The MORRIS Mini-Minor

WORKSHOP MANUAL

ADO15

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. AKD1181B) can only be obtained from a Morris Distributor.

Issued by

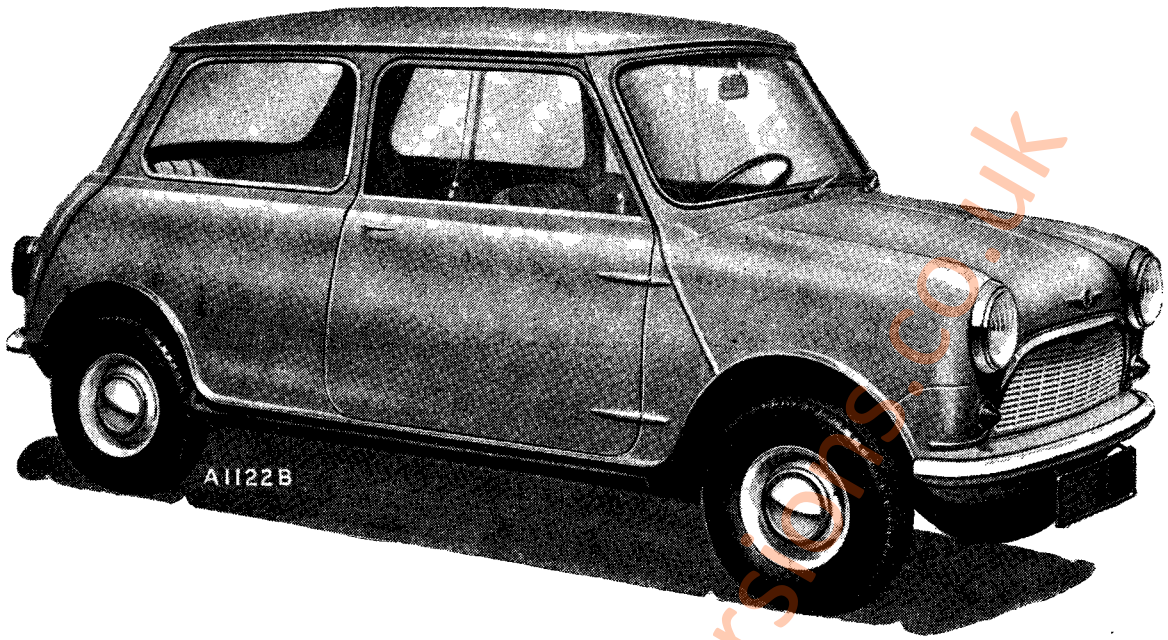
MORRIS MOTORS LIMITED
COWLEY · OXFORD · ENGLAND

Sole Exporters

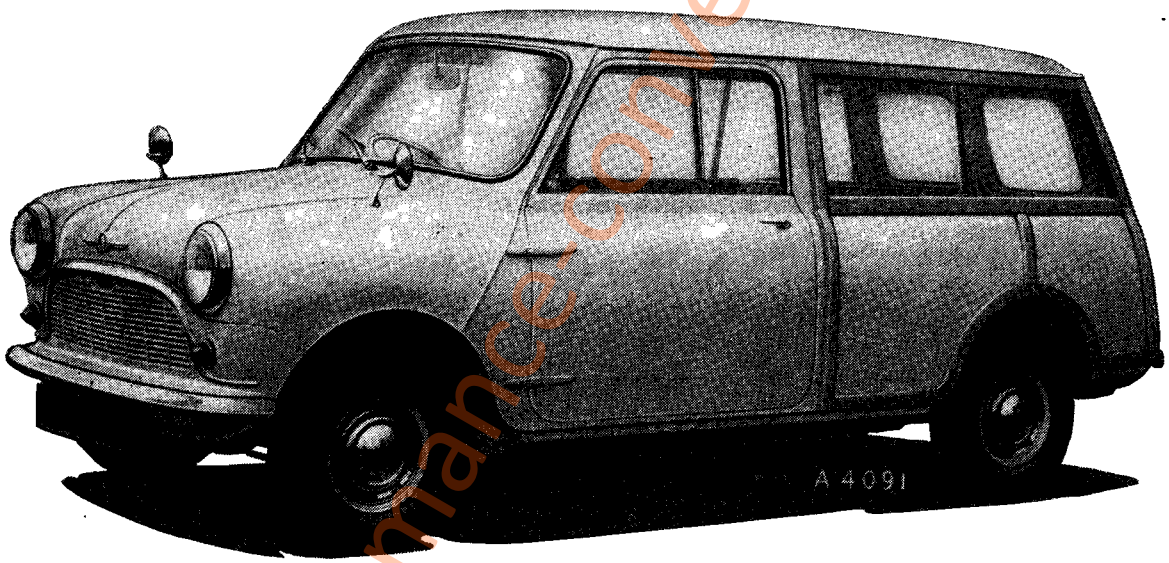
NUFFIELD EXPORTS LIMITED
Proprietors: MORRIS MOTORS LIMITED
COWLEY · OXFORD · ENGLAND

PRINTED IN ENGLAND

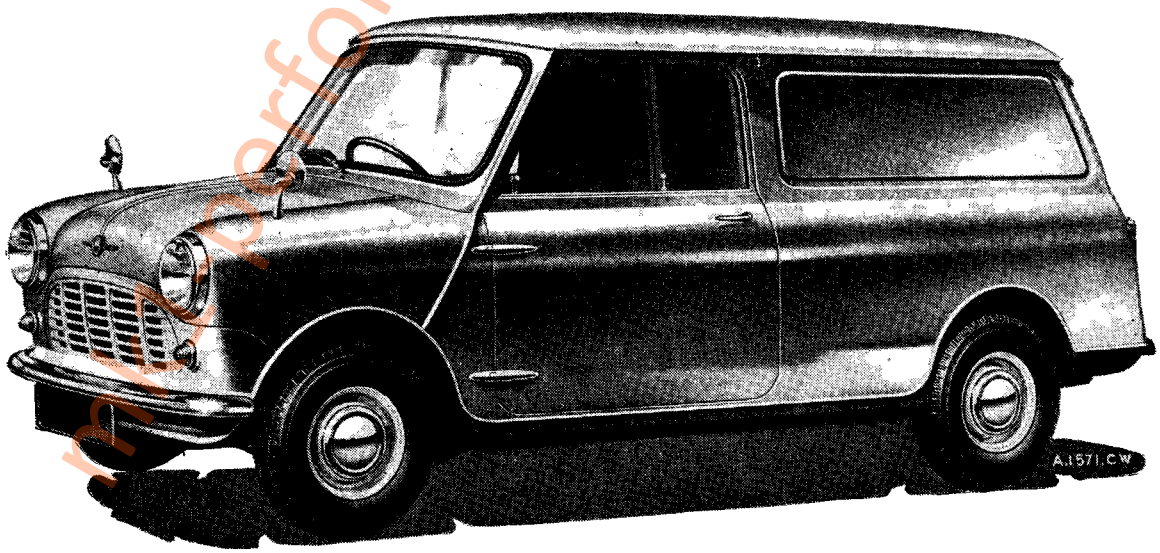
Morris Mini-Minor. Issue 4. 32303



THE MORRIS MINI-MINOR SALOON



THE MORRIS MINI-TRAVELLER



THE MORRIS MINI-VAN

CONTENTS

INTRODUCTION

This Manual has been prepared to provide service operators with the necessary information for the correct maintenance and repair of the Morris Mini-Minor. The Manual also serves as a ready-reference book for service supervision and covers items of procedure for guidance of both fully qualified and the less-experienced mechanic.

The early pages contain general data, general information, and a summary of the maintenance attentions relating to this car.

The main body of the publication deals with dismantling, repair, and reassembly, and is grouped into Sections. The pages and illustrations are numbered consecutively within each Section, and the Section title and letter are shown at the top of each page.

GENERAL DATA

ENGINE

Type	8MB.
Number of cylinders	4.
Bore	2·478 in. (62·94 mm.).
Stroke	2·687 in. (68·26 mm.).
Capacity	51·7 cu. in. (848 c.c.).
Firing order	1, 3, 4, 2.
Compression ratio	8·3 : 1.
Capacity of combustion chamber (valves fitted)	1·49 cu. in. (24·5 c.c.).
Valve operation	Overhead by push-rod
B.M.E.P.	128 lb./sq. in. (9 kg./cm.²) at 2,900 r.p.m.
Torque	44 lb. ft. (6·08 kg. m.) at 2,900 r.p.m.
Oversize bore: 1st	+·010 in. (·254 mm.).
Max	+·040 in. (1·016 mm.).

CRANKSHAFT

Main journal diameter	1·7505 to 1·751 in. (44·46 to 44·47 mm.).
Minimum regrind diameter	1·7105 in. (43·45 mm.).
Crankpin journal diameter	1·6254 to 1·6259 in. (41·28 to 41·29 mm.).
Crankpin minimum regrind diameter	1·5854 in. (40·27 mm.).
Main bearings	
Number and type	3 shell type.
Material	Steel-backed white metal.
Length	1·187 in. (30·16 mm.).
End-clearance	·002 to ·003 in. (·051 to ·076 mm.).
End-thrust	Taken on centre main bearing.
Running clearance	·0005 to ·002 in. (·013 to ·051 mm.).

CONNECTING RODS

Length between centres	5·75 in. (14·605 cm.).
Big-end bearings	
Material	Steel-backed lead-bronze with lead-indium-plated surface, or steel-backed copper-lead with lead-tin-plated surface.
Bearing side-clearance	·008 to ·012 in. (·203 to ·305 mm.).
Bearing diametrical clearance	·001 to ·0025 in. (·025 to ·063 mm.).

PISTONS

Type	Split skirt.
Clearances: Bottom of skirt	·0006 to ·0012 in. (·015 to ·030 mm.).
Top of skirt	·0026 to ·0032 in. (·066 to ·081 mm.).
Oversizes	+·010 in., +·020 in., +·030 in., +·040 in. (·254 mm., ·508 mm., ·762 mm., 1·016 mm.).

PISTON RINGS

Compression: Plain	Top ring.
Tapered	Second and third rings.
Width	·069 to ·070 in. (1·75 to 1·78 mm.).
Thickness	·095 to ·101 in. (2·41 to 2·56 mm.).
Fitted gap	·007 to ·012 in. (·178 to ·305 mm.).
Clearance in groove	·0015 to ·0035 in. (·038 to ·089 mm.).
Oil control type	Slotted scraper.
Width	·124 to ·125 in. (3·15 to 3·175 mm.).
Thickness	·095 to ·101 in. (2·41 to 2·56 mm.).
Fitted gap	·007 to ·012 in. (·178 to ·305 mm.).
Clearance in groove	·0015 to ·0035 in. (·038 to ·089 mm.).

GUDGEON PIN

Type	Clamped in little-end.
Fit in piston	Hand push-fit.
Diameter (outer)	·624 in. (15·86 mm.).

VALVES AND VALVE GEAR

Valves

Seat angle: Inlet	45°.
Exhaust	45°.
Head diameter: Inlet	1·093 to 1·098 in. (27·76 to 27·89 mm.).
Exhaust	1·000 to 1·005 in. (25·40 to 25·53 mm.).
Stem diameter: Inlet	·2793 to ·2798 in. (7·096 to 7·109 mm.).
Exhaust	·2788 to ·2793 in. (7·081 to 7·096 mm.).
Valve lift	·285 in. (7·24 mm.).
Valve stem to guide clearance: Inlet	·0015 to ·0025 in. (·038 to ·064 mm.).
Exhaust	·002 to ·003 in. (·051 to ·076 mm.).
Valve rocker clearance: Running	·012 in. (·305 mm.) (cold).
Timing	·019 in. (·48 mm.).
Timing markings	Dimples on timing wheels, marks on flywheel.
Chain pitch and number of pitches	⅜ in. (9·525 mm.). 52.
Inlet valve: Opens	5° B.T.D.C.
Closes	45° A.B.D.C.
Exhaust valve: Opens	40° B.B.D.C.
Closes	10° A.T.D.C.

With ·019 in. (·48 mm.) valve rocker clearance (for checking purposes only).

Valve rocker bush bore (reamed)	·5630 to ·5635 in. (14·30 to 14·312 mm.).

VALVE GUIDES

Length: Inlet and exhaust	1·687 in. (42·86 mm.).
Diameter: Outside: Inlet and exhaust	·469 in. (11·91 mm.).
Inside: Inlet and exhaust	·2813 to ·2818 in. (7·145 to 7·257 mm.).

VALVE SPRINGS

Free length: Inlet and exhaust	1·625 in. (41·27 mm.).
Number of working coils	4½.
Pressure: Inlet and exhaust: Valve open	70 lb. (31·8 kg.).
Valve closed	37·5 lb. (17·027 kg.).

TAPPETS

Type	Barrel type.
Diameter	·812 in. (20·64 mm.).
Length	1·5 in. (38·10 mm.).

CAMSHAFT

Journal diameters: Front	1·6655 to 1·666 in. (42·304 to 42·316 mm.).
Centre	1·62275 to 1·62325 in. (41·218 to 41·231 mm.).
Rear	1·3725 to 1·3735 in. (34·862 to 34·887 mm.).
End-float	·003 to ·007 in. (·076 to ·178 mm.).
Bearings: Type: Front	White-metal-lined, steel-backed.
Centre and rear	Plain (running in block).
Inside diameter (reamed in position)	1·667 to 1·6675 in. (42·342 to 42·355 mm.).
Clearance: Front	·001 to ·002 in. (·025 to ·051 mm.).
Centre and rear	·00125 to ·00275 in. (·0317 to ·0698 mm.).

ENGINE LUBRICATION SYSTEM

Oil pump

Type	Hobourn Eaton or Burman
Relief pressure valve operates	60 lb./sq. in. (4·2 kg./cm.²).
Relief valve spring: Free length	$2\frac{55}{64}$ in. (72·63 mm.).
Fitted length	$2\frac{5}{32}$ in. (54·77 mm.).

Oil filter

Type	Full-flow.
Capacity	1 pint (1·2 U.S. pints, ·57 litre)

Oil pressure

Normal running	60 lb./sq. in. (4·22 kg./cm.²).
Idling (minimum)	15 lb./sq. in. (1·05 kg./cm.²).

TORQUE WRENCH SETTINGS

Cylinder head stud nuts	40 lb. ft. (5·5 kg. m.).
Connecting rod big-end bolts	35 lb. ft. (4·8 kg. m.).
Main bearing set screws	60 lb. ft. (8·3 kg. m.).
Flywheel centre-bolt	110/115 lb. ft. (15·2 kg. m.).
Gudgeon pin clamp screws	25 lb. ft. (3·4 kg. m.).
Rocker bracket nuts	25 lb. ft. (3·4 kg. m.).
Transmission case to crankcase	6 lb. ft. (0·8 kg. m.).
Cylinder side cover	2 lb. ft. (0·28 kg. m.).
Timing cover $\frac{1}{4}$ in. UNF. bolts	6 lb. ft. (0·8 kg. m.).
Timing cover $\frac{5}{16}$ in. UNF. bolts	14 lb. ft. (1·9 kg. m.).
Water pump	17 lb. ft. (2·3 kg. m.).
Water outlet elbow	8 lb. ft. (1·1 kg. m.).
Oil filter	16 lb. ft. (2·2 kg. m.).
Oil pump	9 lb. ft. (1·2 kg. m.).
Manifold to cylinder head	15 lb. ft. (2·1 kg. m.).
Rocker cover	4 lb. ft. (0·56 kg. m.).
Crankshaft pulley nut	70 lb. ft. (9·6 kg. m.).
Transmission case studs—$\frac{3}{8}$ in. dia. UNC.	8 lb. ft. (1·1 kg. m.).
Transmission case studs—$\frac{5}{16}$ in. dia. UNC.	6 lb. ft. (0·8 kg. m.).
Transmission case stud nuts—$\frac{3}{8}$ in. UNF.	25 lb. ft. (3·45 kg. m.).
Transmission case stud nuts—$\frac{5}{16}$ in. UNF.	18 lb. ft. (2·5 kg. m.).
Bottom cover set screws—$\frac{1}{4}$ in. dia. UNC. (change speed tower)	6 lb. ft. (0·8 kg. m.).
1st motion shaft nut	90 lb. ft. (12·3 kg. m.).
3rd motion shaft nut	90 lb. ft. (12·3 kg. m.).
Flywheel housing bolts and stud nuts	18 lb. ft. (2·5 kg. m.).

Final drive

Driven gear to differential cage	60 lb. ft. (8·3 kg. m.).
Drive shaft flange nuts	60 lb. ft. (8·3 kg. m.) (and align to next split pin hole)
Nut, driving flange to differential	90 lb. ft. (12·3 kg. m.).
End cover bolts (differential housing)	18 lb. ft. (2·5 kg. m.).

Suspension and steering

Steering lever to hub bolts	35 lb. ft. (4·8 kg. m.).
Steering lever ball joint nut	25 lb. ft. (3·45 kg. m.).
Steering knuckle ball pin bottom nut	35 to 40 lb. ft. (4·8 to 5·5 kg. m.).
Steering knuckle ball pin top nut	35 to 40 lb. ft. (4·8 to 5·5 kg. m.).
Steering knuckle ball pin housing	70 lb. ft. (9·6 kg. m.).
Front hub nut (drive shaft)	60 lb. ft. (8·3 kg. m.).
Rear suspension stub axle nut	60 lb. ft. (8·3 kg. m.). (align to next slot).
Front suspension upper arm pivot pin nut	26 to 28 lb. ft. (3·6 to 3·87 kg. m.).
Steering-wheel nut	41 lb. ft. (5·76 kg. m.).
Road wheel nuts	37·5 to 39·5 lb. ft. (5·2 to 5·5 kg. m.).

FUEL SYSTEM

Carburetter

Make and type	S.U. Type HS2.
Diameter	1¼ in. (31·75 mm.).
Jet	·090 in. (2·29 mm.).
Needle	Standard EB. Rich M. Weak G.G.

AIR CLEANER

Type	Paper element.

FUEL PUMP

Make and type	S.U. electric. PD.
Delivery rate	45 pints/hr. (25·5 litres/hr.).
Delivery pressure	2 to 3 lb./sq. in. (·14 to ·21 kg./cm.²).

COOLING SYSTEM

Type	Pressurized radiator, thermo-siphon, pump- and fan-assisted.
Thermostat setting	72° C. (162° F.).

IGNITION SYSTEM

Sparking plugs	Champion N5.
Size	14 mm.
Plug gap	·025 in. (·625 mm.).
Coil	LA12.
Distributor	DM2.
Distributor contact points gap	·014 to ·016 in. (·36 to ·40 mm.).
Timing	See Section B.7.

CLUTCH

Make and type	B.M.C. single dry plate.
Diameter	7·125 in. (180·9 mm.).
Facing material	Wound yarn.
Pressure springs	6.
Colour	Red spot.
Damper springs	Nil.

GEARBOX

Number of forward speeds	4.
Synchromesh	Second, third, and fourth gears.
Ratios: Top	1·0 : 1.
Third	1·412 : 1.
Second	2·172 : 1.
First	3·627 : 1.
Reverse	3·627 : 1.
Overall ratios: Top	3·765 : 1.
Third	5·317 : 1.
Second	8·176 : 1.
First	13·657 : 1.
Reverse	13·657 : 1.
Speedometer gear ratio	6/17.

STEERING

Type	Rack and pinion.
Steering-wheel turns—lock to lock	2⅛.
Steering-wheel diameter	15½ in. (39·4 cm.).
Camber angle	1° positive to 3° positive.
Castor angle	3°.
King pin inclination	9° 30′.
Toe-out	1/16 in. (1·59 mm.).

FRONT SUSPENSION

Type	Rubber cone spring.

REAR SUSPENSION

Type	Rubber cone spring.
Toe-in	⅛ in. (3·18 mm.).
Camber	1° positive.
Radius arm bushes (reamed bore)	·8125 to ·8130 in. (20·63 to 20·65 mm.).

HYDRAULIC DAMPERS

Type: Front and rear	Tubular telescopic.

DRIVE SHAFTS

Type	Solid shaft, reverse spline.
Make and type of joint	Hardy Spicer. Hemispherical joint.

DIFFERENTIAL

Ratio	3·765 : 1.

ELECTRICAL EQUIPMENT

System	12-volt, positive earth.
Charging system	Compensated voltage control.
Battery	Lucas BLT7A, BLTZ7A, BT7A, BTZ7A.
Capacity : BLT7A, BLTZ7A	34 amp.-hr. at 20-hr. rate.
BT7A, BTZ7A	43 amp.-hr. at 20-hr. rate.
Starter motor	Lucas M35H.
Dynamo	Lucas C40.
Control box	Lucas RB106/2.
Cut-out: Cut-in voltage	12·7 to 13·3.
Drop-off voltage	8·5 to 11·0.
Reverse current	5·0 amps. (max.).
Regulator (at 1,500 r.p.m. dynamo speed):	
Open-circuit setting at 68° F. (20° C.)	15·4 to 16·4 volts.

For ambient temperatures other than 68° F. (20° C.) the following allowances should be made to the above setting:
For every 18° F. (10° C.) above 68° F. (20° C.) subtract ·1 volt.
For every 18° F. (10° C.) below 68° F. (20° C.) add ·1 volt.

BRAKES

Type	Lockheed hydraulic, single leading shoe.
Drum size	7 in. (17·8 cm.) diameter.
Lining dimensions: Front and rear	6·25 in. × 1·25 in. (15·87 cm. × 3·17 cm.).
Lining area: Front and rear	33·75 sq. in. (21·77 cm.²).
Lining material	M32.

WHEELS

Type: Ventilated disc	3·50B × 10.

TYRES

Size	5·20—10.
Tyre pressures:	
Normal: Front	24 lb./sq. in. (1·7 kg./cm.²).
Rear	22 lb./sq. in. (1·55 kg./cm.²).
Fully loaded: Front and rear	24 lb./sq. in. (1·7 kg./cm.²).

CAPACITIES

Transmission casing (including filter)	8½ pints (10·2 U.S. pints, 4·83 litres).
Cooling system	5¼ pints (6·3 U.S. pints, 3 litres).
Fuel tank: Saloon	5½ gallons (6·6 U.S. gallons, 25 litres).
Van	6 gallons (7·2 U.S. gallons, 27·3 litres).
Traveller	6½ gallons (7·8 U.S. gallons, 29·6 litres).

GENERAL DIMENSIONS

Wheelbase: Saloon	6 ft. 8 $\frac{5}{32}$ in. (2·036 m.).
Van and Traveller	7 ft. 0 $\frac{5}{32}$ in. (2·138 m.).
Overall length: Saloon	10 ft. 0¼ in. (3·05 m.).
Van	10 ft. 9⅞ in. (3·259 m.).
Traveller	10 ft. 9⅞ in. (3·259 m.).
Overall width	4 ft. 7½ in. (1·41 m.).
Overall height: Saloon	4 ft. 5 in. (1·35 m.).
Van	4 ft. 6½ in. (1·38 m.).
Traveller	4 ft. 5½ in. (1·36 m.).
Ground clearance	6⅜ in. (16·2 cm.).
Turning circle: Saloon	31 ft. (9·45 m.).
Van and Traveller	32 ft. 9 in. (9·983 m.).
Track: Front	47 $\frac{7}{16}$ in. (1·205 m.).
Rear	45⅞ in. (1·164 m.).
Kerbside weight: Saloon	1,294 lb. (587 kg.).
Van	1,334 lb. (605 kg.) approx.
Traveller	1,456 lb. (660 kg.) approx.

WEIGHTS OF COMPONENTS

Engine and transmission assembly	333 lb. (151 kg.)

GENERAL INFORMATION

CONTROLS, SWITCHES, AND INSTRUMENTS

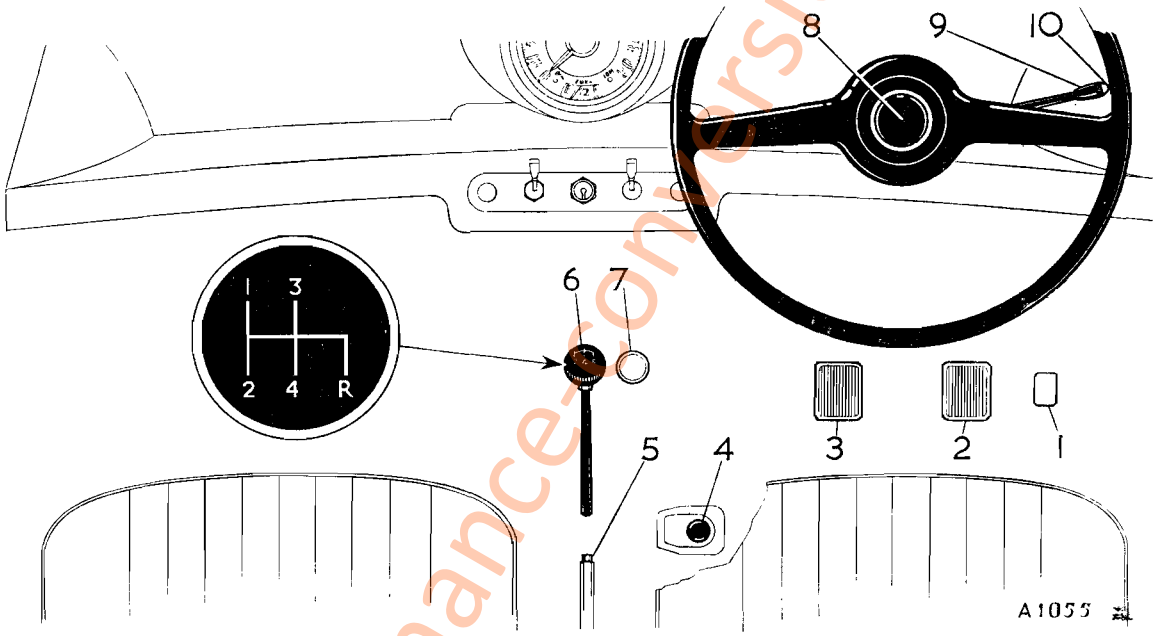
Gear lever

The gear lever is centrally situated and comes readily to hand. First and second gears are selected by moving the lever to the left, and engaged by moving it forwards for first gear or backwards for second gear. Third and fourth gears are selected by moving the lever to the right through the neutral position till resistance is felt, then forwards for third gear and backwards for fourth gear.

To engage the reverse gear move the lever to the right in the neutral position until resistance is felt, continue moving the lever to the right against the spring pressure until the stop is reached, and then move it rearwards to engage the gear.

Pedal controls

The pedal controls are arranged in the orthodox positions—namely, the clutch pedal, brake pedal, and accelerator, reading from left to right. Do not drive with your foot resting on the clutch pedal. It is a bad practice which leads to rapid clutch wear.



The controls

1. Accelerator pedal.
2. Brake pedal.
3. Clutch pedal.
4. Starter switch.
5. Hand brake.
6. Gear lever.
7. Headlamp dip switch.
8. Horn-push.
9. Direction indicator.
10. Direction indicator warning light.

Hand brake

Pulling the lever upwards operates the rear wheel brake-shoes mechanically. Brake release is achieved by pulling on the lever to take the load and then pressing on the ratchet release with the thumb before pushing the handle downwards into the 'off' position.

Ignition switch

The ignition switch is located in the control panel and is operated by a removable key, which also serves to lock the driver's door and the boot lid.

Never let the switch remain in the 'on' position when the engine is not running.

Ignition warning light

The ignition warning light positioned in the speedometer on the right-hand side glows red when the ignition is switched on and will go out when the dynamo is charging adequately. It may glow when the engine is idling, but no harm will be done so long as the engine is running.

On no account must it be allowed to glow for more than a few moments with the car and engine stationary. Switch off the ignition immediately.

Choke or mixture control

To enrich the mixture and to assist starting when the engine is cold pull out the control knob marked 'C' positioned on the right of the control panel. The control will hold in any position, giving a progressively richer mixture as the control is pulled out.

On no account should the engine be run for any length of time with the knob pulled fully out. It should be returned to the 'off' position (pushed in) as soon as possible as the engine warms up. A little practice will soon familiarize the driver with the correct use of this control.

Starter switch

The starter switch is controlled by the circular black knob positioned on the floor just forward of the driver's seat.

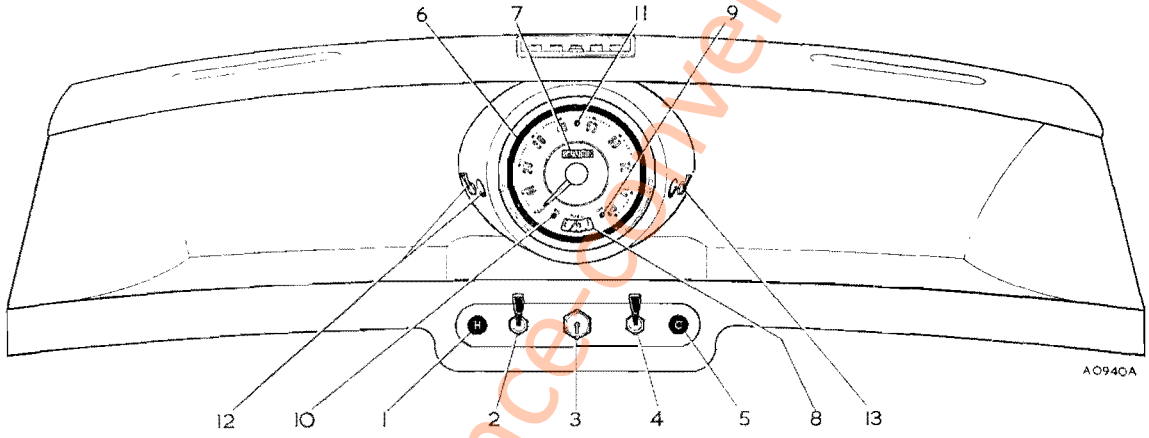
Push the knob downwards to operate the starter and release it smartly immediately the engine fires. Should the engine fail to start, wait until it comes to rest before operating the starter again.

Do not run the battery down by keeping the starter on when the engine will not start.

Headlamps and sidelamps switch

The headlamps and sidelamps switch is positioned to the right of the ignition switch on the control panel.

The sidelamps, tail lamps, and instrument lamp are all brought into operation when the switch is moved downwards to the central position. Further downward movement of the switch to the lower position will bring the headlamps into operation.



The instruments and controls

1. Heater switch.
2. Wiper switch.
3. Ignition switch.
4. Lamp switch.
5. Choke control.
6. Speedometer.
7. Total distance recorder.
8. Fuel gauge.
9. Ignition warning lamp.
10. Oil pressure warning lamp.
11. Headlamp main beam warning lamp.
12. Parcel shelf lamp and switch (instrument light—L.H.D. models).
13. Instrument light switch (parcel shelf lamp—L.H.D. models).

Headlamp beam dipping switch and warning lamp

The headlamp beam dipping switch is situated in the centre of the toeboard and is foot-operated.

It is of the single-acting repeating type, dipping the lamp beams on one depression and raising the beams on the next depression.

A warning lamp at the top of the instrument dial will glow red (or blue [export]) when the headlamp beams are in the raised position.

Windshield wiper switch

The windshield wiper switch is positioned on the left of the ignition switch. Move the switch downwards to operate the wipers, which will function only if the ignition switch is on. Park the blades by switching off at the end of the stroke when the blades are in the required position.

Horn switch

The horn is operated by pressing the central disc of the steering-wheel.

Flashing direction indicators

The flashing direction indicators are operated (when the ignition is switched on) by a lever switch fitted on the right-hand side of the steering-column.

On R.H.D. models the switch lever is moved upwards to operate the left-hand flashing indicators and downwards to operate the right-hand flashing indicators. On L.H.D. models upward movement will operate the right-hand flashing indicators and downward movement the left-hand indicators.

A warning lamp in the end of the switch lever will light up when either indicators are flashing.

Speedometer

In addition to showing the car speed, the speedometer has a total mileage recorder.

Fuel gauge, oil pressure

The fuel level gauge is clearly marked and is incorporated in the combined central instrument dial.

To the left of the fuel gauge is an oil pressure warning lamp which lights up when the ignition is switched on prior to starting the engine. The lamp should go out once the engine is running, but should it not do so under normal running conditions the oil level in the engine sump should be checked and replenished as necessary.

If the lamp continues to glow stop the engine immediately and have the lubrication system checked.

Heater (optional equipment)

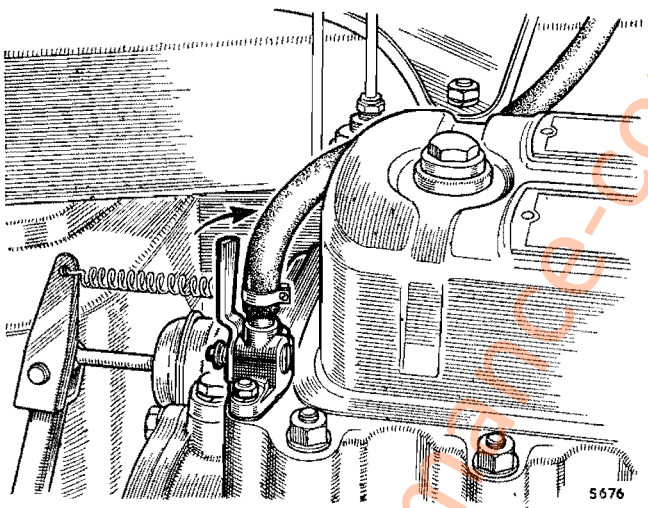
The heater is of the air-recirculating type, which is provided with hot water from the engine cooling system and is equipped with an air-circulating fan.

The operation of the heater is quite simple, there being only two controls:

(1) A rheostat switch on the left of the control panel.

(2) A control valve on the rear of the cylinder head which closes the water circulation.

The blower motor will only operate when the ignition is switched on. The first few degrees of movement of the switch will operate the motor at maximum speed. Further turning of the switch knob will gradually reduce the speed of the fan to regulate the heating of the car interior. The hinged flap on the front of the heater must be opened to obtain the maximum delivery of air at knee level and closed for the maximum delivery to the windshield for demisting.



The hot water control valve, located on the rear of the cylinder head. Push the lever in the direction of the arrow to restrict the water flow to the heater radiator

The valve on the engine is intended to be closed in hot weather when heating inside the car is not required. The circulating fan may be used to circulate the air in the car in hot weather, although it is primarily intended to circulate warmed air in cold weather and provide a current of hot air onto the windshield for demisting.

It must be appreciated that the heater unit is not necessarily cold when the circulation valve is shut off as a certain amount of heat is still transferred by conduction. The blower only circulates the interior air and is not a means of introducing fresh air into the vehicle.

See **'Frost precautions'** on page General Information 7.

Door locks

The passenger door may be locked from the inside by lifting up the small safety catch on the front of the door lock.

The driver's door is locked from the outside by means of the ignition key.

Windows

The front or rear glass of either door may be partially opened by depressing the locking plunger and sliding the glass to the desired position. The locking plunger will secure the glass in a number of positions, providing a variation of openings.

Luggage boot

Turn the handle in an anti-clockwise direction to open the boot lid. To close, shut the lid and turn the handle clockwise.

The boot lid can be locked in the closed position with the ignition key.

Bonnet lock

The bonnet is released by inserting a finger in the centre top louvre of the radiator shell and moving the release lever towards the right-hand side of the car. The bonnet will still be held by the safety catch which is located beneath the bonnet on the left-hand side; push the safety catch inwards and raise the bonnet, which may be held in the open position by a prop secured in a rubber clip on the right-hand side. Detach the prop from the clip and secure the end in the support bracket on the right-hand valance.

To close, raise the bonnet, stow the prop in the clip, and then lower the bonnet to engage the safety catch. Apply double-hand pressure to press the bonnet down into the fully closed position. The safety catch and bonnet lock will be heard to engage.

Seat adjustment

The driver's seat is adjustable and is secured in position by a spring-loaded lever which extends beyond the front of the seat. Move the lever to the left to release the seat for adjustment and move the seat either forwards or rearwards as required. When the lever is released it automatically engages its stop to lock the seat in position.

Both the driver's and passenger's seat on the De-luxe models are adjustable.

Spare wheel (Saloon)

The spare wheel is stowed on the floor of the luggage boot and is secured by a clamp plate which may be released by unscrewing the clamp bolt.

Spare wheel (Van)

The spare wheel is carried beneath the van body floor, and is accessible when the left-hand seat is pulled forward. The wheel is secured in position by a clamp plate and a screwed locating pin; screw the pin anti-clockwise to release the clamp.

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 stud 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.

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)	$\frac{1}{4}$"	$\frac{5}{16}$"	$\frac{3}{8}$"	$\frac{7}{16}$"	$\frac{1}{2}$"	$\frac{9}{16}$"	$\frac{5}{8}$"	$\frac{3}{4}$"	$\frac{7}{8}$"	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	·994	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**	—

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 table.

CAR NUMBER IDENTIFICATION CODE

The car number symbol consists of three letters and one figure followed by a fifth prefix letter (L) if the vehicle is left-hand drive and then by the serial number of the vehicle.

The first letter when related to the code provides an indication of the make of the vehicle—Austin, etc.

The second letter provides an indication of the model's cubic capacity.

The third letter indicates the type of body—4-door Saloon, etc.

The first figure indicates the series of model—1, 2, etc.

1st Prefix Letter—Name

A—Austin	M—Morris		
G—M.G.	R—Riley		
H—Healey	W—Wolseley		

2nd Prefix Letter—Model (cubic capacity)

A—800–999 c.c.	G—1000–1399 c.c.		
B—2000–2999 c.c.	H—1400–1999 c.c.		
D—3000–3999 c.c.	L—Up to 799 c.c.		

3rd Prefix Letter—Body type

A—Ambulance	J—Convertible	P—Hard-top	T—4-seat Tourer
C—Chassis	K—Truck	Q—Chassis and Cab	U—Pick-up
D—Coupé	L—Hire Car	R—Chassis and Scuttle	V—Van
E—G.P.O. Engineers	M—Limousine	S—4-door Saloon	W—Dual-purpose
G—G.P.O. Mail	N—2-seat Tourer	2S—2-door Saloon	X—Taxi
H—Hearse			

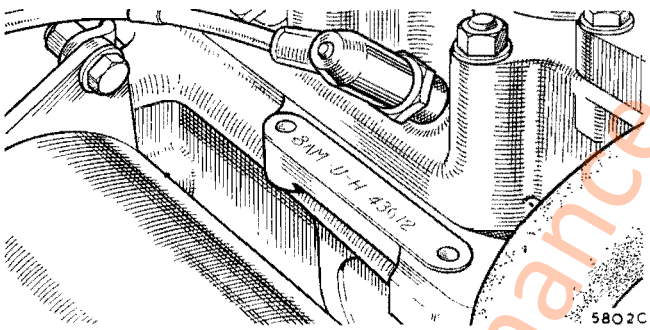
4th Prefix—Series of model (1, 2, etc., used to record a major change).

5th Prefix (used when vehicles differ from standard R.H.D.): L—Left-hand drive.

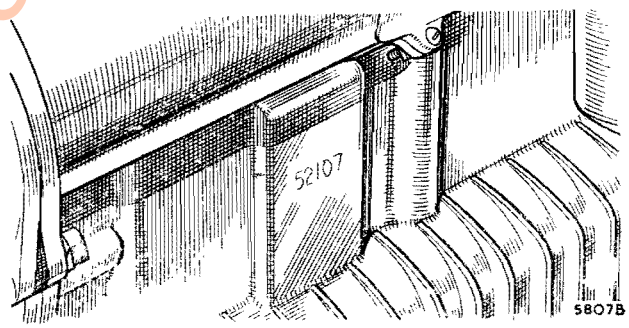
Code Example: MA2S4 1001.

LOCATION OF CAR AND ENGINE NUMBERS

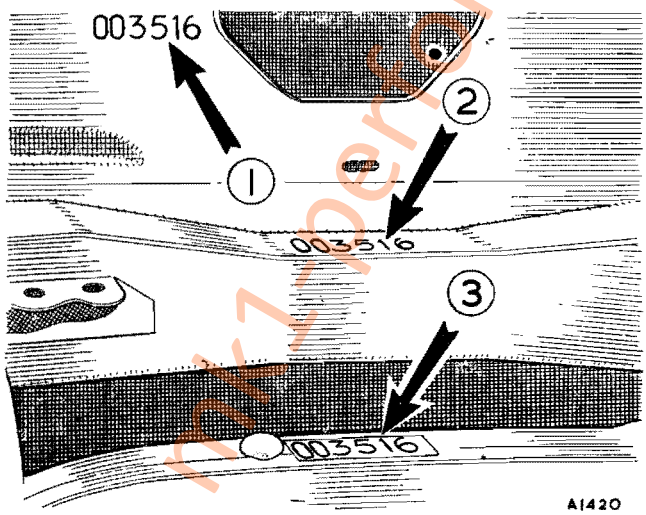
The car and engine numbers must always be quoted in communications between the customer and Dealer and the Dealer and the Company. The registration number is of no assistance and is not required.



Engine Number. This is stamped on a plate secured to the right-hand side of the cylinder block above the oil filter

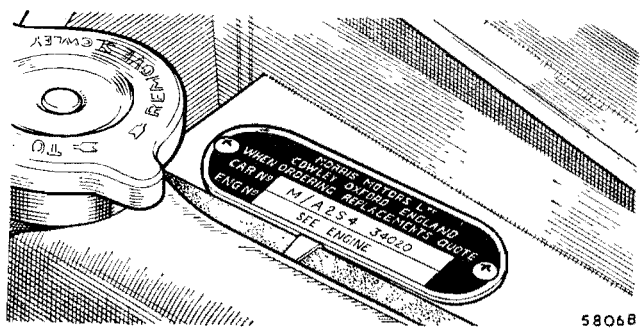


Transmission Assembly. This number is stamped on a facing provided on the front wall of the casing just below the starter motor



Body Number. This is stamped in one of three positions:

1. Dash panel (upper). 2. Dash cross-member.
3. Grille panel stiffener.



Car (Chassis) Number. This is stamped on a plate secured between the radiator and the wing valance

POWER UNIT SERIAL NUMBER CODING

The engine number on later models comprises a series of letters and numbers, presenting in code the capacity, make, and type of unit, gearbox and ancillaries fitted, and the compression rating 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.

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

1st Prefix letter A–Z
- A—Austin
- B—B.M.C. Industrials
- G—M.G.
- H—Miscellaneous special
- J—Commercial
- M—Morris
- R—Riley
- W—Wolseley

2nd Prefix Group—Gearbox and ancillaries

- A—Automatic gearbox
- M—Manumatic clutch
- N—Steering-column gear change gearbox
- O—Overdrive (Borg-Warner)
- P—Police specification
- U—Centre or side gear change gearbox

3rd Group—Compression and serial number

H—High compression / L—Low compression } and serial number of unit

Code Example

8AM–U–H1234

- 1234 — Serial Number
- H — High Compression
- U — Centre Gear Change Gearbox
- 8AM — 850 c.c. Morris Mini-Minor

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.

PRESERVATIVE ON EXPORT CARS

To remove the hard film preservative from the external plated parts a cloth dipped in a solution of equal parts of white spirit and fuel should be used. Take care to keep this solvent from anything other than the plated components.

COOLING SYSTEM

A pressurized cooling system is used on this vehicle and the pressure must be released gradually when removing the radiator filler cap while the system is hot. It is advisable to protect the hands against escaping steam and then turn the cap slowly anti-clockwise until the resistance of the safety stop is felt. Leave the cap in this position until all pressure is released. Press the cap downwards against the spring to clear the safety stops and continue turning until it can be lifted off.

Frost precautions

Water, when it freezes, expands, and if precautions are not taken there is considerable risk of bursting the radiator, cylinder block, or heater (where fitted). Such damage may be avoided by draining the cooling system when the vehicle is left for any length of time in frosty weather, or by adding anti-freeze to the water. When a heater is fitted anti-freeze **must** be used as no provision is made for draining the unit.

Before adding anti-freeze mixture the cooling system must be drained and flushed through by inserting a hose in the filling orifice and allowing water to flow through until clean. The taps should be closed after allowing all the water to drain away and the anti-freeze should be poured in first, followed by the water.

The cooling system is of the sealed type and relatively high temperatures are developed in the radiator header 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 a consequent interruption of circulation.

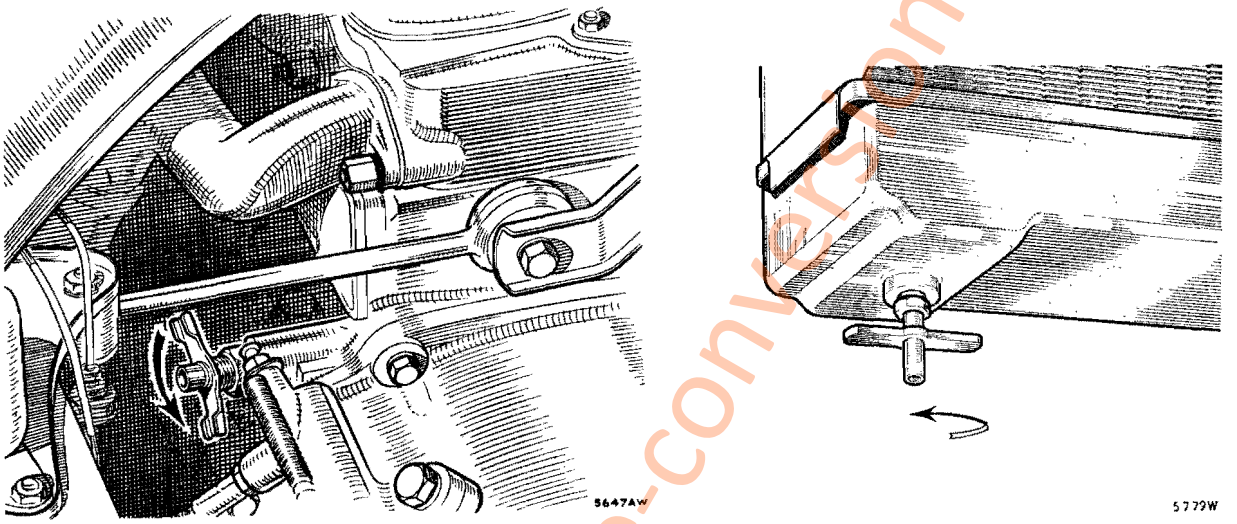
Only anti-freeze of the ethylene glycol type incorporating the correct type of corrosion inhibitor is suitable and owners are recommended to use Bluecol, Shell, or Esso Anti-freeze. We also approve the use of any anti-freeze which conforms to Specification B.S.3151 or B.S.3152.

Do not use radiator anti-freeze solution in the windshield-washing equipment (where fitted).

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

Down to	*Down to*
7° *F.* (−14° *C.*)	0° *F.* (−18° *C.*)
15% solution	20% solution
Quantity ¾ pint (·43 litre)	Quantity 1 pint (·57 litre)

Where temperatures below 0° F. (−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 the makers on this matter.



The cylinder block and radiator drain taps; turn in the direction of the arrows to open

Draining the cooling system

Two drain taps are provided for draining the cooling system: one is at the base of the radiator and the other is at the rear of the cylinder block on the left-hand side. Both taps are accessible from under the bonnet and both must be opened and the filler cap removed to drain the cooling system completely. If the system contains anti-freeze remember to collect it in a clean container for future use.

Filling the cooling system

To avoid wastage by overflow add only sufficient coolant to bring the surface to the level indicator positioned inside the header tank below the filler neck.

RUNNING-IN SPEED

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

During the first 500 miles (800 km.)

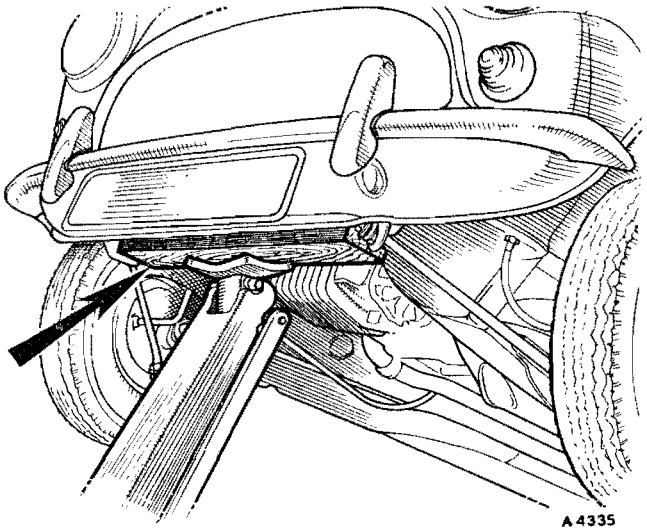
DO NOT exceed 45 m.p.h. (72 km.p.h.).
DO NOT operate at full throttle in any gear.
DO NOT allow the engine to labour in any gear.

AIR CLEANER

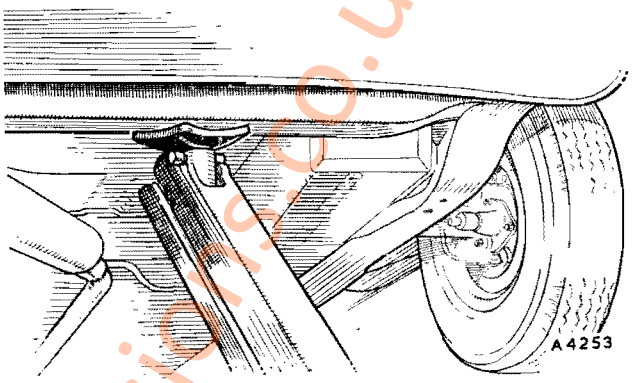
To obviate the possibility of the carburetter icing up when operating the vehicle under cold and winter conditions the air cleaner intake should be positioned adjacent to the exhaust manifold. During warmer weather it is advisable to move the intake away from the manifold.

JACKING

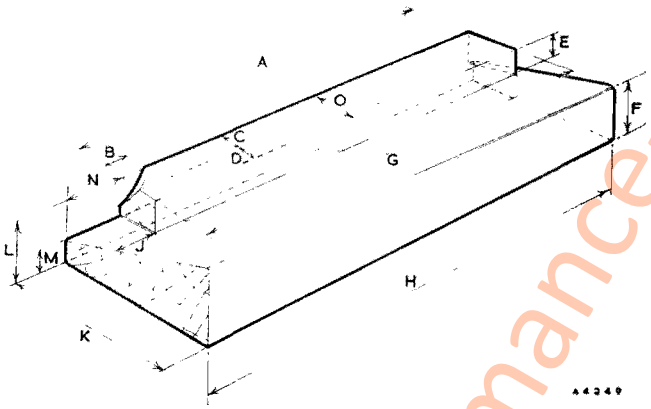
The following illustrations show the recommended jacking points to be used on both the front and rear sub-frames when using the normal workshop jacking and lifting equipment.



Lift the front end of the car with the jack positioned under the centre of the front cross-member and with a specially shaped wooden block interposed between the jack pad and the cross-member

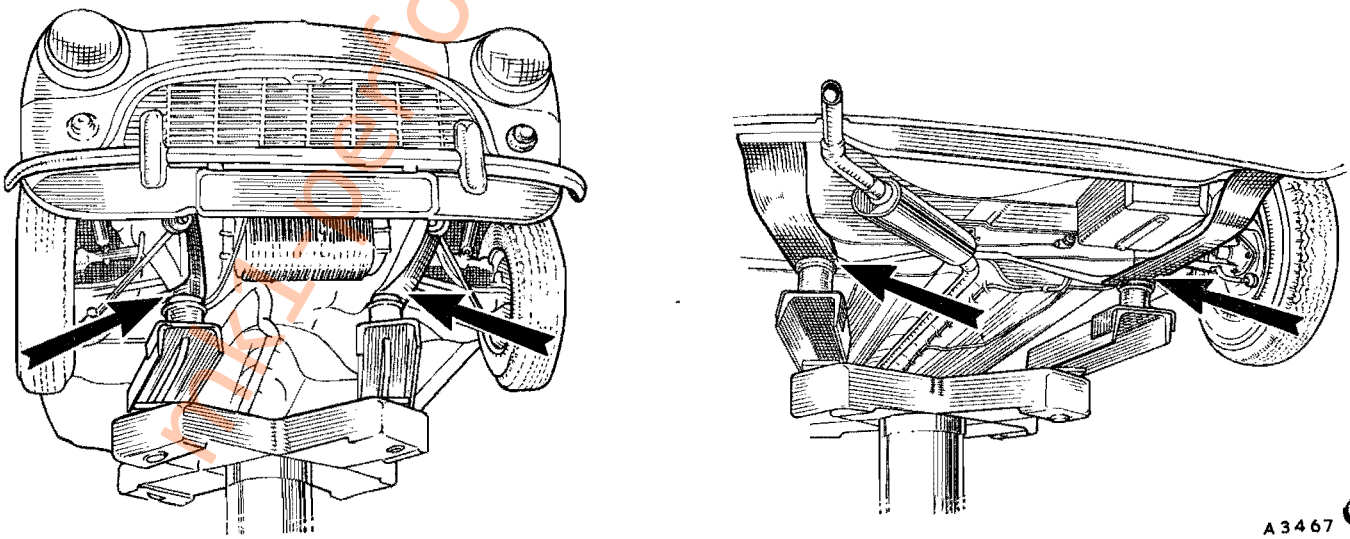


Lift the rear of the car with the jack pad positioned under the centre of the rear frame cross-member. Models with the fuel tank fitted beneath the rear floor will have the cross-member forward of the fuel tank



The specially shaped wood block should be made up to the following dimensions

A. 18 $\frac{3}{16}$ in. (46·12 cm.).	H. 21 $\frac{3}{16}$ in. (53·8 cm.).
B. 1$\frac{1}{2}$ in. (3·8 cm.).	J. 1 in. (2·5 cm.).
C. $\frac{3}{4}$ in. (1·9 cm.).	K. 4 in. (10·1 cm.).
D. $\frac{3}{4}$ in. (1·9 cm.).	L. 2 $\frac{5}{16}$ in. (5·8 cm.).
E. $\frac{7}{8}$ in. (2·2 cm.).	M. $\frac{5}{8}$ in. (1·5 cm.).
F. 2 $\frac{5}{16}$ in. (5·8 cm.).	N. 1 $\frac{5}{16}$ in. (3·0 cm.).
G. 19 $\frac{5}{16}$ in. (48·74 cm.).	O. 1$\frac{5}{8}$ in. (4·12 cm.).



When lifting the complete vehicle with the weight taken off the road wheels always place the supports beneath the sub-frame in the positions shown

MAINTENANCE ATTENTION

500 MILES (800 Km.) FREE SERVICE ATTENTION

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 Morris Dealer from whom you purchased it, or, if this should not be convenient, by any other Morris 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 valve rocker shaft brackets to recommended pressures.
   Check valve rocker clearances, and reset if necessary.
   Tighten fan belt if necessary.
   Check all water connections, and tighten clips if necessary.
   Examine and clean carburetter, and reset slow-running adjustment if necessary.
2. *Ignition*
   Examine, and adjust if necessary, sparking plugs and distributor points.
   Check working of automatic ignition controls and, if necessary, reset ignition timing.
3. *Clutch*
   Check clutch pedal free travel, and adjust if necessary.
   Check level of fluid in the hydraulic clutch supply tank, 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 level of fluid in the hydraulic brake supply tank, and top up if necessary.
6. *Hydraulic dampers*
   Inspect hydraulic dampers for leaks.
   Check mounting nuts for tightness.
7. *Body*
   Check doors for ease in opening and closing. If necessary, lightly smear all dovetails and striking plates with a suitable lubricating agent.
8. *Electrical*
   Check electrical system functionally.
   Examine battery and top up to correct level with distilled water as may be required.
   Clean and tighten terminals.
9. *General*
   Check tightness of all nuts and bolts on universal joints, suspension, etc.
10. *Lubrication*
    Change oil in engine and transmission casing and wipe magnetic drain plug.
    Oil and grease all points of the vehicle.
11. *Wheels and tyres*
    Check tyre pressures.
    Check tightness of wheel nuts.

Regular servicing, as proven 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

PERIODICAL

Daily

Check oil level in engine and transmission casing. Top up if necessary.
Check water level in radiator. Top up if necessary.

Weekly

Test tyre pressures, and regulate if necessary.

1,000 miles (1600 km.) service

1. *Engine*
   Top up carburetter piston damper.
   Lubricate carburetter controls.
   Top up radiator.
2. *Clutch*
   Check level of fluid in the hydraulic clutch supply tank, and top up if necessary.
3. *Brakes*
   Check brake pedal travel and report if adjustment is required.
   Make visual inspection of brake lines and pipes.
   Check level of fluid in the hydraulic brake supply tank, and top up if necessary.
4. *Hydraulic dampers*
   Examine all hydraulic dampers for leaks.
5. *Electrical*
   Check battery cell specific gravity readings and top up to correct level.

1,000 miles (1600 km.) service—*continued*

6. *Lubrication*
   Top up oil level in engine and transmission casing.
   Lubricate all grease nipples.
   Grease hand brake cable guide channels.

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,** with the following addition:

1. *Wheels and tyres*
   Change road wheels round diagonally, including spare, to regularize tyre wear.

3,000 miles (4800 km.) service

1. *Engine*
   Top up carburetter piston damper.
   Lubricate carburetter controls.
   Top up radiator.
   Check dynamo drive belt tension.
   Clean and adjust sparking plugs.

2. *Clutch*
   Check level of fluid in the hydraulic clutch supply tank, and top up if necessary.
   Check clearance at return stop, and adjust if necessary.

3. *Brakes*
   Check brakes, and adjust if necessary.
   Make visual inspection of brake lines and pipes.
   Check level of fluid in the hydraulic brake supply tank, and top up if necessary.

4. *Hydraulic dampers*
   Examine all hydraulic dampers for leaks.

5. *Body*
   Lubricate door hinges, door locks, bonnet lock operating mechanism and safety catch.

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

7. *Lubrication*
   Change oil in engine and transmission casing and wipe magnetic drain plug.
   Lubricate all grease nipples.

8. *Wheels and tyres*
   Check tyre pressures.

4,000 miles (6400 km.) service

Carry out the **1,000 miles (1600 km.) service,** with the following addition:

1. *Wheels and tyres*
   Change road wheels round diagonally, including spare, to regularize tyre wear.

5,000 miles (8000 km.) service

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

6,000 miles (9600 km.) service

1. *Engine*
   Top up carburetter piston damper.
   Lubricate carburetter controls.
   Top up radiator.
   Check dynamo drive belt tension.
   Lubricate water pump sparingly.
   Check valve rocker clearances, and adjust if necessary.

2. *Ignition*
   Check automatic ignition control, lubricating drive shaft, cam, and advance mechanism.
   Check, and adjust if necessary, distributor contact points.
   Clean and adjust sparking plugs.

3. *Clutch*
   Check level of fluid in the hydraulic clutch supply tank, and top up if necessary.
   Check clearance at return stop, and adjust if necessary.

4. *Brakes*
   Check brakes, and adjust if necessary.
   Make visual inspection of brake lines and pipes.
   Check level of fluid in the hydraulic brake supply tank, and top up if necessary.

5. *Hydraulic dampers*
   Examine all hydraulic dampers for leaks.
   Check mounting nuts for tightness.

6. *General*
   Check tightness of all nuts and bolts on universal joints and suspension, etc.

7. *Body*
   Check and, if necessary, tighten door hinges and striker plate securing screws.
   Lubricate door hinges, door locks, bonnet lock operating mechanism and safety catch.

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

6,000 miles (9600 km.) service—*continued*

9. *Lubrication*
   Change oil in engine and transmission casing and wipe magnetic drain plug.
   Fit new oil filter element.
   Lubricate all grease nipples.
   Repack rear hubs with grease.
   Grease hand brake cable guide channels.

10. *Wheels and tyres*
    Change round road wheels diagonally, including spare, to regularize tyre wear.
    Check tyre pressures.
    Check wheel alignment.

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,** with the following addition:

1. *Wheels and tyres*
   Change road wheels round diagonally, including spare, to regularize tyre wear.

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,** with the following addition:

1. *Wheels and tyres*
   Change road wheels round diagonally, including spare, to regularize tyre wear.

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 chamber and piston, clean, reassemble, and top up.
   Remove carburetter float-chamber, empty sediment, and refit.
   Lubricate carburetter controls.
   Check valve rocker clearances, and adjust if necessary.
   Check dynamo drive belt tension.
   Lubricate water pump sparingly.
   Fit new air cleaner element (dry type).

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

3. *Clutch*
   Check level of fluid in the hydraulic clutch supply tank, and top up if necessary.
   Check clearance at return stop, and adjust if necessary.

4. *Steering*
   Check steering and suspension moving parts for wear.

5. *Brakes*
   Check brakes, and adjust if necessary.
   Make visual inspection of brake lines and pipes.
   Check level of fluid in the hydraulic brake supply tank, and top up if necessary.

6. *Hydraulic dampers*
   Examine all hydraulic dampers for leaks.

7. *Radiator*
   Drain, flush out, and refill radiator.

8. *General*
   Check tightness of all nuts and bolts on universal joints, hydraulic dampers, and suspension.

9. *Body*
   Check, and tighten if necessary, door hinges and striker plate securing screws.
   Lubricate door hinges, door locks, bonnet lock operating mechanism and safety catch.

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

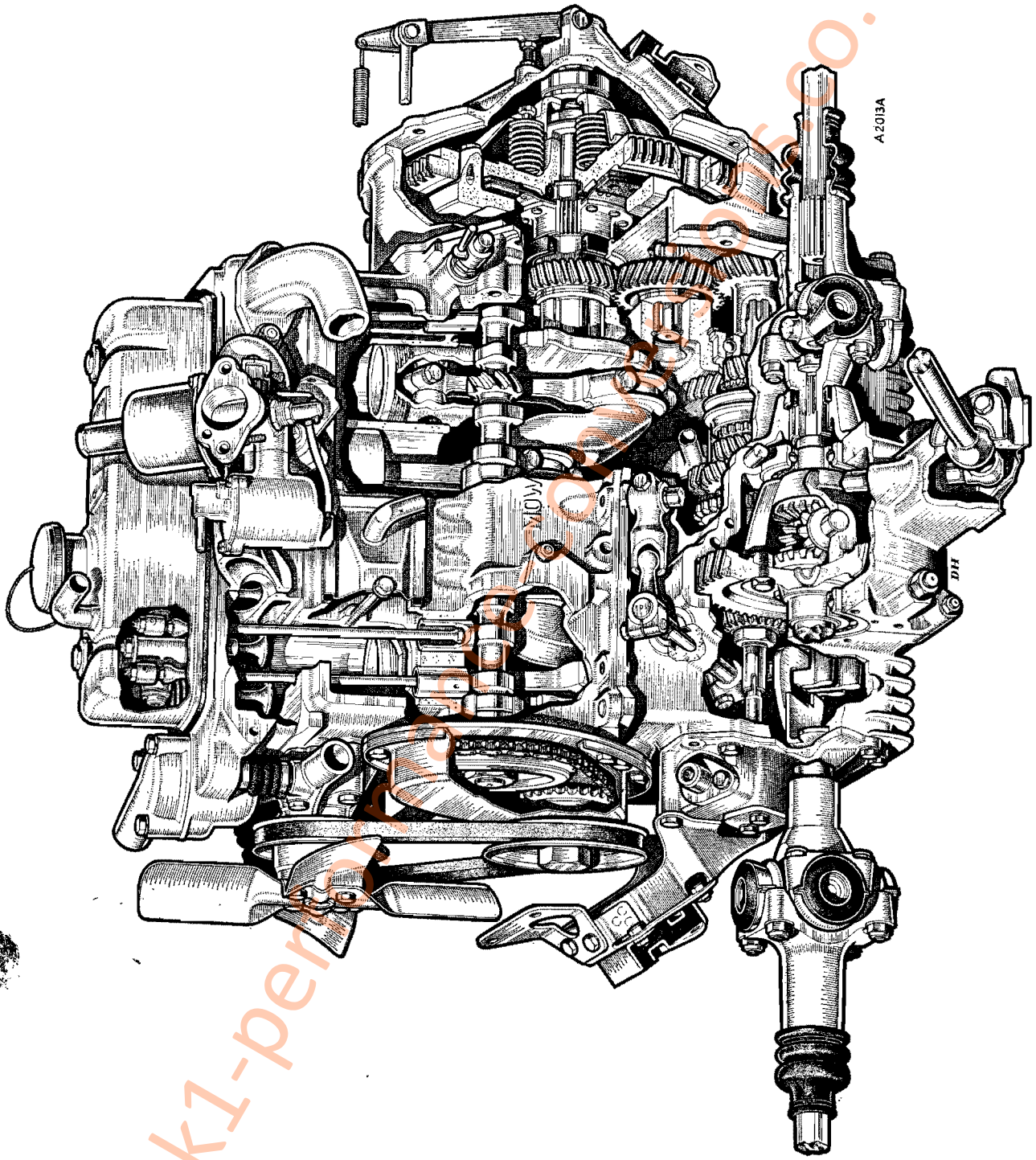
11. *Lubrication*
    Drain oil in engine and transmission casing, wipe magnetic drain plug, and refill with engine oil.
    Fit new oil filter element.
    Lubricate speedometer drive cable.
    Lubricate all grease nipples.
    Repack rear hub caps with grease.
    Grease hand brake cable guide channels.

12. *Wheels and tyres*
    Change road wheels round diagonally, including spare, to regularize tyre wear.
    Check tyre pressures.
    Check wheel alignment.

13. *Headlamps*
    Check beam setting, and adjust if necessary.

SECTION A

THE ENGINE



GENERAL DESCRIPTION

The overhead-valve engine is of unit construction with one reverse and four forward gears, assembled into a combined transmission casing and oil sump below the engine crankcase. The unit is transversely mounted on flexible rubber mountings with the mainshaft in constant mesh with a differential assembly mounted on the side of the transmission casing. Drive is transmitted from the differential by short driving shafts to each of the front wheel hubs.

Engine valves are set in line in the left-hand side of the cylinder head. Oil seals are fitted to the valve stems and there is normal provision on the valve rockers for clearance adjustment.

The camshaft is roller-chain-driven from the crankshaft, with synthetic rubber chain tensioners. At the timing gear end the camshaft has a steel-backed white-metal bearing, the other two journals running direct in the crankcase. Both the oil pump and the distributor are driven from the camshaft by a transverse shaft with helical gear drive.

Pistons are of the split-skirt type with two compression rings and one slotted oil control ring. The gudgeon pins are clamped to the connecting rods, which have renewable steel-backed big-end bearings with lead-indium or lead-tin-plated surfaces.

Owing to the ease with which the front sub-frame can be removed, it is preferable to withdraw the sub-frame complete with the engine from the vehicle for any major attention.

The engine can, however, be removed from the vehicle through the bonnet aperture, provided facilities are available for an operator to work beneath the front of the vehicle.

LUBRICATING SYSTEM

The oil supply for the engine, gears, and differential is carried in the transmission case below the crankcase, and is replenished through a filler aperture in the valve rocker cover.

Oil is drawn from the base of the transmission casing by a rotary pump mounted on the rear end of the crankcase and delivered to a full-flow external oil filter, passing on through drilled passages to the main, big-end, and camshaft bearings. Jet holes in the connecting rods deliver oil quickly to the cylinder walls, and the overhead rocker gear is provided with oil at reduced pressure via the camshaft front bearing.

The tappets are lubricated by oil returning from the rocker gear by way of the push-rod apertures and by splash.

An oil pressure warning light in the instrument panel is operated by a switch situated at the rear end of the main oil gallery. A vent pipe in the tappet cover and a breather in the rocker cover are connected with the air filter.

Section A.1

DRAINING THE TRANSMISSION CASING

The transmission casing on new and reconditioned engines must be drained and filled with new oil after the first 500 miles (800 km.) and then at intervals of every 3,000 miles (4800 km.). The drain plug is at the rear end of the casing on the right-hand side. Draining is preferable when the engine is hot as the oil will flow more readily in this condition; allow at least 10 minutes for draining before replacing the plug.

At every alternate oil change, or every 6,000 miles (9600 km.), a new oil filter element must be fitted. See Section P.5 for details of removal.

NOTE.—Disconnect the battery cable from its terminal on the starter before commencing work on the filter.

Section A.2

OIL PRESSURE

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

(1) That there is a good supply of (the correct grade) oil in the transmission casing.

(2) That there is no air leakage at the pump pick-up union on the suction side of the pump and that the oil pump is not worn and is functioning correctly. See Section A.24 for oil pump removal and dismantling.

(3) That the strainer in the transmission casing is clean and not choked with sludge.

(4) That the bearings to which the oil is fed under pressure have the correct working clearance. Should the bearing 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.

The points mentioned can all cause a drop in pressure.

Continuous cold running and the unnecessary use of the mixture control are often the causes of oil dilution by petrol (gasoline) and a consequent fall off in pressure. Particular attention should be given to oil changes at the recommended periods.

NOTE.—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. Details of the relief valve are given in Section A.3.

Section A.3

OIL PRESSURE RELIEF VALVE

The non-adjustable oil pressure relief valve is situated at the rear right-hand side of the cylinder block and is held in position by a $\frac{9}{16}$ in. domed hexagon nut and

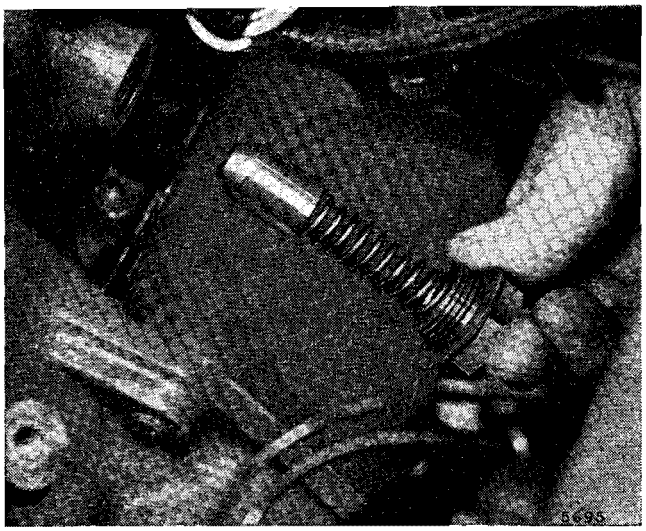


Fig. A.1
The oil pressure relief valve

sealed by two fibre washers. The relief valve spring maintains a valve cup against a seating machined in the cylinder block to provide an extra return passage for the oil should the pressure become excessive.

The valve cup should be examined to ensure that it is seating correctly and that the spring has not lost its tension. The cup can be removed and ground into its seating with Service tool 18G69 and the spring checked by measuring its length; this should be $2\frac{7}{8}$ in. (7·3 cm.) to give the required relief pressure of 60 lb./sq. in. (4·2 kg./cm.²). Fit a new cup and spring if necessary.

Section A.4

CARBURETTER AND AIR CLEANER

Removing

Disconnect the breather hose from the rocker cover, slacken the air cleaner retaining clip on the carburetter air intake pipe, and remove the air cleaner.

Disconnect the mixture and throttle control cables, the suction advance pipe, and the fuel delivery hose from their respective positions on the carburetter.

Remove the two nuts and spring washers securing the carburetter to the manifold flange. Lift off the carburetter and the cable abutment plate.

Refitting

It should be noted that the cable abutment plate fitted between the carburetter and manifold flange has a gasket fitted on both faces. Should either gasket be damaged, the plate and the flanges must be thoroughly cleaned and new gaskets fitted.

Section A.5

EXHAUST SYSTEM

Slacken off the exhaust pipe to manifold clamp, and release the pipe from its fixing point (see Fig. A.11) on the gear change extension and from the two locations on the rear sub-frame.

Refitting

To obtain the maximum freedom from engine vibration, and to avoid subjecting the exhaust system to strain, the following refitting procedure must be followed.

Unscrew and withdraw the bolt securing the engine tie-rod to the cylinder block.

Assemble the exhaust system to the car, leaving the pipe to manifold clamp slack enough to permit articulation on the spherical joint and the rear pipe support clips loose enough to allow endwise float of the whole system.

Push the engine forward to line up the hole in the tie-rod with the threaded hole in the cylinder block, and wedge the engine in this position with a suitable wooden block placed between the manifold and the bulkhead. If appreciable force is required to align the two holes, slacken the two bolts securing the engine mounting to the sub-frame to ease alignment, subsequently retightening them. Insert and tighten up the tie-rod bolt.

With the engine still wedged in this position insert sufficient slip packings to fill the gap between the transmission casing lug and the pipe support stay. Insert the bolt and tighten up at this point. If the hole in the lug is threaded, it should be drilled out with a ·316 in. (8 mm.) drill, and a $\frac{5}{16}$ in. bolt and nut used to replace the set screw.

Tighten up the pipe to manifold clamp, also the pipe and tail pipe support clips. Remove the wedge from between the manifold and the bulkhead.

Section A.6

EXHAUST MANIFOLD

Removing

Remove the carburetter and air cleaner as detailed in Section A.4. Slacken off and release the exhaust pipe clamp. Remove the six nuts and washers securing the manifold to the cylinder head; withdraw the manifold.

Refitting

Reverse the above order, but thoroughly clean the joint faces and fit a new gasket, placing the perforated metal face of the gasket towards the manifold.

Section A.7

VALVE ROCKERS

Removing

Drain the cooling system; use a clean container for the coolant if it contains anti-freeze intended for further use.

Remove the air cleaner as in Section A.4.

Unscrew the two securing screws and lift off the rocker cover, taking care not to damage the cork gasket.

Slacken the eight rocker shaft bracket fixing nuts and the five external cylinder head stud nuts gradually, a turn at a time, in the order shown in Fig. A.4, until all the load is released.

NOTE.—The five external cylinder head fixing nuts must be slackened at the same time as the rocker shaft securing nuts, and in the order given in Fig. A.4, otherwise distortion may take place and result in water finding its way into the cylinder bores and the transmission casing.

Completely unscrew the eight rocker shaft bracket nuts and remove the rocker assembly, together with the brackets.

Withdraw the push-rods, at the same time marking them for replacement in their original positions.

Dismantling

Remove the grub screw locating the rocker shaft in the front rocker mounting bracket. Withdraw the split pins, flat washer, and spring washer from the end of the shaft and slide the rockers, brackets, and springs from the shaft. Remove the screwed plug fitted to one end of the shaft and clean out the oilway.

Reassembly

When reassembling commence with the front mounting bracket, securing it with the grub screw. Follow up with the remaining brackets and springs, replacing them in their original position on the shaft. The screwed plug end of the shaft should be positioned to the front of the engine.

Refitting

Refitting is a reversal of the removal procedure, with special emphasis on the tightening of the rocker bracket and cylinder head stud nuts; these must be tightened in the order shown in Fig. A.4 and to the torque wrench figure given under **'GENERAL DATA'.**

Refer to Section A.15 for details of valve rocker adjustment.

Section A.8

VALVE ROCKER BUSHES

Rebushing of the pressed-steel valve rocker fitted as an alternative to the forged is not practical and must not be undertaken. When bushes become worn new

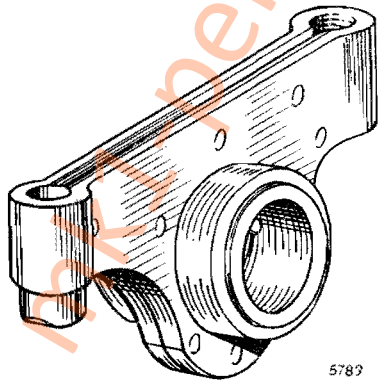


Fig. A.2

The pressed-steel type of valve rocker, which must not be rebushed

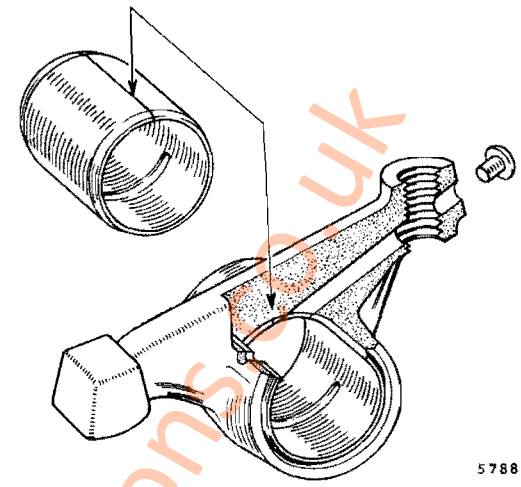


Fig. A.3

When rebushing the forged-type valve rocker make certain that the joint in the bush is in the position indicated

rocker assemblies must be fitted. The forged type of rocker can, however, be rebushed, and the following procedure is given for this type of rocker only.

Remove and dismantle the rocker shaft assembly as detailed in Section A.7.

To remove and replace worn bushes the use of special service tools 18G226 and 18G226A comprising a drift and anvil is recommended. Bushes and rockers are very easily damaged by the use of improvised drifts.

The anvil is recessed to hold the rocker in position while the worn bush is driven or pressed out.

Press the new bush into the rocker bore with the butt joint of the bush positioned at the top of the bore as in Fig. A.3. The drift is recessed to prevent the bush opening when being driven into position.

It will be necessary to drill the oil holes in the bush to coincide with the oilways in the rocker. Should the oil hole to the adjuster end be drilled before the bush is fitted, extra care must be taken to keep the holes in the bush and rocker in line during the pressing-in operation. If the holes are drilled after fitting, the following procedure must be adopted. Remove the adjuster screw and use a No. 43 drill (·089 in. [2·26 mm.]) to drill out the end plug and to continue the oilway through the bush. Replug the end after the operation with a rivet (Part No. 5C2436) and weld it in position.

The hole in the top of the rocker barrel must be continued through the bush with a No. 47 (·0785 in. [1·98 mm.]) diameter drill. Finally, burnish-ream the bush to the dimensions given under **'GENERAL DATA'.**

Section A.9

CYLINDER HEAD

Removing

Drain the cooling system by means of the drain taps on the radiator bottom tank and at the rear left-hand

side of the cylinder block. If anti-freeze mixture is in use it should be drained into a suitable clean container.

Disconnect the negative cable from the battery. Slacken the retaining clip on the hose connecting the radiator to the thermostat housing and pull the hose clear of the housing.

Remove the three set screws securing the radiator tie-plate to the thermostat housing.

Remove the carburetter and air cleaner as described in Section A.4. Take out the two rocker cover retaining screws and rubber cups and remove the cover.

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

Whenever the head has been disturbed or the valves have been ground in or otherwise disturbed it is necessary to check the valve clearances as in Section A.15. These, of course, will be finally adjusted after the engine has been completely reassembled and run for a short period.

Replace the inlet and exhaust manifold.

If a heater is fitted attach the heater hose to the heater control valve and refit the suction advance pipe to its fixture at the rear right-hand side of the cylinder head.

Replace the rocker cover, being careful to fit its cork gasket correctly into position and securing it by its nuts, washers, and rubber cups.

Replace the carburetter and air cleaner (as in Section A.4).

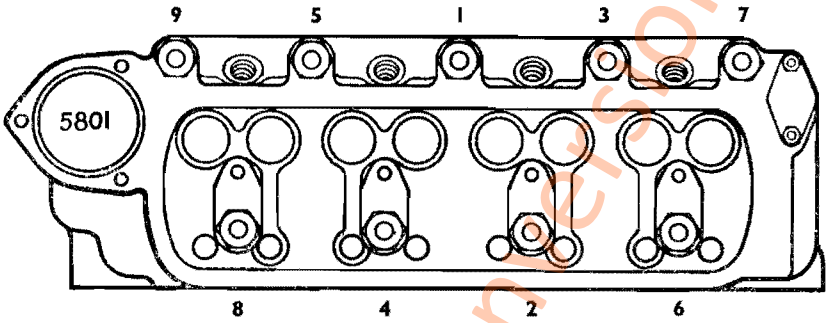


Fig. A.4

The order of slackening and tightening the cylinder head retaining nuts

Remove the suction advance pipe clip from its fixture on the thermostat housing. If the car is fitted with a heater remove the hose from the control valve, which is situated at the rear right-hand top of the cylinder head.

Slacken the top clip on the water by-pass hose.

Remove the inlet and exhaust manifold as described in Section A.6.

Remove the rocker assembly as described in Section A.7, not forgetting to slacken the five external cylinder head holding nuts at the same time. Withdraw the push-rods, keeping them in order of removal.

The cylinder head may now be removed.

NOTE.—To facilitate breaking the cylinder head joint, tap each side of the head with a hammer, using a piece of wood interposed to take the blow. When lifting the head a direct pull should be given so that the head is pulled evenly up the studs.

Refitting

Make sure that the surfaces of both the cylinder block and the cylinder head are clean; it is not necessary to use jointing compound or grease for the gasket. It will be noticed that the cylinder head gasket is marked 'FRONT' and 'TOP' so that it will be replaced correctly. Having slipped the gasket over the studs, lower the cylinder head into position and fit the five cylinder head securing nuts finger-tight.

Insert the push-rods, replacing them in the positions from which they were taken. Replace the rocker assembly and securing nuts and fit the nuts finger-tight. Tighten all 13 nuts gradually, a turn at a time, in the order given in Fig. A.4.

Secure the radiator tie-plate and reconnect the radiator hose to the thermostat housing.

Connect the negative cable to the battery terminal; close the water drain taps and refill the cooling system.

Check, adjust, and replace the sparking plugs, and clip on the high-tension leads.

Switch on the ignition and check the fuel system for leaks.

Start the engine and run it until the normal working temperature is reached. Remove the rocker cover and check the valve clearances (see Section A.15). Replace the rocker cover.

Refit the bonnet.

Section A.10

DECARBONIZING

Remove the cylinder head as described in Section A.9.

Withdraw the valves as described in Section A.11

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, cylinder block, 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 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 and dry off.

Fit a new cylinder head gasket when replacing the head if the old one has been damaged, noting that the gasket is marked to indicate the top face and the front end.

Section A.11

VALVES

Removing

Remove the cylinder head as detailed in Section A.9.

Before removing the valves stamp the head of each valve with a number to indicate the position to which it must be returned. Commence with No. 1 at the front of the engine.

Remove the cotter clip, compress the valve spring with a special valve spring compressor, and remove the split cotters.

Release the valve spring and remove the compressor. Remove the retaining cap, shroud, valve spring, and rubber seal. Withdraw the valve from the guide.

Keep the valves in their relative positions when removed from the cylinder head to ensure replacement in their original valve guides. The exhaust valve heads are concave and are smaller than the inlet valves.

Refitting

Place each valve in its respective guide and fit the spring, spring shroud, and the retaining cap. Compress the spring and fit a new sealing rubber to the valve stem, push the seal against the bottom shoulder of the cotter recess, and refit the cotters. Ensure that the rubber seal is not pushed out of the cotter recess onto the larger diameter of the stem, release the compressing tool, and fit the split cotter retaining clip.

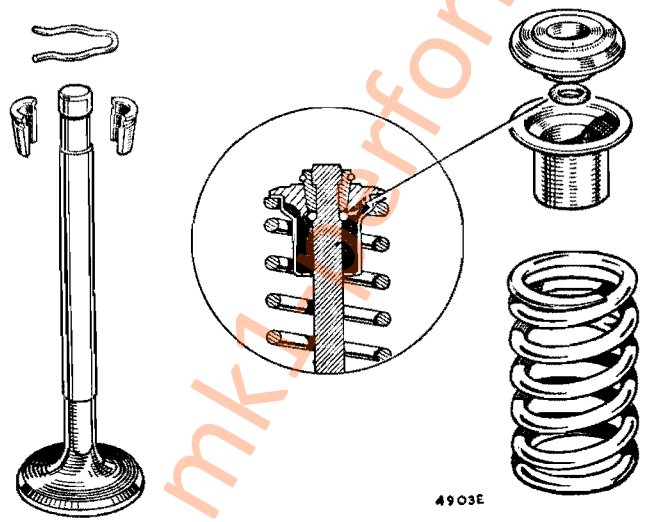


Fig. A.5

The component parts of the valve assembly. The inset shows the valve packing ring fitted correctly at the bottom of the cotter groove below the cotters

Section A.12

VALVE-GRINDING

Remove the valves as in Section A.11.

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. Stamp any new valve with the number of the port to which it is fitted.

If the valve seats show signs of pitting or unevenness they should be trued by the use of the special service cutting tools illustrated at the end of Section A. These tools will save lengthy and wasteful grinding in. When using a cutting tool take care to remove only as much metal as necessary to ensure a true surface. Worn valve seats usually have a glass-hard surface, and the glaze breaker illustrated should be used to prepare the valve seat surface for any recutting that may be necessary. Narrowing cutters should be used to maintain the valve seats to the dimension given under **'GENERAL DATA'.**

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. 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

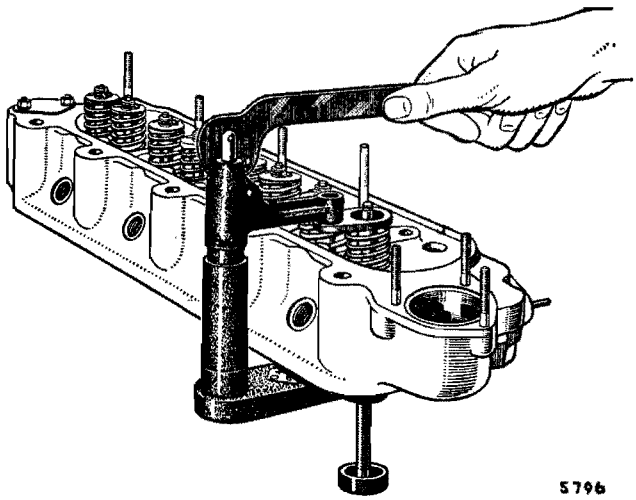


Fig. A.6

Compressing a valve spring, using the special compressing tool 18G45

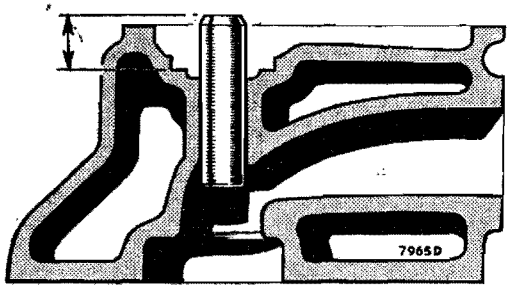


Fig. A.7

When fitting valve guides they must be driven in until they are $\frac{19}{32}$ in. (15·1 mm.) above the machined face of the valve spring seat

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 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.

Refer to Section A.11 for details of valve refitting.

Section A.13

VALVE GUIDES

Removing

Remove the cylinder head as shown in Section A.9.

Remove the appropriate valve and spring as in Section A.11. Rest the cylinder head with its machined face downwards on a clean surface and drive the valve guide downwards into the combustion space with a suitable-sized drift. This should take the form of a hardened-steel punch $\frac{7}{16}$ in. (11 mm.) in diameter and not less than 4 in. (10 cm.) in length, with a locating spigot $\frac{9}{32}$ in. (7·14 mm.) diameter machined on one end for a length of 1 in. (2·5 cm.) to engage the bore of the guide.

Refitting

When fitting new valve guides they should be driven in from the top of the cylinder head. The inlet valve guides must be inserted with the largest chamfer at the top, and the exhaust valve guides should have their counterbored ends at the bottom. The valve guides should be driven into the combustion spaces until they are $\frac{19}{32}$ in. (15·1 mm.) above the machined surface of the valve spring seating (see Fig. A.7).

Section A.14

TAPPETS

Removing

Remove the carburetter (see Section A.4) and the rocker cover.

Remove the manifold (see Section A.6).

Disconnect the high-tension leads from the sparking plugs.

Remove the rocker assembly as in Section A.7 and withdraw the push-rods, keeping them in their respective positions to ensure their replacement onto the same tappets. Remove the tappet covers and lift out the tappets, also keeping them in their correct order to assist in replacing them in their original locations.

Fitting

Refitting is a reversal of the removal sequence.

New tappets should be fitted by selective assembly so that they just fall into their guides under their own weight when lubricated.

Assembly is a reversal of the above procedure, but care should be taken to see that the tappet cover joints are oiltight and that the rockers are adjusted to give the correct valve clearance.

Section A.15

VALVE ROCKER ADJUSTMENT

If the engine is to give its best performance and the valves are to retain their maximum useful life it is essential to maintain the correct valve clearance. Accordingly it is recommended that the clearance be checked at regular intervals of 6,000 miles (9600 km.) and any necessary adjustments made.

The clearance for both the inlet and exhaust valves is ·011 in. (·28 mm.) when the engine is hot. The engine has been designed to operate with this clearance and no departure from it is permissible. An additional ·001 in. (·025 mm.) must be allowed when the engine is cold.

Provision for adjusting the valve clearance is made in the rocker arm by an adjustable screw and locknut.

The rocker adjusting screw is released by slackening the hexagon locknut with a spanner while holding the screw against rotation with a screwdriver. The valve clearance can then be set by carefully rotating the rocker

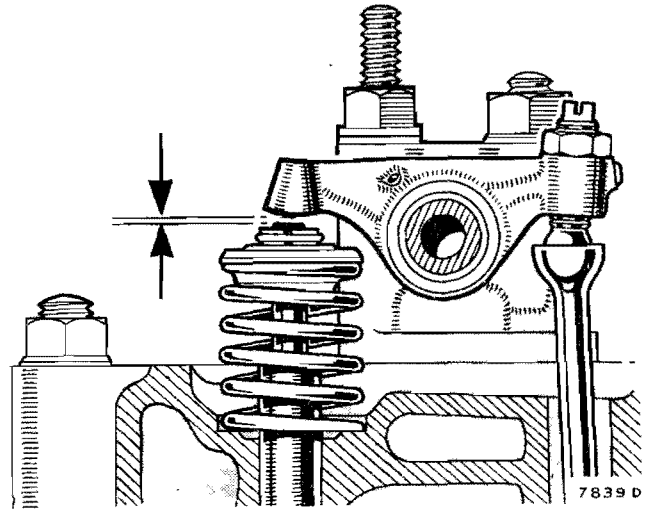


Fig. A.8

The clearance between the valve stem and the valve rocker indicated above must be ·012 in. (·30 mm.) with the engine cold and ·011 in. (·28 mm.) when hot

screw while checking the clearance with a feeler gauge. This screw is then relocked by tightening the hexagon locknut while again holding the screw against rotation.

It is important to note that while the clearance is being set the tappet of the valve being operated upon is on the back of its cam, i.e. opposite to the peak.

As this cannot be observed accurately the rocker adjustment is more easily carried out in the following order, and this also avoids turning the engine over more than is necessary.

Adjust No. 1 rocker with No. 8 valve fully open

,,	,,	3	,,	,,	,,	6	,,	,,	,,
,,	,,	5	,,	,,	,,	4	,,	,,	,,
,,	,,	2	,,	,,	,,	7	,,	,,	,,
,,	,,	8	,,	,,	,,	1	,,	,,	,,
,,	,,	6	,,	,,	,,	3	,,	,,	,,
,,	,,	4	,,	,,	,,	5	,,	,,	,,
,,	,,	7	,,	,,	,,	2	,,	,,	,,

Section A.16

DISTRIBUTOR DRIVING SPINDLE

Removing

Remove the distributor as detailed in Section B.6.

Take out the screw securing the distributor housing to the cylinder block and withdraw the housing.

Screw a $\frac{5}{16}$ in. UNF. bolt approximately $3\frac{1}{2}$ in. (89 mm.) long into the tapped end of the distributor drive spindle and withdraw the spindle.

Refitting

Turn the engine until No. 1 piston is at T.D.C. on its compression stroke. When the valves on No. 4 cylinder are 'rocking' (i.e. exhaust just closing and inlet just opening) No. 1 piston is at the top of its compression stroke. If the engine is set so that the 1/4 mark on the flywheel is in line with the pointer on the clutch cover, or the dimples in the crankshaft and camshaft gears are in line, the piston is exactly at T.D.C.

Screw the $\frac{5}{16}$ in. by $3\frac{1}{2}$ in. UNF. bolt into the threaded end of the distributor drive gear and, holding the drive gear with the slot just below the horizontal and the large offset uppermost, enter the gear. As the gear engages with the camshaft the slot will turn in an anti-clockwise direction until it is approximately in the one o'clock position.

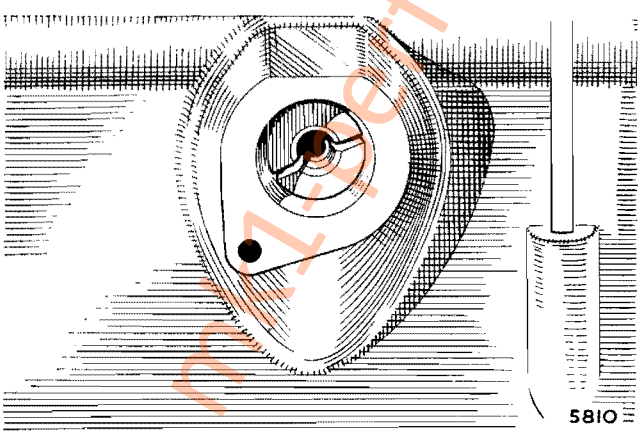


Fig. A.9

The distributor drive with the slot in the correct position and the large offset uppermost

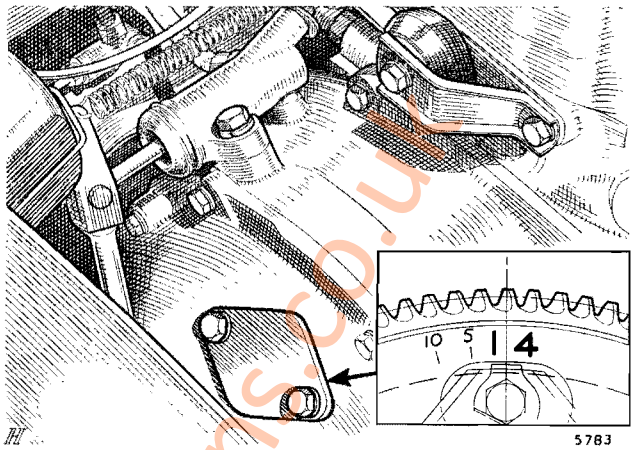


Fig. A.10

The timing marks on the flywheel can be seen with the aid of a mirror after removing the inspection cover. T.D.C. position is indicated by the mark 1/4. Marks giving 5° and 10° B.T.D.C. are also provided

Remove the bolt from the gear and insert the distributor housing and secure it with the special bolt and washer.

Ensure that the correct bolt is used and that the head does not protrude above the face of the housing.

Refit the distributor, referring to Section B.6 if the clamp plate has been released.

Section A.17

FLYWHEEL AND CLUTCH

Removing

Disconnect the 'CB' and 'SW' leads from the coil, extract the two mounting screws, and remove the coil from the flywheel housing.

Remove the starter as in Section N.5.

Withdraw the split pin from the clutch operating lever pivot, release the tension spring, pull the push-rod from the hydraulic slave cylinder, and remove the lever assembly from the clutch cover.

Withdraw the slave cylinder mounting screws and secure the cylinder against the engine bulkhead.

Remove the exhaust pipe clamp and the radiator cowling steady bracket.

Remove the two nuts and set screws securing the engine mounting to the sub-frame side-member and extract the nine set screws securing the clutch cover to the flywheel housing.

Raise the engine with suitable lifting equipment sufficient only to enable the cover to be removed. Make sure that the fan blades do not make contact with and damage the radiator core.

Undo the three retaining nuts and remove the clutch thrust plate from the pressure spring housing.

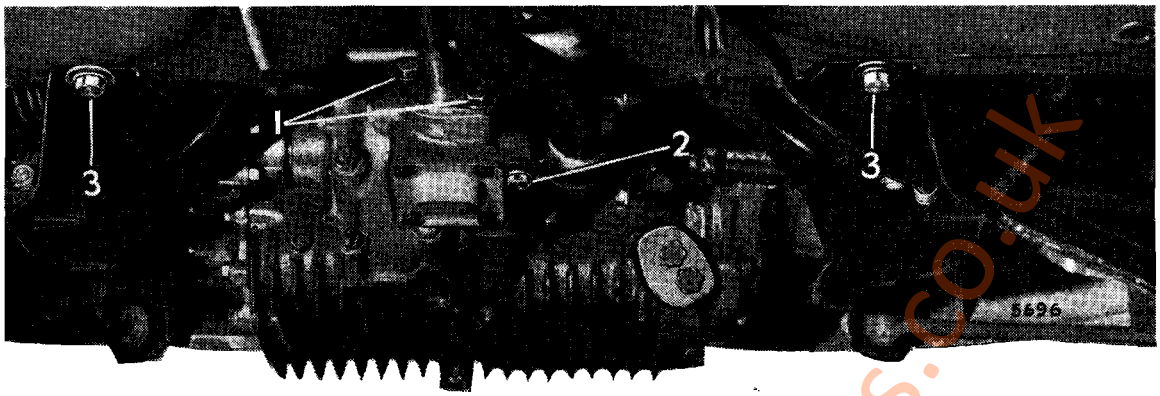


Fig. A.11

The front sub-frame and transmission casing viewed from beneath the car, showing (1) *the gear change lever retaining screws,* (2) *the exhaust system fixing point,* (3) *the front sub-frame rear mounting point (four set screws)*

It is essential that the engine is turned to T.D.C. on Nos. 1 and 4 cylinders before removing the flywheel. In this position the 'C' washer locating the primary gear is fitted with the bridge linking the two flats above the crankshaft and cannot drop. If this precaution is not taken the 'C' washer can fall and become wedged behind the flywheel oil seal and prevent the removal of the flywheel without serious damage to the seal.

Knock up the locking washer and slacken off the flywheel retaining screw three or four threads. Use service tool 18G304 together with adaptor set 18G304L to break the flywheel away from its seating on the taper of the crankshaft.

WARNING.—As the flywheel is pulled from the crankshaft, oil from the annulus at the back of the flywheel oil seal may spill down the face of the flywheel onto the clutch driven plate. This should be observed at the time of removal to avoid assuming that oil has passed the seal whilst the vehicle was in service. Every care must be taken to maintain the flywheel in a vertical position during the removal operation to prevent oil from this source wetting the clutch facings.

Screw the three studs from the adaptor set into the flywheel through the recessed holes in the clutch spring housing. Fit the plate of tool 18G304 over the three studs and screw the nuts onto the studs, screwing them down evenly so that the plate remains parallel with the flywheel. Insert the short centre screw and withdraw the flywheel. Remove the extractor immediately the taper is broken.

Unscrew and remove the flywheel retaining screw and the keyed driving washer. Withdraw the flywheel and clutch as a complete assembly. The clutch dismantling details are given in Section E.1.

NOTE.—A rubber plug is fitted into the rear end of the crankshaft ahead of the flywheel retaining screw as an added precaution against oil leakage past the normal brass taper plug. If oil leakage is evident at this point the rubber plug should be removed, the brass taper plug driven firmly into the oil gallery, and a new rubber plug fitted

The crankshaft primary gear cannot be removed from the crankshaft without the flywheel housing being removed; this operation is covered in Section A.22.

Refitting is a reversal of the removal procedure.

The flywheel oil seal must be lubricated prior to re-assembly to prevent burning up of the sealing lip before adequate lubricant can reach this point.

Wipe all traces of oil from the crankshaft and flywheel tapers, and make sure that the primary gear retaining 'C' washer is positioned correctly in its groove. It is essential that these tapers are degreased and completely dry before the flywheel is mounted. Turn the crankshaft to bring the circlip to the top of the shaft to obviate the possibility of it falling out of position and thereby preventing the flywheel from being pushed fully onto the crankshaft taper. Make certain that the flywheel retaining screw is tightened up to a torque reading of 110 to 115 lb. ft. (15·21 to 15·9 kg. m.).

Section A.18

FRONT SUB-FRAME AND ENGINE ASSEMBLY

Removing

Unscrew the hexagon plug and remove the anti-rattle spring and plunger from the gear change extension casing.

Remove the two set screws securing the change speed lever retaining plate to the casing, and pull the lever out of the casing from inside the car.

Detach the earth lead from the battery.

Detach the bonnet from the bonnet hinges and remove the bonnet.

Disconnect the heater inlet and outlet hoses (if applicable).

Remove the carburetter as in Section A.4.

Disconnect the oil pressure warning light lead from the switch on the cylinder block.

Release the leads from the stop light switch, coil, dynamo, and distributor. Remove the distributor cap complete with sparking plug and coil leads. Remove the cable from the starter motor and from the retaining clip on the sub-frame; pull the cable clear of the frame. Release the earth cable from its location on the clutch cover.

Unscrew the sleeve nut and release the speedometer cable from the back of the instrument.

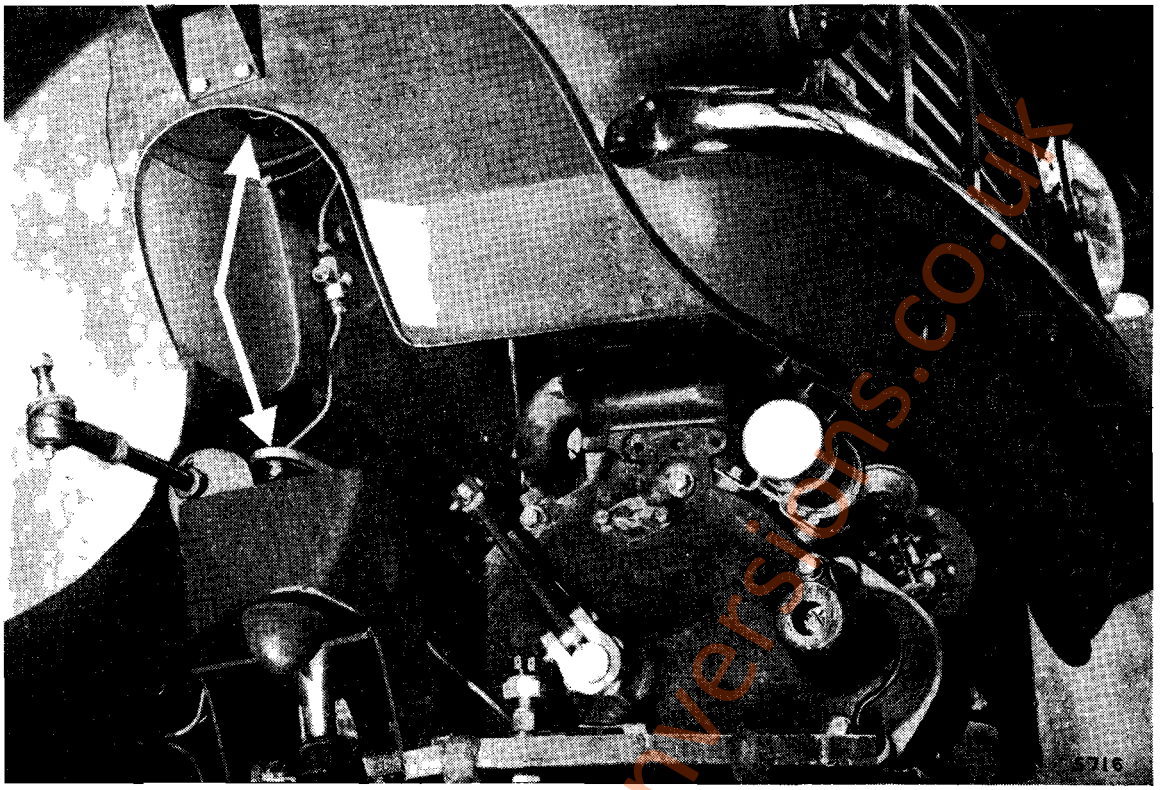


Fig. A.12

The front sub-frame and engine disconnected as in Section A.18, and the body raised to enable the engine and sub-frame to be removed as a complete assembly

Disconnect the hydraulic brake supply pipe at the three-way union on the engine bulkhead and plug the union with a clean $\frac{3}{8}$ in. UNF. screw to prevent the system draining.

Remove the exhaust system as detailed in Section A.5.

Support the body with suitable slings underneath each front wing.

Withdraw the two set screws securing the slave cylinder to the flywheel housing, release the lever tension spring, pull the push-rod from the cylinder, and secure the slave cylinder against the engine bulkhead.

Disconnect the steering rack ball ends from the steering levers and remove the telescopic dampers.

Release the engine tie-rod from the bracket on the rear of the cylinder block.

Support the engine beneath the transmission casing.

Knock back the lock plate tabs and withdraw the four body to sub-frame bolts, two on each side of the bulkhead cross-member. Take out the four set screws securing the rear of the sub-frame to the front floor and the two screws securing the front of the frame to the bottom of the grille panel.

Lift the body clear of the engine and withdraw the sub-frame and engine assembly. Care should be taken when lifting the body to avoid damaging the radiator and cowling; also the steering rack rubber gaiters.

Removing engine from sub-frame

Drain the oil from the transmission casing.

Disconnect the drive shafts at the differential.

With the sub-frame supported under both side-members, take the weight of the engine with suitable lifting tackle and remove the two screws securing each engine mounting to the sub-frame. Lift the engine out of the frame.

The approximate weight of the engine and sub-frame is 428 lb. (193 kg.).

Note the paper gaskets fitted between the engine mountings, the sub-frame, and the clutch cover on engines up to Engine No. 4354. It is essential that gaskets are refitted to all engine units up to this serial number.

Refitting

Refitting the engine to the sub-frame and the sub-frame to the vehicle is a reversal of the removal procedure.

Make certain that the change speed lever is pulled up into the car interior before the body is lowered onto the frame; ensure that the electric lead to the rear of the car is not trapped between the body and the sub-frame.

Tighten the steering-arm ball joint nut to torque loading of 25 lb. ft. (3·45 kg. m.).

Bleed the hydraulic brake system when reassembly is completed.

Section A.19

TIMING COVER

Removing

Remove the engine as detailed in Section A.34.

On later models fitted with a split fan cowling this

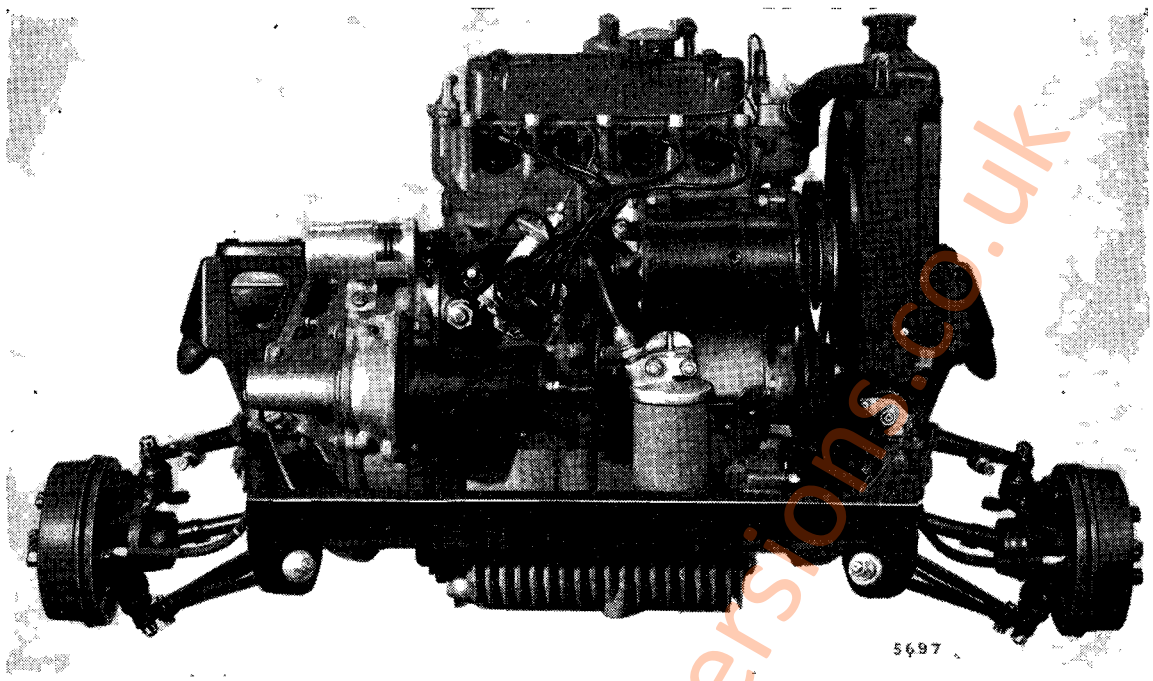


Fig. A.13
The engine and front suspension assembly

operation can be carried out without removing the engine.

Remove the radiator as in Section C.3.

Slacken the dynamo attachment bolts and the adjusting screw; remove the fan belt.

Bend back the tab on the crankshaft pulley locking washer, remove the pulley securing screw, and carefully lever the pulley from the crankshaft.

Unscrew the 10 set screws on the timing case flange and remove the cover.

Refitting

Reverse the removal procedure when refitting the cover.

The oil seal in the cover must be renewed if it shows signs of damage or deterioration. A new cover gasket should also be fitted.

It should be noted that the oil thrower behind the crankshaft pulley is fitted with its concave facing forward.

The crankshaft pulley should be assembled to the cover before the cover is fitted and used to ensure correct centralization of the oil seal. Lubricate the hub of the pulley and insert it into the oil seal, turning the pulley in a clockwise direction to avoid damaging the lip of the seal. Push the pulley and cover onto the crankshaft, making sure that the keyway on the pulley bore is lined up with the Woodruff key fitted to the crankshaft before finally drifting the pulley into position. Replace the cover set screws and tighten them up evenly.

Section A.20

TIMING GEARS

Removing

Remove the timing cover and oil thrower as in Section A.19.

Unlock and remove the camshaft chain wheel nut and remove the nut and lock washer. Note that the locating tag on the lock washer fits into the keyway of the camshaft chain wheel.

The camshaft and crankshaft chain wheels may now be removed, together with the timing chain, by easing

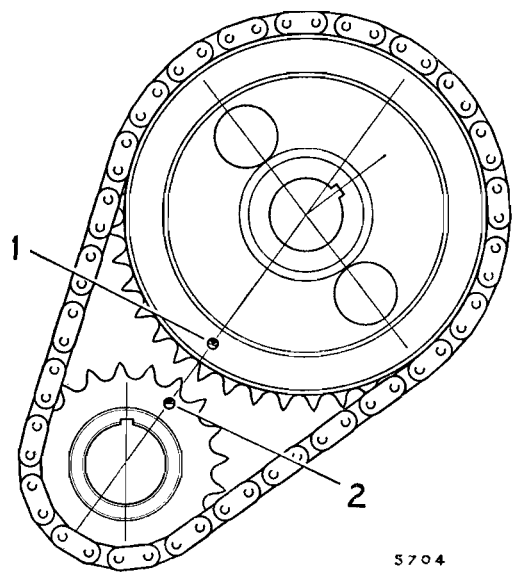


Fig. A.14
The timing gears assembled into the timing chain with the two marks on the gears opposite each other

each wheel forward a fraction at a time with suitable small levers. Note the packing washers immediately behind the crankshaft gear.

Refitting

When reassembling, replace the same number of washers as was found when dismantling unless new camshaft or crankshaft components have been fitted which will disturb the alignment of the two gear wheels. To determine the thickness of washers required place a straight-edge across the sides of the camshaft wheel teeth and measure with a feeler gauge the gap between the straight-edge and the crankshaft gear.

When replacing the timing chain and gears set the crankshaft with its keyway at T.D.C. and the camshaft with its keyway approximately at the one o'clock position as seen from the front. Assemble the gears into the timing chain with the two marks on the gear wheels opposite to each other, as in Fig. A.14. Keeping the gears in this position, engage the crankshaft gear keyway with the key on the crankshaft and rotate the camshaft until the camshaft gear keyway and key are aligned. Push the gears onto the shafts as far as they will go and secure the camshaft gear with the lock washer and nut.

Replace the oil thrower, concave side forward, and the remaining components as detailed in Section A.19.

Section A.21

VALVE TIMING

Set No. 1 cylinder inlet valve to ·019 in. (·48 mm.) clearance with the engine cold, and then turn the engine until the valve is about to open.

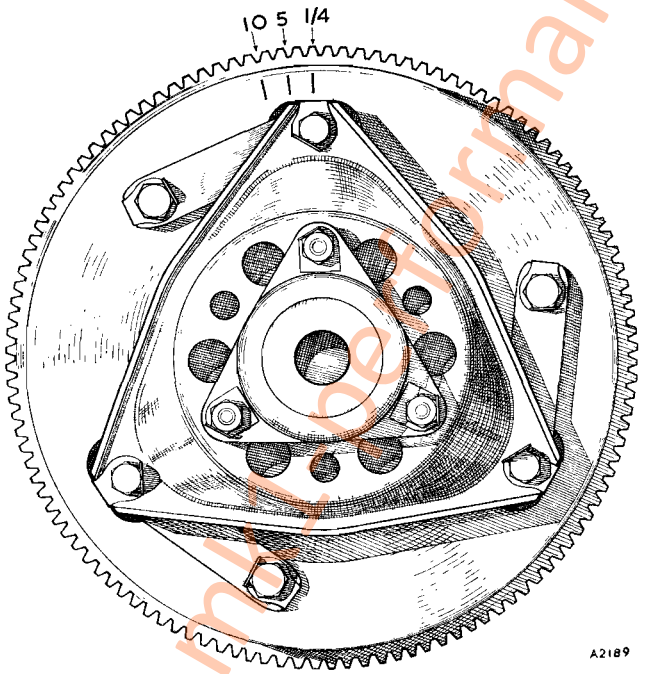


Fig. A.15

The flywheel and clutch assembly, showing the position of the 10° and 5° B.T.D.C. and the 1/4 T.D.C. markings

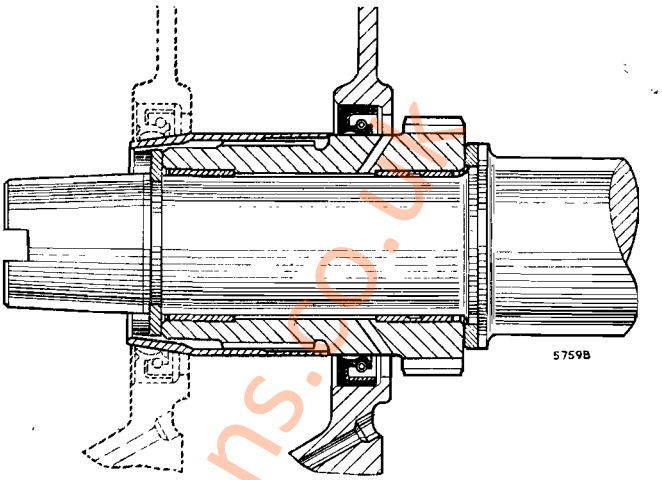


Fig. A.16

The Service tool 18G570 positioned over the clutch splines of the crankshaft primary gear to prevent damage to the lip of the oil seal

The 5° B.T.D.C. indicating mark on the flywheel should then be opposite the pointer in the clutch cover inspection aperture, i.e. the No. 1 valve should be about to open and No. 4 piston will be 5° B.T.D.C. on its compression stroke.

NOTE.—Do not omit to reset the inlet valve clearance to ·011 in. (·28 mm.) with the engine hot (·012 in. [·30 mm.] cold) when the timing check has been completed. The clearance of ·019 in. (·48 mm.) is necessary to bring the opening position of the valve to 5° B.T.D.C. It is not possible to check the valve timing accurately with the valve rockers set at their normal running clearance.

Section A.22

FLYWHEEL HOUSING

Removing

Remove the engine as in Section A.34.

Remove the clutch cover-plate and extract the flywheel and clutch assembly as in Section A.17.

Slacken off and remove the nine set screws and six stud nuts securing the flywheel housing to the cylinder block and transmission case. Take particular note of the position in which the screws are fitted to facilitate their replacement in the same positions from which they were removed.

Extra care must be taken when withdrawing the housing to avoid damaging the lips of the oil seal on the clutch plate splines of the crankshaft primary gear. The sleeve shown in Fig. A.16 should be pushed over the gear splines and held firmly in this position while the housing is withdrawn.

Refitting

Refitting is a reversal of the dismantling procedure, with special attention being given to the following points.

Make certain that the crankshaft primary gear inner thrust washer is refitted with its chamfered bore against the crankshaft flange.

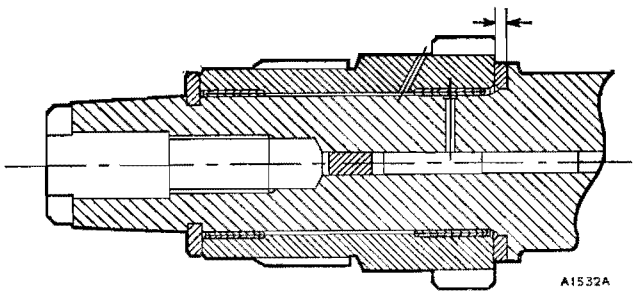


Fig. A.17

The crankshaft primary gear must be assembled with the correct running clearance of between ·003 and ·006 in. (·076 and ·152 mm.). Measure the gap indicated and use the following table to determine the correct thickness of the thrust washer required to obtain this clearance

When gap is	*Use washer thickness*	*Part No.*
·1295 to ·1315 in. (3·27 to 3·34 mm.)	·125 to ·127 in. (3·17 to 3·22 mm.)	22A83
·1315 to ·1335 in. (3·34 to 3·39 mm.)	·127 to ·129 in. (3·22 to 3·27 mm.)	22A238
·1335 to ·1345 in. (3·39 to 3·42 mm.)	·129 to ·131 in. (3·27 to 3·32 mm.)	22A239

Check the primary gear running clearance, and adjust any discrepancy from the recommended figure of between ·003 and ·006 in. (·076 and ·152 mm.) by selective assembly of the thrust washer, as indicated in Fig. A.17.

Thoroughly clean the joint faces of the cylinder block, transmission casing, and the flywheel housing. All traces of the old joint must be removed and a new gasket fitted. Use only a gasket as supplied by B.M.C. Service Ltd.; this is most important.

Renew the crankshaft primary gear oil seal if it shows signs of damage or oil leakage. Damaged seals can be detected by careful examination of the sealing knife edge. Seals with imperfections must be renewed. If the engine has covered a large mileage new seals should be fitted as a matter of routine. Pack the first motion shaft bearing rollers with H.M.P. grease to prevent them falling out of position as the housing is being refitted. A special thin sleeve (Part No. 18G570) is available to fit over the splines of the primary gear to prevent the edges of the seal being cut by the splines (see Fig. A.16). The two pilot bars supplied as part of this tool set should be screwed into the two bottom tapped holes in the crankcase. In addition to piloting the housing into position they will take the weight off the lip of the seal.

NOTE.—Should it be necessary to renew the gear train, the transmission casing must be removed to enable the idler gear end-float measurement to be taken (see Sections A.23 and F.2).

The three set pins securing the housing to the bottom of the transmission casing have UNC. threads, and must be refitted in this position. Make certain that the correct short set pin is fitted at the right-hand top position in the housing. This is most important as a long screw could possibly cause damage to the oil gallery in the cylinder block.

The flywheel housing bolts and stud nuts should be tightened with a torque spanner to 18 lb. ft. (2·49 kg. m.). This figure gives the desired compression of the gasket to obtain a compressed thickness of ·030 in. (·762 mm.). There is a small cut-away in the housing gasket which enables a feeler gauge to be inserted between the two machined faces to check that the gasket has been compressed to its correct thickness.

Section A.23

TRANSMISSION

Removing

Remove the engine as detailed in Section A.34.

Withdraw the eight set screws, remove the clutch cover-plate, and extract the flywheel and clutch as in Section A.17.

Remove the starter motor.

Remove the flywheel housing as in Section A.22.

Withdraw the 12 set screws from the flange of the transmission case, taking due note of the length of the screws and the position in which the shorter screws are fitted. Lift the engine with suitable lifting equipment to separate the engine from the transmission case.

Details of dismantling are given in Section F.1.

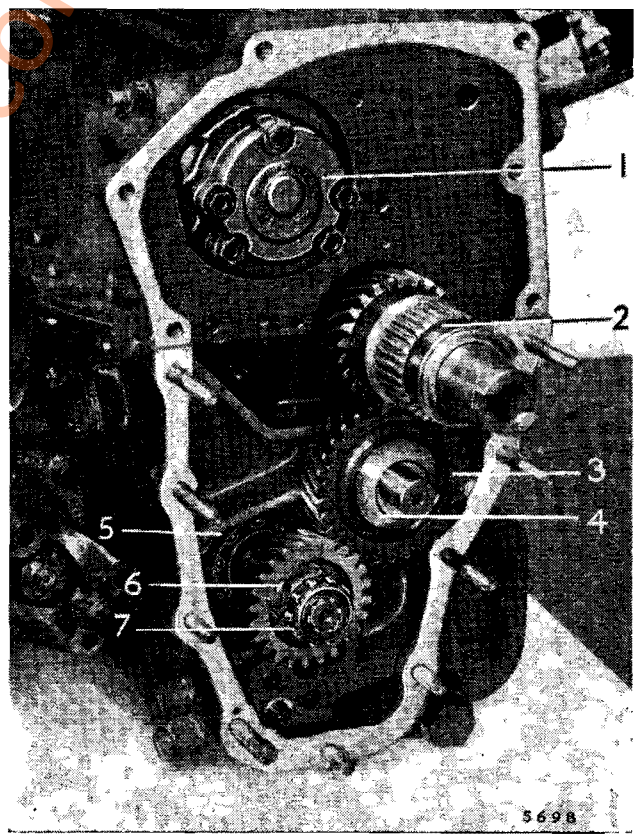


Fig. A.18

The engine and transmission assembly with the flywheel housing removed, showing the gear train to the first motion shaft

1. Oil pump.
2. Crankshaft primary gear.
3. Idler gear.
4. Idler gear thrust washer.
5. First motion shaft bearing.
6. First motion shaft driving gear.
7. Roller bearing.

Refitting

Refitting is a reversal of the removal sequence, with particular attention being given to the following points.

Thoroughly clean all joint faces of the transmission case, crankcase, and flywheel housing. All traces of damaged joints must be removed.

Should it be necessary to fit a new gear train, the end-float of the idler gear must be checked before the transmission case is refitted (see Section F.2).

When refitting the transmission case and flywheel housing screw up the set screws and nuts until they are finger tight, and then tighten them down a turn at a time to ensure an even pressure all round. This is most important, not only to ensure a good oiltight joint but to keep the correct relationship between the crankshaft primary gear, the roller gear, and the first motion shaft driving gears.

Make certain that the front bearing cork oil seal remains correctly positioned as the engine is being lowered onto the casing.

Insert the short sump to crankcase screw, located near the change speed remote-control shaft boss, before the crankcase is lowered onto the transmission case, and screw it up as far as possible before the flanges are finally brought together.

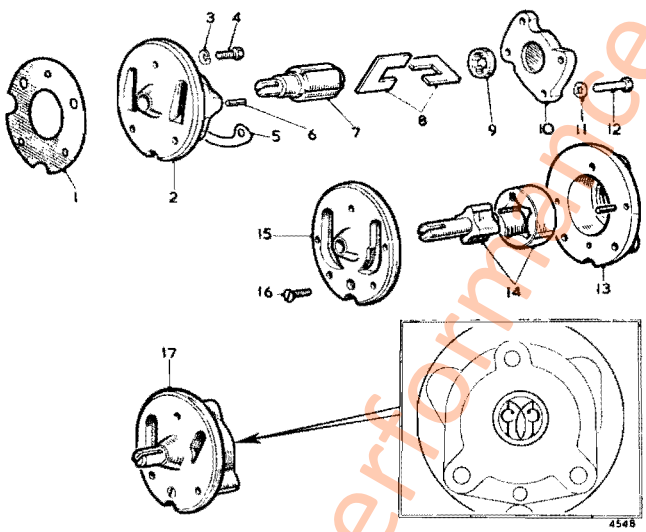


Fig. A.19

The three types of oil pump which may be fitted

Burman

1. Joint washer.
2. Pump body.
3. Washer.
4. Set screw.
5. Lock plate.
6. Dowel.
7. Rotor.
8. Vane.
9. Sleeve.
10. Body cover.
11. Shakeproof washer.
12. Screw—cover to body.

Hobourn-Eaton

13. Body.
14. Shaft and rotor.
15. Cover.
16. Screw—cover to body.

Centrifugal Manufacturing Co

17. Pump (serviced as assembly only).

Section A.24

OIL PUMP

Removing

Remove the engine as detailed in Section A.34.

Remove the flywheel and clutch assembly and the flywheel housing as detailed in Sections A.17 and A.22.

Bend back the locking washers and remove the three ¼ in. UNF. screws securing the pump to the crankcase. Withdraw the pump, noting the position of the slot in the driving shaft in order to assist in replacement.

Dismantling and reassembling (Hobourn-Eaton)

The pump cover is located on the pump body by two dowels and a machine screw. When the screw is removed the pump can be separated for examination and replacement where necessary.

Dismantling and reassembling (Burman)

Unscrew and remove the two screws and spring washer securing the cover to the pump body. Remove the cover and withdraw the rotor and vane assembly. Prise off the retaining sleeve from the end of the rotor and extract the vanes.

The component parts of the pumps are shown in Fig. A.19.

Reassembly is a reversal of the dismantling procedure.

Refitting

The refitting of the pump to the cylinder block is a reversal of the removal procedure; particular attention must, however, be given to the fitting of the paper joint washer to ensure that the intake and delivery ports are not obstructed. Use a new paper joint washer if the old one is damaged in any way.

Section A.25

CAMSHAFT

Removing

Remove the engine as detailed in Section A.34.

Remove the rocker assembly (Section A.7), the inlet and exhaust manifold (Section A.6), and the timing cover and gears (Sections A.19 and A.20).

Disconnect the high-tension leads from the coil and sparking plugs, and the low-tension wire from the side of the distributor.

Disconnect the suction advance unit pipe from the distributor and take out the two bolts with flat washers securing the distributor to the housing. Do not slacken the clamping plate bolt or the ignition timing setting will be lost.

Withdraw the distributor.

Take out the bolt securing the distributor housing to the cylinder block. Using one of the tappet cover bolts as an extractor screwed into the tapped end of the distributor drive spindle, withdraw the spindle.

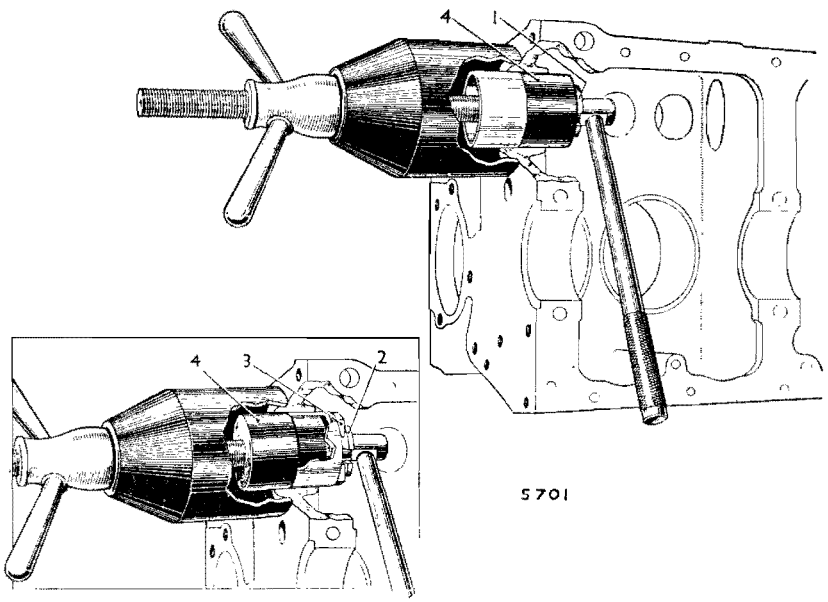


Fig. A.20

Removing a camshaft front liner, using adaptor 18G124K in conjunction with service tool 18G124A. Inset shows the bearing being replaced

1. 'C' washer.
2. 'C' washer.
3. 'D' washer.
4. Adaptor 18G124K.

Take out the three set screws and shakeproof washers which secure the camshaft locating plate to the cylinder block and withdraw the camshaft.

Should the front camshaft bearing clearance be excessive, a new bearing liner must be fitted, and as this will entail line-reamering after fitting, both the flywheel housing and the transmission case must be removed as in Sections A.22 and A.23.

Removing a liner

A worn liner can be removed and a new liner pulled into the cylinder block with service tool 18G124A together with adaptor 18G124K.

Place the adaptor in the liner from inside the cylinder block and screw the centre screw of the tool through the adaptor from the front of the block. Position the 'C' washer on the flat at the end of the screw and the tommy-bar into the small hole behind the washer to prevent the screw turning.

Continued tightening of the large wing nut will withdraw the worn liner.

Liner fitting

Place the new liner on the small diameter of the adaptor and position the adaptor in the liner bore from inside the cylinder block, lining up the oil holes in the liner and bore. Place the 'D' washer in position behind the liner and pass the centre screw of the tool through the adaptor and the 'D' washer, and tighten up the screw. Secure the tommy-bar in the hole at the rear end of the centre screw to prevent it from turning, and tighten the wing nut to draw the liner squarely into position.

Liner reaming

After fitting a new front liner it must be line-reamed to size, using service tool 18G123A in conjunction with the appropriate pilots and cutter shown at the end of Section A.

Fit the pilots 18G123AH and 18G123AJ into the centre and rear camshaft bearing bores, push the cutter onto the arbor of tool 18G123A, and locate it in position No. 8. A peg retained in the centre groove of the cutter by a spring clip will locate in the arbor to hold the cutter

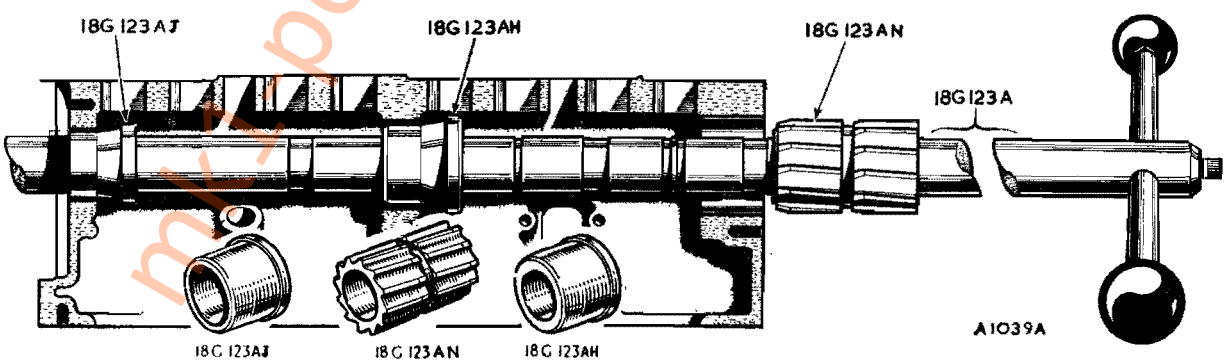


Fig. A.21

The camshaft liner reamer, with the pilots and cutters positioned to ream the front liner

in the desired position. The cutter is made up of a combined roughing and finishing cutter, and care must be taken to ensure that it is placed on the arbor with the relieved flutes of the roughing cutter to enter the liner first.

Pass the arbor through the camshaft bore and the two pilots and commence to ream, always turning in a clockwise direction. Do not force the reamer through the liners, proceed gently, and keep the cutter dry. Swarf should be cleared away during the operation, preferably with air-blast equipment.

When the cutter has passed through the liner release its locating peg from the arbor and hold it inside the block while the arbor is withdrawn.

NOTE.—On no account must the cutter be brought through the reamed hole on the arbor.

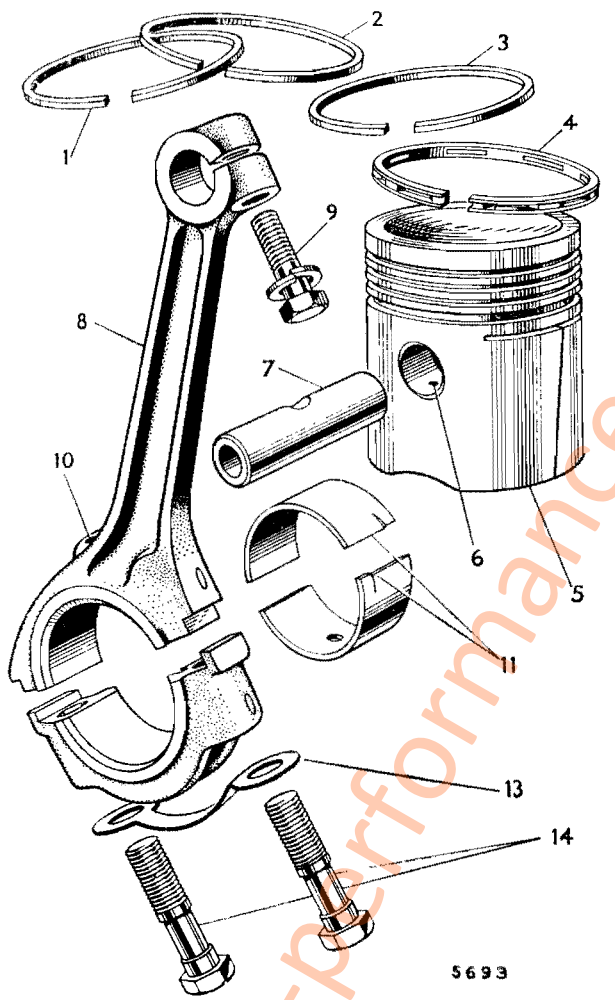


Fig. A.22

A connecting rod and piston assembly

1. Piston ring—parallel.
2. Piston ring—taper.
3. Piston ring—taper.
4. Piston ring—scraper.
5. Piston.
6. Gudgeon pin lubricating hole.
7. Gudgeon pin.
8. Connecting rod.
9. Clamping screw and washer.
10. Cylinder wall lubricating jet.
11. Connecting rod bearing.
13. Lock washer.
14. Set screws.

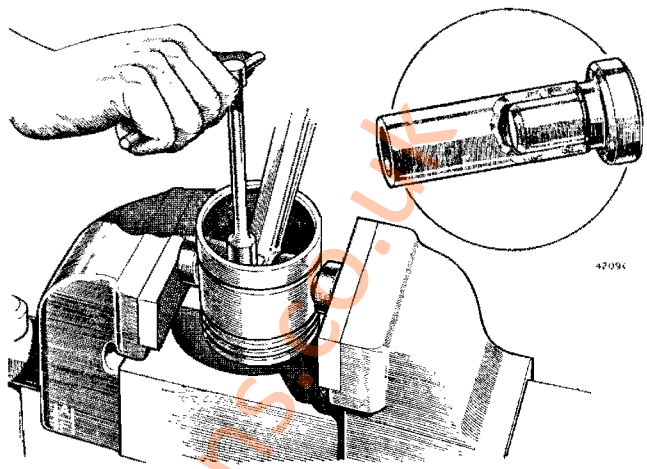


Fig. A.23

The use of special gudgeon pin plugs to hold the connecting rod and piston assembly while the gudgeon pin clamp screw is tightened or loosened is essential

Refitting

Refitting is a reversal of the removal procedure; lubricate the journal with engine oil and refer to Section A.16 when replacing the distributor gear.

Section A.26

PISTONS AND CONNECTING RODS

Removing

Drain the transmission casing and external oil filter.

Remove the engine from the frame (Section A.34).

Remove the flywheel and clutch (Section A.17), flywheel casing (Section A.22), transmission (Section A.23), and cylinder head (Section A.9).

Unlock and remove the big-end bolts and remove the bearing cap. 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 each cap and connecting rod on the sides which are fitted together with the number of the cylinder from which they were taken.

Dismantling

The gudgeon pin is rigidly held in the split little-end of the connecting rod by a clamp bolt engaging the central groove of the gudgeon pin.

Before the piston and gudgeon pin can be dismantled from the connecting rod it is necessary to remove the clamp screw. To enable the assembly to be held in a vice for this operation without damage, special holding plugs

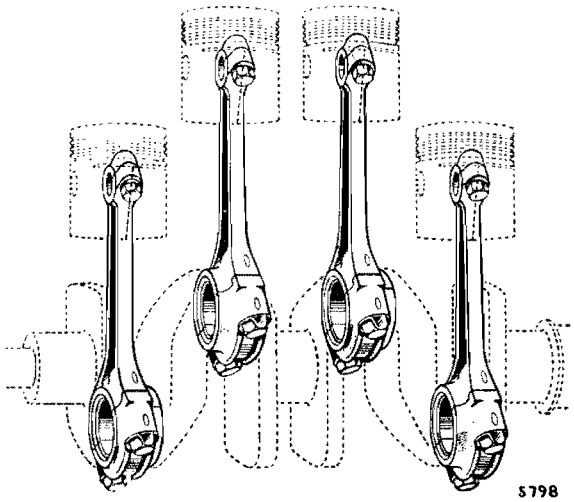


Fig. A.24

The correct assembly of connecting rods to the pistons and crankshaft

should be inserted in each end of the gudgeon pin (see Fig. A.23).

Unscrew the gudgeon pin clamp screw and remove it completely. Push out the gudgeon pin.

Reassembling

A certain amount of selective assembly must be used when fitting new gudgeon pins. They must be a thumb-push fit for three-quarters of their travel, to be finally tapped home with a rawhide mallet. This operation must be carried out with the piston and gudgeon pin cold.

When reassembling, particular attention must be given to the following points:

(1) That the piston is fitted the same way round on the connecting rod. The crown of the piston is marked 'FRONT' to assist this and the connecting rod is fitted with the gudgeon pin clamp screw on the camshaft side.

(2) That the gudgeon pin is positioned in the connecting rod so that its groove is in line with the clamp screw hole.

(3) That the clamp screw spring washer has sufficient tension.

(4) That the clamp screw will pass readily into its hole and screw freely into the threaded portion of the little-end, and also that it will hold firmly onto the spring washer.

Refitting

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.

It is essential that each connecting rod and piston assembly should be replaced in its own bore and fitted the same way round, i.e. with the split skirt opposite to the thrust side and the gudgeon pin clamp screw on the same side as the split skirt, on the camshaft side of the engine. The piston crowns are marked 'FRONT' to facilitate this.

Refit the big-end bearings in their original positions.

The top and bottom halves of new bearings are, however, interchangeable, each being drilled for cylinder wall lubrication.

Section A.27

PISTON RINGS

Removing

If no special piston ring expander is available use a piece of thin steel such as a smoothly ground hacksaw blade or 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 round 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.

Refitting

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 gastightness.

Test new rings 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 ·006 to ·011 in. (·15 to ·28 mm.).

The second and third rings are tapered and must be fitted with the narrow taper upwards. A letter 'T' is stamped on the narrow face to facilitate identification.

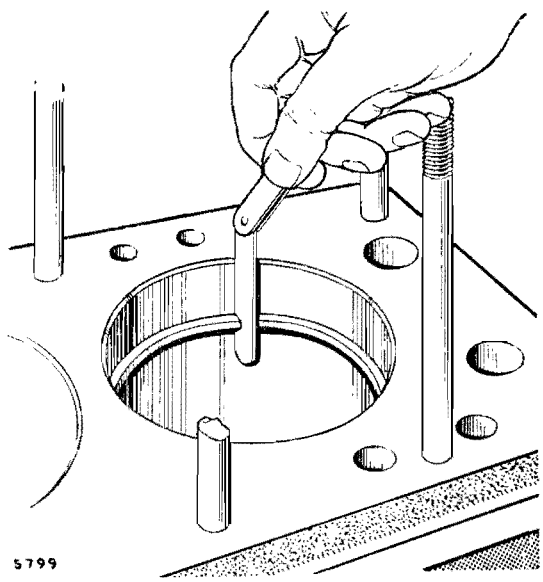


Fig. A.25

Checking the piston ring gap

Section A.28

PISTON SIZES AND CYLINDER BORES

In production, pistons are fitted by selective assembly, and to facilitate this the pistons are stamped with identification figures on their crowns.

A piston stamped with a figure 2 enclosed in a diamond is for a bore bearing a similar stamp.

In addition to the standard pistons there is a range of four oversize pistons available for Service purposes. Oversize pistons are marked with the actual oversize dimensions enclosed in an ellipse. A piston stamped ·020 is suitable only for a bore ·020 in. (·508 mm.) larger than the standard bore and, similarly, pistons with other markings are suitable only for the oversize bore indicated.

The piston markings indicate the actual bore size to which they must be fitted, the requisite running clearance being allowed for in the machining.

After reboring an engine, or whenever fitting pistons differing in size from those removed during dismantling, ensure that the size of the piston fitted is stamped clearly on the top of the cylinder block alongside the appropriate cylinder bore (see Fig. A.26).

Pistons are supplied in the sizes indicated in the following table:

Piston marking	*Suitable bore size*	*Metric equivalent*
STANDARD	2·4778 to 2·4781 in.	62·935 to 62·940 mm.
OVERSIZE		
+·010 in. (·254 mm.)	2·4878 to 2·4881 in.	63·189 to 63·194 mm.
+·020 in. (·508 mm.)	2·4978 to 2·4981 in.	63·443 to 63·448 mm.
+·030 in. (·762 mm.)	2·5078 to 2·5081 in.	63·697 to 63·702 mm.
+·040 in. (1·016 mm.)	2·5178 to 2·5181 in.	63·951 to 63·956 mm.

Section A.29

CRANKSHAFT AND MAIN BEARINGS

The crankshaft is statically and dynamically balanced and is supported in the crankcase by three renewable main bearings. The end-float is controlled by a thrust washer fitted on both sides of the centre main bearing.

Removing

Drain the transmission casing and external oil filter.

Remove the engine as in Section A.34.

Extract the flywheel and clutch assembly (Section A.17) and remove the flywheel housing (Section A.22).

Remove the timing cover and gears (Sections A.19 and A.20), and the transmission (Section A.23).

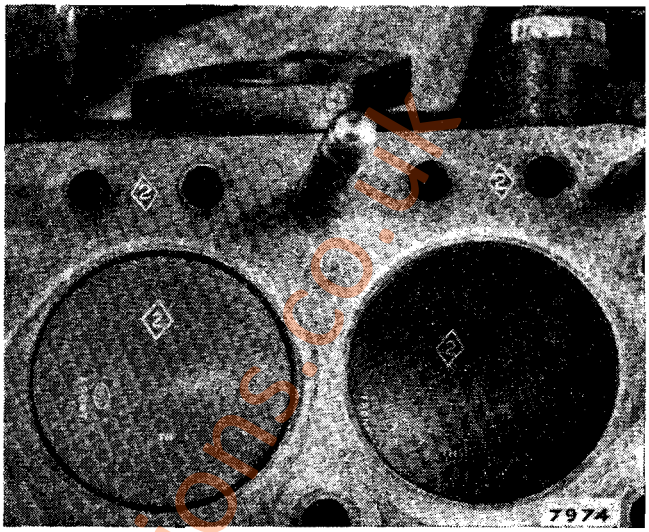


Fig. A.26

The pistons are marked on their crowns with a figure enclosed in a diamond to indicate their size, which should correspond with the similar size stamped on the cylinder block adjacent to the bore. The piston crowns are also stamped 'FRONT' to indicate which way they should be fitted, and 'oversize' pistons have their oversize dimension indicated by figures in a small ellipse

Lift the cylinder block and place it upside-down in a dismantling fixture. Take out the sparking plugs to facilitate turning the crankshaft.

Check the crankshaft end-float to determine whether renewal of the thrust washers is necessary.

Remove the connecting rod bearing caps and shells, keeping the shells with their respective caps for correct replacement, and release the connecting rod from the crankshaft.

Prise out the retaining circlip to release the primary gear from the flywheel end of the crankshaft.

Withdraw the main bearing caps complete with the bottom bearing shells; caps and their respective shells must be kept together. Note that each main bearing cap is stamped with a number, this number being repeated on the web of the crankcase near the bearing cap. The bottom halves of the two thrust washers will be removed with the centre main bearing cap.

Remove the crankshaft, the two remaining halves of the thrust washers, and the top half-shells of the main bearings from the crankshaft.

Inspecting

Inspect the crankcase main journals and crankpins for wear, scores, scratches, and ovality. If necessary, the crankshaft may be reground to the minimum limits shown under **'GENERAL DATA'**. Main bearings for reground crankshafts are available in sizes shown under **'GENERAL DATA'**.

Clean the crankshaft thoroughly, ensuring that the connecting oilways between the journals and crankpins

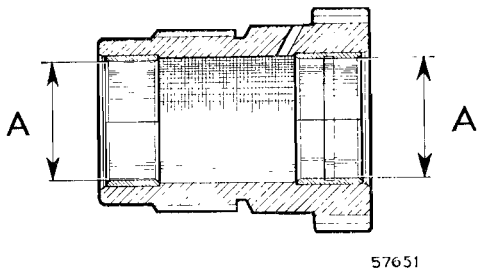


Fig. A.27

A section through the crankshaft primary gear. The bushes (A) *must be line-reamed to* 1·3775 *to* 1·3780 *in.* (34·98 *to* 35·00 *mm.*) *after fitting*

are perfectly clear. They can be cleaned out by applying a pressure gun containing fuel or paraffin (kerosene). When clean, inject a thin oil in the same manner.

A rubber plug is fitted into the rear end of the crankshaft ahead of the flywheel retaining screw as an added precaution against the possibility of oil leakage past the normal brass taper plug sealing the oil gallery. During overhaul the old rubber plug should be extracted and a new one fitted. On later engines an improved brass plug was fitted and the rubber plug was discontinued.

Thoroughly clean the bearing shells, caps, and housings above the crankshaft.

Examine the bearing shells for wear and pitting, and look for evidence of breaking away or picking up. Renew the shells if necessary.

Bearings are prefinished with the correct diametral clearance, and do not require bedding in. New bearings should be marked to match up with the marking on the cap, and **on no account should they be filed to take up wear or to reduce running clearance.**

Check the thrust washers for wear on their bearing surfaces, and renew if necessary to obtain the correct end-float.

Refitting

Installation of the crankshaft and bearings is a reversal of the removal procedure, particular attention, however, being given to the following points:

(1) Ensure that the thrust washers are replaced the correct way round (the oil grooves should face outwards) and locate the bottom half tab in the slot in the bearing cap.
(2) The bearing shells are notched to fit the recesses machined in the housing and cap.
(3) Remember to fit the packing washers behind the crankshaft timing chain wheel.
(4) Lubricate the bearings freely with engine oil.
(5) Tighten the main bearing nuts (see **'GENERAL DATA'** for torque spanner settings).

Section A.30

CRANKSHAFT PRIMARY GEAR

Follow the flywheel housing removal procedure given in Section A.22 to gain access to the primary gear. Extract the retaining 'C' washer and withdraw the gear from the crankshaft.

Should the bushes fitted to the bore of the gear become worn, they can be removed and new bushes pressed into position. Burnish-ream in line to the dimensions given in Fig. A.27.

When refitting, make certain that the correct running clearance of ·003 to ·006 in. (·076 to ·152 mm.) is maintained between the inner face of the 'C' washer and the primary gear. If the clearance is outside these limits, select and fit the appropriate washer from the size range shown under the caption to Fig. A.17.

The crankshaft primary gear is pressure-lubricated through drillings in the crankshaft.

Section A.31

VALVE SEAT INSERTS

Should the valve seatings become so badly worn or pitted that the normal workshop cutting and refacing tools cannot restore them to their original standard of efficiency, special valve seat inserts can be fitted.

The seatings in the cylinder head must be machined to the dimensions given in Fig. A.28. Each insert should have an interference fit of ·0025 to ·0045 in. (·063 to ·11 mm.) and must be pressed and not driven into the cylinder head.

After fitting, grind or machine the new seating to the dimensions given in Fig. A.28. Normal valve-grinding may be necessary to ensure efficient valve-seating.

Section A.32

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

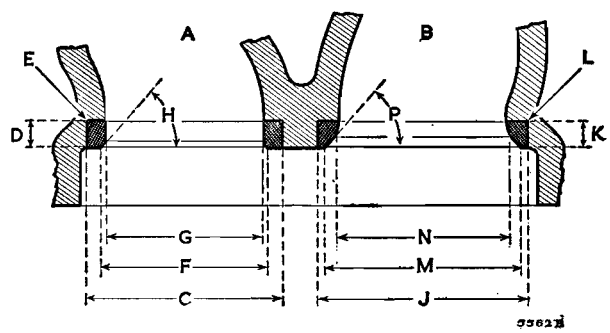


Fig. A.28

Valve seat machining dimensions

Exhaust (A)	Inlet (B)
C. 1·124 to 1·125 in. (28·55 to 28·58 mm.).	J. 1·187 to 1·188 in. (30·16 to 30·17 mm.).
D. ·186 to ·188 in. (4·72 to 4·77 mm.).	K. ·186 to ·188 in. (4·72 to 4·77 mm.).
E. Maximum radius ·015 in. (·38 mm.).	L. Maximum radius ·015 in. (·38 mm.).
F. 1·0235 to 1·0435 in. (25·99 to 26·50 mm.).	M. 1·0855 to 1·1055 in. (27·58 to 28·07 mm.).
G. ·844 in. (21·43 mm.).	N. 1·000 to 1·006 in. (25·4 to 25·55 mm.).
H. 45°.	P. 45°.

of the new ring and its mating surface on the flywheel are free from burrs and are perfectly clean.

To fit the new ring it must be heated to a temperature of 575 to 752° F. (300 to 400° C.), indicated by a light-blue surface colour. Do not exceed this temperature, otherwise 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.

Section A.33

CYLINDER LINERS

Should the condition of the cylinder bores be such that they cannot be cleaned up to accept standard oversize pistons, dry cylinder liners can be fitted. This operation may be carried out by the use of specialized proprietary equipment or with a power press using pilot adaptors to the dimensions shown in Fig. A.29. The press must be capable of 3 tons (3048 kg.) pressure to fit new liners and 5 to 8 tons (5080 to 8128 kg.) to remove old liners.

Remove the engine from the vehicle as detailed in Section A.18. Dismantle the engine and remove the cylinder head studs. If liners have not previously been fitted the bores must be machined and honed to the dimensions given in the table below.

Removing worn liners

Place the cylinder block face downwards on suitable wooden supports on the bed of the press, making sure that there is sufficient space between the block and the bed of the press to allow the worn liner to pass down. Insert the pilot in the bottom of the liner and carefully press the liner from the bore.

Pressing in new liners

Thoroughly clean the inside of the bores and the outside of the liners. Stand the cylinder block upright on the bed of the press, insert the pilot guide in the top of the liner, and position the liner with its chamfered end in the top of the bore. Make certain that the liner is square with the top of the block and that the ram of the press is over the centre of the pilot. Press the liner into the bore.

Each liner must be machined to the dimensions given below after pressing into position.

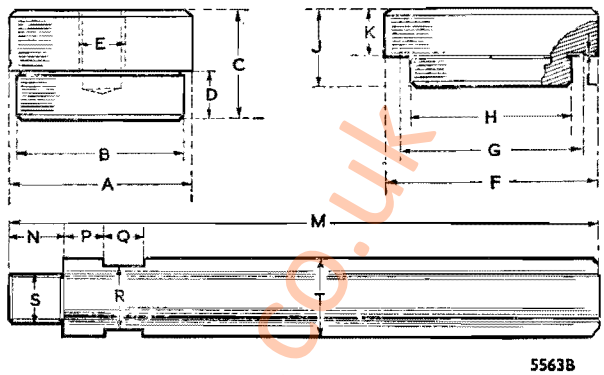


Fig. A.29

Cylinder liner pilots should be made to the above dimensions from 55-ton hardening and tempering steel and hardened in oil at a temperature of 1,020° *F.* (550° *C.*)

Pressing-out pilot

A. $2\frac{37}{64}\ ^{+\cdot005}_{-\cdot0}$ in. (65·48 $^{+\cdot127}_{-\cdot0}$ mm.).
B. 2·465 $^{+\cdot0}_{-\cdot005}$ in. (62·61 $^{+\cdot0}_{-\cdot127}$ mm.).
C. $1\frac{3}{4}$ in. (44·45 mm.).
D. $\frac{3}{4}$ in. (19·05 mm.).
E. $\frac{3}{4}$ in. B.S.W. thread.

Pressing-in pilot

F. 3 in. (76·20 mm.).
G. $2\frac{5}{8}$ in. (66·68 mm.).
H. 2·455 $^{+\cdot0}_{-\cdot005}$ in. (62·35 $^{+\cdot0}_{-\cdot127}$ mm.).
J. $1\frac{1}{4}$ in. (31·75 mm.).
K. $\frac{3}{4}$ in. (19·05 mm.).
L. ·015 in. (·38 mm.).

Pilot extension

M. $14\frac{1}{2}$ in. (36·83 cm.).
N. $\frac{7}{8}$ in. (22·22 mm.).
P. $\frac{5}{8}$ in. (15·87 mm.).
Q. $\frac{5}{8}$ in. (15·87 mm.).
R. 1 in. (25·4 mm.) flats.
S. $\frac{3}{4}$ in. B.S.W. thread.
T. $1\frac{1}{4}$ in. (31·75 mm.).

Section A.34

ENGINE AND TRANSMISSION

The engine and transmission assembly can be removed and refitted through the bonnet aperture, provided a service pit is available or supports are placed under the front road wheels to raise the vehicle to a sufficient height for an operator to work beneath the front end.

Removing

Detach the earth lead from the battery and remove the bonnet from its hinges.

Unscrew the hexagon plug and remove the anti-rattle spring and plunger from the gear change extension casing.

Engine type	*Liner Part No.*	*Machine bores of cylinder block to this dimension before fitting liner*	*Outside diameter of liner*	*Interference fit of liner in cylinder block bore*	*Machine liner bore to this dimension after fitting*
'A' (848 c.c.)	2A784	2·6035 to 2·604 in. (66·128 to 66·14 mm.)	2·606 to 2·60675 in. (66·19 to 66·21 mm.)	·002 to ·00325 in. (·05 to ·08 mm.)	2·477 to 2·4785 in. (62·915 to 62·954 mm.)

Remove the two set screws securing the change speed lever retaining plate and pull the lever out of the casing from inside the car.

Unscrew the nuts and remove the two 'U' bolts securing the flexible coupling to the drive shaft sliding joint. Push the sliding joint onto the drive shaft to enable the coupling to be separated from and to clear the sliding joint when the engine is lifted. Take care not to damage the flexible rubber boot on the sliding joint. Disconnect the exhaust system from its fixing point on the transmission casing.

Disconnect the heater inlet and outlet hoses (if applicable).

Remove the carburetter as in Section A.4.

Disconnect the leads from the following: warning light switch on the cylinder block, coil, dynamo, distributor, earth lead on the clutch cover, and the cable from the starter motor.

Disconnect the sparking plug leads and remove the distributor cap.

Unscrew the sleeve nut to release the drive cable from the back of the speedometer. Remove the windshield washer bottle and bottle carrier from the wing valance of the instrument, and release the cable from the clip on the bulkhead cross-member.

Release the exhaust pipe to manifold clamp, and secure the pipe against the engine bulkhead.

Remove the two set screws securing the clutch slave cylinder to the flywheel housing, release the clutch cover tension spring, pull the push-rod from the slave cylinder, and secure the cylinder body against the engine bulkhead.

Disconnect the engine tie-rod from the cylinder block and swing the rod away from the engine.

Remove the valve rocker cover and cover gasket.

Remove the nuts from the second and fourth cylinder head studs on the forward side of the engine and fit two lifting eyes.

Take the weight of the engine with suitable lifting tackle, remove the two set screws securing each engine mounting to the sub-frame, and lift the engine from the vehicle.

When lifting the engine make certain that it does not foul the clutch slave cylinder, and ensure that the drive shaft sliding joints are held clear of the flexible couplings. Allow the engine tie-rod to pass between the clutch cover and lever. A millboard shield should also be inserted between the radiator and the wing valance to protect the radiator core from damage during the lifting operation.

Refitting

Refitting is a reversal of the removal procedure, with particular attention being given to the following points.

Make certain that the change speed lever is pulled up into the interior of the car before the engine is lowered into the engine compartment.

Keep the sliding joints pushed well onto the drive shaft splines while the flexible couplings are moved into position.

Refit the exhaust system, following the procedure given in Section A.5.

Section A.35

ENGINE MOUNTINGS

Removing

Left-hand mounting

Remove the radiator as in Section C.3.

Support the engine to take the weight off the mountings.

Remove the nuts securing the mounting bracket to the transmission casing, the two set screws, nuts, and spring washers securing the mounting to the sub-frame side-members, and withdraw the bracket and mounting assembly.

Right-hand mounting

Remove the clutch cover and engine mounting together as detailed in Section A.17. Unscrew three set screws to release the mounting from the cover.

Refitting

Refitting is a reversal of the removal procedure. Make certain that the paper gaskets are fitted between the left-hand mounting and the transmission casing and between the right-hand mounting and the clutch cover on all engines up to Engine No. 4354.

Section A.36

FIRST MOTION SHAFT OUTER RACE

Removal

To remove the outer race of the first motion shaft roller bearing from the flywheel housing remove the spring ring from its groove immediately above the outer race. Expand the bearing housing by immersing the flywheel housing in very hot water for several minutes. **Do not use other methods of heating the housing.** Overheating or the use of a flame can easily damage or destroy the flywheel housing.

Dismantle Service tool 18G617, grip together the spring handles of the split collet, place the collet inside the race till the lips of the collet register evenly under the lower edge of the race, and release the handles. Place the outer cover of the tool squarely on the bearing boss, run back the nut to the head of the screw, and fit the screw, nut, and plain washer through the outer cover into the threaded centre of the collet. Screw down until the nut and washer reach the top of the outer cover. Hold the hexagon of the screw and screw down the nut against the top of the outer cover of the tool. Continue screwing down the nut, and the outer bearing race will be withdrawn easily without damage to the housing.

Refitting

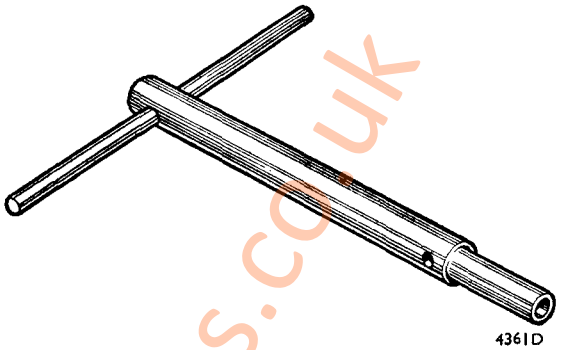
When refitting an outer race expand the flywheel housing as previously described and position the race squarely in the mouth of the bore of the housing with the flywheel housing resting on a flat wooden surface. Using the driver portion of Service tool 18G617, gently drift or press in the race until the top edge is just sufficiently clear of the ring groove to enable the spring ring to be refitted.

Refit the spring ring and lightly oil the race.

SERVICE TOOLS

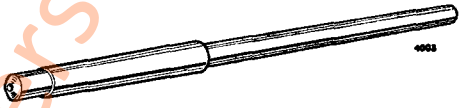
18G27. Valve Seat Cutter Handle

Both the pilot and the handle are used with the finishing cutter, the glaze breaker, and the narrowing cutter.



18G27

18G167D. Valve Seat Cutter Pilot

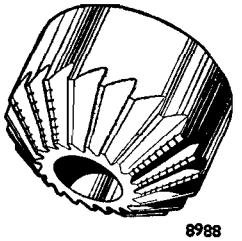


18G167D

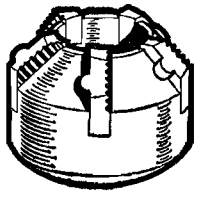
18G167. Valve Seat Finishing Cutter

18G167A. Valve Seat Glaze Breaker

The use of these cutters will save lengthy and wasteful grinding in when the valve seats are pitted. Worn seats usually have a glass-hard surface, and the glaze breaker will prepare these seats for any cutting that may be necessary.



18G167

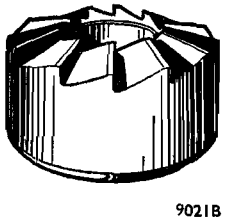


18G167A

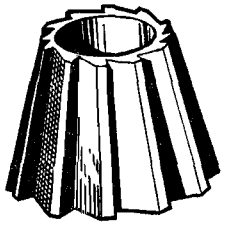
18G167B. Valve Seat Narrowing Cutter—Top

18G167C. Valve Seat Narrowing Cutter—Bottom

These narrowing cutters will enable the valve seats to be maintained at their original dimensions. See **'GENERAL DATA'.**



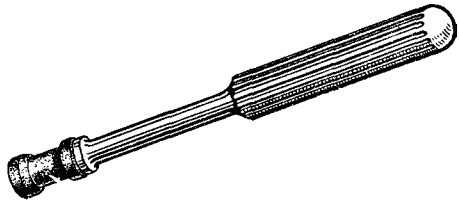
18G167B



18G167C

18G29. Valve Suction Grinder

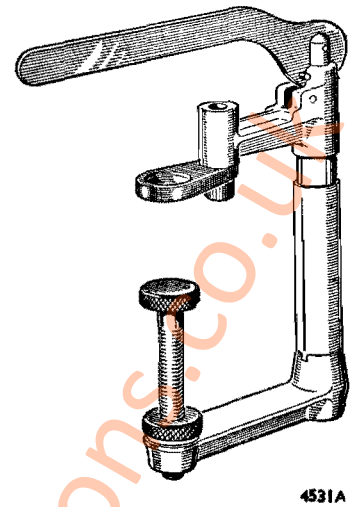
A metal handle complete with a detachable rubber suction pad (18G29A). An additional pad (18G29B) is required for use with this model.



18G29

18G45. Valve Spring Compressor

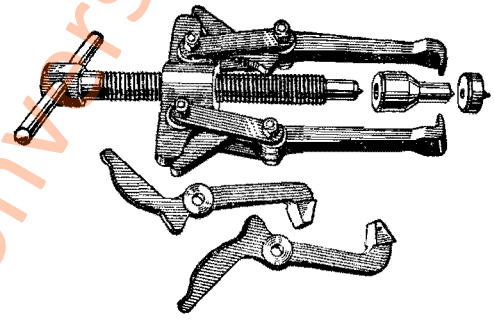
This tool is designed with a cam and lever action which is both positive and speedy. The adaptor ring is specially shaped to facilitate the removal and replacement of split collets. Screw adjustment is also provided.



18G45

18G2. Crankshaft Gear and Pulley Remover

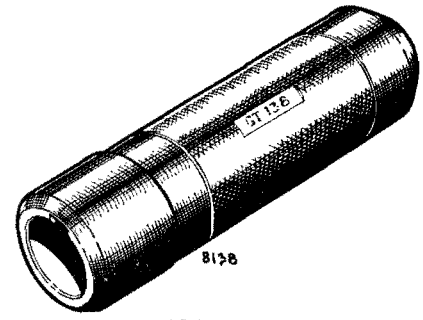
A multipurpose tool with alternative legs readily interchangeable: one pair with thin flat ends designed to remove the crankshaft gear, and the other pair with tapered ends suitable for pulley grooves.



18G2

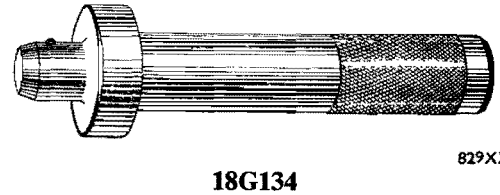
18G138. Crankshaft Gear and Pulley Replacer

This tool will replace the crankshaft gear and ensure that the timing cover is located correctly. The felt oil seal and cover must be concentric with the crankshaft, thus safeguarding against oil leaks.



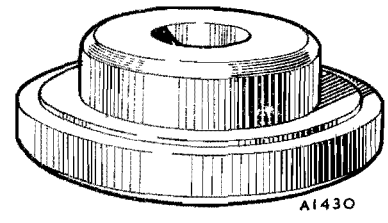
18G138

18G134. Bearing and Oil Seal Replacer (basic tool)



18G134

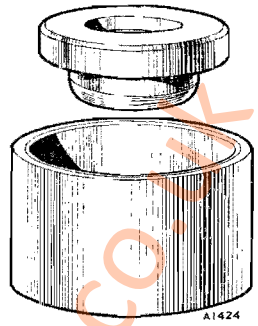
18G134BC. Crankshaft Primary Gear Oil Seal Replacer Adaptor



18G134BC

18G134BD. Timing Case Oil Seal Replacer Adaptor

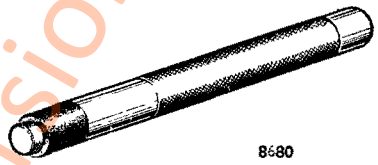
The fitting of the primary gear and timing case oil seals to their respective positions must be carried out with extreme care. Both the handle (Part No. 18G134) and adaptors (Part Nos. 18G134BC and 18G134BD) must be used to ensure that the seals are fitted to their respective positions correctly and without damage.



18G134BD

18G69. Oil Pump Release Valve Grinding-in Tool

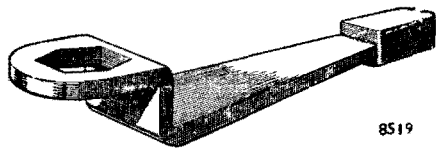
Designed to facilitate the removal and grinding in of the engine oil release valve. Tightening the set screw will expand the rubber plunger to ensure that the tool is a tight fit when inserted into the hollow oil release valve.



18G69

18G98. Shock Spanner

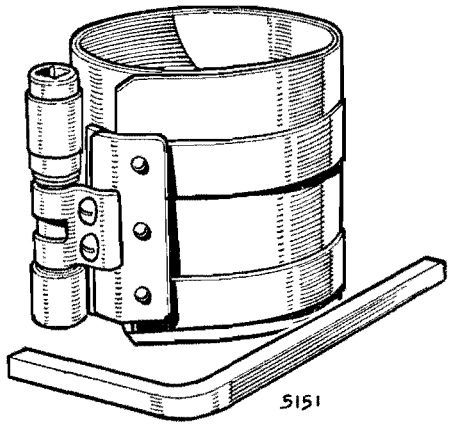
A shock-type spanner designed to remove the crankshaft pulley screw without having to lock the crankshaft by improvised means, which invariably damages the engine components.



18G98

18G55A. Piston Ring Compressor

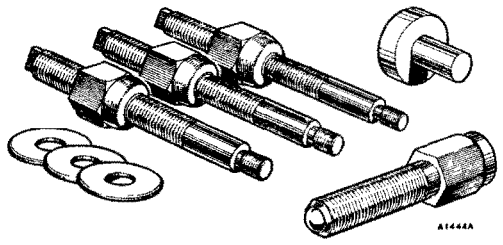
A clamping device to compress the piston rings, enabling the operator to push the piston assembly into the cylinder bore with minimum of pressure, thus avoiding damage to the piston and piston rings.



18G55A

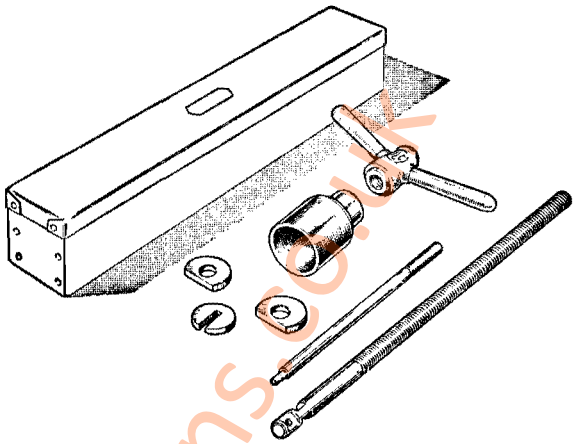
18G304M. Flywheel and Clutch Remover Adaptor

These adaptors are for use with basic tool 18G304 (shown at the end of Section K) to remove the flywheel from the crankshaft. The three identical screws must be screwed through the plate of this tool into the flywheel and the fourth screw used to replace the centre screw of the tool.



18G304M

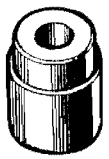
18G124A. Camshaft Liner Remover and Replacer (basic tool)



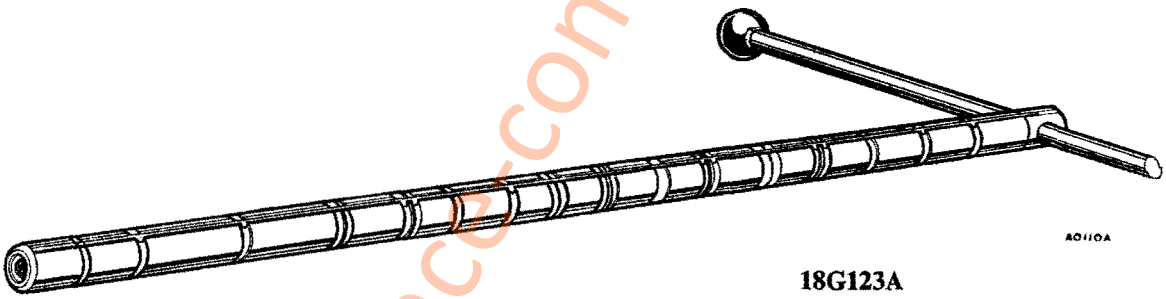
18G124A

18G124K. Camshaft Liner Remover Adaptor

With the aid of this tool and adaptor a camshaft liner can be removed and a new liner pulled into the cylinder block without the damage invariably associated with the use of improvised drifts.



18G124K

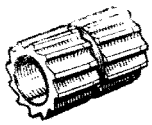


18G123A

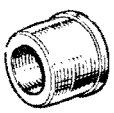
18G123A. Camshaft Liner Reamer (basic tool)
18G123AH. Camshaft Liner Reamer Pilot—Centre
18G123AJ. Camshaft Liner Reamer Pilot—Rear
18G123AN. Camshaft Liner Reamer Cutter

This equipment is essential when reconditioning cylinder blocks, otherwise camshaft liners cannot be reamed in line, and in consequence the clearance between the camshaft journal and the bearing will be incorrect.

18G123AJ



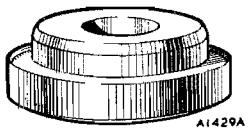
18G123AN



18G123AH

18G134BH. Flywheel and Front Hub Oil Seal Replacer Adaptor

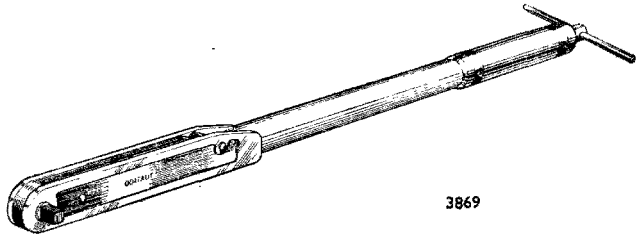
For the correct and easy replacement of the flywheel oil seal. Use in conjunction with handle (Part No. 18G134).



18G134BH

18G372. Torque Wrench—30 to 140 lb. ft. (4·15 to 19·4 kg. m.)

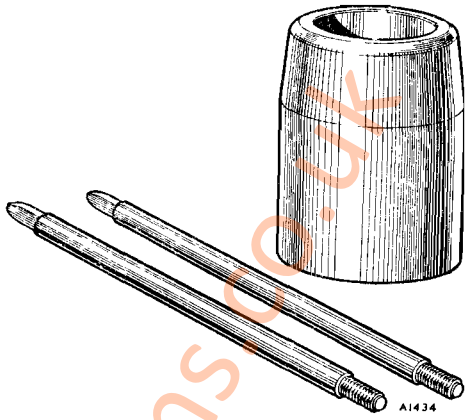
A universal torque wrench for use with standard sockets. This tool is essential if the recommended torque figure for cylinder head stud nuts is not to be exceeded.



18G372

18G570. Crankshaft Primary Gear Oil Seal Protector Sleeve

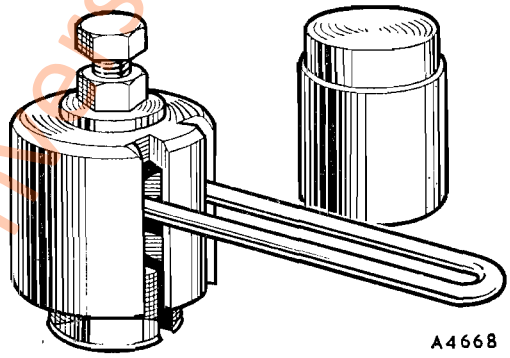
For use when fitting the flywheel housing to prevent the clutch splines on the crankshaft primary gear damaging the oil seal. The two pilot studs must be screwed into the two bottom tapped holes in the cylinder block.



18G570

18G617. Flywheel Housing Bearing (First Motion Shaft) Outer Race Remover/Replacer

This tool will remove and replace the outer race of the roller bearing without the damage to the flywheel housing which occurs when improvised methods are used.



18G617

SECTION B

THE IGNITION SYSTEM

GENERAL DESCRIPTION

The ignition system consists of two circuits—primary and secondary. The primary circuit includes the battery, the ignition switch, the primary or low-tension circuit of the coil, and the distributor contact breaker and capacitor. The secondary circuit includes the secondary or high-tension circuit of the coil, the distributor rotor and cover segments, the high-tension cables, and the sparking plugs.

The ignition coil, which is mounted on the right-hand side of the engine, consists of a soft-iron core around which is wound the primary and secondary windings. The coil carries at one end a centre high-tension terminal and two low-tension terminals marked 'SW' (switch) and 'CB' (contact breaker) respectively.

The ends of the primary winding are connected to the 'SW' and 'CB' terminals and the secondary winding to the 'CB' terminal and the high-tension terminal.

The distributor is mounted on the right-hand side of the engine and is driven by a shaft and helical gear from the camshaft. Automatic timing control of the distributor is controlled by a centrifugal mechanism and a vacuum-operated unit each opening entirely independently of each other. The centrifugal mechanism regulates the ignition advance according to engine speed, while the vacuum control varies the timing according to engine load. The combined effect of the two mechanisms gives added efficiency over the full operating range of the engine. A micrometer adjuster is provided to give a fine timing adjustment to allow for the engine condition and the grade of fuel used.

A keyed moulded rotor with a metal electrode is mounted on top of the cam. Attached to the distributor body above the centrifugal advance mechanism is a contact breaker plate carrying the contact breaker points and a capacitor connected in parallel. A cover is fitted over the distributor body and retained by two spring clips attached to the body.

Inside the cover is a centre electrode and spring-loaded carbon brush which makes contact with the rotor electrode. The brush is of composite construction, the top portion being made of a resistive compound, while the lower portion is made of softer carbon to prevent wear of the rotor electrode. Under no circumstances must a short, non-resistive brush be used to replace this long, resistive type. A measure of radio interference suppression is given by this brush.

Spaced circumferentially around the distributor cap are the sparking plug high-tension cable segments.

The distributor is secured in position on the cylinder block by a clamp plate.

The sparking plugs are located on the right-hand side of the engine and have a 14-mm. thread with a $\frac{3}{4}$-in. reach.

When the ignition is switched on, the current from the battery flows through the primary circuit and a magnetic field is built up around the core of the coil. When the contact breaker points are opened by rotation of the distributor cam the current flow is interrupted, causing a high voltage to be induced in the secondary winding of the coil by the sudden collapse and consequent change in the magnetic field. The high-tension current thus generated in the secondary winding of the coil is conveyed by the coil high-tension cable to the centre terminal of the distributor cover. From here the current passes through the carbon brush to the rotor electrode, and is distributed to the segments and thence to the sparking plugs via the high-tension cables.

Section B.1

UNEVEN FIRING

To test with sparking plugs in position

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

(2) Short-circuit each plug in turn by 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.

(3) 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 $\frac{3}{16}$ in. (4·8 mm.) from the cylinder head.

(4) 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, or alternatively fit a replacement plug. See Section B.4.

(5) 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 rubber 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 soft 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 have 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 in the places indicated. A replacement distributor cap must be fitted in place of one that has become tracked.

Section B.2

TESTING THE LOW-TENSION CIRCUIT

Testing in position

(1) 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.

(2) 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 when the contacts are fully opened is between ·014 and ·016 in. (·36 and ·40 mm.). Correct the gap if necessary.

(3) Disconnect the cable at the contact breaker terminal 'CB' 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.

Locating a fault

(1) Having determined, by testing as previously described, 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.

(2) 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.

(3) *Battery to starter switch.* Connect a voltmeter between the starter terminal and a good earthing point. No reading indicates a damaged cable or loose connections.

(4) *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 damaged cable or loose connections.

(5) *Control box.* Connect a voltmeter to the control box terminal 'A1' and to earth. No reading indicates a broken or loose connection.

(6) *Control box terminal 'A1' and feed terminal of the lighting switch* (brown with blue lead). Connect a voltmeter to the feed terminal of the lighting switch and to earth. No reading indicates a damaged cable or loose connections.

(7) *Lighting switch feed terminal to terminal on ignition switch* (brown with blue). Connect a voltmeter to the ignition switch terminal and to earth. No reading indicates a damaged cable or loose connections.

(8) *Ignition switch.* Connect a voltmeter to the other ignition switch terminal and to earth. No reading indicates a fault in the ignition switch.

(9) *Ignition switch to fusebox terminal 'A3'* (white lead). Connect the voltmeter to the fusebox terminal 'A3' and to earth. No reading indicates a damaged cable or loose connections.

(10) *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 damaged cable or loose connections.

(11) *Ignition coil.* Disconnect the cable from the 'CB' terminal of the ignition coil and connect a voltmeter to this terminal and to earth. No reading indicates a fault in the primary winding of the coil and a replacement coil must be fitted. If the correct reading is given, remake the connections to the coil terminal.

(12) *Ignition coil to distributor* (white with black lead). Disconnect the cable from the low-tension terminal on the distributor and connect the voltmeter to the end of this cable and to earth. No reading indicates a damaged cable or loose connections.

(13) *Contact breaker and capacitor.* Connect the voltmeter across the contact breaker points. No reading indicates a fault in the capacitor.

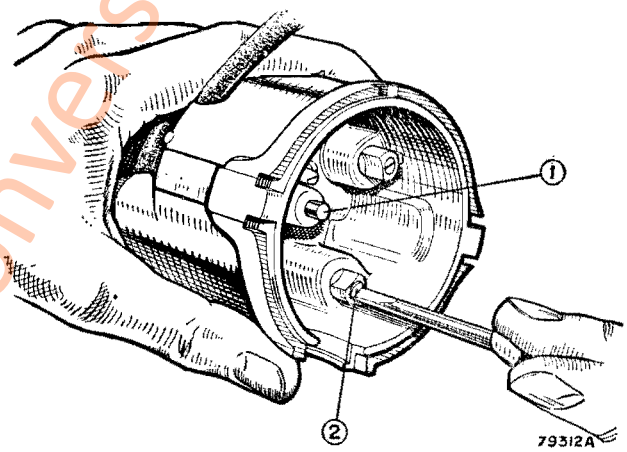


Fig. B.1

The method of connecting high-tension leads

1. Carbon brush. 2. Cable-securing screw.

Section B.3

HIGH-TENSION CABLES

(1) The high-tension cables must be examined carefully and any which have the insulation cracked, perished, or damaged in any way must be replaced by 7-mm. rubber-covered ignition cable.

(2) To fit the cable to the terminal of the ignition coil thread the knurled moulded terminal over the lead, bare the end of the cable for about ¼ 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 into its terminal.

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, fill the cable sockets in the moulding with Silicone grease, and push the cables completely home, watching in the process that the displaced surplus grease exudes evenly all

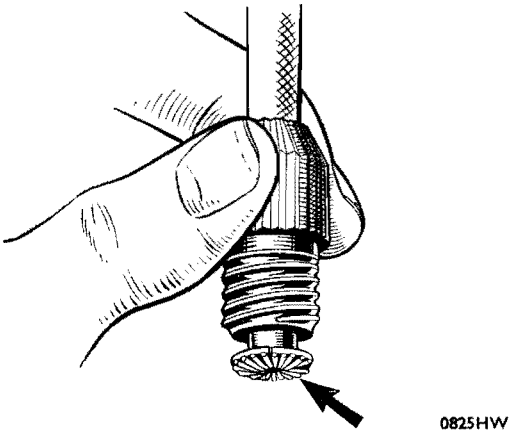


Fig. B.2

The correct method of fitting a high-tension cable to the ignition terminal nut

round the leads to form a perfect seal. Care should be taken to leave an adequate surplus on the surface of the cap at the lead entry points. Tighten the screws. They will pierce the rubber insulation and make good contact with the cable core.

(3) The cables from the distributor to the sparking plugs must be connected up in the correct firing order, which is 1, 3, 4, 2.

Section B.4

SPARKING PLUGS

Service procedure

To maintain peak sparking plug performance plugs should be inspected, cleaned, and regapped at 3,000 miles (4800 km.). Under certain fuel and operating conditions, particularly extended slow-speed town driving, sparking plugs may have to be serviced at shorter intervals.

Disconnect the ignition cables from all sparking plugs. Loosen the sparking plugs about two turns counter-clockwise, using the proper size deep socket wrench.

Blow away the dirt from around the base of each plug. Remove the sparking plugs and place them in a suitable holder, preferably in the order they were in the engine.

Analysing service conditions

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

Examine the firing ends of the sparking plugs, noting the type of the deposits and the degree of electrode erosion. Remember that if insufficient voltage is delivered to the sparking plug, no type of plug can fire the mixture in the cylinder properly.

Normal condition—look for powdery deposits ranging from brown to greyish tan. Electrodes may be worn slightly. These are signs of a sparking plug of the correct heat range used under normal conditions—that is, mixed periods of high-speed and low-speed driving. Cleaning and regapping of the sparking plugs is all that is required. Watch for white to yellowish powdery deposits. This usually indicates long periods of constant-speed driving or a lot of slow-speed city driving. These deposits have no effect on performance if the sparking plugs are cleaned thoroughly at approximately 3,000-mile (4800-km.) intervals. Remember to 'wobble' the plug during abrasive blasting in the Champion service unit. Then file the sparking surfaces vigorously to expose bright, clean metal.

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

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

Burned or overheated sparking plugs are usually identified by a white, burned, or blistered insulator nose and badly eroded electrodes. Inefficient engine cooling and improper ignition timing can cause general overheating. Severe service, such as sustained high speed

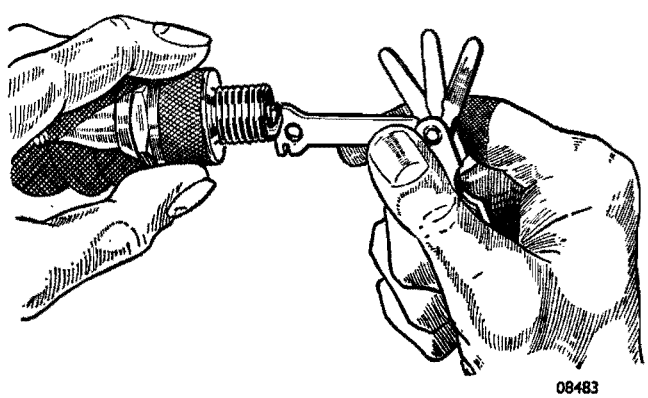


Fig. B.3

Reset the plug gap, using the Champion special gap setting tool shown above

and heavy loads, can also produce abnormally high temperatures in the combustion chamber which necessitate use of colder-type sparking plugs.

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

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

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

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

Clean the threads by means of a hand or power-driven wire brush. If the latter type is used wire size should not exceed ·005 in. diameter. Do not wire-brush the insulator or the electrodes.

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

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

Finally tighten the sparking plugs to the following values (pounds feet):

Size	*C.I. head*	*Alum. head*	*Turns*
14 mm.	30	27	½

The number of turns listed approximate to the proper torque values and should be used if a torque wrench is not available or cannot be used because of limited accessibility.

Connect the H.T. terminals after the plugs are installed.

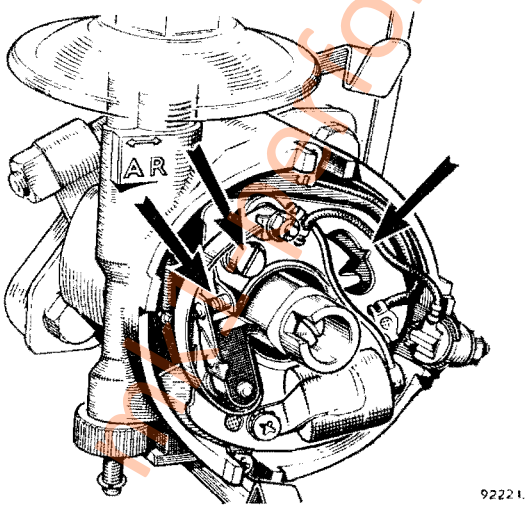


Fig. B.4

The distributor with the moulded cap and rotor arm removed, showing the contact breaker mechanism

Standard gap setting

The sparking plug gap settings recommended and listed under **'GENERAL DATA'** have been found to give the best overall performance under all service conditions. They are based on extensive dynamometer testing and experience on the road and are generally a compromise between the wide gaps necessary for best idling performance and the small gaps required for the best high-speed performance.

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

Section B.5

CONTACT BREAKER MECHANISM

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

(1) Remove the distributor cap, taking care not to disturb the seals of water-repellent Silicone grease at the points of entry of the ignition leads into the cap. Adequate sealing is vital, since otherwise water may in extreme circumstances penetrate into the cap down the outside of the leads and cause ignition failure.

(2) Turn the engine until the contact breaker points are fully opened and check the gap with a gauge having a thickness of from ·014 to ·016 in. (·36 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 and then slacken the two screws securing the fixed contact plate. Adjust the position of the plate until the gap is set to the thickness of the gauge and then tighten the two locking screws.

Remember that the cam only keeps the contact points fully open over a very small angle and that care must be taken to ensure that the points are in the fully open position.

(3) 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 fuel-moistened cloth. The moving contact can be removed from its mounting in order to assist cleaning. Check and adjust the contact breaker setting after cleaning the contacts.

(4) Check that the moving arm moves freely on its pivot. If it is sluggish remove the moving 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.

(5) Check the Silicone grease water seal where the ignition leads enter the distributor cap, and renew if necessary.

Section B.6

DISTRIBUTOR

Removal

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

(2) To facilitate the replacement of the distributor turn the engine over until the rotor arm is pointing to the segment in the cover for No. 1 cylinder plug lead to provide a datum for replacement. Also, ascertain the approximate position of the vacuum unit in order to facilitate the connection of the vacuum pipe on replacement.

(3) Remove the distributor cover and disconnect the low-tension lead from the terminal on the distributor. Disconnect the suction advance pipe at the union on the distributor.

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

Dismantling

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 first remove the rotor arm and then withdraw the slotted nylon low-tension terminal insulator 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, make a careful note of 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 and spring and flat washers securing the fixed contact plate and remove the plate.

(5) Take out the securing screw and remove 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.

Unhook the flexible actuating link connecting the diaphragm in the vacuum unit with the moving contact breaker plate.

IMPORTANT.—Note the relative positions 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 spring toggle (when fitted).

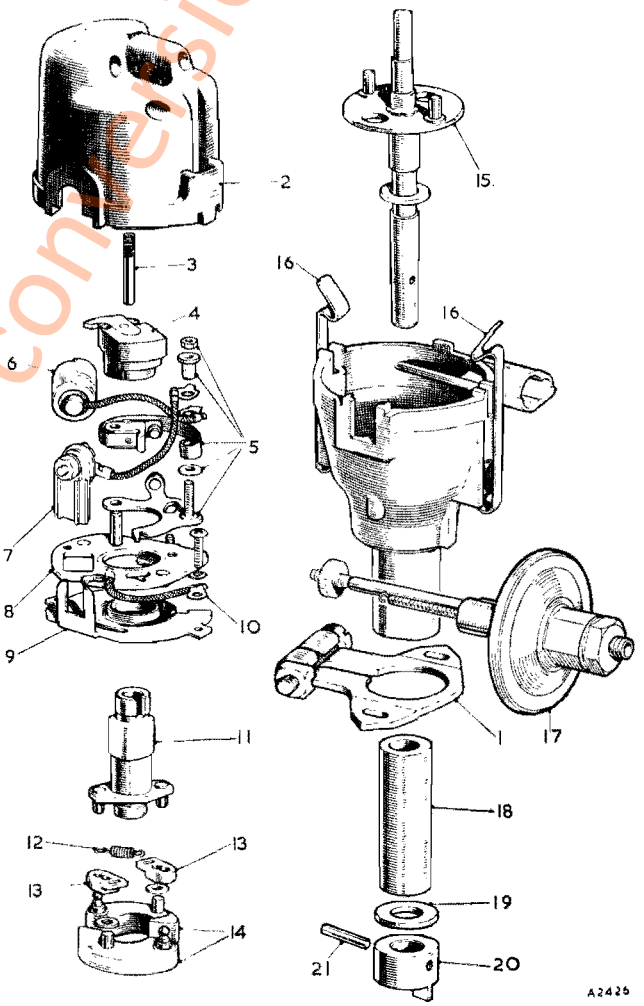


Fig. B.5

The components of the DM2P4 distributor

1. Clamping plate.
2. Moulded cap.
3. Brush and spring.
4. Rotor arm.
5. Contacts (set).
6. Capacitor.
7. Terminal and lead (low-tension).
8. Moving contact breaker plate.
9. Contact breaker base plate.
10. Earth lead.
11. Cam.
12. Automatic advance springs.
13. Toggles.
14. Weight assembly.
15. Shaft and action plate.
16. Cap-retaining clips.
17. Vacuum unit.
18. Bush.
19. Thrust washer.
20. Driving dog.
21. Taper pin.

(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.

(11) Clean the distributor cover and examine it for signs of cracks and evidence of 'tracking', i.e. a conducting path may have formed between adjacent segments. This is indicated by a thin black line between the segments; when this has occurred the cover should be renewed.

(12) Ensure that the carbon brush moves freely in the distributor cover.

(13) Examine the attachment of the metal electrode to the rotor moulding. If slack or abnormally burned, renew the rotor.

(14) The contact face of the contact breaker points should present a clean, greyish, frosted appearance. If burned or blackened, renew the contact set or polish the contact face of each point with a fine oil-stone, working with a rotary motion. Care should be taken to maintain the faces of the points flat and square, so that when re-assembled full contact is obtained. Clean the points thoroughly in fuel.

(15) Check that the movable contact arm is free on its pivot without slackness.

(16) Check the centrifugal timing control balance weights and pivot pins for wear, and renew the cam assembly or weights if necessary.

(17) The cam assembly should be a free sliding fit on the driving shaft. If the clearance is excessive, or the cam face is worn, renew the cam assembly or shaft as necessary.

(18) Check the fit of the shaft in the body bearing bush. If slack, renew the bush and shaft as necessary.

Press out the old bush. The new bush should be allowed to stand completely immersed in thin engine oil for 24 hours, or alternatively for two hours in oil which has been heated to 212° F. (100° C.), before pressing it into the distributor body.

Reassembling

Reassembly is a direct reversal of the dismantling procedure, 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.

(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. (·36 to ·40 mm.).

Refitting

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 assembling is now in the reverse order to that of removal.

Provided that the engine has not been turned, the rotor arm will be opposite the segment for No. 1 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 anti-clockwise when viewed from above.

Normal ignition adjustment is given in Section B.8.

NOTE.—If the clamping plate has been removed, or even slackened, resulting in lost timing, the procedure given in Section B.7 should be undertaken to reset the distributor.

Renew the coating of Silicone grease where the high-tension leads enter the distributor head.

Section B.7

TIMING THE IGNITION

Where the ignition timing has been lost the following procedure should be undertaken to reset the distributor to its correct firing position:

(1) Remove the distributor and make quite certain that the distributor driving spindle has been refitted correctly as in Section A.16.

(2) Turn the engine in the direction of rotation until No. 1 piston is at T.D.C. on its compression stroke; this can be effected by turning the engine and observing the valves. When the valves are 'rocking' (i.e. exhaust just closing and the inlet just opening) on No. 4 cylinder No. 1 piston is approximately at T.D.C. on its compression stroke. If the engine is now rotated until the 1/4 mark on the flywheel is in line with the pointer in the aperture on the clutch cover (see Fig. B.7) the piston is exactly at T.D.C. Turn the engine back from this position until the pointer indicates the correct setting.

The static ignition timing for engines fitted with a distributor suitable for operating with premium grade fuel is at T.D.C. In countries where the engine is required to operate on regular grade fuels of 90 octane and below an alternative distributor

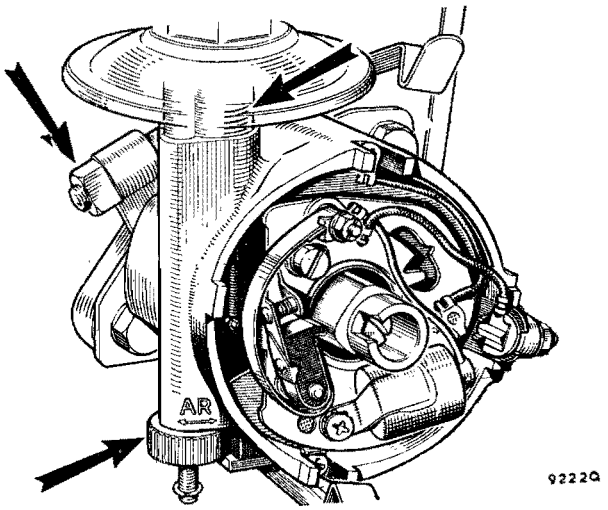


Fig. B.6

The distributor clamp plate pinch-bolt and vernier scale. The lower arrow indicates the ignition firing point adjusting nut

is fitted, and can be identified by the letters 'Fa' included in the engine serial number. The static ignition timing for engines up to Engine No. 14824 fitted with this distributor is 3½° B.T.D.C., and after this engine serial number the timing is 2½° B.T.D.C.

(3) Set the contact breaker points to ·014 to ·016 in. (·36 to ·40 mm.) when in their position of maximum opening. Insert the distributor into its housing, and engage the drive dog lug with the slot in the driving spindle (both of which are offset) by slowly rotating the rotor arm.

(4) Screw in the two set screws to secure the distributor clamp to the distributor housing. Tighten up the clamp plate pinch-bolt to ensure correct alignment before tightening the set screws down in the centre of the elongated holes of the clamp plate.

(5) To obtain an accurate setting the electrical method should be used to determine the actual position at which the points must break, and the following procedure should be adopted.

Slacken the clamp pinch-bolt and rotate the distributor body in an anti-clockwise direction until the points are fully closed.

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 rotate the distributor clockwise until the lamp lights, indicating that the points have just opened. Secure the distributor body in this position by tightening up the clamp plate pinch-bolt.

Finally, check that the rotor arm is opposite the correct segment in the distributor cap for the No. 1 cylinder.

Reconnect the suction advance pipe.

Should a stroboscopic lamp be used, care must be taken that with the engine running the engine speed is low enough to ensure that the centrifugal weights are not in operation. When the vacuum advance take-off is direct from the induction manifold this should be disconnected before attempting the timing check, otherwise the engine timing will be set retarded.

Section B.8

IGNITION ADJUSTMENT

Adjustment is provided for the ignition point to enable the best setting to be attained for varying fuels. The adjustment nut is indicated by the lower arrow in Fig. B.6; turning the nut clockwise retards, and anti-clockwise advances, the ignition. Each graduation on the adjusting spindle barrel represents approximately 5° timing movement and is equal to 55 clicks on the knurled adjuster nut. The range of adjustment provided by this micrometer adjuster is normally ample to deal with any variation encountered.

Do not disturb the pinch-bolt unless absolutely necessary. Should the ignition timing have been lost, retiming should be undertaken as given in Section B.7.

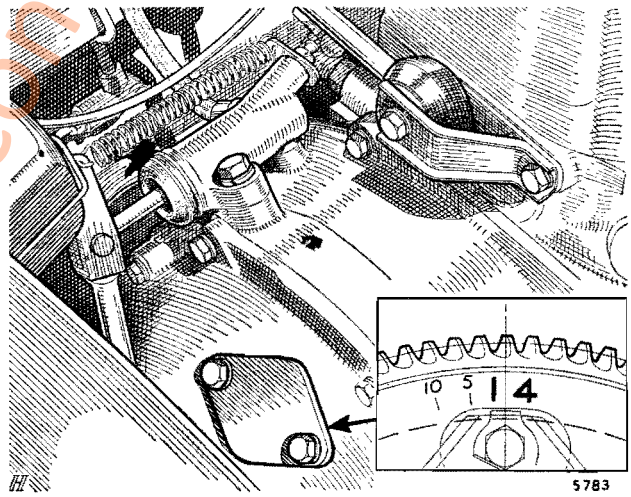


Fig. B.7

The timing marks on the flywheel, and the indicator, may be seen with the aid of a mirror after removing the inspection plate on the clutch cover. T.D.C. position is indicated by the mark 1/4, and, in addition, 5° and 10° B.T.D.C. marks are also provided

Section B.9

CAPACITOR

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.

Should a new capacitor be necessary, it is advisable to fit a complete capacitor and bracket, but should a capacitor only be available, use a hot iron to soften the solder securing the defective capacitor to the bracket. Care must be taken not to overheat the new capacitor when soldering it in position. The capacity of the capacitor is ·2 microfarad.

SECTION C

THE COOLING SYSTEM

GENERAL 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 cylinders and cylinder head, reaching the header tank of the radiator core via the thermostat and the top water hose. From the header tank it passes down the radiator core to the base tank of the radiator. Air is blown through the radiator by a fan attached to the water pump pulley.

The thermostat opens at approximately 158 to 167° F. (70 to 75° C.).

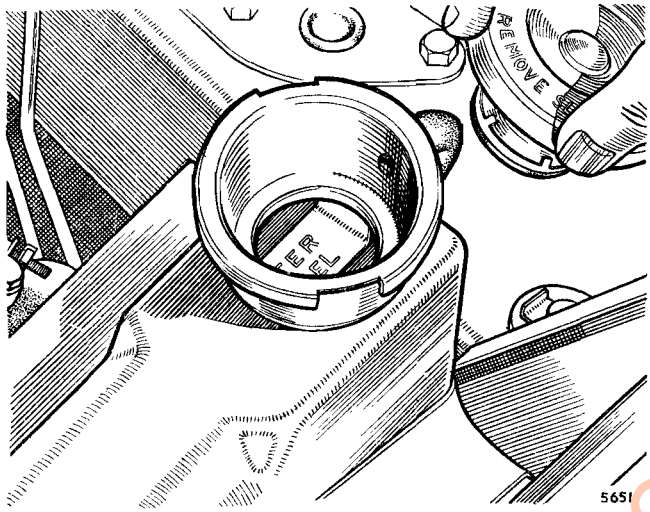


Fig. C.1

The filler cap of the sealed cooling system removed, showing the water level indicator

Section C.1

RADIATOR FILLER CAP

The cooling system is under appreciable pressure while the engine is hot after a run, and the radiator 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 radiator is fully released before finally removing the cap.

It is advisable to protect the hand against escaping steam when removing the cap while the system is warm.

Section C.2

DRAINING AND FLUSHING THE SYSTEM

Draining

Remove the radiator header tank filler cap.

Open both drain taps, one at the base of the radiator and the other on the rear of the cylinder block.

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

Flushing

To ensure sufficient circulation of the coolant and to reduce the formation of scale and sediment in the radiator the system should be periodically flushed with clean running water, preferably before putting in anti-freeze in the autumn and again when taking it out in the spring. The water should be allowed to run through until it comes out clear from the drain tap.

Where furring is excessive the radiator should be removed as in Section C.3 and flushed through in the reverse way to the flow, i.e. turn the radiator upside-down and let the water flow in through the bottom hose connection and out through the top. The use of radiator reverse-flush adaptor 18G187 is recommended for this purpose, used with 1 in. (25·4 mm.) diameter water hose.

Refilling

Close the drain tap.

Ensure that the water hose clips are tightened.

Fill up the system through the filler in the radiator header tank until the water is up to the level indicator strip.

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

Avoid overfilling when anti-freeze is in use to prevent unnecessary loss on expansion.

Screw the filler cap firmly into position.

The cooling system is unsuitable for use with anti-freeze mixtures having an alcohol base owing to the high temperatures attained in the top tank. Only anti-freeze mixtures of the ethylene glycol or glycerine type should be employed.

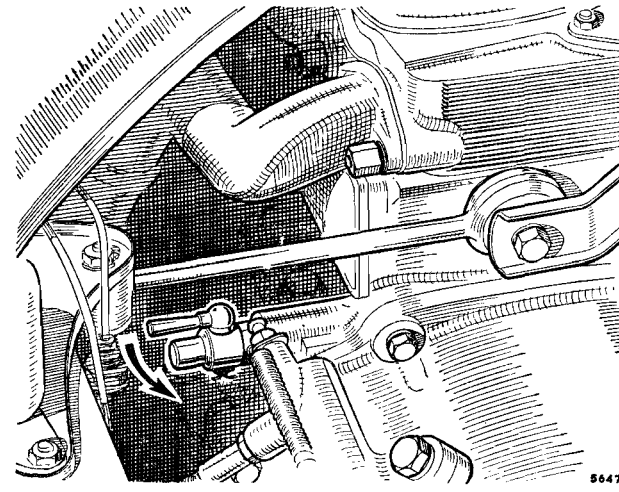


Fig. C.2

The cylinder block drain tap is on the left-hand side of the block at the rear end

Section C.3

RADIATOR

Removing

Remove the bonnet.

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

One-piece cowling

Remove the cowling upper support bracket and withdraw the two bolts securing the cowling to the support bracket on the engine mounting.

Release the clips on the top and bottom water hoses. Detach the top hose from its connection and completely remove the bottom hose.

Remove the four screws securing the radiator to the cowling. Lift out both the radiator and cowling.

Two-piece cowling fitted from Car No. 3941

Remove the cowling upper support bracket.

Withdraw the two bolts securing the bottom support bracket to the engine mounting.

Release the clips and pull the top hose from its connection on the radiator and the bottom hose from the water pump.

Extract the six screws securing the radiator to the cowling and remove the top half of the cowling.

Manœuvre the bottom hose to the outside of the bottom half of the cowling and lift the radiator from the vehicle.

Refitting

Installation is a reversal of the removal procedure. Refer to Section C.2 before refilling.

Section C.4

FAN BELT

Adjustment

The adjustment of the dynamo and fan belt tension is effected by slackening the two dynamo pivot bolts, releasing the bolt on the slotted adjusting link, and raising the dynamo bodily until the belt tension is correct. Tighten up the bolts with the dynamo held in this position. A gentle hand-pull only must be exerted on the dynamo, otherwise the tension will be excessive and undue strain will be thrown on the dynamo bearings.

The belt should be sufficiently tight to prevent slip, yet it must be possible to move it laterally about 1 in. (2·54 cm.).

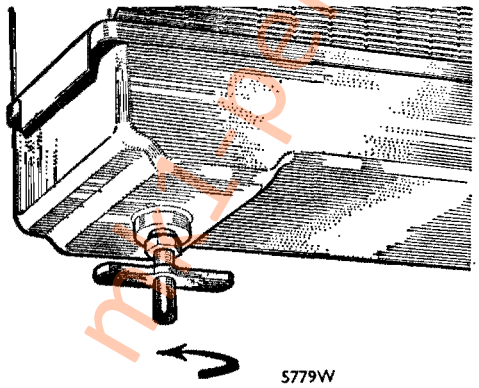


Fig. C.3

Access to the radiator drain tap is from beneath the car. Turn the tap anti-clockwise to open

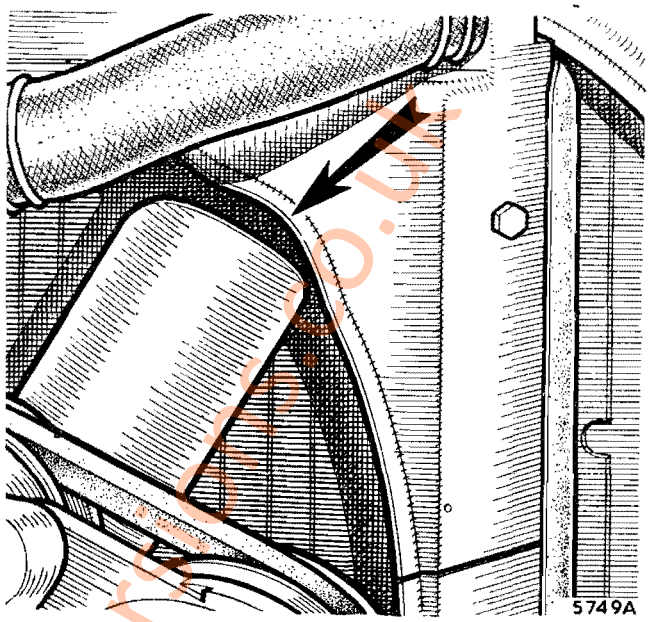


Fig. C.4

Turn the fan blades to the position indicated where the fan belt can be extracted through the recess provided in the radiator cowling

Removing

Slacken the dynamo pivot and adjusting link bolts. Lift the dynamo, release the belt from the crankshaft pulley, and remove the belt by manœuvring it between

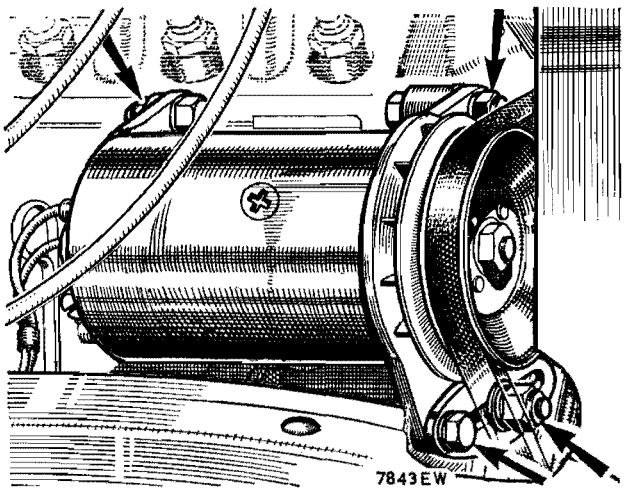


Fig. C.5

The four dynamo attachment points to be slackened for fan belt adjustment

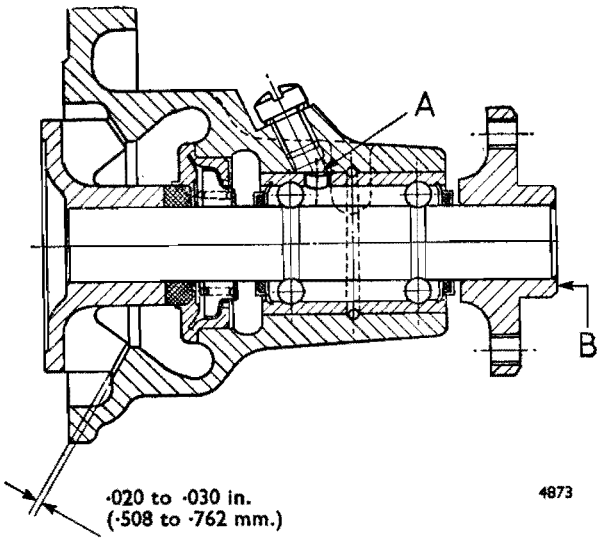


Fig. C.6

A section through the water pump showing the location of the components. When assembled, the hole (A) *in the bearing must coincide with the lubricating hole in the water pump and the face of the hub* (B) *must be flush with the end of the spindle*

the fan blades and the radiator. Sufficient clearance has been provided to allow the belt to pass between the fan blades and the right-hand top of the cowling flange.

Section C.5

WATER PUMP

The water pump is of the centrifugal impeller type mounted on a common spindle with the fan, and operating in a cast housing mounted on the front of the cylinder block. Water-sealing is effected by a spring-loaded carbon washer bearing upon a seating in the impeller housing. It is necessary to dismantle the pump and fan assembly to obtain access to the sealing gland. Removing, dismantling, and refitting instructions are given in the following paragraphs.

Removing

Drain the water from the cooling system and remove the radiator as in Section C.3.

Remove the hose from the water pump inlet connection and slacken the top clip of the thermostat by-pass hose, the dynamo mounting bolts, and the adjusting screw. Withdraw the four set screws securing the fan blades to the water pump hub and remove the blades, belt, and pulley.

Unscrew the four set screws securing the pump to the cylinder block and remove the pump complete with the by-pass hose.

Dismantling

Pull out the bearing locating wire through the hole in the top of the pump body.

Gently tap the spindle rearwards to release the combined spindle and bearing assembly, together with the seat and vane.

Withdraw the vane from the spindle with a suitable extractor and remove the pump seal assembly.

Should the bearing show signs of wear or damage, it must be replaced by a new bearing and spindle assembly; bearings alone are not serviced. The seal assembly should also be replaced with a new seal if wear or damage is apparent or if the pump is leaking.

Reassembling

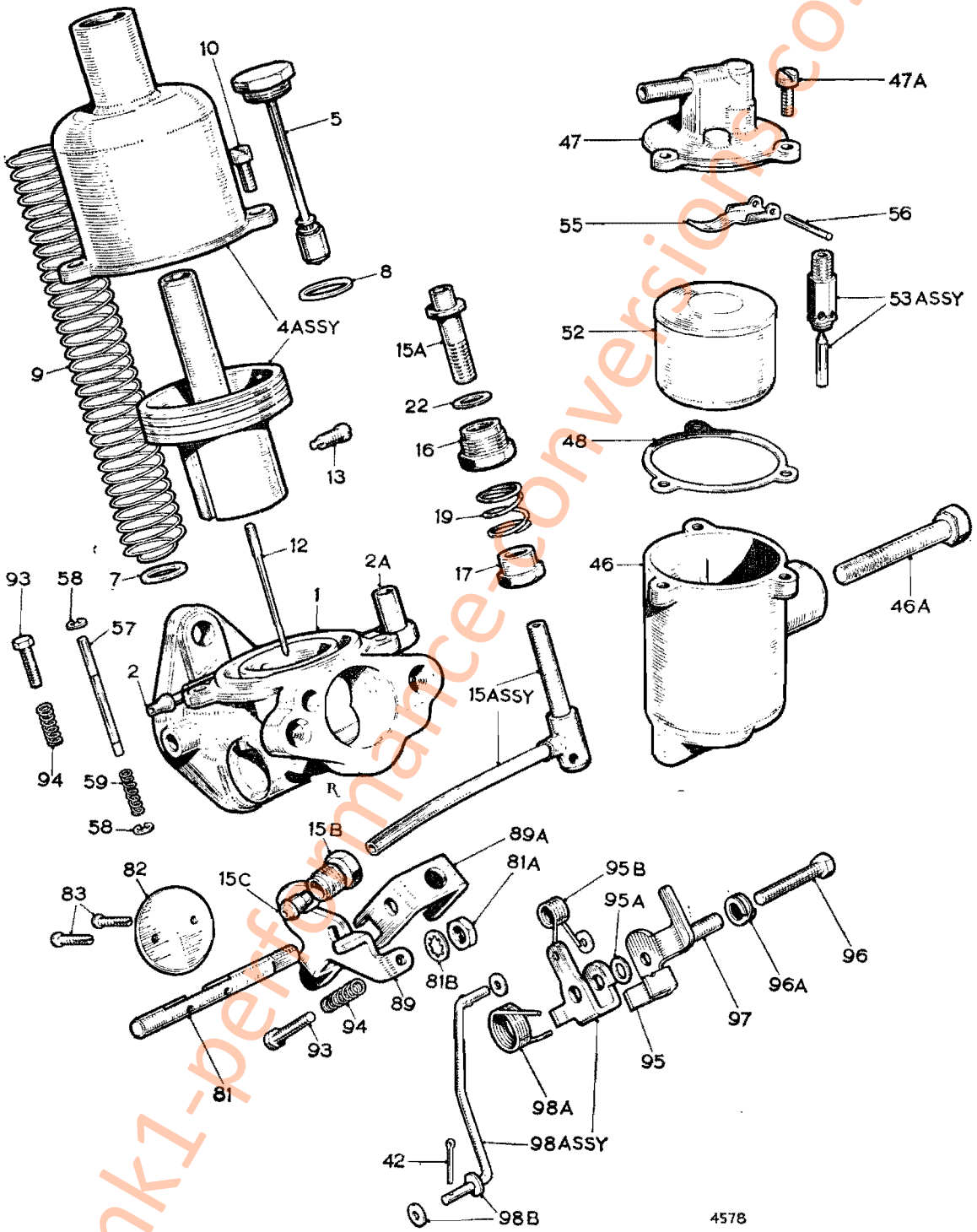
Reassembly is a reversal of the dismantling procedure. Make certain that the hole in the bearing is lined up with the lubricating hole in the pump body before pressing the bearing and spindle into position.

Should the interference fit of the fan hub have been impaired when the hub was withdrawn from the spindle, a new hub must be fitted.

SECTION D

THE FUEL SYSTEM

THE CARBURETTER COMPONENTS



KEY TO THE CARBURETTER COMPONENTS

No.	*Description*
1.	Body.
2.	Automatic ignition tube.
2A.	Choke guide tube.
4.	Suction chamber and piston assembly.
5.	Oil cap damper assembly.
7.	Piston spring thrust washer.
8.	Washer (fibre).
9.	Piston spring.
10.	Screw for suction chamber.
12.	Jet needle.
13.	Locking screw.
15.	Jet assembly.
15A.	Jet bearing.
15B.	Gland nut.
15C.	Nipple.
16.	Jet screw.
17.	Adjusting nut.
19.	Jet adjusting spring.
22.	Washer (brass).
42.	Cotter pin.
46.	Float-chamber.
46A.	Bolt—float-chamber to body.
47.	Float-chamber lid.
47A.	Screw for float-chamber lid.
48.	Gasket for float-chamber lid.

No.	*Description*
52.	Float.
53.	Needle and seat assembly.
55.	Hinged lever.
56.	Lever pin.
57.	Piston lifting pin.
58.	Pin circlip.
59.	Pin spring.
81.	Throttle spindle.
81A.	Nut for spindle.
81B.	Shakeproof washer.
82.	Throttle disc.
83.	Screw for disc.
89.	Throttle lever.
89A.	Lever adaptor.
93.	Adjusting screw.
94.	Spring for screw.
95.	Cam lever.
95A.	Spacing washer.
95B.	Lever spring.
96.	Pivot bolt.
96A.	Spring washer.
97.	Pivot tube.
98.	Lever and link rod assembly.
98A.	Return spring.
98B.	Plain washer.

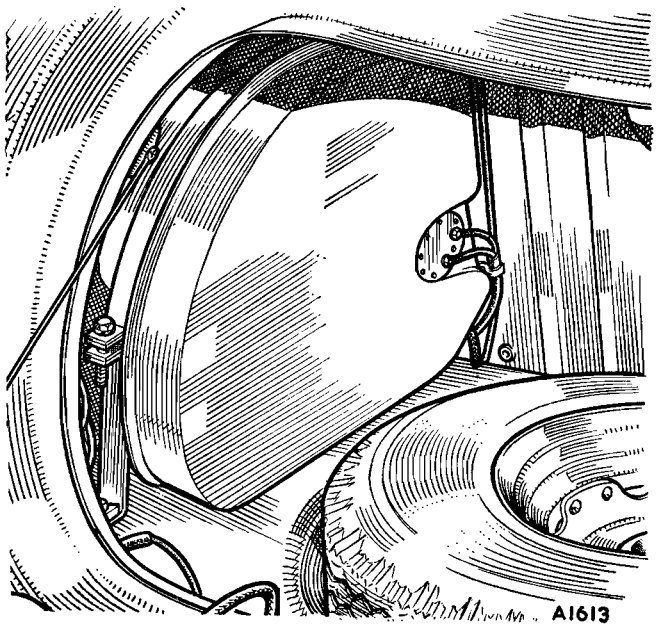


Fig. D.1

The fuel tank located on the left-hand side of the luggage compartment, showing the position of the tank gauge unit and the tank strap securing screw. The tank locating plate is shown in Fig. D.2

Section D.1

FUEL TANK

Removing

Disconnect the flexible fuel hose from the pump connection located on the inside of the left-hand rear sub-frame member and drain the fuel into a suitable container.

A fuel tank drain plug is fitted to later models and can be reached from beneath the rear of the vehicle with a tubular box spanner $\frac{7}{16}$ in. across the flats and 5 in. long. The plug operates on the same principle as a brake bleed screw, thus it is only necessary to unscrew it approximately three turns to release the fuel. Allow the fuel to flow down the drain tube clear of the exhaust pipe.

Remove the filler cap. Disconnect the lead from the fuel tank gauge unit and remove the securing bolt from the tank strap. Manœuvre the tank from the luggage compartment, at the same time drawing the fuel pipe and the breather pipe through the floor.

Note the locating plate fitted beneath the tank.

A modified fuel tank is fitted to later models incorporating a fuel drain tube. Where this drain tube is fitted the drain plug and tube must be removed before the tank can be withdrawn from the luggage compartment, and must not be refitted to the tank until the tank is repositioned in the vehicle.

Refitting

When refitting make sure that the breather pipe is pushed through the same hole in the floor as the wiring harness.

Secure the free end of the breather pipe with a rubber clip against the flexible fuel feed pipe clear of the petrol pump.

Care must also be taken on reassembly to ensure that the seal between the drain plug housing and the body is watertight.

Refit the locating plate beneath the tank before the straps are fastened.

Section D.2

FUEL TANK GAUGE UNIT

Remove the earth lead from the battery terminal and disconnect the electrical lead from the fuel gauge unit.

Unscrew the six screws securing the gauge unit to the tank and withdraw the complete assembly, taking care not to strain or bend the float lever.

When replacing the gauge unit a new joint washer must be fitted and a suitable sealing compound employed to make a fueltight joint.

Section D.3

FUEL PUMP

Description

The type PD fuel pump is located on the left-hand member of the rear sub-frame and differs from previous designs in that the diaphragm is actuated magnetically through the medium of a hydrostatic as distinct from a direct mechanical connection. By this arrangement the lost motion between the volumetric displacement of the pump diaphragm and its centre plate by mechanical means is eliminated. The pumping diaphragm suffers very little flexure, and it is, therefore, possible to make use of a Terylene film diaphragm in place of the synthetic rubber material formerly employed.

Three pressings soldered to a central brass tube comprise the main structure of the pump. The brass tube houses a permanent magnet with two steel pole-pieces, a steel plunger separated from the magnet by an insulated distance piece, and a coil spring to impel the magnet and plunger downwards. The tube is completely filled with a light mineral oil and hermetically sealed by the upper and lower diaphragms. The contact breaker mechanism is mounted on a plate above the solenoid windings, and is not serviced separately.

Operation

The following résumé of the PD fuel pump action is given for information only, and dismantling must not be undertaken.

When the pump is at rest the plunger assembly with the magnet and pole-pieces is at the bottom of its stroke; in this position the lower pole-piece will attract the lower ear of the contact breaker rocker, and with the rocker

finger pressing upwards against the spring blade will ensure that the tungsten points are in contact. With the electric circuit completed the solenoid is energized, and the plunger, magnet, and pole-pieces are magnetically impelled upwards. The fluid contained in the tube is hermetically sealed and will therefore follow the plunger and displace the diaphragm upwards, causing a volumetric increase in the pumping space below the diaphragm and thereby drawing in fuel via the inlet valve.

As the plunger approaches the extremity of its upward stroke the upper pole-piece will attract the upper ear of the contact breaker rocker; the rocker finger will recede from the lower contact blade and allow the tungsten points to break contact. The electro-magnetic system will now become demagnetized, allowing the plunger and its associated parts to descend under the load of the feed spring, and so reverse the action of the diaphragm to expel fuel through the delivery valve. The pumping cycle is then repeated.

When the outlet valve is obstructed by the limited rate at which the engine will draw upon the maximum flow available some downward movement of the plunger under spring pressure will still take place. To prevent the plunger becoming hydraulically locked a recuperating valve is incorporated in the plunger, returning any excess fluid from the upper to the lower regions bounding the plunger.

Removing

Disconnect the leads from the terminals on the pump body. Pull the fuel lines from the inlet and outlet connections on the pump, at the same time draining the fuel into a suitable container.

Remove the two screws securing the mounting bracket to the sub-frame side-member to release the pump and pump bracket.

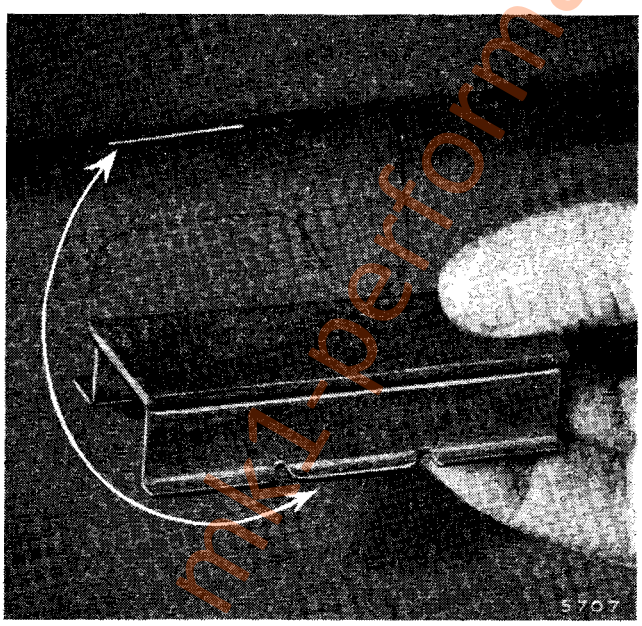


Fig. D.2

The tongue of the fuel tank locating plate must be secured in the slot in the luggage compartment floor

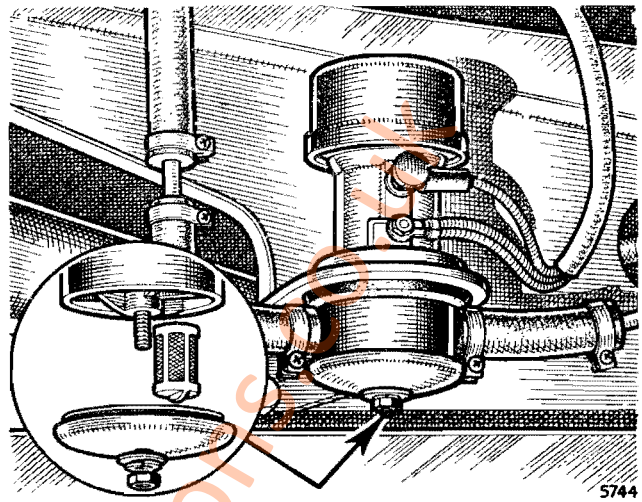


Fig. D.3

The electric fuel pump is located on the inside of the rear sub-frame left-hand side-member. The inset shows the method of access to the filter

Servicing

Owing to the hermetic sealing employed in the main construction of the pump, only the component parts listed in the caption to the illustration (Fig. D.4) are accessible and serviced separately. Should a breakdown occur and the pump fail to respond to the following attentions, a replacement pump must be fitted.

The petrol pump is often blamed for trouble associated with fuel starvation, but this may be due to a variety of causes. Therefore, before renewing the pump, first check the following points:

(1) Venting of petrol tank.
(2) Dirt or water in the petrol system.
(3) Sticking carburetter piston or float needle valve.
(4) Fault in petrol pump connections.

Cleaning the filter

Blockage of the filter will result in gradual falling off in maximum delivery of the pump, and will be detected by a tendency to fuel starvation at high engine speeds and loads. When such symptoms are detected it will be necessary to remove the pump from the vehicle. Release the cover-plate and gasket from the bakelite moulding and withdraw the filter. Wash the filter in fuel, lightly blow through with air, and clean any sediment from the bakelite moulding. When replacing the cover-plate the cork gasket must be renewed.

Cleaning the contact points

If trouble from the contact points be suspected the top cover should be removed and the points cleaned by drawing a piece of clean paper or card between them. Great care must be taken during this operation to avoid overstressing the contact blades.

The extremities of the blades should bear downwards on the respective platforms provided on the bakelite contact breaker mounting plate after the operating rocker

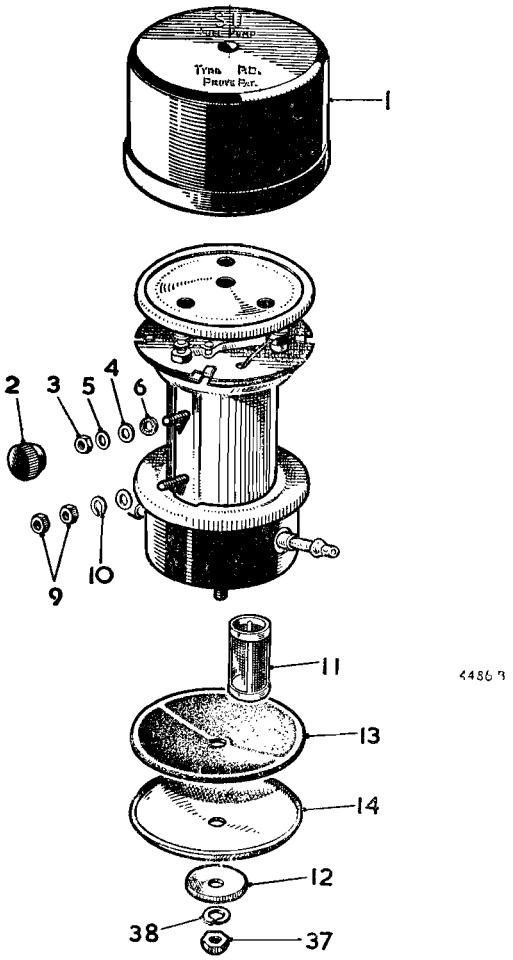


Fig. D.4

The S.U. type PD electric fuel pump. Only the components shown in the following key to the illustration are supplied for servicing

1. Top—cover.
2. Knob for terminal.
3. Nut for terminal.
4. Plain washer.
5. Lead washer.
6. Insulating collar.
9. Nut for earth terminal.
10. Washer for earth terminal.
11. Filter.
12. Dished washer.
13. Cork gasket.
14. Cover-plate.
37. Nut.
38. Spring washer.

has been manually moved over until its upper extremity contacts the brass centre tube. In this situation the blades should be straight and parallel, and the gap between the two pairs of contact points should be perceptible. When the rocker is then released both blades should be deflected upwards and mechanical contact between both pairs of points observed to be firmly established. The gap between the extremity of the upper contact blade and its stop face should then be not less than ·015 in. (·381 mm.).

It occasionally happens that, due to the pump having been dropped or otherwise roughly handled at some time, the above conditions are not fulfilled. In such cases a discreet resetting of the blades can generally be achieved, using a pair of thin-nosed pliers. It is essential that the downward bearing of the ends of the contact blades upon their stop faces, as described above, while being quite positive, should be extremely light.

Air leakage

Rapid operation accompanied by a diminished fuel delivery is indicative of air leakage into the suction side of the pump. This fault is best detected by disconnecting the delivery pipe at the carburetter and allowing fuel to discharge into an open receptacle with the end of the pipe submerged in the fuel. Should any significant quantity of air bubbles be observed, check and, if necessary, replace the cover-plate cork gasket. The rubber connections at either end of the suction line should be examined and renewed if they show signs of damage or deterioration.

Section D.4

CARBURETTER

Description

The HS2 carburetter is of the automatically expanding choke type in which the size of the main air passage (or choke) over the jet, and the effective area of the jet, are variable according to the degree of throttle opening used on the engine against the prevailing road conditions (which may differ widely from light cruising to heavy pulling).

Therefore, to serve the complete throttle range a single jet only is used, being a simple metal tube sliding in a single bearing bush, fed by fuel along a small-diameter nylon tube leading direct from the base of the float-chamber. The jet is varied in effective area by a tapered fuel metering needle sliding into it.

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 piston damper and lifting the piston by pressing the piston lifting pin; the piston 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.

Water and dirt in the carburetter

Should this be suspected, lift the piston with a pencil, when the jet can then be seen. Flood the carburetter and watch the jet; if fuel does not flow freely there is a blockage. To remedy this start the engine, open the throttle, and block up the air inlet momentarily, keeping the throttle open until the engine starts to race.

If the jet is completely blocked and the engine will not run, the jet must be removed and thoroughly cleaned.

Float-chamber flooding

This is indicated by fuel flowing from the drain hole in the top of the float-chamber lid below the main fuel feed pipe, and is generally caused by grit between the float-chamber needle and its guide. The float-chamber lid should be removed and the needle and its guide thoroughly cleaned.

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 carburetter 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 the 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.

Adjustments

Slow-running is governed by the setting of the jet adjusting nut and the throttle adjusting screw, both of which must be correctly set and synchronized if satisfactory results are to be obtained.

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

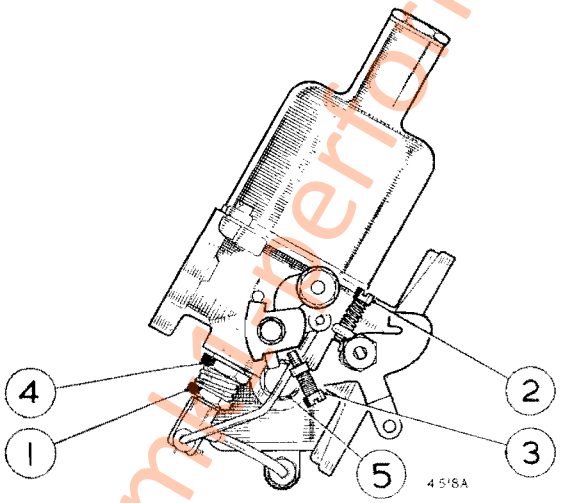


Fig. D.5

The carburetter adjusting screws

1. Jet adjusting nut.
2. Throttle adjusting screw.
3. Fast-idle adjustment screw.
4. Jet locking nut.
5. Float-chamber bolt.

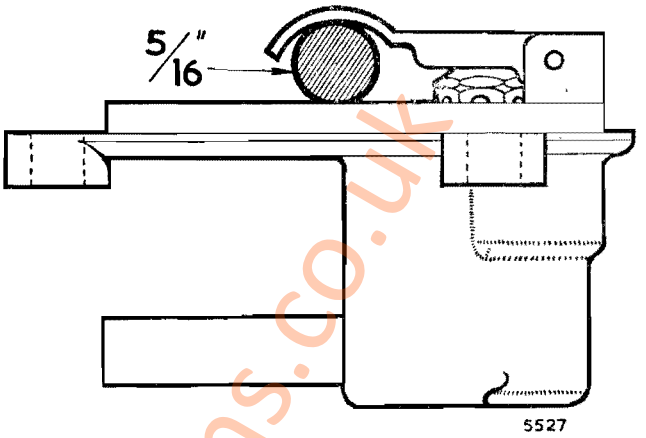


Fig. D.6

The method of checking the correct adjustment of the float lever

Adjusting the jets

Run the engine until it attains its normal running temperature.

Remove the air cleaner.

Disconnect the mixture control cable.

Unscrew the throttle lever adjusting screw until the throttle is completely closed. Turn the adjusting screw in a clockwise direction approximately one turn to set the throttle for fast idling.

With the engine running, set the jet adjusting nut 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 $\frac{1}{32}$ in. (1 mm.). 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 $\frac{1}{4}$ in. (6 mm.) the mixture is too rich.

When the carburetter is correctly adjusted for mixture set the throttle adjusting screw to give the required slow-running.

Slow-running

Turn the throttle adjusting screw to give a fast idling speed. Then unscrew, a fraction of a turn at a time, until the desired slow-running is obtained.

Float-chamber

The position of the float lever in the float-chamber must be such that the level of the float (and therefore the height of the fuel at the jet) is correct.

This is checked by inserting a $\frac{5}{16}$ in. (7·94 mm.) round bar between the float lever and the machined lip of the float-chamber lid. The forked end of the lever should just rest on the bar (see Fig. D.6) when the needle is on its seating. If this is not so, the lever should be reset at the point where the forked end meets the shank.

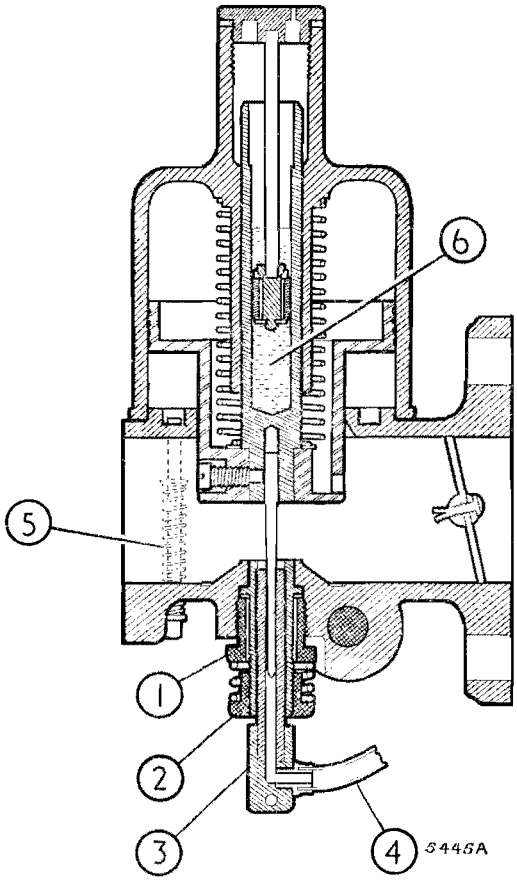


Fig. D.7

A section through the carburetter showing:

1. Jet locking nut.
2. Jet adjusting nut.
3. Jet head.
4. Nylon fuel pipe.
5. Piston lifting pin.
6. Piston damper oil well.

Do not bend the shank, which must be perfectly flat and at right angles to the needle when it is on its seating.

Centring the jet

When the suction piston is lifted by the spring-loaded piston lifting pin it should fall freely and hit the inside jet bridge with a soft, metallic click—that is, with the jet adjusting nut (2) (Fig. D.7) in its topmost position.

If this click is not audible, but is so when the test is repeated with the jet in the fully lowered position, then the jet unit requires recentring on the needle, as described below.

(1) Disconnect the rod between the jet lever and the jet head (3) (Fig. D.7).

(2) Unscrew the union holding the nylon feed tube into the base of the float-chamber, and withdraw the tube and jet together. Unscrew the jet adjusting nut and remove the lock spring. Replace the adjusting nut and screw it right up to its topmost position, then replace the jet and feed tube.

(3) Slacken off the large jet locking nut (1) (Fig. D.7) until the jet bearing is just free to rotate by finger pressure.

(4) With the damper removed and using a pencil on top of the piston rod, gently press the piston and needle down onto the jet bridge.

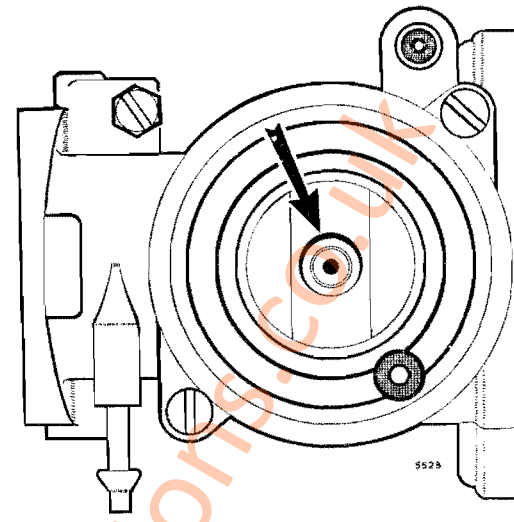


Fig. D.8

Indicates an incorrectly centred jet which is eccentric to the jet aperture in the carburetter body

(5) Tighten the jet locking nut, observing that the jet head is still in its correct angular position.

(6) Lift the piston and check that it falls freely and evenly, hitting the jet bridge with a soft, metallic click. Then fully lower the jet and re-check to see if there is any difference in the sound of the impact; if there is and the second test produces a sharper impact sound, the centring operation will have to be repeated until successful, the nut and lock spring being replaced after the conclusion of the operation.

Removing from engine

Remove the air cleaner as detailed in Section D.5.

Disconnect the mixture and throttle control cables, the suction advance pipe, and the fuel delivery hose from their respective positions on the carburetter.

Remove the two nuts and spring washers securing the carburetter to the manifold flange. Lift off the carburetter and the cable abutment plate.

Refitting

It should be noted that the cable abutment plate fitted between the carburetter and manifold flange has a gasket fitted on both faces. Should either gasket be damaged, the plate and the flanges must be thoroughly cleaned and new gaskets fitted.

Section D.5

AIR CLEANER

Removing

To remove the element for cleansing, unscrew the wing nut from the top of the cleaner, remove the cover, and extract the element. Tap the element gently or blow air from the inside to remove all dust deposit. Wipe the inside of the container before refitting the element.

To remove the air cleaner body disconnect the breather hose from the rocker cover, slacken the air cleaner retaining clip on the air intake pipe, and lift the cleaner from the engine.

Section D.6

INDUCTION AND CARBURETTER SUCTION CHAMBER HEATERS

Heaters are fitted between the carburetter and the induction manifold and to the carburetter suction chamber on models exported to countries where conditions of extreme cold exist.

The induction heater is fitted with the bulb of the thermostat pointing inwards towards the centre-line of the engine and the insulating washer against the manifold. Earth return is through a small cut-away in the insulating washer, and contact is made against the manifold flange. The accelerator cable abutment plate is interposed between the heater and the carburetter with an insulating washer on each side of the plate.

The carburetter suction chamber heater is fitted on the outside of the suction chamber and secured in position with a retaining clip. The lead is connected to the thermostat on the induction heater.

Section D.7

FUEL TANK (VAN)

Removing

Unscrew the drain plug in the bottom of the tank and drain the fuel into a suitable container. Remove the filler cap and disconnect the lead from the fuel tank gauge unit; disconnect the fuel pipe from the tank connection. Support the tank and remove the six screws that secure the tank flange to the body. Lower the tank to the ground and retain the nylon spacers.

Refitting

Position the tank beneath the body and insert the nylon spacers between the holes in the tank flange and the holes in the body; secure the tank to the body with the screws.

Connect the lead to the fuel tank gauge unit and the fuel pipe to the tank connection. Refit the filler cap and replace the drain plug.

Section D.8

AIR CLEANER (IMPREGNATED ELEMENT)

A chemically impregnated filter element is fitted in the air cleaner from Car No. 14794 and the 3,000 miles (4800 km.) cleansing service recommended for the non-impregnated elements must not be carried out. Fit a new element every 12,000 miles (19200 km.), or earlier in dusty operating conditions. Do not disturb the air cleaner cover or remove the element at any other time.

When fitting an impregnated element to a car previously fitted with a non-impregnated element the conflicting service instructions appearing on the filter body should be obliterated.

NOTE.—The air cleaner intake should be positioned adjacent to the exhaust manifold during winter operating conditions in order that the possibility of carburetter icing is reduced to the minimum. It is advisable to move the intake away from the manifold in warmer weather.

Section D.9

FUEL TANK (TRAVELLER)

Removing

Slacken off the screws and remove the trim liner from the body side immediately above the tank and the metal finishers from the rear seat squab support.

Lift out the luggage platform floor, disconnect the battery, and ease the trim panel away from the tank.

Drain the fuel from the tank, remove the drain tube, and disconnect the fuel delivery pipe at the tank union.

Remove the set screws securing the tank to the support brackets.

Disconnect the fuel gauge lead and pull the breather pipe from the connector on the tank.

Remove the fuel filler cap and manœuvre the tank from the vehicle.

Refitting

Refitting is a reversal of the dismantling procedure. Make certain that the breather pipe is pushed firmly onto the connector, secured by its retaining clip inside the vehicle, and fastened away from the exhaust pipe underneath.

SECTION E

THE CLUTCH

GENERAL DESCRIPTION

The clutch is of the single-plate dry-disc type with the pressure and driven plates operating on the inner face of the flywheel. Lugs on the pressure plate extend through the flywheel and are secured to driving straps on the outer face of the flywheel and the pressure spring housing by three shouldered set pins. The driving straps are themselves anchored to the flywheel by three more shouldered set pins.

Six coil springs assembled in the housing pull the housing and pressure plate rearwards to keep the friction lining of the driven plate in contact with the inner face of the flywheel.

Disengagement is accomplished by moving the operating lever pressure pad forward against the thrust plate of the pressure spring housing; further pressure will then force the pressure plate away from the driven plate, which will in turn release itself from the flywheel and be permitted to revolve freely on the crankshaft.

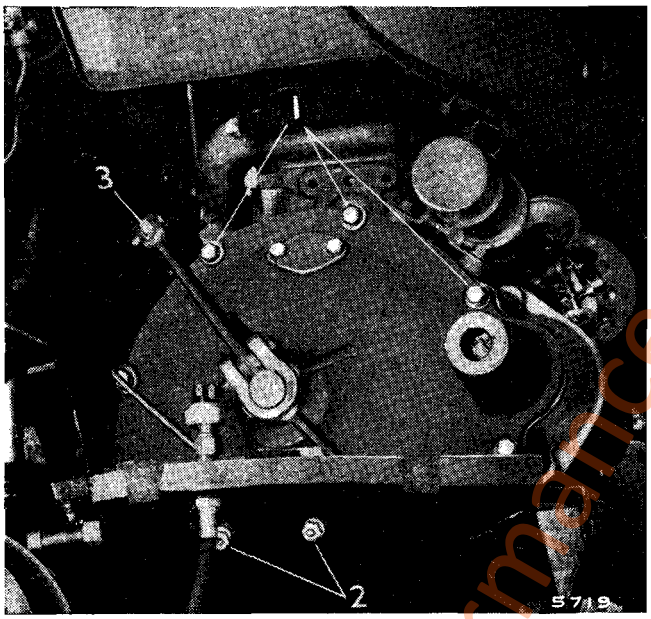


Fig. E.1

A view of the clutch cover with the body raised for clarity

1. Three of the nine clutch cover set screws.
2. Engine mounting set screws.
3. Slave cylinder push-rod.

Section E.1

CLUTCH

Remove the flywheel and clutch assembly as detailed in Section A.17.

NOTE.—The clutch to flywheel driving straps are laminated, i.e. two straps fitted to each of the three driving points. Mark all components, including both the straps and driving pins, before dismantling in order to identify them for refitting in their original positions.

Dismantling

The clutch pressure springs must be compressed in order that the spring housing can be released from the flywheel. Insert the three screws of Service tool set 18G304L through the three recessed holes in the spring housing, screw them fully into the flywheel, and screw the three nuts down finger tight against the housing. Tighten the nuts a turn at a time until the complete load is taken from the three flywheel to clutch driving pins. Remove the pins and gradually release the spring housing from compression until the springs are fully extended.

Examine and renew any worn parts, taking particular note of the pressure spring housing for signs of elongation in the driving pin holes. Should the shoulders of the driving pins show signs of wear or ridging, they must be replaced as a set of three and not as individual pins; this also applies to the three driving straps on the flywheel.

Reassembling

Reassembly is a reversal of the dismantling sequence, with particular attention given to the following points.

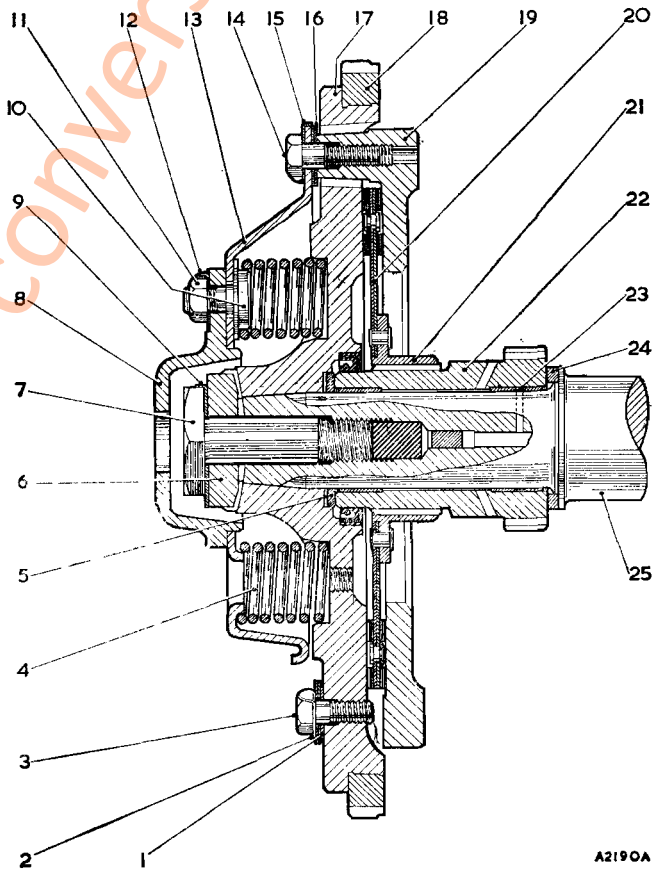


Fig. E.2

A section through the clutch assembly

1. Driving strap.
2. Lock washer.
3. Driving pin.
4. Pressure spring.
5. Circlip.
6. Keyed washer.
7. Flywheel screw.
8. Thrust plate.
9. Locking washer.
10. Pressure spring guides.
11. Guide nut.
12. Lock washer.
13. Pressure spring housing.
14. Driving pin.
15. Lock washer.
16. Driving strap.
17. Flywheel.
18. Starter ring.
19. Pressure plate.
20. Driven plate.
21. Driven plate hub.
22. Crankshaft primary gear.
23. Primary gear bearing.
24. Thrust washer.
25. Crankshaft.

Use service tool 18G571 to make certain that the hub of the driven plate is centralized with the hub of the flywheel, and remains so during assembly. Insert the tool through the hub of the driven plate and the bore of the flywheel, and secure it in position with the screw and retaining plate against the flywheel boss.

Ensure that the pressure spring locating guides are seating correctly in their slots in the spring housing. Make certain that all the components marked during the dismantling are refitted in their original positions.

When reassembling the clutch to the flywheel use service tool 18G304L to compress the pressure springs. This tool will also ensure that the holes in the pressure spring housing and the driving straps are lined up with the tapped holes of the clutch pressure plate lugs. If these holes are not lined up correctly difficulty will be experienced when inserting the shouldered driving pins. Screw the driving pins into position, making certain that the shoulders of the driving pins are through the driving straps. Tighten up, and knock up the locking washers.

Make certain that two driving straps are fitted to each of the three driving points, at the same time ensuring that the straps and pins are returned to their original positions.

Refit the flywheel and clutch as in Section A.17.

Adjusting

It is important that a clearance exists between the clutch thrust race and the thrust ring. As wear takes place this clearance will diminish, and if neglected clutch slip will result.

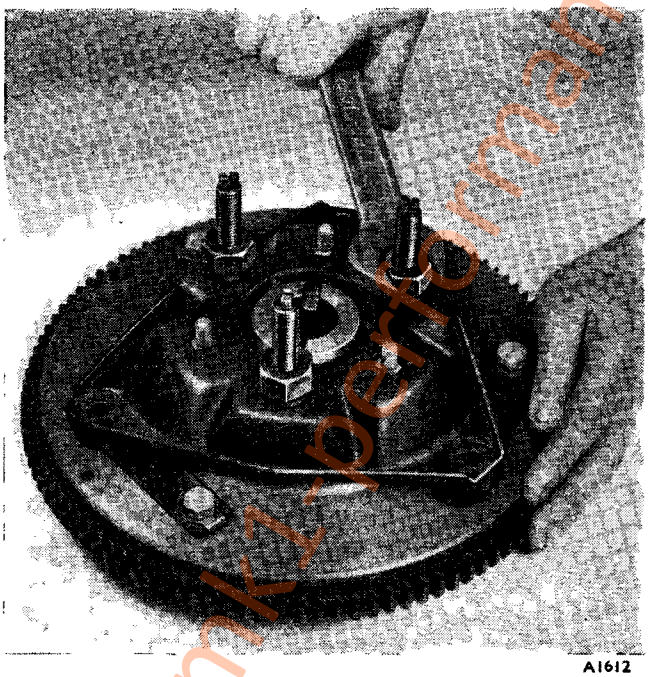


Fig. E.3

The clutch pressure springs being compressed with the aid of service tool 18G304L, with service tool 18G571 used to keep the driven plate and flywheel hubs centralized during the operation

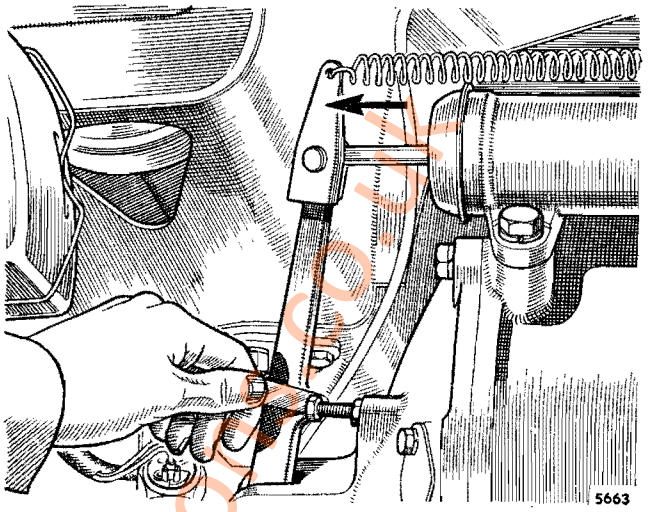


Fig. E.4

A clearance of ·060 in. (1·52 mm.) must exist between the adjustable clutch return stop and the operating lever

An adjustable stop is provided on the transmission casing just forward of the clutch operating lever. Pull the operating lever outwards until all free movement is taken up and then check with a feeler gauge that there is a clearance of ·060 in. (1·52 mm.) between the operating lever and the head of the adjustment bolt. Correct if necessary.

Section E.2

MASTER CYLINDER

Construction and operation

The master cylinder piston is backed by a rubber cup and is normally held in the 'off' position by a return spring. Immediately in front of the cup, when it is in the 'off' position, is a compensating orifice connecting the cylinder with the fluid supply. This port allows free compensation for any expansion or contraction of fluid, thus ensuring that the system is constantly filled; it also serves as a release for additional fluid drawn into the cylinder during clutch applications.

Pressure is applied to the piston by means of the push-rod attached to the clutch pedal.

The reduced skirt of the piston forms an annular space which is filled with fluid from the supply tank via the feed hole. Leakage of fluid from the open end of the cylinder is prevented by the secondary cup fitted to the flange end of the piston.

By releasing the clutch pedal after application the piston is returned quickly to its stop by the return spring, thus creating a vacuum in the cylinder; this vacuum causes the main cup to collapse and pass fluid through the small holes in the piston head from the annular space formed by the piston skirt. This additional fluid finds its way back to the reserve supply through the compensating orifice.

No pressure is maintained in the clutch line when the pressure is released.

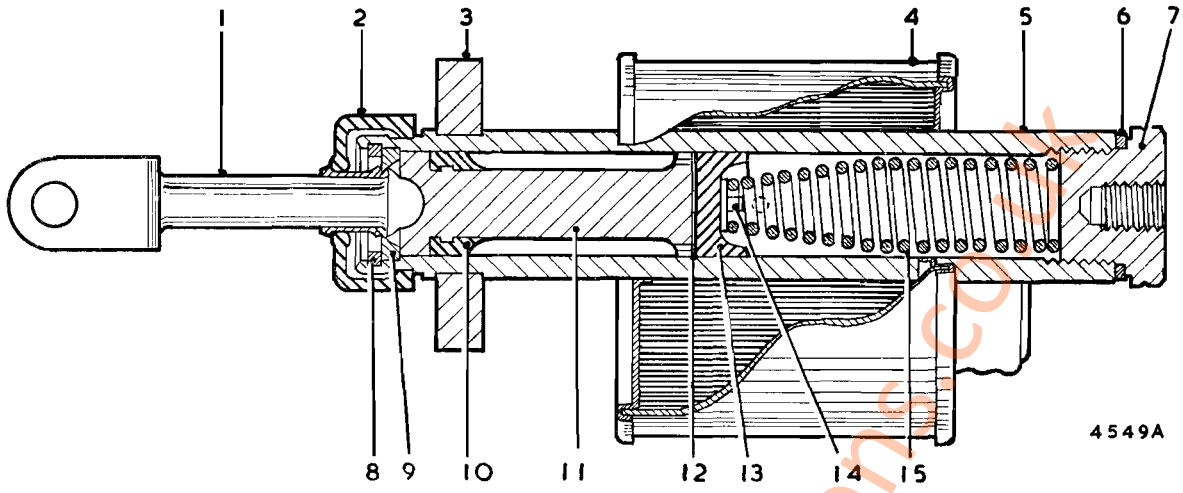


Fig. E.5

A section through the clutch master cylinder

1. Push-rod.
2. Rubber boot.
3. Mounting flange.
4. Supply tank.
5. Body.
6. Washer.
7. End plug.
8. Circlip.
9. Stop washer.
10. Secondary cup.
11. Piston.
12. Piston washer.
13. Main cup.
14. Spring retainer.
15. Return spring.

Removing

Remove the circlip and withdraw the clevis pin securing the master cylinder push-rod to the clutch pedal lever.

Disconnect the pressure pipe union from the cylinder, remove the two bolts securing the cylinder to the bulkhead, and withdraw the assembly complete from the car.

Dismantling

Remove the filler cap and drain out the fluid.

Pull back the rubber dust cover and remove the circlip with a pair of long-nosed pliers; the push-rod and dished washer can then be removed.

Withdraw the remaining parts shown in Fig. E.5 from the cylinder barrel.

To remove the secondary cup from the piston carefully stretch the cup over the end flange of the piston, using only the fingers.

Reassembling

Clean all parts thoroughly, using Lockheed Genuine Brake Fluid for all rubber components. All traces of petrol (gasoline), paraffin (kerosene), or trichlor-ethylene used for cleaning the metal parts must be removed before assembly.

Examine all 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.

Stretch the secondary cup over the end flange of the piston with the lip of the cup facing towards the opposite end of the piston. When the cup is in its groove, work it round gently with the fingers to ensure correct seating.

Insert the return spring, largest-diameter coils first, into the barrel. Make sure the spring seat is positioned on the small-diameter end of the spring.

Insert the master cup, lip first, taking care not to damage or turn back the lip, and press it down onto the spring seat.

Insert the piston, taking care not to damage or turn back the lip of the secondary cup.

Push the piston down the bore, and replace the push-rod, retaining circlip, and rubber dust cover.

Test the master cylinder by filling the tank with fluid and pushing the piston down the bore and allowing it to return; after one or two applications fluid should flow from the outlet.

Refitting

Secure the master cylinder by means of the two bolts to the bulkhead cross-member. Refit the pressure pipe to the cylinder barrel.

Line up the push-rod yoke with the pedal lever and reconnect them with the clevis pin and retaining clip.

Refill the supply tank with hydraulic fluid and bleed the system as in Section E.3.

Section E.3

SLAVE CYLINDER

Removing

Attach a bleed tube to the nipple on the body of the slave cylinder and open the bleed 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 from the cylinder, remove the two bolts securing the cylinder body to the clutch housing, and remove the clevis pin to release the cylinder push-rod from the clutch lever.

Dismantling

Clean the exterior of the assembly thoroughly before dismantling. Withdraw the push-rod and remove the rubber dust seal; use only the fingers to displace the seal retaining ring.

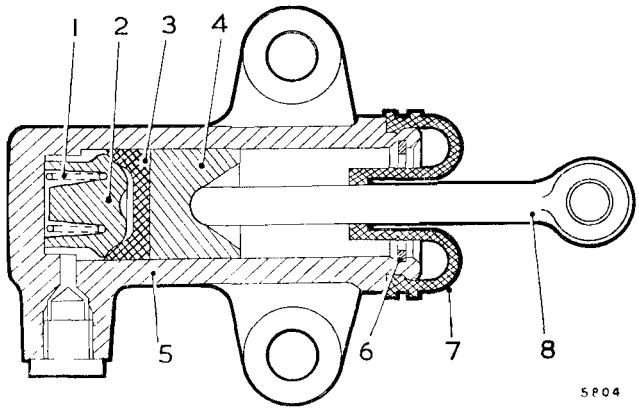


Fig. E.6

A section through a clutch slave cylinder

1. Spring.
2. Cup filler.
3. Cup.
4. Piston.
5. Body.
6. Circlip.
7. Rubber boot.
8. Push-rod.

The piston, piston cup, cup filler, and the return spring can be removed in that order.

Examine the parts, especially the seal, and renew them if they are worn or damaged; it is usually advisable to renew all rubber parts when rebuilding the cylinder.

Reassembling

Insert the return spring, largest-diameter coils first, into the barrel with the piston cup filler attached to the small-diameter end of the spring.

Replace the piston cup, lip first, taking care not to damage or turn back the lip and press it down onto the cup filler.

Push the piston down the bore and replace the rubber dust seal, first making sure that the retaining ring is in position on the centre flange of the seal. Secure the seal to the cylinder body with the large steel retaining ring.

Replace the operating plunger.

Refitting

Refitting is a reversal of the removal procedure, but the system must be bled to expel any air from the fluid lines.

Bleeding

Fill the master cylinder reservoir with the recommended fluid and attach a rubber tube to the slave cylinder bleed valve; immerse the open end of the tube in a clean receptacle containing a small amount of fluid. With a second operator to pump the clutch pedal, open the bleed screw on the slave cylinder approximately three-quarters of a turn; at the end of the down stroke on the clutch pedal close the bleed screw before allowing the pedal to return to the 'off' position.

Continue this series of operations until clear fluid free from air bubbles is delivered into the container.

Ensure that the fluid level is maintained in the reservoir throughout the operation.

Section E.4

CLUTCH THROW-OUT STOP

On later models a shouldered stop is fitted to the clutch throw-out plunger operating against the central boss of the clutch cover. This stop is set and locked in its correct position during initial assembly and should not be disturbed during normal servicing. Clutch free pedal adjustment is only undertaken at the lever stop screw as detailed in Section E.1. If it is found necessary to remove the throw-out plunger during overhaul the stop must be reset. Screw the stop and locknut away from the cover boss to the limit of its travel. Depress the clutch pedal to fully release the clutch, hold it in this position and screw the locknut up against the stop, release the clutch pedal to fully engage the clutch, screw the stop up a further ·007 to ·010 in. (·178 to ·254 mm.) (equivalent to approximately one flat of the hexagon locknut), and fully tighten the locknut.

Re-check the clearance at the lever stop screw, and adjust if necessary.

Section E.5

CLUTCH OVERTHROW

The design of the clutch calls for only sufficient movement of the clutch mechanism to free the driven plate. Should overthrow of the clutch occur the excess movement will impose a load on the crankshaft thrust washers far beyond that for which they were designed. This overload will certainly cause abnormal wear of the thrust washers, and may result in their complete disintegration, with serious damage to the transmission from the particles of metal thus introduced.

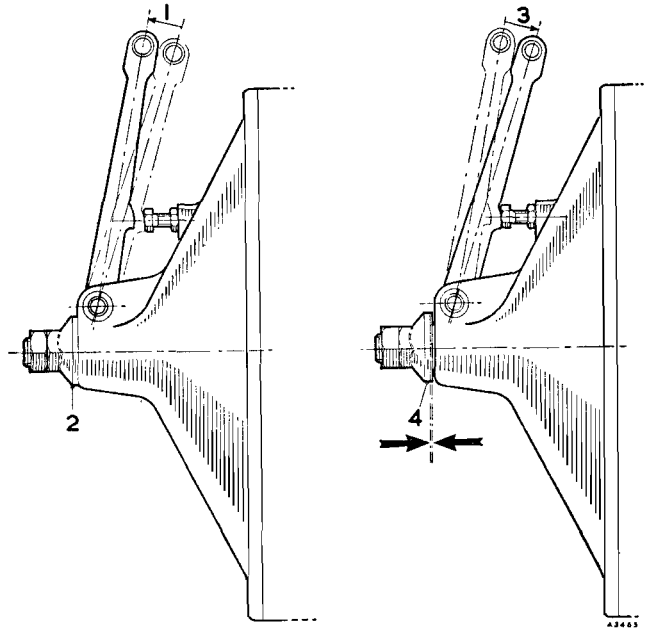


Fig. E.7

(1) *The clutch fully released, with* (2) *the throw-out stop screwed up to the cover boss.* (3) *The clutch fully engaged and the stop* (4) *screwed up a further* ·007 *to* ·010 *in.* (·178 *to* ·254 *mm.*) *towards the cover boss*

The amount of throw is controlled under normal circumstances by the clearance between the clutch operating lever and the adjustable clutch return stop (Fig. E.4).

There are, however, two conditions in which overthrow of the clutch can take place, even though the clearance between the clutch operating lever and the clutch return stop is correct, i.e. (1) stiffness of operation in the operating mechanism preventing the operating lever from returning fully, or (2) incorrect clutch pressure springs becoming coil-bound.

To test for clutch overthrow, warm up the engine to its normal running temperature and allow it to tick over at a speed not exceeding 500 r.p.m.

Depress the clutch pedal fully and release it normally, repeating this action three or four times without pause. If the engine slows down appreciably or stalls, clutch overthrow is occurring.

In this case proceed as follows.

Check the external operating mechanism for stiffness of operation, and rectify where necessary. Fit a stronger operating lever return spring (Part No. 1G5999); the fitting of the stronger spring and the rectification of any stiffness will almost certainly overcome any tendency to clutch overthrow from stiffness of operation (1).

Repeat the test for stalling, and if a cure has not been effected the clutch pressure springs must be suspected (2).

Increase the clearance between the operating lever and the return stop to a maximum of ·075 in. (1·91 mm.) and re-test.

If this adjustment is of no avail the clutch must be dismantled (Section E.1) and a new set of correct pressure springs fitted.

Section E.6

CLUTCH DRAG

Because of the type of clutch layout, cold and congealed oil between the crankshaft primary gear bushes and the crankshaft can create a condition of clutch drag.

Movement between these components will restore normal conditions; therefore, if clutch drag is experienced, hold the car at rest in gear with the clutch released and the engine running for several seconds.

If clutch drag still persists after this operation check for the following possible faults:

Air in the hydraulic operating system.

Incorrect adjustment of the operating lever stop.

Excessive crankshaft end-float.

Flywheel oil seal displaced.

If air is present in the hydraulic system, check for leakage of fluid and ingress of air and rectify as necessary. Bleed the system thoroughly as described in Section E.3. Check the clearance at the operating lever stop (Fig. E.4), and adjust as necessary; crankshaft end-float must be taken into account when setting this clearance.

Measure the crankshaft end-float externally by mounting a clock gauge at the pulley end of the shaft. Prise the crankshaft in the direction of the flywheel and set the gauge at zero. Disengage the clutch by operating the clutch pedal and observe the reading on the gauge. Should this reading indicate an excessive crankshaft end-float, attention must be given to the crankshaft thrust washers.

When adjusting the clearance at the clutch operating lever stop the crankshaft must be held in its most forward position, i.e. away from the clutch.

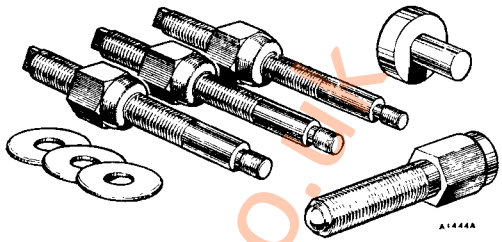
If a damaged flywheel oil seal is suspected the clutch must be dismantled and the condition of the oil seal inspected.

If a new seal is necessary ensure that the replacement seal is of the type with a metal outer case. Coat the bore of the seal housing with jointing compound before fitting the oil seal but ensure that the jointing compound is confined to the seal housing only.

SERVICE TOOLS

18G304M. Flywheel and Clutch Remover Adaptors

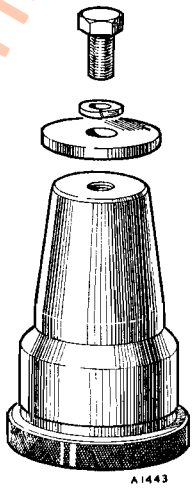
A set of four screws, three designed to screw into the flywheel and hold the clutch cover and pressure springs under compression in order to dismantle and reassemble the clutch. The fourth screw is used to replace the centre screw of the removing tool 18G304 when this tool is used to remove the clutch and flywheel from the crankshaft.



18G304M

18G571. Clutch Centralizer

The use of this tool will ensure that the clutch pressure plate and the flywheel remain centralized throughout the reassembly operation. Insert the tapered centralizer through the hub of the clutch plate and the bore of the flywheel, and secure it firmly in position with its retaining plate, spring washer, and set screw.



18G571

SECTION F

THE TRANSMISSION

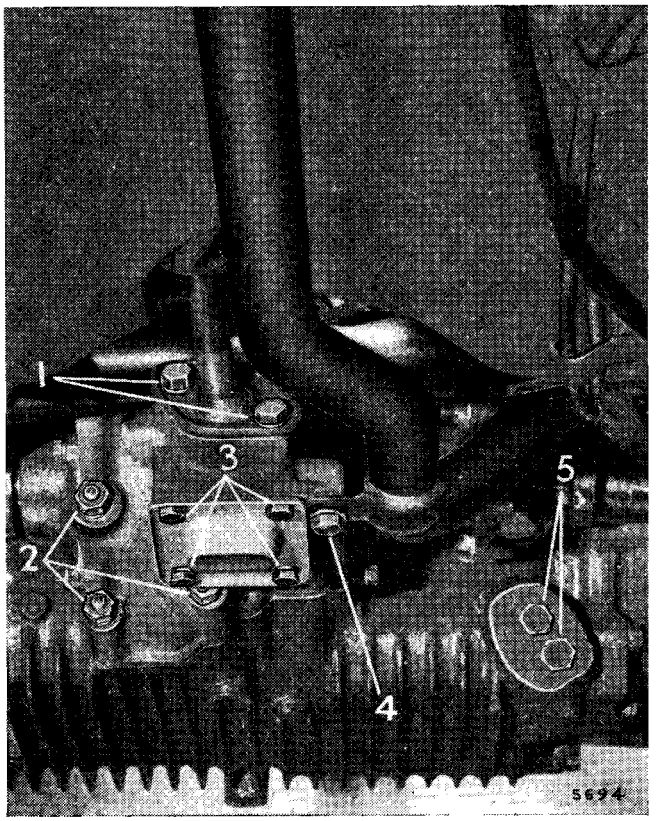


Fig. F.1

The rear of the transmission assembly from beneath the car

1. Change speed lever retaining screws.
2. Three of the four differential stud nuts.
3. Extension cover-plate screws.
4. Exhaust pipe front-fixing point.
5. Plugs, interlocking plungers, and spring.

NOTE

A list of Service tools necessary when dismantling or reassembling the transmission is shown at the end of Section F.

Section F.1

DISMANTLING THE TRANSMISSION

Remove the transmission casing from the crankcase as detailed in Section A.23.

Remove the idler gear from the crankcase. Note the thrust washers fitted each side of the gear. Use Service tool 18G581 to remove the idler gear bearings.

Remove the differential assembly as in Section F.4.

Remove the change speed reverse detent plunger plug and withdraw the spring and plunger.

Remove the clamp screw from the selector lever and withdraw the gear change operating shaft, taking care not to damage the oil seal in the transmission casing with the Woodruff key fitted to the lower end of the shaft.

Unscrew the speedometer pinion housing screw, remove the housing, and withdraw the pinion. Take out the two set screws and remove the speedometer gear retaining plate from the transmission case front cover; withdraw the speedometer gear.

Remove the nine set screws and take off the transmission casing end cover.

Remove the screw securing the oil suction pipe bracket to the lug on the transmission casing, and the two screws through the pipe flange and the external blanking plate. Withdraw the pipe from the strainer. Note the paper joint washer fitted between the pipe flange and blanking plate and the casing.

Unscrew and remove the set pins and locking plate securing the third motion shaft bearing retainer to the centre web of the casing, and extract the retainer together with the packing shims.

Remove the third motion shaft drive pinion nut, locking washer, and the drive pinion.

Remove the circlip and roller bearing from the end of the first motion shaft, knock up the locking washer and remove the nut from the end of the shaft, and withdraw the first motion shaft driving gear.

Remove the lay and reverse shaft locking plates, push the layshaft out of the casing, and remove the laygear and thrust washers.

Remove the screwed retaining plugs from the outside of the casing and extract the selector rod interlocking plungers and spring.

Extract the first motion shaft bearing circlip and carefully withdraw the bearing from the casing, using Service tool 18G284 with adaptor 18G284B.

Unlock the first and second speed selector fork, withdraw the fork rod, and extract the selector fork from the casing.

To remove the third motion shaft bearing carefully drift the third motion shaft rearwards until Service tool 18G613 can be interposed between the first speed gear hub and the bearing. The recessed face of the tool must be towards the bearing. Carefully drift the third motion shaft forward until the bearing is practically out of its housing. The bearing can then be gently levered off the shaft and out of its housing.

Extra care must be taken when drifting the third motion shaft forward not to damage the selector forks. With the bearing withdrawn the third motion shaft can be removed from the casing.

Unscrew and remove the remaining oil strainer bracket screw and locking plate and withdraw the strainer assembly.

Release the locknut and slacken off the third and fourth gear selector fork locating set screw. Withdraw the selector rod and remove the fork from the casing.

Remove the reverse gear shaft, gear, and selector fork, and extract the detent spring and plunger.

Release the circlip from the reverse gear shifter lever pivot pin and remove the lever.

Section F.2

REASSEMBLING THE TRANSMISSION

Press the reverse gear shifter lever pivot pin into its drilling in the bottom of the transmission casing; fit the shifter lever and secure it to the pivot with a circlip. Place the reverse gear and gear fork in position to engage

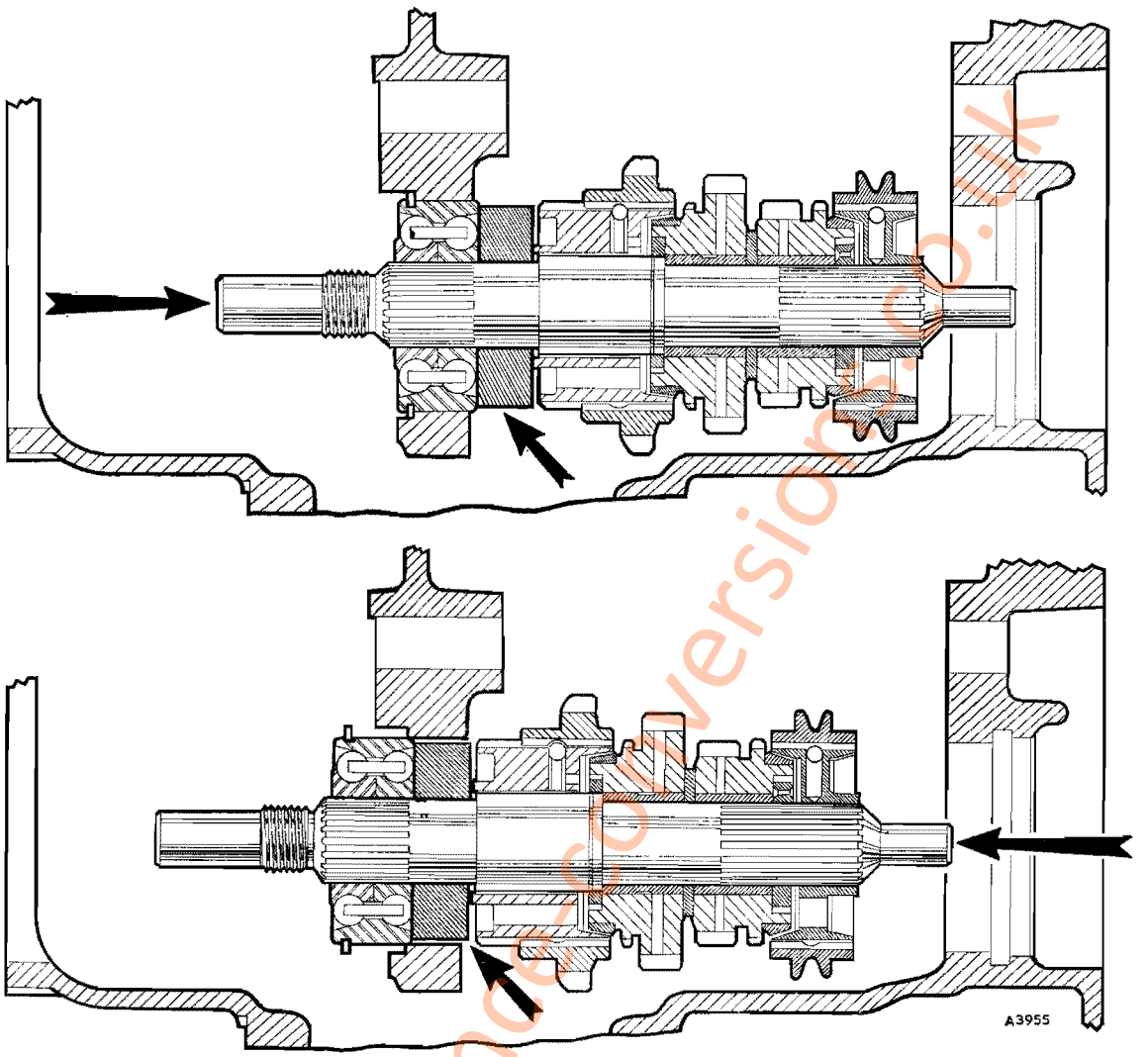


Fig. F.2

Showing the method of removing the third motion shaft bearing, using Service tool 18G613

the reverse shifter lever and push the reverse gear shaft through the centre web of the casing into the gear, plain end foremost, leaving the slotted end exposed.

Insert the reverse selector rod interlock spring and plunger. Push the reverse selector rod into the casing from the front to pick up the reverse gear fork on the way through.

Position the third and fourth gear selector fork in the casing and push the selector rod through from the front to pick up the fork on the way through. Screw in the selector fork set screws to engage the indentations on the selector rods; tighten up and secure with the locking nuts.

Place the pick-up strainer in the casing and insert the fixing screws through the strainer bracket and the lug in the casing, leaving the nuts slack on the screws. Smear a small quantity of grease on the sealing ring fitted between the bracket and the strainer; this will help the oil suction pipe to pass through and not push the seal out when it is fitted.

Take the third motion shaft assembly and place it in the casing with the slotted end passing through the centre web of the casing, and with the first and second sliding hubs engaging the selector forks.

Place the ball race on the first motion shaft and insert the assembly into the casing. Position the third motion shaft bearing in the centre web of the casing; make certain that both the first and third motion shafts line up, and carefully drift both the bearings into position. Use Service tool 18G579, together with the distance collar, to drift the third motion shaft bearing into the centre web of the casing. The collar must be placed in the recess on the end of the tool in order that the outer race will be driven into the casing at the same time as the inner race is driven onto the third motion shaft. The same tool is used to drift the first motion shaft bearing into the casing; in this case the distance collar is not used. Fit the first motion shaft bearing retaining circlip (see Fig. F.4).

Refit the first and second speed gear selector fork and fork rod and secure the fork with its locating screw and locking nut.

Refit the first and second, third and top selector rod detent plungers and springs, not forgetting the sealing washers to fit under the head of the screwed retaining plugs.

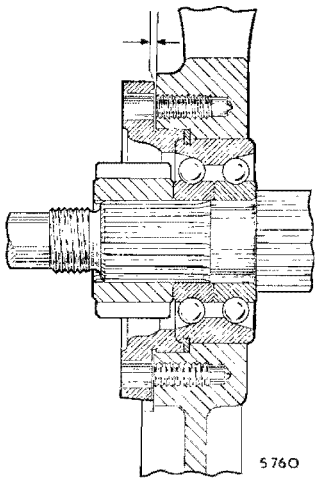


Fig. F.3

A section through the third motion shaft bearing and bearing retainer. It is essential that the correct thickness of shim is used to take up the gap indicated in the illustration. Use the following table to ensure that the correct shim thickness is used

When the gap is	*Use shims totalling*
·005 to ·006 in. (·127 to ·152 mm.)	·005 in. (·127 mm.)
·006 to ·008 in. (·152 to ·203 mm.)	·007 in. (·178 mm.)
·008 to ·010 in. (·203 to ·254 mm.)	·009 in. (·229 mm.)
·010 to ·012 in. (·254 to ·304 mm.)	·011 in. (·279 mm.)
·012 to ·014 in. (·304 to ·256 mm.)	·013 in. (·330 mm.)
·014 to ·015 in. (·356 to ·381 mm.)	·015 in. (·381 mm.)

Replace the drive pinion, locking washers, and nut on the front end of the third motion shaft; tighten the pinion nut, and bend over the locking washer.

Refit the first motion shaft driving gear, ensuring that the locating pegs on the locking washer are engaged in the two holes in the gear; tighten up the nut and bend up the washer.

Refit the laygear with a thrust washer at each end and with the slotted end of the shaft to the front. Use Service tool 18G471 to retain the thrust washers in position when the layshaft is being fitted. There must be an end-clearance of between ·002 and ·006 in. (·051 and ·152 mm.) when the laygear and thrust washer are fitted; thrust washers ranging in size from ·125 to ·134 in. (·635 to ·991 mm.) are available to enable this clearance to be obtained. Turn the layshaft and reverse shaft to line up the slotted ends; the slots must face each other to enable the shaft locating plate to be refitted. Replace the third motion shaft bearing retainer, fitting shims as necessary (see Fig. F.3) to take up the area between the bearing outer race and the retainer. Note that the shims must be positioned underneath the reverse shaft and layshaft locating plate. Secure in position with four set screws and the lock plates.

Remove the front screw of the two holding the pick-up filter bracket and insert the oil suction pipe into the filter, taking care not to push the sealing rubber between the strainer and strainer bracket out of position; lightly grease the seal before inserting the pipe. Replace the two paper gaskets between the pipe flange, the outer blanking plate, and the casing; insert and tighten up the two set screws. Replace the strainer bracket screw to secure the oil pipe support bracket, replace the locking plate, and tighten down both bracket screws; bend up the locking plate.

Refit the selector interlocking arm and the front end cover and gasket.

Insert the speedometer drive gear through the front cover to engage the slot in the third motion shaft, and secure it in position with the cover-plate, paper gasket, and two set screws.

Examine the seal in the pinion shaft housing, and renew it if necessary. Replace the paper gasket, should it be damaged; push the housing carefully over the pinion shaft and secure it with the one set screw.

Insert the gear change operating shaft into the casing, taking care not to damage the oil seal in the casing with

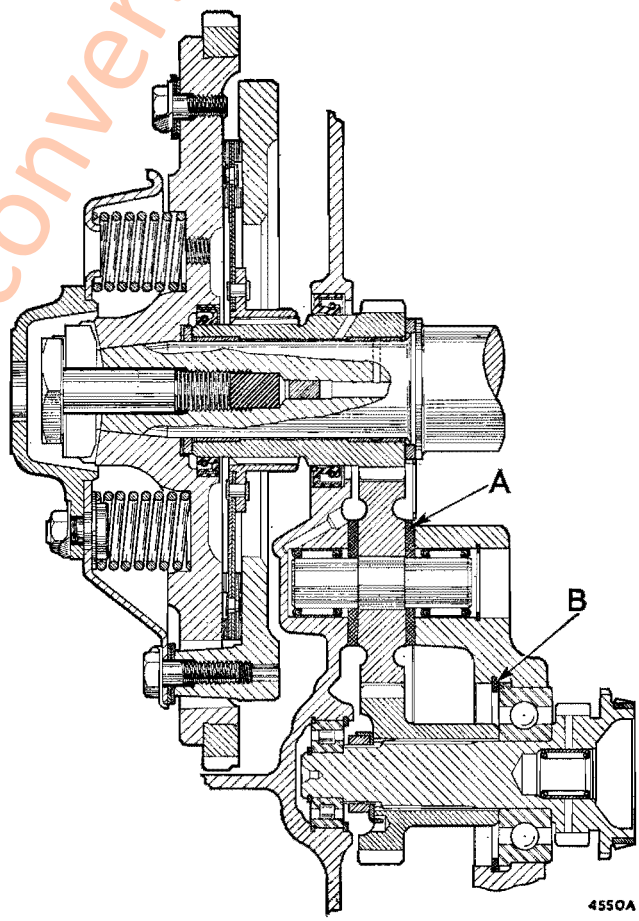


Fig. F.4

A section through the idler gear and the first motion shaft

A. The idler gear must have from ·003 to ·008 in. (·076 to ·20 mm.) end-float.

B. Take the measurement between the first motion shaft bearing face and the bearing register. Use Service tool 18G569 for this purpose.

For measurements (B)	*Use circlip Part No.*
·096 to ·098 in. (2·43 to 2·48 mm.)	2A3710
·099 to ·100 in. (2·51 to 2·54 mm.)	2A3711

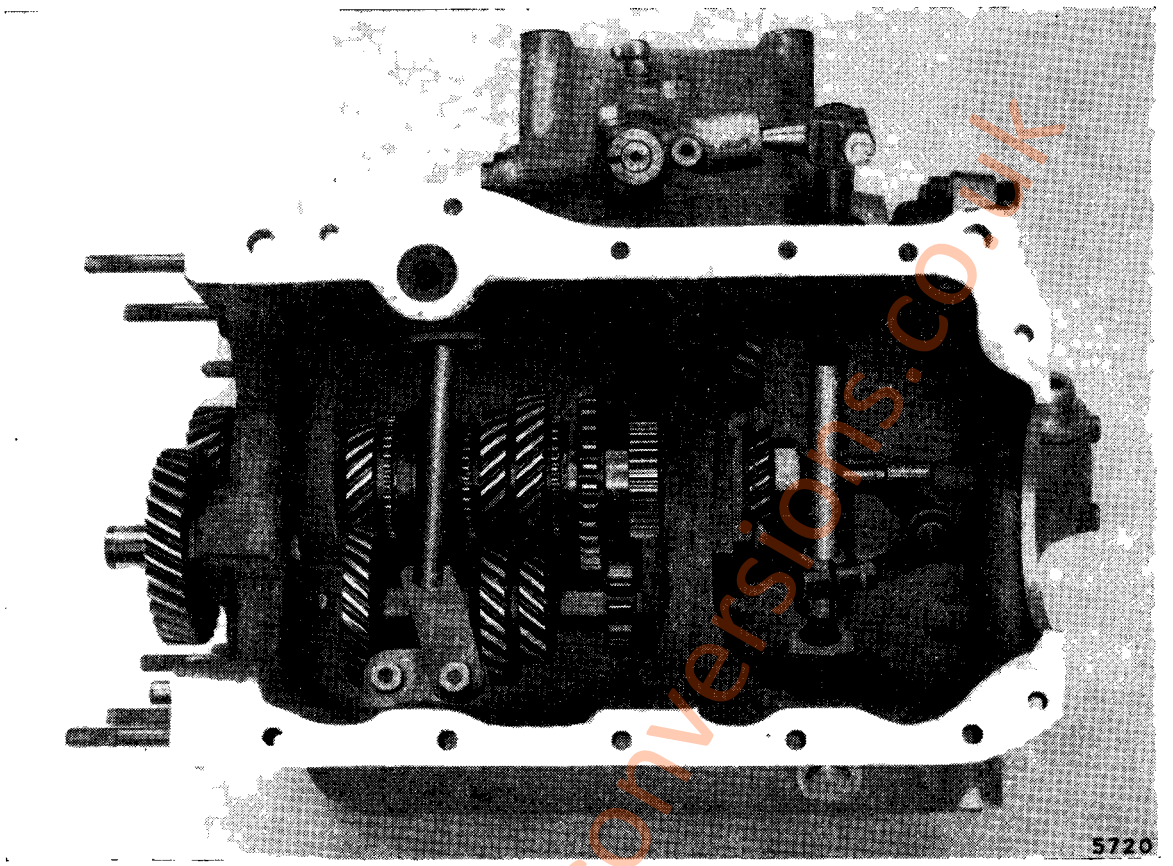


Fig. F.5

A view of the transmission assembly with all the gears assembled into the casing

the Woodruff key fitted in the lower half of the shaft. Should it be necessary to replace the oil seal, use Service tool 18G573 to drift the new seal into position. Position the selector lever inside the casing with the end engaged in the interlocking arm and push the shaft through the lever boss into its lower bearing point in the casing. Line up the recess in the shaft with the drilling through the lever boss, insert and tighten the set screw, and bend up the locking washer.

Refit the gear change operating shaft reverse detent plunger, spring, and plug.

Refit the differential assembly as in Section F.4.

Should the idler gear bearing in the flywheel casing require renewing, the area round the bearing boss must be well supported during the pressing-in operation.

Use Service tool 18G582 to refit the idler gear bearing to both the flywheel housing and the transmission casing. The collar supplied with this tool must be used to control the depth to which the bearing is pressed into the flywheel housing. Should the bearing be pressed in to the full depth of the bearing bore, it would mask the oil supply hole. The collar is not required when refitting the idler gear bearing to the transmission casing.

Replace the idler gear with a thrust washer on either side of the gear, and fit the washers with the chamfered bore against the gear face. Refit the roller bearing on the end of the first motion shaft and fit the flywheel housing and gasket to the transmission casing.

With the housing nuts tightened up there should be between ·003 and ·008 in. (·076 and ·203 mm.) end-float on the idler gear. Thrust washers ranging in thickness from ·132 to ·139 in. (·8 to 1 mm.) are available for this purpose. Remove the housing and gasket.

Refit the transmission case assembly to the crankcase as detailed in Section A.23.

Section F.3

THIRD MOTION SHAFT

Remove the shaft assembly from the transmission casing as detailed in Section F.1.

Dismantling

Withdraw the top and third gear synchromesh hub from the forward end of the shaft, observing that the plain side of the hub faces to the rear of the gearbox.

Remove the front thrust washer by pressing down the spring-loaded locating plunger and rotating the washer until the splines register with those on the shaft. Withdraw the thrust washer and gear. Take out the plunger and spring and withdraw the third gear bush and interlocking ring. Withdraw the second speed gear and bush. Remove the rear thrust washer and the first speed gear and hub.

If it is necessary to separate the second or third and fourth speed striking dog from the synchromesh hub

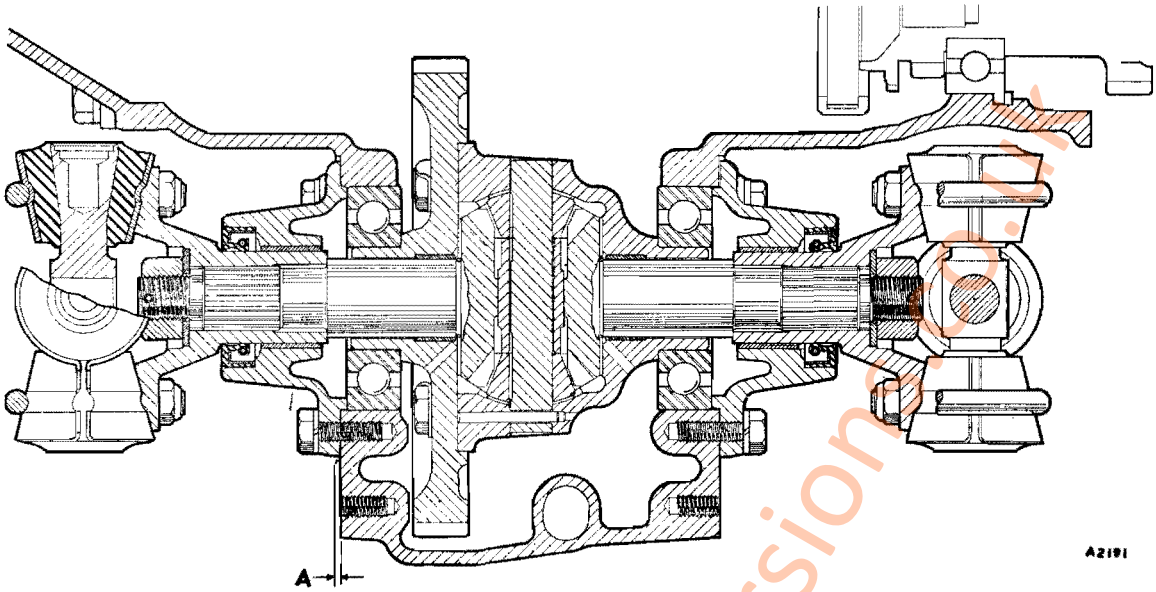


Fig. F.6

A section through the differential assembly and final drive end covers. In order to obtain the correct preload on the differential bearings a feeler gauge measurement must be taken at point (A), *indicated in the above illustration with the left-hand final drive cover fitted without its joint washer*

and cone assemblies the assembly should be wrapped in a suitable piece of cloth in order to retain the three balls and springs which are located in each hub.

Reassembling

When assembling the first and second speed hub ensure that the cone side of the hub is on the same side of the assembly as the plain side of the first gear teeth.

Reassembly of the mainshaft is a reversal of the dismantling procedure.

The first and second speed hub is fitted with the cone side away from the bearing position and is followed by the rear thrust washer and the plain half of the split bush, with the plain end against the thrust washer. Follow this with the second speed gear, the interlocking ring, and the splined half of the centre bush, engaging the dogs of each half-bush with the central interlocking ring.

To facilitate relocking the front thrust washer insert the spring and plunger and draw half the split bush forward until it just overlaps the plunger and retains it within the shaft. Carefully position the third speed gear, plain side first, and follow with the thrust washer. When the washer abuts the bush give it a sharp tap to position the bush and place the washer above the plunger. Turn the thrust washer until the plunger engages the spline and locks the washer.

The end-float of the second and third speed gear when assembled on the third motion shaft must be between ·0035 and ·0055 in. (·09 and ·12 mm.).

Finally, replace the top and third speed synchromesh hub, plain side towards the retaining thrust washer.

Refit the assembly as detailed in Section F.2.

Section F.4

DIFFERENTIAL ASSEMBLY

Removing

Remove the engine as detailed in Section A.34.

Remove the transmission as detailed in Section A.23.

Unscrew the hexagon cap, and remove the change speed lever anti-rattle spring and plunger from the gear change extension.

Take out the four set screws and remove the bottom cover-plate from the gear change extension. Remove the clamp screw securing the lever to the top of the remote-control shaft and withdraw the shaft. Remove the nylon seating and tension spring from both the remote-control shaft and the shaft lever.

NOTE.—The fitting of a nylon seating and tension spring in the cup of the remote-control shaft lever was discontinued on later engines to give more freedom of movement to the shifter lever, and they should be discarded when removed from the earlier engines during overhaul.

Extract the split pin from the slotted nuts securing both right- and left-hand driving flanges to the differential gear shafts, remove the nuts, and withdraw the flanges.

Do not under any circumstances use the transmission casing as a stop or leverage point when removing the driving flange nuts or other components of the transmission. Serious damage to the casing can easily result from misuse in this way.

Unscrew the five set screws from each of the final drive end covers and remove the covers from the differential housing. Note the number of shims fitted between the differential bearing and the housing.

Remove the differential housing stud nuts, withdraw the housing from the transmission case, and remove the differential assembly.

Dismantling

Withdraw the two differential bearings, using Service tool 18G2. Knock back the locking plate tabs and remove the six set bolts securing the driving gear to the cage.

Mark the gear and cage to assist in refitting them in their original positions. Separate the gear from the cage and extract the differential gear and thrust washer from the bore of the driving gear. Tap out the taper pin to release both the pinions and thrust washers, pinion spacer, and the other differential gear and washer. The taper pin cannot be removed until the cage and driving gear are separated. On later models knurled oil grooves have been introduced to improve the lubrication between the pinions and the pinion spacer.

Reassembling

Reassembly is a reversal of the dismantling procedure; make sure, however, that the differential gear thrust washers are replaced with their slightly chamfered bores against the machined face of the differential gears. It is essential that all component parts are replaced in their original positions.

Refitting

Place the differential assembly in the transmission casing with a slight bias towards the flywheel end of the engine. Refit the differential housing with its joint washers, tightening up the nuts sufficiently only to hold the bearings firmly and yet still allow the assembly to be displaced by the fitting of the right-hand final drive end cover.

Refit the right-hand-drive end cover together with its joint washer. Make certain that the holes in the cover flange and the tapped hole in the transmission casing and differential housing are correctly lined up, insert the set screws, and tighten them up carefully and evenly to ensure maximum contact between the register on the inner face of the cover and the differential bearing outer race. As the screws are tightened up the differential assembly will be displaced away from the flywheel side of the engine.

Fit the left-hand final drive cover without its joint washer.

As the cover flange will not have the support of the joint washer tighten up the set screws sufficiently only for the cover register to nip the bearing outer race; overtightening will distort the cover flange. Take a feeler gauge measurement between the cover flange and the differential housing and transmission casing. This measurement must be taken in more than one position; variations in measurement will indicate that the set screws have not been tightened up evenly, resulting in the differential assembly being pulled out of alignment. Adjust the tension on the cover set screws accordingly, at the same time avoiding excessive tension being placed upon the cover flange, and measure again with the feeler gauge. If a feeler gauge cannot be inserted between the cover flange and the housing shims to the value of ·008 in. (·203 mm.) must be fitted between the bearing outer race and the register on the end cover.

The compressed thickness of the cover joint washer is ·007 in. (·178 mm.) and the required preload on the bearings is ·001 to ·002 in. (·025 to ·051 mm.). The correct gap is, therefore, ·008 to ·009 in. (·203 to ·229 mm.). Any deviation from this figure must be made up by shimming; for example, if the gap as measured by the feeler gauge is ·005 in. (·127 mm.) a shim of ·003 in. (·076 mm.) thickness must be added between the bearing and the register on the inner face of the end cover.

Remove the end cover and refit the joint washer and shims to the dimensions as found necessary by the above procedure, and tighten up the cover screws.

Tighten up the differential housing nuts; refit the driving flanges to the differential gear shafts and secure them with the slotted nuts and split cotter pins.

When servicing a differential unit operators must make certain that the drive shafts are equally free to rotate on both sides, as tightness on either one would tend to make the vehicle's steering pull one way or the other.

Fit the operating lever to the splined end of the gear change operating shaft; make certain that the recess in the shaft is correctly lined up with the drilling in the boss of the lever before inserting the set screw. Position the remote-control shaft lever on the ball end of the operating lever, insert the remote control shaft into the gear change extension from the bottom, to engage and enter the splined bore of the lever.

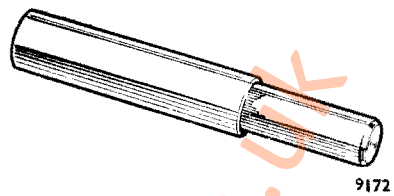
NOTE.—Do not refit the nylon seating and tension spring to the cup of the remote-control shaft lever; they should be discarded. Make certain that the recess in the splined end of the shaft is lined up with the drilling in the lever boss before attempting to insert the set screw.

Fit the tension spring and nylon seating to the operating shaft cup and refit the change speed lever, securing it in position with the retaining cover and two set screws, plus any packing removed during dismantling. Insert the anti-rattle plunger and spring and secure in position. Replace the bottom cover-plate.

SERVICE TOOLS

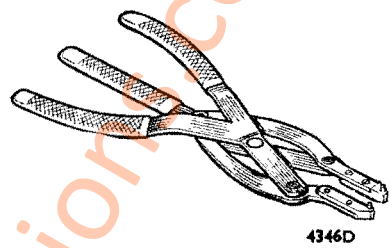
18G194. Laygear Needle-roller Bearing Replacer

The fitting of needle-roller bearings in the laygear is made considerably easier by the use of this tool. It can also be used to refit the bearing retaining spring ring.



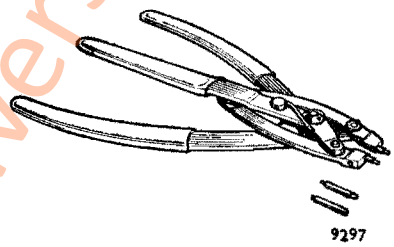
18G194

18G214A. Circlip Pliers



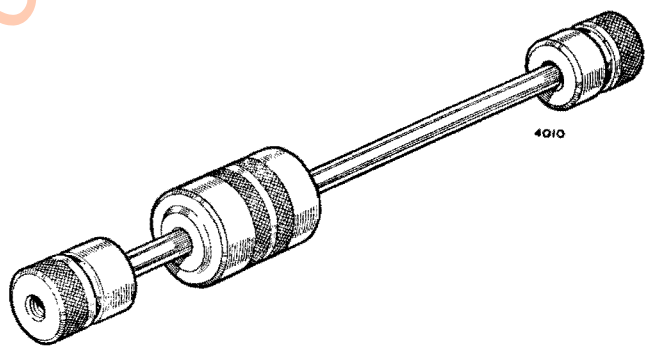
18G214A

18G257. Circlip Pliers—Large



18G257

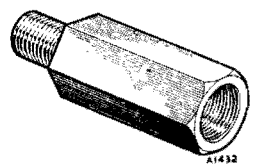
18G284. Impulse Extractor (basic tool)



18G284

18G284B. First Motion Shaft Remover Adaptor

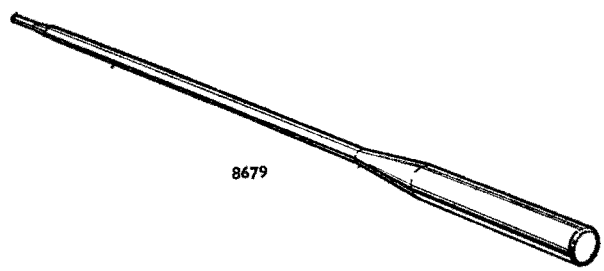
This extractor with the adaptor positioned in the screwed end will withdraw both the first motion shaft and bearing, provided the drive gear has been removed and the bearing circlip extracted.



18G284B

18G471. Dummy Layshaft

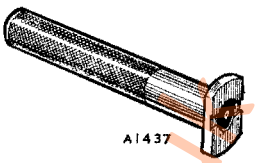
A pilot for lining up the gears and retaining the thrust washers in position prior to inserting the layshaft proper.



18G471

18G569. First Motion Shaft Bearing Circlip Gauge

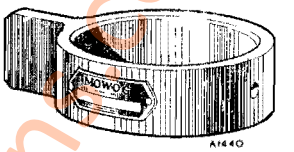
The use of this gauge will help to determine the correct size circlip required to retain the first motion shaft bearing in position, and at the same time ensure that the essential amount of end-float is still maintained. The two gauge sizes are shown on the handle adjacent to the relevant gauge.



18G569

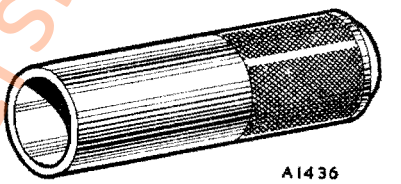
18G572. Synchromesh Unit Assembly Ring

Designed to facilitate the assembly of mated synchronizer and sleeve by enabling the springs and balls to be inserted quickly and easily.



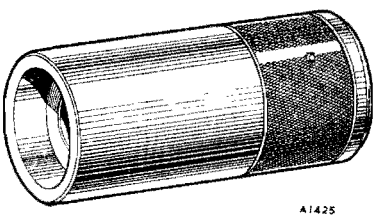
18G572

18G573. Change Speed Shaft Oil Seal Replacer



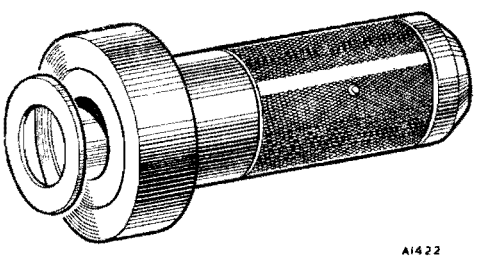
18G573

18G578. Differential Bearing Replacer



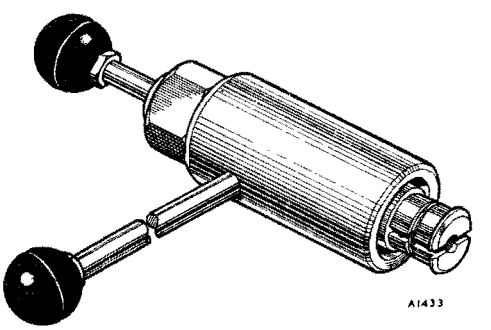
18G578

18G579. First and Third Motion Shaft Bearing Replacer



18G579

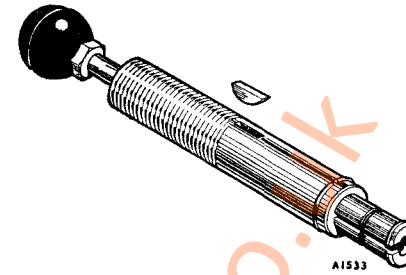
18G581. Front Suspension and Idler Gear Needle-bearing Remover



18G581

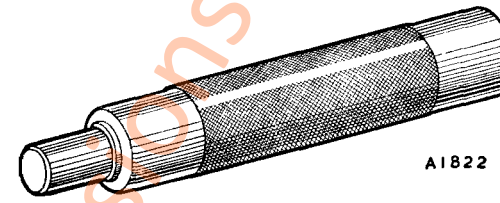
18G581B. First Motion Shaft Spigot Bearing Remover Adaptor

Use with the body of 18G581 to remove the needle-roller assembly from the first motion shaft.



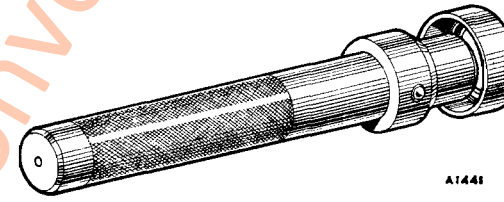
18G581B

18G589. First Motion Shaft Spigot Bearing Replacer



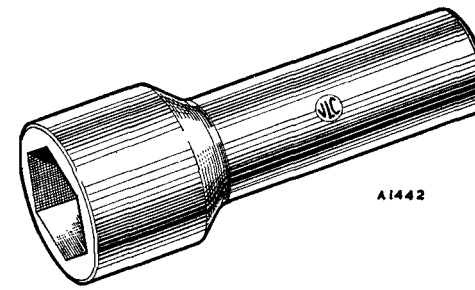
18G589

18G582. Front Suspension and Idler Gear Bearing Replacer



18G582

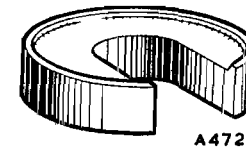
18G586. Final Drive Gear Nut Spanner



18G586

18G613. Third Motion Shaft Bearing Remover

For use when removing the third motion shaft bearing to prevent damage to the housing bore.



18G613

SECTION G

THE DRIVE SHAFTS

GENERAL DESCRIPTION

Each of the two drive shafts employed has two principal members incorporating a Hardy Spicer Birfield constant-velocity joint. The hemispherical interior of the driven shaft and exterior of the driving shaft have six grooves machined in line with the shaft axis, and a ball cage carrying six steel balls is interposed between the two. The steel balls engage the grooves of both members to key them together and at the same time allow the members to hinge freely upon each other.

The rubber boot enclosing this joint must be examined periodically and a new boot fitted immediately there is any sign of damage or deterioration. Ingress of water and road grit through a damaged boot will quickly ruin the joint and require a new drive shaft assembly to be fitted. To fit a new boot the complete drive shaft assembly must be removed from the vehicle.

Section G.1

DRIVE SHAFTS

Removing

To remove the drive shafts, the removal and dismantling procedure as given for swivel hubs in Section K.3 must be followed.

Constant-velocity joint

The constant-velocity (outer) joint of the driving shaft must not be dismantled; should the shaft become unserviceable, a replacement shaft must be fitted.

If the rubber boot enclosing the joint shows signs of damage or deterioration it must be removed and a new boot fitted.

Release the rubber boot from the shaft at the sliding joint and separate the shaft from the joint.

Remove the old boot from the constant-velocity joint, thoroughly clean all traces of rubber from the shaft and carefully wipe the old contaminated grease from the joint itself. It is most important that all the work carried out is undertaken in conditions of extreme cleanliness.

Do not attempt to flush the grease out of the joint. Should the joint have suffered obvious damage through the entry of road dirt, etc., a new shaft drive assembly must be fitted.

Lubricate the splined end of the drive shaft and the small internal diameter of the new rubber boot. Carefully slide the boot over the splines onto the shaft. Repack the constant-velocity joint with 1 oz. (28·35 gm.) of Vaughan's M.L. 2 Grease, obtainable in 1 oz. (28·35 gm.) tubes, to B.M.C. Part No. 97H2612; do not use any other lubricant. Pull the rubber boot over the joint, making certain that the moulded rib of the rubber boot is seating in the retaining grooves of the shaft and joint. Secure both the large and small diameters of the boot in position with two turns of 18 S.W.G. (1·22 mm.) soft iron wire, twisting the ends and bending them neatly in the opposite direction to forward rotation (see Fig. G.1). Make certain that the ends of the wire do not damage the rubber boot.

Sliding joint

On later models the lubricating nipple has been deleted from the drive shaft sliding joint and the joint prepacked with special grease and sealed with a rubber boot. Should it be necessary to separate the drive shaft at the sliding joint, it must be repacked with ¾ oz. of special grease, obtainable in tubes of this quantity under B.M.C. Part No. 97H2611.

To repack a sliding joint, remove the wire securing the rubber boot to the joint flange, ease the boot from the flange, and withdraw the shaft. If the sealing ring fitted to the threaded end of the joint flange is disturbed it must be removed from the flange and the threads resealed with Araldite sealing compound. This sealing ring is not fitted to later models. Fill the cavity of the joint flange to point (A), Fig. G.2, with the special grease. Remove the old rubber boot from the drive shaft and clean off any particles of rubber adhering to the shaft. Slide the new rubber seal over the drive shaft and insert the

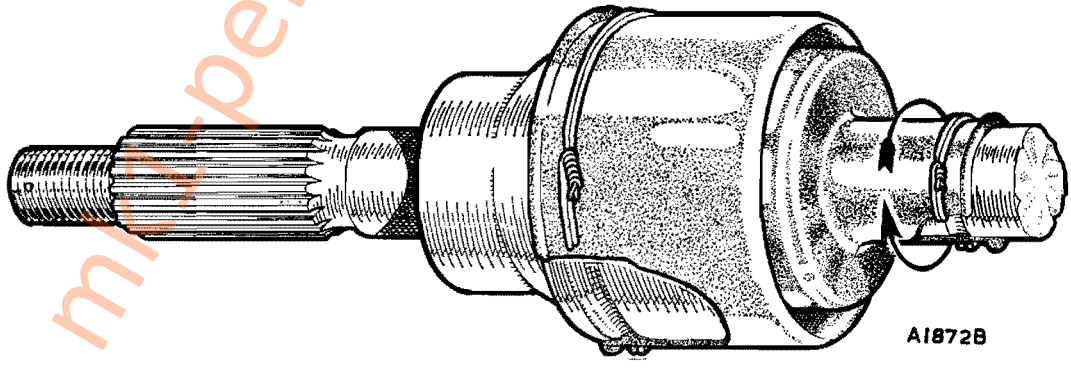


Fig. G.1

The constant-velocity joint cut away to show the method of securing the rubber boot to the shaft and joint. The loose end of the retaining wire must be bent over away from the direction of rotation

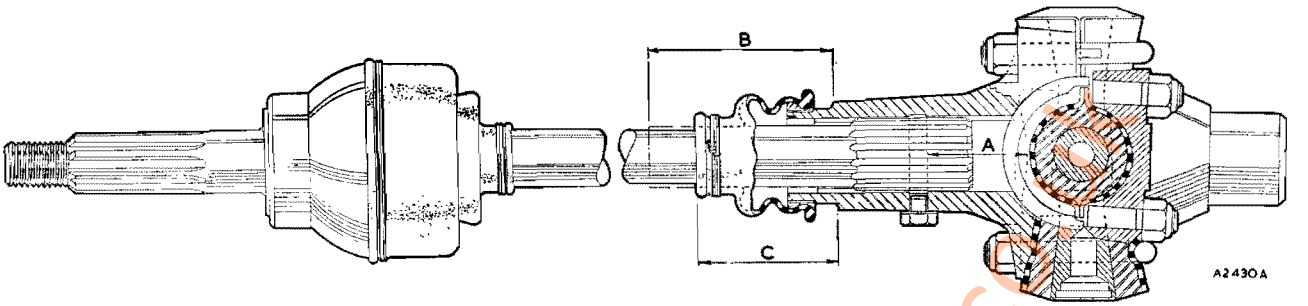


Fig. G.2

A section through the drive shaft sliding joint, showing: (A) *the depth to which the joint flange must be packed with grease;* (B) 2½ *in.* (63·50 *mm.*), *the distance between the shoulders on the flange and shaft, to which dimension the shaft must be adjusted before the boot is secured to the shaft;* (C) 1⅞ *in.* (47·63 *mm.*), *the correct measurement from the flange shoulder to the outer lip of the boot with the shaft and flange adjusted to dimension* (B)

shaft into the joint flange to the position (B) shown in Fig. G.2. Secure the boot to the joint flange with two turns of 20 S.W.G. soft-iron wire twisted firmly together to ensure a good greasetight seal. Bend the ends of the wire away from the convolutions to ensure that they cannot damage the boot. Hold the drive shaft in a vice and push the flange fully onto the shaft, at the same time holding the outer lip of the boot open with the tang end of a file to allow the displaced air and surplus grease to escape.

Check the diameter of the boot bellows; this should not exceed 1¾ in. (4·5 cm.) approximately with the drive shaft pushed fully into the flange; if necessary, squeeze the bellows by hand to reduce the diameter to this figure.

Withdraw the shaft until the seal is positioned as shown at dimension (C), Fig. G.2, and secure the boot to the shaft with two turns of 20 S.W.G. soft-iron wire.

Refitting

Refitting is a reversal of the removal procedure given in Section K.3.

When fitting a replacement drive shaft assembly (of the type fitted with a rubber boot on the sliding joint) to the left-hand side of an early model, it will also be necessary to fit a modified lower arm inner pivot pin to ensure sufficient clearance for the rubber boot. Reference should be made to Fig. G.3 for the dimension of the modified pivot pin.

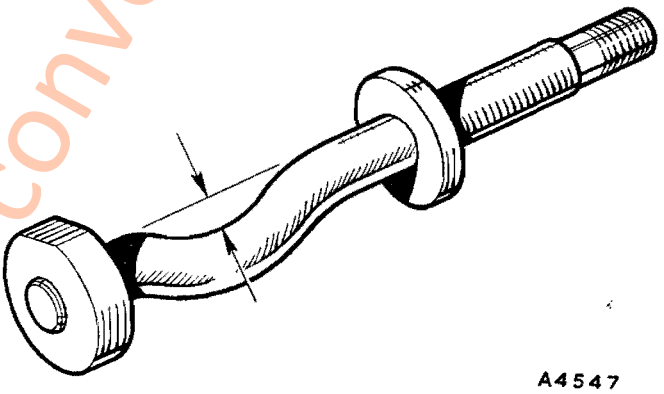


Fig. G.3

The lower arm pivot pin. The measurement at the position indicated must be ·312 *in.* (7·9 *mm.*) *to accommodate the rubber boot of later drive shaft assemblies.*

SECTION H

THE REAR SUSPENSION

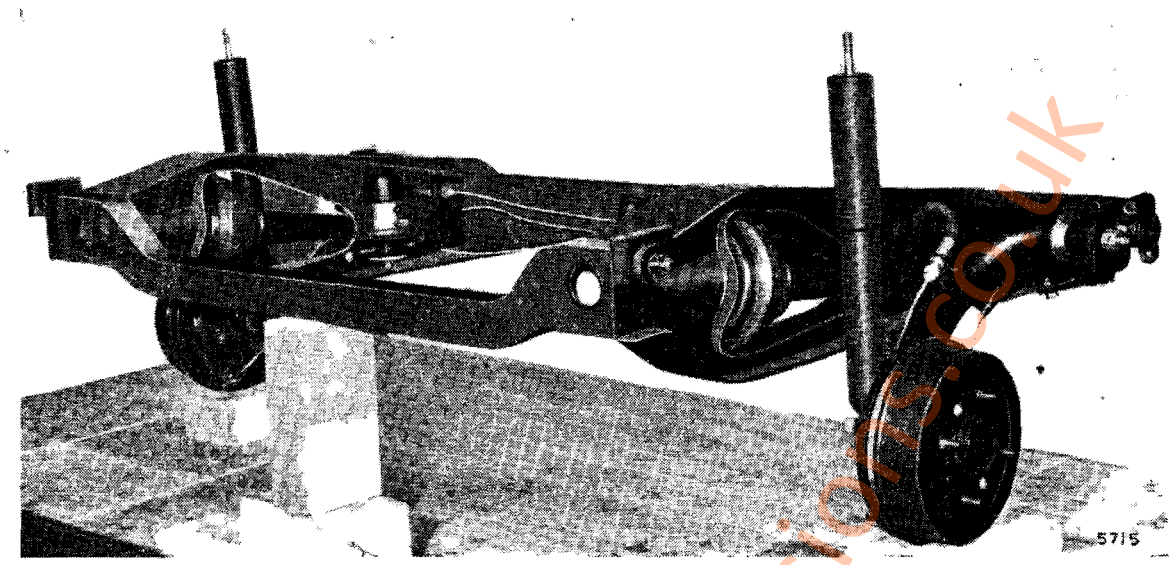


Fig. H.1

The rear sub-frame assembly

Section H.1

SUB-FRAME

Removing

Disconnect and remove the earth lead from the battery and both leads from the fuel pump. Release the flexible hoses from both the inlet and delivery connections on the fuel pump, and in doing so drain the fuel tank.

Unscrew the tube nut to release the hydraulic pipe line from the pressure regulating valve mounted on the rear sub-frame front member.

Slacken off and remove the exhaust pipe to manifold clamp, and release the pipe from its fixing point on the gear change extension casing and from the two locations on the rear sub-frame. Take particular note of the number of spacing washers on the gear change casing fixing point. Remove the exhaust pipe assembly from the car.

Remove the end finishers from the sill panels and disconnect the rear dampers from inside the luggage compartment. To gain access to the left-hand damper nut remove the fuel tank as detailed in Section D.1.

Remove the two hand brake cable fairleads from the floor and disconnect the cables from the lever trunnion. Pull the cable through the floor from beneath the car.

Support the body with a sling, locating padded hooks under the rear wings or the luggage compartment top panel.

Withdraw the eight mounting bolts (two at each attachment point) and raise the body to release the complete sub-frame.

Refitting

Refitting is a reversal of the dismantling procedure, with particular attention being given to the following points.

Make certain that the tapped holes in the body are lined up with the holes in the mounting blocks.

The exhaust system must be refitted without the system being subjected to strain; this is most important. The refitting procedure given in Section A.5 must be followed.

Finally, bleed the hydraulic system and readjust the hand brake cables.

Section H.2

RADIUS ARMS

Removing

Release the telescopic damper upper mounting from inside the luggage compartment. To release the left-hand damper drain and remove the fuel tank as detailed in Section D.1.

As an alternative to removing the tank the left-hand damper mounting can be released by undoing the tank strap and gently lifting the tank towards the centre-line of the car, pivoting about the rubber fuel line connector at its forward end without detachment at this point. If this method is adopted it must be undertaken with extreme care, otherwise the rubber connecting hose may be damaged.

Raise the car and support it beneath the rear sub-frame side-member. Remove the road wheel and disconnect the brake hose from the bracket on the trailing arm.

With the radius arm hanging and thereby taking the load off the spring unit, the strut can be prised away from the spring unit flange and pulled out of its seating cup in the trailing arm boss. The nylon cup may be left in the arm when the strut is pulled away; it can, however, be removed with the fingers unless it is damaged and unfit for further service, when it may be necessary to prise it from the arm.

Disconnect the hand brake cable from the actuating lever on the brake backplate, prise the guide tube from

its retaining clip on the arm, lift the arm, and pull the tube away from its anchorage hole on the arm boss. This will enable the cable to be released when the arm is withdrawn. On later models remove the nut from the cable sector pivot and withdraw the sector and cable.

Unscrew the three set screws and remove the end finisher from the sill panel.

Remove the nut and washers from the trailing arm shaft, and the four set screws to release the arm outer support bracket.

Lift the arm assembly away from the car, taking care not to lose the thrust washers and rubber seal fitted between the arm and the side-member.

Dismantling

Remove the dust seal and thrust washers from the ends of the shaft and withdraw the shaft. Should the bronze bushes fitted in the bore of the arm be worn or the shaft show signs of ridging, the bearings should be renewed and a new shaft fitted. Use Service tool 18G583 to remove the old bushes and tool 18G584 to fit the new bushes.

Later models are fitted with a cast-type radius arm which has a needle-roller bearing on the inner end of the pivot and a bronze bush on the outer end. The outer bush is renewed in the same way as that of the earlier type. Before reaming the bush the needle bearing and grease tube **must** be removed. Fit the reamer guide bush 18G588A in place of the needle bearing and pass the reamer 18G588 through the guide bush. After reaming, remove the reamer and guide bush and thoroughly clean out all swarf from the interior of the bore of the radius arm. Adequately lubricate all pivot components with grease to Ref. C and reassemble.

Oil is not a satisfactory lubricant at this joint and must not be used.

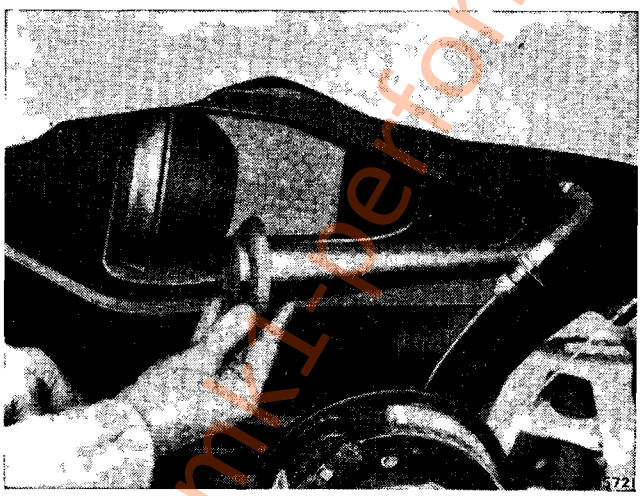


Fig. H.2

Extract the strut from the spring unit and pull it rearwards to disengage the ball end from the radius arm

Fig. H.3

Removing the rear sub-frame front mounting support pin assembly

The needle-bearing outer race is removed by the use of Service tool 18G583B in conjunction with Service tool 18G583, and is replaced with Service tool 18G620.

If the existing shaft is in good order, make certain that the lubricator is clear before refitting to the arm.

The rear hub stub shaft is pressed in.

Refitting

The radius arms may be replaced by carrying out the removal instructions in the reverse order, provided the following points are given special attention.

The nylon cup and dust seal must be repacked with Dextagrease Super G.P., supplied by B.M.C. Service Ltd. in 1-lb. (·45-kg.) tins (Part No. 97H2276), refitted to the ball end of the spring strut, and the dust seal lipped over the edge of the cup; this is most important. If the nylon seat is fitted into the arm and then followed by the strut ball end, the rubber seal cannot be lipped over the cup to make dust-sealing effective.

Refit the strut and the spring unit (see Section H.3).

Push the cable guide tube (fitted to early models only) into its locating hole on the trailing arm boss and secure it under the clip on the arm before the arm is refitted to the sub-frame.

Finally, bleed the hydraulic system.

Section H.3

SPRING UNITS

Removing

Release the telescopic damper from the inside of the luggage compartment as in Section L.2.

Raise the car, support it beneath the sub-frame side-member, and remove the road wheel.

With the radius arm hanging in its lowest position the spring strut can be extracted from the frame side-member and the spring unit removed.

The nylon seating can be prised out of the arm boss.

Refitting

Refitting is a reversal of the removal sequence.

The nylon seating must be fitted to the strut ball end and the rubber dust seal lipped over the edge of the seal before the strut is refitted.

Refit the strut and then insert the spring unit.

Make certain that the spring unit and spring strut are correctly located on their individual spigots whilst the radius arm is being raised to reconnect the upper end of the damper. Failure to observe this instruction may result in a vehicle having the appearance of being trimmed too high at the back, and would probably damage both the spring and spring strut beyond recovery.

Section H.4

SUB-FRAME MOUNTINGS

Front mounting

Jack up the car at a point between the bumper and the rear body panel.

Remove the radius arm as detailed in Section H.2.

Unscrew and remove the nut securing the mounting support pin to the sub-frame. Withdraw the mounting block to body screws. Prise the body and sub-frame apart sufficiently to enable the support pin, blocks, and rubbers to be extracted.

When refitting, insert the mounting block to body screws before tightening up the support pin nut.

Rear mounting

Jack up the car at a point between the bumper and the rear body panel.

Withdraw the mounting block to body screws and remove the nut from the end of the mounting support pin.

Prise the body and the frame apart sufficiently only to allow the block and rubbers to be removed.

When refitting, insert the mounting block to body screws before tightening up the support pin nut.

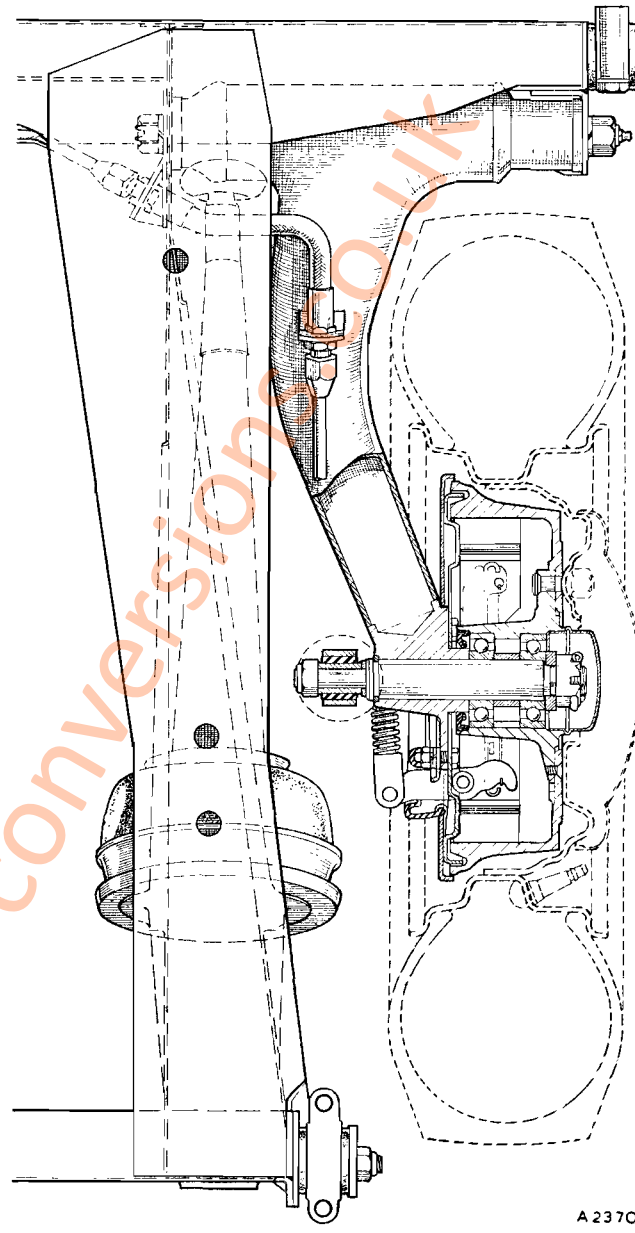


Fig. H.4

The rear radius arm, showing a section through the hub assembly

Section H.5

HUBS

Removing

Jack up the vehicle, and remove the road wheel and the brake-drum.

Prise off the grease-retaining cap.

Extract the split cotter pin and remove the slotted nut from the end of the stub shaft.

Withdraw the hub assembly with a suitable removing tool.

Dismantling

To remove the hub bearings drift the inner races of both bearings from the hub bore. Remove the grease-retaining seal and extract the outer bearing races, using Service tool 18G260 with adaptor 18G260C.

Reassembling

Make certain that the outer race of both bearings are fitted hard against the register in the hub bore.

Refit the inner races and bearing spacer, at the same time repacking with grease to Ref. C. Fit a new grease-retaining seal in the hub bore if the old seal was damaged during removal.

Refitting

When refitting the hub and bearing assembly to the stub shaft care must be taken to ensure that the bearing spacer is lifted over the shoulder on the stub shaft before pressure is applied to push the assembly onto the shaft.

Place the thrust washer on the end of the stub shaft with the chamfered bore towards the bearing, refit the slotted nut, tighten up, and secure with the split cotter pin.

Repack the grease cap with grease to Ref. C before refitting.

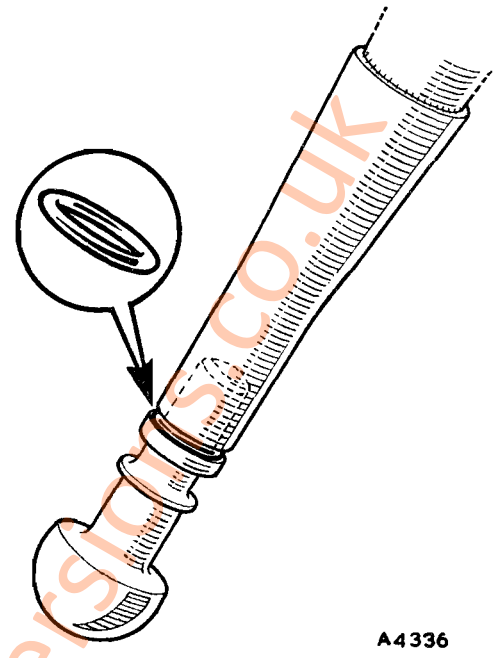


Fig. H.5

A suspension strut, showing the special circular-section washer fitted between the strut body and the knuckle shoulder

Section H.6

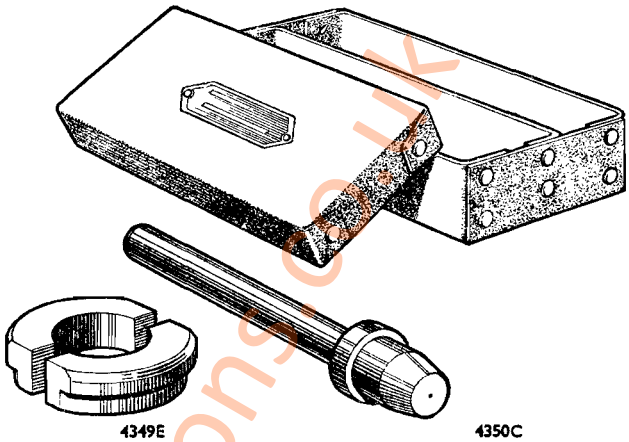
SUSPENSION STRUTS

From Car No. 34099 the trim height of the vehicle has been raised to give an increased ground clearance by the fitting of circular-section washers between the body of the suspension strut and the shoulder of the knuckle end. When removing a defective strut fitted with one of these washers make certain that a washer is also fitted to the new strut. It is important that only one washer is fitted to each of the four struts.

SERVICE TOOLS

18G260. Hub Bearing Outer Race Remover (basic tool)

18G260C. Hub Bearing Outer Race Remover Adaptor

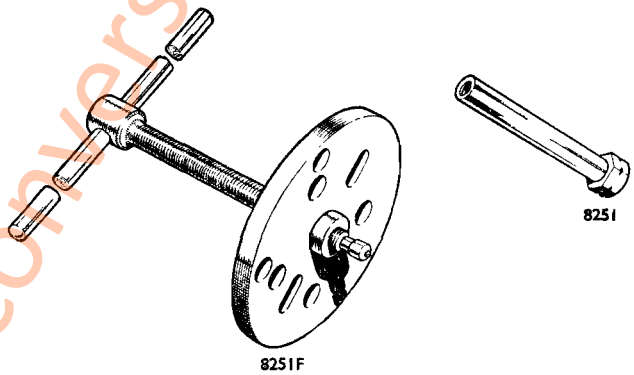


18G260C **18G260**

18G304. Front and Rear Hub Remover (basic tool)

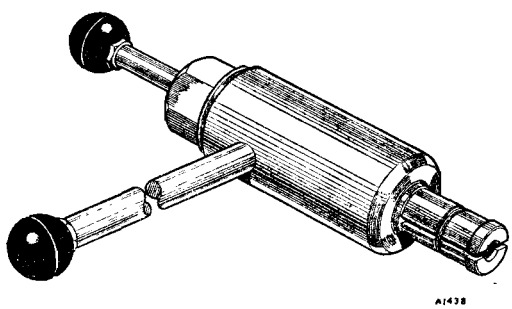
18G304F. Front and Rear Hub Remover Bolt Adaptor

Two of the adaptor bolts 18G304F are required in order to pull the rear hub from the rear radius arm.



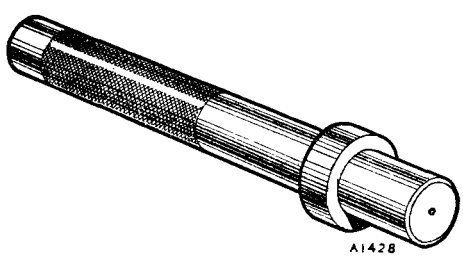
18G304 **18G304F**

18G583. Rear Radius Arm Bush Remover



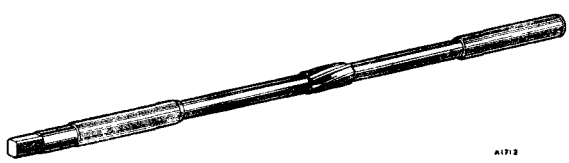
18G583

18G584. Rear Radius Arm Bush Replacer



18G584

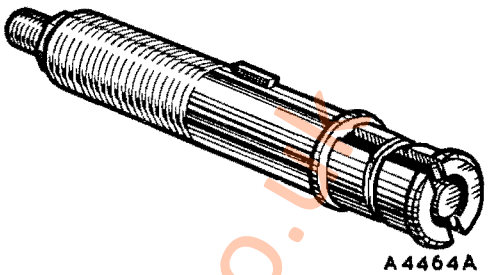
18G588. Rear Radius Arm Bush Reamer



18G588

18G583B. Rear Radius Arm Needle Bearing Remover Adaptor

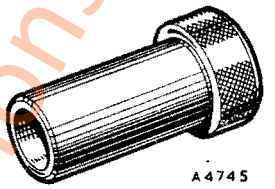
For use in conjunction with Service tool 18G583 when removing the needle bearing outer race on cast-type radius arms only.



18G583B

18G588A. Reamer Guide Bush

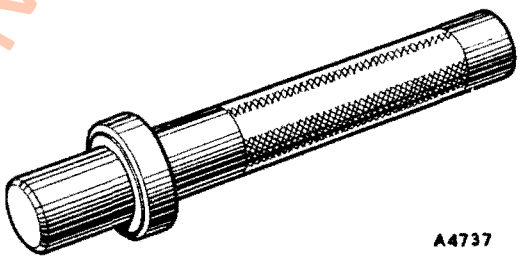
Use with 18G588 when reaming the outer bush on the cast-type rear radius arms.



18G588A

18G620. Rear Radius Arm Needle Bearing Replacer

This tool is essential to ensure correct fitting of the needle bearing in the cast-type rear radius arm.



18G620

SECTION J

THE STEERING GEAR

GENERAL DESCRIPTION

The rack and pinion type steering gear is secured to the engine bulkhead. Tie-rods, operating the steering arms, are attached to each end of the steering rack by ball joints enclosed in rubber gaiters.

The steering-column engages the splined end of a helical-toothed pinion to which it is secured by a clamp bolt.

Pinion end-play is eliminated by adjustment of the shims fitted beneath the pinion tail bearing retaining plate. A damper pad inserted beneath the steering rack controls the backlash between the pinion and rack.

WARNING.—When the vehicle is hoisted so that the front wheels are clear of the ground, forceful movement of the wheels from lock to lock must be avoided, otherwise damage may occur within the steering mechanism.

Section J.1

STEERING-WHEEL

Remove the screw in the wheel hub to release the horn-push control. Unscrew and remove the steering-wheel retaining nut and withdraw the steering-wheel, using special Service tool 18G310.

When refitting the steering-wheel apply a torque of 41 lb. ft. (5·76 kg. m.) to tighten the steering-wheel nut.

Section J.2

STEERING-COLUMN

Removing

Disconnect the direction indicator and horn control wire snap connectors located below the parcel shelf.

Remove the nut, bolt, and spring washer clamping the column to the steering pinion shaft.

Remove the nut and bolt from the column support clip, pull the column assembly upwards to disengage it from the pinion shaft splines, and lift it from the car.

Refitting

The method of replacing the steering assembly is a reversal of the above instructions. Make sure that the slot in the column clamp is correctly located with the road wheels in the straight-ahead position. On right-hand-drive models the clamp must be underneath the column and horizontal in order to bring the direction indicator cancelling lug into the correct position. On left-hand-drive models or where the switch is moved to the left-hand side of the column the clamp must be positioned with the slot uppermost.

Section J.3

STEERING RACK AND PINION

Removing

Slacken the steering-column to parcel shelf clamp bolt.

Remove the nut, bolt, and spring washer securing the steering-column to the pinion shaft and pull the column from the shaft.

Jack up the car beneath the front sub-frame and remove both the front road wheels and the hydraulic dampers.

Knock back the locking plate tabs and remove the four bolts securing the sub-frame towers to the engine bulkhead cross-member.

Remove the exhaust pipe to manifold clamp and disconnect the pipe from its fixing on the gear change extension.

Release the engine tie-rod from the cylinder block.

Remove the four set screws securing the rear of the sub-frame to the front floor, and lever the sub-frame away from the body just far enough to allow the 'U' bolts to be withdrawn. Use a lever between the sub-frame tower and the wing valance.

Withdraw the steering rack assembly from the driver's side of the vehicle.

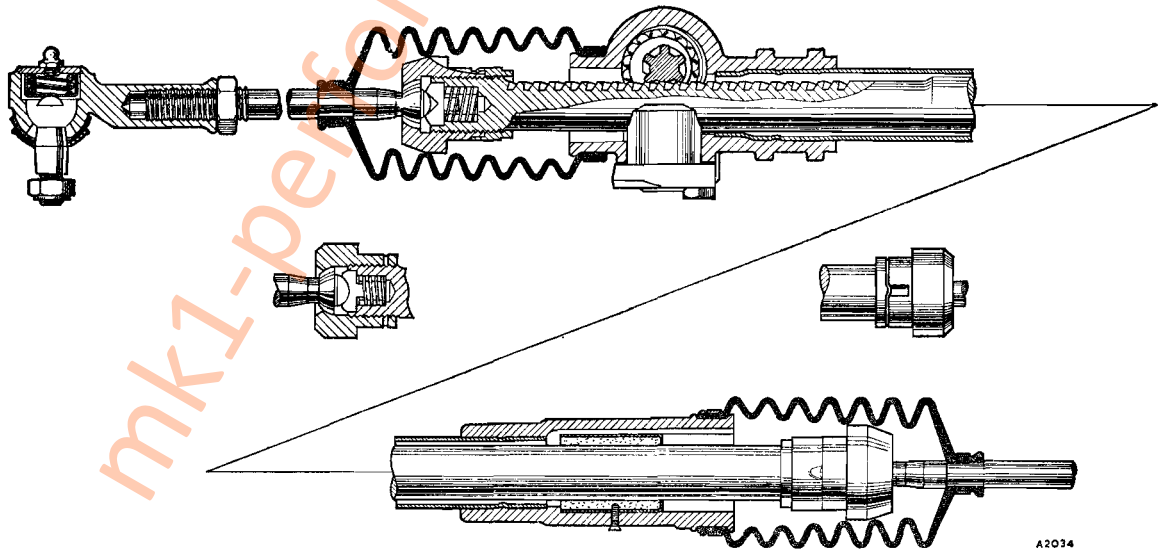


Fig. J.1

A section through the steering rack and tie-rod, with the early-type ball housing and locking ring shown inset

Dismantling

Unlock the ball end retaining nuts on the steering tie-rods and remove the ball end assemblies.

Release the gaiter clips from the rack housing and tie-rods, drain the lubricating oil, and remove the rubber gaiters.

Remove the two damper housing retaining bolts and withdraw the housing, together with the damper and damper spring. Care must be taken not to lose any of the housing shims.

Unscrew the two bolts securing the pinion shaft tail bearing retaining plate, and remove the plate and packing shims. Extract the lower thrust washer, bearing, and bearing race, and withdraw the pinion. The top bearing race, bearing, and thrust washer will be trapped behind the rack teeth and can be removed after the pinion is withdrawn.

Extract the pinion shaft oil seal.

Use the steering rack ball joint clamp (Service tool 18G580) to hold the ball housing firmly in a vice while the housing is unlocked and removed.

Punch the indentations in the lock washer clear of the slots in the locking ring and the ball housing. On later models where a locking washer is not fitted punch or prise up the indentations in the locking ring clear of the slots in the rack and ball housing. Slacken back the locking ring and unscrew the housing to release the tie-rod, ball seat, and seat tension spring.

Withdraw the rack from the pinion end of the rack housing; this will obviate damage to the felt bush fitted in the opposite end of the housing by the rack teeth.

To remove the felt bush unscrew the self-tapping screw securing the bush housing through the rack housing about two turns. Prise up the felt at the joint and extract it with a pair of thin, long-nosed pliers.

Examining for wear

Thoroughly clean and examine all parts of the assembly; components showing signs of wear must be replaced with new parts. Fractures, hollows, or roughness in the surfaces of the rack or pinion teeth will render them unserviceable.

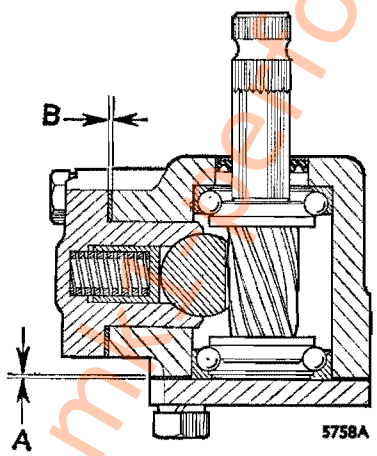


Fig. J.2

A section through the steering pinion and rack damper. Feeler gauge measurements at both (A) *and* (B) *must be taken without the packing shims fitted*

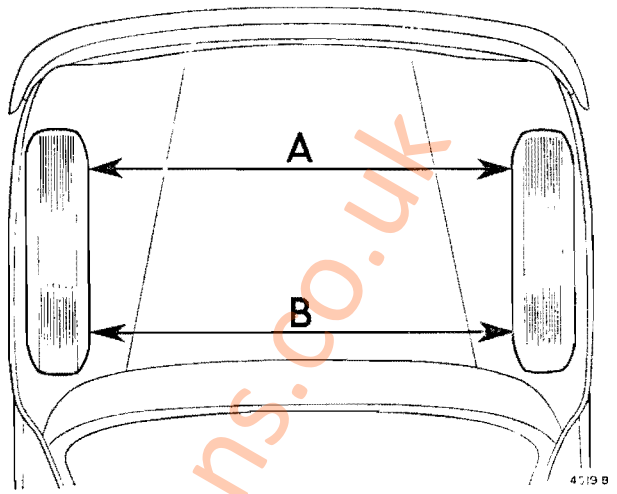


Fig. J.3

The front wheel alignment check must be taken with the front wheels in the straight-ahead position. Dimension (A) *must be* $\frac{1}{16}$ *in.* (1·59 *mm.*) *greater than* (B)

Take particular note of the rubber gaiters; should they be damaged or show the slightest signs of deterioration. they must be replaced with new ones. The tie-rod ball housing and ball seat should also be subjected to a careful check and new parts fitted if excessive wear is evident.

The outer ball socket assembly cannot be dismantled, and must therefore be renewed complete if it is worn or damaged.

Examine the felt bush fitted in the end of the rack housing and fit a new one if it shows signs of damage or deterioration.

Reassembling

Fit a new felt bush to the end of the rack housing; soak the new felt in S.A.E. 140 oil. Grip and roll the felt with a pair of long-nosed pliers, carefully insert it into the housing, withdraw the pliers, and even out the felt, pressing it to the contour of the housing. It is most important that the felt bush housing is secured with the self-tapping screw through the rack housing. Before tightening up the screw apply a sealing compound under the screw head.

Refit the top pinion bearing. Insert the rack into the housing and refit the pinion and lower pinion bearing. Replace the pinion tail bearing cover without the packing shims and use a feeler gauge to measure the clearance between the cover and the housing ([A], Fig. J.2). Do not overtighten the cover screws or an incorrect measurement may be obtained.

Remove the cover and refit with packing shims to the value of the feeler gauge measurement minus ·002 in. (·051 mm.) to obtain the recommended preload. The joint faces must be treated with shellac to prevent lubricant seepage.

Screw the ball housing lock ring onto the rack end to the limits of the thread and refit the locking washer. On later models where a locking washer is not fitted a new locking ring must be used. Refit the seat spring, seat, tie-rod, and ball housing, tightening up firmly until the

tie-rod is pinched. Advance the locking ring to meet the ball housing and check that the tie-rod is still pinched. Slacken back the ball housing one-eighth of a turn to allow full articulation of the tie-rod. Relock the housing by tightening up the locking ring to a torque of 33 to 37 lb. ft. (4·60 to 5·63 kg. m.), at the same time ensuring that the ball housing does not rotate. Lock up by punching the washer into the slots of the housing and the locknut. On later models where a locking washer is not fitted the housing is secured in the locked position by punching the lips of the locking ring into the slots in the ball housing and rack.

To adjust the rack damper the plunger must be replaced in the damper housing and refitted without the plunger spring or the packing shims. Tighten up the two securing bolts with the rack in the straight-ahead position until it is just possible to rotate the pinion shaft with the bearing preload gauge 18G207 and adaptor 18G207A set to 15 lb. in. (·173 kg. m.). Take a feeler gauge measurement between the damper housing flange and its seating on the rack housing ([B], Fig. J.2). Remove the damper housing, insert the spring and the plunger, and refit the assembly with packing shims to the value of the feeler gauge measurement plus ·002 in. (·051 mm.). The joint faces must be treated with shellac to prevent lubricant seepage.

Fit a new pinion shaft seal.

Refit the rubber gaiters to the housing and the tie-rods. Before securing the gaiter clip on the tie-rod at the pinion end, stand the assembly upright and pour in approximately ⅓ pint (·44 U.S. pint, ·19 litre) of S.A.E. 140 oil through the end of the gaiter.

Refit and tighten the gaiter clip.

Refit the ball ends and locking nuts.

Refitting

Reverse the removal procedure.

Reassembling is a reversal of the dismantling procedure.

The exhaust system and engine tie-rod must be reconnected by following the procedure detailed in Section A.5.

Check the wheel alignment as in Section J.4.

Section J.4

FRONT WHEEL ALIGNMENT

When correctly adjusted the front wheels must toe out a total of $\frac{1}{16}$ in. (1·59 mm.) or an angle of 7 min. 30 sec. per wheel with the car in an unladen condition. To carry out any necessary adjustment first check that all tyres are inflated to the recommended pressures (see **'GENERAL DATA'). Measurements are taken on a 14½ in. (368·3 mm.) diameter (on the side wall of the tyre) at a distance of 9·4 in. (239 mm.) above the ground surface.**

Turn the wheels to the straight-ahead position. With conventional base-bar-type alignment gauges measurements in front of and behind the wheel centres should be taken at the same points on the tyres. This is achieved by marking the tyres where the first reading is taken and moving the car forward approximately half a road wheel revolution before taking the second reading at the same points.

With an optical gauge two or three readings should be taken with the car **moved forward** to different positions—180° road wheel turn for two readings and 120° for three readings. The average figure should then be calculated.

Wheels and tyres vary laterally within their manufacturing tolerances or as the result of service, and alignment figures obtained without moving the car are unreliable.

If the wheel alignment is incorrect adjust the track by slackening the locknut for each tie-rod ball joint and the clips securing the rubber gaiters to the tie-rods, then rotate each tie-rod equally in the necessary direction. Both tie-rods have right-hand threads.

NOTE.—To ensure that the steering rack 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.

After adjustment tighten the ball joint locknuts.

Section J.5

STEERING RACK LUBRICATION

No provision is made for periodical lubrication of the steering rack; replenishment is necessary only where there is evidence of oil loss from the rack housing or the rubber gaiters. Since lubricating nipples are not provided, the following procedure should be followed in order to make good any oil loss, provided the leakage can be rectified without the rack assembly being removed from the vehicle.

Remove the retaining clip and release the rubber gaiter from the right-hand end of the rack housing (left-hand end on left-hand-drive vehicles) and move the rack to the straight-ahead position. Insert an oil nozzle into the end of the rack housing and inject not more than ⅓ pint (·44 U.S. pint, ·19 litre). Use S.A.E. 140 oil. Reconnect the rubber gaiter and move the rack from side to side to distribute the oil throughout the housing.

WARNING.—If the vehicle is hoisted with its front wheels clear of the ground care should be taken to avoid forceful movement of the wheels from lock to lock, otherwise damage may occur within the steering mechanism.

Section J.6

NYLON TIE-ROD BALL ENDS

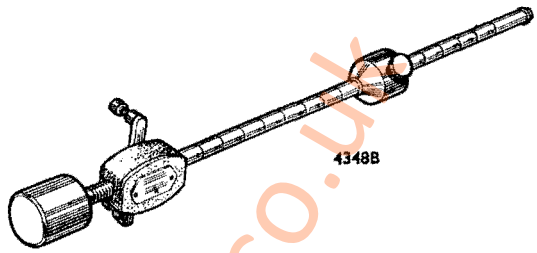
Later ball joints have nylon seats sealed for life and protected by rubber boots; no lubrication is required.

The rubber boots must be maintained in good condition, and if it is found that a boot has become damaged in service both boot and joint must be renewed. However, if a boot is damaged in the workshop during the removal of a joint which has therefore not become contaminated by road dirt, the boot alone may be renewed.

Before fitting a boot smear the area adjacent to the joint with a little Dextagrease Super G.P. lubricant.

SERVICE TOOLS

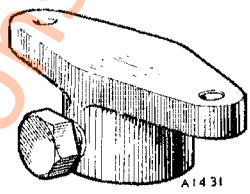
18G207. Bearing Preload Gauge



18G207

18G207A. Steering Rack Pinion Preload Adaptor

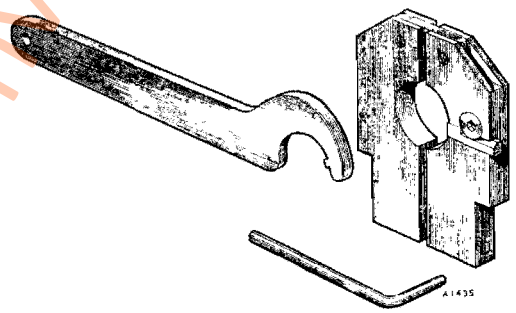
Use this gauge together with the adaptor to test the preloading on the steering pinion during reassembly. Secure the adaptor to the pinion shaft and attach the gauge in the adaptor flange. Move the weight along the bar to the poundage required.



18G207A

18G580. Steering Rack Ball Joint Spanner and Clamp

A tool set comprising a clamp to hold the steering rack ball housing firmly in a vice without the housing being subjected to damage and a 'C' spanner to unlock the locking ring. The spanner is designed to enable the correct torque to be applied to the ball joint locking ring; extensions must not be used. Slacken the adjustable register screw with the key provided, push the register fully into one of the slots in the ball housing, and re-tighten the register screw.

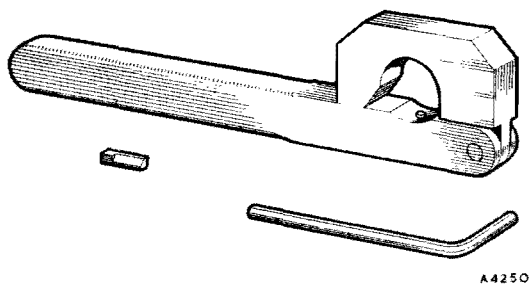


18G580

18G580A. Steering Rack Ball Joint Spanner Adaptor Set

A clamp-type spanner and key together with an additional adjustable register for use with clamping tool 18G580 when locking or unlocking the steering rack ball joints on later models fitted with the positive-type locking ring. The adjustable register has a 12° angle contact face and must replace the 30° register supplied with Service tool 18G580 when required to operate on these later-type ball joints. Make certain that the register is pushed fully into the slot in the ball housing and the locking screw retightened.

Fit the spanner onto the ball joint locking ring with the peg engaging the hole in the ring. Screw up and tighten the locking screw before applying any pressure to the spanner. Should the peg become damaged in service, it can be punched through from the under side and refaced.



18G580A

SECTION K

THE FRONT SUSPENSION

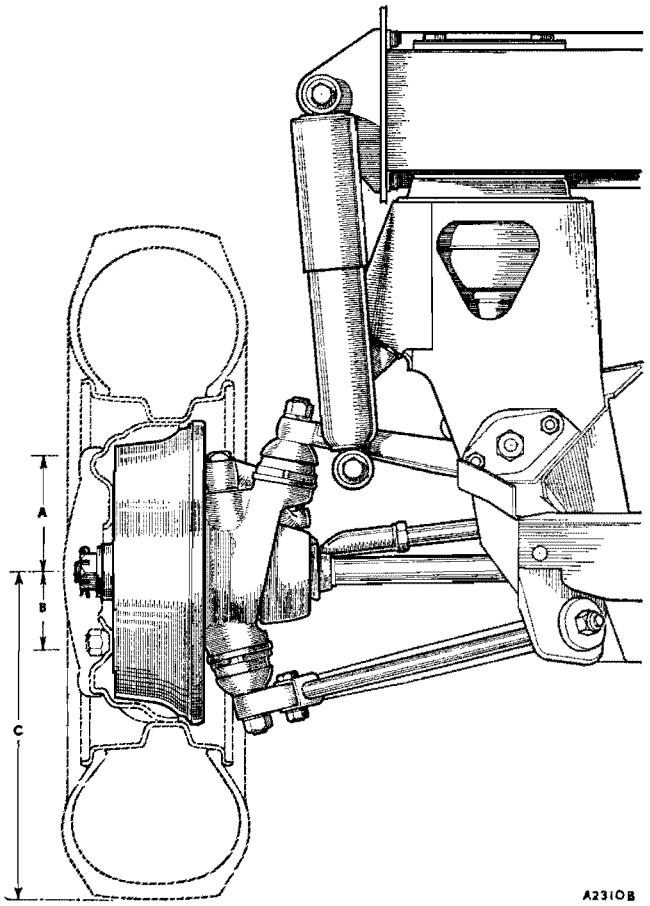


Fig. K.1

The general arrangement of the front suspension: (A) *indicates the maximum upward deflection from normal,* $3\frac{11}{32}$ *in.* (84·93 *mm.*); (B) *the rebound figure,* $2\frac{9}{32}$ *in.* (57·94 *mm.*); (C) *the normal distance above ground surface*

GENERAL DESCRIPTION

The independent front suspension comprises upper and lower suspension arms located in the side-members of the front sub-frame with their outer ends attached by ball joints to the swivel hubs. Rubber cone spring units are mounted in the front sub-frame towers with tubular struts interposed between the springs and the suspension upper support arms. Telescopic dampers are mounted on the upper support arms, with their top spigots anchored on the wing valance.

Maintenance is confined to lubrication as detailed in Section P.3.

WARNING.—When working on the front of the vehicle with the wheels hoisted clear of the ground forceful movement of the road wheels from lock to lock must be avoided. Some damage may occur within the steering mechanism when the considerable momentum of the steering-wheel (due to enforced rotation) is suddenly halted.

Section K.1

CASTOR AND CAMBER ANGLES AND SWIVEL HUB INCLINATION

The castor and camber angles and swivel hub inclination are three design settings of the front suspension that have a very important bearing on the steering and general riding of the car. Each of these settings is determined by machining and assembly of the components during manufacture, and are not adjustable.

Should the car suffer damage to the suspension, the angles (as given in **'GENERAL DATA'**) must be verified with a camber, castor, and hub inclination gauge and new parts fitted as found necessary.

Section K.2

SPRING UNITS

Compressing

Knock down the locking tabs and slacken both bolts securing the front sub-frame towers to the engine bulkhead cross-member. Withdraw one bolt and move the washer plate to one side to expose the access hole in the cross-member, replace the bolt, and retighten both bolts; do not overtighten.

Assemble Service tool 18G574, making certain that the spindle nut is fully tightened to lock the spindle firmly into the end of the centre screw. Insert the tool through the cross-member, locate the body of the tool over the heads of the two sub-frame bolts, and screw the centre screw of the tool nine complete turns, not more nor less, into the spring unit. Keep the wing nut screwed well up the centre screw, clear of the cross-member, during this operation. Turn the compressing wing nut down to make contact with the body of the tool. Hold the centre screw

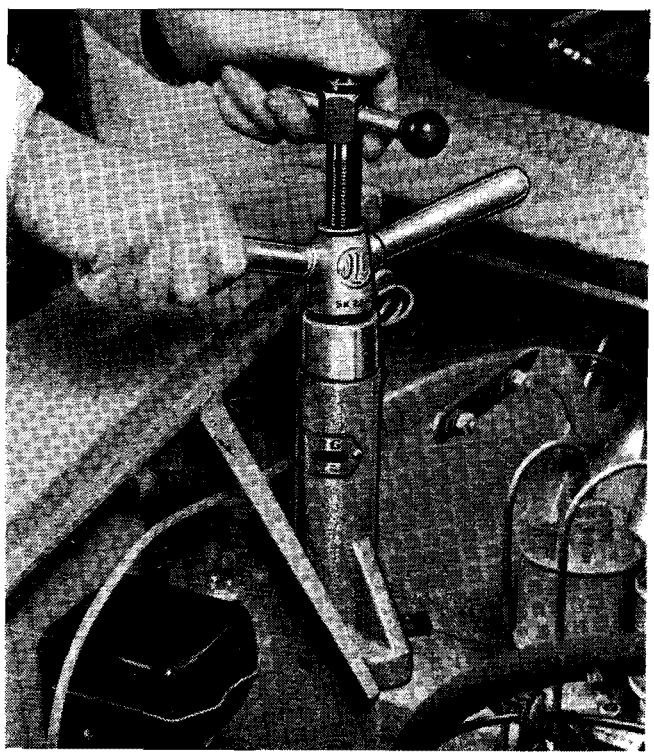


Fig. K.2

The front sub-frame mounting on the engine bulkhead cross-member, showing the method of compressing the spring unit using Service tool 18G574

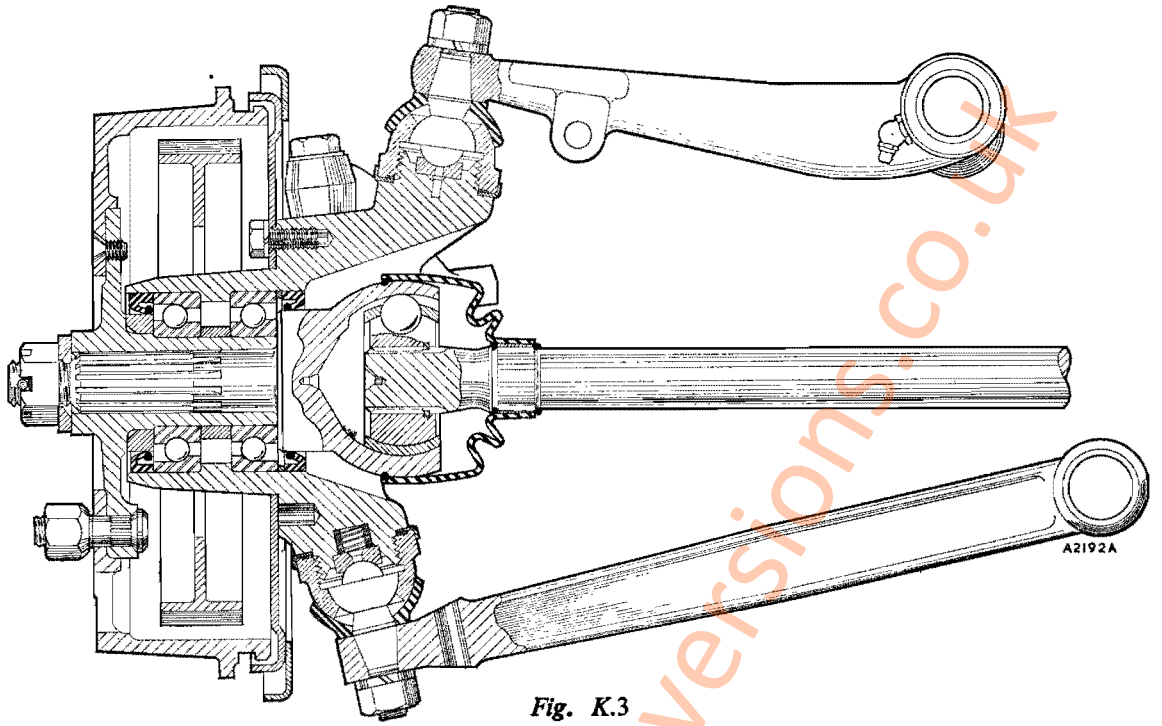


Fig. K.3
A section through the front suspension assembly

to prevent further rotation and turn the wing nut clockwise to compress the spring unit sufficiently to allow the spring strut to be extracted from the sub-frame tower and the spring unit removed. Slacken off the compressing wing nut before attempting to remove the centre screw from the spring unit.

Removing

Jack up the car after compressing the spring as detailed above.

Remove the bump rubber from the sub-frame tower.

Take off the nut securing the upper arm to the swivel hub ball and remove the arm from the ball pin.

With the spring unit compressed the strut can be levered away from its seating in the spring unit.

Hold the centre screw of the compressing tool to prevent it turning, screw the wing nut up to release the pressure on the spring unit, and extract the spring from within the sub-frame tower.

Refitting

Ensure that the spring unit is seating correctly on its spigot within the sub-frame tower. Use service tool 18G574 to compress the spring rubber, and refit the strut between the spring and the suspension upper support arm.

Secure the dust seal over the lip of the nylon seating located in the upper arm.

Refit the bump rubber to the sub-frame, reconnect the upper arm to the swivel hub ball pin, and release the spring unit from compression.

Section K.3

SWIVEL HUBS

Removing

Jack up the vehicle and remove the road wheel.

Disconnect the ball end from the steering lever and the drive shaft at the inner flexible joint, removing only the four outer nuts from the coupling 'U' bolts. Mark the drive flange and the flexible joint to enable them to be replaced in their original position.

Slacken the brake hose at the frame union and remove it from the brake backplate.

Release the upper suspension arm from the swivel hub ball pin. Remove the nut and spring washer from the rear end of the lower arm pivot pin and push the pin forward to release the arm. Withdraw the swivel hub assembly complete with the drive shaft.

Dismantling

Unscrew the two brake-drum retaining screws and remove the brake-drum.

Extract the split cotter pin and remove the slotted nut and spacing washer from the end of the drive shaft. Remove the drive shaft and driving flange with service tool 18G575.

Remove the outer bearing spacer and extract both the inner and outer grease seals.

Drift the inner races of both the inner and outer bearings from the hub bore, and use service tool 18G260 together with adaptor 18G260H to withdraw the outer races.

The hub bore is machined to form a register between the two bearings; removal must therefore be from their respective sides of the hub bore.

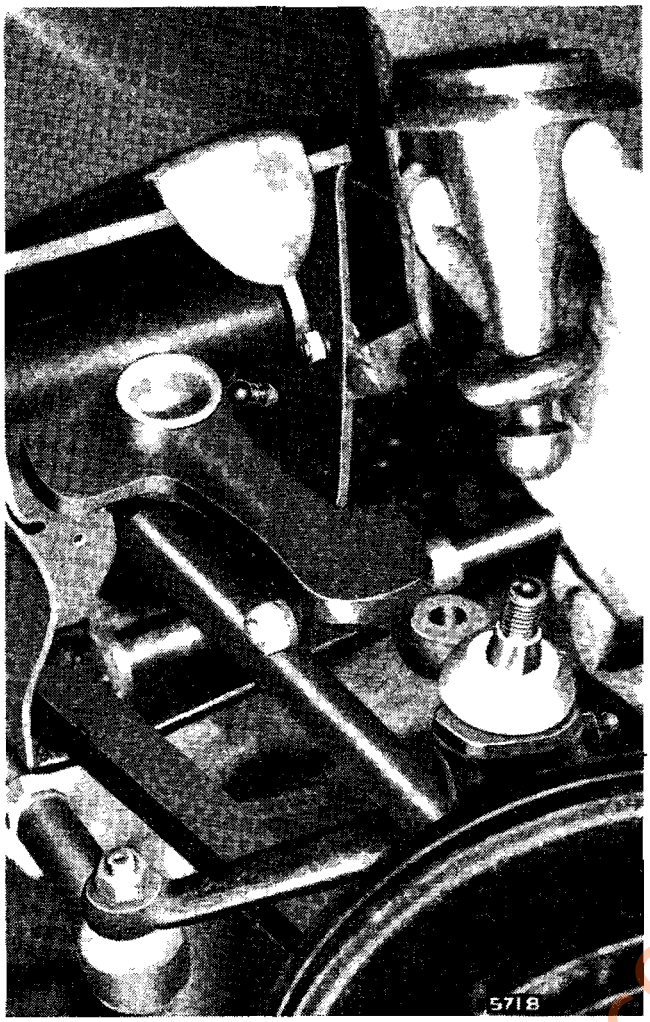


Fig. K.4

The method of removing the spring strut with the spring unit compressed and the upper support arm removed from the hub ball pin

Reassembling

Reassembly is a reversal of the removal procedure. with particular attention given to the following points.

Pack the bearings with grease to Ref. C and make certain that they are fitted with their outer races hard against their register in the swivel hub bore.

When fitting the grease-retaining seals, the outer bearing spacer, and the driving flange washer make certain that they are fitted the right way round; the outer bearing spacer must have the chamfered bore facing outwards and the driving flange washer inwards.

Refitting

Refitting is a reversal of the removal procedure.

When refitting the lower arm follow the procedure given in Section K.6.

Tighten the steering lever ball joint nut to a torque figure of 25 lb. ft. (3·45 kg. m.).

Bleed the hydraulic system when the operations are completed.

Section K.4

SWIVEL HUB BALL JOINTS

Removing

Compress the spring unit as in Section K.2.

Jack up the car and place supports under the front sub-frame side-member. Remove the road wheel and release the tie-rod yoke from the lower arm.

Remove the nut and spring washer securing the upper suspension arm to the ball pin and use a suitable extractor to break the taper joint and draw the arm from the pin. Take off the ball housing dust seal, remove the lubricator, and knock up the tab of the locking washer; unscrew the housing to release the ball and ball seat. The same procedure is used to remove the lower ball joint. Note the spring fitted under the lower ball joint seat.

Refitting

Thoroughly clean all components and refit the ball seat, pin, and ball housing without the packing shims, locking washer, or lower ball joint seat spring. Screw down the ball housing until there is no free movement between the ball and the ball seating, and measure with a feeler gauge the gap between the housing and the swivel hub. Remove the housing and ball pin (refit the spring under the lower joint ball seat), and repack the assembly with grease to Ref. C. Add shims to the value of the feeler gauge measurement less the thickness of the locking washer, ·036 in. (·91 mm.). Replace the washer and refit the assembly to the swivel hub. With the ball housing fully tightened it must be possible to move the ball pin without any sign of free play. Should there be evidence of play or excessive tightness, the housing shims must be adjusted accordingly. Tap up the locking washer to secure the housing after it has been fully tightened.

Replace the dust seal, refit the suspension arm, and tighten the ball pin nut. Use the service torque wrench 18G372 with adaptor 18G587 to tighten the ball pin nut to a torque figure of 35 to 40 lb. ft. (4·8 to 5·5 kg. m.).

Reconnect the tie-rod yoke to the lower arm.

Refit the road wheel and release the spring unit from compression.

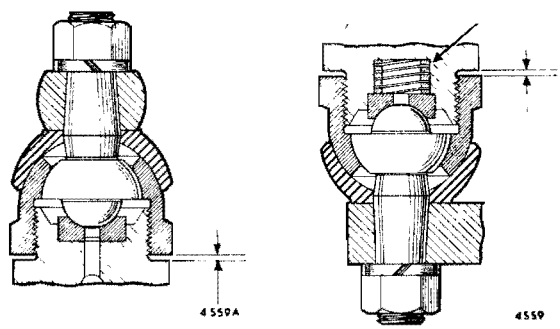


Fig. K.5

A section through the swivel hub ball joints. Take feeler gauge measurements at the positions indicated without the locking washers fitted and without the seat spring fitted to the lower ball joint

Section K.5

UPPER ARM

Removing

Compress the spring unit to remove the load from the upper arm as in Section K.2.

Jack up the vehicle and remove the road wheel and the hydraulic damper.

Disconnect the outer end of the arm from the swivel hub ball pin.

Remove the nuts from the arm pivot pin. Take off the front thrust washer retaining plate, extract the washer, and push the pivot pin forward. Remove the rear thrust washer and manœuvre the arm from the frame.

The needle-roller bearings fitted in each side of the arm bore can be removed with Service tool 18G581 and new bearings fitted with Service tool 18G582 and adaptor 18G582A. This adaptor will ensure that the new bearings are fitted to the correct depth. The nylon seating fitted to the spring strut recess can also be prised out and a new seating fitted.

Refitting

Before the arm is refitted make certain that the hole in the lubricating nipple is clear. Adequately lubricate the components with grease to Ref. C before assembly.

Oil is not a satisfactory lubricant at this point and must not be used.

Place the pivot pin rear thrust washer against the bore of the arm and secure it in this position with its rubber dust seal. Stretch the front dust seal over the arm and insert the pivot pin into the arm bore. With the spring unit compressed, insert the arm into the sub-frame member and locate the spring unit strut in the nylon seating.

The nylon seating cup and the rubber dust seal must be repacked with Dextagrease Super G.P., supplied by B.M.C. Service Ltd. in 1-lb. (·45-kg.) tins under Part No. 97H2276.

Push the pivot pin into its correct position, refit the front thrust washer, and secure it with the retaining plate. Slide the dust seal over the thrust washer and refit the strut ball end dust seal over the lip of the nylon seating. Replace and tighten up the pivot pin nuts and spring washers.

Reconnect the outer end of the arm to the swivel hub ball pin and secure it with the nut and spring washer.

Refit the hydraulic damper, apply a grease gun to the lubricator on the pivot arm, and refit the road wheel.

Release the spring unit from compression.

Section K.6

LOWER ARM

Removing

Jack up the vehicle and remove the road wheel and hydraulic damper.

Support the suspension beneath the brake-drum; disconnect the outer end of the arm from the swivel hub ball pin and from the tie-rod yoke.

Remove the nut and spring washer from the rear end of the pivot pin and push the pin forward to remove it and release the arm.

Refitting

Refitting is a reversal of the removal sequence. Make certain that the rubber bushes fitted in the bore of the arm are in good condition; new bushes should be fitted if they show signs of wear or deterioration.

The front suspension lower arm must be supported in its normal position (see Fig. K.1) when the lower arm pivot pin is locked up. This will prevent the rubber bushes being subjected to preloading, as would be the case if the pin were locked up with the lower arm hanging down.

Section K.7

SUSPENSION STRUTS

From Car No. 34099 the trim height of the vehicle has been raised to give an increased ground clearance by the fitting of circular-section washers between the body of the suspension strut and the shoulder of the knuckle end. When removing a defective strut fitted with one of these washers make certain that a washer is also fitted to the new strut. It is important that only one washer is fitted to each of the four struts.

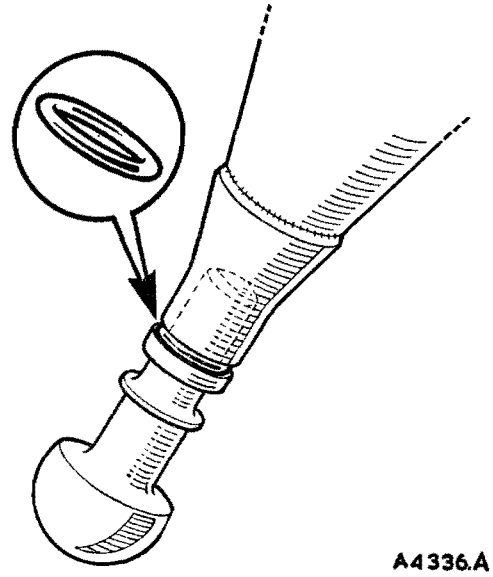


Fig. K.6

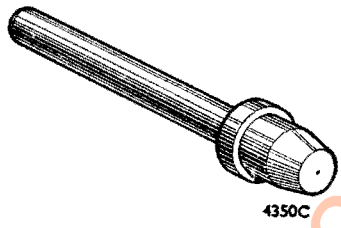
A suspension strut, showing the special circular-section washer fitted between the strut body and the knuckle shoulder

SERVICE TOOLS

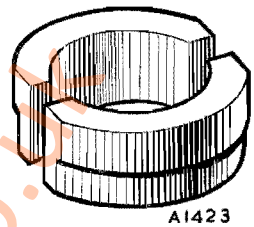
18G260. Hub bearing Outer Race Remover (basic tool)

18G260H. Front Hub Drive Flange Bearing Outer Race Remover Adaptor

An adaptor designed for use in conjunction with basic tool 18G260 for the removal of the outer bearing races from the front hub.

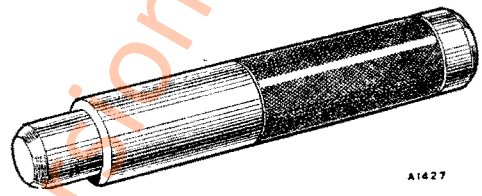


18G260



18G260H

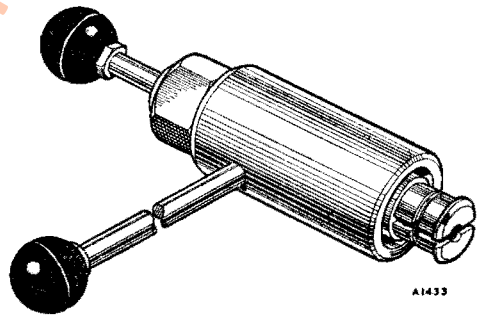
18G575. Front Hub Drive Flange Remover



18G575

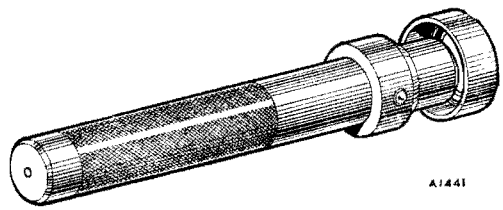
18G581. Front Suspension and Idler Gear Needle Bearing Remover

This tool will make the removal of a defective needle bearing from the bore of the upper suspension arm an easy operation, and at the same time avoid damaging the bore.



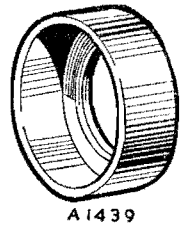
18G581

18G582. Front Suspension and Idler Gear Needle Bearing Replacer



18G582

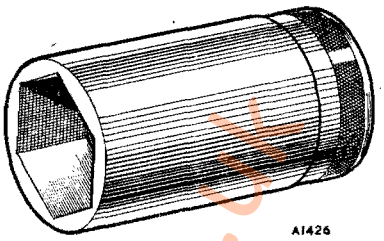
18G582A. Front Suspension and Idler Gear Needle Bearing Replacer Adaptor



18G582A

18G587. Swivel Hub Ball Pin Nut Spanner

This socket must be used with torque wrench 18G372 in order that the correct torque figure may be applied to the swivel hub ball nut on reassembly.

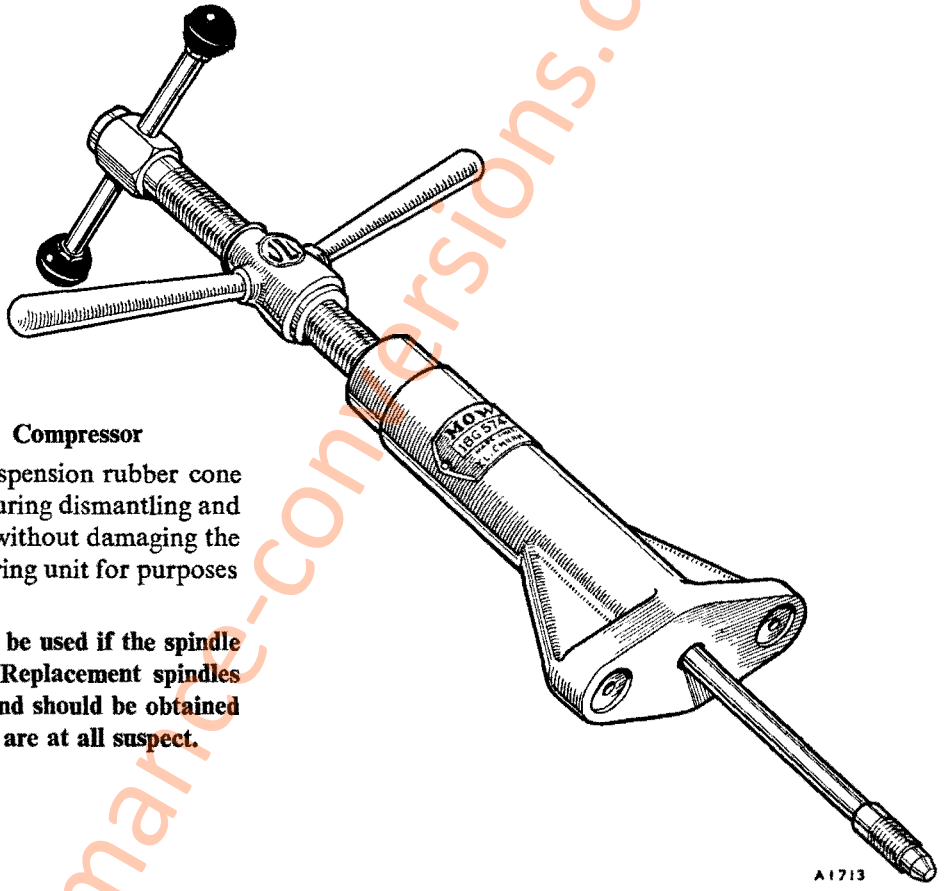


18G587

18G574. Suspension Rubber Spring Compressor

This tool will enable the front suspension rubber cone spring to be compressed with ease during dismantling and reassembly of the suspension arms without damaging the thread of the nut welded into the spring unit for purposes of spring compression.

WARNING.—This tool must not be used if the spindle thread is badly worn or damaged. Replacement spindles (Part No. 18G574A) are available and should be obtained if the threads on the existing spindle are at all suspect.



18G574

SECTION L

THE HYDRAULIC DAMPERS
(TELESCOPIC)

GENERAL DESCRIPTION

Telescopic hydraulic dampers are fitted at both front and rear of the vehicle. All working parts are immersed in oil and the dampers are set before dispatch. They cannot be adjusted or refilled with fluid; when defective they must be replaced with new units.

Inspect the dampers at 12,000-mile (19200-km.) intervals.

Section L.1

FRONT DAMPERS

Jack up the vehicle and remove the road wheel.

Support the suspension assembly beneath the brake-drum, remove the upper and lower mounting securing nuts, and pull the damper from its mounting spigots.

Make certain that the rubber bushes are in good order; replace them with new bushes if they show signs of deterioration.

Before refitting the damper to the car hold the damper vertically in a vice, gripping it by the bottom mounting eye, and fully extend and compress the damper about six times to expel any air from the pressure cylinder chamber. The damper must be retained in an upright position until refitted.

Section L.2

REAR DAMPERS

Remove the upper damper mounting nuts from inside the luggage boot. To gain access to the left-hand damper mounting remove the fuel tank as detailed in Section D.1.

As an alternative to removing the tank the left-hand damper mounting can be released by undoing the tank strap and gently lifting the tank towards the centre-line of the car, pivoting about the rubber fuel line connector at its forward end without detachment at this point. If this method is adopted it must be undertaken with extreme care, otherwise the rubber connecting hose may be damaged.

Jack up the vehicle and remove the road wheel. Take off the lower mounting nut and washer, collapse the damper, and remove it from its anchorage point on the radius arm.

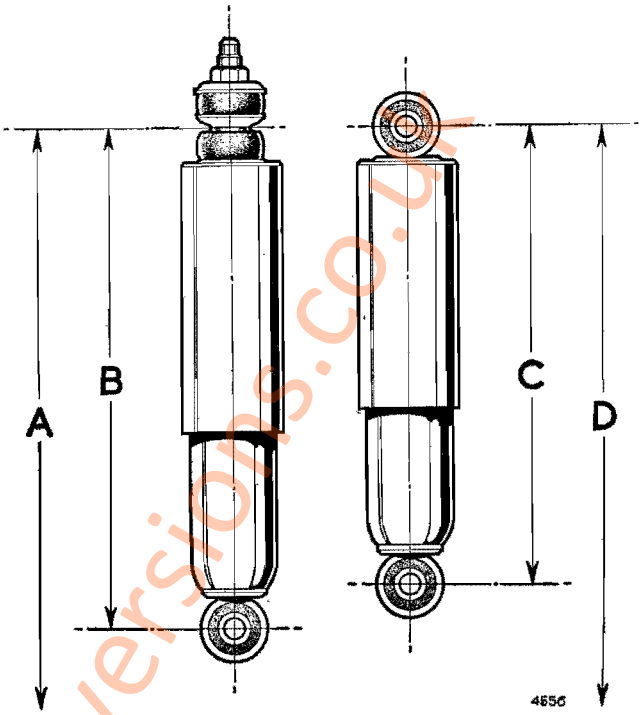


Fig. L.1

The hydraulic dampers

Rear

A. Extended length 15⅛ in. (384·18 mm.).
B. Compressed length 9½ in. (241·3 mm.).

Front

C. Compressed length 8½ in. (215·90 mm.).
D. Extended length 12¾ in. (323·85 mm.).

Retain the damper in an upright position after removal from the car.

Make certain that the rubber bushes are in good condition; fit new bushes if they are worn or damaged.

Before refitting the damper to the car hold the damper vertically in a vice, gripping it by the bottom mounting eye, and fully extend and compress the damper about six times to expel any air from the pressure cylinder chamber. The damper must be retained in an upright position until refitted.

When refitting the rear dampers make certain that the rubber cone spring and the spring strut are correctly located on their individual spigots whilst the radius arm is being raised to reconnect the upper end of the damper. Failure to observe this instruction may result in a vehicle having the appearance of being trimmed too high at the back, and would probably damage both the spring and the spring strut beyond recovery.

SECTION M

THE BRAKING SYSTEM

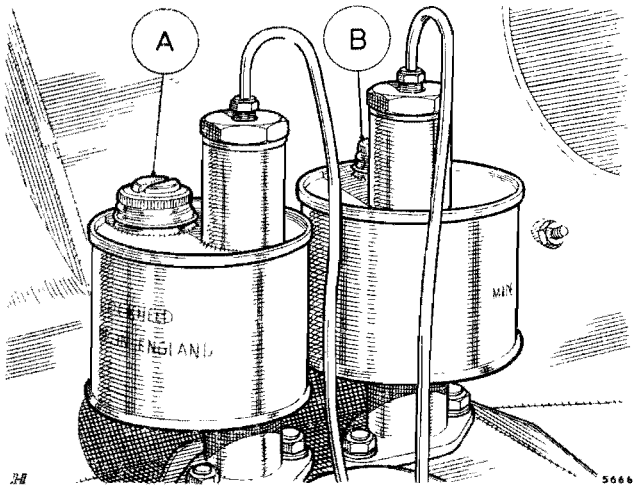


Fig. M.1

(A) *The clutch and* (B) *the brake master cylinder and hydraulic fluid reservoir*

GENERAL DESCRIPTION

The Lockheed hydraulic brake operating equipment comprises a combined fluid supply tank and master cylinder in which the hydraulic pressure is generated and wheel cylinders which operate the brake-shoes. Steel pipe lines, unions, and rubber hoses convey the hydraulic pressure from the master cylinder to a single wheel cylinder in each brake-drum. A valve is fitted in the fluid line to limit the pressure to the rear wheel cylinders.

Section M.1

MAINTENANCE

Periodically examine the quantity of brake fluid in the master cylinder. The level should be kept $\frac{1}{2}$ in. (13 mm.) below the bottom of the filler neck, but not higher. The necessity for frequent topping up is an indication of overfilling or a leak in the system which should at once be traced and rectified.

Adjust the brake-shoes to compensate for wear of the linings. The need for this is shown by the pedal going down almost to the floorboards before solid resistance is felt. For foot brake adjustments see Section M.2.

Section M.2

BRAKE-SHOE ADJUSTMENTS

As the brake linings wear the foot pedal will travel nearer to the floorboards before the brakes come into operation. When the travel becomes excessive the brake-shoes must be adjusted to bring the linings into closer relation with the brake-drum.

One common adjuster controlling the adjustment on both the leading and trailing brake-shoes is located on the back of each brake backplate.

Jack up the car and turn the adjuster screw in a clockwise direction until the brake-drum is locked, then slacken the screw until the shoe is just free of the drum. The drum should be free to rotate without rubbing.

Repeat this adjustment on the other three road wheels.

Section M.3

HAND BRAKE ADJUSTMENT

Should the hand brake lack power or the lever show signs of reaching the end of its travel on the ratchet before the brake-shoes come into operation, readjustment is necessary; this will also be indicated by excessive pedal travel.

Raise the rear of the car until both wheels are clear of the ground.

Set the hand brake to the 'off' position and see that the two wheels rotate quite freely. Adjust the shoes by means of the adjusting screws as detailed in Section M.2.

Check the hand brake action, and if excessive travel is still present which prevents proper application of the brakes it is probable that the brake-shoe linings are worn or, in exceptional cases, the cables have stretched. Examine the brake-shoe linings, and if worn renew or reline them if replacement shoes are not available.

If excessive brake lever travel is still present with new shoes or linings it is permissible to take up the excess travel at the brake hand lever trunnion, provided the following procedure is strictly adhered to.

First make sure that the shoes are properly adjusted by means of the shoe adjusters as explained in Section M.2. This is most important.

Apply the hand brake until the pawl engages with the fifth notch on the ratchet, and adjust the nuts at the hand brake lever until it is just possible to rotate the wheel

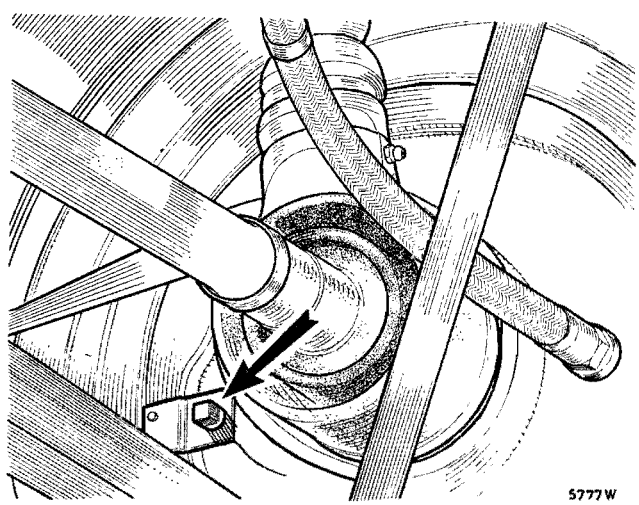


Fig. M.2

The front brake-shoe adjuster. One square-headed adjuster is provided on each of the four brake backplates

by hand under heavy pressure. It is important that the road wheels offer **equal resistance** in order to get full braking power.

Return the lever to the 'off' position and check that both wheels are perfectly free. If they are not, remove the brake-drum of the brake that tends to bind and check that the brake-shoe pull-off springs are correctly fitted and that the wheel cylinder has not seized. Remove any stiffness present, readjust, and check.

Section M.4

BLEEDING THE HYDRAULIC SYSTEM (Expelling Air)

Bleeding the braking system is not a routine maintenance job and should only be necessary when some portion of the hydraulic equipment has been disconnected or the fluid level allowed to fall so low that air has entered the system through the master cylinder.

Fill the fluid reservoir with Lockheed Genuine Brake Fluid (or if not available, with fluid to Specification S.A.E. 70.R1) and keep it at least half-full throughout the bleeding operation, otherwise air will be drawn into the system, necessitating a fresh start.

Attach the bleeder tube to the wheel cylinder bleeder screw and immerse the free end of the tube in a clean jar containing a little brake fluid.

Open the bleed nipple one full turn. Depress the brake pedal slowly and allow it to return without assistance. Repeat this pumping action with a slight pause before each depression of the pedal. When the fluid entering the jar is completely free of air bubbles hold the pedal firmly against the floorboards and tighten the bleeder screw.

Fig. M.3

A rear wheel cylinder bleeder screw. One bleeder screw is provided on each of the four brake backplates

This process must be repeated on each bleed screw at the three remaining backplates.

After bleeding top up the fluid reservoir to its correct level.

NOTE.—Clean fluid bled from the system must be allowed to stand until it is clear of air bubbles (approximately 24 hours) before it is used again. Dirty fluid must be discarded.

Section M.5

MASTER CYLINDER

Construction and operation

The master cylinder piston is backed by a rubber cup and is normally held in the 'off' position by a return spring. Immediately in front of the cup, when it is in the 'off' position, is a compensating orifice connecting the cylinder with the fluid supply. This port allows free compensation for any expansion or contraction of fluid, thus ensuring that the system is constantly filled; it also serves as a release for additional fluid drawn into the cylinder during brake applications.

Pressure is applied to the piston by means of the push-rod attached to the brake pedal.

The reduced skirt of the piston forms an annular space which is filled with fluid from the supply tank via the feed hole. Leakage of fluid from the open end of the cylinder is prevented by the secondary cup fitted to the flange end of the piston.

By releasing the brake pedal after application the piston is returned quickly to its stop by the return spring, thus creating a vacuum in the cylinder; this vacuum causes the main cup to collapse and pass fluid through the small holes in the piston head from the annular space formed by the piston skirt. This additional fluid finds its way back to the reserve supply tank under the action of the brake return springs through the outlet valve and compensating orifice until the system finally comes to rest. If the compensating orifice is covered by the piston cup when the system is at rest pressure will build up as a result of brake application. The combination inlet and outlet check valve in the head of the cylinder bore prevents fluid pumped out from the cylinder when 'bleeding' the system returning to the cylinder, thus ensuring a fresh charge being delivered at each stroke of the pedal.

Removing

Remove the circlip and withdraw the clevis pin securing the master cylinder push-rod to the pedal lever.

Disconnect the pressure pipe union from the master cylinder, remove the two bolts securing the cylinder to

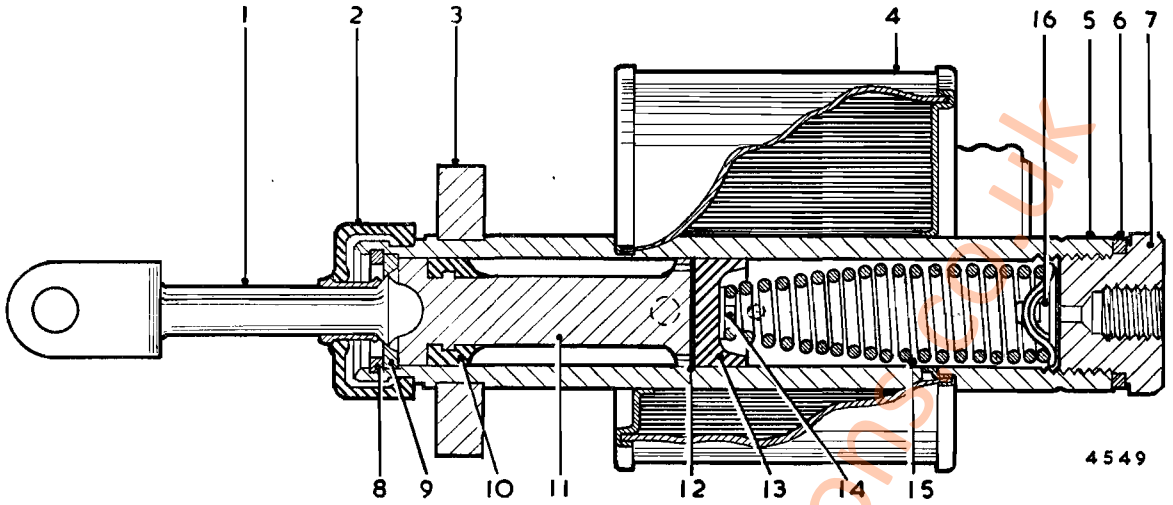


Fig. M.4

A section through the brake master cylinder

1. Push-rod.
2. Rubber boot.
3. Mounting flange.
4. Supply tank.
5. Body.
6. Washer.
7. End plug.
8. Circlip.
9. Stop washer.
10. Secondary cup.
11. Piston.
12. Piston washer.
13. Main cup.
14. Spring retainer.
15. Return spring.
16. Non-return valve.

the bulkhead, and then withdraw the assembly complete from the car.

Dismantling

Remove the filler cap and drain out the fluid.

Pull back the rubber dust cover, remove the circlip with a pair of long-nosed pliers, and the push-rod and dished washer can then be removed.

Withdraw the remaining parts from the cylinder barrel.

To remove the secondary cup from the piston carefully stretch the cup over the end flange of the piston using only the fingers.

Reassembling

Clean all parts thoroughly, using Lockheed Genuine Brake Fluid for all rubber components. All traces of petrol (gasoline) or trichlor-ethylene used for cleaning the metal parts must be removed before assembly.

Examine all 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

Stretch the secondary cup over the end flange of the piston with the lip of the cup facing towards the opposite end of the piston. When the cup is in its groove work it round gently with the fingers to make sure it is correctly seated. Fit the valve cup and body to the return spring.

Insert the return spring into the barrel, making sure that the spring seat is positioned on the end of the spring to receive the piston master cup.

Insert the master cup, lip first, taking care not to damage or turn back the lip, and press it down onto the spring seat.

Replace the dished washer with its concave side in contact with the main cup.

Insert the piston, taking care not to damage or turn back the lip of the secondary cup.

Push the piston down the bore and replace the push-rod, retaining circlip, and rubber dust cover.

Refitting

Secure the master cylinder by means of the two bolts to the bulkhead and refit the pressure pipe union to the cylinder barrel.

Line up the push-rod yoke with the pedal lever and secure the yoke to the lever with the clevis pin and circlip.

Check the brake-shoe adjustment as detailed in Section M.2.

Refill and bleed the system as in Section M.4.

Check the system for leaks with the brakes fully on.

Section M.6

FRONT WHEEL CYLINDER ASSEMBLY

Removing

Jack up the car, remove the road wheel, and thoroughly clean the brake backplate.

Disconnect the flexible fluid supply hose as detailed in Section M.9.

Unscrew and remove the bleed screw. Remove the circlip and dished washer from the wheel cylinder boss protruding through the brake backplate.

Take out the two brake-drum retaining screws and withdraw the drum. Pull the brake-shoes apart and extract the cylinder.

Examining

Remove the dust seals from the ends of the cylinder and extract both pistons. The rubber piston seals can be removed from their recesses and new seals fitted by using the fingers only.

Do not clean the rubber parts with anything other than Lockheed Brake Fluid. All traces of petrol (gasoline), etc., used for cleaning metal parts must be removed before reassembly.

Refitting

The procedure for refitting a front wheel cylinder is a reversal of the removal sequence. In addition, attention must be given to bleeding the hydraulic system and adjusting the brake-shoes as detailed in Sections M.4 and M.2.

Section M.7

REAR WHEEL CYLINDERS

Removing

Jack up the car under the rear sub-frame, remove the road wheel, and thoroughly clean the brake backplate.

Disconnect the flexible fluid supply hose as detailed in Section M.9.

Unscrew and remove the bleed screw. Remove the circlip and dished washer from the cylinder boss protruding through the brake backplate.

Take out the two brake-drum retaining screws and withdraw the drum. Remove the brake-shoes (see Section M.8) and extract the cylinder.

Examining

Remove the dust seals from the ends of the cylinder and extract both pistons. The rubber piston seals should be removed and new seals fitted by using the fingers only.

Do not clean the rubber parts with anything other than

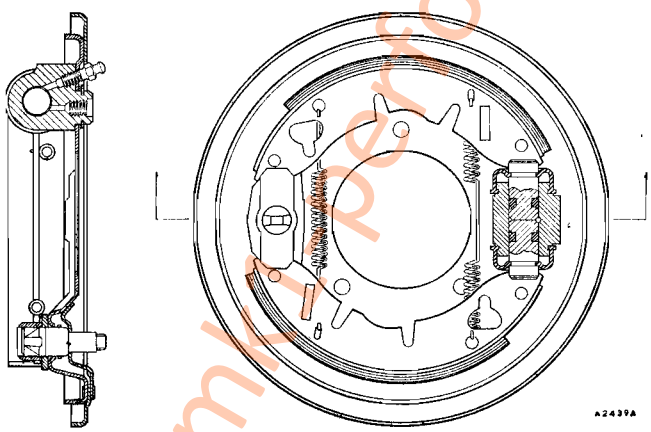


Fig. M.5

The right-hand front brake assembly, showing the fitted positions of the leading and trailing brake-shoes, with the pull-off springs anchored in the correct holes in the shoe web

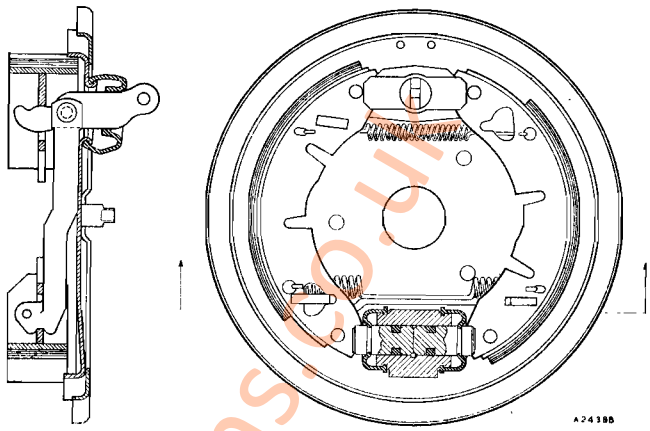


Fig. M.6

The right-hand rear brake assembly, showing the pull-off springs anchored in the correct holes in the shoe web

Lockheed Brake Fluid. All traces of petrol (gasoline), etc., used for cleaning metal parts must be removed before reassembly.

Refitting

The procedure for refitting a rear wheel cylinder is a reversal of the removal sequence. In addition, attention must be given to bleeding the hydraulic system and adjusting the brake-shoes as detailed in Sections M.4 and M.2.

Section M.8

BRAKE-SHOE ASSEMBLIES

Removing front shoes

Jack up the car and remove the road wheel.

Unscrew the two retaining screws and remove the brake-drum.

Note the position in which the pull-off springs are fitted. Release the springs from the shoe web and remove the shoes from the backplate.

NOTE.—Do not operate the brake pedal with the shoes removed from the backplate.

Refitting is a reversal of the above procedure; make sure that the pull-off springs are anchored in their correct holes in the shoe web (see Fig. M.5).

Removing rear shoes

Chock the front road wheels and set the hand brake in the 'off' position.

Jack up the car under the rear sub-frame and remove the road wheel.

Unscrew the two brake-drum retaining screws and remove the drum.

Note the position in which the pull-off springs are fitted. Release the springs and remove the shoes.

NOTE.—Do not operate the brake pedal with the shoes removed from the backplate.

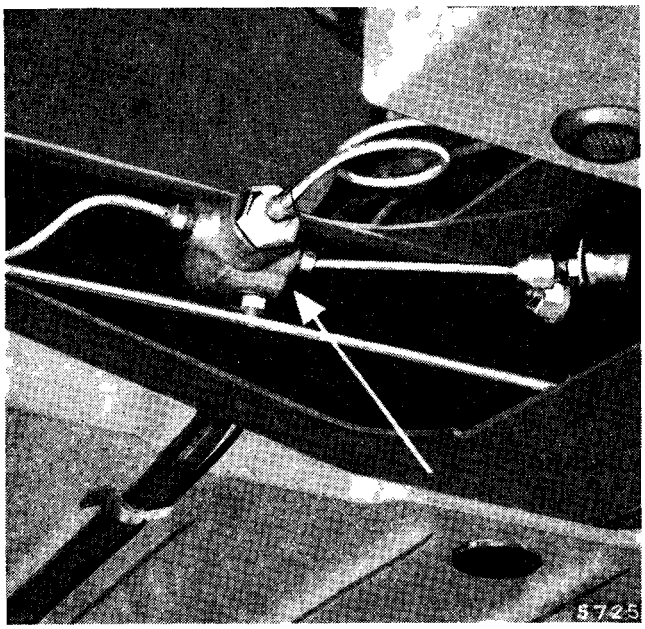


Fig. M.7

The hydraulic pressure regulating valve

Refitting is a reversal of the above procedure; make sure that the pull-off springs are anchored in their correct holes in the shoe web and that the shoes on the front brake assembly are fitted with their leading and trailing edges as shown in Figs. M.5 and M.6.

Relining

If it becomes necessary to renew the full set of brake linings due to excessive wear it is essential that the material used for relining is the same as originally specified or of an approved alternative, otherwise the present front to rear brake balance will be adversely affected.

Under no circumstances can linings of varying manufacture, type, or characteristic be tolerated at the different brake stations.

Any divergence from these stipulations may give rise to serious consequences due to out-of-balance braking.

For information as to approved lining materials refer to **'GENERAL DATA'.**

Do not reline the brake-shoes with different types of lining.

Owing to the need for the brake linings to be perfectly concentric with the brake-drums, special precautions must be taken when relining the shoes. It is not recommended that relining be undertaken unless all the specialist facilities are available. We advise the use of replacement shoes obtainable through our Special Repair Service. Renewal should be carried out in axle sets to ensure even braking conditions.

After riveting the new linings to the brake-shoes it is essential that any high-spots should be removed before replacement on the backplate.

When new linings are fitted considerable adjustment must be made to the foot brake mechanism; turn the adjusters to their fully 'off' position before attempting to refit the brake-drums over the new linings. The hand brake must also be in the fully released position.

Do not allow grease or paint to come into contact with the brake linings.

Do not clean the rubber parts with anything other than Lockheed Brake Fluid. All traces of petrol (gasoline), etc., used for cleaning metal parts must be removed before reassembly.

Section M.9

PRESSURE REGULATING VALVE

A regulating valve is fitted in the brake fluid line (see (Fig. M.7) and is designed to control the hydraulic pressure to the rear brake-shoe operating cylinders at a maximum pressure of 325 lb./sq. in. (22·8 kg./cm.²). When the pressure in the fluid line reaches this figure the valve will close and prevent any pressure in excess of this being applied to the rear brakes; all additional pressure is transferred to the wheel cylinders operating the front brakes.

Removing

Disconnect the three pressure lines from their connections on the valve body and remove the nut and washer to release the valve from its location on the rear sub-frame front cross-member.

Dismantling

Clean the exterior of the assembly.

Unscrew and remove the end plug and sealing washer.

Extract the valve assembly and the return spring.

Examine the rubber seals; if they are worn or damaged a new piston and seal assembly must be fitted.

Reassembling

Thoroughly clean and lubricate the body bore and all the component parts with Lockheed brake fluid. Fit a new taper seal and piston seal in the positions shown in Fig. M.8; make certain that the taper seal is fitted with the small diameter positioned to enter the valve bore first.

Refit the return spring and the valve assembly, and secure in position with the end plug and sealing washer.

Refitting

Refit the assembly to the sub-frame cross-member, reconnect the three pressure lines, and bleed the system as detailed in Section M.4.

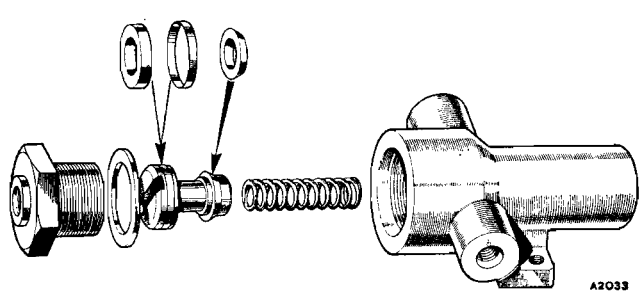


Fig. M.8

The hydraulic pressure regulating valve components

Section M.10

REMOVING THE FLEXIBLE HOSE

Do not attempt to release a flexible hose by turning either end with a spanner; it should be removed as follows.

Unscrew the metal pipe line union nut from its connection to the hose.

Hold the hexagon on the flexible hose and remove the locknut securing the flexible hose union to the bracket.

Unscrew the flexible hose from the cylinder.

Section M.11

HAND BRAKE CABLES

Removing

Chock the front road wheels and set the hand brake lever in the 'off' position.

Remove the cable adjusting nuts and remove the cable fairlead located in the centre of the floor and to the rear of the front seat. Draw the cable through the floor from underneath the car and release the cable from the guide channel on the rear sub-frame front cross-member.

Jack up the car under the rear sub-frame and remove the road wheel.

Prise the guide tube from the clip on the radius arm and pull it from its anchorage hole in the arm boss. On later models remove the nut securing the cable swivel sector to the radius arm and allow the sector to be removed with the cable. Draw the cable through the frame and release it from the actuating lever on the brake backplate.

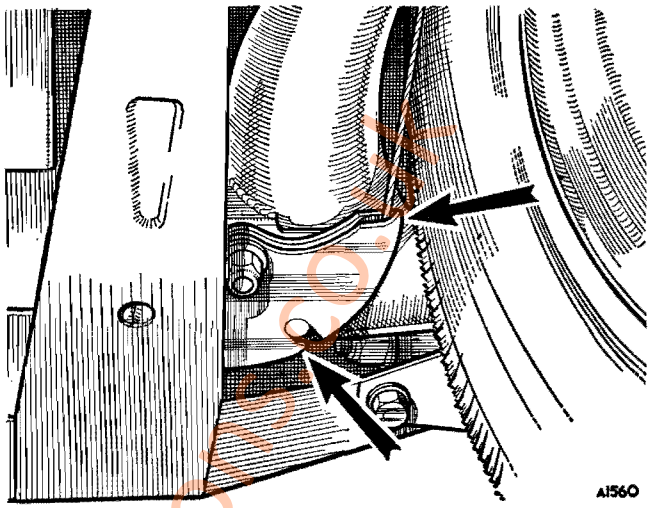


Fig. M.9

The hand brake cable sector mounted on the rear radius arms. Only the corners indicated must be 'nipped' to position the cable

When fitting a new cable make certain that the corners of the sector are 'nipped' as shown in Fig. M.9.

Refitting

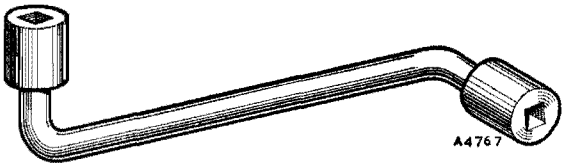
Refitting is a reversal of the removal procedure. Make certain that the guide channel is well lubricated and that the guide tube (fitted to early models only) is pushed into its anchorage hole and secured firmly in position with its clip on the radius arm.

Readjust the hand brake as detailed in Section M.3.

SERVICE TOOLS

18G619. Brake Adjusting Spanner

The use of this spanner obviates damage to the adjusters, enables the brakes to be adjusted more speedily and effectively, and removes the possibility of damaged knuckles and fingers.



18G619

SECTION N

THE ELECTRICAL SYSTEM

GENERAL DESCRIPTION

The 12-volt electrical equipment incorporates compensated voltage control for the charging circuit. The positive earth system of wiring is employed.

The battery is located in the floor of the luggage boot of the saloon model, beneath the loading platform of the Traveller, and behind the passenger's seat of the Van.

The generator is mounted on the right of the cylinder block and driven by an endless belt from the crankshaft pulley. A rotatable mounting enables the belt tension to be adjusted.

The voltage control unit adjustment is sealed and should not normally require attention. The fuses are carried in external holders mounted in an accessible position on the right-hand side of the engine compartment together with spare fuses.

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 are fitted with double-filament bulbs, both dipping either vertically or to the left or right according to the regulations existing in the countries concerned.

Section N.1

BATTERY MAINTENANCE

The battery is a 12-volt lead-acid type, having six cells, each cell consisting of a group of positive and negative plates immersed in a solution of sulphuric acid (electrolyte).

The battery has three functions: to supply current for starting, ignition, and lighting; to provide a constant supply of current to the electrical equipment under normal operating conditions and when the consumption of the electrical equipment exceeds the output of the generator; to control the voltage of the electrical supply system.

Adjustments in the vehicle

The purpose of the following operations is to maintain the performance of the battery at its maximum.

The battery and its surrounding parts should be kept dry and clean, particularly the tops of the cells, as any dampness could cause a leakage between the securing strap and the battery negative terminal, resulting in a partially discharged battery. Clean off any corrosion from the battery bolts, strap, and tray with diluted ammonia, afterwards painting the affected parts with anti-sulphuric paint.

Remove the vent plugs and check that they are not perished or cracked, otherwise leakage of electrolyte will occur. Clean out the vent holes if necessary with a piece of wire.

The electrolyte levels should be maintained just above the tops of the separators by adding distilled water. Never add acid.

Check the terminal posts. If they are corroded remove the cables and clean with diluted ammonia. Smear the posts with petroleum jelly before remaking the connections and ensure that the cable terminal screws are secure.

Test the condition of the battery cells by using a hydrometer.

The specific gravity readings and their indications are as follows:

For climates below 90° *F.* (32° *C.*)

Cell fully charged	1·270 to 1·290
Cell about half-charged	1·190 to 1·210
Cell completely discharged ..	1·110 to 1·130

For climates above 90° *F.* (32° *C.*)

Cell fully charged	1·210 to 1·230
Cell about half-charged .. .	1·130 to 1·150
Cell completely discharged ..	1·050 to 1·070

These figures are given assuming an electrolyte temperature of 60° F. (15·5° C.). If the temperature of the electrolyte exceeds this ·002 must be added to hydrometer readings for each 5° F. rise to give the true specific gravity. Similarly, ·002 must be subtracted from hydrometer readings for every 5° F. below 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. In this case it is advisable to have the battery examined by a battery specialist. 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 3·5 amps. until the cells are gassing freely.

Removing

Disconnect both cables from the battery.

Release the battery clamp and lift out the battery.

Viewing

Place the battery on a lead-covered bench or on a wooden bench treated with anti-sulphuric paint.

Check the electrolyte levels.

Inspect the container for cracks, which may be indicated by external corrosion or extreme variation in the electrolyte levels. A cracked container must be renewed.

Test the condition of the battery cells by using a hydrometer. All readings should be uniform. The hydrometer values given indicate the state of charge of the battery.

If the electrolyte level is below the tops of the separators, it will not be possible to withdraw a sufficient amount to raise the hydrometer float. In such circumstances a high-rate discharge tester should be used.

NOTE.—The use of a discharge tester is not recommended for normal testing, but only where a hydrometer reading cannot be obtained due to an excessively low electrolyte level.

Recharging from an external source

The length of time for a used battery to remain on charge before it can be accepted as fully charged depends

entirely on the specific gravity before charging commences and the charging rate. The charging should continue at 3·5 amps. until all cells are gassing freely and evenly and the specific gravity in each of the six cells has reached a maximum, i.e. has shown no further rise in four hours. The specific gravity at the end of charging should be within the limits given and should not vary ·005 from the values given.

Do not allow the temperature of the electrolyte to exceed the maximum permissible temperature, i.e.
For climates below 90° F. (32° C.) .. 100° F. (37·7° C.).
For climates above 90° F. (32° C.) .. 120° F. (48·8° C.).

If this temperature is reached the charge should be suspended to allow the temperature to fall at least 10°, otherwise the life of the battery will tend to be shortened.

Installing

The installation of the battery is a reversal of the procedure **'Removing'**. Smear the terminal posts and cable connections with petroleum jelly and tighten the clamp bolts sufficiently to prevent the cables from moving on the terminal posts when tested by hand, but do not overtighten.

Section N.2

PREPARING DRY-CHARGED BATTERIES FOR SERVICE

Dry-charged batteries are supplied without electrolyte but with the plates in a charged condition. When they are required for service it is only necessary to fill each cell with sulphuric acid of the correct specific gravity. No initial charging is required. This procedure ensures that there is no deterioration of the efficiency of the battery during the storage period before the battery is required for use.

In these batteries porous rubber separators are used between the plates.

Preparing electrolyte

The electrolyte is prepared by mixing together distilled water and concentrated sulphuric acid, taking the precautions given in Section N.3. The specific gravity of the filling electrolyte depends on the climate in which the battery is to be used.

The approximate proportions of acid and water are indicated in the following table:

For climates	*To obtain specific gravity (corrected to 60° F.) of*	*Add 1 vol. of acid to 1·835 S.G. (corrected to 60° F.) to*
Below 90° F. (32° C.)	1·270	2·8 volumes of water
Above 90° F. (32° C.)	1·210	4·0 volumes of water

Heat is produced by the mixture of acid and water and the electrolyte should be allowed to cool before pouring into the battery.

The total volume of electrolyte required to fill a two-volt dry-charged cell is ½ pint (·28 litre).

Filling the battery

Carefully break the seals in the cell filling holes and fill each cell with electrolyte to the top of the separators, **in one operation.** The temperature of the filling room, battery, and electrolyte should be maintained between 60 and 100° F. (15·5 and 37·8° C.). If the battery has been stored in a cool place it should be allowed to warm up to room temperature before filling.

Putting into use

Batteries filled in this way are capable of giving a starting discharge **one hour after filling.** When time permits, however, a short freshening charge at the normal recharge rate (3·5 amps.) will ensure that the battery is fully charged.

During the charge the electrolyte must be kept level with the top edge of the separators by addition of distilled water. Check the specific gravity of the acid 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 now be between 1·210 and 1·230. After filling, a dry-charged battery needs only the attention normally given to a lead-acid battery.

Section N.3

PREPARING NEW, UNFILLED, UNCHARGED BATTERIES FOR SERVICE

Preparing electrolyte

Batteries should not be filled with acid until required for initial charging. Electrolyte is prepared by mixing distilled water and concentrated sulphuric acid, usually of 1·835 S.G. The mixing must be carried out either in a lead-lined tank or in suitable glass or earthenware vessels. Slowly add the acid to the water, stirring with a glass rod. **Never add the water to the acid,** as the resulting chemical reaction causes violent and dangerous spurting of the concentrated acid. The approximate proportions of acid and water are indicated in the following table:

For climates	*To obtain specific gravity (corrected to 60° F.) of*	*Add 1 vol. of acid of 1·835 S.G. (corrected to 60° F.) to*
Below 90° F. (32° C.)	1·270	2·8 volumes of water
Above 90° F. (32° C.)	1·210	4·0 volumes of water

Heat is produced by mixing acid and water, and the electrolyte should be allowed to cool before taking hydrometer readings—unless a thermometer is used to measure the actual temperature and a correction applied to the readings before pouring the electrolyte into the battery.

The total volume of electrolyte required to fill a two-volt cell is ½ pint (·28 litre).

Filling the battery

The temperature of the acid, battery, and filling room must not be below 32° F. (0° C.).

Carefully break the seals in the filling holes and **half-fill** each cell with electrolyte of the appropriate specific gravity. Allow the battery to stand for at least six hours in order to dissipate the heat generated by the chemical action of the acid on the plates and separators, and then add sufficient electrolyte to fill each cell to the top of the separators. Allow to stand for a further two hours and then proceed with the initial charge.

Initial charge

The initial charging rate is 2·0 amperes. Charge at this rate until the voltage and specific gravity readings show no increase over five successive hourly readings. This will take from 40 to 80 hours, depending on the length of time the battery has been stored before charging.

Keep the current constant by varying the series resistance of the circuit or the generator output. **This charge should not be broken by long rest periods.** If, however, the temperature of any cell rises above the permissible maximum, i.e.

For climates below 90° F. (32° C.) .. 100° F. (37·7° C.)
For climates above 90° F. (32° C.) .. 120° F. (48·8° C.),

the charge must be interrupted until the temperature has fallen at least 10° F. (5·5° C.) below that figure. Throughout the charge the electrolyte must be kept level with the top of the separators by addition of acid solution of the same specific gravity as the original filling-in acid until specific gravity and charge readings have remained constant for five successive hourly readings. If the charge is continued beyond that point, top up with distilled water.

At the end of the charge carefully check the specific gravity in each cell to ensure that, when corrected to 60° F. (15·6° C.) it lies between the specified limits. If any cell requires adjustment some of the electrolyte must be siphoned off and replaced either by distilled water or by acid of strength originally used for filling in, depending on whether the specific gravity is too high or too low. Continue the charge for an hour or so to ensure adequate mixing of the electrolyte and again check the specific gravity readings. If necessary, repeat the adjustment process until the desired reading is obtained in each cell. Finally, allow the battery to cool, and siphon off any electrolyte over the tops of the separators.

Section N.4

DYNAMO

Testing 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 ½ in. (13 mm.) at the centre of its longest run between two pulleys with moderate hand pressure. If the belt is too slack tightening is effected by slackening 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 short length of wire.

(5) Start the engine and set to run at normal 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 r.p.m.

If there is no reading check the brush gear.

If the reading is low (approximately 1 volt) the field winding may be faulty.

If the reading is approximately 5 volts the armature winding may be faulty.

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 on 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.6).

Removing and replacing

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 withdrawing the two upper and one lower attachment bolts.

Replacement of the dynamo is an exact reversal of this procedure.

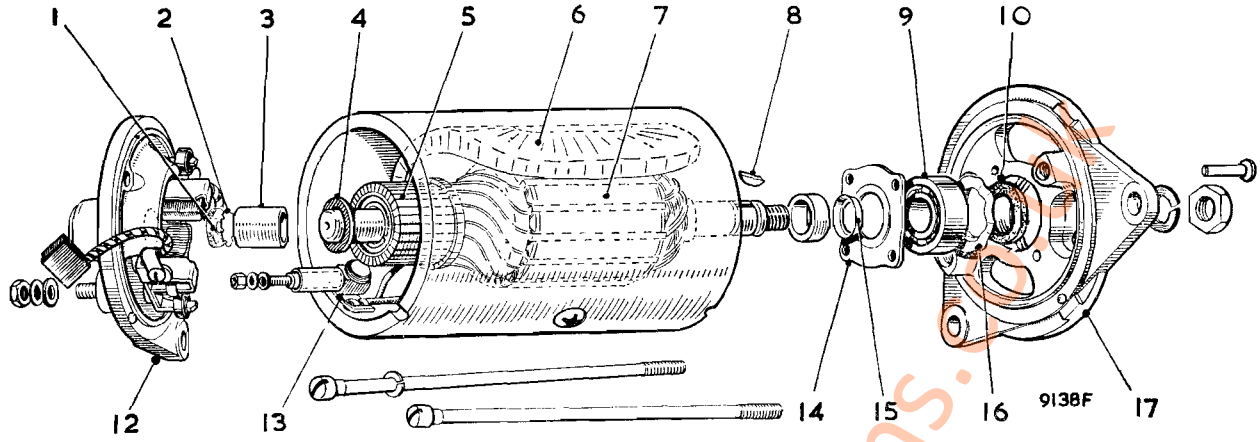


Fig. N.1

The windowless yoke 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.

Dismantling

Remove the securing nut and take off the drive pulley.

Remove the Woodruff key from the commutator shaft.

Unscrew and remove the two through-bolts and take off the commutator end bracket. The driving end bracket, together with the armature and its ball bearing, can now be lifted out of the yoke. Unless the ball bearing is damaged or requires attention it need not be removed from the armature. Should it be necessary to remove the bearing, the armature must be separated from the end bracket by means of a hand press.

Servicing

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; the correct tension is between 18 and 26 oz. (510 and 737 grm.). Fit new springs if the tension is below limits.

If the brushes are worn to a minimum length of $\frac{1}{4}$ in. (6·35 mm.) new brushes must be fitted and bedded to the commutator.

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 $\frac{1}{32}$ in. (·8 mm.) with a hacksaw blade ground down to the thickness of the mica.

Later-type commutators are of the moulded type 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. (1·02 mm.)
Depth	..	·020 to ·035 in. (·51 to ·89 mm.)

It is important that the insulating material is cleared from the sides of the undercut to a minimum depth of ·015 in. (·381 mm.).

Field coils

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:

(1) Remove the insulation piece which is provided to prevent the junction of the field coils from connecting the yoke.

(2) Mark the yoke and pole-shoes in order that they can be refitted in their original positions.

(3) Unscrew the two pole-shoe retaining screws by means of the wheel-operated screwdriver.

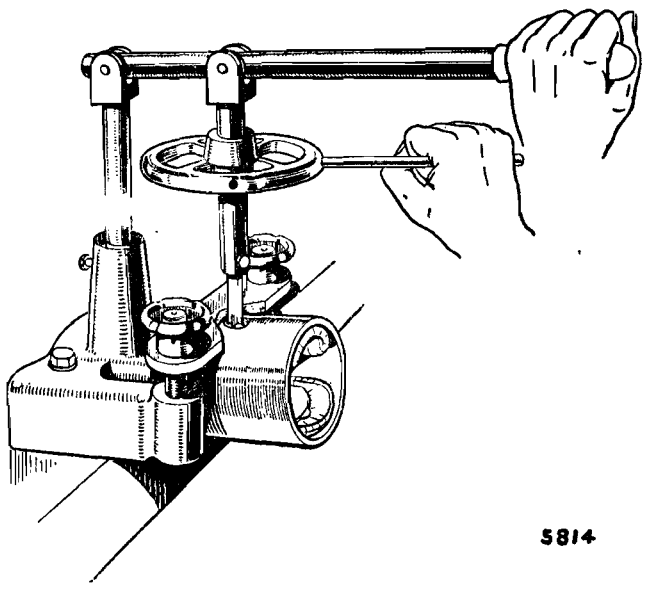


Fig. N.2

Using a wheel-operated screwdriver to remove the pole-shoe screws

(4) Draw the pole-shoes and coils out of the dynamo yoke and lift off the coils.
(5) 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.
(6) Locate the pole-shoes and field coils by lightly tightening the fixing screws.
(7) Insert the pole-shoe expander, open it to the fullest extent, and tighten the screws.
(8) Finally, tighten the screws by means of the wheel-operated screwdriver and lock them by caulking.
(9) 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:

(1) Screw a $\frac{5}{8}$ in. tap squarely into the old bush and remove the bush.
(2) 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.

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:

(1) Knock out the rivets which secure the bearing retaining plate to the end bracket and remove the plate.
(2) Press the bearing out of the end bracket and remove the corrugated washer and felt washer.
(3) Before fitting the replacement bearing see that it is clean and pack it with a high-melting-point grease.
(4) Place the felt washer and corrugated washer in the bearing housing in the end bracket.
(5) Locate the bearing in the housing and press it home by means of a hand press.
(6) Fit the bearing retaining plate. Insert the new rivets from the outside of the end bracket and open the rivets by means of a punch to secure the plate rigidly in position.

Reassembling

The reassembly of the dynamo is a reversal of the dismantling sequence.

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. When assembling the commutator end bracket the brushes must first be held clear of the commutator by partially withdrawing them 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 by a small screwdriver or similar tool when the end bracket is assembled to within about $\frac{1}{2}$ in. (12·7 mm.) of the yoke. Before closing the gap between the end bracket and the yoke see that the springs are in correct contact with the brushes.

Add a few drops of oil through the hole in the armature end cover.

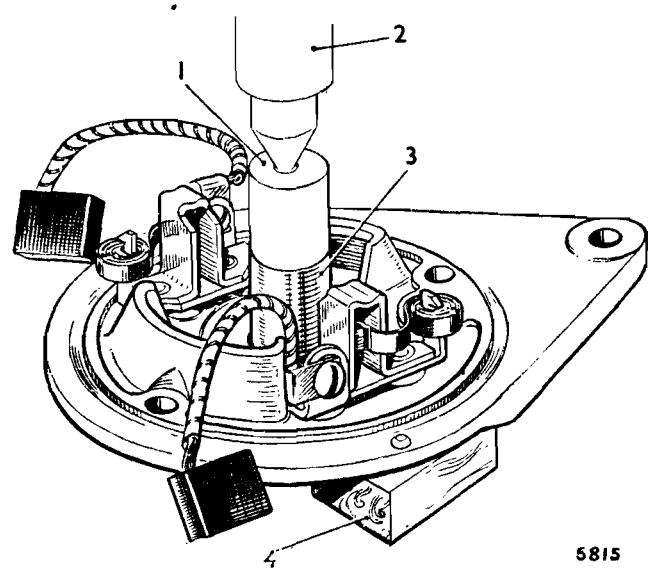


Fig. N.3

The method of pressing in the commutator end bracket bush

1. Shouldered mandrel.
2. Hand press.
3. Bearing bush.
4. Support block.

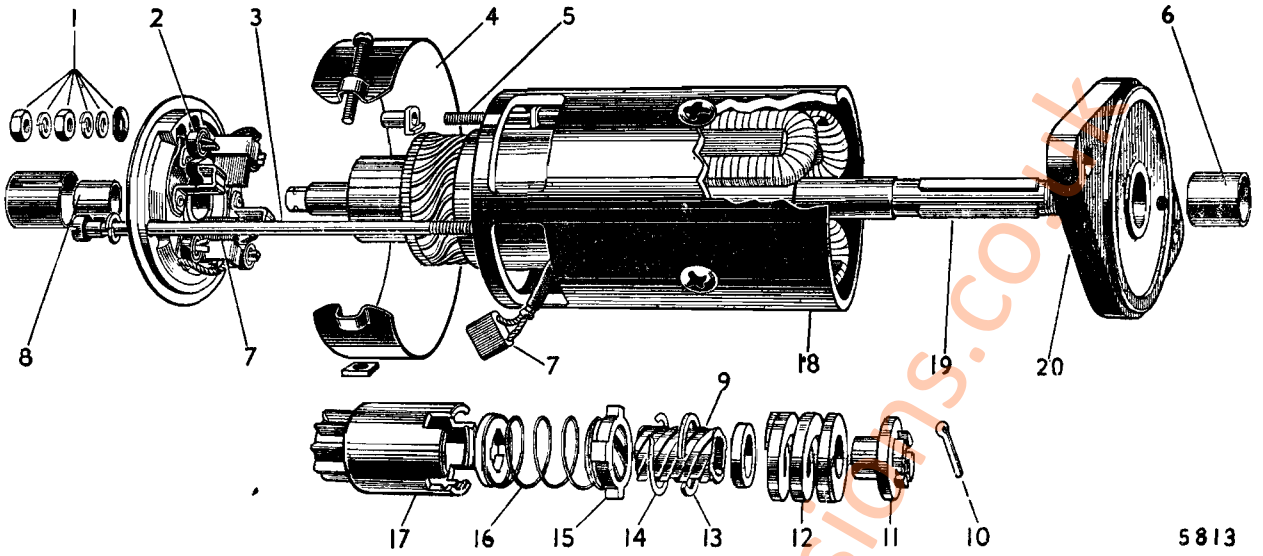


Fig. N.4

An exploded view of the starter motor and drive

1. Terminal nuts and washers.
2. Brush spring.
3. Through-bolt.
4. Band cover.
5. Terminal post.
6. Bearing bush.
7. Brushes.
8. Bearing bush.
9. Sleeve.
10. Split pin.
11. Shaft nut.
12. Main spring.
13. Retaining ring.
14. Washer.
15. Control nut.
16. Restraining spring.
17. Pinion and barrel.
18. Yoke.
19. Armature shaft.
20. Driving end bracket.

Section N.5

STARTER

Testing 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 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.

Removing and refitting

Release the starter cable from the terminal and unscrew the two starter securing bolts. Manœuvre the starter towards the radiator and lift it clear of the engine.

Refitting is a reversal of this procedure.

Examining commutator and brush gear

Remove the starter cover band (4) (Fig. N.4) and examine the brushes (7) (Fig. N.4) and the commutator. Hold back each of the brush springs (2) (Fig. N.4) 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 fuel-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 (4) (Fig. N.4) at the commutator end, hold back the brush springs (2) (Fig. N.4), and take out the brushes (7) (Fig. N.4) from their holders.

Remove the armature complete with drive from the commutator end bracket and starter frame.

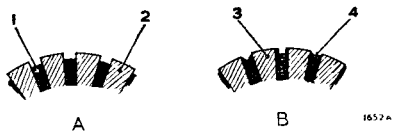


Fig. N.5

The correct method of undercutting the commutator segments (dynamo only)

(A) *Right way*
1. Insulator
2. Segments.

(B) *Wrong way*
3. Segments.
4. Insulator.

Remove the terminal nuts and washers (1) from the terminal post (5) 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.

Servicing

Brushes

(1) Test the brush springs with a spring scale. The correct tension is 30 to 40 oz. (850 to 1134 gm.). Fit a new spring if the tension is low.

(2) 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 terminal eyelets attached to the brush boxes on the commutator end bracket. The other two brushes (7) (Fig. N.4) 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 preformed, so that bedding of the working face to the commutator is unnecessary.

Drive

If the pinion is tight on the sleeve wash in paraffin; renew any worn or damaged parts.

To dismantle the drive extract the split pin and remove the shaft nut (11) (Fig. N.4); 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 (13).

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 a 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.4.

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.

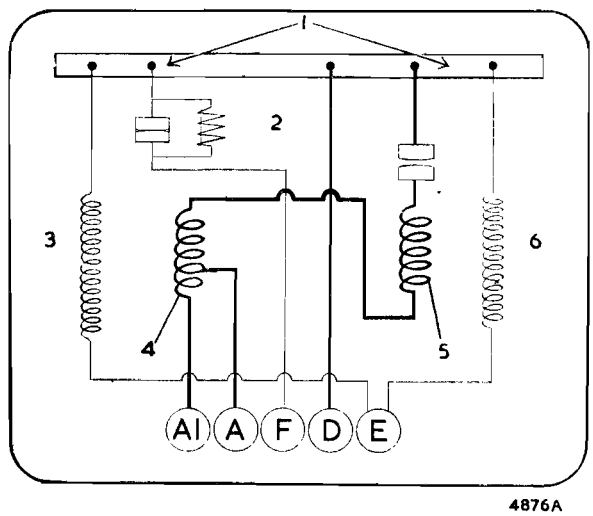


Fig. N.6

The control box (regulator and cut-out) internal connections

1. Regulator and cut-out frame.
2. Field resistance.
3. Shunt coil.
4. Tapped series coil.
5. Series coil.
6. Shunt coil.

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 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 24 hours in thin engine oil in order to fill the pores of the bush with lubricant.**

Reassembling

The reassembly of the starter is a reversal of the operations described in this section.

Section N.6

CONTROL BOX

Description

The control box contains two units—a voltage regulator and a cut-out. Although combined structurally, the regulator and cut-out are electrically separate (see Fig. N.6).

Both are accurately adjusted during manufacture, and the cover protecting them should not be removed unnecessarily.

Regulator

The regulator is set to maintain the dynamo output between close limits at all speeds above the regulating point, the field strength being controlled by the automatic insertion and withdrawal of a resistance in the dynamo field circuit. When the dynamo output reaches a predetermined value the magnetic flux in the regulator core, induced by the shunt or voltage winding, becomes sufficiently strong to attract the armature to the core. This causes the contacts to open, thereby inserting the resistance in the dynamo field circuit.

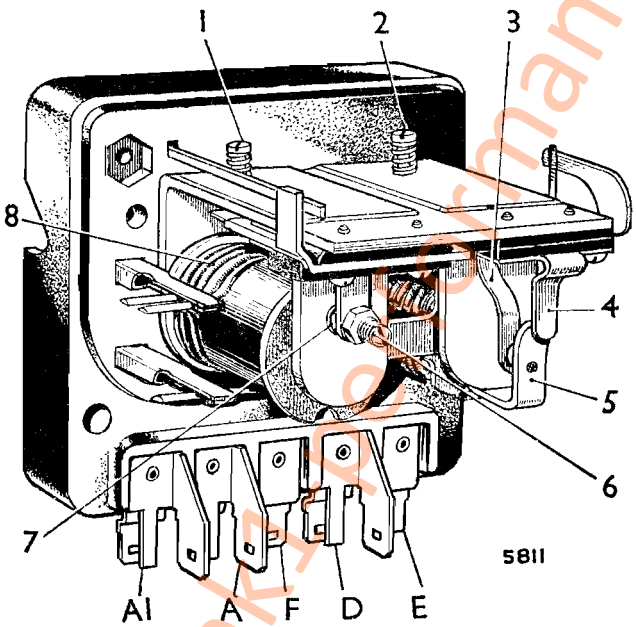


Fig. N.7

The control box

1. Regulator adjusting screw.
2. Cut-out adjusting screw.
3. Fixed contact blade.
4. Stop arm.
5. Armature tongue and moving contact.
6. Regulator fixed contact screw.
7. Regulator moving contact
8. Regulator series windings.

The consequent reduction in the dynamo field current lowers the dynamo output, and this in turn weakens the magnetic flux in the regulator core. The armature therefore returns to its original position, and with the contacts closed the dynamo output rises again to its regulated maximum. This cycle is then repeated, and an oscillation of the armature is maintained.

As the speed of the dynamo rises above that at which the regulator comes into operation the periods of contact separation increase in length, and as a result the mean value of the dynamo output undergoes practically no increase once this regulating speed has been attained.

The series or current winding provides a compensation on this system of control, for if the control were arranged entirely on the basis of voltage there would be a risk of seriously overloading the dynamo when the battery was in a low state of charge, particularly if the lamps were in use simultaneously.

Under these conditions, with a battery of low internal resistance the dynamo output rises and, but for the series winding, would exceed its normal rating. The magnetism due to the series winding assists the shunt winding, so that when the dynamo is delivering a heavy current into a discharged battery the regulator comes into operation at a somewhat reduced voltage, thus limiting the output accordingly. As shown in Fig. N.6, a split series winding is used, terminal 'A' being connected to the battery and terminal 'A1' to the lighting and ignition switch.

By means of a temperature compensation device the voltage characteristic of the dynamo is caused to conform more closely to that of the battery under all climatic conditions. In cold weather the voltage required to charge the battery at a given rate increases, whilst in warm weather the voltage required is lower. The compensation device is in the form of a bi-metal spring located behind the tensioning spring of the regulator armature. By causing the operating voltage of the regulator to be increased in cold weather and reduced in hot weather the bi-metal spring compensates for the changing temperature characteristics of the battery and prevents undue variation of the charging current which would otherwise occur. The bi-metal spring also compensates for effects due to increases in resistance of the copper windings from cold to working values.

Cut-out

The cut-out is an electro-magnetically operated switch connected in the charging circuit between the dynamo and the battery. It automatically connects the dynamo with the battery when the dynamo output exceeds that of the battery and disconnects the two when the dynamo output falls below that of the battery, and so prevents the battery from discharging and possibly damaging the dynamo windings.

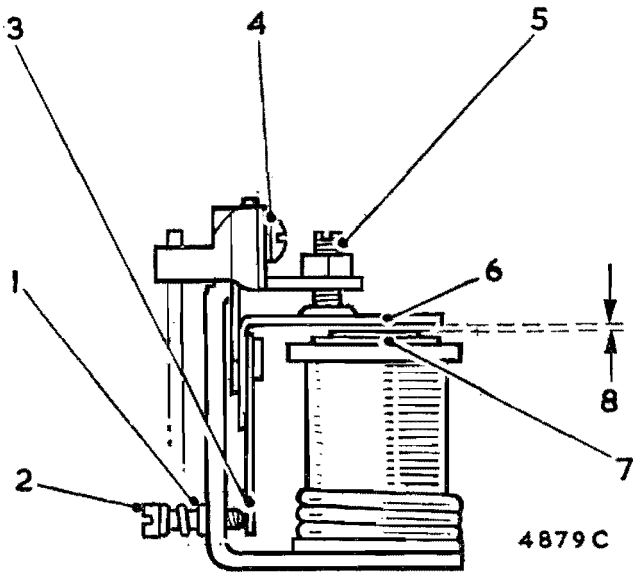


Fig. N.8

Mechanical setting of the regulator

1. Locknut.
2. Voltage adjusting screw.
3. Armature tension spring.
4. Armature securing screws.
5. Fixed contact adjustment screw.
6. Armature.
7. Core face and shim.
8. ·021 in. (·533 mm.).

The cut-out consists of an electro-magnet fitted with an armature which operates a pair of contacts. The electro-magnet employs two windings—a shunt winding of many turns of fine wire and a series winding of a few turns of heavier-gauge wire. The contacts are normally held open and are closed only when the magnetic pull from the armature is sufficient to overcome the tension of the adjusting spring.

The shunt coil is connected across the dynamo. When starting, the speed of the engine and thus the output of the dynamo rises until the electro-magnet is strong enough to overcome the spring tension and close the cut-out contacts. The effect of the charging current flowing through the cut-out windings creates a magnetic field in the same direction as that produced by the shunt winding. This increases the magnetic pull on the armature so that the contacts are firmly closed and cannot be separated by vibration. When the speed of the dynamo falls to a point where its output is lower than that of the battery, current flows from the battery through the cut-out series winding and dynamo in a reverse direction to the charging current. This reverse current through the cut-out will produce a differential action between the two windings and partly demagnetize the electro-magnet. The spring, which is under constant tension, then pulls the armature away from the magnet and so separates the contacts and opens the circuit.

Like the regulator, the operation of the cut-out is temperature-controlled by means of a bi-metal tensioning spring.

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.

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.

Electrical setting (with unit cold)

The electrical setting of the control unit can be checked without removing the cover. Use a good-quality moving-coil voltmeter (0–20 volts).

Withdraw the cables from the control box terminals 'A' and 'A1' and connect these cables together.

Connect the negative lead of the voltmeter to the control box terminal 'D' and connect the other lead to terminal 'E'.

Slowly increase the speed of the engine until the voltmeter needle flicks and then steadies. This should occur at a voltmeter reading between 15·8 and 16·7 volts according to the ambient temperature.

If the voltage at which the reading becomes steady occurs outside these limits the regulator must be adjusted.

Switch off the engine and remove the control box cover.

Turn the voltage adjusting screw (1) (Fig. N.8) in a clockwise direction to raise the setting or in an anti-clockwise direction to lower the setting. Turn the screw only a fraction of a turn at a time. Repeat as above until the correct setting is obtained.

The adjustment of the regulator open-circuit voltage should be completed within 30 seconds, otherwise heating of the shunt winding will cause false settings to be made.

A dynamo run at high speed on open circuit will build up a high voltage. Therefore, when adjusting the regulator increase the engine speed slowly until the regulator operates, otherwise a false setting may be made.

Reconnect the wires.

Mechanical setting

The mechanical or air gap settings of the regulator shown in Fig. N.8 are accurately adjusted before leaving the Works, and, provided that the armature carrying the moving contact is not removed, these settings must not be tampered with. If, however, the armature has been removed the regulator will have to be reset. To do this proceed as follows.

Slacken the fixed contact locking nut and unscrew the contact screw until it is quite clear of the armature moving contact.

Unscrew the voltage adjusting screw until it is well clear of the armature tension spring.

Slacken the two armature assembly securing screws.

Using a ·021 in. (·533 mm.) thick feeler gauge, wide enough to cover completely the core face, insert the

gauge between the armature and the core shim, taking care not to turn up or damage the edge of the shim.

Press the armature **squarely** down against the gauge and retighten the two armature assembly securing screws.

With the gauge still in position, screw the adjustable contact down until it just touches the armature contact. Retighten the locking nut.

Reset the voltage adjusting screw as described under **'Regulator adjustment'.**

Cleaning contacts

After long periods of service it may be found necessary to clean the regulator contacts. Clean the contacts by means of a fine carborundum stone or fine emery-cloth.

Carefully wipe away all traces of dust or other foreign matter with methylated spirits.

Cut-out adjustment

Electrical setting

If the regulator is correctly set but the battery is still not being charged the cut-out may be out of adjustment. 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 its 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.

If the cut-out operates outside these limits it will be necessary to adjust it to within the limits. To do this turn the cut-out adjusting screw in a clockwise direction to raise the voltage setting or in an anti-clockwise direction to reduce the setting. Turn the screw only a fraction of a turn at a time. Test after each adjustment by increasing the engine speed and noting the voltmeter readings at the instant of contact closure. Electrical settings of the cut-out, like the regulator, must be made as quickly as possible because of the temperature rise effects.

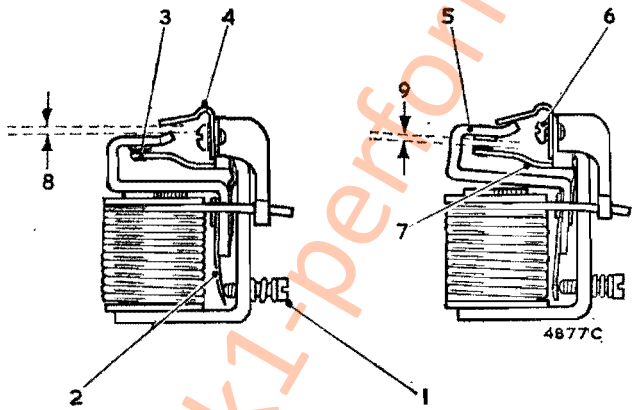


Fig. N.9

Mechanical setting of the cut-out

1. Cut-out adjusting screw.
2. Armature tension spring.
3. 'Follow through'—·010 to ·020 in. (·254 to ·508 mm.).
4. Stop arm.
5. Armature tongue and moving contact.
6. Armature securing screws.
7. Fixed contact blade.
8. ·030 in. (·762 mm.).
9. .010 to ·020 in. (·254 to ·508 mm.).

If the cut-out does not operate there may be an open circuit in the wiring of the cut-out and regulator unit, in which case the units should be removed for examination or renewal.

Mechanical setting

If for any reason the cut-out armature has to be removed from the frame care must be taken to obtain the correct air gap settings on reassembly. These can be obtained as follows.

Unscrew the cut-out adjusting screw until it is well clear of the armature tension spring.

Slacken the two armature securing screws.

Press the armature **squarely** down against the copper-sprayed core face and retighten the armature securing screws.

Using a pair of thin-nosed pliers, adjust the gap between the armature stop arm and the armature tongue by bending the stop arm. The gap must be ·030 in. (·762 mm.) when the armature is pressed **squarely** down against the core face.

Similarly, the fixed contact blade must be bent so that when the armature is pressed **squarely** down against the core face there is a 'follow through' of blade deflection of ·010 to ·020 in. (·254 to ·508 mm.). See (3) (Fig. N.9).

Reset the cut-out adjusting screw in accordance with the instructions already given.

Cleaning contacts

Do not use emery-cloth or a carborundum stone for cleaning cut-out contacts. If the contacts appear dirty, rough, or burnt place a strip of fine glass-paper between the contacts and then, with the contacts closed by hand, draw the paper through. This should be done two or three times with the rough side of the glass-paper towards each contact.

Wipe away all dust or other foreign matter, using a clean, fluffless cloth moistened with methylated spirits.

Section N.7

FUSES

Two 35-amp. fuses are mounted in a separate fusebox and are therefore accessible without removing the control box cover (see Fig. N.10).

Units protected

The units which are protected by each fuse can readily be identified by referring to the wiring diagram on page N.17.

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

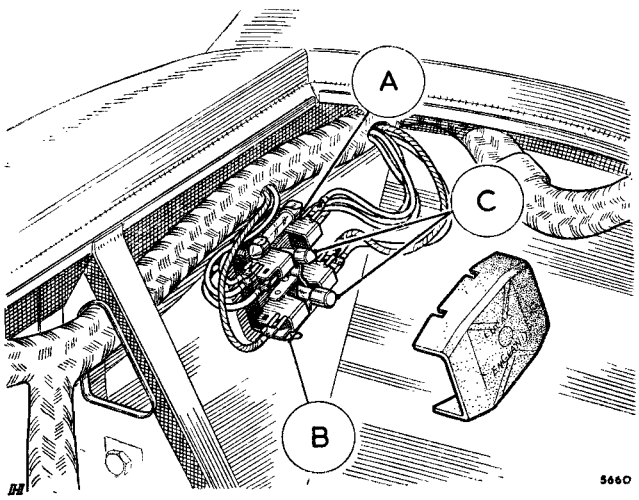


Fig. N.10

The fuse block mounted on the right-hand valance

A. 35-amp. fuse.
B. 35-amp. fuse.
C. Spare fuses.

evidence of a short circuit or other faults which may have caused the fuse to blow, and remedy the cause of the trouble.

Section N.8

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.

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 the 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, tighten any loose connections, or renew any 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 to 4 amps.

If the ammeter reading is in excess of this value it is advisable to check the regulator setting, and adjust if necessary.

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 the 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.

Section N.9

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.

To detach the cable rack from the motor and gearbox

Unscrew the pipe union nut.

Remove the gearbox cover.

Remove the retaining washer from the crankpin and final gear wheel.

Lift off the connecting link.

Commutator dirty

Remove the connecting leads to the terminals and withdraw the three screws securing the cover at the commutator end. Lift off the cover. Clean the commutator with a cloth moistened with petrol (gasoline)

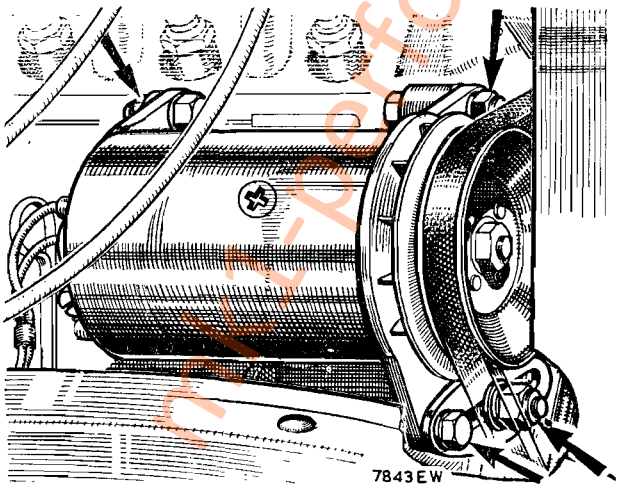


*Fig. N.*11

The four mounting points that must be slackened for fan belt adjustment

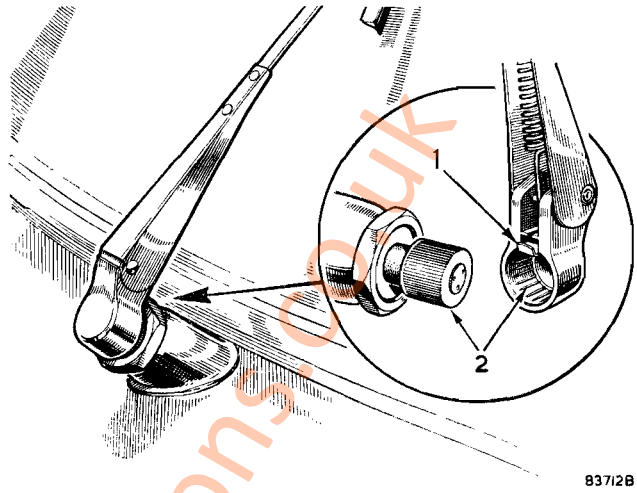


*Fig. N.*12

Removal and replacement of the windshield wiper arm

1. Retaining clip. 2. Splined drive.

and carefully remove any carbon dust from between the commutator segments.

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.

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. C (page P.2).

Thrust screw adjustments

The thrust screw is located on the top of the cross-head 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.

To remove the motor

Detach the cable rack from the motor and gearbox as detailed above. Disconnect the leads. Turn back the body trimming on the left-hand side of the scuttle panel above the parcel tray, and remove the three nuts securing the motor to the panel.

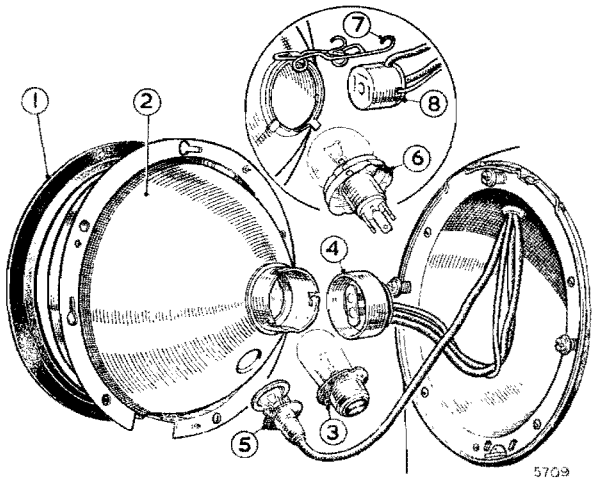


Fig. N.13

The headlamp light unit showing the European type bulb and socket inset

1. Rubber seal.
2. Reflector.
3. Bulb.
4. Back-shell.
5. Pilot lamp.
6. Bulb.
7. Bulb retainer.
8. Socket.

} European type.

Section N.10

HEADLAMPS

The headlamp main bulb is correctly positioned in relation to the reflector, and no focusing is required when a replacement bulb is fitted.

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.

Removing the light unit

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 the light unit to be withdrawn sufficiently to give attention to the wiring and bulbs.

Bulb replacement—R.H.D. and L.H.D. (except European type)

With the light unit withdrawn, 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.

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.

Bulb replacement (European type)

The headlamps fitted to left-hand-drive cars for use in European countries are fitted with special front lenses giving an asymmetrical light beam to the right-hand side. Access to the bulb is achieved in the same way as with right-hand-drive cars, but the bulb 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. When replacing the bulb make certain that the rectangular pip on the bulb flange engages the slot in the reflector seating.

Replace the spring clip with its coils resting in the base of the bulb flange and engaging the two retaining lugs on the reflector seating.

Refitting the light unit

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 $\frac{1}{2}$ in. (13 mm.).

Replace the dust-excluding rubber on the light rim with its flanged face forward and refit the plated rim.

Beam-setting

The lamps should be set so that the main driving beams are parallel with the road surface or in accordance with local regulations.

If adjustment is required this is achieved by removing the plated rim and dust-excluding rubber. Vertical adjustment can then be made by turning the screw 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.14).

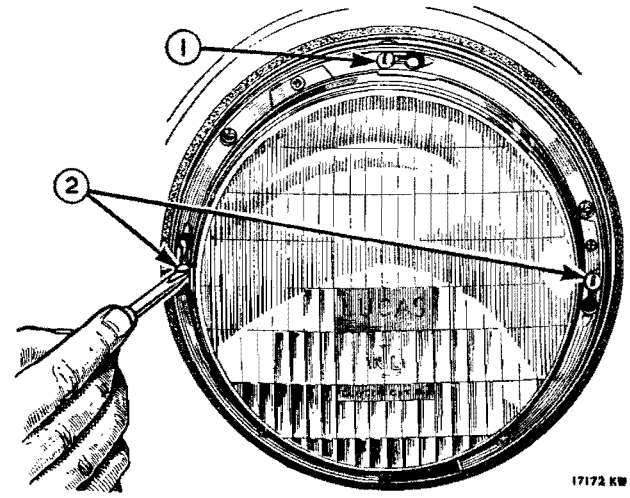


Fig. N.14

The headlamp setting screws

1. Vertical setting adjusting screw.
2. Horizontal setting adjusting screws.

Pilot lamp bulbs

On models where the pilot lamp bulb is incorporated in the headlamp it is accessible when the light unit is removed.

On models where separate pilot lamps are fitted refer to Section N.11 for details of bulb replacement.

Section N.11

PILOT AND FLASHING DIRECTION INDICATOR LAMPS

Access to the bulb for removal and replacement is obtained by folding back the rubber retaining flange and gently prising out the bezel and lens from the lamp body. Use the fingers only to fold back the rubber retaining flange.

To remove the lamp body, extract the three self-tapping screws securing the body to the wing, pull the body forward to separate it from the rubber cover, and release the leads from their connections on the body. When refitting make certain that the spring nuts are positioned over the screw holes in the wing to accept and retain the three self-tapping screws.

Ensure that the lens is seating correctly in the rubber body before refitting the retaining bezel.

Section N.12

FLASHING DIRECTION INDICATORS

The flashing direction indicators are operated by a hand-actuated switch on the steering-column through a flasher unit to the dual-filament bulbs in the pilot lamps 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.

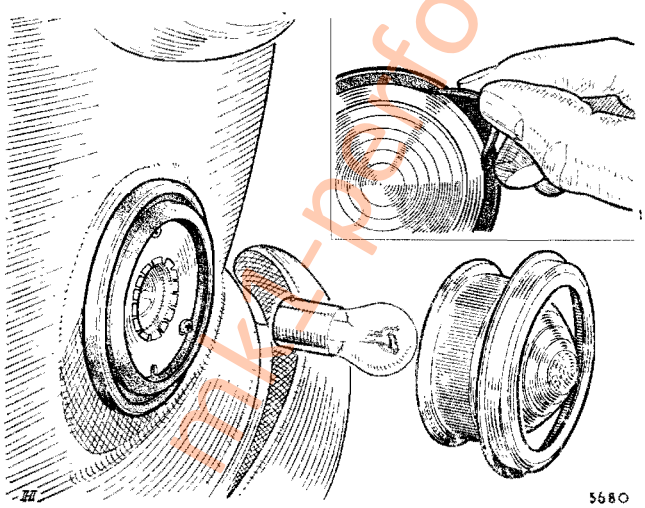


Fig. N.15

The pilot and flashing indicator lamp, showing the method of access to the bulb

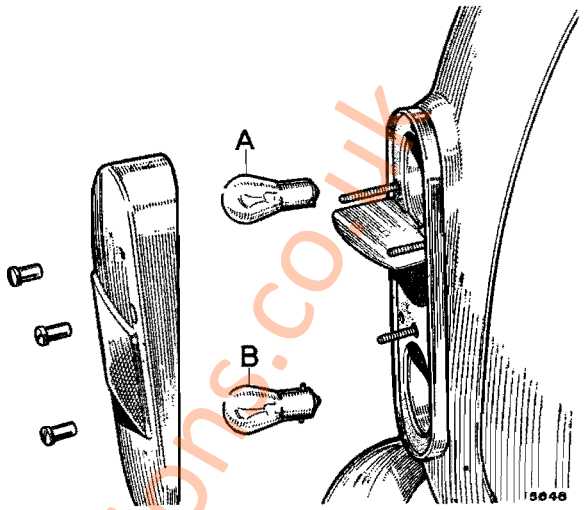


Fig. N.16

The tail lamp, showing the method of access to (A) *the flashing direction indicator bulb and* (B) *the stop/tail lamp bulb*

(3) Switch on the ignition and check that terminal 'B' on the flasher is at 12 volts with respect to earth.

(4) Connect together terminals 'B' and 'L' at the flasher unit and operate the direction indicator switch. If the flasher lamps light up, the flasher unit is at fault and must be renewed. If the lamps do not light a further check of the circuit and the switch must be undertaken.

Maintenance

Flasher units cannot be dismantled for subsequent reassembly. A defective unit must therefore be renewed, care being taken to connect as the original.

Replacement of flasher unit

When replacing a flasher unit or installing a flashing light system it is advisable to test the circuits before connections to flasher terminals are made. When testing join the cables normally connected to those terminals (green, green with brown, and light green) together and operate the direction indicator switch. In the event of a wrong connection having been made, the ignition auxiliaries fuse will blow but no damage will be done to the flasher unit.

Section N.13

TAIL AND STOP AND DIRECTION INDICATOR LAMPS

The tail lamp bulbs are of the double-filament type, the second filament giving a marked increase in brilliance when the brakes are applied.

Access to the bulb is gained by extracting the three female screws from the outer face of the lamp lens to release the lens from the body.

The tail and stop lamp bulb must be fitted one way only; offset retaining pegs ensure that they are replaced correctly.

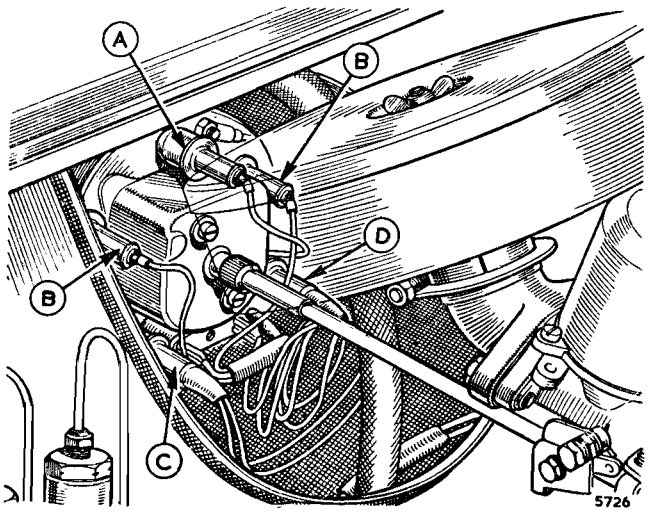


Fig. N.17

The panel and warning lamp bulb holders

A. Headlamp main beam warning lamp.
B. Instrument illumination lamp.
C. Ignition warning lamp.
D. Oil pressure warning lamp.

The lamp body can be removed when the lens is taken off as indicated in Fig. N.16 and the three screws located in the centre of the body withdrawn. When refitting the glass to the body make certain that it is seating correctly over the sealing rubber.

Section N.14

PANEL AND WARNING LAMPS

Access to the warning lamps for the ignition, headlamp beam, and oil pressure indicators is effected from under the bonnet by withdrawing the push-in-type holders from the rear of the central instrument.

A list of the correct types of bulbs for replacement purposes and their part numbers appears in Section N.16.

Section N.15

NUMBER-PLATE ILLUMINATION LAMP

The number-plate is illuminated by a separate lamp with a miniature bayonet-fitting bulb.

The cover is removed by unscrewing the single attachment screw, which enables it to be withdrawn, giving easy access to the bulb.

Section N.16

REPLACEMENT BULBS

	B.M.C. Part No.	*Volts*	*Watts*
Headlamps (dip left—R.H.D. except Sweden)	13H140	12	50/40
Headlamps (dip right—L.H.D. except Europe)	13H141	12	50/40
Headlamps (dip vertical—Europe except France)	13H138	12	45/40
Headlamps (dip vertical—France)	13H139	12	45/40
Headlamps (dip vertical—Sweden)	3H921	12	45/40
Pilot lamp	2H4817	12	6
Pilot lamp and front flashing direction indicator	1F9026	12	21/6
Flashing direction indicator	1F9012	12	21
Flashing direction indicator—rear	1F9012	12	21
Number-plate lamp	2H4817	12	6
Panel and warning lamps	2H4732	12	2·2
Direction indicator warning lamp (Lilliput bulb)	27H5388	12	1·5
Stop/tail lamp	1F9026	12	21/6
Parcel shelf lamps	2H4732	12	2·2
Rear companion pocket lamps	2H4732	12	2·2

Section N.17

SEALED-BEAM LIGHT UNITS

A new, improved type of sealed-beam light unit is being fitted to the headlamps of cars exported to U.S.A. and can be identified by the figure '2' moulded into the lens at the two o'clock position. These headlamps must be aimed and set with the beams in the dip position, with the beam setting carried out in accordance with the regulations of the country or state in which the vehicle is operating.

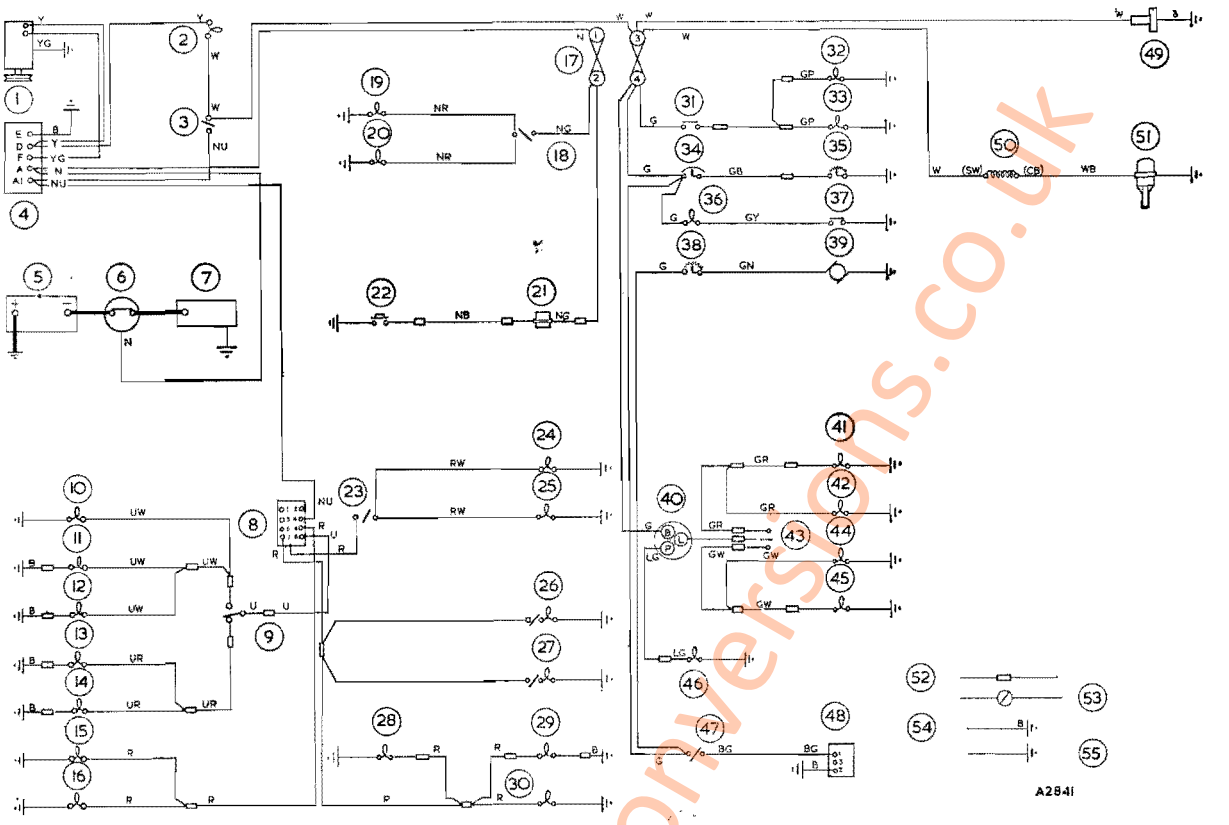


Fig. N.18
Wiring diagram

1. Dynamo.
2. Ignition warning light.
3. Ignition switch.
4. Control box.
5. 12-volt battery.
6. Starter switch.
7. Starter motor.
8. Lighting switch.
9. Main beam dipping switch.
10. Main beam warning light.
11. R.H. headlamp main beam.
12. L.H. headlamp main beam.
13. R.H. headlamp dip beam.
14. L.H. headlamp dip beam.
15. L.H. sidelamp.*
16. R.H. sidelamp.*
17. Fuse unit.
18. Parcel shelf lamp switch.
19. R.H. parcel shelf lamp.
20. L.H. parcel shelf lamp.
21. Horn.
22. Horn-push.
23. Panel light switch.
24. Panel light.
25. Panel light.
26. R.H. companion pocket lamp and switch.
27. L.H. companion pocket lamp and switch.
28. R.H. tail lamp.
29. Number-plate lamp.
30. L.H. tail lamp
31. Stop lamp switch.
32. R.H. stop lamp.
33. L.H. stop lamp.
34. Fuel gauge.
35. Fuel gauge tank unit.
36. Oil pressure warning light.
37. Oil pressure light switch.
38. Heater rheostat.
39. Heater motor.
40. Flasher unit.
41. L.H. rear flasher.
42. L.H. front flasher.
43. Flasher switch.
44. R.H. front flasher.
45. R.H. rear flasher.
46. Flasher warning light.
47. Windshield wiper switch.
48. Windshield wiper motor.
49. Fuel pump.
50. Ignition coil.
51. Distributor.
52. Snap connectors.
53. Terminal blocks or junction box.
54. Earth made via cable.
55. Earth made via fixing bolts.

* On Export models sidelamps are fed from terminal 7 of the lighting switch.

CABLE COLOUR CODE

B	Black	P	Purple	Y	Yellow
U	Blue	R	Red	L	Light
N	Brown	S	Slate	D	Dark
G	Green	W	White	M	Medium

When a cable has two colour code letters the first denotes the main colour and the second denotes the tracer colour.

SECTION O

THE WHEELS AND TYRES

(TUBELESS TYRES)

Section O.1

TYRE MAINTENANCE

Even tyre wear is promoted by changing the positions of the tyres on the car at intervals of about 2,000 miles (3200 km.). The spare tyre should be brought into use with the others.

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 daily by means of a suitable gauge and restore any air lost. It is not sufficient to make a visual inspection of the tyre for correct inflation. Inflate the spare wheel tyre to the correct front 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 necessary.

Keep the clutch and brakes adjusted correctly and in good order. Fierceness or uneven action in either of these units has a destructive effect upon the tyres.

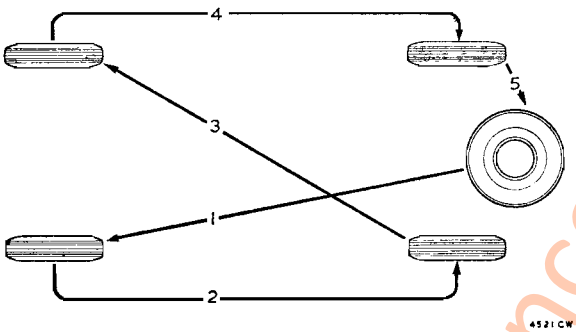


Fig. O.1

Interchange the road wheels diagonally in the order shown above, bringing the spare wheel into use

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.4 for details on front wheel alignment.

Should the tyres get oily, fuel should be applied sparingly and wiped off at once.

Avoid under- and over-inflation.

Avoid kerbing and other causes of severe impact.

Have any damage repaired immediately.

Remove tyres when smooth for remoulding.

Section O.2

VALVES

A mushroom-headed rubber valve is used with tubeless tyres. The valve is secured in the wheel by a small stepped flange on the rubber valve and by the pressure of air inside the tyre.

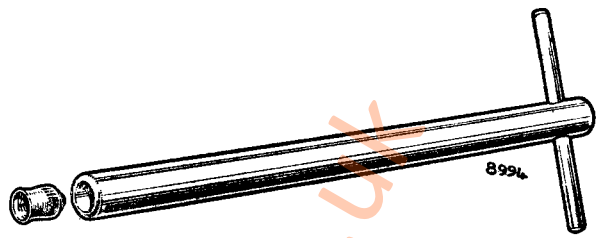


Fig. O.2

A simple tool for fitting tubeless tyre valves

A simple but effective tool (Fig. O.2) for fitting the valve can be made up from a 7 in. (177·8 mm.) length of $\frac{1}{2}$ in. (12·7 mm.) steel bar or 13 S.W.G. steel tubing. Using a letter 'S' (8·83 mm.) drill, in one end drill a hole to a depth of approximately $\frac{5}{8}$ in. (15·87 mm.).

Obtain an ordinary valve dust cap and solder the cap in the drilled hole.

The opposite end of the tool requires a hole drilling about $\frac{1}{2}$ in. (12·7 mm.) from the end to accept a short piece of $\frac{1}{4}$ in. (6·35 mm.) diameter rod to provide a handle.

To fit the valve with the aid of the tool first liberally coat the rubber valve and the perimeter of the valve hole in the wheel with soapy water. Insert the valve into the hole and screw on the special tool. A sharp pull will seat the valve correctly.

The valves may be tested for air-tightness by rotating the wheel until the valve is at the top and inserting the end of the valve in a small container of water. If bubbles appear the seating is faulty and the valve interior should be replaced with a new one. Valve caps, in addition to preventing dirt entering the valve, form a secondary air seal and should always be fitted.

Section O.3

REMOVING A ROAD WHEEL

Remove the hub cover on a Standard model by inserting the flattened end of the wheelbrace into the recess between the cover and the road wheel adjacent to the retaining lobes. Employ a twisting motion to the wheelbrace and not a levering movement.

On De-luxe models lever the cover away from the wheel with the blade of a screwdriver inserted between the lip of the cover and the wheel. Work carefully round the outer circumference until the cover is free. To refit the

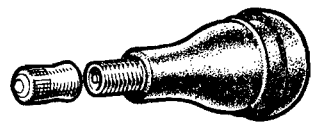


Fig. O.3

Valve for a tubeless tyre

cover place it on the wheel centre with the slot having the additional radius over the valve. Centralize the cover and give a sharp blow with the fist to force the cover retainers into the recess on the wheel.

On later De-luxe models the cover is removed with the flattened end of the wheelbrace and using the tyre as a fulcrum at a point diametrically opposite the tyre valve.

Apply the hand brake, slacken the four nuts securing the road wheel to the hub, and raise the car with the jack. Remove the nuts and take off the wheel. If wheel-changing is being undertaken on a hill it is advisable to scotch both front and rear wheels on the opposite side to prevent any possible movement when the car is on the jack and the wheel removed.

When refitting ensure that the wheel nuts are replaced with their chamfer against the wheel and are tightened in the order 1, 3, 4, 2 in rotation. Do not overtighten; the correct torque figure of 450 to 475 lb. in. (5·02 to 5·5 kg. m.) must not be exceeded.

Section O.4

TYRE REMOVAL

Remove the valve interior to completely deflate the tyre.

Using spoon-shaped tyre levers, which must be in good condition, separate the beads from the rim flange in the manner shown in Fig. O.4 until both beads are in the base of the rim. As inextensible wires are incorporated

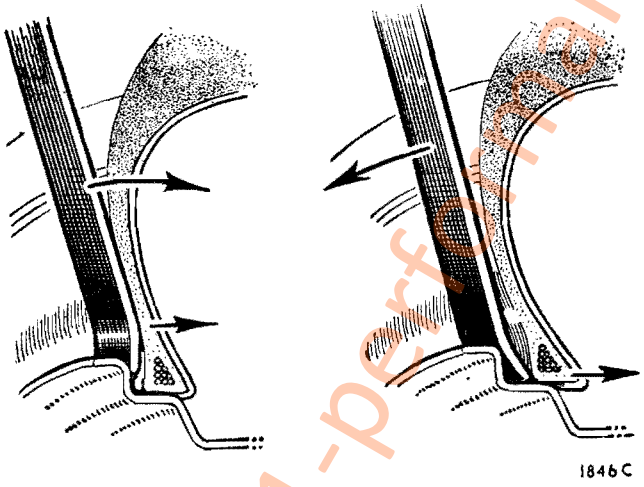


Fig. O.4

The tyres have wired edges and no attempt must be made to stretch them. If the cover fits tightly on the rim seating it should be freed by using the tyre levers as indicated

1. Insert lever between bead and rim, with curved end against tyre. Press lever towards tyre.
2. Insert second lever in space between lever and rim, with curved end outwards, and pull lever away from tyre. Repeat at intervals round tyre until bead is free. Several circuits of tyre may be necessary.

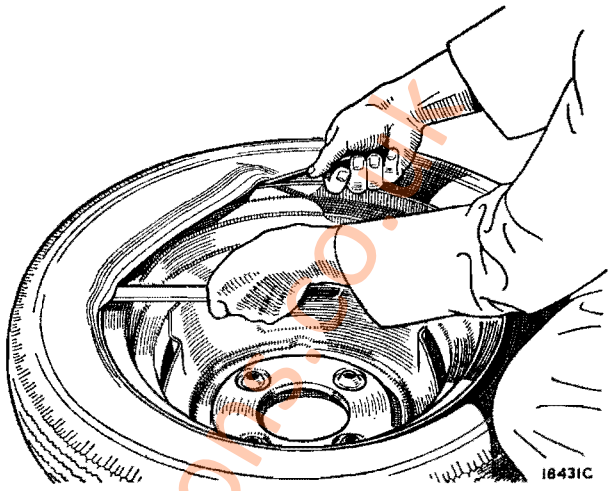


Fig. O.5

Lever the cover over the rim, using tyre levers in good condition to avoid damaging the sealing edge of the tyre

in the edges of the tyres, no attempt should be made to stretch the edges over the rim as the beads must **IN NO WAY BE DAMAGED.**

Owing to the construction of the wheel the tyres must be removed over the inner rim of the wheel only. **Tyres cannot be removed or refitted over the outer rim.**

Push both cover edges into the well-base of the wheel and lubricate the tyre beads and the fitting levers with Dunlop Tyre Bead Lubricant or a thin vegetable oil soap solution. Commence at a point diametrically opposite and lever the cover edge over the inner rim of the wheel using two levers at intervals of 6 in. (15 cm.) apart. Continue working round the wheel until the cover on one side is completely free.

Take small bites when lifting the beads over the rim flanges.

Section O.5

TYRE FITTING

The tubeless tyre relies primarily on a good air seal between the tyre bead and the rim, and also between the rim and the valve. Great care is therefore necessary to avoid the slightest damage to the tyre bead. As the narrow bead seat is on the inside of the wheel the tyre must be mounted over the inner rim flange. The following instructions are of great importance.

Rim preparation

(1) Remove any visible dents in the flange by careful hammering.

(2) Clean the flange and rim seat with steel wool, emery, or other cleaning medium and remove all foreign matter, rust, rubber, etc. Paint need not be removed but irregularities in the surface should be

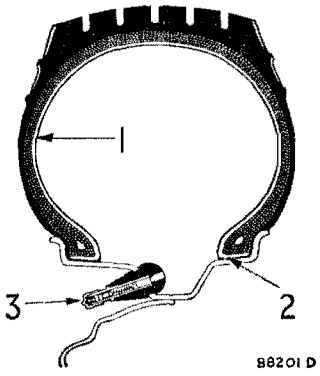


Fig. O.6

A section through a tubeless tyre

1. Air-retaining liner. 2. Rubber air seal.
3. Rubber-sealed valve.

smoothed out. In extreme cases of rusting it may be necessary to use a wire brush or a file.

(3) File or buff away any high-spot at the butt-weld joint.

(4) Wipe the flange and bead seat with a water-moistened cloth.

Before fitting moisten the beads of the tyre, the rim flange, and the tyre levers with Dunlop Tyre Bead Lubricant or a thin vegetable oil soap solution; **do not use fuel.** Mount the tyre on the inner rim and push one edge of the cover over the edge of the rim; continue working round the tyre towards the valve position. The portion of the tyre first fitted should be kept pushed into the well-base of the wheel rim and then no difficulty will be encountered in fitting the last portion of the cover. Do not forget that the white or coloured balance spot on the tyre must be in line with the valve position.

Before inflation bounce the crown of the tyre on the ground at various points to snap home the beads of the tyre against the rim of the wheel and provide a partial seal.

With the wheel in an upright position inflate the tyre. If a seal cannot be obtained at the first rush of air bounce the tyre again with the air-line attached. In cases of difficulty apply a tourniquet of strong cord around the circumference of the tyre and tighten. When a seal is obtained inflate until the beads are completely forced against both rim flanges. Remove the air-line, insert the valve interior, and inflate to 50 lb./sq. in. (3·52 kg./cm.²) for testing.

Allow the tyre to stand for a few minutes so that any free air trapped between the flange and the bead clinch can escape. Test the complete assembly in a water tank, paying special attention to the areas at the beads, valve, and wheel rivets.

Sealing leaks located during testing

Loss of air may occur at any or all of the following points:

(1) The area of the bead seat, showing as a leak at the top of the flange. This is usually due to a high-spot on the rim and can usually be cured by holding the bead away from the rim to allow further cleaning.

(2) The wheel rivets. In this case, and in extreme cases of leakage in the area of the bead seat (paragraph 1), it is necessary to remove the tyre. Before doing so mark the position of the leak on the tyre and rim.

Loss of air at the rivets can be cured by peening over the rivet heads.

(3) The base of the valve or the valve interior. Provided the valve is correctly fitted, this may be due to dirt under the valve seat. Clean the valve seat and fit a new valve interior.

Inflate the tyre to the correct pressure before fitting the wheel assembly to the vehicle and driving.

Section O.6

REPAIRING TYRES

Penetrations

Normally a tubeless tyre will not leak as the result of penetration by a nail or other puncturing object, provided that it is left in the tyre. It is necessary to examine the tyres after every 2,000 miles (3200 km.) and to withdraw such objects at a time when loss of air pressure will cause least inconvenience.

Use of plugging kit—location and preparation

If a hole fails to seal mark the spot and extract the puncturing object, taking note of the direction of penetration. If the tyre is leaking and the puncturing object cannot be located by sight it is necessary to immerse the inflated tyre in water.

Dip the plugging kit needle into the flask of solution and insert it into the hole in the tyre, following the same direction as the penetration.

Repeat the operation until the hole is well lubricated with solution.

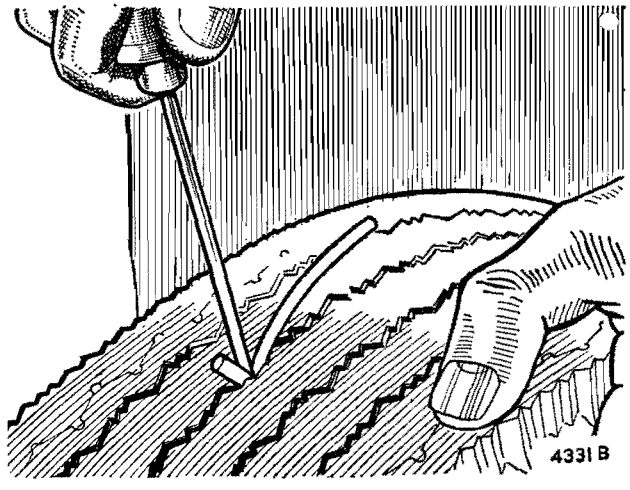


Fig. O.7

Inserting the plug and needle through a hole in the tyre

Repair

Select a plug about twice the diameter of the puncturing object, stretch it, and roll it into the eye of the needle $\frac{1}{4}$ in. (6·35 mm.) from the end. After dipping the plug into the solution insert the needle into the hole and push the plug through the tyre (Fig. O.7).

Withdraw the needle and cut off surplus plug about $\frac{1}{8}$ in. (3·18 mm.) from the surface of the tread (Fig. O.8). The tyre can now be inflated and used immediately. More severe injuries which are outside the scope of simple puncture repair methods are dealt with in nearly the same way as similar injuries to conventional covers.

If the tyre deflates on the road following an unusually large penetration a tube can be fitted to enable the owner to remain on the road until it is convenient for the necessary repairs to be carried out. (The valve used for the tubeless tyre must be removed before the fitting of the tube.)

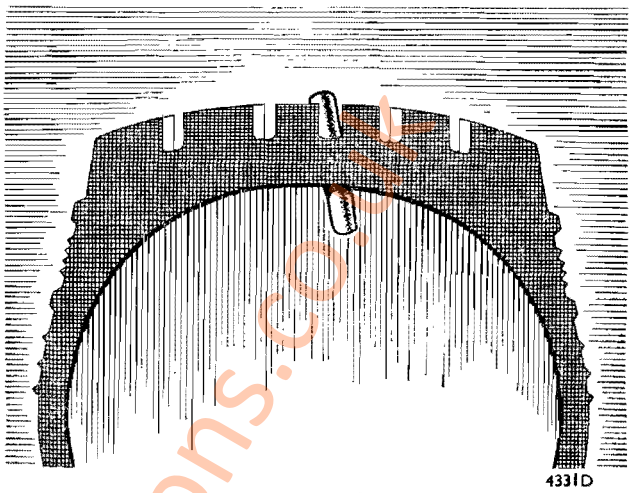


Fig. O.8

The plug inserted in the tyre and cut off to the correct length

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 parentheses throughout the Manual refer to the appropriate section of the recommended lubricants table given on page P.2.

Section P.1

The following is a list of lubricants recommended:

A ENGINE AND TRANSMISSION

Climatic conditions	Duckham's	Castrol	Esso	Mobil	Shell	BP Energol	Filtrate	Sternol
Tropical and temperate down to 32° F. (0° C.)	Duckham's NOL Thirty	Castrol X.L.	Esso Extra Motor Oil 20W/30	Mobiloil A	Shell X—100 30	Energol S.A.E. 30	Medium Filtrate 30	Sternol W.W. 30
Extreme cold down to 10° F. (−12° C.)	Duckham's NOL Twenty	Castrolite	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
Arctic consistently below 10° F. (−12° C.)	Duckham's NOL Ten	Castrol Z	Esso Motor Oil 10	Mobiloil 10W	Shell X—100 10W	Energol S.A.E. 10W	Sub-Zero Filtrate 10W	Sternol W.W. 10

B STEERING GEAR AND WATER PUMP

All conditions	Duckham's NOL E.P. 140	Castrol Hi-Press	Esso Expee Compound 140	Mobilube G.X. 140	Shell Spirax 140 E.P.	Energol E.P. S.A.E. 140	E.P. Filtrate Gear 140	Ambroleum E.P. 140

C WHEEL HUBS AND LUBRICATION NIPPLES

Wheel hubs, hand brake cable guides, and lubricating nipples	Duckham's L.B. 10 Grease	Castrolease L.M.	Esso Multi-purpose Grease H	Mobilgrease M.P.	Shell Retinax A	Energrease L. 2	Super Lithium Filtrate Grease	Ambroline L.H.T.

D UTILITY LUBRICANT, S.U. CARBURETTER DAMPER, OILCAN POINTS, ETC.

All conditions	Duckham's NOL Twenty	Castrolite	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

E UPPER CYLINDER LUBRICANT

All conditions	Duckham's Adcoid Liquid	Castrollo	Esso Upper Cylinder Lubricant	Mobil Upperlube	Shell Upper Cylinder Lubricant	Energol U.C.L.	Filtrate Petroyle	Sternol Magikoyl

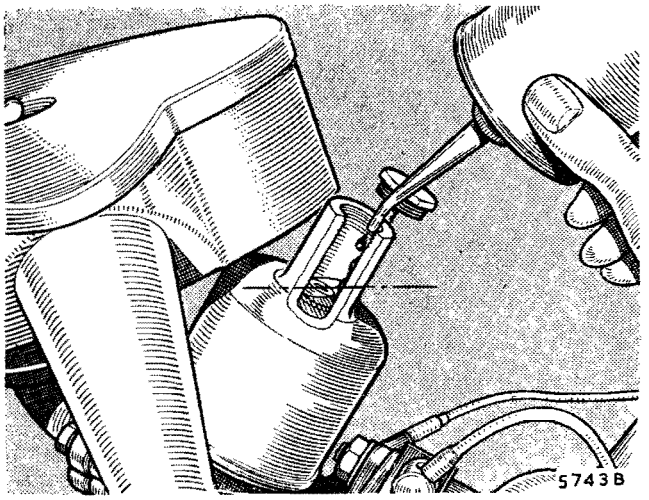


Fig. P.1

Use thin engine oil to lubricate the carburetter piston damper. Maintain the oil level at the top of the hollow piston rod

Section P.2

DAILY SERVICE

ENGINE AND TRANSMISSION CASING (A)

Inspect the oil level in the transmission casing, and refill if necessary to the 'FULL' mark on the dipstick, using oil to Ref. A (page P.2). The oil filler cap is on the top of the engine valve rocker cover and is released by turning it anti-clockwise.

Section P.3

1,000 MILES (1600 Km.) SERVICE

Carry out the instructions detailed in Section P.2, and then continue with the following.

CARBURETTER DAMPER (D)

Unscrew the cap from the top of the suction chamber, pour in a small quantity of thin engine oil, and replace the cap. Under no circumstances should a heavy-bodied lubricant be used. Failure to lubricate the piston damper will cause the piston to flutter and reduce acceleration. Maintain the oil at the level indicated in Fig. P.1.

Oil to Ref. D (page P.2) should be used.

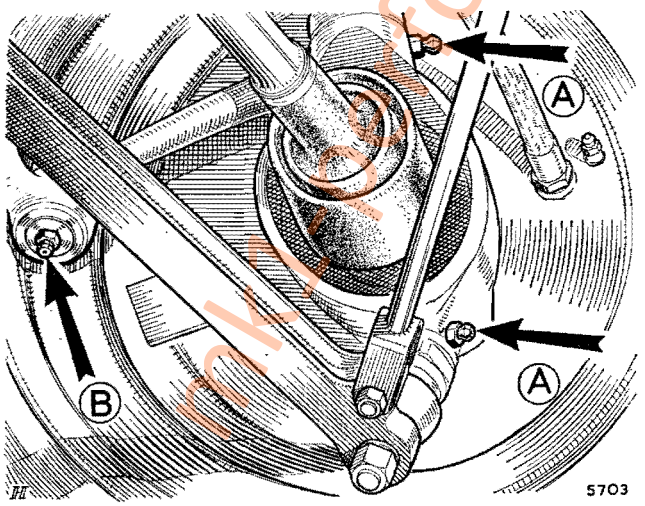


Fig. P.2

The swivel hub lubricating nipples

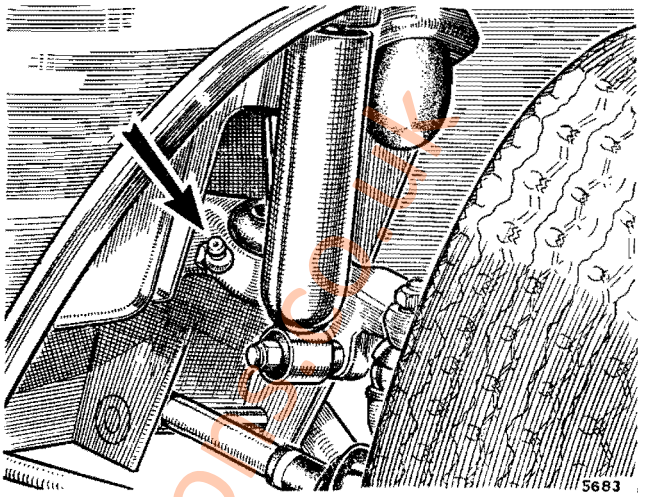


Fig. P.3

The upper suspension arm pivot lubricating nipple

CARBURETTER CONTROLS (D)

Using oil to Ref. D (page P.2), lubricate lightly all carburetter linkages.

GREASING POINTS (C)

Lubricating nipples are located at the following points; a grease gun filled with grease to Ref. C (page P.2) should be applied to the nipples and given three or four strokes.

(1) Upper and lower steering swivel knuckles (two each side). Jack up the front of the vehicle to take the load off the swivel knuckles and make certain that the lubricating nipples are clean and are not

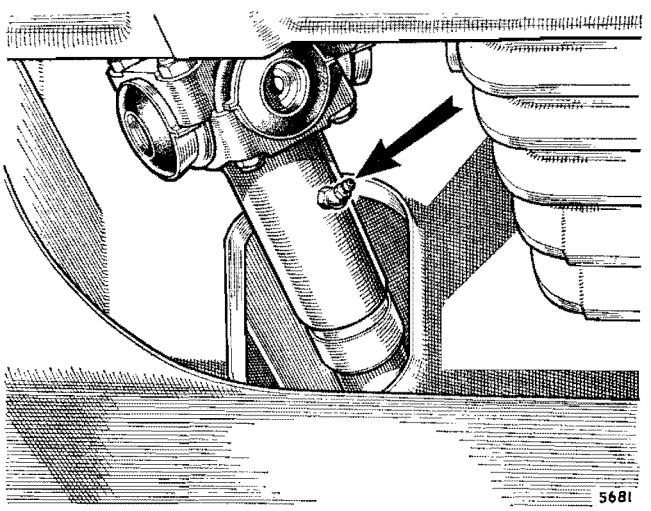


Fig. P.4

One of the two drive shaft sliding joint lubricating nipples (fitted to early models only)

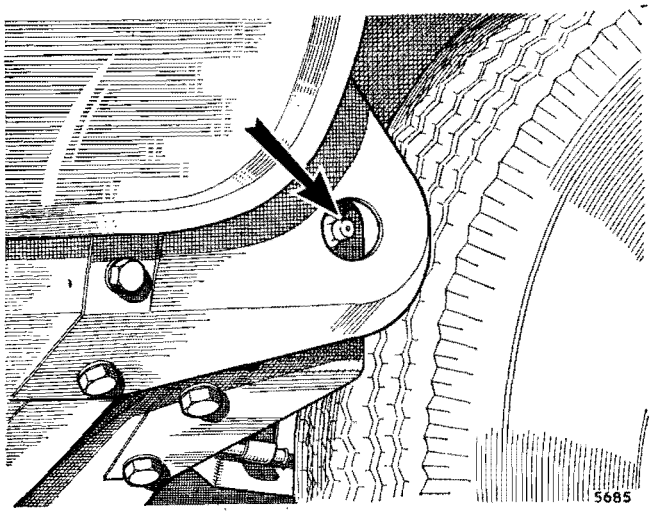


Fig. P.5

The rear radius arm lubricating nipple

blocked with road dirt. If the knuckles are already filled with grease no further grease can usually be forced in.

(2) Swivel hub upper support arm pivot (one nipple each side).

(3) Steering tie-rods (one nipple on each shaft).

(4) Drive shaft sliding joint (one nipple on each shaft) (fitted to early models only).

(5) Rear radius arm (one nipple on each arm). The grease gun must be applied to the nipple on the rear radius arm and remain there until the grease exudes from the inner bush.

In addition to the above greasing points the hand brake cable guide channels on the rear sub-frame and the guide tube (sector on later models) on the rear radius arm should also receive a liberal application of grease. The cables should be slackened at the lever trunnion to ensure that the greasing is made as effective as possible.

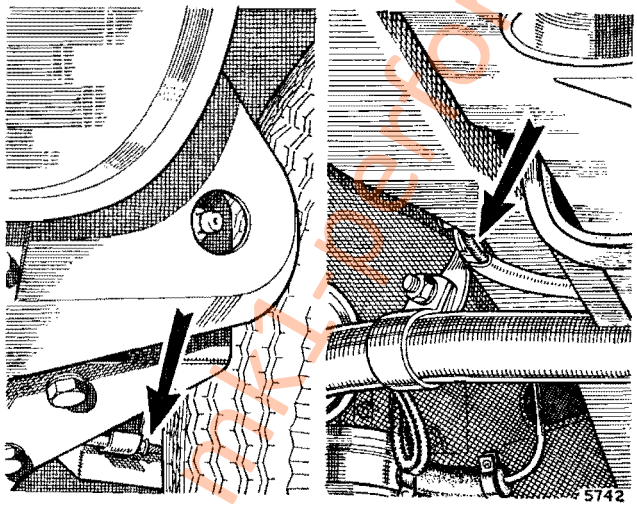


Fig. P.6

The hand brake cable guide tube (fitted to early models only) and channels on the radius arm and rear sub-frame must be lubricated

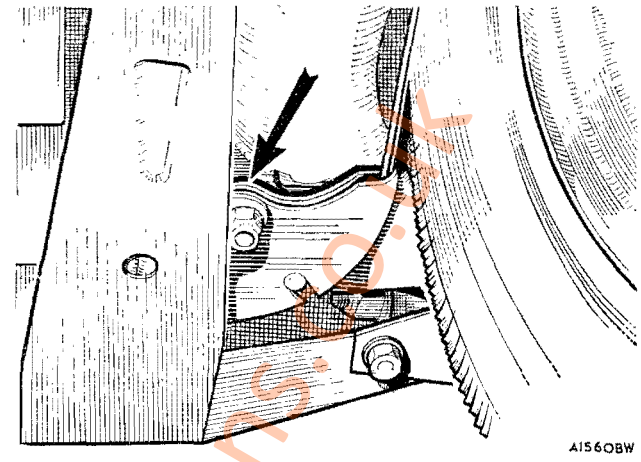


Fig. P.7

The hand brake cable sector fitted to the radius arm on later models. Lubricate with oil at the point indicated

The cable sector pivot on the radius arm of later models (Fig. P.7) must be lubricated with oil to Ref. D. Readjust the cables as detailed in Section M.3.

Section P.4

3,000 MILES (4800 Km.) SERVICE

Carry out the instructions detailed in Section P.3 where applicable, and continue with the following.

ENGINE AND TRANSMISSION CASING OIL CHANGE (A)

Drain the oil from the transmission casing. The sump plug should be removed after a journey when the oil is still warm and will drain easily. Thoroughly clean the drain plug before it is refitted.

Refill the transmission casing with oil to Ref. A (page P.2).

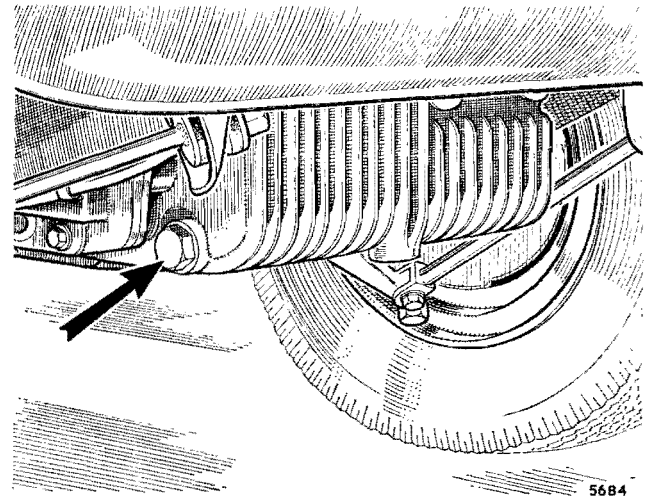


Fig. P.8

The transmission casing drain plug

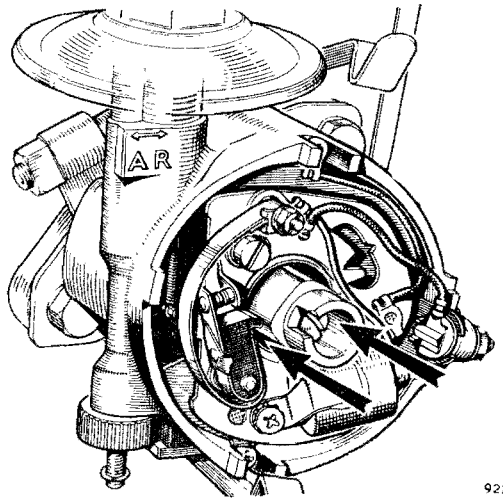


Fig. P.9

The distributor cam bearing and automatic advance control lubricating points

MISCELLANEOUS ITEMS

Lubricate the door hinges, door locks, bonnet lock, safety catch, and operating mechanism.

Section P.5

6,000 MILES (9600 Km.) SERVICE

Carry out the instructions in Sections P.3 and P.4 where applicable 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 to Ref. D (page P.2) to the cam bearing. Do not remove the screw which is exposed when the rotor arm is removed. There is a clearance between the screw and the inner face of the spindle for the oil to pass.

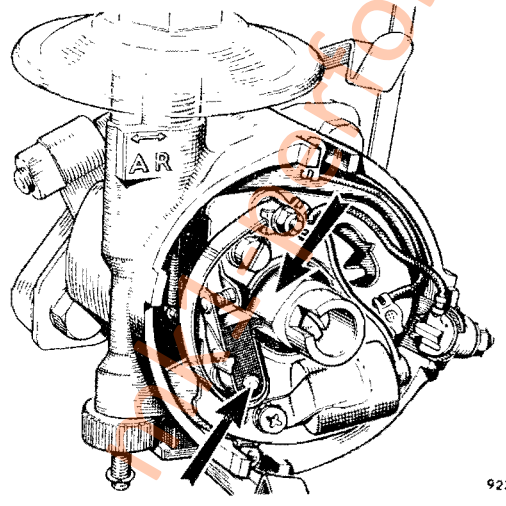


Fig. P.10

The distributor cam spindle and contact breaker lubricating points

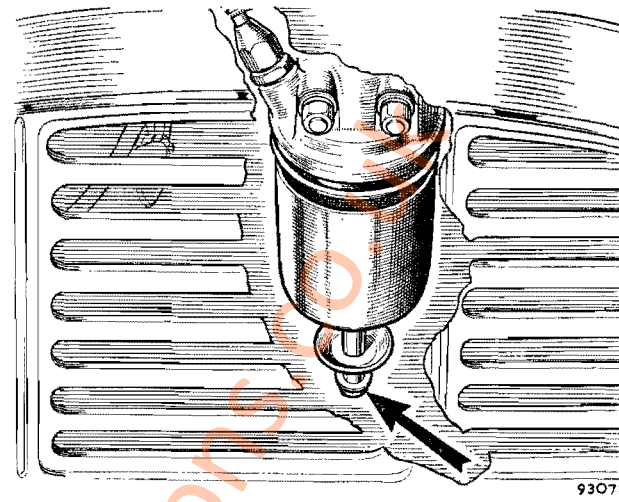


Fig. P.11

The oil filter bowl retaining bolt

Replace the rotor with its drive lug correctly engaging the spindle slot and push it onto the shaft as far as it will go.

Cam (C)

Lightly smear the cam with a very small amount of grease to Ref. C (page P.2), 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 to Ref. D (page P.2) 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 to Ref. D (page P.2) to the moving contact pivot pin.

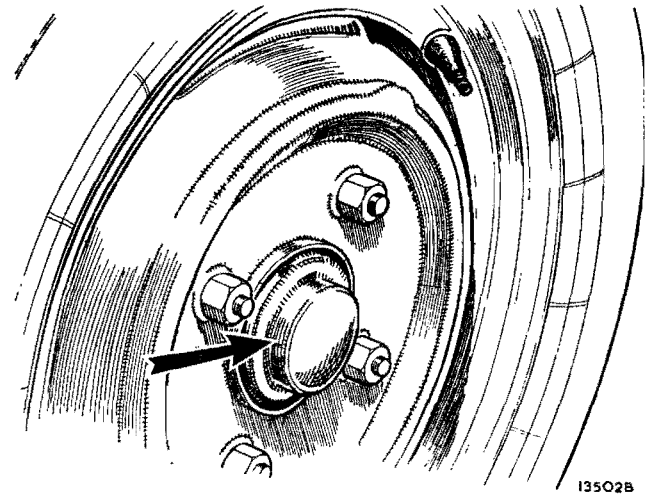


Fig. P.12

A rear wheel hub grease-retaining cap. Prise off the cap and repack with grease

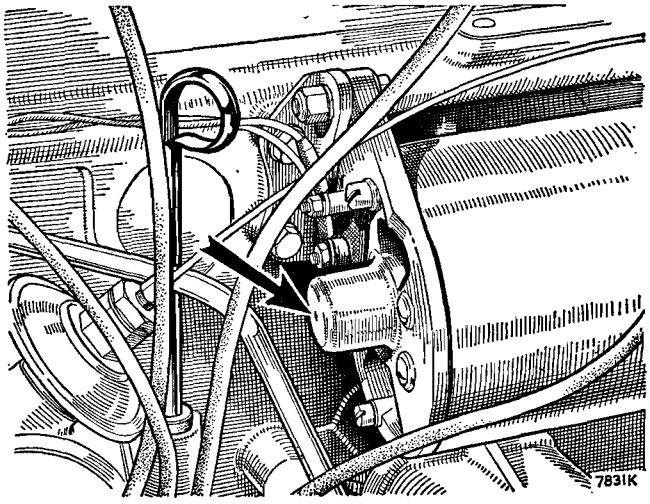


Fig. P.13
The dynamo end bearing lubricating aperture

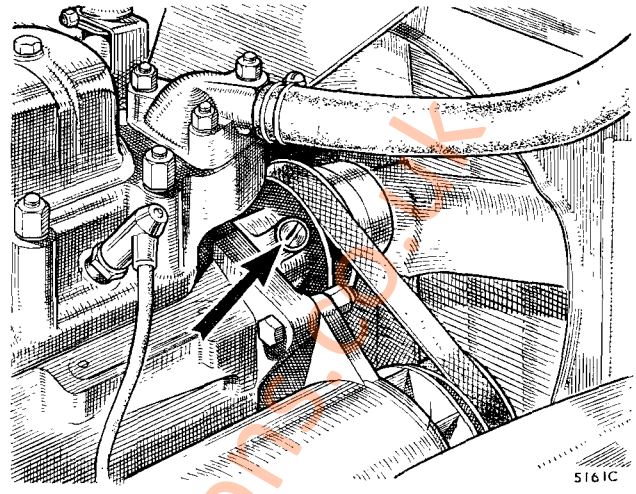


Fig. P.14
The water pump lubricating aperture; remove the screw indicated and lubricate sparingly

ENGINE OIL FILTER

Unscrew the central bolt to release the oil filter bowl, withdraw the element, wash the bowl in fuel and fit a new element. Care must be taken to see that the washer below the element inside the bowl is refitted 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 a snug fit on the centre-securing bolt.

Make certain that the seating washer for the filter bowl is in good condition and that the bowl is fitted securely to prevent oil leaks.

WATER PUMP (B)

Remove the oiling plug on the water pump casing and add a small quantity of S.A.E. 140 oil. Lubrication 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.

REAR WHEEL HUBS (C)

Remove the wheel discs and prise off the grease-retaining cap from the end of each hub. Fill the cap with grease to Ref. C (page P.2) and refit.

Section P.6

12,000 MILES (19200 Km.) SERVICE

Carry out the instructions detailed in Sections P.3, P.4, and P.5 where applicable and continue with the following.

DYNAMO (D)

Add two drops of engine oil to Ref. D (page P.2) in the lubrication hole in the centre of the rear end bearing plate.

Do not over-oil.

SPEEDOMETER DRIVE

Disconnect the cable from the speedometer end and pull the inner member out of the casing. This should be lubricated sparingly by smearing it with light grease. It is important that the drive is **not** overlubricated, otherwise damage will be caused to the speedometer should the lubricant find its way into the head. Wipe the surface grease from the top 8 in. (20 cm.) of the inner cable.

To reassemble, thread the cable with a twisting movement into the casing, since this will help the cable to engage easily with its union at the gearbox end. When this engagement is felt the cable can be pushed home so that the square end stands out approximately $\frac{3}{8}$ in. (9·53 mm.) from the casing.

SECTION R

THE BODY

Section R.1

REPAIR PROCEDURE

Body jack

The specially designed body jack, obtainable under Part No. 18G308B, is an essential item when rectifying any misalignment of the body construction. The jack is provided with a ratchet turnscrew, and the pitch of the centre spindle thread is such that considerable force (either pulling or pushing) can be exerted. The extension pieces are made from solid drawn steel tubes and their lengths are such that the effective length of the jack can be made to vary between 21 and 94 in. (533 and 2388 mm.).

When using the jack care must be taken to use it in the correct positions to rectify the fault or misalignment. Reference should be made to pages R.12 and R.13 for details of the necessary alignment checks.

With the addition of a suitable oxy-acetylene outfit (Section R.3) any type of mono-construction repair can be effected. The initial outlay need only be small, and, considering the wide range of operations covered, there should be no hesitation in deciding that the kit must figure as part of the equipment of your repair shop.

Rectification of buckled panels or underframe

Experience will prove that parts of the body which at first sight would be considered beyond repair can be rectified easily by the use of the body jack.

It is of paramount importance to return the damaged portion of the body to its original position before deciding whether replacement panels are necessary or not.

With the use of the special jack this method enables a buckled or damaged structure to be returned to its original relative position without straining the surrounding metal, which would be the inevitable result if the damaged portion were pounded by means of a hammer.

Fig. R.1

Removing a dent by tapping with a spoon; a dolly is held below the dent

Fig. R.2

A dolly block and mallet

At this stage a decision can be reached as to whether any damaged panel is to be repaired or renewed.

Spoon for removal of small dents

To remove small dents a spoon which is made from a coarse-cut file, specially shaped and having the teeth intact, is used in conjunction with a suitably shaped dolly block (Fig. R.1).

The use of a hammer to remove small dents is to be deprecated, as hammer-blows tend to stretch the surrounding metal, giving rise to further complications. It is for this reason that the spoon is recommended, as by its use a depression can be raised to its original level without stretching.

On panel work such as doors, or where inside reinforcements prevent the use of a dolly block, a hole can be punched or drilled through the inside panel and a suitable drift pin, about ½ in. (13 mm.) in diameter, used in conjunction with the spoon in place of the dolly block.

Sharper dents or a dent or collection of dents covering a large area will require the use of heat, a dolly, and a spoon in the following manner.

With the welding torch heat a small area at the outside of the collection of dents, then, holding the dolly below, hammer the raised portion with a wooden mallet. When the metal cools remove the dolly and place a large handful of wet asbestos over the heated area to prevent the heat spreading. Continue to heat and tap, working from the outside of the damaged area, until something like the original contour and level is attained.

Lightly file the surface to show up the high-spots and remove these with the dolly and spoon without further heating.

Take care when using the file not to thin the metal more than is necessary to show up the high-spots.

Alternative checking by filing and raising with the dolly block and spoon will eventually produce a flat and clean surface without weakening the metal unduly, provided excessive filing is avoided. Care should be

Fig. R.3
Heating the damaged area before tapping with a mallet

exercised to reduce filing to a minimum as otherwise the thickness of the panel will be seriously reduced.

On completion, the surface may be tinned and any small indentations filled with plumber's solder.

Preservation of paintwork

A special spoon, having the teeth removed and its surface planished and polished, is required to enable small dents to be removed without damage to paintwork. Where it is possible to preserve paintwork when rectifying comparatively large dents a sandbag should be placed against the painted surface of the panel and the dent removed from the under side by the use of a wooden mallet. A suitable sandbag for this operation may be made from a leather oval bag 8 in. (203 mm.) long, 6 in. (152 mm.) wide, and 4 in. (102 mm.) thick which is packed tightly with sand.

Stretched panels

Stretched panels which are liable to cause drumming can be rectified by local shrinking. A liberal heap of wet asbestos is placed over the stretched panel at the point of greatest resiliency, and a hole just large enough to apply

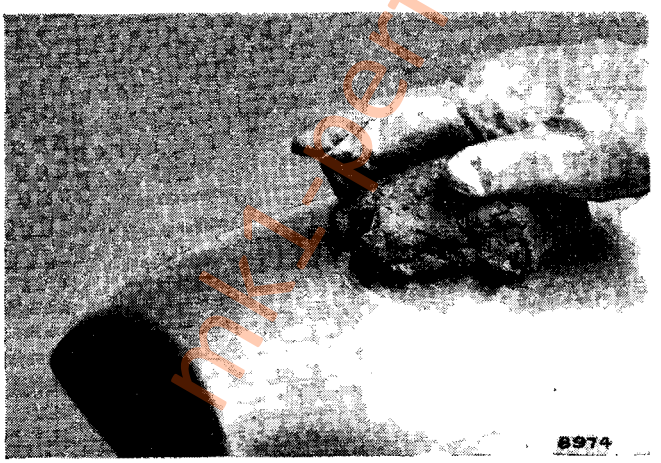


Fig. R.4
Cooling the damaged area with wet asbestos

Fig. R.5
Piercing holes in the wet asbestos prior to heating

the flame of the oxy-acetylene torch is made with a finger through the centre of the asbestos. The portion of the panel which is visible is heated to a cherry-red colour and is afterwards cooled off by the wet asbestos which surrounds it. For large panels it may be necessary to repeat this operation several times at different locations over the area.

Where a panel is stretched over a fairly extensive area and produces what is known as an 'oilcan' effect the following shrinking method should be used to restore the original contour.

Mix a quantity of wet asbestos sufficient to cover the damaged area with a thickness as shown in Fig. R.5. Press the asbestos down firmly to ensure that no air is

Fig. R.6
Heating a stretched panel through holes in the asbestos

trapped below, as it is important to confine the applied heat to the points of application.

With a finger pierce a series of holes in the asbestos extending to the surface of the metal. Direct the flame of the welding torch to one of the holes near the perimeter of the asbestos and heat the metal to cherry red, remove the torch, and immediately press the surrounding asbestos into the hole (Fig. R.6).

Carry out the same procedure with the remaining holes, working around the asbestos and inwards towards the centre. When the asbestos is removed the surface is cleaned up in the usual manner.

Patching

It is frequently more economical to patch an extensively damaged panel than to renew the entire assembly. This type of repair does not in the least weaken the surrounding structure, as a patch which is correctly

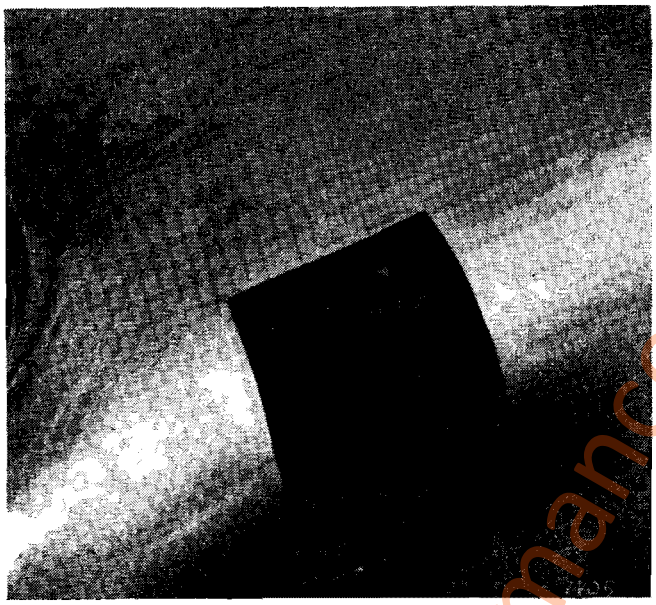


Fig. R.7
A damaged panel with piece removed for patching

gas-welded in position is equal in strength to the original structure. A patch can be introduced so efficiently that it is impossible to trace its presence.

The damaged portion of the panel should be cut out with a cold chisel or, if possible, by means of a hacksaw. The edges of the opening should then be filed until an even contour is obtained (Fig. R.7).

The patch to be fitted should preferably be cut from sheet metal of similar gauge and specification to that being repaired. First, it is rough-shaped to the contour of the panel, after which it is fitted to the opening to allow a clearance on all sides equal to the gauge of the metal.

In all probability, particularly during welding operations, difficulty will be experienced in holding the patch in place. This can be overcome satisfactorily by welding one or two short pieces of welding wire to act as convenient handles.

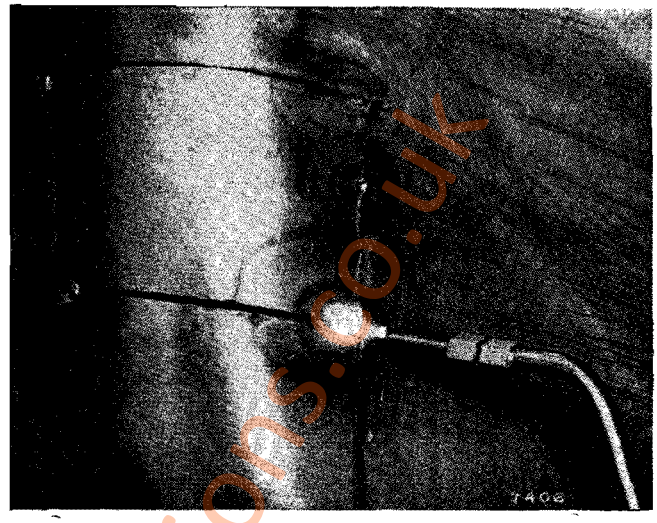


Fig. R.8
The formed patch held in position by gas-weld tacks

The patch is now fastened at intervals of 2 to 3 in. (51 to 76 mm.) to the panel by means of gas-weld tacks (Fig. R.8). During the tacking operation it should be reshaped to the panel to ensure that the contour is correct.

To prevent expansion and possible buckling of the surrounding panel during the welding operation a liberal quantity of wet asbestos must be placed on the panel round the patch, approximately ¼ in. (6 mm.) away from the joint (Fig. R.9). The joint is now gas-welded between the tacks, whilst precautions are taken to keep the patch to the correct contour by using a suitable dolly block and bumping hammer. On completion, any excrescences in the welding are removed by filing and,

Fig. R.9
Surround the joint with wet asbestos to prevent buckling during welding

after straightening with the dolly block and bumping hammer, the patching is finally finished by tinning and solder-filling as described on pages R.8 and R.9.

Patch forming

Where it is necessary to 'form' a patch from the flat sheet to any particular contour a wooden or lead raising block is generally employed. The raising block should have several elliptical depressions of varying depths and diameters.

The patch is placed over the selected depression and is raised by hammering with the ball-peen end of a hammer, starting from the outer edges and gradually working towards the centre. A mistake frequently made is to strike too hard whilst raising the centre, with the result that the curve is of greater depth than that required.

Repair of beadings and mouldings

Where difficulty is experienced in straightening or renewing a beading, moulding, or corner the original contour may be obtained by careful tinning and filling with plumber's solder. The finished work will be equal in appearance and equal in strength, whilst the substitution of soldering for straightening, or renewing, will save the necessity for removing inside trimmings, etc.

Filing

It should be clearly understood that in every case filing must be reduced to a minimum owing to the thinness of the material. Wrinkles or ridges should be removed by the spoon or dolly block, as explained on page R.2, and finished finally by tinning and solder-filling.

Replacing panels

In cases of extreme damage it will be found more economical to remove the damaged portions and replace them with new panels which are obtainable from B.M.C. Service Ltd.

Owing to the fact that damage is usually localized, it will only infrequently be found necessary to remove a complete panel or unit. In the great majority of cases the damaged portion can be removed and a corresponding part cut from a replacement unit and located in position by gas-welding.

Section R.2

WELDING METHODS

Spot-welds

This form of welding is used extensively throughout the assembly of the mono-construction body.

The units to be joined are pressed together between two copper electrodes through which an electric current of low voltage and high amperage is passed. The resistance of the steel to the electric current raises the metal to welding temperature and the pressure between the electrodes produces complete fusion. The resulting joint is as strong as the surrounding structure, and a correctly made spot-weld will not break or become loose by vibration.

Spot-welds cannot be broken satisfactorily by inserting a cold chisel or lever between the two panels. Each weld must be carefully drilled in the centre, using a drill approximately $\frac{3}{16}$ in. (4·76 mm.) in diameter. There is no necessity to drill through both panels as it is sufficient if the point of the drill merely penetrates the second panel. The weld is finally broken by inserting a thin, sharp, cold chisel between the joint and tapping it lightly with a hammer.

On panels where the spot-welds are covered by paint it is necessary to use a suitable paint remover to clean the paint from the joints. The spot-welds will easily be located by the discoloration of the metal. Reference to the body build-up illustrations will facilitate tracing the various joints.

Gas-welds

A gas-weld may be broken either by cutting with a hacksaw or, alternatively, with a sharp cold chisel. Place a suitable support at the back of the panel to act as an anvil whenever possible.

Lap-welds

Most lap-welds used in the mono-construction body are hidden from view by solder-filling. Reference should be made to the illustrations showing the build-up of the body in order to obtain the location of the various lap joints. This will enable the operator to direct the flame of the oxy-acetylene blowpipe onto the joint so that the solder filling can be melted and removed by the use of a duster. A lap-weld is broken by drilling out the spot-welds as previously explained.

Butt-welds

A butt-weld can be broken by the use of a hammer and chisel, the blows being directed against the panel which is to be renewed. If this method does not quickly break the weld heat applied from the oxy-acetylene torch will soften the fused edges, thus assisting the operation. Alternatively, the joint may be cut by a hacksaw.

Remaking welds

The special section of this Manual devoted to welding should be studied carefully before any attempt is made to re-weld a joint on the body by an operator who has not had the necessary experience in this class of work.

When a joint is remade it is necessary, prior to painting, to clean the surface of the weld. During this operation, as previously mentioned, care should be taken to see that the structure is not unnecessarily weakened by excessive grinding or filing. It is preferable to hammer the joint so that it lies slightly lower than the surrounding metal and to flow solder into the depression. No amount of filing on the surface of the solder can reduce the strength of the joint below (see Section R.4).

When placing a new panel in position it should be joined where possible by gas-welding through the holes drilled in breaking the original spot-welds. During the

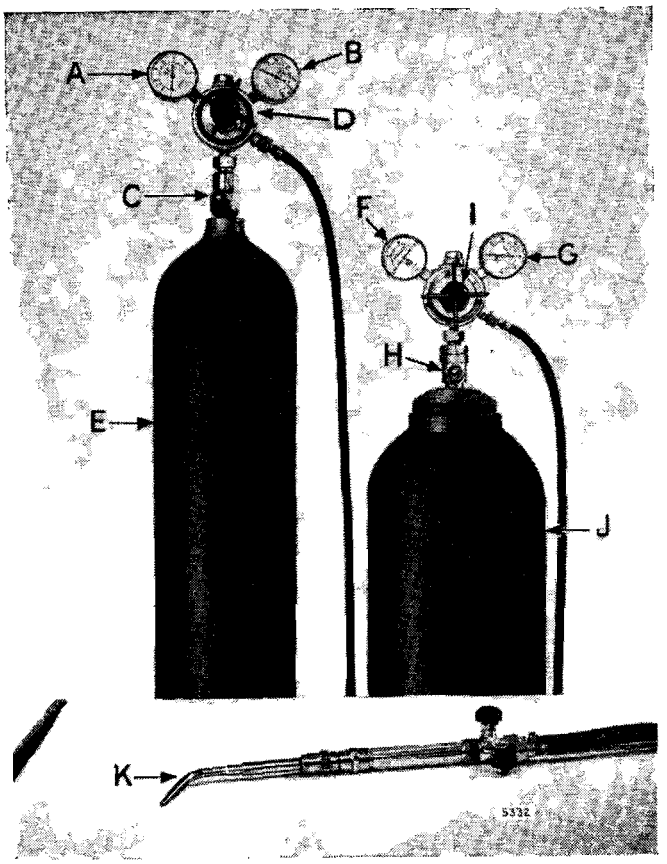


Fig. R.10

High-pressure oxy-acetylene welding outfit

A. Outlet pressure gauge (O).
B. Cylinder contents gauge (O).
C. Valve.
D. Pressure regulating screw.
E. Oxygen cylinder (BLACK).
F. Outlet pressure gauge (A).
G. Cylinder contents gauge (A).
H. Valve.
I. Pressure regulating screw.
J. Acetylene cylinder (MAROON).
K. Blowpipe interchangeable nozzles.

welding operations a liberal heap of wet asbestos should be placed over the surrounding panels to prevent buckling and distortion due to heat.

Section R.3

WELDING TECHNIQUE

The following apply to equipment supplied by the British Oxygen Co. Ltd., although they also apply, in the main, to other similar equipment.

Welding equipment

High-pressure oxy-acetylene welding equipment using dissolved acetylene is recommended. This consists of:

(1) Supply of acetylene in cylinders.
(2) Supply of oxygen in cylinders.
(3) Blowpipe with necessary nozzles.
(4) Acetylene pressure regulator.
(5) Oxygen pressure regulator.
(6) Two lengths of rubber-canvas hose.
(7) Set of spanners and spindle key.
(8) Welding goggles and spark lighter.
(9) Welding rods.
(10) Welding fluxes.
(11) Trolley for accommodating complete equipment and cylinders.

Assembly

(1) Stand both cylinders vertically on the ground or on a trolley. Oxygen cylinders are painted BLACK. Acetylene cylinders are painted MAROON. **Never** attempt to interfere with the colour of cylinders or to repaint them.
(2) See that jointing surfaces in cylinder valves and regulators are free from oil or grease.
(3) Open the valve on the oxygen cylinder momentarily in order to dislodge dirt or obstruction in the cylinder valve, then close.
(4) Screw the oxygen regulator (painted BLACK) into the oxygen cylinder valve. The oxygen cylinder valve outlet and oxygen regulator connection have **right-hand** screw threads.
(5) Screw the acetylene regulator (painted MAROON) into the acetylene cylinder valve. The acetylene cylinder valve outlet and acetylene regulator connection have **left-hand** screw threads.
(6) Tighten the regulator in the cylinder valve. Do not use excessive force, but make certain that the joints are gastight.
(7) Connect the hose (acetylene RED, oxygen BLACK) to the screwed outlets of the regulators by means of the screwed connections secured in the ends of the hose. Blow the hose through before attaching to the regulator or blowpipe in order to remove dust or dirt and to remove chalk when the hose is new.
(8) Connect the other end of the hose, that fitted with a hose protector, to the blowpipe—the acetylene

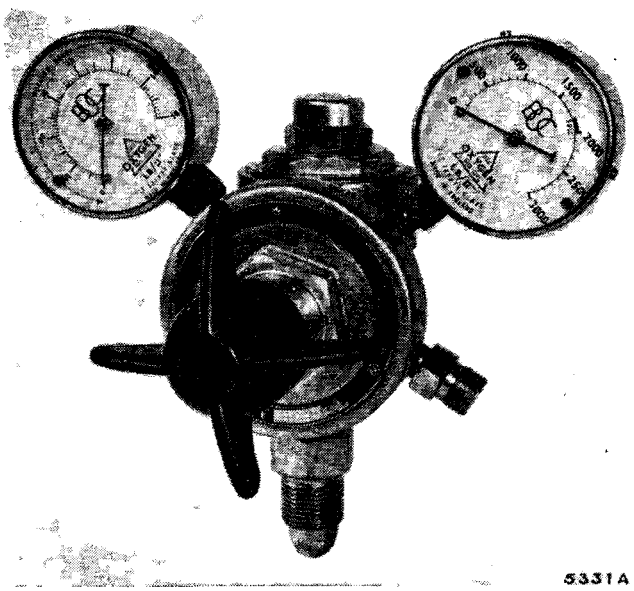


Fig. R.11

Type B.O.R.12A two-stage oxygen regulator

WELDING

HIGH-PRESSURE BLOWPIPES

Nozzle Sizes, Working Pressures, and Gas Consumptions for Various Metal Thicknesses

M.S. plate thickness		*Nozzle size*	*Regulator pressures, oxygen and acetylene Saffire equipment*		*Approximate consumption of each gas*	
in.	*mm. (approx.)*		*lb./sq. in.*	*kg./cm.²*	*cu. ft./hr.*	*m.³/hr.*
1/32	·8	1	2	·14	1	·028
3/64	1·2	2	2	·14	2	·056
1/16	1·6	3	2	·14	3	·084
3/32	2·4	5	2	·14	5	·140
1/8	3·2	7	2	·14	7	·196
5/32	4·0	10	3	·21	10	·283
3/16	4·8	13	3	·21	13	·367
1/4	6·4	18	3	·21	18	·504
5/16	8·0	25	4	·28	25	·700

hose to the connection marked 'A', the oxygen to the connection marked 'O'. Keep the blowpipe control valves closed. (A high- or low-pressure blowpipe can be used with the dissolved acetylene. If a low-pressure blowpipe is used the acetylene pressure should never exceed 2 lb./sq. in. [·14 kg./cm.²].)

(9) Fix the appropriate nozzle to the blowpipe. (See the table above.)

(10) Open the cylinder valves very slowly by means of the cylinder key. Do not open suddenly, or there may be serious damage to the regulator and the possibility of an accident. Open the cylinder valve spindle one turn only.

Fig. R.12

Type B.A.R.9 two-stage acetylene regulator

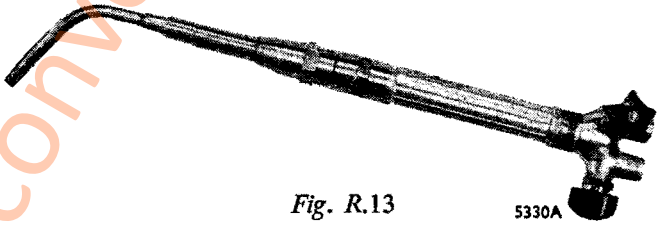


Fig. R.13

The welding blowpipe

(11) Set the regulators at the correct working pressures. (See the table.)

(12) Open the acetylene control valve on the blowpipe, wait a few seconds until air is blown out and pure acetylene is coming from the blowpipe nozzle, then light, preferably by means of a spark lighter, type S.L.1.

(13) Reduce or increase the acetylene supply by the blowpipe valve until the flame just ceases to smoke.

(14) Turn on the oxygen by the blowpipe control valve until the white inner cone in the flame is sharply defined, with the merest trace of an acetylene haze.

The blowpipe is now adjusted for welding steel, and work may be commenced.

The size of nozzle given for a particular thickness of steel is for general guidance only and will vary according to the skill of the welder, mass of metal, etc. The capacity of each nozzle overlaps the capacities of those next in size to it. The values given are for downhand butt-welds in mild steel. For other techniques nozzle size and pressure may have to be varied slightly, e.g. for copper select a larger nozzle, for aluminium a smaller nozzle.

On thin-gauge steel up to and including 1/16 in. (1·59 mm.) thickness tacks should be slightly closer together—say, 1 to 1½ in. (25 to 38 mm.) apart—to keep the edges in alignment and minimize distortion.

For the same reason patches should, wherever possible, be oval or circular. Before welding, these should be slightly 'dished' below the level of the surface to be

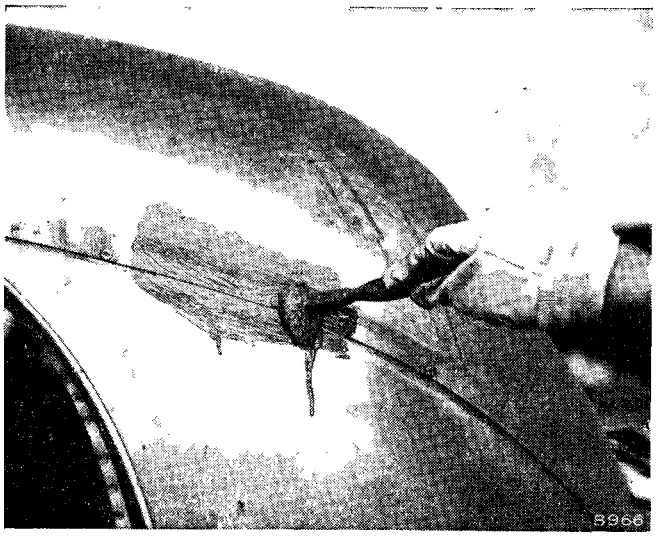


Fig. R.14
Painting the hollow area with flux

patched, since welding—even by the correct 'sequence'—will cause them to expand and rise.

Do not light the blowpipe until everything else has been prepared for welding in accordance with the instructions given above. On completion of the job proceed as follows:

(1) Turn off the acetylene first by the blowpipe control valve, and then the oxygen.
(2) Close the cylinder valves.
(3) Open the blowpipe valves one at a time to release the pressure in the hose—open the oxygen valve and shut it, open the acetylene valve and shut it.
(4) Unscrew the pressure regulating screws on the oxygen and acetylene regulators.
(5) In the case of backfire turn off the oxygen first.

Section R.4

TORCH-SOLDERING

Torch-soldering is the method employed to obtain the desired contour of a panel without weakening the structure and with the minimum amount of straightening, filing, and polishing.

Fig. R.15
Applying the solder

Fig. R.16
Tinning by heating the flux-painted area

The solder used is an alloy of lead and tin. Lead melts at a temperature of 621° F. (327° C.) and tin at 450° F. (232° C.). Alloys of the two metals change from a solid to a liquid state over this range of temperature within which they are in a plastic condition. The alloys used for torch-soldering are known as tinman's solder (which contains 60 per cent. lead and 40 per cent. tin) and plumber's solder (which contains 70 per cent. lead and 30 per cent. tin). Tinman's solder, as a result of its higher tin content, alloys more readily with the surface of the sheet steel and is applied as a 'base' to which the plumber's solder adheres firmly. Plumber's solder remains plastic over a wide range of temperature (from 509 to 358° F. [265 to 181° C.]), and within this range can be moulded to any desired shape. For this reason it is used to obtain the required contours.

Where it is desired to build up a contour with solder the surface of the steel must first of all be cleaned thoroughly. Rust, scale, welding oxide, or any other impurity must be removed by means of a wire brush,

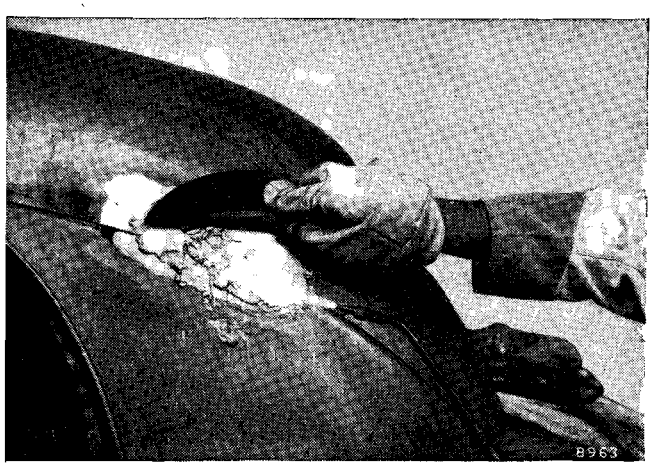


Fig. R.17
Spreading the solder

file, and emery-cloth. A polishing wheel, if available, is useful for this operation.

The surface of the metal is heated gently with a blow-lamp or gas-torch, and soldering flux applied with a brush (see Fig. R.14).

The flux will melt and act upon the heated surface so that when tinman's solder is applied and rubbed with a wad of hemp the metal will become evenly coated with a thin layer of solder, or 'tinned' (Fig. R.16). The secret of successful torch-soldering lies in the thoroughness with which the tinning operation is carried out as it is the foundation on which the plumber's solder is to be built up.

A second application of flux should be made and gently heated by means of the torch. When wiped by the wad of hemp the entire surface of the metal should have a spotlessly clean and bright appearance.

Plumber's solder is now melted onto the surface (Fig R.15) and maintained by careful use of the torch in the plastic condition whilst it is moulded to the desired contour with a hardwood paddle coated with palm oil (Fig. R.17). During the moulding operation frequent immersion of the paddle in palm oil assists in the manipulation of the solder. If palm oil is not available boiled linseed, lard, or machine oil will be found satisfactory.

The final contour is obtained by filing or, if available, by the use of a polishing wheel. If the work is carefully carried out it should be impossible to trace the presence of the filling.

Section R.5

WINDSHIELD GLASS

Removing

Lift the windshield wiper arms clear of the glass.

Prise up the end of the locking filler and carefully pull it from the channel in the surround rubber.

Press the glass from inside the car, commencing at a corner, and ease the surround rubber from the metal edge of the body aperture.

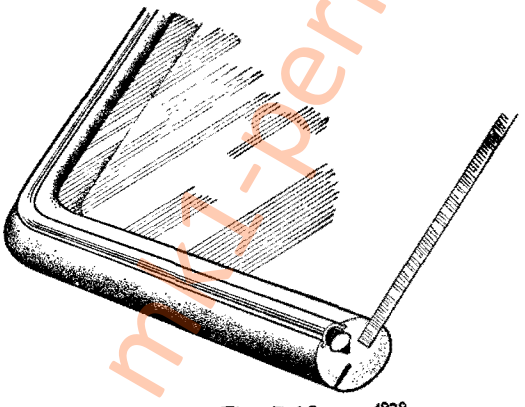


Fig. R.18

The section shows the outside finisher strip and rubber filler positioned in the seal and the seal pressed onto the glass

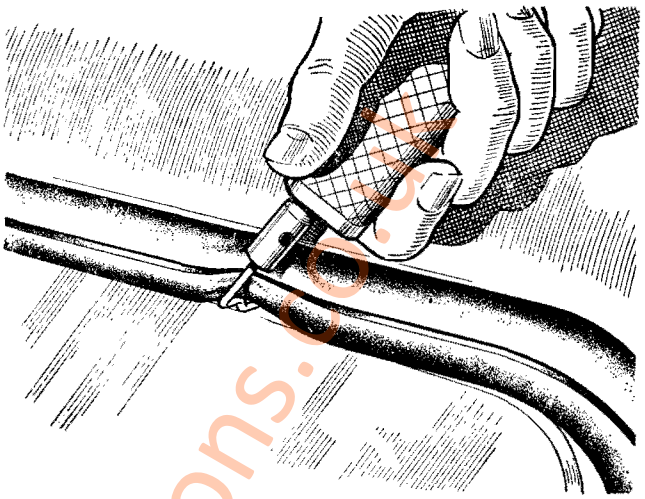


Fig. R.19

Use special tool 18G468 to ease the channel lip over the windshield glass

Refitting

If the glass has been broken, remove any pieces which remain in the channel. Examine the rubber, and use a new rubber should there be any signs of damage or deterioration.

Fit the surround rubber to the body aperture and lubricate the 'glass' channel with a soap and water solution. Place the windshield glass into the lower channel of the rubber surround and commence at the corner to lift the lip of the rubber over the glass, using special tool 18G468. Use the short peg on the handle of the installation tool for this purpose.

Apply soap-and-water solution to the locking filler strip channel to assist in fitting the strip.

Using the installation tool and eye, thread the locking filler strip through the handle and eye. Insert the tool into the filler strip channel, hold the end of the filler in position with the thumb, and commence to draw the tool along the channel, feeding the filler through the handle and eye into the channel. A slight agitating side-to-side

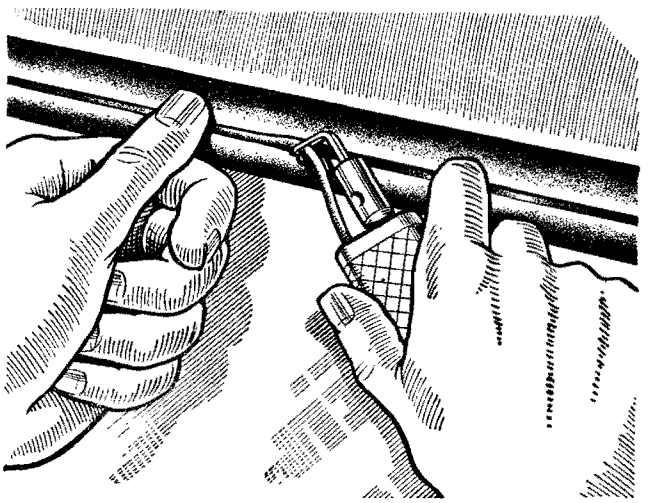


Fig. R.20

The use of the glazing tool and eye to thread the locking filler strip into the rubber channel

movement will assist in rounding the corners. After making the complete circuit, the tool is removed and the filler strip cut off, allowing an overlap so that, on forcing both ends in position, this results in the joint being under pressure.

NOTE.—In the event of windshield breakage, minute particles of glass fall into the windshield demister ducts and tubes. When the blower motor is switched on these particles are discharged into the driver's or passenger's face. The demister ducts and tubing must be disconnected from the heater box and blown out before the new windshield glass is fitted.

Section R.6

BACK-LIGHT GLASS

To remove and refit the back-light glass follow the instructions given in Section R.5.

Section R.7

DOOR GLASSES

To remove the sliding door glasses withdraw the self-tapping screws securing the bottom channel to the top of the door panel. With the screws removed both the sliding glasses and the channel can be lifted away.

Section R.8

QUARTER-LIGHT GLASSES

Removing

Support the glass on the outside with the palm of the hand and strike it sharply with the flat of the free hand at the top of the glass from the inside of the car. The glass and rubber will be displaced sufficiently at the top edge to allow removal.

Refitting

If the glass has been broken, remove any pieces that remain in the channel. Examine the surround rubber very carefully; use a new rubber should it show signs of damage or deterioration.

Fit the surround rubber to the glass and pass a piece of thin cord round the outer channel of the surround rubber, leaving the ends hanging down on the inside of the glass. Lubricate the body aperture flange with a soap-and-water solution, and offer the glass into position from the outside of the car. With the surround rubber pressed lightly against the aperture flange, a second operator must pull the cord from inside the car to draw the lip of the rubber channel over the flange.

Section R.9

DOOR LOCKS

Removing

Withdraw the three screws securing the lock to the inner door panel and the retaining screw from the end of the locking handle spindle.

In order to remove the door handle release the inner control operating lever by slackening the screw clamping the lever to the handle spindle. Both the handle and the escutcheon can then be withdrawn.

Refitting

When refitting make certain that the inner control cable operating lever is fitted upright to ensure lock operation from inside the car when the cable is pulled or pushed downwards. Tighten up the operating lever clamping screws.

Striker plate

Adjustment of the striker plate position is usually only necessary when the striker itself has been replaced. Do not interfere with its setting otherwise. Repositioning is carried out by a process of trial and error, proved by checking the closing action of the door and its position when closed.

Section R.10

LUGGAGE COMPARTMENT LOCK

To remove the luggage compartment lock extract the two set screws and two self-tapping screws securing the lock to the lid. Remove the two nuts from the handle retaining studs to release the handle and locking mechanism.

Section R.11

BUMPERS

Both the front and rear bumpers can be removed when the six nuts and plain and spring washers securing each bumper to the body are removed from the mounting screws.

Section R.12

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 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. Metal polishes, or abrasives of any sort, must not be used on chromium, but a good-quality metal polish may be used on stainless steel.

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; a little neutral soap may be used if necessary. Neither detergents, caustic soaps, nor spirits of any kind must be used.

Section R.13

HEATER

Operation

The heater when fitted is controlled by a rheostat switch located on the right-hand side of the control panel. The first few degrees of movement in a clockwise direction will bring the air-circulating fan into operation at its maximum speed; further movement in this direction will gradually reduce the speed of the fan to regulate the heating of the car interior.

A tap on the rear of the engine is intended to be closed in hot weather or when heating is not required. The fan can then be used to circulate air in the interior of the car, although it is primarily intended for the circulation of warmed air.

Removing

Disconnect the battery. Drain the water from the cooling system. Disconnect the snap connectors on the two leads from the heater motor located beneath the parcel shelf. Slacken the clips securing the demister tubes and the inlet and outlet hoses to the matrix. Take the necessary precautions to prevent any coolant remaining in the heater matrix and the hoses from dripping or splashing the floor covering and upholstery before pulling the hoses from their connectors on the heater.

The inlet and outlet water hoses can be withdrawn from the car when the clips are slackened and removed.

Refitting

Refit the heater and connect up the inlet and outlet water hoses, and the demister tubes.

Reconnect the leads to the heater motor. Make certain that both the drain taps are turned off, open up the heater tap on the rear of the engine, and refill the cooling system. Reconnect the battery and run the engine at a fast tick-over and switch on the heater. If the water return hose does not warm up in a few minutes there may be an air lock in the system. To clear the air lock switch off the engine and disconnect the return hose at its connection to the radiator bottom hose. Extend the return hose with a length of hose long enough to enable the coolant to be returned via the radiator filler aperture, and plug the return connection on the radiator bottom hose. Start the engine and note the water flow into the radiator aperture. When the flow becomes smooth and bubble-free switch off the engine and remake the connection to the radiator bottom hose and tighten up as quickly as possible.

Section R.14

REAR DOORS (VAN)

Removing

Open the doors and disconnect the door stop stays by removing the nut washer and bolt in the end of each stay. Bend down the tab washer on each door hinge, support the door, and remove the nut, tab washer, spring, hinge bolt, and the spherical bush from each pair of door hinges in turn.

Refitting

Refitting is a reversal of the removal sequence. After refitting the doors ensure that the door lock engages correctly and that a positive lock is obtained at the end of each door lock stay.

Windows

The door windows may be removed and replaced as described in Section R.8.

Door lock

To remove the door lock unscrew the four screws that secure the lock to the door and ease the lock and the stays from the stay guides. Unscrew the two nuts securing the handle to the door and remove the handle.

Replacement is a reversal of this procedure.

Section R.15

HEATER FITTING INSTRUCTIONS
(Recirculatory Type)

Disconnect the battery, drain the cooling system, and remove the parcel shelf floor lining and the curved bulkhead lining; the curved bulkhead lining is in two halves and is retained at each end by a self-tapping screw.

Check the position of the fixing holes in the shelf in relation to the fixing points on the heater, and, if necessary, reposition the holes in the shelf to suit the heater (earlier cars were drilled for three-point fixing only).

Heater and air hoses

Secure the heater firmly to the under side of the shelf with the two nuts and the two bolts provided. Two weld nuts and two weld bolts are incorporated in the heater.

Connect the end of one air hose to the right-hand demister nozzle and the end of the other hose to the left-hand demister nozzle. Pass the free end of each hose through the appropriate hole in the parcel shelf and connect them to their respective air outlet connections on the heater. Fit the demister nozzles to the fascia panel and secure each nozzle with the two screws provided.

Water pipes

Remove the blanking plate from the cylinder head and use the existing bolts and washers to fit the water tap. Connect one end of the longer hose to the tap and thread the other end through the right-hand hole in the footboard and connect it to the lower heater inlet pipe.

Remove the lower radiator hose and in its place fit the hose having the moulded 'take-off' pipe. Connect one end of the remaining water hose to the 'take-off' pipe, and thread the other end of the hose through the left-hand hole in the footboard and connect it to the top heater outlet pipe.

Secure all water hoses with the hose clips provided.

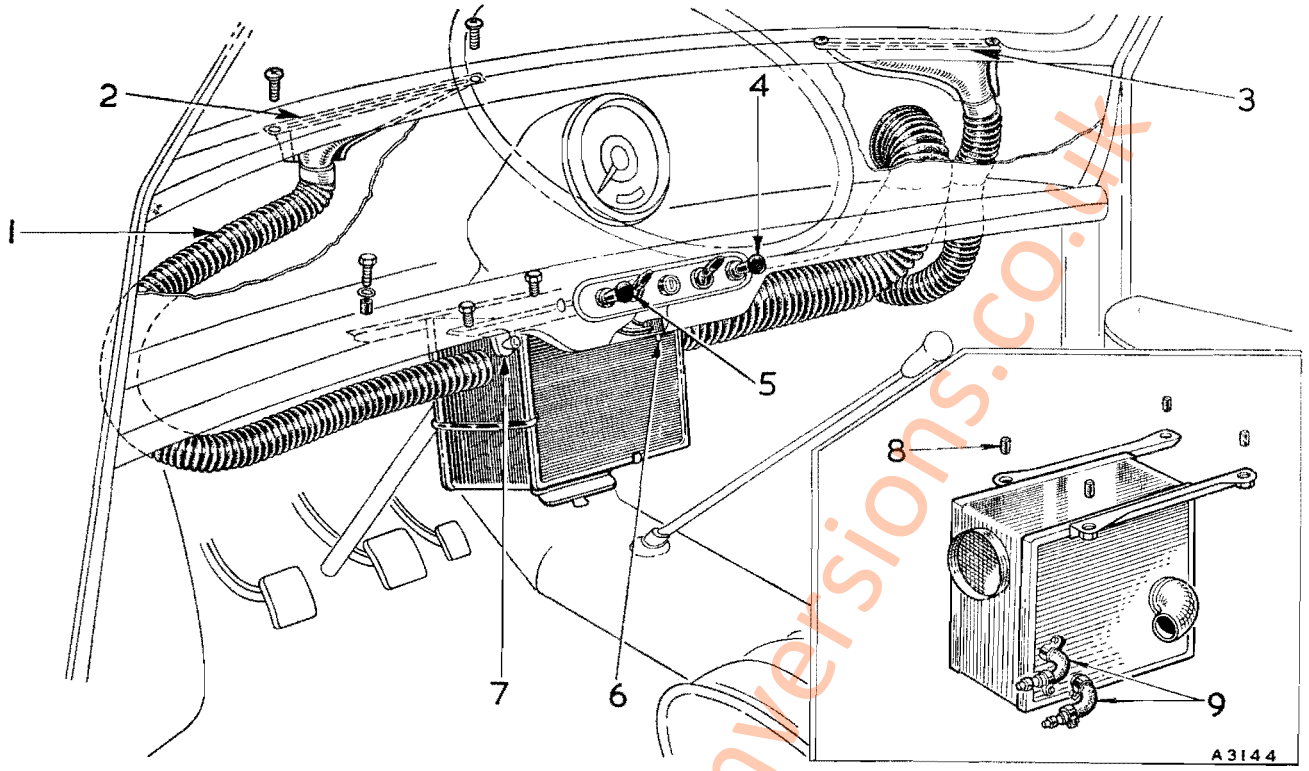


Fig. R.21
Air hoses and fittings

1. Demister hose.
2. Demister duct—L.H.
3. Demister duct—R.H.
4. Air control.
5. Heat control.
6. Blower switch.
7. Choke control (repositioned).
8. Spacers.
9. Inlet and outlet hoses.

Electrical connections

Remove the switch knob, ring nut, and the washer from the rheostat. Connect the black lead from the heater motor to the black lead emerging from the loom beneath the fascia shelf. Connect the remaining lead from the motor to its mating terminal on the switch. From the loom select the green lead with brown tracer and connect it to the remaining terminal on the switch.

Remove the blanking plug from the control fascia, fit the switch to the fascia, and secure it with the spring washer and the nut. Refit the control knob.

Section R.16

HEATER FITTING INSTRUCTIONS
(Fresh-air Type)

Introduction

The heater is fitted below the parcel shelf and is supplied with fresh air from a blower that is mounted behind the front grille. Before commencing installation disconnect the battery, drain the cooling system, and remove the parcel shelf floor lining and the curved bulkhead lining; the bulkhead lining is in two halves and is retained at each end by a self-tapping screw.

Air hoses and blower

(1) Mark out and cut two 3½ in. (88·9 mm.) diameter holes, one in the parcel shelf floor as close to the demister air hose and the shelf/bulkhead seam as is practicable and the other one directly above in the vertical bulkhead about ⅝ in. (15·875 mm.) above the shelf floor. Bostik the strip grommets to the edges of the holes and feed the large-diameter air hose through each hole.

(2) Fit the right-hand and left-hand demister nozzles and secure them with the screws provided. Pass the small-diameter air hoses through the holes in the parcel shelf and secure the end of each hose to its respective nozzle.

(3) Reposition the horn approximately 3 in. (76·2 mm.) towards the centre of the vehicle and secure it with the screws provided.

(4) Remove the coil and clamping bracket. Fit the right-angled bracket supplied, then fit the coil clamping bracket to the vertical face of the right-angled bracket. Replace the coil in the coil clamping bracket.

(5) Fit the air intake flap valve into the blower outlet and secure it with the screws provided.

(6) Position the blower and flap valve on the wing valance to obtain at least ½ in. (12·7 mm.) clearance between the blower and the engine. Mark off the fixing holes in the wing valance from the bolts in the blower-securing bracket.

(7) Drill the holes in the valance, place the tagged lead from the blower motor over the nearest fixing

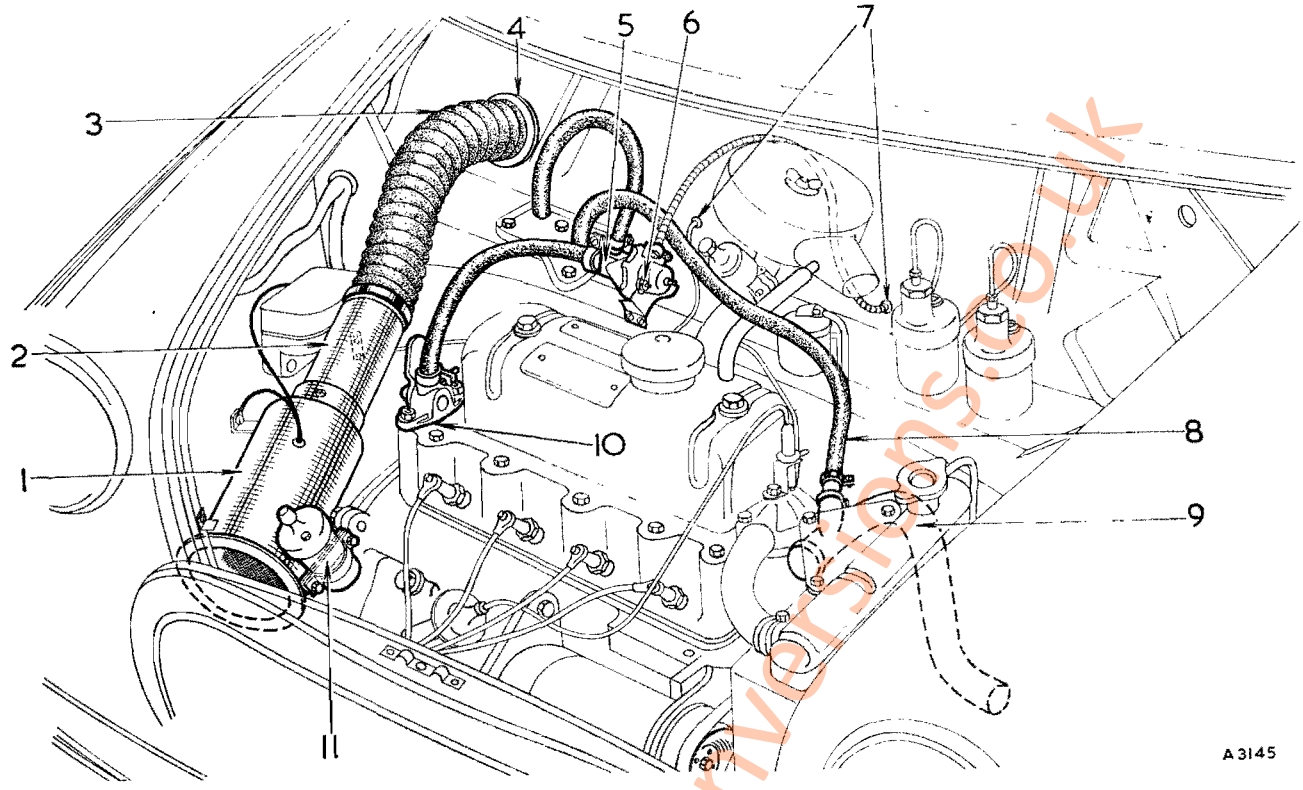


Fig. R.22

Water hoses and fittings

1. Blower.
2. Flap valve.
3. Air input hose.
4. Strip grommets.
5. Water valve.
6. Trunnion screw.
7. Control cable grommets.
8. Water hose.
9. Radiator bottom hose.
10. Water control tap.
11. Coil mounting bracket.

bolt, assemble the blower to the valance, and secure it with the four washers and nuts provided.

(8) Fit the air hose over the flap valve outlet and secure it with the strip clip.

Water connections

(1) Remove the blanking plate from the cylinder head and use the existing washers and nuts to fit and secure the flange, gasket, and union.

(2) Remove the lower radiator hose and in its place fit the hose with the moulded take-off pipe.

(3) Position the water valve assembly on the bulkhead near the brake and clutch reservoir blanking plate, mark off the fixing hole positions, and secure the assembly with the washers and screws provided.

(4) Pierce the rubber seal on the reservoir blanking plate and route the water hose as follows, cutting to length as required:

(*a*) Cylinder head union to water valve inlet.

(*b*) Water valve outlet through the blanking plate to the lower water pipe on the heater.

(*c*) Heater upper pipe through the blanking plate to the take-off pipe on the lower radiator hose.

(5) Secure all water joints with hose clips.

Controls

(1) Remove the choke control and assemble it to the bracket supplied. Position the bracket below the parcel shelf as shown in Fig. R.21 and mark off the fixing hole position on the shelf.

(2) Drill the fixing holes in the parcel shelf and a further hole in the bulkhead to accept the choke cable.

(3) Re-route the choke cable, assemble the choke control and the bracket to the shelf, and secure it with the two 4 B.A. bolts, nuts, and washers provided.

(4) Enlarge the old choke aperture to accept the push-pull air control; remove the blanking plug from the control panel and enlarge the aperture to accept the push-pull heating control. Drill two $\frac{3}{8}$ in. (9·525 mm.) holes in the vertical bulkhead in the flange of the stiffening member; the holes are to be opposite the control panel fixing screws.

(5) Unscrew the control knobs and remove the securing nuts and washers. Fit the heating control to the left of the control panel and the air control to the right of the panel and secure the controls with the washers and nuts. Replace the control knobs.

(6) Push the heater control fully in, pass the cable through the bulkhead, and secure the outer cable to the clamp on the water valve. Pass the inner cable through the trunnion on the forked lever of the water valve, rotate the forked lever anti-clockwise to the top of its slot, press firmly into

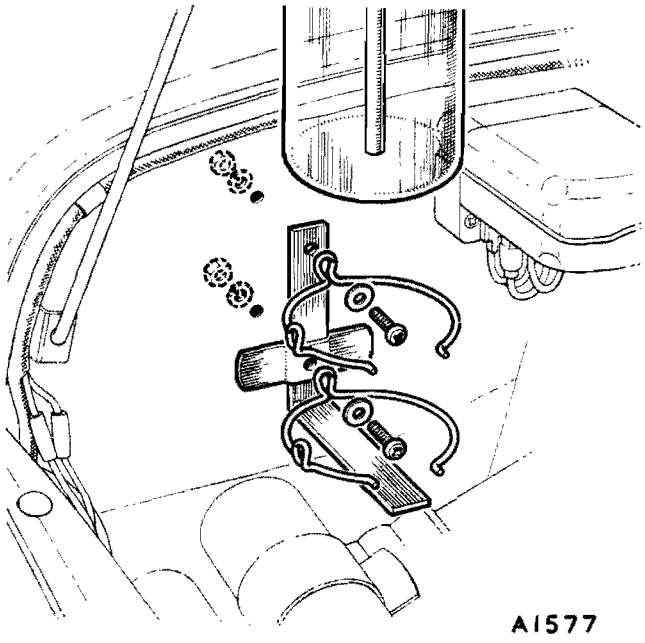


Fig. R.23
Fitting the container bracket

position, and tighten the trunnion screw. Operate the control and ensure that the water valve shuts off completely when the control is pulled out.

(7) Push the air control fully in, pass the cable through the bulkhead, and secure the outer cable to the clamp on the air valve. Rotate the forked lever on the air valve away from the cable clamp into the open position. Pass the inner cable through the trunnion on the forked lever and tighten the trunnion screw. Operate the air control and ensure that the air control shuts off when the control is pulled out.

(8) Assemble a snap connector, nipple, and sleeve to one end of the wire supplied and a snap connector nipple to the remaining motor lead. Plug the wire onto the motor lead and thread the wire through the bulkhead. Slide back the sleeve and solder the end of the wire to one terminal of the heater switch; slide the sleeve over the soldered connection.

(9) Remove the Lucar connection from the green lead emerging from the loom below the fascia. Slide back the sleeve and solder the bare end to the remaining switch terminal; slide the sleeve over the soldered connection.

(10) Cut a $\frac{7}{16}$ in. (11·11 mm.) hole in the fascia rail in the position shown in Fig. R.21 and fit the switch to the rail.

Heater

(1) Place the heater below the parcel shelf and align the holes in the rear fixing bracket with the holes in the shelf; from the front fixing bracket mark off two holes in the shelf and drill the holes $\frac{1}{4}$ in. (6·35 mm.) diameter.

(2) Fit the two rubber elbows to the heater pipes and connect the water hoses to the elbows. The hose from the water valve must be connected to the lower elbow on the heater. Secure the hoses with hose clips.

(3) Place the heater below the parcel shelf, position the four spacers, and secure the heater with the bolts and washers provided.

(4) Connect the air hose and the demist hoses to the heater and secure them with the strip clips.

(5) Pull back the trimming on the parcel shelf and right-hand bulkhead trim panels, cut the panels to fit around the hoses, cut the trim, and restick it to the panels.

(6) Refill the cooling system, reconnect the battery, and run the engine at a fast tick-over. If the water return hose does not warm up in a few minutes an air lock may be present. The air lock must be cleared as described in Section R.13.

Section R.17

WINDSHIELD WASHER FITTING INSTRUCTIONS

Fluid container bracket

(1) Position the bracket on the inside of the right-hand valance, and from the bracket mark off the two fixing holes. Drill the holes $\frac{13}{64}$ in. (5·16 mm.) diameter.

(2) Secure the bracket and the container retaining clip to the valance with two No. 10×$\frac{1}{2}$ in. screws, washers, and nuts.

(3) Snap the container into the retaining clip.

Pump assembly

(1) Remove the shelf lining and position the pump assembly bracket under the parcel shelf as shown in Fig. R.24; mark off and drill two $\frac{7}{32}$ in. (5·56 mm.) holes in the shelf.

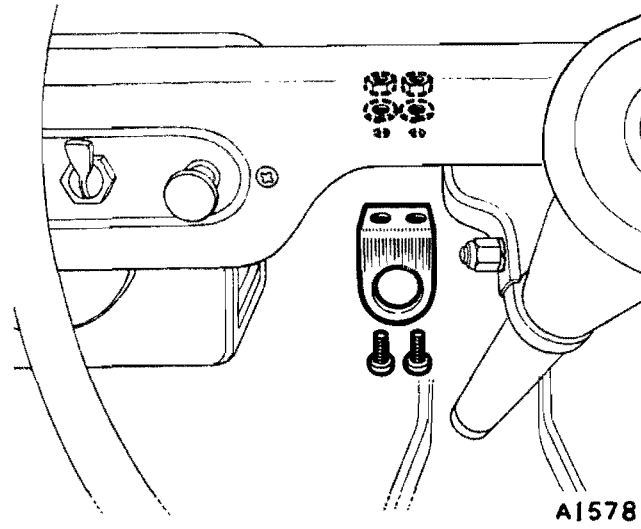


Fig. R.24
Fitting the plunger bracket

(2) Secure the bracket to the shelf with two No. 10 × ⅜ in. screws, washers, and nuts. Replace the shelf lining.
(3) Remove the outer nut and the nameplate from the pump assembly. Fit the pump to the bracket, replace the nameplate, and secure the pump assembly with the outer nut.

Jets

(1) The jets are fitted to the vehicle during production

Delivery hoses

(1) Wet the ends of the plastic hoses before fitting.
(2) Fit the valve and sleeve end of the suction hose to the lid of the container and the other end to any one of the pump connections.
(3) Fit the valve end of the delivery hose to the three-way connector and the other end to the remaining pump connection.
(4) Fit the jet hoses to the three-way connector and the jets.

Priming

(1) Fill the container to within 1 in. (25·4 mm.) of the top with clean water or Trico windshield washer fluid.
(2) Depress and release the plunger continuously until fluid emerges from the jets.
(3) Adjust the jet nozzles so that the jet makes contact with the windshield at the top of the wiper sweep. The nozzles may be turned by inserting a pin in the jet orifice, but care must be taken not to enlarge the orifice.

Section R.18

DOOR DRAINAGE

On early vehicles the drainage for the doors may be improved as follows.

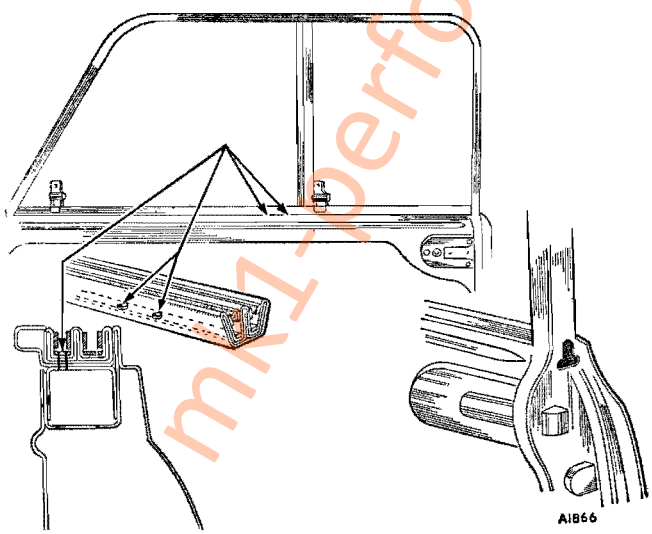


Fig. R.25
Window water drain holes

Doors

(1) Close the door windows.
(2) Mark off two centres in both the front door glass channels, one ½ in. (12·7 mm.) and the other 1 in. (25·4 mm.) in front of the rear sliding glass (see Fig. R.25).
(3) Remove the windows as described in Section R.7 and drill the holes through each channel section and retaining strip.
(4) Refit the channel supports and the windows. Push the rear window vertical channel section down until it abuts the base of the chrome retainer.
(5) Elongate the drain holes in the front and rear of each door until the resulting slots are the same height as the glass channel supports.

Section R.19

ROOF LINER

Removal

Mark the position of the rear edge of the front liner on the side rail to act as a datum for refitting. Remove the liner by gripping the outer edges of the liner and pulling rearwards, at the same time exerting a gentle inwards pressure.

Mark the position of the forward edge of the rear liner, and remove by pulling it forwards, using a gentle inwards pressure at the same time.

Refitting

To refit, reverse the above procedure, fitting the rear liner first and ensuring that it is pushed fully home to its original position.

When refitting the front liner check that the three retaining hooks on the forward edge of the rear liner engage in the three sockets formed in the rear rail of the front liner before pushing the liner fully home.

Section R.20

ROOF LINER (TRAVELLER)

Removal

Disconnect the battery and remove the roof light.

Mark the rear edge position of the front liner on the cant rail to facilitate its replacement in the original position. Grip the outside edge of the liner, apply a gentle inward pressure, and at the same time pull the liner rearwards to remove it from the retaining channel.

Remove the trim liner from over the rear door.

Mark the forward edge of the rear liner on the cant rail, apply gentle inward pressure from the outside edges, and pull the liner forward to remove it from the retaining channel.

Refitting

Refit the rear liner, sliding it rearwards until the forward edge is lined up with the mark made on the cant rail to indicate its original position.

Refit the front liner, pushing it forward slowly until the rear edge is lined up with the mark on the cant rail. During this operation make certain that the clip on the front liner enters the bracket on the forward edge of the rear liner.

Refit the roof light, reconnect the battery, and replace the trim liner over the rear door.

Section R.21

BODY SIDE WOOD FRAME ASSEMBLY (TRAVELLER)

This wood frame is a complete assembly and must be removed and refitted as such.

Removal

Remove the sliding windows as in Section R.23.

Remove the interior trim liners from the body side and from the rear door pillar. The fuel tank must also be removed as in Section D.9 when removing the left-hand frame assembly.

Remove the rear door complete with hinges, disconnecting the hinges from the door pillar.

Disconnect the battery and remove the rear lamp assembly.

Mark the fitted position of the wood inserts between the cant rail and the roof panel, and against the front door pillar, to ensure that they can be refitted in exactly the same position from which they were removed. Extract the wood inserts and remove all the screws securing the wood frame to the body from inside the vehicle. Remove the nuts and plain washers from the frame studs protruding through the side panel adjacent to the wheel arch. Access to two of the studs is through the spare wheel compartment.

Carefully ease the wood frame from the body side, extra care being taken when easing it away from the rear bumper.

Refitting

Refitting is a reversal of the removal procedure.

Clean all the old sealing compound from the body panel and the wood frame, and remake the joint with new sealing compound.

Insert all screws before tightening them up.

Section R.22

REAR DOOR WOOD FRAME ASSEMBLY (TRAVELLER)

This wood frame is a complete assembly and must be removed and refitted as such.

Removal

Remove the rear door and take off the lock as in Section R.14. A felt covering should be used on the work bench to protect the polished surface of the wood frame.

Remove the two screws from the centre of the inner door panel. Note the two distance pieces.

Remove the door sealing rubber and the retaining clips.

Extract all the self-tapping screws from edge of the door and carefully ease the frame assembly from the door panel.

Refitting

Clean off all the old sealing compound from the door panel and the wood frame assembly, and remake the joint with new sealing compound.

Refit the wood frame, locating all the screws before finally tightening up.

Clean out all surplus sealing compound, and refit the sealing rubber, using new retaining clips.

Section R.23

BODY SLIDING GLASSES (TRAVELLER)

Removal

Extract the retaining screws and remove the trim panel from above the sliding windows.

Locate and remove the self-tapping screws securing both the top sliding channels to the body. Support the glasses on the inside of the vehicle while a second operator pushes the glasses carefully at the top from the outside. The glasses complete with the top channels can then be removed from inside the vehicle.

Refitting is a reversal of the removal procedure.

Section R.24

REAR SEAT (TRAVELLER)

Removal

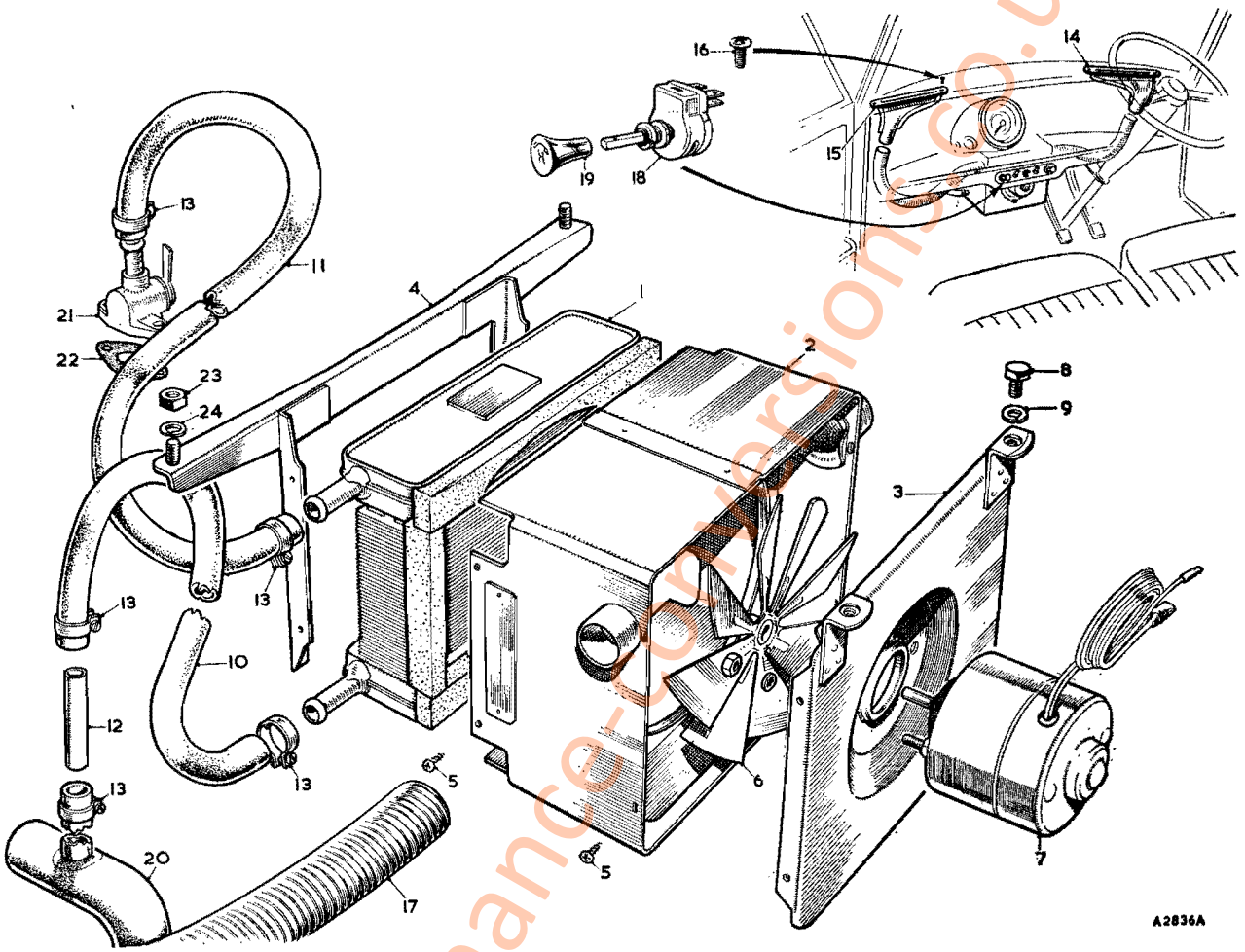
Extract the hexagon set screws from each of the two pivot brackets located on the front lower edge of the rear seat cushion and remove the cushion.

Extract the screws securing the seat back squab hinges to the support rail at the front end of the luggage platform. Release the sliding bolts securing the squab to the seat support brackets and remove the squab.

Refitting

Refitting is a reversal of the removal procedure; make certain, however, that the sliding bolts and the locating pins are lined up before the bracket and hinge screws are fully tightened.

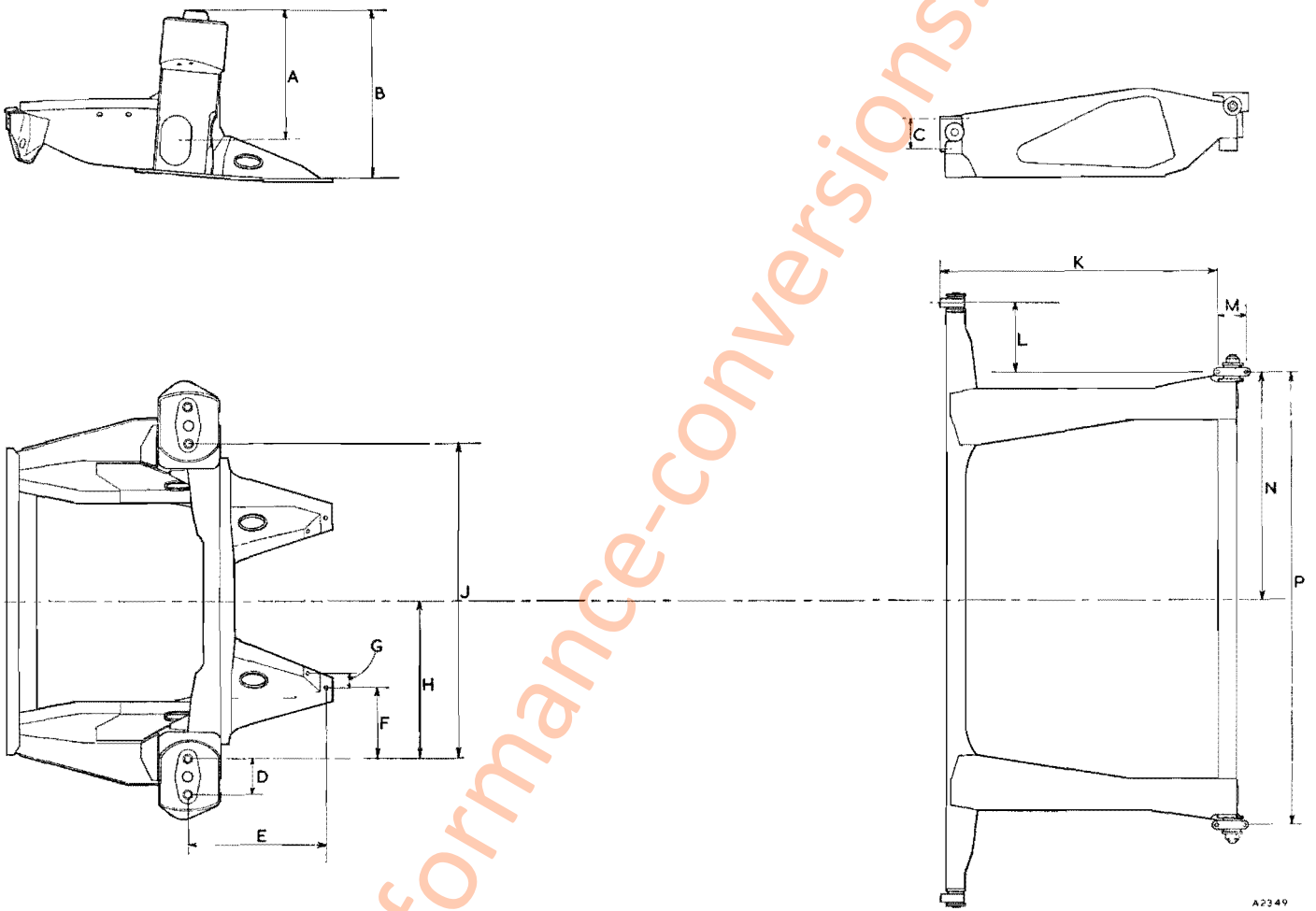
THE HEATER ASSEMBLY COMPONENTS
(Recirculatory Type)



No.	*Description*
1.	Radiator.
2.	Cowling.
3.	Cover.
4.	Bracket.
5.	Screw.
6.	Fan assembly.
7.	Motor.
8.	Screw.
9.	Washer.
10.	Hose—outlet.
11.	Hose—inlet.
12.	Connection for hoses.

No.	*Description*
13.	Clips for hoses.
14.	Duct—demister—R.H.
15.	Duct—demister—L.H.
16.	Screw.
17.	Hose—demister.
18.	Switch—heater.
19.	Knob for switch.
20.	Hose—radiator.
21.	Tap—heater control.
22.	Washer—joint.
23.	Nut.
24.	Washer.

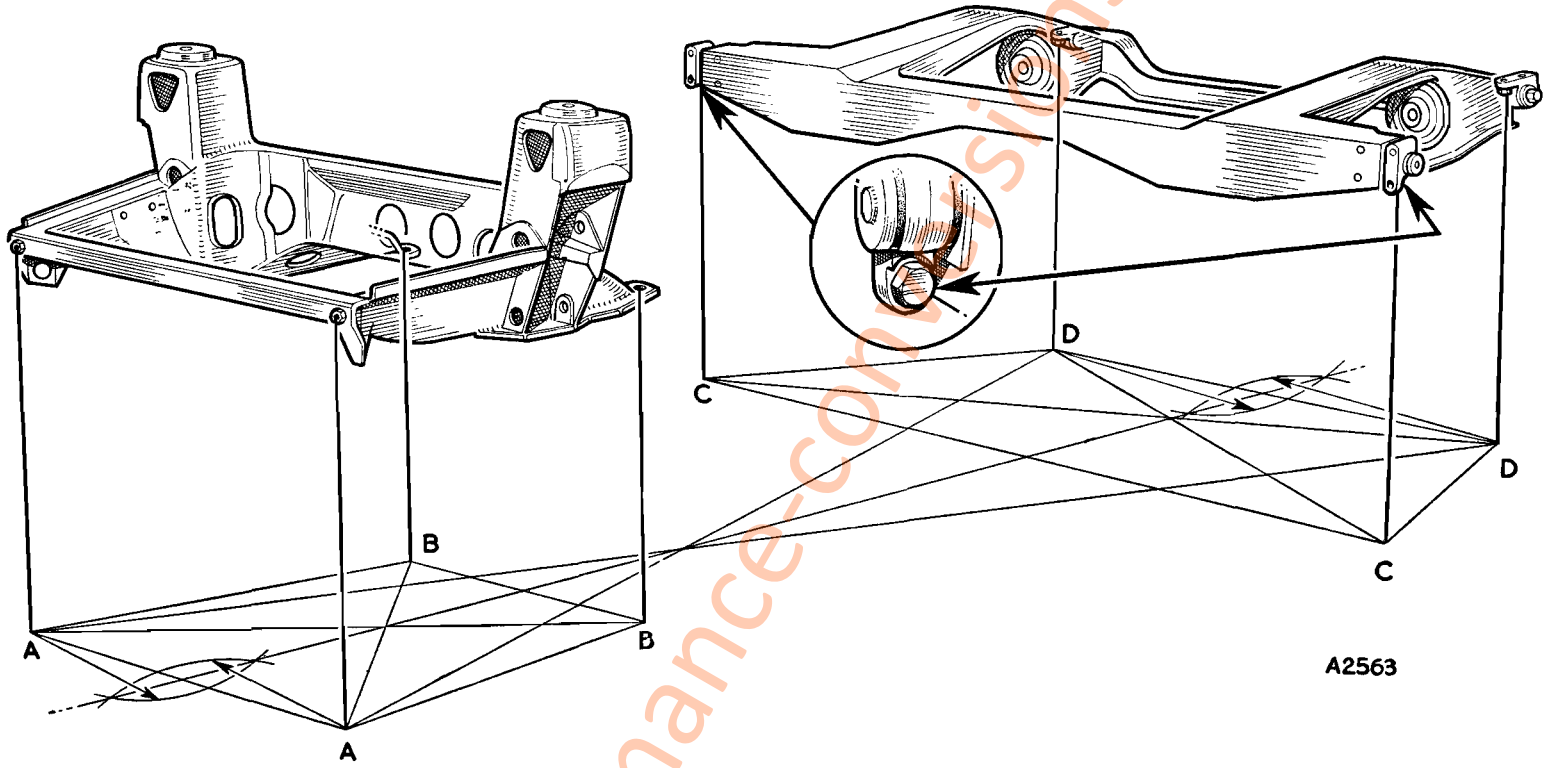
SUB-FRAME ALIGNMENT DIAGRAM



KEY TO DIMENSIONS

A. 10 $\frac{47}{64}$ in. $\pm \frac{1}{8}$ in. (276·62 mm. $\pm {}^{1\cdot59}_{0}$ mm.).
B. 14 $\frac{47}{64}$ in. $\pm \frac{1}{16}$ in. (374·45 mm. $\pm {}^{0}_{1\cdot59}$ mm).
C. 2$\frac{1}{4}$ in.±·010 in. crs. (57·15 mm.±·254 mm.).
D. 3 in.±·010 in. crs. (76·20 mm.±·254 mm.).
E. 10 $\frac{7}{32}$ in.± $\frac{1}{32}$ in. (259·56 mm.±·800 mm.).
F. 5$\frac{1}{2}$ in.±·010 in. (139·7 mm.±·254 mm.).
G. 1$\frac{1}{2}$ in. (38·10 mm.).
H. 13$\frac{5}{8}$ in.± $\frac{1}{32}$ in. (346·08 mm.±·800 mm.).
J. 27$\frac{1}{4}$ in.±·010 in. (692·55 mm.±·254 mm.).
K. 23 $\frac{47}{64}$ in.± $\frac{1}{32}$ in. (598·88 mm.±·800 mm.).
L. 6 in.±·010 in. (152·4 mm.±·254 mm.).
M. 2$\frac{1}{4}$ in.±·010 in. crs. (57·15 mm.±·254 mm.).
N. 19$\frac{1}{4}$ in.± $\frac{1}{32}$ in. (488·75 mm.±·800 mm.).
P. 38$\frac{1}{2}$ in.±·010 in. (977·5 mm.±·254 mm.).

HORIZONTAL ALIGNMENT CHECK



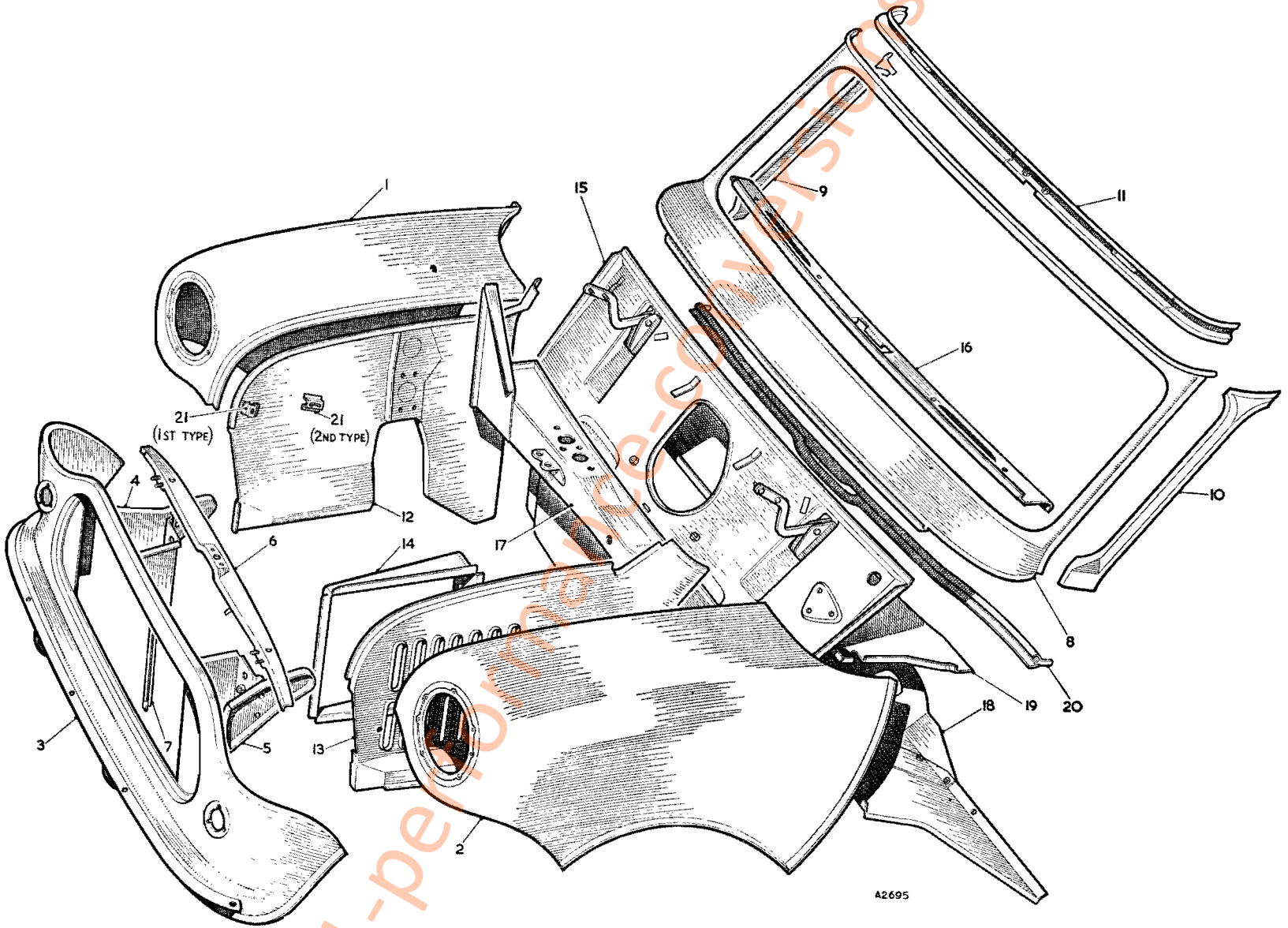
TRANSVERSE DIMENSIONS

AA	BB	CC	DD
Width between centres of the front sub-frame front mounting set screws 26 in. (660·4 mm.)	Width between centres of the front sub-frame rear mounting set screws 16¾ in. (412·75 mm.)	Width between centres of the rear sub-frame front mounting block lower set screws 50½ in. (1282·7 mm.)	Width between centres of the rear sub-frame rear mounting block set screws 38½ in. (977·9 mm.)

A preliminary check of the alignment can best be carried out by the system of diagonals and measurement checks from points projected onto a level floor by means of a plumb-bob.

A centre-line can then be established by means of a large pair of compasses and any deviation from correct alignment will be evident by failure of the diagonals to intersect on the centre-line or by considerable deviations in the measurements.

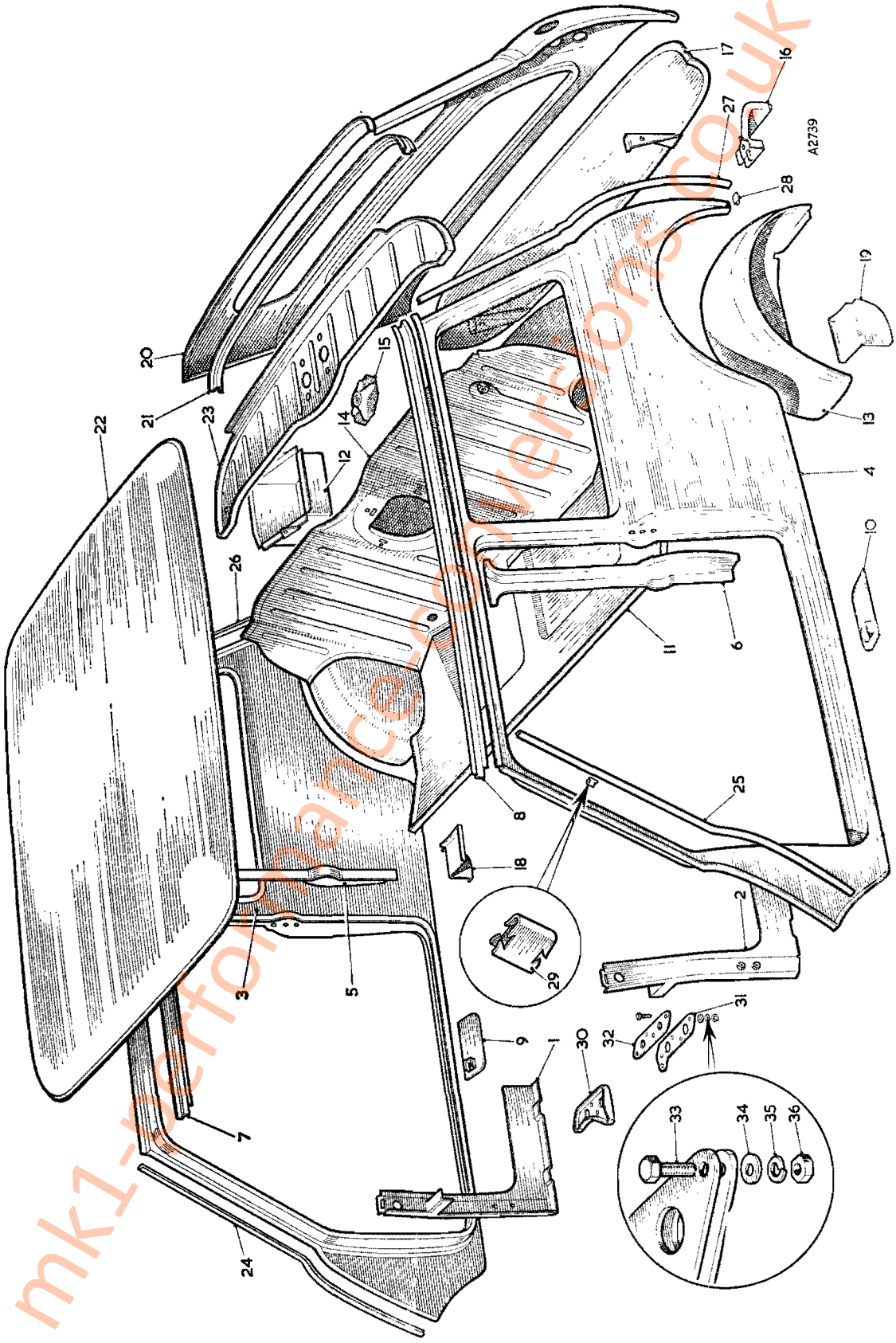
THE FRONT BODY PANEL COMPONENTS



KEY TO THE FRONT BODY PANEL COMPONENTS

No	*Description*
1.	Wing assembly—front—R.H.
2.	Wing assembly—front—L.H.
3.	Panel assembly grille.
4.	Bracket attachment—front—R.H.
5.	Bracket attachment—front—L.H.
6.	Stiffener—grille panel.
7.	Stay—grille panel.
8.	Panel assembly—windscreen.
9.	Boxing plate—front pillar—R.H.
10.	Boxing plate—front pillar—L.H.
11.	Cant-rail assembly—front.
12.	Wing valance—R.H.
13.	Wing valance—L.H.
14.	Radiator cowl.
15.	Panel assembly—dash.
16.	Panel assembly—fascia.
17.	Cross-member assembly—dash panel.
18.	Panel assembly—toeboard.
19.	Panel—parcel shelf front.
20.	Moulding—front parcel tray.
21.	Bracket for prop rod.

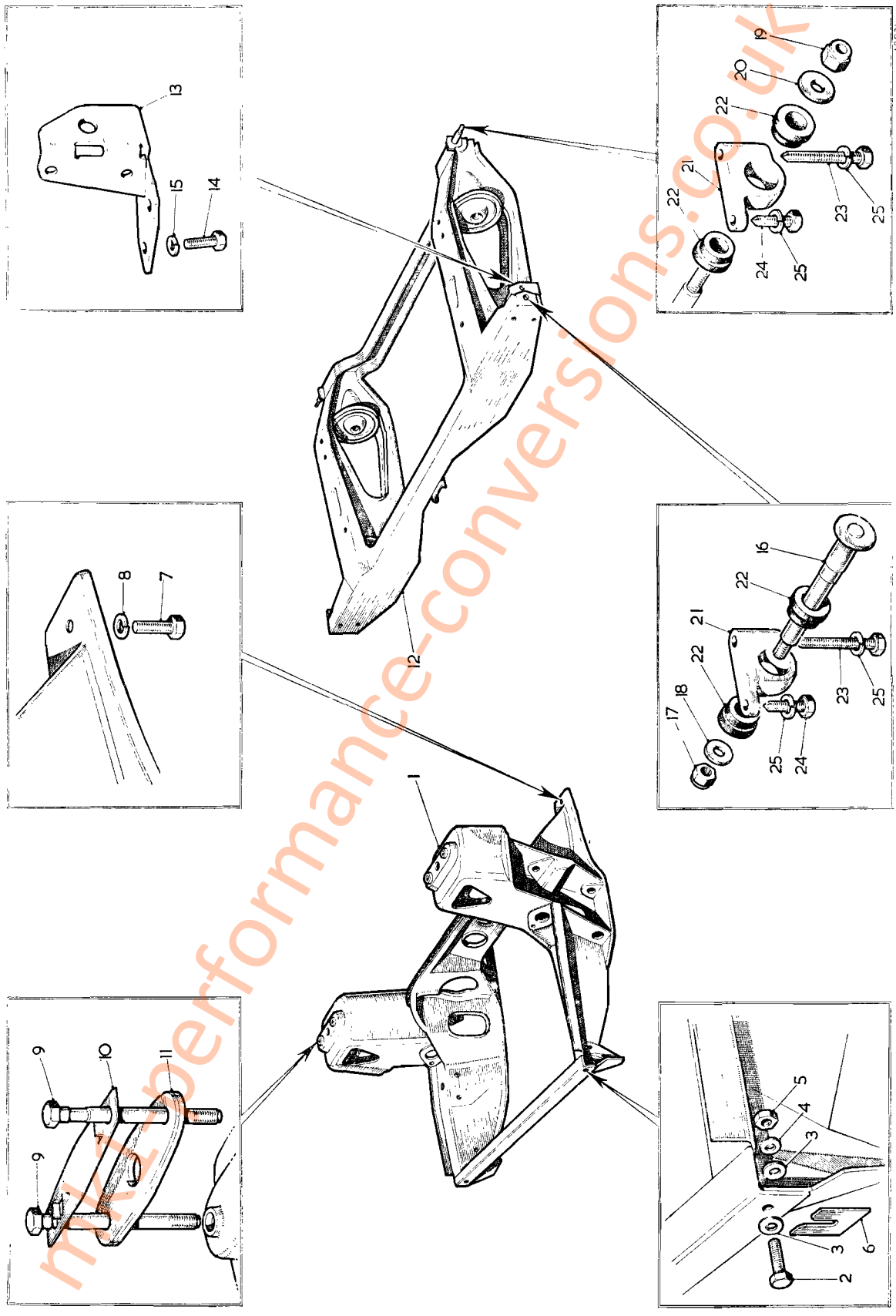
THE BODY PANEL COMPONENTS



KEY TO THE BODY PANEL COMPONENTS

No.	*Description*
1.	Boxing plate—front lower—R.H.
2.	Boxing plate—front lower—L.H.
3.	Panel assembly—body side—R.H.
4.	Panel assembly—body side—L.H.
5.	Centre pillar assembly—R.H.
6.	Centre pillar assembly—L.H.
7.	Cant-rail assembly—R.H.
8.	Cant-rail assembly—L.H.
9.	Bracket—jack reinforcement—R.H.
10.	Bracket—jack reinforcement—L.H.
11.	Seat pan and rear floor assembly.
12.	Box—battery.
13.	Panel assembly—wheel arch—L.H.
14.	Panel—seat brace.
15.	Bracket—spare wheel mounting.
16.	Plate reinforcement.
17.	Panel assembly—back—lower.
18.	Filler—rear wheel arch—front—R.H.
19.	Filler—rear wheel arch—front—L.H.
20.	Panel assembly—back.
21.	Cant-rail assembly—rear.
22.	Panel assembly—roof.
23.	Panel—parcel shelf—rear.
24.	Finisher—front—R.H.
25.	Finisher—front—L.H.
26.	Finisher—rear—R.H.
27.	Finisher—rear—L.H.
28.	Finisher—rear—lower.
29.	Clip—finisher retaining.
30.	Seating plate.
31.	Blanking plate.
32.	Blanking plate.
33.	Screw.
34.	Washer.
35.	Spring washer.
36.	Nut.

THE SUB-FRAME ASSEMBLIES



KEY TO THE SUB-FRAME ASSEMBLIES

No.	*Description*
1.	Sub-frame assembly—front.
2.	Bolt—sub-frame to body.
3.	Washer for bolt.
4.	Washer for nut.
5.	Nut for bolt.
6.	Packing—sub-frame to body.
7.	Screw—sub-frame to body.
8.	Washer for screw.
9.	Screw—tower to bulkhead.
10.	Washer for screw.
11.	Pad—pressure—towers to bulkhead.
12.	Sub-frame—rear.
13.	Bracket—outer radius arm.
14.	Screw—bracket to frame.
15.	Washer for screw.
16.	Pin—front support.
17.	Nut for support pin.
18.	Washer for nut.
19.	Nut—rear support pin
20.	Washer for nut.
21.	Mounting—support pin.
22.	Bush for support pin.
23.	Screw for support pin.
24.	Screw for support pin.
25.	Washer for screw.

LUBRICATION DIAGRAM

KEY TO THE LUBRICATION DIAGRAM

DAILY

(1) ENGINE. Inspect the oil level by the dipstick, and replenish if necessary with oil to Ref. A.

AFTER THE FIRST 500 MILES (800 Km.)

(2) ENGINE. Drain off the old oil and refill with fresh oil to Ref. A.

EVERY 1,000 MILES (1600 Km.)

(3) STEERING JOINT NIPPLES.

(4) REAR SUSPENSION RADIUS ARM.

Give three or four strokes of a gun filled with lubricant to Ref. C.

(5) HAND BRAKE CABLE GUIDE CHANNELS. Slacken off the cable and lubricate with grease to Ref. C. Lubricate the cable sector pivot (later models) with oil to Ref. D.

(6) CARBURETTER. Remove the cap from the top of the suction chamber and add a teaspoonful of oil to Ref. D.

EVERY 3,000 MILES (4800 Km.)

(7) ENGINE. Drain off the old oil and refill with fresh oil to Ref. A.

BODY. Lubricate door hinges, bonnet lock, and operating mechanism.

EVERY 6,000 MILES (9600 Km.)

(8) DISTRIBUTOR. Withdraw the rotor arm and add a few drops of oil to Ref. D to the cam bearing and to the advance mechanism through the gap around the cam spindle. Smear the distributor cam spindle and contact breaker pivot with grease to Ref. C.

(9) OIL FILTER. Wash the bowl in fuel and fit a new element.

(10) WATER PUMP. Remove the oiling plug from the water pump body and lubricate the pump sparingly with S.A.E. 140 oil to Ref. C.

(11) REAR HUBS. Remove each rear wheel hub disc, prise off the grease-retaining cap, refill the cap with grease to Ref. C, and replace securely.

EVERY 12,000 MILES (19200 Km.)

(12) DYNAMO. Add a few drops of oil to Ref. D through the oil hole in the commutator end bearing.

(13) Every 1,000 miles (1600 km.) the lubricating nipples fitted to the drive shaft sliding joint on early models must be given three or four strokes of a grease gun filled with grease to Ref. C.

The two (one only on later models) gear change shaft lubricating nipples also shown on indicator 13 require attention at major overhaul periods only, when grease to Ref. C should be used.

Use the lubricating oils and greases to the letter references given above and shown in the recommended lubricants chart in Section P.1.

MULTIGRADE MOTOR OILS

In addition to the recommended lubricants listed we approve the use of these motor oils, as produced by the oil companies shown in our Manuals, for all climatic conditions unless the engine is in poor mechanical condition.

LUBRICATION DIAGRAM