pump assembly has been removed as indicated in Section C.7 the water pump may be dismantled in the following manner.

Unscrew the four set bolts and remove the fan blades from the hub. Unscrew the nut and spring washer from the end of the pump spindle and pull off the fan hub with a suitable extractor. Release the two bolts securing the aluminium inlet pipe to the pump body and remove the pipe.

Remove the felt seal and the Woodruff key from the spindle, taking care to remove any burrs from the keyway. Withdraw the dished oil seal washer.

Remove the four bolts securing the pump body to the scroll casing and separate the two parts. Gently tap the spindle rearwards out of the pump body and remove the flat sealing washer, the felt seal, and the dished sealing washer. The rubber sealing gland is withdrawn from the spindle after removing the felt seal locating circlip.

Should it be necessary to remove the ball races, the front one can be withdrawn with an extractor.

When the front bearing is removed it releases the distance tube between the bearings and gives access to the rear bearing retaining circlip. Remove the circlip and withdraw the rear bearing if required.

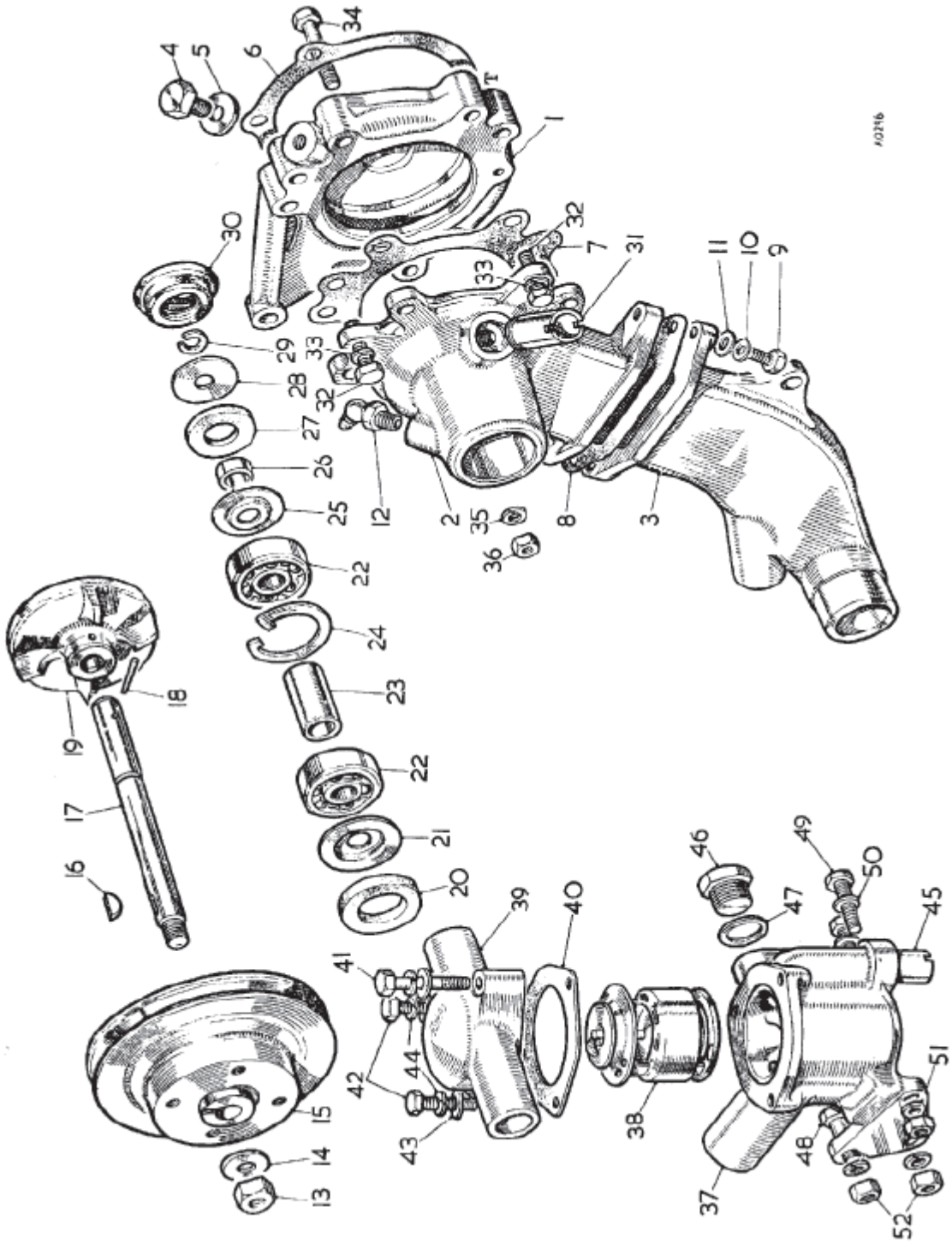
Reassembly is a reversal of the dismantling procedure, but care must be taken to see that the seal is in good condition before proceeding.

Before assembling the pump body to the scroll casing, ensure that a running clearance exists between the body and the pump vane as indicated in Fig. C.5. No adjustment is provided for varying the designed clearance, which should always be present.

Renew the pump body gasket and the felt seals if necessary.

Repack with grease to Ref. C.

THE WATER PUMP AND THERMOSTAT COMPONENTS



KEY TO THE WATER PUMP AND THERMOSTAT COMPONENTS

1. Scroll
2. Body.
3. Inlet pipe.
4. Scroll vent plug.
5. Washer for vent plug.
6. Joint-scroll to timing case.
7. Joint-scroll to water pump body.
8. Joint water inlet pipe to pump.
9. Set screw-inlet pipe to pump.
10. Spring washer.
11. Plain washer.
12. Bearing grease nipple.
13. Nut for spindle.
14. Lock washer.
15. Fan pulley.
16. Spindle key.
17. Spindle.
18. Vane taper pin,
19. Vane.
20. Felt washer.
21. Dust cover.
22. Bearing.
23. Bearing distance tube.
24. Circlip-bearing
25. Dust cover.
26. Collar.
27. Felt washer.
28. Dust cover.
29. Circlip-spindle.
30. Seal.
31. Hose connection—thermostat by-pass.
32. Set screw-pump body to scroll.
33. Spring washer.
34. Bolt-water pump and scroll to front plate.
35. Spring washer.
36. Nut.
37. Thermostat housing,
38. Thermostat
39. Housing cover.
40. Joint for cover.
41. Bolt-cover to housing
42. Set screw--cover to housing.
43. Plain washer.
44. Spring washer.
45. Thermostat by-pass pipe.
46. Plug-heater take-off.
47. Washer for plug.
48. Bolt-thermostat housing and timing case to front plate.
49. Set screw-thermostat housing and timing cast to front plate.
50. Plain washer.
51. Spring washer.
52. Nut.

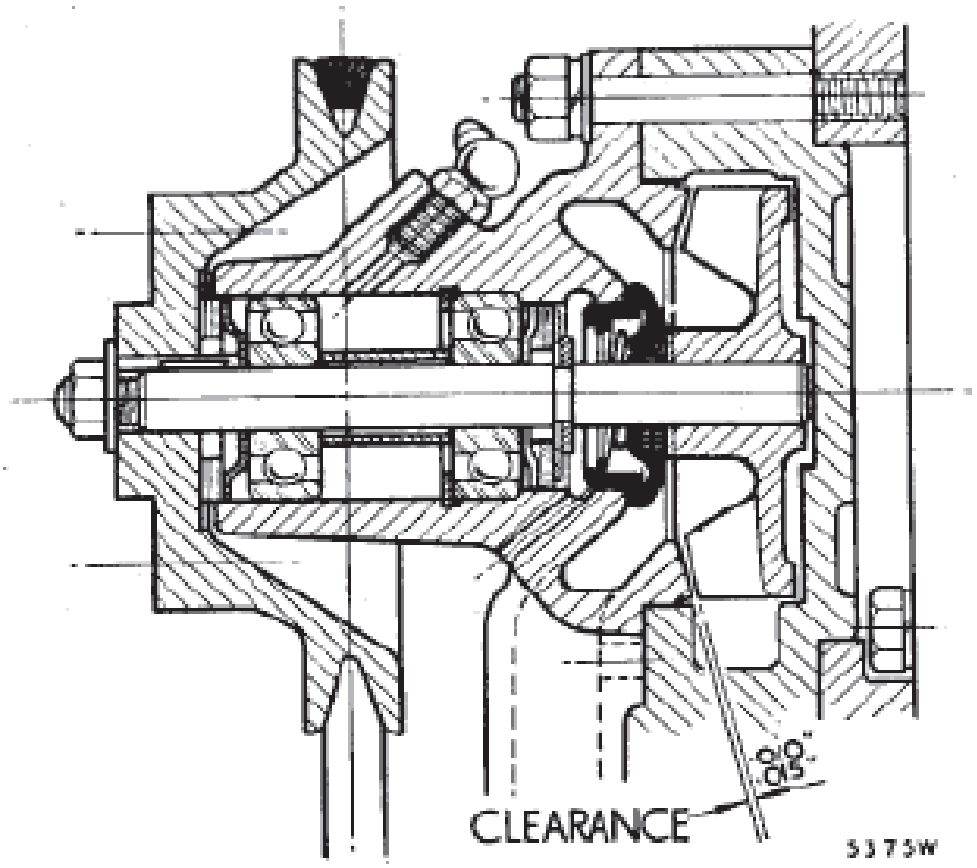


Fig. C.5 A sectioned view of the water pump showing the clearance between the body and the pump vane

C.9 RADIATOR PRESSURE VALVE

To prevent loss of coolant due to vibration of the valve in the filler cap, a 7 lb. (3.175 kg.) remote radiator pressure valve is now fitted. Cars equipped with the new valve are numbered as follows:

Car Nos. 575, 613, 623, 633, 648, and from 652 onwards.

To modify an existing radiator the following procedure must be carried out.;

Remove the existing filler neck from the header tank, rotate through 180°, and replace.

Fit the pressure valve (Part No. AHH5903), together with its bracket (Part No. AHH5906), to the inner face of the left-hand air duct.

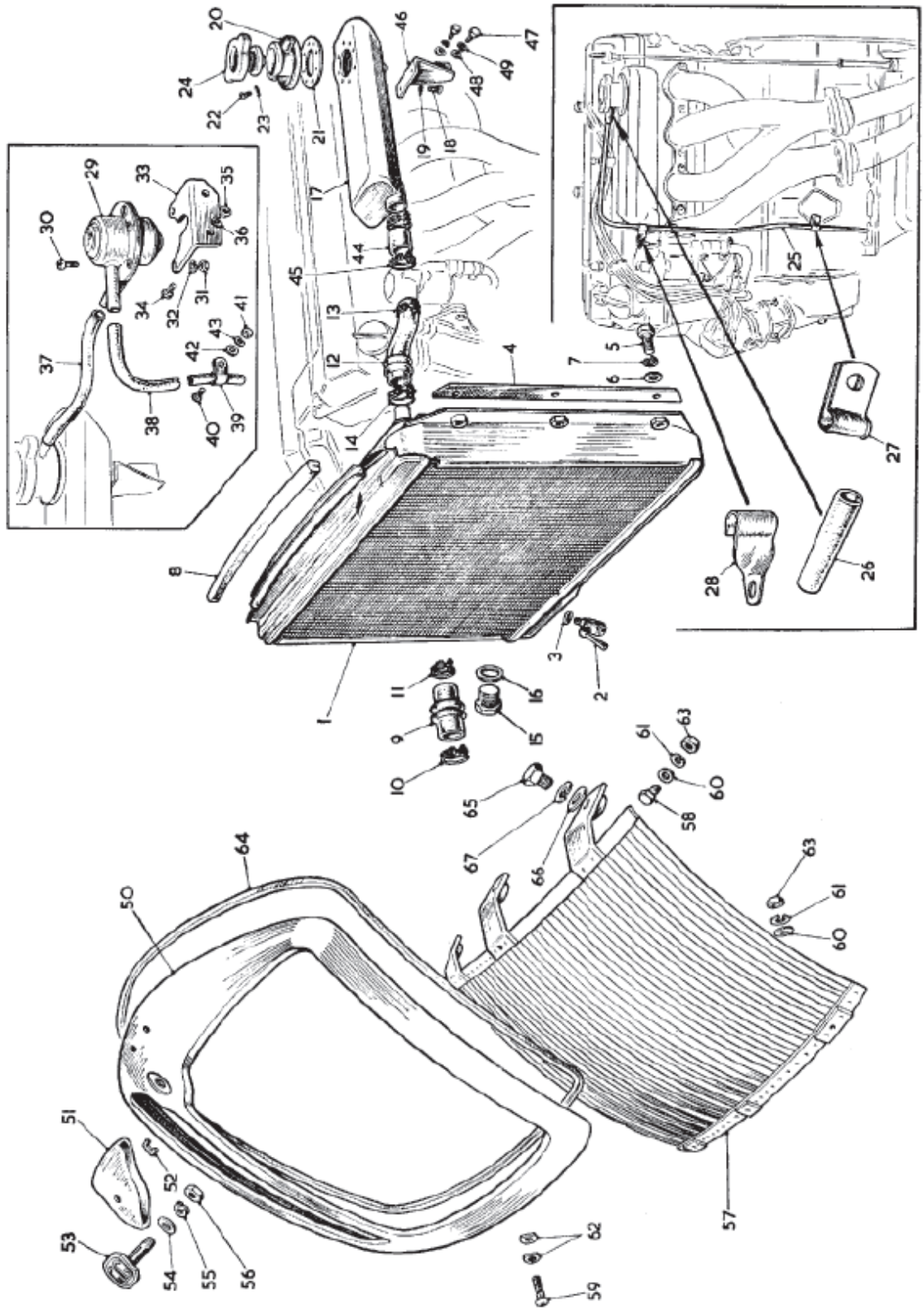
Fit the rubber connecting hose (Part No. AHH5905) from the filler neck to the valve, and the overflow pipe (Part No. AHH5907) from the valve to the draining point. The overflow pipe is retained in position at its lower end by a clip (Part No. PCR0607).

The parts required for this modification are listed below.

Description	Part No.	Quantity

Filler cap	AHH5904	1
Hose-neck to valve	AHH5905	1
Pressure valve	AHH5903	1
Screw-valve to bracket	PMZ0308	2
Washer	LWZ203	2
Nut	FNZ103	2
Bracket-valve	AHH5906	1
Screw-bracket to panel	HZS0404	2
Washer	LWZ204	2
Nut	FNZ104	2
Overflow pipe	AHH5907	1
Clip	PCR0607	1
Screw	PMZ0306	1
Plain washer	PWZ103	1
Spring washer	LWZ203	1
Nut	FNZ103	1

THE COOLING SYSTEM COMPONENTS



KEY TO THE COOLING SYSTEM COMPONENTS

1. Block assembly-radiator.
23. Washer for screw (spring).
45. Clip for hose.

2. Tap-drain.

3. Washer for tap.

4. Packing piece-block to body.

5. Screw for block.

6. Washer for screw (plain).

7. Washer for screw (spring).

8. Rubber-radiator air seal.

9. Hose (bottom).

10. Clip (Large).

11. Clip (small).

12. Hose (top).

13. Clip (Large).

14. Clip (small).

15. Plug-connector pipe.

16. Washer for plug.

17. Tank-header.

18. Screw-tank to bracket.

19. Washer for screw (spring).

20. Filler neck

21. Joint for filler neck.

22. Screw for filler neck.

24. Cap-header tank.

25. Pipe-overflow

26. Connection for overflow pipe.

27. Clip-pipe to blanking plate.

28. Clip-pipe to thermostat cover,

29. Relief valve and cage assembly.

30. Screw fixing--valve to bracket.

31. Nut for screw.

32. Washer for nut (spring).

33. Bracket-valve.

34. Screw (fixing).

35. Nut for screw.

36. Washer for nut (spring).

37. Hose-header tank to valve.

38. Tube-overflow.

39. Clip for Overflow tube.

40. Screw (fixing).

41. Nut for screw.

42. Washer for nut (plain).

43. Washer for nut (spring).

44. Hose-tank to thermostat housing:

46. Bracket for header tank.

47. Screw (fixing).

48. Washer for screw (plain).

49. Washer for screw (spring).

50. Case-sub-assembly.

51. Nose assembly-false.

52. Speed-fix--nose to case.

53. Badge.

54. Washer for badge (plain).

55. Washer for badge (spring).

56. Nut for badge

57. Grille assembly.

58. Stud-grille retaining,

59. Stud-grille lower fixing.

60. Washer for stud.

61. Washer for stud (spring).

62. Washer for stud (D).

63. Nut for stud

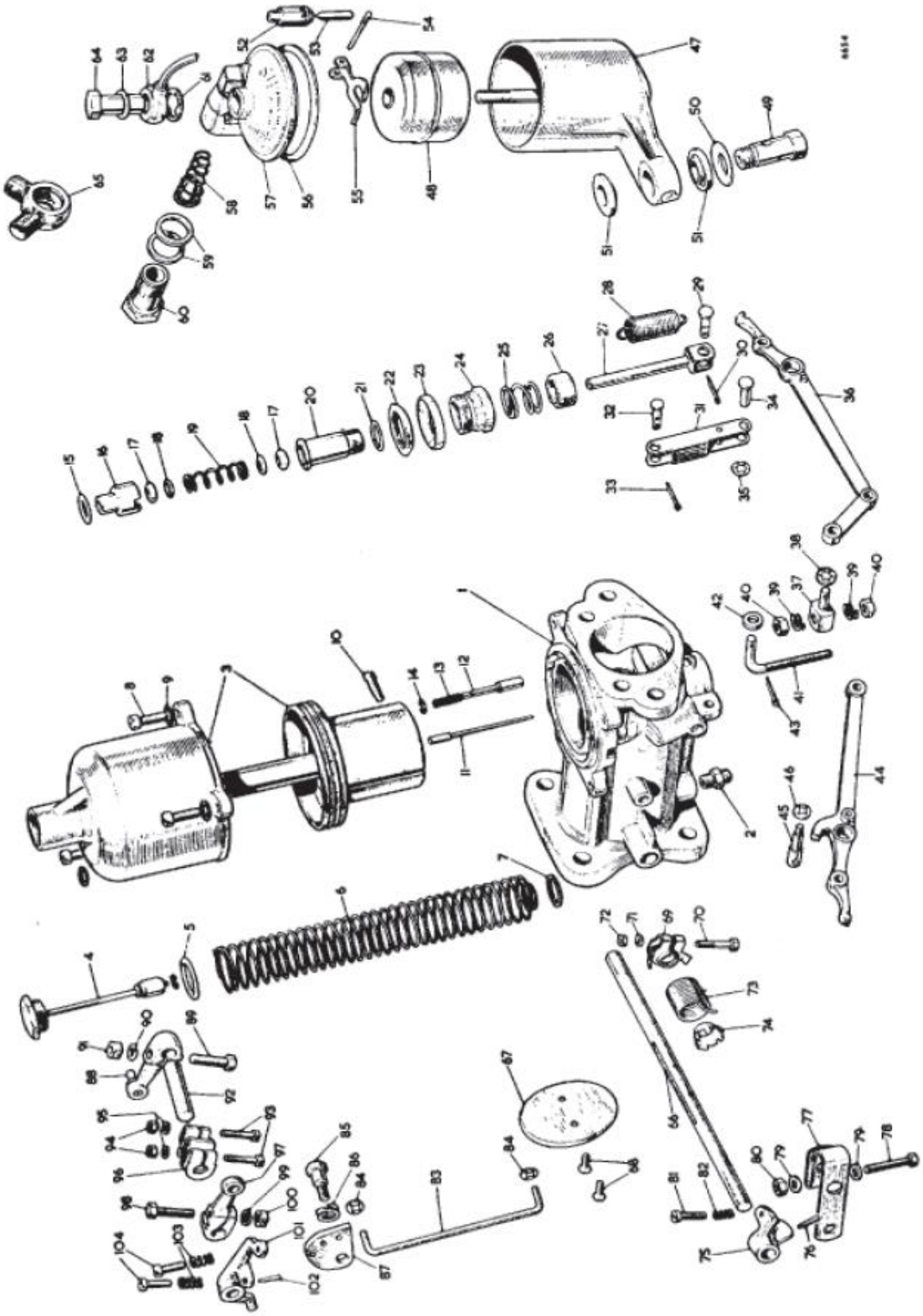
64. Piping grille.

65. Screw fixing grille.

66. Washer for screw (plain).

67. Washer for screw (spring)

SECTION D THE FUEL SYSTEM



KEY TO THE CARBURETTER COMPONENTS

1. Body (front).
2. Auto-ignition union.
3. Suction chamber and piston assembly.
4. Oil cap damper assembly.
5. Fibre washer for oil cap damper.
6. Piston spring
7. Thrust washer.
8. Suction chamber securing screw.
9. Shake proof washer.
10. Jet needle locking screw.
11. Jet needle.
12. Piston lift pin.
13. Spring for lift pin.
14. Circlip for lift pin.
15. Jet copper washer (top half).
16. Jet bearing (top half).
17. Jet gland washer (cork).
18. Jet gland washer (brass).
19. Jet gland spring.
20. Jet bearing (bottom half).
21. Jet copper washer (bottom half).
22. Jet scaling ring (neoprene).
23. Jet scaling ring
24. Jet screw.
25. Jet adjusting lock spring.
26. Jet adjusting nut
27. Jet with head.
28. Return spring-jet lever.
29. Pivot pin.
30. Split pin.
31. Jet link
32. Pivot pin.
33. Split pin.
34. Pivot pin.
35. Star lock washer.
36. Jet lever (front).
37. Trunnion.
38. Star lock washer.
39. Spring washer for connecting rod.
40. Nut for connecting rod.
41. Connecting rod.
42. Washer for connecting rod.
43. Split pin.
44. Jet lever (rear).
45. Pivot pin.
46. Star lock washer.
47. Float-chamber.
48. Float.
49. Holding-up bolt--float-chamber.
50. Washer for holding-up bolt.
51. Rubber grommet for holding-up bolt.
52. Float needle seat.
53. Float needle.
54. Float hinged lever pin.
55. Float hinged lever.
56. Float-chamber lid scaling ring.
57. Float-chamber lid (front).
58. Filter.
59. Fibre washer for banjo bolt.
60. Banjo bolt.
61. Serrated fibre washer.
62. Vent pipe.
63. Aluminium washer.
64. Cap nut.
65. Banjo union-double (rear).
66. Throttle spindle (front).
67. Throttle disc.
68. Screw for throttle disc.
69. Retainer clip.
70. 4 BA bolt
71. 4 BA washer.
72. 4 BA nut.
73. Throttle return spring (front).
74. Throttle return spring anchor plate.
75. Stop lever (front).
76. Taper pin for stop lever.
77. Throttle spindle connector (front half).
78. Bolt for throttle spindle connector.
79. Washer.
80. Nut.
81. Stop adjusting screw.
82. Stop adjusting screw spring.
83. Link rod.
84. Star lock washer.

85. Pivot bolt for cam.
86. Spring washer for pivot bolt.
87. Cam.
88. Throttle spindle connector (rear half).
89. Bolt for throttle spindle connector.
90. Spring washer.
91. Nut.
92. Connecting rod.
93. 4 BA bolt.
94. 4 BA nut.
95. 4 BA washer.
96. Connecting link.
97. Lever-throttle spindle.
98. Bolt-throttle spindle lover.
99. Washer,
100. Nut.
101. Stop lever (rear).
102. Taper pin for stop lever.
103. Spring for stop adjusting screw.
104. Stop adjusting screw.

D.1 REMOVING THE FUEL TANK

Remove the hexagon drain plug and empty the tank.

Slacken the two clips on the filler neck hose and withdraw the filler extension.

Pull the hose from the tank. Take out the three screws and remove the tank filler neck seal and clamp plate.

Disconnect the fuel pipe at the union and the fuel gauge cable from the tank unit, each on the right-hand side of the tank.

Remove the two nuts from the bolts securing the rear of the tank to the anchorage brackets on the frame and remove the two bolts with spring washers which secure the front of the tank to the frame.

Withdraw the rear bolts and distance tubes.

Replacement is a reversal of the above instructions.

D.2 REMOVING THE FUEL PUMP

Raise the hood and remove the spare wheel.

Remove the hood stowage compartment floor. This is secured by two quick-release screws and each requires only a quarter-turn anti-clockwise to release the cover.

Disconnect the inlet and outlet pipe union nuts.

Disconnect the earth lead and the supply lead from the terminals on the pump.

Remove the two set screws securing the fuel pump to the bracket on the frame cross-member.

D.3 CONSTRUCTION OF THE FUEL PUMP

The fuel pump is a 12-volt electric S.U. type LCS and is located close to the right-hand side of the fuel tank.

The pump consists of three main assemblies: the body, the magnet assembly, and the contact breaker.

The body (17) is an aluminium die-casting, to which two identical cover-plates (6 and 18) are secured by six 2 BA screws with spring washers. Removal of the lower cover-plate (18) gives access to the fuel filter (see Fig. D.5), whilst the top plate covers the outlet valve cage (5). When the outlet valve cage is removed the inlet valve (3) is revealed. The valves consist of thin brass discs which should be assembled smooth side downwards.

The outlet valve can be extracted after the spring retaining circlip has been detached. Care should be taken not to distort the circlip, or the correct valve lift may be affected.

A 1 in. diameter hole connects the space between the valves to the pumping chamber, which is a shallow depression in one face of the body casting. This space contains the diaphragm unit (20)

which is clamped on its rim between the iron coil housing (9) and the main body (17).

A bronze rod (10) is screwed through the centre of the armature, to which the diaphragm is attached, and it passes through the magnet core to the contact breaker, which is located at the other end. A volute spring (22) is interposed between the armature and the end plate of the coil to return the armature and diaphragm.

The magnet consists of a cast-iron pot having an iron core (23), on which is wound a coil of copper wire which energizes the magnet. Between the magnet housing and the armature are fitted 11 spherical-edged rollers (7). These locate the armature centrally within the magnet at all times and allow absolute freedom of movement in a longitudinal direction. The contact breaker consists of a Small bakelite moulding carrying two rockers (11 and 12) which are both hinged to the moulding at one end and are connected at the top end by two small springs arranged to give a 'throw-over' action. A trunnion is fitted into the centre of the inner rocker, and the bronze pushrod (10) connected to the armature is screwed into this. The outer rocker (11) is fitted with a tungsten point, which contacts a further tungsten point on a spring blade (14). This spring blade is connected to one end of the coil, and the other end of the coil is connected to the terminal (26).

To provide a good earth a short length of flexible wire connects the outer rocker to one of the screws which hold the bakelite moulding,

D.4 ACTION OF THE FUEL PUMP

The action of the pump is as follows.

When the pump is at rest the outer rocker lies in the outer position and the tungsten points are in contact. The current passes from the terminal through the coil back to the blade, through the points, and to the earth return, thus energizing the magnet and attracting the armature. This comes forward, bringing the diaphragm with it and sucking fuel through the suction valve into the pumping chamber. When the armature has advanced nearly to the end of its stroke the 'throw-over' mechanism operates and the outer rocker flies back, separating the points and breaking the circuit. The spring (22) then pushes the armature and diaphragm back, forcing fuel through the delivery valve at a rate determined by the requirements of the engine. As soon as the armature gets near the end of this stroke the throw-over' mechanism again operates, the points again make contact, and the cycle of operations is repeated.

D.5 DISMANTLING AND REASSEMBLING THE FUEL PUMP

When a pump comes in for reconditioning the first thing to do is to determine whether it has been in contact with gum formation in the fuel, resulting in the parts in contact with the fuel becoming coated with a substance similar to varnish. These deposits cause the eventual destruction of the neoprene diaphragm. The easiest way to identify this deposit is to smell the outlet union. If an unpleasant, stale smell is noticed it indicates the presence of gum in the pump. The ordinary sharp, acrid smell of petrol (gasoline) denotes that no gum is present.

If trouble with gum formation is indicated, the whole of the parts coming into contact with fuel will have to be dismantled. Those made in brass or steel should be boiled in 20 per cent. caustic soda solution, given a dip in strong nitric acid, and then washed in boiling water. Those made in aluminium should be well soaked in methylated spirits and cleaned.

To dismantle the pump

First remove the six bottom cover securing screws and withdraw the filter, which may be found to be completely clogged with gum. Remove the top cover, the outlet valve retaining circlip, and the outlet valve disc. Unscrew the valve cage and withdraw the inlet valve disc.

Next undo the six screws holding the two main components of the pump together. All the components of the pump body--with the exception of the washer but including the pump body itself-should now be cleaned to remove all trace of gum. New fibre washers should be used on replacement.

If there is no evidence of gum formation, proceed as follows: first undo the six screws holding the two

parts of the pump together. The action of the valves can then be checked by blowing and sucking in the inlet union to check the suction valve and in the outlet union to check the delivery valve. In the former case it should be possible to blow freely but not to suck air back, and with the latter to suck and not blow.

Clean the filter in fuel with a brush and swill out the body of the pump.

Next unscrew the diaphragm assembly from its trunnion in the contact breaker. This is done by rotating the whole assembly in an anti-clockwise direction. Take care not to lose the brass rollers fitted behind the diaphragm. The easiest method is to hold the body in the left hand and to rotate the diaphragm.

Now remove the contact breaker cover by taking off the nut which holds it in place on the terminal, and then undo the last nut on the terminal, which acts as a seating for the cover. Beneath this will be found a lead washer which is squeezed into the thread on the terminal. This should be cut away with a pocket-knife, allowing the terminal to be pushed down a short way so that the tag on the coil and is free on the terminal.

Remove the 2BA screw holding the contact blade in position, together with its spring washer and the contact blade.

Remove the two long 2 BA screws holding the bakelite pedestal in place, together with their spring wasters. Take off the contact breaker assembly, using great care to get the coil end tag over the terminal without damaging the coil end.

Push out the hinge pin sideways and the pump is completely dismantled, since the rocker mechanism is supplied only as a complete assembly.

Do not disturb the core of the magnet; it can only be located correctly with special press tools.

To reassemble the pump

When reassembling. see that all parts are clean. The valves (3 and 4) should be fitted with the smooth side downwards. Care should be taken that the valve retaining clip in the outlet valve cage (5) is correctly located in its groove. When refitting the top and bottom covers new gaskets should be used.

The contact breaker should be assembled on its pedestal in such a manner that the rockers are free in their mountings, without appreciable side-play. Any excessive side-play on the outer rocker will allow the points to get out of line, while excessive tightness will make the action of the contact breaker sluggish. To obtain the required freedom in cases of tightness it may be necessary to square up the outer rocker with a pair of thin-nosed pliers**. The hinge pin is case-hardened, and on no account should ordinary wire be used as a replacement. Always use the correct hardened pin.**

Should the spring contact breaker blade be removed, it must always be replaced bearing directly against the bakelite pedestal, i.e. underneath the tag.

When properly fitted the blade should rest against the ledge on the pedestal while the points are separated, and it should not be sufficiently stiff to prevent the outer rocker from coming right forward when the points are in contact. The points should make contact when the rocker is in its midway position. The simplest way to check this is to hold the blade in contact with the pedestal, taking care not to press on the overhanging portion, and ascertain that a .030 in. (.76 mm.) feeler can be inserted between the white rollers and the cast-iron body of the pump. If necessary, the tip of the blade may be set to give the correct clearance

NOTE. -The Spring Washer on the BA screw to which the earth connection is made should be fitted between the tag and the pedestal. The spring washer is not a reliable conductor, and the brass tag must bear directly against the head of the screw.

All four connections, namely, the two ends of the earthing tag and the two ends of the coil, should be soldered. The coil end leading to the terminal should be soldered to its tag and not to the retaining nut. In the case of the terminal screw which holds the bakelite cover in position similar considerations apply, the assembly being: spring washer (1), wiring tag (2), lead washer (3), and recessed nut (4)

(see Fig. D.2). A lead washer has been found necessary at this point as some few cases of bad connection have been found. Under no circumstances must the spring washer be omitted, or the assembly shortened in any way. Any attempt to do so is likely to lead to breakage of the pedestal when the nut retaining the cover in position is tightened up.

The armature return spring should be fitted with its larger diameter towards the coil and its smaller diameter resting against the armature. This spring must not be stretched or otherwise interfered with, or the action of the pump will be affected.

1. Outlet union.
2. Rubber ring,
3. Inlet valve.
4. Outlet valve.
5. Outlet valve cage.
6. Top cover-plate.
7. Spherical rollers.
8. Magnet coil.
9. Iron coil housing
10. Bronze rod
11. Outer rocker.
12. Inner rocker.
13. Tungsten points
14. Spring blade.
15. Inlet union.
16. Rubber ring.
17. Body.
18. Lower cover-plate.
19. Filter.
20. Diaphragm.
21. Armature.
22. Armature spring.
23. Magnet core.
24. Trunnion.
25. Bakelite moulding
26. Terminal screw

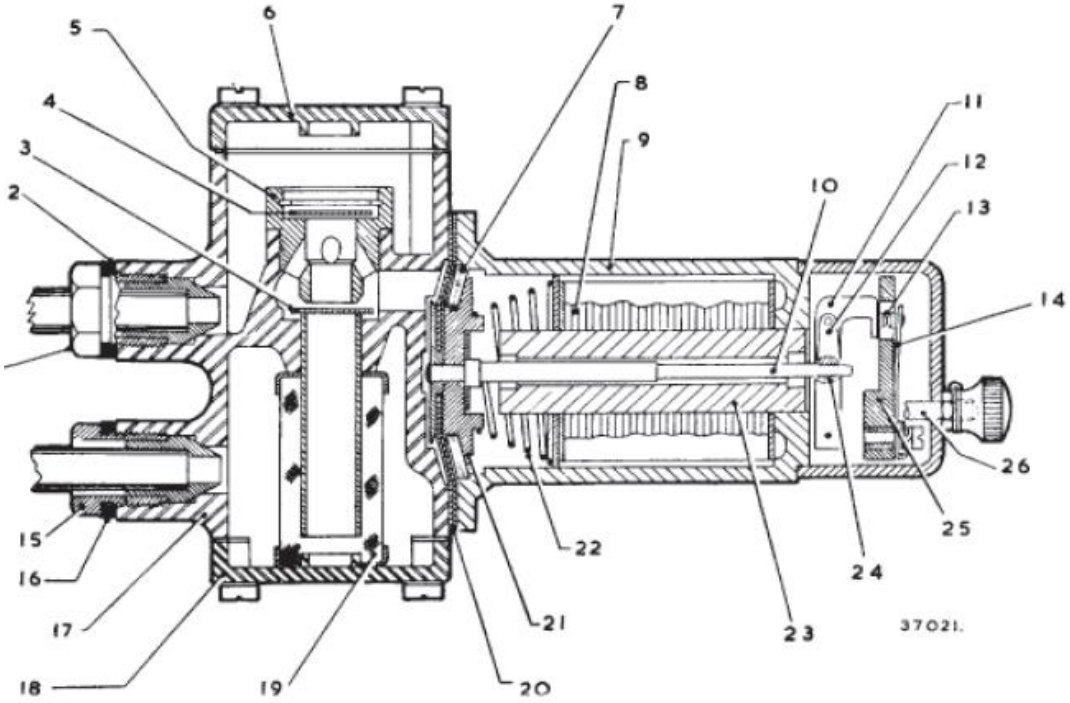


Fig. D.1 The type LCS fuel pump components

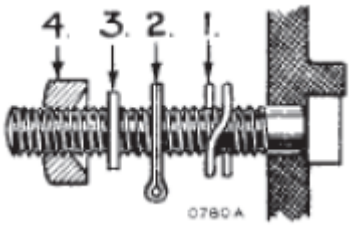


Fig. D.2 The correct sequence of assembly of the connecting components on the terminal screw

D.6 RESETTING THE DIAPHRAGM FOR CONTACT BREAKER "THROW-OVER"

If the armature and centre rod have been unscrewed it will be necessary to reset as follows:

1. Swing to one side the spring blade which carries the contact points.
2. Fit the impact washer in the recess of the armature.
3. Screw the armature into position.
4. Place the 11 guide rollers in position around the armature. Do not use jointing compound on the diaphragm.
5. Hold the magnet assembly in the left hand in an approximately horizontal position.
6. Screw the armature inwards until the "throw over ceases to operate, and then screw it back gradually, a sixth of a turn (or one hole) at a time, and press the armature in after each part of a turn until it is found that when it is pushed in slowly and firmly the 'throw-over' mechanism operates. Unscrew the armature a further two-thirds of a turn (four of the six holes). When a new diaphragm is fitted it is probable that considerable pressure will be required to push the armature right home.
7. Place the cast-iron body in position on the main body, taking care to see that the drain hole in the cast-iron body is at the bottom and all the rollers are still in their correct positions.
   If a roller drops out of position it will get trapped between the two ports, and this will cut a hole in the diaphragm.

   Make sure that the cast-iron body is seating properly on the main body and insert the six securing screws. Before tightening the screws down, it is essential that the diaphragm should be stretched to its outermost position.

   This may be done by inserting a matchstick behind one of the white fibre rollers on the outer rocker, thus holding the points in contact (after first repositioning the spring blade into its normal position). If a current is then passed through the pump the magnet will be energized and will pull the armature and diaphragm forward, and while it is in this position the six screws should be tightened. Although the diaphragm-stretching operation can be effected by the matchstick method, a special tool for this purpose is available from the S.U. Carburetter Co. or their Distributors. The tool is a steel wedge, to be inserted under the trunnion in the centre of the inner rocker in order to stretch the diaphragm to its outermost position before tightening the six flange screws.
8. Finally, check that when the spring blade is in its normal position the clearance hole in it is so positioned around the locking screw that each contact point, according to the operation of the outer rocker, wipes over the centre-line of the other contact point and that this action is not to one side of the centre on either contact. The width of the gap at the points is approximately .030 in. (.76 mm.).
9. The pump should now be placed on test, using a cut-away cover to enable the contact breaker action to be observed and at the same time to prevent the rocker hinge pin from falling out. A test rig of the type illustrated in Fig. D.4 is advised; either petrol (gasoline) or paraffin (kerosene) may be used for testing purposes. Test figures are given in "GENERAL DATA'. The use of a glass tube and rubber connections between the sump and the test tank is advised. When the pump is switched on it should prime itself promptly, and the paraffin, which is normally used for testing, should rise in the glass container until it flows over the top of the pipe having the lin. (4 mm.) hole drilled in it 2 in. (5 cm.) below the top of the pipe. If the output of the pump is not up to normal the 1/6 in. (4 mm.) diameter hole will be able to deal with all the paraffin pumped and the liquid will not flow over the top of the pipe. If a time-test is used, 1.5 pints (-9 litre) of fuel per minute should be pumped.

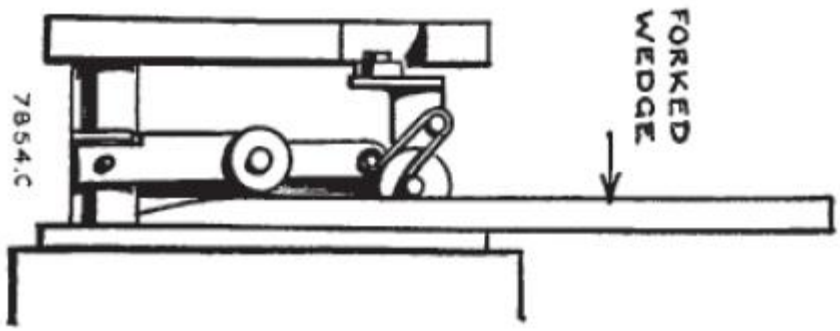
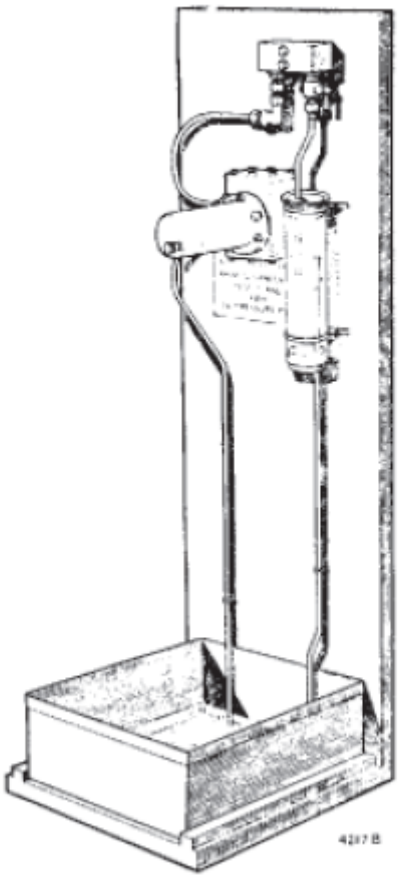


Fig. D.3 The use of a forked wedge to keep the armature in the correct position for fitting the diaphragm

These test rigs can be obtained complete from the Service Parts Department of the S.U. Carburetter Co. or their Distributors.

This, therefore, constitutes a simple form of flowmeter which establishes in a simple manner whether the pump is giving a sufficient output or not. If there is any air leak in the pump or in its connections, bubbles will be seen coming out of the pipe projecting downwards into the flow-meter. Bubbles will certainly come through here for a short while after starting up, but they should cease after the pump has been running for a minute or so. The tap should then be turned right off, and the pump should stand without repeating its action for at least 12 seconds. If it repeats within this time the suction valve is not seating correctly.



The tap should then be turned on slowly to see if the pump idles satisfactorily and that the outer rocker comes forward till it contacts the pedestal, and while it is in this position the tip of the blade should be pressed inwards to reduce the stroke of the pump gradually. However much this stroke is reduced, the pump should go on pumping normally until it fails altogether owing to there being no gap left. If instead of pumping it buzzes, it usually indicates excessive flexibility in the diaphragm. This, of course, is not likely to be experienced with a new diaphragm. Then, with the tap turned on fully, the pump should be tested on 10 volts and it should work satisfactorily under these conditions, although probably with a reduced output.

It is as well to let the pump run for 10 minutes or so before carrying out these various tests. The cover should then be fitted and held in place with two ordinary brass nuts fitted on the end of the terminal.

Fig. D.4 Checking rig

NOTE. -There are three important points which are repeatedly overlooked by operators. These seriously affect the functioning of the pump, they are:

1. To keep the contact breaker blade out of contact while obtaining the correct diaphragm

setting.

2. To press firmly and steadily on the armature, instead of jerking it while obtaining the setting.
3. Omission to stretch the diaphragm to the limit of its stroke while tightening up the body screws.

D7. TRACING FUEL PUMP TROUBLES

Should the pump cease to function, first disconnect the fuel delivery pipe from the pump. If the pump then works the most likely cause of the trouble is a sticking needle in the float-chamber of the carburetter. Should the pump not work, disconnect the lead from the terminal and strike it against the body of the pump after switching on the ignition. If a spark occurs it indicates that the necessary current is available at the terminals and that the trouble arises with the pump mechanism. If no spark can be detected, then it is an indication that the current supply has failed, and that attention should be given to the wiring and battery. If no current is present, further investigation should be carried out by removing the bakelite cover which is retained by the terminal nut. Touch the terminal with the lead. If the pump does not operate and the contact points are in contact, yet no spark can be struck off the terminal, it is very probable that the contact points are dirty and require cleaning. These may be cleaned by inserting a piece of card between them, pinching them together, and sliding the card backwards and forwards.

It is possible that there may be an obstruction in the suction pipe, which should be cleared by blowing air through it, or that some irregularity in the pump itself is preventing the correct movement. This may be due either to the diaphragm having stiffened, or to foreign matter in the roller assembly which supports the diaphragm, in which case the diaphragm should be removed and the whole assembly cleaned and reassembled in accordance with the instructions given in

On the other hand, if the points are not making contact see that the tips of the inner rocker (12) are in contact with the magnet housing. If they are not, it is an indication that the armature has failed to return to the end of its normal travel.

To cure this, loosen the six screws which attach the magnet housing to the pump body and make sure that the diaphragm is not sticking to the face of the magnet housing by carefully passing a penknife between the two. The hinge pin should then be removed, and the six retaining screws tightened up again. The tips of the inner rockers will probably now be found to be making contact with the face of the magnet housing, but if they are not it will be necessary to remove and dismantle the whole magnet assembly in order to ascertain if an accumulation of foreign matter has caused a jam. Remember that whenever the magnet housing is removed care should be taken to see that the guide rollers (7) do not drop out.

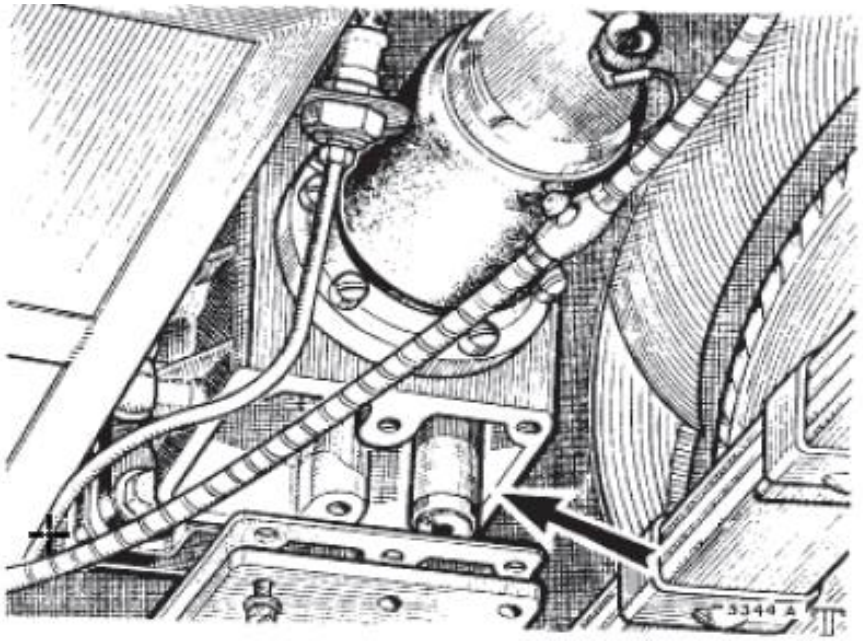


Fig. D.5 The pump filter should be cleaned with a brush every 6,000 miles (10000 km.)

Pump noisy

If the pump becomes noisy and works rapidly it is usually an indication that there is an air leak on the Suction side of the pump. Check the level of the fuel in the tank and see that it is not too low.

The simplest way to test for air leakage is to disconnect the fuel pipe from the carburetter and place its end in a glass jar (approximately 1 pint or half a litre) and allow the pump to deliver fuel into it. If air bubbles appear when the end of the pipe has become submerged in the fuel it is a clear indication of an air leak on the suction side of the pump in the fuel feed pipe between the tank and the pump which should be found and cured, Check all the unions and joints, making sure that the filter union and inlet unions are all quite airtight.

Failure to deliver fuel

Should the pump continue beating without delivering fuel, it is probable that dirt has become lodged under one of the valves, in which case they should be dismantled by removing the top cover and unscrewing the valve cage, when they can be cleaned and reassembled.

If the pump struggles to operate and becomes very hot it is probable that the filter has become clogged or there is an obstruction on the suction side. The filter is readily removed for cleaning by unscrewing the six 2 BA screws securing the bottom plate.

D.8 FUEL PUMP MAINTENANCE

Apart from keeping the contacts clean and removing the filter at regular intervals for cleaning, there is no maintenance required on the fuel pump.

The filter can be extracted by removing the pump body bottom cover, when it can be cleaned in fuel with a stiff brush. Never use rag to clean a filter.

D.9 CARBURETTERS

The S.U. carburetters are of the controllable jet type drawing air through oil-wetted air cleaners.

A damper is provided in each unit, consisting of a plunger and non-return valve attached to the oil cap nut. The damper operates in the hollow piston rod, which is partly filled with oil. Its function is to give a slightly enriched mixture on acceleration by controlling the rise of the piston, and also to prevent flutter.

D.10 CARBURETTER ADJUSTMENTS

Slow running is governed by the setting of the jet adjusting nuts and the throttle stop screws, all of which must be correctly set and synchronized if satisfactory results are to be obtained.

The two throttles are interconnected by a coupling shaft and coupling clips, enabling them to be set and correctly synchronized when adjustments are being made.

The mixture control levers are also connected, between the carburetters, by a short adjustable link.

Before blaming the carburetter settings for poor slow running make certain that the trouble is not caused by badly adjusted contact points, faulty plugs, incorrect valve clearance, or faulty valves and springs.

Adjusting the jets

Run the engine until it attains its normal running temperature.

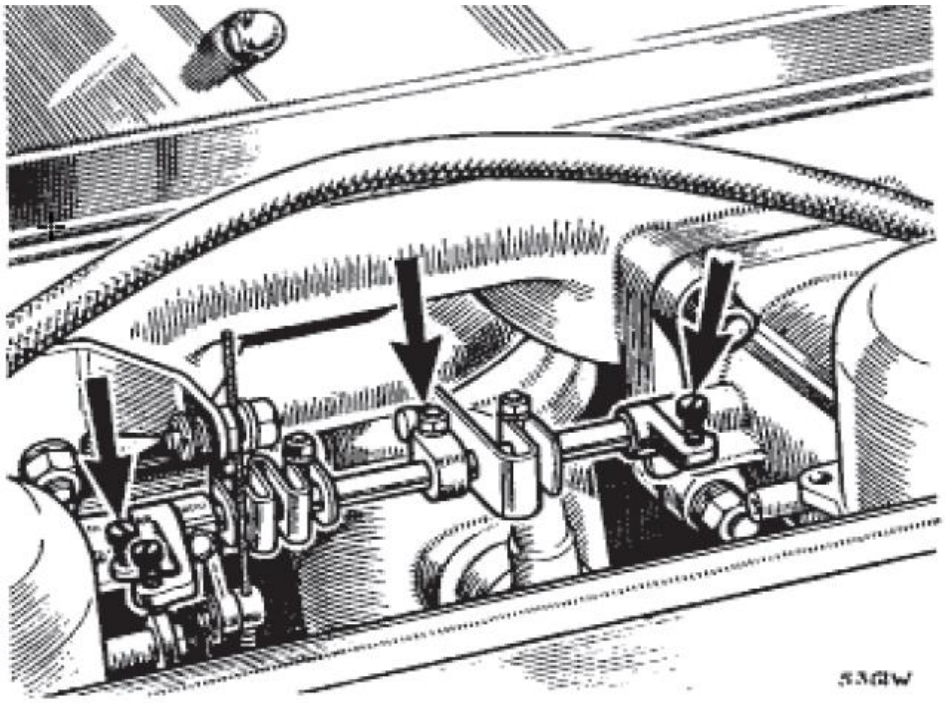


Fig. D.6 After slackening the nut indicated by the centre arrows the slow running can be regulated on each carburetter by adjusting the two screws indicated by the outer arrows

Slacken the nut indicated by the centre arrow (Fig. D.6) to allow each carburetter spindle to operate independently.

Disconnect the mixture control cable and the connecting link between the two jet adjusting levers.

Unscrew both throttle lever setting screws until the throttles are completely closed. Turn the adjusting screw of the rear carburetter in a clockwise direction approximately one turn to set the throttle for fast idling; lift the piston of the front carburetter 1/2 in. (13 mm.) to leave the carburetter out of action.

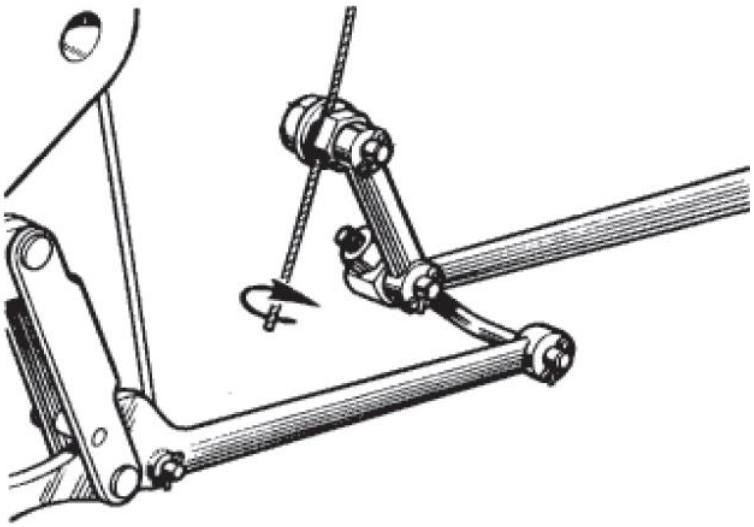


Fig. D.7 When connecting the mixture control wire give a twist as indicated to ensure correct operation of the lock

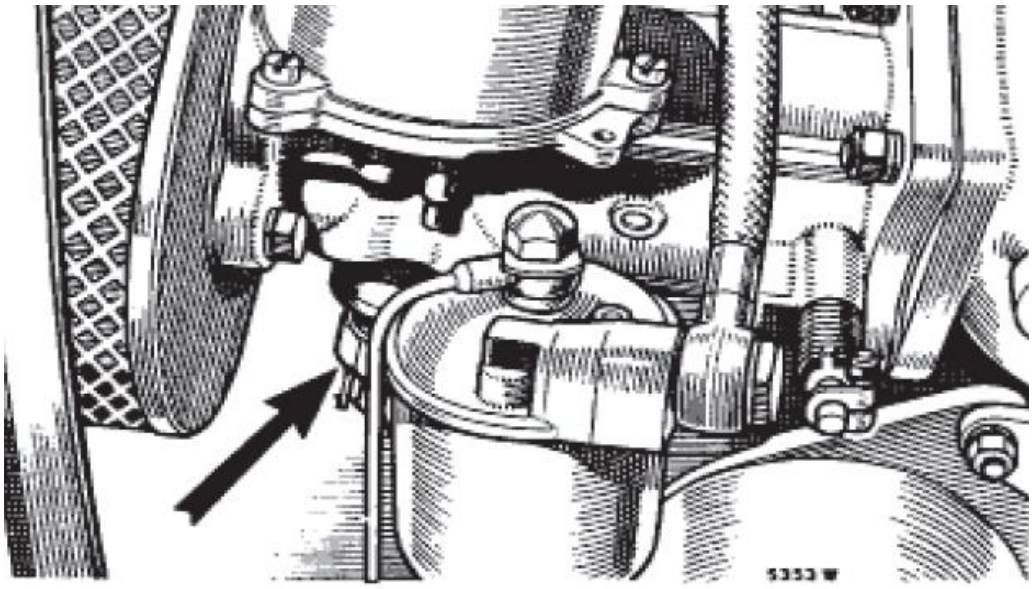


Fig. D.8 The arrow indicates the jet adjusting nut

With the engine running, set the jet adjusting nut of the rear carburetter so that a mixture strength is obtained which will give the best running speed for this particular throttle opening, taking care to see that the jet head is in firm contact with the adjusting nut the whole time.

The correctness or otherwise of this setting can be checked by raising the suction piston about 1/32 in (.8 mm.) with the piston lifting pin. This should cause a very slight momentary increase in the speed of the engine without impairing the evenness of the running If the engine stops the mixture is too weak. If the speed increases and continues to increase when the piston is raised as much as 1/4 in. (6 mm.) the mixture is too rich

When the setting of the mixture is correct for the rear carburetter, unscrew the throttle adjusting screw until the throttle is fully closed and lift the piston ½ in. (13 mm.) to put it out of action. Repeat the adjustment operations on the front carburetter.

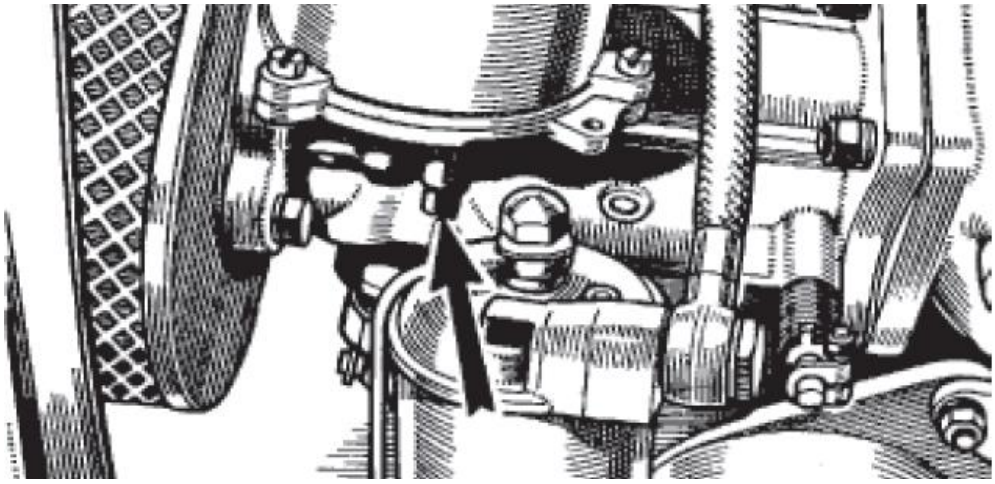


Fig. D.9 The piston lifting pin

When both carburetters are correctly adjusted for mixture set the throttle adjustment screw of each to give the required slow running. Adjust the link between the mixture levers so that each lever is moved the same amount when the mixture control is used.

Slow running and synchronization

Turn the throttle adjustment screw of each carburetter to give a fast idling speed, taking care to turn each screw the same amount. Next unscrew each throttle lever adjustment screw an equal amount, a fraction of a turn at a time, until the desired slow-running speed is obtained.

Accuracy of synchronization can be checked by listening at each carburetter air intake in turn through a length of rubber tubing and noticing if the noise produced by the incoming air is the same at both. Any Variation in the intensity of the sound indicates that one throttle is set more widely open than the other.

When the same intensity of sound is given by both carburetters the coupling shaft clip should be tightened to ensure that the throttles work in unison.

Note that a small peg in one lever fits loosely in a hole in the other lever to form a connection between the two spindles. When tightening the lever clamping nut make certain that the peg is located centrally in the hole when both throttles are closed.

Since the delivery characteristics when both carburetters are working together vary somewhat from those existing when each is working separately, it will be necessary to check again for correctness of mixture strength by lifting each piston in turn as indicated in "Adjusting the jets' and adjusting as necessary.

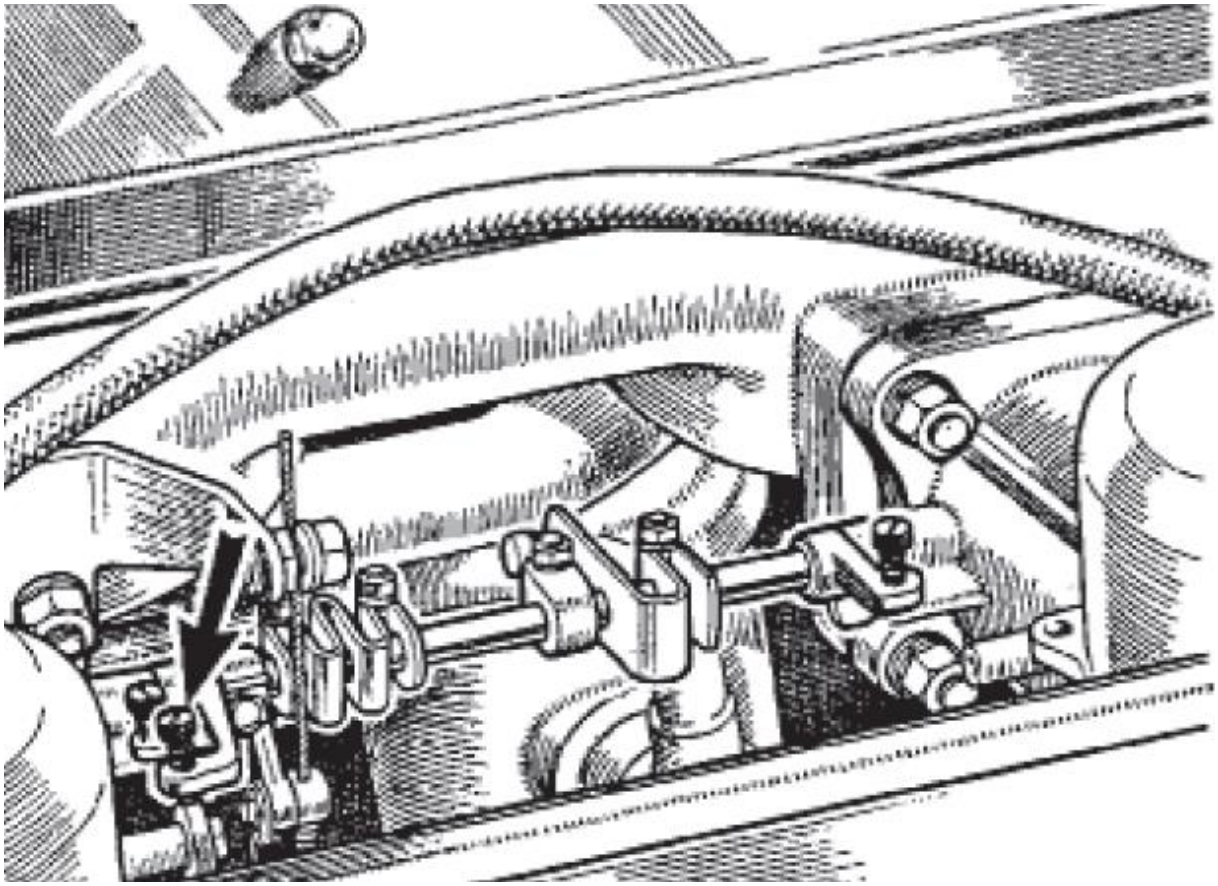


Fig. D.10 With the mixture control right home there should be a small clearance between the adjusting screw (arrowed) and the cam beneath it

D.11 REMOVING AND REPLACING THE CARBURETTERS

Disconnect the fuel supply pipe and the flexible connecting pipe at the rear carburetter union.

Remove the two set screws and spring washers securing each air cleaner and remove the air cleaners. Remove the split pin and flat washer and release the mixture cable and clevis pin from the mixture control linkage, and release the mixture outer cable abutment complete with bracket.

Remove the split pin from the jet lever interconnecting link to separate the two jet levers. Detach the throttle return spring and release the throttle cable.

Unscrew the union nut and disconnect the ignition vacuum control pipe from the front carburetter,

Remove the nut and flat washer on top of each float chamber to release the vent pipes.

Remove the four puts, spring washers, and plain washers securing each carburetter flange and withdraw the carburetters. The throttle cable abutment bracket and throttle return spring bracket will also be withdrawn.

Replacement is a reversal of the above instructions.

Do not attempt to remove the carburetters and induction manifold as an assembly. The induction manifold is secured by two studs inside the intakes and cannot be released until the carburetters are removed...!!

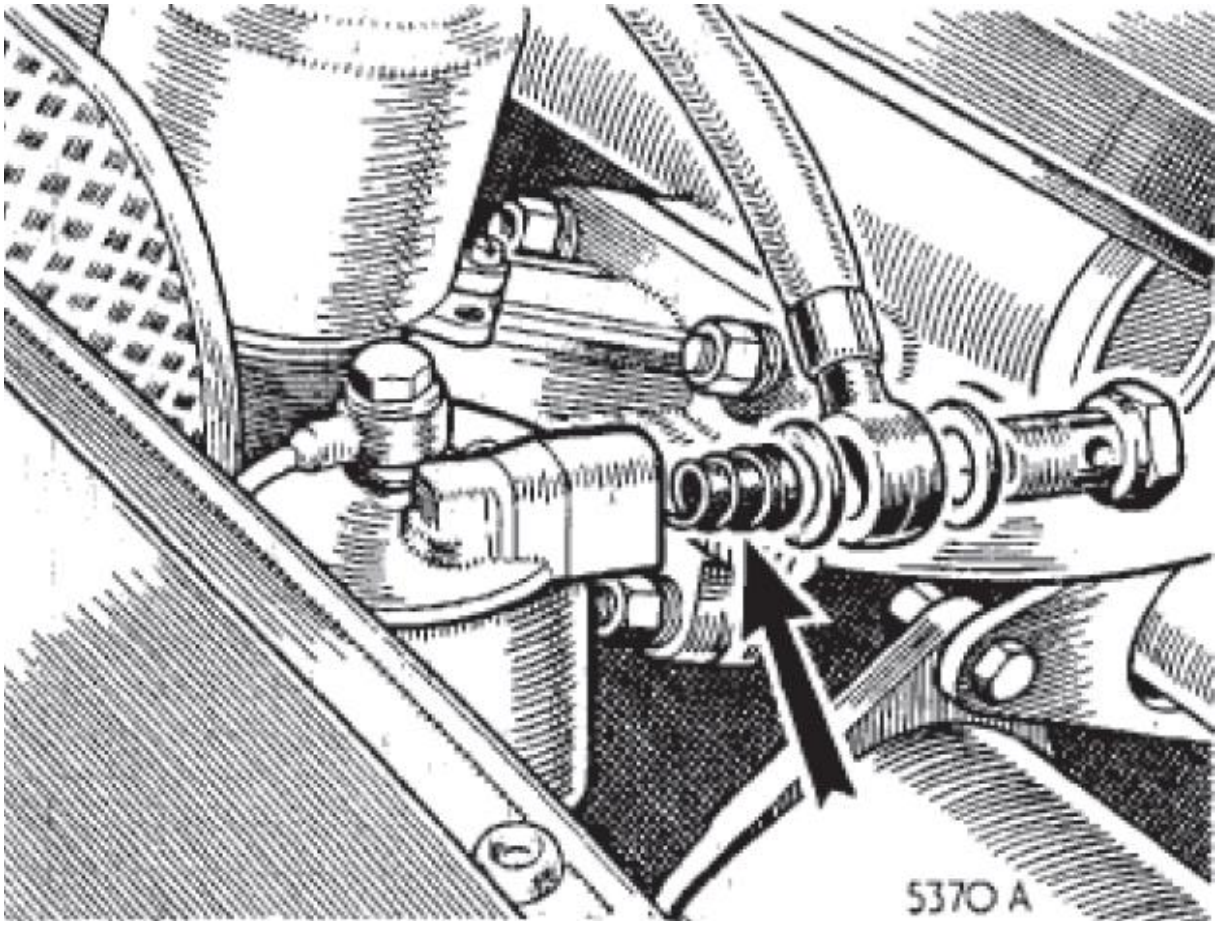


Fig. D.11 The carburetter filters should be removed and cleaned with a brush every 6,000 miles (10000 km.)

D.12 CENTERING THE JET

First remove the clevis pin at the base of the jet which attaches the jet head to the jet operating lever; withdraw the jet completely, and remove the adjusting nut and the adjusting nut spring. Replace the adjusting nut without its spring and screw it up to the highest position. Slide the jet into position until the jet head is against the base of the adjusting nut.

When this has been done remove the dashpot piston and test for free piston movement by lifting it with a finger. If it is not perfectly free, slacken the jet holding screw and manipulate the lower part of the assembly, including the projecting part of the bottom half jet bearing, adjusting nut, and jet head. Make sure that the assembly is now slightly loose. The piston should rise and fall quite freely as the needle is now able to move the jet into the required central position. Tighten the jet holding screw and check the position again. If it is still not free, slacken the jet holding screw and repeat the operation. When the piston is completely free-moving remove the adjusting nut and replace its spring. Replace the nut, screwing it to its original position.

Experience shows that a large percentage of the carburetters returned for correction have had jets removed and incorrectly centred on replacement.

D.13 SOURCES OF CARBURETTER TROUBLE

Piston sticking

The piston assembly comprises the suction disc and the piston forming the choke, into which is inserted the hardened and ground piston rod which engages in a bearing in the centre of the suction chamber and in which is, in turn, inserted the jet needle. The piston rod running in the bearing is the only part which is in actual contact with any other part, the suction disc, piston, and needle all having

suitable clearances to prevent sticking. If sticking does occur the whole assembly should be cleaned carefully, and the piston rod lubricated with a spot of thin oil. No oil must be applied to any other part except the piston rod. A sticking piston can be ascertained by removing the dashpot damper, inserting a finger in the air intake, and lifting the piston, which should come up quite freely and fall back smartly onto its seating when released. On no account should the piston return spring be stretched or its tension altered in an attempt to improve its rate of return.

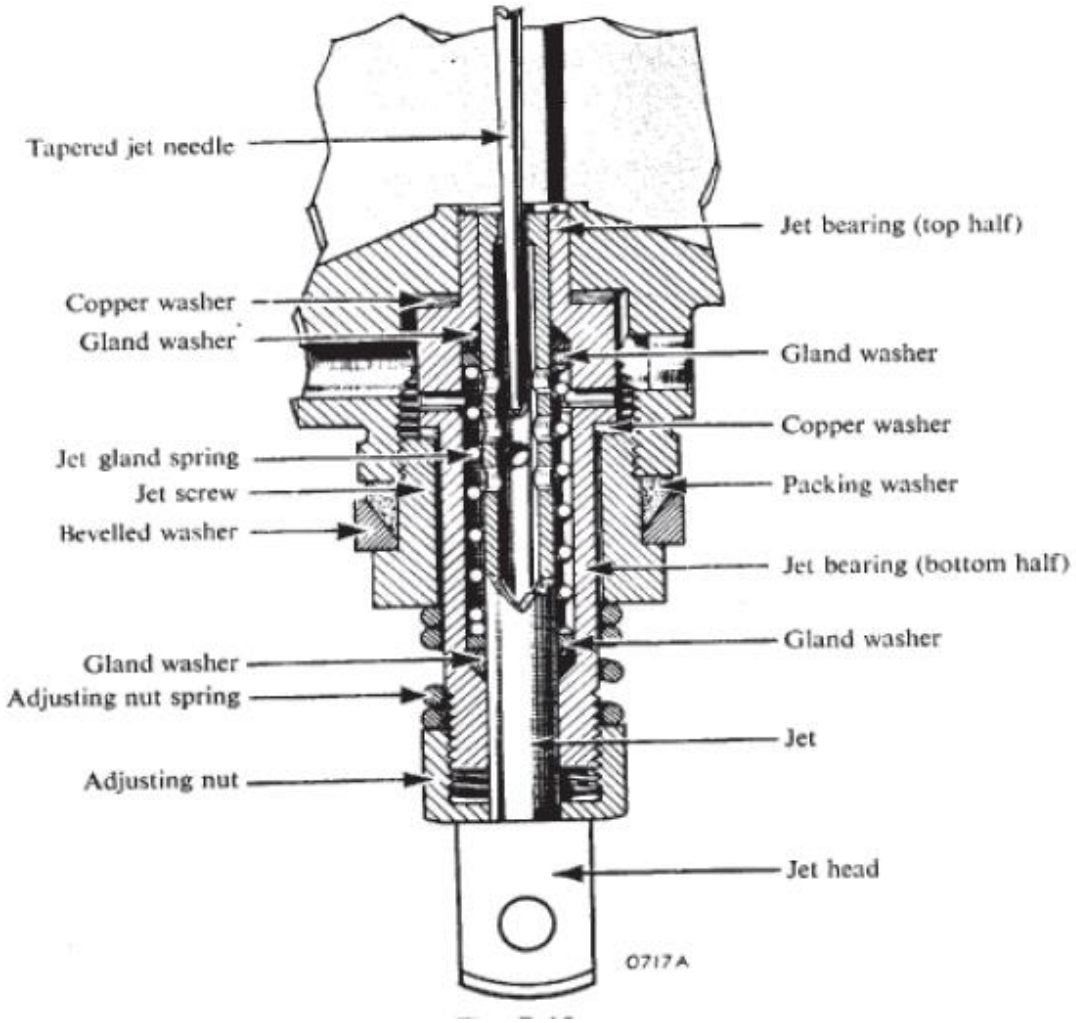


Fig. D.12 An enlarged view of the jet assembly, showing the component parts

Water or dirt in the carburetter

When this is suspected remove the air cleaners, start the engine, open the throttle, and block up the air inlet momentarily without shutting the throttle, keeping the throttle open until the engine starts to race. This trouble seldom arises with the S.U. carburetter owing to the size of the jet and fuel ways. When it does happen, the above method will nearly always clear it. Should it not do so, the only alternative is to remove the jet. This, however, should on no account be done unless it is absolutely necessary, as it has to be carefully centred when refitting. (See Section D.12.)

Float-chamber flooding

This is indicated by the fuel dripping from the drain pipe, and is generally caused by grit between the float chamber needle and its guide. This is cured by removing the float-chamber, washing the valve and float-chamber components, and reassembling. Float needle sticking

If the engine stops, apparently through lack of fuel, when there is plenty in the tank and the pump is working properly, the probable cause is a sticking float needle. An easy test for this is to disconnect the pipe from the electric pump to the carburetters and switch the ignition on and off quickly while the

end of the pipe is directed onto a pad of cloth or into a container.

If fuel is delivered, starvation is almost certainly being caused by the float needle sticking to its seating, and the float-chamber lid should therefore be removed and the needle and seating cleaned and refitted. At the same time, it will be advisable to clean out the entire fuel feed system, as this trouble is caused by foreign matter in the fuel and unless this is removed it is likely to recur. It is of no use whatever renewing any of the component parts of either carburetter, and the only cure is to make sure that the fuel tank and pipe lines are entirely free from any kind of foreign matter or sticky substance capable of causing this trouble.

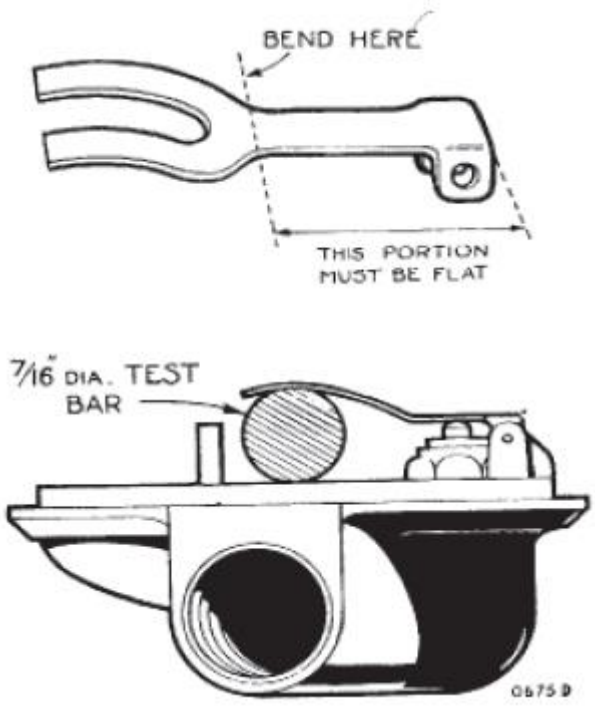


Fig. D.13 Showing the place where the float lever should be set and the method of checking the correct adjustment of the lever

D.14 AIR CLEANERS

Every 3,000 miles (4800 km.), or more frequently in dusty conditions, the air cleaners should be serviced as follows: unscrew and remove the two bolts, remove the outer cover, and withdraw the element from the body of each cleaner. Wash the element thoroughly in petrol (gasoline), drain, and dry. Wet the element with S.A.E. 20 engine oil and allow to drain before replacing.

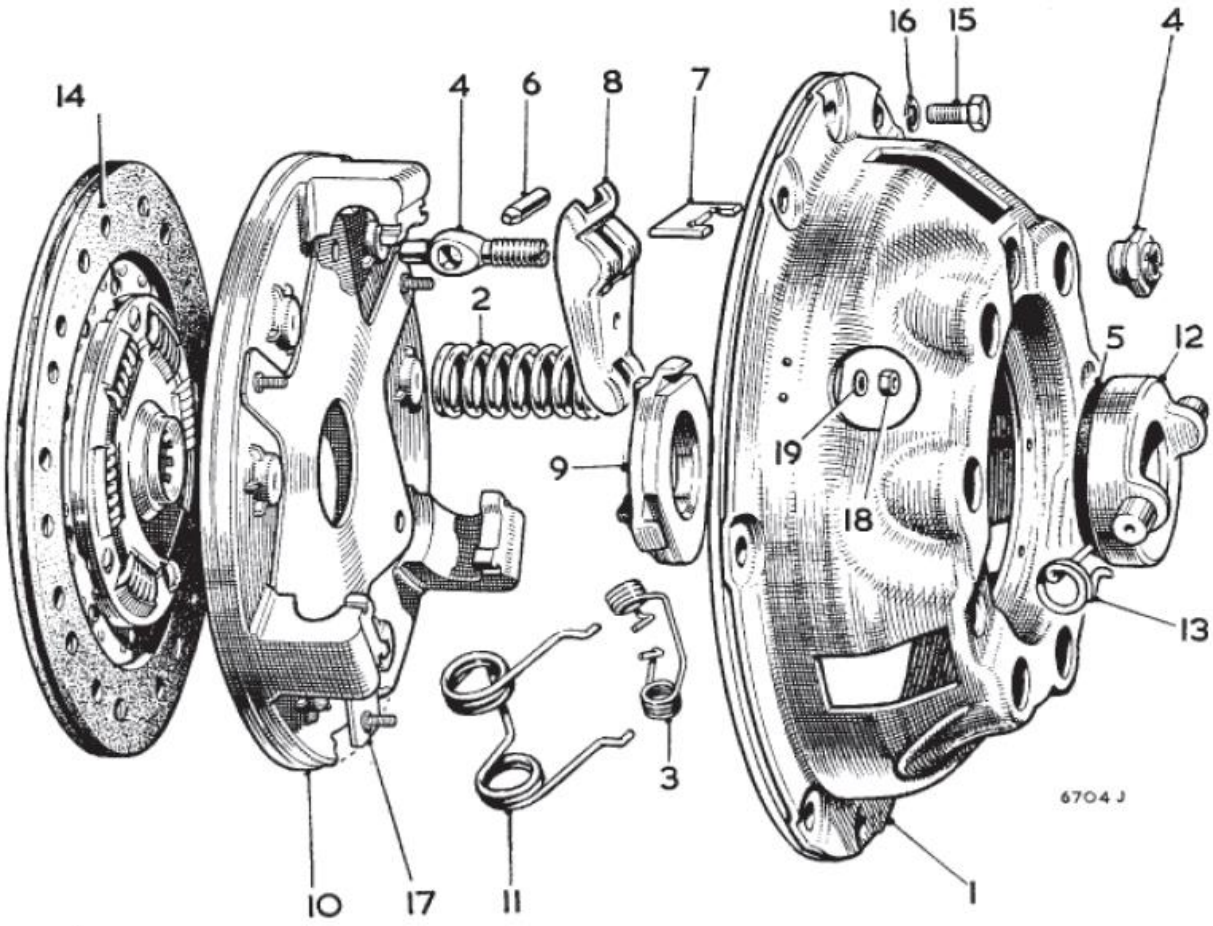
A modified air cleaner, incorporating a venturi, was introduced at Car No. 2468.

D.15 MODIFIED CARBURETTER DAMPER ASSEMBLIES

To allow the carburetter pistons to lift more freely new hydraulic damper assemblies have been fitted in production. The damper pistons of the new assemblies have been shortened from .378 in. (9.596 mm.) to .308 in. (7.823 mm.).

The new hydraulic damper assemblies (Part No. AUC8114) are identified by the letter 'O' stamped on the brass hexagon caps. They can be fitted, with advantage, to earlier carburetters in pairs. Alternatively, the original damper pistons may be modified by machining .070 in. (1.78 mm.) off their lower faces.

SECTION E THE CLUTCH



1. Clutch cover,
2. Pressure plate spring.
3. Lever retainer.
4. Eyebolt and nut.
5. Ring (carbon).
6. Pin for lever.
7. Strut.
8. Release lever.
9. Bearing thrust plate.
10. Pressure plate.
11. Anti-rattle spring.
12. Thrust ring assembly.
13. Retainer.
14. Driven plate assembly.
15. Screw over to flywheel
16. Spring washer for cover Screw.
17. Spider.
18. Nut--spider stud to cover.
19. Shake proof washer for spider nut

GENERAL DESCRIPTION

The clutch is of the single-plate dry-disc type operated hydraulically.

Driven plate assembly

This consists of a splined hub and flexible steel driven plate (c), to the outer diameter of which are fixed the annular friction facings. This plate is attached to the splined hub by a spring mounting which provides a torsional cushion.

Withdrawal bearing assembly

This comprises the graphite release bearing (D) mounted in a cup attached to the throw-out fork and a release plate (E) attached to the inner ends of the release levers (F) by means of the retainer springs (G). Release is accomplished by moving the release bearing forward into contact with the release plate and thus applying pressure to the release levers.

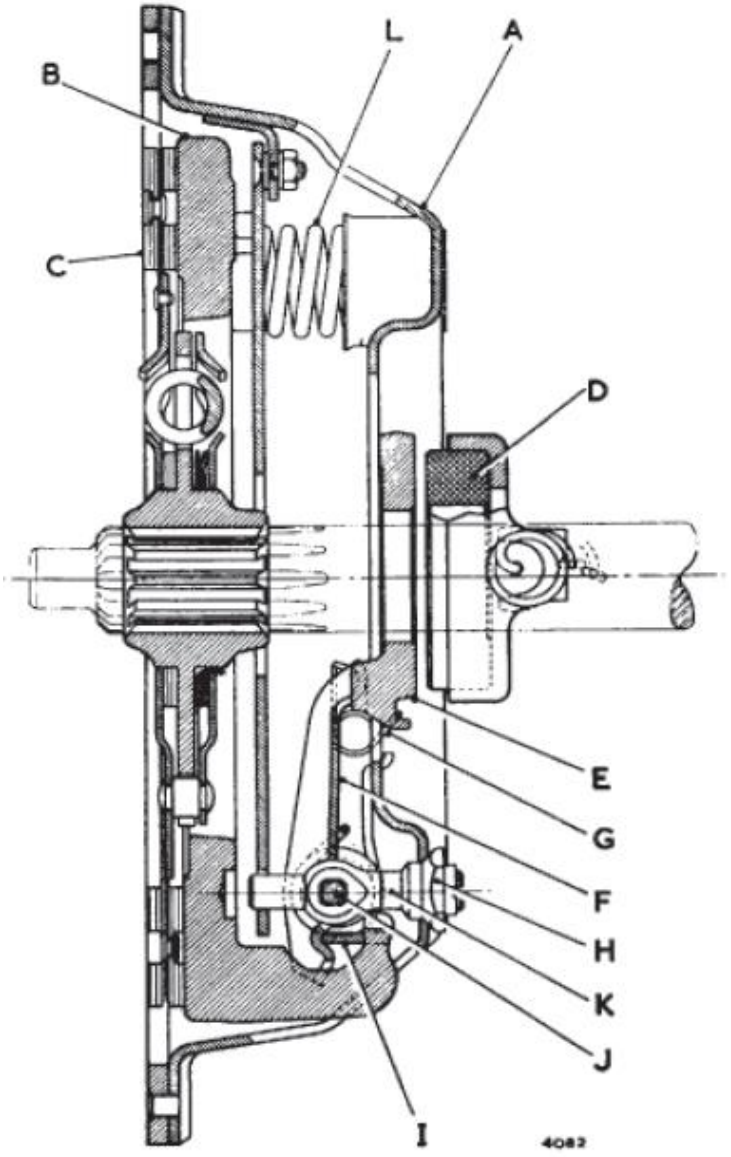


Fig. E. 1 A section through the clutch

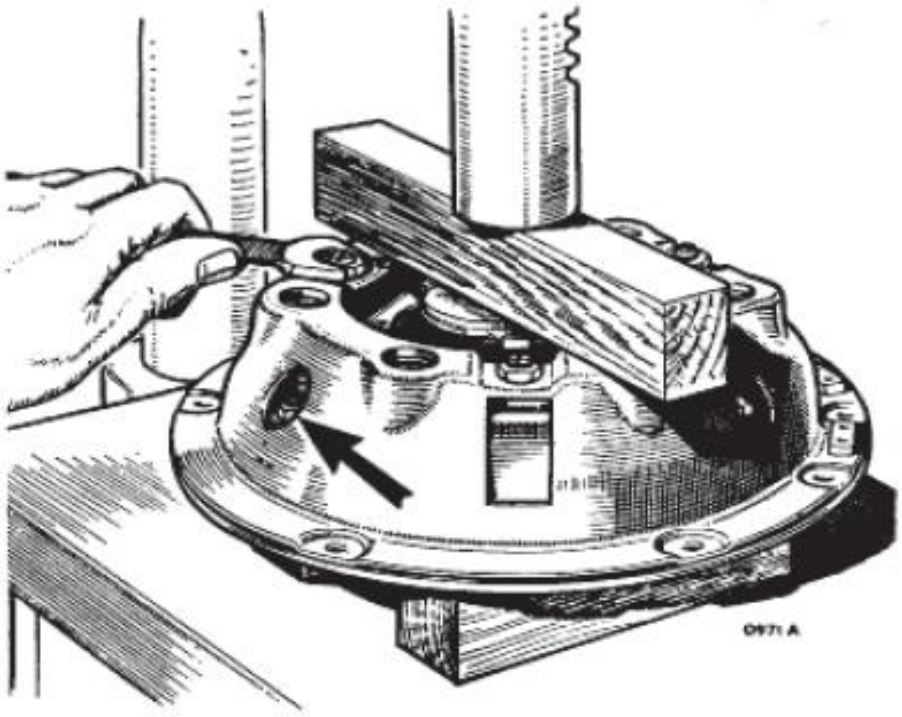


Fig. E.2 Compressing the springs with wood blocks and press. A spider securing nut is indicated by the arrow

Cover assembly

Each release lever is pivoted on a floating pin (1), which remains stationary in the lever and rolls across a short flat portion of the enlarged hole in the eyebolts (K). The outer ends of the eyebolts extend through holes in the clutch cover and are fitted with adjusting nuts (H) by means of which each lever is located in its correct position. The outer or shorter ends of the release levers engage the pressure plate lugs by means of struts (1) which provide knife-edge contact between the outer ends of the levers and the pressure plate lugs, eliminating friction at this point. Thus, the pressure plate (B) is pulled away from the driven plate (c), compressing the six thrust coil springs (L) which are assembled between the pressure plate and the clutch cover (A).

When the foot pressure is removed from the clutch pedal the clutch springs force the pressure plate forward against the driven plate, gradually and smoothly applying the power of the engine to the rear wheels.

Hydraulic operation

The clutch master cylinder, complete with integral reservoir, is bolted to the chassis frame adjacent to the brake master cylinder. Depression of the clutch pedal causes the piston to move along the polish-finished master cylinder bore. Fluid pressure is transmitted to a slave cylinder bolted to the clutch housing, moving the piston, push-rod, and clutch lever and disengaging the clutch.

E.1 ADJUSTMENT

It is essential that there should be a clearance between the master cylinder push-rod and the piston when the clutch pedal is released. This clearance, 1 in. (-8 mm.), is adjusted by slackening the locknut and rotating the push-rod in the appropriate direction. Ensure that the pedal is not obstructed by the toeboard or by the floor covering. The free movement at the pedal pad must be sufficient to allow the piston to return fully in the cylinder and still retain the1/32 in. (.8 mm.) clearance at the pushrod.

Excessive movement may indicate lack of fluid or the need for bleeding; whenever the system is drained, bleeding will be required after refilling.

E.2 MASTER CYLINDER

Description

The inner assembly of the master cylinder is made up of the push-rod, circlip, dished washer, plunger, end seal, plunger seal, spring thimble, plunger return spring, valve spacer, spring washer, valve stem, and valve seal. The open end of the cylinder is protected by a rubber dust seal.

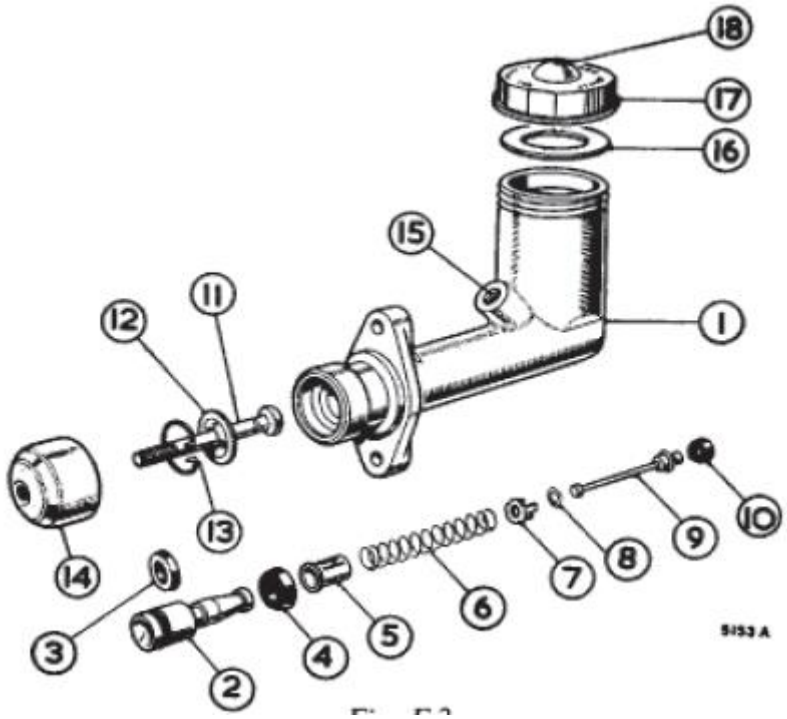


Fig. E.3 The clutch master cylinder components

1. Master cylinder body.
2. Plunger.
3. End seal.
4. Plunger seal.
5. Spring thimble
6. Spring
7. Valve spacer.
8. Spring washer
9. Valve stem.
10. Valve seal.
11. Push-rod.
12. Retaining washer.
13. Circlip.
14. Dust cover
15. Outlet.
16. Cap washer.
17. Filler cap.
18. Air vent

Removal

Extract the split pin and withdraw the clevis pin from the push-rod yoke. Disconnect the pressure pipe union from the cylinder and remove the two self-locking nuts, washers, and bolts from the master cylinder mounting bracket. The master cylinder may now be withdrawn from the vehicle.

Dismantling

Remove the retaining circlip with a pair of long nosed pliers and extract the dished washer and pushrod. When the push-rod has been removed the plunger with seals attached will be exposed; remove the plunger assembly complete. The assembly can be separated by lifting the thimble leaf over the shouldered end of the plunger. Depress the plunger return spring, allowing the valve stem to slide through the elongated hole in the thimble, thus releasing the tension on the spring. Remove the thimble, spring, and valve complete. Detach the valve spacer, taking care of the spacer spring washer which is located under the valve head, and remove the seal from the valve head.

Examine all parts, especially the seals, for wear or distortion and fit new parts where necessary.

Assembly

Replace the valve seal so that the flat side is correctly seated on the valve head. The spring washer should then be located with the domed side against the underside of the valve head, and held in position by the valve spacer, the legs of which face towards the valve seal. Replace the plunger return spring centrally on the spacer, insert the thimble into the spring, and depress until the valve stem engages through the elongated hole of the thimble, ensuring that the stem is correctly located in the centre of the thimble. Check that the spring is still central on the spacer. Fit a new plunger seal with the flat face of the seal against the face of the plunger. Refit the plunger end seal, using a new seal if necessary.

Insert the reduced end of the plunger into the thimble until the thimble leaf engages under the shoulder of the plunger. Press home the thimble leaf.

Smear the plunger assembly with the recommended fluid, and insert the assembly into the cylinder bore, valve end first, carefully easing the plunger seal lips into the bore. Replace the push-rod, with the dished side of the washer under the spherical head, into the cylinder, followed by the circlip, which engages in the groove machined in the cylinder body.

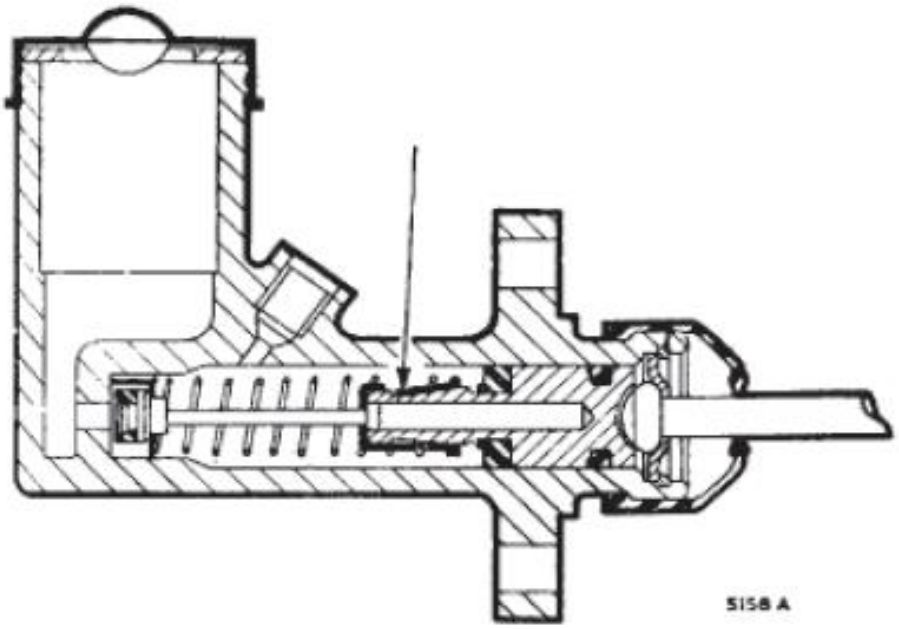


Fig. E.4 The master cylinder. The arrow indicates the thimble

Replacement

Locate the master cylinder on the mounting bracket on the bulkhead and fit the bolts, washers, and self-locking nuts. Replace the rubber dust cover. Line up the push-rod fork with the hole in the clutch pedal lever, insert the clevis pin, and secure it with a new split pin. Finally, bleed the system as detailed in Section E.4.

E.3 SLAVE CYLINDER

Description

The slave cylinder is of simple construction, consisting of an alloy body, piston with seal, spring, and bleed screw. The open end is protected by a rubber dust cover. Two bolts with spring washers secure the slave cylinder to the clutch housing.

Dismantling

Remove the rubber dust cover, and with an air-line blow out the piston and seal. Extract the spring.

Examine all parts, especially the seal, and renew if worn or damaged.

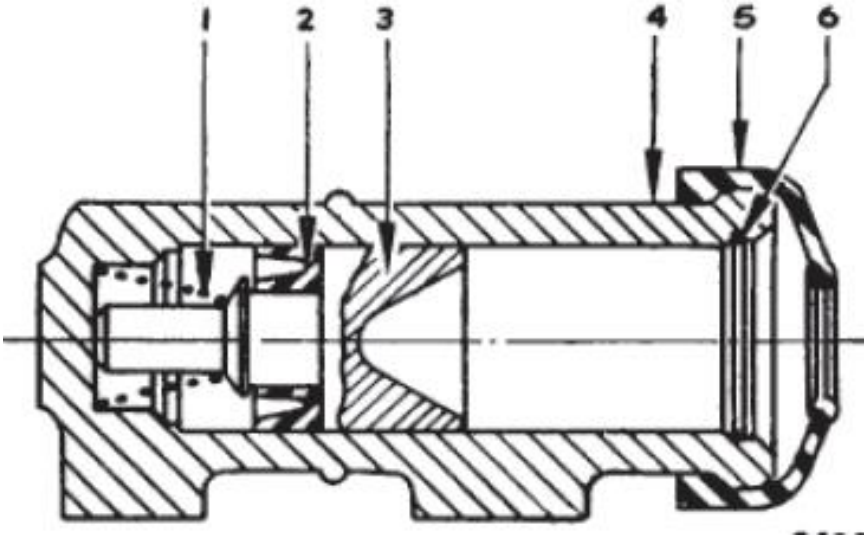


Fig. E.5 The clutch slave cylinder components

1. Spring
2. Seal.
3. Piston.
4. Body.
5. Dust cover.
6. Circlip

Removal

Attach a rubber tube to the bleed screw and open the screw three-quarters of a turn. Pump the clutch pedal until all the fluid has been drained into a clean container. Unscrew the pressure pipe union and remove the two bolts and spring washers securing the cylinder to the clutch housing. The cylinder may now be removed from the vehicle, leaving the push-rod attached to the clutch fork.

Assembly

Place the seal on the stem of the piston with the back of the seal against the piston (see Fig. E.5). Replace the spring with the small end on the stem, smear well with the recommended fluid, and insert into the cylinder.

Replacement

Replace the rubber dust cover on the cylinder and locate the cylinder in its correct position on the clutch housing, ensuring that the push-rod enters the hole in the rubber boot. Replace the two mounting bolts and spring washers. Refit the pressure pipe union, taking care to fit the copper washers correctly, and bleed the system as described in Section E.4.

E.4 BLEEDING THE CLUTCH SYSTEM

Open the bleed screw on the slave cylinder threequarters of a turn and attach a tube, immersing the open end in a clean receptacle containing a small quantity of the recommended hydraulic fluid. Fill the master cylinder reservoir with fluid. The use of Girling Hydraulic Brake Fluid is recommended, but if this is not available an alternative fluid conforming to Specification S.A.E. 70. RI should be used. Using slow, full strokes, pump the clutch pedal until the fluid entering the container is completely free from air bubbles. On a downstroke of the pedal tighten the bleed screw and remove the bleed tube.

E.5 REMOVING THE CLUTCH

Remove the gearbox as detailed in Section F.I.

Loosen each of the hexagon bolts securing the clutch to the flywheel by slackening them a turn at a time until spring pressure is released. The clutch cover can now be disengaged from the flywheel

dowels and the whole assembly lifted from the flywheel.

E.6 DISMANTLING THE CLUTCH

Two methods are possible in dismantling the clutch: (a) Using the clutch gauging fixture, and (b) Using a press and blocks of wood.

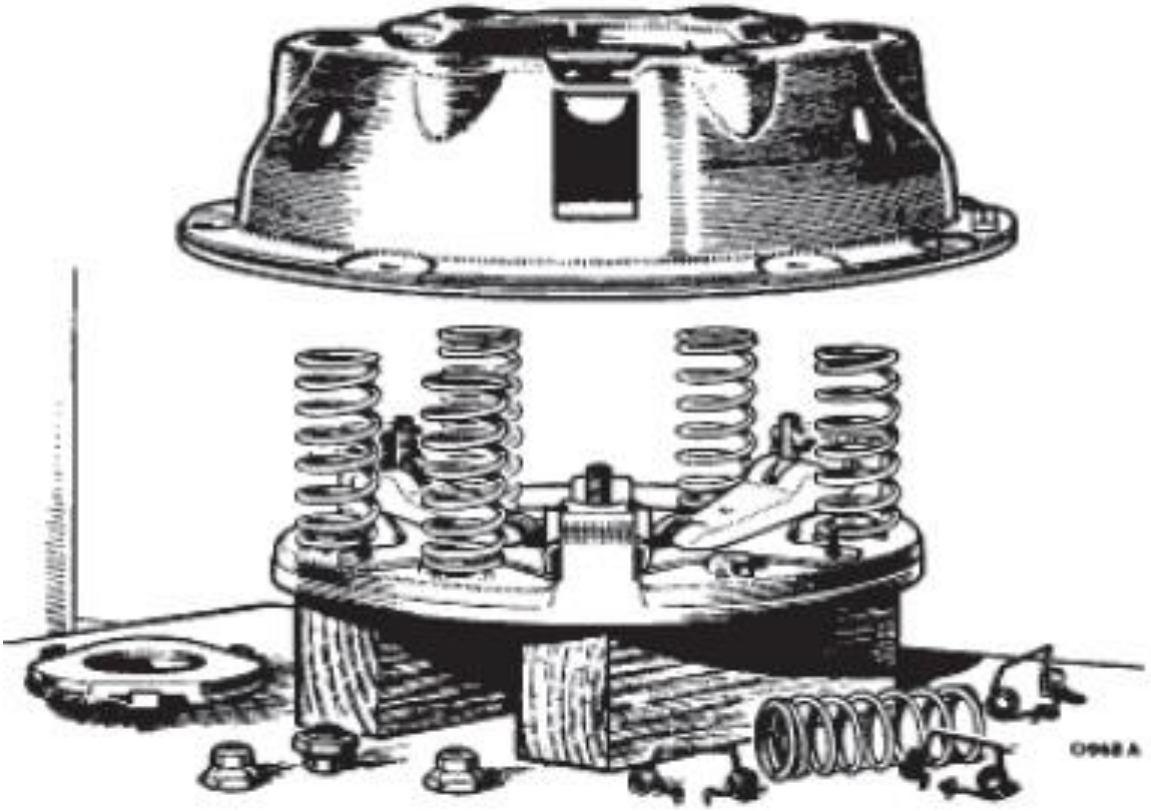


Fig. E.6 The clutch dismantled

Using the clutch gauging fixture (Fig. E.8)

Remove the three release plate retaining springs and lift off the release plate. Consult the code card to determine the correct spacers for the particular clutch. Place the spacers on the base plate in the positions indicated on the code card and place the clutch on the spacers. Screw the set bolts firmly into the base plate to secure the cover.

Remove the three adjuster nuts gradually to relieve the load of the thrust springs. Remove the three 2 BA nuts and shake proof washers (see Fig. E.2) securing the spider to the cover.

Unscrew the set bolts from the base plate and lift off the clutch cover.

Any additional dismantling that may be necessary can now be carried out using a press and wood blocks (Fig. E.2)

Place the cover on the bed of a press with the pressure plate resting on wood blocks so arranged that the cover is left free to move downwards. Place a block or bar across the top of the cover, resting it on the spring bosses.

Apply pressure to the cover with the spindle of the press and, holding it under compression, remove the three adjusting nuts. Remove the three 2 BA nuts and shake proof washers securing the spider to the clutch cover (see Fig. E.2). The pressure from the press may now be released gradually until the clutch springs are fully extended.

While stripping down the cover-plate assembly the parts should be marked so that they may be reassembled in the same relative position to each other, to ensure that the correct balance is

maintained. When a new pressure plate is fitted it is essential that the complete cover and pressure plate assembly be accurately balanced, for which reason it is not a practical proposition to fit new pressure plates unless balancing facilities are available

All parts are available for inspection when the cover is lifted off.

To remove the release levers, grasp the lever and eyebolt between the thumb and fingers so that the inner end of the lever and the threaded end of the eyebolt are as near together as possible, keeping the eyebolt pin seated in its socket in the lever. The strut can then be lifted over the ridge on the end of the lever, making it possible to lift the eyebolt off the spider. It is advisable to renew any parts which show signs of wear.

E.7 ASSEMBLING THE CLUTCH

Lay the pressure plate on the wood block on the bed of the press (or on the base plate of the special tool with the three adaptors in position). Place the spider on the pressure plate in its correct position and seat the springs on their small locating bosses on the pressure plate. Thoroughly clean all parts and renew any which show excessive wear.

Assemble the release levers, eyebolts, and eyebolt pins. Hold the threaded end of the eyebolt and the inner end of the lever as close together as possible. With the other hand insert the strut in the slots of the pressure plate lug just sufficiently to allow the plain end of the eyebolt to be inserted through the hole in the spider and into the hole in the pressure plate. Move the struts upwards into the slots in the pressure plate lugs, over the ridge on the short end of the lever, and drop it into the grooves formed in the lever.

Lay the cover over the parts, taking care that the anti-rattle springs are in position as shown in Fig. E.6 and that the springs are located in the cups provided in the cover. Also make sure, if using the original parts, that the eyebolts, eyebolt nuts, pressure plate lugs, and cover are fitted in their correct relative positions, as marked when dismantling, to ensure the correct balance being maintained.

Compress the springs either by fitting and tightening evenly the six clutch cover bolts (if the special tool is being used), or by the use of a wooden block across the cover and a press. Take care to guide the eyebolts and the pressure plate lugs through the correct holes in the cover. The three studs on the spider must also be lined up to pass through their locations in the cover when the pressure is applied. Make certain that the thrust springs remain correctly in their seats on the pressure plate and the cups in the cover.

Replace the eyebolt nuts on the eyebolts and secure the spider to the clutch cover with the three 2 BA nuts and shake-proof washers.

Release the pressure compressing the cover assembly and adjust the release levers (Section E.8).

E.8 ADJUSTING THE RELEASE LEVERS

Satisfactory operation of the clutch is dependent upon accurate adjustment of the release levers, so that the pressure plate face is maintained parallel to the flywheel face. This cannot be accomplished by setting the levers parallel to the face of the release bearings after the clutch has been assembled to the flywheel because of the variations in the thickness of the driven plate.

For accurate adjustment the universal gauging fixture must be used.

After carrying out any necessary servicing reassemble the parts on the clutch pressure plate, and place the cover on it and the whole assembly on the base plate of the gauging fixture. The release plate should not be fitted at this stage. It is essential that the correct spacers (see note) be used.

Bolt the cover to the base plate and screw the adjusting nuts onto the bolts until the tops of the nuts are flush with the tops of the bolts. Screw the actuator into the base plate and work the handle a dozen times to settle the mechanism. Remove the actuator. Screw the pillar firmly into the base plate and place the special adaptor (see note) on the pillar with the recessed side downwards; place the gauge finger in position.

Turn the adjusting nuts until the finger just touches each release lever, pressing downwards on the finger assembly to ensure that it is bearing squarely on the adaptor. Remove the finger and the pillar and replace the actuator; operate the actuator several times. Re-check with the finger assembly and make any necessary further adjustments.

Lock the adjusting nuts.

NOTE. —The clutch used on this vehicle differs from the normal 8" type and a special adaptor (Part No. 18699B) must be used in conjunction with the gauge plate in place of the adaptor (code No. 6) shown on the code card. The three spacers to be used with this adaptor are the same as those indicated for use on the standard 8" clutch (code No. 2).

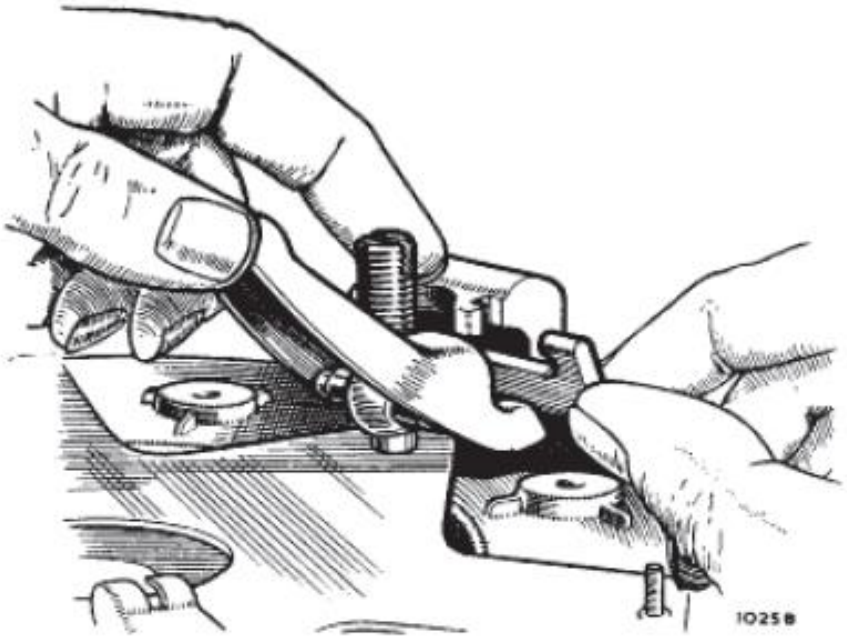


Fig. E.7 Assembling the release levers

E.9 REFITTING THE CLUTCH

Position the driven plate assembly on the flywheel, taking care to place the larger-chamfered spline end of the driven plate hub away from the flywheel.

Centralize the driven plate by means of the special alignment bar (Part No. 18G39) which fits the splined bore of the driven plate hub and the pilot bearing in the flywheel. As an alternative a spare first motion shaft can be used.

Locate the cover assembly on the flywheel dowels and secure with the bolts, tightening them a turn at a time by diagonal selection. Do not remove the clutch alignment bar until all the bolts are securely tightened.

Remove the clutch alignment bar and refit the gearbox. The weight of the gearbox must be supported during refitting in order to avoid strain on the shaft and distortion or displacement of the release plate or driven plate assembly.

E.10 SERVICING THE CLUTCH

As the clutch facings wear, the pressure plate moves closer to the flywheel face and the outer or shorter ends of the release levers follow. This causes the inner or longer ends of the levers to travel farther towards the gearbox. As the release bearing moves rearwards it must result in pushing the piston in the clutch slave cylinder inwards. The piston then forces the excess fluid back into the master cylinder via the compensating orifice.

Provided that the minimum 1/32 in. (.8 mm.) free movement is maintained between the clutch pedal

push-rod and the master cylinder piston, this automatic compensation for wear will always take place.

Should there be no free movement at this point, the master cylinder piston will not be allowed to return fully to its stop and therefore the compensating orifice will be cut off.

Excessive pedal movement causes coil binding of the springs and imposes an undue load on the bearing and on the crankshaft, causing excessive and rapid bearing wear. It therefore follows that the required pedal travel is the sum of the two movements:

1. The free movement or travel necessary to take up the clearance between the master cylinder push-rod and the master cylinder piston, provided to ensure that the clutch is fully engaged when the foot is removed from the pedal. (See Section E.1.)
2. The effective movement, or travel necessary to release the clutch, i.e. the amount of effective pedal movement necessary to move the release plate the distance required to free the clutch completely.

If any difficulty is experienced in freeing the clutch when the correct release movement is provided, on no account should efforts be made to improve matters by attempting to increase the effective pedal travel. The actual cause of the trouble must be ascertained and rectified.
To obtain a clean release the release lever plate should move a distance of 5/16in. (8 mm.) towards the flywheel.

Spring pressure

A tolerance of not more than 10 to 15 lb. (4.5 to 6.8 kg.) pressure is allowable on the compression load of the operating springs when at their assembled height, and all clutch springs are tested for this before assembly.

The clutch operating springs are not affected by high clutch temperatures, as the pressure plate absorbs heat rapidly, the springs have only line contact, and a draught is continually passing under them when the engine is running.

Tolerances

Wear on the working faces of the driven plate is about .001 in. (.02 mm.) per 1,000 miles (1600 km.) under normal running conditions. The accuracy of the alignment of the face of the driven plate must be within .015 in. (.38 mm.).

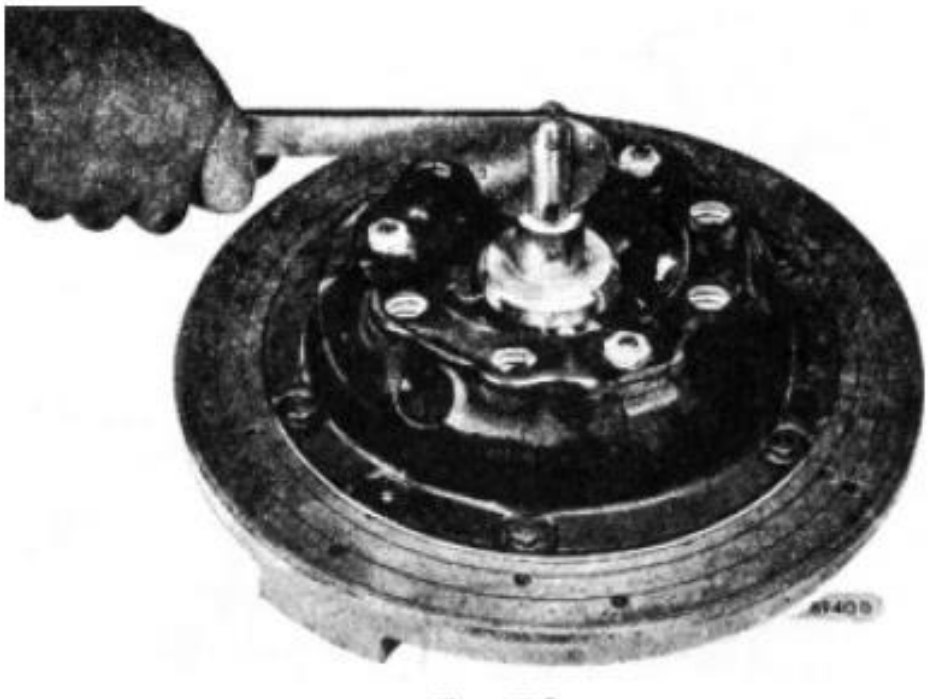


Fig. E.8 The use of the actuator to compress the clutch springs

Driven plates

It is important that neither oil nor grease should contact the clutch facings.

Lubrication of the splines of the driven plate is provided at assembly only, when CS881 graphite grease or zinc-based Keenol is used.

It is essential to install a complete driven plate assembly when renewal of the friction surfaces is required. If the facings have worn to such an extent as to warrant renewal, then slight wear will have taken place on the splines, and also on the torque reaction springs and their seating. The question of balance and concentricity is also involved. Under no circumstances is it satisfactory to repair or rectify faults in clutch driven plate centres, and we do not countenance this as manufacturers.

Condition of clutch facings in service

It is natural to assume that a rough surface will give a higher frictional value against slipping than a polished one, but this is not necessarily correct. A roughened surface consists of small hills and dales, only the "high spots' of which make contact. As the amount of useful friction for the purpose of taking up the drive is dependent upon the area in actual contact, it is obvious that a perfectly smooth face is required to transmit the maximum amount of power for a given surface area.

Since non-metallic facings of the moulded asbestos type have been introduced in service the polished surface is common, but it must not be confused with the glazed surface which is sometimes encountered due to conditions to be detailed subsequently. The ideally smooth or polished condition will therefore provide proper surface contact, but a glazed surface entirely alters the frictional value of the facing and will result in excessive clutch slip. These two conditions might be simply illustrated by comparison between a piece of smoothly finished wood and one with a varnished surface; in the former the contact is made directly by the original material, whereas in the latter instance a film of dry varnish is interposed between the contact surfaces and actual contact is made by the varnish.

If the clutch has been in use for some little time under satisfactory conditions the surface of the facings assumes a high polish through which the grain of the material can be seen clearly. This polished facing is of light colour when in perfect condition.

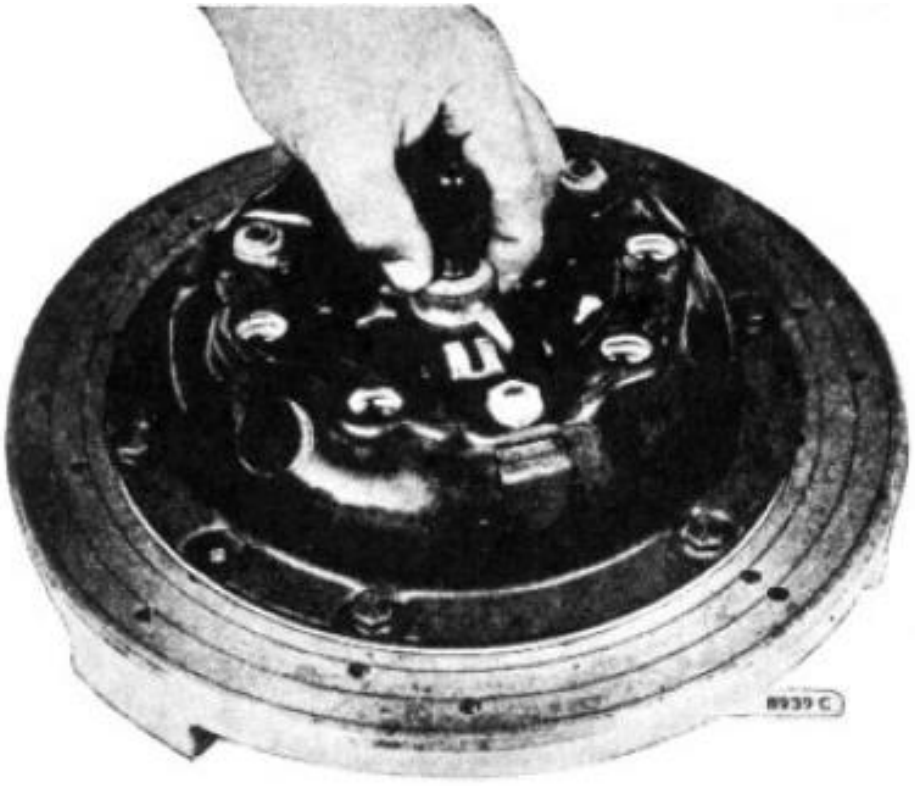


Fig. E.9 Checking the setting of the release levers

Should oil in small quantities gain access to the clutch and find its way onto the facings, it will be burnt off as a result of the heat generated by the slipping occurring under normal starting conditions. The burning of this Small quantity of lubricant has the effect of gradually darkening the facings, but, provided the polish of the facing remains such that the grain of the material can be distinguished clearly, it has little effect on clutch performance.

Should increased quantities of oil obtain access to the facing, then one of two conditions, or a combination of these, may arise, depending upon the nature of the oil.

1. The oil may burn off and leave a carbon deposit on the surface of the facings, which assume a high glaze, producing further 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. This has a tendency to produce a fierce clutch, and may also cause excessive ‘spinning' due to the tendency of the face of the linings to adhere to the surface of the flywheel or pressure plate.
3. There may be a combination of conditions (1) and (2) which produces a tendency to 'judder' on such engagement.

Still greater quantities of oil produce a dark and soaked appearance of the facings, and the result will be further slip, accompanied by fierceness or 'juddering:

If the conditions enumerated above are experienced, the clutch driven plate should be replaced by a new one. **The cause of the presence of the oil must be traced and removed.** It is, of course, necessary for the clutch and flywheel to be cleaned out thoroughly before assembly.

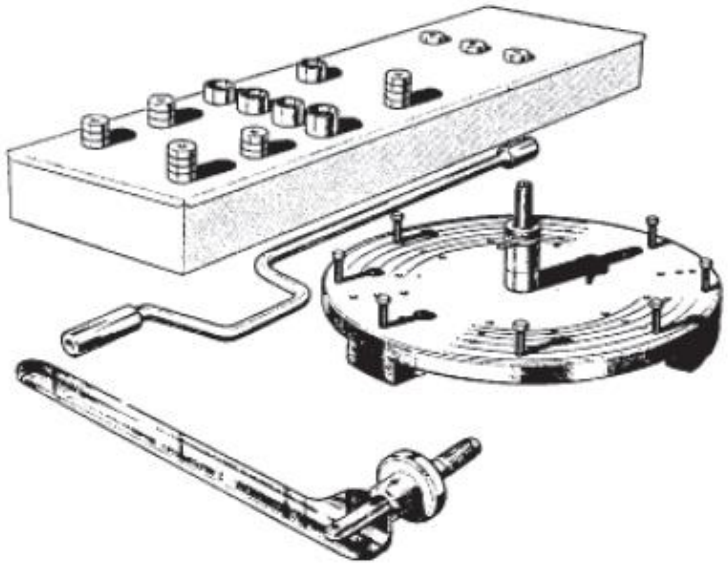
Where the graphite release bearing ring is badly worn in service a complete replacement assembly should be fitted, returning the old assembly for salvage of the metal cup. These graphite rings are inserted into their metal cup by heating the metal cup to a cherry red, then forcing the graphite ring into position. Immediately the ring is forced into position the whole should be quenched in oil. Alignment of the thrust pad in relation to its face and the trunnions should be within .005 in. (.12 mm.).

In almost every case of rapid wear on the splines of the clutch driven plate misalignment is responsible.

Looseness of the driven plate on the splined shaft results in noticeable backlash in the clutch. Misalignment also puts undue stress on the driven member, and may result in the hub breaking loose from the plate, with consequent total failure of the clutch.

It may also be responsible for a fierce chattering or dragging of the clutch, which makes gear changing difficult. In cases of persistent difficulty, it is advisable to check the flywheel for truth with a dial indicator. The dial reading should not vary more than 003 in. (-07 mm.) anywhere on the flywheel face.

SERVICE TOOLS



18G99A

18G99A. Clutch Dismantling, Reassembling and Gauging

Fixture With the use of this tool a clutch assembly can be quickly dismantled, rebuilt and finally adjusted with a high degree of accuracy. This is a universal tool for clutch assemblies from 6 ¼ in. to 11 in. (158 to 279 mm.) diameter.

18G99B

18G99B. Adaptor

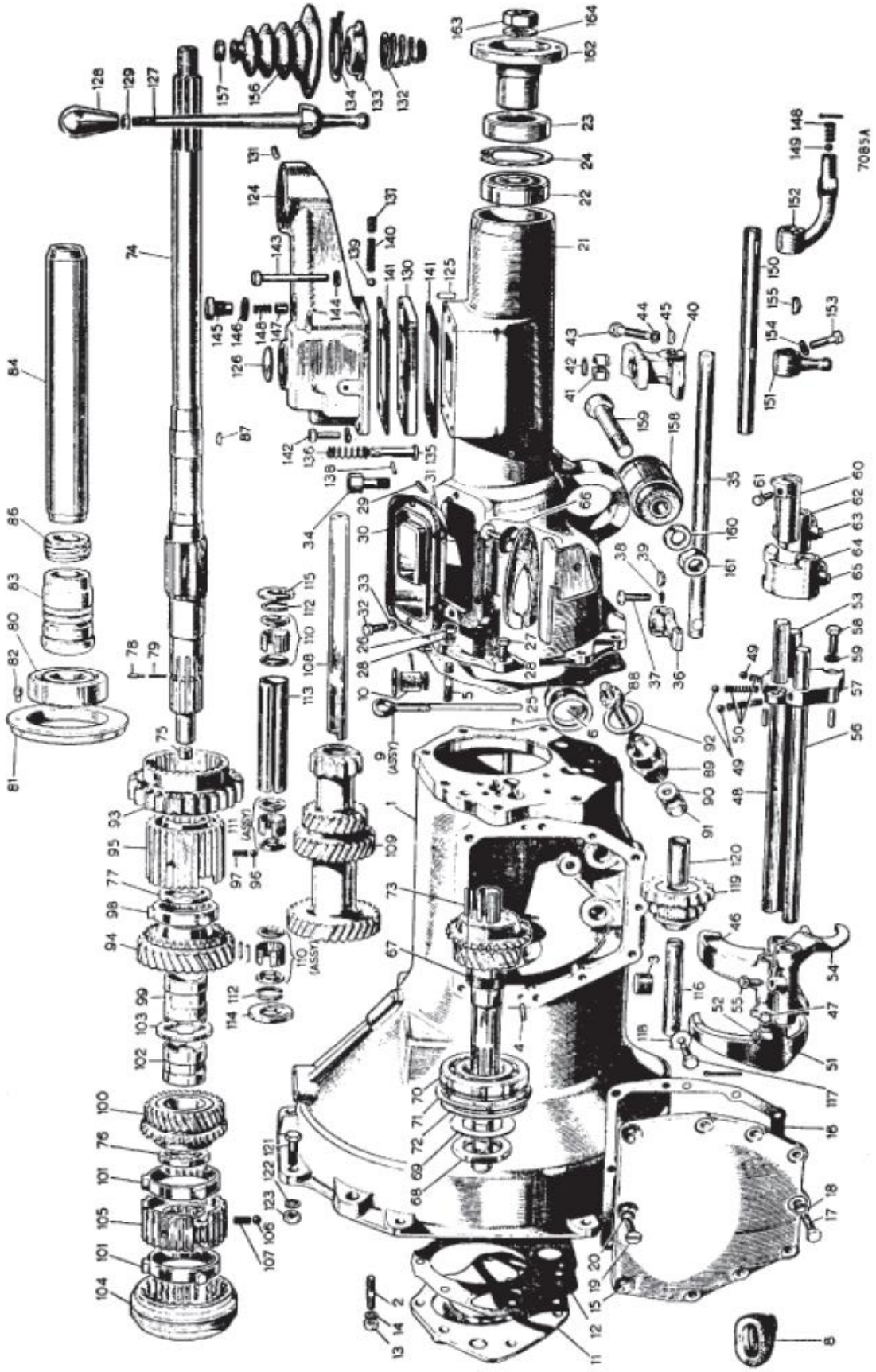
This adaptor is essential when carrying out adjustments to the 8-in. sports clutch as fitted to the MGA (Twin Cam). It is used in conjunction with the gauging fixture (18699A) in place of the adaptor (Code No. 6) shown on the code card for use on the standard type 8-in. clutch.

18G39

18G39. Clutch Plate Centralizer

This tool is used when bolting the clutch cover assembly to the flywheel to centralize the driven plate. It ensures that when fitting the gearbox to the engine that the first motion shaft passes easily through the clutch driven plate hub and locates in the spigot bearing in the end of the crankshaft.

SECTION F THE GEARBOX



1. Casing-gearbox.
2. Stud-front cover.
3. Plug-drain.
4. Dowel-side cover to gearbox.
5. Stud-gearbox extension.
6. Plug-blanking.
7. Joint washer-blanking plug.
8. Dust cover-clutch withdrawal lever
9. Dipstick.
10. Felt.
11. Cover-front
12. Joint-front cover
13. Nut-front cover studs.
14. Spring washer-front cover stud.
15. Cover-side.
16. Joint-side cover.
17. Set screw-side cover.
18. Spring washer-side cover screw.
19. Countersunk screw-side cover.
20. Shake proof washer-countersunk screw
21. Extension-gearbox.
22. Rear extension bearing.
23. Oil seal.
24. Circlip
25. Joint extension to gearbox.
26. Nut-gearbox extension stud.
27. Set screw - gearbox extension.
28. Spring washer-stud and set screw.
29. Plug-taper-gearbox extension
30. Cover-extension side
31. Joint-extension side cover
32. Set screw-extension side cover
33. Spring washer
34. Breather assembly.
35. Shaft-remote control.
36. Lever-selector-front.
37. Set screw-front lever.
38. Spring washer-set screw
39. Key-selector lever.
40. Lever-selector-rear.
41. Bush-rear selector lever.
42. Circlip-lever bush.
43. Set screw-rear lever.
44. Spring washer-set screw.
45. Key-selector lever.
46. Fork-1st and 2nd speed.
47. Screw-fork locating.
48. Shaft-1st and 2nd speed fork.
49. Ball-shaft.
50. Spring-ball.
51. Fork-3rd and 4th speed.
52. Screw-fork locating
53. Shaft-3rd and 4th speed fork
54. Fork-reverse.
55. Screw-fork locating.
56. Shaft-reverse fork.
57. Block-shaft locating.
58. Set screw-block to casing.
59. Spring washer-block screw.
60. Selector-1st and 2nd gear.
61. Screw-selector locating.
62. Selector-3rd and 4th gear.
63. Screw-selector locating.
64. Selector-reverse gear.
65. Screw-reverse gear selector.
66. Interlock arm complete.
67. Shaft-1st pinion.
68. Nut-shaft.
69. Lock washer.
70. Bearing-ball-shaft.
71. Spring ring-bearing.
72. Shim-bearing.
73. Rollers-needle-shaft
74. Shaft-3rd motion
75. Restrictor-oil.
76. Washer-thrust-front.
77. Washer-thrust-rear.
78. Peg-thrust washer-front.
79. Spring-peg.
80. Bearing – rear- 3rd motion shaft
81. Housing bearing
82. Peg - locating

83. Distance-piece-speedometer
84. Nut-shaft and speedometer gear.
85. Lock washer.
86. Gear-speedometer drive.
87. Key-gear.
88. Pinion-speedometer drive.
89. Bush-pinion.
90. Oil seal-pinion.
91. Ring-oil seal retaining.
92. Joint-bush to rear cover
93. Gear 1st speed
94. Gear-2nd speed
95. Synchroniser-2nd speed.
96. Ball-synchroniser.
97. Spring-ball.
98. Baulk ring-2nd speed gear.
99. Bush-2nd speed gear.
100. Gear-3rd speed.
101. Baulk ring-3rd and 4th gear.
102. Bush-3rd speed gear.
103. Ring-interlocking-2nd and 3rd bushes
104. Coupling-sliding-3rd and 4th speed.
105. Synchroniser-3rd and 4th speed.
106. Ball-synchroniser.
107. Spring-ball.
108. Layshaft.
109. Gear unit-layshaft. 1
110. Bearing-needle roller-layshaft --outer
111. Bearing-needle roller-layshaft -inner
112. Spring ring-needle rollers.
113. Distance-piece-bearing.
114. Washer-thrust-front
115. Washer-thrust-rear.
116. Shaft-reverse.
117. Screw-locking-shaft.
118. Lock washer-screw
119. Gear-reverse.
120. Bush.
121. Bolt-gearbox to mounting plate.
122. Washer-spring.
123. Nut-mounting plate bolt.
124. Tower-remote control.
125. Dowel-remote control tower.
126. Core plug-tower.
127. Lever-change speed.
128. Knob-change speed lever.
129. Locknut change speed lever knob
130. Stop plate.
131. Snug-change speed ball.
132. Spring-change speed lever.
133. Cover-ball spring.
134. Circlip-ball spring cover.
135. Plunger-reverse selector.
136. Spring-reverse plunger.
137. Plug-reverse plunger.
138. Dowel-reverse plunger.
139. Ball-reverse plunger.
140. Spring-reverse plunger detent.
141. Gasket-control tower.
142. Bolt-short-tower.
143. Bolt-long-tower.
144. Spring washer.
145. Plug-ball retaining-box cover.
146. Washer-plug.
147. Plunger.
148. Spring-plunger.
149. Ball-selector lever.
150. Shaft-remote control.
151. Lever-front-selector.
152. Lever-rear-selector.
153. Set screw-front and rear lever.
154. Spring washer.
155. Key.
156. Draught excluder-rubber-gear lever
157. Ring – lever draught excluder.
158. Flexible bush – rear engine mounting
159. Bolt – rear mounting bush
160. Washer-spring.
161. Nut-rear mounting bush bolt.
162. Third motion shaft flange
163. Nut for flange
164. Washer for nut

GENERAL DESCRIPTION

The gearbox has four forward speeds and one reverse. Top gear is obtained by direct drive, third and second by gears in constant mesh, and first and reverse by sliding spur gears.

A sliding joint of the reverse spline type is fitted to the rear end of the third motion shaft and is lubricated from the gearbox.

F.1 REMOVING THE GEARBOX

Remove the power unit as described in Section A. 24.

Remove the starter motor, unscrew the bolts and nuts securing the bell housing and exhaust pipe support brackets, and withdraw the gearbox and rear extension from the engine. Take care to keep the gearbox flange parallel with the crankcase face until the first motion shaft is clear of the clutch.

F.2 DISMANTLING THE GEARBOX

Extract the dipstick, drain plug, and speedometer drive.

Unscrew the nuts and remove the gear lever remote control tower and joint washer. Remove the nut and spring washer securing the propeller shaft driving flange and withdraw the flange. Use service tool 18G34A to hold the flange while the nut is removed.

Unscrew and remove the six bolts and the rear extension cover and joint washer. Remove the interlock arm and bracket.

Remove the two nuts and six set screws securing the gearbox extension to the gearbox. Pull the extension from the gearbox, at the same time manoeuvring the remote-control shaft selector lever from the selectors.

Unscrew the three countersunk screws and the seven hexagon-headed set screws holding the gearbox cover; remove the cover and overshoot stop.

Cut the locking wire and unscrew the three change speed fork set screws.

Unscrew the two set screws and remove the shifter shaft locating block with shifter shafts from the gearbox; note the two dowels in the block; take care to catch the three selector balls and springs.

Withdraw the forks from the box in the following order-reverse, top and third, and first and second.

Unscrew the clutch lever pivot nut; screw out the pivot bolt and remove the lever with the thrust bearing.

Unscrew the nuts and remove the gearbox front cover; note the bearing shims between the cover and the bearing.

Tap out the layshaft, allowing the gear cluster to rest in the bottom of the box.

Unscrew the retaining set screw and remove the reverse shaft and gear.

Withdraw the mainshaft assembly to the rear.

Withdraw the first motion shaft complete with 18 spigot needle rollers.

Lift out the layshaft gear cluster and the two thrust washers.

Rear extension

Release the front and rear selector levers from the remote-control shaft by removing the clamping screws and sliding the levers from the rod. Extract the keys from the shaft and withdraw the remote-control shaft from the rear extension.

F.3 DISMANTLING THE THIRD MOTION SHAFT

Remove the following items in this order: baulk ring; synchromesh sleeve and hub; second baulk ring. If the synchromesh sleeve is removed from the hub take care not to lose the three locating balls and springs which will be released in consequence. Press down the third speed gear cone thrust washer plunger; rotate the thrust washer to align its splines with those on the shaft and remove the washer.

Withdraw the third speed gear and its splined bush.

Withdraw the bush interlocking washer to release the second speed gear with its bush and baulk ring.

Remove the thrust washer from the splines on the shaft and withdraw the first and second speed hub and gear; if necessary slide the gear from the hub, taking care not to lose the three balls and springs.

Tap up the locking tab and unscrew the rear retaining nut; withdraw the washer, speedometer drive gear and key and the distance sleeve from the shaft.

Press the rear bearing and housing from the shaft.

F.4 ASSEMBLING THE THIRD MOTON SHAFT

Assemble from the front end.

1. Locate the rear thrust washer on the front end of the splines, ground face to the front.
2. Push the longer brass bush up to the splines with the dog towards the front.
   Note-This bush must be fitted so that the oil hole is in line with the one in the shaft and the cut-away portion of the third speed splined bush will be over the locating peg hole when the dogs of the two bushes are engaged with the bush interlocking washer.
3. Fit the second speed baulk ring and gear onto the bush with the plain side of the gear towards the front.
4. Slide on the bush interlocking ring and the shorter splined bush, locating the dogs of both bushes in the interlocking ring.
5. Insert the spring and locating peg into the hole in the shaft.
6. Fit the third speed gear onto the bush with the cone towards the front.
7. Thread on the front thrust washer, machined face towards the gear, while holding down the locating peg with a thin punch through the hole in the gear cone, and push the washer over it; turn the washer to allow the locating peg to engage in one of the splines.
8. Fit the three springs and balls to the third speed synchronizer and push on the synchronizer sleeve (striking dog).
9. Push on the top and third gear synchromesh assembly hub with its two baulk rings. The plain side of the hub faces the rear.
10. Assemble the following items from the rear:
    a. Insert the three balls and springs in the second gear hub and push the synchronizer sleeve (striking dog) into position on the hub.
    b. Fit the first speed gear and synchromesh hub assembly, and the baulk ring, to the splines on the shaft.
    c. Press the rear bearing into its housing and fit it to the shaft, outer flange of the housing to the rear.
    d. Push on the distance sleeve, speedometer drive gear and key, lock washer and nut.

F.5 LAYSHAFT GEAR

The assembly sequence of the layshaft bearings is as follows: a circlip at the rear, a needle race, a single long distance tube, a circlip, a needle race, a circlip, a needle race, a circlip, two races being fitted at the front end and one at the rear.

When assembling, fit a circlip to the innermost groove in the gear, pushing it in from the front, or large gear, end.

Hold the layshaft vertically in the vice, stepped end downwards.

Smear the shaft with grease and assemble a roller bearing on the shaft against the vice jaws and then slide the gear cluster over the shaft and the bearing with the large gear downwards.

Remove the shaft from the vice and push the bearing into the gear against the circlip. Fit a retaining circlip and follow with the end roller bearing assembly and retaining circlip.

Slide the distance tube into the other end of the gear, followed by the other end bearing and circlip. Withdraw the shaft from the gear.

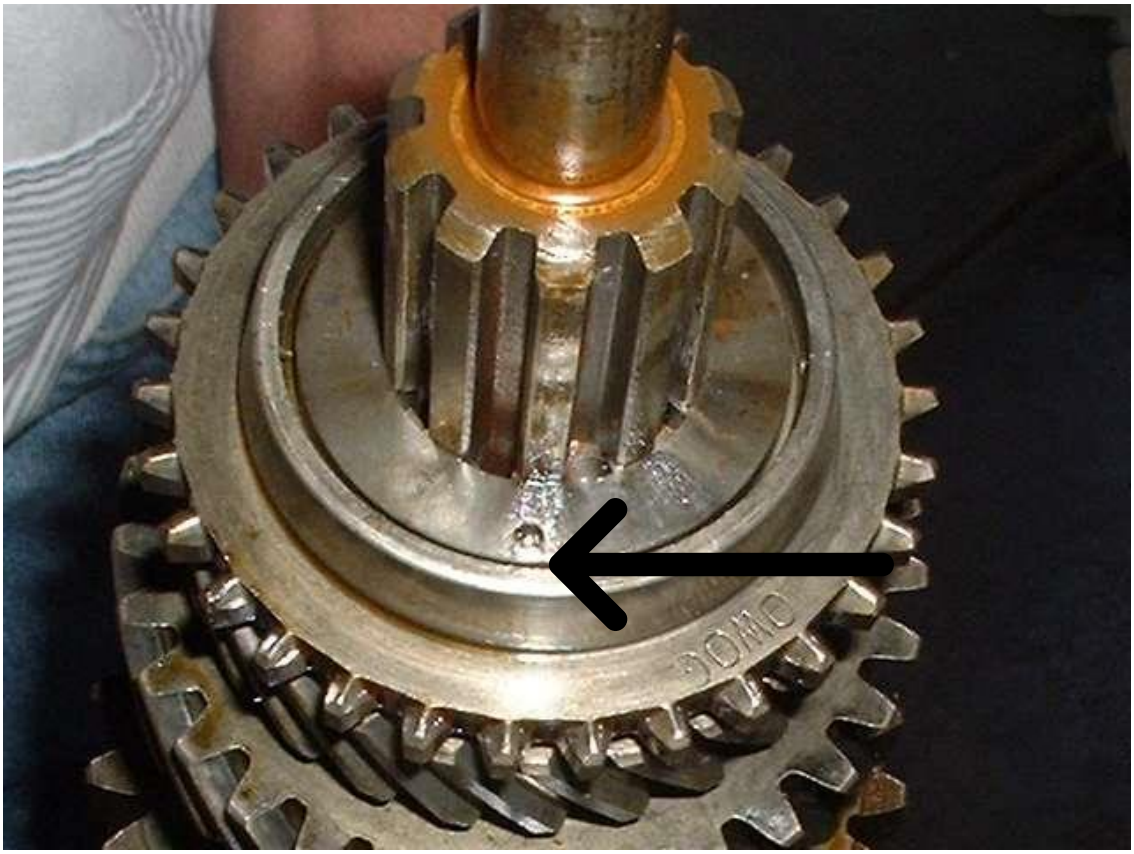


Fig. F.1 The arrow indicates the third speed thrust washer and locating peg. Note the hole in the gear

F.6 ASSEMBLING THE FIRST MOTION SHAFT

Fit the bearing to the shaft with the spring ring away from the gear. Replace the lock washer and tighten the retaining nut; bend over the locking tab. Fit the shaft to the housing. Do not fit the front end cover until the layshaft has been refitted.

F.7 ASSEMBLING THE REAR EXTENSION

Locate the remote control shaft in the rear extension. Fit the front and rear selector levers to the remote control shaft; note that they are secured and located by keys and set screws.

Fit the rear extension to the gearbox, locating the control shaft front selector lever in the shifter rod selectors.

Replace the interlock arm on the rear extension side cover flange and refit the cover.

F.8 ASSEMBLING THE GEARBOX

Place the layshaft gear in the box complete with end thrust washers but do not fit the shaft.

Assemble and replace the first motion shaft, and replace the 18 needle-roller bearings.

Insert the third motion shaft from the rear; use the gasket fitted between the box and rear extension to position the dowel and bearing housing. Push home the shaft, the rear bearing and housing, and enter the spigot in the needle-roller race of the first motion shaft.

Fit the layshaft and thrust washers. Line up the cutaway portion of the front end with the layshaft locating groove in the front cover.

Fit the reverse gear and shaft; tighten and lock the Set Screw.

Refit the front end cover, replacing the bearing shims that were removed on dismantling. Refit the clutch lever and fork. Fit the selectors to the shifter shaft rear ends. Bolt the shifter shaft locating block to the rear face of the gearbox; replace the balls and springs and insert the shifter shafts.

Position the gear change forks in the box in the following sequence: reverse, first and second, third and top. Push the shifter shafts into the box and through the forks; insert, tighten, and wire up the set screws.

Position the selectors on the rear ends of the shifter shafts; insert, tighten, and wire up the set screws.

Refit the gearbox rear extension. Locate the change speed gate in the gearbox and fit the side cover, using a new joint as necessary.

Screw in the speedometer drive gear assembly, plugs and breather.

The remote control assembly is fitted to the gearbox, and the gearbox filled with oil, after the power unit is installed in the chassis.

F.9 RENEWING THE GEARBOX EXTENSION OIL SEAL

Remove the four bolts securing the propeller shaft front universal joint to the gearbox flange.

Hold the flange steady with Service tool 18G34A and remove the nut and spring washer.

Remove the flange.

Using Service tool 18G389 with adaptor 18G389B, withdraw the old seal.

Use Service tool 18G134 with adaptor 18G134N to fit the new seal.

Refit the flange, nut, and spring washer

F.10 REFITTING THE GEARBOX FRONT COVER

To prevent oil leaking past the gearbox front cover oil seal the cover must be correctly fitted to ensure that the seal is concentric with the first motion shaft. When refitting the cover proceed as follows.

Clean off the cover and examine it carefully for burrs and bruising, particularly around the bore, stud holes, and machined surfaces. Check the flat surfaces for twist and warp and correct it if necessary. If the condition is too bad to correct, fit a new cover.

Remove and discard the front cover to gearbox gasket and clean off the flat surfaces around the base of all studs.

Offer the front cover (less oil seal) to the gearbox and push it fully home on the studs. The cover should be free to move in all directions, and points at which the holes may be binding on the studs must be relieved until the cover is free to float.

Remove the cover and, using Service tool 18G134 with adaptor 18G134N, fit the oil seal so that its lip faces inwards towards the gearbox. Lightly grease and fit a new gasket to the gearbox front face, then fit the centralizer (Service tool 18G598) to the bore of the front cover and push it in until it is tight. Lightly oil the seal and pass the cover over the first motion shaft, taking particular care not to cut or damage the knife edge of the sea).

Keep the centralizer firmly in position, push the cover onto the studs, and fit the spring washers and nuts, tightening the nuts finger-tight only. Use a suitable socket spanner and long extension to tighten the nuts a half-turn at a time by diametrical selection until all nuts are fully tightened.

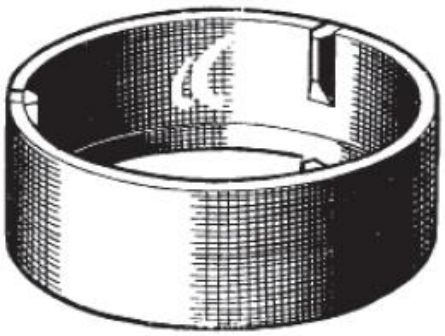
Remove the centralizer and refit the clutch operating components.

SERVICE TOOLS

18G34A

18G34A. Flange Wrench

This wrench prevents the rotation of the gearbox flange when releasing or tightening the flange securing nut. The pegs of the holding wrench fit into the bolt holes of the flange.



18G222
18G223

18G222. Synchromesh Unit Assembly Ring-Second Speed

Designed to facilitate the assembly of mated synchronizer and sleeve by enabling the springs and balls to be inserted quickly and easily.

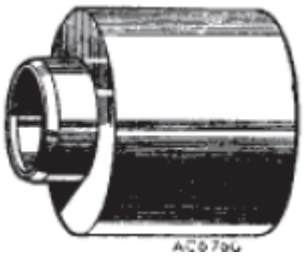
18G223. Synchromesh Unit Assembly Ring—Third and Top

18G471

18G471. Dummy Layshaft

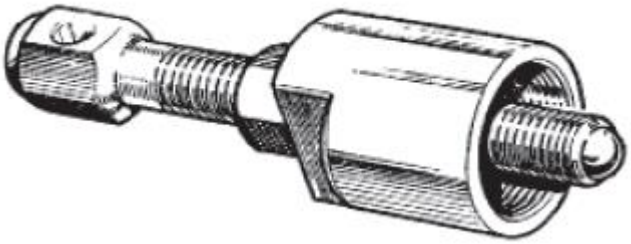
A pilot for lining up the gears and retaining the thrust washers in position prior to inserting the layshaft proper, it being necessary to drop the laygear for the first motion shaft to be inserted.

18G134. Bearing and Oil Seal Replacer Adaptor Handle (basic tool) For use with adaptor 18G134P to replace the gearbox extension oil seal.



18G134N. Oil Seal Replacer Adaptor

Used with handle 18G134 for the replacement of gearbox extension oil seals.

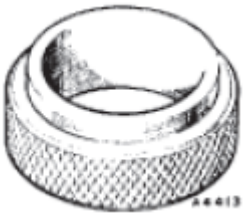


18G389. Oil Seal Remover (basic tool)

This basic tool together with the appropriate adaptor is essential for removing the gearbox extension oil seal easily and without damage to the extension.

18G389B. Oil Seal Remover Adaptor

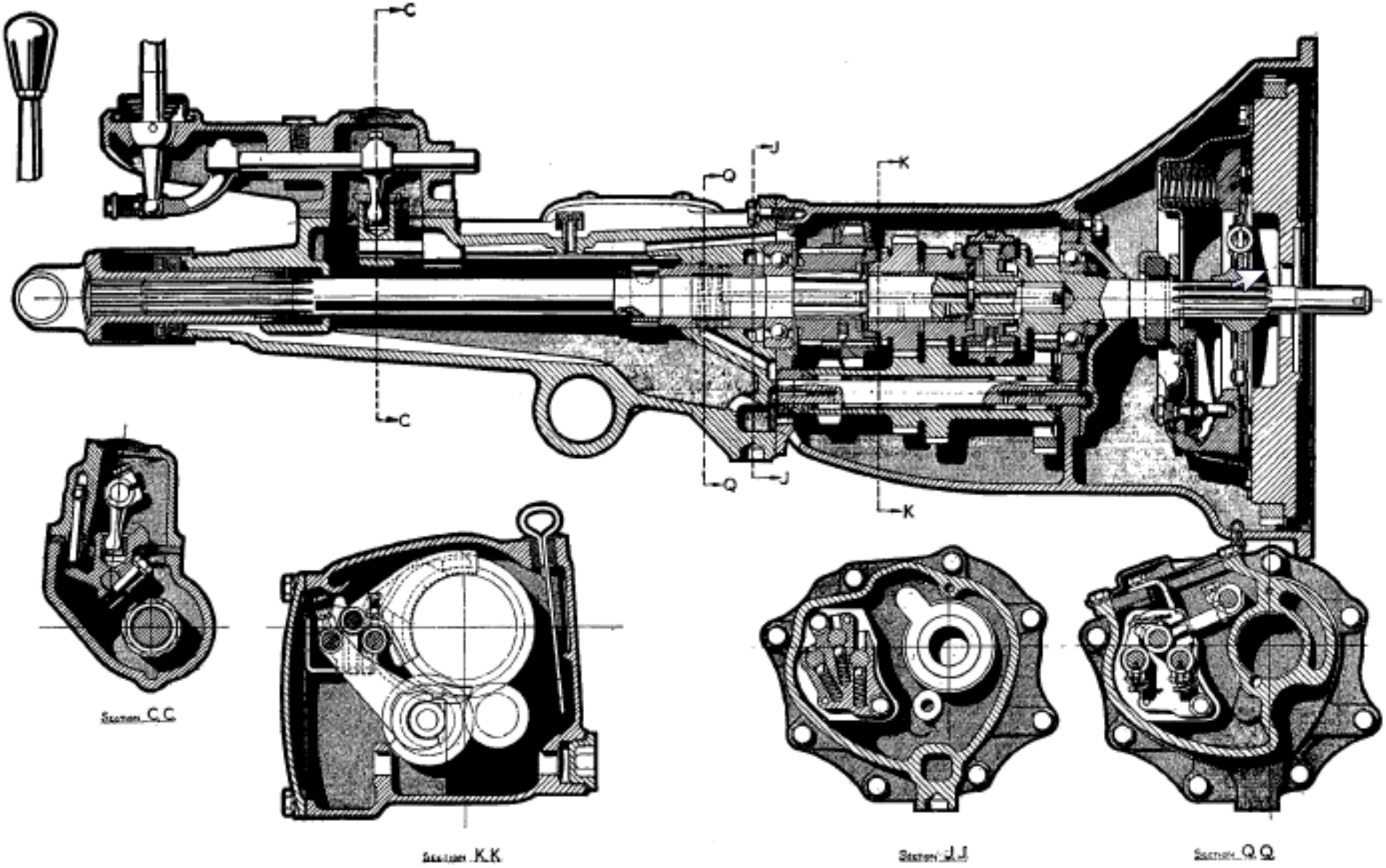
Use with basic tool 18G389.



18G598. Gearbox Front Cover Centralizer

This tool ensures that the front cover oil seal is concentric with the first motion shaft when the front cover is refitted to the gearbox.

THE GEARBOX AND REMOTE CONTROL IN SECTION



SECTION G THE PROPELLER SHAFT

GENERAL DESCRIPTION

The propeller shaft and universal joints are of the Hardy Spicer type with needle-roller bearings.

A single shaft connects the rear axle and the gearbox. To accommodate fore and aft movement of the axle, a sliding joint of the reverse-spline type is fitted between the gearbox and the front universal joint flange. Each joint consists of a centre spider, four needle-roller bearing assemblies and two yokes.

G.1 LUBRICATING THE UNIVERSAL JOINTS

A lubricator is fitted to each front and rear spider and should be charged fully after overhauling and subsequently given three or four strokes with the gun every 3,000 miles (5000 km.). The correct lubricant is shown at Ref. C (page P.2).

If a large amount of lubricant exudes from the oil seal the joint should be dismantled and new oil seals fitted.

The sliding joint is automatically lubricated from the gearbox.

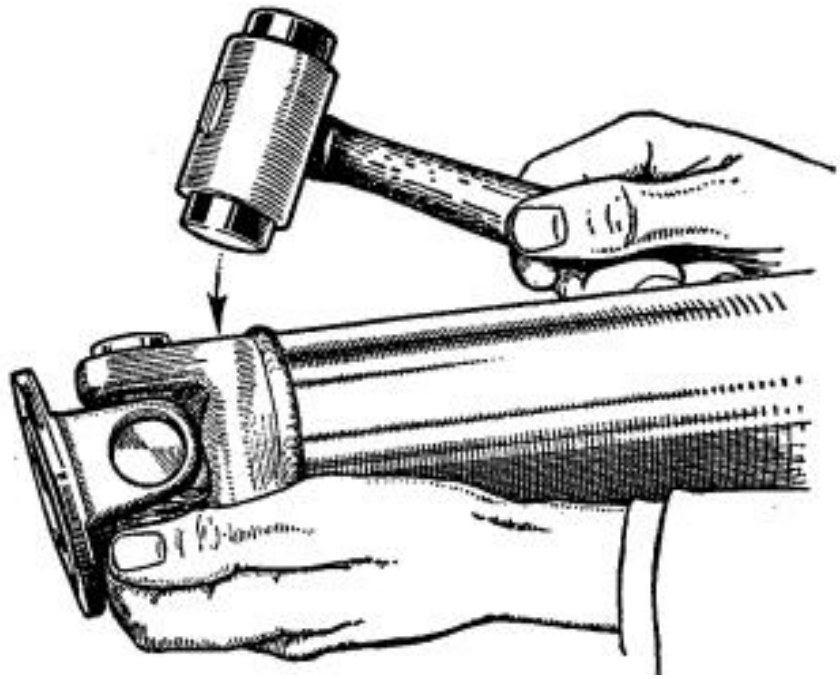


Fig. G.1 Where to apply light blows to the yoke after removing the retaining circlip

G.2 TESTING FOR WEAR

Wear on the thrust faces is ascertained by testing the lift in the joint, either by hand or with the aid of a length of wood suitably pivoted.

Any circumferential movement of the shaft relative to the flange yokes indicates wear in the needle-roller bearings, or in the splined shaft in the case of the forward joint.

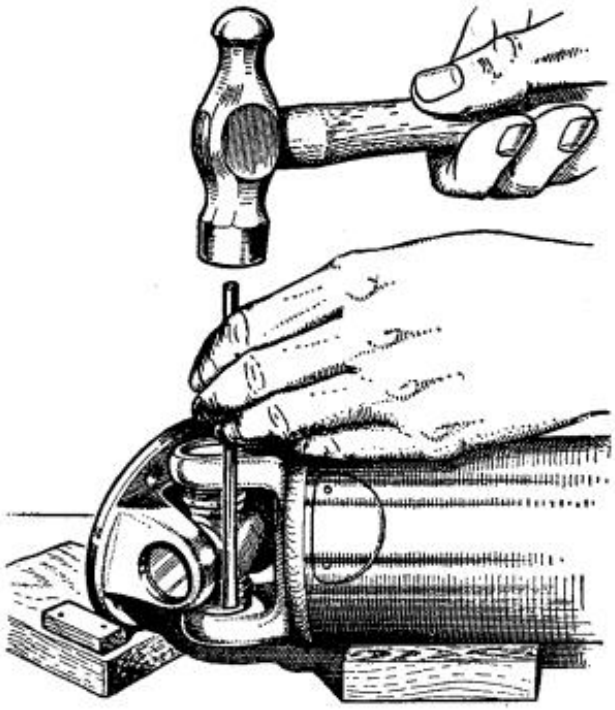


Fig. G.2 When dismantling a universal joint, the bearings may be tapped out with a small-diameter rod from the inside as shown. Take care not to damage the roller races

G.3 REMOVING THE PROPELLER SHAFT

Before removing the bolts and nuts securing the propeller shaft universal joint flange to the rear axle flange, carefully mark the flanges to assist in refitting them in their original positions. This is important.

Remove the bolts securing the propeller shaft to the rear axle flange. The shaft can now be removed from the car downwards and rearwards.

G.4 DISMANTLING THE PROPELLER SHAFT

Remove the enamel and dirt from the snap-rings and bearing races. Remove all the snap-rings by pinching their ears together with a pair of thin-nosed pliers and prising them out with a screwdriver.

If a ring does not slide out of its groove readily, tap the end of the bearing race slightly to relieve the pressure against the ring. Remove the lubricator from the journal and, holding the joint in one hand, tap the radius of the yoke lightly with a copper hammer. The bearing should begin to emerge; turn the joint over and finally remove with the fingers. If necessary, tap the bearing race from inside with a small-diameter bar, taking care not to damage the bearing face, or grip the needle bearing race in a vice and tap the flange yoke clear.

Be sure to hold the bearing in a vertical position, and when free remove the race from the bottom side to avoid dropping the needle rollers.

Repeat this operation for the opposite bearing. Rest the two exposed trunnions on wood or lead blocks to protect their ground surfaces and tap the top lug of the flange yoke to remove the bearing race. Turn the yoke over and repeat the operation.

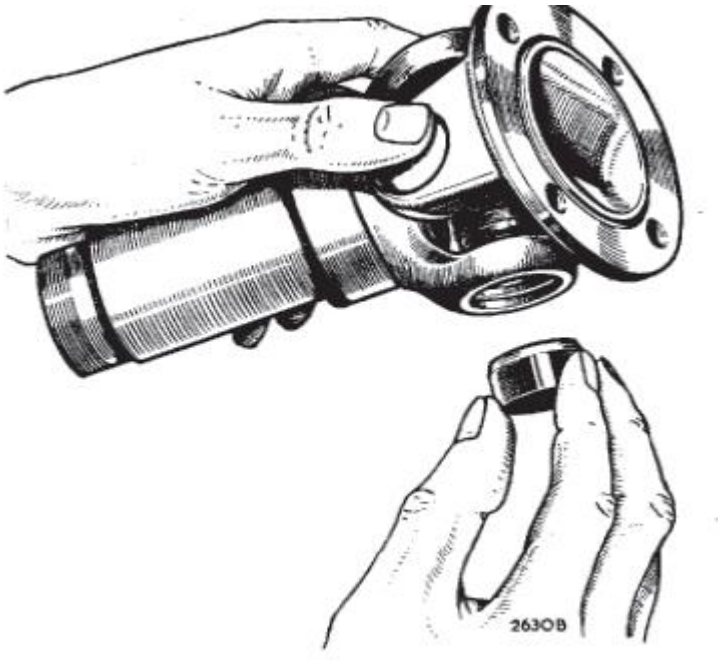


Fig. G.3 Showing the manner of withdrawing the needle bearing after it has been partly withdrawn. When bearings are removed or replaced they should be held vertically to prevent the needle bearings from being displaced

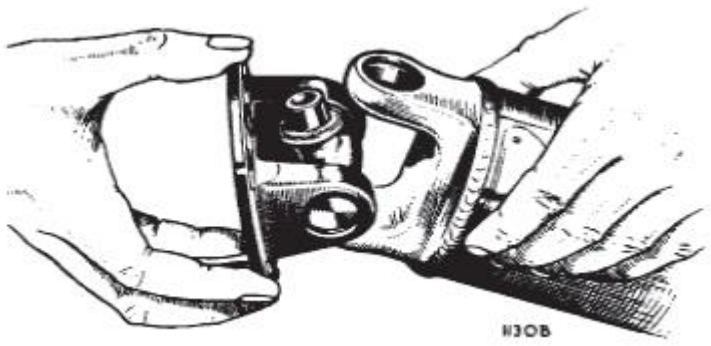


Fig. G.4 When the needle roller bearings have been withdrawn from opposite sides of the spider, the joint can be separated as shown

G.5 TO EXAMINE AND CHECK FOR WEAR

The parts most likely to show signs of wear after long usage are the bearing races and the spider journals. Should looseness, load markings, or distortion be observed, the affected part must be renewed complete; no oversized journals or races are provided.

It is essential that the bearing races are a light drive fit in the yoke trunnions. In the event of wear taking place in the yoke cross-holes, rendering them oval, the yokes must be renewed. In case of wear in the cross holes in the fixed yoke, which is part of the tubular shaft assembly, it should be replaced by a complete tubular shaft assembly.

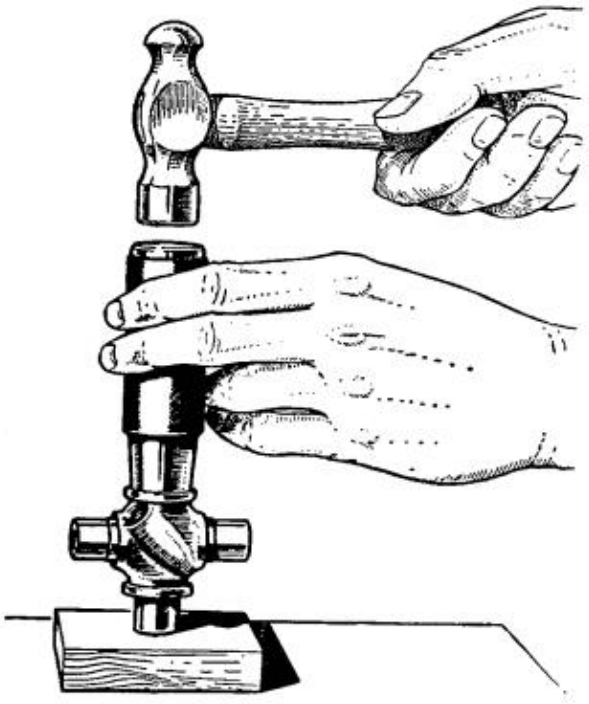


Fig. G.5 When replacing the gasket retainer, use should be made of a hollow drift to tap it into place without damage

G.6 REASSEMBLING THE SHAFT

See that all the drilled holes in the journals are thoroughly cleaned out and free of grease or oil.

Assemble the needle rollers in the bearing races and fill with lubricant to Ref. C (page P.2). Should difficulty be experienced in retaining the rollers under control, smear the walls of the races with lubricant to Ref. C (page P.2) to retain the needle rollers in position while reassembling.

Insert the spider in the flange yoke, ensuring that the lubricator boss is fitted away from the yoke. Using a soft-nosed drift, about in. (8 mm.) smaller in diameter than the hole in the yoke, tap the bearing into position. Repeat this operation for the other three bearings. Replace the circlips and be sure that these are firmly located in their grooves. If the joint appears to bind, tap lightly with a wooden mallet; this will relieve any pressure of the bearings on the end of the journals.

It is always advisable to replace the cork gasket and the gasket retainers on the spider journals by means of the tubular drift shown in Fig. G.5. The spider journal shoulders should be shellacked prior to fitting the retainers, to ensure a good oil seal.

G.7 REPLACING THE PROPELLER SHAFT

Wipe the faces of the flanges clean and place the propeller shaft in position on the car. Ensure that the flange registers engage correctly, that the components are replaced in exactly the same relation as before removal and that the joint faces bed down evenly all round. Insert the bolts and tighten the self-locking nuts.

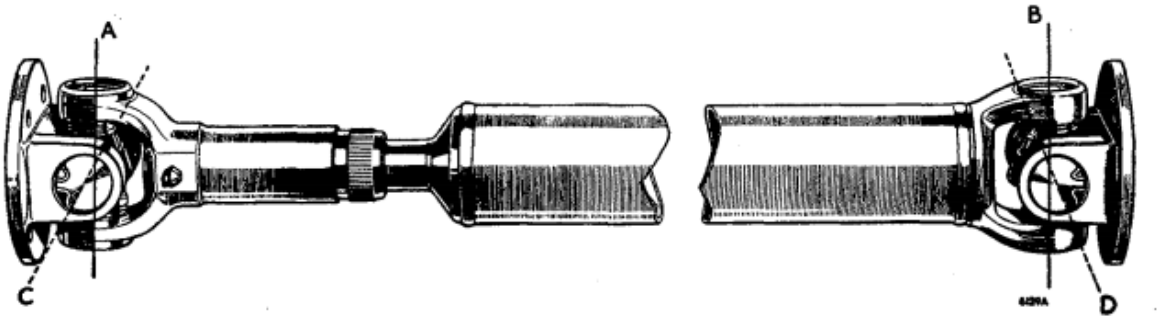


Fig. G.6 When the splined shaft is assembled to the drive shaft it is essential to see that the forked yokes on both shafts have their axes parallel to each other. In other words, the yoke (A) must be in alignment with the yoke (B), and the flange yoke (c) must be in alignment with the flange yoke (D)

G.8 MODIFIED PROPELLER SHAFT

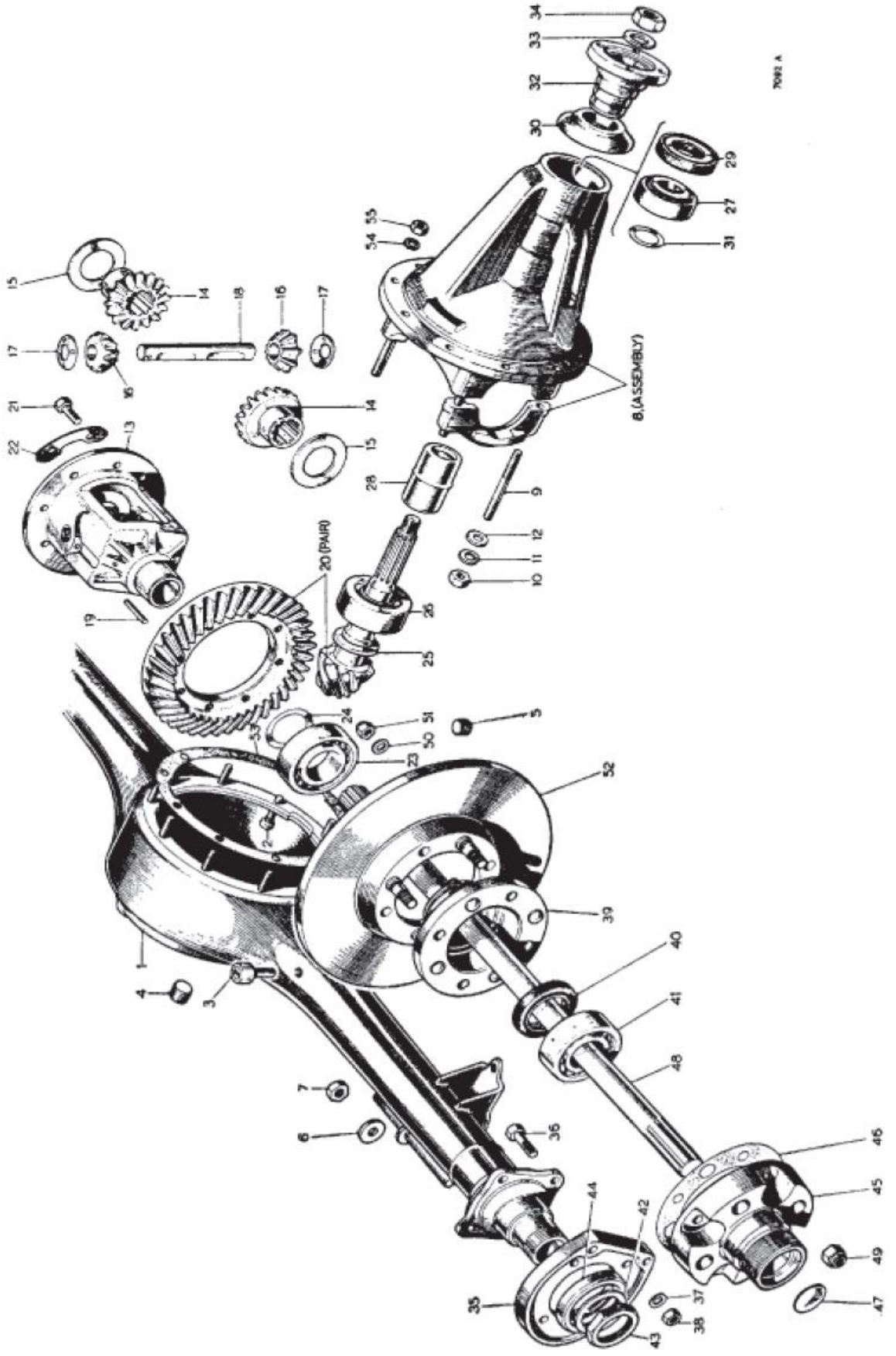
Coincident with the introduction of the modified power unit (15GD series) described in Section A.44, a propeller shaft incorporating a splined sliding joint at its front end was fitted.

In addition to the nipples fitted to each universal joint, a nipple is also provided on the sleeve yoke for the lubrication of the sliding joint splines. This nipple must receive attention every 3,000 miles (5000 km.) with the gun filled with lubricant to Ref, C (page P.2).

Instructions given for the servicing of the earlier propeller shaft apply, in the main, to the modified propeller shaft. The following points, however, should be noted:

1. In order to remove the propeller shaft it is necessary to remove the four nuts and bolts securing the front universal joint flange to the gearbox flange, as well as those securing the rear flange to the rear axle flange.
2. Check the sliding splines for wear by attempting to turn the splined sleeve yoke in relation to the splined shaft. If excessive circumferential movement is present a reconditioned propeller shaft assembly will be required.
3. When fitting new universal joints, it will be found helpful to separate the two parts of the propeller shaft at the sliding joint.
4. Before refitting the splined sleeve yoke to the shaft push the threaded dust cover, the metal washer, and the felt washer over the splines onto the splined shaft. When assembling the joint ensure that the trunnions of the front and rear universal joints are in line (see Fig. G.6). This can be checked by observing that the arrows marked on the splined sleeve yoke and the splined shaft are in line.
5. Fit the propeller shaft to the car with the sliding joint at the gearbox end.

SECTION H THE REAR AXLE



KEY TO THE REAR AXLE COMPONENTS

1. Axle centre case.
2. Serrated bolt.
3. Breather.
4. Filler plug
5. Drain Plug
6. Plain washer.
7. Nut.
8. Gear carrier.
9. Stud.
10. Nut.
11. Spring washer.
12. Washer.
13. Differential case.
14. Differential wheel.
15. Thrust washer.
16. Differential pinion.
17. Thrust washer.
18. Pinion centre.
19. Peg.
20. Crown wheel and pinion.
21. Bolt
22. Lock washer.
23. Differential bearing.
24. Packing washer.
25. Pinion head washer.
26. Pinion bearing.
27. Pinion bearing (outer).
28. Pinion bearing spacer.
29. Oil seal.
30. Dust Cover
31. Pinion bearing shim.
32. Flange.
33. Spring washer.
34. Nut.
35. Adaptor plate.
36. Bolt.
37. Spring washer.
38. Nut.
39. Wheel bearing housing.
40. Oil seal.
41. Rear wheel bearing.
42. Tab washer.
43. Locknut.
44. Dust cover.
45. Hub extension.
46. Joint washer.
47. Welch plug.
48. Axle shaft.
49. Pinnacle nut.
50. Plain washer.
51. Pinnacle nut.
52. Rear brake disc.
53. Differential joint.
54. Spring washer.
55. Nut

GENERAL DESCRIPTION

The rear axle is of the three-quarter-floating type, incorporating hypoid final reduction gears. The axle shafts, pinion, and differential assemblies can be withdrawn without removing the axle from the vehicle.

The rear axle wheel bearing outer races are located in the hubs; the inner races are mounted on the axle tube and secured by nuts and lock washers.

The differential and pinion shaft bearings are preloaded, the amount of preload being adjustable by shims. "The position of the pinion in relation to the crown wheel is determined by a spacing washer. The backlash between the gears is adjustable by shims.

Suspension is by semi-elliptic leaf springs, rubber mounted, and the shackles are fitted with rubber bushes of the flexing type.

Fig. H.1 Unscrew and remove the four self-locking nuts to withdraw the hub extension

LUBRICATION

The axle is filled or topped up with oil through the filler plug in the rear cover by means of an oil gun with a special adaptor.

It is of the utmost importance that only hypoid oils of the approved grades and manufacture be used if satisfactory service is to be obtained from the hypoid gears.

Inspect the oil level every 1,000 miles (1600 km.) and top up as necessary to the level of the filler opening with oil to Ref. B.

After the first 500 miles (800 km.) and subsequently every 6,000 miles (10000 km.) drain off the old oil

and refill with new. The capacity of the axle is 23 pints (3-3 U.S. pints, 1-56 litres).

The hub bearings are lubricated from the axle and no provision is made for any other attention.

H.1 REMOVING AND REPLACING A HUB EXTENSION AND AXLE SHAFT

Jack up the car and place blocks under the spring as close as possible to the axle.

Remove the wheel. Release the hand brake.

Unscrew and remove the four self-locking nuts securing the hub extension driving flange to the hub.

Withdraw the hub extension and axle shaft by gripping the driving flange or the winged hub nut, which may be temporarily refitted for this purpose.

Remove the welch plug and apply pressure to the end of the axle shaft with a hand press to remove the hub extension from the spline on the shaft.

To replace the shaft and driving flange reverse the above sequence of operations. If the welch plug has been distorted on removal a new one should be fitted.

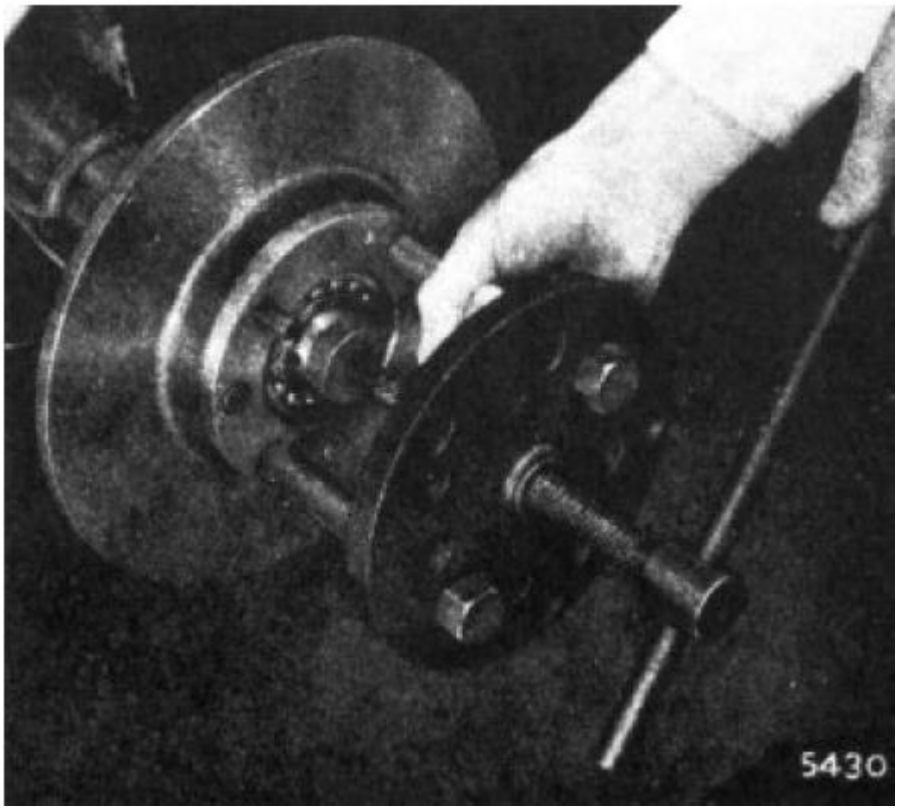


Fig. H.2 Using hub remover 18G304 with adaptors 18G304B and thrust pad 18G304J

H.2 REMOVING AND REPLACING A HUB

Remove the hub extension and axle shaft as detailed in Section H.1. Remove the wheel brake unit by the method described in Section M.7.

Knock back the tab of the hub nut locking washer, unscrew the nut using spanner 18G152, and pull off the washer. The left-hand hub bearing nut has a left-hand thread and is turned in a clockwise direction to unscrew.

The hub and brake disc assembly can then be withdrawn, using rear hub remover 18G304 together with adaptors 18G 304B and thrust pad 18G304J. The bearing and oil seal will be withdrawn with the hub.

The bearing is not adjustable and is replaced in one straightforward operation. Replace the hub and drift it into position with replacer 18G134 and adaptor 18G134P. The remainder is a reversal of the above sequence of operations.

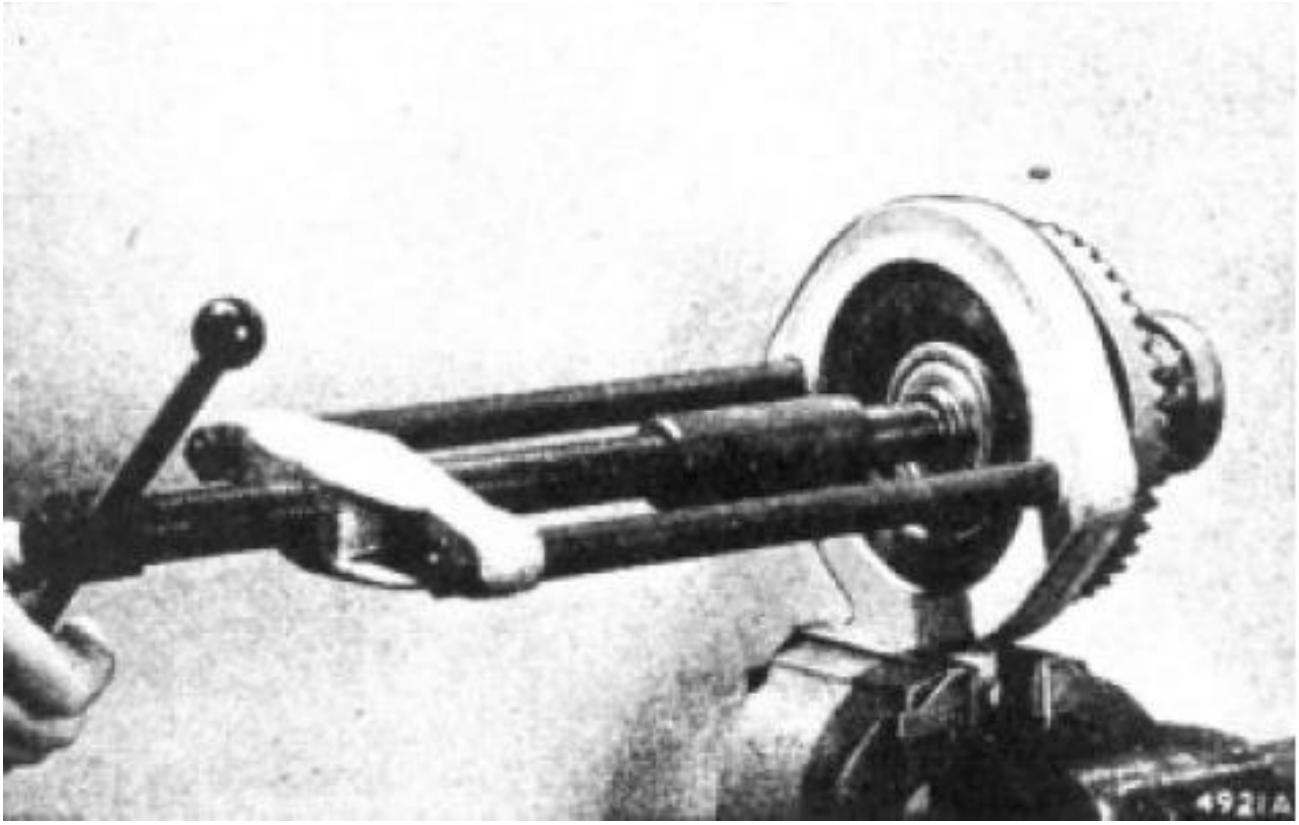


Fig. H.3 Using service tool 18G47C and adaptors 18G477 to remove the differential bearings

H.3 RENEWING THE BEVEL PINION OIL SEAL

Mark the propeller shaft and the pinion driving flanges so that they may be replaced in the same relative positions. Disconnect the propeller shaft.

Unscrew the put in the centre of the driving flange using bevel pinion flange wrench 18G34A to prevent the flange from turning. Remove the nut and washer and withdraw the flange and pressed-on end cover from the pinion shaft.

Extract the oil seal from the casing.

Press a new oil seal into the casing with the edge of the sealing ring facing inwards.

Replace the driving flange end cover, taking care not to damage the edge of the oil seal. Tighten the nut with a torque Wrench (service tool 18G372) to a reading of 140 lb. ft. (19.4 kg. m.).

Reconnect the propeller shaft, taking care to fit the two flanges with the locating marks in alignment.

H.4 REMOVING THE DIFFERENTIAL PINIONS

Drain the oil from the axle casing. Remove the axle shafts as detailed in Section H.1. Mark the propeller shaft and pinion shaft driving flanges so that they may be replaced in the same relative positions; unscrew the self-locking nuts and disconnect the joint.

Unscrew the 10 nuts securing the bevel pinion and gear carrier to the axle casing; withdraw the gear carrier complete with the pinion shaft and differential assembly.

Tap out the dowel pin locating the differential pinion shaft. The diameter of the pin is 3/16in. (4.8 mm.)

and it must be tapped out from the crown wheel side as the hole into which it fits has a slightly smaller diameter at the crown wheel end to prevent the pin from passing right through. It may be necessary to clean out the metal peened over the entry hole with a 3/16in. (4.8 mm.) drill in order to facilitate removal of the dowel pin. Drive out the differential pinion shaft. The pinions and thrust washers can then be removed from the cage.

H.5 REPLACING THE DIFFERENTIAL PINIONS

Examine the pinions and thrust washers and renew as required.

Replace the pinions, thrust washers, and pinion shaft in the differential cage and insert the dowel pin. Peen over the entry hole.

Reassembly is now a reversal of the instructions given in Section H.4. Refill the axle with fresh oil to Ref. B

If it proves necessary to fit any new parts other than those detailed in Sections H.2, H.3, or H.5 the axle assembly must be set up as in Section H.7.

H.6 DISMANTLING THE CROWN WHEEL AND PINION

Remove the differential assembly as detailed in Section H.4.

Make sure that the differential bearing housing caps are marked so that they can be replaced in their original positions, then remove the four nuts and spring and plain washers. Withdraw the bearing caps and differential assembly.

Remove the differential bearings from the differential cage, using the differential bearing remover 18G47C together with the adaptors 18G471.

Note that the word "THRUST' is stamped on the thrust face of each bearing and that shims are fitted between the inner ring of each bearing and the differential cage.

Knock back the tabs of the locking washers, unscrew the bolts securing the crown wheel to the differential cage and remove the crown wheel.

Unscrew the pinion nut, using a bevel pinion flange wrench (service tool 18G34A) to prevent the flange from turning during this operation.

Remove the spring washer, the driving flange, and the pressed-on end cover.

Drive the pinion shaft towards the rear; it will carry with it the inner race and the rollers of the rear bearing, leaving the outer race and the complete front bearing in position.

The inner race of the front bearing may be removed with the fingers, and the outer race of both the front and rear bearings removed with the special bevel pinion bearing outer race remover (service tool 18G264) together with the adaptors 18G264E and 18G264F. (See Fig. H.4).

Slide off the pinion sleeve and shims; withdraw the rear bearing inner race from the pinion shaft with service tool 18G285, noting the spacing washer against the pinion head.

Assembly and adjustment procedure are detailed in Section H.7.

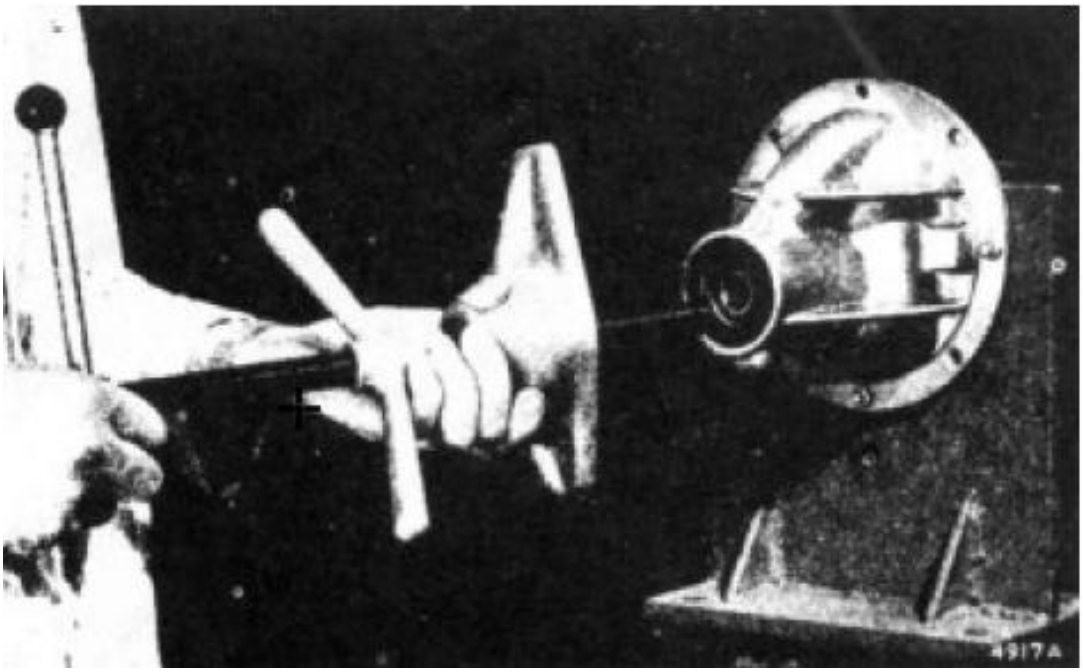


Fig. H.4 Both front and rear bearing outer races may be removed, using service tool 18G264 with adaptors 18G264E and 18G 264F

H.7 ASSEMBLING AND SETTING THE CROWN WHEEL AND PINION

Apart from the fitting of components as detailed in Sections H.2, H.3, and H.5 it is not permissible to fit any new parts (e.g. crown wheel and pinion, pinion bearings, differential bearings, etc.) to the axle assembly without working through the procedure given in this section. Furthermore, if a new crown wheel or a new pinion is needed, a mated pair-crown wheel and pinion-must be fitted.

Fitting a new crown wheel and pinion involves four distinct operations:

1. Setting the position of the pinion.
2. Adjusting the pinion bearing preload.
3. Setting the crown wheel position.
4. Adjusting the backlash between the gears.

The following special service tools are required to enable these operations to be carried out correctly:

Bevel pinion and differential setting gauge.

Bevel pinion inner race remover and replacer.

Bevel pinion outer race remover and replacer.

Bevel pinion preload gauge.

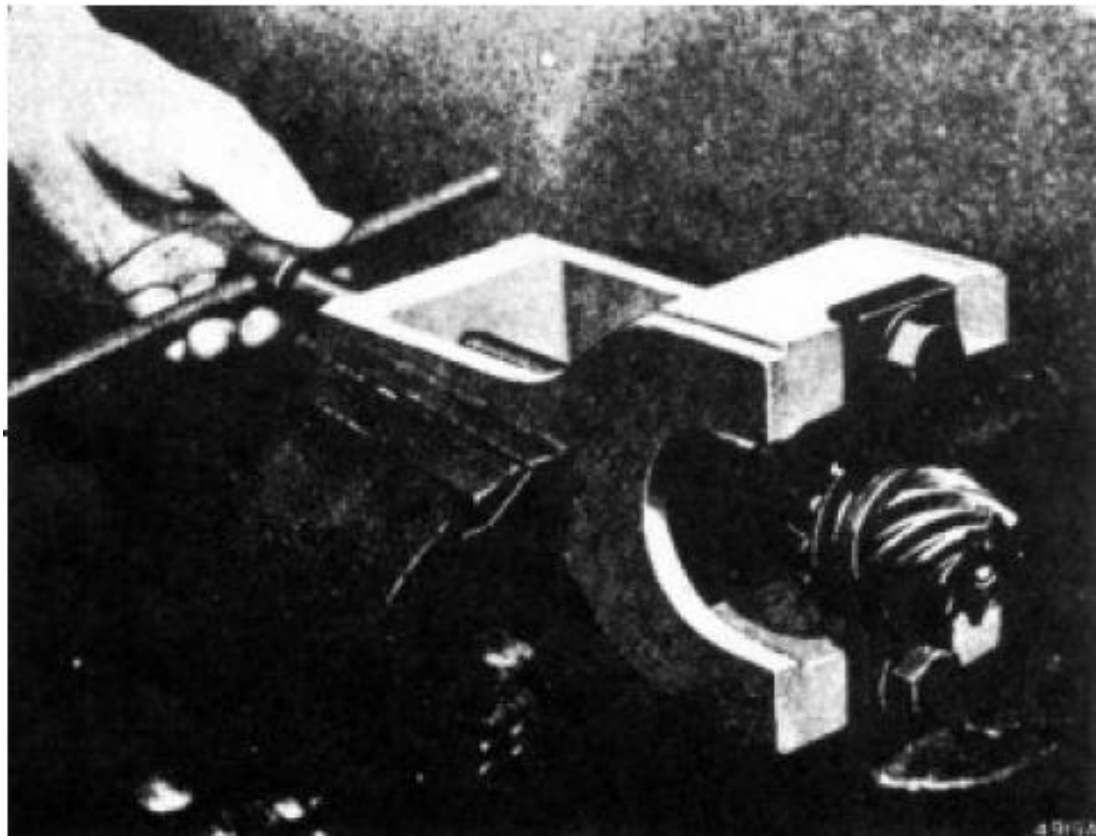


Fig. H.5 Using service tool 18G285 to remove the bevel pinion

A. SETTING THE PINION POSITION

1. Fit the bearing outer races to the gear carrier, using the special pinion race replacing tool.
2. Smooth off the pinion head with an oil-stone but do not erase any markings that may be etched on the pinion head.
3. Assemble the pinion and rear bearing with a washer of known thickness behind the pinion head,
4. Position the pinion in the gear carrier without the shims, bearing spacer, and oil seal.
5. Fit the inner ring of the front bearing and the universal joint driving flange and tighten the nut gradually until a bearing preload of 10 to 12 lb. in. (.12 to .14 kg. m.) is obtained.
6. Remove the keep disc from the base of the magnet. Adjust the dial indicator to zero on the machined step 'B* of the setting block.
7. Clean the pinion head and place the magnet and dial indicator in position (Fig. H.7). Move the indicator arm until the foot of the gauge rests on the centre of the differential bearing bore at one side and tighten the knurled locking screw. Obtain the maximum depth reading and note any variation from the zero setting. Repeat the check in the opposite bearing bore. Add the two variations together and divide by two to obtain a mean reading
8. Take into consideration any variation in pinion head thickness. This will be shown as an unbracketed figure etched on the pinion head and will always be minus (-). If no unbracketed figure is shown the pinion head is of nominal thickness.

   Using the mean clock gauge reading obtained and the unbracketed pinion head figure (if any), the following calculation can be made.

   a. If the clock reading is minus add the clock reading to the pinion head marking, the resulting sum being minus. Reduce the washer thickness by this amount.

Example:

Clock reading	-.002 in.
Pinion marking	-.005 in.
Variation from nominal	-.007 in.

Reduce the washer thickness by this amount.

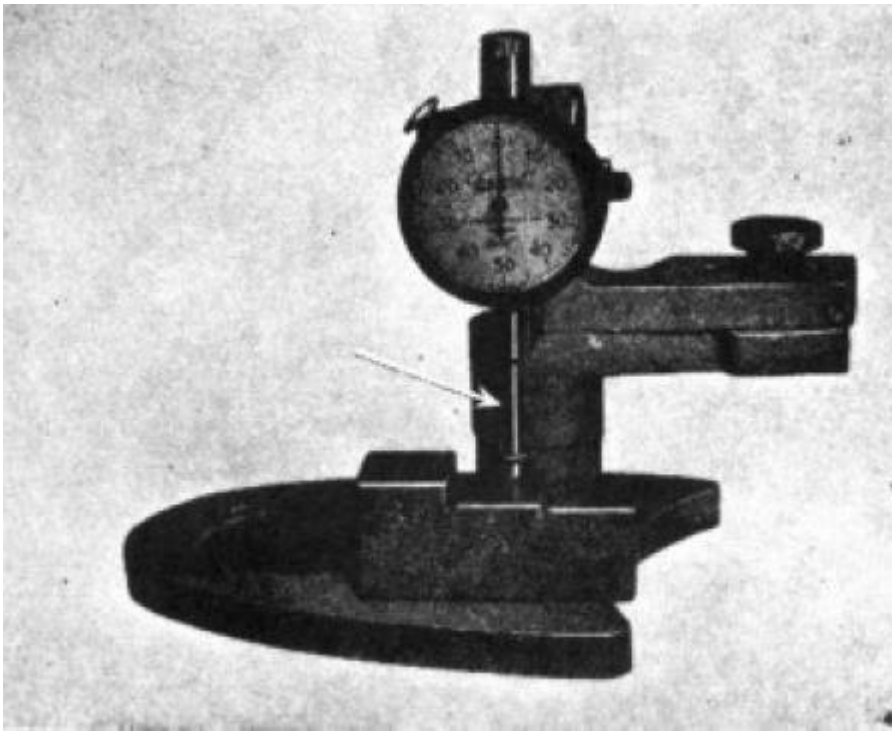


Fig. H.6 Setting the gauge to zero on the special block for determination of the pinion position. The arrow indicates the extension to the contact foot

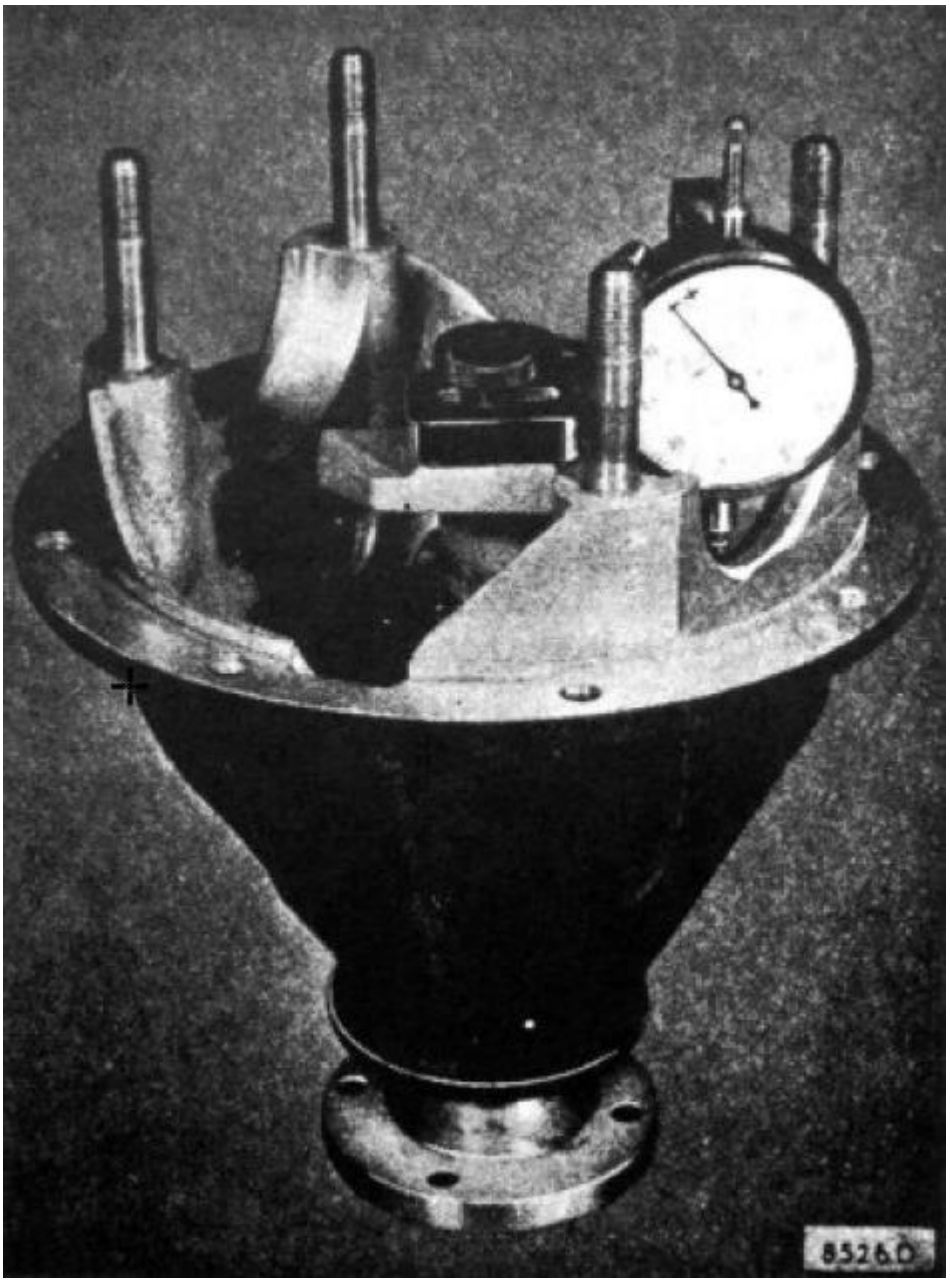


Fig. H.7 The gauge in position on the pinion with the dial indicating a variation from the standard setting

b. If the clock reading is plus and numerically less than the pinion marking, reduce the washer thickness by the difference.

Example:

Clock reading	-.005 in.
Pinion marking	+.004 in.
Variation from nominal	-.003 in.

Reduce the washer thickness by this amount.

c. If the clock reading is plus and numerically greater than the pinion marking, increase the washer thickness by the difference.

Example:

Clock reading	+.008 in.
Pinion marking	-.003 in.
Variation from nominal	+.005 in.

Increase the washer thickness by this amount.

Table of washer and shim thicknesses	
Pinion head washer thickness	.112 to .126 in. in steps of .002 in.
Pinion bearing preload shims	.004 to .012 in. in steps of .002 in., plus .020 in, and .030 in.
Crown wheel bearing shims	.002 in., .003 in., .004 in., .006 in. and .010 in
Pinion bearing preload	10 to 12 lb. in. without oil seal; 13 to 15 lb. in. with oil seal
Crown wheel bearing pinch	.002 in. each side

The only cases where no alterations are required to the washer thickness are when the clock reading is plus and numerically equal to the unbracketed pinion marking, or when the clock reading is zero and there is no unbracketed marking on the pinion head.

9. Allowance should then finally be made for the mounting distance marked on the pinion head in a rectangular bracket as follows.

If the marking is a plus figure, reduce the washer thickness by an equal amount.

If the marking is a minus figure, increase the washer thickness by an equal amount.

A tolerance of .001 in. is allowed in the thickness of the washer finally fitted.

Fit the appropriate washer to the pinion head

B. ADJUSTING PINION BEARING PRELOAD

Assemble the pinion, pinion bearings, bearing spacer, and shims to the gear carrier; fit the oil seal and driving flange. Shims to a thickness of .008 to .011 in. (.2 to .28 mm.) should be used as a starting-point for adjustment of the bearing preload.

Tighten the driving flange nut gradually with a torque Wrench to 140 lb. ft. (19.4 kg. m.) and check the preload on the bearings during tightening to ensure that it does not exceed 13 to 15 lb. in. (.150 to .173 kg. m.), i.e. 3 lb. in. (.034 kg, m.) greater than the recommended figure, since the oil seal is now fitted. If the preload is too great more shims must be added. If the preload is too small when the nut is tightened correctly the shim thickness must be reduced.

C. SETTING THE CROWN WHEEL POSITION

(1) Before fitting the crown wheel and differential

assembly to the gear carrier it is necessary to calculate the shim thickness required behind each bearing to give the required pinch. To facilitate the calculation machining variations are indicated by stamped numbers on the carrier adjacent to the bearing bores. The dimensions to be considered are shown in Fig. H.8, (A) being the distance from the centre-line to the bearing register of the carrier on the left-hand side and (8) the distance from the centre-line to the bearing register of the carrier on the right-hand side. The (C) dimension is from the bearing register on one side of the cage to the register on the other side, while the (D) dimension is from the rear face of the crown wheel to the bearing register on the opposite side. Any variation from nominal on the (A) dimension will be found stamped on the carrier adjacent to the bearing bore, and similarly with the (B) dimension. The variations from nominal on the (C) and (D) dimensions are stamped on the machined face of the differential cage.

It is possible to calculate the shim thickness required on the left-hand side by the use of the following formula:

A+D-C+.007 in.

Substituting the actual variations shown, this formula gives the shim thickness required to compensate for the variations in machining plus the extra .002 in. (.05 mm.) to give the necessary bearing pinch. In addition, allowance must be made for variations in bearing thickness in the following manner.

Rest the bearing, with the inner race over the recess and the outer ring thrust face downwards, on the small surface plate of tool 18G191B. Drop the magnet onto the surface plate and set the clock gauge to zero on the small gauge block on the step marked *B'. (See Fig. H.9.) This is the thickness of the standard bearing. Swing over the indicator until it rests on the plain surface of the inner race and, holding the inner race down against the balls, take a reading (Fig. H.11). Normally the bearing will be standard to –.003 in., though in some cases the tolerance may be from standard to ---005 in. A negative variation shown by this test indicates the additional thickness of shimming to be added to that side of the differential.

The formula for **the right-hand side** is:

B-D+.006 in.

and here again final allowance must be made for variation in bearing thickness.

(2) When a framed number is marked on the back of the crown wheel, e.g. +2, it must be taken into account before assembling the shims and bearings to the differential cage. This mark assists in relating the crown wheel with the pinion.

If, for example, the mark is +-2, then shims to the value of .002 in. (.05 mm.) must be transferred from the left-hand side (the crown wheel side) to the right-hand side. If the marking is –2, then shims to the value of .002 in. (.05 mm.) must be moved from the right-hand side to the left-hand side.

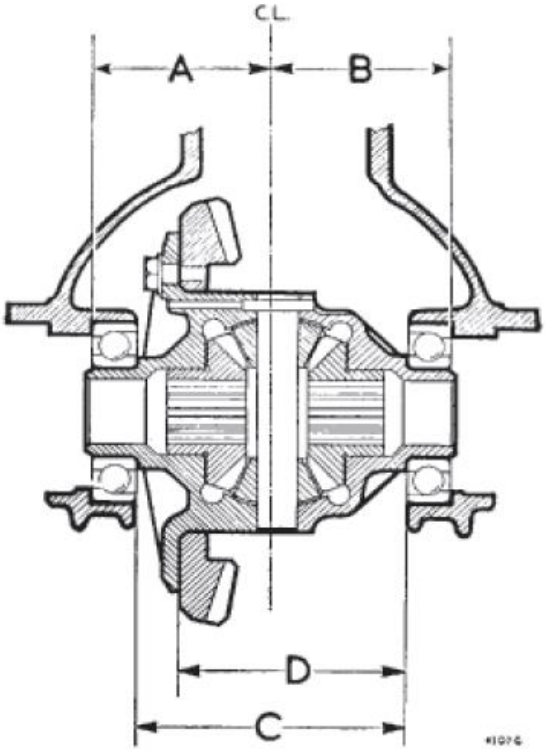


Fig. H.8 The dimensions referred to in the instructions for differential setting

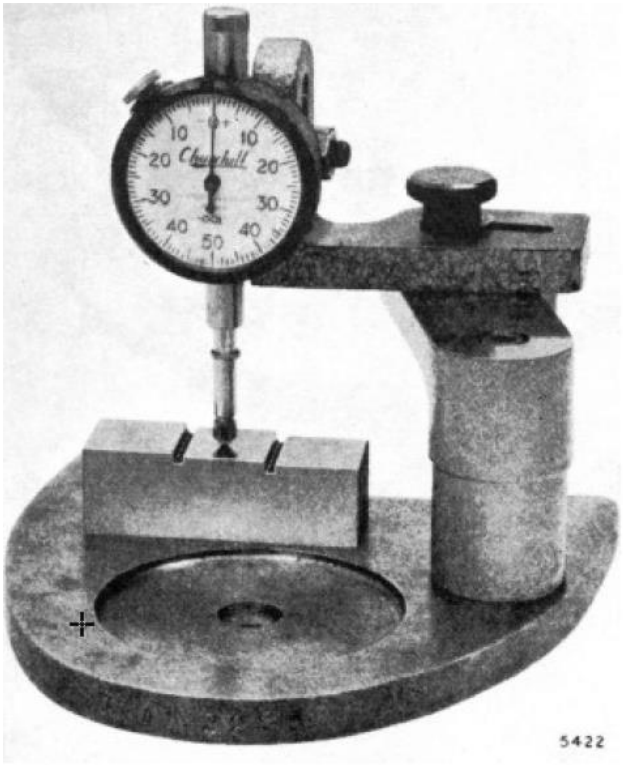


Fig. H.9 To measure variations in bearing thickness first zero the gauge on the portion of the gauge block marked 'B' for the "MGA' axles

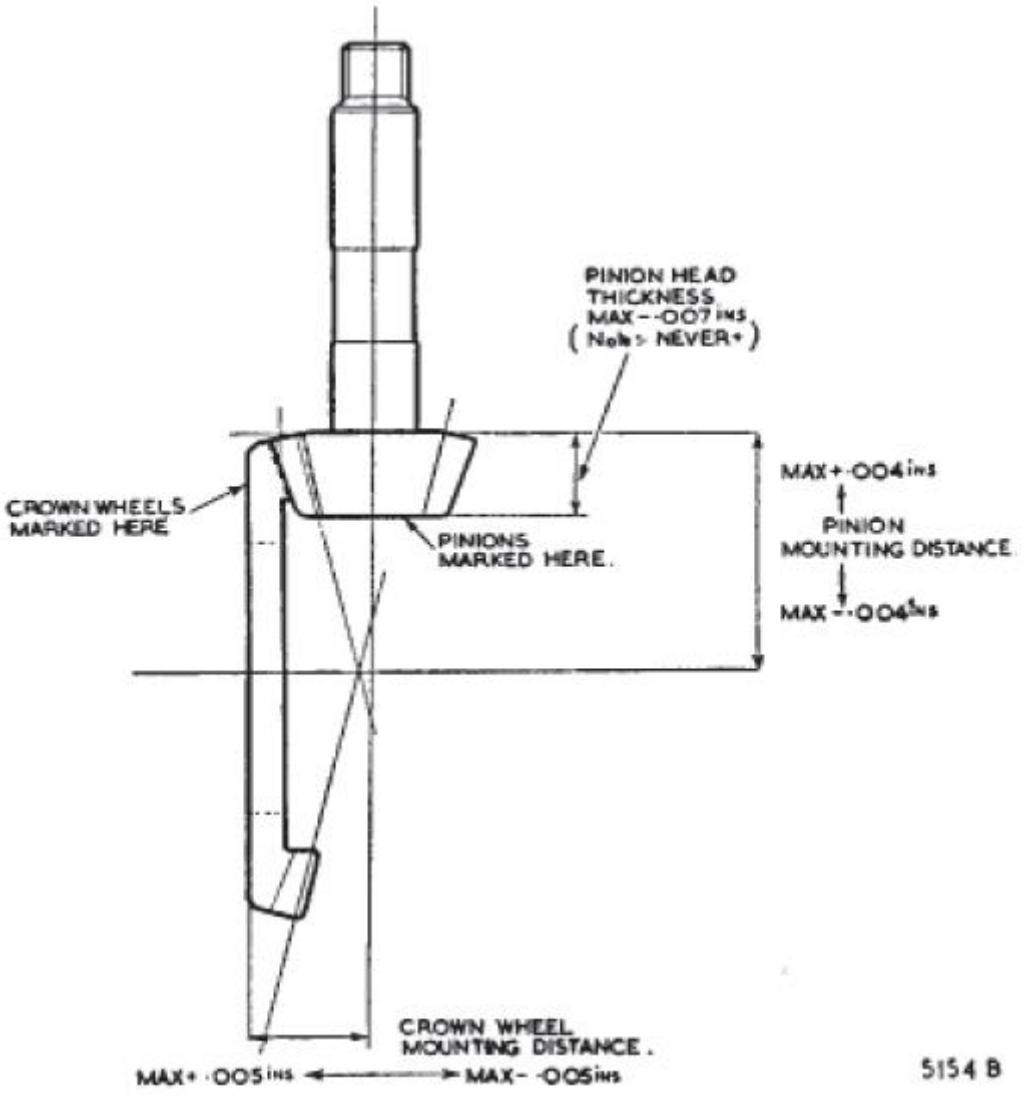


Fig. H.10 Crown wheel and pinion markings

D. ADJUSTING THE BACKLASH

1. Assemble the bearings (thrust side outwards) and shims as calculated to the differential cage.
2. Bolt the crown wheel to the differential cage, but do not knock over the locking tabs. Tighten the nuts to a torque Wrench reading of 60 lb. ft. (8-3 kg. m.).

   Mount the assembly on two 'V' blocks and check the amount of run-out of the crown wheel, as it is rotated, by means of a suitably mounted dial indicator.

   The maximum permissible run-out is .002 in. (.05 mm.) and any greater irregularity must be corrected. Detach the crown wheel and examine the joint faces on the flange of the differential cage and crown wheel for any particles of dirt.

   When the parts are thoroughly cleaned it is unlikely that the crown wheel will not run true.

   Tighten the bolts to the correct torque Wrench reading and knock over the locking tabs.

3. Fit the differential to the gear carrier. Replace the bearing caps and tighten the nuts to a torque wrench reading of 65 lb. ft. (8.99 kg, m.). Bolt the special tool surface plate to the gear carrier flange and mount the clock gauge on the magnet bracket in such a way that an accurate backlash figure may be obtained. (See Fig. H.12). The minimum backlash allowed in any circumstances is .005 in. (.127 mm.) and the maximum is .007 in. (.178 mm.).

The correct figure for the backlash to be used with any particular crown wheel and pinion is etched on the rear face of the crown wheel concerned and must be adhered to strictly.

A movement of-002 in. (-05 mm.) shim thickness from one side of the differential to the other will produce a variation in backlash of approximately -002 in. (-05 mm.). Thus, it should be possible to set up the differential, even though the backlash is incorrect, by removing the bearings on one occasion only.

Great care must be taken to ensure absolute cleanliness during the above operations, as any discrepancies resulting from dirty assembly would affect the setting position of the crown wheel or pinion.

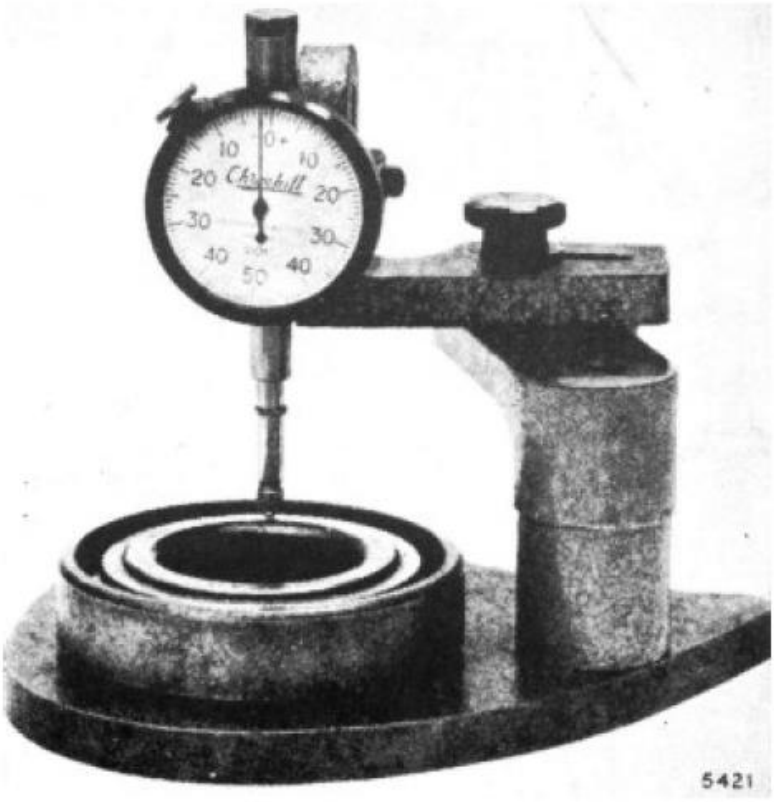


Fig. H.11 Checking the variation in bearing thickness

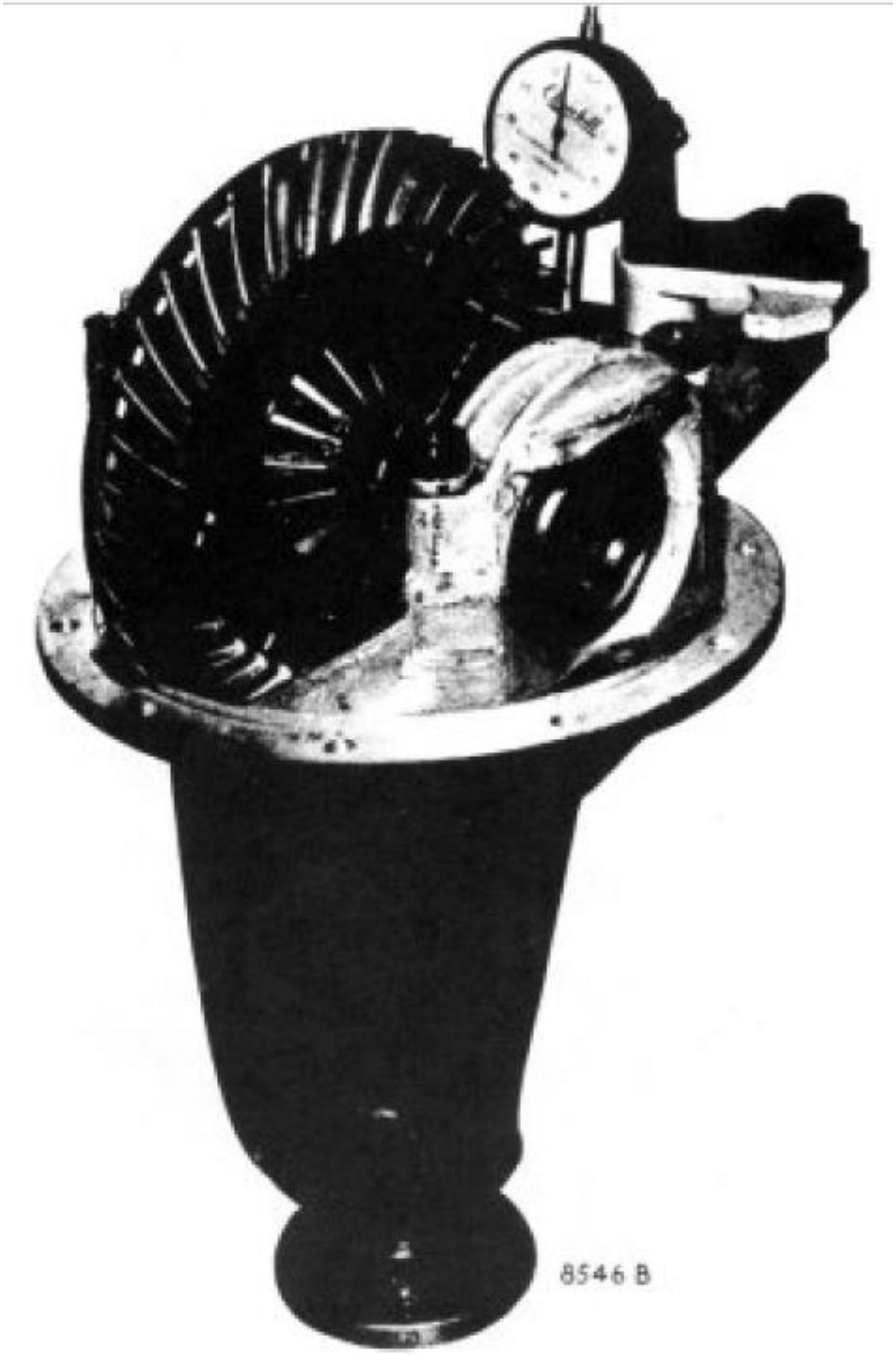


Fig. H.12 Measuring the crown wheel backlash

H.8 REMOVING AND REFITTING THE AXLE

Raise the rear of the car. Mark the propeller shaft coupling flanges so that they may be replaced in the original relative positions. Remove the four bolts and self-locking nuts and release the rear end of the propeller shaft from the axle. Remove the nuts and spring and flat washers securing each end of each check strap to the anchor pins and remove the check straps.

Remove the split pin and clevis pin securing the brake cables to each brake operating lever. Remove the small nut and Phillips recessed-head screw securing the hand brake cable clip to the axle casing. Remove the self-locking nut and large flat washer securing the brake balance lever to the pivot on the axle casing.

Remove the nut and spring washer securing the lower end of each damper link to the rear spring

clamp plate.

Unscrew the brake fluid supply pipe union and release the flexible pipe from the battery box support bracket.

Release the exhaust pipe from the exhaust manifold and the three supporting brackets and remove the exhaust pipe assembly.

Remove the nut and spring washer from the spring front anchor pin.

Support the axle casing and remove the rear shackle plates, brackets, and rubbers. Lower the axle support until the axle and spring assembly rests on the road wheels. Withdraw the front anchor pins and roll the assembly from beneath the car.

Uncouple the propeller shaft at the rear flange by unscrewing the four self-locking coupling nuts and bolts. Support the tail end of the propeller shaft.

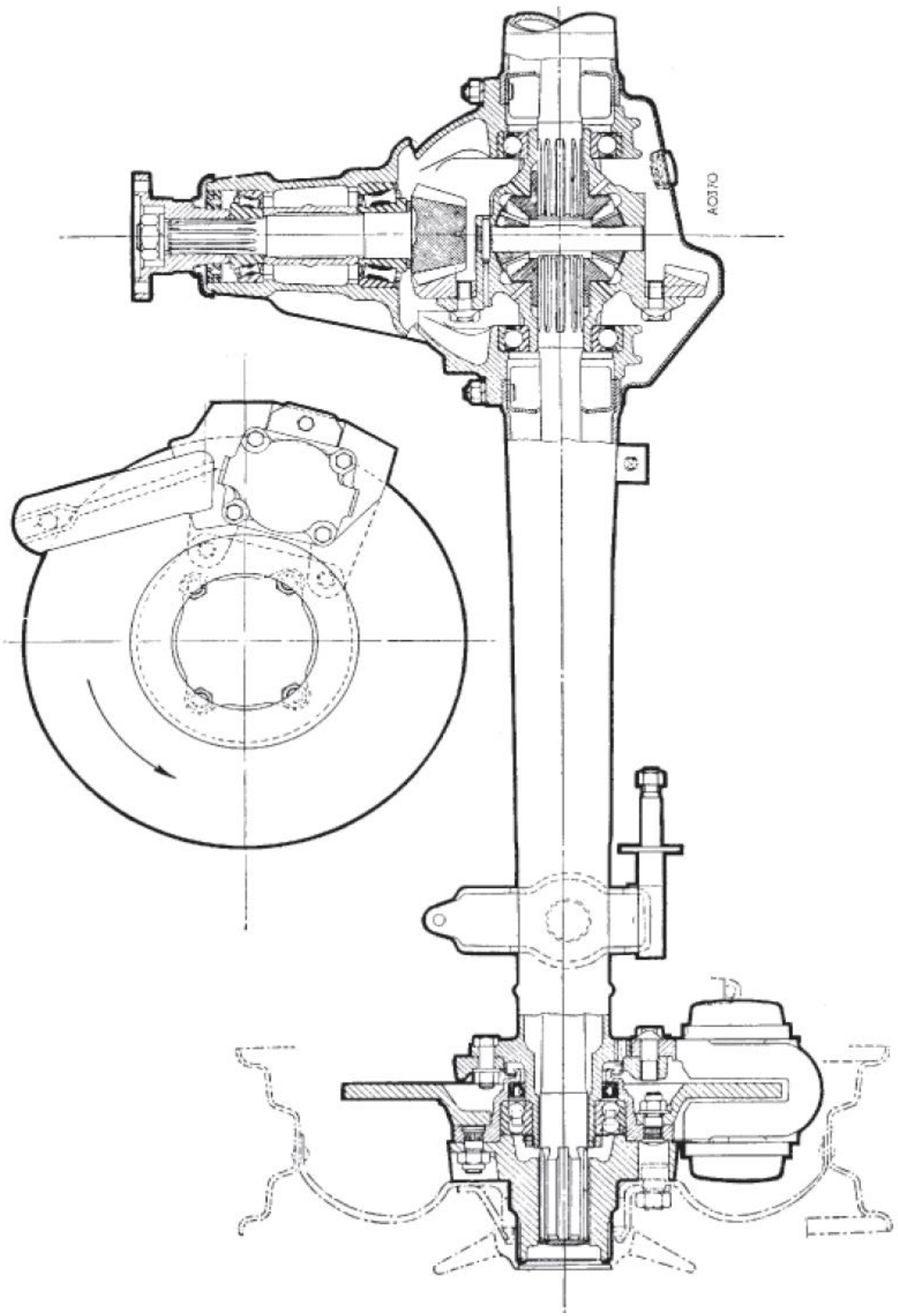
Remove the rear shackle nuts and bolts.

Remove the spring front anchorage bolts after removing the retaining nuts and spring washers.

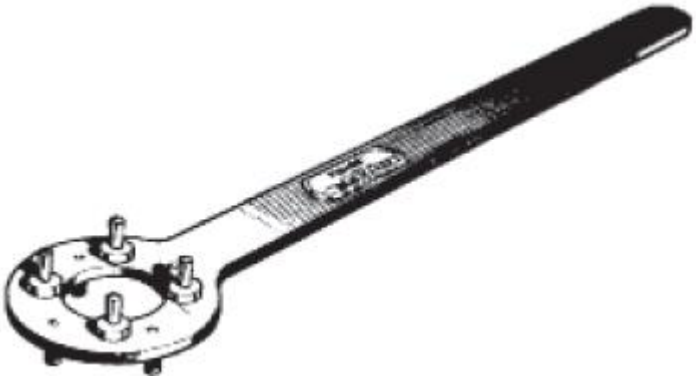
The axle is now free to be withdrawn on the stand rearwards from the car.

Replacement is the reverse of the above sequence of operations.

(See pages H.13 onwards for service tools.)

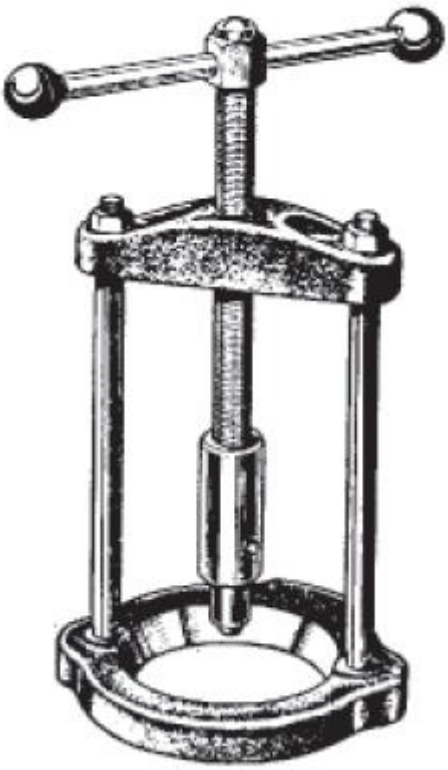


SERVICE TOOLS



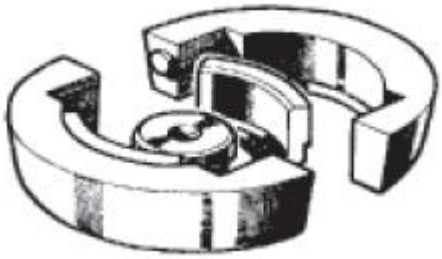
18G34A. Bevel Pinion Flange Wrench

This wrench prevents the rotation of the bevel pinion flange when releasing or tightening the flange securing nut. The pegs of the holding wrench fit into the bolt holes of the flange.



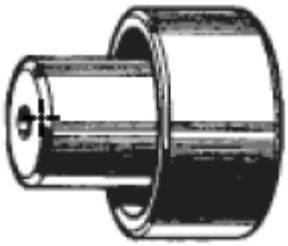
18G47C. Differential Bearing Remover (basic tool)

This standardized basic tool used in conjunction with adaptors 18G47T permits easy and safe withdrawal of the differential bearings.



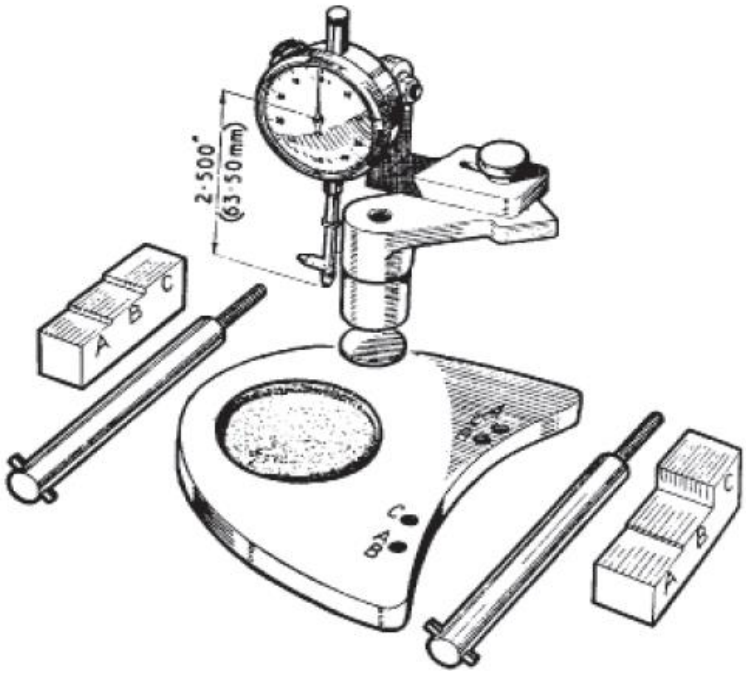
18G47T. Differential Bearing Remover-Adaptors

For use with basic tool 18G47C.



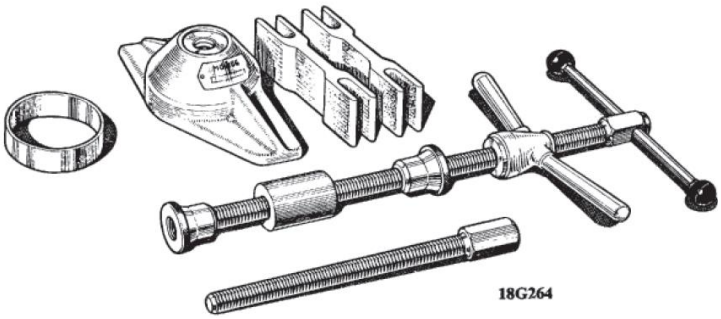
18G134P. Rear Hub Bearing Remover, Differential Bearing Replacer, and Rear Hub Assembly Replacer

Adaptor Use with handle 18G134.



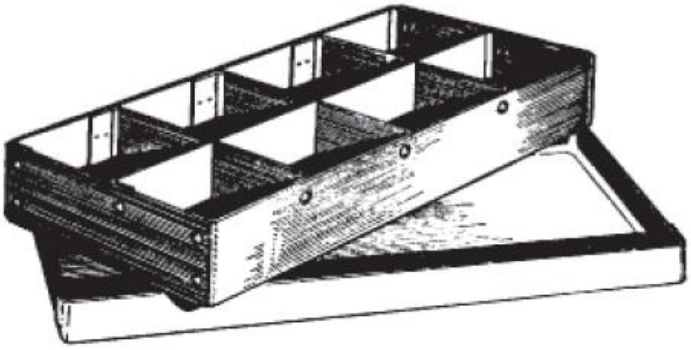
18G191B. Bevel Pinion and Differential Bearing Setting Gauge.

Correct assembly and adjustment of the pinion and differential gear is impossible without this special tool.



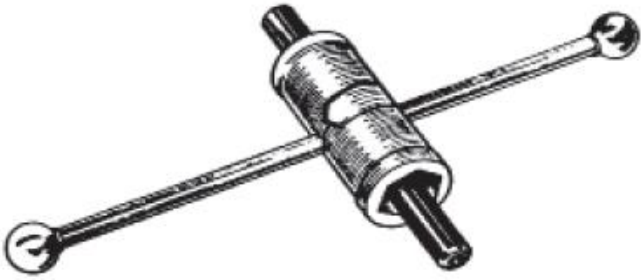
18G264. Bevel Pinion Bearing Outer Race Remover (basic tool)

Comprising a body, centre screw with extension and tommy bar, wing nut, guide cone, and two distance pieces. A plain ring is also included to serve as a pilot when the rear bearing outer races are being replaced.



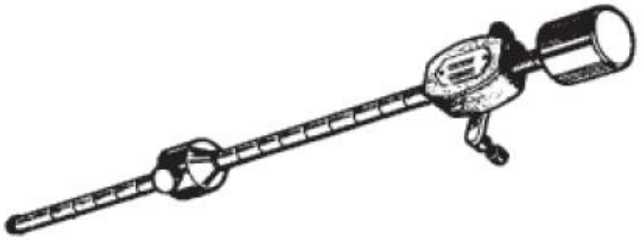
18G264K, Partitioned Fibre Box

A strong fibre box for storing the bevel pinion bearing outer race remover adaptors.



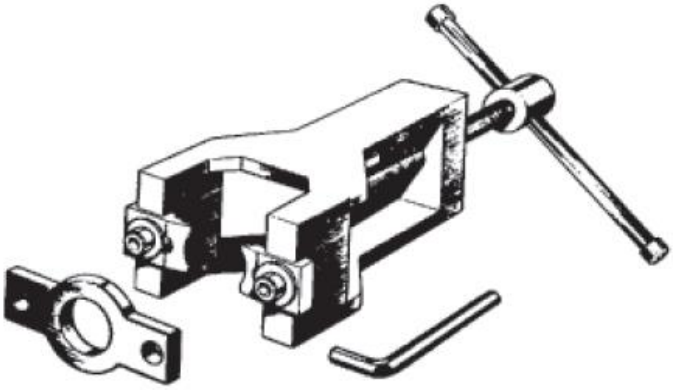
18G152. Rear Hub Nut Spanner

A reinforced tubular spanner complete with tommy bar, designed to pilot in the axle tube with the axle shaft withdrawn.



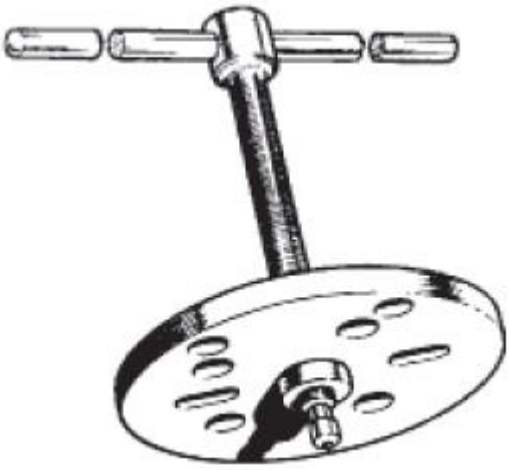
18G207. Bevel Pinion Bearing Preload Gauge

The movable arms of the tool are located in opposite holes of the bevel pinion flange and the weight moved along the rod to the poundage required.



18G285. Bevel Pinion Inner Race Remover and Replacer

A tool which is essential when withdrawing or replacing the inner bearing race of the pinion shaft

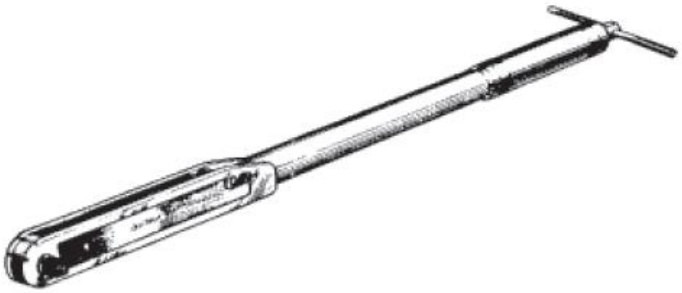


18G304. Hub Remover (basic tool)

The remover 18G304 is a basic tool for use with various adaptor bolts supplied separately. Screw the two adaptor bolts 18G304B onto the wheel studs and insert the thrust pad into the axle tube. The rear hub can then be removed by screwing up the centre screw against the thrust pad.

18G304B. Adaptor Bolts 7 in. UNF (2)

18G304J. Thrust Pad



18G372. Torque Wrench

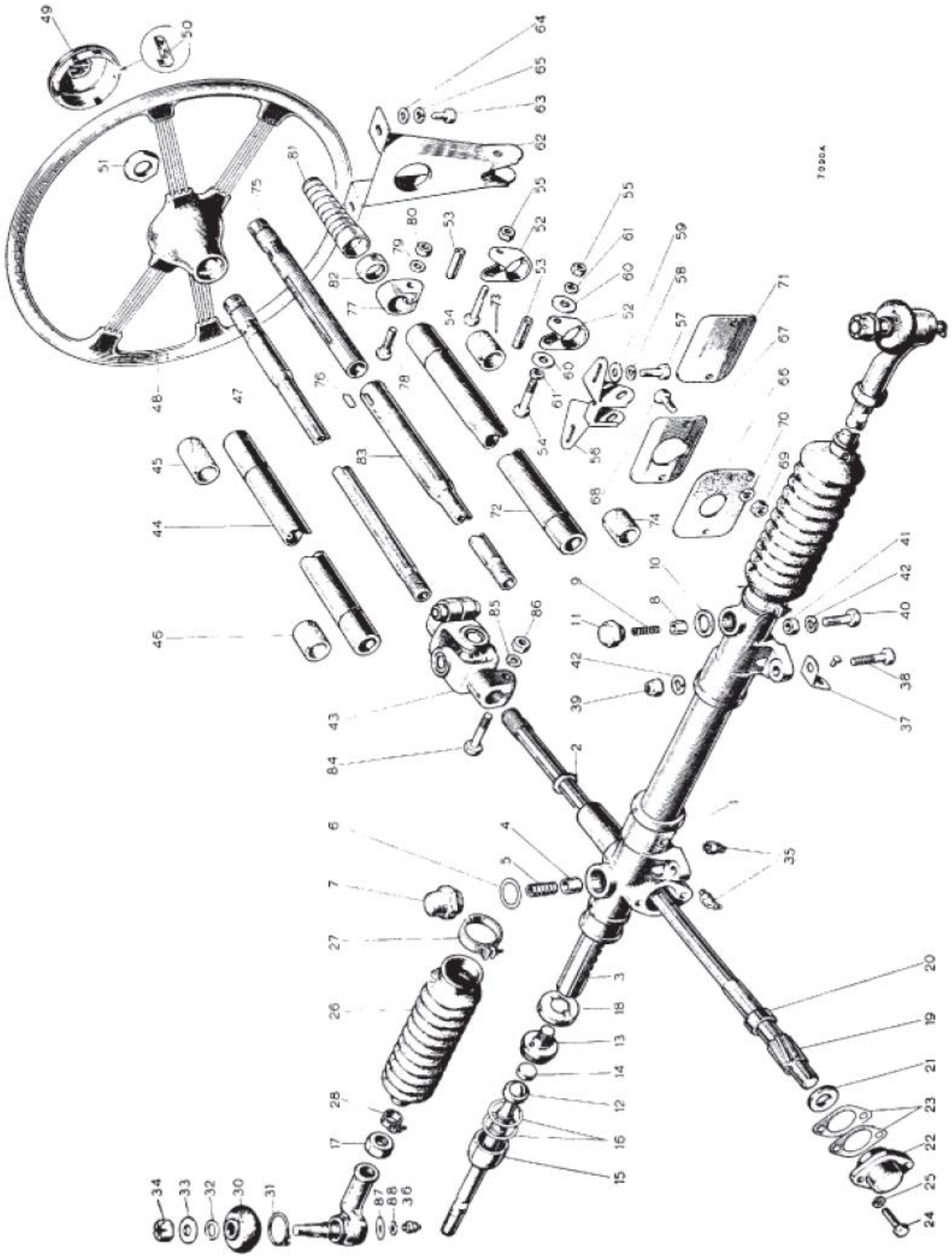
This tool is essential if the recommended maximum torque for the bevel pinion flange securing nut is not to be exceeded. This tool is used with a standard-type socket and in conjunction with the flange holding wrench 18G34A.s

18G264E. Adaptor for Front Bearing

18G264F. Adaptor for Rear Bearing

For use with basic tool 18G264.

SECTION J THE STEERING GEAR



KEY THE STEERING GEAR

1. Rack housing assembly (R.H.D.).
2. Pinion shaft seal.
3. Steering rack
4. Rack damper pad.
5. Rack damper spring.
6. Shim for pad housing.
7. Rack damper housing.
8. Pad for rack damper secondary.
9. Spring for rack damper secondary.
10. Washer for rack damper secondary.
11. Rack damper secondary housing
12. Tie-rod.
13. Male ball housing.
14. Seat for ball.
15. Female ball housing
16. Shim for ball housing (.003 in.).
17. Locknut for tie-rod.
18. Lock washer for tie-rod.
19. Steering pinion.
20. Thrust washer for upper pinion.
21. Thrust washer for lower pinion.
22. Pinion tail bearing.
23. Shim for tail bearing (.005 in.).
24. Screw-bearing to steering box.
25. Spring washer for bearing screw.
26. Rack seal.
27. Clip assembly for seal (Large).
28. Clip assembly for seal (small).
29.
30. Boot (rubber).
31. Clip for boot.
32. Ring for boot clip.
33. Washer for ball socket.
34. Nut for ball socket.
35. Greaser for pinion/rack.
36. Greaser for ball socket.
37. Shim-steering rack to bracket.
38. Bolt-rack to bracket (front).
39. Nut-rack to bracket (nylon).
40. Bolt-rack to bracket (rear.)
41. Nut-rack to bracket (rear).
42. Spring washer-rack to bracket.
43. Steering column universal joint.
44. Tube (outer).
45. Bush--upper end (felt).
46. Bush-lower end (felt).
47. Tube assembly (inner).
48. Steering wheel.
49. Cover for steering wheel.
50. Spring clip for cover.
51. Nut for steering wheel.
52. Steering column clamp.
53. Distance piece for clamp.
54. Bolt for clamp.
55. Nut for clamp bolt.
56. Steering column bracket (lower).
57. Screw-bracket to frame.
58. Spring washer-bracket to frame.
59. Plain washer-bracket to frame.
60. Plain washer-lower bracket to clamp.

61. Spring washer-lower bracket to clamp.
62. Steering column bracket (upper).
63. Screw-bracket to body rail.
64. Plain washer.
65. Spring washer,
66. Column seal (rubber).
67. Retainer for column seal.
68. Screw-seal and retainer to dash.
69. Nut for seal/retainer screw.
70. Spring washer for seal/retainer screw.
71. Blanking plate.
72. Column tube (outer).
73. Bush (upper).
74. Bush (lower).
75. Top end-adjustable,
76. Key for top end.
77. Collar clamp.
78 Bolt for clamp.
79. Spring washer for clamp bolt.
80. Nut for clamp bolt.
81. Spring cover
82. Cup for spring cover.
83. Tube assembly (inner).
84. Bolt for universal joint.
85. Spring washer.
86. Nut for universal joint bolt.
87. Washer (steel).
88. Washer (fibre).

GENERAL DESCRIPTION

The steering gear is of the direct-acting rack and pinion type, providing light and accurate control under all conditions.

It consists of a rack bar and toothed pinion, both working in the plain bearings of the housing.

No adjustment for bearing wear in the box is provided, except by the fitting of the necessary new parts.

When in new condition the backlash in the tooth engagement is hardly perceptible, i.e. .001 to .003 in. (.025 to .075 mm.).

The steering shaft is attached to the steering gearbox by a universal coupling,

MAINTENANCE

All working parts are immersed in oil. An oil gun nipple is provided in the centre of the box to replenish the oil, and a nipple on the pinion housing enables the upper end of the pinion shaft to be lubricated,

Felt bushes are fitted to the steering column. These are impregnated with oil and graphite, and no lubrication should be necessary, but if, after long periods, a dry squeak develops, this may be cured by a small application of oil.

J.1 REMOVING AND REPLACING THE STEERING WHEEL

Carefully prise the steering wheel cover from the hub of the wheel without chipping the material or the paintwork.

Unscrew the steering wheel nut and mark the wheel hub and column to ensure replacement in the original position. Pull of the wheel with service tool 18G310.

When replacing the wheel, position it on the column splines in the original position to place the spokes equally about a horizontal datum line.

Tighten the nut to the torque Wrench setting shown in "GENERAL DATA'.

The steering wheel on a car fitted with the optional adjustable steering column may be removed complete with the column extension if necessary.

Remove the clamping nut and bolt from the telescopic adjustment clamp and extend the column as far

as possible. Contract the plated helical sleeve and clamp collar towards the steering wheel and extract the key which engages the splined shaft.

Withdraw the steering wheel and column extension.

J.2 REMOVING THE STEERING COLUMN

Withdraw the clamping bolt and nut securing the universal joint to the steering mast. Remove the nuts and clamp plate to release the draught-excluding rubber from the toeboard at the lower end of the column.

Withdraw the two clamping bolts, nuts, spring and flat washers, and distance tube which support the steering column, and withdraw the column complete with steering mast and steering wheel.

J.3 REMOVING THE STEERING COLUMN BUSHES

Remove the steering wheel and column assembly as detailed in Section J.2 and withdraw the shaft from the outer column. Prise out the felt bushes.

New bushes should be soaked in graphite oil before reassembly

J.4 REMOVING THE STEERING COLUMN UNIVERSAL JOINT

Bolts and nuts clamp the universal joint splines on the steering mast and steering pinion, and the bolts must be withdrawn completely to release the universal joint assembly.

Slacken the bolts supporting the steering column below the dash panel.

Withdraw the clamping bolts from the universal joint.

Move the steering column and steering mast assembly upwards to withdraw the steering mast from the universal joint.

Withdraw the universal joint from the steering pinion. When replacing the universal joint see Section J.9.

J.5 DISMANTLING THE UNIVERSAL JOINT

The Hardy Spicer joint has four needle-roller bearings retained on a centre spider by circlips. The joints are packed with grease on assembly and there is no further provision for lubrication.

Remove any enamel and dirt from the snap rings and bearing races. Remove the snap rings by pinching the ears together and prising them out with a screwdriver.

If a ring does not slide readily from its groove, tap the end of the bearing race lightly to relieve the pressure against the bearing.

Hold the joint in one hand with the side of a yoke at the top and tap the radius of the yoke lightly with a copper hammer. The bearing should begin to emerge; turn the joint over and remove the bearing and needle rollers with the fingers. If necessary, tap the bearing race from the inside with a small-diameter bar, taking care not to damage the bearing face, or grip the needle bearing race in a vice and tap the yoke clear.

Repeat this operation for the opposite bearing. One yoke can now be removed. Rest the two exposed trunnions on wood or lead blocks to protect their ground faces and tap the top lug of the flange yoke to remove the bearing race.

Turn the yoke over and repeat the operation. When reassembling, replace the cork gasket and gasket retainers on the spider journals, using a tubular drift. The spider journal shoulders should be shellacked prior to fitting the retainers to ensure a good oil seal.

Smear the walls of the races with grease and assemble the needle rollers to the bearing races and pack with grease.

Insert the spider on one yoke and, using a soft-nosed drift slightly smaller in diameter than the hole in

the yoke, tap the bearings into position. It is essential that the bearing races are a light drive fit in the yoke trunnions.

Repeat this operation for the other bearings and replace the circlips, making sure that they are firmly located in their grooves. If the joint appears to bind, tap lightly with a wooden mallet to relieve any pressure by the bearings on the ends of the journals.

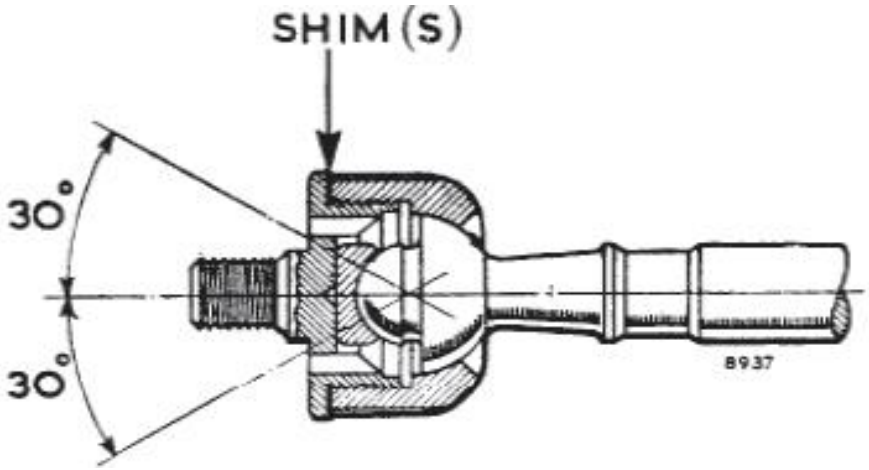


Fig. J.1 The assembly of a tie-rod ball joint

J.6 REMOVING AND REPLACING THE STEERING GEARBOX

The procedure detailed here will remove the steering rack from a completely assembled car. If the chassis frame front extension has been removed, the steering rack can be removed with the pinion in position.

Remove the steering rack damper and secondary damper assemblies.

Take out the two bolts and spring washers and withdraw the pinion tail bearing and shims and bottom thrust washer, placing a container to catch any oil that may drain from the steering rack. Support the front end of the car by placing jacks beneath the lower suspension arm spring pans and remove the road wheels.

Remove the split pins and nuts and drive the tie-rod ball pins from the steering arms. Turn the steering onto the left lock (R.H.D. cars) or right lock (L.H.D. cars). Withdraw the clamping nut and bolt from the universal joint on the pinion shaft and withdraw the pinion assembly. Remove the nuts and bolts securing the steering rack to the chassis frame, noting that the front bolts are fitted with self-locking nuts, and packing shims may be found between the rack and the frame bracket

Move the steering assembly towards the centre of the car until the steering tie-rod is clear of the front extension plate and withdraw the assembly downwards.

Replacing

The steering gearbox is assembled to the car by reversing the above procedure although special attention should be given to the instructions in Section J.9.

When re-engaging the pinion with the universal joint splines, ensure that the cut-away portion for the clamp bolt is aligned with the bolt hole.

J.7 DISMANTLING THE STEERING GEARBOX

If the steering rack assembly is removed complete with the steering pinion in position, remove the pinion as follows

Remove the damper housing, spring, pad, and shins from above the pinion housing.

Unscrew the secondary damper housing and remove complete with washer, spring, and damper pad.

Withdraw the pinion tail bearing and shims and the pinion bottom thrust washer, placing a container to catch any oil that may drain from the steering rack. The top thrust washer will remain trapped behind the steering rack.

Unlock the tie-rod ball-end locknuts and remove the ball-end assemblies. Release the rubber gaiter seal clips and remove the seals.

Secure the rack housing between suitable clamps in a vice and tap back the washers locking the tie-rod ball housings. Unscrew the ball housings and remove the lock washers.

J.8 REASSEMBLING THE STEERING GEAR

Insert the ball end of the tie-rod in the female housing and assemble the ball seat, male seat housing, and shims. Tighten the two housings together with special tools 18G312 and 186313. The ball must be a reasonably tight sliding fit without play. Adjustment is carried out by varying the thickness of the shims between the ball housings. The shims are provided in thicknesses of .003 and .005 in. (.08 and .13 mm.). When correctly adjusted fit a new lock washer to one end of the steering rack, then replace and tighten the ball housing with special tool 18G313. The ball housing must be locked in three places by the flange of the lock washer.

Insert the top thrust washer (the thick one) with the slotted side away from the pinion and insert the rack in its housing. Refit and adjust the other ball seat.

Refit the rubber gaiters and clips.

Replace the ball-end locknuts and joint assemblies in their approximate original positions.

Fit a new pinion shaft felt seal.

If the chassis frame front extension is in position, the steering rack assembly should be positioned on its mounting brackets by reversing the procedure detailed in Section J.6 before refitting the pinion.

Replace the smaller thrust washer on the plain end of the pinion shaft.

Replace the shims and the pinion tail bearing and secure them in position. Check the end-play of the pinion shaft, which should be between .002 and .005 in. (.05 and .13 mm.). If necessary, the shims must be adjusted to give this degree of play.

To adjust the rack damper the plunger must be replaced in the cap and the cap screwed into position without the spring or shims until it is just possible to rotate the pinion shaft by drawing the rack through its housing. A feeler gauge is then used to measure the clearance between the hexagon of the plunger cap and its seating on the rack housing. To this figure must be added an additional clearance of .002 to .005 in. (.05 to .13 mm.) to arrive at the correct thickness of shims which must be placed beneath the damper cap. The shims are .003 in. (.08 mm.) thick.

Remove the damper cap and plunger and replace and tighten the assembly with the requisite number of 003 in. (-08 mm.) shims as defined in the previous paragraph.

Replace the secondary damper without shims

Pump approximately 1/2 pint (.28 litre) of Hypoid oil to Ref. B into the rack housing through the nipple provided, or release one of the outer rubber gaiter clips and pour the oil in through a funnel. Move the rack assembly backwards and forwards slowly to distribute the oil.

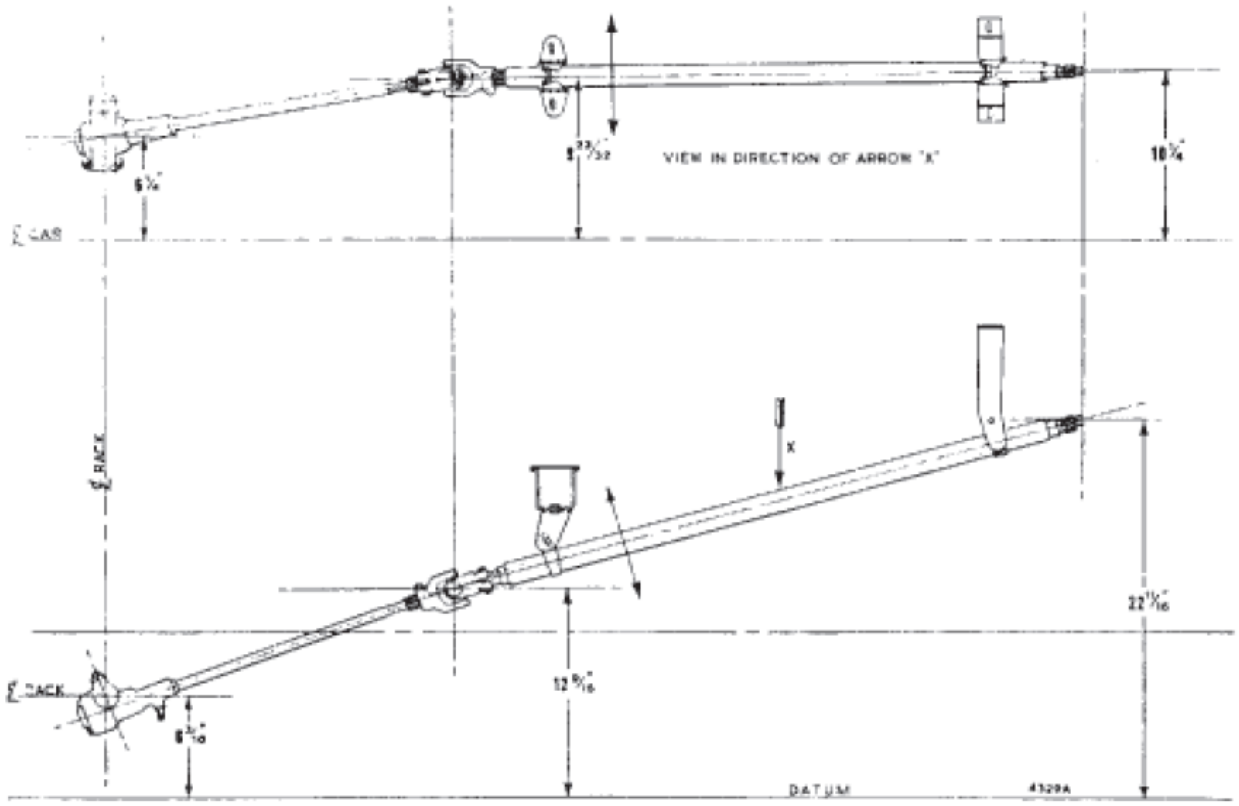


Fig.J.2 Steering column alignment

J.9 STEERING COLUMN ALIGNMENT

When assembling the steering column or steering gearbox assembly to the car care must be taken to ensure a free condition at the universal joint before the column or gearbox securing bolts are tightened. For the universal joint to be completely unloaded the centre line of the steering column and the centre-line of the steering rack pinion must pass through the centre of the universal joint spider when the assembly is viewed from above and from the side. Failure to ensure complete freedom at the universal joint will load the steering pinion upper bearing and cause extreme wear and steering stiffness.

To enable the assembly to be secured in the correct position the attachment holes in the support bracket at the lower end of the steering column are slotted to permit up and down and sideways movement, and packing shims (see Fig. J.3) are fitted between the steering gearbox mounting bosses and the brackets on the front suspension member

Tighten the universal joint clamp bolts.

With the steering column draught-excluding rubber clamp plate and all column and rack securing bolts slack, position the universal joint and tighten the support bracket clamp bolts at the lower end of the column.

Should there be a gap between the gearbox bosses and mounting brackets, remove the bolts, pack with shims as required, and replace and tighten the securing bolts

To ensure complete alignment again slacken and retighten the steering column lower support bolt.

Tighten the upper support bracket bolt.

J.10 CHECKING AND ADJUSTING FRONT WHEEL ALIGNMENT

When checking the track width at the front and the rear of the front wheels use a suitable trammel or any special proprietary alignment gauge available.

The wheels should run parallel and have no toe-in.

See that the tyres are inflated to the correct pressures. Set the wheels in the straight-ahead position.

Set the arms of a suitable trammel to the height of the hub centre on the outside of the wheels.

Place the trammel to the rear of the wheels and adjust the pointers to register with the wheel rims. Chalk the position of the pointers in each wheel rim and push the car forward one half-turn of the wheels.

Take the front reading from the same marks on the rims. For the alignment to be correct the pointers should again register with the marks on the rims.

If adjustment is necessary, proceed as follows.

Slacken the locknuts at the ends of the short tie-rods and the clips securing the rubber gaiters to the tie-rods.

Use the spanner flats on the rods to rotate each of the tie-rods **equally** in the desired direction. These both have right-hand threads.

NOTE. —To ensure that the steering gearbox is in the central position and that the steering geometry is correct it is important that the tie-rods are adjusted to exactly equal lengths. This can be ascertained by measuring from the end of the flats to the locknuts.

After adjustment retighten the ball joint locknuts and rubber gaiter clips and ensure that the machined under sides of the ball joints are in the same plane.alignment

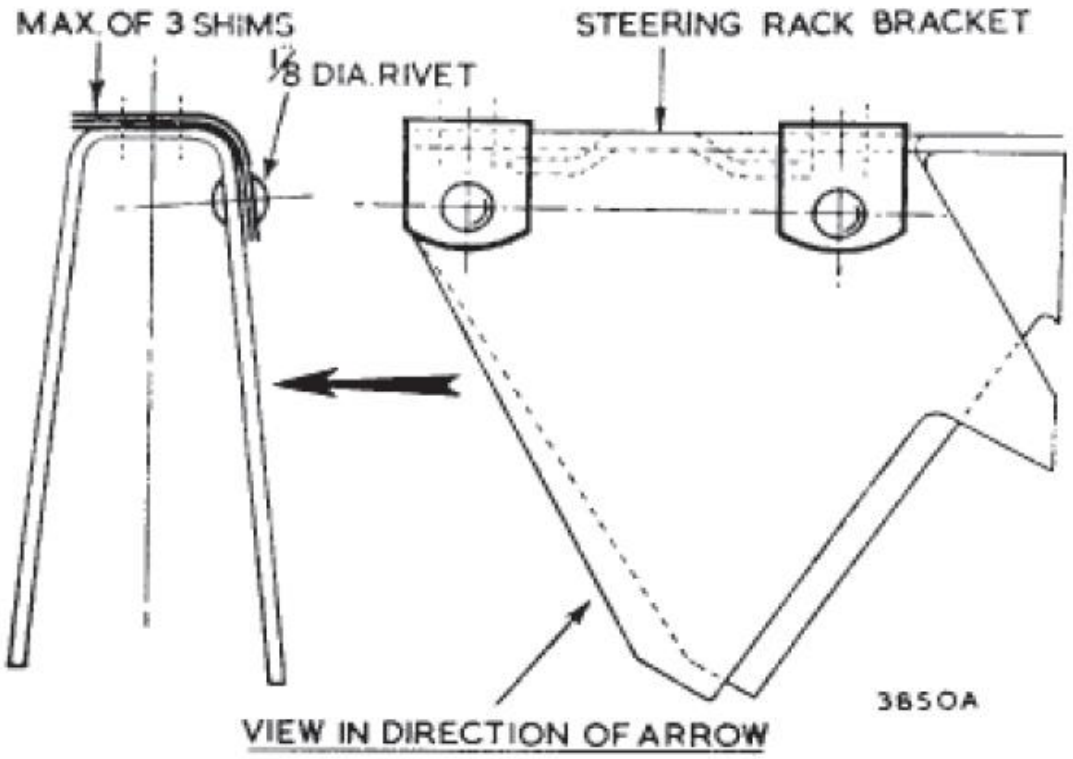


Fig. J.3 The location of the steering gearbox mounting bracket shims which are used to position the gearbox and assist in obtaining correct steering column alignment. When the necessary thickness of shims has been determined they are riveted to the chassis frame to prevent their loss

J.11 FITTING AN ADJUSTABLE STEERING COLUMN

Remove the steering wheel as detailed in Section J.1.

Remove the steering column assembly as detailed in Section J.2.

Fit the steering column to the car and tighten the clamp bolts.

Fit the steering wheel, locating it on the splines to bring the centre-line of the spokes horizontal when the road wheels are in the straight-ahead position.

SERVICE TOOLS

18G310. Steering Wheel Remover

This extractor has been specially designed to remove the steering wheel without damage.

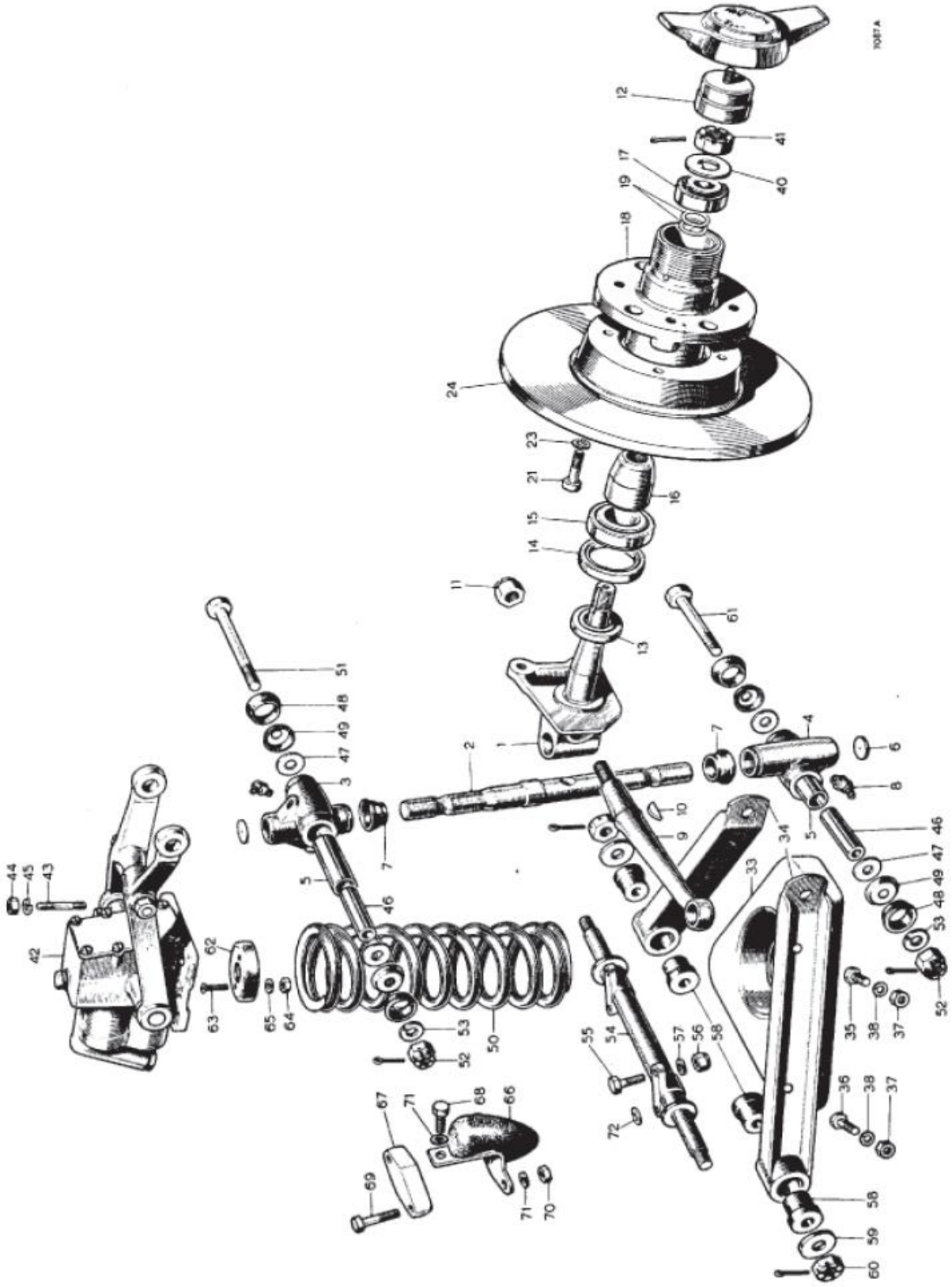
18G312. Steering Tie-rod Pin Spanner

This tool is designed for use with the C-spanner 18G313 for dismantling the steering tic-rod ball housing. In use it is clamped in a vice and the pins of the spanner are engaged with the holes in the housing. Use the spanner 184313 to unscrew the housing cap.

18G313. Steering Tie-rod C-Spanner

Designed to engage the shallow splines of the steering rack ball housing cap and remove it without damage.

SECTION K THE FRONT SUSPENSION



KEY TO THE FRONT SUSPENSION COMPONENTS

1. Steering knuckle-L/H.
2. Swivel pin-L/H.
3. Link-swivel pin-upper L/H.
4. Link-swivel pin—lower-L/H.
5. Bush.
6. Plate.
7. Seal-swivel pin.
8. Grease nipple-link.
9. Steering lever-L/H.
10. Key-Woodruff No. 8-steering lever.
11. Nut for steering lever.
12. Grease-retaining cup.
13. Distance washer-hub.
14. Oil seal-hub.
15. Bearing-hub-large.
16. Distance piece-hub bearing.
17. Bearing-hub-small.
18. Hub assembly-front.
19. Shims-bearing adjustment.
21. Bolt for brake disc mounting.
23. Spring washer for disc mounting holt.
24. Disc--brake.
33. Spring pan assembly.
34. Bottom wishbone assembly.
35. Screw-spring pan to wishbone.
36. Screw-spring pan to wishbone.
37. Nut-spring pan to wishbone screw,
38. Spring washer-pan to wishbone screw.
40. Washer.
41. Nut (L/H thread).
42. Hydraulic damper.
43. Stud-hydraulic damper to cross-member.
44. Nut-hydraulic damper to cross-member stud.
45. Spring washer--hydraulic damper to crossmember.
46. Distance tube-link.
47. Thrust washer--link.
48. Seal-link.
49. Support-link seal,
50. Spring-coil.
51. Bolt--wishbone to link.
52. Castle nut-wishbone to link.
53. Spring washer-wishbone to link.
54. Wishbone pivot.
55. Bolt-pivot to member.
56. Nut-pivot to member bolt.
57. Spring washer-pivot to member bolt.
58. Bush for bottom wishbone.
59. Washer for wishbone pivot.
60. Slotted nut for wishbone pivot.
61. Bolt-bottom wishbone to link.
62. Spigot-spring.
63. Screw-spigot to member.
64. Nut-spigot to member screw,
65. Washer-spigot to member screw.
66. Check rubber.
67. Distance piece-check rubber.
68. Screw-check rubber to member,
69. Bolt-check rubber to member.
70. Nut for bolt-check rubber to member.
71. Spring washer-check rubber to member.
72. Plain washer--front outer head pivot to member bolt
52. Castle nut-wishbone to link.

GENERAL DESCRIPTION

The independent front suspension is the wishbone type with coil springing. The front wheels follow the road surface without influencing each other, and each wheel is permitted to rise and fall vertically. The suspension gives perfect stability with riding comfort, and by the combination of the direct-acting rack and pinion steering gear it also provides light and accurate control under all conditions.

The inner mountings of the lower wishbones are fitted with flexing rubber bearings which require no lubrication and form a silent and resilient connection to the box section chassis frame cross-member.

The steering swivel pins are of a special design, with the top and bottom bearings threaded to provide large areas and absorb both thrust and journal loads. The swivel pin threads are of opposite hand on each side of the car and are therefore not interchangeable. The steering connection from wheel to wheel is provided by the steering gearbox rack bar and two short tic-rods, with ball joints at each end. The outer ball joints are fitted with grease gun nipples, but the inner ball sockets are enclosed in the telescopic rubber dust excluders and are automatically lubricated from the steering gearbox.

K.1 REMOVING THE FRONT SUSPENSION

Lift the front of the car with a jack placed under the centre of the front cross-member until the front wheels arc just clear of the ground.

Remove the front wheels.

Place the jack under each spring pan in turn and lift until the hydraulic damper arms are just clear of the rebound rubbers.

Disconnect the hydraulic brake hose (Section M.18).

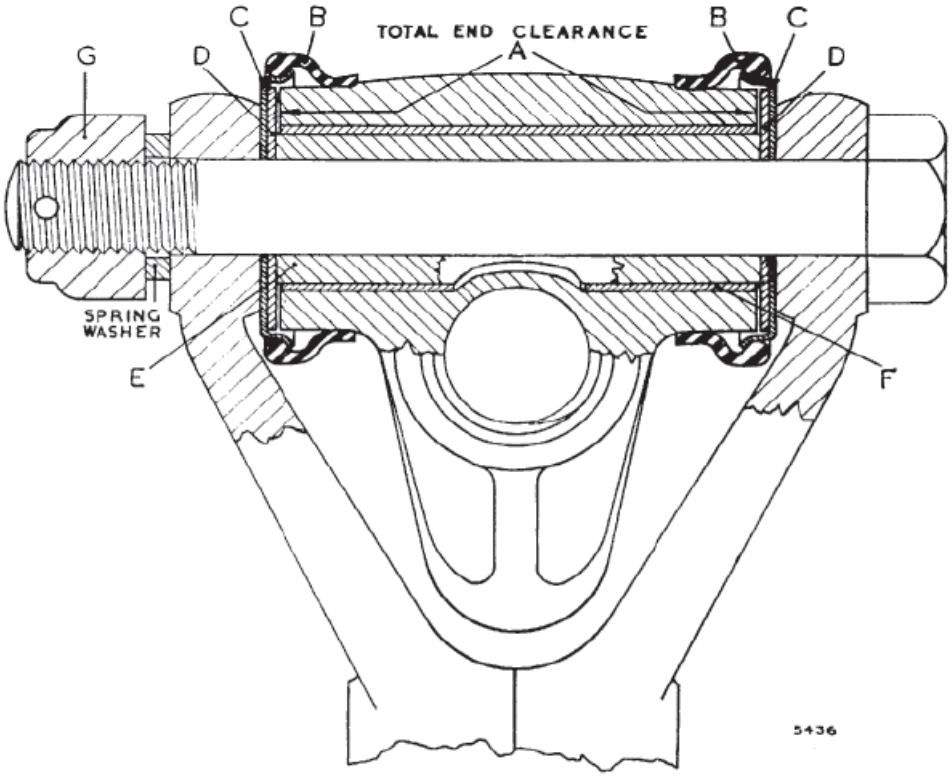


Fig. K1 The assembly of the king pin swivel link

Slacken the steering tie-rod nuts and screw the tie-rods out of the steering ball joints, using a spanner on the flats on the rods.

Remove the split pins and nuts from the two outer fulcrum bolts. Draw out the bolts and take away the front hub and swivel pin units complete. (Take care of the thrust washers, rubber seals, retainers, and fulcrum pins.)

Release the jacks from under the spring pans.

Press down the lower wishbone assemblies and remove the coil springs

Remove the four bolts holding the spring pan to the levers

Remove the split pins, nuts, and washers from the ends of the inner lower fulcrum pin and slide off the levers and the rubber bushes.

Remove the bolts holding the lower fulcrum pins to the chassis cross-member.

Remove the nuts from the studs securing the hydraulic dampers to the top of the suspension cross-member.

Inside the outer ends of the suspension cross-member will be found the coil spring locating plates. These are each attached by two bolts and nuts

K.2 DISMANTLING THE SWIVEL PINS

Unscrew the upper and lower links from the ends of the swivel pins. The left-hand swivel pin has a left-hand thread at each end.

The stub axle is located by a collar on the swivel pin and the stem of the steering lever engaging a groove in the pin. To separate the two the steering lever must be withdrawn from the stub axle, but this procedure is not advised unless absolutely necessary.

K.3 EXAMINING PARTS FOR WEAR

Examine the following parts before reassembling:

Bushes for bottom wishbone

If these are split, perished, eccentric, or oil-soaked they should be renewed

Bottom wishbone

Examine the end holes for elongation and the assembly for looseness. If there is any sign of slackness between the wishbone arms and the pan separate the components and check the bolt holes for elongation. The bolt holes are 21/64 in. (8.33 mm.) diameter.

Coil spring

Examine for cracks and check for tension, if necessary, to details in the "GENERAL DATA' section. Renew the springs if they are defective.

Swivel link assemblies

Check the swivel links. The dimension across the thrust faces should be 2.327 in. (59.11 mm.). If these are appreciably worn the assembly of link and bush should be renewed. If the bush only is worn a new one should be pressed in, reamed, and burnished to .750 in. (19-05 mm.)

NOTE. When pressing in this bush see that the hole in the bush faces the threaded bore. (See Fig. K.1.)

Check the threaded bores of the links on the swivel pins. When new, these are a free turning fit without slack. An appreciable amount of slack is permissible in these threaded bearings and they do not require renewal unless they are very slack.

Check the fulcrum pin distance tubes for scoring or wear. These should be 2.337 in. (59.36 mm.) long by .7480 in. (19.00 mm.) diameter.

Examine the case-hardened thrust washers for ridges; the faces should be flat and parallel within .0005 in. (.01 mm.).

The thickness should be .068 to .065 in. (1.73 to 1.68 mm.), the bore .510 to .505 in. (12.95 to 12.83 mm.), and the outside diameter 1.25 in. (31.75 mm.).

When the swivel links, distance tubes, and thrust washers are assembled the total end clearance between the link and the thrust washers should be .008 to .013 in. (.2 to .33 mm.) (see [A], Fig. K.1).

Check that all grease nipples are clear

Examine the rubber seals, and if these are perished or Split renew them.

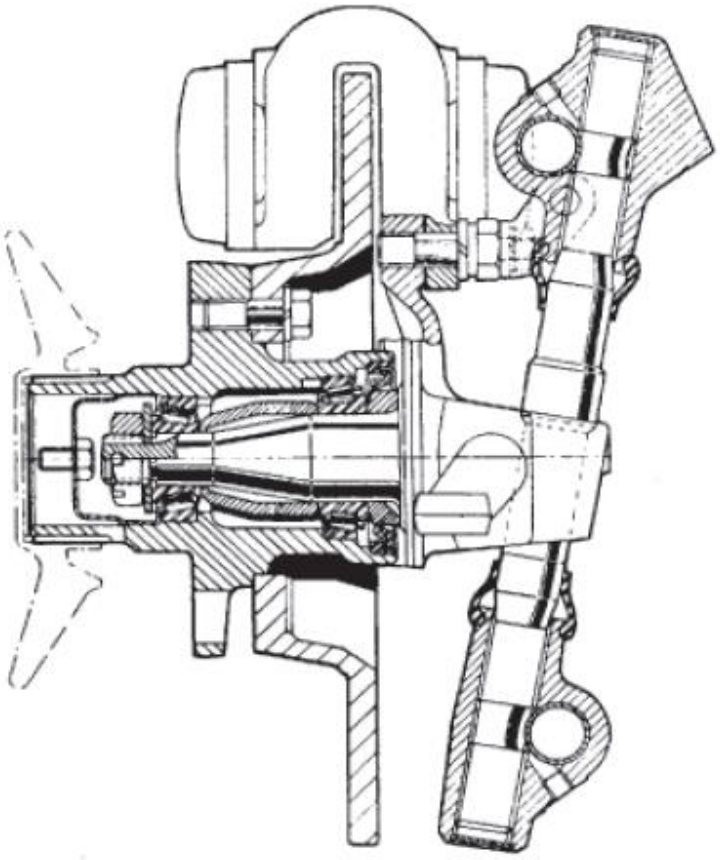


Fig. K.2 A section of the front hub and brake disc. The brake unit is shown out of position for clarity

K.4 REASSEMBLING THE SWIVEL PINS

The swivel pin assembly may be reassembled without difficulty by carrying out the removal instructions in the reverse order, provided the following points are given special attention:

1. The swivel pin and links fitted to the left-hand side of the car have left-hand threads at each end and those fitted to the right-hand side have right-hand threads.
2. The swivel pin links screw onto threads on each end of the swivel pin and the threads are waisted at their centre to avoid fouling the pivot bolts passing through the links. Before the pivot bolt is replaced the link must be correctly positioned on the thread.

   First screw the link onto the swivel pin until the waisted portion of the pin lines up with the pivot bolt hole.

   Place the pivot bolt in position in the link and screw the link to the extent of its maximum travel on the swivel pin thread; this is about three revolutions total. Screw the link back approximately one and a half times to obtain the maximum clearances for the pivot pin in each direction.

   The lower link must also be centralized in a similar manner before the swivel pin is fitted to the suspension arm.

3. Before the lower steering knuckle link is bolted in position ensure that both thrust washers and rubber seals are fitted correctly (see Fig. K.1) and make sure that the links have a total end-clearance of .008 to .013 in. (.2 to .33 mm.) between the end faces of the link and the thrust washers.

K.5 REPLACING THE FRONT SUSPENSION

Bolt up the coil spring top locating plates inside the front cross-member.

Replace the hydraulic dampers.

The dampers are interchangeable from side to side.

Bolt up the lower fulcrum pins. The two front outer bolts have their nuts uppermost and the six other bolts have their nuts below.

Fit the rubber bushes into the lower levers. These bushes will be found to be a loose fit in the lever, but when clamped up by the nut and washer will expand into their housing. These bushes do not rotate on their surfaces, the angular movement being taken up by the flexing of the rubber.

Special care should be taken when assembling these bushes to maintain a central location so that the expansion of each half of the bush is equal.

To attain this, insert each bush so that it protrudes equally each side of the housing (see Fig. K.4), and then clamp up with the washer and nut and fit the split pins. When central, the outer flanges of the bushes should all be of equal proportions.

It is essential to clamp up the bushes when the lower suspension levers are set parallel with the ground to ensure even stresses on the bushes in service.

Fit the spring pans between the levers, but with the heads of the bolts inside the spring pan.

Do not fully tighten up the spring pan bolts—leave them half a turn slack.

Press down the lower wishbone assemblies.

Smear each end of the coil springs with grease to prevent any slight squeaking in operation.

Push the coil springs up into the cross-member and over the locating plates.

Jack up the lower wishbone assemblies until they are approximately parallel to the ground.

NOTE.-The king pin bearing threads, the stub axles, and the stub axle nuts are right-hand-threaded on the right-hand side of the car and left-hand-threaded on the left-hand side.

Fit the swivel pin and hub units to the suspension levers.

Ensure that the thrust washers, rubber seals, and retainers are assembled in the right order (see Fig. K.1).

Lubricate these parts and the fulcrum pins during assembly and again afterwards with the grease gun, using the recommended lubricant

Do not fully tighten up the top or bottom slotted nuts -leave them half a turn slack.

Connect the hydraulic brake hoses. See the correct method as explained in Section M.18.

Screw the steering tie-rods into the outer steering ball joints. Screw the rods right in and then slack off five complete turns. This will give a rough wheel alignment and render subsequent accurate alignment easier.

Adjust and bleed the front brakes as detailed in Section M.2.

Fit the front wheels.

Bounce the front end of the car up and gown a few times. This allows the suspension fulcra to settle down.

Tighten the spring pan bolts and the outer fulcrum bolts, fitting new split pins.

Check and adjust the front wheel alignment.

K.6 REMOVING AND DISMANTLING A FRONT HUB

Apply the hand brake and raise the front of the car until the wheel to be operated on is clear of the ground.

Remove the wheel.

Remove the wheel brake unit as detailed in Section M.7.

Withdraw the grease retainer by applying a suitable extractor (service tool 18G568) to the thread on the cap.

Extract the split pin from the stub axle nut and remove the nut, remembering that the stub axle on the left-hand side of the car has a left-hand thread.

Draw off the hub and brake disc assembly, using service tool 18G304. The brake disc can now be removed from the hub by removing the four securing screws and spring washers.

Remove the distance washer, which will have remained on the stub axle.

The centre of the outer hub bearing may now be withdrawn together with the shims which are fitted between the bearing and the distance piece.

Remove the oil seal and draw out the centre of the inner bearing and the bearing distance piece.

Place the hub on a press with the outer end downwards and press out the outer bearing ring. Press out the inner bearing ring in the same manner with the inner end of the hub downwards.

K.7 REASSEMBLING AND REPLACING A FRONT HUB

If all grease has been cleaned from the hub and the bearings washed for examination, ensure that they are repacked with grease before the hub is reassembled.

Press the two bearing outer rings into the hub. Insert the bearing distance piece. Fit the inner bearing centre, the oil seal, and the distance washer, with the metal face of the oil seal and the chamfered side of the distance washer away from the bearing.

Mount the assembly on the stub axle shaft and fit the adjusting shims and outer bearing centre. Adjust the bearing end-float if necessary, and, finally, lock up as detailed in Section K.8.

Pack the assembly with grease and replace the grease retaining cap. Replace the wheel brake unit as detailed in Section M.10.

K.8 ADJUSTING THE FRONT HUB BEARINGS

The end-float in the hub bearings must be checked and adjusted whenever the hub has been dismantled for attention or when the play in the hub bearings becomes excessive. The end-float is adjustable by means of shims situated between the outer bearing and the bearing distance piece.

Proceed as follows to obtain the correct setting:

1. Assemble the hub, using no shims, and mount the assembly on the stub axle. Fit the stub axle nut and washer and tighten the nut until the hub bearings bind. This will pull the outer rings of the bearings fully against their locating flanges inside the hub.
2. Remove the stub axle nut and washer and pull out the centre of the outer bearing. Insert a sufficient thickness of shims to produce an excessive amount of end-float and note the total thickness of the shims used. Fit the bearing centre, stub axle nut, and washer and tighten the nut.
3. Measure accurately the total amount of end-float in the bearings. Remove the stub axle nut, washer, and outer bearing centre. Reduce the number of shims to a thickness which will give an end-float of between .002 and .004 in. (.051 and .102 mm.).
4. Replace the stub axle nut and washer and tighten the nut to a torque Wrench reading of 40 to

70 lb. ft. (5.33 to 9.68 kg, m.). Latitude for the torque Wrench reading is given so that the nut can be tightened sufficiently to align a castellation with the stub axle split pin hole. Insert a new split pin.

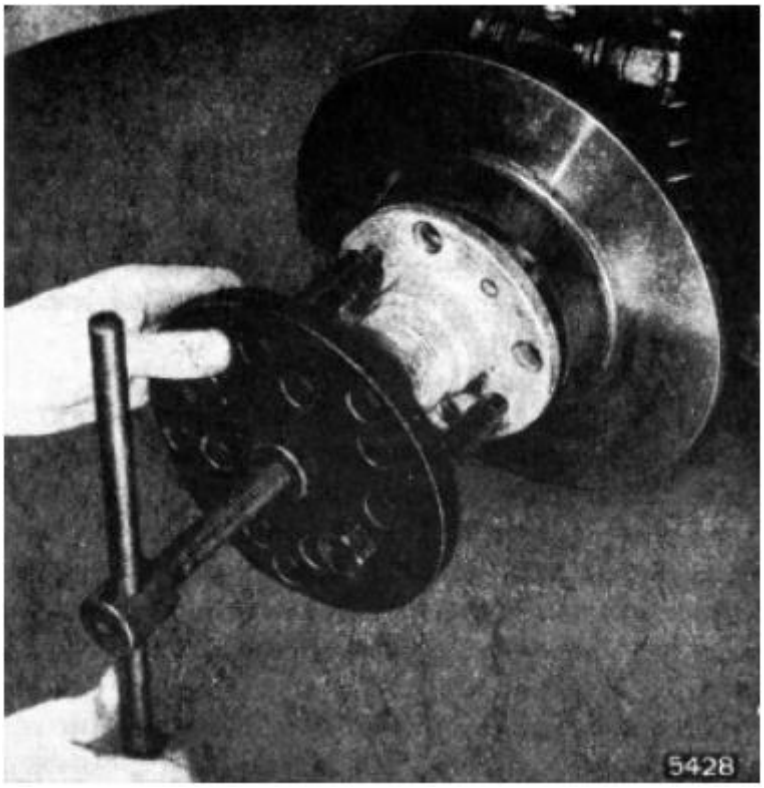


Fig. K.3 Withdrawing the front hub, using service tool 18G304

K.9 REMOVING AND REPLACING THE FRONT COIL SPRING

Apply the hand brake and, using a suitable jack placed under the centre of the front cross-member, jack up the front end of the car until the wheels are clear of the ground.

Remove the front wheel on the side affected.

Place an additional jack under the lower spring pan and jack up until the hydraulic damper levers are clear of the rebound rubber.

Remove the lower fulcrum bolt. Swing up the hub unit and rest it on a suitable block.

Release the jack from under the spring pan, press down the lower wishbone assembly, and remove the coil spring.

Replacement is carried out in the reverse manner to that detailed for removal.

NOTE. —Take care that the thrust washers, rubber seals, and retainers are assembled in the right order (see Fig. K.1).

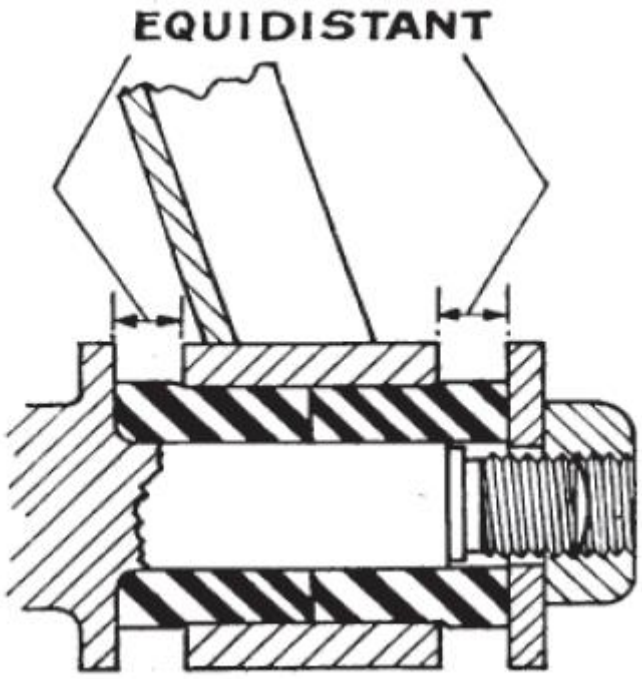


Fig. K.4 The correct method of clamping the rubber bushes of the lower suspension arm

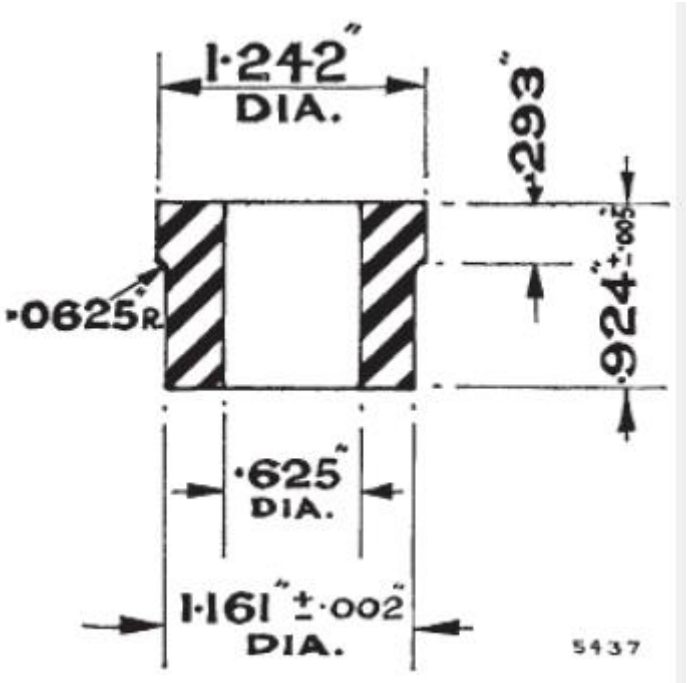


Fig. K.5 The dimensions of the lower wishbone bushes when in new condition

Lubricate these parts and the fulcrum pins during and after assembly.

Smear each end of the coil spring with grease and ensure that the upper end of the spring is correctly located.

K.10 FITTING NEW RUBBER BUSHES

Remove the coil springs as detailed in Section K.9.

Remove the four bolts holding the spring pan to the levers.

Remove the cotters, nuts, and washers from the ends of the inner lower fulcrum pin and slide off the levers and the rubber bushes.

Fit the new rubber bushes into the levers. These will be found to be quite a loose fit in the lever, but when clamped up by the nut and washer will expand into their housing. These bushes do not rotate on their surfaces, the angular movement being taken by the rubber deflecting torsionally in itself. Special care should be taken when assembling these bushes to maintain a central location so that the expansion of each half of the bush is equal.

To attain this, insert each bush so that it protrudes equally each side of the housing (see Fig. K.4), and then clamp up with the washer and nut. When central, the outer flanges of the bushes should be of equal proportions.

It is essential to clamp up the bushes when the suspension levers are set parallel with the ground to ensure even stresses on the bushes.

Now fit the spring pan between the levers, but with the heads of the bolts inside the spring pan.

Do not fully tighten up the spring pan bolts-leave them half a turn slack.

Press down the lower wishbone assembly.

Smear each end of the coil spring with grease and push the spring up into the front cross-member and over its top locating plate.

Jack up the lower wishbone assembly until it is approximately parallel to the ground.

Swing down the hub unit and fit the lower fulcrum bolt.

NOTE. —Take care that the thrust washers, rubber seals, and retainers are assembled in the right order. (See Fig. K.1.)

Lubricate these and the fulcrum pin with the grease gun during and after assembly.

Remove the jack from under the wishbone assembly.

Finally, tighten up the spring pan bolts and insert the split pins in all castellated nuts.

K.11 ANTI-ROLL BAR ASSEMBLY

Commencing at Chassis No. 2275 a modified front extension, modified spring pans and bottom wishbone assemblies, and an anti-roll bar assembly were introduced.

Cars prior to Chassis No. 2275 may be modified to permit the fitting of anti-roll bar equipment by fitting the following components in lieu of the existing ones.

AHH5924X	Front extension assembly.
AHH5925Z	Spring pan assemblies.
AHH5927Z	Bottom wishbone assembly-R.H.
AHH5929Z	Bottom wishbone assembly--L.H.

K.12 FITTING THE ANTI-ROLL BAR

NOTE. ---Andrex Dampers and anti-roll bar equipment MUST NOT be used simultaneously.

Place a jack under the centre of the front cross member and lift the front of the car; support the chassis side members on stands. Remove the bumper bar and the front apron and the four body holding bolts on the front extension. Unscrew and remove the eight nuts and bolts securing the front extension to the chassis and remove the extension

Locate the anti-roll bar, the split bushes, and the bush housings on the front extension cradles and

ensure that the washers on the bar are interposed between the locating plates and the flange on the bushes. Secure the bush housings to the extension with the four 5/16 in. bolts, spring washers, and nuts.

Refit the front extension to the chassis and secure the body to the body plates on the extension.

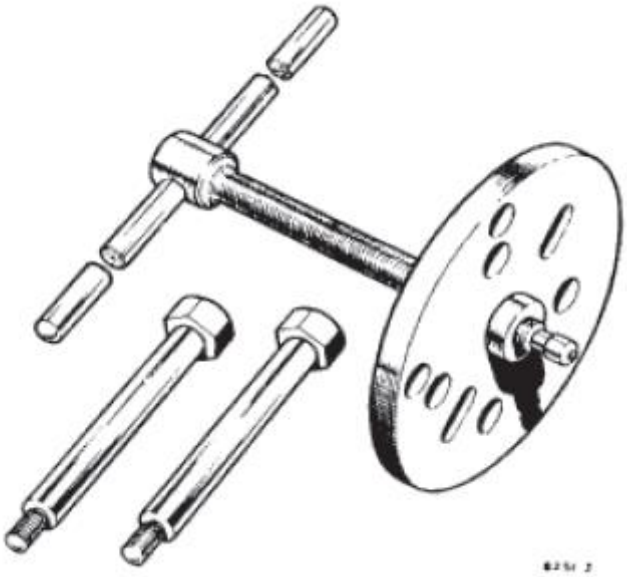
Fit the fork end of the left-hand link and the righthand link to the appropriate ends of the anti-roll bar, insert a 7/16 in. washer between each side of the Metalastik bushes and the fork ends, and secure the links with the 5/16 in. clamp bolts and Aerotight nuts

Locate the ball end of each link in the appropriate wishbone and spring pan assembly and secure them with the ½ in spring washers and nuts.

Replace the front apron and the bumper bar.

SERVICE TOOLS

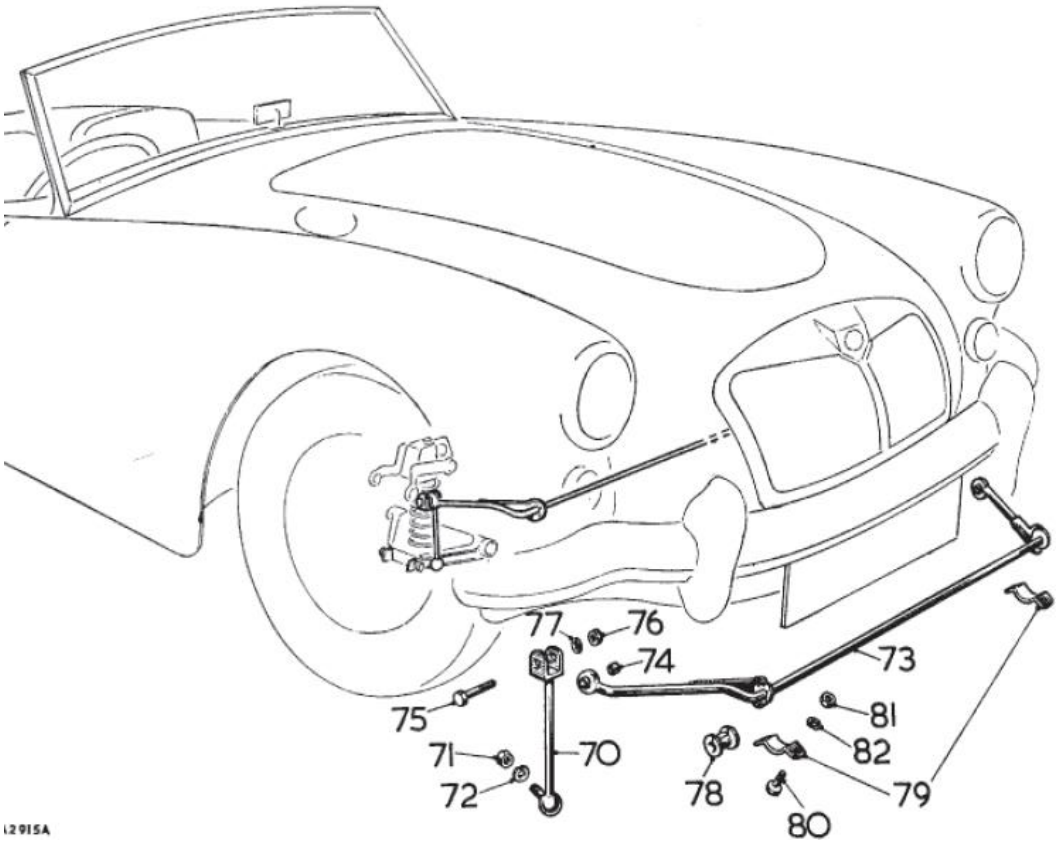
18G304. Hub Remover (basic tool)



18G304C. Adaptor Bolts

The remover 18G304 is a basic tool used for numerous applications. When used with the adaptor bolts 18G304C the most difficult hub can be withdrawn with ease and without damage.

K.10 THE ANTI-ROLL BAR EQUIPMENT COMPONENTS



70. Link

71. Nut.

72. Spring washer,

73. Anti-roll bar,

74. Bush.

75. Bolt.

76. Nut.

77. Plain washer,

78. Bush.

79. Housing

80. Screw

81. Nut.

82. Spring washer

SECTION L THE HYDRAULIC DAMPERS

MAINTENANCE

The maintenance of the hydraulic dampers, when in position on the vehicle, is confined to examination for leakage and examination of the anchorage to the chassis to ensure that the fixing bolts are tight. No adjustment of the hydraulic dampers is required or provided. They are accurately set before leaving the manufacturer to give the amount of damping most suitable for the car. Any attempt to dismantle the assembly will seriously affect the operation and performance.

L.1 TOPPING UP

The fluid level of the front hydraulic dampers should be topped up by removing the filler plug and filling up to the bottom of the filler plug hole. Use Armstrong Super (Thin) Shock Absorber Fluid No. 624. (If this fluid is not available, any good-quality mineral oil to Specification S.A.E. 20/20W should be used, but this alternative is not suitable for low-temperature operation.)

Before removing the filler cap, which is located on the top of the damper, carefully wipe the exterior, as it is of utmost importance that no dirt whatever enters through the filler hole.

On no account neglect the operation of topping up the damper fluid because if the low-pressure chamber of the unit is allowed to become empty, air will enter the pressure cylinders and the action of the damper will be impaired.

The rear dampers must be removed from the chassis frame (see Section L.2) for topping up of the fluid.

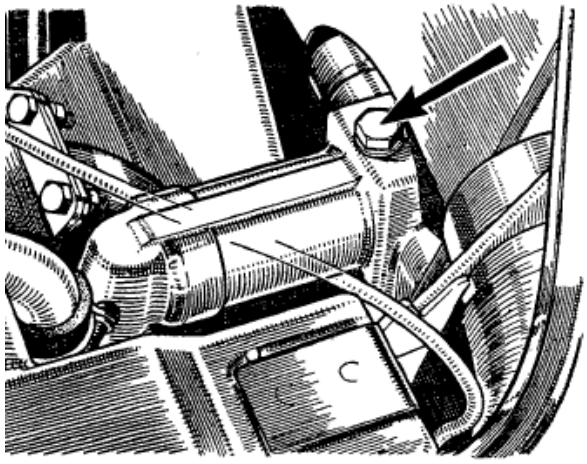


Fig L1.A front damper, showing the filler plug.

L.2 REMOVING AND REPLACING REAR DAMPERS

Jack up the rear of the car below the axle or rear springs and remove the rear wheel.

Remove the nut and spring washers securing the damper arm to the bracket on the rear spring.

Remove the nuts and spring and flat washers from the two bolts securing the damper to the chassis side member and withdraw the damper.

When replacing the damper, it is advisable to work the lever arm up and down a few times through its full stroke to expel trapped air from the pressure chambers.

NOTE. When handling hydraulic dampers that have been removed from the chassis for any purpose, it is important to keep the assemblies upright as far as possible, otherwise air may enter the operating chamber, resulting in free movement.

L.3 REMOVING A FRONT DAMPER

Jack up the car under the lower wishbone spring pan until the wheel is clear of the ground.

Remove the wheel and take out the swivel pin top pivot bolt. Swing out the hub unit clear of the upper wishbone and support it on a suitable stand to prevent straining the brake hose. Unscrew the four nuts holding the damper to the chassis frame.

L.4 TESTING THE DAMPERS

If the hydraulic dampers do not appear to function satisfactorily, the resistance may be roughly checked by bouncing each corner of the car up and down. A uniform movement indicates that no attention is required, but if the resistance is erratic or free movement of the car is felt, the damper should be removed for checking and topping up.

Indication of their resistance can be obtained by carrying out the following check.

Bolt the damper, in an upright position, to a plate held in a vice.

Move the lever arm up and down through its complete stroke. A moderate resistance throughout the full stroke should be felt. If the resistance is erratic, and free movement in the lever arm is noted, it may indicate lack of fluid.

While adding fluid the lever arm must be worked throughout its full stroke to expel any air that may be present in the operating chamber.

If the addition of fluid gives no improvement a new damper should be fitted.

Too much resistance, i.e. when it is not possible to move the lever arm by hand, indicates a broken internal part or a seized piston.

As it is essential for the dampers to apply the correct restraining action on the suspension, they should be checked whenever there is any doubt regarding their functioning.

The arms should not be removed from the dampers at any time as it is essential that they should be assembled to the damper shaft in the right relation to the damper cam lever so that there is the full range of movement on either side of the centre-line.

It must be clearly understood that there is no provision for adjusting the setting of the dampers, and if they are in any way defective they must be returned to the manufacturers for attention.

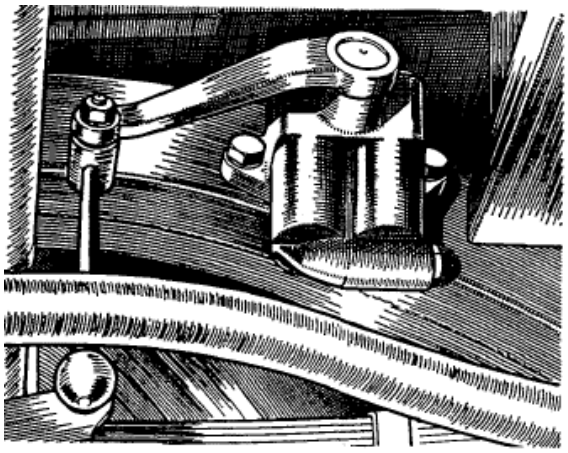


Fig L2. Rear dampers must be removed by unscrewing the two securing bolts and disconnecting the lower end of the link from the rear spring bracket

SECTION M THE BRAKING SYSTEM

GENERAL DESCRIPTION

The braking system consists of four Dunlop calliper type disc brakes hydraulically controlled by means of a foot-operated master cylinder

Steel pipe lines, unions, and flexible hoses convey the hydraulic pressure from the master cylinder to each. wheel cylinder.

The cable-actuated hand brake mechanism is entirely separate in operation from the hydraulic system and operates on the rear wheels only. Each brake consists of two carriers to which friction pads are riveted. The carriers are mounted on the top of the rear callipers, one each side of the disc, by means of hinge bolts.

BRAKE UNITS

Each wheel brake unit comprises a hub-mounted disc rotating with the wheel and a braking unit rigidly attached to the axle at the rear and to the swivel pin at the front. The brake unit consists of a calliper which straddles the disc and houses a pair of rectangular friction pad assemblies. Cylinder blocks bolted to the outer faces of each calliper accommodate piston assemblies keyed to the friction pad and securing plate 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. When the piston is assembled to the cylinder block the seal engages a lip on the block face and so protects the assembly from intrusion of moisture and foreign matter. The central blind bore of the piston inner face accommodates the end of a retractor pin and its friction bush. A piston seal is located between the piston inner face and a plate secured to the piston by peen-locked screws. The piston assembly when pressed into the cylinder bore locates on the retractor pin assembly, which is peened into the base of the cylinder bore. This assembly comprises a retractor stop bush, two spring washers, a dished cap, and the retractor pin; it functions as a return spring and maintains the brake-off working clearance of approximately .008 to .010 in. (.203 to .254 mm.) between the pads and the disc throughout the life of the pads.

MASTER CYLINDER

The components of the master cylinder are housed within the bore of a cylinder body with an integral reservoir. The reservoir is fitted with a detachable cover which incorporates the filler orifice and is secured by means of six bolts and spring washers. A fluid-tight joint is maintained by a cork gasket between the cover and reservoir faces. The enclosed end of the cylinder is bored to provide communication between the reservoir and the cylinder; a housing for an outlet connection is provided by an internally threaded boss integral with the cylinder. Formed around the opposite end of the cylinder is a flange with two holes for the master cylinder attachment bolts. In the unloaded condition a spring-loaded piston carrying a rubber 'O' ring in a groove is held against the underside of a dished washer retained by a circlip at the head of the cylinder. A hemispherically ended push-rod seats in a similarly formed recess at the head of the piston. The head of the master cylinder is shrouded by a rubber dust excluder, the lip of which seats in a groove in the cylinder body.

A cylindrical spring support is fitted 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 is in a central blind bore in the piston. The valve passes through the bore of a vented spring support and protrudes into the fluid passage which communicates with the reservoir. Interposed between the spring support and an integral flange formed on the valve is a small coiled spring. A rubber seal is fitted between the end of the cylinder body and the underside of the valve flange. 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 priming and bleeding operation of the brake system.

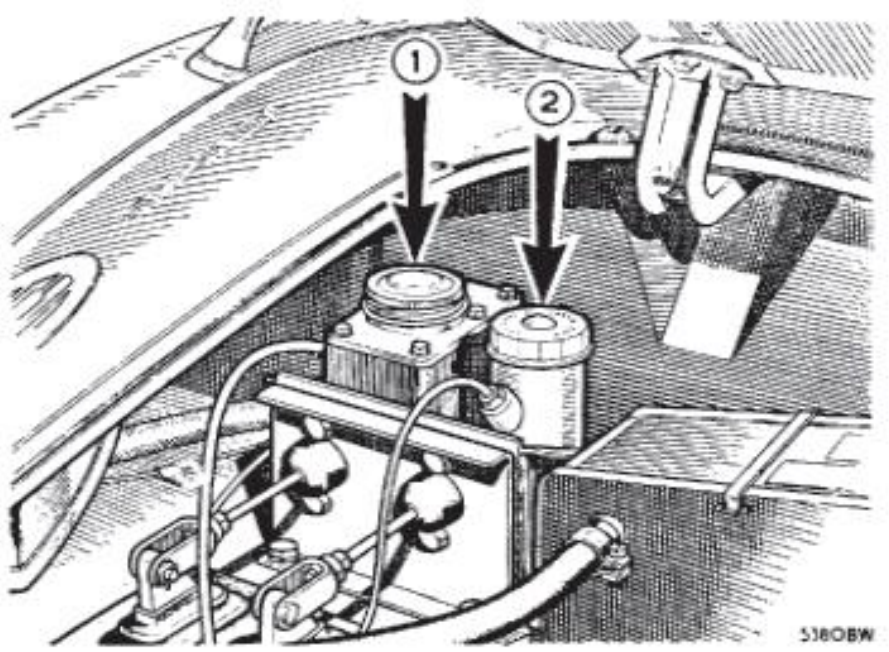


Fig. M.1 Periodically examine the quantity of fluid in the brake master cylinder reservoir (arrow 1). The clutch master cylinder reservoir is indicated by arrow 2

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 and restores the open condition between the cylinder and reservoir previously described

MAINTENANCE

Periodically examine the quantity of brake fluid in the master cylinder. It should never be less than half-full nor closer than 1/2 in. (13 mm.) to the bottom of the filler neck. The necessity for frequent topping up is an indication of overfilling or of a leak in the system which should be traced and rectified at once.

If the travel of the hand brake lever becomes excessive the mechanism should be adjusted as detailed in Section M.14.

The friction pads should be checked for wear every 3,000 miles (4800 km.) by visual observation and measurement. When wear has reduced the pads to the minimum permissible thickness of .250 in. (6.35 mm.) the pads must be renewed.

Every 1,000 miles (1600 km.) apply three or four strokes of the grease gun filled with grease to Ref. C (page P.7) to the nipple provided on the brake cable.

M.1 ADJUSTING THE BRAKE PEDAL

The correct amount of free movement between the master cylinder push-rod and piston is set during the erection of the vehicle and should not require adjustment during normal service.

In the event of the adjustment having been disturbed a check should be made to ensure that there is no preloading of the master cylinder piston when the brake pedal is in the fully "off' position. In this

position the piston should be held against the dished washer at the head of the master cylinder unit by the pressure of the piston return spring, thus forming a return stop, and a free axial movement of approximately .015 to .020 in. (.381 to .508 mm.) should be felt at the master cylinder push-rod. If necessary, the effective length of the push-rod should be reset to this figure,

M.2 PRIMING AND BLEEDING THE BRAKE SYSTEM (Expelling Air)

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. Air may enter the system if pipe connections become loose or if the level of fluid in the reservoir is allowed to fall below the recommended level. During the bleeding operation it is important that the reservoir be kept at least half-full to avoid drawing air into the system.

1. Check that all connections are tightened, and all bleed screws closed.
2. Fill the reservoir with brake fluid. The use of Wakefield Crimson Brake Fluid is recommended, but if this is not available an alternative fluid conforming to Specification S.A.E. 70.R1 should be used.
3. 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.
4. Repeat for each brake in turn.
5. Repeat the complete bleeding sequence until the brake fluid pumped into the jar is completely free from air bubbles.
6. Lock all bleed screws and top up the fluid level in the reservoir.
7. Apply a normal working load on the brake pedal for a period of two or three minutes and examine the entire system for leaks.

NOTE-Clean fluid bled from the system must be allowed to stand until it is clear of air bubbles before it is used again. Dirty fluid should be discarded.

M.3 REMOVING THE MASTER CYLINDER

Remove the split pin and washer and withdraw the clevis pin from the push-rod yoke. Remove the push-rod.

Remove the two bolts, nuts, and washers securing the front end of the master cylinder to the mounting plate and disconnect the brake pipe at the rear of the cylinder. On right-hand-drive vehicles this operation will be eased if the brake pipe securing clip on the bulkhead is released first.

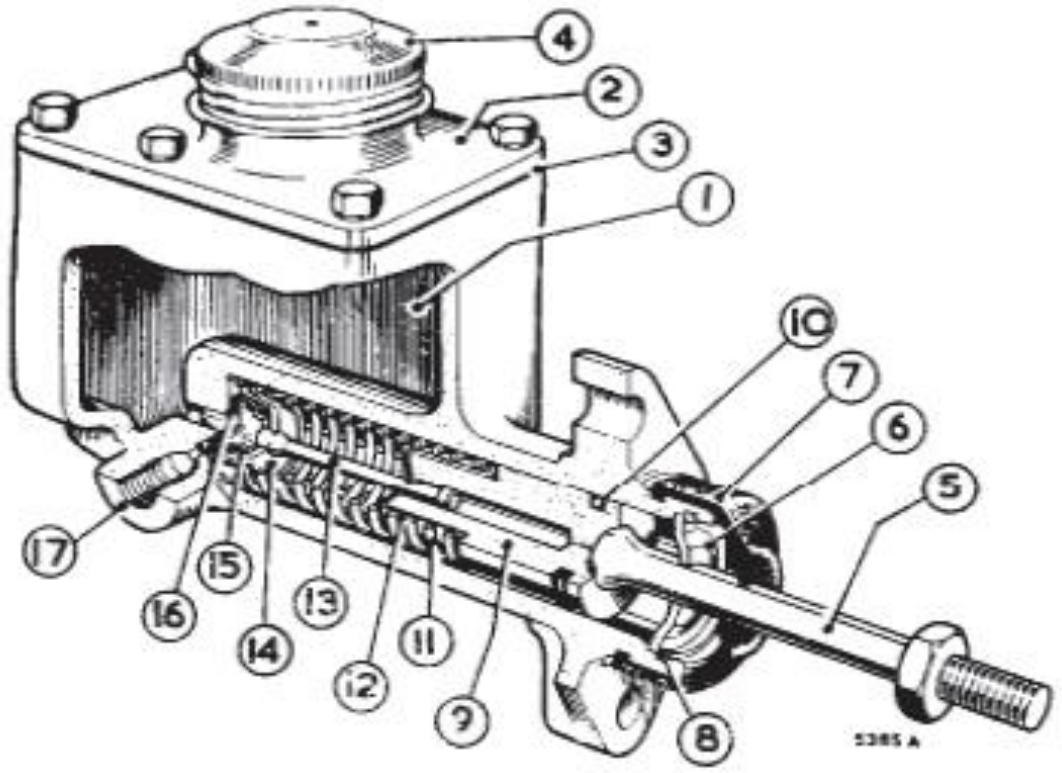


Fig. M.2 The brake master cylinder components

1. Reservoir.
2. Cover.
3. Cork gasket.
4. Filler cap.
5. Push-rod.
6. Dished washer.
7. Dust excluder,
8. Circlip.
9. Piston.
10. O-ring.
11. Return spring.
12. Spring support.
13. Valve.
14. Spring support.
15. Valve spring
16. Seal.
17. Outlet connection

M.4 DISMANTLING THE MASTER CYLINDER

Remove the master cylinder filler cap and drain the brake fluid from the unit.

Ease the dust excluder clear of the head of the master cylinder. Remove the retaining circlip with a suitable pair of pliers and withdraw the push-rod complete with dished washer. Draw out the piston and remove the rubber '0' ring. The valve assembly complete with springs and supports can then be extracted and the valve sealing ring removed from the seal bush.

M.5 ASSEMBLING THE MASTER CYLINDER

Clean all parts thoroughly, using only the recommended brake fluid for all rubber components. All

traces of petrol (gasoline), paraffin (kerosene), or trichlorethylene used for cleaning the metal parts must be removed before assembly.

Examine all the rubber parts for damage or distortion. It is usually advisable to renew the rubbers when rebuilding the cylinder. Dip all the internal parts in brake fluid and assemble them wet. Fit the valve seal around the seal bush and the 'O' ring in the groove on the piston.

Place the seal bush in position on the valve stem and insert the piston into the spring support, ensuring that the head of the valve engages the piston bore. Slide the complete assembly into the cylinder body, taking particular care not to damage or twist the O-ring.

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 in the groove.

Fill the dust excluder with Wakefield No. 3 Rubber Grease and reseat the excluder around the head of the master cylinder.

M.6 REPLACING THE MASTER CYLINDER

The replacement procedure is the reverse of the removal instructions given in Section M.3.

After replacement, bleed the brake system as detailed in Section M.2. Finally, check for leaks with the brakes fully applied.

M.7 REMOVING A BRAKE UNIT

Front

Unscrew the brake pipe union nut below its support bracket and disconnect and blank off the pipe. Remove the two nuts securing the brake hose support bracket and remove the bracket.

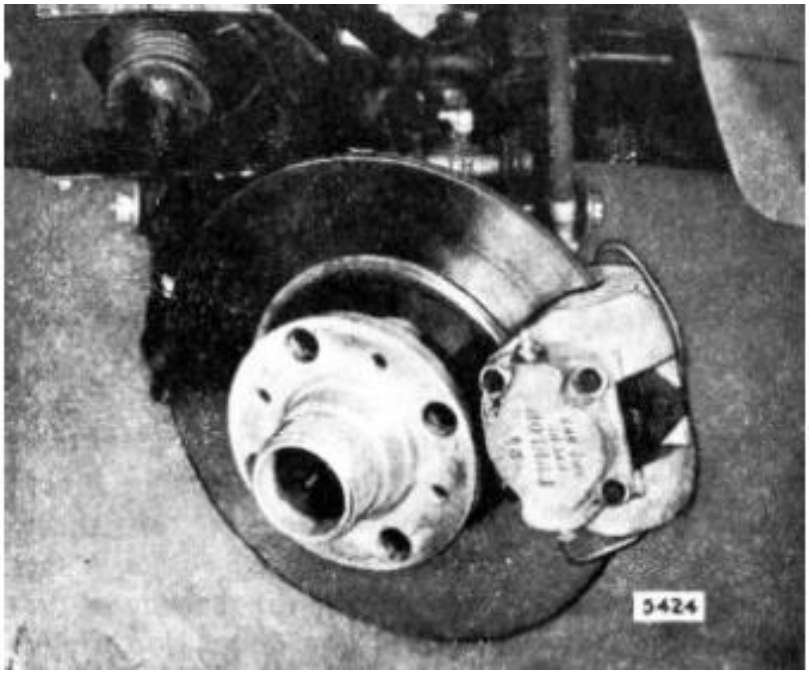


Fig. M.3 A front disc brake calliper

Unscrew the two calliper retaining bolts and remove the calliper assembly complete with cylinders.

Take care not to misplace the shims which are fitted behind the mounting lugs on the calliper body. **The shims must be retained for reassembly and replaced in their original positions**

Rear

Unscrew the fluid supply pipe union (below the inner cylinder block) and disconnect and blank off the pipe. Remove the split pin and clevis pin from the hand brake cable yoke to disconnect the cable from the calliper lever.

Tap back the tab washers and unscrew the two set screws securing the calliper to the mounting flange on the axle. The calliper complete with parking mechanism may now be removed from the vehicle.

The shims taken from behind the calliper body mounting lugs must be retained **and replaced in their original positions on reassembly.**

M.8 DISMANTLING A BRAKE UNIT

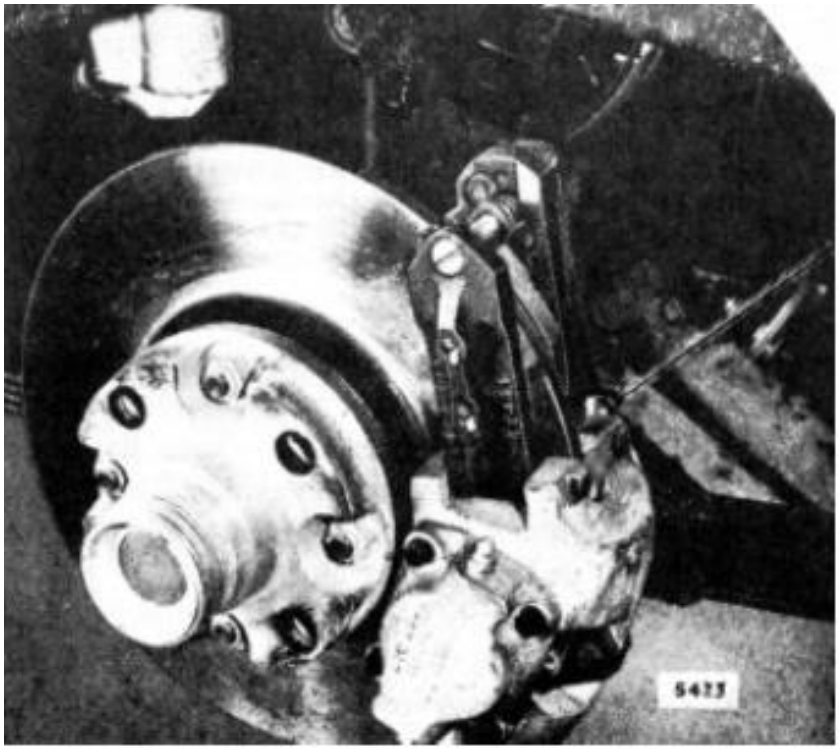


Fig. M.4 A rear disc brake calliper with hand brake carriers

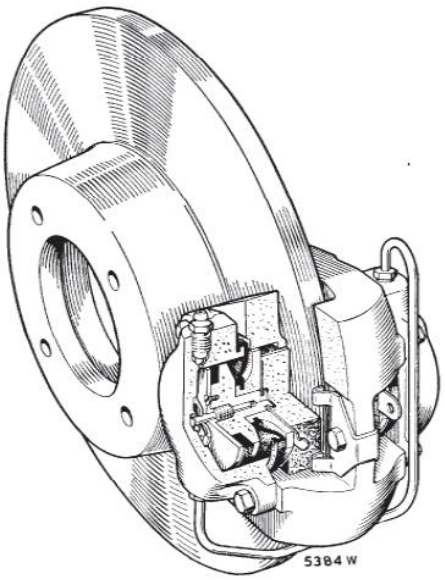


Fig. M.5 Sectioned view of a brake calliper

Remove the bolts securing the cylinder blocks to the calliper and withdraw the cylinder blocks.

Disengage the dust seal from the lip on the cylinder block face, connect the cylinder to a source of fluid supply, and apply pressure to eject the piston assembly. Remove the screws securing the plate to the piston, lift off the plate and piston seal, and withdraw the retractor bush from within the piston bore. Carefully cut away and discard the dust seal.

Support the backing plate on a bush of sufficient bore just to accommodate the piston; with a suitable tubular distance piece placed against the end of the piston spigot around the shouldered head press out the piston from the backing plate. Care must be taken during the operation to avoid damaging the piston.

M.9 ASSEMBLING A BRAKE UNIT

Clean all components thoroughly, using only the recommended brake fluid for all rubber parts.

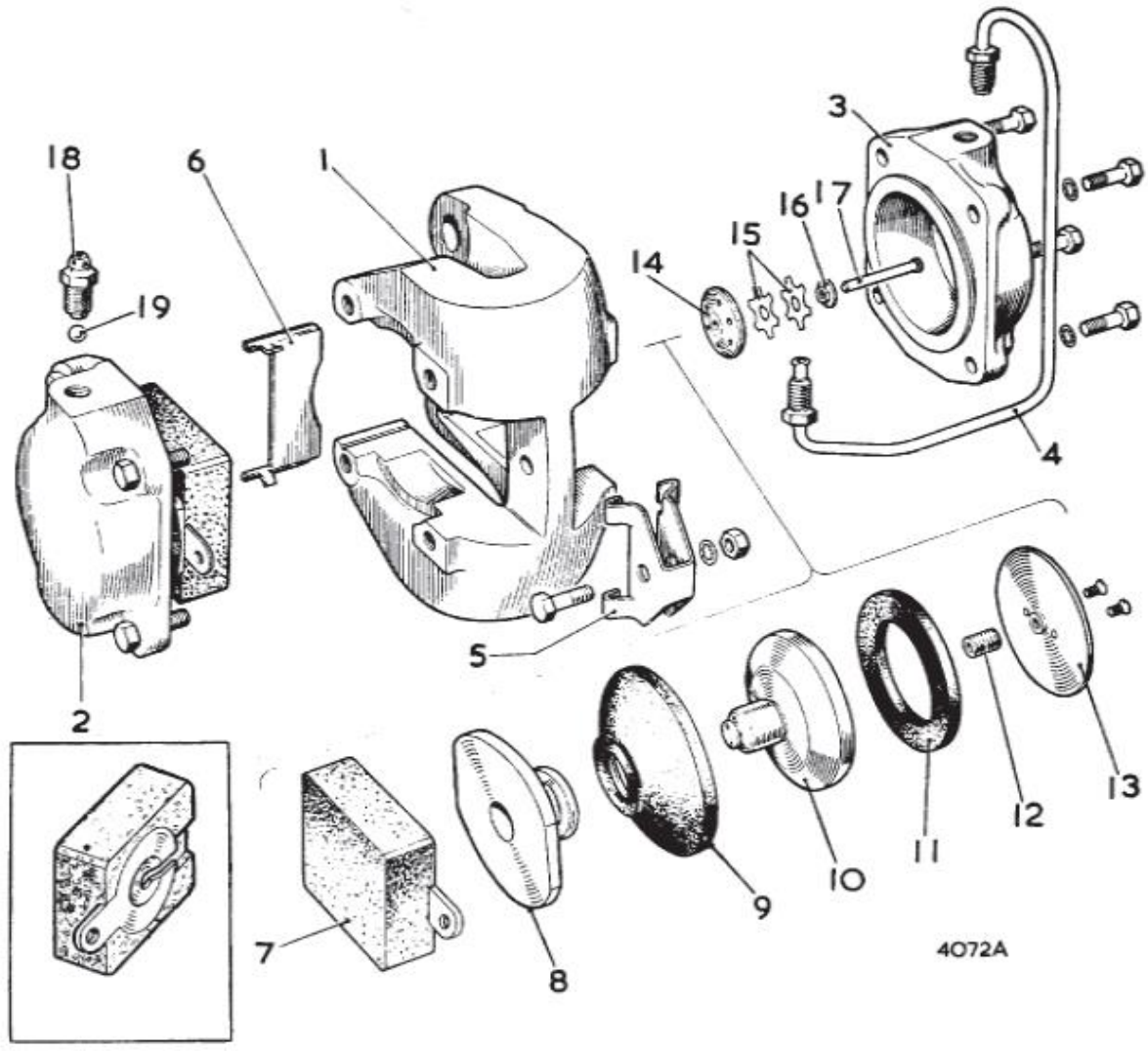


Fig. M.6 The disc brake calliper components

1. Calliper.
2. Cylinder block.
3. Cylinder block,
4. Bridge pipe.
5. Keep plate.
6. Support plate.
7. Friction pad assembly.
8. Backing plate.
9. Dust seal.
10. Piston.
11. Piston seal.
12. Retractor bush.
13. Plate.
14. Cap.
15. Spring washer.
16. Retractor stop bush.
17. Retractor pin.
18. Bleed screw.
19. Bleed screw ball.

Engage the collar of a new dust seal with the lip on the backing plate on the piston spigot, and with the piston suitably supported press the backing plate fully home.

Insert the retractor bush into the bore of the piston. Lightly lubricate the piston seal with brake fluid (if there is any doubt about the condition of this component it should be renewed) and fit it to the piston face. Attach and secure the plate with the screws, and peen-lock the screws.

Check that the piston and the cylinder bore are thoroughly clean and show no signs of damage. Locate the piston assembly on the end of the retractor pin, and with the aid of a hand press slowly apply an even pressure to the backing plate and press the assembly into the cylinder bore. Ensure that 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 the cylinder bore. Engage the lip of the dust seal with the lip on the cylinder block face.

Reassemble the cylinder blocks to the calliper, tighten the set pins to a torque Wrench reading of 8 lb. ft. (1.11 kg. m.) **with the threads greased**, and fit the bridge pipe, ensuring that it is correctly positioned (with the near-vertical part of the pipe farthest from the wheel). If the complete brake unit has been removed it should be replaced as detailed in Section M.10.

Remove the blank, replace the supply pipe, and fit the friction pads as described in Section M.12.

Finally, bleed the system (Section M.2) and check for leaks with the brakes fully applied.

M.10 REPLACING A BRAKE UNIT

The replacement procedure is a reversal of the instructions given in Section M.7 with the exception of the following details. Replace the brake pads as detailed in Section M.12.

Check the gap between each side of the calliper and the disc. The difference should not exceed .010 in. (.254 mm.) and the shims may be altered to obtain this figure. Bleed the system as detailed in Section M.2 and, finally, check for leaks with the brakes fully applied.

M.11 REMOVING THE FRICTION PADS

Remove the nut, washer, and bolt securing the keep plate and withdraw the plate. Withdraw the pad assemblies with a suitable hooked implement engaged in the hole in the lug of the securing plate.

Thoroughly clean the backing plate, dust seal, and the surrounding area of the calliper.

M.12 REPLACING THE FRICTION PADS

Where the original friction pads are to be refitted it is only necessary to reverse the instructions given in Section M.11.

If wear has reduced the pads to the minimum permissible thickness of .25 in. (6.35 mm.) the pads

must be renewed. Use service tool 18G553 to press the piston assemblies to the base of the cylinder bores against the resistance offered by the retractor pin and bush. Insert the new friction pad assemblies, replace the keep plate, and secure it with the bolt, washer, and nut.

M.13 RELINING THE HAND BRAKE

Unscrew and remove the adjuster bolt and locknut and swing the pad carriers away from the disc. Extract the split pin and withdraw the lever pivot pin (see Fig. M.7).

Remove the bifurcated rivets from both carriers and prise off the worn linings. Place the new linings in position and secure them with new bifurcated rivets.

Place the lever in the position indicated in Fig. M.8. Hold the locknut firmly against the outer face of the trunnion and screw in the adjuster bolt until three or four threads engage in the locknut. Align the holes in the lever and pivot seat, fit the pivot pin, and lock it with a split pin.

Reset the clearance as detailed in Section M.14.

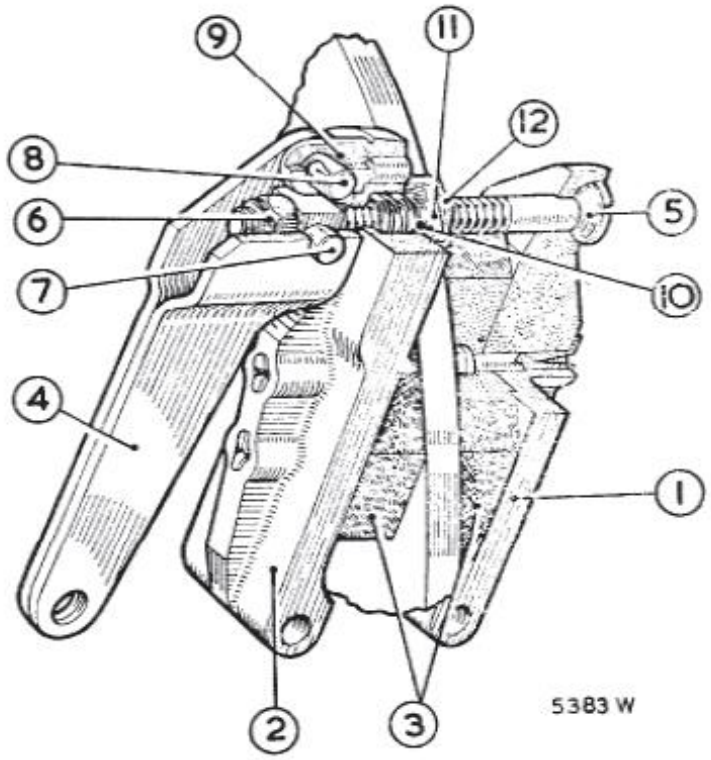


Fig. M.7 The hand brake carrier component

1. Pad carrier (outer).	5. Adjuster bolt.	9. Pivot seat.
2. Pad carrier (inner).	6. Locknut.	10. Spring.
3. Pads.	7. Trunnion.	11. Spring retaining nut.
4. Lever.	8. Pivot pin	12. Spring plate

M.14 ADJUSTING THE HAND BRAKE

Adjustment to compensate for pad wear must be made at the hand brake units and not on the relay lever adjuster. The adjustments should be made in the following manner when the travel of the hand brake lever becomes excessive.

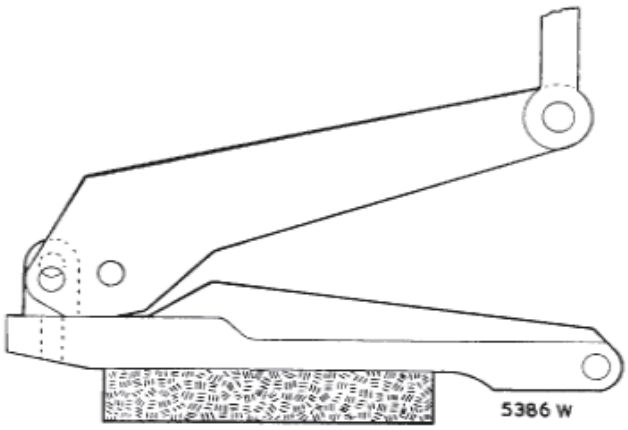


Fig. M.8 When replacing a hand brake friction pad place the lever against the inner carrier in the position shown. Hold the locknut against the trunnion and screw in the adjuster bolt three or four threads

Raise the rear of the car-making certain that the front wheels are suitably blocked to prevent the car running forward-and remove both rear wheels. The hand brake lever should be in the fully off position whilst the adjustments are made.

Slacken the brass adjuster nut fitted to the relay lever (located beside the front universal joint on the propeller shaft) so that the operating cable hangs loosely.

Tighten each adjuster bolt until the pads 'nip' the brake disc. Screw up the brass adjuster nut on the relay lever until all slackness is taken up, ensuring that there is no preload on the linkage.

Set the clearance between the pads and the brake disc by unscrewing each adjuster bolt approximately one-third of a turn. Make sure that the discs rotate freely,

M.15 REMOVING THE HAND BRAKE CABLE

Unscrew and remove the adjuster nut; withdraw the end of the cable from the lower end of the lever and remove the spring.

Disconnect the clips securing the cable assembly to the body.

Remove the clevis pins from the levers on the wheel brake units,

Unscrew the two nuts on the axle balance lever; separate the two halves of the lever and remove the cable and trunnion.

M.16 REMOVING A BRAKE DISC

Remove the brake unit as detailed in Section M.7 and withdraw the hub by the method described in Section K.6 (front) or Section H.2 (rear).

The rear disc is separated from the hub by removing the four securing nuts and washers. The front disc is secured to the hub by four set bolts with spring washers, and after removing these the two components may be separated.

M.17 REPLACING A BRAKE DISC

Assemble the brake disc to the hub by a reversal of the instructions given in Section M.16 and fit the assembly to the vehicle.

Check the disc for true rotation by clamping a dial indicator to a suitable fixed point on the vehicle with the needle pad bearing on the face of the disc. Run-out must not exceed .006 in. (.152 mm.), and in the event of the value being exceeded the components should be examined for damage and, if necessary, renewed.

Replace the brake unit as detailed in Section M.10.

M.18 FLEXIBLE HOSES

The flexible pipes must show no signs of deterioration or damage and the bores should be cleared with a jet of compressed air. No attempt should be made to clear a 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 should be held with the appropriate spanner to prevent the pipe from twisting. A twisted pipe will prove detrimental to efficient brake operation

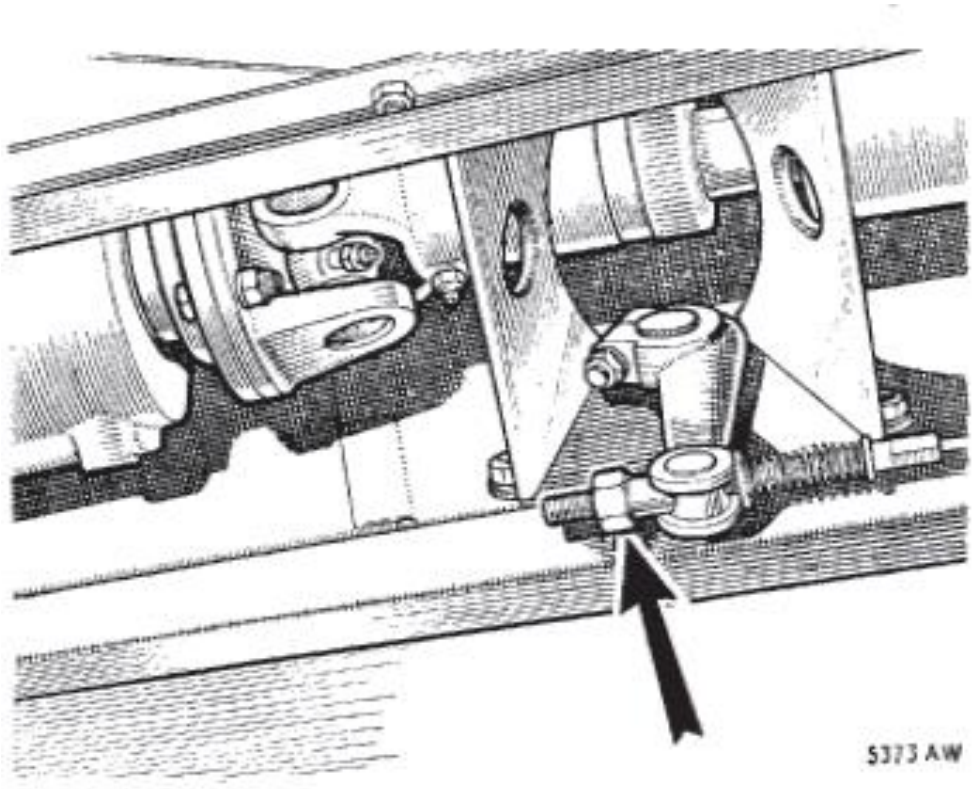


Fig. M.9 The arrow indicates the brass adjuster nut fitted to the cable relay lever

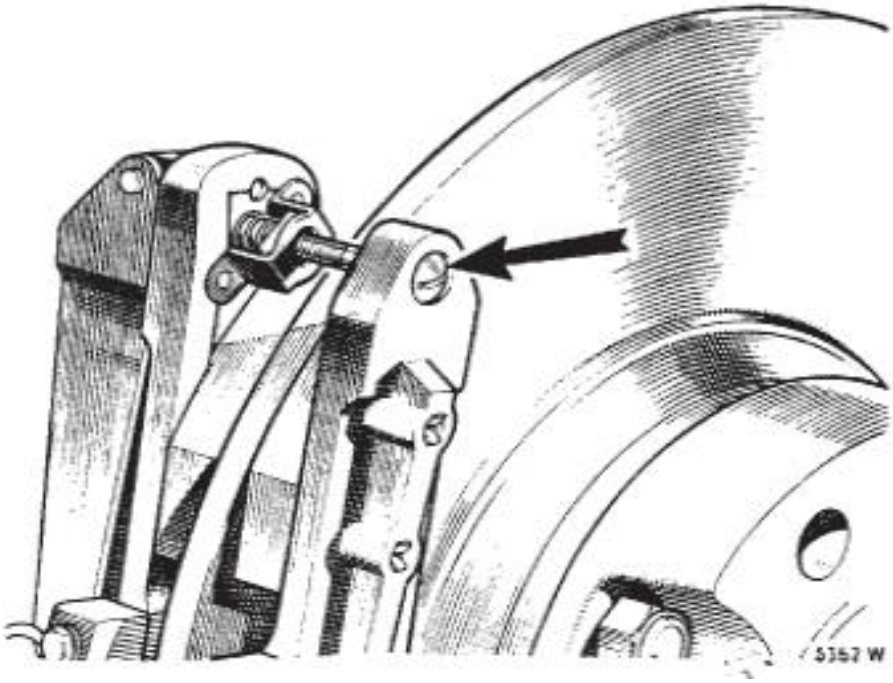


Fig. M.10 The arrow indicates the hand brake carrier pad adjusting bolt

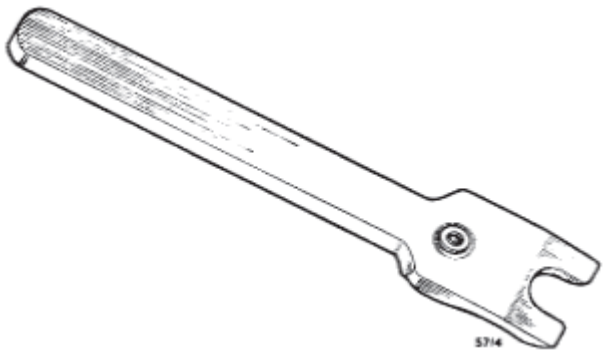
Removing a rear hose

The front end of the rear flexible hose is held in a bracket mounted on the right-hand battery box. Unscrew the metal pipe union nut and release the pipe. Hold the hexagon on the flexible hose with a spanner and remove the large retaining nut and its shake-proof washer from the underside of the support bracket. The pipe may now be unscrewed at its rear end from the three-way piece on the rear axle.

Removing a front hose

Unscrew the metal pipe union nuts at each end of the front hose. Hold the hexagon on the flexible hose and remove the nut and shake-proof washer on the underside of the mounting bracket

SERVICE TOOL



18G553. Disc Brake Resetting Tool.

SECTION N. ELECTRICAL EQUIPMENT

GENERAL DESCRIPTION

The 12-volt electrical equipment incorporates compensated voltage control for the charging circuit. The positive earth system of wiring is employed.

The two 6-volt batteries, mounted to the rear of the seats, are accessible for examination and maintenance attention.

The dynamo is mounted on the right of the cylinder block and driven by endless belt from the engine crankshaft. A rotatable mounting enables the belt tension to be adjusted.

The control box is sealed and should not normally need attention. The fuses and spare fuses are carried in external holders.

The starter motor is mounted on the flywheel housing on the right-hand side of the engine unit and operates on the flywheel through the usual sliding pinion device.

The headlamps employ the double-filament dipping system. Both lamps dip according to the regulations existing in the country concerned.

N.1 BATTERY MAINTENANCE

In order to keep the batteries in good condition, a periodical inspection must be made.

Unscrew the five quick-release fasteners securing the panel immediately behind the seats and lift the panel away to obtain access to the batteries.

Topping up

Weekly, remove the filler plug from each cell and examine the level of the electrolyte. Add distilled water to bring the level of the electrolyte just above the separators.

NOTE-Do not use tap-water and do not use a naked light when examining the condition of the cells. Wipe away all dirt and moisture from the top of the battery.

Testing the condition of the battery

Every 6,000 miles (10000 km.) examine the condition of the batteries by taking hydrometer readings. The hydrometer contains a graduated float on which is indicated the specific gravity of the acid in the cell from which the same is taken.

The specific gravity readings and their indications are as follows:

Climates below 27°C. (80°F)

1.270 to 1.290 Cell fully charged.

1.190 to 1.210 Cell about half-discharged.

1.110 to 1.130 Cell fully discharged.

Climates frequently above 27°C. (80°F)

1.210 to 1.230 Cell fully charged.

1.130 to 1.150 Cell about half-discharged.

1.050 to 1.070 Cell fully discharged.

These figures are given assuming an electrolyte temperature of 16° C. (60. F.). If the temperature of the electrolyte exceeds this, 0.02 must be added to hydrometer readings for each 3° C. (5 F) rise to give the true specific gravity. Similarly, 0.02 must be subtracted from hydrometer readings for every 3° C. (5 F) below 16 C. (60°F).

The readings of all the cells should be approximately the same. If one cell gives a reading very different from the rest it may be that the electrolyte has been spilled or has leaked from the cell or there may be an internal fault. Should a battery be in a low state of charge, it should be recharged by taking the car for a long daytime run or by charging from an external source of D.C. supply at a current rate of 5 amperes until the cells are gassing freely.

After examining the battery, check the vent plugs, making sure that the air passages are clear.

Storage

If a battery is to be out of use for any length of time, it should first be fully charged and then given a freshening charge about every fortnight.

A battery must never remain in a discharged condition, as the plates will become sulphated.

Initial filling and charging

When a new battery has been supplied dry it is necessary to fill the cells with electrolyte of the correct specific gravity.

All batteries, including those having type suffix letter "Z" (e.g. SGZ, etc.) and those having no additional suffix letter (e.g. SG, BT, etc.), are assembled with dry separators. The specific gravity of the filling-in solution depends upon the climate in which the battery is to be used (i.e. 1.260 for climates below 27° C. (80 F) and 1.210 for climates frequently above 27° C. (80 F). For more details of the requirements of "dry-charged batteries see Section N.31.

The electrolyte is prepared by mixing distilled water and concentrated sulphuric acid 1835 S.G. The mixing must be carried out in a lead-lined tank or a suitable glass or earthenware vessel. Steel or iron containers must not be used. The acid must be added slowly to the water, while the mixture is stirred with a glass rod. **Never add the water to the acid,** as the severity of the resulting chemical reaction may have dangerous consequences.

Heat is produced by the mixture of acid and water, and it should, therefore, be allowed to cool before it is poured into the battery, otherwise the plates, separators and moulded container may be damaged.

The temperature of the filling-in acid, battery and charging room should be above 0°C. (32°F.).

To produce electrolyte of the correct specific gravity:

To obtain specific gravity (corrected to 60°F (16°C)	*Add 1 part by volume of 1835 S.G. acid to distilled water by volume as below*
1.290	2 parts
1.270	2.7 parts
1.260	3 parts
1.210	4 parts

Carefully break the seals in the filling holes and half-fill each cell in the battery with dilute sulphuric acid solution of the appropriate specific gravity (according to temperature). The quantity of electrolyte required to half-fill a two-volt cell is ½ pint (0.28 litre). Allow to stand for at least six hours, then complete the filling of the cells by the addition of more diluted acid of the same specific gravity as before until the level reaches the bottom of the filling holes and allow the battery to stand for at least another two hours before commencing the first charge.

Charge at a constant current of 35 amps. until the voltage and temperature-corrected specific gravity readings show no increase over five successive hourly readings. This period is dependent upon the length of time the battery has been stored since manufacture, and will be from 40 to 80 hours, but usually not more than 60.

Throughout the charge the acid must be kept level with the tops of the separators in each cell by the addition of electrolyte of the same specific gravity as the original filling-in acid.

If, during charge, the temperature of the acid in any cell of the battery reaches the maximum permissible temperature of 38°C. (100°F) in a climate below 80° F. (27°C.) or 49° C. (120°F) in a climate frequently above 80 F. (27° C), the charge must be interrupted and the battery temperature allowed to fall at least 5.5°C. (10 F) before charging is resumed.

At the end of the first charge, i.e. when specific gravity and voltage measurements remain constant,

carefully check the specific gravity in each cell to ensure that it lies within the limits specified. If any cell requires adjustment, the electrolyte above the plates must be siphoned off and replaced either with acid of the strength used for the original filling in, or distilled water, according to whether the specific gravity is too low or too high respectively. After such adjustment, the gassing charge should be continued for one or two hours to ensure adequate mixing of the electrolyte. Re-check, if necessary, repeating the procedure until the desired result is obtained.

N.2 DYNAMO

To test on vehicle when dynamo is not charging

1. Make sure that belt slip is not the cause of the trouble. It should be possible to deflect the belt approximately in. (13 mm.) at the centre of its longest run between two pulleys with moderate hand pressure. If the belt is too slack, loosen the two dynamo suspension bolts and then the bolt of the slotted adjustment link. A gentle pull on the dynamo outwards will enable the correct tension to be applied to the belt and all three bolts should then be tightened firmly.
2. Check that the dynamo and control box are connected correctly. The dynamo terminal 'D' should be connected to the control box terminal 'D' and the dynamo terminal “F” connected to the control box terminal "F".
3. After switching off all lights and accessories, disconnect the cables from the dynamo terminals marked 'D' and 'F' respectively.
4. Connect the two terminals with a length of wire.
5. Start the engine and set to run at idling speed.
6. Clip the negative lead of a moving-coil-type voltmeter, calibrated 0-20 volts, to one dynamo terminal and the other lead to a good earthing point on the dynamo yoke. (7) 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. Do not race the engine in an attempt to increase the voltage. It is sufficient to run the dynamo up to a speed of 1,000 rpm. If there is no reading, check the brush gear. If the reading is low (approximately 1 volt), the field winding may be faulty.

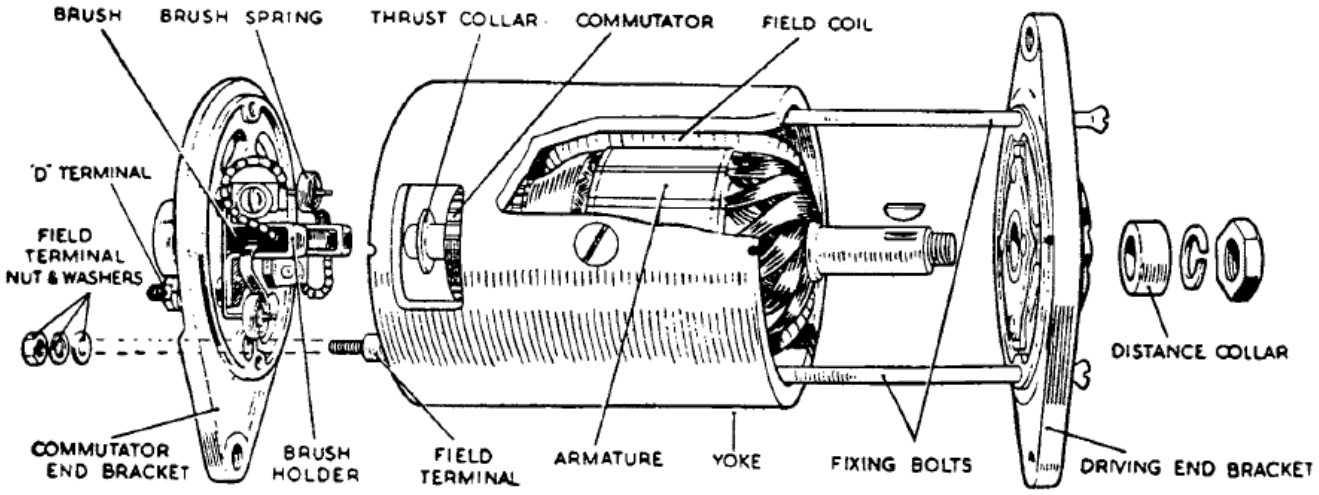


Fig. N.1 An exploded view of the dynamo

If the reading is approximately 5 volts, the armature winding may be faulty. (8) Remove the dynamo 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. If the brushes are worn so that they no longer bear on the commutator, or if the brush flexible lead has become exposed on the running face, new brushes must be fitted. 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-cranking. Re-test the dynamo; if there is still no reading on the voltmeter there is an internal fault and the complete unit should be renewed.

If the dynamo is in good order, leave the temporary link in position between the terminals and restore the original connections, taking care to connect the dynamo terminal 'D' to the control box terminal 'D' and the dynamo terminal 'F' to the control box terminal 'F'. Remove the lead from the 'D' terminal on the control box and connect the voltmeter between this cable and a good earthing point on the vehicle. Run the engine as before. The reading should be the same as that measured directly at the dynamo. No reading on the voltmeter indicates a break in the cable to the dynamo. Carry out the same procedure for the "F terminal, connecting the voltmeter between cable and earth. Finally remove the link from the dynamo. If the reading is correct test the control box (Section N.9).

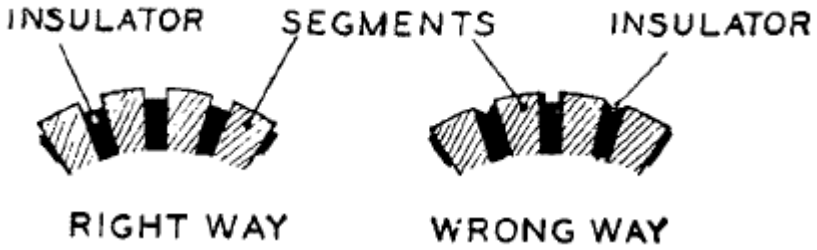


Fig. N.2 The correct method of undercutting the dynamo

N.3 REMOVING AND REPLACING THE DYNAMO

To remove the dynamo, disconnect the dynamo leads from the dynamo terminals.

Slacken all four attachment bolts and pivot the dynamo towards the cylinder block to enable the fan belt to be removed from the dynamo pulley. The dynamo can then be removed by completely removing the two upper and one lower attachment bolts.

Replacement of the dynamo is an exact reversal of this procedure.

N.4 DISMANTLING THE DYNAMO

Take off the dynamo pulley. Remove the cover band, hold back the brush springs and remove the brushes from their holders.

Unscrew the locknuts from the through-bolts at the commutator end. Withdraw the two through-bolts from the driving end.

Remove the nut, spring washer and flat washer from the smaller terminal (i.e. field terminal) on the commutator end bracket and remove the bracket from the dynamo yoke.

The driving end bracket, together with the armature, can now be lifted out of the yoke.

The driving end bracket which, on removal from the yoke, has withdrawn with it the armature and armature shaft ball bearing, need not be separated from the shaft unless the bearing is suspected and requires examination, in which event the armature should be removed from the end bracket by means of a hand press.

N.5 SERVICING THE DYNAMO

Brushes

Test if the brushes are sticking. Clean them with petrol and, if necessary, ease the sides by lightly polishing with a smooth file. Replace the brushes in their original positions.

Test the brush spring tension with a spring scale if available. The correct tension is 20.5 oz. (567-709 gm.). Fit a new spring if the tension is low.

lf the brushes are worn so that the flexible lead is exposed on the running face, new brushes must be fitted. Brushes are pre-formed so that bedding to the commutator is unnecessary.

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 the 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 mica insulation between the segments to a depth of in. (8 mm.) with a hacksaw blade ground down to the thickness of the mica.

Test the field coils, without removing them from the dynamo yoke, by means of an ohmmeter. The reading on the ohmmeter should be between 6.0 and 6.3 ohms. If this is not available, connect a 12-volt D.C. supply with an ammeter in series between the field terminal and the dynamo yoke. The ammeter reading should be approximately 2 amps. If no reading is indicated the field coils are open-circuited and must be renewed. To test for earthed field coils, unsolder the end of the field winding from the earth terminal on the dynamo yoke and, with a test lamp connected from Supply mains, test across the field terminal and earth. If the lamp lights, the field coils are earthed and must be renewed.

When fitting field coils, carry out the procedure outlined below, using an expander and wheel-operated screwdriver:

(a) Remove the insulation piece which is provided to prevent the junction of the field coils from contacting the yoke.
(b) Mark the yoke and pole-shoes in order that they can be refitted in their original positions.

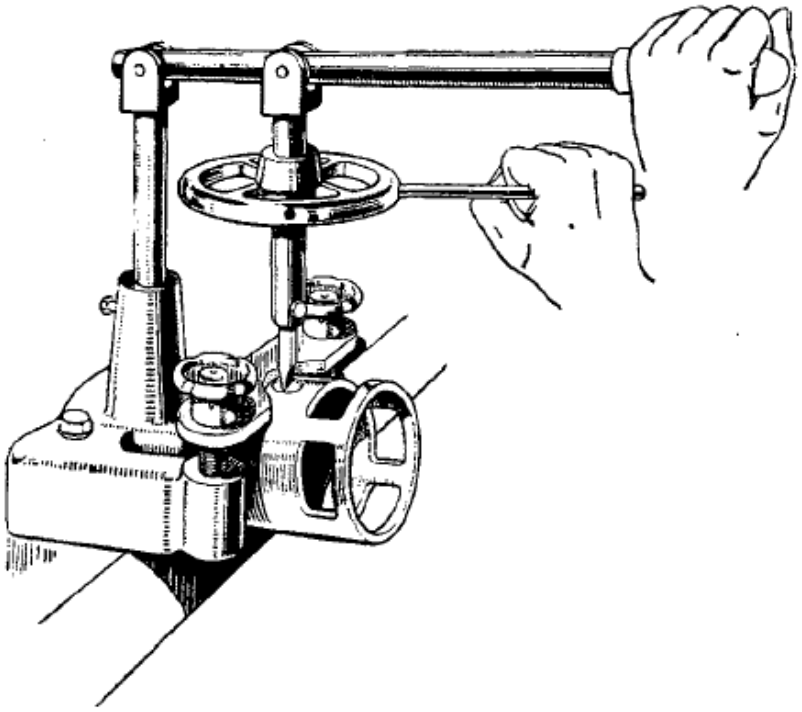


Fig. N.3 Showing the use of a wheel-operated screwdriver to remove the pole-shoe attachment screws

(c) Unscrew the two pole-shoe retaining screws by means of the wheel-operated screwdriver.
(d) Draw the pole-shoes and coils out of the dynamo yoke and lift of the coils.
(e) 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.
(f) Locate the pole-shoes and field coils by lightly tightening the fixing screw.
(g) Insert the pole-shoe expander, open it to the fullest extent and tighten the screws.
(h) Finally tighten the screws by means of the wheel operated screwdriver and lock them by caulking.
(i) Replace the insulation piece between the field coil connections and the yoke.

Armature

The testing of the armature winding requires the use of a voltage 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.

Bearings

Bearings which are worn to such an extent that they will allow side movement of the armature shaft must be replaced by new ones.

To fit a new bearing at the commutator end of the dynamo proceed as follows:

(a) Press the bearing bush out of the commutator end bracket.
(b) Press the new bearing bush into the end bracket, using a shouldered mandrel of the same diameter as the shaft which is to fit in the bearing.

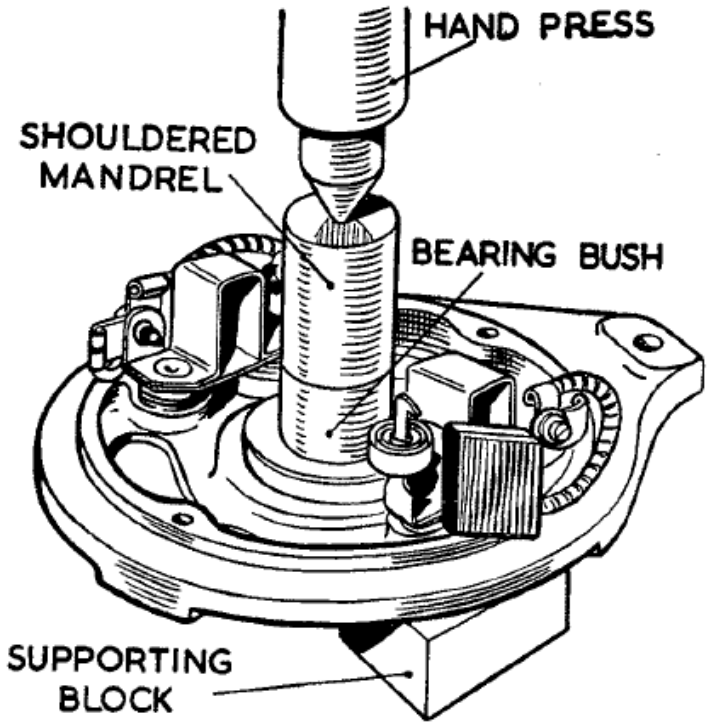


Fig. N4 The method of pressing out the commutator end bracket bush is shown in this illustration

Before fitting the new bearing bush, allow it to stand completely immersed in thin engine oil for 24 hours, to fill the pores of the bush with lubricant. The ball bearing at the driving end is renewed as follows:

(a) Knock out the rivets which secure the bearing retaining plate to the end bracket and remove the plate.
(b) Press the bearing out of the end bracket and remove the corrugated washer, felt washer and oil retaining washer.
(c) Before fitting the replacement bearing, see that it is clean and pack it with a high-melting-point grease.
(d) Place the oil retaining washer, felt washer and corrugated washer in the bearing housing in the end bracket.
(e) Locate the bearing in the housing and press it home by means of a hand press.
(f) Fit the bearing retaining plate. Insert the new rivets from the inside of the end bracket and open the rivets by means of a punch to secure the plate rigidly in position.

Reassembly

The reassembly of the dynamo is a reversal of the operations described in Section N.4

If the end bracket has been removed from the armature in dismantling, press the bearing end bracket onto the armature shaft, taking care to avoid damaging the end plate and armature winding.

Add a few drops of oil through the hole in the armature end cover.

N.6 THE STARTER

To test on vehicle

Switch on the lamps and operate the starter control. If the lights go dim, but the starter is not heard to operate, an indication is given that current is flowing through the starter windings but that the starter pinion is meshed permanently with the geared ring on the flywheel. This was probably caused by the starter being operated while the engine was still running. In this case the starter must be removed from the engine for examination.

Should the lamps retain their full brilliance when the starter switch is operated, check that the switch is functioning. If the switch is in order, examine the connections at the battery, starter switch and starter, and also check the wiring between these units. Continued failure of the starter to operate indicates an internal fault, and the starter must be removed from the engine for examination.

Sluggish or slow action of the starter is usually caused by a poor connection in the wiring which produces a high resistance in the starter circuit. Check as described above.

Damage to the starter drive is indicated if the starter is heard to operate but does not crank the engine.

N.7 REMOVING AND REPLACING THE STARTER

Release the starter cable from the terminal and unscrew the two starter securing bolts. Manoeuvre the starter forwards below the oil filter, then rearwards and upwards.

N.8 SERVICING THE STARTER

Examination of commutator and brush gear

Remove the starter cover band (A) (Fig. N.5) and examine the brushes (C) (Fig. N.5) and the commutator. Hold back each of the brush springs (B) (Fig. N.5) 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 with a smooth file. Always replace brushes in their original positions. If the brushes are worn so that they no longer bear on the commutator, or if the brush flexible lead has become exposed on the running face, they must be renewed.

If the commutator is blackened or dirty, clean it by holding a petrol-moistened cloth against it while the armature is rotated.

Secure the body of the starter in a vice and test by connecting it with heavy-gauge cables to a battery of the correct voltage. One cable must be connected to the starter terminal and the other held against the starter body or end bracket. Under these light load conditions, the starter should run at a very high speed.

If the operation of the starter is still unsatisfactory, the starter should be dismantled for detailed inspection and testing.

Dismantling

Take off the cover band “A” (Fig. N.5) at the commutator end, hold back the brush springs "B' (Fig. N.5) and take out the brushes “C” (Fig. N.5) from their holders.

Withdraw the jump ring and shims from the armature shaft at the commutator end and remove the armature complete with drive from the commutator end bracket and starter frame.

Remove the terminal nuts 'E' and washers “F ' from the terminal post “G” at the commutator end bracket and also withdraw the two through bolts. Remove the commutator end bracket and the attachment bracket from the starter frame.

Brushes

(a) Test the brush springs with a spring scale. The correct tension is 30-40 oz. (850-134 gm.). Fit a new spring if the tension is low.

(b) If the brushes are worn so that they no longer bear on the commutator, or if the flexible connector has become exposed on the running face, they must be renewed. Two of the brushes are connected to terminals eyelets attached to the brush boxes on the commutator end bracket. The other two brushes (Fig. N.5) are connected to tappings on the field coils. The flexible connectors must be removed by unsoldering and the connectors of the new brushes secured in

place by soldering. The brushes are pre-formed, so that bedding of the working face to the commutator is unnecessary.

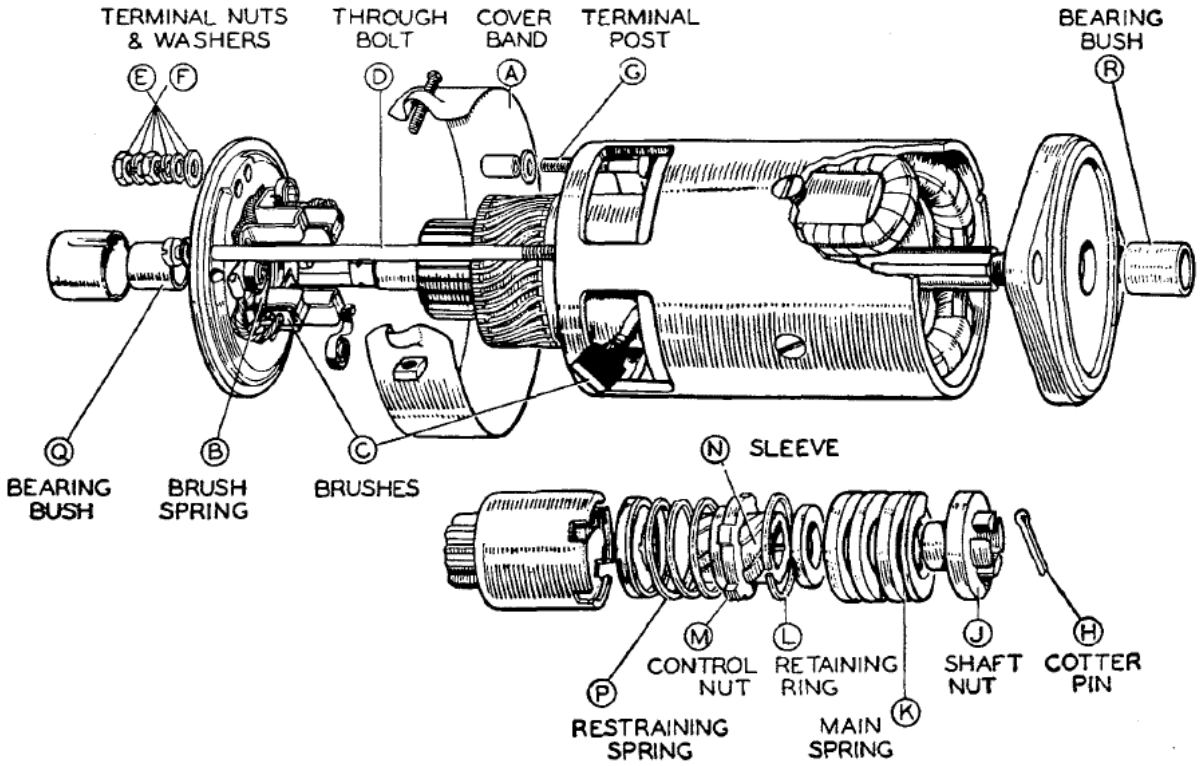


Fig. N.5. *An exploded view of the starter and drive.*

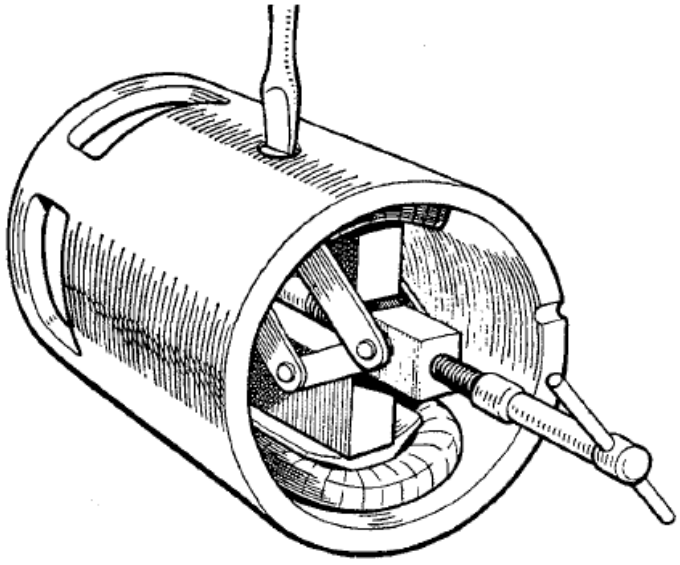


Fig. N.6. An expander in use for fitting pole shoes.

Drive

If the pinion is tight on the sleeve, wash in paraffin; replace any worn or damaged parts.

To dismantle the drive, extract the split pin and remove the shaft nut “J” (Fig. N.5); withdraw the main spring and collar.

Rotate the barrel to push out the sleeve; remove the barrel and pinion.

The barrel and pinion are supplied as an assembly, but the parts may be separated by extracting the

retaining ring “ L.”

Note-Should either the control nut or screwed sleeve be damaged, a replacement assembly, consisting of a screwed sleeve and control nut, must be fitted. These components must not be fitted individually.

Commutator

A commutator in good condition will be smooth and free from pits and burned spots. Clean the commutator with a cloth moistened with petrol. 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 as described above and remove the armature from the end bracket. Now mount the armature in a lathe, rotate it at a high speed and take a light cut with a very sharp tool. Do not remove any more metal than is absolutely necessary, and finally polish with very fine glass-paper.

The mica on the starter commutator must not be undercut,

Field coils

The field coils can be tested for an open circuit by connecting a 12-volt battery, having a 12-volt bulb in one of the leads, to the tapping point of the field coils to which the brushes are connected, and the field terminal post. If the lamp does not light, there is an open circuit in the wiring of the field coils.

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 by removing the lead from the brush connector and holding it on a clean part of the starter yoke. Should the bulb now light it indicates that the field coils are earthed.

Should the above tests indicate that the fault lies in the field coils, they must be renewed. When renewing field coils carry out the procedure detailed in the Dynamo Section N.5.

Armature

Examination of the armature will in many cases reveal the cause of failure, e.g. conductors lifted from the commutator due to the starter being engaged while the engine is running and causing the armature to be rotated at an excessive speed. A damaged armature must in all cases be renewed-no attempt should be made to machine the armature core or to true a distorted armature shaft.

Bearings (commutator end)

Bearings which are worn to such an extent that they will allow excessive side play of the armature shaft must be renewed. To renew the bearing bush, proceed as follows: -

Press the new bearing bush into the end bracket, using a shouldered mandrel of the same diameter as the shaft which is to fit in the bearing.

The bearing bush is of the porous phosphor bronze type, and before fitting, new bushes should be allowed to stand completely immersed for twenty-four hours in thin engine oil in order to fill the pores of the bush with lubricant.

Reassembly

The reassembly of the starter is a reversal of the operations described in this section.

N.9 THE CONTROL BOX

Regulator adjustment

The regulator is carefully set before leaving the Works to suit the normal requirements of the standard equipment, and in general it should not be necessary to alter it. If, however, the battery does not keep in a charged condition, or if the dynamo output does not fall when the battery is fully charged, it may be advisable to check the setting and, if necessary, to readjust it.

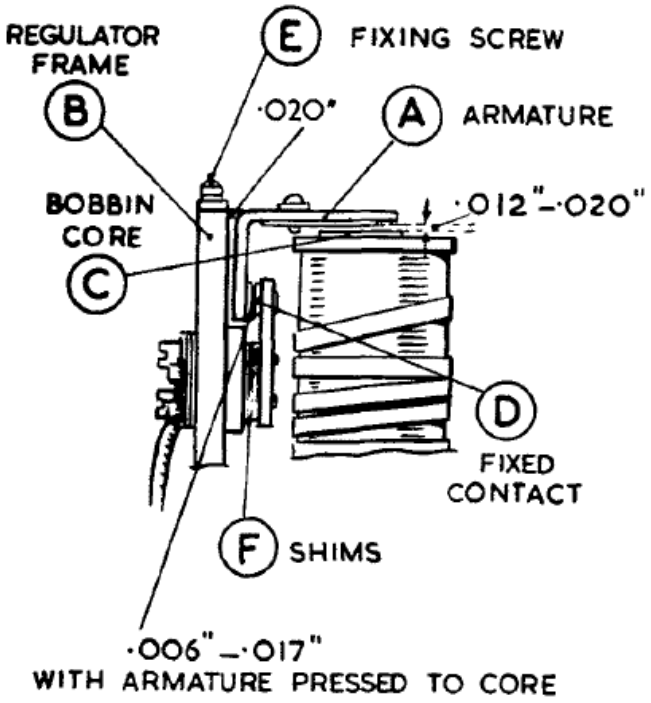


Fig. N.7 Mechanical regulator adjustment

It is important, before altering the regulator setting, when the battery is in a low state of charge, to check that its condition is not due to a battery defect or to the dynamo belt slipping.

How to check and adjust electrical setting

The regulator setting can be checked without removing the cover of the control box.

Withdraw the cables from the terminals marked 'A' and 'Al' at the control box and join them together. Connect the negative lead of a moving-coil voltmeter (0-20 volts full-scale reading) to the 'D' terminal on the dynamo and connect the other lead from the meter to a convenient chassis earth.

Slowly increase the speed of the engine until the voltmeter needle flicks and then steadies; this should occur at a voltmeter reading between the limits given below for the appropriate temperature of the regulator.

Setting at 10° C. (50°F)	16.1 -16.7 Volts
Setting at 20° C. (68°F)	15.8 - 16.4 Volts
Setting at 30° C. (86°F)	15.6 – 16.2 Volts
Setting at 40° C. (104°F)	15.3 – 15.9 Volts

If the voltage at which the reading becomes steady occurs outside these limits, the regulator must be adjusted.

Shut off the engine, remove the control box cover, release the locknut (A) (Fig. N.8) holding the adjusting screw (B) and turn the screw in a clockwise direction to raise the setting or in an anti-clockwise direction to lower the setting. Turn the adjusting screw a fraction of a turn and then tighten the locknut.

When the dynamo is run at a high speed on open circuit, it builds up a high voltage. When adjusting the regulator, do not run the engine up to more than 3,000 RPM. or a false voltmeter reading will be obtained.

Mechanical setting

The mechanical setting of the regulator is accurately adjusted before leaving the Works, and provided that the armature carrying the moving contact is not removed, the regulator will not require mechanical adjustment. If, however, the armature has been removed from the regulator for any reason, the contacts will have to be reset. To do this, proceed as follows:

Slacken the two armature fixing screws (E) (Fig. N.7). Insert a 020 in. (51 mm.) feeler gauge between the back of the armature (A) and the regulator frame.

1. Press back the armature against the regulator frame and down onto the top of the bobbin core with the gauge in position and lock the armature by tightening the two fixing screws.
2. Check the gap between the underside of the arm and the top of the bobbin core. This must be 012 to 020 in. (30 to 51 mm.). If the gap is outside these limits correct by adding or removing shims (F) (Fig. N.7) at the back of the fixed contact (D) or, in later types, by carefully bending the fixed contact bracket.
3. Remove the gauge and press the armature down, when the gap between the contacts should be between 006 in. (15 mm.) and 017 in, (43 mm.).

Cleaning contacts

To render the regulator contacts accessible for cleaning, slacken the screws securing the plate carrying the fixed contact. It will be necessary to slacken the upper screw (C) (Fig. N.8) a little more than the lower screw (D), so that the contact plate can be swung outwards. Clean the contacts by means of fine carborundum stone or fine emery-cloth. Carefully wipe away all traces of dirt or other foreign matter. Finally tighten the securing screws.

Cut-out Adjustment

If it is suspected that the cutting-in speed of the dynamo is too high, connect a voltmeter between the terminals marked 'D' and 'E' at the control box and slowly raise the engine speed. When the voltmeter reading rises to between 127 and 13.3 volts the cut-out contacts should close.

If the cut-out has become out of adjustment and operates at a voltage outside these limits it must be reset. To make the adjustment, slacken the locknut (E) (Fig. N.8) and turn the adjusting screw (F) a fraction of a turn in a clockwise direction to raise the operating voltage or in an anti-clockwise direction to lower the voltage. Tighten the locknut after making the adjustment.

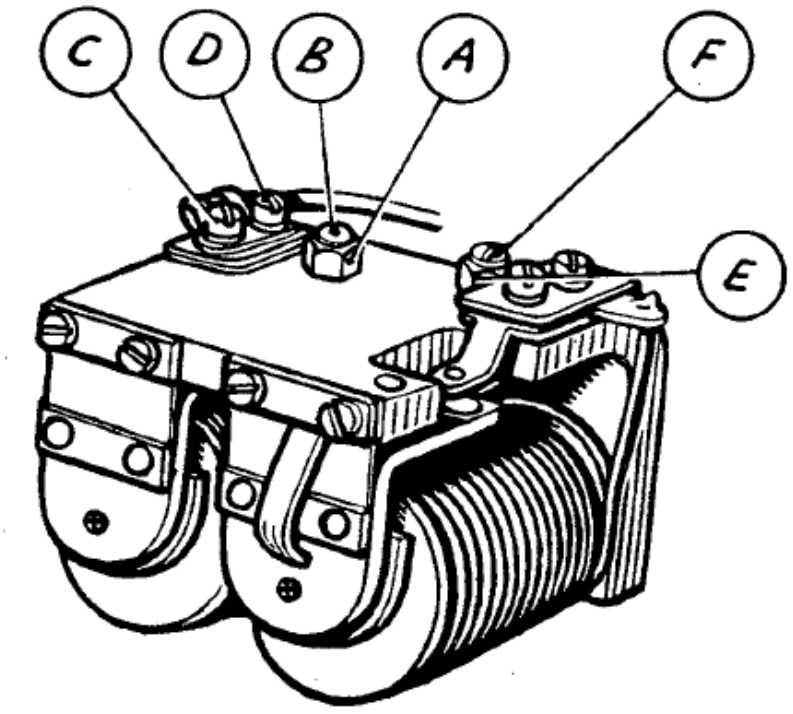


Fig. N.8 The cut-out and regulator assemblY

Cleaning

To clean the contacts, remove the cover, place a strip of fine glass-paper between the contacts and then, closing the contacts by hand, draw the paper through. This should be done two or three times, with the rough side towards each contact.

Radio suppression

When it is desired to fit suppressors for radio equipment, make sure that this is done only in accordance with recommended practice. Suppressors and capacitors wrongly fitted may cause damage to the electrical equipment.

N.10 FUSES

The fuses are mounted in a separate fuse box and are therefore accessible without removing the control box cover.

Units protected

The units which are protected by each fuse can readily be identified by referring to the wiring diagram on page N.14.

Blown fuses

A blown fuse is indicated by the failure of all the units protected by it, and is confirmed by examination of the fuse, which can easily be withdrawn from the spring clips.

If it has blown, the fused state of the wire will be visible inside the glass tube. Before renewing a blown fuse, inspect the wiring of the units that have failed for evidence of a short circuit or other faults which may have caused the fuse to blow, and remedy the cause of the trouble.

N.11 THE ELECTRIC HORN

If the horn fails or becomes uncertain in its action, it does not follow that the horn has broken down. First ascertain that the trouble is not due to a loose or broken connection in the wiring of the horn. If the fuse has blown, examine the wiring for the fault and replace with the spare fuse provided.

The performance of a horn may be upset by a loose fixing bolt, or by some component near the horn being loose. If after carrying out the above examination the trouble is not rectified, the horn may need adjustment.

Adjustment does not alter the pitch of the note: it merely takes up wear of moving parts. When adjusting the horn, short-circuit the fuse, otherwise it is liable to blow. Again, if the horn will not sound on adjustment, release the push instantly.

Adjustment

Remove the fixing screw from the top of the horn and take off the cover. Detach the cover securing bracket by springing it out of its location.

Slacken the locknut on the fixed contact and rotate the adjusting nut until the contacts are just separated (indicated by the horn failing to sound). Turn the adjusting nut half a turn in the opposite direction and secure it in this position by tightening the locknut.

N.12 FLASHING DIRECTION INDICATORS

The flashing direction indicators are operated by a pneumatic time switch through a flasher unit and a relay to the dual-filament bulbs in the side and tail lamps. In the event of failure, carry out the following procedure:

1. Check bulbs for broken filaments.
2. Refer to the wiring diagram and check over flasher circuit connections.
3. Switch on the ignition and check that terminal 'B' on the flasher is at 12 volts with respect to earth.
4. Connect terminals 'B' and 'L' at the flasher unit and operate the direction indicator switch. If the

flasher lights now work, the flasher unit is defective and must be renewed.

If the lights do not work the relay is defective and must be renewed.

The length of time the flasher is operating can be altered by screwing up the adjusting screw located in the small boss at the back of the time switch. Screw in to lengthen the time of operation and out to shorten the period.

N.13 THE WINDSHIELD WIPER

Normally the windshield wiper will not require any servicing apart from the occasional renewal of the rubber blades.

Should any trouble be experienced, first check for loose connections, worn insulation, etc., before dismantling the motor.

1. To detach the cable rack from the motor and gearbox

a) Unscrew the pipe union nut.
b) Remove the gearbox cover.
c) Remove the split pin and washer from the crankpin and final gear wheel.
d) Lift off the connecting link.

2. Commutator dirty

Remove the connecting leads to the terminals and withdraw the three screws securing the cover at the commutator end. Lift of the cover. Clean the commutator with a cloth moistened with petrol (gasoline) and carefully remove any carbon dust from between the commutator segments.

3. Brush lever stiff or brushes not bearing on commutator

Check that the brushes bear freely on the commutator. If they are loose and do not make contact, a replacement tension spring is necessary. The brush levers must be free on their pivots. If they are stiff they should be freed by working them backwards and forwards by hand and by applying a trace of thin machine oil. Packing shims are fitted beneath the legs of the brush to ensure that the brushes are central and that there is no possibility of the brush boxes fouling the commutator. If the brushes are considerably worn they must be replaced by new ones.

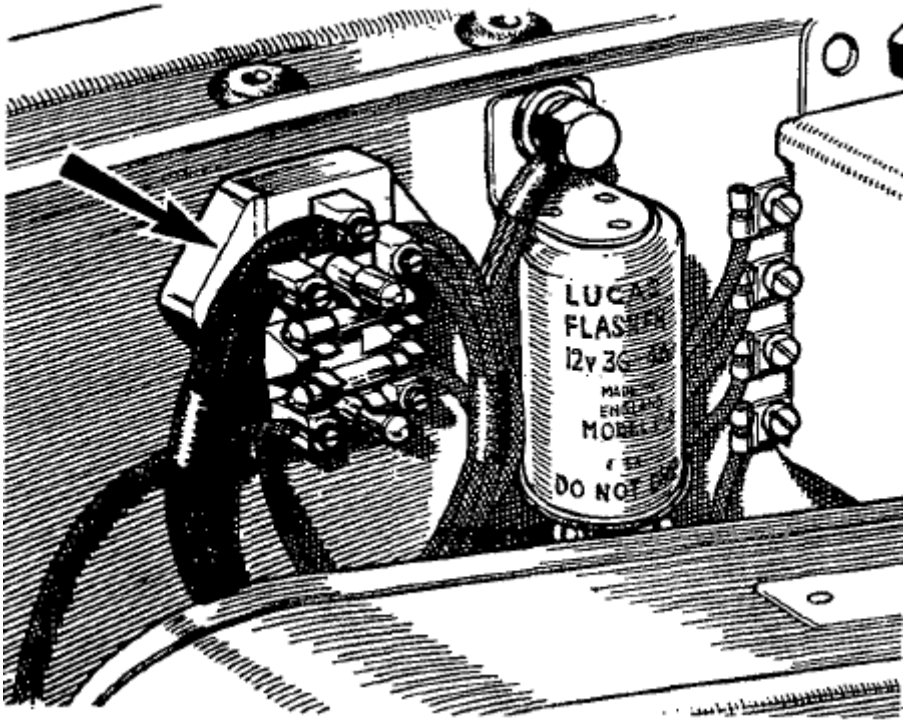


Fig. N.9 The fuses and flasher unit

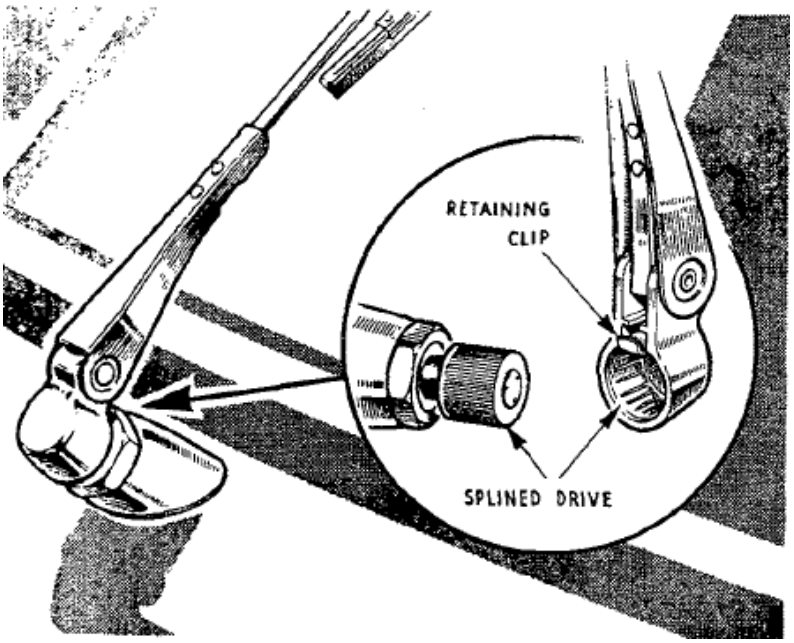


Fig. N.10 A windshield wiper arm and drive

4. Motor operates but does not transmit motion to spindles

Remove the cover of the gearbox. A push-pull motion should be transmitted to the inner cable of the flexible rack. If the cross-head moves sluggishly between the guides, lightly smear a small amount of medium grade engine oil in the groove formed in the die-cast housing. When overhauling, the gear must be lubricated by lightly packing the gearbox with a grease to Ref. D.

5. Thrust screw adjustments

The thrust screw is located on the top of the crosshead housing. To adjust, slacken the locknut, screw down the thrust screw until it contacts the armature and then turn back a fraction of a turn. Hold the thrust screw with a screwdriver and tighten the locknut.

6. To remove the motor

Detach the cable rack from the motor and gearbox as detailed above. Disconnect the lead. Remove the two screws securing the mounting bracket to remove the motor.

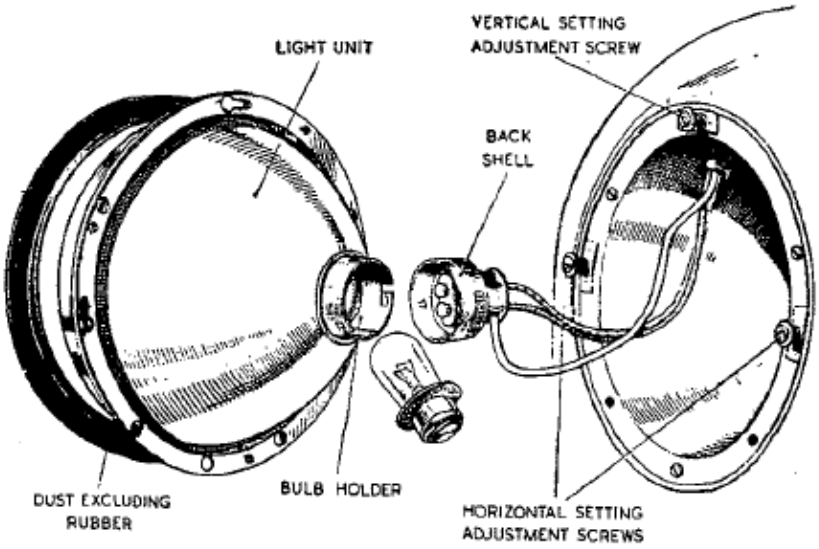


Fig. N.11 A light unit

N.14 THE HEADLAMPS

The headlamps are built into the wings and are fitted with double-filament bulbs. The design is such that the bulb is correctly positioned in relation to the reflector, and no focusing is required when a replacement bulb is fitted.

The anti-dazzle device

The double-filament bulbs are controlled by a foot operated dipping switch deflecting both headlamp beams downwards to avoid dazzle.

Certain countries have lighting regulations to which the foregoing arrangements do not conform, and cars exported to such countries have suitably modified lighting equipment.

N.15 THE LIGHT UNITS

The light units consist of a lamp glass, reflector, and a back shell. The light unit is located to the front wing by three spring-loaded attachment screws in a domed shield attached to the wing. The back of the lamp is therefore sealed to give complete protection.

A dust- and weather-excluding rubber is fitted in the recess of the rim of the light unit and a plated rim is fitted over this to complete the weather-sealing.

N.16 REMOVING THE LIGHT UNITS

To remove the light unit for bulb replacement, unscrew the retaining screw at the bottom of the plated lamp rim and lift the rim away from the dust-excluding rubber.

Remove the dust-excluding rubber, which will reveal the three spring-loaded screws. Press the light unit inwards against the tension of the springs and turn it in an anti-clockwise direction until the heads of the screws can pass through the enlarged ends of the keyhole slots in the lamp rim.

This will enable you to withdraw the light unit sufficiently to give attention to the wiring and bulbs.

N.17 SETTING THE HEADLAMPS

The lamps should be set so that the main driving beams are parallel with the road surface or in accordance with your local regulations.

If adjustment is required, this is achieved by removing the plated rim and dust-excluding rubber as indicated in Section N.16.

Vertical adjustment can then be made by turning the screws at the top of the lamp in the necessary direction.

Horizontal adjustment can be effected by using the adjustment screws on each side of the light unit. (See Fig. N.12.)

N.18 REPLACING HEADLAMP BULBS

Twist the back shell anti-clockwise and pull it off, Withdraw the bulb from the holder.

Insert the replacement bulb in the holder, making sure that the slot in the periphery of the bulb flange engages the projection in the holder.

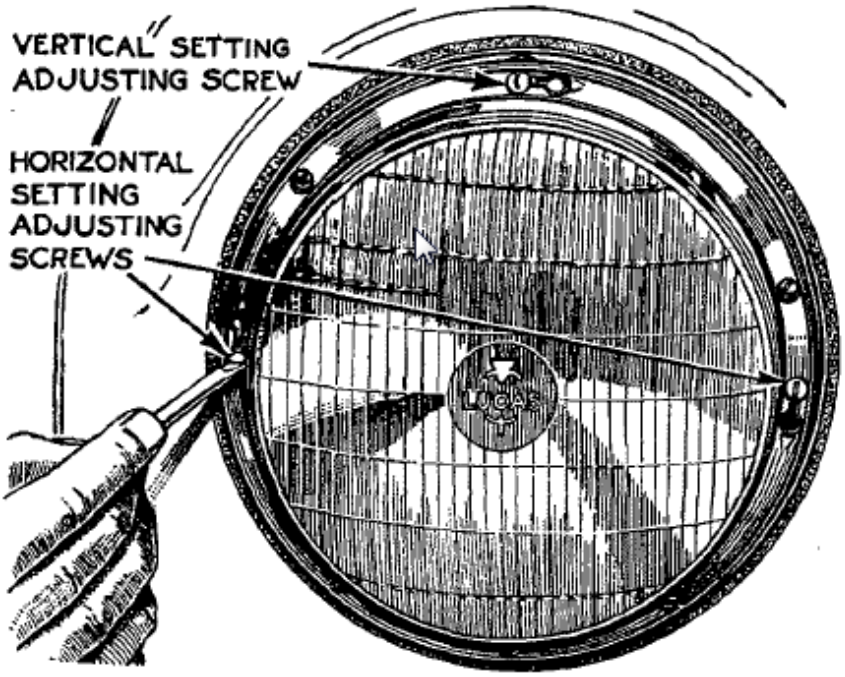


Fig. N.12 The headlamp setting screws

Sidelamp bulb removal.

Engage the projections on the back shell with the slots of the holder, press it on and twist it clockwise until it engages with its catch.

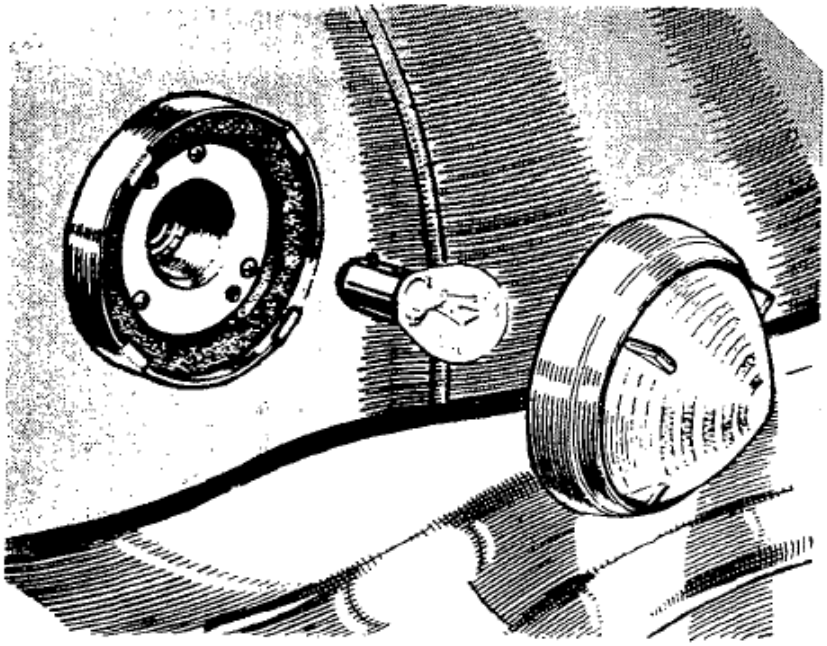


Fig. N.13 Sidelamp bulb removal

N.19 REPLACING THE LIGHT UNITS

Position the light unit so that the heads of the adjusting screws coincide with the enlarged ends of the attachment slots. Push the light unit towards the wing to compress the springs and turn the unit to the right as far as it will go, that is, approximately ½ in. (13 mm.).

Replace the dust-excluding rubber on the light rim with its flanged face forward and refit the plated rim.

N.20 THE TAIL-LAMPS AND STOP-LIGHTS

The tail-lamps are of the double-filament type, the second filament giving a marked increase in brilliance when the brakes are applied.

To obtain access to the bulbs, remove the glass by withdrawing the two screws. The bulbs are held in bayonet-type holders with offset pins to ensure correct fitting.

N.21 CLEANING THE LAMPS

Care must be taken when handling headlamp reflectors to prevent them from becoming finger-marked. If they do become marked a transparent and colourless protective covering enables any finger-marks to be removed by polishing with a chamois-leather or a very soft dry cloth. Do not use metal polish on reflectors.

Chromium-plated surfaces such as lamp rims should be washed with plenty of water, and when the dirt is completely removed they may be polished with a chamois-leather or soft dry cloth. Do not use metal polishes on chromium plating.

N.22 THE SIDELAMPS

To obtain access to the bulb press the lamp front inwards and turn it anti-clockwise until it is free to be withdrawn. Reverse this movement to replace the front. The locating pins on the bulbs are offset to ensure that it is fitted correctly to give increased brilliance when the flashing equipment is operating.

N.23 THE NUMBER-PLATE ILLUMINATION

The number-plate is illuminated by a separate lamp and the domed cover is removed for bulb replacement by unscrewing the slotted screw and withdrawing the cover.

N.24 THE PANEL AND WARNING LIGHTS

The locations of the lamps illuminating the instruments and the warning lights are shown by arrows on the illustrations on page N.15.

The bulbs are accessible from below the instrument panel.

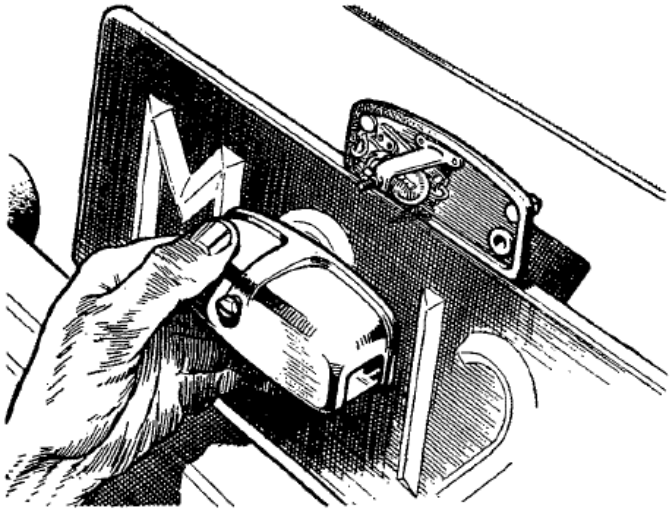
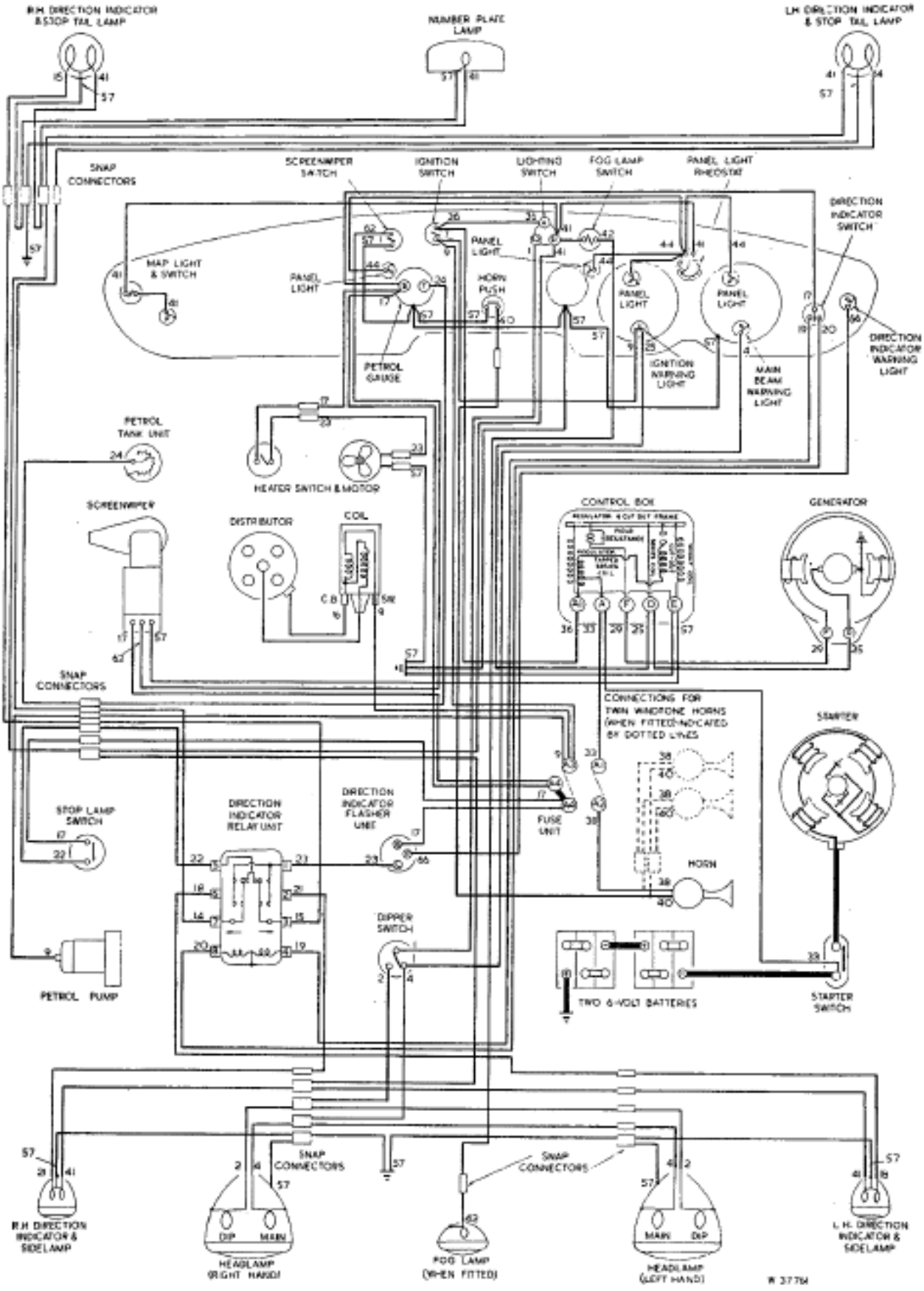
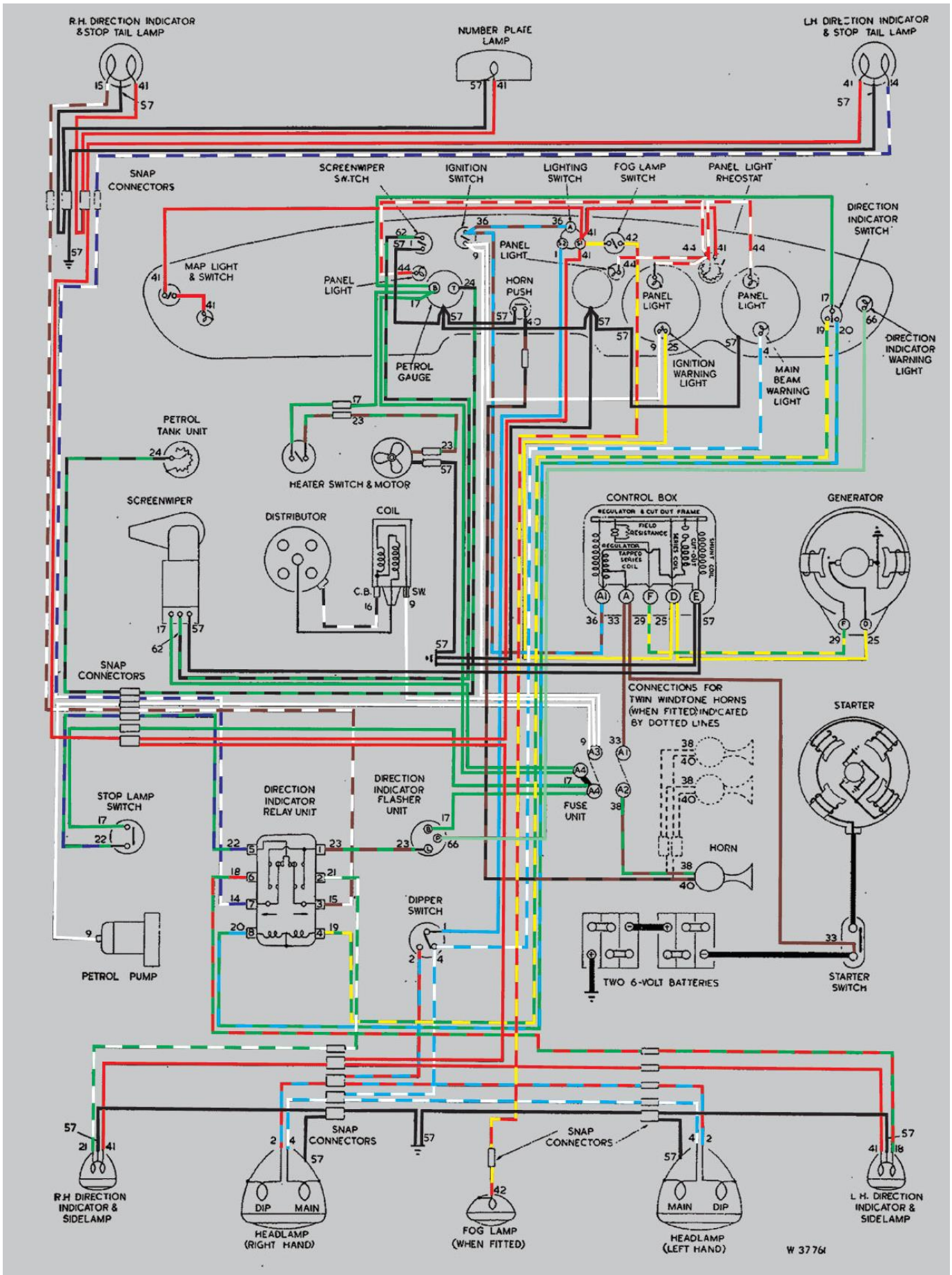


Fig. N. 14. The number-plate lamp.

WIRING DIAGRAM



For index to cable colour code numbers see below.



KEY TO WIRING COLOURS

1. Blue
2. Blue with Red
3. Blue with Yellow
4. Blue with White
5. Blue with Green
6. Blue with Purple
7. Blue with Brown
8. Blue with Black
9. White
10. White with Red
11. White with Yellow
12. 12 White with Blue
13. 3 White with Green
14. 14 White with Purple
15. White with Brown
16. White with Black
17. Green
18. Green with Red
19. Green with Yellow
20. Green with Blue
21. Green with White
22. Green with Purple
23. Green with Brown
24. Green with Black
25. Yellow
26. Yellow with Red
27. Yellow with Blue
28. Yellow with White
29. Yellow with Green
30. Yellow with Purple
31. Yellow with Brown
32. Yellow with Back
33. Brown
34. Brown with Red
35. Brown with Yellow
36. Brown with Blue
37. Brown with White
38. Brown with Green
39. Brown with Purple
40. Brown with Black
41. Red
42. Red with Yellow
43. Red with Blue
44. Red with White
45. Red with Green
46. Red with Purple
47. Red with Brown
48. Red with Black
49. Purple
50. Purple with Red
51. Purple with Yellow
52. Purple with Blue
53. Purple with White
54. Purple with Green
55. Purple with Brown
56. Purple with Black
57. Black
58. Black with Red
59. Black with Yellow
60. Black with Blue
61. Black with White
62. Black with Green
63. Black with Purple
64. Black with Brown
65. Dark Green
66. Light Green

N.25 REPLACEMENT BULBS

	BMC Part No	Watts	Volt
Headlamps (Home and Export R.H.D.-dip left)	13H140	50/40	12
Headlamps (Europe and U.S.A. L.H.D.-dip right)	13H141	50/40	12
Headlamps (Europe except France-vertical dip)	3H921	45/40	12
Headlamps (Europe except France-vertical dip) from Car No 58918	13H138	45/40	12
Headlamps (France-vertical dip) from Car No. 60340	13H139	45/40	12
Sidelamp and stop / tail lamp	1F9026	6/21	12

Number-plate illumination lamp	2H4817	6	12
Panel lamps	2H4732	2.2	12

N.26 FITTING A FOG LAMP

A fog lamp is not fitted as standard equipment but can be supplied as an optional extra. The necessary wiring together with the switch (marked 'F' on the instrument panel) is already provided to accommodate the fitment.

To fit a fog lamp bracket, remove the over-rider and place the bracket in position. Mark off and drill a further hole through the bumper to accommodate an additional in. screw.

When mounted the lamp is connected up to the spare red and yellow lead located behind the radiator grille to the right-hand side,

The necessary parts are shown below, together with their part reference numbers.

ADH785	Fog lamp	2
AHH5454	Lead-fog lamp	2
AHHS521	Bracket-right-hand	1
AHHS520	Bracket-left-hand	1
RG103	Grommet-lead	4
HZSO506	Screw-bracket to blade-lower	2
FNZ05	Nut	2
LWZ205	Spring washer	2
PMP0518	Screw	2
PMP105	Washer	2

N.27 LOCATION AND REMEDY OF FAULTS

Although every precaution is taken to eliminate possible causes of trouble, failure may occasionally develop through lack of attention to the equipment, or damage to the wiring. The following pages set out the recommended procedure for a systematic examination to locate and remedy the causes of some of the more usual faults encountered.

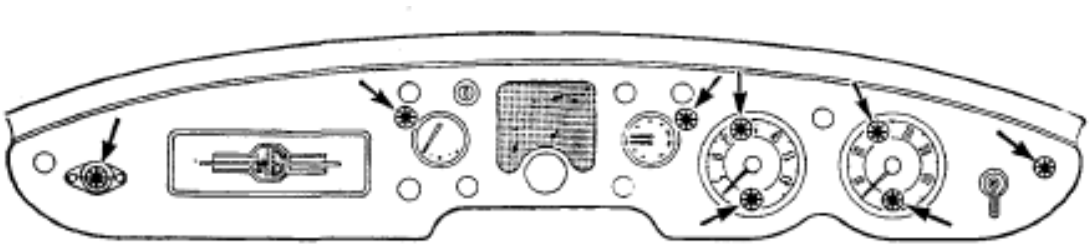


Fig. N.15 The panel and warning lights

The sources of trouble are by no means always obvious, and in some cases a considerable amount of deduction from the symptoms is needed before the cause is disclosed.

For instance, the engine might not respond to the starter switch; a hasty inference would be that the starter motor is at fault. However, as the motor is dependent on the batteries, it may be that the

batteries are exhausted.

This, in turn, may be due to the dynamo failing to charge the batteries, and the final cause of the trouble may be, perhaps, a loose connection in some part of the charging circuit.

If, after carrying out an examination, the cause of the trouble is not found, the equipment should be checked by the nearest Lucas Service Depot or Agent.

CHARGING CIRCUIT

1. Batteries in low state of charge

(a) This state will be shown by lack of power when starting, poor light from the lamps, and hydrometer readings below 1:200. It may be due to the dynamo not charging or giving low or intermittent output. The ignition warning light will not go out if the dynamo fails to charge, or will flicker on and off in the event of intermittent output.

(b) Examine the charging and field circuit wiring, tightening any loose connections or replacing broken cables. Pay particular attention to the battery connections.

(c) Examine the dynamo driving belt; take up any undue slackness by swinging the dynamo outwards on its mounting after slackening the attachment bolts.

(d) Check the regulator setting and adjust if necessary.

(e) If, after carrying out the above, the trouble is still not cured, have the equipment examined by a Lucas Service Depot or Agent.

2. Batteries overcharged

This will be indicated by burnt-out bulbs, very frequent need for topping up the batteries, and high hydrometer readings. Check the charge reading with an ammeter when the car is running. It should be of the order of only 3-4 amperes.

If the ammeter reading is in excess of this value, it is advisable to check the regulator setting and adjust if necessary.

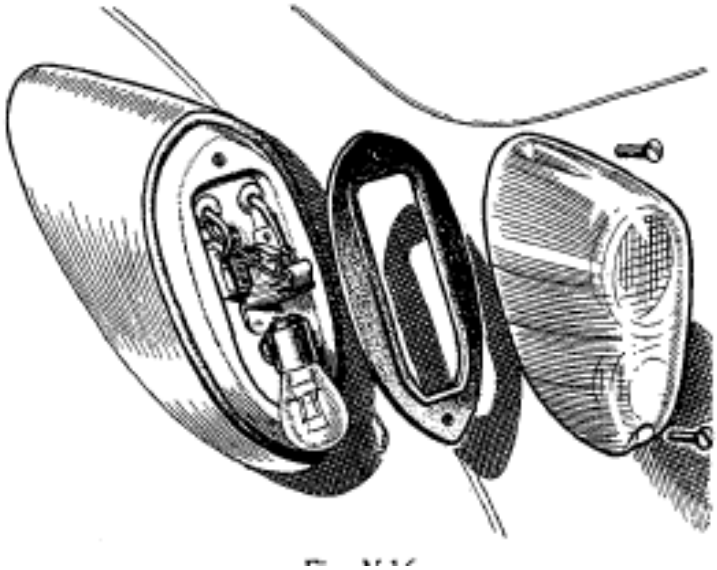


Fig. N. 16 Removing a tail lamp bulb

STARTER MOTOR

1. Starter motor lacks power or fails to turn engine

(a) See if the engine can be turned over by hand. If not, the cause of the stiffness in the engine must be located and remedied.

(b) If the engine can be turned by hand, first check that the trouble is not due to a discharged battery.

(c) Examine the connections to the batteries, starter and starter switch, making sure that they are tight and that the cables connecting these units are not damaged.

(d) It is also possible that the starter pinion may have jammed in mesh with the flywheel, although this is by no means a common occurrence. To disengage the pinion, rotate the squared end of the starter shaft by means of a spanner.

2. Starter operates but does not crank engine

This fault will occur if the pinion of the starter drive is not allowed to move along the screwed sleeve into engagement with the flywheel, due to dirt having collected on the screwed sleeve. Remove the starter and clean the sleeve carefully with paraffin (kerosene).

3. Starter pinion will not disengage from flywheel when engine is running

Stop the engine and see if the starter pinion is jammed in mesh with the flywheel, releasing it if necessary by rotation of the squared end of the starter shaft. If the pinion persists in sticking in mesh, have the equipment examined at a Service Depot. Serious damage may result to the starter if it is driven by the flywheel.

LIGHTING CIRCUITS

1. Lamps give insufficient illumination

(a) Test the state of charge of the battery, recharging it if necessary from an independent electrical supply.

(b) Check the setting of the lamps.

(c) If the bulbs are discoloured as the result of long service, they should be renewed.

2. Lamps light when switched on but gradually fade out

As paragraph 1 (a).

3. Brilliance varies with speed of car

(a) As paragraph 1 (a).

(b) Examine the battery connections, making sure that they are tight, and renew any faulty cables.

WINDOWLESS YOKE DYNAMO

Engines numbered from 487 are fitted with a new dynamo (Part No. 11G220) without brush gear inspection windows (see Fig. N.17). Access to the brush gear in these dynamos is gained by undoing the two through bolts and withdrawing the commutator end bracket. Every 12,000 miles (19200 km.) the unit should be partially dismantled for the inspection of brush gear and commutator.

To check the brush spring tension, the yoke should be completely withdrawn from the armature and the commutator end bracket refitted to the shaft.

When reassembling a windowless yoke dynamo, the brushes must first be held clear of the commutator in the usual way, i.e. by partially withdrawing the brushes from their boxes until each brush is trapped in position by the side pressure of its spring. The brushes can be released onto the commutator with a small screwdriver or similar tool when the end bracket is assembled to within about in. (13 mm.) of the yoke. Before closing the gap between the end bracket and yoke, see that the springs are in correct contact with the brushes.

Coil steady plate, Part No. 11G221, should always be used with dynamo, Part No. 11G220.

N.29 MODIFIED CONTROL BOX

A modified C.V.C. control box, model RB106/2, with revised settings (Part No. AHH5356) is introduced on later cars. Servicing instructions remain as before (see Section N.9), but adjustments must be made within 30 seconds, otherwise heating of the shunt winding will cause false settings to be made.

The voltmeter readings should be within the limits given below at approximately 1,500 dynamo RPM

Setting at 10° C. (50°F.) ...15.9 to 16.5 volts

Setting at 20° C. (68°F). 15.6 to 16.2 volts

Setting at 30° C. (86°F). 15.4 to 16.0 volts

Setting at 40° C. (104°F) 15.1 to 15.7 volts

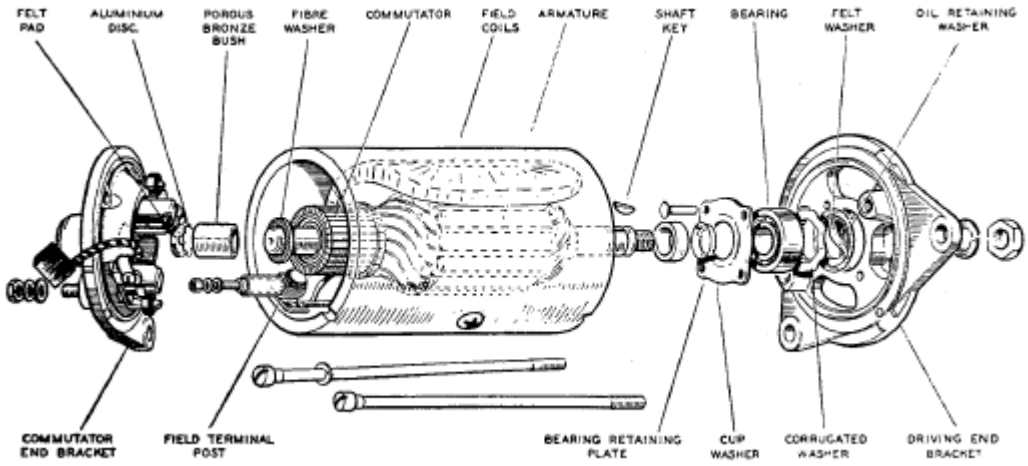


Fig. N.17

The windowless yoke dynamo

N.30 HEADLAMP BEAM SETTING

Refer to Section N.17 for details of the headlamp adjustment screws.

In the absence of specialized proprietary equipment, the setting of the lamps can be carried out by placing the vehicle squarely in front of a blank wall at a distance of 25 ft. (76 m.) or more, taking care that the surface on which the car is standing is level and not sloping in relation to the wall. The vehicle should be loaded. It will be found an advantage to cover one lamp while setting the other.

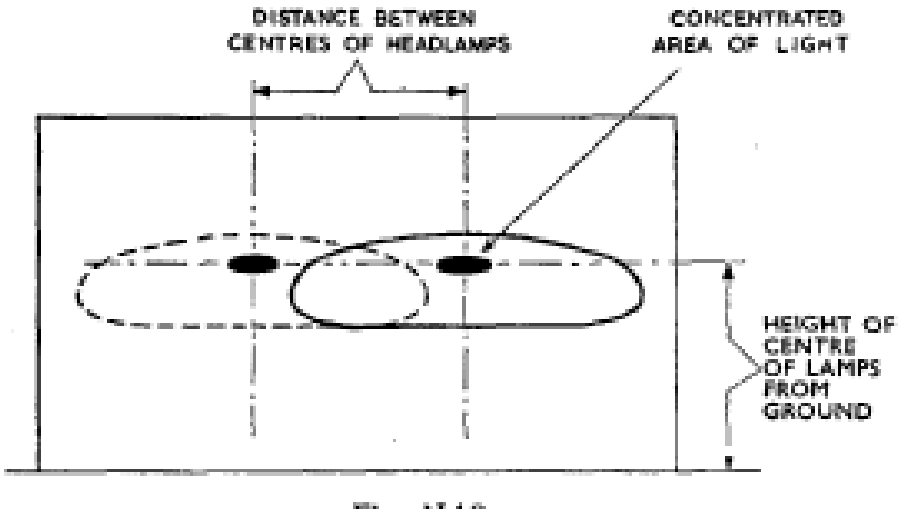


Fig. N.18 Headlamp-alignment

N.31 DRY-CHARGED BATTERIES

“Dry-charged' batteries are supplied without electrolyte but with the plates in a charged condition. This ensures that there is no deterioration of the battery if it is stored for a period before use. These batteries have the type suffix letter “Z” (e.g. SGZ, etc.).

Filling the cells with electrolyte of the correct specific gravity (see Initial filling and charging of Section N.1) in one operation renders the battery capable of giving a starting discharge one hour after filling. The temperature of the filling-in solution, battery, and filling room should be maintained between 60° F. (16° C) and 100°F. (38° C). If the battery has been stored in a cool place, it should be allowed to warm up to room temperature before filling.

When time permits, a freshening charge at the normal recharge rate of the battery will ensure that the battery is fully charged. During the charge keep the electrolyte level with the top edge of the separators by the addition of distilled water. Check the electrolyte specific gravity 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 was used, the specific gravity should be between 1.210 and 1.230.

N.32 MODIFIED EUROPEAN LIGHT UNIT

Cars exported to Europe are now fitted with the new European-type headlamps. These lamp units are fitted with special bulbs and front lenses giving an asymmetrical beam to the right-hand side. This modification was introduced on the following cars:

From Car No. 58918 (Europe except France). From Car No. 60340 (France). Access to the bulb is gained in the same way as described in Section N.16. The bulb, however, is released from the reflector by withdrawing the three-pin socket and pinching the two ends of the wire retaining clip to clear the bulb flange (see Fig. N.18).

When replacing the bulb care must be taken to see that the rectangular pip on the bulb flange engages the slot in the reflector seating for the bulb.

Replace the spring clip with its coils resting in the base of the bulb flange and engaging in the two retaining lugs on the reflector seating.

The appropriate replacement bulbs are listed in Section N.25. They are not interchangeable with those used in conjunction with the Continental-type headlamps previously fitted.

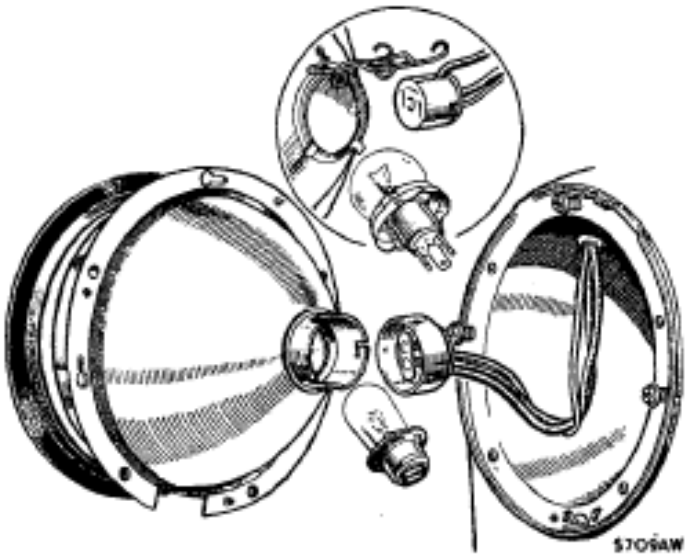
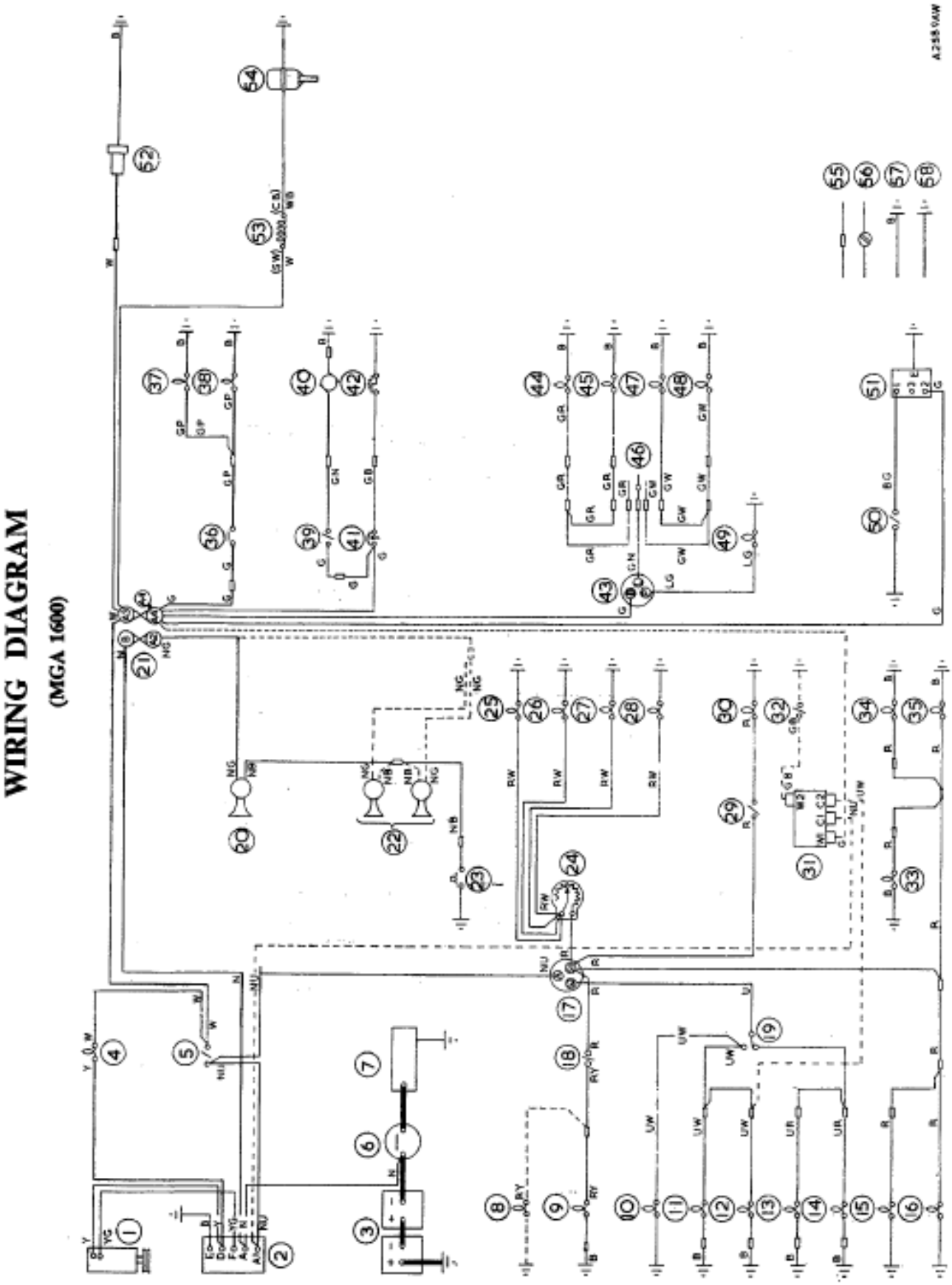
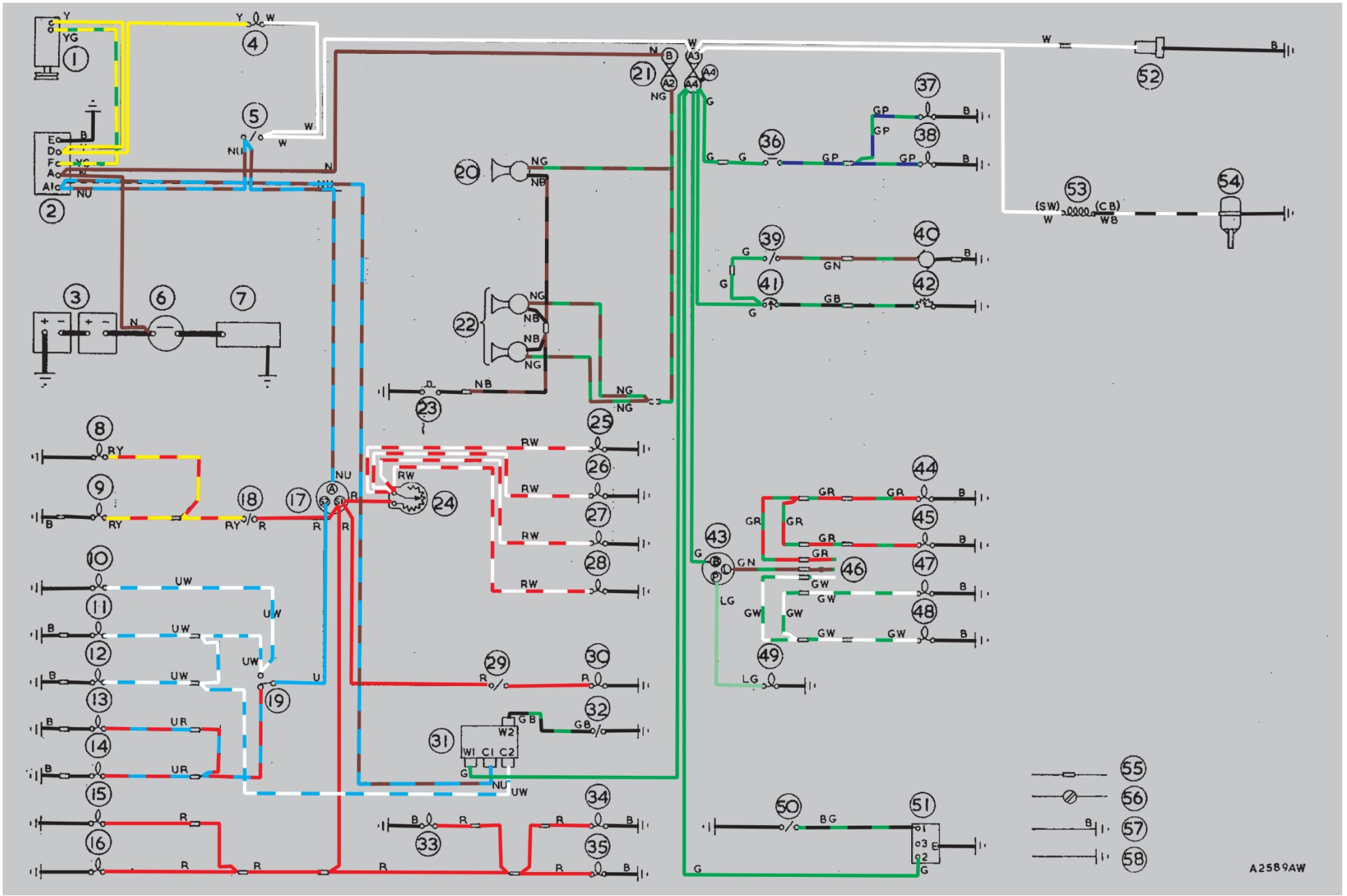


Fig. N.19 The headlamp light unit, with the European-type lamp bulb arrangement inset

SECTION NN (MGA 1600)

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KEY TO WIRING DIAGRAM (R.H.D., AND L.H.D.)

1 Dipper switch.

2 Horn.

3 Fuse unit,

4 Twin wind tone horns (if fitted)

5 Horn-push,

6 Panel lamp rheostat

7 Panel lamp.

8 Panel lamp

9 Panel lamp

10 Panel lamp,

11 Map lamp switch,

12 Map lamp.

13 Headlamp flick relay.

14 Headlamp flick switch.

15 LH Tail lamp.

16 Number-plate lamp.

17 R.H. taillamp,

18 Stop lamp switch.

19 LH stop lamp,

20 RH stop lamp.

21 Heater switch (when fitted).

22 Heater motor.

23 Fuel gauge.

24 Fuel tank unit.

25 Flasher unit.

26 L.H. rear flasher,

27 L.H., front flasher.

28 Flasher switch.

29 R.H. front flasher.

30 R.H. rear flasher

31 Flasher warning light,

32 Windshield wiper switch,

33 Windshield wiper motor.

34 Fuel pump.

35 Ignition coil,

36 Distributor.

37 Snap connectors,

38 Terminal blocks or junction box

39 Earth connections made via cable

40 Earth connections made via fixing bolts.

CABLE COLOUR CODE

B Black

U Blue

N Brown

G Green

K Pink

P Purple

R Red

S Slate

W White

Y Yellow

D Dark

L Light

M Medium

NN.1 FRONT PILOT AND FLASHING INDICATOR LAMPS

To gain access to the front pilot and flashing indicator bulbs press the front of the lamp inwards and turn it in a clockwise direction.

Both bulbs have single filaments and may be replaced either way round.

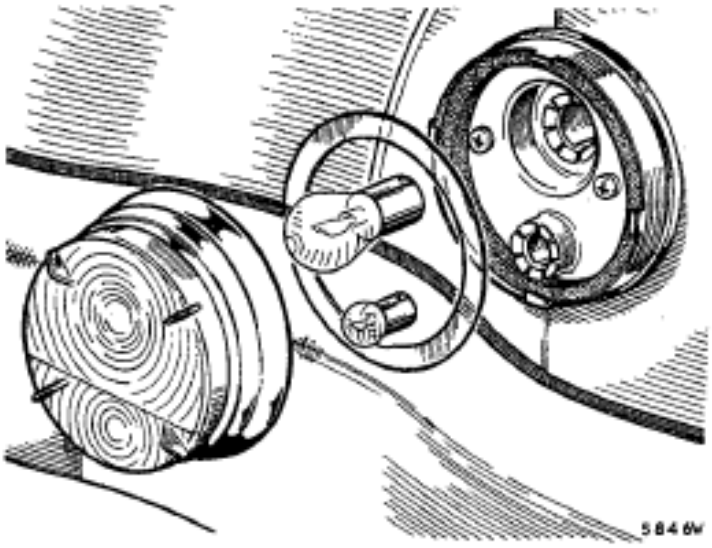


Fig. NN.1 A front pilot and flashing indicator bulb with the lens and rim removed

NN.2 REAR FLASHING INDICATOR LAMPS

Fold back the rubber lip surrounding the lamp rim and withdraw the rim and lens.

The bulb has a single filament and may be replaced either way round.

NN.3 REPLACEMENT BULBS

	B.M.C. Part No	Watts	Volts
Headlamps (Home and Export R.H.D.-dip left).	3H140	50/40	12
Headlamps (Export and U.S.A. L.H.D.-dip right)	3H141	50/40	12
Headlamps (Europe except France-dip vertical)	13H138	45/40	12
Headlamps (France L.H.D.-dip vertical)	13H139	45/40	12
Headlamps (Sweden R.H.D.-dip vertical)	3H921	45/40	12
Headlamps (Sweden R.H.D.-left dip, from Car No. 72040).	13H138	45/40	12
Stop/tail lamps	1F9026	6/21	12
Number-plate illumination lamp. .	2H4817	6	12
Flashing indicator lamps	1F9012	21	12
Panel lamps.	2H4732	2.2	12

NN.4 HEADLAMPS

From Car No. 70222 Mk. VIII headlamps with sealed beam units (Part No. BHA4144) were fitted to cars exported to U.S.A.

From Car No. 72040 cars exported to Sweden have special headlamps with asymmetrical left dip (Part No. BMK391). These are interchangeable with earlier types in pairs only.

NN.5 LUCAS C4011 DYNAMO

A later type of dynamo with increased output, Lucas type C40/1, was introduced, complete with Lucar connectors, modified Lucas type RB106/2 control box, and a new-type ignition coil bracket.

The modified control box must not be fitted with the earlier-type dynamo,

NN.6 DISMANTLING A C40/1 DYNAMO

The instructions for dismantling the dynamo are basically the same as those given in Section N.4. The C40/1 dynamo has a windowless yoke and is therefore not fitted with a cover band.

Access to the brushes is obtained by removing the commutator end bracket.

Ambient temperature Open-circuit voltage

50° F. (10° C) 16.1 to 167 68°F. (20° C) 160 to 16-6 86° F (30° C) 159 to 165 104°F. (40° C) 158 to 164

An unsteady voltmeter reading may be due to dirty contacts, but if the reading is outside the appropriate limits the regulator must be adjusted.

Switch off the engine, remove the control box cover, restart the engine, and run the dynamo at 3,000 RPM. Turn the regulator adjusting screw (1, Fig. NN.3) in a clockwise direction to raise the setting, or in an anticlockwise direction to lower the setting.

NOTE: -The operations of checking and adjusting the regulator should be completed within 30 seconds, otherwise false readings and settings, due to the heating of the shunt coil, will be made.

After adjustment a further check of the setting should be made by switching off and restarting the engine and then raising the dynamo speed to 3,000 RPM., when the open-circuit voltage must conform to the figures stated.

Refit the control box cover and restore the original connections.

Cut-out adjustments

To check the voltage at which the cut-out operates remove the control box cover and connect the voltmeter between terminals 'D' and 'E'.

Start the engine and slowly increase speed until the cut-out contacts are seen to close, noting the voltage at which this occurs. It should be 12.7 to 13.3 volts.

An alternative method of determining the exact point of contact closure is to switch on an electrical load, such as a pair of headlamps, when the instant of contact closure will be indicated by a slight flick of the voltmeter pointer.

If the cut-out operates outside the above limits it will be necessary to adjust it to within the limits. To do this turn the adjusting screw (2, Fig. NN.3) in a clockwise direction to raise the setting or in an anti-clockwise direction to reduce the setting.

Turn the screw only a fraction of a turn at a time and test the setting after each adjustment by increasing the engine speed from zero and noting the voltmeter reading at the instant of contact closure.

NOTE. -Like the regulator, the setting of the cut-out must be carried out as quickly as possible to avoid errors due to the heating of the shunt coil.

Having set the cut-in voltage correctly, the 'drop-off setting should now be checked, and adjusted if necessary so that the instant of contact opening occurs between 85 and 11-0 volts.

To check the voltage at which the contacts open remove the control box cover, disconnect the cables

from the control box terminals 'A' and 'Al', and join these cables together. Connect the voltmeter between terminal "A1" and earth; start the engine and run up to speed.

Decelerate the engine slowly and watch the voltmeter pointer, which will return to zero immediately the contact points open. The opening of the contacts should occur between 8-5 and 10 volts.

Should the opening of the contacts occur outside these limits, the setting of the fixed contact must be adjusted. Using a pair of thin-nosed pliers, carefully bend the fixed contact blade towards the bobbin to reduce the drop-off voltage, or away from the bobbin to increase the drop-off voltage. After each adjustment, which should be very small, test the setting, as previously described. and readjust as necessary.

Restore the original connections and refit the cover.

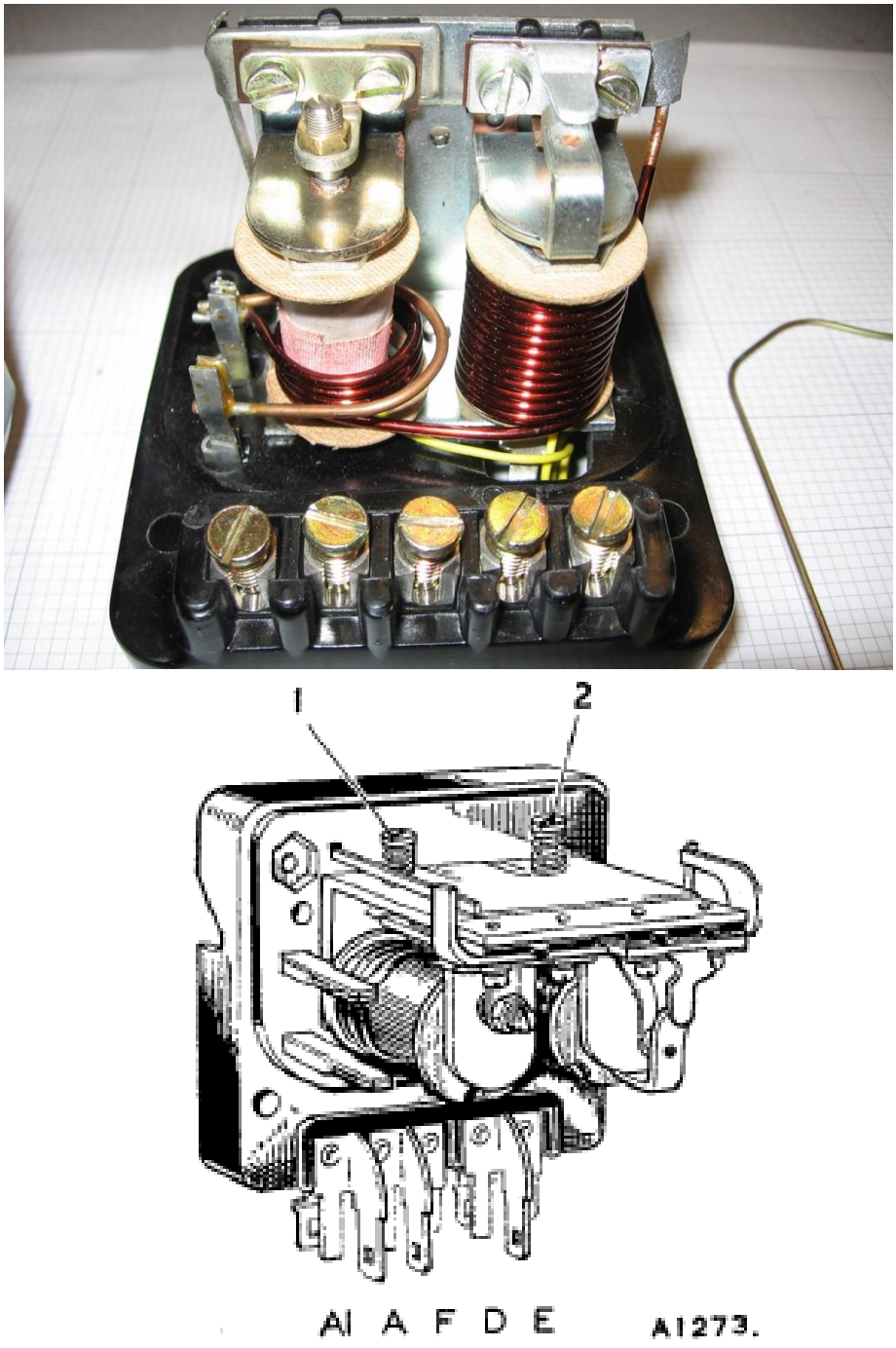


Fig. NN.3 The control box with cover removed

1. Regulator adjusting screw.

2. Cut-out adjusting Screw.

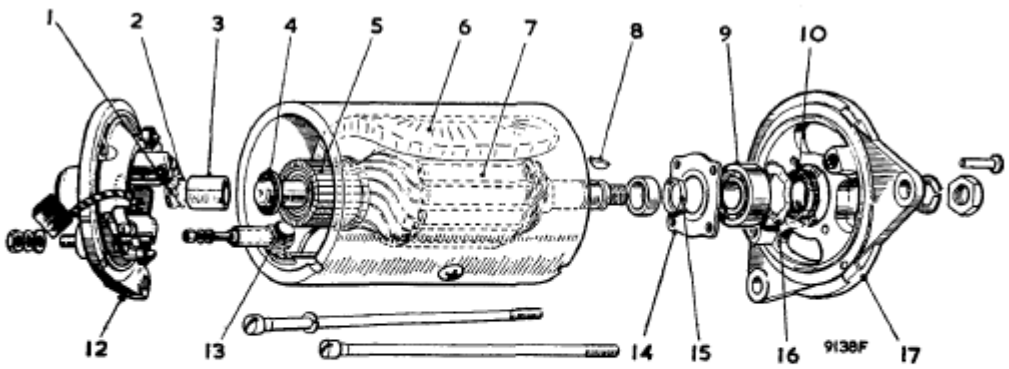


Fig. NN.2

The C40/1 dynamo

1. Felt pad.
2. Aluminium disc.
3. Bronze bush.
4. Fibre washer.
5. Commutator.
6. Field coils.
7. Armature.
8. Shaft key.
9. Bearing.
10. Felt washer.
12. Commutator end bracket.
13. Field terminal post.
14. Bearing retaining plate.
15. Cup washer.
16. Corrugated washer.
17. Driving end bracket.

Fig. NN.2 The C40/1 dynamo

NN.7 SERVICING A C40/1 DYNAMO

The instructions for servicing the dynamos are generally the same as given in Section N.5, with the following exceptions.

Brushes

The minimum permissible length of a worn brush is ¼ in. (7.14 mm.). Badly worn brushes must be renewed, and the new brushes bedded to the commutator. The correct spring tension is 30 oz. (85 kg), maximum, on a new brush, and 13 oz. (37 kg), minimum, on a brush worn to in. (714 mm.).

Commutator

The later type of commutators are moulded, and may be reskimmed to a minimum diameter of 1.450 in. (36.8 mm.). The undercut must conform to the following dimensions:

Width 040 in. (1-016 mm) Depth -020 to 035 in. (508 to -889 mm) It is important that the side of the undercut should clear the moulding material by a minimum of -015 in. (381 mm.).

Field coil

The resistance of the field coil is 6.0 ohms.

Bearings

To remove the bearing bush in the commutator end plate, screw a in. tap squarely into the bush and withdraw the bush: then remove the felt ring and its retainer. When refitting the bearing plate to the front bracket insert the rivets from the outer face of the bracket.

NN.8 MODIFIED RB106/2 CONTROL BOX

The instructions for adjusting the modified Lucas Type RB106/2 control box are as follows.

Regulator adjustment

The electrical setting of the control unit can be checked without removing the cover. Use a good-quality moving coil voltmeter (0 to 20 volts).

Remove the cables from the control box terminals 'A' and 'Al' and connect the cables together.

Connect the negative lead of the voltmeter to the control box terminal 'D' and connect the other lead to the terminal 'E'.

Run the dynamo at 3,000 RPM., and watch the voltmeter reading, which should be between the limits given below, according to the ambient temperatures.

NN.9 Mk. II SEALED-BEAM HEADLAMPS

Commencing at Chassis No. 103857, Mk. X sealed beam light units are fitted to all cars exported to the U.S.A. The lamp housing is secured to the wing by four screws and the back-shell is retained in the housing by a single coil spring. Two screws, each having a flange beneath its head, engage in slotted lugs on the rim of the back-shell and bear against the lamp housing; the screws are used to adjust the vertical and horizontal alignment. The lamp wiring passes through the housing and terminates in a three-hole socket.

Three pins at the back of the sealed-beam unit engage the holes in the socket, and the unit is retained in the back-shell by a lamp retaining plate that is secured to the back-shell by three screws. The lamp rim engages two lugs at the top of the housing and is retained in position by a screw.

To gain access to the lamp unit remove the rim retaining screw and lift the rim of the locating lugs. Slacken the three lamp retaining plate screws, turn the plate anticlockwise, and remove it from the back-shell. Withdraw the lamp unit and disengage the three-pin plug.

To refit the lamp unit, engage the three-pin plug and place the unit in the back-shell; ensure that the three lugs formed on the rear circumference of the unit engage the slots in the back-shell. Refit the lamp retaining plate, press it firmly, and rotate it in a clockwise direction to the full extent of the slotted holes. Tighten the retaining plate screws. Fit the rim over the locating lugs, press the rim downwards and inwards, and secure it with its retaining screw.

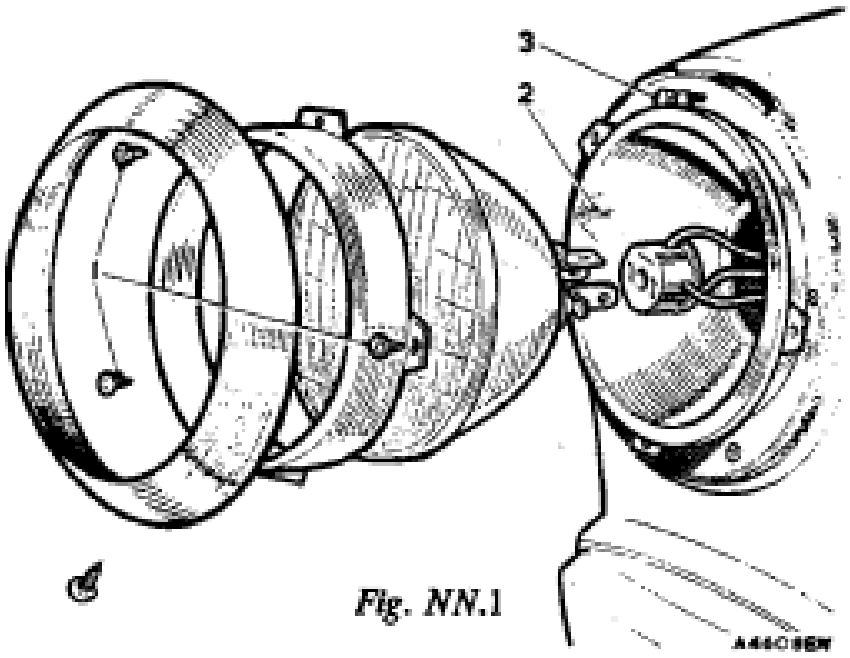


Fig. NN.1 The sealed-beam headlamp, showing the locating lugs and adjusting screws

1. Retaining plate screw.
2. Horizontal adjustment screw.
3. Vertical adjustment screw.

SECTION O THE WHEELS, TYRES, AND JACKING

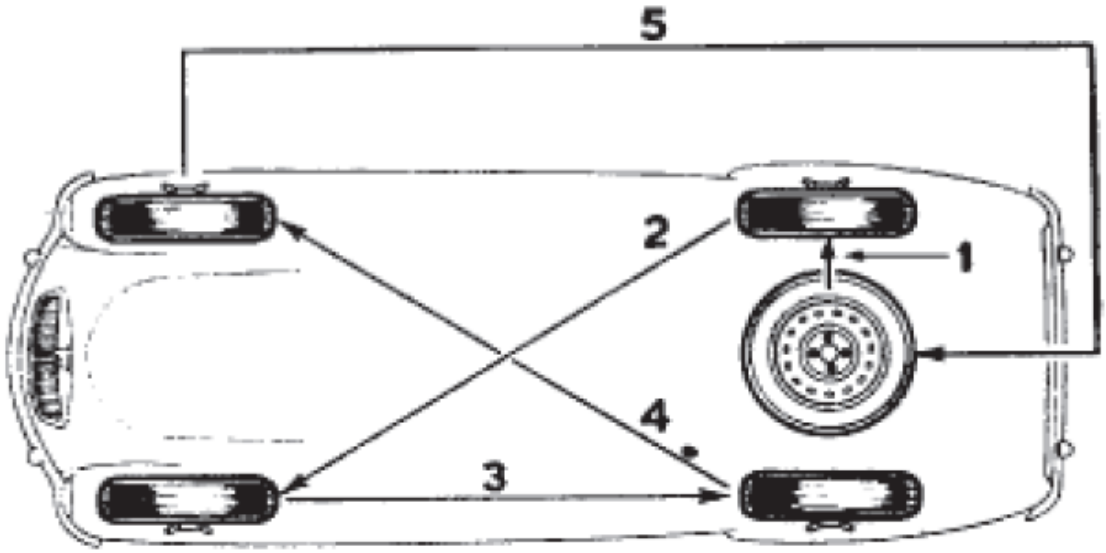


Fig. O.1 Change the position of the tyres in the order shown

GENERAL

The spare wheel is housed in the luggage compartment and clamped in position beneath the cover.

Remember that the spare wheel tyre pressure should be maintained at the correct running pressure for the rear wheels.

Pressures are given in “GENERAL DATA'.

The jack and tyre pump are contained in the tool roll strapped above the spare wheel in the luggage compartment.

O.1 TYRE MAINTENANCE

Even tyre wear is promoted by changing the positions of the tyres on the car at intervals of about 3,000 miles (4800 km.). The spare tyre should take its turn with the others (see Fig. O.8).

Attention should be paid to the following points, with a view to obtaining the maximum mileage from the tyre equipment of the vehicle.

Test the pressures of the tyres every 500 miles (800 km) by means of a suitable gauge, and restore any air lost. It is not sufficient to make a visual examination of the tyre for correct inflation. Inflate the spare wheel to the correct rear wheel pressure.

Keep the treads free from grit and stones and carry out any necessary repairs. Clean the wheel rims and keep them free from rust. Paint the wheels if required.

Keep the brakes and clutch adjusted correctly and in good order. Fierceness or uneven action in either of these units has a destructive effect on the tyres.

Misalignment is a very costly error. Suspect it if rapid wear of the front tyres is noticed and correct the fault at once. See Section J. 10 for details of front wheel alignment.

Should the tyres get oily, petrol (gasoline) should be applied sparingly and wiped off at once.

Avoid under- and over-inflation. Avoid kerbing and other causes of severe impact. Have damage repaired immediately. Remove tyres in time for remoulding.

O.2 JACKING UP THE CAR

When jacking a front wheel, the jack pad should be engaged in the depression in the lower suspension arm spring seating.

At the rear the jack should be placed below the rear spring centre plate or under the spring as close to the axle as possible.

Always apply the hand brake and place blocks each side of the wheels remaining on the ground when the front or rear of the car is to be raised.

The car must not be jacked under the frame side members.

O.3 REMOVING AND REPLACING ROAD WHEELS

Use the copper mallet provided in the tool kit to slacken the winged hub nut securing the wheel on the hub. The hub nuts on the left-hand side of the car have right-hand threads (unscrew anti-clockwise) and the nuts on the right-hand side of the car have left-hand threads (unscrew clockwise).

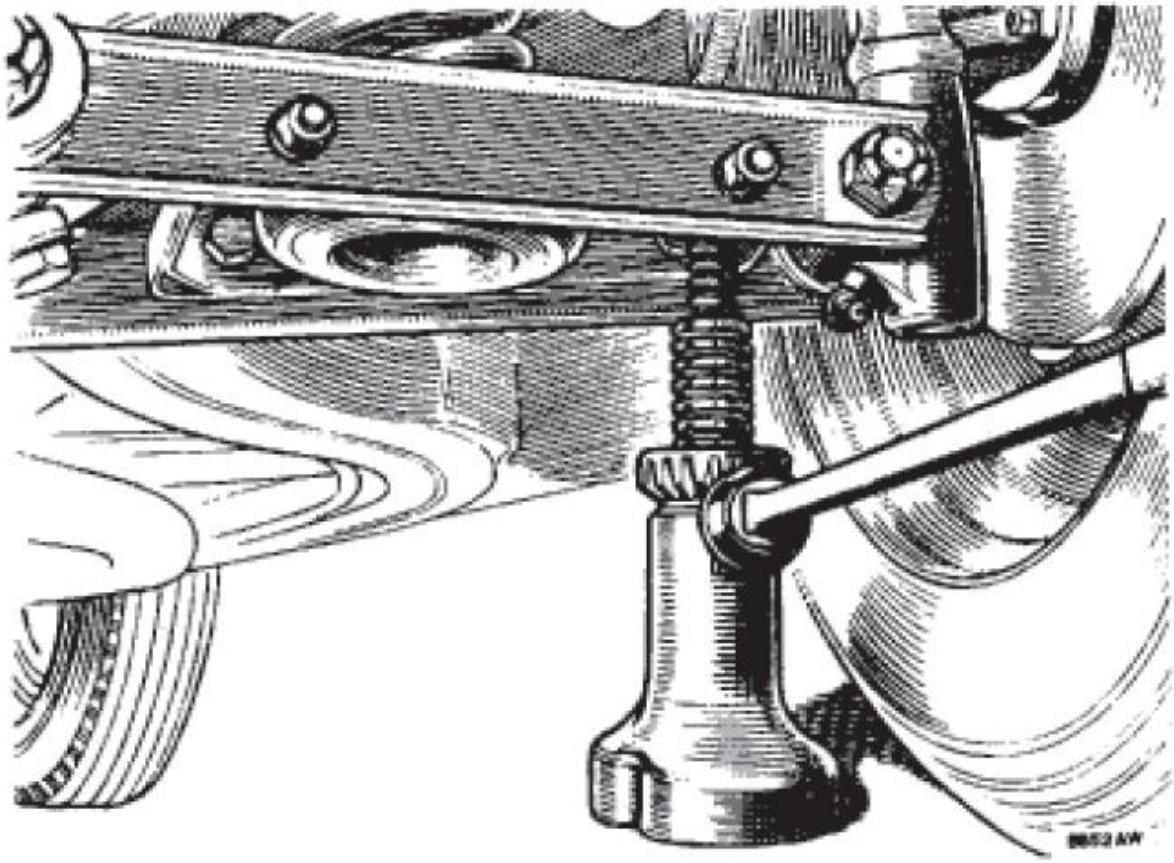


Fig. 0.2 Jacking a front wheel

Each road wheel is fitted with four large pegs which locate in holes in the face of each wheel hub. Make certain that these pegs register correctly in the holes before applying the wheel locknut.

If the wheel is fitted correctly the nut should go on approximately six turns.

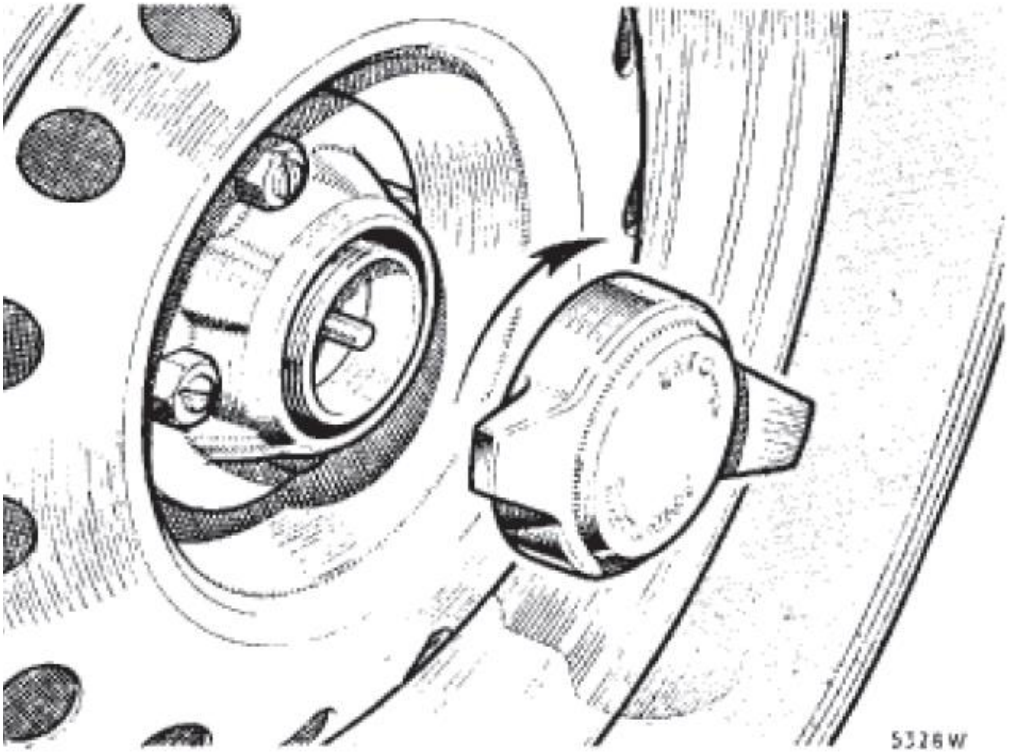


Fig. O.3 Removing a winged hub nut

O.4 VALVES

Valve caps, in addition to preventing dirt from entering the valve, form a secondary air seal and should always be fitted. The valves may be tested for airtightness by rotating the wheel until the valve is at the top and inserting its end in an eggcup full of water. If bubbles appear the seating is faulty and should be removed and a new one fitted. It is advisable to change the valve interiors every 12 months.

O.5 TYRE REMOVAL

Remove all valve parts to deflate the tyre completely and push both edges into the base of the rim at a point diametrically opposite the valve. Lever the cover edge, near the valve, over the rim of the wheel, using two levers at intervals of 6 in. (15 cm.) apart.

NOTE. Do not attempt to stretch the edges of the tyre cover over the rim edge.

Force is entirely unnecessary and is detrimental, as it tends to damage the wired edges. Fitting or removing is quite easy if the tyre edges are carefully adjusted into the rim base; if found difficult, the operation is not being performed correctly.

Remove the tube carefully; do not pull on the valve. Stand the tyre and wheel upright, keeping the bead on the base of the rim. Lever the bead over the rim flange and at the same time push the wheel away from the cover with the other hand.

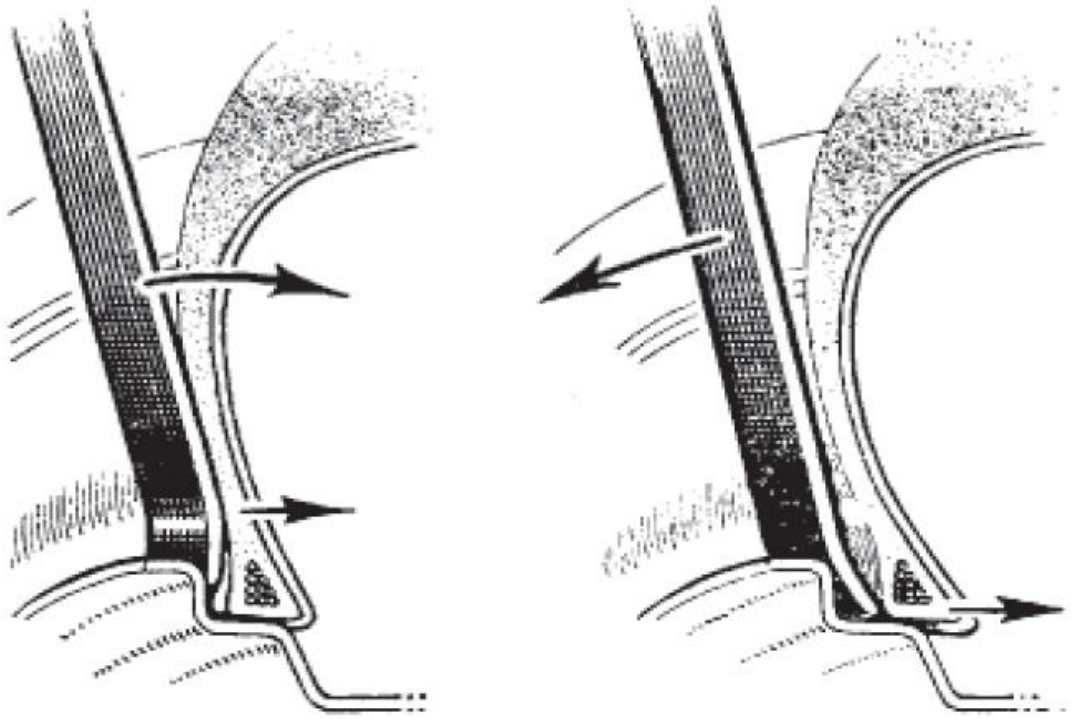


Fig O.4 The use of a tyre lever to ease the fire head from the wheel rim

O.6 THE IMPORTANCE OF BALANCE

In order to obtain good steering, it is of importance to ensure that the wheels, with tyres fitted, are in good balance. To assist this, the tyre manufacturers are now marking their tyres with a white spot in the neighbourhood of the bead at the lightest point of the cover; similarly, they are marking the inner tubes with spots to indicate their heaviest point. When tyres are assembled care must therefore be taken to see that they are assembled with the spots on the cover coinciding with the spots on the tube.

It must be noted, in addition, that special balancing discs are fitted to the inside of the cover casing in some cases and that these should on no account be removed as the tyre balance will be upset if this is done. These balance discs are not repair patches and do not indicate any fault in the tyre.

Special balance weights, which cover a range of weights weighing from to 1/2 oz. in steps of 1/2 oz., are supplied by the Dunlop Rubber Co. for attachment to the wheel rim under Part Nos. WBW/1 to 7.

The correct balance is 6 in. (dynamic) and zero (static).

The balance weights are fitted to both sides of the wheel.

O.7 FITTING TYRES AND TUBES

Inspect the inside of the cover carefully and remove all dirt. The wheel rim must be clean, free from rust and undamaged.

Dust the inside of the cover with French chalk. Inflate the tube until it begins to round out, then insert it in the cover.

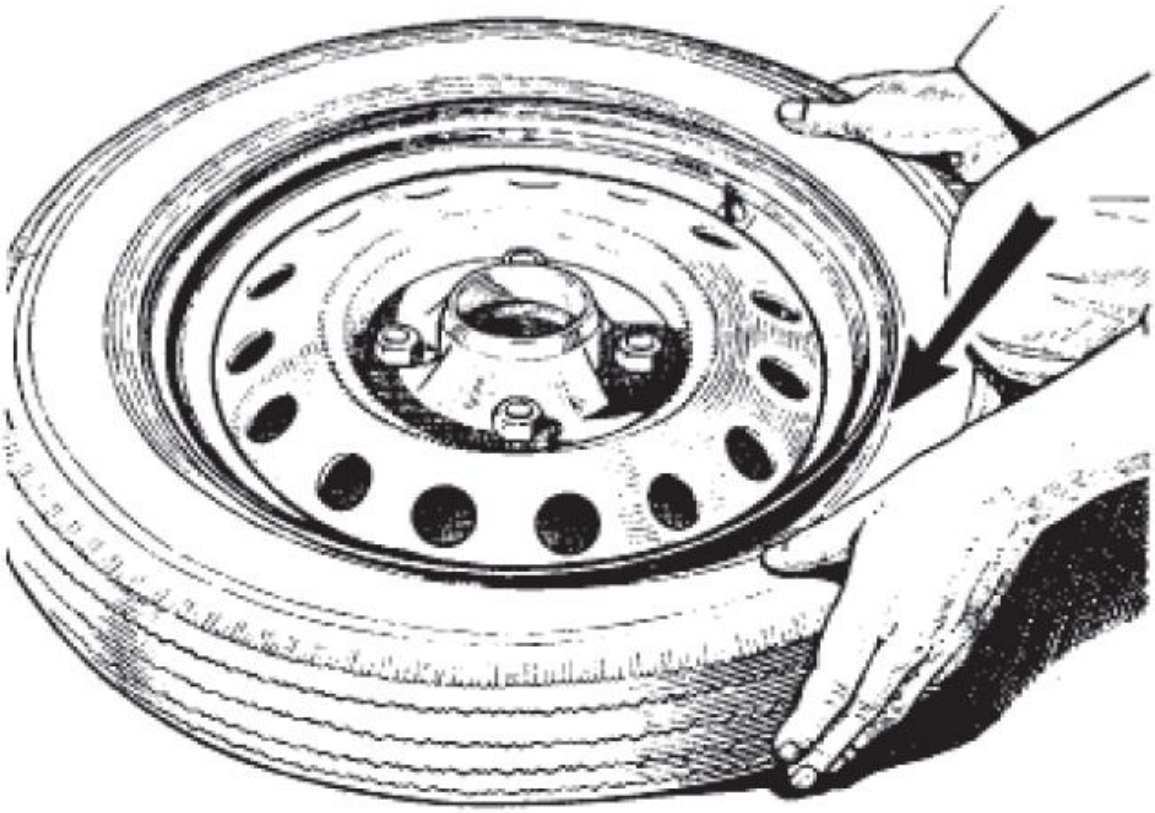


Fig. O.5 Pushing the tyre bead into the well

Apply a frothy solution of soap and water generously around the centre base of the tube, extending upwards between the tyre beads and the tube itself for at least 2 in. (50.8 mm.) on both sides. Also apply the solution to the bottom and outside of the tyre beads. Do not allow the solution to run into the crown of the tyre. The solution must be strong enough to feel slippery when the fingers are wetted with the solution and rubbed together.

Mount the tyre on the rim immediately, whilst the soap solution is still wet.

Push one edge of the cover over the edge of the rim. It will go quite easily if the part first put on is fitted on the opposite side of the valve and is pushed right down into the rim base. Move it round so that its balance spots coincide with those of the inner tube when it is inserted with the valve passing through the hole in the rim. (Take care that the valve, fitted in the side of the tube, is on the correct side of the rim.)

Before inflating, be sure that the tyre beads are clear of the well of the rim all the way round and **push the valve into the tyre as far as possible in order to ensure the tube is not trapped between the bead and the rim, then pull it out again into its correct position.**

Inflate slowly until the beads are fully seated. Remove the valve core to deflate the tube completely.

Reflate to the correct working pressure (see GENERAL DATA). This procedure must be followed whenever a tube is fitted.

The object of the double inflation is to permit any stretched portions of the tube to readjust themselves in the cover and relieve any local strains in the tube.

In an emergency French chalk may be used as a substitute for the soap solution, provided it is evenly and generously applied. This practice, however, is not recommended.

Repairing tubes

Punctures or injuries must be vulcanized. Ordinary patches should only be used for emergencies and

cannot be relied upon.

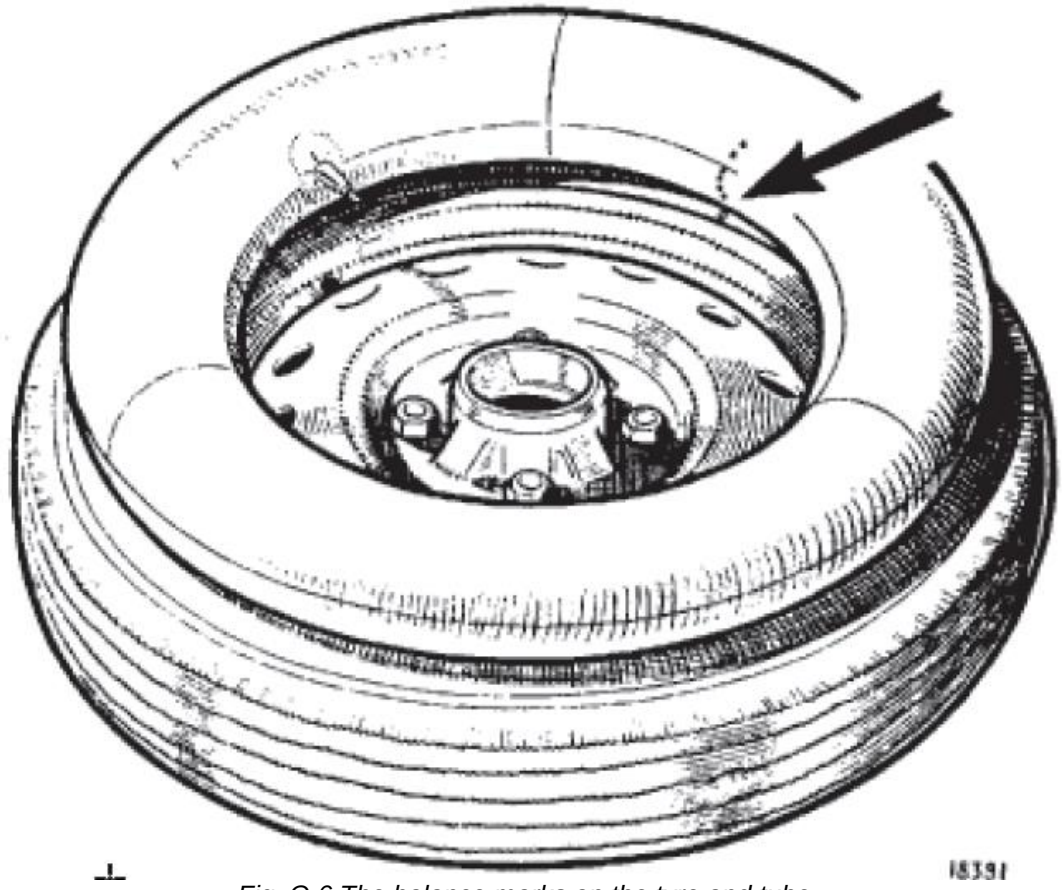


Fig. O.6 The balance marks on the tyre and tube

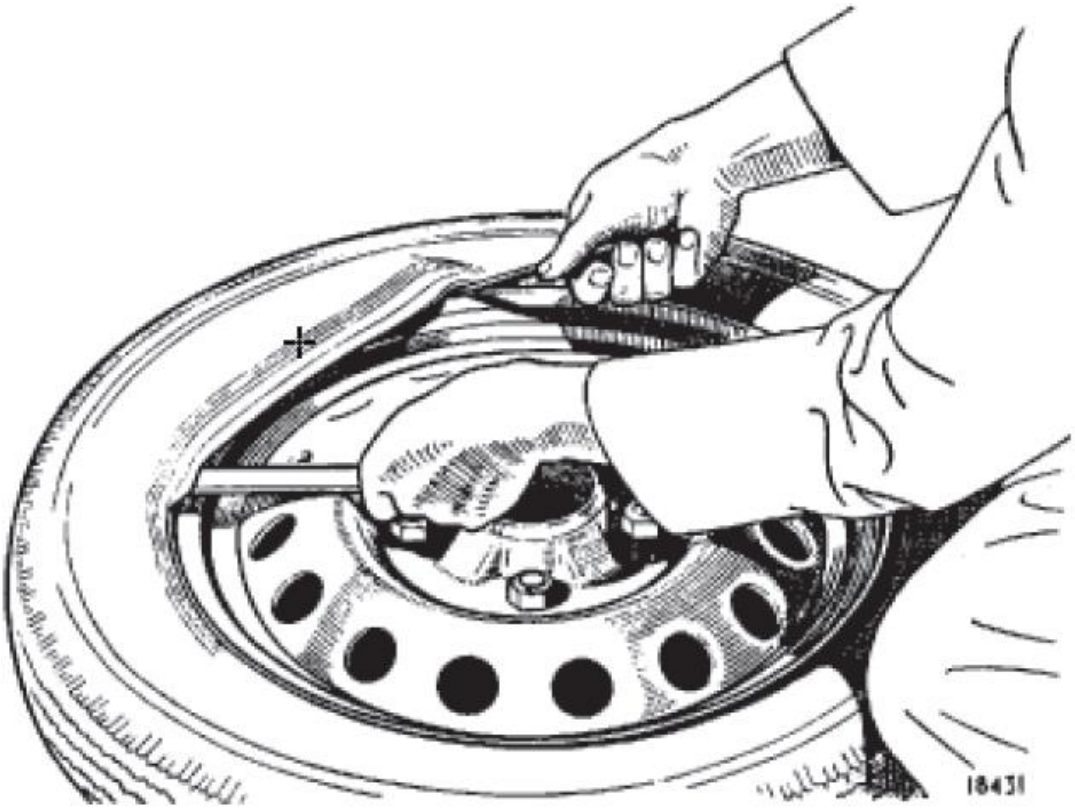


Fig. O.7 Refitting the tyre to the wheel

SECTION P LUBRICATION

Correct lubrication of any piece of mechanism is of paramount importance, and in no instance is it of greater importance than in the correct choice of lubricant for a motor-car engine. Automobile engines have different characteristics, such as operating temperatures, oiling systems, size of oilways, clearances, and similar technicalities, and the use of the correct oil is therefore essential.

NOTE. -The letters given in brackets throughout the Manual refer to the appropriate section of the recommended lubricants table

The following is a list of lubricants recommended:

A ENGINE AND AIR CLEANER

Climatic conditions	Esso	Mobil	Shell	BP	Filtrate	Sternol	Duckham's	Castrol
Tropical and temperate down to 32° F. (0° C.)	Esso Extra Motor Oil 20W/30	Mobiloil A	Shell X—100 30	Energol S.A.E. 30	Medium Filtrate 30	Sternol W.W. 30	Duckham's NOL Thirty	Castrol X.L.
Extreme cold down to 10° F. (—12° C.)	Esso Extra Motor Oil 20W/30	Mobiloil Arctic	Shell X—100 20/20W	Energol S.A.E. 20W	Zero Filtrate 20	Sternol W.W. 20	Duckham's NOL Twenty	Castrolite
Arctic consistently below 10° F. (—12° C.)	Esso Motor Oil 10	Mobiloil 10W	Shell X—100 10W	Energol S.A.E. 10W	Sub-Zero Filtrate 10W	Sternol W.W. 10	Duckham's NOL Ten	Castrol Z

GEARBOX

All conditions	Esso Extra Motor Oil 20W/30	Mobiloil A	Shell X—100 30	Energol S.A.E. 30	Medium Filtrate 30	Sternol W.W. 30	Duckham's NOL Thirty	Castrol X.L.

B REAR AXLE (HYPOID) AND STEERING GEAR

All conditions down to 10° F. (—12° C.)	Esso Gear Oil G.P. 90/140	Mobilube G.X. 90	Shell Spirax 90 E.P.	Gear Oil S.A.E. 90 E.P.	Filtrate Hypoid Gear 90	Ambroleum E.P. 90	Duckham's Hypoid 90	Castrol Hypoy
Arctic consistently below 10° F. (—12° C.)	Esso Gear Oil 80	Mobilube G.X. 80	Shell Spirax 80 E.P.	Gear Oil S.A.E. 80 E.P.	Filtrate Hypoid Gear 80	Ambroleum E.P. 80	Duckham's Hypoid 80	Castrol Hypoy Light

C LUBRICATION NIPPLES AND WHEEL HUBS

Wheel hubs, hand brake cable, and all lubrication nipples except water pump and steering rack and pinion	Esso Multi-purpose Grease H	Mobilgrease M.P.	Shell Retinax A	Energrease L. 2	Filtrate •Super Lithium Grease	Ambroline L.H.T.	Duckham's L.B. 10 Grease	Castrolease L.M.
Alternative for all lubrication nipples except hand brake cable and steering rack and pinion	Esso Gear Oil G.P. 90/140	Mobilube G.X. 140	Shell Spirax 140 E.P.	Gear Oil S.A.E. 140 E.P.	Filtrate e Gear 140 E.P.	Ambroleum E.P. 140	Duckham's NOL E.P. 140	Castrol Hi-Press

D UTILITY LUBRICANT, S.U. CARBURETTER DASHPOT, OILCAN POINTS, ETC.

All conditions	Esso Extra Motor Oil 20W/30	Mobiloil Arctic	Shell X—100 20/20W	Energol S.A.E. 20W	Zero Filtrate 20	Sternol W.W. 20	Duckham's NOL Twenty	Castrolite

E UPPER CYLINDER LUBRICANT

All conditions	Esso Upper Cylinder Lubricant	Mobil Upperlube	Shell Upper Cylinder Lubricant	Upper Cylinder Lubricant	Filtrate Petroyle	Sternol Magikoyl	Duckham's Adcoid Liquid	Castrollo

P.1 DAILY SERVICE

ENGINE (A) Inspect the oil level in the engine, and refill if necessary to the *MAX' mark on the dipstick. The oil filler cap is on top of the exhaust camshaft cover and is released by turning it anti-clockwise.

P.2 1,000 MILES (1600 Km.) SERVICE

Carry out the instructions detailed in Section P.1 and then continue with the following.

STEERING GEAR (C)

Lubrication nipples are provided at the top and bottom of each swivel pin and on the steering tie-rods. The gun filled to Ref. C should be applied to the nipples and three or four strokes given.

PROPELLER SHAFT (C)

The two needle-type universal joints and the front end sliding yoke should receive lubrication to Ref. C

The front end of the propeller shaft is provided with two lubrication nipples and there is also one at the rear.

GEARBOX (A)

Top up the oil level and ensure that the gearbox is not filled above the "HIGH" mark on the dipstick. If the level is too high oil may get into the clutch case and cause clutch slip. The combined filler plug and dipstick are located beneath the rubber plug in the gearbox cover.

REAR AXLE (B)

The combined filler and level plug is reached from below the rear of the car. The oil should be replenished if necessary to the level of the filler plug hole. (See Fig. P.10).

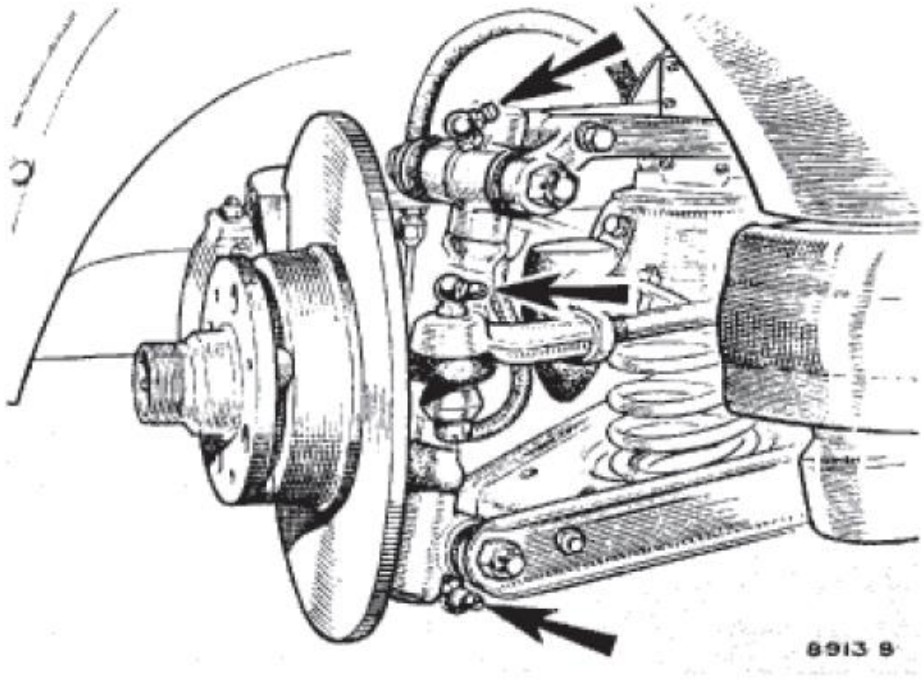


Fig. P.1 The steering gear lubrication nipples on the right-hand side

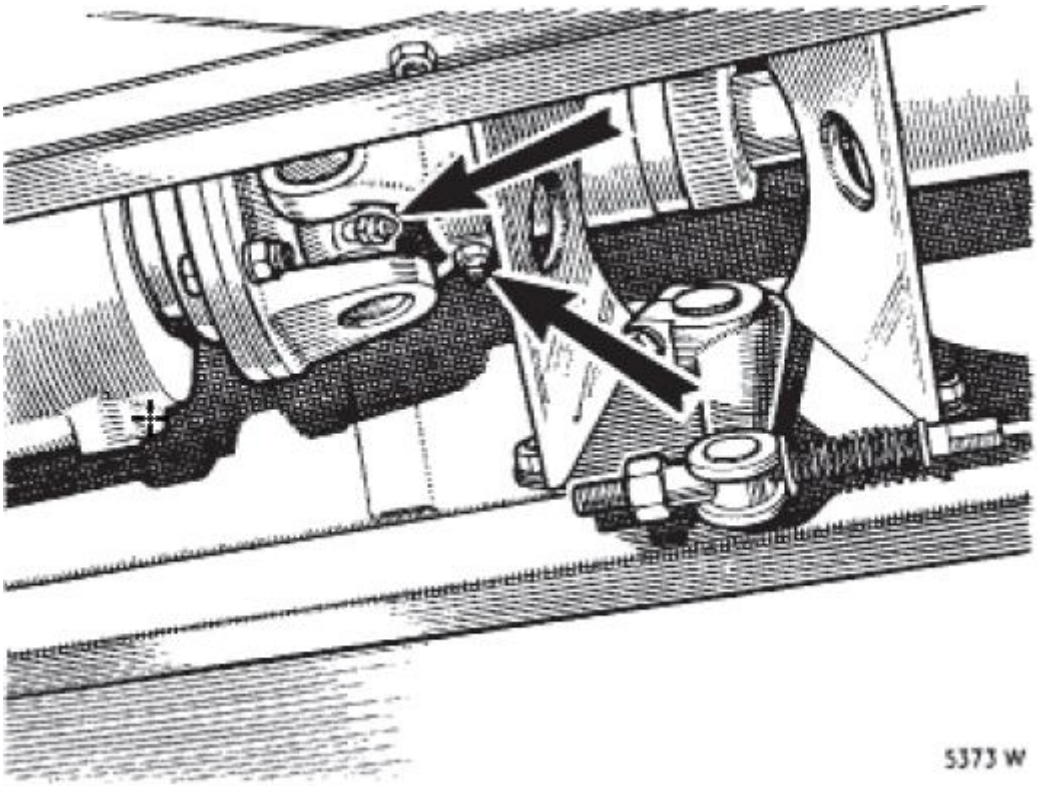


Fig. P.2 The universal joint and sliding yoke lubrication nipples at the front end of the propeller shaft

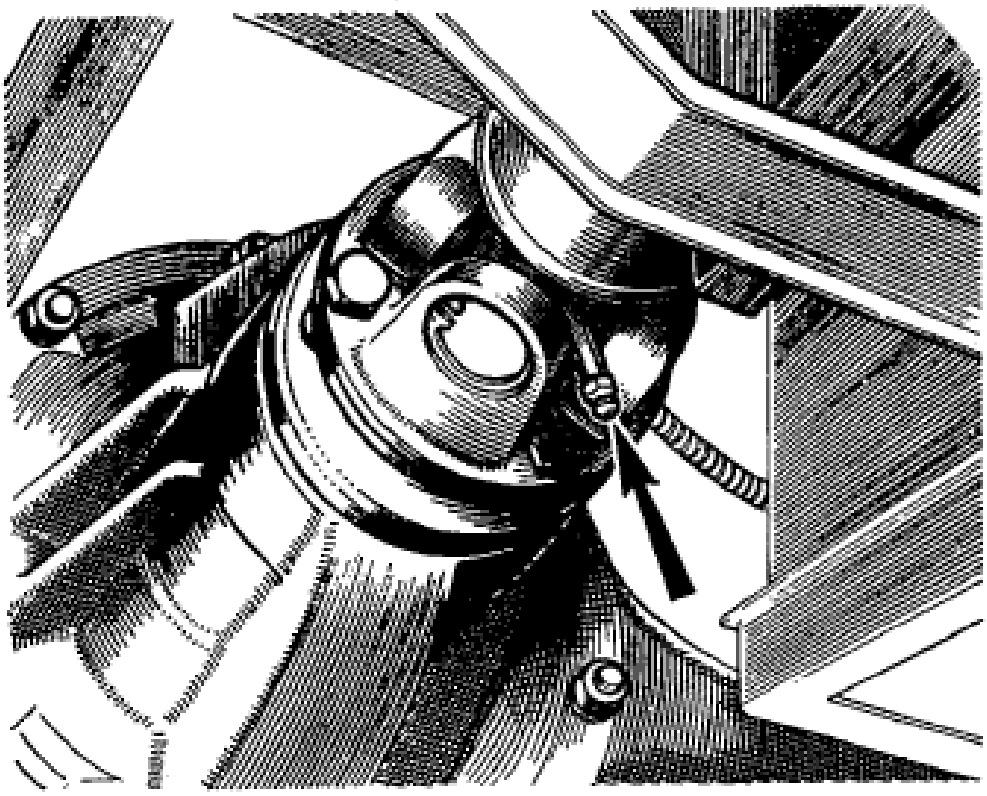


Fig. P.3 The rear universal joint lubrication nipple

NOTE. -It is essential that only Hypoid oil be used in the rear axle

CARBURETTER DAMPERS (D)

Unscrew the oil cap at the top of each suction chamber, pour in a small quantity of thin engine oil, and replace the caps. Under no circumstances should a heavy-bodied lubricant be used. Failure to lubricate the piston dampers will cause the pistons to flutter and reduce acceleration.

An oil indicated under Ref. D should be used.

HAND BRAKE CABLE (C)

The grease nipple on the hand brake cable should be given three or four strokes with a grease gun filled with grease to Ref. C

P. 3 3,000 MILES (4800 Km.) SERVICE

Carry out the instructions detailed in Section P.2, except those under "ENGINE* (Section P.1) and continue with the following.

ENGINE OIL CHANGE (A)

Drain the oil from the engine sump after 3,000 miles (4800 km.). The drain plug is on the right-hand side of the sump and should be removed after a journey while the oil is still warm and will drain easily.

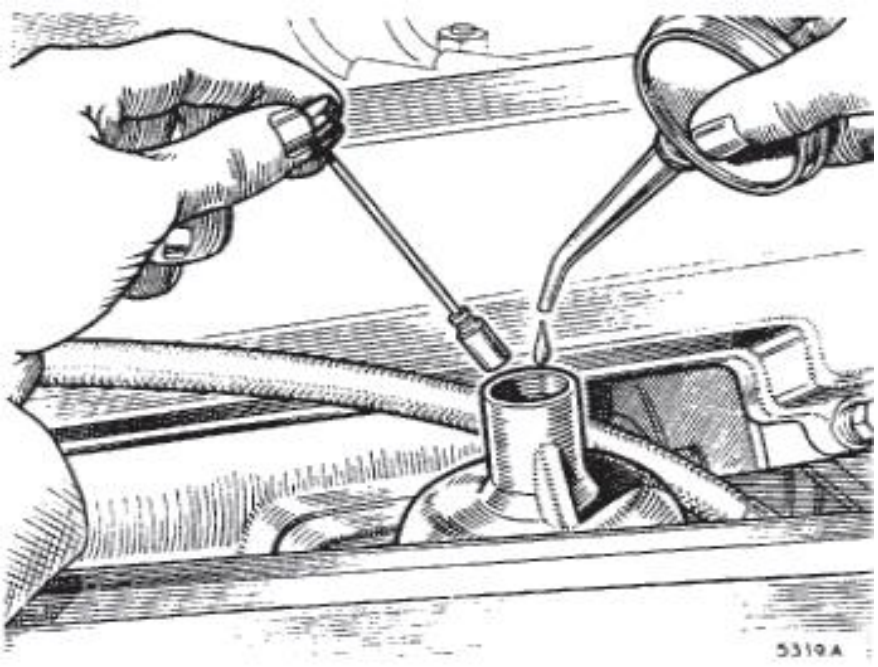


Fig. P.4 Add a small quantity of thin engine oil to the carburetter dampers

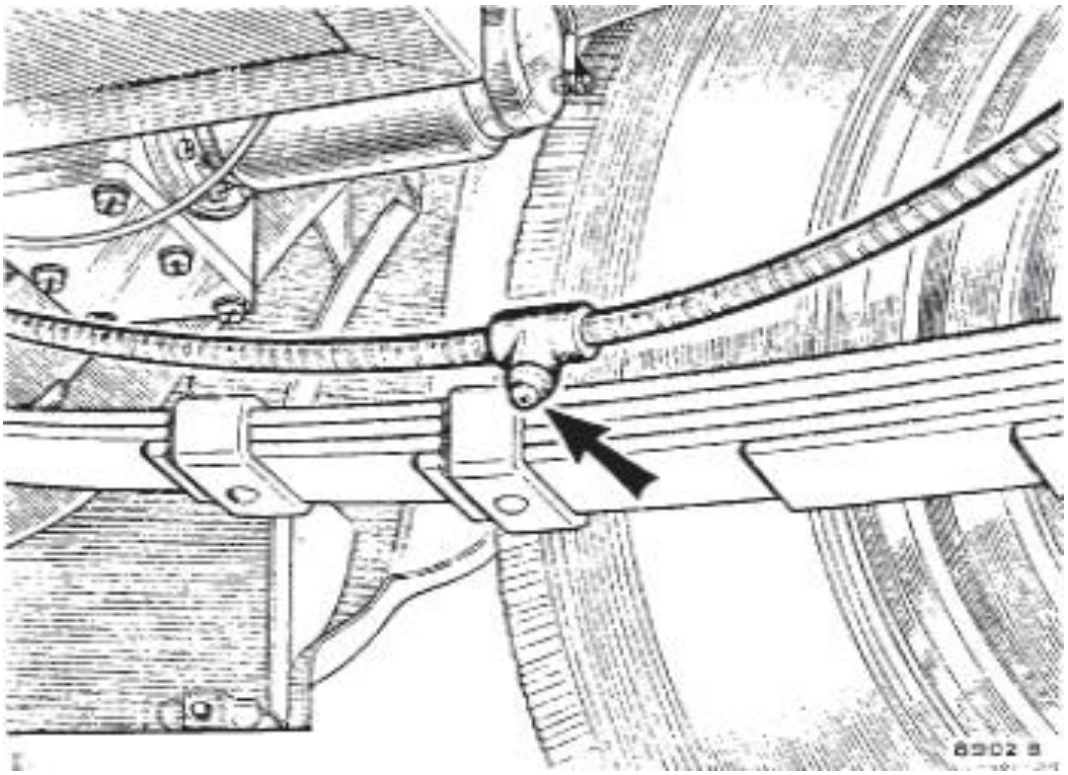


Fig. P.5 The hand brake cable grease nipple

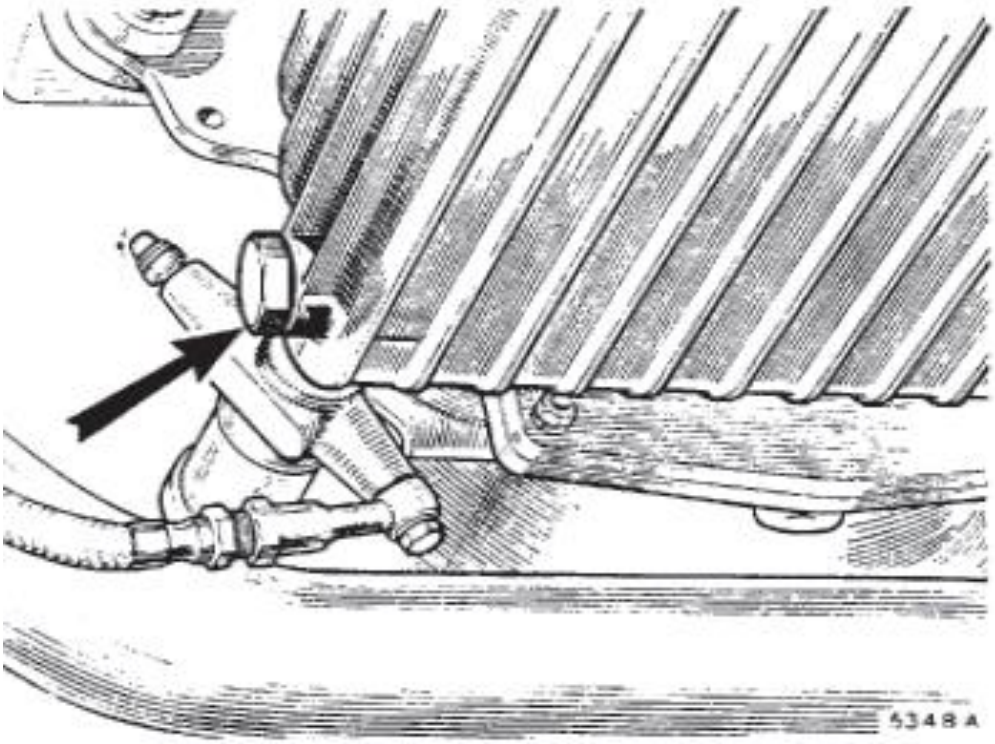


Fig. P.6 The engine sump drain plug is on the right-hand side

AIR CLEANERS (A)

Wash the filter elements in petrol and allow to dry. Re-oil the elements with S.A.E. 20 engine oil and allow to drain before reassembling.

It is only necessary to withdraw the two hexagon headed screws and lift off the outer cover to release each corrugated element.

P.4 6,000 MILES (9600 Km.) SERVICE

Carry out the instructions detailed in Sections P.2 and P.3 except those under "GEARBOX' and 'REAR AXLE* (Section P.2) and continue with the following.

DISTRIBUTOR

Cam bearing (D)

Lift the rotor off the top of the spindle by pulling it squarely and add a few drops of thin engine oil (Ref. D) to the cam bearing Do not remove the screw which is exposed.

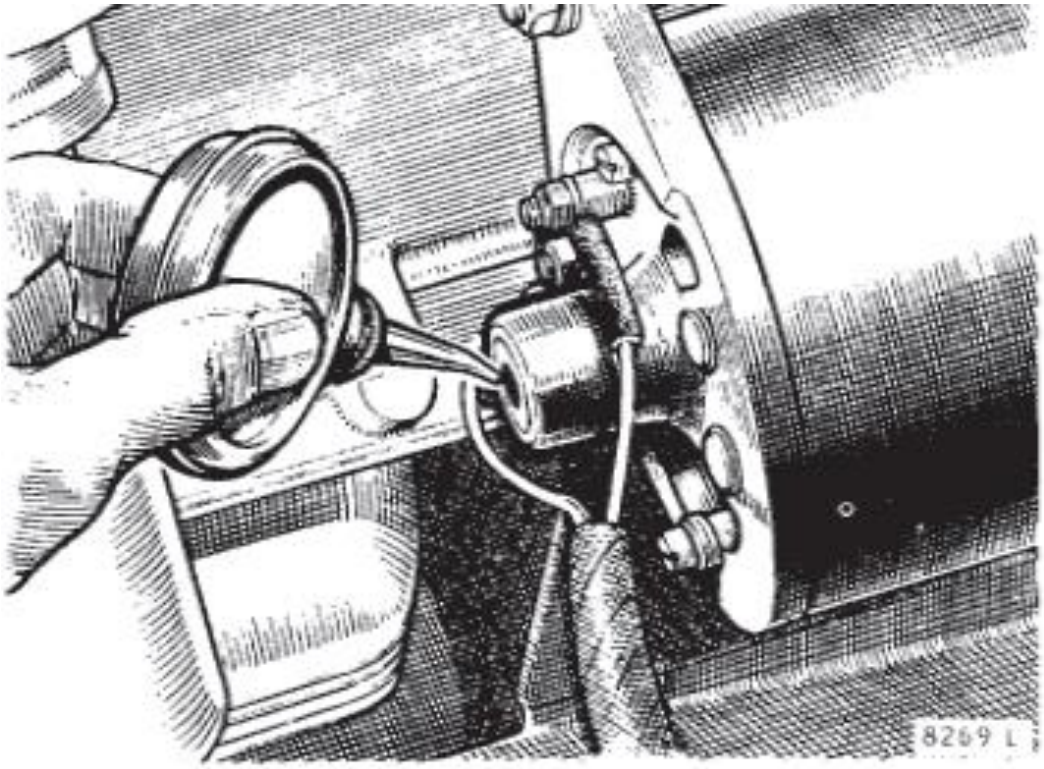


Fig. P.7 Lubricate the dynamo with a few drops of thin engine oil in the hole in the centre of the rear end bearing,

Cam (C)

Lightly smear the cam with a very small amount of grease (Ref. C, page P.7), or if this is not available clean engine oil can be used.

Automatic timing control (D)

Carefully add a few drops of thin engine oil (Ref. D, page P.7) through the hole in the contact breaker base through which the cam passes. Do not allow the oil to get on or near the contacts. Do not over-oil.

Contact breaker pivot (D)

Add a spot of engine oil (Ref. D) to the moving contact pivot pin.

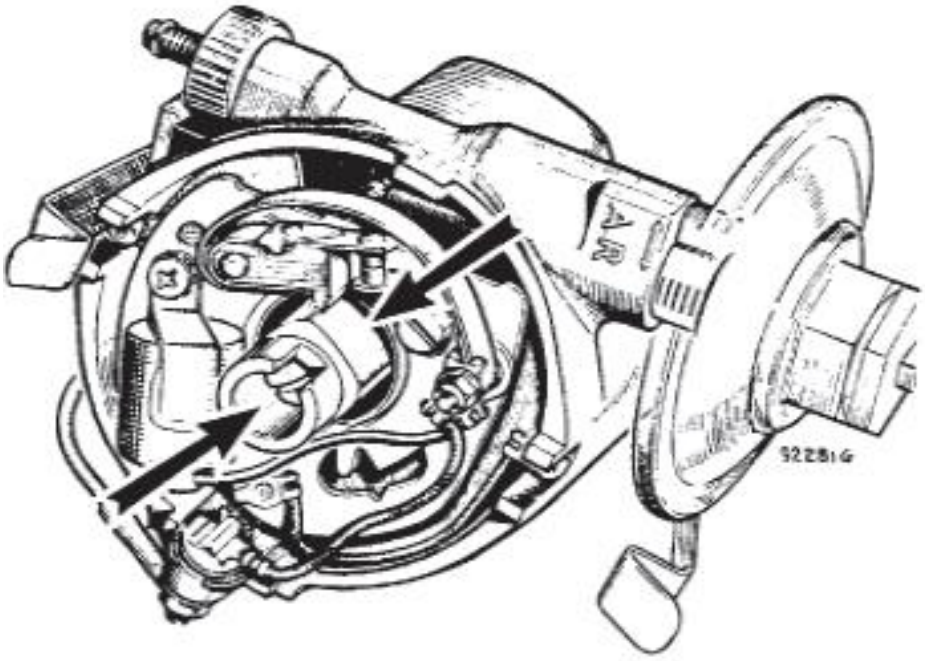


Fig. P.8 Add a few drops of thin engine oil to the cam bearing (lower arrow) and lightly smear the cam (upper arrow) with a small amount of grease

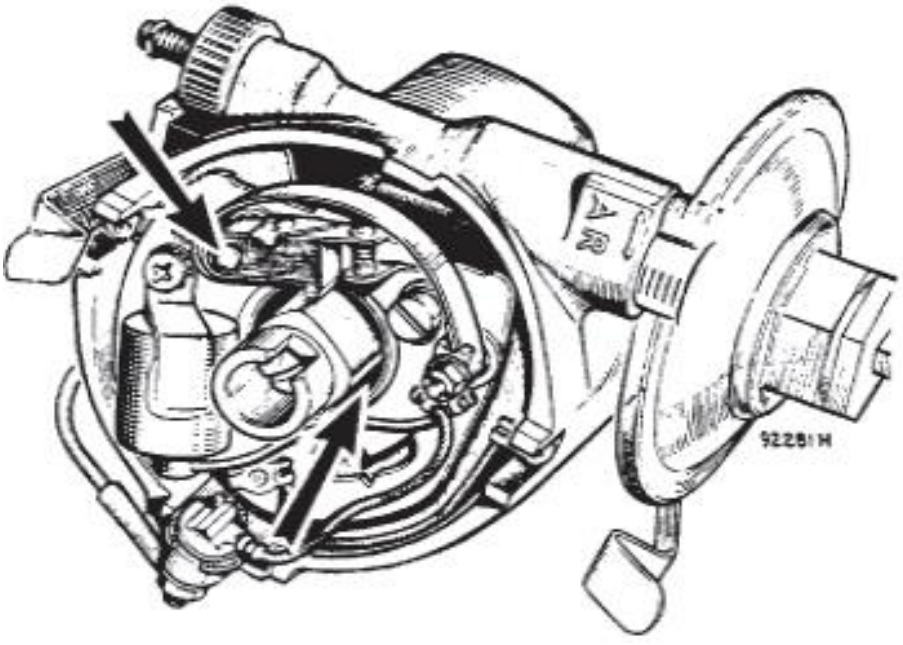


Fig. P.9 The contact breaker pivot is indicated by the upper arrow. The lower arrow indicates the aperture through which the automatic timing control is lubricated

GEARBOX OIL CHANGE (A) Drain the gearbox oil. When the gearbox has been drained completely replace the drain plug and refill with oil to Ref. A through the filler hole

REAR AXLE OIL CHANGE (B) Remove the drain plug and drain out the oil. Refill with Hypoid oil (Ref.

B) to the level of the filler plug hole.

There is a clearance between the screw and the inner face of the spindle for the oil to pass.

Replace the rotor with its drive lug correctly engaging the spindle slot and push it onto the shaft as far as it will go.

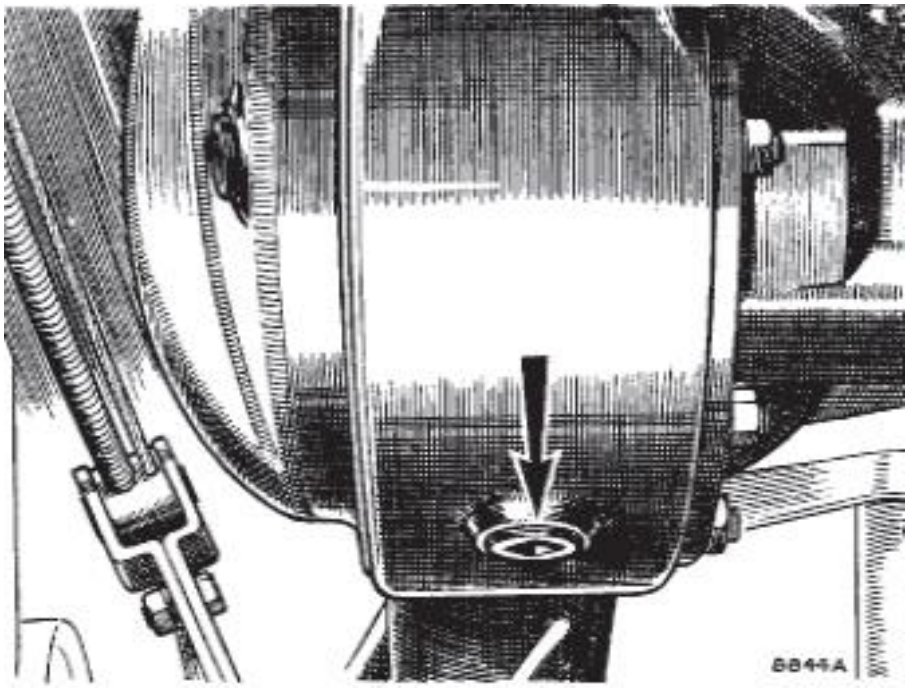


Fig. P.10 The rear axle drain plug is indicated by the arrow. The combined filler and level plug may be seen at the rear of the axle casing

FRONT WHEEL HUBS (C) Remove the front wheel hub nuts and pull out the grease-retaining cap from the end of each hub, using a suitable extractor

Pack with grease (Ref. C, page P.7) and replace

ENGINE OIL FILTER Fit a new engine oil filter element. The filter is released by unscrewing the central bolt securing the filter body to the filter head. When fitting the new element make sure that the sealing washer for the filter body is in good condition and that the body is fitted securely to prevent oil leaks. Care must also be taken to ensure that the washers below the element inside the bowl are fitted correctly. The small felt washer must be positioned between the element pressure plate and the metal washer above the pressure spring. It is essential for correct oil filtration that the felt washer should be in good condition and be a snug fit on the centre-securing bolt.

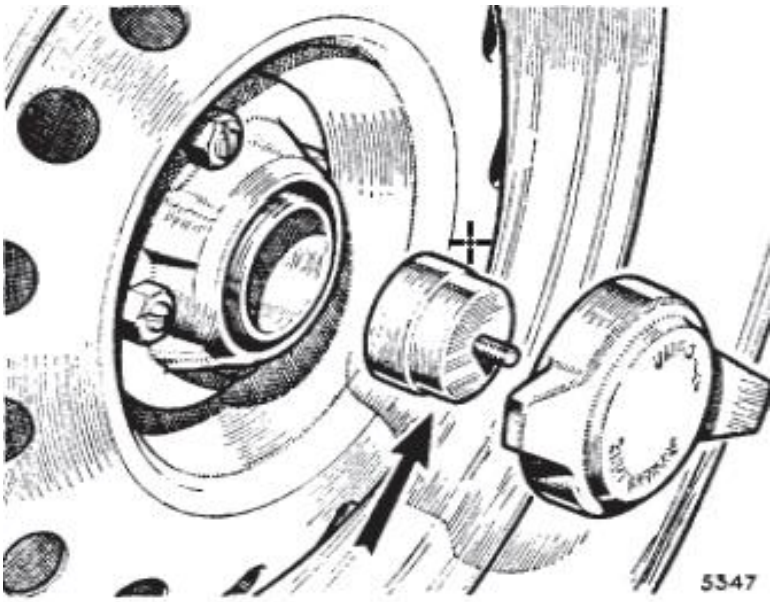


Fig. P.11 Unscrew the hub nut and withdraw the grease-retaining cap to repack the hub with grease

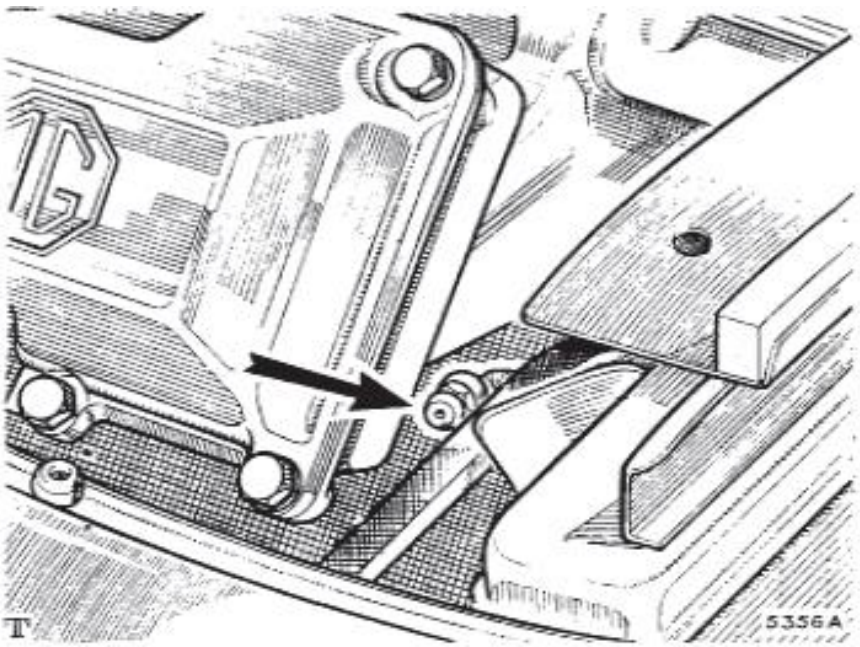


Fig. P.12 The arrow indicates the water pump oil nipple, which must receive one stroke only from the oil gun

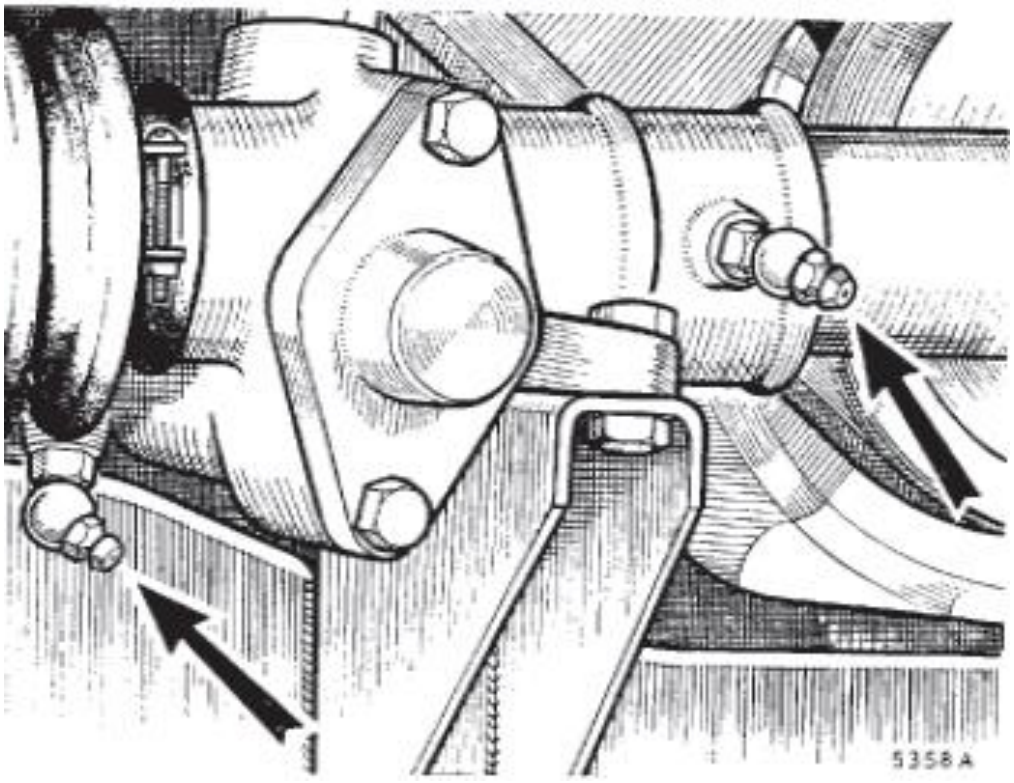


Fig. P.13 The steering-rack oil nipples which must receive attention

WATER PUMP

Give the nipple on the water pump body one stroke only with the gun filled with S.A.E. 140 oil. The oiling of the pump must be done very sparingly, otherwise oil will flow past the bearings onto the face of the carbon sealing ring and impair its efficiency.

P.5 12,000 MILES (19200 Km.) SERVICE

Carry out the instructions detailed in Sections P.2, P.3, and P.4 in addition to the following.

ENGINE-FLUSHING (A)

Remove the engine sump drain plug and allow the old oil to drain completely.

Replace the drain plug and refill the engine with approximately 6 pints (7.2 U.S. pints, 3.41 litres) of Hushing oil manufactured by one of the approved oil companies.

Run the engine at a fast idling speed for 2 1/2 to 3 minutes.

After stopping the engine special care must be taken to ensure complete drainage of the flushing oil.

Replace the sump drain plug and fill the engine with oil to Ref. A

DYNAMO (D)

Add two drops of engine oil to Ref. D (page P.7) in the lubrication hole in the centre of the rear end bearing plate. Do not over-oil.

STEERING GEARBOX (B) The two nipples for the steering gearbox and pinion are reached from beneath the front of the car.

Give the gearbox nipple 10 strokes only and the pinion nipple two strokes only at the same time with a gun filled with oil to Ref. B

SPEEDOMETER AND TACHOMETER CABLES (C)

Unscrew the speedometer and tachometer drive cable outer casings from the instrument heads. Extract their inner cables and lubricate sparingly with grease to Ref. C. oil must not be used. After replacing each cable in its outer casing withdraw the upper end approximately 8 in. (20 cm.) and wipe off the surface grease before reconnecting it to the instrument head.

SECTION R THE CHASSIS

GENERAL DESCRIPTION

This section deals with the repair of the M.G. type of box-sectioned chassis frame damaged in accident, where the facilities as used by frame manufacturers are not available. The manufacturers, naturally, have the benefit of their production equipment, but the methods adopted by them, particularly in regard to the use of assembly jigs and welding equipment, are out of reach of the average repair organization.

These instructions will therefore deal mainly with methods of repairing damage to chassis frames without dismantling, the component parts, i.e. breaking down welds, any more than is absolutely necessary to eliminate torn or badly buckled metal or deformed cross-members which are beyond economic repair.

Repairs carried out in this manner fall into two categories:

1. Repair of the frame in position in the vehicle, which may be regarded as an emergency repair,

and

2. Repair of the frame out of the vehicle, in which complete rectification of the chassis frame is attempted.

In general terms it may be stated that chassis frames with considerable damage may be recovered sufficiently to be serviceable units, but, naturally, the skill and experience of the repairer and the extent of the equipment available will determine whether any particular frame is repairable, bearing in mind that there are certain fundamental accuracies to be restored, also that the cost of labour and material involved in effecting a complete repair will not always be economically justified if it exceeds the cost to the user of replacing the entire frame assembly.

Damage to a frame is usually a combination of torn and buckled metal, either in side-members or crossmembers, and lateral or vertical displacement of side members, causing misalignment. The resultant repair is concerned with elimination of the local damage by smoothing or renewal of parts--generally both—and the recovery of alignment of the frame as a whole

In practice this result is achieved by carrying out the local repairs to the metal and applying the necessary corrective loads to the side-members, coupled with the judicious use of heat to the strains to permit the members to recover their natural positions.

R.1 FRAME REPAIRS

As the heating of the frame plays a vital part in its repair, it is essential that a good gas-welding equipment is available. At certain points spot- and arc-welding are preferable, but a skilled gas-welder will be able to make effective welds with the use of a gas-welding torch only.

A screw or hydraulic jack is then required, with a few adaptors to make it of universal application. A selection of bending irons, some metal-straightening equipment, such as dolly blocks, spoons, levers, and hammers, will complete the equipment necessary. If a suitable hydraulic press is available, this in conjunction with hardwood reaction blocks would be preferable than some of the methods detailed later, using jacks.

When the frame is heated for straightening, the area affected should be maintained at a cherry-red throughout the entire straightening operation.

When an acetylene torch is used for heating, a 'neutral' flame should be employed and played over the entire area to be heated until the metal has reached a uniform cherry-red. Never heat the metal beyond a cherry-red as it will seriously weaken the steel. It is good practice to frequently check the temperature of the heated metal with a dry pine stick, while it is being worked, to maintain it at the proper state of ductility and avoid burning. Touching a dry pine stick to metal that has been heated to a cherry-red will cause the stick to glow and char, but not to ignite. The heated area of the frame should be protected from draughts to prevent sudden cooling of the metal.

An important point to observe here, prior to commencing repairs, is in regard to the front suspension cross-member. Correct alignment of the front suspension is of such vital importance that if there is appreciable distortion of this member it should be renewed, due to the fact that it is a very difficult operation to re-form it to its exact shape.

NOTE. —We do not recommend that this operation be carried out by the Distributor or Dealer unless adequate assembly fixtures are available, but that the frame be returned to the Service Department, The M.G. Car Co. Ltd., Abingdon, Berks.

R.2 INVESTIGATION OF DAMAGED CHASSIS

Although in most cases of accident the resultant primary damage to the frame is readily apparent, there are cases where the damage may only be slight and is masked by the wings and body structure, and in such cases, it may be necessary to carry out a complete check of chassis alignment, including front suspension and rear axle, to determine the full extent of the damage.

When checking cars damaged in accident it is most essential to do the checking on a flat surface large enough to receive the complete car. It is preferable to use a large iron slab, but a concrete slab carefully prepared and hand-surfaced will be suitable. The car may then be directly checked by comparative measurements, or a centre-line dropped down from the front and rear centre of the frame and parallel track lines laid out. From these lines the squareness of the car may easily be checked.

R.3 A TWISTED FRAME

Checking the alignment of the frame bare is relatively a simple matter, especially if the frame can be set up on a large flat surface or face plate. It involves establishing a datum or centre-line, from which all measurements can be taken. Diagonals are checked from suitable fixed locating points, which can be cross-checked at the centre line on which the diagonals should cross, as detailed in chassis dimensional drawing Fig. R.1. The angle of the front cross-member should be 4 degrees but may given an allowance of +1° or -0°. Diagonal measurements quickly determine which section of the frame is bent.

Accuracies of side-members are usually checked with suitable straight-edges, and squareness of side rails is checked with straight-edge and square. Twist is checked visually against straight-edges laid transversely across the frame at suitable points.

In the event of the frame being twisted, this condition can be corrected by anchoring the frame to a fixed trestle and by using a suitable lever or a stout beam of timber. The frame can then be sprung back with effort applied at the end of the lever.

If necessary, apply a well-spread heat at the twisted section.

The frame being completely dismantled, it is possible to remove all signs of damage by cutting out holes for access in the inner liner plates with the welding torch, hammering out bulges, dents, or buckled areas, and closing the holes by welding in the piece previously be removed. The welds can be cleaned up and the repair is then invisible.

When any adjustment to the frame is carried out do not forget the light gauge of the material.

Final checking of the frame should be carried out in accordance with the dimensions and diagonals indicated.

Comparative vertical measurements should reveal any frame twist.

Check the wheel camber, castor angle, king pin angle, and front wheel alignment.

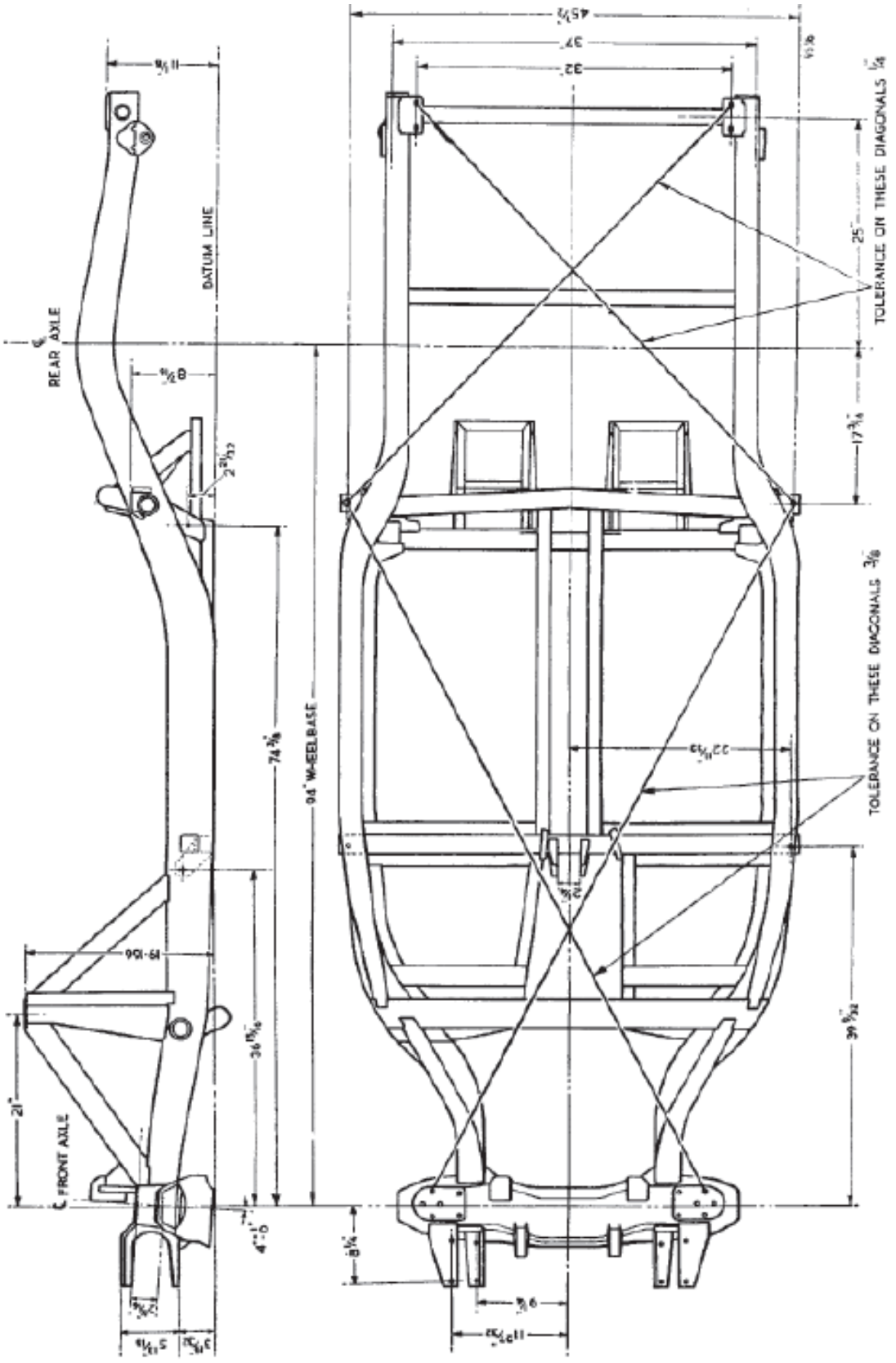


Fig. R.1 Chassis frame dimensions and the recommended triangulation points for a diagonal check

R.4 DIAGONAL FRAME CHECK

(Complete Car)

In checking the frame for distortion, diagonal measurements may be taken without removing the body from the chassis by using a plumb-bob as follows.

Place the car on a level surface and block up the car equally at each wheel approximately 12 in. (30 cm.) high with all tyres properly inflated.

Perform the measuring with accuracy and care.

Suspend the plumb-bob from various corresponding points on the frame, such as indicated by the diagonal lines in Fig. R.1. The plumb-bob should be suspended slightly above the floor. When the plumb-bob comes to rest mark the floor directly underneath it. The marks made on the floor will represent various points of the frame to be checked diagonally.

Measure the diagonal distance between the points; this distance should agree within 1/4 to 3/8 in. (6.5 to 10 mm.).

Care must be taken to see that any two diagonals compared represent exactly corresponding points on each side of the frame.

Upon the result of this preliminary investigation a decision can be taken whether the frame can be repaired in position or whether the frame must be stripped out completely.

SECTION S THE BODY

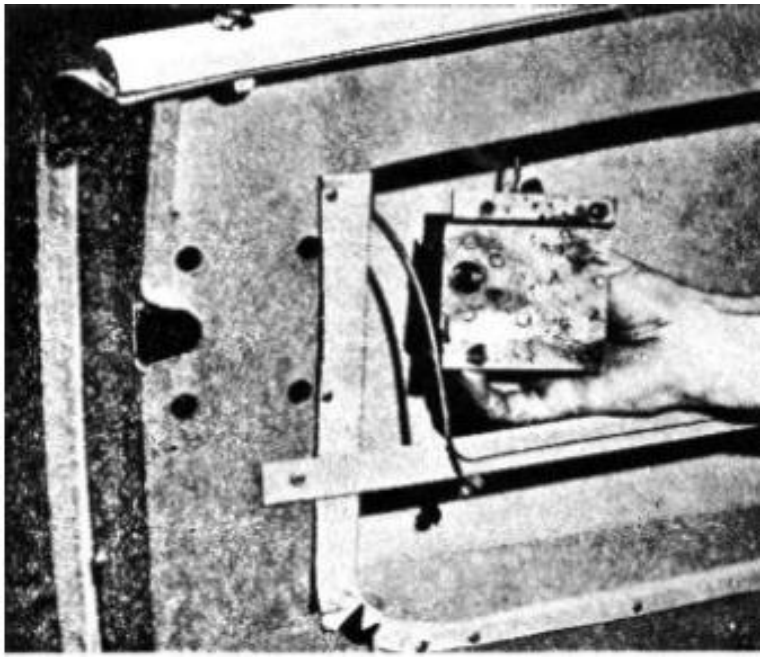


Fig. 5.1 Withdrawing a door lock

S.1 REMOVING A DOOR LOCK

Take out the three securing screws and remove the sidescreen clamp plate.

Unscrew the 10 recessed-headed screws securing the trim panel to the door. Lower the trim panel downwards to free it from the lipped rail along the bottom edge of the pocket.

Remove the nut and bolt securing the door lock cable to the bracket in the top forward corner of the pocket. Note which one of the four holes is used in the bracket to secure the cable.

Take out the four screws securing the lock to the door panel and withdraw the lock through the opening at the top of the door pocket, at the same time feeding the cable through the grommet.

Reassembly is a reversal of the dismantling procedure.

S.2 REMOVING THE WINDSHIELD

Unscrew the six recessed-headed screws securing the interior trim panel on either side of the car, forward of the doors.

Remove the two pieces of sealing material which cover the windshield securing bolt holes and unscrew the bolts, taking care not to drop the plain and spring washers between the two body panels.

Take out the three screws securing the windshield frame to the hand-grip on each side and lift away the windshield.

Reassembly is a reversal of the dismantling procedure. Replace the pieces of sealing material with Bostik.

S.3 REMOVING THE FRONT BUMPER

The front bumper is secured to four mounting brackets attached to the front frame extension assembly. Remove the four nuts and spring and plain washers.

If necessary, release one of the outer bumper mounting brackets from the frame extension by unscrewing the three nuts and bolts.

The bumper may now be withdrawn forward from the brackets.

One bolt secures each over-rider to the bumper. Unscrew the bolt and the over-rider will become detached.

S.4 REMOVING THE REAR BUMPER

The rear bumper is secured to two mounting brackets attached to the rear of the frame.

Remove the two bumper securing nuts and spring and plain washers.

Disconnect the wiring to the rear number-plate light. Withdraw the bumper from the mounting brackets. Each over-rider is secured to the bumper by one bolt.

S.5 REMOVING THE HOOD

Place the hood in the folded position.

Remove from one side the three recessed-headed screws securing the hood frame to the body. With an assistant holding the free end, remove the three screws securing the hood on the opposite side.

The hood may now be lifted away.

S.6 REMOVING A REAR WING

Disconnect the wiring to the rear lamps (see Section N).

Remove from inside of the rear wing the five bolts and spring and plain washers securing the wing to the body. Five more bolts are situated behind the baffle panel inside the rear of the wing.

Remove the bolt securing the baffle panel to the wing flange.

Gently ease away the rear portion of the trim panel situated behind the seats and remove the bolt securing the upper corner of the wing.

Remove the two nuts and bolts from the forward end of the wing on the underside.

Remove the three recessed-headed screws securing the wing to the door striker panel.

Remove the wing rearwards to disengage it from the flange of the door striker panel.

Reassembly is a reversal of the dismantling procedure.

When refitting the wing ensure that the piping is correctly and neatly positioned before finally tightening the wing bolts.

S.7 REMOVING A FRONT WING

Disconnect the wiring to the lamps (see Section N).

Remove the four nuts and bolts from the rear under side of the front wing, also the six bolts and spring and plain washers securing the baffle panel to the body. Remove the panel.

Take out the three bolts situated just above and to the outside rear of the front bumper.

Remove from inside of the wing the nine bolts and spring and plain washers securing the wing to the body and also two more situated under the bonnet in the rear corner.

Remove the trim panel from inside the car forward of the doors (see Section S.2) and take out the two bolts situated at the top. Remove the four remaining bolts running down the side of the body panel and the wing may be lifted away.

Have an assistant to bear the weight of the wing while the securing bolts are being removed.

Reassembly is a reversal of the dismantling procedure.

When refitting the wing ensure that the piping is correctly and neatly positioned before finally tightening the wing bolts.

S.8 REMOVING THE BODY

The following items must be disconnected or dismantled when removing the body.

Wiring

Disconnect the positive lead from the battery,

Disconnect the horn wires and the wires from the dynamo and 'SW' connection on the coil. Disconnect the low-tension lead from the starter solenoid and finally the snap connectors situated at the rear of the front wheel arch.

Pipes, controls, etc.

Unscrew the oil gauge pipe union nut from the flexible hose adaptor.

Disconnect the hydraulic clutch pipe from the flexible hose union, and detach the brake pipe from the five way connector on the frame.

Disconnect the speedometer cable from the gearbox, the cable clip on the engine bulkhead, and the tachometer drive cable from the engine.

Unscrew the gland nut and remove the thermal transmitter from the thermostat housing. Remove the header tank as detailed in Section A.7.

Release the mixture control cable from the carburetters.

Unscrew the bolts and remove both the air cleaners, Remove the carburetters as detailed in Section A.7.

Drain and remove the radiator (see Section C.4).

Remove the front and rear bumpers (see Sections S.3 and S.4). The rear bumper support brackets must be removed by undoing the two nuts and bolts securing them to the chassis at either side. Three nuts and bolts secure each outer front bumper support bracket to the front extension, and these bolts and brackets must be removed.

Remove the fuel tank (see Section D.1).

Remove the nut and bolt securing the top steering column clamp to the body bracket and release the clamp.

Unscrew the nine bolts situated along the top forward edge of the engine bulkhead, and also the four bolts securing the brake and clutch pedal assembly bracket to the bulkhead cross-member. These four bolts are situated inside the car, two on either side of the pedals.

Body mounting points

Remove the front small nut and bolt securing the baffle plate to the bottom flange of the wing and the seven bolts securing each baffle plate inside the front wings

Take out the four bolts each side securing the body valances to the frame goalpost on the chassis frame.

Undo the two nuts and bolts on each side at the front, gaining access between the radiator and the grille.

Remove the trim panels from inside of the car forward of each door, and lift off the loose trimming covers which envelop the body mounting bracket at this point. Take out the bolt each side which secures the body bracket to the chassis frame.

Gaining access from underneath the car, remove the bolt from each side just forward of the rear wheel arch.

Working from inside the boot, remove from each rear corner the two bolts which secure the rear of the body to the chassis.

The body may now be lifted from the chassis. As the body is lifted it must be maneuvered slightly

forward to disengage it from the two remaining front bumper mounting brackets which protrude through the body.

Before replacing the body by reversing the dismantling procedure ensure that the laminated cork on each body mounting point is in good condition and squarely mounted; also check the rubber strips along the chassis longitudinal members, the engine bulkhead crossmember, and the cross-member forward of the battery box.

S.9 FITTING THE OPTIONAL HEATING AND DEMISTING EQUIPMENT

Drain the cooling system. Remove the spare wheel and battery cover and disconnect the battery leads.

Remove the cover-plate from the platform at the rear of the engine compartment by unscrewing the eight fixing screws. Discard the plate and seals. Fit the heater assembly (1) together with two new sealing gaskets and secure to the platform with seven of the fixing screws.

On the lever control assembly (2) attach the inner wire of the temperature control cable to the central lever by means of a trunnion and screw. Leaving about 4 in. (4-76 mm.) of the inner wire protruding, tighten the clamp on the outer cable and set the lever control to the "MAX'. position.

Withdraw the knobs from the two push-pull controls by depressing the spring-loaded plungers. Unscrew the large hexagonal nuts from the controls and feed the threaded diameters through the holes in the lever control escutcheon. Replace and tighten the hexagonal nuts and push the knobs back into position on their spindles. The push-pull control with the shorter length of cable (4) must be assembled to the right-hand side (marked DEMIST), and the control with the longer length of cable (3) to the left-hand side (marked 'AIR). Remove the two Phillips screws securing the radio mounting rails to the underside of the fascia and bolt the complete control panel to the fascia using the screws provided.

Pierce the two large blind grommets in the bulkhead. Feed the temperature control cable through the righthand grommet and the "AIR' cable through the left-hand grommet.

Pull the left-hand knob (*AIR') out to its stop and fit a trunnion (16) and screw (22) to the forked lever on the air intake tube. Pass the inner cable through the trunnion and rotate the lever towards the cable clamp, pressing it firmly into position to ensure that the flap valve completely seals the tube. Tighten the screw and the clamp on the outer cable. Making certain that the temperature control lever on the fascia is still in the 'MAX' position, fit the trunnion (16) and screw (22) to the water valve. Pass the inner wire through the trunnion and rotate the valve lever anti-clockwise to the end of its slot. Tighten the trunnion screw and the screw on the outer cable. Pull the right-hand knob (DEMIST) out to its stop and close the heater outlet door. Fit the trunnion (15) and screw (22) to the door. Pass the inner cable from the *DEMIST' control through the trunnion. Tighten the trunnion screw and the clamp on the outer cable.

Remove the radiator grille and the blanking card from the air hose connector on the left-hand side of the radiator. Fit the angled end of the shorter air hose (8) to the connector, securing the hose to the valance tie-plate through the hole provided with a cleat, 1 in. (25.4 mm.) screw, nut, and washer. Refit the radiator grille.

Remove the uppermost plug from the rear of the thermostat housing directly under the forward end of the radiator header tank. Assemble the copper feed pipe and union (10) and the joint washer (28) to the threaded hole in the thermostat housing. Remove the setscrew from the header tank rear support lug on the exhaust manifold. Position the feed pipe clip against the lug, and replace and tighten the setscrew.

Connect the longer rubber water hose (13) to the feed pipe using a clip (32). Pass the hose below the brake and clutch master cylinder push-rods (L.H.D. vehicles only) and connect to the water valve using a clip (32). Secure the rubber water hose to the bulkhead platform using the cleat (29) and the front left-hand brake and clutch pivot platform securing screw (L.H.D. vehicles) or the front left-hand cover-plate securing screw (R.H.D. vehicles).

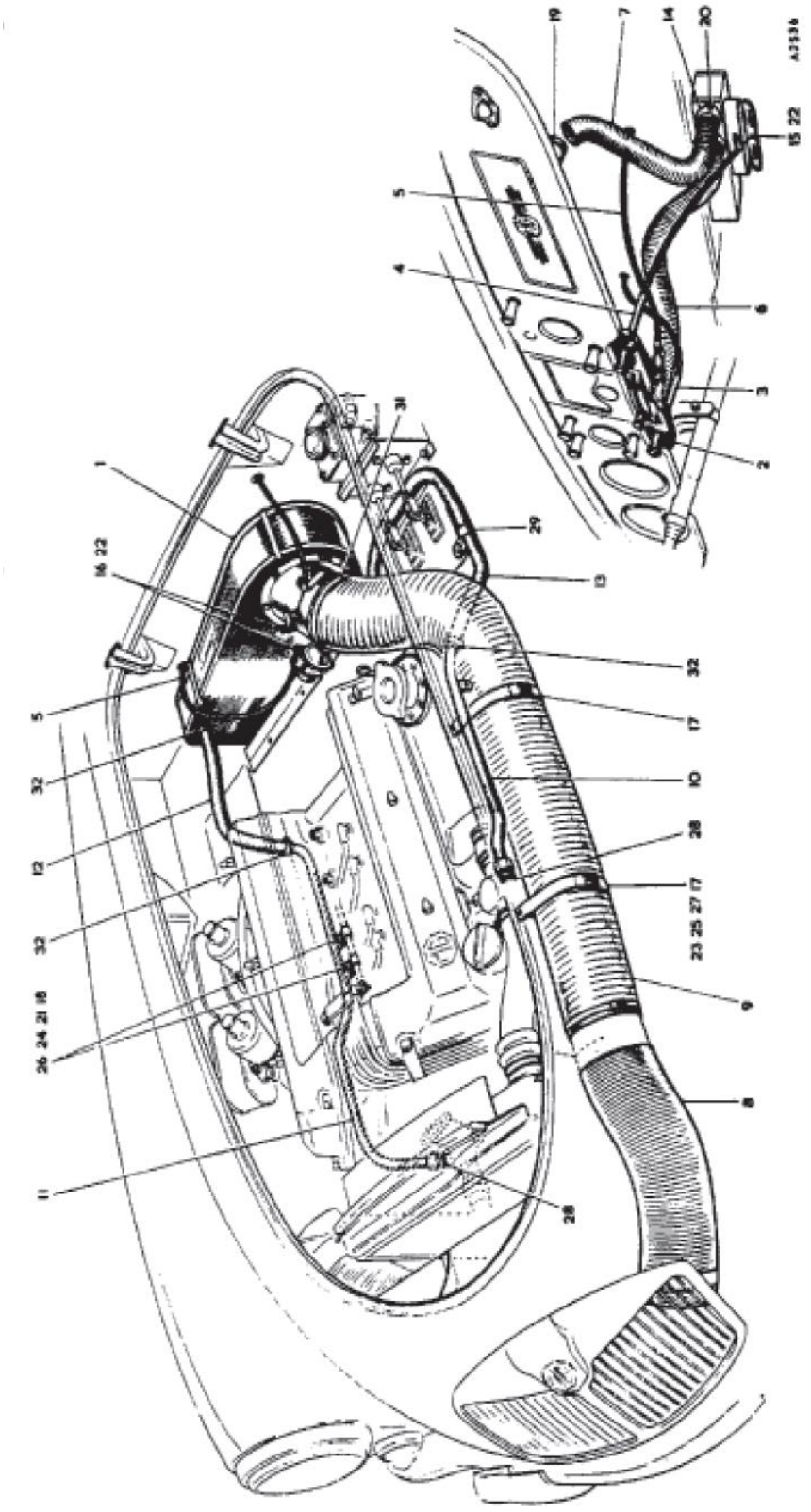


Fig. 5.2 Components of the M.G. (Series MGA Twin Cam) heater kit fired in position

Jack up and support the front of the vehicle, and remove the right-hand front wheel. Fit the copper return pipe and union (11) and joint washer (28) to the threaded hole in the water return casting,

Secure the pipe by tightening the union firmly. Fit the two clips (18) to the oil filter pipe and fasten them to the clips on the copper return pipe using two screws (21), two washers (26), and two nuts (24). Connect the heater outlet to the copper return pipe with the short rubber water hose (12) and secure at both ends with two clips (32).

Fit the two demist tubes (14) to the holes in the lower heater case seen under the fascia above the air outlet door using six screws (20). Fit the 14 in. (35-6 cm.) air hose (6) to the left-hand demist tube and the 25 in. (63-5 cm.) air hose (7) to the right-hand demist tube. Connect both air hoses to the demist nozzles already fitted under the dash panel with the two rubber adaptors (19).

Connect the switch leads from the temperature control lever to the green lead and the green lead with brown tracer issuing from the harness below the fascia (on the car these two wires may be found already joined together by a snap connector). Connect the leads from the heater motor to the black lead and the green lead with brown tracer issuing from the harness behind the heater (snap connectors on all leads). Reconnect the battery leads.

Refill the cooling system, start the engine and check for water leaks. Push the 'AIR' and 'DEMIST' knobs in, pull the central control out and slide the temperature control lever to the "MAX'. position. If the heater has been fitted correctly a cool stream of air will enter the car interior through the air outlet door and will be heated as the cooling system warms up.

If the water return hose does not warm up in a few minutes an air-lock may be present in the system. If this happens switch off the engine and remove the rubber hose from the copper return pipe. Extend the rubber hose by some temporary means so that the water will flow back into the radiator through the filler neck. Plug the copper pipe temporarily.

Start the engine and allow it to run at a fast idling speed. Note the water flow-back into the radiator. When this is smooth and bubble-free reconnect the hose to the copper pipe and tighten the clip as quickly as possible.

Fit the longer air hose (9) between the rear of the air hose connector on the left-hand side of the radiator and the air intake on the heater. Secure at both ends using the two flexible clips (31) and fasten the hose to the bonnet drain channel with two cleats (17) together with two screws (23), two washers (27), and two nuts (25). It may be necessary to drill two #in, (5-16 mm.) diameter holes in the bonnet drain channel for the securing screws.

When draining the cooling system, it is not possible to completely drain the heater unit. Anti-freeze must, therefore, be used in the cooling system when frost is anticipated.

MGA' (TWIN CAM) HEATER KIT. Part No. 8G9037

Item number	Description	Part Number	Quantity
1	Heater assembly	AHH5760	1
2	Lever control assembly	AHH5531	1
3	Push-pull control Air	AHH5786	1
4	Push-pull control 'Demist	AHH5787	1
5	Cable	AHH5529	1
6	Air hose (1 ½ in. X 14 in.)	AHH5427	1
7	Air hose (1 ½ in. X25 in.)	AHH5428	1
8	Air hose short	AHH5394	1
9	Air hose-long (4 in. x 36 in.)	AHH5785	1

10	Copper pipe and union assembly (inlet)	AHH5843	1
11	Copper pipe and union assembly (outlet)	AHH5844	1
12	Water hose-12 ½ in. long	AHH5437	1
13	Water hose-25 in. long	BHA4089	1
14	Tube demist	AHH5426	2
15	Trunnion	14A5753	1
16	Trunnion	14G6451	3
17	Cleat	AHH5714	3
18	Clip-pipe	AHH5429	2
19	Rubber adaptor	BHA4090	2
20	Screw-No. 4 P.K.	AHH5591	6
21	Screw- ¼ in. UNF. X 5/8 in	HZS0405	2
22	Screw-No. 6 UNC	53K155	4
23	Screw—No. 10 UNF.x1 in	PMZ0316	3
24	Nut-1 in. UNF	FNZ104	2
25	Nut-No. 10 UNF	FNZ103	3
26	Washer- ¼ in..	LWZ204	2
27	Washer-2 B.A Shake-proof	17H1638	3
28	Washer aluminium	BHA4088	2
29	Cleat-hose	BHA4091	1
30	Clip	17H486	2
31	Clip-water hose	301140	4
32	Sealing gasket	AHH5253	2

S.10 COLD AIR VENTILATION EQUIPMENT

A cold air ventilation kit is available which provides fresh cold air to the car interior.

The fittings for this installation are similar to those of the heater kit, bearing in mind the fact that there are no water or demister fitments or connections.

Remove the spare wheel and battery cover. Disconnect the battery leads.

Remove the cover-plate from the platform at the rear of the engine compartment by unscrewing the eight fixing screws. Discard the plate and seals. Fit the ventilator unit (1) together with two new scaling gaskets and secure to the platform with seven of the fixing screws.

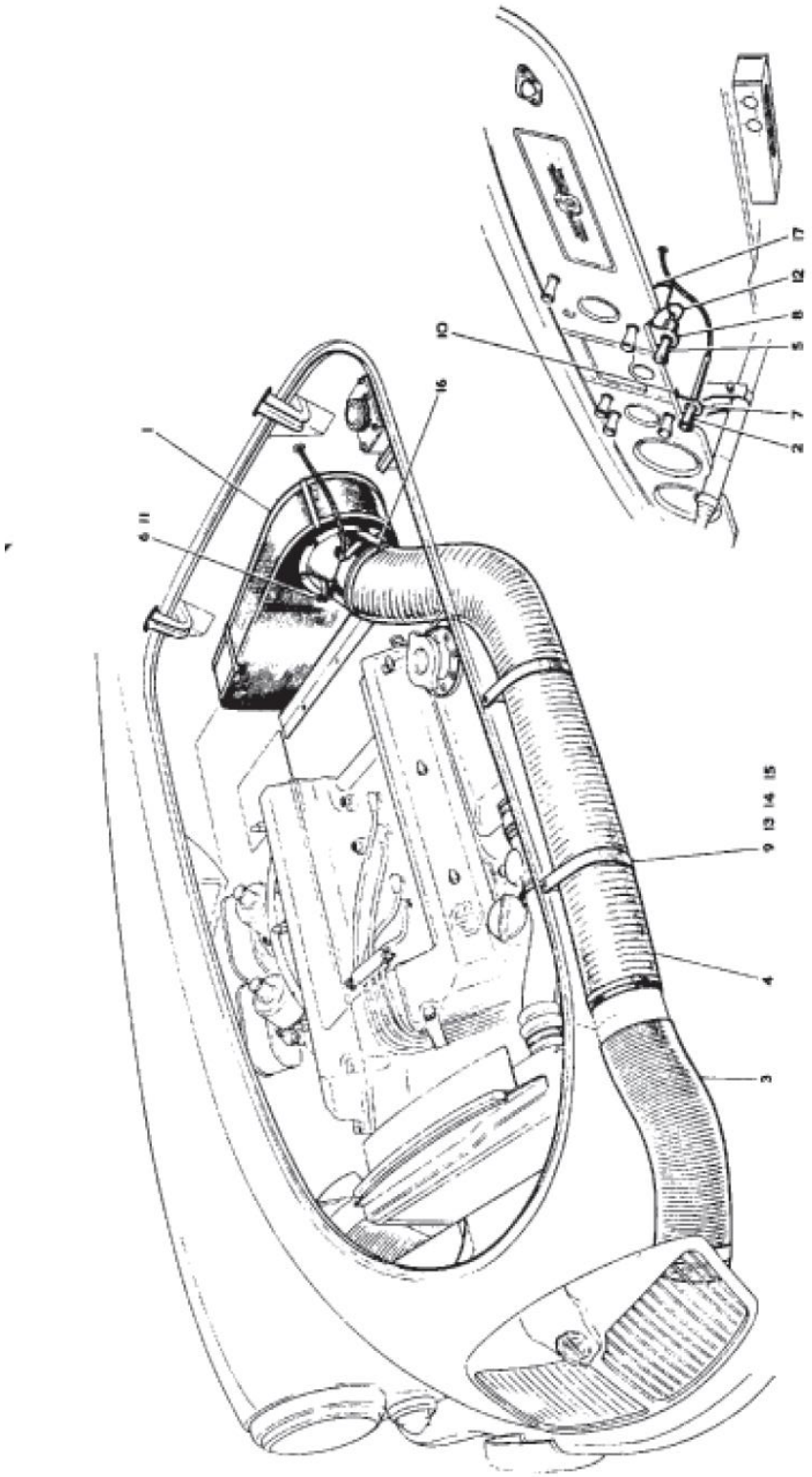


Fig. S.3 Components of the M.G. (Series MGA Twin Cam) fresh air ventilation kit fitted in position

MGA TWIN CAM FRESH AIR VENTILATION KIT Part No. 8G9038

Item number	Description	Part Number	Quantity
1	Cold air unit	AHH5797	
2	Push-pull control	AHH5786	
3	Hose—air intake	AHH5394	
4	Air hose-(4 in. X 36 in.)	AHH5785	
5	Switch-blower	17H 1941	
6	Trunnion	14G6451	
7	Bracket (push-pull)	17H1938	
8	Bracket (switch)	17H1939	
9	Cleat.	AHH5714	
10	Screw-No. 6 P.K.	17H 1940	
11	Screw—No. 6 UNC. Xin	53K155	
12	Wire assembly	17H1983	
13	Screw-No. 10 UNF.X1 in	PMZ0316	
14	Nut—No. 10 UNF	FNZ103	
15	Washer-spring	LWZ203	
16	Clip	17H486	
17	Wire assembly	17H1984	
	Sealing gasket	AHH5253	

Remove the two Phillips headed screws securing the two mounting rails to the underside of the centre of the fascia. Assemble the blower switch bracket (8) to the right-hand cage nut, replace and tighten the screw and washer. Assemble the push-pull control bracket (7) to the left-hand cage nut, replace and tighten the screw and washer. Drill two | in. (3-18 mm.) diameter holes through each of the brackets, using the existing outside holes in the brackets as guides for the drill. Screw the four screws (10) into the holes and tighten them.

Assemble the bare ends of the two leads (12) and (17) supplied in the kit to the blower switch (5). Withdraw the knob from the switch by depressing the spring-loaded plunger. Remove the ring nut. Assemble the switch to the right-hand bracket and replace the ring nut and knob.

Withdraw the knob from the push-pull control (2) by depressing the spring-loaded plunger. Pierce the large left-hand blind grommet in the bulkhead. Thread the push-pull control cable through the hole in the mounting bracket and through the bulkhead grommet. Secure the control to the bracket and replace the knob.

Pull out the air control knob to its full extent. Fit the trunnion (5) and screw (11) to the forked lever on the air intake tube. Pass the inner cable through the trunnion and rotate the lever towards the cable clamp, pressing it firmly into position to ensure that the flap valve completely seals the tube. Tighten the trunnion screw and the clamp on the outer cable.

Remove the radiator grille and the blanking card from the air hose connector on the left-hand side of the radiator. Fit the angled end of the shorter air hose (3) to the connector, securing the hose to the valance tie-plate through the hole provided with a cleat, 1 in. (25.4 mm.) screw, nut, and washer. Refit the radiator grille.

Fit the longer air hose (4) between the rear of the air hose connector and the air intake on the ventilator unit. Secure the hose at both ends, using the two flexible clips (16), and fasten it to the bonnet drain channel with the two cleats (9) together with two screws (13), two washers (15), and two nuts (14). It may be necessary to drill two # in. (5.16 mm.) diameter holes in the bonnet drain channel for the securing screws.

Connect the switch leads to the green lead and the green lead with brown tracer issuing from the harness below the fascia (on the car these two wires may be found already joined together by a snap connector). Connect the leads from the ventilator unit motor to the black lead and the green lead with brown tracer issuing from the harness behind the unit (snap connectors on all leads). Reconnect the battery leads.

S.11 MAINTENANCE OF BODYWORK AND UPHOLSTERY

It is advisable to wash the coachwork of the car with an abundant quantity of water to remove all traces of dust, mud, and traffic film. Polish the paintwork frequently with a good-quality car polish which is free from abrasive.

Wash the chromium parts frequently with soap and warm water, and when the dirt has been removed polish the surface with a clean dry cloth, or a chamois-leather, until bright. Neither metal polishes nor abrasives of any sort must be used on chromium, but a good-quality metal polish may be used on stainless-steel window frames, windshield surrounds, and radiator grilles.

When cleaning windshields it is advisable to use methylated spirits (denatured alcohol) to remove tar spots and other stains. It has been found that the use of some silicon- and wax-based polishes for this purpose can be detrimental to the windshield wiper blades.

The upholstery of the car should be cleaned periodically by wiping over with a damp cloth. Accumulations of dirt, if left too long, eventually work into the pores of the leather, giving a soiled appearance. A little neutral soap may be used, but detergents, caustic soaps, or spirits of any kind must not be used.

When necessary, the hood cloth may be cleaned with water applied with a brush. Soaps and detergents must not be used.

S.12 REGLAZING THE WINDSHIELD

To detach the frame from the body

Remove the three cap nuts and screws attaching each grab handle to the windshield frame flange. Remove the four screws and lift the frame forward and upward away from the body. Note that of these four screws on each side the three top screws are 5/8 in. (15.9 mm.) long and the bottom screw ¾ in. (19.1 mm.) long.

To remove the glass from the frame

Remove the two screws at the top and bottom corners of the frame side rails which screw into the angle bracket in the frame channel at the mitred corners. The frame may now be pulled apart and the glazing rubber removed.

To reglaze

Check the frame top and bottom rails with the curvature of the glass and set where necessary

to suit any variation. A tolerance of 1/8 in. (3.2 mm.) is permitted.

The rails can be set by placing the rear face over a soft wood block. Grip the rails with the hands on each side of the block, about 12 in. (305 mm.) apart, and gently slide from side to side over the block, exerting sufficient graduated pressure to shape the rail to the desired curvature.

When the curvature of the rails is correct reassemble the windshield by reversing the order for extracting the glass, taking care that the mitred corners are correctly aligned, and all the screws are tight. Replace the frame on the body, using the correct screws as detailed above.

S.13 REMOVING THE WINDSHIELD (COUPÉ)

Extract the two screws securing the driving mirror and remove the mirror.

Remove the windshield wiper-arms.

Unscrew the seven screws at each side securing the R/H and L/H side fillets. Remove the fillets.

Withdraw the five screws retaining the front windshield fillet and remove the fillet.

Press the glass from the inside of the car, commencing at one corner, and carefully ease the sealing rubber from the metal edge of the windshield housing.

Before attempting to refit the windshield glass to the body it should be assembled into the rubber channel. Make sure that the glass is right home in the channel.

To facilitate the assembly of the windshield to the car body and the outside finisher to the glass lengths of cord each about 15 feet (4.6 m.) long should be threaded around the rubber channel. Insert one length of cord into the channel to be fitted over the metal edge of the windshield housing and the other into the finisher channel on the outer side. It is convenient to have the ends of the inner cord at the bottom of the windshield and the ends of the outer cord at the top.

Threading the cords is easily carried out if one end of a cord is threaded through approximately 6 in. (15 cm.) of small-diameter tubing-brake pipe is ideal (see Fig. S.4). Radius one end of the tube inside and out and bell out the opposite end. Allow 6 in. (15 cm.) of the cord to protrude from the plain end of the tube and then press that end of the tube into the channel to which the cord is to be fitted. Run the tube around the channel, allowing the cord to flow freely through it until it surrounds the windshield and the free ends overlap and hang from the channel. The ends should be long enough to allow a good pull when the windshield is fitted.

Insert one edge of an external finisher into the channel in the rubber, press in position, and finally position by withdrawing the string. Insert the second finisher in the same manner and fit the upper and lower cappings.

To fit the windshield to the body it must be offered to the windshield aperture from outside the car. With the assembly pressed into position from the outside the inner cord must be pulled away progressively round the aperture to draw the inside lip of the rubber channel over the flange.

Use a rubber mallet round the outside edge of the windshield to ensure complete seating of the assembly.

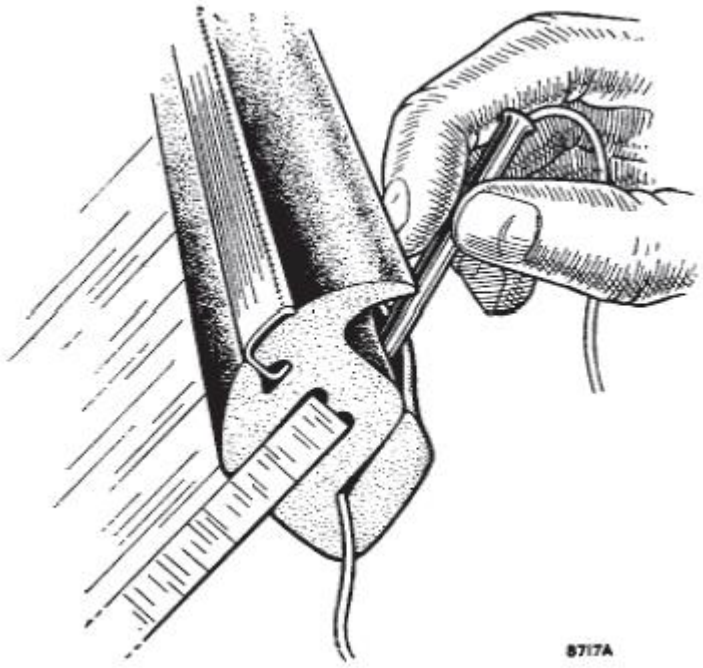


Fig. S.4 Inserting the cord in the outside tip of the rubber channel after fitting the plated finisher

Seelastik sealing compound should be injected between the outer lip of the rubber seal and the body and between the seal and the glass. The application must be evenly distributed round the windshield. To ensure this the outside lip should be firmly pressed down, with the fingers or a wooden roller, to spread the sealing compound under the rubber seal.

Fig. S.5 shows the method of applying Seelastik sealing compound between the channel lip and body flange, using an Expandite pressure applicator gun, if possible, fitted with a special 3/16 in. (4.5 mm.) bore brass tube nozzle.

Refit the driving mirror.

S.14 REMOVING AND REPLACING THE REAR LIGHT (COUPÉ)

Push the glass, and rubber seal, towards the outside of the car until it is free.

To replace, fit the rubber seal round the glass. Thread a length of cord along the inner flange of the rubber seal with the ends protruding.

With the aid of a second operator to apply hand pressure to the outside of the glass draw the string from the rubber seal so that the flange is lifted over the metal edge of the window opening.

Seelastik sealing compound should be injected between the outer lip of the rubber channel and the body flange.

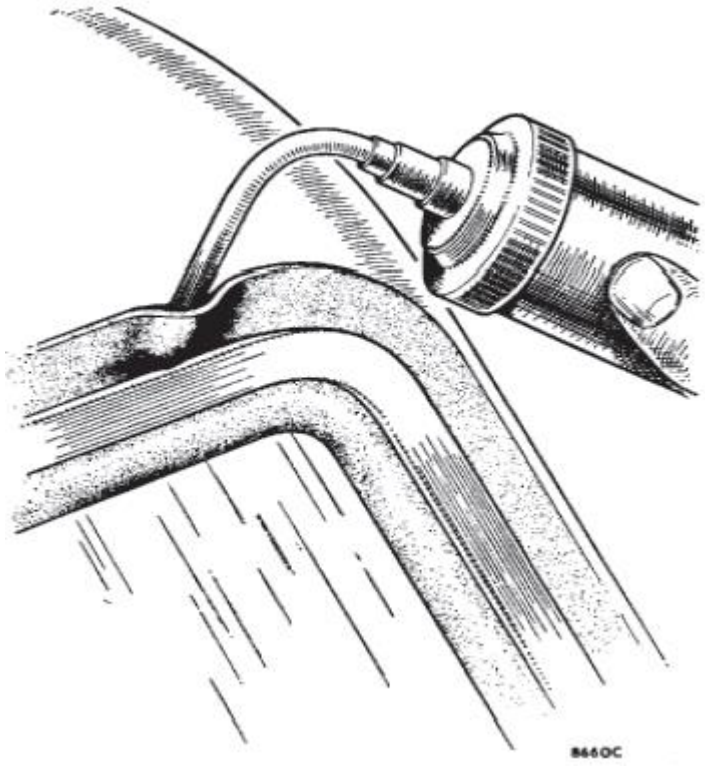


Fig. S.5 Showing the use of a pressure gun to apply Seelastik

The application must be evenly distributed right round the glass. To ensure this the outside lip should be firmly pressed down with the fingers or a wooden roller to spread the sealing compound under the rubber seal.

S.15 REMOVING A DOOR LOCK OR WINDOW REGULATOR (COUPÉ)

Extract the three securing screws and remove the top finisher pane. Remove the three retaining screws from the door-pull and plate.

Push the inner escutcheons clear of the shanks of the door lock handle and the window regulator handle and push out the exposed retaining pins to release the handles.

Remove the eight recessed-headed screws securing the trim panel to the door. Remove the door aperture scaling material.

Extract the two recessed-headed screws securing the window channel top brackets, one either side, to the top of the door. Lift the felt from the bottom of the channel and remove the screws from the bottom brackets.

With the glass fully raised, remove the self-locking nut and tension spring from the ventilator window through the aperture in the door. Lift out the ventilator window.

Unscrew the two barrel nuts securing the window frame to the door.

Withdraw the three screws securing the waist rail finisher to the outside of the door and prise the finisher up and out away from the door.

Extract the screw securing the wooden glass stop to the top rear inner face of the door. Raise the glass and withdraw the quadrant arm from the window lift channel and remove the glass.

Lift out the window frame assembly

To remove the door lock

Take out the three screws securing the remote control to the door and the four screws in the shut face of the door securing the lock. The lock, remote control, and remote control link can then be withdrawn from the door.

To remove the window regulator

Extract the six screws securing the regulator to the inner door panel and lift out the regulator.

Reassembly is a reversal of the dismantling procedure

Replace the piece of sealing material with rubber cement.

S.16 REMOVING THE HEAD LINER (COUPÉ)

Unscrew the seven screws at each side securing the R.H. and L.H. side fillets and the five screws securing the front fillet and remove the fillets.

Remove the rear light as detailed in Section S.14.

Carefully ease the head liner away from the roof above the windshield, rear light, and above the doors; the head liner is attached to the roof with rubber cement.

Extract the two screws from each side of the three head liner lists and remove the head liner with lists.

Reassembly is a reversal of the dismantling procedure.

When re-sticking the liner to the roof, work from the rear to the front and from the centre to the sides

S.17 MODIFIED WHEEL ARCHES

Later models of both the Tourer and the Coupe are fitted with louvred detachable panels in the front wheel arches.

The modification is introduced primarily to assist in cooling and secondly to give access to the retaining bolt on the oil filter.

This modification cannot be incorporated on earlier models.

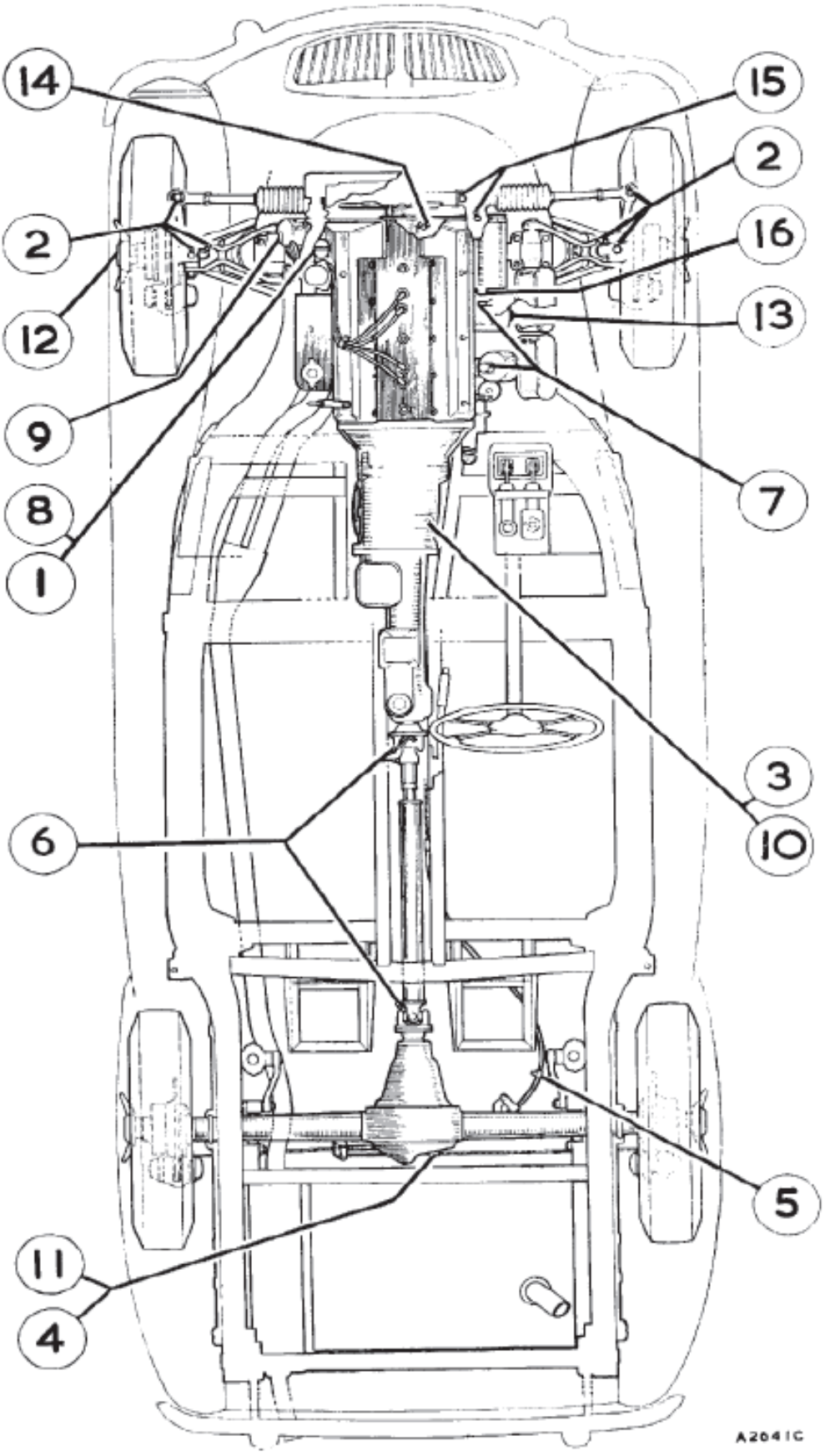
S.18 MODIFIED BODIES

Commencing at Chassis Nos. 2193 (Standard) and 2292 (Coupé), modified bodies incorporating tajl lamp plinths and front flashing indicator lamp mountings have been introduced to provide for the fitting of separate front and rear amber flashing direction indicators.

Provision is also made for the fitting of sliding side screens to the standard body.

Additional body space has been made available in Coupé models by re-positioning the spare wheel mounting in the boot and reducing the size of the parcel shelf

LUBRICATION CHART



KEY TO LUBRICATION CHART

DAILY

(1) ENGINE. Check the oil level with the dipstick. Replenish if necessary with new oil (Ref. A).

EVERY 1,000 MILES (1,600 km.)

(2) STEERING. Give three or four strokes with the lubricating gun filled to Ref. C to the nipples on the steering joints on both sides of the car.

(3) GEARBOX. Check the oil level with the dipstick. Replenish if necessary with new oil (Ref. A).

(4) REAR AXLE. Replenish the oil to the level of the filler plug hole. Use new oil (Ref. B).

(5) HAND BRAKE. Give the cable nipple three or four strokes with the gun filled with grease (Ref. C).

(6) PROPELLER SHAFT. Give the nipples three or four strokes with the gun filled to Ref. C.

(7) CARBURETTERS. Remove the cap *f*rom each suction chamber and insert a small quantity of oil (Ref. D).

EVERY 3,000 MILES (4,800 km.)

(8) ENGINE. Drain the used oil from the sump. Refill to the "MAX' mark on the dipstick with new oil (Ref. A).

EVERY 6,000 MILES (9,600 Km.)

(9) DISTRIBUTOR. Withdraw the rotating arm and add a few drops of oil (Ref. D) to the spindle and also to the advance mechanism. Smear the cam and contact pivot with grease or oil.

(10) GEARBOX. Drain the used oil and refill to the 'HIGH' mark on the dipstick with new oil (Ref. A).

(11) REAR AXLE. Drain the used oil and refill to the level of the filler plug hole with new oil (Ref. B).

(12) FRONT HUBS. Remove the front wheel hub nuts and grease caps. Fill the caps with grease (Ref. C) and replace.

(13) OIL FILTER. Renew the element and wash the bowl in fuel.

(14) WATER PUMP. Give the nipple one stroke only with the gun filled with S.A.E. 140 oil.

EVERY 12,000 MILES (19200 Km.)

(15) STEERING RACK. Give up to 10 strokes to the nipple on the steering rack and two strokes only to the pinion shaft nipple with the gun filled with oil (Ref. B).

(16) DYNAMO. Add two drops of oil (Ref. D) to the oil hole in the rear end bearing plate.

A ENGINE AND AIR CLEANER

Climatic conditions	Esso	Mobil	Shell	BP	Filtrate	Sternol	Duckham's	Castrol
Tropical and temperate down to 32° F. (0° C.)	Esso Extra Motor Oil 20W/30	Mobiloil A	Shell X—100 30	Energol S.A.E. 30	Medium Filtrate 30	Sternol W.W. 30	Duckham's NOL Thirty	Castrol X.L.
Extreme cold down to 10° F. (−12° C.)	Esso Extra Motor Oil 20W/30	Mobiloil Arctic	Shell X—100 20/20W	Energol S.A.E. 20W	Zero Filtrate 20	Sternol W.W. 20	Duckham's NOL Twenty	Castrolite
Arctic consistently below 10° F. (−12° C.)	Esso Motor Oil 10	Mobiloil 10W	Shell X—100 10W	Energol S.A.E. 10W	Sub-Zero Filtrate 10W	Sternol W.W. 10	Duckham's NOL Ten	Castrol Z
GEARBOX								
All conditions	Esso Extra Motor Oil 20W/30	Mobiloil A	Shell X—100 30	Energol S.A.E. 30	Medium Filtrate 30	Sternol W.W. 30	Duckham's NOL Thirty	Castrol X.L.

B REAR AXLE (HYPOID) AND STEERING GEAR

All conditions down to 10° F. (−12° C.)	Esso Gear Oil G.P. 90/140	Mobilube G.X. 90	Shell Spirax 90 E.P.	Gear Oil S.A.E. 90 E.P.	Filtrate Hypoid Gear 90	Ambroleum E.P. 90	Duckham's Hypoid 90	Castrol Hypoy
Arctic consistently below 10° F. (−12° C.)	Esso Gear Oil 80	Mobilube G.X. 80	Shell Spirax 80 E.P.	Gear Oil S.A.E. 80 E.P.	Filtrate Hypoid Gear 80	Ambroleum E.P. 80	Duckham's Hypoid 80	Castrol Hypoy Light

C LUBRICATION NIPPLES AND WHEEL HUBS

Wheel hubs, hand brake cable, and all lubrication nipples except water pump and steering rack and pinion	Esso Multi-purpose Grease H	Mobilgrease M.P.	Shell Retinax A	Energrease L. 2	Filtrate •Super Lithium Grease	Ambroline L.H.T.	Duckham's L.B. 10 Grease	Castrolease L.M.
Alternative for all lubrication nipples except hand brake cable and steering rack and pinion	Esso Gear Oil G.P. 90/140	Mobilube G.X. 140	Shell Spirax 140 E.P.	Gear Oil S.A.E. 140 E.P.	Filtrate e Gear 140 E.P.	Ambroleum E.P. 140	Duckham's NOL E.P. 140	Castrol Hi-Press

D UTILITY LUBRICANT, S.U. CARBURETTER DASHPOT, OILCAN POINTS, ETC.

All conditions	Esso Extra Motor Oil 20W/30	Mobiloil Arctic	Shell X—100 20/20W	Energol S.A.E. 20W	Zero Filtrate 20	Sternol W.W. 20	Duckham's NOL Twenty	Castrolite

E UPPER CYLINDER LUBRICANT

All conditions	Esso Upper Cylinder Lubricant	Mobil Upperlube	Shell Upper Cylinder Lubricant	Upper Cylinder Lubricant	Filtrate Petroyle	Sternol Magikoyl	Duckham's Adcoid Liquid	Castrollo