The

MIDGET

WORKSHOP MANUAL

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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. AKD1775) can only be obtained from an M.G. Distributor.

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INTRODUCTION

This Manual has been prepared to provide service operators with the necessary information for the correct maintenance and repair of the M.G. Midget. The Manual also serves as a ready-reference book for service supervision and covers items of procedure for guidance of both the 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.

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General Data

General Information

Maintenance Attention

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THE M.G. MIDGET

Getting the Best from your M.G. Midget

(Compression ratio 9·1:1)

The high-compression engine is a highly developed unit, and it is essential that you should know something about the specialized maintenance it requires if you are to maintain it at the peak of its mechanical efficiency. Special recommendations on the sparking plugs, ignition settings, and fuel to be used are given by the manufacturers, and it is stressed that failures are bound to occur if these are not strictly adhered to. Particular care is needed with this engine owing to its high compression ratio, which makes it extremely sensitive to variations in fuel, ignition timing, and the heat range of the sparking plugs.

In lower compression engines a much wider range of fuels can be tolerated without causing serious damage to the engine, and ignition settings will stand variations of a reasonable amount. Also, even if the incorrect sparking plugs are used, no more damage may be incurred than burnt-out plugs or leaky valves. But with an engine having a very high compression ratio the range of fuels, sparking plugs, and ignition settings is much narrower and it is essential that the mixture should always be correct, and particularly never overweak at maximum load or power.

High-compression engines are very sensitive to variations in spark advance (over-advance) and to fuel/air ratio (mixture). Variations in these settings will increase the combustion temperature, and if the variation is excessive pre-ignition will cause high shock waves, resulting in damage to the engine.

The engine should be decarbonized at regular intervals as excessive deposits of ash from the combustion of lubricating oil and fuel can cause pre-ignition difficulties.

Choice of fuel

The octane number of a motor fuel is an indication given by the fuel technicians of its knock resistance. High-octane fuels have been produced to improve the efficiency of engines by allowing them to operate on high compression ratios, resulting in better fuel economy and greater power. Owing to the high compression ratio of this engine, fuels with an octane rating below 96 are **not** suitable; should it be necessary to use a fuel with a lower octane number, the car must be used very carefully until the correct fuel can be obtained.

It is recommended that Super grade fuels with an octane rating of 100 be used when optimum performance is required.

Sparking plugs

The correct grade of sparking plug for use under normal driving conditions is the Champion N5. Plugs of a lower heat range (hotter running) should not be used, otherwise pre-ignition will occur, with consequent rise in combustion temperature and resulting engine damage. For competition work or hard driving where high output is consistently sustained the Champion N3 sparking plug should be used. This is a cooler-running plug and will ensure lower combustion temperatures and an increased margin of safety. Accumulated deposits of carbon, leaking or cracked insulators, and thin electrodes are all causes of pre-ignition. The plugs should therefore be examined, cleaned, and adjusted at the specified intervals and defective ones renewed. New plugs should be fitted every 12,000 miles (19200 km.).

Ignition setting

It is of the utmost importance that the correct setting should always be maintained. It will be appreciated that any variation in the contact breaker gap will affect the ignition setting, and your particular attention is called to the 3,000 miles (4800 km.) check and adjustment of the distributor points specified in Section B. After adjusting the contact breaker gap to the correct setting of ·014 to ·016 in. (·36 to ·40 mm.) it is advisable to check the ignition timing, and to correct it if necessary.

An accurate static check can be carried out by a very simple electrical method. To do this, connect a 12-volt lamp between the low-tension terminal on the side of the distributor and a good earth point on the engine. With the ignition switched on and the sparking plugs removed, turn the crankshaft until the crankshaft pulley T.D.C. pointer is exactly at the correct number of degrees as stated under **'GENERAL DATA'.** If the ignition timing is correct the lamp will light at exactly this point. Any discrepancy in the ignition setting can be rectified by turning the vernier adjusting nut on the distributor until the test lamp lights at exactly the correct setting. If pinking should occur due to the use of a fuel of a lower range than our recommendations, retarding the ignition 2 to 3° can be tolerated. Under no circumstances should the ignition be advanced beyond the correct setting.

GENERAL DATA

ENGINE

Type	9CG.
Number of cylinders	4.
Bore	2·478 in. (62·94 mm.).
Stroke	3·00 in. (76·2 mm.).
Capacity	57·87 cu. in. (948 c.c.).
Firing order	1, 3, 4, 2.
Compression ratio	9·1 : 1.
Capacity of combustion chamber (valves fitted)	24·5 c.c.
Valve operation	Overhead, by push-rod.
Oversize bore: 1st	·010 in. (·254 mm.).
Max.	·040 in. (1·016 mm.).

CRANKSHAFT

Main journal diameter	1·7505 to 1·7510 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 41·30 mm.).
Crankpin minimum regrind diameter	1·5854 in. (40·27 mm.).
Main bearings	
Number and type	3 shell type.
Material: Bottom half	Steel-backed, lead-indium-lined.
Top half	Steel-backed, lead-indium-lined.
Length	1·312 in. (33·32 mm.).
End-clearance	·002 to ·003 in. (·051 to ·076 mm.).
End-thrust	Taken by thrust washers at centre main bearing.
Running clearance	·0005 to ·002 in. (·0127 to ·0508 mm.).

CONNECTING RODS

Length between centres	5·75 in. (14·605 cm.).
Big-end bearings	
Material: Bottom half	Steel-backed, lead-indium-lined.
Top half	Steel-backed, lead-indium-lined.
Bearing side clearance	·008 to ·012 in. (·203 to ·305 mm.).
Bearing diametrical clearance	·001 to ·0025 in. (·025 to ·063 mm.).

PISTONS

Type	Flat crown, aluminium alloy, anodized.
Clearances: Bottom of skirt	·0016 to ·0022 in. (·040 to ·559 mm.).
Top of skirt	·0036 to ·0042 in. (·0914 to ·1067 mm.).
Oversizes	+·010 in., +·020 in., +·030 in., +·040 in. (+·254 mm., +·508 mm., +·762 mm., +1·02 mm.).

PISTON RINGS

Compression: Plain	Top ring.
Tapered	Second and third rings.
Width (plain)	·069 to ·070 in. (1·75 to 1·78 mm.).
Thickness	·103 to ·109 in. (2·62 to 2·78 mm.).
Fitted gap	·007 to ·012 in. (·178 to ·30 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	·103 to ·109 in. (2·62 to 2·78 mm.).
Fitted gap	·007 to ·012 in. (·178 to ·30 mm.).
Clearance in groove	·0015 to ·0035 in. (·038 to ·089 mm.).

GUDGEON PIN

Type	Semi-floating.
Fit in piston	·0001 to ·00035 in. (·0025 to ·009 mm.).
Fit in connecting rod	·0001 to ·0006 in. (·0025 to ·015 mm.).
Diameter (outer)	·6244 to ·6246 in. (15·86 to 15·865 mm.).

VALVES AND VALVE GEAR

Valves

Seat angle: Inlet and exhaust	45°.
Head diameter: Inlet	1·151 to 1·56 in. (29·23 to 29·36 mm.).
Exhaust	1·000 to 1·005 in. (25·4 to 25·53 mm.).
Stem diameter: Inlet	·2793 to ·2798 in. (7·094 to 7·107 mm.).
Exhaust	·2788 to ·2793 in. (7·081 to 7·094 mm.).
Valve lift	·285 in. (7·24 mm.).
Valve stem to guide clearance: Inlet	·0015 to ·0025 in. (·038 to ·063 mm.).
Exhaust	·002 to ·003 in. (·051 to ·076 mm.).
Valve rocker clearance: Running (hot)	·012 in. (·305 mm.); ·015 in. (·381 mm.) for competition work.
Timing	·029 in. (·725 mm.).
Timing markings	Dimples on timing wheels.
Chain pitch and number of pitches	$\frac{3}{8}$ in. (9·52 mm.). 52 pitches.
Inlet valve: Opens	5° B.T.D.C. With
Closes	45° A.B.D.C. ·021 in. (·533 mm.).
Exhaust valve: Opens	51° B.B.D.C. clearance at
Closes	21° A.T.D.C. valve.
Valve rocker bush bore (reamed)	·5630 to ·5635 in. (14·30 to 14·31 mm.).

VALVE GUIDES

Length: Inlet and exhaust	1·687 in. (42·86 mm.).
Diameter—inlet and exhaust: Outside	·4695 to ·470 in. (11·92 to 11·94 mm.).
Inside	·2813 to ·2818 in. (7·145 to 7·177 mm.).
Fitted height above head	$\frac{19}{32}$ in. (15·1 mm.).

VALVE SPRINGS

Free length: Inner	1·672 in. (42·47 mm.).
Outer	1·75 in. (44·45 mm.).
Fitted length: Inner	1·179 in. (29·95 mm.).
Outer	1·291 in. (32·79 mm.).
Number or working coils: Inner	$6\frac{1}{2}$.
Outer	$4\frac{1}{2}$.
Pressure: Valve open: Inner	30 lb. (13·6 kg.).
Outer	88 lb. (39·9 kg.).
Valve closed: Inner	18 lb. (8·17 kg.).
Outer	52 lb. (23·6 kg.).

TAPPETS

Type	Bucket.
Diameter	·8120 in. (20·62 mm.).
Length	1·505 in. (38·23 mm.).

GENERAL DATA—*continued*

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.).
Bearing: number and type		3. Steel-backed white metal.
Inside diameter (reamed in position):	Front	1·667 to 1·6675 in. (42·342 to 42·355 mm.).
	Centre	1·6245 to 1·6255 in. (41·261 to 41·287 mm.).
	Rear	1·3748 to 1·3755 in. (34·914 to 34·937 mm.).

ENGINE LUBRICATION SYSTEM

Oil pump

Type	Eccentric rotor or vane type.
Relief pressure valve operates	50 lb./sq. in. (3·52 kg./cm.²).
Relief valve spring: Free length	2·860 in. (72·63 mm.).
Fitted length	2·156 in. (54·77 mm.).

Oil filter

Type	Tecalemit or Purolator.
Capacity	1 pint (·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 nuts	40 lb. ft. (5·5 kg. m.).
Main bearing nuts	60 lb. ft. (8·3 kg. m.).
Connecting rod set bolts	35 lb. ft. (4·8 kg. m.).
Flywheel securing bolts	40 lb. ft. (5·5 kg. m.).
Steering-wheel nut	40 lb. ft. (5·5 kg. m.).
Road wheel nuts	45 lb. ft. (6·22 kg. m.).
Rear damper bolts	25 lb. ft. (3·4 kg. m.).

FUEL SYSTEM

Carburetters

Make and type	S.U. twin HS2 semi-downdraught.
Diameter	1¼ in. (31·75 mm.).
Jet	·090 in. (2·29 mm.).
Needle	V3.
Piston spring	Light blue.

AIR CLEANER

Type	Paper element.

FUEL PUMP

Make and type	A.C. 'Y' type. Mechanical.
Delivery rate	40 pints/hr. (22·8 litres/hr.).
Delivery pressure	1·5 to 2·5 lb./sq. in. (·105 to ·175 kg./cm.²).

COOLING SYSTEM

Type	Pressurized radiator. Thermo-siphon, pump- and fan-assisted.
Thermostat setting	149 to 158° F. (65 to 70° C.).

GENERAL DATA—*continued*

IGNITION SYSTEM

Sparking plugs	Champion N5.
Size	14 mm.
Plug gap	·024 to ·026 in. (·625 to ·660 mm.).
Coil	Lucas Type LA12.
Distributor	Lucas Type DM2P4.
Distributor contact points gap	·014 to ·016 in. (·35 to ·40 mm.).
Static ignition setting	4° B.T.D.C.

CLUTCH

Make and type	Borg & Beck. Single dry plate.
Diameter	6¼ in. (16 cm.).
Facing material	Wound yarn.
Pressure springs	6.
Colour	Yellow and dark green.
Damper springs	4.
Colour	Light grey.
Release lever ratio	3·6 : 1.

GEARBOX

Number of forward speeds	4.
Synchromesh	Second, third, and top gears.
Ratios: Top	1·0 : 1.
Third	1·357 : 1.
Second	1·916 : 1.
First	3·200 : 1.
Reverse	4·114 : 1.
Overall ratios: Top	4·22 : 1.
Third	5·726 : 1.
Second	8·975 : 1.
First	13·504 : 1.
Reverse	17·361 : 1.
Speedometer gear ratio	5/13.

STEERING

Type	Rack and pinion.
Steering-wheel turns—lock to lock	2¼.
Steering-wheel diameter	16 in. (40·6 cm.).
Camber angle	1°.
Castor angle	3°.
King pin inclination	6½°.
Toe-in	0 to ⅛ in. (0 to 3·175 mm.).

FRONT SUSPENSION

Type	Independent. Coil springs.
Free length	9·4 in. (23·8 cm.).
Mean coil diameter	3·625 in. (9·2 cm.).
Number of effective coils	7.
Working load	750 lb. (340 kg.).
Spring rate	271 lb. in. (3·127 kg. m.).
Dampers (front)	Lever arm type.

GENERAL DATA—*continued*

REAR SUSPENSION

Type	Quarter-elliptic.
Spring details: Number of leaves	15.
Width of leaves	5 at $\frac{5}{32}$ in. (3·97 mm.), 10 at $\frac{1}{8}$ in. (3·18 mm.).
Working load	375 lb. (170 kg.).
Free camber	$3\frac{7}{32}$ in. (81·76 mm.).
Dampers (rear)	Lever arm type

PROPELLER SHAFT

Type	Tubular. Reverse spline.
Make and type of joints	Hardy Spicer. Needle-roller.
Propeller shaft length (between centres of joints)	$26\frac{1}{4}$ in. (66·6 cm.).
Diameter	$1\frac{3}{4}$ in. (44·45 mm.).

REAR AXLE

Type	Three-quarter-floating.
Ratio	9/38 (4·22 : 1).

ELECTRICAL EQUIPMENT

System	12-volt. Positive earth.
Charging system	Compensated voltage control.
Battery	Lucas BT7A (BTZ7A Export).
Battery capacity	43 amp./hr. (at 20-hour rate).
Starter motor	Lucas 4-brush M35G/1.
Dynamo	Lucas C39.
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 RB106/2 (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.
Front	Two leading shoes.
Rear	Single leading shoe.
Drum size	7 in. (17·78 cm.).
Lining dimensions: Front and rear	$6\frac{3}{4}$ in. × $1\frac{1}{4}$ in. (17·14 cm. × 3·175 cm.).
Total lining area	67·5 sq. in. (435·37 cm.²).

WHEELS

Type	Ventilated disc. 4-stud fixing.

TYRES

Size	5·20—13.
Tyre pressures—normal and fully loaded: Front	18 lb./sq. in. (1·27 kg./cm.²).
Rear	20 lb./sq. in. (1·41 kg./cm.²).

GENERAL DATA—*continued*

CAPACITIES	*Imp.*	*U.S.*	*Litres*
Engine sump (including filter)	6·5 pts.	7·8 pts.	3·7
Gearbox	2·25 pts.	2·7 pts.	1·3
Rear axle	1·5 pts.	1·8 pts.	·85
Cooling system	10 pts.	12 pts.	5·68
Fuel tank	6 gal.	7·2 gal.	27·3

GENERAL DIMENSIONS

Wheelbase	6 ft. 8 in. (2·03 m.).
Overall length	11 ft. 4¼ in. (3·46 m.).
Overall width	4 ft. 5 in. (1·35 m.).
Overall height	4 ft. 1¾ in. (1·25 m.).
Ground clearance	5 in. (12·7 cm.).
Turning circle: Left lock	32 ft. 1½ in. (9·79 m.).
Right lock	31 ft. 2½ in. (9·51 m.).
Track: Front	3 ft. 9¾ in. (1·16 m.).
Rear	3 ft. 8¾ in. (1·14 m.).
Kerbside weight	1,316 lb. (597 kg.).

WEIGHTS OF COMPONENTS

Engine	246 lb. (111·5 kg.).
Gearbox	44 lb. (19·95 kg.).
Axle	83 lb. (37·64 kg.).
Vehicle (kerbside)	1,566 lb. (710·33 kg.).

GENERAL INFORMATION

CONTROLS, INSTRUMENTS, SWITCHES

Gear lever

The gear change lever positions are clearly shown in the diagram.

To engage reverse gear move the lever to the right of the neutral position until resistance is felt, apply side pressure to the lever to overcome resistance, and then pull it backwards to engage the gear.

Synchromesh is provided on second, third, and fourth gears.

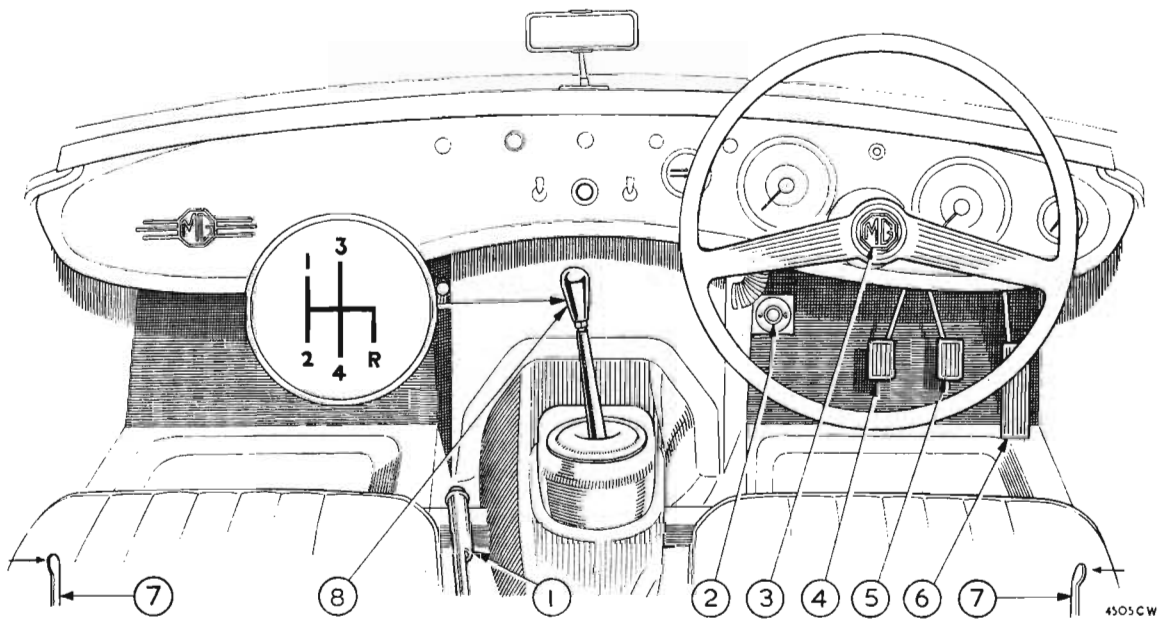
Pedals

The left-hand pedal operates the clutch, the centre pedal the brakes, and the right-hand pedal the accelerator.

Do not allow the foot to rest on the clutch pedal while driving or excessive wear of the operating mechanism will result.

Hand brake

The hand brake is applied by pulling upwards on the lever situated between the driver's and passenger's seats. The ratchet mechanism will hold the brake in the 'on' position and will be heard engaging as the lever is pulled. To release the hand brake pull upwards on the lever, depress the button on the end, and push the lever downwards to the 'off' position.



Driving controls—right-hand drive

1. Hand brake.
2. Headlamp dip switch.
3. Horn switch.
4. Clutch pedal.
5. Brake pedal.
6. Accelerator pedal.
7. Seat adjuster lock.
8. Gear lever.

Headlamp dip switch

The foot-operated dip switch is mounted on the floor to the left of the clutch pedal. It is of the repeating type, lowering the beams on one application and raising them on the next. The headlamp beam warning light glows when the beams are in the raised position.

Direction indicators and horns

The direction indicator switch is mounted on the fascia above the ignition switch. To operate, move the switch to the left or right according to whichever indicator is required; a warning light flashes green when the indicators are in use.

The horn is operated by pressing the button in the centre of the steering-wheel.

Windtone horns

These horns are fitted as optional extras only.

Ignition switch

The switch is situated in the centre of the fascia and is operated by a removable key, which is turned clockwise to switch on the ignition.

Starter switch (marked 'S')

Pull the knob smartly and firmly to operate the starter motor. Release it immediately the engine starts. If the engine fails to start first time wait until the starter motor has come to rest before operating the control again.

Choke or mixture control (marked 'C')

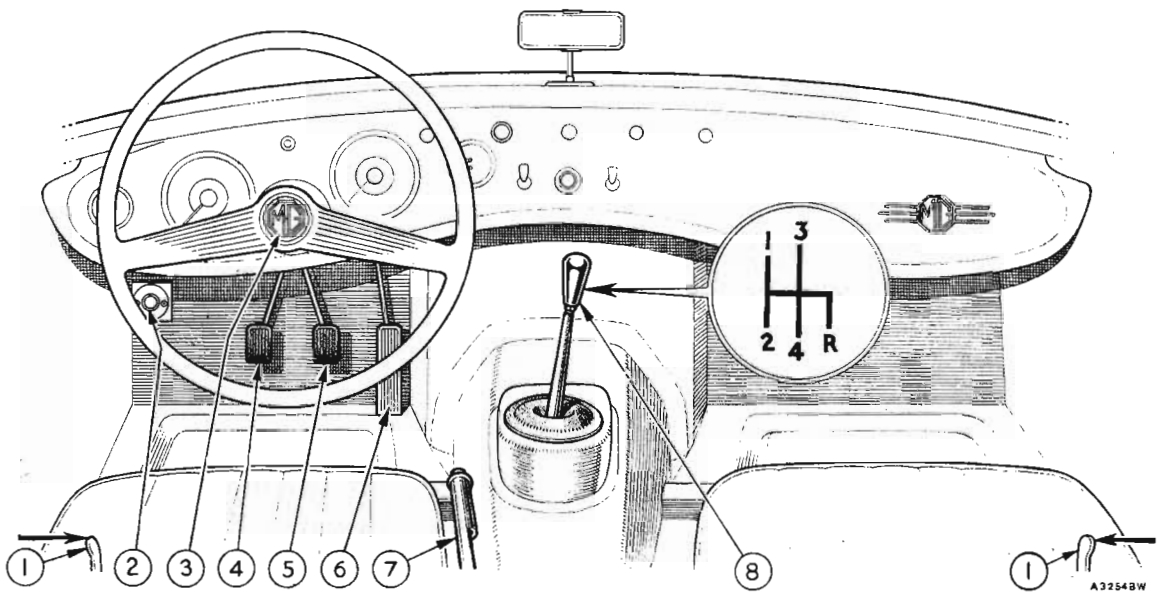
Pull out the control to its limit when starting the engine from cold. Return the control to its normal running position (pushed right in) as soon as possible after starting the engine.

Do not use the control when the engine is warm.

Windshield wiper switch

Move the switch lever downwards to set the wipers in motion. The blades are automatically parked when the switch is returned to the 'off' position.

The windshield wipers will operate only if the ignition is also switched on.



Driving controls—left-hand drive

1. Seat adjuster lock.
2. Headlamp dip switch.
3. Horn switch.
4. Clutch pedal.
5. Brake pedal.
6. Accelerator pedal.
7. Hand brake.
8. Gear lever.

Lighting switch

Move the lever downwards to switch on the side and tail lamps, and into the fully down position for the head, side, and tail lamps.

Panel light switch

This is situated on the lower edge of the fascia below the speedometer. No light will be obtained unless the side-lamps are in operation.

Windshield washer (optional extra)

To operate the washer press the control knob at the far left-hand side of the fascia. In cold weather it is important to fill the reservoir with a mixture of water and Trico to prevent freezing of the water in the container and on the windshield.

Do not use radiator anti-freeze solution in the windshield-washing equipment.

Heating and demisting system (optional extra)

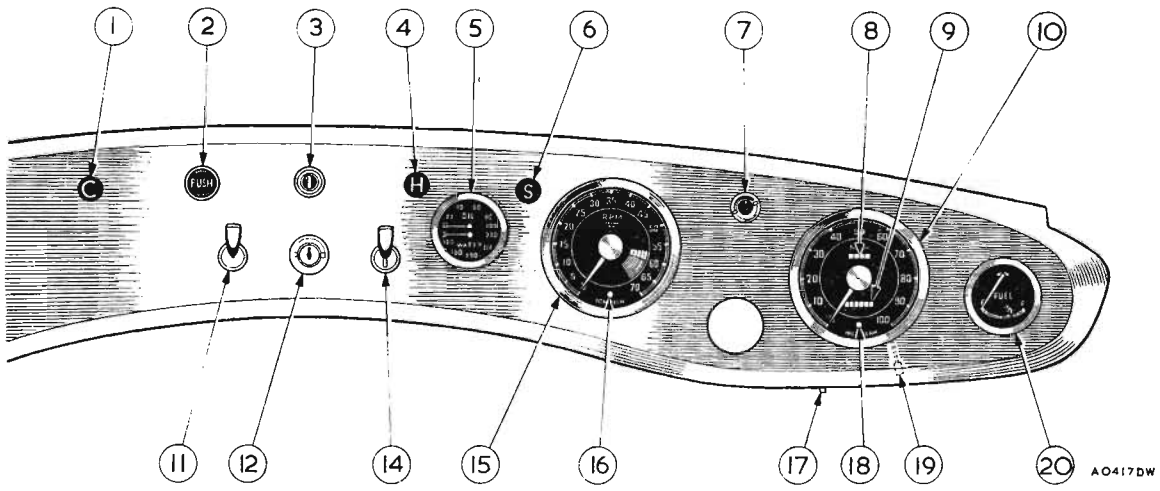
The heating and demisting system is provided for two purposes: (*a*) heating the interior of the car, (*b*) demisting and defrosting the windshield.

Air for the heater is drawn from a forward-facing intake via an auxiliary blower which should only be needed at speeds below 25 m.p.h. (40 km.p.h.). A shut-off valve is incorporated in the heater intake to prevent fumes from entering the car in traffic. The valve must always be open when heating is required. A water tap is fitted at the rear of the engine. In summer conditions this tap may be shut off and the heating system may then be used for cool air ventilation.

The heating and ventilating system is operated by a single control located on the fascia and marked 'H'. To close the shut-off valve pull out the knob, and to bring the blower into operation push in the knob and turn in a clockwise direction. Two doors located forward at either side of the gearbox tunnel control distribution of air between screen and car interior. For heating open the doors; for defrosting and demisting close the doors.

Speedometer

In addition to showing the car speed this has total distance and trip recorders. The trip recorder can be set to zero by pushing the resetting knob upwards and turning it anti-clockwise.



Instruments and switches—right-hand drive

1. Choke control.
2. Windshield washer control.
3. Direction indicator switch.
4. Heater switch.
5. Oil pressure and water temperature gauge.
6. Starter switch control.
7. Direction indicator warning lamp.
8. Trip mileage indicator.
9. Total mileage indicator.
10. Speedometer.
11. Windshield wiper switch.
12. Ignition switch.
14. Lighting switch.
15. Tachometer.
16. Ignition warning light.
17. Panel light switch.
18. Headlamp main beam warning light.
19. Trip mileage resetting knob
20. Fuel gauge.

Tachometer (optional extra)

The speed of the engine is indicated by this dial, which is calibrated in hundreds of revolutions per minute. Normal use of the engine will not require speeds over 5,000 r.p.m.; with care and under favourable conditions between 5,500 and 6,000 r.p.m. may be attained, but this speed must not be exceeded.

Water temperature gauge

The needle registers the coolant temperature only when the ignition is switched on. The normal running temperature is 164° F. (73° C.). Should there be a sudden change from the usual running temperature, immediate attention should be given to the cooling system and the cause of the trouble rectified.

Oil pressure gauge

The normal working pressure when the engine is warm is 60 lb./sq. in. (4·2 kg./cm.^{2}) with a proportionately lower idling pressure. Should the gauge fail to register, stop the engine immediately, and investigate and rectify the trouble before starting the engine again.

Fuel gauge

This shows the amount of fuel in the tank and operates only when the ignition is switched on.

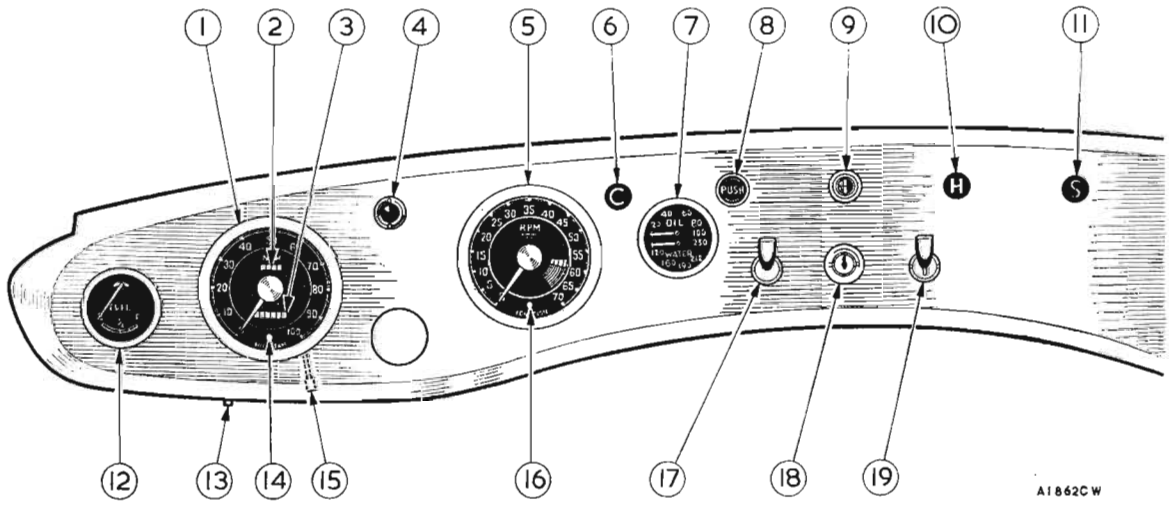
Warning lamps

The headlamp main beam warning light is in the lower half of the speedometer dial. Coloured dark red to avoid dazzle, the warning lamp glows when the headlamps are in the raised position and is extinguished when the beams are dipped for approaching traffic.

In the lower half of the tachometer dial is the ignition warning light. The bright-red light will go out as the engine speed is increased; should it glow at all engine speeds, the dynamo is not charging the battery, and after ascertaining that the dynamo belt is not broken the circuit should be examined.

Bonnet release

The bonnet lock is released by pulling the control knob marked 'B' located below the fascia and on the left-hand side of the gearbox tunnel. Insert a finger under the left-hand front edge of the bonnet and push the safety catch rearwards to fully release the bonnet and allow it to be lifted into the open position.



Instruments and switches—left-hand drive

1. Speedometer.
2. Trip mileage indicator.
3. Total mileage indicator.
4. Direction indicator warning light.
5. Tachometer.
6. Choke control.
7. Oil pressure and water temperature gauge.
8. Windshield washer control.
9. Direction indicator switch.
10. Heater switch.
11. Starter switch control.
12. Fuel gauge.
13. Panel light switch.
14. Headlamp main beam warning light.
15. Trip mileage resetting knob.
16. Ignition warning light.
17. Windshield wiper switch.
18. Ignition switch.
19. Lighting switch.

Luggage compartment

The luggage compartment is locked by the ignition key. Located within this compartment are the spare wheel and tool kit.

Spare wheel and jack

The spare wheel is retained in position horizontally on the floor of the luggage compartment by webbing straps.

The spare wheel should always be maintained in good repair and inflated to the correct pressure, otherwise its value in an emergency is reduced and tiresome roadside pumping may be involved. It should also be exchanged with the road wheels periodically to ensure even wear on all tyres—every 3,000 miles (4800 km.) is recommended.

The jack and ratchet handle are also housed in the luggage compartment. When using the jack, always ensure that the jack lug is properly engaged in the socket below the front doors (normally closed by a rubber plug).

Fuel filler

The fuel filler is located towards the rear on the right-hand side of the body. The tank is sealed by a cap which must be turned anti-clockwise for removal.

A locking filler cap can be supplied as an optional extra.

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. When 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—M.G., etc.

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

The third letter indicates the type of body—2-seater Tourer, 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

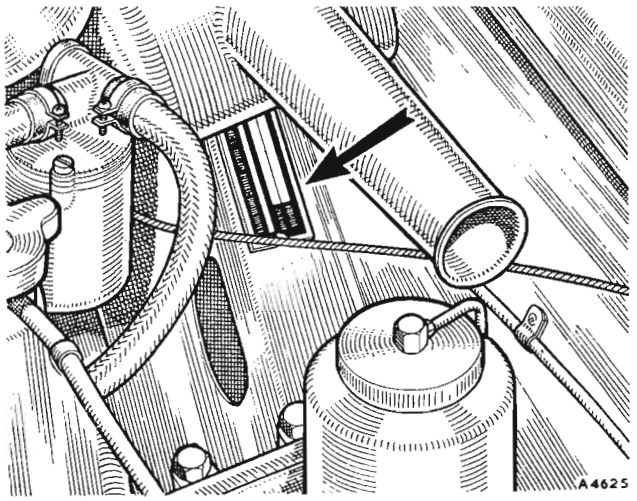
A—Ambulance	J—Convertible	P—Hard-top	T—4-seat Tourer
C—Chassis	K—Truck	Q—Chassis and Cab	U—Pick-up
D—Coupé	L—Hire Car	R—Chassis and Scuttle	V—Van
E—G.P.O. Engineers	M—Limousine	S—4-door Saloon	W—Dual-purpose
G—G.P.O.	N—2-seater Tourer	2S—2-door Saloon	X—Taxi
H—Hearse			

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

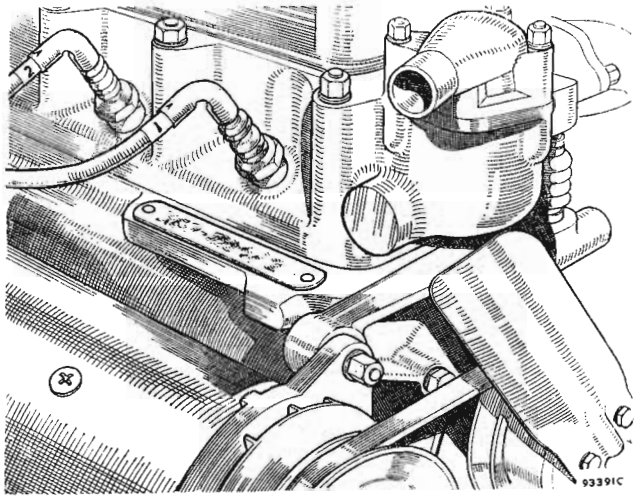
5th Prefix (used when vehicles differ from standard R.H.D.) L—Left-hand drive.

LOCATION OF MAJOR COMPONENT SERIAL NUMBERS

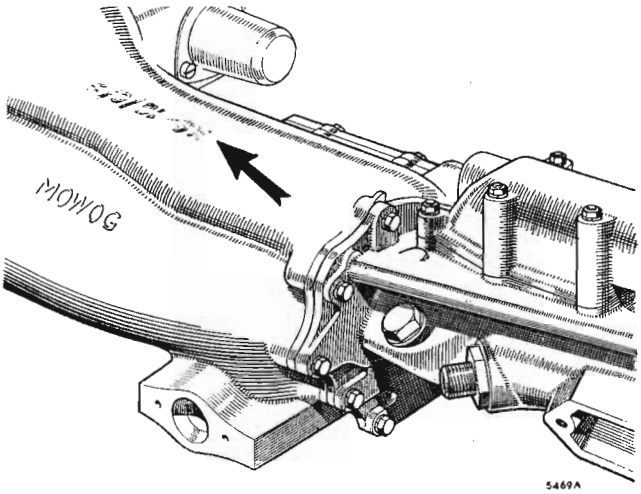
The car and engine numbers must always be quoted in communications between the customer and Dealer and the Dealer and the Company. The registration number is of no assistance and is not required.



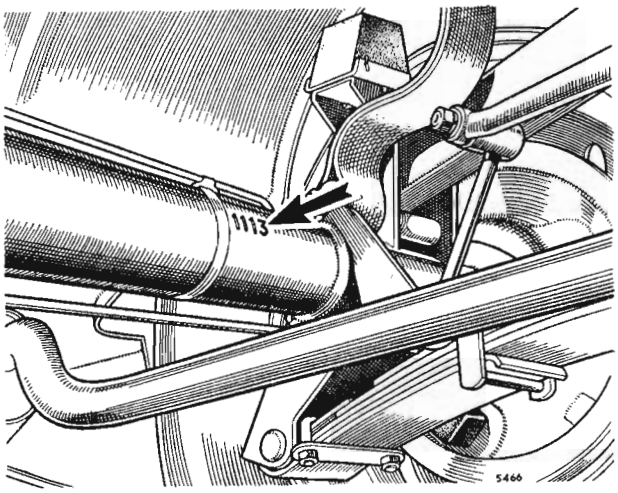
Car (Chassis) Number. This is stamped on a plate mounted on the left-hand inner wheel arch valance under the bonnet



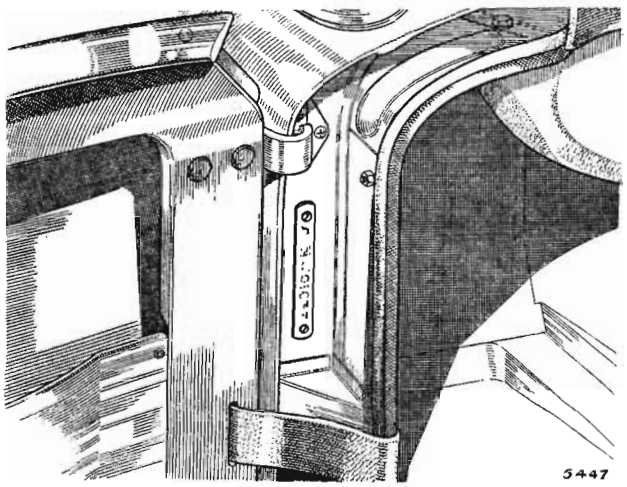
Engine Number. This is stamped on a plate secured to the right-hand side of the cylinder block above the dynamo



Gearbox Number. This is stamped on the top of the gearbox casing



Rear Axle Number. This is stamped on the front of the left-hand rear axle tube adjacent to the spring anchorage



Body Number. This is stamped on a plate secured to the left-hand front door pillar

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.

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

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

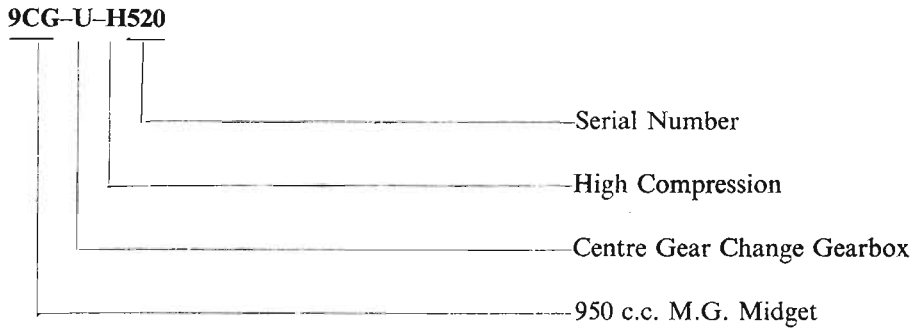
2nd Prefix Group—Gearbox and ancillaries

- A—Automatic gearbox
- M—Manumatic clutch
- N—Steering-column gear change gearbox
- 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



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.

Except in cases of emergency Warranty work should always be carried out by a franchise holder, since this ensures that no doubt can arise in connection with circumstances of the vehicle history when claims are put forward.

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.

FILLING UP WITH FUEL

Considerable loss of fuel can occur as a result of filling the fuel tank so that the fuel is visible in the filler tube. If this is done and the vehicle is left in the sun, expansion due to heat will cause leakage, with consequent loss of and danger from exposed fuel.

When filling up, therefore:

(1) Avoid overfilling the tank so that the fuel is visible in the filler tube.

(2) If the tank is advertently overfilled, take care to park the vehicle in the shade with the filler as high as possible.

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.

RUNNING-IN SPEEDS

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

During the first 500 miles (800 km.)

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

DO NOT operate at full throttle in any gear.

DO NOT allow the engine to labour in any gear.

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 M.G. Dealer from whom you purchased it, or, if this should not be convenient, by any other M.G. Dealer by arrangement. This attention given during the critical period in the life of the car makes all the difference to its subsequent life and performance.

This service includes:

1. *Engine*
   Tighten cylinder head and manifold nuts to recommended pressures.
   Check tightness of 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 carburetters 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 operation, and bleed if necessary.
   Check level of fluid in the hydraulic clutch and brake supply reservoir, 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 and clutch master cylinder reservoir, 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 or diluted acid as may be required.
   Clean and tighten terminals.

9. *General*
   Check tightness of all nuts and bolts on universal joints, suspension, wings (fenders), etc.

10. *Lubrication*
    Drain oil from engine, gearbox, and rear axle and refill.
    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. 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 dampers.
   Lubricate carburetter controls.
   Top up radiator.

2. *Brakes*
   Check brake pedal free travel and report if adjustment is required.
   Make visual inspection of brake lines and pipes.
   Check level of fluid in the hydraulic brake and clutch master cylinder, and top up if necessary.

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

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

MAINTENANCE ATTENTION—*continued*

5. *Lubrication*
   Top up levels in engine, gearbox, and rear axle.
   Lubricate all nipples (except steering-rack).

6. *Wheels and tyres*
   Check tyre pressures.
   Check wheel nuts for tightness.

2,000 miles (3200 km.) service

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

3,000 miles (4800 km.) service

1. *Engine*
   Top up carburetter piston dampers.
   Lubricate carburetter controls.
   Top up radiator.
   Check dynamo drive belt tension.

2. *Ignition*
   Clean and adjust sparking plugs.

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

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

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

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

7. *Lubrication*
   Change engine oil.
   Top up oil levels in gearbox and rear axle.
   Lubricate all nipples (except steering-rack).

8. *Wheels and tyres*
   Change wheels round diagonally, including spare, to regularize tyre wear.
   Check tyre pressures.

4,000 miles (6400 km.) service

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

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 dampers.
   Lubricate carburetter controls.
   Top up radiator.
   Check dynamo drive belt tension.
   Lubricate water pump sparingly.
   Check valve rocker clearances, and adjust if necessary.
   Clean fuel pump sediment chamber and filter.

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. *Brakes*
   Check brakes, and adjust if necessary.
   Make visual inspection of brake lines and pipes.
   Check level of fluid in the hydraulic brake and clutch master cylinder reservoir, and top up if necessary.

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

5. *General*
   Tighten rear road spring anchorage bolts.

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

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

8. *Lubrication*
   Change oil in engine, gearbox, and rear axle.
   Fit new oil filter element.
   Lubricate all nipples (except steering-rack).
   Repack front hubs with grease.

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

7,000 miles (11200 km.) service

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

8,000 miles (12800 km.) service

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

9,000 miles (14400 km.) service

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

10,000 miles (16000 km.) service

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

11,000 miles (17600 km.) service

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

12,000 miles (19200 km.) service

1. *Engine*
   Remove carburetter suction chambers and pistons, clean, reassemble, and top up.
   Remove carburetter float-chambers, empty sediment, and refit.
   Lubricate carburetter controls.
   Check valve rocker clearances, and adjust if necessary.
   Fit new air cleaner elements.
   Check dynamo drive belt tension.
   Lubricate water pump sparingly.
   Clean fuel pump sediment chamber and filter.

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

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

4. *Brakes*
   Check brakes, and adjust if necessary.
   Make visual inspection of brake lines and pipes.
   Check level of fluid in the hydraulic brake and clutch master cylinder reservoir.

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

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

7. *General*
   Tighten rear road spring anchorage bolts.

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

9. *Electrical*
   Check battery cell specific gravity readings and top up to correct level.
   Lubricate dynamo bearing.
   Check headlamp beam setting, and reset if necessary.

10. *Lubrication*
    Drain and flush out engine, refilling with fresh oil.
    Fit new oil filter element.
    Change oil in gearbox and rear axle.
    Lubricate all nipples.
    Lubricate steering-rack.
    Repack front hubs with grease.
    Lubricate speedometer and tachometer drive cables.

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

24,000 miles (39400 km.) service

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

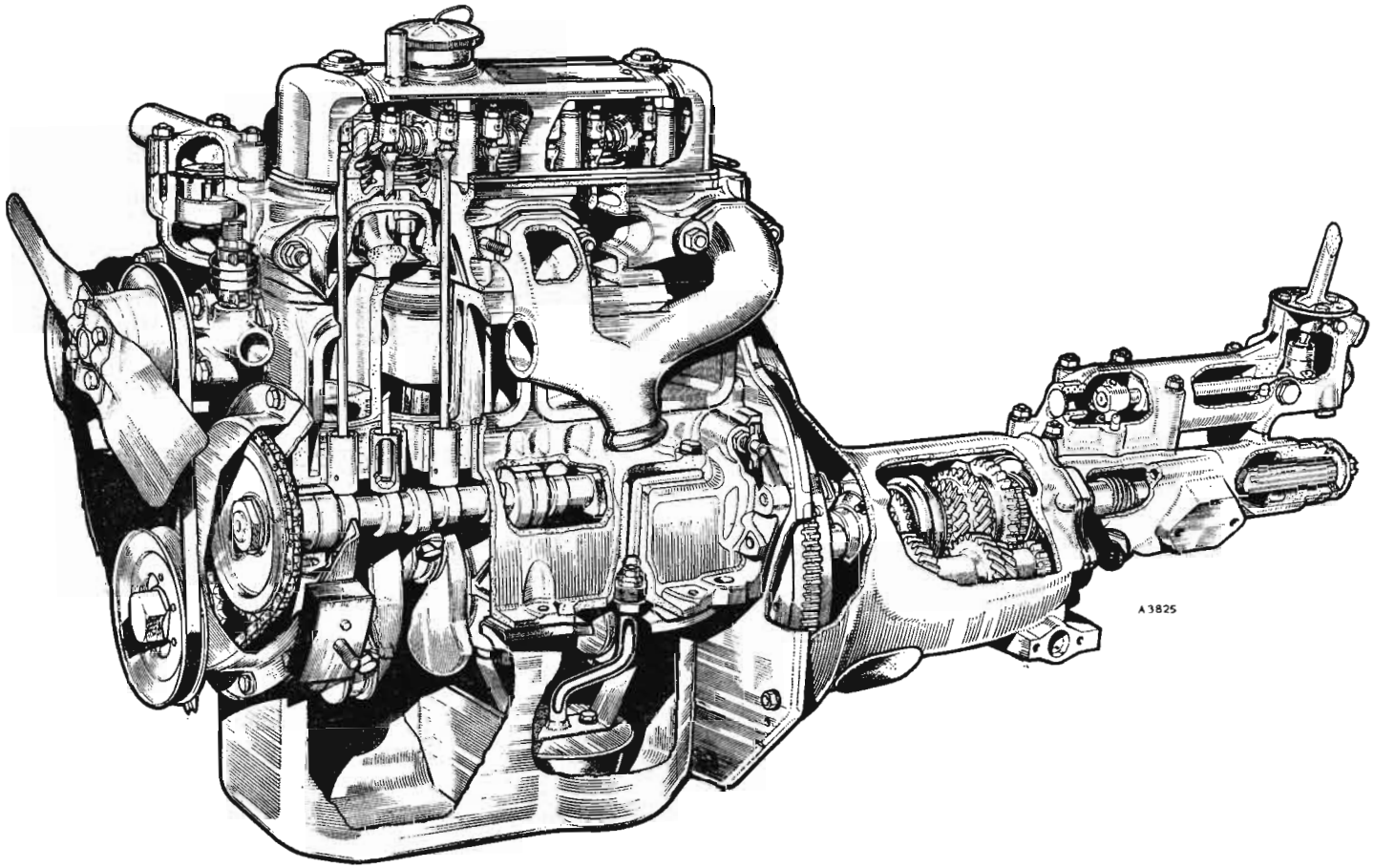
1. *Engine*
   Remove engine sump and pick-up strainer, clean, and reassemble, filling with fresh oil.

SECTION A

THE ENGINE

	Section
General description	
Lubrication	
Camshaft	A.25
Carburetters and air cleaners	A.9
Clutch, flywheel, and engine rear plate	A.20
Crankshaft and main bearings	A.29
Cylinder head	A.12
Cylinder liners	A.30
Decarbonizing	A.13
Distributor driving spindle	A.19
Draining the sump	A.1
Engine	A.31
Engine mountings	A.32
Exhaust system	A.10
Flywheel starter rings	A.21
Inlet and exhaust manifold	A.11
Oil pressure	A.2
Relief valve	A.3
Oil pump	A.5
Piston rings	A.27
Pistons and connecting rods	A.26
Piston sizes and cylinder bores	A.28
Rocker bushes	A.8
Rocker shaft assembly	A.6
Service Tools	End of Section
Sump and gauze strainer	A.4
Tappets	A.7
Timing cover	A.22
Timing gears	A.23
Valves	A.14
Grinding	A.15
Guides	A.17
Rocker adjustment	A.18
Seat inserts	A.16
Timing	A.24

THE POWER UNIT



GENERAL DESCRIPTION

The four-cylinder in-line overhead-valve engine is of unit construction and incorporates a detachable cylinder head of cast iron carrying the push-rod-operated valve gear. The push-rods are operated from the camshaft situated on the left-hand side of the engine. Oil seals are fitted to the valves and there is the normal provision on the rockers for clearance adjustment.

A centrifugal water pump and fan is driven from the crankshaft by the fan belt. Large-area water-circulating passages and full-length water jackets enable the engine to be cooled even under the most arduous conditions.

The camshaft is roller-chain-driven from the crankshaft with all three journals running in steel-backed white-metal bearings. The distributor is driven from the camshaft by a transverse shaft with helical gear drive.

Pistons are fitted with three compression rings and one oil control ring. The gudgeon pins are clamped to the connecting rods, which have renewable, steel-backed, lead-bronze or copper-lead bearings with lead-indium surfaces.

Removal of the engine through the bonnet aperture can be accomplished provided facilities are available for an operator to work beneath the front of the car.

LUBRICATION

The oil is contained in the sump beneath the cylinder block and the filler cap is fitted to the valve rocker cover. The oil dipstick is on the right-hand side of the engine and is marked to indicate the maximum and minimum levels.

The eccentric-vane non-draining-type oil pump is mounted on the rear end of the crankcase and is driven by the camshaft. Oil drawn through a gauze strainer in the sump is delivered to a gallery on the right-hand side of the crankcase. The oil then passes by way of drilled passages to the main, big-end, and camshaft bearings.

The connecting rods have jet holes to deliver oil quickly to the cylinder walls when starting up. The camshaft front bearing feeds oil at a reduced pressure to the overhead-valve rocker gear and also to the timing chain. The tappets are lubricated by oil returning from the rocker gear by way of the push-rod apertures and by splash.

The external oil filter carried on the right-hand side of the engine crankcase is of the full-flow, renewable-element type. It is connected to the main oil gallery by a drilled passage. An oil pipe connects the rear end of the main oil gallery with the oil gauge on the instrument panel, and below the oil pipe union is a non-adjustable pressure relief valve.

Section A.1

DRAINING THE SUMP

The sump 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 3,000 miles (4800 km.). The drain plug is situated at the rear end of the sump on the right-hand side.

The oil will flow more readily if drained when the engine is hot; 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.

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

Section A.2

OIL PRESSURE

The normal operating pressure is 30 to 60 lb/sq. in. (2·1 to 4·2 kg./cm.^{2}).

The oil gauge is combined with the thermometer on the instrument panel.

A pressure of 10 to 25 lb./sq. in. (0·7 to 1·7 kg/cm.^{2}) should be registered when the engine is idling. **If no pressure is registered by the gauge, stop the engine at once and investigate the cause.**

NOTE.—The automatic relief valve in the lubrication system deals with any excessive oil pressure when starting from cold.

Checking for low oil pressure

Check the level of the oil in the sump by means of the dipstick, and top up if necessary. Ascertain that the gauze strainer in the sump is clean and not choked with sludge, also that there is no leakage at the strainer union on the suction side of the pump.

In the unlikely event of the oil pump being defective, remove the unit and rectify the fault (see Section A.5). The oil relief valve should be examined (see Section A.3).

If the engine bearings are worn the oil pressure will be reduced. A complete bearing overhaul and the fitting of replacement parts is the only remedy, necessitating the removal of the engine from the vehicle.

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.

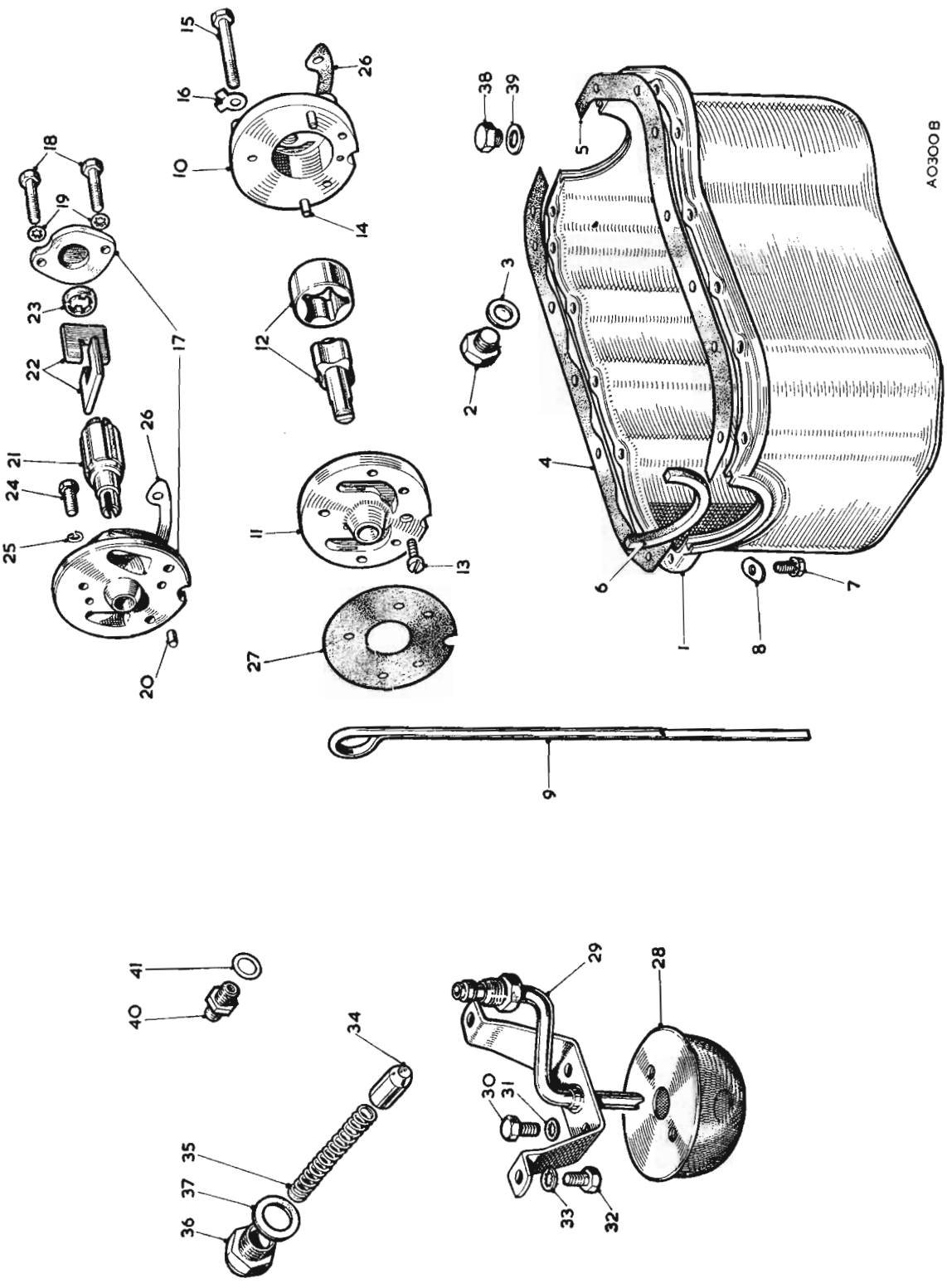
Section A.3

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 compressed coil spring; this compression is maintained by two fibre washers and a domed screw plug.

The relief valve spring maintains a pressure on the valve cup, which in turn seats on the machined face in the cylinder block to provide an extra oil return passage should the pressure become excessive.

THE OIL PUMP AND SUMP



KEY TO THE OIL PUMP AND SUMP

No.	*Description*
1.	Sump.
2.	Sump drain plug.
3.	Washer.
4.	Sump to crankcase joint—R.H.
5.	Sump to crankcase joint—L.H.
6.	Main bearing cap oil seal.
7.	Screw and captive washer.
8.	Washer.
9.	Dipper rod.
10.	Oil pump body.
11.	Cover (plain hole).
12.	Driving shaft with inner and outer rotors.
13.	Cover to body screws.
14.	Dowel.
15.	Pump to crankcase screw.
16.	Lock washer.
17.	Body and cover assembly.
18.	Screw.
19.	Shakeproof washer.
20.	Dowel.
21.	Rotor.
22.	Vane.
23.	Sleeve.
24.	Pump to crankcase screw.
25.	Spring washer.
26.	Lock plate (for all pumps).
27.	Pump to crankcase joint.
28.	Oil strainer.
29.	Suction pipe with oil strainer bracket.
30.	Screw.
31.	Shakeproof washer.
32.	Screw (bracket to bearing cap).
33.	Shakeproof washer.
34.	Oil relief valve.
35.	Spring for oil relief valve.
36.	Cap nut.
37.	Washer.
38.	Oil priming plug.
39.	Washer (copper).
40.	Oil pressure union.
41.	Washer (fibre).

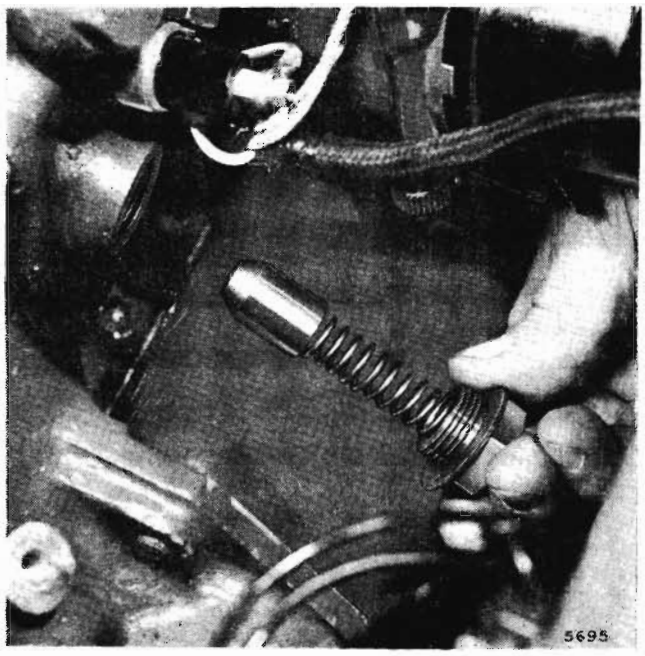


Fig. A.1

The location of the oil pressure relief valve

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).

A new cup and spring should be fitted if required.

Section A.4

SUMP AND GAUZE STRAINER

Removing

Drain the oil into a suitable container. Remove the set screws and spring washers and lower the sump.

Unscrew the oil suction pipe at its connection with the crankcase. Remove the two set screws securing the strainer support bracket to the main bearing cap. Remove the strainer and support bracket from the engine. Clean the strainer in petrol (gasoline) and dry thoroughly with a non-fluffy rag.

Refitting

Refit the strainer and its securing bracket, ascertaining that the oil suction pipe is located in its connection to the crankcase.

Secure the suction pipe connection and the two strainer support bracket set screws.

Clean the sump thoroughly inside and out, paying particular attention to the joint faces. Remove all traces of cleaning fluid.

Refit the sump by reversing the sequence of operations for removal, using a new joint washer if necessary.

Section A.5

OIL PUMP

Removing

Remove the engine as described in Section A.31.

Remove the flywheel, clutch assembly, and the engine back plate as detailed in Section A.20, thus gaining access to the oil pump.

Tap back the locking washers and remove the 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 new parts fitted as required.

Dismantling and reassembling (Burman)

Unscrew and remove the two screws and spring washers 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.

Reassembling is the reverse of the dismantling procedure.

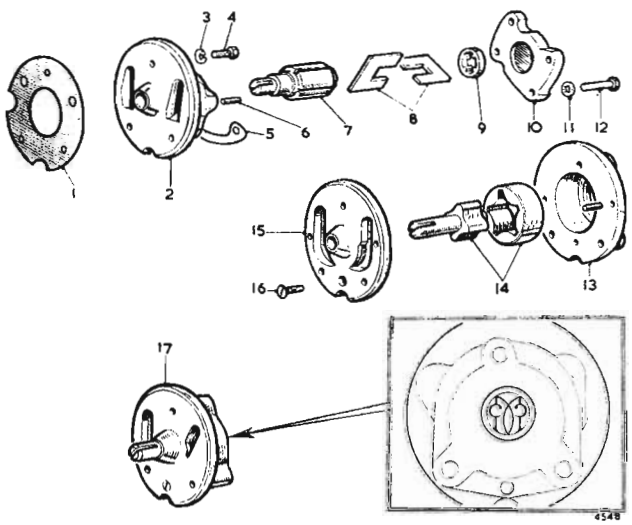


Fig. A.2

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).

Refitting

The refitting of the pump to the cylinder block is the reverse 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.6

ROCKER SHAFT ASSEMBLY

Removing

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

Remove the two securing screws and lift off the rocker cover, care being taken not to damage the cork gasket.

Release the eight rocker shaft bracket securing nuts and the five external cylinder head stud nuts gradually, a turn at a time, in the order shown in Fig. A.6, until all the load is released.

It is of great importance that the five external cylinder head fixing nuts should be released at the same time in order to eliminate any distortion that might take place and result in water finding its way into the cylinder bores and the engine sump.

Remove the eight rocker shaft bracket nuts and lift off 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.

Reassembling

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 positions on the shaft. The screwed plug end of the shaft should be positioned to the front of the engine.

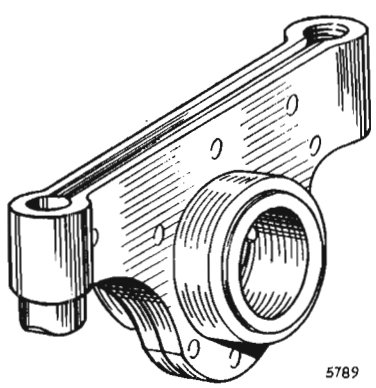


Fig. A.3

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

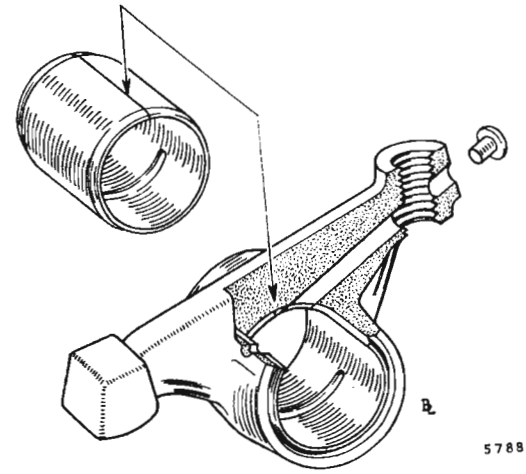


Fig. A.4

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

Refitting

Refitting is the reverse 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.6 and to the torque wrench figure given under **'GENERAL DATA'.**

Refer to Section A.18 for details of valve rocker adjustment.

Section A.7

TAPPETS

Removing

Remove the carburetters and the rocker cover.

Remove the manifold and disconnect the high-tension leads from the sparking plugs.

Remove the rocker assembly 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 orginal locations.

Refitting

Refitting is the reverse 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 the reverse of the above procedure, but care should be taken to see that the tappet cover joints are oil-tight and that the rockers are adjusted to give the correct valve clearance.

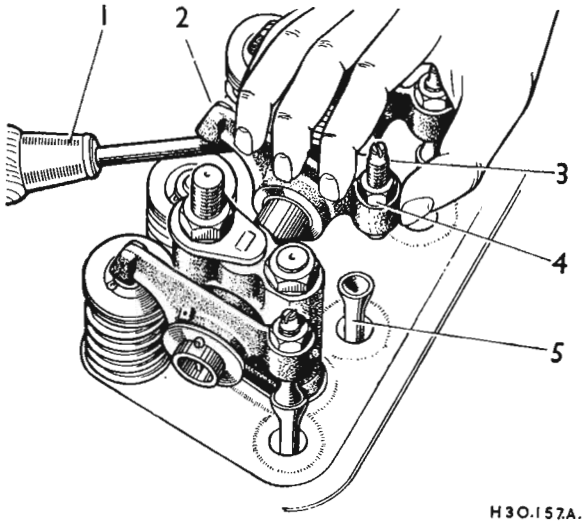


Fig. A.5

Push-rod removal

1. Screwdriver.
2. Valve rocker.
3. Adjusting screw.
4. Locknut.
5. Push-rod.

Section A.8

ROCKER BUSHES

Pressed-steel type

Remove and dismantle the rocker shaft assembly as detailed in Section A.6.

Rebushing is not practicable and must be not undertaken. When bushes become worn new rocker assemblies must be fitted.

Forged type

To rebush, 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.4. 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.] diameter) 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

CARBURETTERS AND AIR CLEANERS

Removing

Disconnect the breather pipe from the rocker cover and the fuel feed pipe from the fuel pump. Remove the throttle cable from its fixing point on the interconnecting lever. Disconnect the choke control and remove the adjustable cable nipple at the end of the choke control. Remove the interconnecting fuel pipe fixing bracket from the carburetter heat shield. Remove the securing nuts and washers from the carburetter induction manifold flanges and lift off the twin-carburetter assembly as one unit. For carburetter dismantling and reassembling see Section D.

Refitting

Reverse the removal procedure.

Section A.10

EXHAUST SYSTEM

Removing

Release the securing clip and disconnect the down pipe from its fixing point on the clutch housing and from the two locations on the rear body section.

Refitting

Refitting is the reverse of the removal procedure.

Section A.11

INLET AND EXHAUST MANIFOLD

Removing

Remove the carburetters and air cleaners as detailed in Section A.9. Slacken off and release the exhaust pipe clamp. Remove the nuts and washers securing the manifold to the cylinder head; withdraw the manifold.

When a heater is fitted remove the water pipe brackets from the induction 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.12

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 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 carburetters and air cleaners as described in Section A.9. Take out the 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.

Remove the suction pipe clip from its fixture on the hot water control valve. If a heater is fitted release the retaining clip and detach the inlet hose.

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

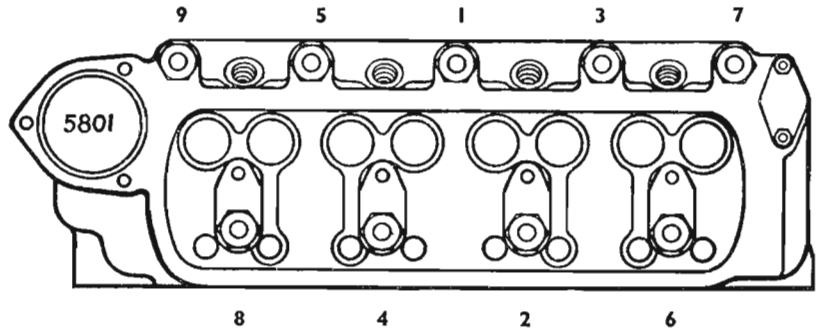


Fig. A.6

The order of loosening and tightening the cylinder head nuts

When a heater is fitted remove the water pipe from the induction manifold.

Remove the inlet and exhaust manifold as described in Section A.11.

Remove the rocker assembly as described in Section A.6, 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 to 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. Lift the head squarely to prevent the studs binding in their holes.

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.6.

Whenever the head has been moved or the valves have been ground in or otherwise disturbed it is necessary to check the valve clearances as in Section A.18. 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 hose to the heater inlet pipe.

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 carburetters and air cleaners (as in Section A.9).

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 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.18). Replace the rocker cover.

Refit the bonnet.

Section A.13

DECARBONIZING

Remove the cylinder head as described in Section A.12.

Withdraw the valves as described in Section A.14.

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

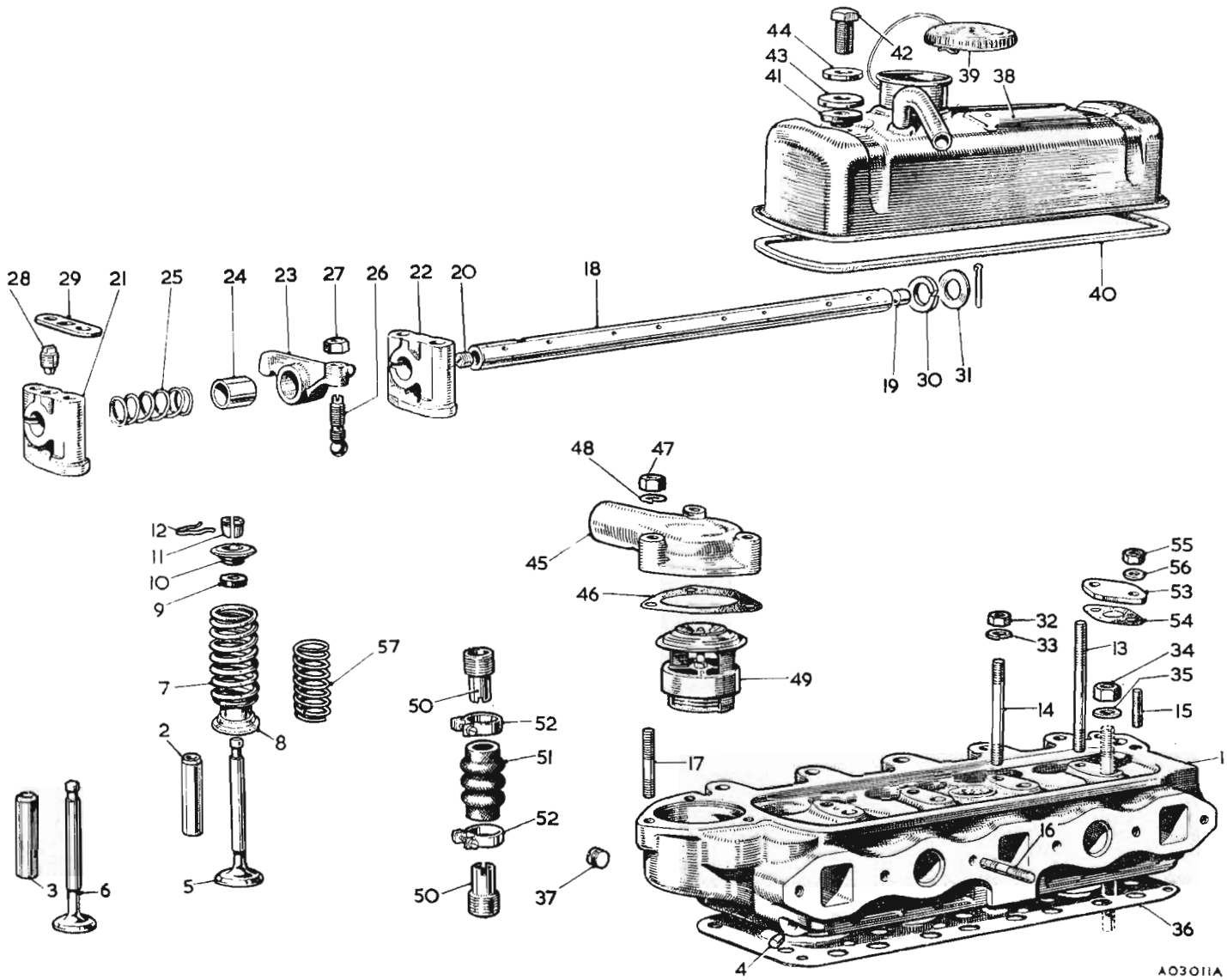
If special equipment is not available scrape the carbon deposit from the piston crowns, cylinder block, and cylinder head, using a blunt scraper.

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, then thoroughly clean with paraffin and dry off.

Fit a new 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.

THE CYLINDER HEAD AND VALVE GEAR



KEY TO THE CYLINDER HEAD AND VALVE GEAR

No.	*Description*
1.	Cylinder head with valve guides.
2.	Inlet valve guide.
3.	Exhaust valve guide.
4.	Oil hole plug.
5.	Inlet valve.
6.	Exhaust valve.
7.	Outer valve spring.
8.	Shroud for valve guide.
9.	Valve packing ring.
10.	Valve spring cup.
11.	Valve cotter.
12.	Valve cotter circlip.
13.	Rocker bracket stud (long).
14.	Rocker bracket stud (short).
15.	Cover-plate stud.
16.	Manifold stud.
17.	Water outlet elbow stud.
18.	Valve rocker shaft (plugged).
19.	Rocker shaft plug (plain).
20.	Rocker shaft plug (screwed).
21.	Rocker shaft bracket (tapped).
22.	Rocker shaft bracket (plain).
23.	Rocker (bushed).
24.	Rocker bush.
25.	Rocker spacing spring.
26.	Tappet adjusting screw.
27.	Locknut.
28.	Rocker shaft locating screw.
29.	Rocker shaft bracket plate.
30.	Spring washer.
31.	Washer.
32.	Nut.
33.	Spring washer.
34.	Cylinder head nut.
35.	Washer.
36.	Cylinder head gasket.
37.	Thermal indicator boss screwed plug.
38.	Valve rocker cover.
39.	Oil filler cap.
40.	Cover joint.
41.	Cover bush.
42.	Nut.
43.	Distance piece.
44.	Cup washer.
45.	Water outlet elbow.
46.	Joint.
47.	Nut.
48.	Spring washer.
49.	Thermostat.
50.	By-pass adaptor.
51.	By-pass connector (rubber).
52.	By-pass clip.
53.	Cover-plate.
54.	Joint (plate to cylinder head).
55.	Cover nut.
56.	Spring washer.
57.	Inner valve spring.

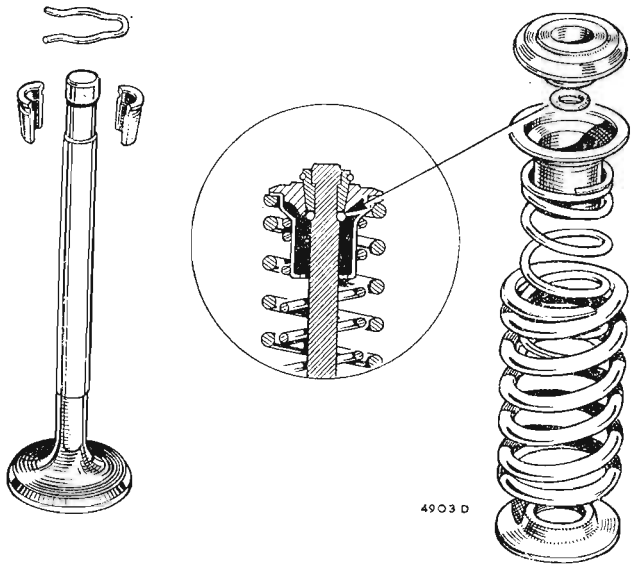


Fig. A.7

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

Section A.14

VALVES

Removing

Remove the cylinder head as detailed in Section A.12.

Before removing the valves stamp the head of each with a number to indicate its position. Commence with No. 1 at the front of the engine.

Remove the cotter clip, compress the valve springs, and remove the split cotters.

Release the valve springs and remove the compressor. Remove the retaining cap, shroud, valve springs, 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 springs, spring shroud, and the retaining cap. Compress the springs 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.

Section A.15

VALVE-GRINDING

Remove the valves as in Section A.14.

Clean each valve thoroughly and examine for pitting. Valves in a pitted condition should be refaced 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. 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 dimensions given under **'GENERAL DATA'.**

When grinding a valve the 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.

The inner 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 inner coil spring. This assists in spreading the paste evenly over the valve face and seat. Carry out the grinding operation until a dull, even, mat 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.14 for details of valve refitting.

Section A.16

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.

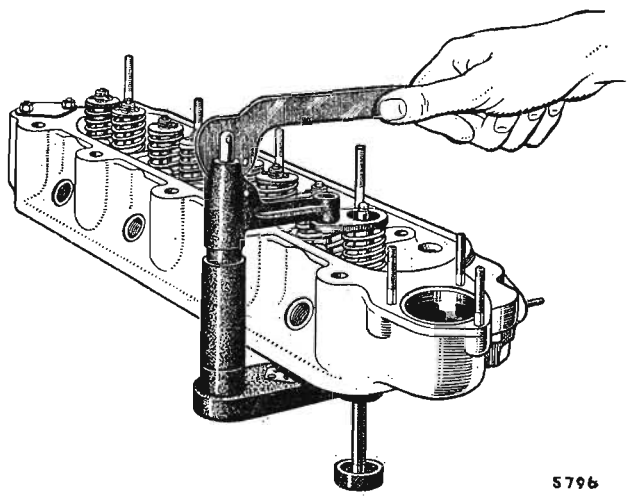


Fig. A.8

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

The seatings in the cylinder head must be machined to the dimensions given in Fig. A.9. 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.9. Normal valve-grinding may be necessary to ensure efficient valve-seating.

Section A.17

VALVE GUIDES

Removing

Remove the cylinder head as shown in Section A.12.

Remove the appropriate valve and spring as in Section A.14. 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 suitably 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.11).

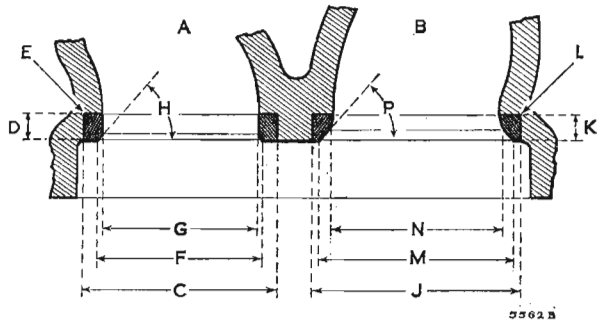


Fig. A.9

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°.

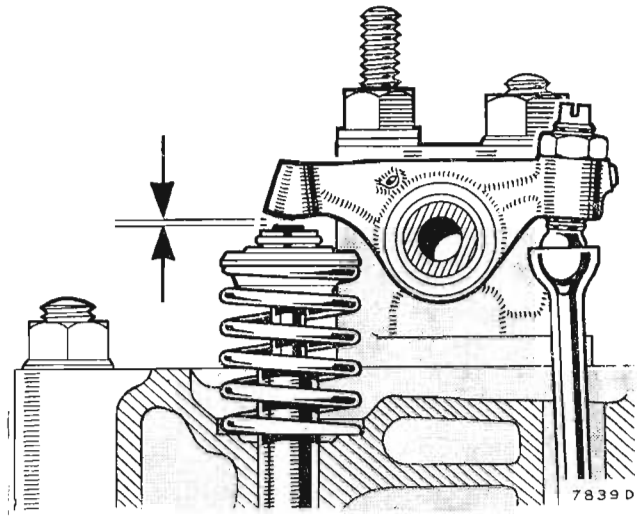


Fig. A.10

The clearance between the valve stem and the valve rocker indicated above must be ·012 in. (·30 mm.) with the engine hot and ·013 in. (·33 mm.) when cold

Section A.18

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 engine has been designed to run with a valve rocker clearance of ·012 in. (·30 mm.) and performance will be impaired if this is changed. When adjusting the clearance with a cold engine the clearance should be set ·001 in. (·025 mm.) greater at ·013 in. (·33 mm.) to allow for expansion as the engine becomes hot.

Provision for adjusting the 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 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.

While the clearance is being set it is important to have the tappet 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 crankshaft more than is necessary.

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

,, ,, 3 ,, ,, ,, 6 ,, ,, ,,
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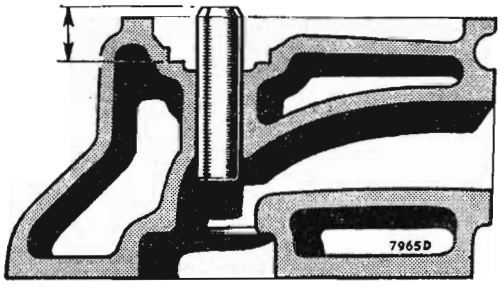


Fig. A.11

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

Section A.19

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 crankshaft 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.

Remove the bolt from the gear, 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.20

CLUTCH, FLYWHEEL, AND ENGINE REAR PLATE

Removing

Remove the engine as detailed in Section A.31. If the engine complete with gearbox has been removed, see Section F for gearbox removal.

Release the clutch cover screws, a turn at a time, by diagonal selection until the spring pressure is relieved. Two dowels locate the clutch cover on the flywheel.

Tap back the tabs on the lock plates, release the four securing bolts, and remove the flywheel.

Remove the set screws and withdraw the engine rear plate.

Refitting

Before reassembling, the engine rear plate should be checked for distortion, and a new joint washer fitted if necessary.

Care must also be taken when refitting the flywheel. This is positioned so that the timing mark '1/4' is at T.D.C. when the first throw of the crankshaft is at T.D.C. All bolts and set screws should be fitted to the torque wrench settings given under **'GENERAL DATA'.**

Refitting is the reverse of the removal procedure.

NOTE.—Use pilot shaft 18G139 for driving plate centralization.

Section A.21

FITTING FLYWHEEL STARTER RINGS

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

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

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

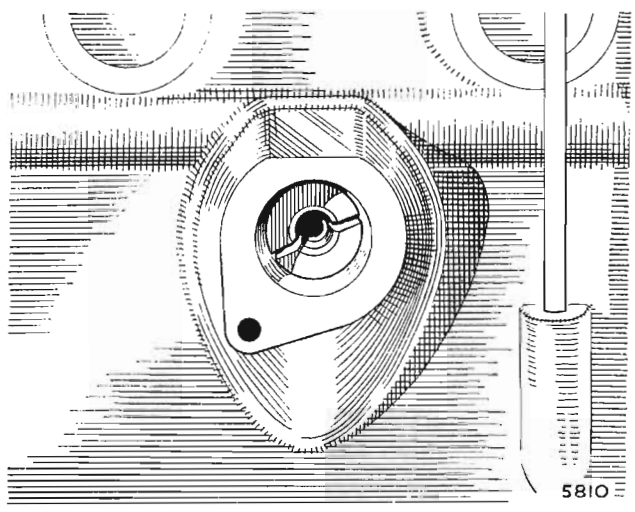


Fig. A.12

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

Section A.22

TIMING COVER

Removing

Drain the cooling system as described in the Section C. Remove the radiator (see Section C.4). Release but do not remove the generator attachment bolts and lift off the fan belt. Tap back the tab on the crankshaft pulley nut locking washer. Remove the pulley nut and carefully lever the pulley from the crankshaft.

Remove the set screws securing the timing cover to the front engine plate and lift off 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 face 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 evenly.

Section A.23

TIMING GEARS

Removing

Remove the timing cover and oil thrower as in Section A.22.

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.

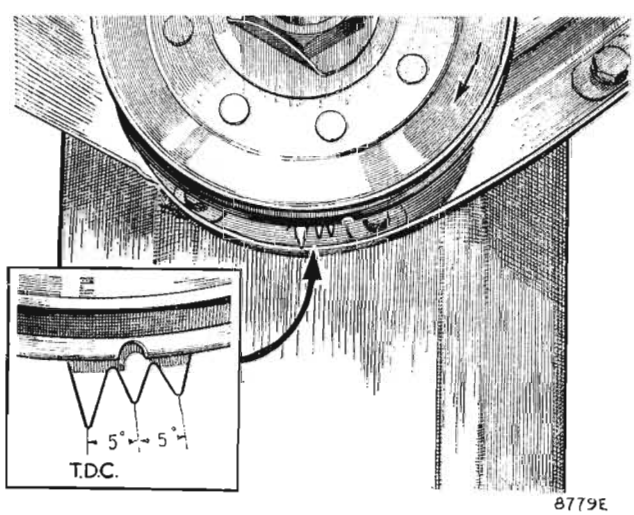


Fig. A.13

The notch in the pulley approaching the T.D.C. position for pistons 1 and 4. The pointers are provided to assist in accurate ignition timing

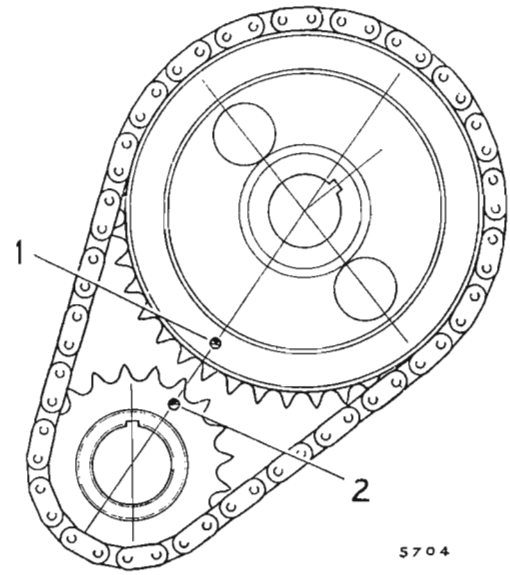


Fig. A.14

The timing gears assembled into the timing chain with the two marks on the gears opposite each other

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

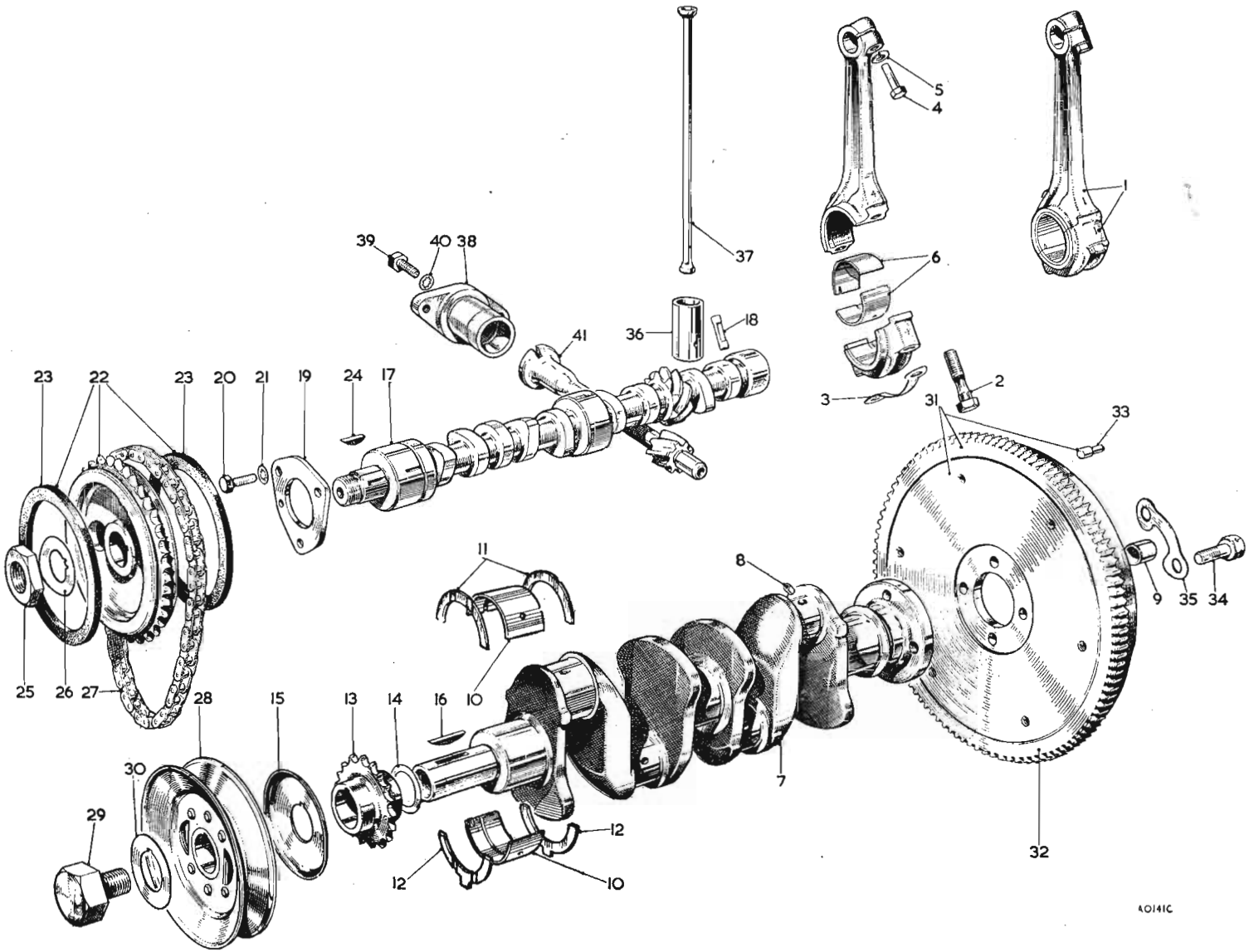
Replace the oil thrower, concave side forward, and the remaining components as detailed in Section A.22.

Section A.24

VALVE TIMING

Set No. 1 cylinder inlet valve clearance to ·021 in. (·53 mm.) with the engine cold, and then turn the crankshaft until the valve is about to open. The indicator

THE ENGINE INTERNAL COMPONENTS



KEY TO THE ENGINE INTERNAL COMPONENTS

No.	*Description*
1.	Connecting rod cap.
2.	Cap screw.
3.	Lock washer for screw.
4.	Clamping screw.
5.	Spring washer for clamping screw.
6.	Big-end bearing.
7.	Crankshaft with oil restrictors and bush.
8.	Oil restrictor.
9.	First motion shaft bush.
10.	Main bearing.
11.	Upper thrust washer.
12.	Lower thrust washer.
13.	Crankshaft gear.
14.	Packing washer.
15.	Oil thrower.
16.	Gear and crankshaft key.
17.	Camshaft with oil pump driving pin.
18.	Oil pump driving pin.
19.	Locking plate.
20.	Plate to crankcase screw.
21.	Shakeproof washer.
22.	Camshaft gear with tensioner rings.
23.	Tensioner ring.
24.	Gear key.
25.	Gear nut.
26.	Lock washer.
27.	Camshaft driving chain.
28.	Crankshaft pulley.
29.	Pulley retaining bolt.
30.	Lock washer.
31.	Flywheel with starter ring and dowels.
32.	Starter ring.
33.	Dowel.
34.	Flywheel to crankshaft screw.
35.	Lock washer.
36.	Tappet.
37.	Push-rod.
38.	Distributor housing.
39.	Screw.
40.	Shakeproof washer.
41.	Distributor driving spindle.

groove in the flange of the crankshaft pulley should then be opposite the centre pointer (this indicates 5° B.T.D.C. of No. 1 and No. 4 pistons) on the indicator bracket, situated beneath the crankshaft pulley. The other two pointers indicate T.D.C. and 10° B.T.D.C. respectively.

NOTE.—It is not possible to check the valve timing accurately with the valve rockers set at their normal running rocker clearance. Reset the inlet valve rocker clearance to ·013 in. (·33 mm.) when the timing check is completed (engine cold) to give the correct running clearance of ·012 in. (·30 mm.) when the engine is hot.

Section A.25

CAMSHAFT

Drain the sump and remove it from the engine.

Remove the rocker assembly, push-rods, and tappets (Sections A.6 and A.7), the timing cover and gears (Sections A.22 and A.23), and the oil pump (Section A.5).

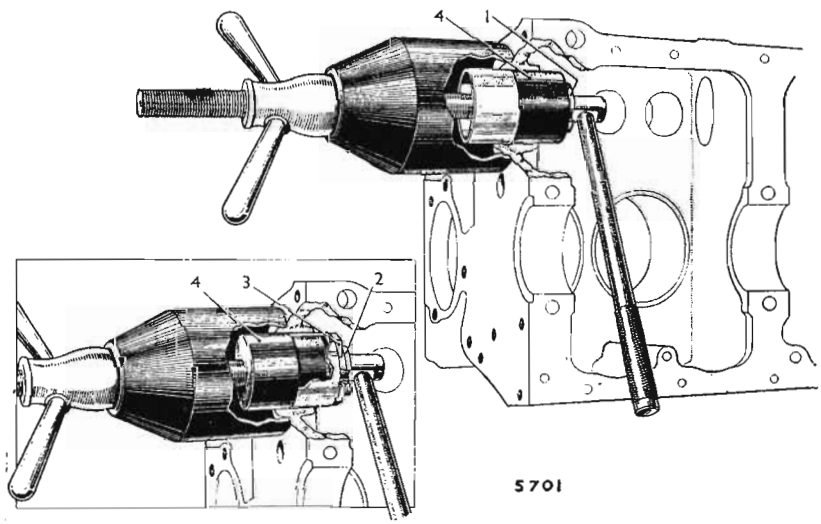


Fig. A.15

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.

Remove the distributor assembly as described in Section A.19.

Remove the set screws securing the camshaft locating plate to the cylinder block, and withdraw the camshaft forward, rotating it slowly to assist this operation.

Removing a liner

Should the front camshaft bearing clearance be excessive, a new bearing liner must be fitted which will entail line-reaming after fitting. This will necessitate the removal of the engine back plate as described in Section A.19.

The following instructions apply to the front liner only; part numbers of pilots and cutters for the centre and rear bearings will be notified later.

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.

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 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 entering 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 on the arbor through the reamed hole.

Refitting

Refitting is the reverse of the removal procedure, lubricate the journal with engine oil and refer to Section A.19 when replacing the distributor gear.

Section A.26

PISTONS AND CONNECTING RODS

Removing

Remove the cylinder head assembly (Section A.12), and drain and remove the sump. Tap back the two locking plate tabs and remove the big-end securing bolts. Remove the bearing cap and release the connecting rod from the crankshaft.

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 hold the assembly in a vice for this operation without damage special holding plugs should be inserted in each end of the gudgeon pin.

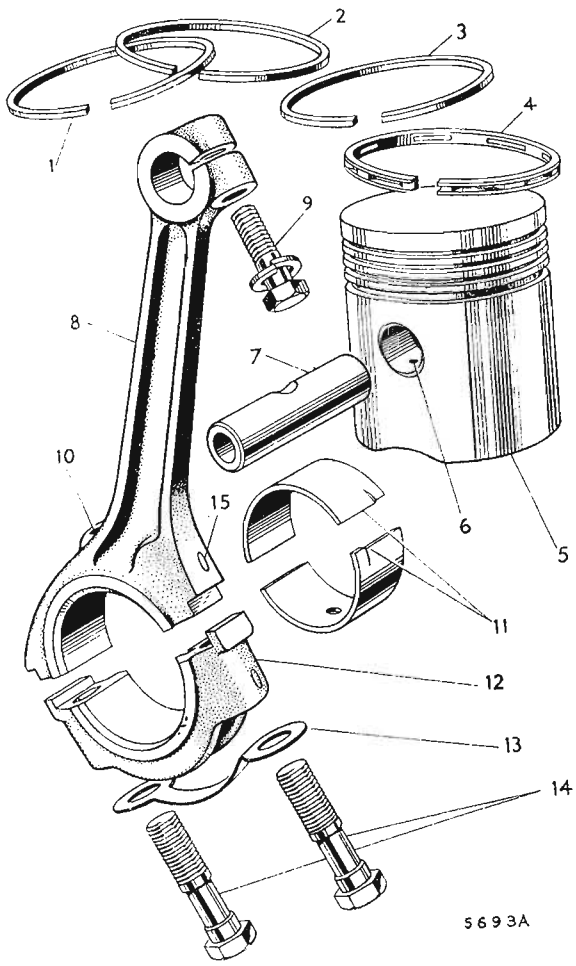


Fig. A.16

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.
12. Connecting rod cap.
13. Lock washer.
14. Set screws.
15. Connecting rod and cap marking.

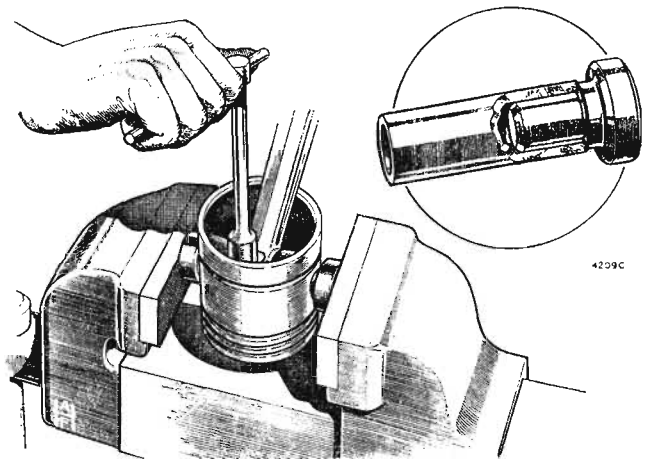


Fig. A.17

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

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 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 removal, 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, the gudgeon pin clamp screw on the camshaft side of the engine.

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.

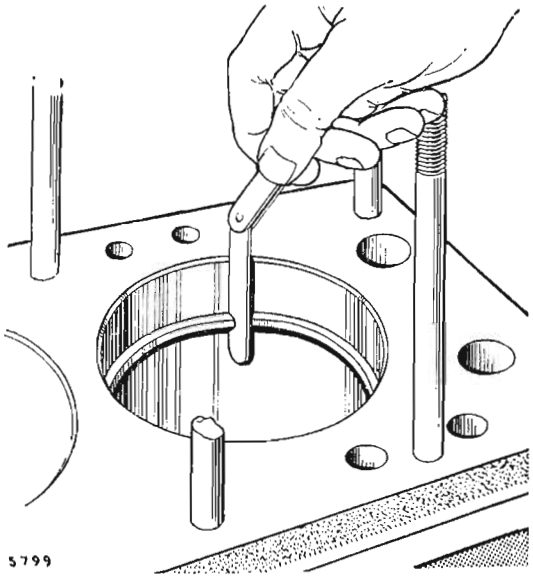


Fig. A.18

Checking the piston ring gap

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. Take care not to remove any metal, or side-play between the ring and the groove will result, with consequent excessive oil consumption and gas leakage.

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.

Section A.28

PISTON SIZES AND CYLINDER BORES

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.

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

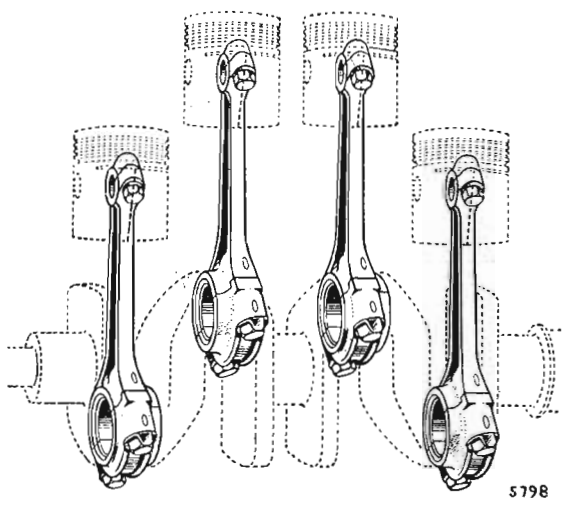


Fig. A.19

The correct assembly of connecting rods to the pistons and crankshaft

main bearings. The end-float is controlled by a thrust washer fitted on each side of the centre main bearing.

Removing

Drain the sump. Remove the engine (Section A.31) and place upside-down in a dismantling fixture.

Remove the oil strainer, timing chain and gears, and the flywheel and engine rear plate. Remove 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 rods from the crankshaft.

Withdraw the main bearing caps complete with the bottom bearing shells; caps and their respective shells must be kept together.

Remove the screwed plug from the rear bearing cap oil return pipe and withdraw the pipe. 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 are perfectly clear. They can be cleaned out by applying a pressure gun containing petrol or paraffin. When clean inject engine oil to Ref. A, page P.2, in the same manner.

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 caps, and **on no account should the caps 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 cap.
(3) Remember to fit the packing washers behind the crankshaft timing chain wheel.
(4) Lubricate the bearings freely with engine oil.
(5) The rear main bearing cap horizontal joint surfaces should be thoroughly cleaned and lightly covered with Wel-Seal sealing compound (manufactured by Messrs. Wellworthy Ltd.) before the cap is fitted to the cylinder block. This ensures a perfect oil seal when the cap is bolted down to the block.
(6) Tighten the main bearing nuts (see **'GENERAL DATA'** for torque spanner settings).

Section A.30

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.20. 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.31. 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

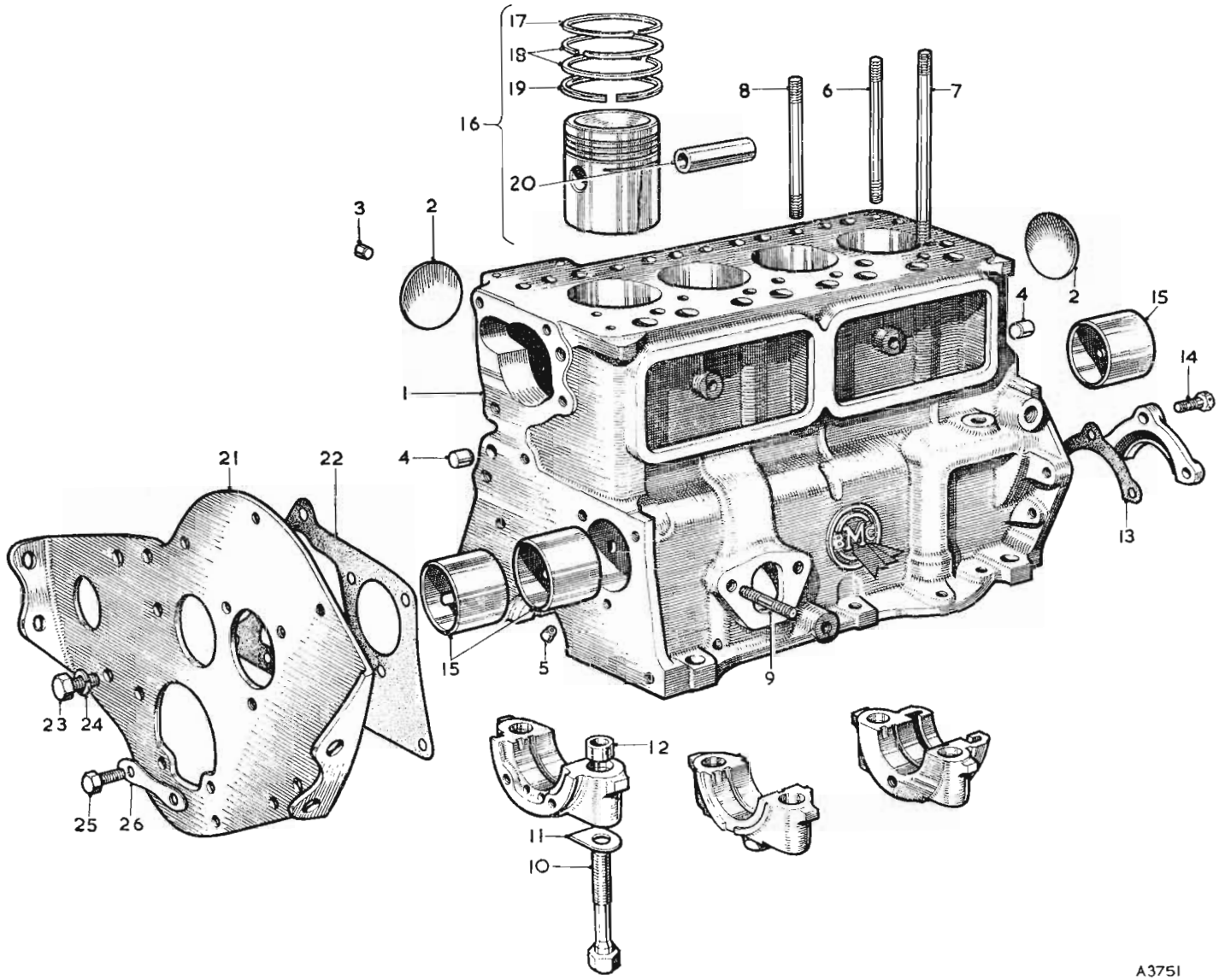
Place the cylinder block face downwards on suitable wooden supports on the bed of the press, making sure that there is sufficient space between the block and the bed of the press to allow the worn liner to pass down. Insert the pilot in the bottom of the liner and carefully press the liner from the bore.

Pressing in new liners

Thoroughly clean the inside of the bores and the outside of the liners. Stand the cylinder block upright on

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' (948 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.)

THE ENGINE EXTERNAL COMPONENTS



KEY TO THE ENGINE EXTERNAL COMPONENTS

No.	*Description*
1.	Block assembly.
2.	Welch plug.
3.	Oil pressure relief valve passage plug.
4.	Oil gallery plug.
5.	Camshaft bearing oil feed restrictor.
6.	Cylinder head stud.
7.	Cylinder head stud (long).
8.	Cylinder head stud (short).
9.	Fuel pump stud.
10.	Main bearing cap set screw.
11.	Lock washer.
12.	Main bearing cap dowel.
13.	Rear cover joint.
14.	Rear cover set screw.
15.	Camshaft bearing liners.
16.	Piston assembly.
17.	Compression ring (plain).
18.	Compression ring (taper).
19.	Scraper ring.
20.	Gudgeon pin.
21.	Engine mounting plate (front).
22.	Mounting plate joint.
23.	Mounting plate screw to crankcase.
24.	Washer.
25.	Mounting plate to bearing cap screw.
26.	Locking plate.

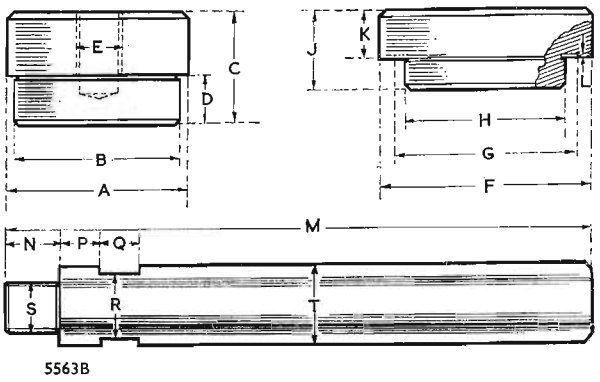


Fig. A.20

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.).

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 on page A.21 after pressing into position.

Section A.31

ENGINE

Removing

Disconnect the earth lead from the battery and remove the bonnet from the bonnet hinges.

Remove the radiator as in Section C, and if a heater is fitted disconnect the inlet and outlet hoses at the heater unit.

Disconnect the choke and throttle cables from the carburetter assemblies and remove the oil pressure gauge pipe from its terminal on the right-hand rear of the cylinder block. When the vehicle is fitted with a tacho-meter unit the cable complete with the reduction drive must be removed from the rear end of the dynamo.

All Lucar connectors fitted to the generator, coil, and distributor low-tension cables should be disconnected.

Detach the high-tension cables from their connections at the coil and the sparking plugs and remove the distributor cap.

Remove the starter cable from its connection on the rear end of the starter motor and disconnect the fuel inlet pipe at the fuel pump union. Release the clamp attaching the exhaust manifold to the down pipe and lower the down pipe from the manifold.

With gearbox

NOTE.—The following operations apply only when the engine is removed complete with the gearbox assembly.

Working from within the vehicle, remove the self-tapping screws securing the gear lever aperture cover to the gearbox surround and lift off the cover. Remove the anti-rattle cap, spring, and plunger. Remove the gear change lever retaining plate set screws and extract the gear change lever complete with the retaining plate. Turn back the carpet and remove the gearbox rear mounting set screws. From beneath the car remove the speedometer drive cable at its union with the gearbox rear extension and release the securing clip on the bell housing. Detach the slave cylinder from the gearbox bell housing by removing the securing set screws and withdrawing the push-rod from the rear of the cylinder. Disconnect the propeller shaft from the rear axle and remove it from the vehicle over the axle assembly and to the left-hand side of the differential casing. Remove the remaining gearbox mounting set screws.

Without gearbox

NOTE.—The following operations apply only when the engine is removed as a single unit.

Remove the filter bowl and the starter motor from the right-hand rear of the cylinder block. Take the weight of the gearbox on a suitable jack and remove the set screws securing the gearbox to the engine crankcase.

Remove the left-hand front engine mounting complete with its bracket and the right-hand front engine mounting rubber together with the front exhaust down pipe support bracket from its fixing on the gearbox bell housing.

Take the weight of the assembly or assemblies with suitable lifting equipment and remove the engine from the vehicle.

Refitting

Refit the engine by reversing the sequence of operations detailed for removal.

Section A.32

ENGINE MOUNTINGS

Removing

Support the engine assembly with suitable lifting equipment and remove both the left- and right-hand mounting rubber securing nuts and mounting rubber

bracket-to-body securing set screws. Release the exhaust down pipe manifold clamp and remove the front down pipe strap from the support bracket. Lift the engine approximately $\frac{3}{4}$ in. (19·1 mm.), ensuring that the fan assembly will not foul the radiator fan cowling. Swing the engine to the left as far as possible and remove the right-hand rubber mounting together with its body bracket.

The left-hand front rubber mounting and bracket assembly can now be easily removed.

Refitting

When refitting, the right-hand front rubber mounting and bracket should be positioned first. Both mounting rubbers and brackets should be fitted before any set screws or nuts are replaced.

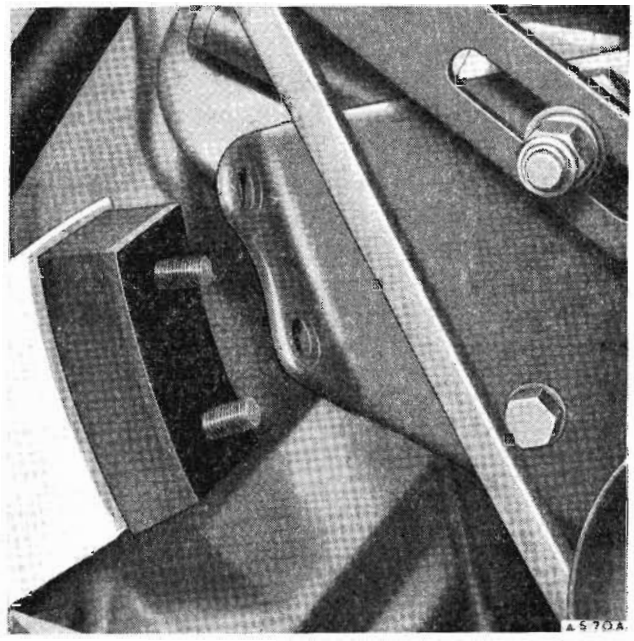


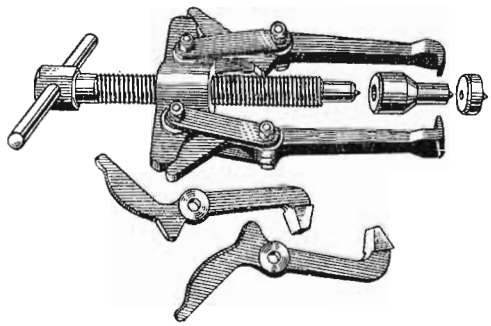
Fig. A.21

Illustrating the position of the rubber mounting and mounting bracket

SERVICE TOOLS

18G2. Crankshaft Gear, Pulley, and Propeller Shaft Flange Remover

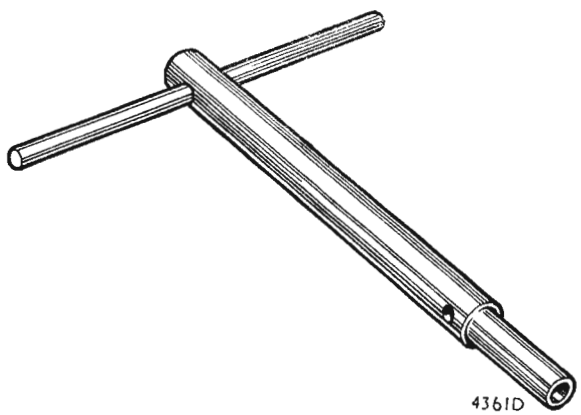
A multipurpose tool, with alternative legs readily interchangeable: one pair has thin flat ends designed for removing crankshaft gears and propeller shaft and bevel pinion flanges, the other pair has tapered ends suitable for fan pulley grooves other than later-type models fitted with narrow-section fan belts.



18G2

18G27. Valve Seat Cutter and Pilot Handle

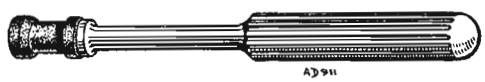
For use with pilot 18G167D, cutters 18G167, 18G167C, 18G167B, and glaze breaker 18G167A.



18G27

18G29. Valve Grinding-in Tool

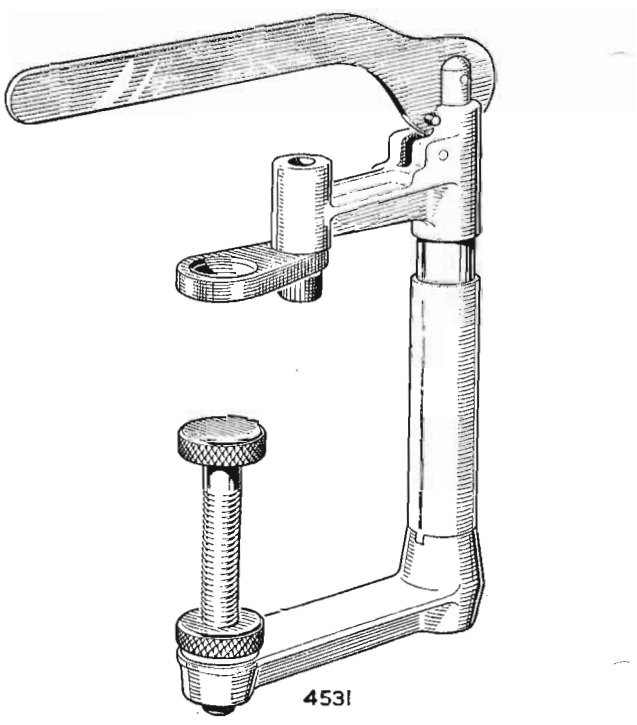
A metal handle complete with a detachable suction pad. For the M.G. Midget use alternative suction pad 18G29B.



18G29

18G45. Valve Spring Compressor

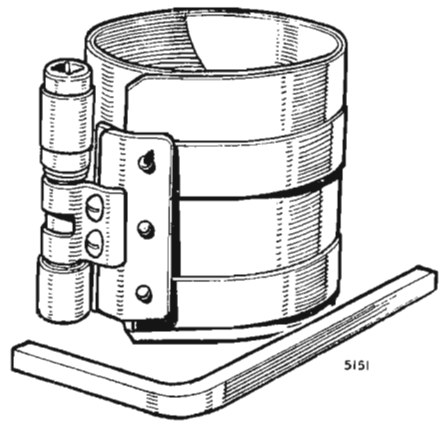
This tool is designed for o.h.v. engines. It has a cam and lever action and screw adjustment. The adaptor ring is shaped to facilitate the fitting of cotters.



18G45

18G55A. Piston Ring Clamp

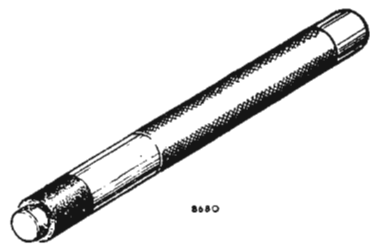
Designed to cover a wide range of pistons, it is easy to operate and will compress the strongest piston ring, making assembly to the bore a quick and easy operation.



18G55A

18G69. Oil Pump Relief Valve Grinding-in Tool

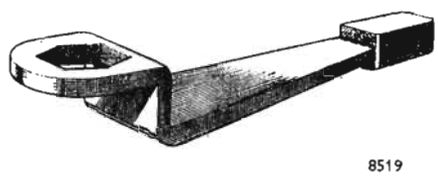
Designed to facilitate the removal and grinding in of the engine oil relief valve. Tightening the set screw when inserted into the hollow oil relief valve expands the rubber plunger, which ensures that the tool is a tight fit.



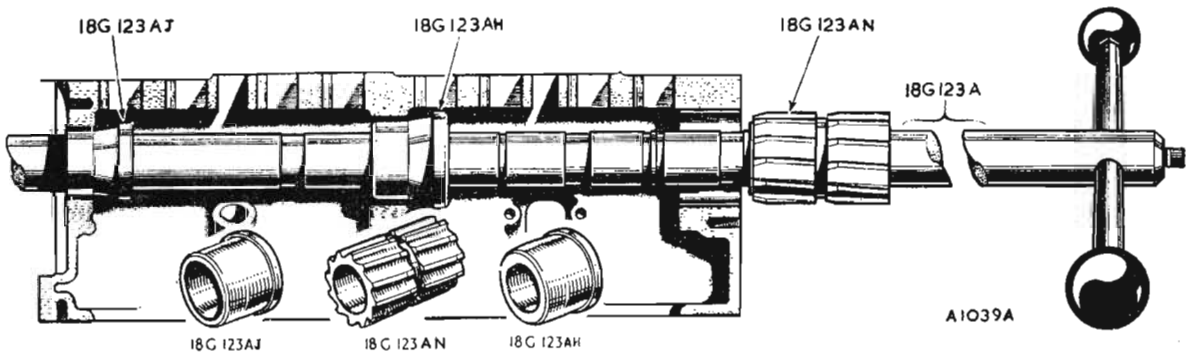
18G69

18G98. Starter Nut Spanner

This shock-type spanner enables the starter nut on M.G. Midget models to be removed without the need for locking the crankshaft with improvised means, which may cause damage to the components.



18G98



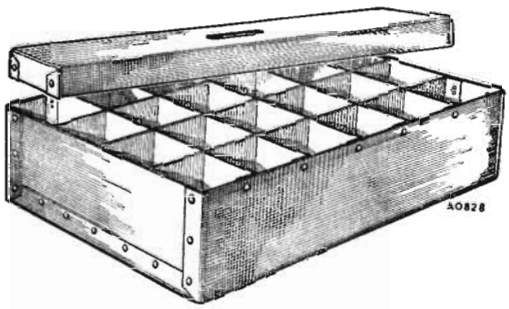
18G123A, 18G123W, 18G123AH, and 18G123AJ

18G123A, 18G123W, 18G123AH, and 18G123AJ. Camshaft Liner Reamer

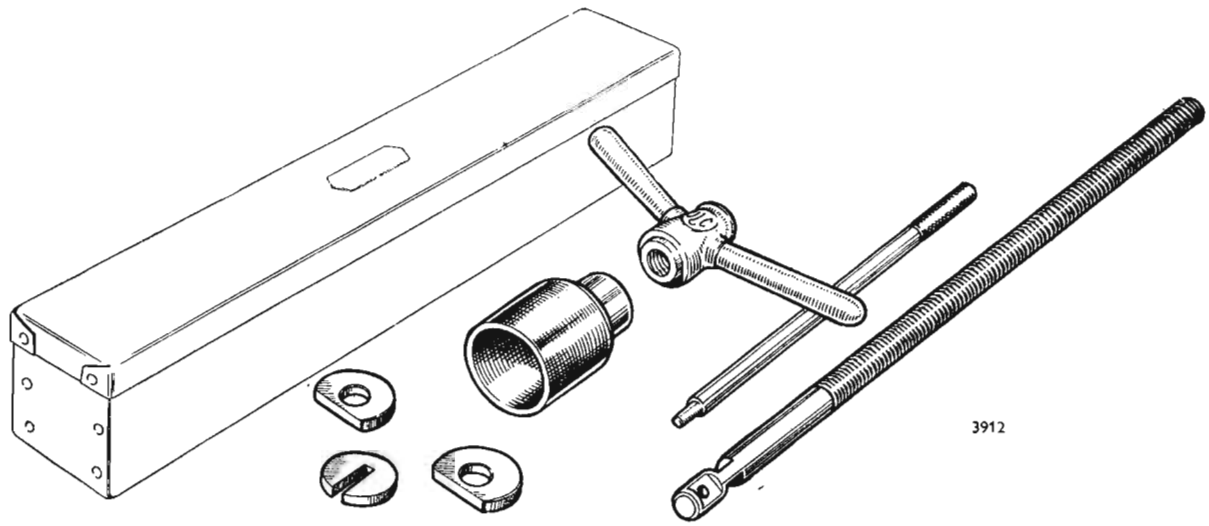
This equipment is essential when reconditioning cylinder blocks on the M.G. Midget, otherwise camshaft liners cannot be reamed in line, and in consequence the clearance between the camshaft journal and liner will be incorrect. This basic tool 18G123A must be used with the cutter 18G123W and pilots 18G123AH and 18G123AJ Full instructions for using the equipment will be supplied with each basic tool.

18G123AL. Fibre Box (Camshaft Reamers)

A fibre box for the storage of camshaft liner reamer cutters and pilots, and partitioned to protect the edge of the cutters.



18G123AL



18G124A

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

The equipment consists of a basic tool 18G124A and various adaptors (supplied separately) for different types of engines. Liners can be renewed and replaced without the damage invariably associated with the use of improvised drifts. Full instructions for using the equipment will be supplied with each basic tool.

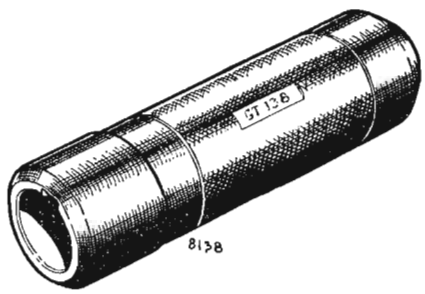
18G124K. Camshaft Liner Remover Adaptor

For use with 18G124A.

18G124K

18G138. Crankshaft Gear, Pulley, and Propeller Shaft Flange Replacer

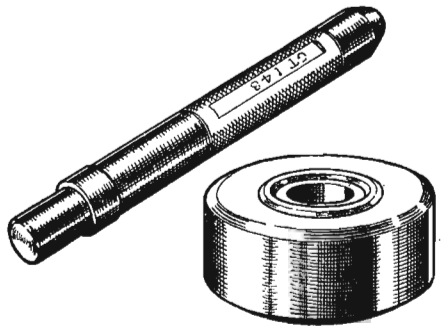
This tool is used for driving on the crankshaft gear and for lining up the timing cover.



18G138

18G148. Valve Rocker Bush Remover and Replacer

The flange of the driver is recessed to prevent the split bush from opening when being driven into position. The anvil is also recessed to retain the rocker during the operation. Use of a light press is desirable when using this tool, alternatively a vice or copper-faced hammer may be used.

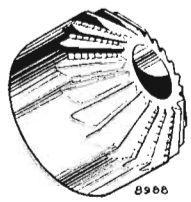


8154

18G148

18G167. Valve Seat Finishing Cutter

Use with pilot 18G167D and handle 18G27.

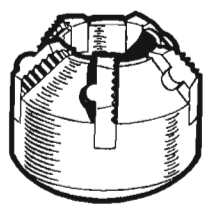


8988

18G167

18G167A. Valve Seat Glaze Breaker

For use with pilot 18G167D and handle 18G27.

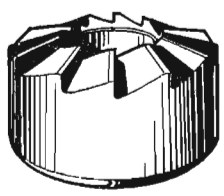


9165

18G167A

18G167B. Valve Seat Narrowing Cutter—Top

Designed to enable seats of the M.G. Midget to be maintained at their original dimensions. Use with pilot 18G167D and handle 18G27. These cutters must not be used on hardened valve seat inserts—the inserts must be renewed.

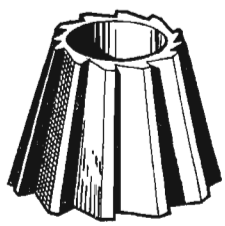


9021B

18G167B

18G167C. Valve Seat Narrowing Cutter—Bottom

Use with pilot 18G167D and handle 18G27.



9021A

18G167C

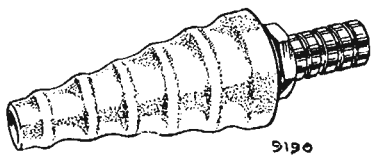
18G167D. Valve Seat Cutter Pilot

For use with glaze breaker 18G167A, cutters 18G167, 18G167B, 18G167C, and handle 18G27.

18G167D

18G187. Radiator Reverse-flush Adaptors

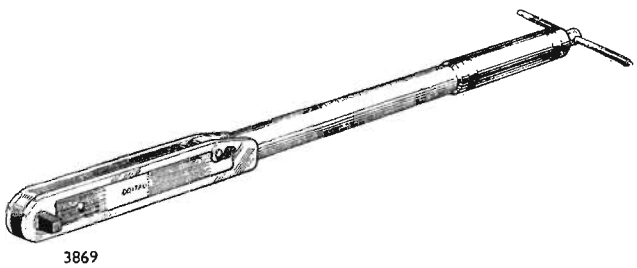
The adaptors should be used in pairs, one for the radiator inlet hose and one for the outlet hose. The hose connection is 1 in. (25·4 mm.) diameter.



18G187

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

A universal torque spanner for use with standard sockets. This tool is essential if the recommended maximum torque for various studs and nuts is not to be exceeded.



18G372

18G528. Tool Board Hook—2 in. (5·1 cm.)

A strongly made hook in mild steel with non-corrosive finish used for the display and storage of Service tools. Supplied in packs of one dozen.

18G529. Tool Board Hook—3 in. (7·6 cm.)

A larger size of 18G528. Supplied in packs of one dozen.

SECTION B

THE IGNITION SYSTEM

	Section
General description	
Capacitor	B.9
Contact breaker	B.5
Distributor	B.6
High-tension cables	B.3
Ignition adjustment	B.8
Sparking plugs	B.4
Testing the low-tension circuit	B.2
Timing the ignition	B.7
Uneven firing	B.1

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 to 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 windings 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 by a centrifugal mechanism and a vacuum-operated unit each operating entirely independently of the 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. An adjuster is provided, giving a fine manual timing adjustment to allow for the engine condition and the grade of fuel used.

A 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 cover 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. (19·01 mm.) 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

LOCATING THE CAUSE OF UNEVEN FIRING

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

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

Having located the cylinder which is at fault, stop the engine and remove the cable from the terminal of the sparking plug. Restart the engine and hold the end of the cable about $\frac{3}{16}$ in. (4·8 mm.) from the cylinder head.

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

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

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

Section B.2

TESTING THE LOW-TENSION CIRCUIT

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

Check that the contacts are clean and free from pits, burns, oil, or grease. Turn the crankshaft and check that the contact points are opening and closing correctly and that the clearance between them is correct when they are fully opened.

Reset the gap if necessary to between ·014 and ·016 in. (·36 and ·40 mm.).

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

Locating a fault

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

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

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

(1) *Battery to control box terminal 'A'* (brown lead). Connect a voltmeter between the control box terminal 'A' and earth. No reading indicates a damaged cable or loose connections.

(2) *Control box.* Connect a voltmeter between the control box auxiliary terminal and earth. No reading indicates a broken or loose connection.

(3) *Control box auxiliary terminal to terminal on ignition switch* (brown with blue lead). Connect a voltmeter between the ignition switch terminal and earth. No reading indicates a damaged cable or loose connections.

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

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

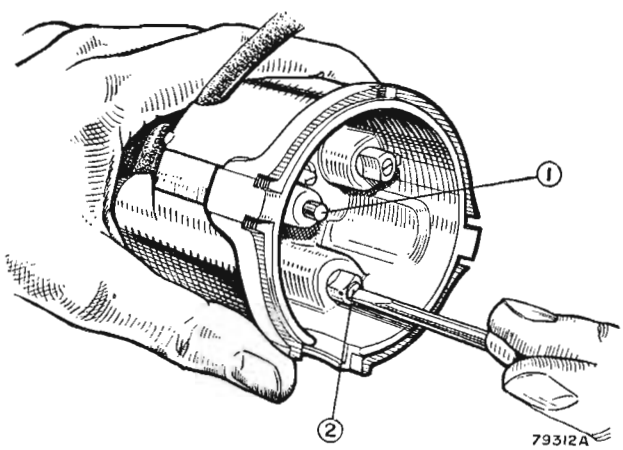
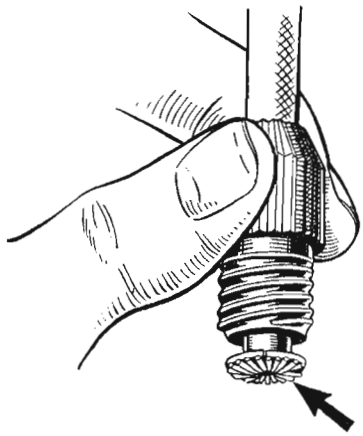


Fig. B.1

The method of connecting high-tension leads

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



0825HW

Fig. B.2

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

(6) *Fusebox terminal 'A3' to ignition coil terminal 'SW'* (white lead). Connect a voltmeter between the ignition coil terminal 'SW' and earth. No reading indicates a damaged cable or loose connections.

(7) *Ignition coil.* Disconnect the cable from the 'CB' terminal of the ignition coil and connect a voltmeter between this terminal and 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.

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

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

Section B.3

HIGH-TENSION CABLES

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

To fit the cables to the terminal of the ignition coil thread the knurled moulded terminal nut over the lead, bare the end of the cable for about 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 the terminal into the coil.

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

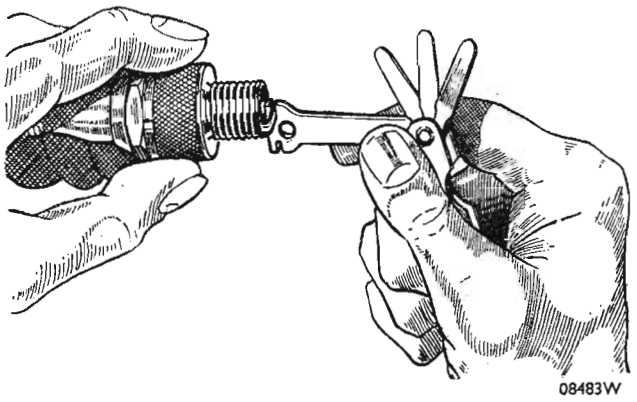


Fig. B.3

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

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

Section B.4

SPARKING PLUGS

Service procedure

To maintain peak sparking plug performance plugs should be inspected, cleaned, and adjusted every 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 correct socket or box spanner.

Blow away the dirt from around the base of each plug. If compressed air is not available blow out the dirt with a tyre pump.

Remove the sparking plugs and place them in a suitable holder, preferably in the order that they were installed 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 deposit 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 the plugs and resetting the gaps is all that is required. Watch for white to yellowish powdery deposits. These usually indicate 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 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 or excessive use of the mixture control 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 incorrect ignition timing can cause general overheating. Severe service, such as sustained high speed and heavy loads, can also produce abnormally high temperatures in the combustion chamber which necessitate the use of colder-type sparking plugs.

File the sparking surfaces of the electrodes with a points file until they are bright, clean, and parallel. For best results hold the plug in a vice and, if necessary, enlarge the gaps slightly.

Reset the gaps, using the bending fixture of the Champion gap-setting 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 the wire diameter should not exceed ·005 in. (·13 mm.). 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:

Size	*C.I. head*	*Turns*
14 mm.	30 lb. ft. (4·15 kg. m.)	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.

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

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

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

Turn the crankshaft until the contact breaker points are fully opened and check the gap with a gauge having a thickness of ·014 to ·016 in. (·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 crankshaft in the position which gives maximum opening of the contacts. Slacken the fixed contact plate securing screw and adjust the contact gap by inserting a screwdriver in the notched hole and turn clockwise to reduce the gap and anti-clockwise to increase it. Tighten the securing screw.

If the contacts are dirty or pitted they must be cleaned by polishing them with a fine carborundum stone and afterwards wiping them with a cloth moistened with fuel. 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.

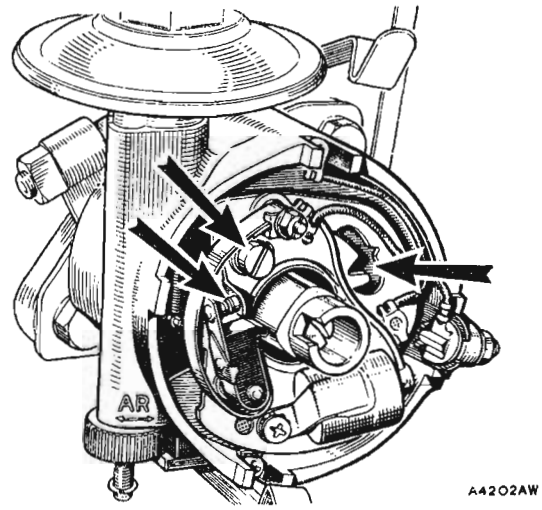


Fig. B.4

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

Check that the moving arm is free on its pivot. If it is sluggish remove the arm and polish the pivot pin with a strip of fine emery-cloth. Afterwards clean off all traces 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.

Section B.6

DISTRIBUTOR

Removing

Before removing the distributor turn the crankshaft until the rotor arm is pointing to the segment in the cover for No. 1 cylinder plug lead. This is to provide a datum for replacement.

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

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.

Unscrew the tachometer drive (if fitted) from its connection at the rear of the dynamo.

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.

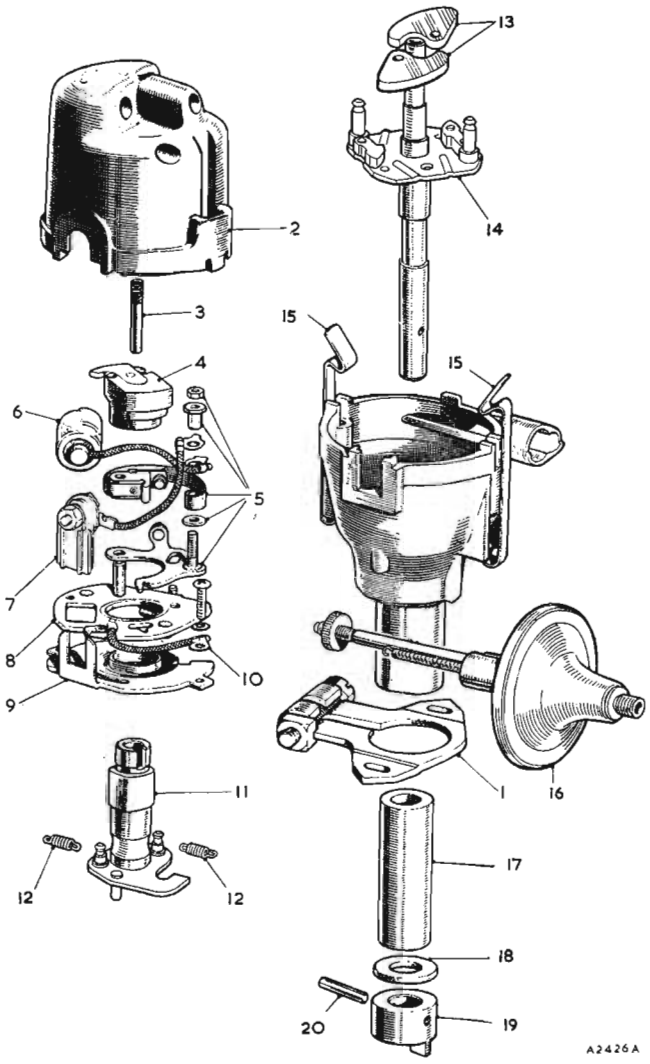


Fig. B.5

The components of the 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. Weight assembly.
14. Shaft and action plate.
15. Cap-retaining clips.
16. Vacuum unit.
17. Bush.
18. Thrust washer.
19. Driving dog.
20. Taper pin.

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.

Spring back the clips and remove the moulded cap.

Lift the rotor off the top of the spindle. If it is a tight fit it must be levered off carefully with a screwdriver.

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.

Take out the screw and spring and flat washers securing the fixed contact plate and remove the plate.

Take out the securing screw and remove the capacitor.

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.

Take out the cam retaining screw and remove the cam spindle.

Take out the centrifugal weights. These may be lifted out as two assemblies, each complete with a spring and toggle.

To release the suction advance unit remove the circlip, adjusting nut, and spring. Withdraw the unit.

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.

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

Ensure that the carbon brush moves freely in the distributor cover.

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

The contact faces 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 reassembled full contact is obtained. Clean the points thoroughly in fuel.

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

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

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.

Check the fit of the shaft in the body bearing bushes. If slack, renew the bushes and shaft as necessary.

Press out the old bushes. The new bushes 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 them into the distributor body.

Reassembling

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

As they are assembled, lubricate the components of the automatic advance mechanism, the distributor shaft, and the portion of the shaft on which the cam fits with thin, clean engine oil.

Turn the vacuum control adjusting nut until it is in the half-way position when replacing the control unit.

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.

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. Rotate the rotor arm 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 of that of removal.

Provided that the crankshaft 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.

Static ignition timing is given under **'GENERAL DATA'.**

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.

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.

Remove the distributor and make quite certain that the distributor driving spindle has been refitted correctly as in Section A.19.

Remove the valve rocker cover so that the valve action can be observed. Rotate the crankshaft, using a spanner on the crankshaft pulley securing nut until No. 1 piston is at the top of its compression stroke (i.e. the exhaust valve of No. 4 cylinder is just closing and the inlet valve just opening). Turn the crankshaft until the recess in the crankshaft pulley flange is in line with the largest pointer (T.D.C.) on the timing case cover (Fig. B.6). If the timing cover has been removed, align the timing marks on the camshaft and crankshaft wheels. Nos. 1 and 4 pistons are

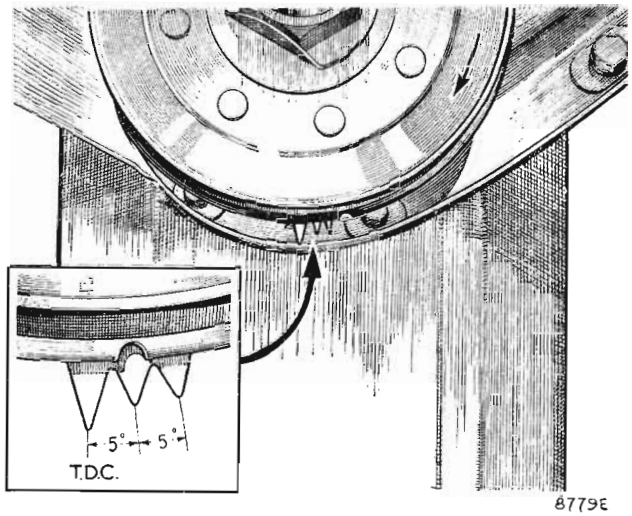


Fig. B.6

The timing pointer and the groove in the crankshaft pulley are provided to assist in accurate ignition timing

now at T.D.C. Set the micrometer adjustment on the distributor in its central position. The crankshaft should now be rotated backwards 4° to obtain its correct position.

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.

Screw in the two set screws to secure the distributor clamp plate 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.

To obtain an accurate setting the electrical method should be used in determining 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, 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 and refit the distributor cover and valve rocker cover.

When using a stroboscopic lamp, do not allow the engine r.p.m. to rise high enough to operate the centrifugal advance weights.

If the vacuum advance take-off is direct from the manifold, disconnect it before checking the timing otherwise this will be set retarded.

Section B.8

IGNITION ADJUSTMENT

Manual adjustment is provided for the ignition point to enable the best setting to be attained for varying grades of fuel. The adjustment nut is indicated by the lower arrow in Fig. B.7; 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.

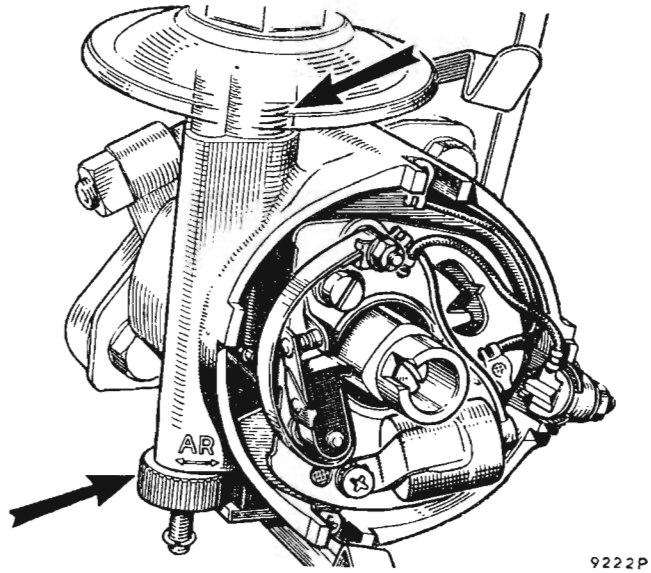


Fig. B.7

Showing the adjustment nut and the vernier scale

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 ·18 to ·22 microfarad.

SECTION C

THE COOLING SYSTEM

	Section
General description	
Draining and flushing the system	C.2
Fan belt	C.5
Radiator	C.4
Filler cap	C.1
Temperature gauge	C.7
Thermostat	C.3
Water pump	C.6

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 drawn through the radiator by a fan attached to the water pump pulley.

The thermostat opens at approximately 149 to 158° F. (65 to 70° C.).

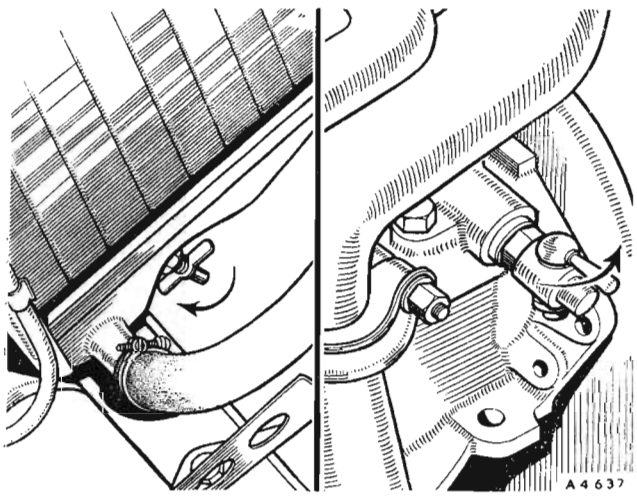


Fig. C.1

(Left) Access to the radiator drain tap is gained from beneath the front of the car. Turn in the direction of the arrow to open the tap

(Right) The drain tap for the cylinder block is located on the right-hand side of the block at the rear. Turn in the direction of the arrow to open the tap

Section C.1

RADIATOR FILLER CAP

The cooling system is under appreciable pressure while the engine is hot, 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.

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 anti-freeze mixture is being used it should be drained into a clean 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. The water should be allowed to run through until it comes out clear from the drain tap. This service is preferably carried out before adding anti-freeze in the autumn, and again when the anti-freeze is drained off for the summer.

If furring is excessive, remove the radiator as in Section C.4 and flush 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 with a 1 in. (25·4 mm.) diameter water hose is recommended for this purpose.

Refilling

Close the drain taps.

Ensure that the water hose clips are tightened.

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

When possible, use rain-water 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.

Section C.3

THERMOSTAT

Removing

Drain the cooling system (Section C.2). Disconnect the outlet hose from the outlet elbow. Remove the securing nuts and spring washers from the thermostat cover and lift the cover away from its studs. Remove the paper joint washer and lift out the thermostat. Test the thermostat opening temperature by immersing it in water at a temperature between 149 and 158° F. (65 and 70° C.). If the thermostat valve does not start to open or if the valve sticks in the fully open position, renew the thermostat; under no circumstances should any attempt be made to repair it.

Refitting

Installation of the thermostat assembly is the reverse of the removal procedure. Fit a new paper joint washer if the existing one is damaged.

Section C.4

RADIATOR

Removing

Drain the cooling system (see Section C.2). Release the hose clip on the thermostat housing and remove the hose from the housing extension. Remove the radiator bottom hose by releasing the clips on the bottom radiator connection. Remove the fresh air induction pipe from its connection on the front cowling. Remove the temperature gauge thermal element from the right-hand side of the radiator. Remove the bolts which secure the radiator to the support brackets and remove the radiator.

Refitting

Reverse the removal procedure.

Section C.5

FAN BELT

Adjusting

To adjust the dynamo and fan belt tension slacken the two dynamo pivot bolts, release the bolt on the slotted adjusting link, and raise the dynamo bodily until the belt tension is correct. Tighten 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.) at the centre of its longest run.

Removing

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

Section C.6

WATER PUMP

The water pump is of the centrifugal impeller type mounted on a common spindle with the fan and operating in a cast-iron 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 Sections C.2 and C.4.

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 set screws securing the fan blades to the water pump hub and remove the blades, belt, and pulley.

Unscrew the 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 holes 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.

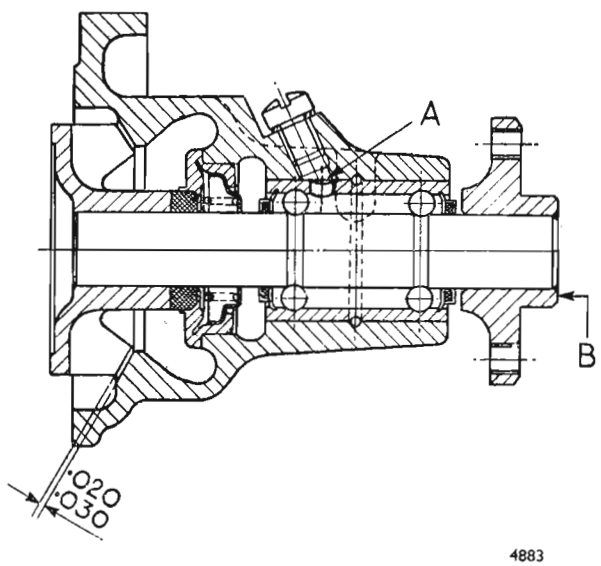


Fig. C.2

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*

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

If the bearing shows signs of wear or damage, replace it by a new bearing and spindle assembly; bearings alone are not serviced. Renew the seal assembly 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.

Refitting

Reverse the removal procedure when refitting.

Section C.7

TEMPERATURE GAUGE

A temperature gauge unit, consisting of a thermal element and dial indicator, is fitted to the vehicle. The thermal element is held in the radiator header tank by a gland nut. The dial indicator is situated in the instrument panel and is connected to the element by a capillary tube filled with mercury.

Damage to any of the above-mentioned parts will necessitate the renewal of the complete temperature gauge unit.

The combined water temperature and oil pressure gauges are of integral construction, and should one of these instruments fail, both will have to be renewed.

SECTION D

THE FUEL SYSTEM

	Section
Air cleaners	D.5
Carburetters	D.4
Fuel pump	D.3
Fuel tank	D.1
Gauge unit	D.2

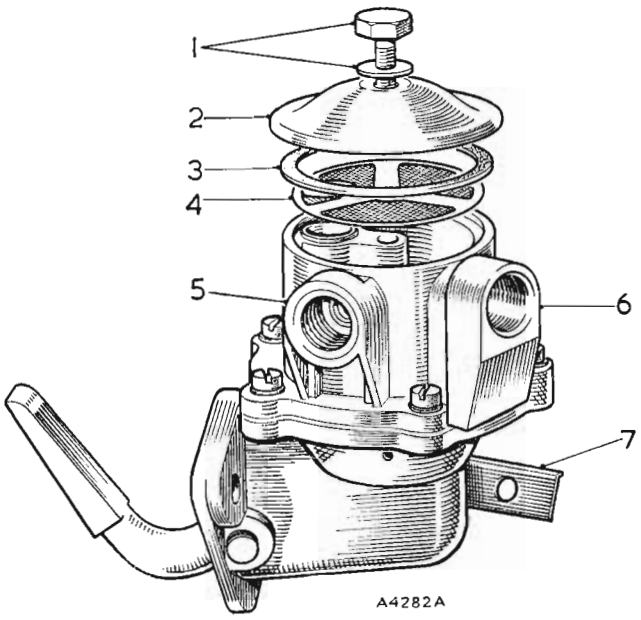


Fig. D.1

Fuel pump top cover exploded

1. Retaining screw.
2. Cover.
3. Cork sealing washer.
4. Gauze filter.
5. Delivery union.
6. Inlet union.
7. Priming lever.

Section D.1

FUEL TANK

Removing

From within the luggage compartment release the securing clips and draw back the hose from the fuel tank inlet. Raise the vehicle to a workable height, remove the drain plug, and drain the petrol into a container.

Disconnect the fuel outlet pipe at its union with the tank. Remove the nuts and washers securing the tank to the under side of the body; at the same time steady the tank with a jack.

Lower the tank sufficiently to allow access to the fuel tank gauge unit and remove the Lucar connector.

The fuel tank can now be removed.

Refitting

Reverse the removal procedure when refitting.

Section D.2

FUEL TANK GAUGE UNIT

Remove the fuel tank as described in Section D.1.

Remove the 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 fuel-tight joint.

Section D.3

FUEL PUMP

Construction

The Y Type A.C.-Sphinx mechanically operated fuel pump is situated on the left-hand side of the engine and is operated by an eccentric on the engine camshaft. Its delivery rate and pressure are 40 pints/hour (22·8 litres/hour) and 1½ to 2½ lb./sq. in. (·11 to ·18 kg./cm.²) respectively. With the top cover removed access is gained to the inlet and outlet delivery valves together with the gauze filter. The upper casting secures the diaphragm assembly. The lower casting or pump body retains the rocker arm anti-rattle spring and connecting link.

Removing

Disconnect the pipe unions, remove the set screws securing the petrol pump to the engine crankcase, and remove the pump.

Dismantling

Remove the securing bolt and lift off the top cover. Remove the filter gauze and cork sealing washer.

Remove the upper chamber securing screws and separate the two halves of the pump body. To assist when reassembling, it is advisable to mark the two halves of the pump body before dismantling.

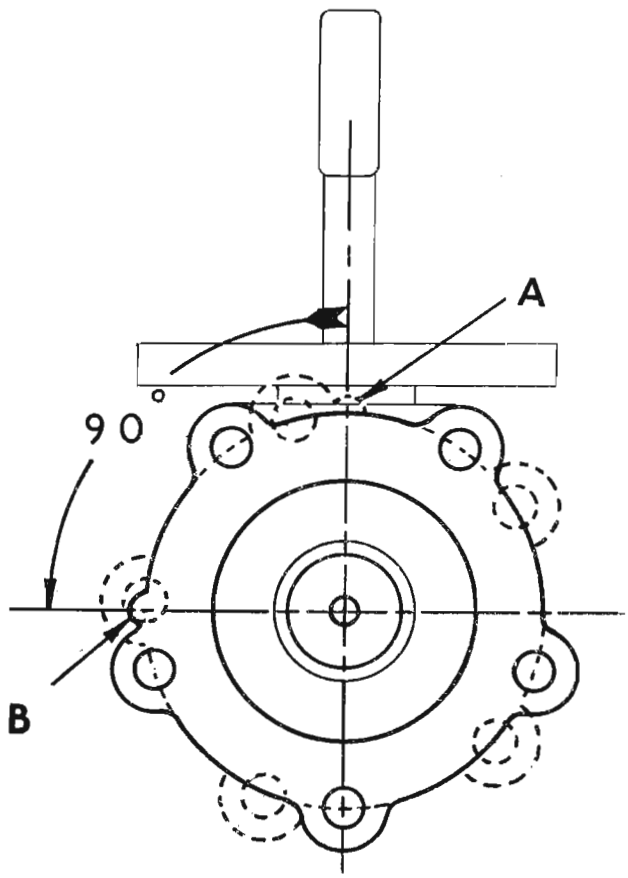


Fig. D.2

When fitting the diaphragm to the pump body the locating tab (A) *should be in the position shown. Turn the diaphragm to the left, so that the pull-rod slots engage in the connecting link fork, until it arrives at position* (B)

Remove the securing screws, valve plate, inlet and delivery valves, valve plate gaskets, springs, and delivery valve spring retainer.

Remove the diaphragm and pull-rod assembly by rotating it through 90°. The diaphragm spring, metal washer, and fibre washer can now be removed.

Removal of the two retaining circlips and washers permits the rocker arm pivot pin to be drawn out, which in turn will release the rocker arm connecting link and anti-rattle spring.

Reassembling

Reassembly is the reverse of the removal procedure, with attention being paid to the following.

The fitting of the rocker arm pin can be simplified by first inserting a piece of ·240 in. (6·096 mm.) diameter rod through the pin hole in one side of the body far enough to engage the rocker arm washers and link, then pushing in the rocker arm pin from the opposite side, removing the guide rod as the pin takes up its proper position. Under certain conditions it is possible to insert the diaphragm pull rod too far through the slot in the operating link, with the result that the connecting link, instead of engaging the two small slots in the pull rod, rides on the pull rod shoulder.

Correct assembly can be checked by measuring the distance from the top of the pump body to the upper diaphragm protector when the diaphragm is held at the top of its stroke by the return spring. A measurement of approximately $\frac{9}{16}$ in. (14·29 mm.) indicates correct assembly, whereas one of $\frac{3}{16}$ in. (4·76 mm.) proves that the assembly is unsatisfactory.

Push the rocker arm towards the pump until the diaphragm is level with the body flanges.

Place the upper half of the pump into the proper position, as shown by the mark made on the flanges before dismantling.

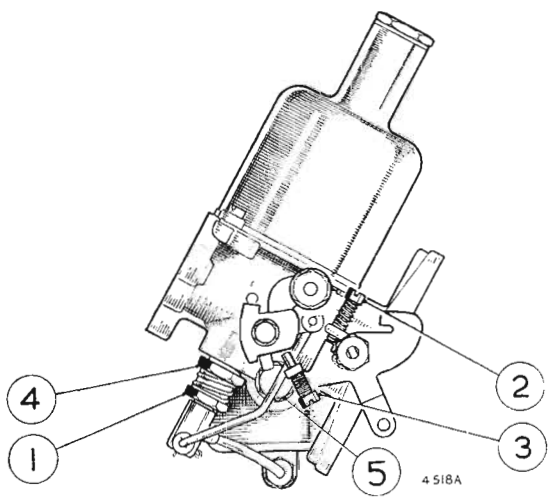


Fig. D.3

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.

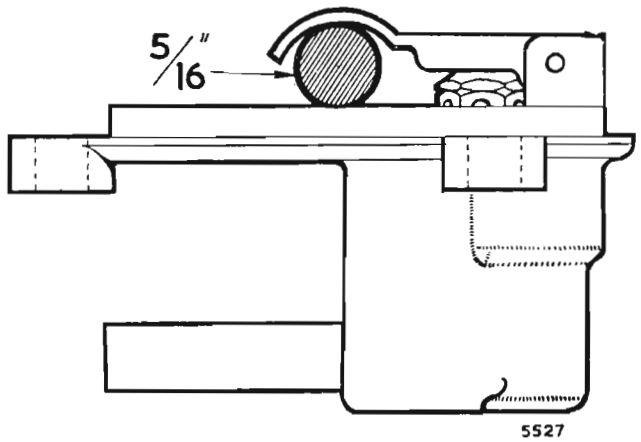


Fig. D.4

The method of checking the correct adjustment of the float lever

Refitting

Reverse the procedure outlined for the removal from the engine. Ensure that the rocker arm is correctly positioned against the eccentric on the camshaft, as there is a possibility of inadvertently getting the rocker arm under the eccentric or to one side, when damage will result on tightening the bolts. After refitting, the engine should be run for a short time and pipe unions and pump examined for fuel leakage.

Section D.4

CARBURETTERS

Construction

The HS2 carburetters are 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).

To serve the complete throttle range a single jet 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 inserted the jet needle. The suction disc, piston, and needle all have 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 part except the piston rod. A sticking piston can be ascertained by removing the piston damper and lifting the

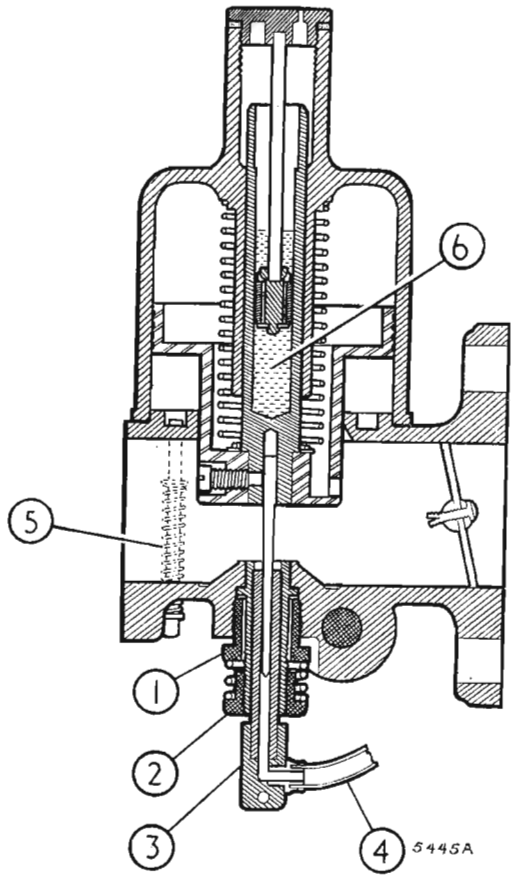


Fig. D.5

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.

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 be altered in an attempt to improve its rate of return.

Water and dirt in the carburetters

Should this be suspected, lift the piston with the piston lifting pin so that the jet can 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 pump to the carburetters and turn the crankshaft by operating the starter 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 a 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 carburetters, and the only cure is to make sure that the fuel tank and pipes lines are entirely free from any kind of foreign matter or sticky substance capable of causing trouble.

Adjustments

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

Before blaming the carburetter settings 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.

Slow-running and synchronization

Slacken the pinch-bolt of the delayed-action lever coupling the rear carburetter throttle spindle to the interconnecting shaft. This will permit each carburetter throttle to be set independently of the other.

Unscrew the throttle adjusting screws and screw these back until they will just hold a thin strip of paper between the end of the screw and the fixed stop web on the butterfly arm when the throttle disc is fully shut; then screw them in one complete turn.

The engine may now be started and left running until thoroughly warmed up, when it may be found necessary to readjust the throttle adjusting screws by equal amounts

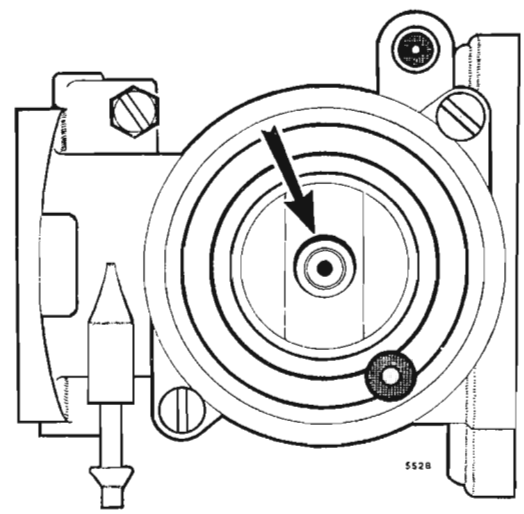


Fig. D.6

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

in either direction according to whether a higher or lower speed is required. To check for exact matching of the throttle openings it is best to listen to the air intake hiss, after first removing the air cleaners. This is most easily done by holding one end of a piece of rubber tubing against the ear and the other end against the intake of each carburetter in turn, when the intensity of the intake hiss can be gauged. The larger the throttle opening, the more intense is the intake hiss, and with this as a guide the necessary adjustments for matching can readily be made after a little experience.

Adjusting the jets

When the degree of throttle opening has been dealt with, slacken the pinch-bolt on one of the coupling levers on the interconnecting shaft and adjust the mixture strength by moving both jet adjusting nuts the same amount. Move upwards for weakening or downwards for enriching until a satisfactory engine beat has been found which should give **the fastest idling speed consistent with even firing.**

When this has been found it may be necessary to lower the idling speed by slackening off slightly both throttle adjusting screws an equal amount.

Note that a weak idling mixture gives a 'splashy', irregular type of misfire, with a colourless exhaust, whilst a rich idling mixture gives a 'rhythmical' or regular misfire, with a blackish exhaust.

When the mixture strength is correct on both carburetters lifting the piston by the special piston lifting pin on the side of the body casting will give uneven firing from excessive weakness on that particular carburetter.

If lifting the piston of one carburetter stops the engine and lifting that of the other does not, this indicates that the mixture on the first carburetter is set weaker than that on the second, and therefore the mixture strength on the first one should be enriched by unscrewing the jet adjusting nut one or two flats of the hexagon.

There is one occasion when the above check does not give a correct indication, and that is the rare condition when the throttle on one carburetter is set open a generous amount coupled with a weak setting of the jet adjusting nut, and the second carburetter is set the opposite way, with a rich setting of the jet adjusting nut coupled with a slight throttle opening. The overall effect will probably give a fair idling performance for the complete unit; but lifting the piston on the second carburetter will stop the engine although it is actually running rich—thus contradicting the original instruction. Also, lifting the piston on the first carburetter will not stop the engine although it is actually running weak; the lifting of the piston in this case only slightly weakens off an already markedly weak mixture and is not enough to stall the engine.

The obvious cure for such a combination of extremes is to make sure firstly (possibly by using the simple rubber stethoscope already described) that both throttles are open the same amount for idling, giving approximately the same suction on each jet.

Make sure that the jets are hard up against the bottom face of the adjusting nuts after any movement of the latter; also check the same point when reconnecting the link shaft between the jet units.

Although it is advisable, before the actual start of the tuning operation, to check that the jet adjusting nuts are all screwed the same amount downwards from the topmost position, later, when a satisfactory setting for each nut has been found giving a correct slow run, it may be that this finalized position is not exactly similar for each nut—that is, one may be two turns down and another two and a half turns down.

This apparent discrepancy is well within normal variation, and even on new carburetters may be as much as one full turn, depending on such factors as exactly similar positioning of each jet needle in the piston, etc. On worn carburetters, where there is also the influencing factor of unequal wear on individual parts, then the variation in jet nut position may be greater, and up to two full turns down.

The throttle coupling lever pinch-bolt may now be tightened, taking care to see that light pressure is put on the head of each throttle stop screw and setting the throttle opening delaying mechanism as the bolt is tightened.

Setting the throttle opening delaying mechanism

To ensure smooth acceleration when initially opening the throttle the linkage between the throttle spindles is designed to delay slightly the opening of the front carburetter throttle. This delaying mechanism is incorporated in the throttle spindle connecting rod and coupling levers.

Connection between the two levers is made by a pin secured to the front lever operating in a slot in the lever slightly larger than the diameter of the pin, and it is this difference which allows a limited amount of free movement between the two levers to delay the opening of the front carburetter throttle.

To set this mechanism, slacken the front lever pinch-bolt and push the pin end of the lever towards the engine until the pin is just bearing against the engine side of the slot in the rear lever. Hold the levers in this position and tighten the pinch-bolt, ensuring that both throttle stop screws are bearing on the stop webs of the butterfly levers, and ensure also that the pin in the slot of the rear lever is set the opposite side to that of the front lever.

Float-chambers

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 end of the lever should just rest on the bar (see Fig. D.4) when the needle is on its seating. If this is not so, the lever should be reset at the point where the end meets the shank.

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.5) 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.

Disconnect the rod between the jet lever and the jet head.

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.

Slacken off the large jet locking nut (1, Fig. D.5) until the jet bearing is just free to rotate by finger pressure.

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.

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

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. Remove the adjusting nut and replace the lock spring after the conclusion of the operation.

Removing

Remove the air cleaners 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 carburetters.

Release the interconnecting coupling tension springs and the throttle stop return spring.

Remove the nuts and spring washers securing the carburetters to the manifold flanges. Lift off the carburetter assemblies as one unit. The carburetter interconnecting couplings are fitted in sleeved nuts, and when the carburetter assemblies are removed the couplings can be lifted away from both carburetters.

It should be noted that the heat shield fitted between the carburetters and the manifold flanges has gaskets, which should be renewed if the shield has been removed.

Refitting

Reverse the removal procedure when refitting, ensuring that there is a clearance of approximately ·012 in. (·30 mm.) between the throttle cable actuating lever and the carburetter heat shield.

Section D.5

AIR CLEANERS

Removing

Remove the centre-securing nut and washer on the tie bracket.

Remove the through-bolts and lift away the air cleaners from the carburetter assemblies.

NOTE.—Servicing of the paper-element-type air cleaners should be carried out every 12,000 miles (19200 km.), at which stage a new element should be fitted.

In countries where dusty operating conditions exist this operation should be carried out at more frequent intervals.

Do not disturb the air cleaner covers or remove the elements at any other time.

Refitting

Refitting is a reversal of the removal procedure.

SECTION E

THE CLUTCH

	Section
General description	
Clutch	E.1
Clutch pedal	E.2
Master cylinder	E.3
Service tools	End of Section
Slave cylinder	E.4

GENERAL DESCRIPTION

The clutch is a Borg & Beck single dry-plate type operated hydraulically. A steel cover bolted to the flywheel encloses the driven plate, the pressure plate, the pressure springs, and the release levers. The driven plate, to which the friction linings are riveted, incorporates springs assembled around the hub to absorb power shocks and torsional vibration. The pressure springs force the pressure plate against the friction linings, gripping the driven plate between the pressure plate and the engine flywheel. When the clutch pedal is depressed the release bearing is moved forward against the release plate, which bears against the three release levers. The outer or shorter ends of the release levers engage the pressure plate lugs; pressure applied by the release bearing causes the pressure plate to be pulled away from the driven plate, compressing the pressure springs which are assembled between the pressure plate and the clutch cover. As the friction linings wear, the pressure plate moves closer to the flywheel face and the outer or shorter ends of the release levers follow. This causes the inner or longer ends of the levers to travel farther towards the gearbox and decreases the clearance between the release lever plate and the release bearing. This is automatically compensated unless the master cylinder has been disturbed.

When the clutch pedal is depressed, fluid pressure is transmitted through the master cylinder to the slave cylinder mounted on the clutch housing, moving the slave cylinder piston and push-rod. As the push-rod is connected to the lower arm of the clutch withdrawal lever, thereby the clutch is released. The push-rod is non-adjustable.

The correct amount of free movement between the master cylinder push-rod and piston is set during erection of the vehicle and should never need alteration.

In the event of the adjustment having been disturbed, reset the effective length of the rod connecting the piston to the pedal until the pedal pad can be depressed approximately $\frac{5}{32}$ in. (4 mm.) before the piston begins to move. The clearance can be felt if the pedal is depressed by hand. It is very important that the push-rod should have a minimum free movement of $\frac{1}{32}$ in. (·8 mm.) before the piston starts to move.

Section E.1

CLUTCH

Removing

Remove the gearbox and the clutch assembly as described in Sections F and A respectively.

Dismantling

The clutch tool No. 18G99A provides an efficient and speedy means of dismantling, reassembling, and adjusting the clutch with a high degree of accuracy. The tool is universal, and a chart detailing the sizes of spacing washers and distance pieces for particular types of clutch is provided on the inside of the metal container lid.

Detach the retaining springs from the release lever plate and remove the springs and plate. Place the tool base plate on a flat surface. Select three spacing washers for a $6\frac{1}{4}$ in. (15·88 cm.) clutch and place them in position (A) on the base plate.

Position the clutch on the three spacing washers so that the hole in the clutch cover aligns with the tapped holes in the base plate with the release levers as close to the spring washers as possible. Insert the tool set screws, tightening them a little at a time in a diagonal pattern until the cover is firmly and evenly secured to the base plate. This is most important if the best results are to be achieved.

Knock back the tab washers and remove the shoulder stud adjusting nuts. Lift off the washers, bearing plates, and release levers.

Unscrew the set screws securing the clutch cover to the base plate in a diagonal pattern, releasing the pressure on the clutch springs gradually and evenly. Lift off the cover and remove the pressure springs.

Clean the clutch parts carefully. If the linings are to be used again they should not be allowed to come in contact with cleaning fluids.

Examine the friction linings for wear or loose rivets and check the driven plate for uneven or worn splines, distortion, or signs of fatigue cracks.

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

Examine the machined face of the pressure plate; if this is badly grooved and rough, the surface may be reground until the grooves disappear.

Examine the machined surface of the release lever plate. If this is badly grooved, renew the plate. A new plate will also be necessary if the surfaces on the reverse side of the plate, which are in contact with the tips of the release levers, are worn down.

Examine the tips of the release levers which bear on the back of the release lever plate. A small amount of worn flat surface is permissible, but if this is excessive the lever should be renewed. Check for excessive wear in the groove in which the fulcrum bears. If the metal here has worn at all thin, the lever must be renewed as there is a danger of it breaking under load, with disastrous results to the whole clutch mechanism.

Examine the release bearing for cracks or bad pitting, also measure the amount of bearing standing proud of the metal cup. If the bearing is cracked or badly pitted, or there is $\frac{1}{16}$ in. (1·6 mm.) or less of bearing standing proud of the cup, the cup and bearing must be renewed.

Examine the pressure springs for weakness or distortion, and renew if necessary. Renew in sets only.

Examine the clutch withdrawal shaft for slackness in the bushes. Renew the bushes if necessary.

Reassembling

Parts not being replaced by new ones must be refitted in their original positions. The clutch must now be adjusted, still using the clutch assembly tool. With the clutch bolted to the tool base plate, as on completion of assembly, proceed as follows. Screw the actuator into the base plate and pump the handle a dozen times to settle the clutch mechanism. Remove the actuator. Screw the tool centre pillar into the base plate and select a distance piece, as shown on the chart. Place the distance piece over the centre pillar with its recessed face downwards. Place the gauge height finger over the centre pillar. Adjust the height of the release levers by tightening or loosening the adjusting nuts until the height finger, when rotated, just contacts the highest point on the tip of each release lever. Press downwards on the height finger to ensure that it bears squarely on the adaptor while rotating. Remove the height finger and pillar, and screw the actuator into the base plate. Operate the clutch several times to enable the components to settle on their knife-edges. Remove the actuator and replace the centre pillar, distance piece, and height finger. Readjust the release levers if necessary. Repeat the procedure to ensure that the release levers are finally seated, and gauge once more. Remove the centre pillar, distance piece, and height finger and secure the adjusting nuts with their tab washers. Fit the release lever plate on the tips of the release levers and secure it by the three retaining springs. Release the tool set screws in diagonal sequence a little at a time, relieving pressure slowly and evenly. Remove the clutch assembly from the base plate.

Refitting

Refitting is a reverse of the removal procedure. Use Service tool 18G139 for clutch centralization.

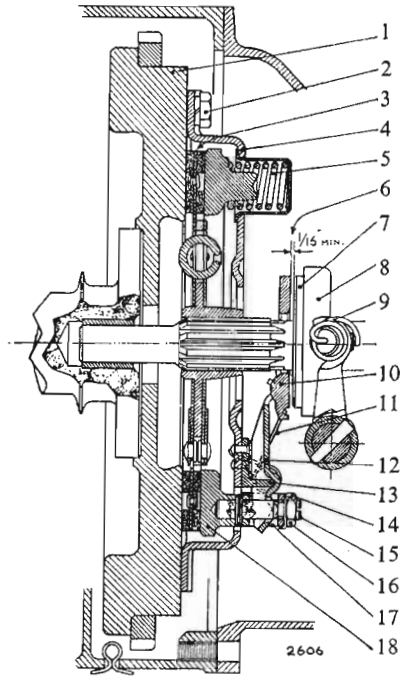


Fig. E.1

The clutch unit in section

1. Flywheel.
2. Holding screw.
3. Driven plate.
4. Cover.
5. Thrust spring.
6. Clearance.
7. Graphite release bearing.
8. Release bearing cup.
9. Release bearing carrier.
10. Release lever plate.
11. Lever retainer and anti-rattle spring.
12. Release lever.
13. Knife-edge fulcrum.
14. Tag lock washer.
15. Stud.
16. Adjusting nut.
17. Bearing plate.
18. Pressure plate.

Section E.2

CLUTCH PEDAL

Removing

Working beneath the bonnet, disconnect the clutch and brake pedal levers from the master cylinder push-rods by removing the spring clips and withdrawing the clevis pins. From within the car, remove the nut and spring washer and withdraw the fulcrum pin; note that a distance piece separates the two pedals. The pedals can now be removed.

The pedals together with the master cylinder assembly can be removed as one unit. This operation is described in the master cylinder removal section.

Refitting

When refitting reverse the removal procedure.

Section E.3

MASTER CYLINDER

Construction

The master cylinder caters for operation of both brakes and clutch. It has two bores side by side and, except for the fact that one has no check valve, each bore accommodates normal master cylinder parts. The bore with the check valve serves the brakes, the other serves the clutch slave cylinder.

Removing

The following removal procedure allows the withdrawal of the master cylinder unit complete with clutch and brake pedals.

NOTE.—Before disconnecting the master cylinder ascertain, for assembly purposes, which bore communicates with the clutch slave cylinder.

Remove the heater blower unit (if fitted) by first releasing the two electrical connections. Remove the set screws securing the heater blower bracket to the bulkhead. Remove the set screws securing the master cylinder mounting plate to the engine bulkhead. Disconnect the two hydraulic pipes at their unions with the rear of the master cylinder unit.

Withdraw the master cylinder unit upwards and at the same time manipulate the clutch and brake pedals through the aperture in the bulkhead.

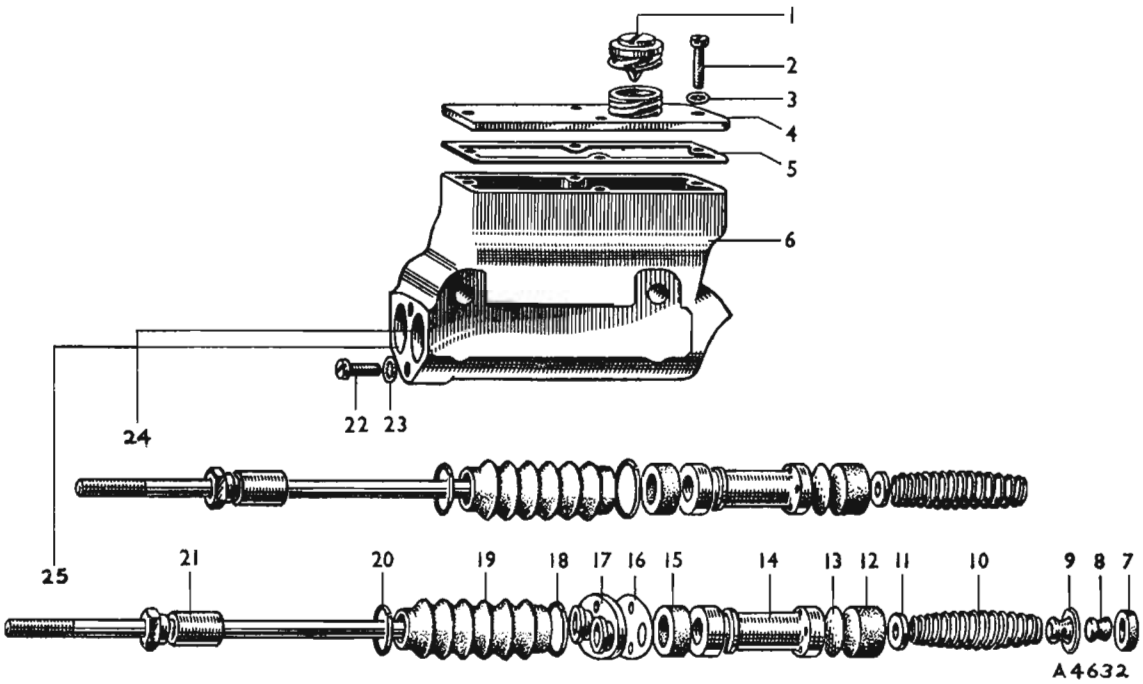


Fig. E.2

Clutch master cylinder (exploded)

1. Filler cap.
2. Fixing screw.
3. Shakeproof washer.
4. Tank cover.
5. Tank cover gasket.
6. Cylinder barrel and tank.
7. Valve washer.
8. Valve cup.
9. Valve body.
10. Return spring.
11. Spring retainer.
12. Main cup.
13. Piston washer.
14. Piston.
15. Secondary cup.
16. Gasket.
17. Boot fixing plate.
18. Boot clip.
19. Boot.
20. Boot clip.
21. Push-rod.
22. Fixing screw.
23. Shakeproof washer.
24. Clutch bore.
25. Brake bore.

Dismantling

Disconnect each pedal from its master cylinder push-rod by removing the spring clips and withdrawing the clevis pins.

Remove the bolts securing the master cylinder unit to its mounting plate and withdraw the complete unit.

Remove the set screws securing the boot fixing plate to the master cylinder body.

Detach the fixing plate from the master cylinder, and remove the boots and push-rods.

Remove the common filler cap and drain the fluid into a clean container.

Withdraw the piston, piston washer, main cup, spring retainer, and the return spring.

Remove the secondary cup by stretching it over the end flange of the piston.

Examine all parts, especially the washers, for wear or distortion, and replace with new parts where necessary.

Reassembling

Reassembly is the reverse of the removal procedure, with particular attention being paid to the fitting of the rubber boots. The vent hole in each boot should be at the bottom when the cylinder is mounted on the vehicle.

Refitting

The installation of the master cylinder unit is the reversal of the removal procedure.

If no further maintenance is necessary, remember to bleed the system.

Section E.4

SLAVE CYLINDER

Construction

The cylinder is bolted to the under side of the clutch housing and comprises a piston, rubber cup, cup filler, return spring, push-rod, and bleeder screw.

Removing

Place a receptacle to catch the fluid and remove the pipe union on the slave cylinder. Remove the split pin and clevis pin from the clutch withdrawal lever yoke. Remove the bolts securing the cylinder to the clutch housing and lift off the slave cylinder assembly.

Dismantling

Remove the rubber cover, push-rod, and circlip, and if a compressed-air line is available blow out the piston and seal. The spring can also be removed. The main casting can be cleaned with any of the normal cleansing fluids, but slave cylinder components should be cleaned in hydraulic fluid. All traces of cleansing fluid should be removed before reassembly. Lubricate the slave cylinder bore and components with hydraulic fluid and renew any rubbers before assembling the slave cylinders.

Reassembling

Reassembling is the reverse of the removal procedure.

Refitting

For refitting reverse the removal procedure. The clutch hydraulic system should always be bled after an overhaul operation.

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 operation until clear fluid free from air bubbles is delivered into the container.

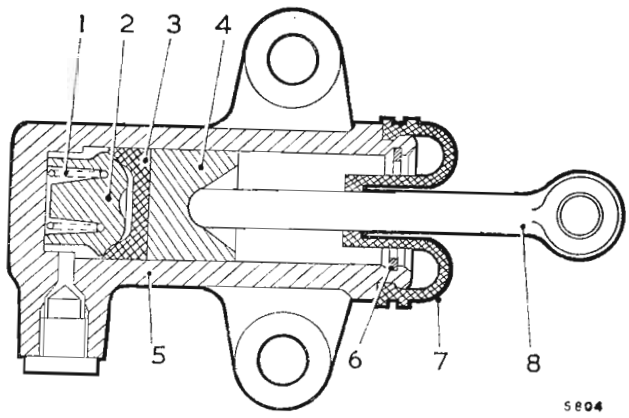
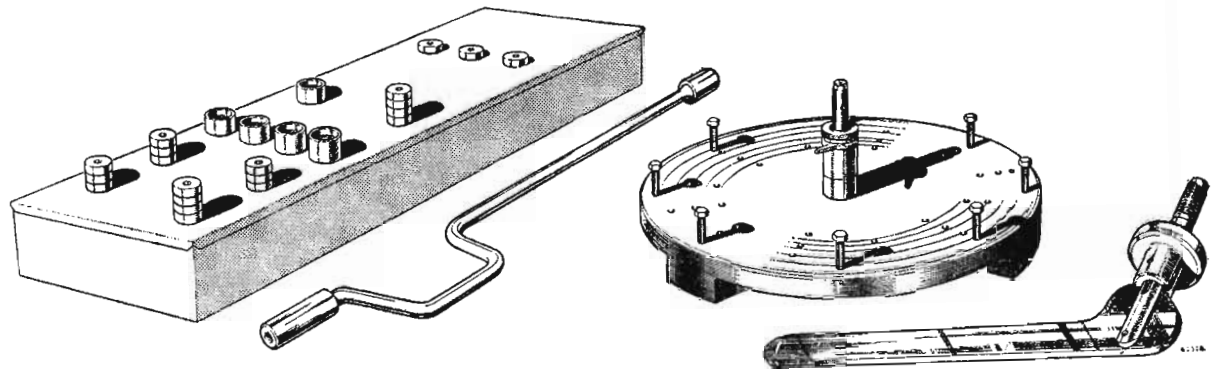


Fig. E.3

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.

SERVICE TOOLS



18G99A

18G99A. Clutch Assembly Gauging Fixture

With the use of this tool a clutch assembly can be quickly dismantled, rebuilt, and finally adjusted with a high degree of accuracy. This is a universal tool for clutch assembly from 6¼ in. (15·9 cm.) to 11 in. (30 cm.) diameter.

18G139. Clutch Centralizer

The driven plate in the M.G. Midget clutch may readily be centralized with the aid of this tool.

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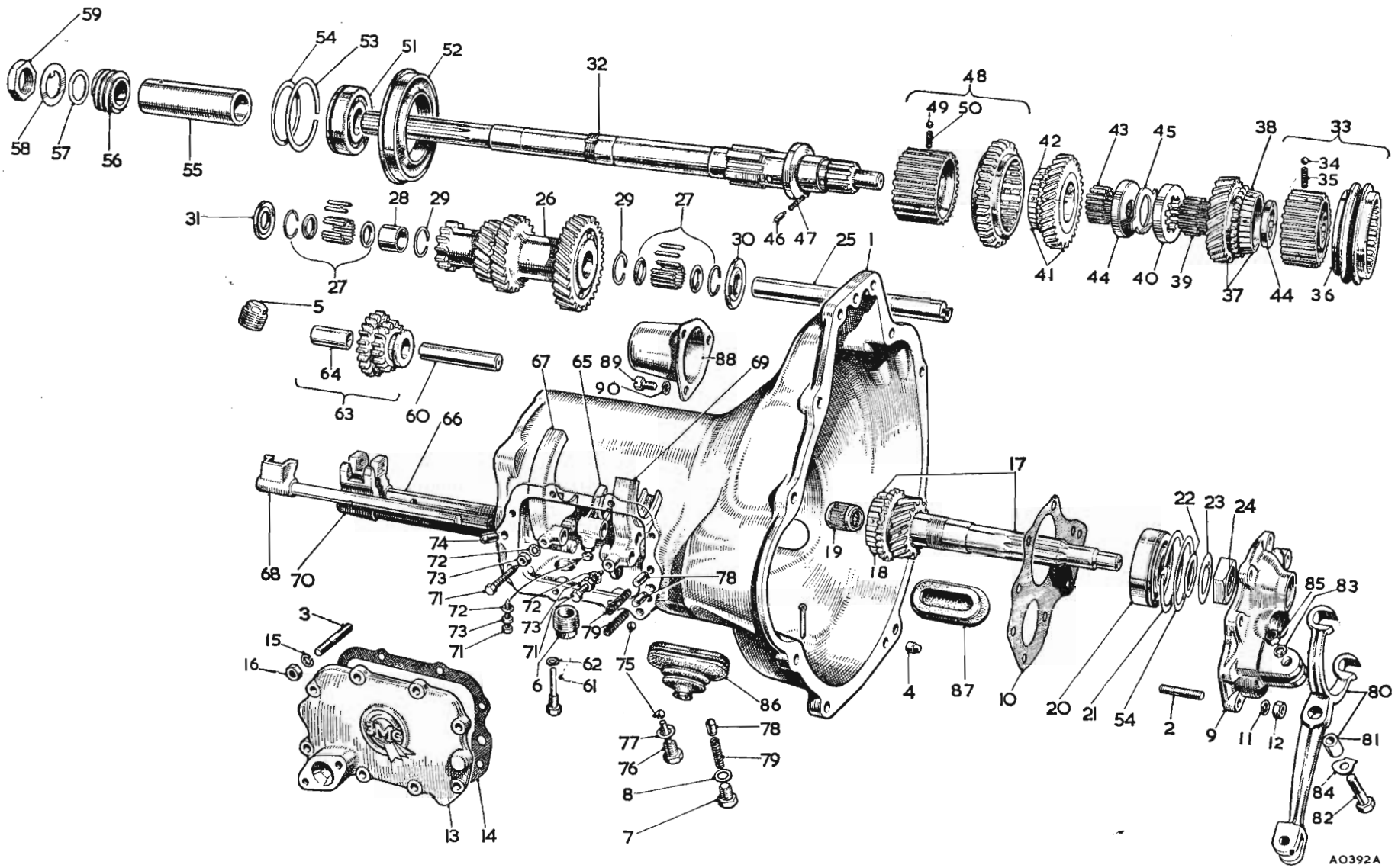
18G139

SECTION F

THE GEARBOX

	Section
General description	
First motion shaft	F.3
Gearbox	F.1
Gear synchronizing cones	F.5
Laygear assembly	F.4
Service tools	End of Section
Third motion shaft	F.2

THE GEARBOX COMPONENTS



KEY TO THE GEARBOX COMPONENTS

No.	Description
1.	Case assembly.
2.	Stud for front cover.
3.	Stud for side cover.
4.	Dowel.
5.	Filler plug.
6.	Drain plug.
7.	Plug for reverse plunger spring.
8.	Washer.
9.	Front cover.
10.	Front cover joint.
11.	Spring washer.
12.	Nut.
13.	Side cover.
14.	Joint for side cover.
15.	Spring washer.
16.	Nut.
17.	First motion shaft with cone.
18.	Synchronizing cone.
19.	Needle-roller bearing.
20.	First motion shaft journal ball bearing.
21.	Spring ring.
22.	Washer.
23.	Lock washer.
24.	Nut.
25.	Layshaft.
26.	Laygear.
27.	Needle-roller bearing with spring ring.
28.	Distance piece.
29.	Spring ring.
30.	Thrust washer (front).
31.	Thrust washer (rear).
32.	Third motion shaft.
33.	Third and fourth speed synchronizer.
34.	Ball.
35.	Spring.
36.	Sleeve.
37.	Third speed gear with cone.
38.	Synchronizing cone.
39.	Needle roller.
40.	Third speed gear locking collar.
41.	Second speed gear with cone.
42.	Synchronizing cone.
43.	Needle roller.
44.	Second speed locking collar.
45.	Collars.
46.	Peg for locking collar.
47.	Spring for peg.
48.	First speed gear assembly.
49.	Ball.
50.	Spring for ball.
51.	Third motion shaft journal ball bearing.
52.	Bearing housing.
53.	Spring ring.
54.	Bearing packing washer.
55.	Third motion shaft distance piece.
56.	Speedometer gear.
57.	Plain washer.
58.	Locking washer.
59.	Third motion shaft nut.
60.	Reverse shaft.
61.	Screw.
62.	Spring washer.
63.	Reverse wheel and bush.
64.	Bush.
65.	Reverse fork.
66.	Reverse fork rod.
67.	First and second speed fork.
68.	First and second speed fork rod.
69.	Third and fourth speed fork.
70.	Third and fourth speed fork rod.
71.	Fork locating screw.
72.	Shakeproof washer.
73.	Nut.
74.	Interlock plunger.
75.	Interlock ball.
76.	Plug.
77.	Washer.
78.	Plunger for fork rod.
79.	Spring.
80.	Clutch withdrawal lever with bush.
81.	Bush.
82.	Bolt.
83.	Spring washer.
84.	Locking washer.
85.	Nut.
86.	Dust cover.
87.	Dust cover for bell housing.
88.	Starter pinion cover.
89.	Screw.
90.	Washer.

GENERAL DESCRIPTION

The gearbox has four forward speeds and one reverse, and synchromesh is incorporated on second, third, and top gears.

Top gear is a direct drive; third and second are in constant mesh; first and reverse are obtained by sliding spur pinions.

Section F.1

GEARBOX

Removing

The engine and gearbox may be removed from the vehicle as a complete unit as described in Section A.31 and then separated. The alternative method is first to remove the engine as detailed in Section A.31 and then withdraw the gearbox after completing the following operations.

Remove the self-tapping screws from the change speed lever cover and withdraw the cover from the lever.

Remove the anti-rattle plunger spring and cap from the side of the change speed lever turret. Remove the change speed lever cover set screws and the lever.

Turn back the carpet surrounding the gearbox cover to expose the gearbox rear mountings and remove the securing set screws.

Working beneath the vehicle, remove the speedometer drive cable at its union with the gearbox rear extension.

Remove the clutch slave cylinder as detailed in Section E.4. Disconnect the propeller shaft from the rear axle (see Section G.1). Remove the remaining gearbox rear mounting set screws and lift the gearbox clear of the vehicle.

Dismantling

Unscrew the filler plug. Drain the oil by removing the plug from the bottom of the gearbox. Unscrew the speedometer pinion sleeve from the left-hand side of the gearbox rear cover, remove the fibre washer, and withdraw the speedometer pinion.

Remove the nuts securing the remote control housing and lift the housing off the rear cover.

Unscrew the set screws and spring washers securing the rear cover to the gearbox.

Pull the rear cover back slightly and turn it in an anti-clockwise direction, as viewed from the rear, to enable the control lever to clear the fork rod ends, and then remove the rear cover from the gearbox.

Remove the control shaft locating screw, and screw it into the tapped front end of the control shaft. Slight pressure on the screw will facilitate the removal of the control shaft, which is a push fit in the rear cover. The control lever will slip off the end of the shaft as the shaft is removed.

Remove the one-piece nylon control lever bush from the control lever.

Unscrew the set screws securing the bottom cover to the change speed lever tower. Retain the paper joint washer if undamaged.

Unscrew and remove the change speed lever locating peg and the anti-rattle springs. The latter are removed by unscrewing the caps and then tilting the remote control housing so that the springs and plungers drop out.

Unscrew the set screws securing the change speed lever cover to the top of the change speed lever tower and remove the lever, taking care to retain the thrust button and thrust button spring.

Unscrew the set screws in the front and rear selector levers, remove the core plugs at either end of the remote control housing, and, using a suitable drift, tap out the remote control shaft. The front and rear selector levers can then be removed.

To remove the reverse selector plunger first unscrew the reverse plunger cap and remove the detent spring and ball, then remove the locating pin.

Remove the clutch release bearing by levering out the two retaining springs.

To remove the clutch withdrawal lever tap back the locking washer and remove the nut and washer. The bolt may then be unscrewed. Do not attempt to knock the bolt out, as it is threaded into the support bracket. To unscrew the bolt remove the rubber dust cover from the hole opposite that through which the clutch withdrawal lever passes, and pass a suitable tool through the hole. On left-hand-drive cars the clutch withdrawal lever passes through the hole on the left-hand side of the bell housing.

Remove from the front cover the nuts and washers situated within the clutch bell housing. The front cover may then be withdrawn by gripping the clutch withdrawal lever brackets with the finger and thumb and pulling. Remove the paper joints and packing shim.

Release the screws set in the side cover. Remove the side cover and joint washer. Remove the two springs from the front edge of the side cover joining face. Turn the gearbox on its side so that the two plungers fall out of the holes from which the springs were removed.

Remove the plugs situated near the clutch bell housing on the side cover side of the gearbox casing. They each have a fibre washer, and the lower of the plugs covers the reverse plunger and springs, which may be removed by tilting the gearbox on its side. The other plug, which has a long shank, blocks the hole through which the interlock ball between the first and second and third and fourth selector rods is inserted.

Select neutral by aligning the slots in the rear ends of the selector rods. Working on the gearbox, with the side cover facing upwards, unlock and remove the reverse fork locating screw, locknut, and shakeproof washer through the drain plug hole. Similarly, remove the locating screw locknut and shakeproof washer from the first and second and third and fourth speed forks.

Tap the third and fourth speed selector rod from the front end and draw it out through the back of the gearbox. Similarly, remove the first and second speed selector rod (nearest side cover) and then the reverse selector rod.

As the selector rods are being drawn out take care to remove the two interlock balls from the front end of the gearbox casing. Also the double-ended interlock plunger should be removed from the back end of the gearbox casing. The three selector forks may now be lifted out of the gearbox.

Tap the layshaft out of the front of the gearbox with a bronze drift. On removing the drift the laygear cluster and thrust washers will drop into the bottom of the gearbox.

Draw the third motion shaft assembly rearwards out of the gearbox case.

Insert a long, soft-metal drift through the mainshaft opening in the rear of the casing and drive the first motion shaft forwards out of the gearbox. The laygear cluster and thrust washers may now be removed.

Remove the reverse shaft locking screw. Place a screwdriver on the slotted end of the reverse shaft and push it into the gearbox with a turning motion. The reverse shaft and gear may now be removed.

Reassembling

Reverse the sequence of operations detailed for dismantling, but note the following important points:

(1) If a new front or rear cover washer is to be fitted, compress it by bolting the cover and washer in position before any other component is fitted; remove the cover and washer.

(2) When refitting the laygear, see Section F.4, subsection **'Laygear thrust washers'.**

(3) To ensure oil-tight joints and the correct fitting of the end covers shims are fitted. The method of determining their thickness is as follows.

End cover shims

Although a ·006 in. (·1524 mm.) shim is usually found to be sufficient, use the following method to shim the front and rear covers. Measure the depth of the front cover recess and the amount by which the bearing outer race protrudes from the casing, and tighten the cover with only the paper joint washer in position to allow it to be compressed. Take off the cover and remove the paper joint washer and measure its thickness. Add the thickness of the joint washer to the depth of the cover recess and subtract the amount by which the bearing protrudes from the casing. The result gives the thickness of shims to be used. Use the least possible number of shims to arrive at the correct thickness.

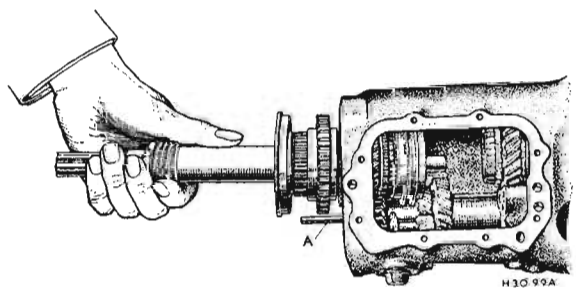


Fig. F.1

Drawing out the third motion shaft assembly after lowering the laygear onto the dummy layshaft (A)

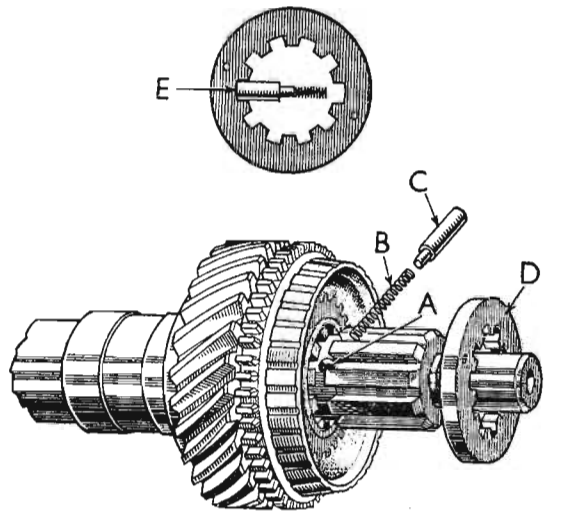


Fig. F.2

Securing the third motion shaft gears

A. Hole in shaft for locking plunger. C. Locking plunger.
B. Spring. D. Locking washer.
E. Locking washer with plunger engaged.

Shims are also available in thicknesses of ·004 in. (·1016 mm.) and ·010 in. (·254 mm.). Tighten the rear cover (evenly by diametrical selection) with the nine long set pins and spring washers. Correct shimming is done in exactly the same way as for the front cover.

Refitting

Refitting is the reverse of the dismantling procedure.

Section F.2

THIRD MOTION SHAFT

Dismantling

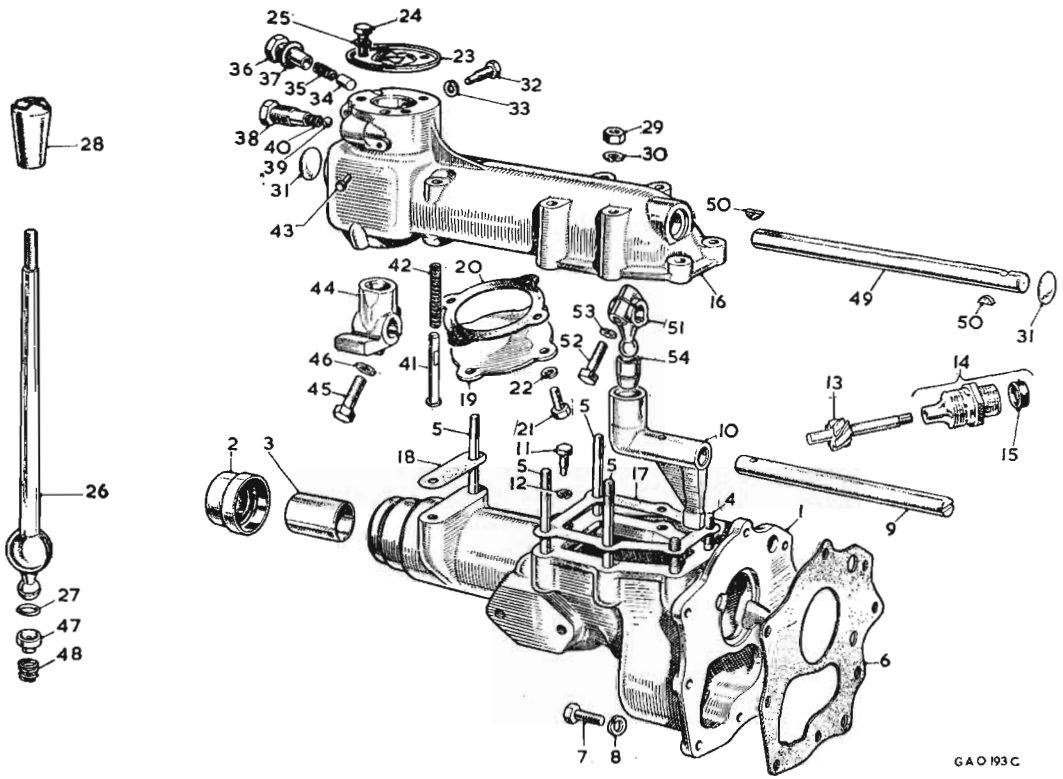
Remove the third and fourth speed synchronizer assemblies. Depress the small spring-loaded plunger which locks the splined ring at the front end of the third motion shaft and turn the ring so that one of its splines covers the plunger (a peg spanner is useful for turning the splined ring). Slide the splined ring and third speed gear off the end of the shaft and remove the plunger and spring; slide the third speed bush interlock ring and second speed gear off the end of the shaft.

Draw the splined ring, first speed ring, and synchronizer off the end of the shaft.

At the other end of the shaft knock back the locking washer and unscrew the securing nut. The speedometer wheel and distance piece may now be removed.

Draw the ball journal bearing off the end of the shaft with its housing, and then drift the bearing out of its housing.

THE REAR EXTENSION COMPONENTS



KEY TO THE REAR EXTENSION COMPONENTS

No.	Description
1.	Rear extension.
2.	Oil seal.
3.	Sliding joint bush.
4.	Stud (short).
5.	Stud (long).
6.	Joint.
7.	Screw.
8.	Spring washer.
9.	Control shaft.
10.	Control lever.
11.	Control lever locating peg.
12.	Spring washer.
13.	Speedometer pinion.
14.	Speedometer pinion oil seal assembly.
15.	Bush.
16.	Remote control casing.
17.	Joint (front).
18.	Joint (rear).
19.	Lever tower bottom cover.
20.	Joint.
21.	Screw.
22.	Spring washer.
23.	Lever seat cover.
24.	Screw.
25.	Spring washer.
26.	Change speed lever.
27.	Ring (rubber).
28.	Knob.
29.	Nut.
30.	Spring washer.
31.	Welch plug.
32.	Lever locating peg.
33.	Spring washer.
34.	Control shaft damper plunger.
35.	Spring.
36.	Spring retaining cap.
37.	Washer.
38.	Reverse selector detent plug.
39.	Ball.
40.	Spring.
41.	Reverse selector plunger.
42.	Spring.
43.	Reverse selector plunger locating pin.
44.	Rear selector lever.
45.	Screw.
46.	Spring washer.
47.	Thrust button.
48.	Spring.
49.	Remote control shaft.
50.	Key.
51.	Front selector lever.
52.	Screw.
53.	Spring washer.
54.	Front selector lever bush.

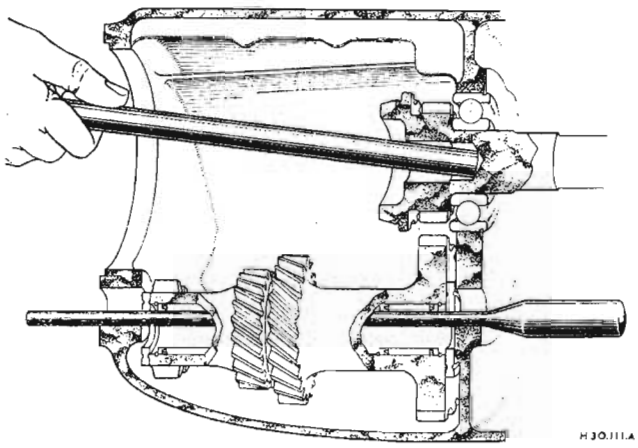


Fig. F.3

Drifting the first motion shaft out of the gearbox casing

Reassembling

The third motion shaft ball journal bearing outer race is grooved to take a spring ring. This spring ring registers in a recess in the bearing housing.

Press the bearing into the end of the housing with the larger diameter so that the spring ring end of the bearing is trailing.

Press the bearing and its housing on from the rear end of the shaft (the end with the long splines) in such a way that the larger diameter of the bearing housing (when fitted) is towards the rear of the shaft. Now fit the distance piece, speedometer drive, lock washer, and locknut in position.

Fit the first speed gear and second speed synchronizer assembly onto the shaft with the protruding end of the synchronizer towards the bearing. Place the large internally splined steel thrust washer behind the second speed synchronizer.

Follow the steel thrust washer with the bush for the second speed mainshaft gear (largest of the remaining gears) so that its legs are away from the steel thrust washer. Slide the second speed mainshaft gear over the bush with its cone towards the first speed gear and second speed synchronizer assembly. Locate the phosphor-bronze interlocking ring on the legs of the second speed mainshaft gear bush and mate the legs of the third speed mainshaft gear bush in the splines of the interlocking ring.

Place the spring and plunger in their hole; depress the plunger and draw the third speed mainshaft gear bush slightly forward; to keep the plunger depressed, slide the third speed mainshaft gear onto the bush with its cone away from the interlocking ring.

Put the remaining steel thrust washer behind the third speed mainshaft gear and push it as far as it will go.

Slip a tube over the end of the shaft and lightly tap the thrust washer; turn the washer until the plunger is released and locks it.

Slide the third and fourth speed synchronizer onto the shaft with the boss on the synchronizer hub away from the thrust washer.

NOTE.—For information on refitting and machining of gear synchronizing cones see Section F.5.

Section F.3

FIRST MOTION SHAFT

Dismantling

Unlock and remove the securing nut and withdraw the lock washer and packing shim.

Press the bearing from the shaft and remove the circlip from the bearing.

Reassembling

Reverse the dismantling procedure, ensuring that the inner tag of the lock washer, which engages the keyway in the shaft, is turned away from the bearing.

Section F.4

LAYGEAR ASSEMBLY

Dismantling

Needle-roller bearings are fitted in each end of the laygear. The needles are held in position in their races (one at each end) by spring rings.

Remove the spring rings from their locating grooves and extract the outer race needle rollers and the inner race. Remove the inner spring ring from its groove in the large end of the laygear and the distance piece and spring ring from the small end of the laygear.

Laygear thrust washers

These washers are designed to permit a laygear end-float of ·001 to ·003 in. (·0254 to ·0762 mm.). If the end-float exceeds this amount, the thrust washers must be renewed. The smaller thrust washer, at the rear, is made in varying thicknesses to allow correct end-float to be obtained. Thrust washers for the laygear small-end are available in thicknesses of ·123 to ·124 in. (3·124 to 3·150 mm.), ·125 to ·126 in. (3·175 to 3·200 mm.), ·127 to ·128 in. (3·226 to 3·250 mm.), and ·130 to ·131 in. (3·302 to 3·327 mm.) to obtain the required end-float.

Reassembling

Reverse the dismantling procedure when in the process of reassembly. Use Service tool 18G471 for layshaft gear alignment.

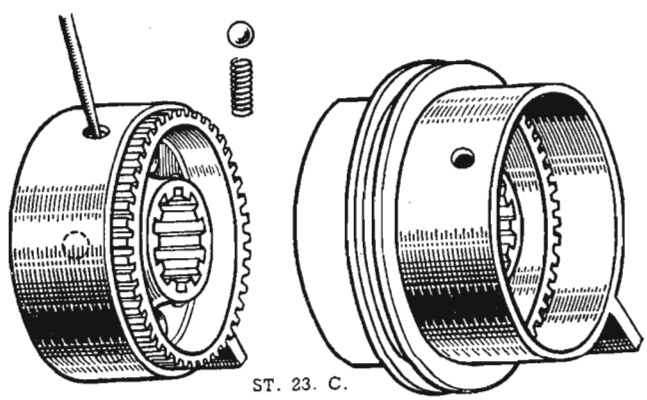


Fig. F.4

Using Service tool 18G144 *to assemble the spring-loaded balls to a coupling sleeve and synchronizer*

Section F.5

GEAR SYNCHRONIZING CONES

These cones are 'shrunk on' to the second, third, and fourth speed gears and are normally supplied as a complete unit for spares purposes. Where facilities exist for shrinking on and finally machining the cones, they can be supplied separately. If the gear is to operate satisfactorily, however, care must be taken in fitting them.

The internal machining of the cone is calculated to allow for a shrinkage fit onto the gear, and the cone must be heat-expanded before it can be fitted.

When heated in oil to approximately 250° F. (121·1° C.) expansion will allow the cone to be pressed home onto the gear without damage.

NOTE.—The six large recesses on the perimeter of the cone must line up with the holes in the boss of the gear.

After shrinking on, the unit should be immediately quenched in water to prevent the gear itself being softened. Punch-mark the cone in each of the six recesses. This ensures resistance to displacement when changing gear.

When the cone is in position the final machining can be done in accordance with the dimensions given in Fig. F.5.

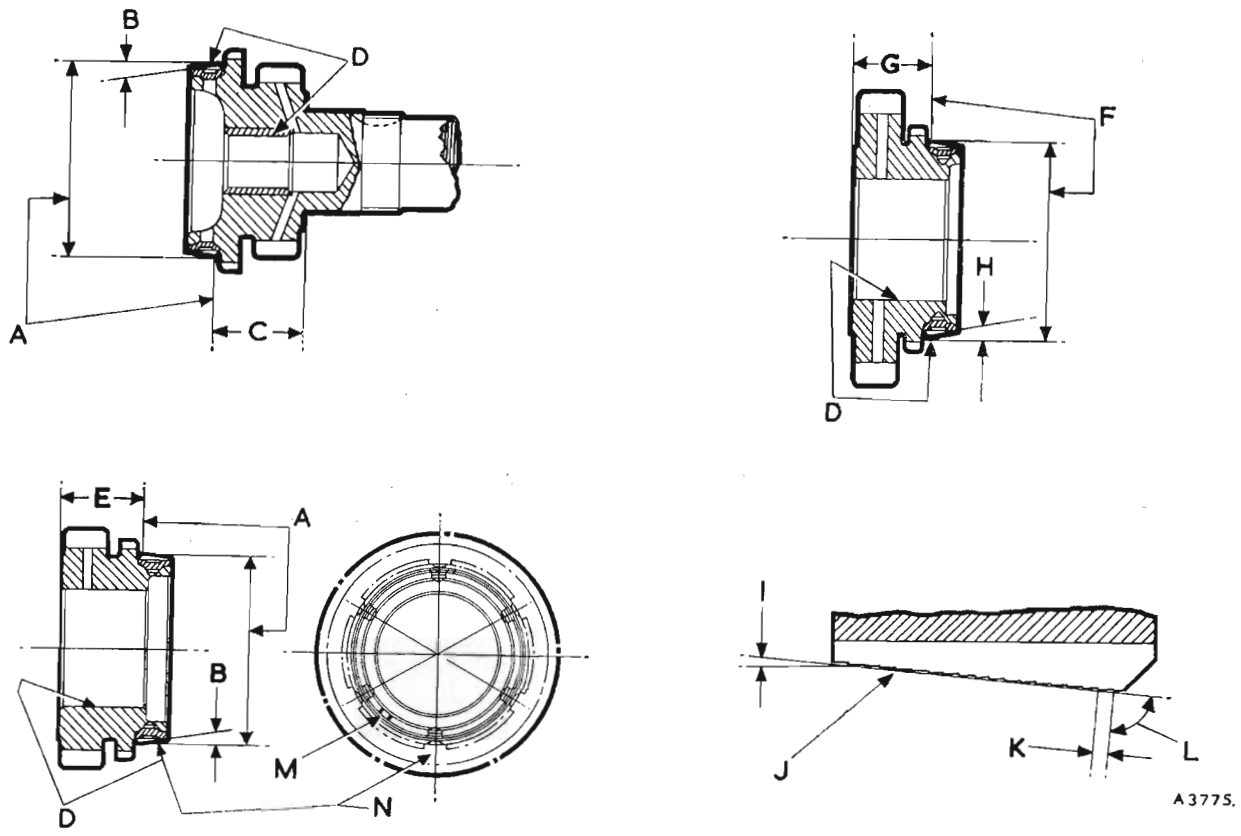


Fig. F.5

Top left: First motion shaft. Lower left: Third speed mainshaft gear. Top right: Second speed mainshaft gear. Lower right: Cone

Dimensions

A. Taper 1·997 in. (50·72 mm.) dia. at this line to gauge.
B. Taper 10° 10′, to be true and concentric with bore to ·001 in. (·025 mm.).
C. ·909/·912 in. (23·09/23·16 mm.).
D. Taper to be true and concentric with bore to ·001 in. (·025 mm.).
E. ·862/·865 in. (21·8/21·9 mm.).
F. Taper 1·966 in. (49·9 mm.) dia. at this line to gauge.
G. ·810/·813 in. (20·57/20·65 mm.).
H. 8° 20′.
I. 6°.
J. Coarse turning may be either right- or left-hand.
K. ·015 in. (·38 mm.).
L. 90°.
M. One notch to be ground in position shown relative to grooves with indentations.
N. Synchronizing cone to be heated in oil, shrunk onto gear, and punched into holes as shown with line-of-centre holes and line-of-centre spaces in cone in line.

SERVICE TOOLS

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

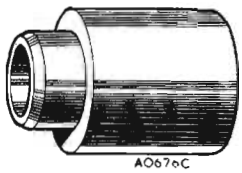
For use with 18G134B, 18G134C, 18G134L, and 18G134Q.

STR829XX

18G134

18G134L. Gearbox Rear Oil Seal Replacer Adaptor

For replacement of gearbox extension oil seals. Use with handle 18G134.

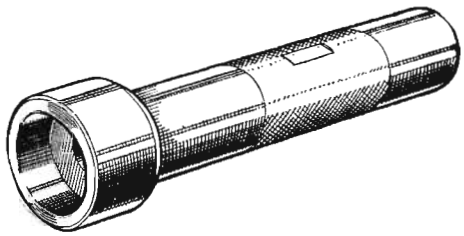


AO67oC

18G134L

18G140. First Motion Shaft Assembly Replacer

When threaded over the first motion shaft this tool registers with the outer race of the bearing, which then can be driven home without damage.



8711A

18G140

18G144. Synchromesh Assembly Ring

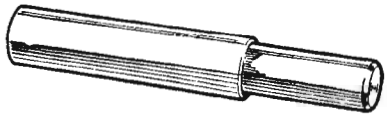
This tool retains the balls and springs in the synchronizer while it is being pushed into the sleeve or first speed wheel.

9261

18G144

18G194. Needle-roller Bearing Replacer

The replacement of needle-roller bearings in the laygear is greatly speeded up by the use of this replacing tool. It can also be used to fit the spring ring after the rollers have been fitted.

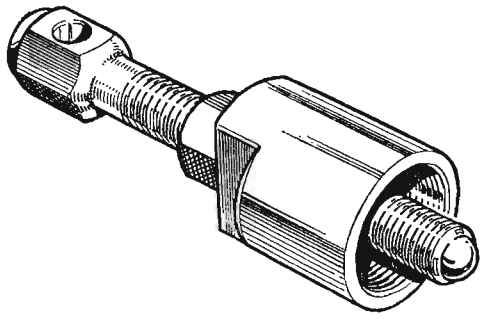


9172

18G194

18G389. Gearbox Rear Oil Seal Remover (basic tool)

This basic tool, together with the appropriate adaptor, is essential for removing the gearbox extension oil seal easily and without damage to the extension on the M.G. Midget.

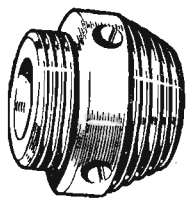


9161B

18G389

18G389A. Gearbox Rear Oil Seal Remover Adaptor

Use with basic tool 18G389.

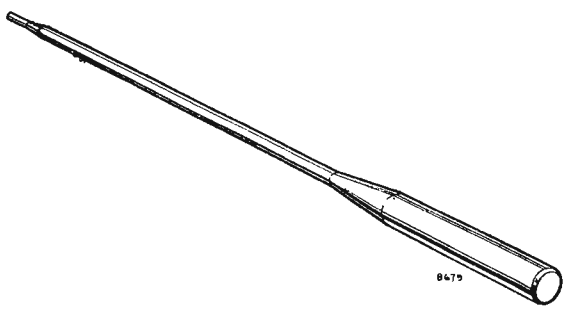


9168

18G389A

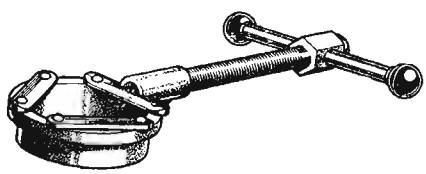
18G471. Dummy Layshaft

The fitting of a layshaft to the laygear on the M.G. Midget is simplified by the use of this tool.



18G471

18G488. Gearbox Oil Seal Clinching Tool



4464G

18G488

SECTION G

THE PROPELLER SHAFT

Description	*Section*
Propeller shaft	G.1
Service tools	End of Section

GENERAL DESCRIPTION

The propeller shaft and universal joints are of unit construction, the latter being of the non-constant-velocity type.

The fore-and-aft movement of the rear axle and other components is allowed for by a sliding spline between the propeller shaft and gearbox unit. Each universal joint consists of a centre spider, four needle-roller bearings, and two yokes.

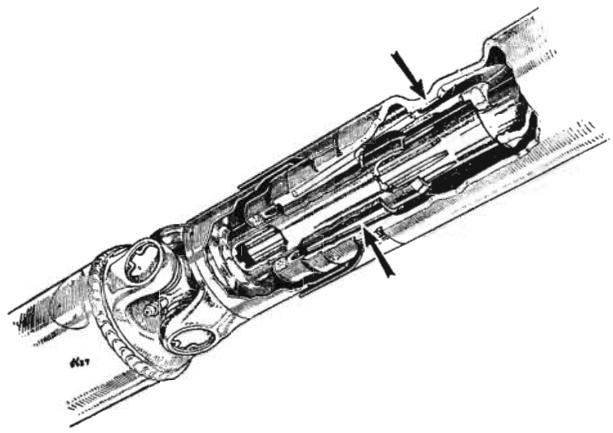


Fig. G.1

The propeller shaft sliding joint, showing the oilways which conduct oil from the gearbox

Section G.1

PROPELLER SHAFT

Removing

Disconnect the propeller shaft from the rear axle and remove it from the vehicle over the axle assembly and to the left-hand side of the differential casing.

Dismantling

Remove the enamel and any road dirt from the snap rings and bearing faces. Remove the snap rings. If the ring does not come out, tap the bearing face lightly to relieve the pressure against the ring. Hold the splined end of the shaft in one hand and tap the radius of the yoke with a lead or copper hammer; the bearing will then begin to emerge. If difficulty is experienced, use a small bar to tap the bearing from the inside, taking care not to damage the race itself. Turn the yoke over and extract the bearing with the fingers, being careful not to lose any of the needles. Repeat this operation for the other bearings.

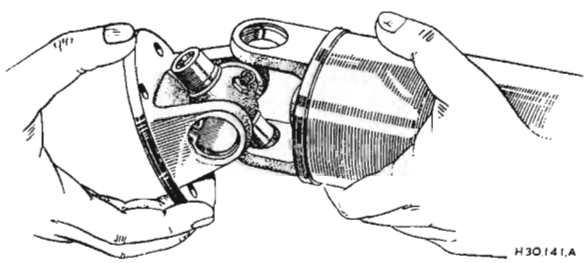


Fig. G.2

Separating the joint

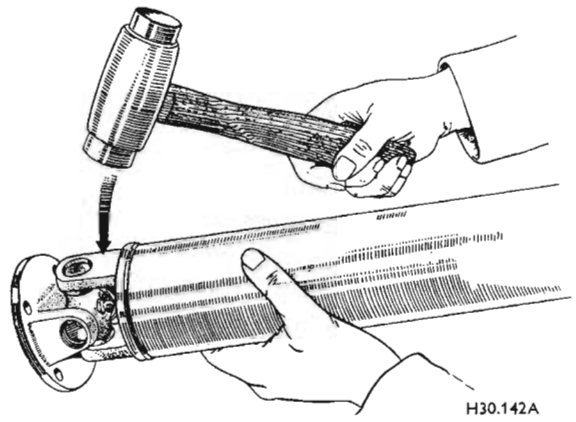


Fig. G.3

Tapping the joint to extract the bearing

Examination

When the propeller shaft has been in use for a long time the parts most likely to show signs of wear are the bearing races and the spider journals.

The complete assembly should be renewed if looseness or stress marks are observed, as no oversize journals or bearings are provided.

It is essential that bearing races should be a light drive fit in the yoke trunnions. Any ovality in the trunnion bearing holes indicates the necessity of fitting new yokes.

Reassembling

Ensure that the holes in the journals of the universal joints are cleaned out and filled with oil. Assemble the needle rollers in the bearing races and fill with oil. Should difficulty be experienced in assembly, smear the walls of the races with light grease to retain the needle rollers in place. It is advisable to renew, if necessary, the cork washer and the washer retainers on the spider journals. Continue assembling in the reverse of the dismantling procedure.

Refitting

When refitting the propeller shaft a second operator is required. With the aid of a screwdriver approximately 8 in. (20 cm.) long inserted through the front universal joint lubricating hole in the propeller shaft tunnel, lift the shaft and guide it onto the splines of the third motion shaft and into the gearbox rear extension.

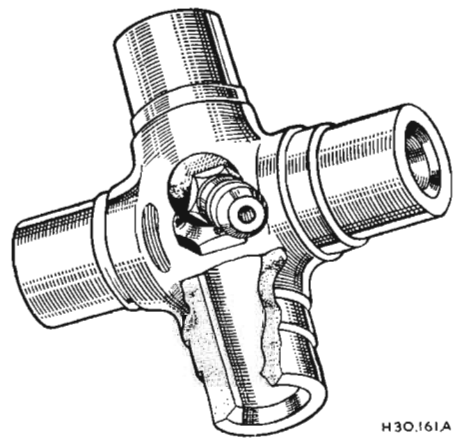


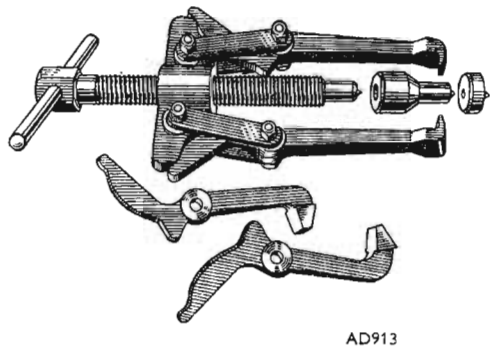
Fig. G.4

Showing the oil channels in the spider

SERVICE TOOLS

18G2. Crankshaft Gear, Pulley, and Propeller Shaft Flange Remover

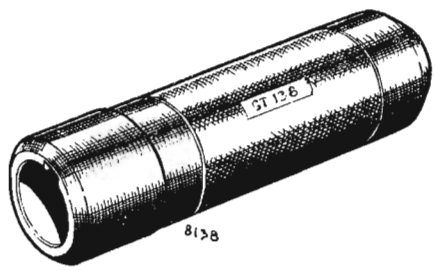
A multipurpose tool with alternative legs readily interchangeable: one pair has thin, flat ends designed for removing crankshaft gears and propeller shaft and bevel pinion flanges, the other pair has tapered ends suitable for fan pulley grooves other than the later-type models fitted with narrow-section fan belts.



18G2

18G138. Crankshaft Gear and Pulley Replacer

The bevel pinion flange can also be replaced with this tool on the M.G. Midget.



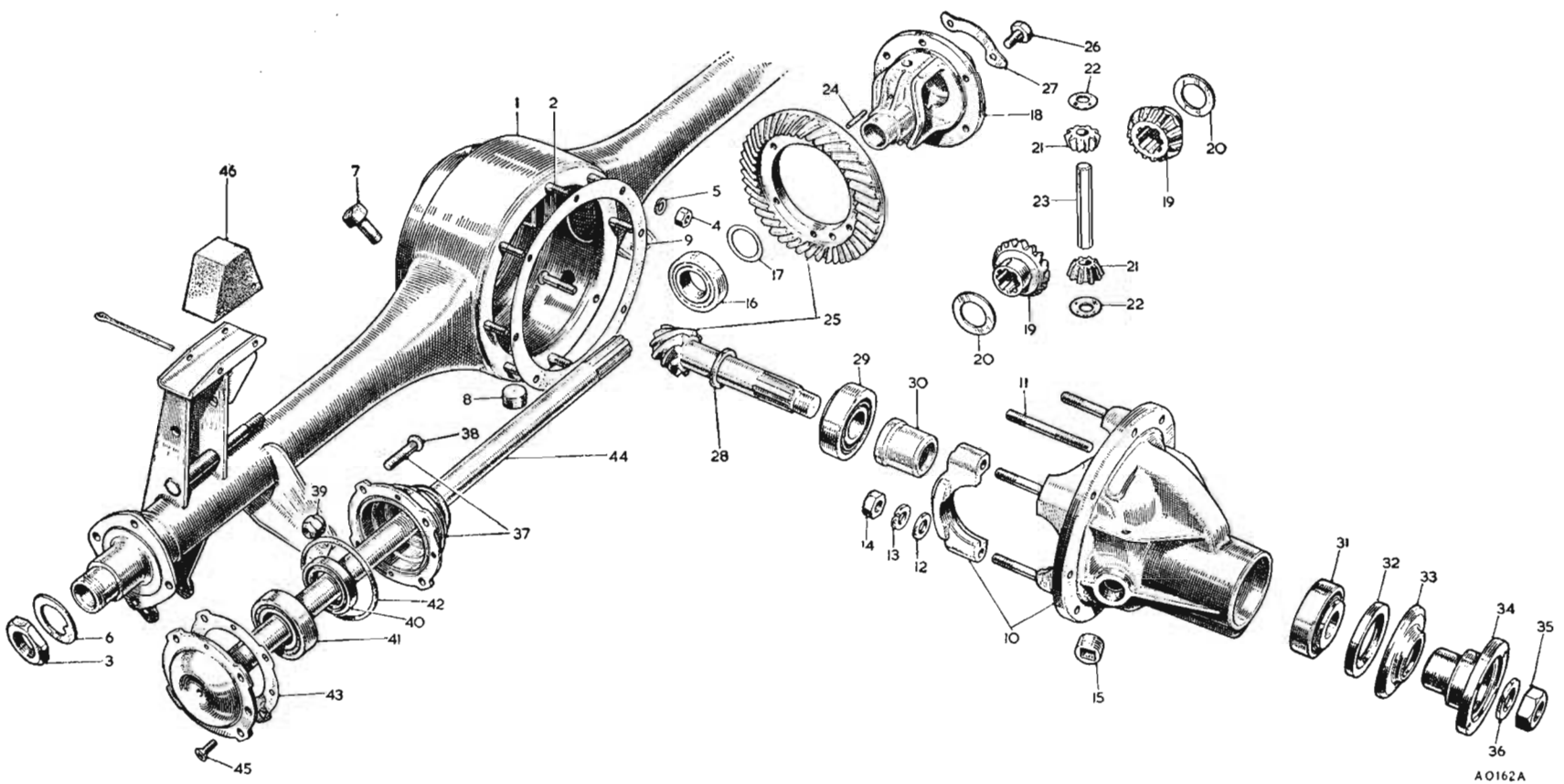
18G138

SECTION H

THE REAR AXLE AND REAR SUSPENSION

	Section
General description	
Axle shafts	H.2
Axle unit	H.1
Differential assembly	H.5
Hubs	H.3
Pinion oil seal—renewing	H.4
Springs	H.6
Service tools	End of Section

THE REAR AXLE COMPONENTS



KEY TO THE REAR AXLE COMPONENTS

No.	*Description*
1.	Case assembly.
2.	Gear carrier stud.
3.	Bearing retaining nut.
4.	Gear carrier to axle case nut.
5.	Spring washer.
6.	Washer.
7.	Breather assembly.
8.	Drain plug.
9.	Gear carrier joint.
10.	Carrier assembly.
11.	Bearing cap stud.
12.	Plain washer.
13.	Spring washer.
14.	Nut.
15.	Filler plug.
16.	Differential bearing.
17.	Bearing packing washer.
18.	Differential cage.
19.	Differential wheel.
20.	Thrust washer.
21.	Differential pinion.
22.	Thrust washer.
23.	Pinion pin.
24.	Pinion peg.
25.	Crown wheel and pinion.
26.	Bolt.
27.	Lock washer.
28.	Pinion thrust washer.
29.	Inner pinion bearing.
30.	Bearing spacer.
31.	Pinion outer bearing.
32.	Oil seal.
33.	Dust cover.
34.	Universal joint flange.
35.	Pinion nut.
36.	Spring washer.
37.	Hub assembly.
38.	Wheel stud.
39.	Nut.
40.	Oil seal.
41.	Hub bearing.
42.	Oil seal ring.
43.	Hub shaft joint.
44.	Axle shaft.
45.	Screw.
46.	Bump rubber.

GENERAL DESCRIPTION

The rear axle is of the three-quarter-floating type incorporating hypoid final drive reduction gears with a ratio of 9/38. The axle shafts, pinion, and differential assemblies can be withdrawn without removing the axle from the vehicle. The rear wheel bearing outer races are located in the hubs, and the inner races are mounted on the axle tube and secured by nuts and lock washers. Wheel studs in the hubs pass through the brake-drums and axle shaft driving flanges. Brake-drums are located on the hub flanges by two countersunk screws in each.

The differential and pinion shaft bearings are preloaded, the amount of preload being adjustable by shims. The position of the pinion in relation to the crown wheel when being adjusted must be kept within the maker's figure limits (see Section H.5). The backlash between the gears is adjustable by shims. Suspension is by rubber-mounted quarter-elliptic leaf springs and the shackles are fitted with rubber bushes of the flexing type.

Section H.1

AXLE UNIT

Removing

Raise the vehicle by placing a jack under the differential housing. Place supports under the rear springs.

The down pipe, silencer, and exhaust pipe should be withdrawn from the car as described in Section A.

Keeping the jack in position, release each check strap by unscrewing the nut and bolt at its body connection.

Release each damper arm from its connecting linkage.

Disconnect each suspension upper link from the rear axle bracket by unscrewing the nut and bolt and tapping the bolt from its housing.

Disconnect the brake cable at the cable adjustment.

Working beneath the car, unscrew the self-locking nuts and remove the bolts securing the propeller shaft flange to the axle pinion flange.

Disconnect the hydraulic brake pipe at the main union just forward of the differential housing.

After ascertaining that the weight of the axle is fully on the jack, unscrew and remove the shackle pins.

Lower the axle and withdraw it from the car.

Refitting

The refitting of the rear axle is a reversal of the removal procedure, with attention to the following. If for any reason it has been necessary to remove the suspension upper link and at the same time the rear axle has been withdrawn from the car, do not tighten the shackle pins until the upper link is mounted in position.

Section H.2

AXLE SHAFTS

Removing

Release the wheel nuts of the wheel concerned before jacking up the car.

Remove the wheel nuts and wheel, and, using a screwdriver, remove the brake-drum locating screws.

With the hand brake in the 'off' position and with the adjusters backed off, the brake-drums can now be removed.

Remove the axle shaft retaining screw and withdraw the shaft from the hub assembly. Should the paper washer be damaged, it must be renewed when reassembling.

Refitting

Reverse the removal procedure when refitting.

Section H.3

HUBS

Removing

Remove the wheel drum, and the axle shaft as described in Section H.2.

Tap back the tab of the locking washer and remove the securing nut.

Tilt the lock washer to disengage the key from the slot in the threaded portion of the axle casing and remove the washer. The hub complete with bearing and oil seal can be removed with Service tool 18G146.

Refitting

The hub bearing is non-adjustable and is replaced in one operation by pressing it into position.

It is essential when fitting the differential shaft that the paper joint washer between its flange and the hub is compressed before the abutment shoulder of the shaft pulls up against the bearing races. If in an emergency a paper joint washer is hand-made, ensure that it is about ·010 in. (·254 mm.) thick. An oil leak will invariably result if the washer is too thin.

It is advisable to use joint washers supplied by B.M.C. Service Ltd. to ensure correct assembly.

If the oil seal has been removed, it must be drifted into position with Service tool 18G14 (lip towards the bearing) before the bearing is inserted.

The hub is then drifted onto the axle casing with Service tools 18G134 and 18G134Q. Continue to assemble to the reverse of the removal procedure.

During reassembly the hubs should be packed with fresh grease, although they receive some lubricant from the axle during normal running.

Section H.4

RENEWING THE PINION OIL SEAL

Mark the propeller shaft and pinion shaft driving flanges so that they can be replaced in the same relative positions, and disconnect the propeller shaft.

Unscrew the nut in the centre of the driving flange, using Service tool 18G34A to prevent the flange from turning. Remove the nut and washer and withdraw the flange and pressed end cover from the pinion shaft.

Extract the oil seal from the casing.

Press a new seal into the casing with the edge of the sealing ring facing inwards.

Replace the driving flange and end cover, taking care not to damage the edge of the oil seal, and tighten the nut with a torque wrench (Service tool 18G372) to a reading of 140 lb. ft. (19·4 kg. m.).

Reconnect the propeller shaft, taking care to fit the two flanges with the locating marks in alignment.

Section H.5

DIFFERENTIAL ASSEMBLY

Removing

Remove the axle shafts as detailed in Section H.2.

Mark the propeller shaft and pinion shaft driving flanges to ensure correct assembly. Remove the self-locking nuts and disconnect the joint.

Remove the nuts securing the differential assembly to the axle banjo and withdraw the complete unit.

Dismantling

Check to ensure that the differential housing caps are marked to ensure correct replacement, then remove the bearing cap securing nuts and spring washers. Remove the bearing caps and withdraw the differential cage.

Remove the differential bearings from the cage, using Service tool 18G47C together with 18G47M. Note that the thrust face of each bearing is marked with the word 'THRUST', and that shims are fitted between the inner ring of each bearing and differential cage.

Knock back the tabs of the locking washers, unscrew the bolts securing the crown wheel to the differential, and remove the crown wheel from the differential cage.

Tap out the dowel pin locating the differential pinion shaft. The diameter of the pin is $\frac{1}{8}$ in. (3·18 mm.) and it must be tapped out from the crown wheel side of the differential cage as the hole into which it fits has a smaller diameter at the crown wheel end to prevent the pin passing right through. It may be necessary to clean out

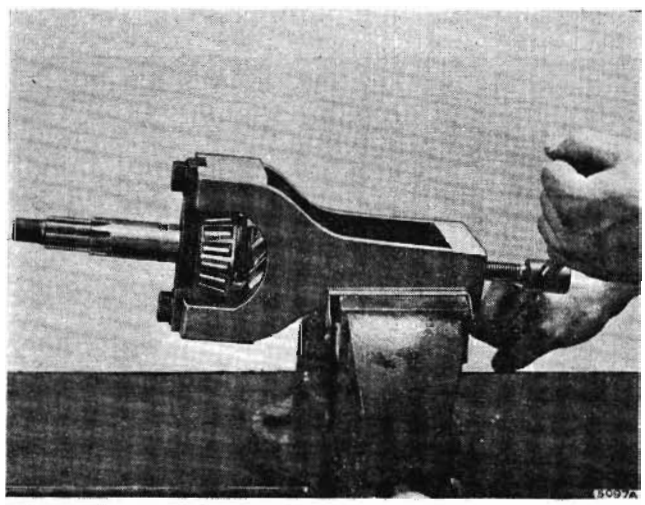


Fig. H.1

Refitting the inner race of the pinion rear bearing, using tool 18G285. *This tool is also used to remove the race*

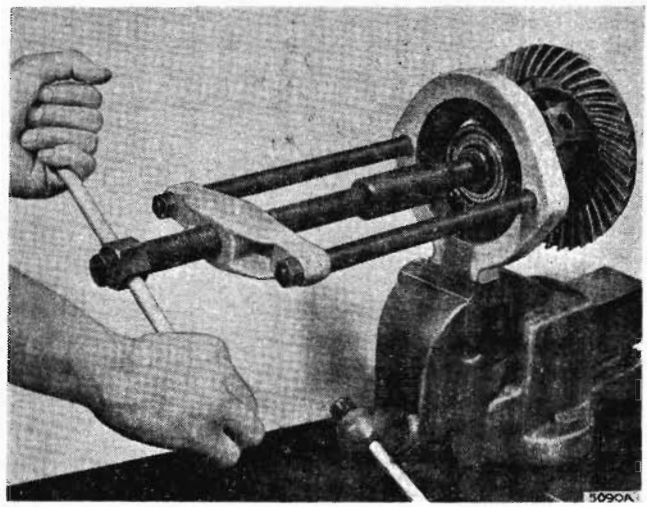


Fig. H.2

Remove the differential bearings, using remover 18G47C *with adaptor* 18G47M

the metal peened over the entry hole with a $\frac{1}{8}$ in. drill in order to facilitate removal of the dowel pin. Drive out the differential pinion shaft and remove the pinions and thrust washers from the differential cage.

Remove the pinion nut, driving flange, and pressed end cover.

Drive the pinion shaft towards the rear through the carrier; it will carry with it the inner race and the rollers of the rear bearing, leaving the outer race and the complete front bearing in position.

Tap out the inner race of the front bearing and the oil seal. The outer races should be withdrawn with Service tool 18G264 with adaptors 18G264D and 18G264E.

Slide off the pinion sleeve and the shims; withdraw the rear bearing inner race from the pinion shaft with Service tool 18G285, noting the spacing washer against the pinion head. Withdraw the rear bearing outer race with Service tool 18G264 and adaptor 18G264E.

Reassembling

Where it is only necessary to fit a replacement oil seal the axle may be reassembled in the reverse order of dismantling, assuming that the original shim thicknesses are retained. Where any part is renewed, such as a crown wheel and pinion, pinion bearings, etc., the setting of the pinion (i.e. its position relative to the crown wheel) must be checked. This work should be carried out with the aid of Service tools 18G191 and 18G191A.

Examine the crown wheel teeth. If a new crown wheel is needed **a mated pair—pinion and crown wheel—must be fitted.**

Refitting

1. SETTING THE PINION POSITION

Fit the bearing outer races to the gear carrier, using Service tools 18G134 and 18G134Q.

Smooth off the pinion head with an oil-stone, but do not erase any markings that may be etched on the pinion head.

Assemble the pinion and rear bearing with a washer of known thickness behind the pinion head.

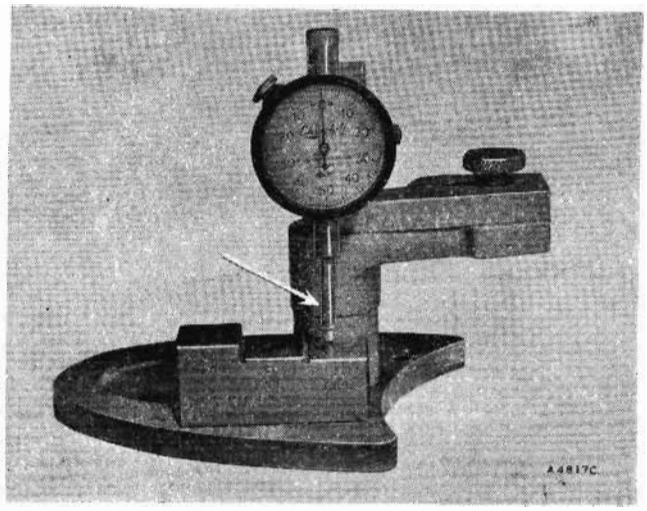


Fig. H.3

Setting the dial gauge to zero on the gauge block pinion position setting. The arrow indicates the extension foot

Position the pinion in the gear carrier without the bearing spacer and oil seal.

Fit the inner ring of the front bearing and the driving flange and tighten the nut gradually until a bearing preload of 8 to 10 lb. in. (·09 to ·12 kg. m.) is obtained.

Remove the keep disc from the base of the magnet. Adjust the dial indicator to zero on the machined step 'A' of the setting block.

Clean the pinion head and place the magnet and dial indicator in position. Move the indicator arm until the foot of the gauge rests on the centre of the differential bearing bore at one side and tighten the knurled locking screw. Obtain the maximum depth reading and note any variation from zero setting. Repeat the check in the opposite bearing bore. Add the two variations together and divide by two to obtain a mean reading.

Take into consideration any variation in pinion head thickness. This will be shown as an unbracketed figure etched on the pinion head and will always be minus (—). If no unbracketed figure is shown, the pinion head is of nominal thickness.

Using the mean clock gauge reading obtained and the unbracketed pinion head figure (if any), the following calculation can be made.

(*a*) **If the clock reading is minus** add the clock reading to the pinion head marking, the resulting sum being minus. **Reduce** the washer thickness by this amount.

Example

Clock reading	—·002 in.
Pinion marking	—·005 in.
Variation from nominal	—·007 in.

Reduce the washer thickness by this amount.

(*b*) **If the clock reading is plus and numerically less** than the pinion marking **reduce** the washer thickness by the difference.

Example

Pinion marking	—·005 in.
Clock reading	+·003 in.
Variation from nominal	—·002 in.

Reduce the washer thickness by this amount.

(*c*) **If the clock reading is plus and numerically greater** than the pinion marking **increase** the washer thickness by the difference.

Example

Clock reading	+·008 in.
Pinion marking	—·003 in.
Variation from nominal ..	+·005 in.

Increase the washer thickness by this amount.

The only cases where no alterations are required to the washer thickness are when the clock reading is **plus** and **numerically equal** to the unbracketed pinion marking, or the clock reading is zero and there is no unbracketed marking on the pinion head.

Allowance should then finally be made as follows for the mounting distance marked on the pinion head in a rectangular bracket.

If the marking is a **plus** figure **reduce** the washer thickness by an equal amount.

If the marking is a **minus** figure **increase** the washer thickness by an equal amount.

A tolerance of ·001 in. is allowed in the thickness of the washer finally fitted.

2. PINION BEARING PRELOAD

A washer of the thickness indicated by the use of the tool and calculations should now be fitted under the pinion head and the pinion assembled with bearings, pinion bearing distance piece, shims to the value of approximately ·008 in. (·20 mm.), oil seal, and universal joint flange.

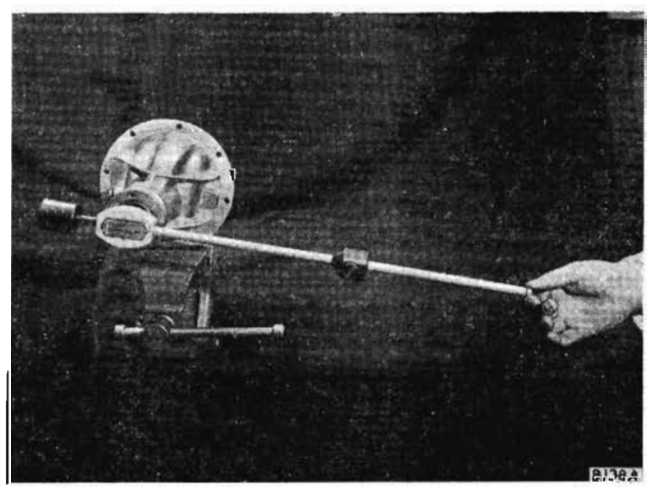


Fig. H.4

Checking the bevel pinion bearing preload (Service tool 18G207)

Prevent the universal joint flange from turning and tighten the pinion nut gradually to a torque spanner reading of 140 lb. ft. (19·4 kg. m.). Checks should be made during the tightening, using Service tool 18G207, to ensure that the pinion bearing preload does not exceed 13 lb. in. (·149 kg. m.). When the nut is correctly tightened it should provide a pinion bearing preload of 11 to 13 lb. in. (·126 to ·149 kg. m.). The shim thickness must be increased if the preload is too great, or reduced if it is insufficient. When the correct preload is obtained no further attention is needed so far as the pinion is concerned.

3. SETTING THE CROWN WHEEL POSITION

The method of setting the position of the crown wheel assembly depends upon the markings given on the differential gear carrier and differential gear cage.

To assist in the calculation of the thickness of shims to be fitted behind each differential cage bearing variations are indicated by stamped numbers on the carrier adjacent to the bearing bores. The dimensions to be considered are shown in Fig. H.6, (A) being the distance from the centre-line to the bearing register of the carrier on the left-hand side and (B) the distance from the centre-line to the bearing register of the carrier on the right-hand side. The (C) dimension is from the bearing register on one side of the cage to the register on the other side, while the (D) dimension is from the rear face of the crown wheel to the bearing register on the opposite side. Any variation on the (A) dimension will be found stamped on the carrier adjacent to the bearing bore, and similarly with the (B) dimension. Variations on the (C) and (D) dimensions are stamped on the machined face of the differential cage.

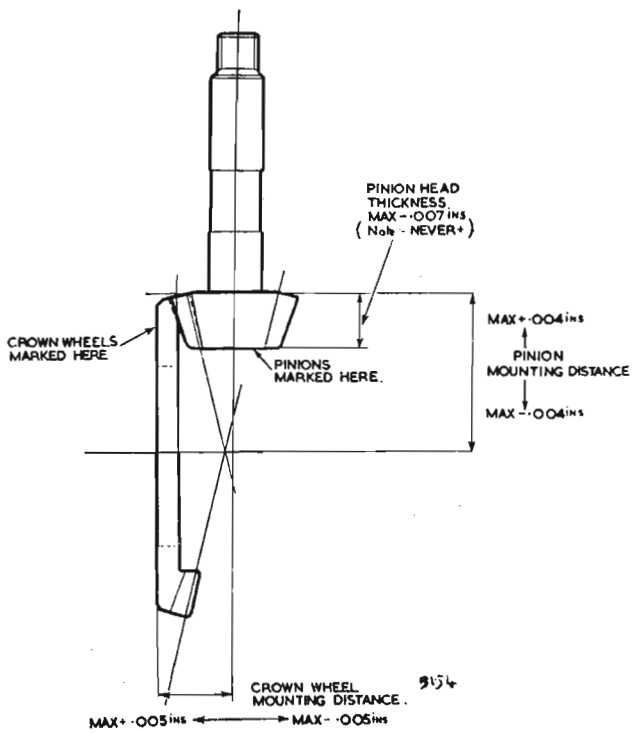


Fig. H.5

Crown wheel and pinion markings

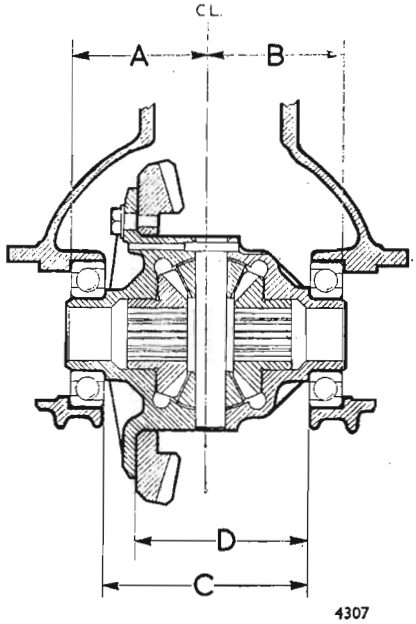


Fig. H.6

Illustrates the points from which the calculations must be made to determine the shim thickness for the bearings on each side of the carrier

It is possible to calculate the shim thickness required on the left-hand side by the use of the following formula:

A+D−C+·002 in.

Substituting the actual variations shown, this formula gives the shim thickness required to compensate for the variations in machining plus the extra ·002 in. (·05 mm.) to give the necessary bearing pinch. In addition, allowance must be made for variations in bearing thickness in the following manner.

Rest the bearing, with the inner race over the recess and outer ring thrust face downwards, on the small surface plate of Service tool 18G191A. Drop the magnet on the surface plate and zero the clock gauge to the small gauge block on its step marked 'A'. (This is the thickness of the standard bearing). Swing over the indicator until it rests on the plain surface of the inner race and, holding the inner race down against the balls, take a reading (Fig. H.7). Normally the bearing will be standard to −·003 in., though in some cases tolerances may be from standard to −·005 in. A negative variation shown by this test indicates the additional thickness of shimming to be added to that side of the differential.

The formula for the right-hand side is:

B−D+·006 in.

and here again final allowance must be made for variation in bearing thickness.

When a framed number is marked on the back of the crown wheel, e.g. +2, it must be taken into account before assembling the shims and bearings to the differential cage. This mark assists in relating the crown wheel with the pinion.

If, for example, the mark is +2, then shims to the value of ·002 in. (·05 mm.) must be transferred from the left-hand side (the crown wheel side) to the right-hand side. If the marking is −2, then shims to the value of

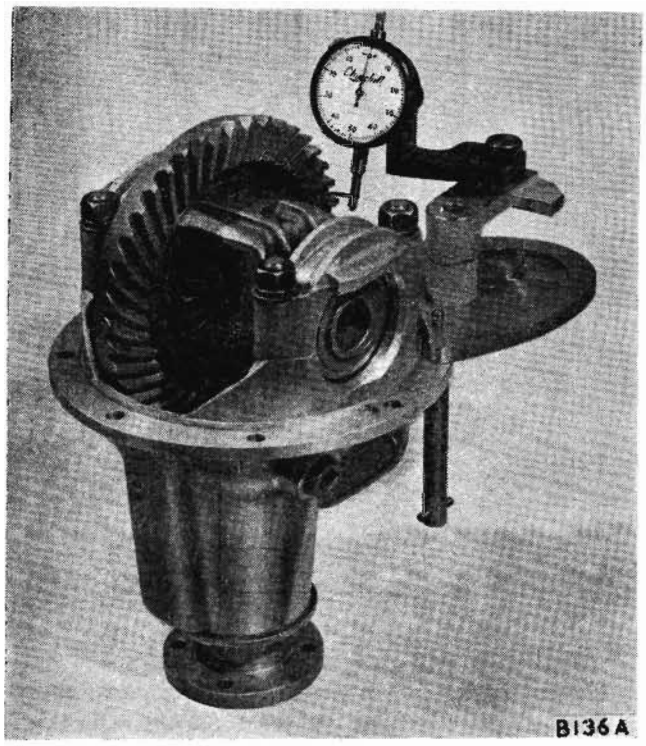


Fig. H.7

Checking differential bearing width with Service tools 18G191 *and* 18G191A

·002 in. (·05 mm.) must be moved from the right-hand side to the left-hand side.

4. ADJUSTING THE BACKLASH

Assemble the bearings (thrust faces outwards) and shims as calculated to the differential cage.

Bolt the crown wheel to the differential cage but do not knock over the locking tabs. Tighten the bolts to a torque wrench reading of 60 lb. ft. (8·30 kg. m.).

Mount the assembly on two 'V' blocks and check the amount of run-out of the crown wheel, as it is rotated, by means of a suitably mounted dial indicator. The maximum permissible run-out is ·002 in. (·05 mm.) and any greater irregularity must be corrected. If there is excessive run-out detach the crown wheel and examine the joint faces on the flange of the differential cage and on the crown wheel for any particles of dirt.

When the parts are thoroughly cleaned it is unlikely that the crown wheel will not run true.

Tighten the bolts to the correct torque wrench reading and knock over the locking washers.

Fit the differential to the gear carrier. Replace the bearing caps and tighten the nuts to a torque wrench reading of 65 lb. ft. (8·99 kg. m.). Bolt the special tool surface plate to the gear carrier flange and mount the clock gauge on the magnet bracket in such a way that an accurate backlash figure may be obtained (see Fig. H.8). The minimum backlash used in any circumstances is ·004 in. (·102 mm.) and the maximum is ·007 in. (·178 mm.). The correct figure for the backlash to be used with any particular crown wheel and pinion is etched on the rear face of the crown wheel concerned and must be adhered to strictly.

NOTE.—To ensure adequate clearance when fitting a crown wheel and pinion to earlier axles it may be found necessary to use a pair of gears of which the crown wheel is unmarked.

A movement of ·002 in. (·05 mm.) shim thickness from one side of the differential cage to the other will produce a variation in backlash of approximately ·002 in. (·05 mm.).

Great care must be taken to ensure absolute cleanliness during the above operations, as any discrepancies resulting from dirty assembly would affect the setting of the crown wheel or pinion.

Refitting is a reversal of the removal procedure.

Section H.6

SPRINGS

Removing

Raise the vehicle by placing a jack under the differential housing and support the body. After ascertaining that the weight of the axle is fully on the jack and that the springs are in the fully unloaded position remove the shackle pins.

The spring can now be removed simply by extracting the bolts which pass upwards at the forward end of the spring into the spring attachment plate. The 'U' bolt must also be removed when the spring can be pulled out of its mounting.

Refitting

Reverse the removal procedure when refitting the spring assemblies.

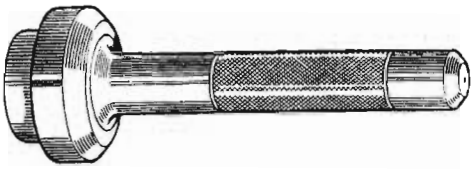
Fig. H.8

Checking crown wheel to pinion backlash (*Service tools* 18G191 *and* 18G191A)

SERVICE TOOLS

18G14. Rear Hub Oil Seal Replacer

This replacer is contoured to the exact shape of the oil seal and bevelled at its leading edge to facilitate insertion of the seal and fitting without damage.

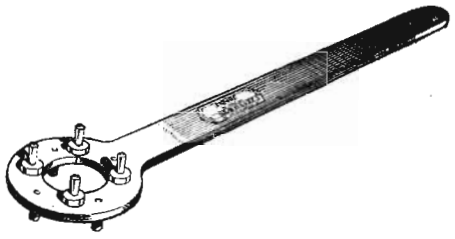


4349J

18G14

18G34A. Bevel Pinion Flange Wrench

The two sets of tapered pins on this tool ensure that it will hold the propeller shaft flange against rotation while the flange nut is released or tightened on semi-floating or three-quarter-floating axles.

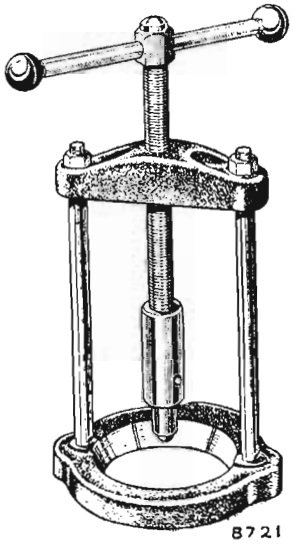


8710

18G34A

18G47C. Differential Bearing Remover (basic tool)

A standardized basic tool; with various adaptors it will cover several models.

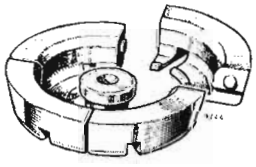


8721

18G47C

18G47M. Differential Bearing Remover Adaptor

For use with 18G47C.



18G47M

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

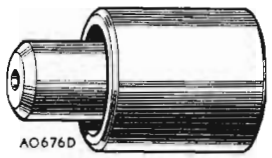
A detachable handle designed for use with the appropriate adaptors.

STR829XX

18G134

18G134Q. Rear Hub Replacer and Adaptor

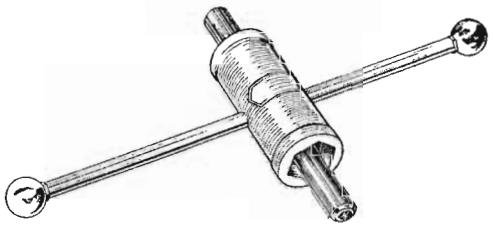
Use with handle 18G134.



18G134Q

18G152. Rear Hub Nut Spanner

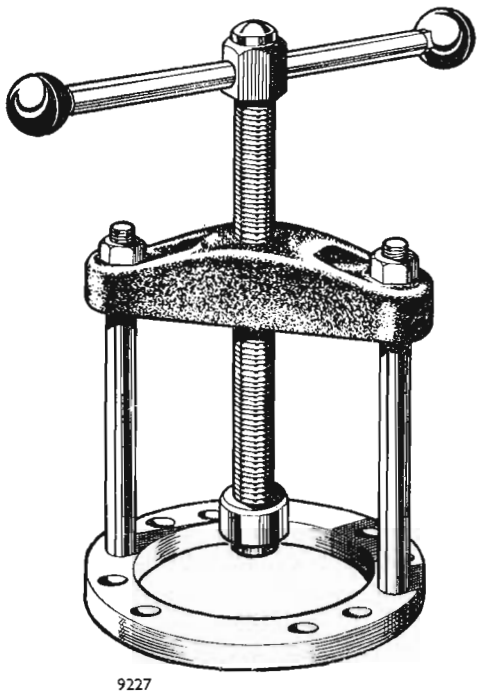
A reinforced tubular spanner complete with tommy-bar designed to pilot in the axle tube with the axle shaft withdrawn.



18G152

18G146. Front and Rear Hub Remover

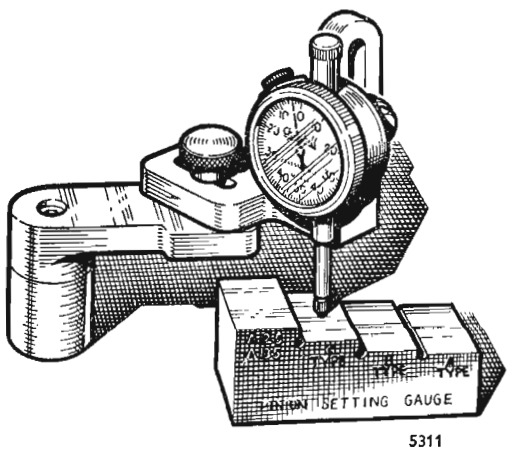
The thrust pad supplied with the tool is for use only when removing the rear hubs.



18G146

18G191. Bevel Pinion Setting Gauge

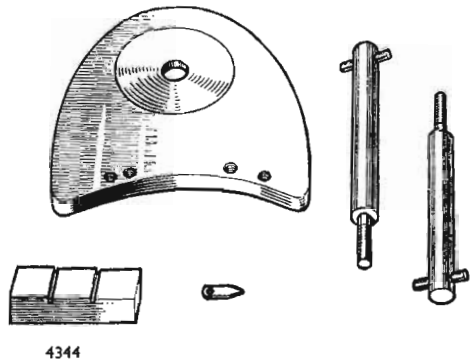
A gauge block and dial indicator is essential to obtain accurate location of the pinion in the axle case.



18G191

18G191A. Differential Bearing Gauge

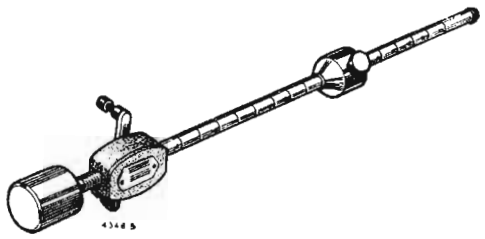
This gauge, used with the component parts of 18G191, is designed to check the bearing width. It can also be used to mount the clock gauge on the gear carrier to check crown wheel and bevel pinion backlash.



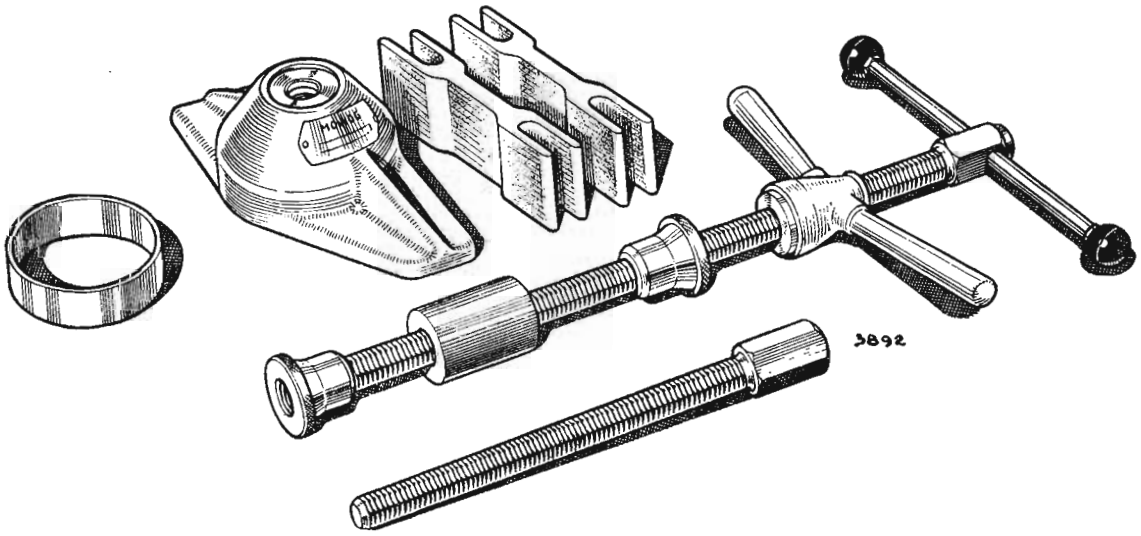
18G191A

18G207. Bevel Pinion Bearing Preload Gauge

The movable arms of the tool are located in opposite holes of the bevel pinion flange and the weight moved along the rod to the poundage required.



18G207



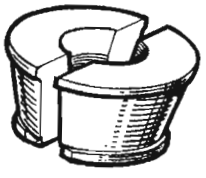
18G264. Bevel Pinion Bearing Outer Race Remover (basic tool)

Comprising a body, centre screw with extension and tommy-bar, wing-nut, guide cone, and two distance pieces. A plain ring is also included to serve as a pilot when the rear bearing outer races are being replaced. Use with adaptors 18G264D, 18G264E.

18G264

18G264D. Bevel Pinion Bearing Outer Race Remover Adaptor

For use with basic tool 18G264.



18G264D

18G264E. Bevel Pinion Bearing Outer Race Remover Adaptor

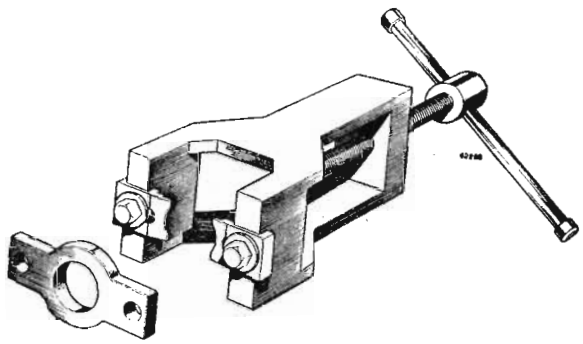
For use with basic tool 18G264.

9154A

18G264E

18G285. Bevel Pinion Bearing Inner Race Remover and Replacer

A tool which is essential when withdrawing or replacing the inner bearing race of the pinion shaft.



18G285

SECTION J

THE STEERING GEAR

	Section
General description	
Front wheel alignment	J.1
Steering	
Column assembly	J.2
Rack and pinion	J.3
Service tools	End of Section

GENERAL DESCRIPTION

The steering gear is of the rack and pinion type and is secured above the front frame cross-member immediately behind the radiator. Tie-rods, operating the swivel 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.

End-play of the pinion is eliminated by adjustment of the shims fitted beneath the pinion tail end bearings. A damper pad inserted in the steering rack controls the backlash between the pinion and the rack.

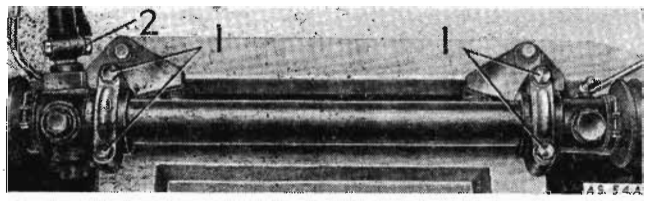


Fig. J.1

Showing the mounting points (1) *of the steering-rack,* (2) *being the steering-column clamp bolt*

Section J.1

FRONT WHEEL ALIGNMENT

When correctly adjusted the front wheels should toe in 0 to $\frac{1}{8}$ in. (0 to 3 mm.). To carry out the necessary adjustment first check that all tyres are inflated to the recommended pressures (see **'GENERAL DATA').**

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 or rim flanges. 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.

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 to adjust the tie-rods to exactly equal lengths.

After adjustment tighten the ball joint locknuts.

Section J.2

STEERING-COLUMN ASSEMBLY

Removing

Remove the connector from the negative battery terminal. Release and remove the clamp bolt nut from the splined lower end of the steering-column. Disconnect the horn wire (brown with black) at its snap connection beneath the fascia. Remove the steering-column surround situated between the fascia panel and the steering-wheel, after removing its securing set screws located behind the fascia. Release the bolts securing the column bracket beneath the fascia panel. The steering-wheel may now be withdrawn. The inner and outer columns can be separated once the steering-wheel motif, steering-wheel securing nut, and steering-wheel have been removed. To avoid damage to the horn switch contact use Service tool 18G562 to unscrew the nut.

Refitting

Refitting of the steering-column assembly is the reverse of the removal procedure. Use Service tool 18G562 when tightening the steering-wheel nut.

Section J.3

STEERING-RACK AND PINION

Remove the clamp nut and bolt from the splined lower end of the steering-column and disengage the column from the splines.

Remove the split pins and castellated nuts from the ball pins and detach the tie-rod ball joint from the swivel arm, using Service tool 18G313.

Remove the set screws securing the steering-rack clamp mounting brackets to the front cross-member. The rack assembly complete with tie-rods and brackets can now be removed.

Dismantling

Measure and record the distance from the spanner flats on the tie-rods to each of the ball joint locknuts; this will be of great assistance when reassembling.

Slacken the ball joint locknuts and unscrew the ball joint assemblies.

Position the rack housing over a receptacle to catch the oil, release the gaiter clips from the rack housing and tie-rods, and remove the rubber gaiters.

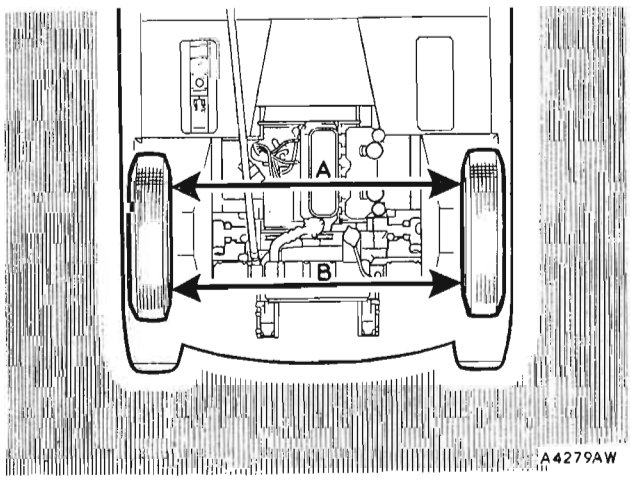


Fig. J.2

The toe-in must be adjusted so that (A) *is* 0 *to* $\frac{1}{8}$ *in.* (0 *to* 3 *mm.) greater than* (B)

Remove the hexagonal cap adjacent to the oil nipple on the housing and withdraw it complete with sealing washer, pressure pad, and spring.

Remove the damper pad housing fitted at the pinion end of the rack housing and withdraw it complete with plunger, spring, and shims.

Extract the bolts securing the pinion shaft tail bearing and remove the bearing and shims. Withdraw the pinion complete with the bottom thrust washer. The top thrust washer (the thickest one) is trapped behind the rack teeth and may be removed after the rack is withdrawn.

Secure the rack housing between suitable clamps in a vice and tap back the washers locking the tie-rod ball housing. Remove the ball joint cap, using Service tool 18G313.

NOTE.—In some cases the latter operation releases the ball seat housing from the ball joint cap; in this case difficulty will be experienced in removing the ball housing from the rack. It is therefore essential to release the ball housing from the rack before the ball seat housing and joint cap are separated.

Remove the lock washer and withdraw the steering-rack from the housing.

Remove the ball seat housing from the ball joint caps, using Service tool 18G313 together with 18G312. The shims and ball seats are now free to be removed: ensure that the shims are kept to their respective sides.

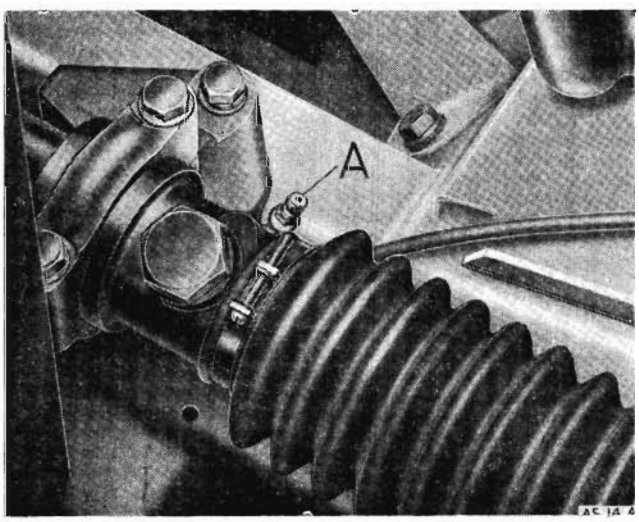


Fig. J.3

Oil nipple provided for lubrication of the steering rack and pinion

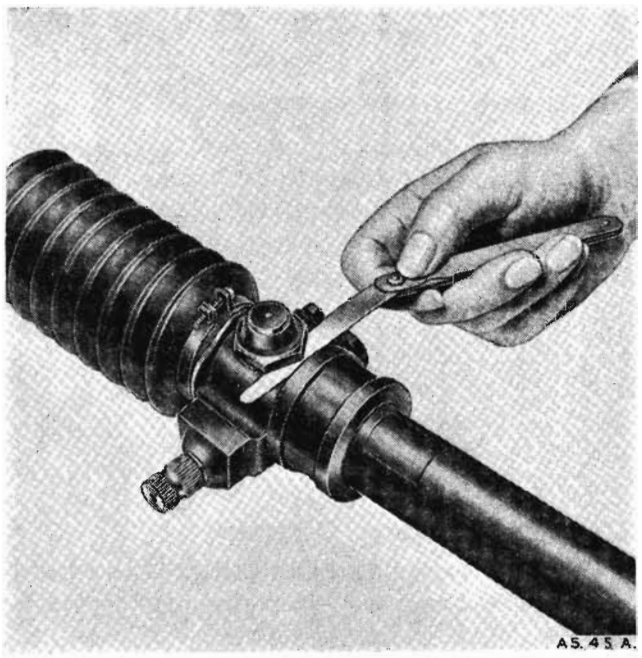


Fig. J.4

Checking the adjustment of the damper cap

Thoroughly clean and examine all parts of the dismantled assembly for wear, and renew if necessary.

Reassembly

Reassemble by reversing the dismantling procedure and pay special attention to the following points.

Place the thickest of the pinion thrust washers in position in the rack housing with its chamfered edge towards the rack. Replace the smaller thrust washer on the plain end of the pinion shaft with the chamfered edge towards the pinion teeth.

Ensure also that the centre tooth on the rack is in line with the mark on the splined end of the pinion shaft when replacing the pinion. Fit a new pinion shaft oil seal and pump 10 fl. oz. (·28 litre) approximately of Hypoid oil into the rack housing through the nipple provided.

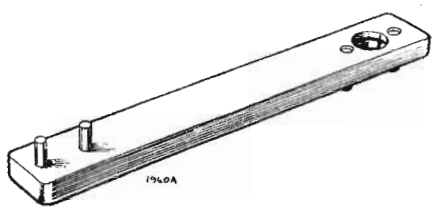
Refitting

Refitting is the reverse of the removal procedure, except that the bolts securing the housing to its mounting brackets should not be fully tightened until the assembly has been replaced. This method of assembly will ensure that the steering-rack pinion is in correct alignment with the column. Finally, tighten the rack housing bolts.

SERVICE TOOLS

18G312. Steering Tie-rod Pin Spanner

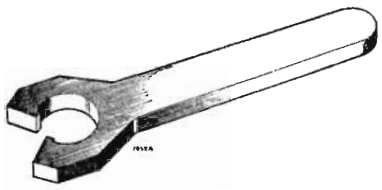
This tool is designed for use with the special 'C' spanner 18G313 for dismantling the steering tie-rod ball housing. In use it is clamped in a vice and the pins of the spanner are engaged with the holes in the housing. Use the spanner 18G313 to unscrew the housing cap.



18G312

18G313. Steering Tie-rod 'C' Spanner

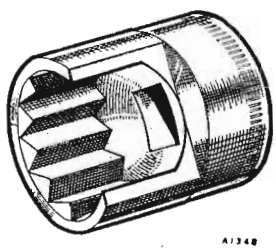
Designed to engage the shallow splines of the steering-rack ball housing cap and remove it without damage.



18G313

18G562. Steering-wheel Nut Spanner

Designed to enable the steering-wheel nut to be tightened without damage to the horn switch contact.



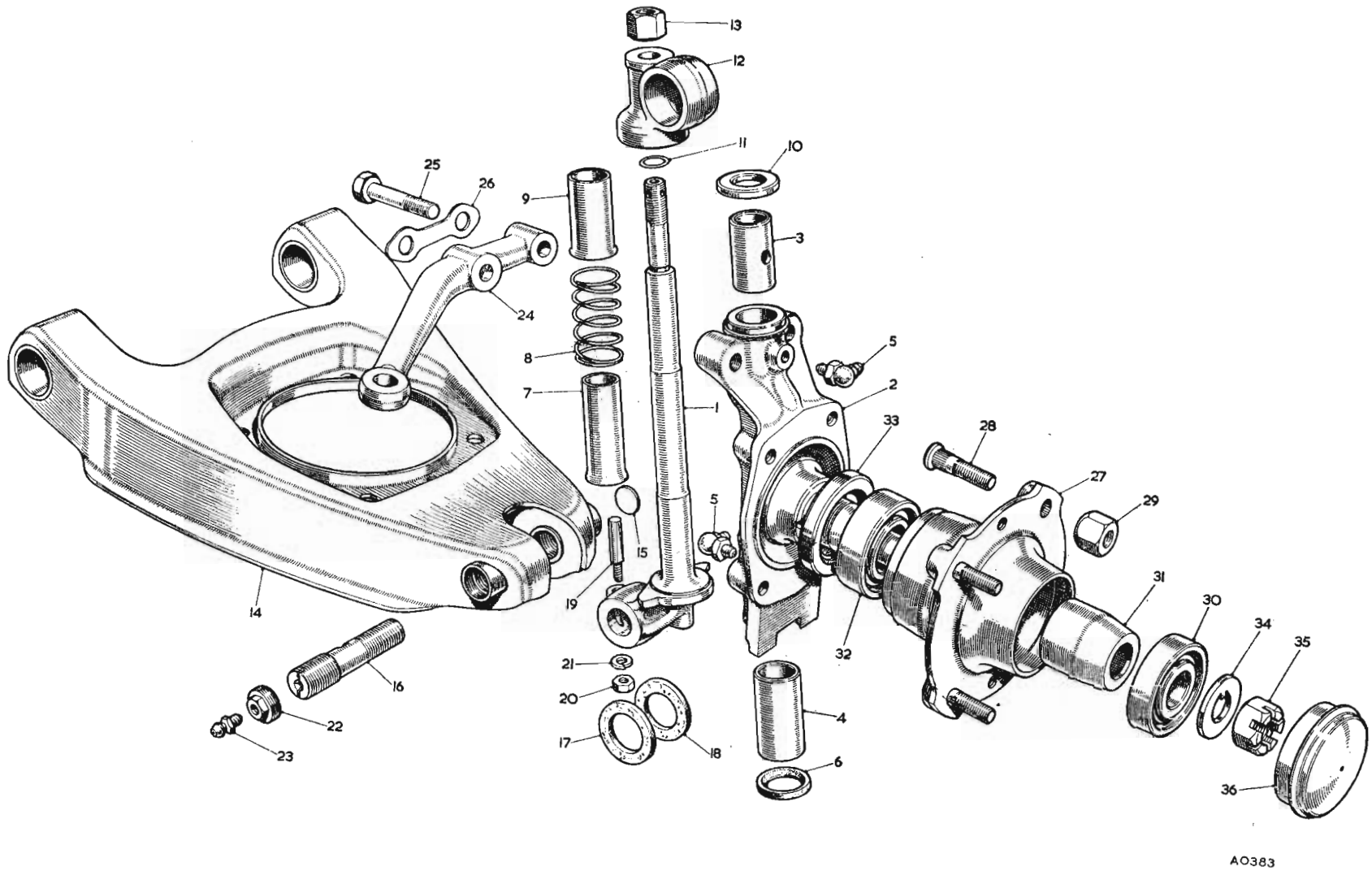
18G562

SECTION K

THE FRONT SUSPENSION

	Section
General description	
Castor, camber, and swivel pin angles	K.1
Coil springs	K.3
Front hubs	K.4
Front suspension assembly	K.2
Service tools	End of Section

THE FRONT SUSPENSION COMPONENTS



KEY TO THE FRONT SUSPENSION COMPONENTS

No.	*Description*
1.	Swivel pin.
2.	Swivel axle assembly.
3.	Bush (top).
4.	Bush (bottom).
5.	Lubricator for swivel axle bush.
6.	Sealing ring.
7.	Dust excluder tube (bottom).
8.	Spring.
9.	Dust excluder tube (top).
10.	Thrust washer.
11.	Adjustment washers.
12.	Suspension link trunnion.
13.	Nut.
14.	Lower link.
15.	Blanking plug.
16.	Fulcrum pin.
17.	Ring (large).
18.	Ring (small).
19.	Cotter pin.
20.	Nut.
21.	Spring washer.
22.	Screwed plug.
23.	Lubricator.
24.	Steering lever.
25.	Swivel axle screw.
26.	Lock washer.
27.	Hub assembly
28.	Wheel stud.
29.	Nut.
30.	Outer hub bearing.
31.	Distance piece.
32.	Inner hub bearing.
33.	Oil seal.
34.	Bearing retaining washer.
35.	Swivel axle nut.
36.	Oil-retaining cap.

GENERAL DESCRIPTION

The independent suspension is of the 'wishbone' type. It consists of a single-armed, double-acting hydraulic damper bolted to its support bracket at its upper end. The single arm is towards the front of the car and is secured to the swivel pin trunnion link by a fulcrum pin

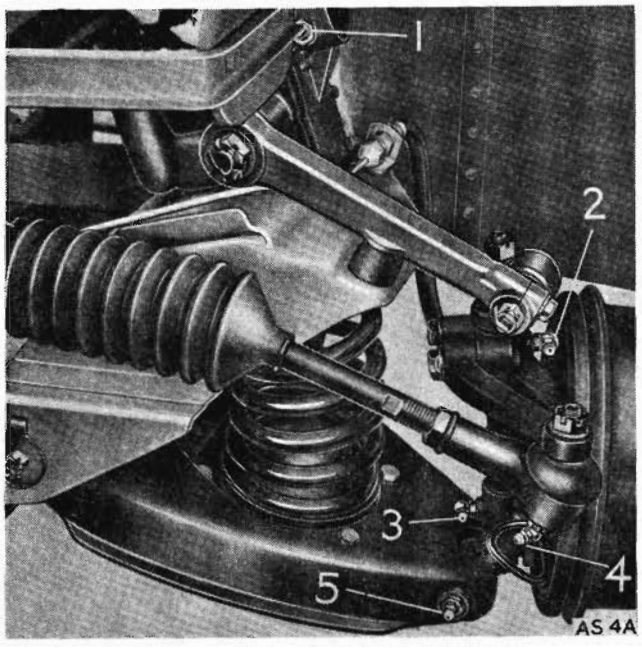


Fig. K.1

Front suspension lubrication

1. Damper filler plug.
2. Swivel axle pin top bush.
3. Swivel axle pin bottom bush.
4. Tie-rod end.
5. Lower link outer bushes.

and Metalastik rubber bushes. The bottom end of the swivel pin is secured to the outer end of the lower links by a fulcrum which is cottered in position.

The inner arms of the lower links are fixed to brackets by Metalastik rubber bushes and fulcrum pins.

A rebound buffer is fitted to the bottom of the coil spring top bracket and a smaller rebound buffer under the damper arm.

A spring seat is secured to the lower links by bolts, flat washers, and self-locking nuts.

Section K.1

CASTOR, CAMBER, AND SWIVEL PIN ANGLES

The castor and camber angles and the swivel pin inclination are 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 swivel pin inclination gauge and new parts fitted as found necessary.

Section K.2

FRONT SUSPENSION ASSEMBLY

Removing

Raise the car and remove the wheel and coil spring (see Section K.3). Disconnect the steering side-tube from the steering-arm by withdrawing the split pin and removing the castellated nut. If the ball pin shank is tight in the steering-arm release the nut, but do not remove. Sharply tap the steering-arm at the side-tube end, when it will be found to come away quite easily on removing the nut. Disconnect the flexible hose. Withdraw the split pins, remove the nuts, tap the fulcrum pins through the lower link inner ends, and take away the two rubber bushes at the outer ends of the lower link inner brackets. The lower end of the suspension is now free.

At the upper end remove the clamp bolt and shakeproof washer in the hydraulic damper arm, withdraw the split pin, and release the castellated nut on the fulcrum pin. Tap off the fulcrum pin and retrieve the rubber bushes. The suspension unit is now free and can be lifted away.

Dismantling

Secure the suspension by clamping the web of the lower links between a dummy baseplate at the bottom and a solid metal disc and bolt at the top. Remove the drum securing screw and withdraw the brake-drum. Remove the hub as described in Section K.4.

Detach the backplate by removing its securing bolts and washers.

Tap back the lock washers and remove the set screws to release the steering lever.

Extract the split pin and remove the castellated nut at the top of the swivel axle pin. Remove the trunnion and preserve the shims for use during assembly. Lift off the phosphor-bronze Oilite thrust washer and the swivel axle along with the dust excluder tubes and their spring, and the bevelled cork sealing ring at the bottom of the swivel axle pin.

Release the lower trunnion swivel pin cotter nut and knock the cotter loose. Remove the nut, spring washer, and cotter. Screw out the swivel pin lower trunnion oil nipple and its housing, which also serves to plug the lower trunnion.

Unscrew the swivel pin lower trunnion fulcrum pin, remove the swivel pin and cork sealing washers, and knock out the welch plug.

Reassembling

Reverse the sequence of operations detailed for dismantling, but note the following point. Place the phosphor-bronze thrust washer over the swivel axle. Put a ·008 in. shim (·008 in. [·2032 mm.] and ·012 in. [·3048 mm.] shims available) onto the swivel pin, followed by the trunnion with its bore towards the hub when it is fitted. Tighten the castellated nut. Resistance should be just felt when the swivel axle is moved from lock to lock and there should be no vertical movement of the swivel axle. Increase the thickness of the shims to loosen and decrease to tighten as required.

Refitting

Wet the spring rebound bumper and push it into its hole in the bottom of the hydraulic damper mounting plate, and the hydraulic damper arm rebound buffer in the top. Wet two of the large rubber bearings and position one from inside each lower link. Lift the two arms into position, insert the fulcrum pin from the inner end so that its washer registers, position the two remaining rubber bearings from outside the lower links, locate the special washer, tighten the castellated nuts, and insert and turn back the split pins.

With the block still under the hydraulic damper arm proceed to connect the top end.

Insert the two small rubber bearings in the upper trunnion eye, tap the fulcrum pin from the rear to go through the bearings and damper arm, and see that the notch in the fulcrum pin is to the top. Tighten the castelated nut till the notch is in line with the clamp bolt hole in the damper arm, split-pin the castellated nut, and tighten the clamp bolt onto its shakeproof washer.

Refit the coil spring (Section K.3). Replace the wheel and lower the car. The block can now be removed from under the hydraulic damper arm.

Section K.3

COIL SPRINGS

Removing

Place a hardwood or metal block 1·125 in. (28·57 mm.) long under the hydraulic damper arm to keep the arm off its rubber rebound buffer when the car is in a raised position. With the vehicle raised to a workable height remove two diametrically opposite spring seat securing nuts and bolts. Using Service tool 18G153 (or two slave bolts) compress the spring. Remove the remaining nuts and bolts from the spring seat and release the centre screw of the Service tool to allow the spring to expand.

Check the spring against makers' specifications. If it has sustained damage in any way it should be renewed.

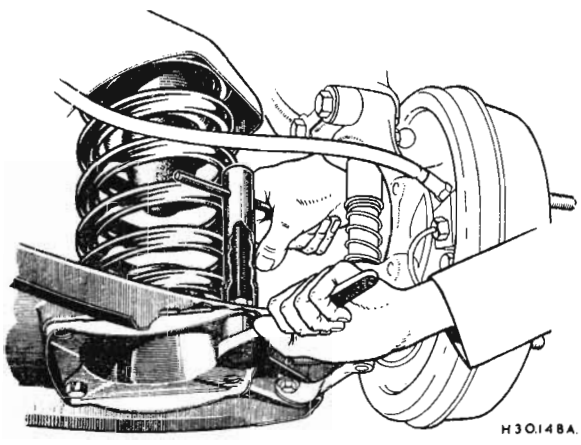


Fig. K.2

Using a pair of slave bolts to remove or replace a coil spring

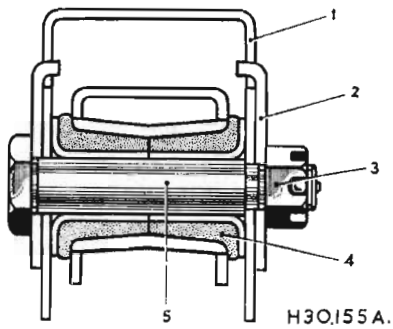


Fig. K.3

Lower link mounting (inner end)

1. Mounting bracket.
2. Special washer.
3. Castellated nut.
4. Rubber bush (bearing).
5. Fulcrum pin.

Refitting

Reverse the removal procedure when refitting, with attention being given to inserting two guide rods in diametrically opposite holes to bring the spring seat and wishbone lower links into line when in the process of compressing the spring.

Section K.4

FRONT HUBS

Removing

Raise the car and remove the wheel. Remove the brake-drum securing screw from the countersunk hole and withdraw the drum.

Remove the hub cap by levering with a screwdriver. Wipe away any excess grease and extract the split pin. Remove the slotted nut and washer. Withdraw the complete hub assembly off the swivel axle, using Service tool 18G146.

Should the inner bearing remain on the swivel axle, it should be carefully extracted, using Service tools 18G8 and 18G8P. It is usually only the inner race of the inner bearing that is left behind, and removal will be found easier if the backplate is first removed.

With the hub removed, the outer bearing and collapsible distance piece can be tapped out, using Service tool 18G260 together with 18G260A. Similarly, the inner bearing and oil seal can be detached by drifting them off from the other side of the hub, using Service tools 18G260 and 18G260B.

Refitting

Reverse the removal procedure, with special attention being given to ensure that the inner and outer bearings are drifted on with their sides marked 'Thrust' towards the centre of the hub, using Service tool 18G134 together with adaptors 18G134B and 18G134C.

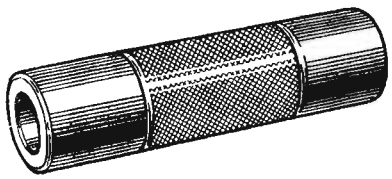
Ensure also that the oil seal is pressed in with its lipped end towards the inner bearing.

Using Service tool 18G7, refit the hub assembly on the swivel axle.

Having ensured that the pegged washer on the swivel axle locates in the slot, fit the slotted nut to a torque wrench reading of 50 to 55 lb. ft. (6·91 to 7·60 kg. m.).

SERVICE TOOLS

18G7. Front Hub Outer Bearing Remover



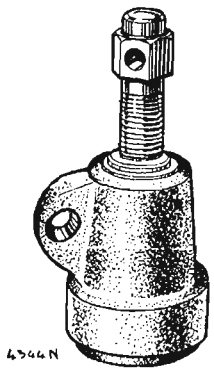
43'6F

18G7

18G8. Hub Assembly Remover (basic tool)

Internally threaded for attachment to the hub and the end of the centre screw provided with a hardened-steel ball to reduce friction when engaging the stub axle. Provision is also made for the use of a tommy-bar to prevent the tool turning in operation.

Used on the M.G. Midget only in conjunction with adaptor 18G8P.

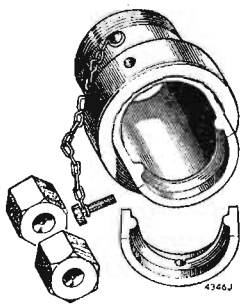


4344N

18G8

18G8P. Front Hub Bearing Inner Race Remover Adaptor

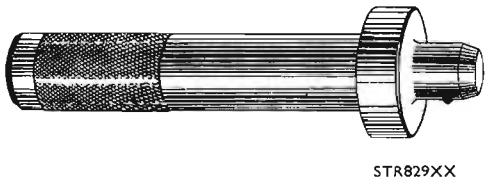
Used with hub remover 18G8; a peg and chain is included to retain the locking ring and half-ring when not in use.



4346J

18G8P

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



STR829XX

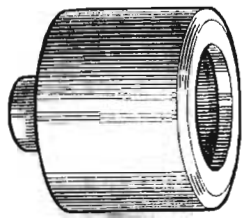
18G134

18G134B. Front Hub Outer Bearing Replacer Adaptor

For use with 18G134.

18G134C. Front Hub Inner Bearing Replacer Adaptor

For use with 18G134.



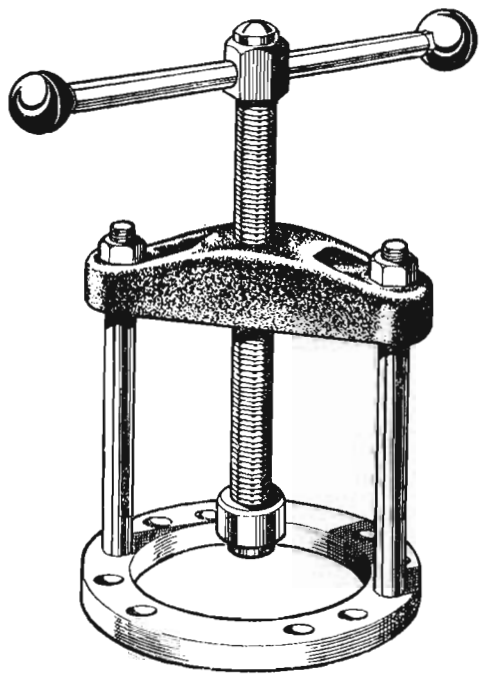
4345F

18G134B

18G134C

18G146. Front and Rear Hub Remover

The thrust pad supplied with the tool is for use only when removing the rear hubs.

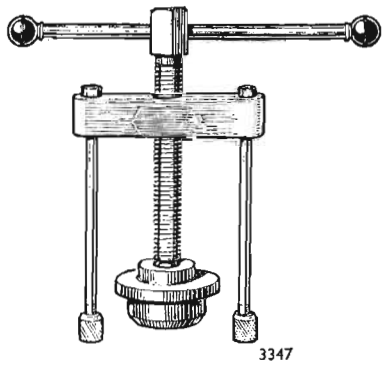


9227

18G146

18G153. Front Suspension Spring Compressor

The spring compressor thrust pad is ball-mounted to assist in lining up the spring and spring seat.

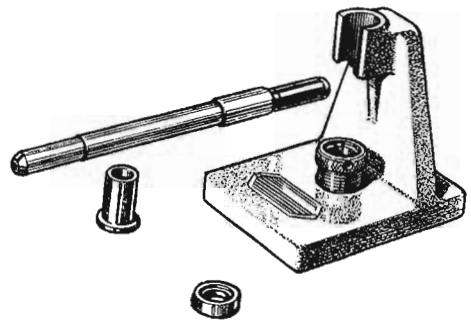


3347

18G153

18G154. Swivel Axle Bush Remover and Replacer

This tool enables the swivel axle bushes to be removed and fitted without the distortion which would occur if an improvised drift were used. The shoulder of the driver is recessed to prevent the split bushes from opening when being pressed into position. The tool is designed for use with a press.

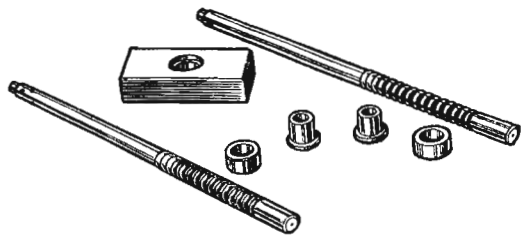


4344A

18G154

18G155. Swivel Axle Bush Broaching Equipment

Consisting of an anvil, two broaches, two guide bushes, and two support adaptors. They are for use with a light press, and will ensure highly finished bores. The worn bushes can be removed, and new bushes fitted with tool 18G154.



4348D

18G155

18G155A. Swivel Axle Bush Broach Guide

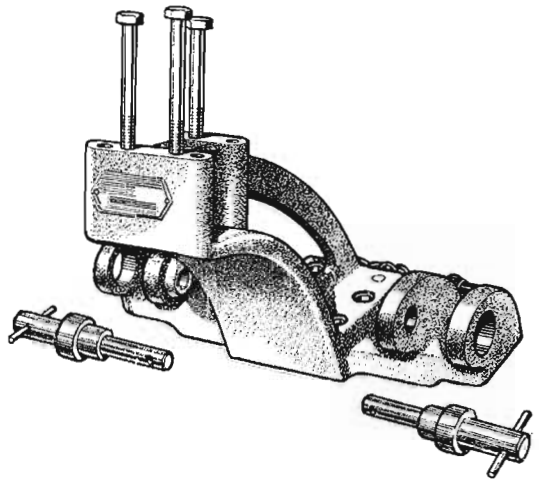
For use with 18G155.

4471E

18G155A

18G253. Front Suspension Assembly Fixture

Designed to serve the dual purpose of accurately assembling a front suspension unit for fitting as a replacement to a vehicle, and also as a means of checking a unit suspected of damage or misalignment.

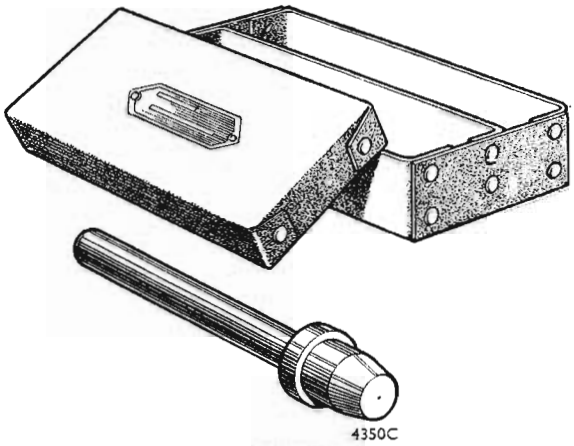


4348E

18G253

18G260. Front Hub Outer Race Remover (basic tool)

The outer race of a front hub bearing often remains inside the hub when dismantling. This remover with the appropriate adaptor will ensure easy extraction from the hub.

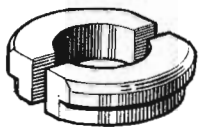


4350C

18G260

18G260A. Front Hub Bearing Outer Race Remover Adaptor

For use with 18G260 to remove the outer race of the outer bearing.



4349E

18G260A

18G260B. Front Hub Bearing Outer Race Remover Adaptor

For use with 18G260 to remove the outer race of the inner bearing.

18G260B

SECTION L

THE HYDRAULIC DAMPERS

Section

General description

Maintenance

Dampers

Front L.1

Rear L.2

GENERAL DESCRIPTION

The hydraulic dampers are of the double-acting piston type. All the working parts are submerged in oil. They are carefully set before dispatch and cannot be adjusted without special equipment. Any attempt to dismantle them will seriously affect their operation and performance. Should adjustment or repair be necessary, they must be returned to their makers.

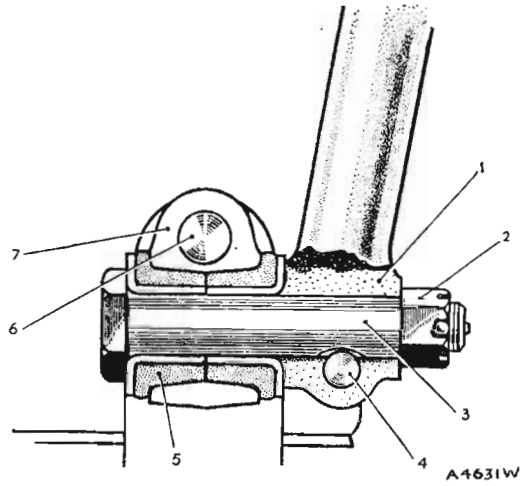


Fig. L.1

Trunnion link/damper arm assembly

1. Damper arm.
2. Castellated nut.
3. Fulcrum pin.
4. Clamp bolt.
5. Rubber bush (bearing).
6. Swivel axle pin.
7. Trunnion link.

MAINTENANCE

The maintenance of the hydraulic dampers should include a periodical examination of their anchorages to the body frame. The fixing bolts must be tightened as necessary (25 to 30 lb. ft. or 3·47 to 4·15 kg. m.).

The cheese-headed screws securing the cover-plates must be kept fully tightened to prevent leakage of the fluid.

When checking the fluid level every 6,000 miles (9600 km.) all road dirt must be carefully cleared away from the vicinity of the filler plugs before the plugs are removed. This is most important as it is absolutely vital that no dirt or foreign matter should enter the operating chamber.

The correct fluid level is just below the filler plug threads.

The use of Armstrong Super (Thin) Damper Oil is recommended. When this is not available any good-quality mineral oil to Specification S.A.E. 20/20W is acceptable. This alternative is not suitable for low-temperature operation and is deficient in various other ways.

Section L.1

FRONT DAMPERS

Removing

Jack up the car and place stands under the body in safe positions. Remove the road wheel, place a jack beneath the outer end of the lower wishbone arm, and raise it until the damper is clear of its rebound rubber.

Remove the damper arm clamp bolt and its shakeproof washer. Remove the Nyloc (self-locking) nut on the fulcrum pin. Withdraw the fulcrum pin and retrieve the trunnion link rubber bushes. On removal of the assembly securing bolts the damper can be removed from the car.

NOTE.—The jack must be left in position under the suspension wishbone while the top link remains disconnected in order to keep the coil spring securely in position and to avoid straining the steering connections.

Refitting

Refitting is the reverse of the removal procedure.

NOTE.—The fulcrum pin bushes must be renewed if softening of the rubber or side-movement is evident. New Nyloc nuts must be used to secure the inner fulcrum pins upon reassembly.

Section L.2

REAR DAMPERS

Removing

Remove the nut and spring washer that secures the damper lever to the link arm. Withdraw the fixing bolts from the damper body and body frame and remove the damper assembly by threading the lever over the link arm bolt.

Refitting

The damper assembly may be refitted by simply reversing the removal procedure. However, when handling dampers that have been removed from their mountings, it is important to keep the assemblies upright as far as possible, otherwise air may enter the working chamber and cause erratic resistance.

NOTE.—The rubber bushes integral with both ends of the damper to axle connecting links cannot be renewed. When these bushes are worn renew the arm.

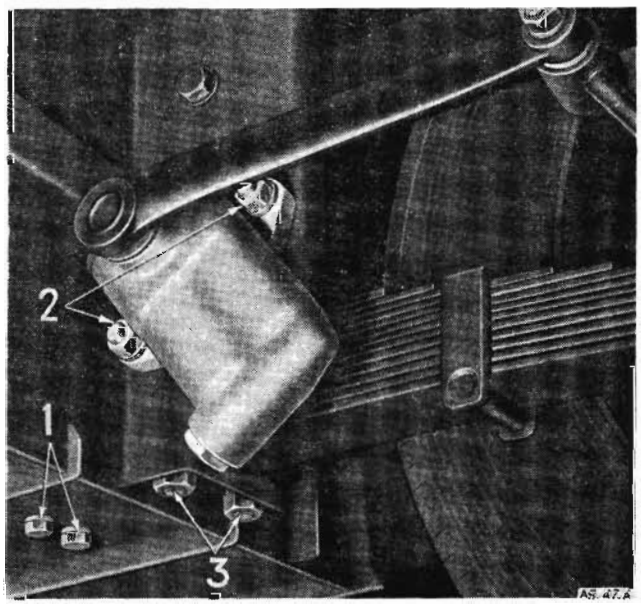


Fig. L.2

Rear spring mounting

1. Spring securing set bolts.
2. Damper nuts.
3. 'U' bolt nuts.

SECTION M

THE BRAKING SYSTEM

	Section
General description	
Bleeding the hydraulic system	M.4
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Rear	M.8
Brake pedal	M.6
Brake-shoe	
Adjustments	M.2
Relining	M.9
Hand brake adjustment	M.3
Maintenance	M.1
Master cylinder	M.5
Removing a flexible hose	M.10

GENERAL DESCRIPTION

The brakes on all four wheels are hydraulically operated by pedal directly coupled to a master cylinder in which the hydraulic pressure of the brake operating fluid is generated. A supply tank cast integrally with the

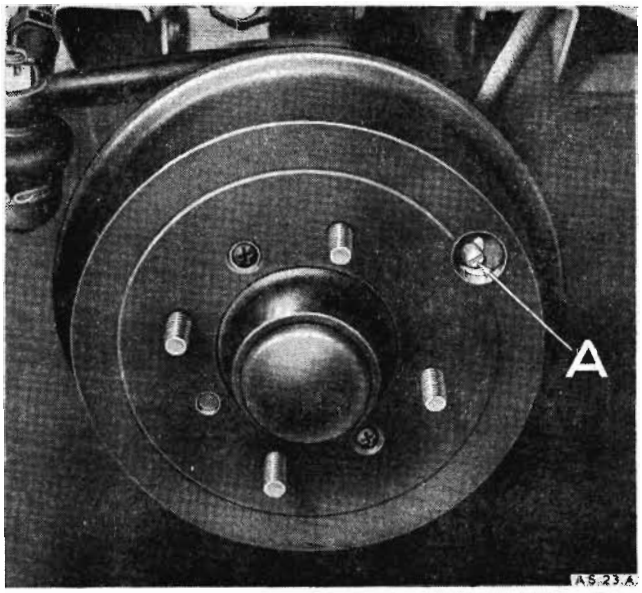

Fig. M.1
Showing front brake-drum with one of the brake-shoe adjusters (A)

master cylinder replenishes the fluid, and a pipe line consisting of tubes and flexible hoses interconnects the master cylinder and wheel cylinders.

The pressure generated in the master cylinder by application with the foot pedal is transmitted with equal and undiminished force to all wheel cylinders simultaneously. This moves the pistons outwards, which in turn expand the brake-shoes, thus producing automatic equalization and efficiency in direct proportion to the effort applied at the pedal.

When the pedal is released the brake-shoe springs return the shoes, which then return the wheel cylinder pistons, and therefore the fluid, to the pipe lines and master cylinder.

An independent mechanical linkage, actuated by a hand brake mounted alongside the propeller shaft tunnel, operates the rear brakes by mechanical expanders attached to the rear wheel cylinder bodies.

The front brakes are of the two-leading-shoe type with sliding shoes, which ensure automatic centralization of the brake-shoe in operation.

The rear brakes are also fitted with sliding shoes.

Section M.1

BRAKE MAINTENANCE

Periodically examine the quantity of brake fluid in the master cylinder. The level should be kept ½ 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.

IMPORTANT.—Serious consequences may result from the use of incorrect fluids, and LOCKHEED GENUINE BRAKE FLUID or a fluid conforming to Specification S.A.E. 70.R3 must be used. This fluid has been specially prepared and is unaffected by high temperature or freezing.

Adjust the brake-shoes to compensate for wear; the need for this is shown by excessive pedal travel before solid resistance is felt. For brake adjustments see Sections M.2 and M.3.

Section M.2

BRAKE-SHOE ADJUSTMENTS

The brakes are adjusted for lining wear **only** at the shoes themselves, and on no account should any alteration be made to the hand brake cable for this purpose.

Front brakes

A separate Micram adjuster is provided for each shoe. Jack up the car until the wheel concerned is clear of the ground. Remove the wheel disc and rubber dust plug from the adjusting hole. Rotate the wheel until the adjusting hole comes opposite one of the adjusters (located at eight and two o'clock). Using a screwdriver, turn the adjuster in a clockwise direction until the brake-shoe is in contact with the brake-drum, then turn the adjuster back one notch; this should provide correct clearance between the shoe and the drum. If closer adjustment is required, spin the drum and apply the brakes hard; this will correctly position the shoe, after which a further adjustment check should be made. Repeat these operations on the second adjuster. Adjust the other wheel shoes in similar manner.

Rear brakes

Place chocks under one of the front wheels and release the hand brake. Proceed as for the front brake adjustment

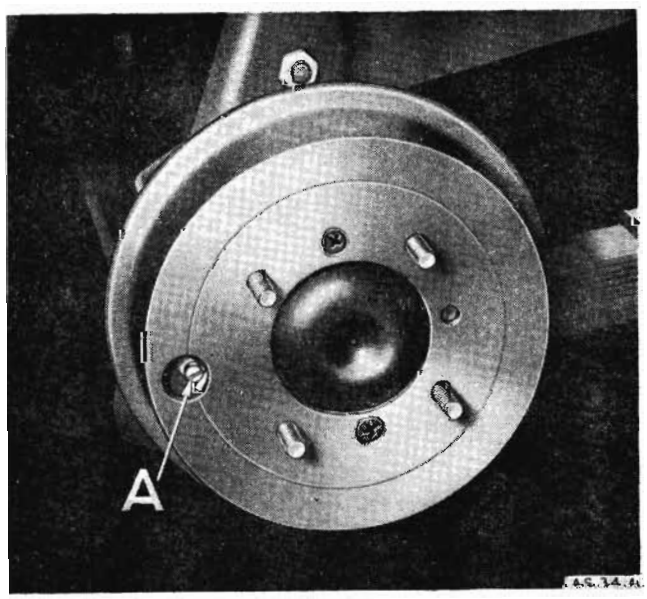

Fig. M.2
Showing rear brake-shoe adjuster (A)

but note that there is only one shoe adjuster for each rear wheel, and that it may be necessary to back off two notches to provide clearance for the two shoes.

Section M.3

HAND BRAKE ADJUSTMENT

The hand brake operates on the rear wheels only and is applied by a pull-up-type lever situated on the side of the propeller shaft tunnel. The Bowden cable from the control is attached to the compensator mounted on the rear axle. From compensator to the brake levers are transverse rods, which are non-adjustable.

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.

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.

Check the hand brake action, and if excessive travel still 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.

The hand brake linkage is set when leaving the Works and should not require any attention. Only when a complete overhaul is necessary should the hand brake linkage require resetting.

To adjust the hand brake the rear shoes should be locked to the drums, the hand brake control just slightly applied, and the cable slackness just removed by adjusting the sleeve nut at the rear of the Bowden cable (Fig. M.4).

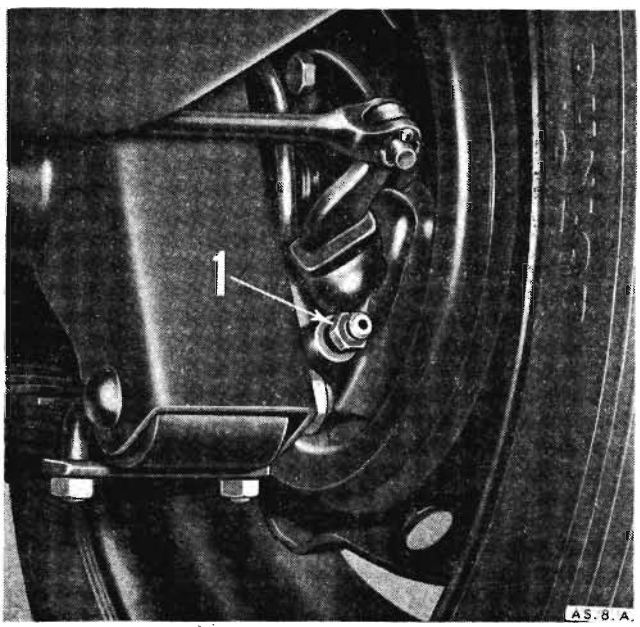

Fig. M.3
Illustrating a rear brake bleed nipple (1)

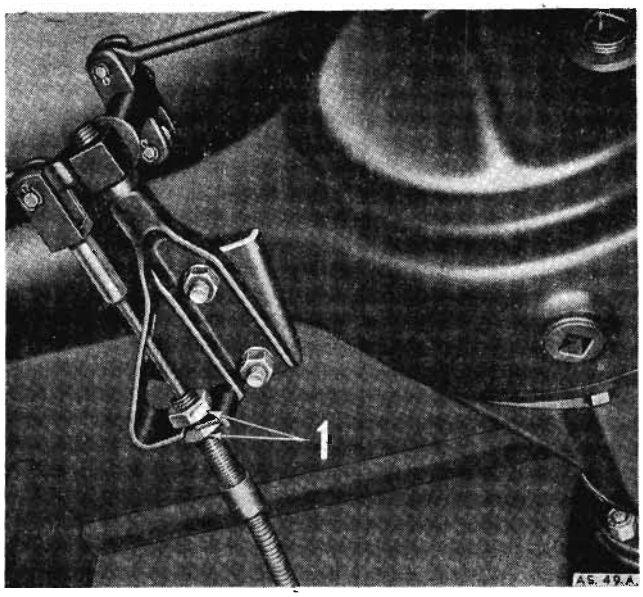

Fig. M.4
Shows location of hand brake cable adjustment (1) *on the rear axle*

The hand brake mechanism is lubricated by two grease nipples, one on the compensating mechanism and the other on the Bowden cable.

Section M.4

BLEEDING THE HYDRAULIC SYSTEM

Bleeding is necessary after any of the hydraulic lines or unions have been disconnected, or if the level of the brake fluid has been allowed to fall so low that air has entered the master cylinder.

With all the hydraulic connections secure and the supply tank topped up with the fluid, remove the rubber cap from the rear bleed nipple which is farthest away from the master cylinder and fit the bleed tube over the bleed nipple, immersing the free end of the tube in a clean jar containing a little brake fluid.

Unscrew the bleed nipple about three-quarters of a turn and then operate the brake pedal with a slow, full stroke until the fluid entering the jar is completely free of air bubbles. Then, during a down stroke of the brake pedal, tigthen the bleed screw sufficiently to seat the ball, remove the bleed tube, and replace the bleed nipple dust cap. **Do not use excessive force when tightening the bleed screws.**

Repeat this process with each bleed screw at each of the three remaining backplates, finishing at the wheel nearest the master cylinder. Always keep a careful check on the supply tank during bleeding since it is most important that a full level be maintained. Should air reach the master cylinder from the supply tank, the whole of the bleeding operation must be repeated.

After bleeding, top up the supply tank to its correct level.

Never use fluid that has just been bled from a brake system for topping up the supply tank, as this brake

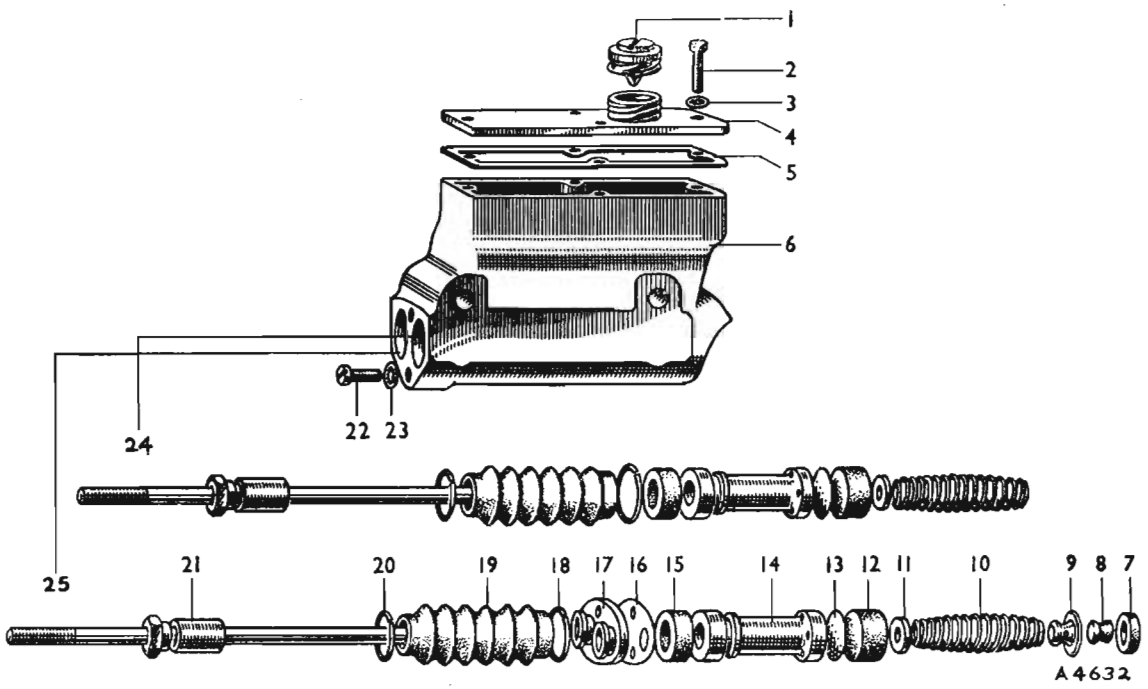

Fig. M.5

The master cylinder exploded

1. Filler cap.
2. Fixing screw.
3. Shakeproof washer.
4. Tank cover.
5. Tank cover gasket.
6. Cylinder barrel and tank.
7. Valve washer.
8. Valve cup.
9. Valve body.
10. Return spring.
11. Spring retainer.
12. Main cup.
13. Piston washer.
14. Piston.
15. Secondary cup.
16. Gasket.
17. Boot fixing plate.
18. Boot clip.
19. Boot.
20. Boot clip.
21. Push-rod.
22. Fixing screw.
23. Shakeproof washer.
24. Clutch bore.
25. Brake bore.

fluid may be to some extent aerated. Such fluid must be allowed to stand for **at least** 24 hours before it is used again. This will allow time for the air bubbles in the fluid to disperse.

Great cleanliness is essential when dealing with any part of the hydraulic system, and especially so where the brake fluid is concerned. Dirty fluid must never be added to the system.

Section M.5

MASTER CYLINDER

Construction

The master cylinder caters for operation of both brakes and clutch. It has two bores which are side by side and, except for the fact that one has no check valve, each bore accommodates normal master cylinder parts. The bore with the check valve serves the brakes, the other serves the clutch slave cylinder.

Removing

The following removal procedure involves the withdrawal of the master cylinder unit complete with clutch and brake pedals as it is not necessary to disconnect the pedals.

NOTE.—Before disconnecting the master cylinder ascertain, for assembly purposes, which bore communicates with the clutch slave cylinder.

Remove the heater blower unit (if fitted) by first releasing the two electrical connections, and then remove the set screws securing the heater blower bracket to the bulkhead. Remove the set screws securing the master cylinder mounting plate to the engine bulkhead. Disconnect the two hydraulic pipes at their unions with the rear of the master cylinder unit. Withdraw the master cylinder unit upwards and at the same time manipulate the clutch and brake pedals through the hole in the bulkhead.

Dismantling

Disconnect each pedal from its master cylinder push-rod by removing the spring clips and withdrawing the clevis pins.

Remove the bolts securing the master cylinder unit to its mounting plate and withdraw the complete unit.

Remove the set screws securing the boot fixing plate to the master cylinder.

Detach the fixing plate from the master cylinder and remove the boots and push-rods.

Remove the common filler cap and drain the fluid into a clean container.

Withdraw the piston, piston washer, main cup, return spring and valve body complete with rubber cup, and rubber washer.

Remove the secondary cup by stretching it over the end flange of the piston.

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

Reassembling

Reassembly is the reverse of the removal procedure, with particular attention being paid to the fitting of the rubber boots. The vent hole in each boot should be at the bottom when the cylinder is mounted on the vehicle.

Refitting

The installation of the master cylinder unit is the reversal of the removal procedure.

If no further maintenance is necessary, remember to bleed the system.

Section M.6

BRAKE PEDAL

Removing

Working beneath the bonnet, disconnect the clutch and brake pedal levers from the master cylinder push-rods by removing the spring clips and withdrawing the clevis pins. From within the car, remove the nut and spring washer and withdraw the fulcrum pin. Note that a distance piece separates the two pedals. The pedals can now be removed.

The pedals together with the master cylinder assembly can be removed as one unit. This operation is described in the master cylinder removal section.

Refitting

When refitting reverse the removal procedure.

Section M.7

FRONT BRAKE ASSEMBLIES

Removing

Disconnect the hydraulic pipe from the master cylinder at the backplate.

Remove the front brake backplate from the front suspension as described in Section K.2.

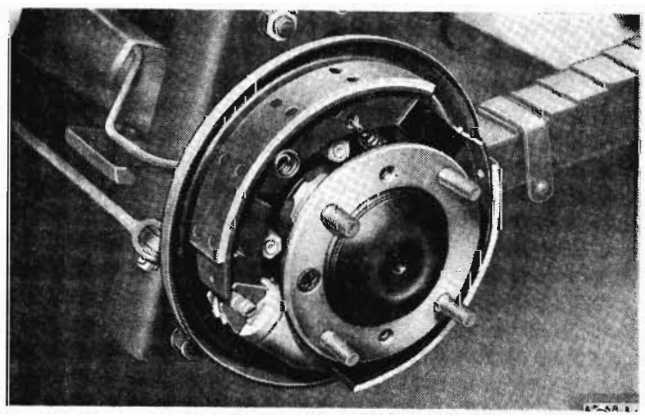

Fig. M.6
The rear brake assembly

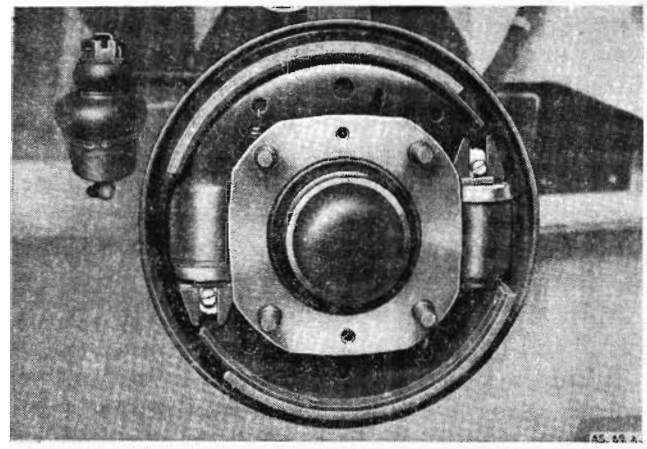

Fig. M.7
The front brake assembly

Dismantling

Pull one of the brake-shoes against the load of the return springs, away from the abutment on the closed end of a brake cylinder, and slide the Micram mask off the piston cover of the operating cylinder; on releasing the tension of the return springs the opposite brake-shoe will fall away.

Disconnect the bridge pipe between the two brake cylinders complete with the banjo adaptors. Unscrew the nuts and withdraw the brake cylinders from the backplate.

To dismantle a brake cylinder withdraw the piston complete with the piston cover from the cylinder and apply a gentle air pressure to the fluid connection to blow out the rubber cup and cup filler.

Reassembling

Clean all components with Lockheed Brake Fluid and renew all rubber cups and washers before reassembly. Take care to fit the small end of the coil spring over the projection in the cup filler.

Reassemble by reversing the dismantling sequence.

Refitting

Reverse the removal procedure when refitting.

Section M.8

REAR BRAKE ASSEMBLIES

Removing

Remove the wheel, drum, and axle shaft as described in Section H.2. Remove the hub assembly (see Section H.3).

Disconnect the hydraulic pipe from the wheel cylinder and the hand brake lever rod, both situated at the back-plate.

Remove the securing nuts and bolts and lift off the backplate.

Dismantling

Pull the trailing shoe against the load of the return springs and away from its abutment at either end. On

releasing the tension of the return springs the leading shoe will fall away together with the Micram adjuster and mask. Remove the bolt securing the banjo adaptor to the wheel cylinder and remove the rubber boot.

Remove the wheel cylinder piston, swing the hand brake lever until the shoulder is clear of the backplate, and slide the cylinder casting forward. Pivot the cylinder about its forward end and withdraw the rear end from the slot in the backplate; a rearward movement of the cylinder will now bring its forward end clear of the backplate.

Withdraw the piston complete with cover from the cylinder. Remove the hand brake pivot pin and lever. Apply a gentle air pressure to the fluid connection and blow out the hydraulic piston, rubber cup, and cup filler.

Reassembling

Reassemble by reversing the dismantling procedure, giving special care to ensure that the slot in the piston coincides with the lever slot in the cylinder casting.

Also ensure that the Micram adjuster is in the slot in the leading shoe with the mask in position, and that the return springs lie between the brake-shoes and the backplate. It should be noted that the unlined end of the leading shoe is to be nearest to the brake cylinder, whilst the unlined end of the trailing shoe is to be nearest the abutment block.

Refitting

Before reversing the removal procedure ensure that all the adjusters are backed off.

Section M.9

BRAKE-SHOE RELINING

If it becomes necessary to renew the full set of brake linings due to excessive wear it is essential to use the same material as originally specified or of an approved alternative, otherwise the present front-to-rear brake balance will be adversely affected.

Do not reline the brake-shoes with different types of lining.

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'.**

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, and renewal should be carried out in 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.

Section M.10

REMOVING A 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 N

THE ELECTRICAL SYSTEM

	Section
General description	
Battery	N.1
Dry-charged—preparation for service	N.2
New, unfilled, uncharged—preparation for service	N.3
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Dynamo	N.4
Faults, location and remedy	N.8
Flasher unit	N.9
Fuse unit	N.7
Headlamps	N.11
Number-plate illumination lamp	N.13
Panel and warning lamps	N.12
Pilot and flashing direction indicator lamps	N.14
Replacement bulbs	N.16
Starter	N.5
Tail and stop and direction indicator lamps	N.15
Windshield wipers	N.10
Wiring diagram	End of Section

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 mounted on the dash under the bonnet and is readily accessible for examination and maintenance attention.

The dynamo 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 for Europe, and a sealed-beam unit is fitted for Home and U.S.A. markets, both types dipping according to the regulations existing in the countries concerned.

Section N.1

BATTERY

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 dynamo; and 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 and result 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-discharged	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. (15·6° C.). If the temperature of the electrolyte exceeds this ·002 must be added to hydrometer readings for each 5° F. (2·8° C.) rise to give the true specific gravity. Similarly, ·002 must be subtracted from hydrometer readings for every 5° F. (2·8° C.) below 60° F. (15·6° C.).

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.

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. (37·8° 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° F., otherwise the life of the battery will tend to be shortened.

Refitting

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 A DRY-CHARGED BATTERY FOR SERVICE

A dry-charged battery is supplied without electrolyte but with the plates in a charged condition. When it is 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 it into the battery.

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. (15·6 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

A battery filled in this way is 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 A NEW, UNFILLED, UNCHARGED BATTERY FOR SERVICE

Preparing electrolyte

A battery 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.

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 2·5 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. (37·8° 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

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.) with moderate hand pressure at the centre of its longest run between two pulleys. 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.

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'.

After switching off all lights and accessories disconnect the cables from the dynamo terminals marked 'D' and 'F' respectively.

Connect the two terminals with a short length of wire.

Start the engine and set to run at normal idling speed.

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.

Gradually increase the engine speed: 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 ½ to 1 volt) the field winding may be faulty.

If the reading is approximately 4 to 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.5).

Removing

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.

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.

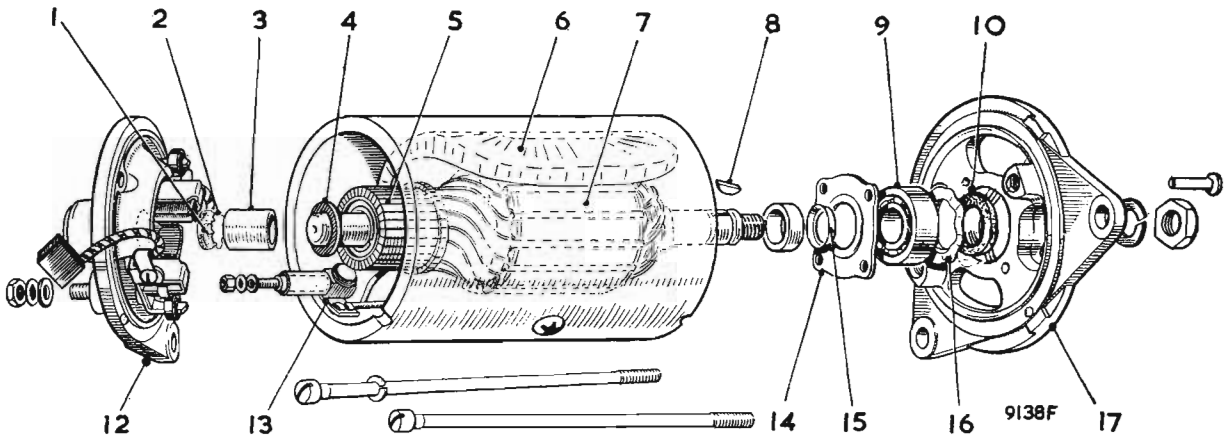

Fig. N.1

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.

Servicing

Brushes

Lift the brushes up in the brush boxes and secure them in that position by positioning each brush spring at the side of the brush. Fit the commutator end bracket over the commutator and release the brushes. Hold back each of the brush springs and move the brush by pulling gently on its flexible connector. If the movement is sluggish, remove the brush from its holder and ease the sides by lightly polishing it on a smooth file. Always refit the brushes in their original positions. If the brushes are badly worn, new brushes must be fitted and bedded to the commutator. The minimum permissible length of brush is $\frac{11}{32}$ in. (8·8 mm.).

Test the brush spring tension, using a spring scale. The tension of the springs when new is 22 to 25 oz. (624 to 709 gm.). In service it is permissible for this value to fall to 15 oz. (425 gm.) before performance may be affected. Fit new springs if the tension is low.

Commutator

A commutator in good condition will be smooth and free from pits or burned spots. Clean the commutator with a cloth moistened with fuel. 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.

The most common armature faults are usually confined to open- or short-circuited windings. Indications of an open-circuited armature winding is given by burnt commutator segments. A short-circuited armature winding is easily identified by discoloration of the overheated windings and badly burnt commutator segments.

Field coils

Test the field coils with an ohmmeter without removing them from the dynamo yoke. 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.

If the current reading is much more than 2 amps. or the ohmmeter reading much below 6 ohms it is an indication that the insulation of one of the fields coil has broken down.

In either case, unless a substitute dynamo is available, the field coils must be renewed. To do this carry out the procedure outlined below.

Drill out the rivet securing the field coil terminal assembly to the yoke and unsolder the field coil connections.

Remove the insulation piece which is provided to prevent the junction of the field coils from contacting the yoke.

Mark the yoke and pole-shoes in order that they can be refitted in their original positions.

Unscrew the two pole-shoe retaining screws by means of a wheel-operated screwdriver.

Draw the pole-shoes and coils out of the yoke and lift off the coils.

Fit the new field coils over the pole-shoes and place them in position inside the yoke. Take care that the taping of the field coils is not trapped between the pole-shoes and the yoke.

Locate the pole-shoes and field coils by lightly tightening the fixing screw.

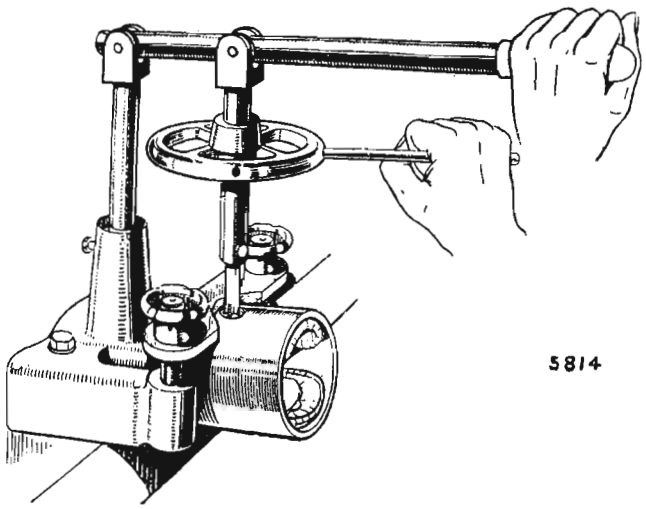

Fig. N.2

Using a wheel-operated screwdriver to remove the pole-shoe screws

Fully tighten the screws by means of a wheel-operated screwdriver and lock them by caulking.

Replace the insulation piece between the field coil connections and the yoke.

Resolder the field coil connections to the field coil terminal tags and rerivet the terminal assembly to 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 renewed.

To renew the bearing bush in a commutator end bracket proceed as follows.

Remove the old bearing bush from the end bracket. The bearing can be withdrawn with a suitable extractor or by screwing a $\frac{3}{8}$ in. tap into the bush for a few turns and pulling out the bush with the tap. Screw the tap squarely into the bush to avoid damaging the bracket.

Press the new bearing bush into the end bracket, using a shouldered, highly polished mandrel of the same diameter as the shaft which is to be fitted in the bearing, until the visible end of the bearing is flush with the inner face of the bracket. Porous bronze bushes should not be opened out after fitting or the porosity of the bush may be impaired.

NOTE.—Before fitting the new bearing bush it should be allowed to stand for 24 hours completely immersed in thin (S.A.E. 20) engine oil; this will allow the pores of the bush to be filled with lubricant. In cases of extreme urgency this period may be shortened by heating the oil to 212° F. (100° C.) for two hours, then allowing it to cool before removing the bearing bush.

The ball bearing is renewed as follows.

Drill out the rivets which secure the bearing retaining plate to the end bracket and remove the plate. Press the bearing out of the end bracket and remove the corrugated washer, felt washer, and oil-retaining washer.

Before fitting the replacement bearing see that it is clean and pack it with high-melting-point grease.

Place the oil-retaining washer, felt washer, and corrugated washer in the bearing housing in the end bracket.

Press the bearing into the housing. The outer bearing journal is a light push-fit in the bearing housing.

Refit the bearing retaining plate, using rivets having the same dimensions as those originally fitted.

NOTE.—When fitting a drive end bracket to the armature shaft the inner journal of the bearing MUST be supported by a mild-steel tube—do not use the drive end bracket.

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.

Refitting

Refitting is a reversal of the removal procedure.

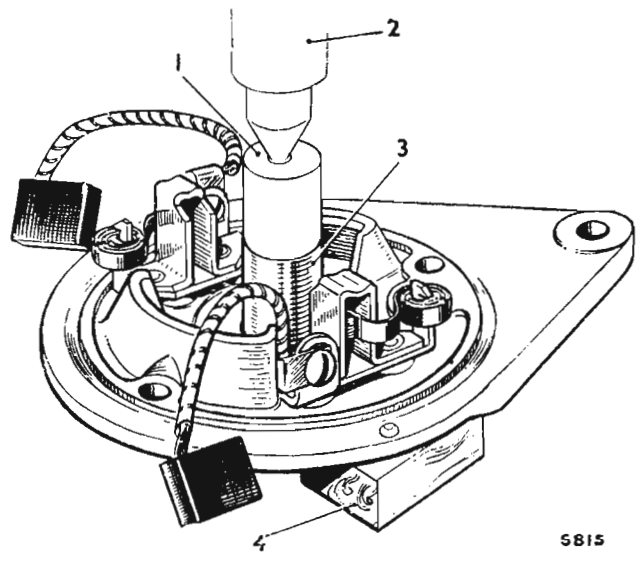

Fig. N.3

The method of pressing in the commutator end bracket bush

1. Shouldered mandrel.
2. Hand press.
3. Bearing bush.
4. Support block.

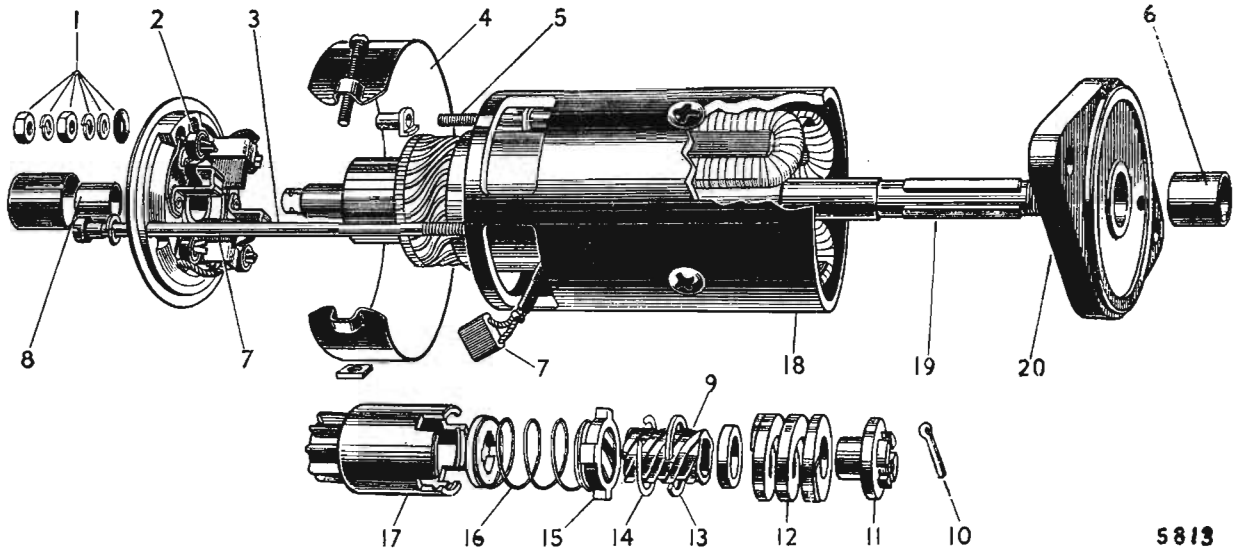

Fig. N.4

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 the vehicle

In the following test it is assumed that the battery is in a charged condition.

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 the current is flowing through the starter motor windings but that for some reason the armature is not rotating; possibly the starter pinion is meshed permanently with the geared ring on the flywheel. This could be caused by the starter being operated while the engine is still moving. In this case the starter motor 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. Next, if the switch is in order, examine the connections at the battery and starter switch, and also examine the wiring joining these units. Continued failure of the starter to operate indicates an internal fault in the starter, which must be removed for examination.

Sluggish action of the starter is usually caused by a poor connection in the wiring which causes a high resistance in the starter circuit. Check the wiring as described above.

Removing

Remove the distributor as described in Section B.

Release the starter cable from the terminal and unscrew the top starter securing bolt.

Working beneath the vehicle, release and withdraw the dirt deflector situated under the starter motor and unscrew the bottom starter securing bolt.

Manoeuvre the starter forward and lift clear of the engine.

Examination of commutator and brush gear

Remove the starter cover band and examine the brushes and commutator.

Hold back each of the brush springs and move the brush by pulling gently on its flexible connector. If the movement is sluggish remove the brush from its holder and ease the sides by lightly polishing 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 12-volt battery. One cable must be connected to the starter terminal, 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, it should be dismantled for detailed inspection and testing.

Dismantling

Hold back the brush springs and take out the brushes.

Extract the split pin at the driving end.

Unscrew the nut (R.H. thread) and take off the main

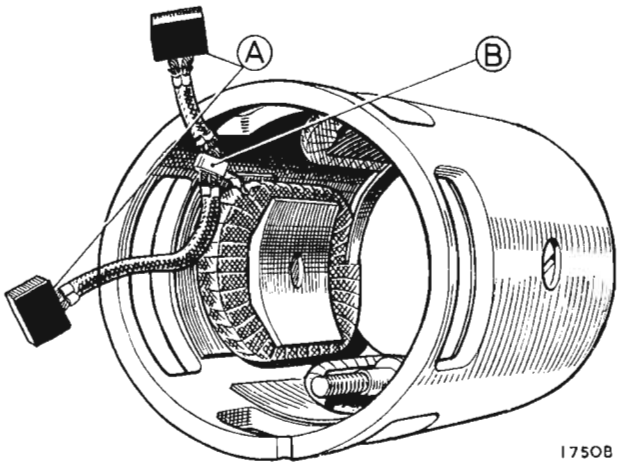

Fig. N.5

The starter brush connections

A. Brushes. B. Tapping on field coils.

spring. The complete drive can now be removed from the splined shaft by withdrawing it with a rotary movement.

Remove the terminal nuts and washers from the terminal post on the commutator end bracket.

Unscrew and withdraw the two through-bolts and take off the commutator end bracket.

Remove the driving end bracket complete with armature.

Brushes

Test the brush springs with a spring balance. The correct tension is 25 to 15 oz. (709 to 425 gm.). Fit a new spring if the tension is low.

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 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 their 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 screwed sleeve, wash away any dirt with paraffin (kerosene).

If any parts are worn or damaged they must be renewed.

Unscrew the nut (R.H. thread) and take off the main spring.

The complete drive can now be removed from the splined shaft by pulling it off with a rotary movement. Unscrew the screwed sleeve from the barrel assembly.

Further dismantling of the barrel assembly is carried out by removing the large retaining ring.

NOTE.—If the screwed sleeve is worn or damaged it is essential that it is renewed together with the control nut.

Reassemble by reversing the above procedure.

Commutator

A commutator in good condition will be smooth and free from pits and burnt spots. Clean the commutator with a cloth moistened with fuel. 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 on a lathe, rotate it at high speed, and take a light cut with a very sharp tool. Do not remove any more metal than is absolutely necessary, and finally polish with very fine glass-paper.

The mica on the starter commutator **must not be undercut.**

Field coils

The field coils can be tested for an open circuit by connecting a 12-volt battery having a 12-volt bulb in one of the leads to the tapping-point of the field coils to which the brushes are connected and the field terminal post. If the bulb does not light there is an open circuit in the wiring of the field coils.

Lighting of the bulb 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 the field coils carry out the procedure detailed in the dynamo section.

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.

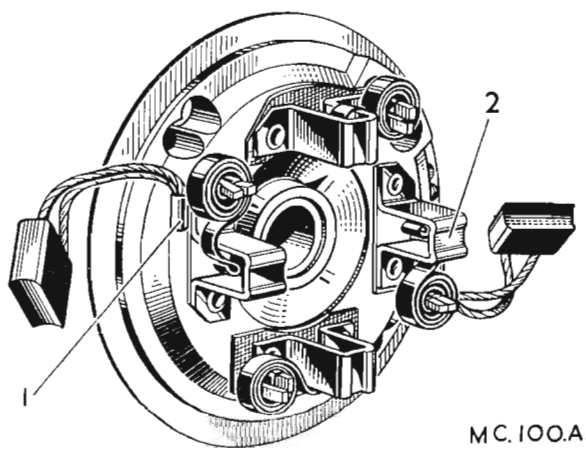

Fig. N.6

Commutator end bracket

1. Terminal eyelet. 2. Brush holder.

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 into the bearing.

NOTE.—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.

Refitting

Refitting is a reversal of the removal procedure.

Section N.6

CONTROL BOX

This unit contains the cut-out and voltage regulator. The regulator controls the dynamo output in accordance with the load on the battery and its state of charge. When the battery is discharged the dynamo gives a high output, so that the battery receives a quick recharge which brings it back to its normal state in the minimum time.

On the other hand, if the battery is fully charged the dynamo is controlled to give only a trickle charge, which is sufficient to keep it in good condition without any possibility of causing damage to the battery by over-charging.

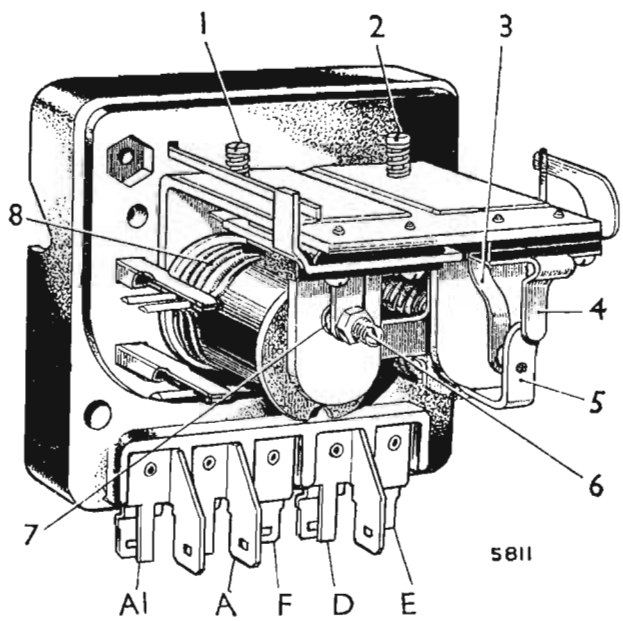

Fig. N.7

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.

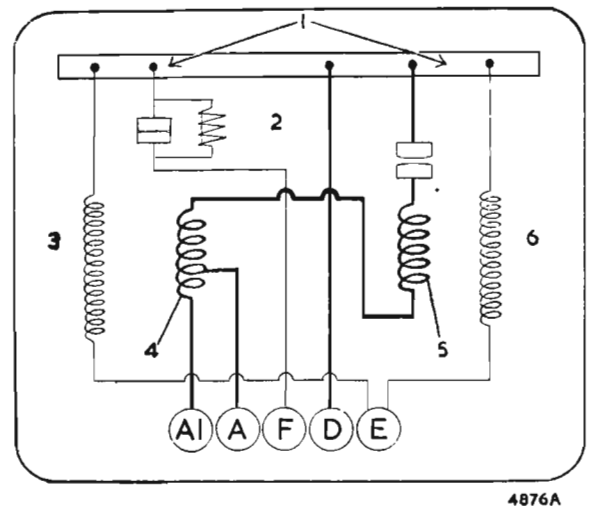

Fig. N.8

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.

The regulator also causes the dynamo to give a controlled boosting charge immediately after starting up, which quickly restores to the battery the energy taken from it when starting. After about 30 minutes' running, the output of the dynamo has fallen to a steady rate best suited to the particular state of charge of the battery.

The cut-out is an automatic switch for connecting and disconnecting the battery with the dynamo. This is necessary because the battery would otherwise discharge through the dynamo when the engine is stopped or running at a low speed.

Regulator adjustment

The regulator is carefully set to suit the normal requirements of the standard equipment before leaving the Works, 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 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.

Checking and adjusting the electrical setting

The regulator setting can be checked without removing the cover of the control box.

Withdraw the cables from the terminals marked 'A' and 'A1' at the control box and join them together. Connect the negative lead of a moving-coil voltmeter (0 to 20 volts full scale reading) to the 'D' terminal on the dynamo and connect the other lead from the meter to a convenient chassis earth.

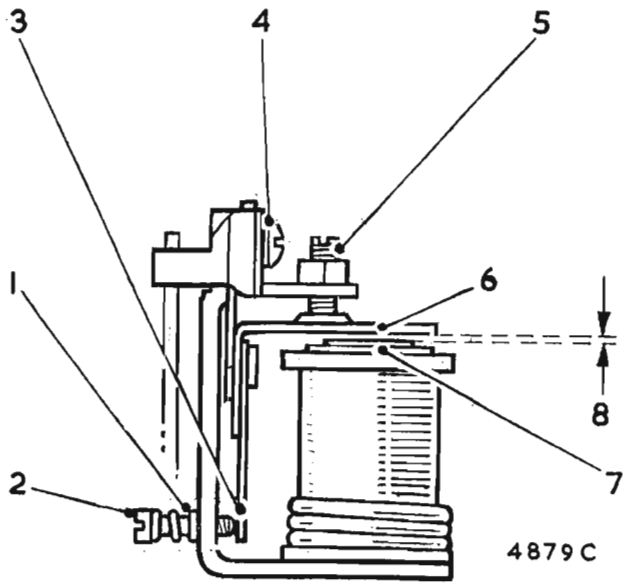

Fig. N.9

Mechanical setting of the regulator

1. Spring.
2. Voltage adjusting screw.
3. Armature tension spring.
4. Armature securing screws.
5. Fixed contact adjustment screw.
6. Armature.
7. Core face and shim.

Slowly increase the speed of the engine until the voltmeter needle 'flicks' and then steadies; this should occur at a voltmeter reading between the limits given for the appropriate temperature of the regulator.

If the voltage at which the reading becomes steady occurs outside these limits, the regulator must be adjusted.

Shut off the engine, remove the control box cover, and turn the adjusting screw (2) in a clockwise direction to raise the setting or in an anti-clockwise direction to lower the setting. Turn the adjustment screw a fraction of a turn at a time until the setting is correct and then tighten the locknut.

When adjusting, do not run the engine up to more than half-throttle because, while the dynamo is in open circuit, it will build up to a high voltage if run at a high speed and in consequence a false voltmeter reading will be obtained.

Electrical settings of the regulator must be made as quickly as possible because of the temperature rise effects.

Mechanical setting

The mechanical settings of the regulator are accurately adjusted before leaving the Factory, and provided that the armature carrying the moving contact is not removed, these settings should 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 locknut and unscrew the contact until it is well clear of the armature moving contact. Slacken the two armature assembly securing screws.

Slacken the voltage adjusting screw locknut and unscrew the adjuster until it is well clear of the armature tension spring.

Insert a ·015 in. (·38 mm.) feeler gauge between the armature and core shim. Take 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. Tighten the locknut and remove the feeler gauge. Reset the voltage adjusting screw as described under **'Electrical setting'.**

Cleaning regulator contacts

After periods of long service it may be found necessary to clean the regulator contacts. Fine carborundum stone or fine emery-cloth may be used. Carefully wipe away all traces of dust or other foreign matter, using a clean, fluffless cloth moistened with methylated spirits.

Cut-out 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 the 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. This should be 12·7 to 13·3 volts.

If operation of the cut-out takes place outside these limits it will be necessary to adjust. To do this, turn the cut-out adjusting screw (2) (Fig. N.7) in a clockwise direction to raise the voltage setting or in an anti-clockwise direction to reduce the setting. Turn the screw a fraction 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 temperature rise effects.

Adjustment of the drop-off voltage is effected by carefully bending the fixed contact blade. If the cut-out

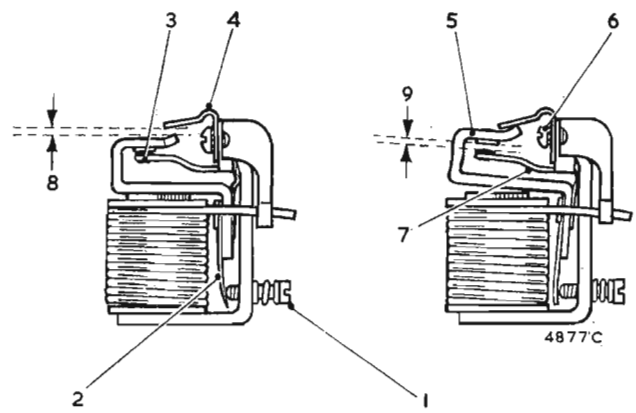

Fig. N.10

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. ·025 to ·040 in. (·63 to 1·01 mm.).
9. ·010 to ·020 in. (·254 to ·508 mm.).

does not operate there may be an open circuit in the wiring of the cut-out and regulator unit, in which case the unit should be removed for examination or renewal.

Cut-out 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.

Turn the adjusting screw until it is well clear of the armature tension spring. Slacken the two armature assembly securing screws (Fig. N.10). Press the armature firmly down against the copper-sprayed core face and retighten the two armature assembly securing screws.

Using a pair of round-nosed pliers, adjust the gap between the armature stop-arm and armature tongue by bending the stop-arm. The gap must be ·025 to ·040 in. (·635 to 1·016 mm.) when the armature is pressed squarely down on the core face.

Similarly, the insulated contact blade must be bent so that when the armature is pressed squarely down against the core face there is a 'follow through' or contact deflection of ·010 to ·020 in. (·254 to ·508 mm.). Reset the cut-out adjusting screw as described under **'Cut-out electrical setting'.**

Cleaning cut-out contacts

If the contacts appear rough or burnt place a strip of fine glass-paper between them, close them by hand, and draw the paper through. This should be done two or three times with the abrasive side towards each contact. Wipe away all dust or other foreign matter, using a clean, fluffless cloth moistened with methylated spirits.

Do not use emery-cloth or carborundum stone for cleaning the cut-out contacts.

Section N.7

FUSE UNIT

Description

The fuse unit, which is located on the right-hand side of the engine compartment, is an open, insulated moulding carrying two single-pole 35-amp. cartridge-type fuses which are held in spring clips between the Lucar connectors. Two spare fuses are carried in recesses in the fuse unit box and are positioned by retaining springs. The fuse which bridges the terminal blocks 'A1'—'A2' is to protect general auxiliary circuits, e.g. the horn, which is independent of the ignition switch. The other fuse, bridging terminal blocks 'A3'—'A4', is to protect the ignition and auxiliary circuits, e.g. the fuel gauge, windshield wiper motor, and flasher indicators, which only operate when the ignition is switched on.

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.

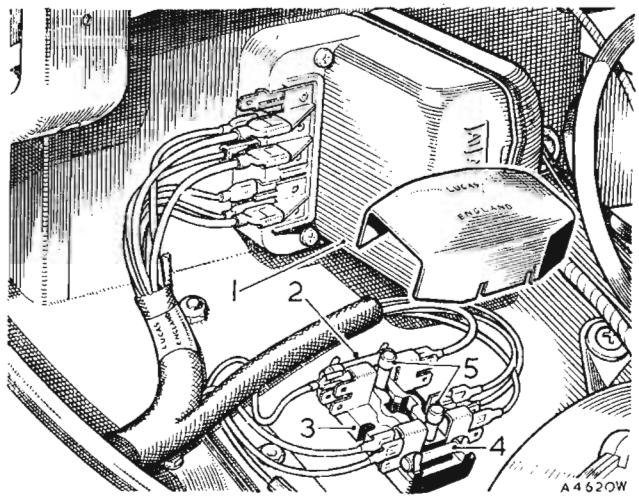

Fig. N.11

Regulator and fuse unit

1. Regulator cover.
2. AUX. IGN. fuse (35-amp.).
3. Fuse block.
4. AUX. fuse (35-amp.).
5. Spare fuses (B.M.C. Part No. 7H5067).

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 battery it may be that the battery is exhausted.

This in turn may be due to the dynamo failing to charge the battery, 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 a Distributor or Dealer.

CHARGING CIRCUIT

1. Battery 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 Distributor or Dealer.

2. Battery overcharged

This will be indicated by burnt-out bulbs, very frequent need for topping up the battery, 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 battery, 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

FLASHER UNIT

Description

The Lucas flasher unit is situated in the engine compartment on the right-hand side and is operated by a switch centrally mounted on the fascia panel, a warning light being provided on the right-hand side of the fascia.

The unit is contained in a small cylindrical metal container, one end of which is rolled over onto an insulated plate carrying the mechanism and three terminals. The unit depends for its operation on the linear expansion of a length of wire which becomes heated by an electric current flowing through it. This actuating wire controls the movement of a spring-loaded armature attached to a central steel core and carrying a moving contact—the sequence of operation being as follows.

When the direction indicator switch is turned either to the left or right, current flows through the actuating wire, ballast resistor, and coil wound on the central core and hence to earth via the flasher lamp filaments. This current is limited by the ballast resistor to a value which will ensure that the flasher lamp filaments do not light at this stage. The actuating wire increases in length under the heating influence of the current and allows the armature to move inwards to its alternative position, thereby closing a pair of contacts in the supply circuit to the flasher lamps and at the same time short-circuiting the actuating wire. The increased electro-magnetic attraction of the armature to the core, due to the full lamp current now flowing through the coils, serves to hold the closed contacts firmly together. At the same time a secondary spring-loaded armature is attracted to the core and closes a pilot warning lamp circuit so that now both flasher lamps and warning lamp are illuminated.

Since, however, heating current no longer flows through the short-circuited actuating wire, the latter cools and consequently contracts in length. The main armature is therefore pulled away from the core, the contacts opened, and the light signals extinguished. The consequent reduction of electro-magnetism in the core allows the secondary armature to return to its original position and so extinguish the pilot warning light. The above sequence of operations continues to be repeated until the indicator switch is returned to the 'off' position.

Functions of warning lamp

The warning lamp not only serves to indicate that the flasher unit is functioning correctly but also gives a warning of any bulb failure occurring in the external direction indicator lamps—since a reduction in bulb current flowing through the coil reduces the electro-magnetic effect acting on the secondary armature and so prevents closure of the pilot light contacts.

Checking faulty operation

In the event of trouble occurring with a flashing light direction indicator system, the following procedure should be followed.

Check the bulbs for broken filaments.

Refer to the vehicle wiring diagram and check all flasher circuit connections.

Switch on the ignition.

Check with a voltmeter between the flasher unit terminal 'B' and earth that battery voltage is present.

Connect together flasher unit terminals 'B' (or 'X') and 'L' and operate the direction indicator switch. If the flasher lamps now light, the flasher unit is defective and must be renewed.

Maintenance

Flasher units cannot be dismantled for subsequent reassembly. A defective unit must therefore be renewed, care being taken to connect as the original.

Renewing flasher unit

When renewing 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.10

WINDSHIELD WIPERS

Maintenance

Inspect the rubber wiping elements, which after long service become worn and should be renewed.

Lubricate the rubber grommet or washer around the wheelbox spindle with a few drops of glycerine.

Methylated spirits (denatured alcohol) should be used to remove oil, tar spots, and other stains from the windshield. It has been found that the use of some silicone- and wax-based polishes for this purpose can be detrimental to the rubber wiper blades.

The gearbox and cable rack are packed with grease during manufacture and need no further lubrication.

Checking switching mechanism

If the wiper fails to park or parks unsatisfactorily, the limit switch in the gearbox cover should be checked. Unless the limit switch is correctly set, it is possible for the wiper motor to overrun the open-circuit position and continue to draw current.

Resetting the limit switch

Slacken the four screws securing the gearbox cover and observe the projection near the rim of the limit switch. Position the projection in line with the groove in the gearbox cover. Turn the limit switch 25° in an anti-clockwise direction and tighten the four securing screws. If the wiping blades are required to park on the opposite side of the windshield, the limit switch should be turned back 180° in a clockwise direction.

Checking current consumption

If the wiper fails to operate, or operates unsatisfactorily, switch on the wiper and note the current being supplied to the motor. The normal running current should be 2·3 to 3·1 amps. Use a 0 to 15 amps. moving-coil ammeter connected in the wiper circuit, then proceed as follows.

Wiper takes no current

Examine the fuse protecting the wiper circuit. If the fuse has blown, examine the wiring of the motor circuit and of all other circuits protected by that fuse. Renew, if necessary, any cables which are badly worn or chafed, fitting protective sleeving over the cables to prevent a recurrence of the fault.

If the external wiring is found to be in order, replace the fuse with one of the recommended rating. Then proceed as for the wiper taking an abnormally high current.

If the fuse is intact, examine the wiring of the motor circuit for breaks, and ensure that the wiper control switch is operating correctly.

When a current-operated thermostat is fitted test it by connecting an ohmmeter across its terminals in place of the two cables. If a closed circuit is indicated the thermostat is in order and the cables must be refitted. An open circuit means that the thermostat has operated but not reset. Check the thermostat by substitution. Adjustment of the thermostat must not be attempted.

If the thermostat is in order, proceed as for the wiper taking an abnormally high current.

Wiper takes abnormally low current

Check that the battery is fully charged. The performance of the motor is dependent on the condition of the battery.

Remove the commutator end bracket and examine the brush gear, ensuring that it bears firmly on the commutator. The tension spring must be renewed if the brushes do not bear firmly on the commutator. Brush levers must move freely on the pivots. If these levers are stiff they should be freed by working them backwards and forwards by hand.

Examine the commutator and, if necessary, clean with a fuel-moistened cloth. A suspected armature should be checked by substitution.

Wiper takes abnormally high current

If an abnormally high current is shown on the ammeter, this may be due to excessive load on the driving shaft. The stall current of the motor when cold is 14 amps. and when hot is 8 amps.

If there is no obvious reason for this, such as a sticking wiper blade, a check should be made at the gearbox.

Remove the gearbox cover and examine the gear assembly, checking that a blow on the gearbox end bracket has not reduced the armature end-float. The armature end-float adjusting screw must be set to give an armature end-play of ·008 in. to ·012 in. (·20 to ·30 mm.).

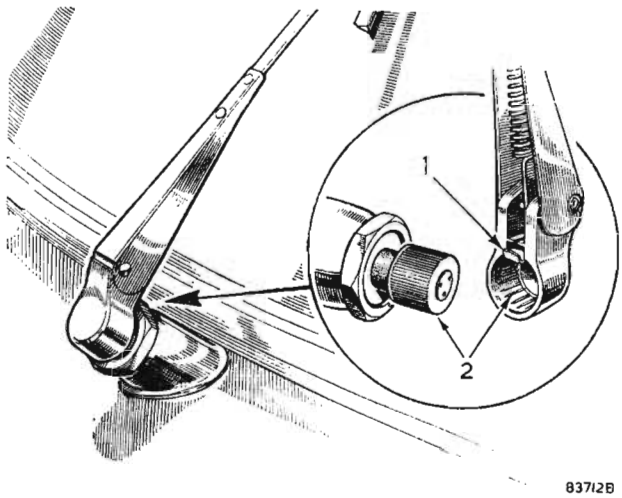

Fig. N.12

Removal and replacement of the windshield wiper arm

1. Retaining clip. 2. Splined drive.

Sluggish operation with excessive current consumption may be caused through frictional losses in badly positioned or defective connecting tubes. The connecting tubes can be checked, using a cable gauge. (Details of this gauge can be obtained from any Lucas Agent.) The gauge cable is similar in appearance to the driving rack but is ·010 in. (·25 mm.) larger in diameter and is less flexible. The gauge will not easily pass through connecting tubes having less than the minimum permissible curvature.

To check the tubing, using the gauge, it is necessary to remove the inner rack. Insert the gauge into the connecting tube as far as the first wheelbox and then withdraw it. Remove the tubing connecting the wheelboxes. Insert and withdraw the gauge. If the gauge moves freely the tubing is correctly installed. If the gauge does not move freely the tubing must be checked for sharp bends and obstructions. Check the wheelboxes for alignment and then reassemble.

Pieces of carbon short-circuiting adjacent segments of the commutator will also cause excessive current consumption. The resistance between adjacent commutator segments should be ·34 to ·41 ohm. Cleaning the commutator and brush gear removes this fault. When dismantling, check the internal wiring of the motor for evidence of short-circuiting due to chafed or charred insulation. Slip a new piece of sleeving over any charred connections, and arrange them so that they do not rub against sharp edges.

While the motor is dismantled check the value of the field resistance. If it is found to be lower than 12·8 to 14 ohms, a short circuit in the windings is indicated and a new field coil must be fitted. Other evidence of a short-circuit will be given by charred leads from the field coil.

Removing the rack and motor unit

Release the wiping arms from the spindles (see Fig. N.12), disconnect the union on the Bundy tube at the gearbox, and remove the nuts from the motor mounting bolts. Withdraw the motor and cable rack clear of the Bundy tube.

Dismantling the motor

Withdraw the four screws securing the gearbox cover and remove the cover.

Withdraw the terminal screws and through-bolts at the commutator end bracket.

Remove the commutator end bracket clear of the yoke.

The brush gear can be removed by lifting it clear of the commutator and withdrawing it as a unit. Care should be taken at this point to note the particular side occupied by each brush so that each may be replaced in its original setting on the commutator.

Access to the armature and field coils can be gained by withdrawing the yoke.

If it is necessary to remove the field coil, unscrew the two screws securing the pole-piece to the yoke. These screws should be marked so that they can be returned to their original holes.

Press out the pole-piece complete with field coil, marking the pole-piece so that it can be replaced in its correct position inside the yoke. The pole-piece can now be pressed out of the field coil.

Dismantling the gearbox unit

Remove the circlip and washer from the cross-head connecting link pin and lift off the cross-head and cable rack assembly. Then remove the circlip and washer from the final gear shaft located underneath the gearbox unit. Remove any burr from the circlip groove before lifting out the final gear. The armature and worm drive can now be withdrawn from the gearbox. All gear teeth should be examined for signs of damage or wear and, if necessary, new gears fitted.

Reassembling

Reassembly is a reversal of the above procedures. When reassembling, the following components should be lubricated, using the lubricants recommended.

Armature bearings

These should be lubricated with S.A.E. 20 engine oil—the self-aligning bearing being immersed in this for 24 hours before assembly.

Armature shaft (commutator end)

Apply S.A.E. 20 engine oil.

Felt lubricator in gearbox

Apply S.A.E. 20 engine oil.

Worm wheel bearings, cross-head, guide channel, connecting rod, crankpin, eccentric coupling assembly, worm, and final gear shaft

Grease liberally as for front hubs.

Cable rack and wheelboxes

Grease liberally as for front hubs.

Testing

Switch on the ignition and the wiper control. The two wiper areas should be approximately symmetrical on the windshield.

Fitting a blade to a wiper arm

Pull the wiper arm away from the windshield and insert the curved 'wrist' of the arm into the slotted spring fastening of the blade. Swivel the two components into engagement.

Fitting a wiper arm to the driving spindle

First ensure that the wiper spindles are in the correct parking position by switching on the ignition and turning the wiper control on and then off.

To fit the arms, press the headpieces onto the spindles at the correct parking angle until the retaining clip is heard to snap over the end of the spindle drum.

Switch off the wiper control. The arms should come to rest in the correct parking position.

Adjusting

Correct operation can be obtained by adjusting the position of the arms relative to the spindles. If necessary, the position of the arms may be adjusted by removing and re-engaging them with the splined driving spindles, the angular pitch of the splines being 5°.

Do not attempt to turn the arms whilst in position, but press back the retaining clip (Fig. N.12) in the headpieces and withdraw the arms from the driving spindles. Refit in the desired position. The above adjustment may affect the self-parking position. If so, it may be corrected by adjustment of the limit switch position as described previously.

If the arms and blades are required to come to rest on the opposite side, the limit switch should be turned through 180°. It should be noted that the switch cover is designed for turning through a sector only and not through 360°. This feature prevents unnecessary twisting of the external flexible connections.

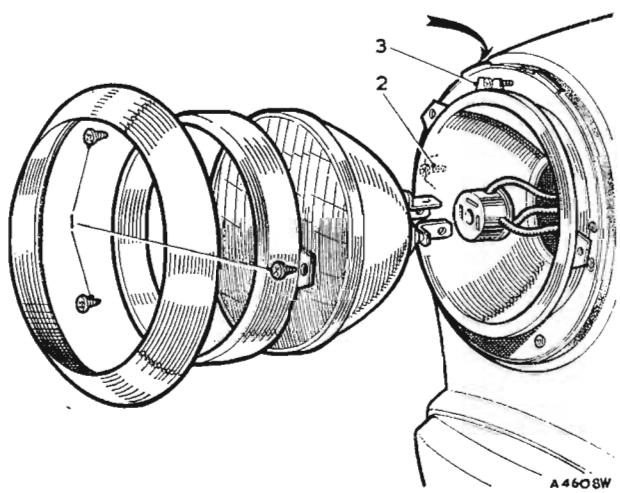

Fig. N.13

The sealed-beam headlamp

1. The light unit securing screws.
2. The light beam horizontal adjustment screw.
3. The light beam vertical adjustment screw.

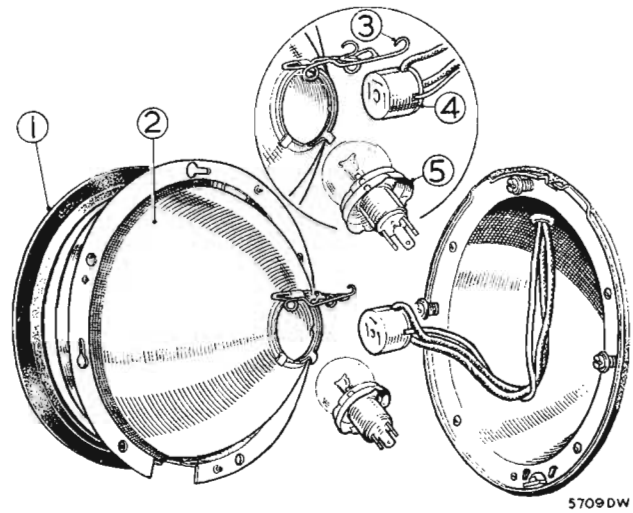

Fig. N.14

The headlamp light unit, showing the European-type bulb and socket

1. Rubber seal.
2. Reflector.
3. Bulb retainer.
4. Socket.
5. Bulb.

Section N.11

HEADLAMPS

Home and U.S.A. type

Headlamps fitted to vehicles operating on the Home or U.S.A. market are of the sealed-beam type and are serviced as complete units only.

European type

Headlamps fitted to vehicles exported to Europe are of the double-filament bulb type.

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 (Home and U.S.A. types)

The lamp rims are fitted with rubber dust excluders and rim retaining screws. Release the retaining screw at the bottom of the rim and the lamp body and lift away the lamp rim. Remove the inner rim securing screws and lift away the sealed-beam assembly after disconnecting the three-pin socket.

Removing the light unit (European type)

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.

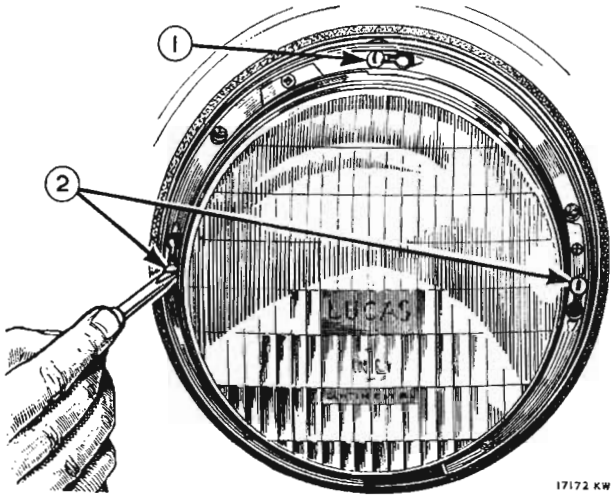

Fig. N.15

The headlamp setting screws

1. Vertical setting adjusting screw.
2. Horizontal setting adjusting screws.

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.

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 (Home and U.S.A.)

Refitting is the reverse of the removal procedure.

NOTE.—When refitting a headlamp rim make certain it is placed over the retaining lip at the top of the lamp body and held firmly in this position while refitting the lamp rim retaining screw.

Refitting the light unit (European type)

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 (European type)

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.15).

Beam-setting (Home and U.S.A. type)

The lamps should be set in the dip position, and should be adjusted to comply with the regulations in the country or state in which the vehicle is operating.

If adjustment is required, this is achieved by removing the headlamp rim. 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 screw on the right-hand side of the lamp.

Section N.12

PANEL AND WARNING LAMPS

Access to the warning lamps for the ignition and headlamp beam is effected from under the fascia by withdrawing the push-in-type holders from the rear of the fascia panel.

A list of the correct types of bulbs for replacement purposes and their part numbers appears in Section N.16.

Section N.13

NUMBER-PLATE ILLUMINATION LAMP

The number-plate is illuminated by a separate lamp with twin bulbs.

The cover is removed by unscrewing the single attachment screw, which enables it to be withdrawn, giving easy access to the bulbs.

Section N.14

PILOT AND FLASHING DIRECTION INDICATOR LAMPS

Remove the two securing screws and lift away the plated rim and glass. An amber cover is fitted over the direction indicator bulb when the vehicle is operating in

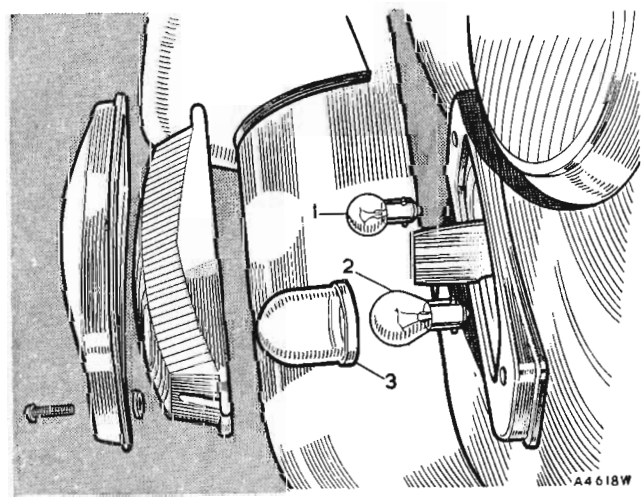

Fig. N.16

The side and direction indicator lamp

1. Sidelamp bulb.
2. Direction indicator bulb.
3. Amber direction indicator bulb cover.

countries where the lighting regulations require amber flashing indicators.

Refitting is a direct reversal of the removal procedure.

Section N.15

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 bulbs is gained by extracting the securing screws from the outer face of the lamp lens to release the lens.

The tail and stop lamp bulbs must be fitted one way only; offset retaining pegs ensure that they are replaced correctly.

The lamp body can be removed when the lens is taken off as indicated in Fig. N.17 and the three screws located in the lamp body withdrawn. When refitting the glass to the body make certain that it is seating correctly over the sealing rubber.

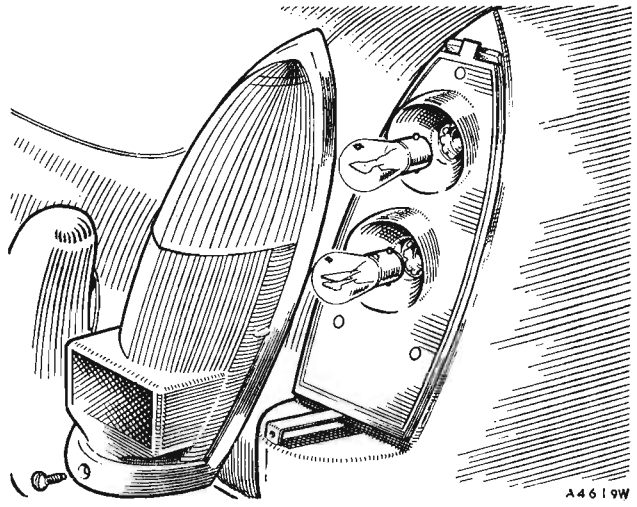

Fig. N.17

The tail, stop, and direction indicator lamps

Section N.16

REPLACEMENT BULBS

	Volts	*Watts*	*B.M.C. Part No.*
Headlamps—United Kingdom only	12·8	60/45	13H496
Headlamps—L.H.D. except U.S.A. and Europe	12	42/36	3H1893
Headlamps—L.H.D. Europe except France	12	45/40	13H138
Headlamps—France only	12	45/40	13H139
Headlamps—Sweden only	12	45/40	13H138
Sidelamps	12	4	1D9081
Sidelamps, direction indicator lamps—North America and Italy	12	6/21	1F9026
Direction indicator lamps (front)	12	21	1F9012
Direction indicator lamps (rear)	12	21	1F9012
Tail and stop lamps	12	6/21	1F9026
Number-plate illumination lamp	12	6	2H4817
Panel and warning lights	12	2·2	2H4732

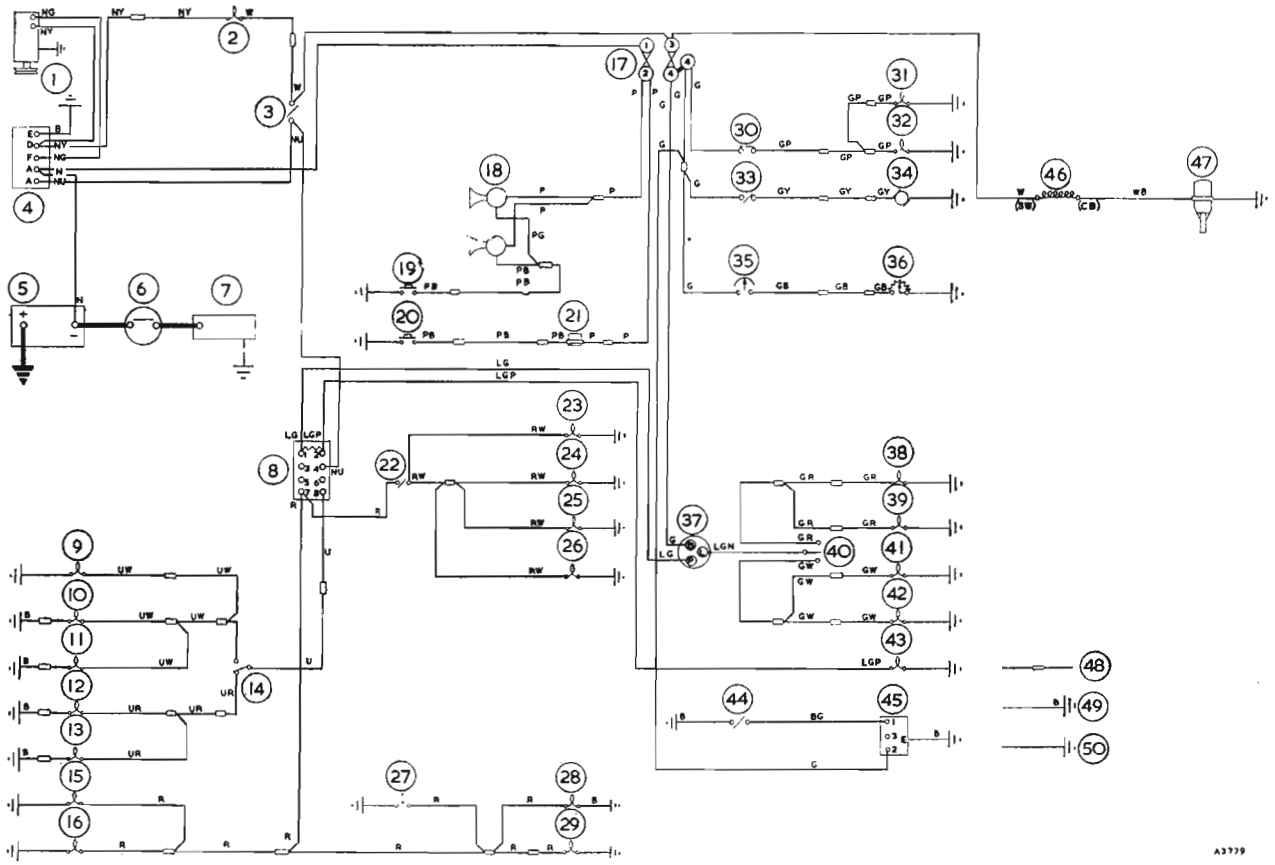

Fig. N.18

Wiring diagram

1. Dynamo.
2. Ignition warning light.
3. Ignition switch.
4. Control box.
5. Battery.
6. Starter switch.
7. Starter motor.
8. Lighting switch.
9. Main beam warning light.
10. R.H. headlamp main beam.
11. L.H. headlamp main beam.
12. R.H. headlamp dip beam.
13. L.H. headlamp dip beam.
14. Dipper switch.
15. L.H. sidelamp.
16. R.H. sidelamp.
17. Fuse unit.
18. Twin horn. } (when fitted).
19. Horn-push }
20. Horn-push.
21. Horn.
22. Panel light switch.
23. Panel light.
24. Panel light.
25. Panel light.
26. Tachometer light (when fitted).
27. R.H. tail lamp.
28. Number-plate lamp.
29. L.H. tail lamp.
30. Stop lamp switch.
31. L.H. stop lamp.
32. R.H. stop lamp.
33. Heater switch.
34. Heater motor (when fitted).
35. Fuel gauge.
36. Fuel gauge tank unit.
37. Flasher unit.
38. L.H. front flasher.
39. L.H. rear flasher.
40. Flasher switch.
41. R.H. rear flasher.
42. R.H. front flasher.
43. Flasher warning light.
44. Windshield wiper switch.
45. Windshield wiper motor.
46. Ignition coil.
47. Distributor.
48. Snap connectors.
49. Earth connections made via cable.
50. Earth connections made via fixing bolts.

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
Maintenance	
Jack	O.6
Tyres	
Fitting	O.4
Removing	O.3
Repairing	O.5
Valves	O.1
Wheel—removing	O.2

TYRE MAINTENANCE

Even tyre wear is promoted by changing the positions of the tyres on the car at intervals of about 3,000 miles (4800 km.). The spare tyre should be brought into use with the others.

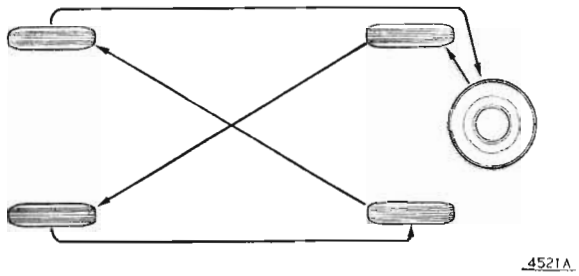

Fig. O.1

Interchange the road wheels diagonally, bringing the spare wheel into use

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.

Misalignment is a very costly error. Suspect it if rapid wear of the front tyre is noticed and correct the fault at once. See Section J.1 for details on front wheel alignment.

Should the tyres get oily, petrol (gasoline) should be applied sparingly and wiped off at once.

Avoid under- and over-inflation.

Avoid kerbing and other causes of severe impact.

Have any damage repaired immediately.

Section O.1

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.

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.).

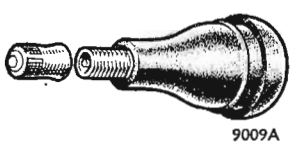

Fig. O.2

Valve for a tubeless tyre

Obtain an ordinary valve dust cap and solder the cap in the drilled hole.

Drill a $\frac{1}{4}$ in. (6·35 mm.) hole about $\frac{1}{2}$ in. (12·7 mm.) from the opposite end of the tool to accept a short rod as 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.

It is advisable to change the valve interiors every 12 months.

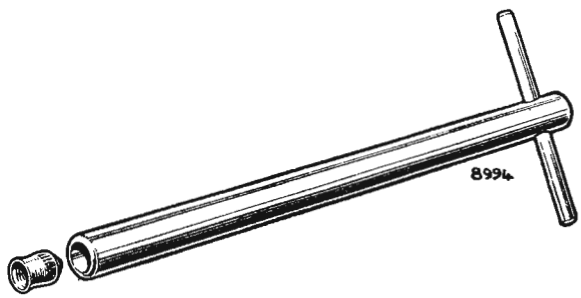

Fig. O.3

A simple tool for fitting tubeless tyre valves

Valve caps, in addition to preventing dirt entering the valve, form a secondary air seal and should always be fitted.

Section O.2

REMOVING A ROAD WHEEL

Remove the hub cover 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 of the wheelbrace and not a levering movement.

Apply the hand brake, slacken the four nuts securing the road wheel to the hub, and raise the car with the jack (Section O.6). 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.3

REMOVING TYRES

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 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.4

FITTING TYRES

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.

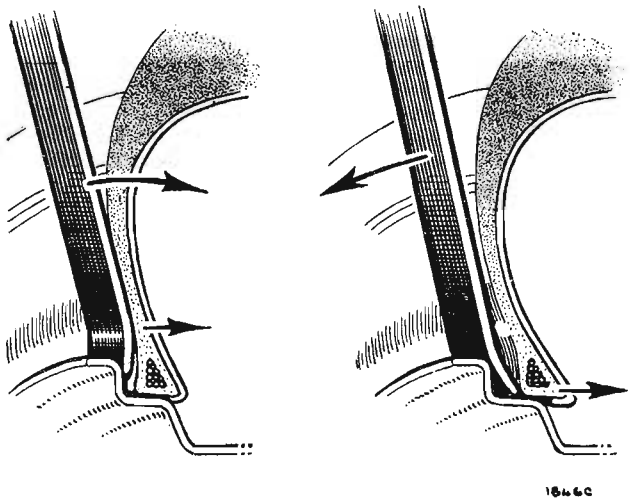

Fig. O.4

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.

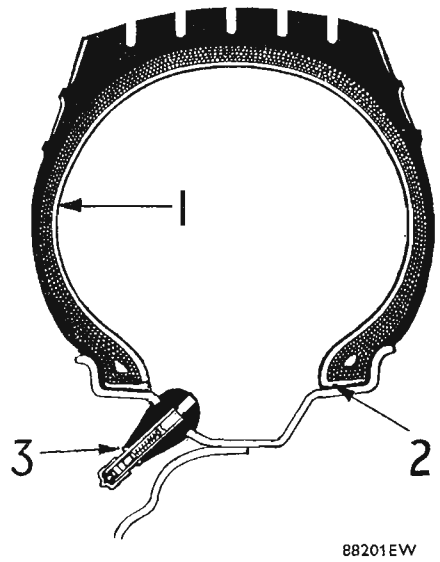

Fig. O.5

A section through a tubeless tyre

1. Air-retaining liner. 2. Rubber air seal.
3. Rubber-sealed valve.

Rim preparation

Remove any visible dents in the flange by careful hammering. 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 smoothed out. In extreme cases of rusting it may be necessary to use a wire brush or file. File or buff away any high-spots at the butt-weld joint. 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 petrol (gasoline).** 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

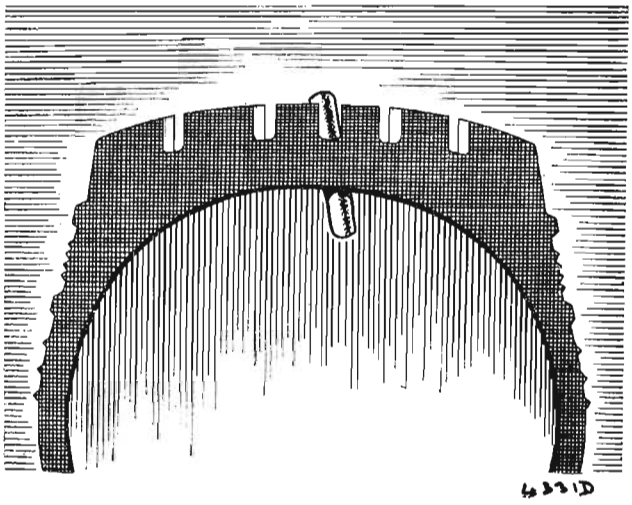

Fig. O.6

The plug inserted in the tyre and cut off to the correct length

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 of the following points.

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 be cured by holding the bead away from the rim to allow further cleaning.

The wheel rivets: in this case and in extreme cases of leakage in the area of the bead seat 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 heads of the rivets.

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.

NOTE.—Ensure the correct tyre pressure before refitting the wheel assembly to the vehicle and driving away.

Section O.5

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.

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.6). 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.)

Section O.6

JACK

The jack is designed to lift one side of the car at a time. Apply the hand brake, and if the car is on an incline it is advisable to scotch one of the wheels on the opposite side of the car to the one being jacked.

Remove the plug from the jacking socket located in the door sill panel and insert the lifting arm of the jack. Make certain that the jack lifting arm is pushed fully into the socket and that the base of the jack is on firm ground. Operate the ratchet-type jack handle until the car has been raised to the desired height.

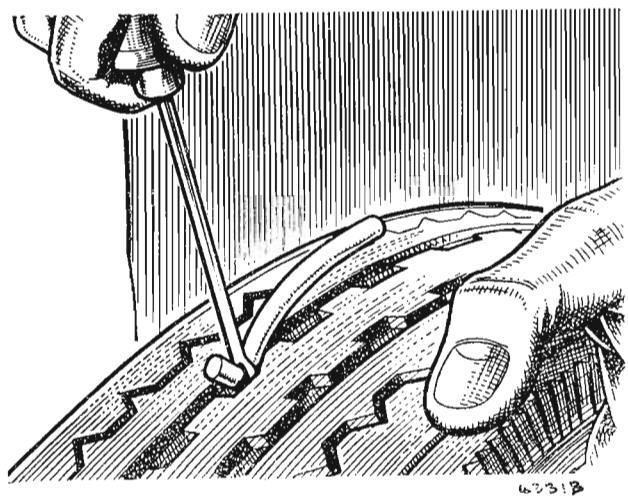

Fig. O.7

Inserting the plug and needle through a hole in the tyre

SECTION P

LUBRICATION

	Section
Recommended lubricants	P.1
Daily attention	P.2
Engine	
1,000 miles (1600 km.) service	P.3
Steering gear	
Propeller shaft	
Hand brake compensator	
Hand brake cable	
Gearbox	
Rear axle	
Carburetter dampers	
Carburetter controls	
Clutch and brake pedal linkage	
3,000 miles (4800 km.) service	P.4
Engine oil change	
Miscellaneous items	
6,000 miles (9600 km.) service	P.5
Distributor	
Gearbox oil change	
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Engine oil filter	
Water pump	
Front wheel hubs	
12,000 miles (19200 km.) service	P.6
Engine-flushing	
Steering-rack	
Dynamo	
Speedometer and tachometer cables	

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.

Section P.1 RECOMMENDED LUBRICANTS

A ENGINE

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

GEARBOX

All conditions	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

B REAR AXLE (HYPOID) AND STEERING GEAR

All conditions down to 10° F. (—12° C.)	Duckham's Hypoid 90	Castrol Hypoy	Esso Gear Oil G.P. 90	Mobilube G.X. 90	Shell Spirax 90 E.P.	Energol E.P. S.A.E. 90	Hypoid Filtrate Gear 90	Ambroleum E.P. 90
Arctic consistently below 10° F. (—12° C.)	Duckham's Hypoid 80	Castrol Hypoy Light	Esso Gear Oil G.P. 80	Mobilube G.X. 80	Shell Spirax 80 E.P.	Energol E.P. S.A.E. 80	Hypoid Filtrate Gear 80	Ambroleum E.P. 80

C LUBRICATION NIPPLES AND WHEEL HUBS

Wheel hubs, hand brake cable, and lubrication 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.
Alternative for all lubrication nipples **except** hand brake cable and wheel hubs	Duckham's NOL E.P. 140	Castrol Hi-Press	Esso Gear Oil G.P. 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

D UTILITY LUBRICANT, S.U. CARBURETTER DASHPOT, 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

Section P.2

DAILY ATTENTION

ENGINE

Inspect the oil level in the engine, and top up if necessary to the 'MAX' mark on the dipstick. The oil filler cap is on top of the engine valve 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.

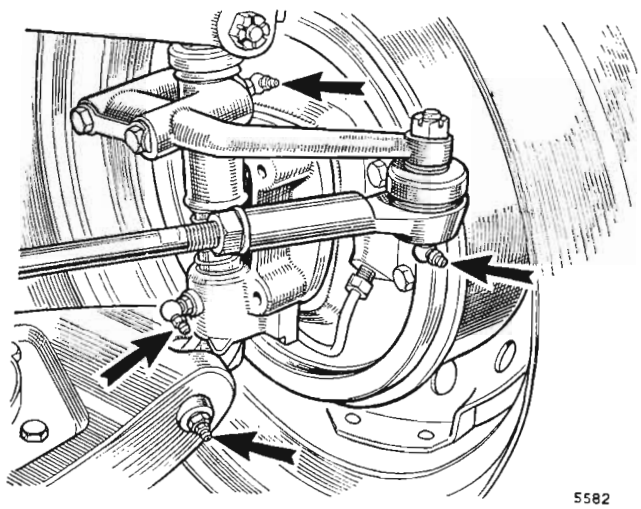

Fig. P.1

The four steering gear nipples on the left-hand wheel assembly

STEERING GEAR

A lubricating gun filled with lubricant to Ref. C (page P.2) should be applied to each of the eight steering gear nipples and three or four strokes given. Nipples are provided on both lower arm joints where they meet the swivel axle housings and on the two tie-rod ball joints. There are two nipples on each swivel axle pin which are best lubricated when the weight of the car has been taken off the suspension with a jack or sling. This will allow the lubricant to penetrate around the bushes more effectively.

PROPELLER SHAFT

The needle-type universal joint at each end of the propeller shaft is provided with a nipple which should receive two or three strokes with a gun filled with oil or grease to Ref. C (page P.2). Access to the front universal joint is gained by lifting the floor covering and removing the rubber plug on the left-hand side of the propeller shaft tunnel. If necessary, move the car to bring the nipple in line with the tunnel hole.

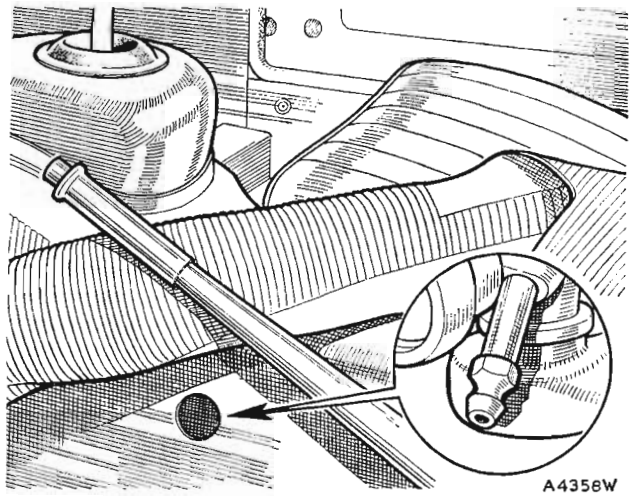

Fig. P.2

The lubricating nipple for the front universal joint. The sliding joint is lubricated from the gearbox

HAND BRAKE COMPENSATOR

There is one lubricating nipple on the top of the hand brake compensating lever, and this is accessible from underneath the rear of the car. Wipe away all the dirt from the nipple and give one or two strokes with a gun filled with oil or grease to Ref. C (page P.2).

Lubricate the clevis pin joints with an oilcan filled with oil to Ref. D (page P.2).

HAND BRAKE CABLE

The hand brake cable nipple located just forward of the rear axle must receive three or four strokes with a grease gun filled with **grease** to Ref. C (page P.2).

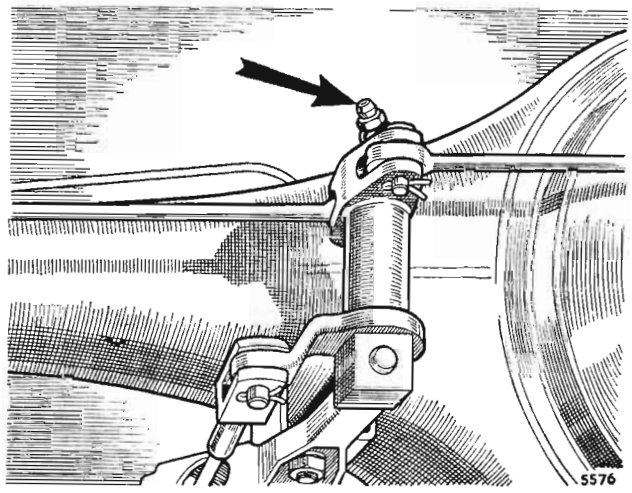

Fig. P.3

The arrow indicates the brake compensator lubricating nipple

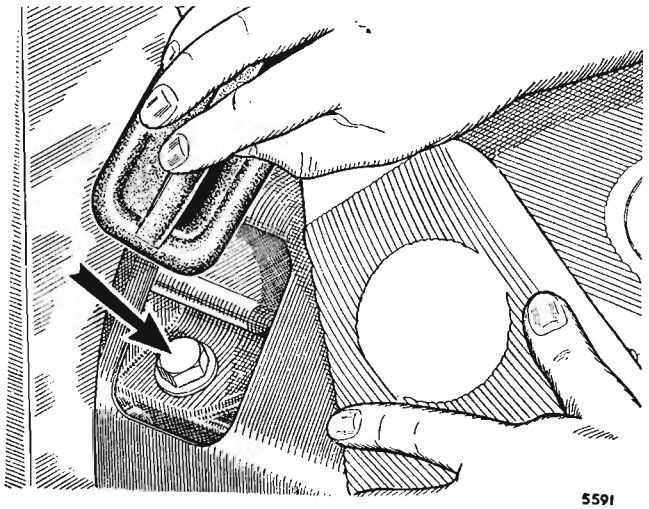

Fig. P.4

The gearbox oil level and filler plug

GEARBOX

Remove the combined filler and level plug on the gearbox extension and top up the oil level to the bottom of the filler hole with oil to Ref. A (page P.2). Access to the plug is gained by lifting the floor covering and removing the rubber plug on the left-hand side of the gearbox cover.

REAR AXLE

The combined filler and level plug situated on the rear of the axle casing is reached from underneath the rear of the car. Use a square key. The oil should be replenished if necessary to the level of the filler plug hole with oil to Ref. B (page P.2).

NOTE.—It is essential that only Hypoid oil be used in the rear axle.

CARBURETTER DAMPERS

Unscrew the caps from the tops of the suction chambers, pour in a small quantity of oil to Ref. D (page P.2), and replace the caps. In no circumstances should a heavy-bodied lubricant be used. Failure to lubricate the piston dampers will cause the pistons to flutter and will reduce acceleration.

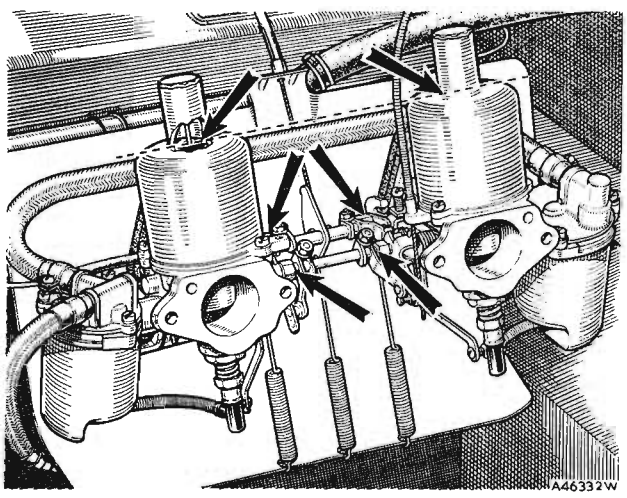

Fig. P.5

Top up the carburetter dampers to the level shown and lubricate each of the throttle linkage joints indicated

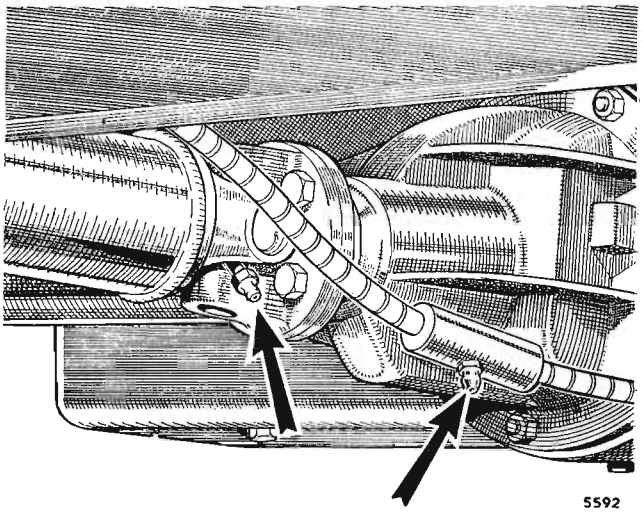

Fig. P.6

The arrows indicate the rear universal joint and hand brake cable lubricating nipples

CARBURETTER CONTROLS

Using an oil to Ref. D (page P.2), lubricate lightly all carburetter linkages.

CLUTCH AND BRAKE PEDAL LINKAGE

Using an oil to Ref. D (page P.2), lubricate lightly all brake and clutch linkage joints.

Section P.4

3,000 MILES (4800 Km.) SERVICE

Carry out the instructions detailed in Section P.3 and continue with the following.

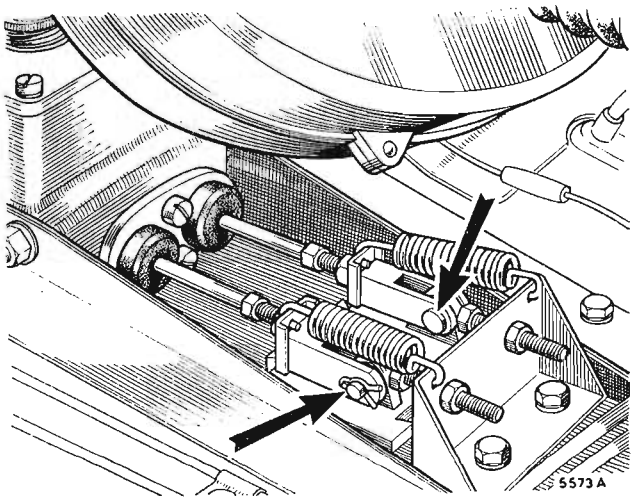

Fig. P.7

The arrows indicate the clutch and brake pedal linkage joints

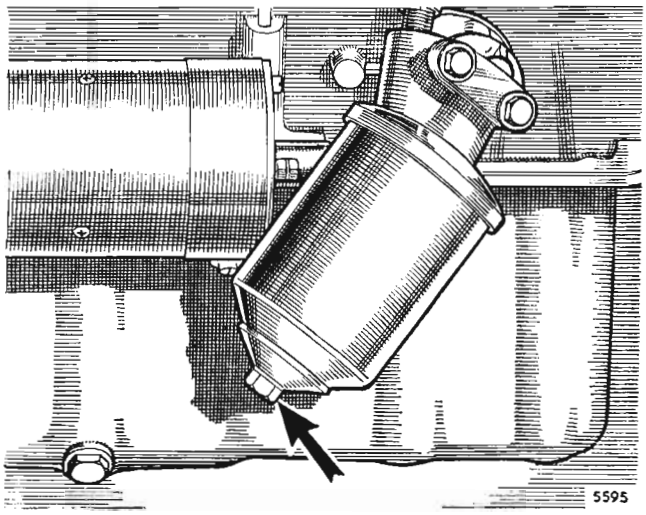

Fig. P.8

Indicated by the arrow is the centre-securing bolt for the engine oil filter

ENGINE OIL CHANGE

Drain the oil from the engine by removing the drain plug on the right-hand side of the engine sump after a journey when the oil is still warm. The sump capacity is 6·5 pints (7·8 U.S. pints, 3·7 litres), including the oil filter.

MISCELLANEOUS ITEMS

With an oilcan filled with oil to Ref. D (page P.2) lubricate lightly the door locks, hinges, and bonnet lock mechanism.

Section P.5

6,000 MILES (9600 Km.) SERVICE

Carry out the instructions detailed in Sections P.3 and P.4 except those under 'GEARBOX' and 'REAR AXLE' (Section P.3) and continue with the following.

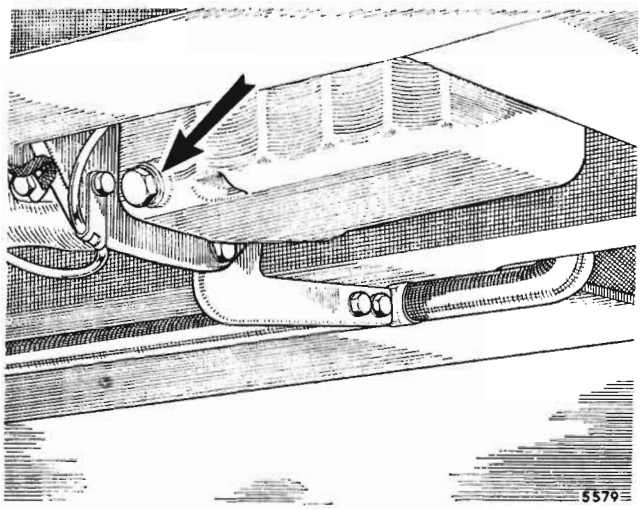

Fig. P.9

The engine sump drain plug

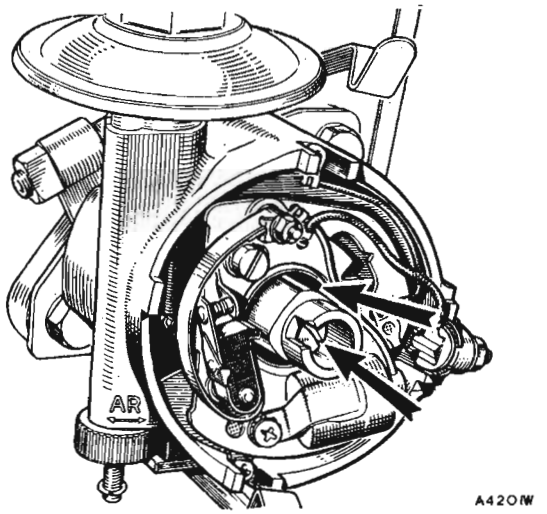

Fig. P.10

Add a few drops of thin engine oil as indicated by the lower arrow to lubricate the cam bearing. Apply a smear of grease to the cam

DISTRIBUTOR

Cam bearing

Lift the rotor off the top of the spindle by pulling it squarely and add a few drops of oil to Ref. D (page P.2) to the cam bearing. Do not remove the screw which is exposed. There is a clearance between the screw and the inner face of the spindle for the oil to pass.

Cam

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 may be used.

Automatic timing control

Carefully add a few drops of oil to Ref. D (page P.2) through the hole in the contact breaker base through

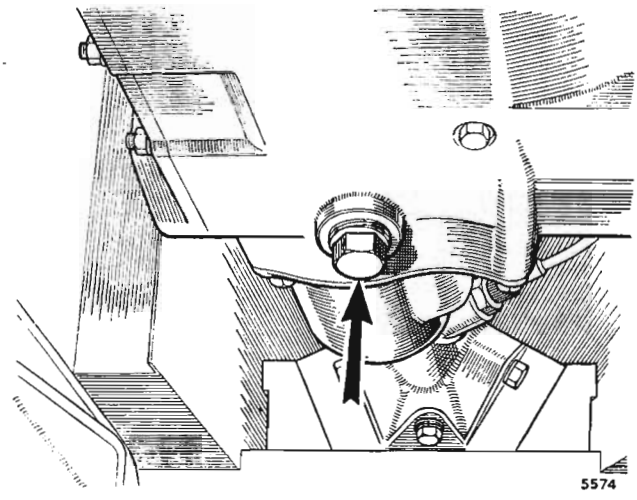

Fig. P.11

The gearbox drain plug

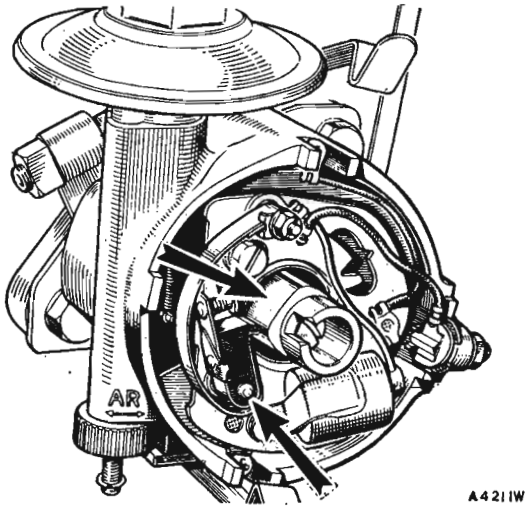

Fig. P.12

The moving contact pivot pin and the automatic timing control mechanism should receive a few spots only of thin engine oil

which the cam passes. Do not allow the oil to get on or near the contacts. Do not over-oil.

Contact breaker pivot

Add a spot of oil to Ref. D (page P.2) to the moving contact pivot pin.

GEARBOX OIL CHANGE

Drain the gearbox oil when the oil is warm by removing the hexagon-headed plug from the base of the gearbox. Ensure that the hollow centre of the drain plug is kept clean. The capacity of the gearbox is 2·25 pints (2·7 U.S. pints, 1·3 litres).

REAR AXLE OIL CHANGE

Remove the drain plug with a square key and drain out the oil while it is warm. Refill with **Hypoid** oil to Ref. B (page P.2) to the level of the filler plug hole.

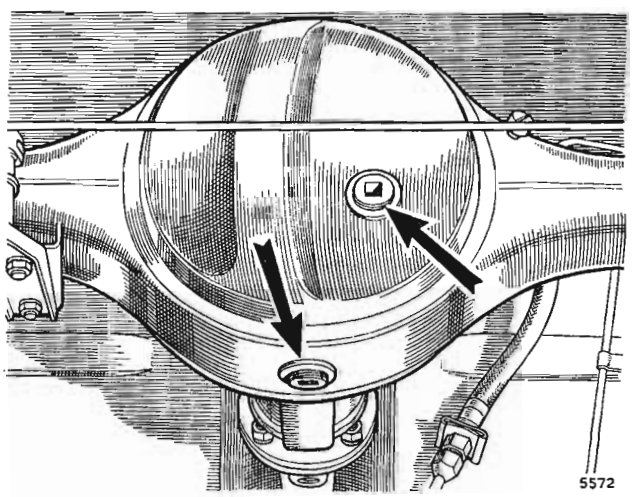

Fig. P.13

The rear axle oil filler and drain plugs

Approximately 1·5 pints (1·8 U.S. pints, ·85 litre) of oil are required to refill the axle.

ENGINE OIL FILTER

Fit a new external engine oil filter element.

The oil filter is of the full-flow type and the bowl should be washed in fuel. The filter is released by unscrewing the central bolt securing the filter to the filter head. When refitting ensure that the seating washer for the filter body is correctly positioned, clean, and serviceable. Care must also be taken to ensure that the washers below the element inside the bowl are fitted correctly. The small felt washer must be positioned between the element pressure plate and the metal washer above the pressure spring. It is essential for correct oil filtration that the felt washer should be in good condition and be a snug fit on the centre-securing bolt.

WATER PUMP

Remove the water pump oiling plug on the water pump casing and add a small quantity of S.A.E. 140 oil.

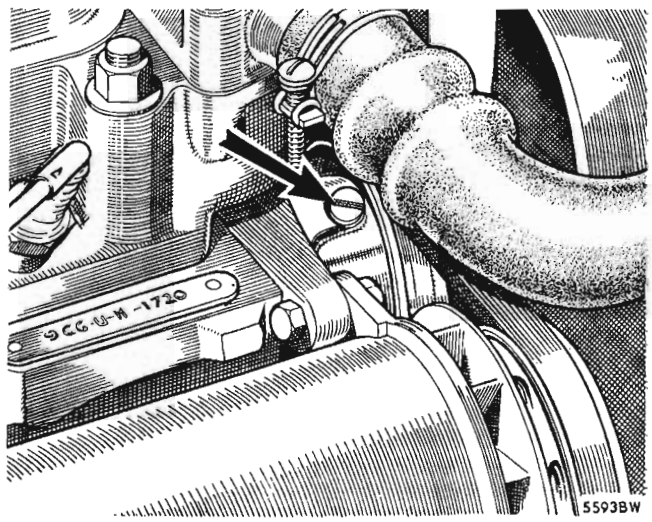

Fig. P.14

The water pump oiling plug

The oiling of the pump must be done very sparingly, otherwise oil will flow past the bearings onto the face of the carbon sealing ring and impair its efficiency.

FRONT WHEEL HUBS

Remove the front wheel hub covers and prise off the grease-retaining cap from the end of each hub.

Refill with **grease** to Ref. C (page P.2) and replace.

Section P.6

12,000 MILES (19200 Km.) SERVICE

Carry out the instructions detailed in Sections P.3, P.4, and P.5 and proceed with the following.

ENGINE-FLUSHING

Flush the engine with a flushing oil supplied by one of the recommended manufacturers (page P.2). This operation must be carried out prior to oil filter changing. Use approximately half the normal sump capacity and run the engine for 2½ to 3 minutes at a fast tick-over, after which special care must be taken to ensure complete draining of the flushing oil.

It is recommended that at 24,000 miles (38400 km.) the sump and oil pump pick-up strainer should be removed for cleaning.

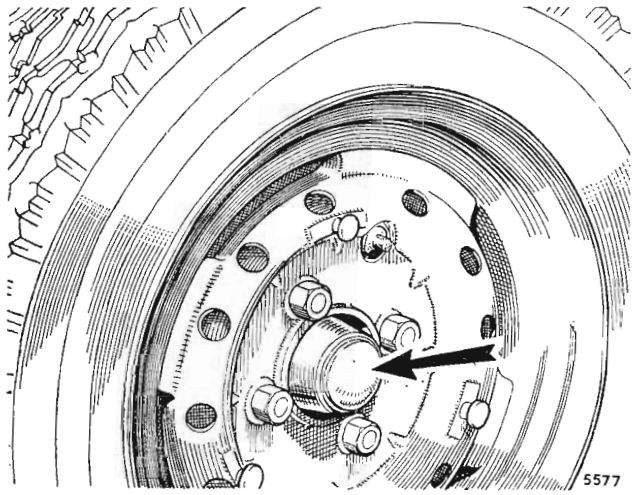

Fig. P.15

A front wheel hub grease-retaining cap

STEERING-RACK

The oil nipple provided at the left-hand side of the rack housing (right-hand side on L.H.D. cars) is accessible when the bonnet is raised. Apply the gun filled with oil to Ref. B (page P.2) and give 10 strokes **only.**

DYNAMO

Unscrew the lubricator, withdraw the felt pad, and half-fill with grease to Ref. C.

SPEEDOMETER AND TACHOMETER CABLES

Unscrew the speedometer and tachometer drive cable outer casings from the instrument heads. Extract their inner cables and lubricate sparingly with grease to Ref. C (page P.2). Oil must not be used. After replacing each cable in its outer casing withdraw the upper end approximately 8 in. (20 cm.) and wipe off the surface grease before reconnecting it to the instrument head.

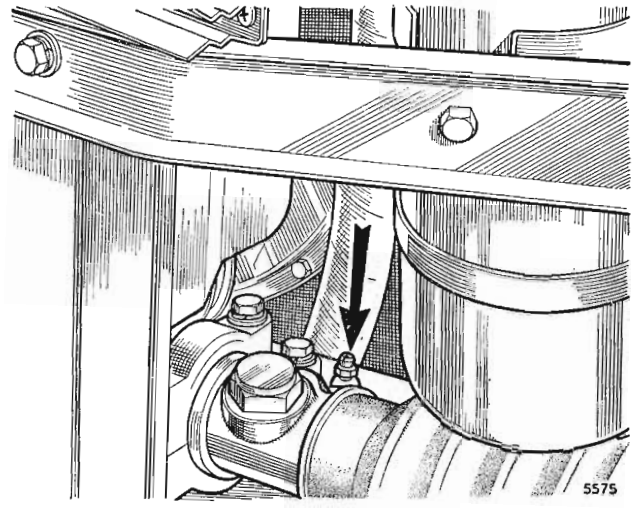

Fig. P.16

The arrow indicates the position of the steering-rack oil nipple

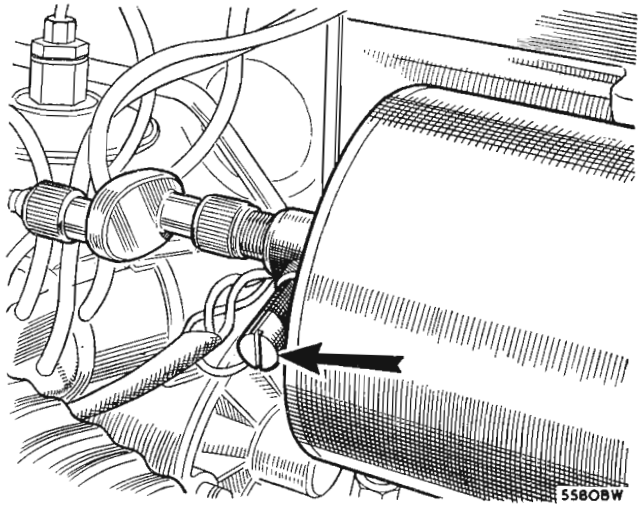

Fig. P.17

The dynamo lubricator cap

SECTION R

THE BODY

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Body	
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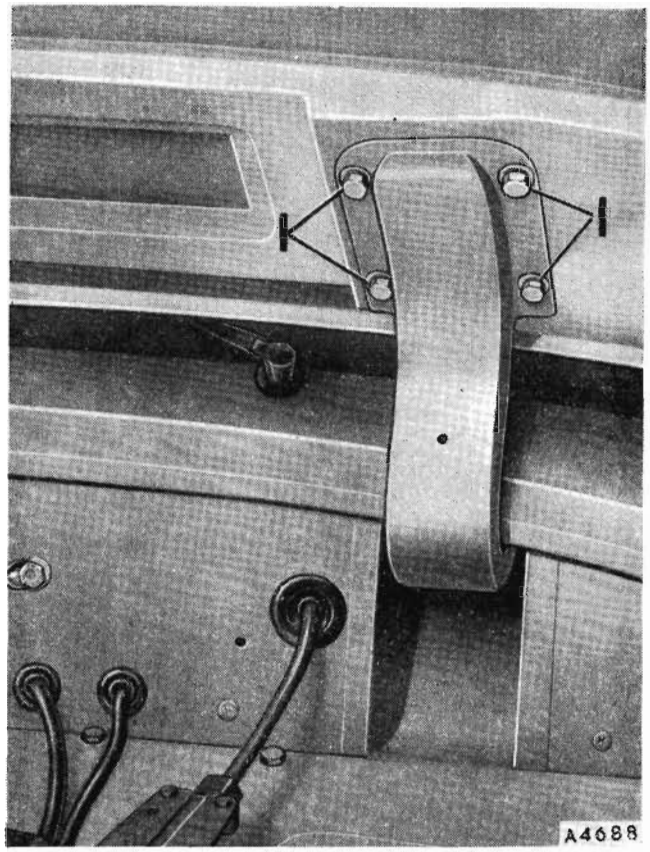


Fig. R.1
The bonnet to hinge securing set screws are shown at (1)

Section R.1

BODYWORK

Coachwork, wings, and windshield

Regular attention and care to the body finish is necessary if the new appearance of the car exterior is to be maintained against the effect of air pollution, rain, and mud.

Frequent washing of the bodywork, using a soft sponge with plenty of water containing a mild detergent, is recommended. Large deposits of mud must be softened with water before using the sponge. When clean, dry the surface of the car with a damp chamois-leather. Any damaged parts should immediately be covered with paint and a complete repair effected as soon as possible. Before 'touching in' light scratches and abrasions with paint ensure that all traces of wax polish are removed from the affected area.

Methylated spirits (denatured alcohol) should be used to remove spots of grease or tar from the bodywork, windshield, and bright parts of the car.

The application of a good-quality liquid polish is recommended to give added lustre to the paintwork. Do not allow silicone- or waxed-based polishes to come into contact with the windshield; they have been known to have a detrimental effect on the wiper blades and are difficult to remove.

Bright trim

Metal polish must not be used to clean chromium, plastic, stainless steel, or anodized aluminium bright parts. Wash them frequently with soap and water, and when the dirt has been removed polish the surface with a clean, dry cloth or chamois-leather until they are bright. Never use an abrasive.

A slight tarnish may be found on stainless steel that has not been washed regularly, and this can be removed with impregnated wadding such as is used for silverware.

Surface deposits on chromium parts can be removed with a chromium cleaner.

An occasional application of wax polish or light mineral oil to the metal trim will help to preserve the finish, particularly in the winter when salt has been used on the roads. These protectives should not be applied to plastic finishes.

Cleaning the hood

To clean the hood it is only necessary to use soap and water, with a soft brush to remove any ingrained dirt. Frequent washing with soap and water considerably improves the appearance and wearing qualities of the hood, and it should be washed at least as often as the rest of the car.

Do not use caustic soaps, detergents, or spirit cleaners to clean the hood or the hood back-light.

Section R.2

BONNET

Removing

Remove the set screws securing each hinge to the under side of the bonnet and lift the bonnet complete with the bonnet prop clear of the vehicle.

To assist when refitting, as the fit of the bonnet will be disturbed during removal, it is advisable to mark the position of the hinges on their mounting brackets on the bonnet; this is best carried out by outlining the profile of the hinge levers where they contact the mounting brackets on the bonnet.

Refitting

Reverse the removal procedure.

Section R.3

RADIATOR GRILLE

Removing

The top bolts and nuts securing the radiator grille to the front body section are easily accessible when the bonnet is raised or removed. Working beneath the car, remove the lower grille securing bolts and lift the grille assembly away from the vehicle.

Refitting

Refitting is a reversal of the removal procedure.

Section R.4

BUMPERS

Front

Removing

The front bumper, when fitted, can be lifted away from the vehicle after the securing nuts and washers have been removed.

Refitting

Reverse the removal procedure.

Rear

Removing

Remove the rear bumper bracket securing set screws and remove the bumper, together with its brackets.

Refitting

Reverse the removal procedure.

Section R.5

WINDSHIELD AND SIDESCREENS

Windshield

Removing

Remove the Phillips screws securing the windshield to the side pillars and slide the windshield out of the pillars. The pillars themselves are attached to the scuttle by one Phillips screw and one bolt, the nut of which is accessible when the door is open.

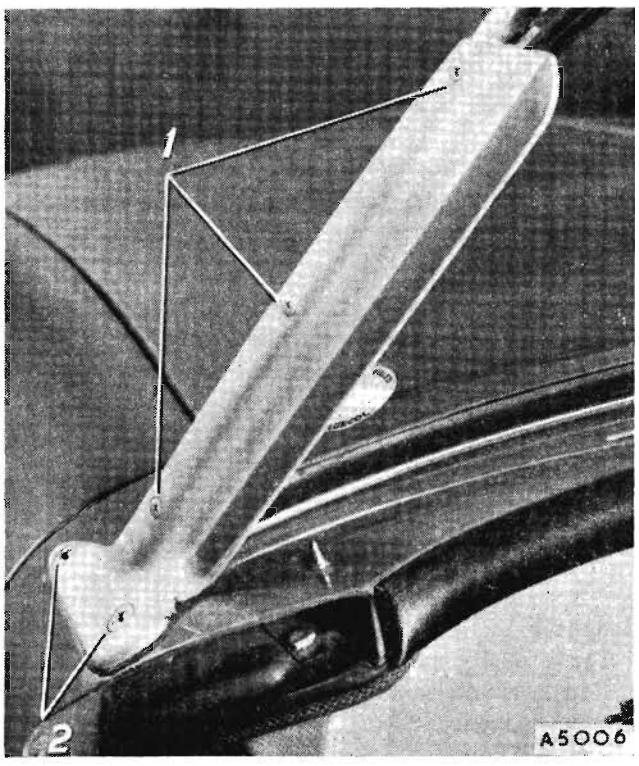


Fig. R.2

Windshield pillar and fascia

1. Pillar to body screws. 2. Windshield to pillar screws.

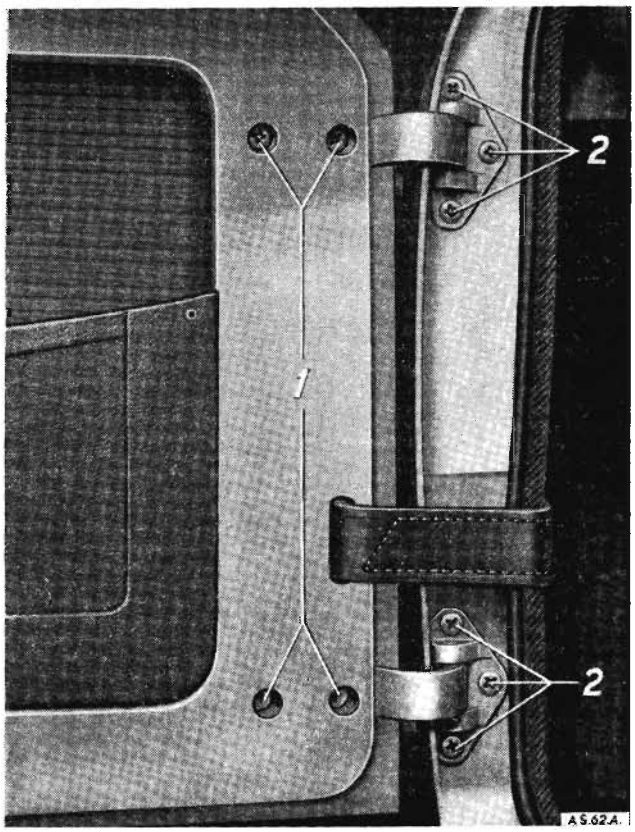


Fig. R.3

Hinge screws

1. Door to hinge screws. 2. Hinge to pillar screws.

Refitting

Reverse the removal procedure.

Sidescreens

Each sidescreen has two clamping brackets at its base which are held by two large-headed set screws at the door top moulding.

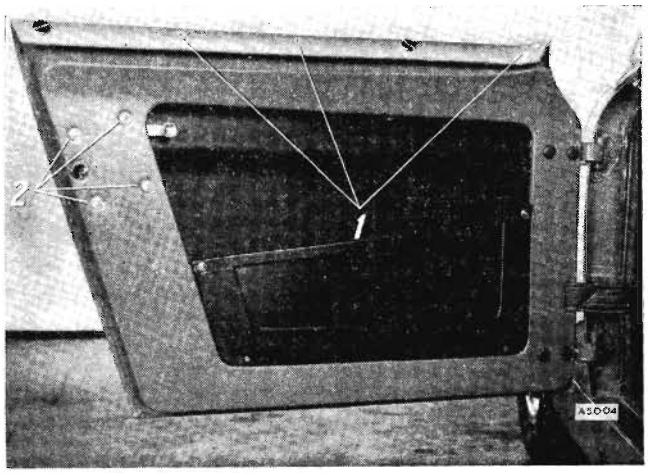


Fig. R.4

The sidescreen, top moulding, and door lock fixings

Fig. R.5
Seat frame securing points

Section R.6

DOORS

Door and hinges

Removing

Both the upper and lower hinge of each door is secured to the door pillar by three Phillips screws. At the door frame each hinge is secured by two Phillips screws.

There is a check strap fitted to each door which must be released when removing a door from the body. This can be done by withdrawing the two set screws from the coupling bracket on the inside of the door pillar. With the door wide open, the hinges can readily be uncoupled from the door pillar and the door and hinges removed.

Refitting

When refitting, reverse the removal procedure.

Door catch and operating handle

Removing

The catch and operating handle complete may be withdrawn by removing the securing set screws positioned inside the door.

Refitting

Reverse the removal procedure.

Section R.7

FASCIA PANEL AND COCKPIT MOULDINGS

Fascia panel

Removing

Remove the steering-wheel as described in Section J. Remove the securing nuts and bolts along the top edge of the fascia.

Remove the Phillips screws securing the fascia at the bottom edge together with the set screws behind the steering-column surround.

Remove the speedometer and tachometer drives at their instrument unions and disconnect the oil pressure pipe from behind the combined oil pressure and water temperature gauge. It is advisable to withdraw the water thermal element from its connection with the radiator.

Release the starter and choke cables. The fascia can then be brought forward into the cockpit, giving access to the rear of each instrument.

Refitting

Reverse the removal procedure.

Cockpit moulding

Removing

The front and rear cockpit mouldings can readily be lifted away from the vehicle after removing the Phillips securing screws.

The door top mouldings are secured in a similar manner.

Refitting

Refitting in each case is a reversal of the removal procedure.

Section R.8

SEATS

Passenger's seat

Removing

Lift out the seat cushion and remove the seat frame securing nuts.

Seat adjustment can be made by releasing the seat frame bracket securing set screws.

Refitting

Refitting is a reversal of the removal procedure.

Driver's seat

Removing

Lift out the seat cushion and remove the frame to runner securing nuts. Remove the bolts and nuts securing the runners to the body floor and lift out the runners.

Refitting

Reverse the removal procedure, ensuring that the seat runner packing pieces are fitted correctly.

An adjustable seat is provided for the driver; it can be moved forwards or rearwards by pushing the lever beneath the seat towards the runner and then moving the seat to the required position and releasing the lever.

Section R.9

REPAIR PROCEDURE

Body jack

The specially designed body jack, obtainable under 18G308B, is an absolutely 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.).

Considerable thought has been given to their construction and design, and careful study of the equipment will be amply repaid.

The body jack is supplied by B.M.C. Service Ltd. A metal box in which the jack and its components can be neatly stored is supplied with the jack.

With the addition of a suitable oxy-acetylene outfit any type of mono-construction repair can be effected.

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 straightening.

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. 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.7).

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,

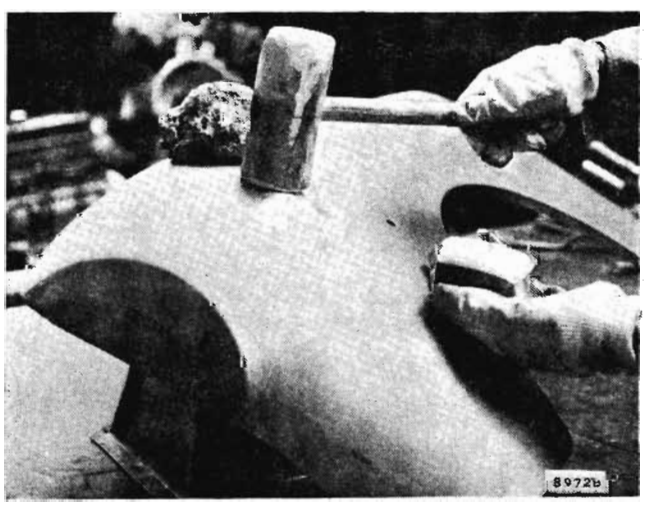


Fig. R.6
A dolly block and mallet

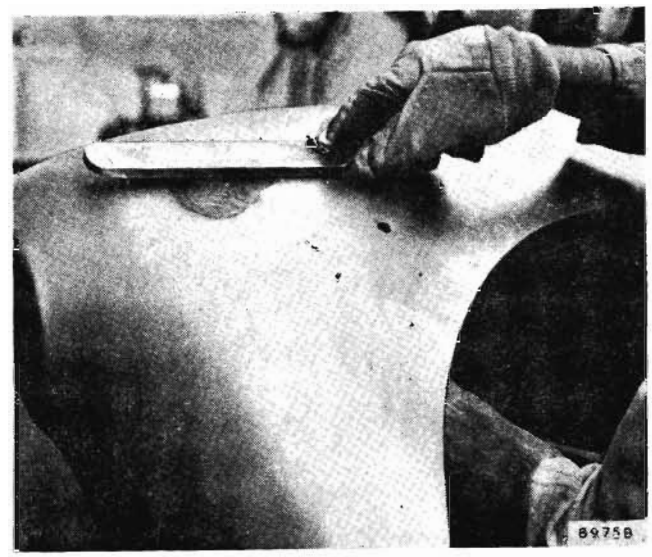


Fig. R.7
Removing a dent by tapping with a spoon; a dolly is held below the dent

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 a 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 (Fig. R.6). 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.

Alternate 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 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 plumbers' 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.

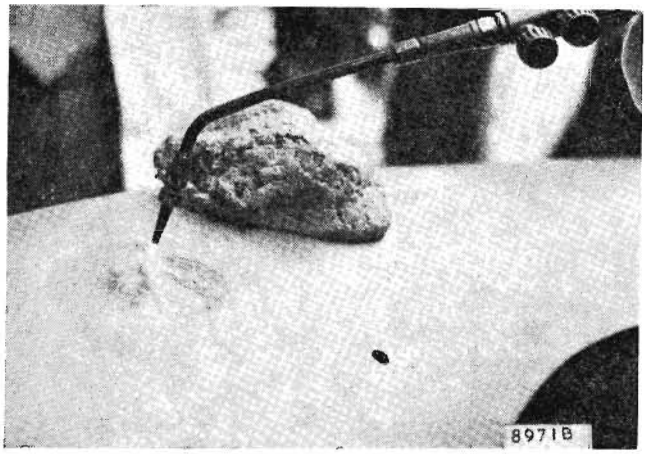


Fig. R.8

Application of heat prior to tapping with a mallet; a dolly is held below the dent while tapping

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 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.10. Press the asbestos down firmly to ensure that no air is 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

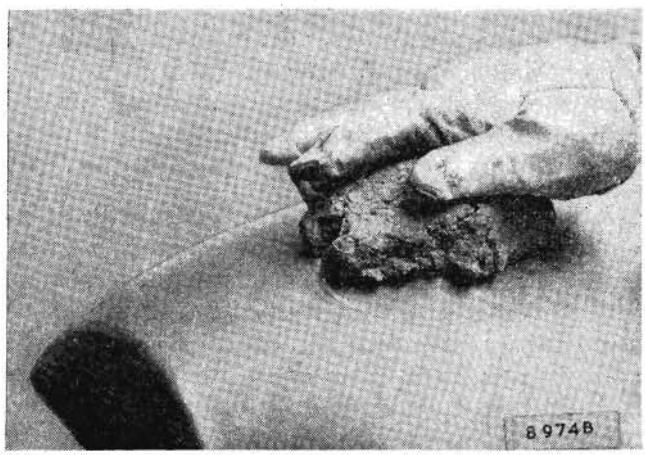


Fig. R.9

Cooling the damaged area with wet asbestos

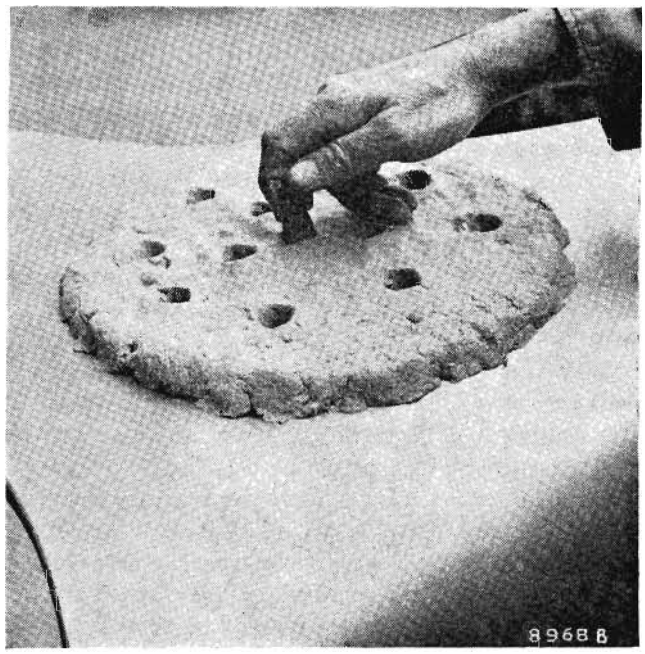


Fig. R.10

Piercing a series of holes in wet asbestos prior to the application of heat

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.11).

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

An extensively damaged panel can frequently be repaired quite satisfactorily and more economically by patching rather than by renewing the entire assembly.

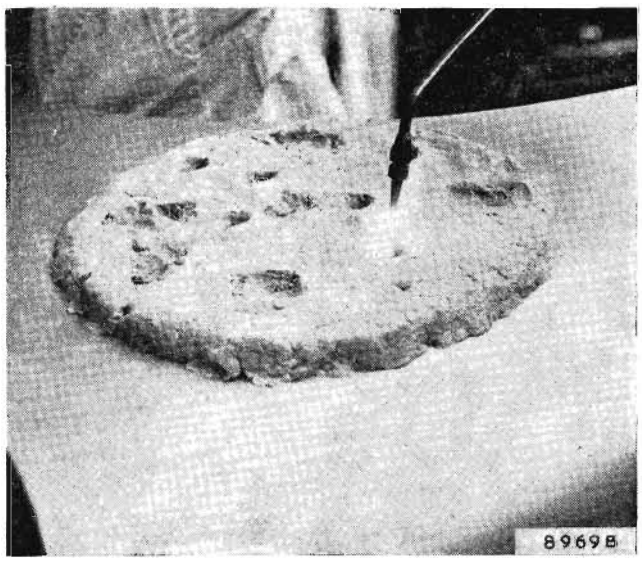


Fig. R.11

Heating the stretched panel through holes in the asbestos

This type of repair does not in the least weaken the surrounding structure, as a patch which is correctly 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.12).

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.

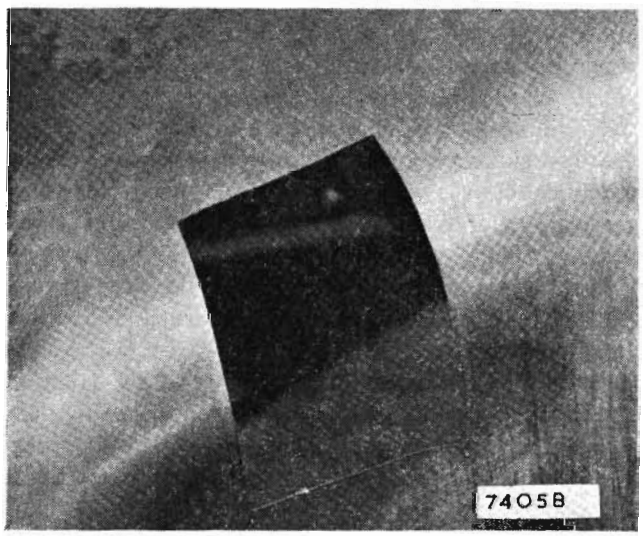


Fig. R.12
A damaged piece removed for patching

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.13). 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 $\frac{1}{4}$ in. (6 mm.) away from the joint (Fig. R.14). 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 after straightening with the dolly block and bumping hammer, the patching is finally finished by tinning and solder-filling as described in Section R.12.

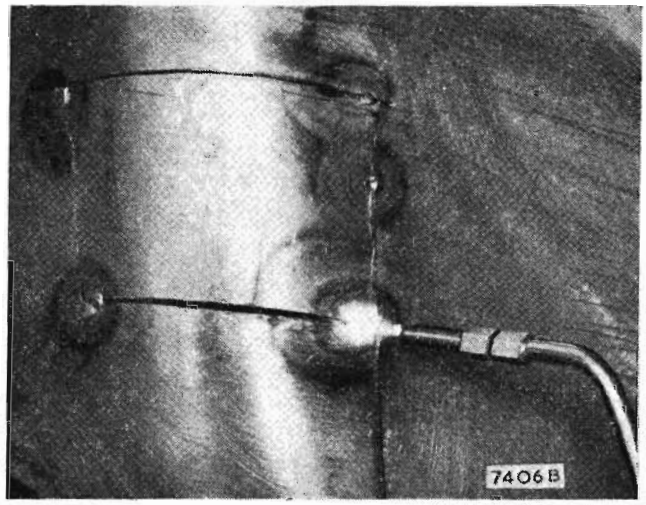


Fig. R.13
After the patch is formed it is held in position by gas-weld tacks

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-pane 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.

Fig. R.14
To prevent buckling of the surrounding metal during welding surround the joint with wet asbestos

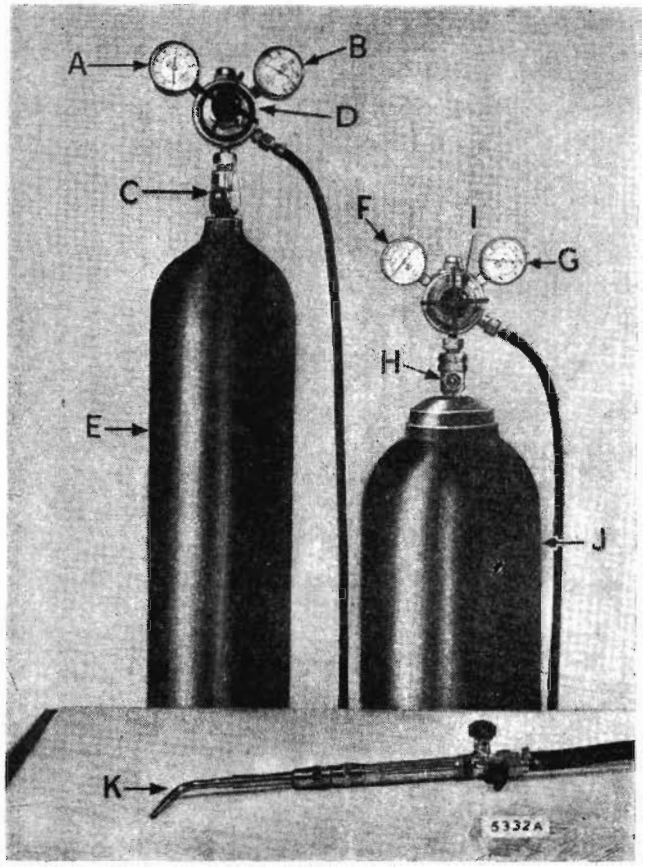


Fig. R.15

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.

Repair of beading 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 and dolly block, 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. The panels and assemblies which are available and the part numbers are given in the current Service Parts List.

The illustrations show clearly the location and types of joints used in the construction of the body, and, following the instructions already given and the instructions to follow on welding, any portion of the body can be removed, either by a hacksaw or cold chisel, and a suitable replacement fitted in position.

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.10

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. 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

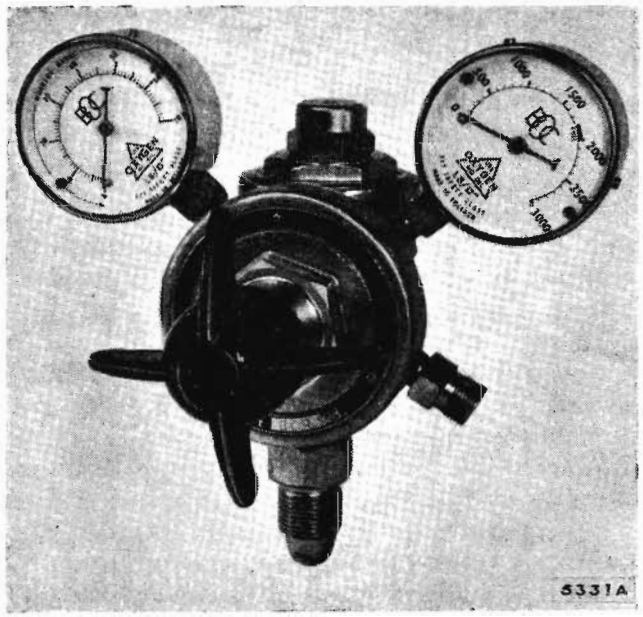


Fig. R.16

Type B.O.R.12A two-stage oxygen regulator

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 reweld 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.

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 welding operations a liberal heap of wet asbestos should be placed over the surrounding panels to prevent buckling and distortion due to heat

Fig. R.17

Type B.A.R.9 two-stage acetylene regulator

Section R.11

WELDING TECHNIQUE

The following applies to equipment supplied by the British Oxygen Co. Ltd., although it also applies, in the main, to other similar equipment.

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.*		*lb./sq. in.*	*kg./cm.²*	*cu. ft./hr.*	*m.³/hr.*
1/32	·79	1	2	·141	1	·028
3/64	1·19	2	2	·141	2	·056
1/16	1·58	3	2	·141	3	·084
3/32	2·38	5	2	·141	5	·140
1/8	3·17	7	2	·141	7	·196
5/32	3·96	10	3	·211	10	·283
3/16	4·76	13	3	·211	13	·367
1/4	6·35	18	3	·211	18	·504
5/16	7·93	25	4	·281	25	·700

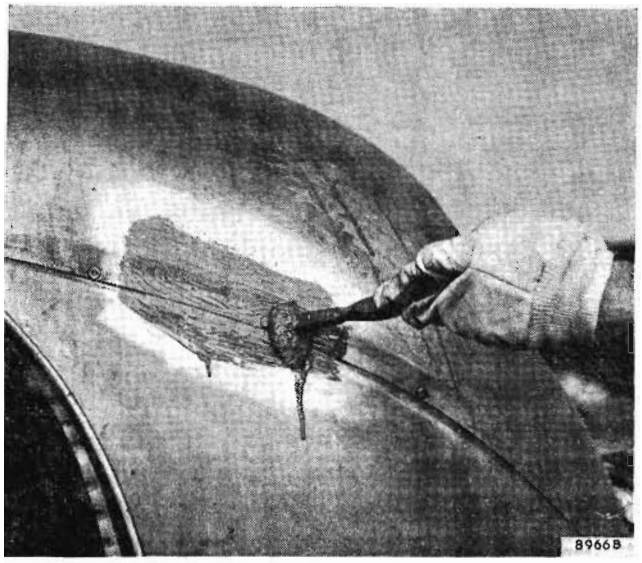


Fig. R.18
Painting the hollow area with flux

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 and grease.
(3) Open the valve on the oxygen cylinder momentarily in order to dislodge dirt or other obstruction in the cylinder valve, then close.
(4) Screw the oxygen regulator (painted BLACK) (Fig. R.16) 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) (Fig. R.17) 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 gas-tight.
(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 and 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 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, page R.9.)
(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.
(11) Set the regulators at the correct working pressures. (See the table, page R.9.)
(12) Open the acetylene control valve on the blowpipe, wait a few seconds until the 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.I.
(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 down-hand butt-welds

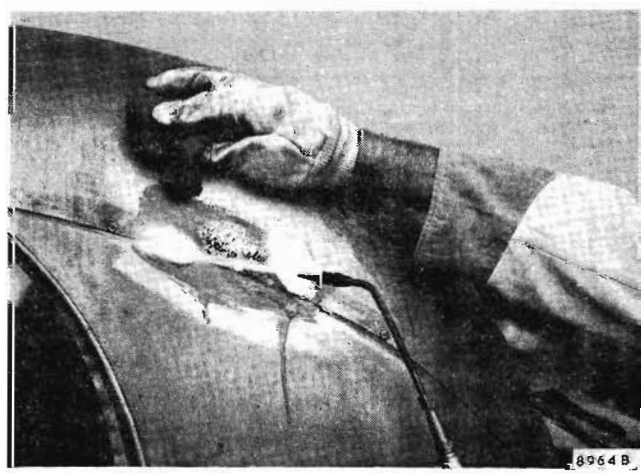


Fig. R.19
Tinning by heating the flux-painted area

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 $\frac{1}{16}$ in. thickness tacks should be slightly closer together—say, 1 to $1\frac{1}{2}$ 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 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.12

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.

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 metal 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.

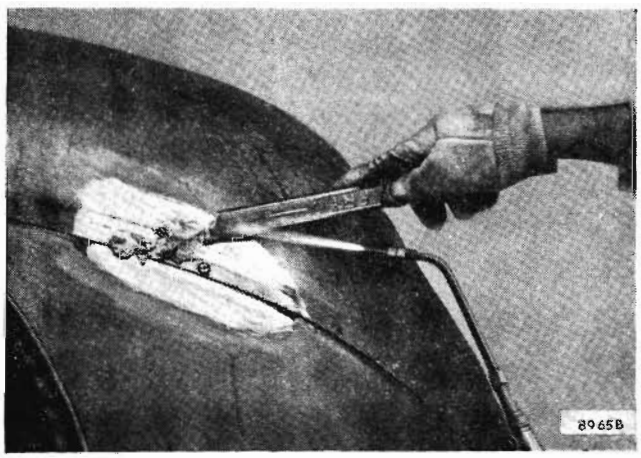


Fig. R.20
Applying the solder

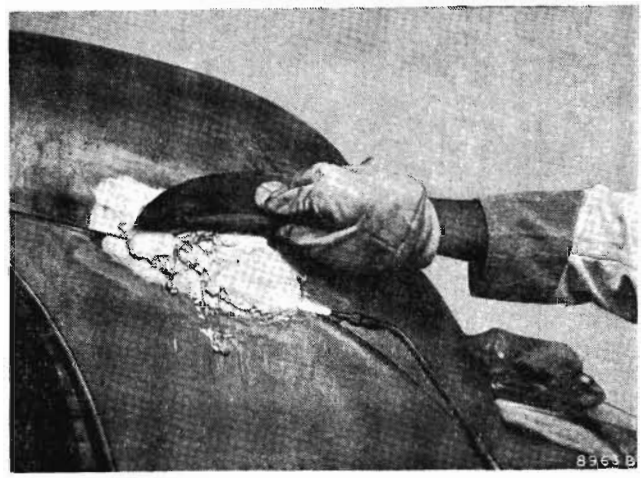


Fig. R.21
Spreading the solder

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, file, and emery-cloth. A polishing-wheel, if available, is useful for this operation.

The surface of the metal is heated gently with a blowlamp or gas-torch, and soldering flux applied with a brush. (See Fig. R.18.)

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.19). 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.20) and maintained by careful use of the torch in a plastic condition whilst it is moulded to the desired contour with a hardwood paddle coated with palm oil (Fig. R.21). 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.13

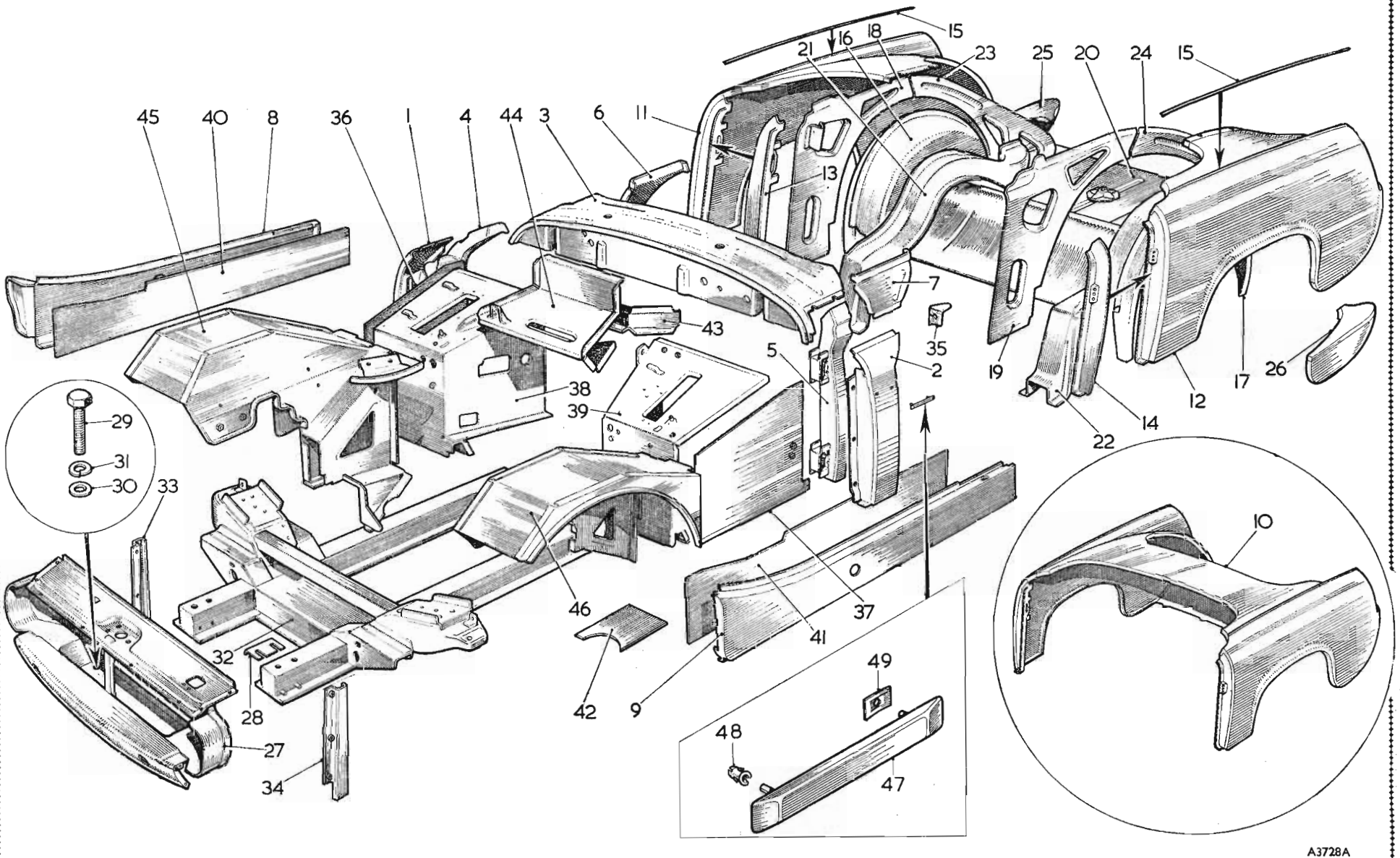
PAINT REFINISHING INSTRUCTIONS

Operation	*Material*	*Thinning*	*Drying times*	*Application*	*Instructions*
Stripping original paint	Water-soluble paint remover, e.g. Sunbeam Anti-corrosives 'Stripolene 799'	—	—	Brush	Remove the original finish with a scraper after allowing paint-strip 10 minutes to react (repeat if necessary). Wash off thoroughly with cold water, rubbing with wire wool. Dry. Blow out crevices with compressed air. Strip a small area at a time to enable correct neutralizing of the stripper
Metal abrading	Emery-cloth, e.g. Howarth Blue Twill, grade 1½ M	—	—	Hand or disc	Paper thoroughly to ensure satisfactory key. Wipe with cleaner solvent or white spirits
Acid etching	Apply Deoxidine 125 (I.C.I.)	1 part Deoxidine, 1 part water	—	Brush	Apply solution generously and rub in with wire wool. Do not allow Deoxidine solution to dry off before the wash-off operation. Allow approximately five minutes to complete reaction. Wash thoroughly with cold water to remove all traces of Deoxidine solution, followed by a hot rinse. Thoroughly dry surfaces with a clean cloth and blow out crevices with compressed air
Priming	Synthetic primer G.I.P. No. S3178	6 to 1 with Z1048	½-hour to 4 hours	Spray	Apply one thin coat of synthetic primer (recommended for superior adhesion) or one thin coat of cellulose primer (recommended for good adhesion). The use of a primer coat enhances adhesion and gives the system a much greater safety factor
	or Grey cellulose primer G.I.P. C3971 MOD	50/50 with 2045M	¼-hour	Spray	
Applying stopper	Stopper Grey G.I.P. 824D or Stopper Brown G.I.P. 1543	—	6–8 hours, or overnight if possible	Glazing knife	Apply stopper in thin layers, allowing 15–20 minutes' drying between applications. Heavy layers result in insufficient drying, with subsequent risk of cracking
Filling	Primer Filler Grey G.I.P. C3663M	50/50 with 2045M	3–4 hours	Spray	Apply two or three full coats, allowing 15–25 minutes' drying time between coats

Wet-sanding	Abrasive paper 280 grade	—	—	—	Rub down wet until smooth; a guide coat (a weak contrasting colour) may be used to ensure that the whole surface is rubbed level. Wash off thoroughly with water, sponge all sludge, wash off, dry with clean sponge. Dry off. Minimum of paint should be removed consistent with a satisfactory surface. Film thickness after rubbing should be ·0025 in. (·06 mm.) min.
Applying sealer or undercoat	Sealer Grey or Sealer White or Red undercoat (see B.M.C. Paint Scheme schedule)	50/50 with 2045M	15–20 minutes	Spray	Apply one coat, flash off
Dry-sanding or de-nibbing as required	320 grade paper	—	—	—	De-nib or dry-sand with 320 paper. Clean with white spirit. The grade of paper quoted is from the 3M Company (Minnesota Mining and Mfg. Co. Ltd.); the grade of paper may vary according to manufacture
Applying colour coats	B.M.C. body finishes (see B.M.C. Paint Scheme schedule)	50/50 with 2045M	5–10 minutes' flash between coats. Overnight dry	Spray	Apply two double coats with a 5–10-minute flash between coats. Overnight dry
Flatting colour coat	320 or 400 paper (dependent on conditions)	—	—	Hand	Flat with 320 or 400 paper, dependent on conditions
Applying final colour coat	B.M.C. body finishes (see B.M.C. Paint Scheme schedule)	50/50 with 2045M	Overnight dry	Spray	Spray final double colour coat
Polishing	Cut and polish (see B.M.C. Paint Scheme schedule)	—	—	Hand or machine	The colour coat must be thoroughly dry before polishing. After cutting, burnish to a high gloss with a clean mop, and finally clean with a liquid polish, e.g. Apollo liquid polish

NOTE.—(1) For faster drying of undercoats or local repairs G.I.P. thinners 1523 may be used.
(2) Under extreme circumstances of heat and/or humidity retarder G.I.P. Z1694 can be used added to the 2045M thinners.

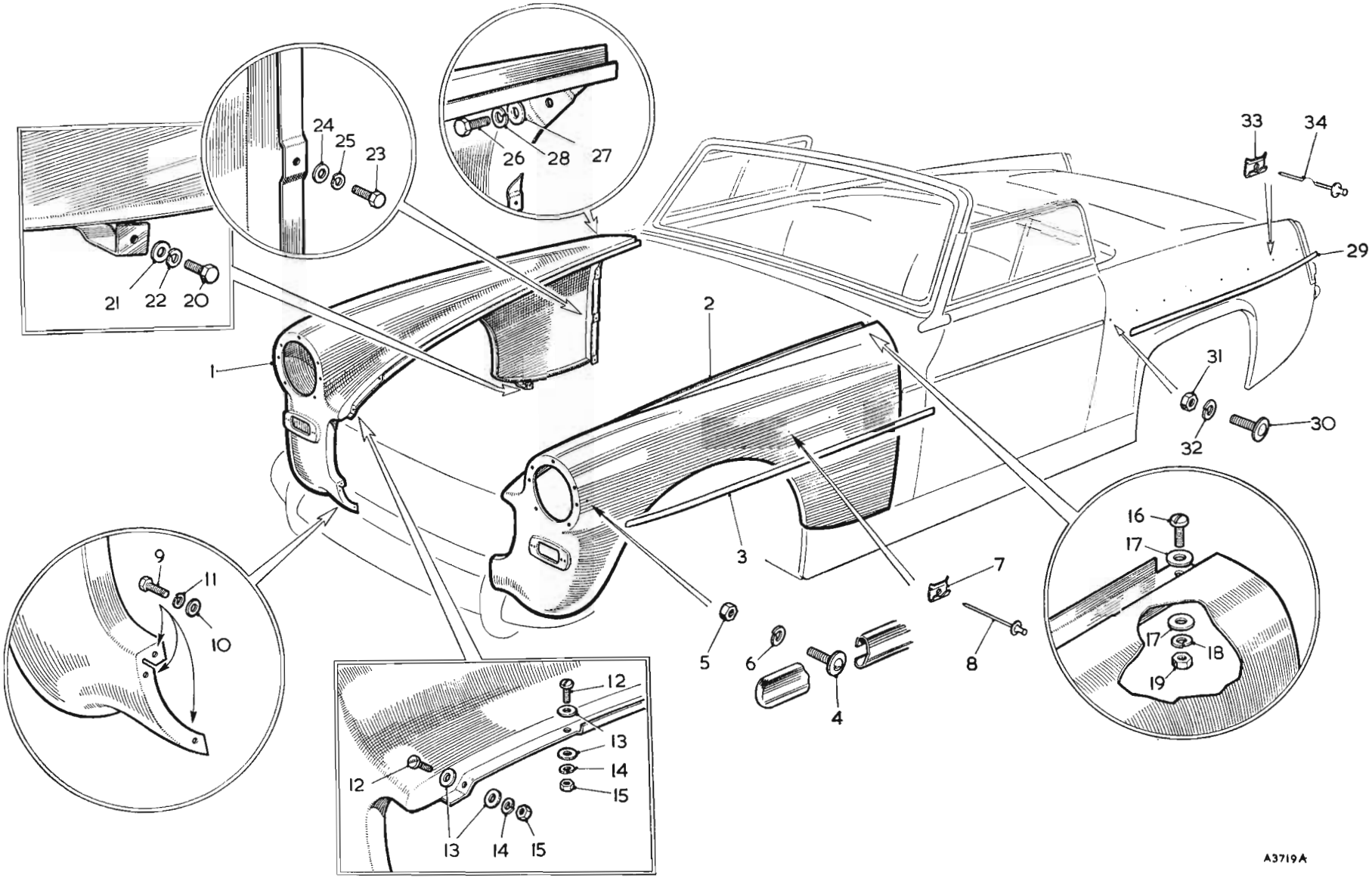
THE BODY SHELL COMPONENTS



KEY TO THE BODY SHELL COMPONENTS

No.	*Description*
1.	Shroud side panel assembly—R.H.
2.	Shroud side panel assembly—L.H.
3.	Shroud and dash top panel assembly.
4.	'A' post assembly—R.H.
5.	'A' post assembly—L.H.
6.	'A' post to scuttle extension—R.H.
7.	'A' post to scuttle extension—L.H.
8.	Outer sill panel—R.H.
9.	Outer sill panel—L.H.
10.	Rear panel assembly.
11.	Rear wing assembly—R.H.
12.	Rear wing assembly—L.H.
13.	'B' post assembly—R.H.
14.	'B' post assembly—L.H.
15.	Rear wing to panel moulding.
16.	Rear wheel arch panel assembly—R.H.
17.	Rear wheel arch panel assembly—L.H.
18.	Reinforcement assembly—R.H.
19.	Reinforcement assembly—L.H.
20.	Luggage floor panel assembly.
21.	Wheel arch to luggage floor reinforcement member—R.H.
22.	Wheel arch to luggage floor reinforcement member—L.H.
23.	Wheel arch to luggage floor gusset—R.H.
24.	Wheel arch to luggage floor gusset—L.H.
25.	Luggage floor rear extension—R.H.
26.	Luggage floor rear extension—L.H.
27.	Front end assembly.
28.	Front end to underframe shim.
29.	Front end to underframe screw.
30.	Plain washer.
31.	Spring washer.
32.	Front suspension and main beam assembly.
33.	Radiator mounting bracket assembly—R.H.
34.	Radiator mounting bracket assembly—L.H.
35.	Hand brake abutment bracket.
36.	Foot-well outer panel assembly—R.H.
37.	Foot-well outer panel assembly—L.H.
38.	Foot-well front and inner side panel assembly —R.H.
39.	Foot-well front and inner side panel assembly —L.H.
40.	Sill side plate—R.H.
41.	Sill side plate—L.H.
42.	Splash plate—L.H.
43.	Heater support platform.
44.	Heater platform assembly.
45.	Front wheel arch assembly—R.H.
46.	Front wheel arch assembly—L.H.
47.	Shroud moulding.
48.	Speed clip.
49.	Push-on fix.

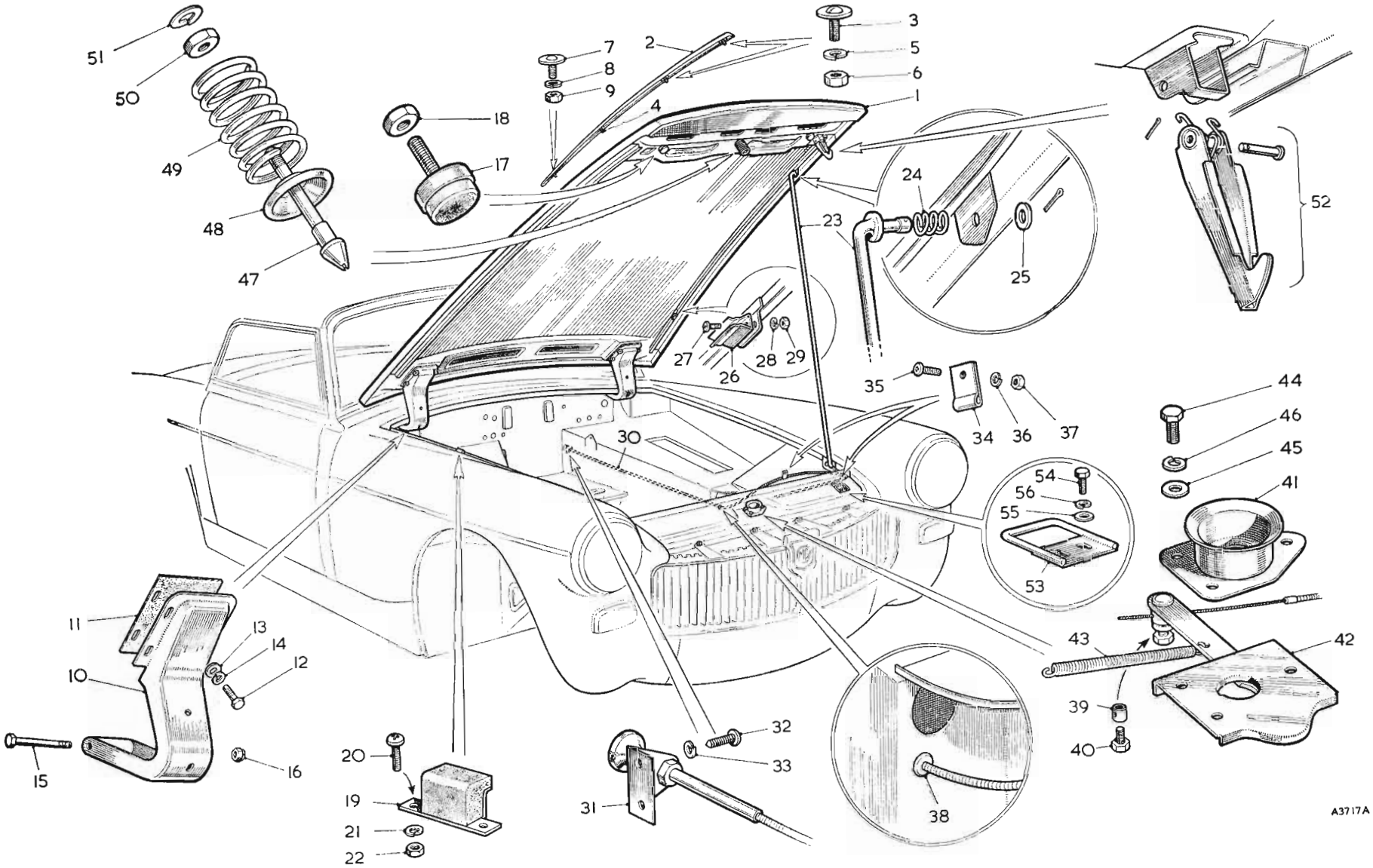
THE WING COMPONENTS



KEY TO THE WING COMPONENTS

No.	*Description*
1.	Wing assembly—R.H.
2.	Wing assembly—L.H.
3.	Front wing moulding.
4.	Moulding stud plate.
5.	Nut.
6.	Spring washer.
7.	Moulding clip.
8.	Fixing clip rivet.
9.	Screw.
10.	Washer.
11.	Spring washer.
12.	Screw.
13.	Washer.
14.	Spring washer.
15.	Nut.
16.	Screw.
17.	Washer.
18.	Spring washer.
19.	Nut.
20.	Screw.
21.	Washer.
22.	Spring washer.
23.	Screw.
24.	Washer.
25.	Spring washer.
26.	Screw.
27.	Washer.
28.	Spring washer.
29.	Rear wing moulding.
30.	Moulding stud plate.
31.	Nut.
32.	Spring washer.
33.	Moulding clip.
34.	Fixing clip rivet.

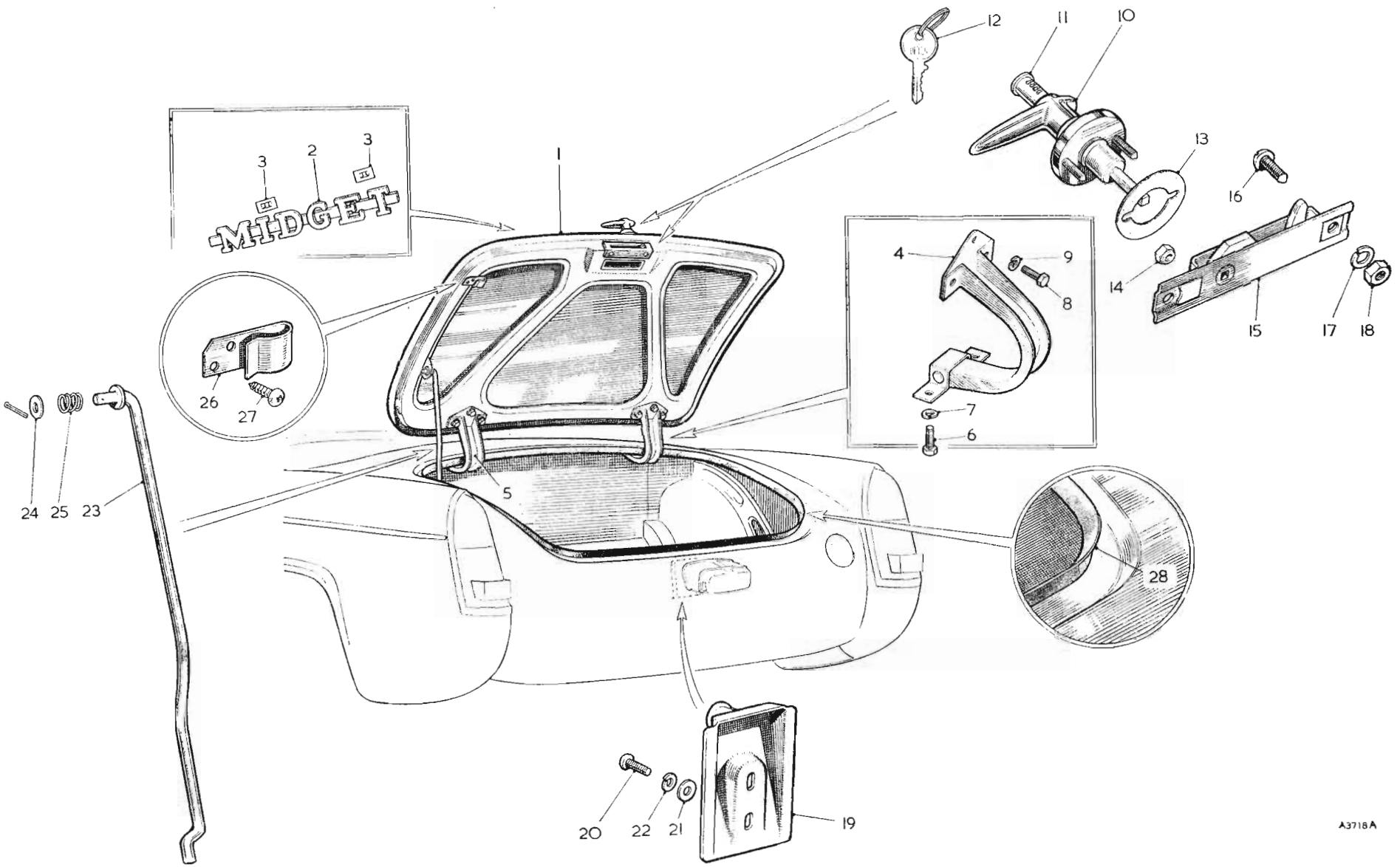
THE BONNET ASSEMBLY COMPONENTS



KEY TO THE BONNET ASSEMBLY COMPONENTS

No.	*Description*
1.	Bonnet top assembly.
2.	Centre moulding.
3.	Front moulding plate stud.
4.	Centre moulding plate stud.
5.	Spring washer.
6.	Nut.
7.	Rear moulding plate stud.
8.	Spring washer.
9.	Nut.
10.	Hinge.
11.	Hinge packing.
12.	Bonnet to hinge screw.
13.	Plain washer.
14.	Spring washer.
15.	Bulkhead to hinge bolt.
16.	Nut.
17.	Bonnet buffer.
18.	Buffer to bonnet locknut.
19.	Side buffer.
20.	Drain channel screw.
21.	Spring washer.
22.	Nut.
23.	Prop rod.
24.	Prop rod spring.
25.	Washer.
26.	Prop rod clip.
27.	Clip screw.
28.	Spring washer.
29.	Nut.
30.	Bonnet release cable.
31.	Bracket.
32.	Screw.
33.	Spring washer.
34.	Cable clip.
35.	Clip screw.
36.	Spring washer.
37.	Nut.
38.	Cable grommet.
39.	Cable clamp.
40.	Clamp screw.
41.	Lock locating cup.
42.	Catch plate.
43.	Catch plate spring.
44.	Cup to locking platform screw.
45.	Washer.
46.	Spring washer.
47.	Bonnet lock pin.
48.	Bonnet lock thimble.
49.	Bonnet lock spring.
50.	Pin to bonnet locknut.
51.	Spring washer.
52.	Safety catch assembly.
53.	Safety catch bracket.
54.	Bracket fixing screw.
55.	Washer.
56.	Spring washer.

THE BOOT LID COMPONENTS



KEY TO THE BOOT LID COMPONENTS

No.	*Description*
1.	Boot lid assembly.
2.	'Midget' motif.
3.	Push-on fix.
4.	Boot lid hinge—R.H.
5.	Boot lid hinge—L.H.
6.	Hinge screw.
7.	Spring washer.
8.	Hinge to boot lid screw.
9.	Spring washer.
10.	Locking handle assembly.
11.	Barrel lock.
12.	Key.
13.	Handle seating washer.
14.	Handle to boot lid nut.
15.	Lock assembly.
16.	Screw.
17.	Spring washer.
18.	Nut.
19.	Striker plate.
20.	Screw.
21.	Plain washer.
22.	Spring washer.
23.	Prop rod.
24.	Plain washer.
25.	Spring.
26.	Prop rod clip.
27.	Screw.
28.	Boot lid sealing rubber.

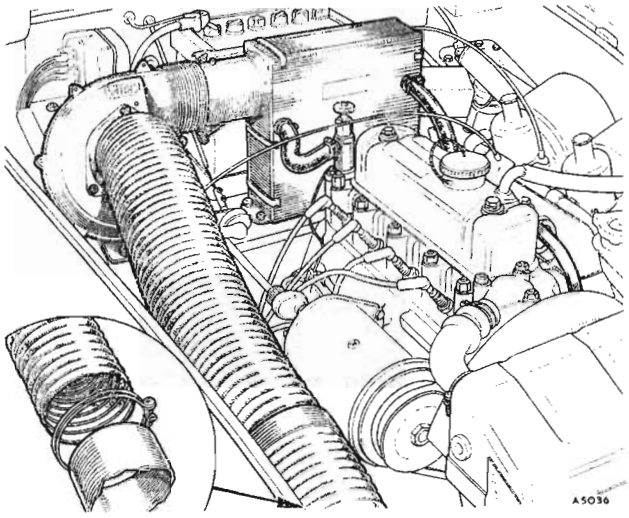


Fig. R.22

Showing the correct location of the heater and inset is the heater blower induction pipe connection at the radiator wing valance

Section R.14

HEATER UNIT

Description

The heating and demisting system is designed to provide heated fresh air to the car interior at floor level and to the windshield for demisting and defrosting.

A valve controlling the flow of hot water through the heater unit is fitted at the rear of the cylinder head. The valve is opened by turning in an anti-clockwise direction when heating is required or shut off by turning clockwise when the system is to be used for cool air ventilation.

Air is drawn into the system through a forward-facing intake, and the ram effect caused by the car's motion will provide a sufficient quantity of air for the heater's requirements at speeds above 25 m.p.h. (40 km.p.h.). A blower motor is provided for use at lower speeds or when a greater quantity of air is required. The blower is switched on by **turning** the control on the fascia (marked 'H') in a clockwise direction.

A shut-off valve is incorporated in the air intake to prevent fumes entering the car in traffic and is operated by **pulling out** the control marked 'H'. The blower motor must be switched off before the valve is closed and cannot be switched on again until the valve is returned to the open position.

Two doors located forward at either side of the engine scuttle control distribution of air between screen and car interior. For heating, open the doors. For defrosting (i.e. boosting flow of hot air to shield), close the doors.

Fitting

Drain the cooling system (see Section C) and disconnect the battery.

Remove the blanking plate from the battery shelf. Place the heater seal in position over the aperture and fit the heater unit. Secure the blower unit to the right-hand bulkhead and fit the earth tag below to any fixing screw. Connect the blower to the heater with the air hose and secure the intake plate and tube to the radiator wing valance support bracket. Connect the intake tube to the blower and fasten the hose to the inner wheel arch, using the air hose securing clip.

Remove the blanking grommets from either side of the engine scuttle and fit the elbow assemblies. Fit the demisting nozzles and connect the elbows to the demisting nozzles with two lengths of air hose.

When fitting the heater control connections a hole will be found in the fascia panel to the right-hand side of the direction indicator switch; cut a corresponding hole in the rexine covering and assemble the push-and-turn switch through the hole.

Push the control cable and one lead through the blind grommet provided in the bulkhead on the right-hand side behind the battery. Connect the other lead to the green lead with the brown tracer issuing from the harness below the fascia. Fit the trunnion to the forked lever below the heater intake tube, pull the control knob out to its fullest extent, and rotate the forked lever towards the rear of the car. Press the lever firmly in position, pass the cable inner wire through the trunnion, and tighten the trunnion screw and the cable clamp on the outer casing. Connect the snap connector from the blower to the push-and-turn switch lead, using the connector tube provided. Before fitting the water connections remove the blanking plate from the rear of the cylinder head and fit the water control valve adaptor. Screw the water control valve into the adaptor and ensure that, when tight, it faces the right-hand side of the car. Connect the water control valve to the heater lower radiator pipe with the moulded hose and secure with hose clips. Bore a hole in the engine-to-radiator return hose with a hose cutter and fit the universal hose connector. Secure the copper heater return pipe to the manifold studs, using the existing fittings. Connect the upper heater radiator pipe to the copper tube with rubber hose, and connect the copper pipe to the universal hose connector with a short length of rubber

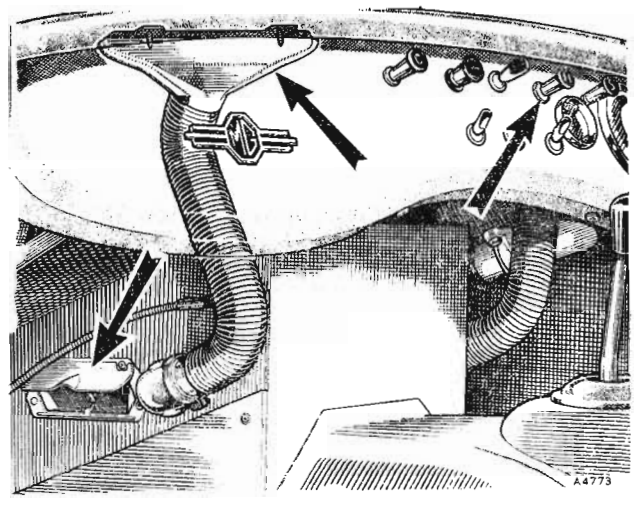


Fig R.23

The heater blower control on the fascia, the interior heating control doors and the demisting duct

hose. Secure all connections with hose clips and fasten a caution label in a prominent position to one of the water hoses.

Reconnect the battery and refill the cooling system, run the engine at a fast tick-over, and switch on the heater.

NOTE.—If the water return hose does not warm up in a few minutes an air lock may be present in the system, and to clear it the procedure is as follows.

Switch off the engine, remove the hose from the universal connector, and extend by temporary hose so that the water will flow back into the radiator via the filler cap; temporarily plug the lower union.

Start the engine and note the water flow into the radiator; when this is smooth and bubble-free, remake the hose-to-union connections and tighten as quickly as possible.

When draining the cooling system the heater may not be completely emptied: therefore, in cold weather it is recommended that 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.

Removing

Removing is a reversal of the fitting procedure.

Section R.15

BODY ALIGNMENT CHECKING JIG

Before checking the body alignment it is most important that the body is raised to a workable height on a level plane. This is done to facilitate body jig checking with the aid of a straight-edge, or with a stout cord stretched from one point to another to obtain measurements between jig components. These measurements should then be checked against the correct dimensions provided in Fig. R.24.

This tool is intended to be used solely as a checking fixture and not as a welding jig. No welding whatsoever is to be undertaken with the body jig in position.

The left-hand inset in Fig. R.24 shows the front section of the jig mounted in position, while the right-hand inset shows the correct method of fitting the rear section to the rear spring mountings.

NOTE.—All jig sections are marked FORWARD to enable easy and correct positioning.

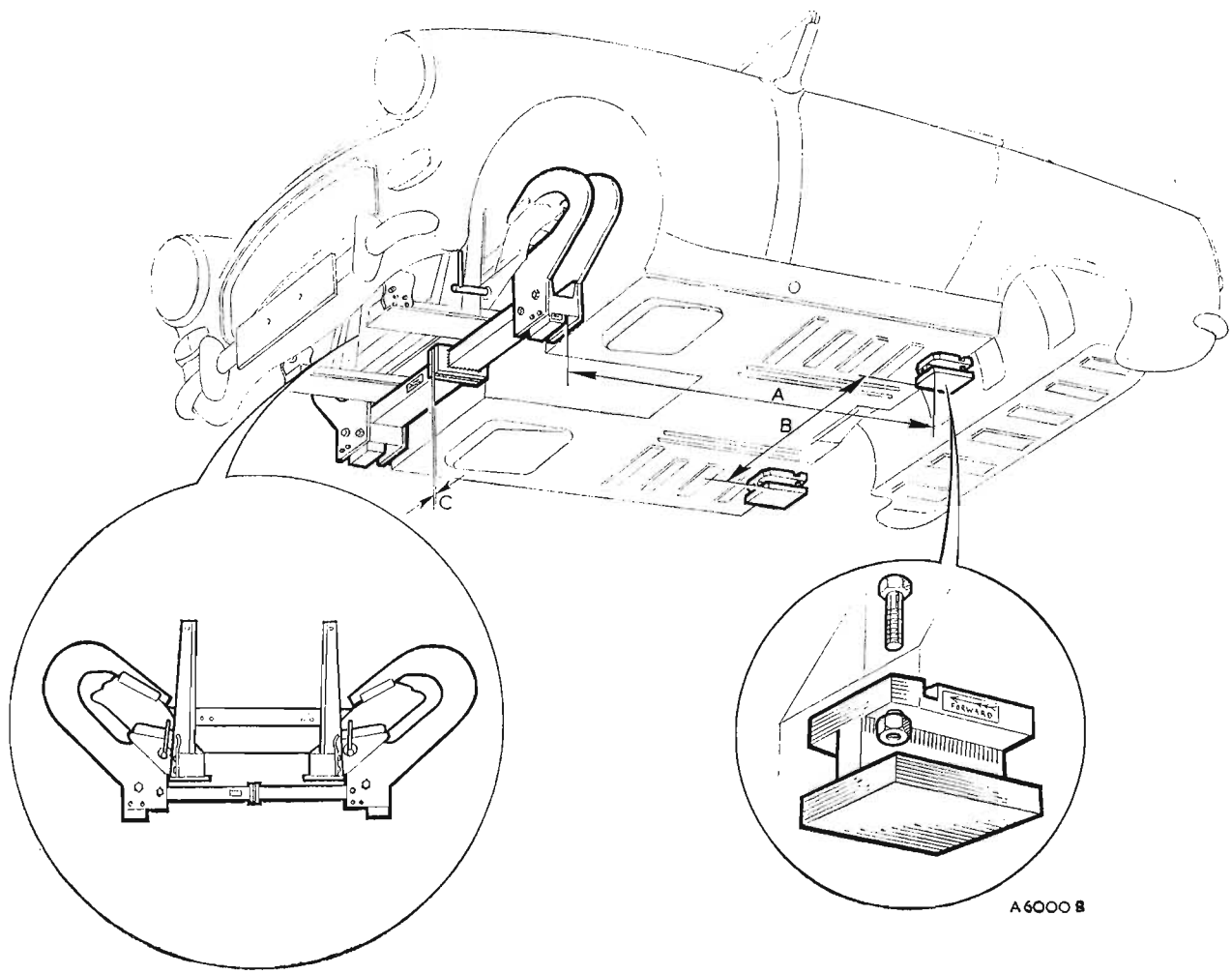


Fig. R.24

A. 63·250 in. (1606·55 mm.). B. 31·75 in. (808·45 mm.). C. ·250 ± ·0625 in. (6·34 ± 1·59 mm.).

LUBRICATION CHART

KEY TO LUBRICATION CHART

DAILY

(1) ENGINE. Inspect the oil level, and top up 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.

(3) GEARBOX. Drain off the old oil and refill with fresh oil to Ref. A.

(4) REAR AXLE. Drain off the old oil and refill with fresh oil to Ref. B.

EVERY 1,000 MILES (1600 Km.)

(5) GEARBOX. Top up if necessary to the filler plug level with oil to Ref. A.

(6) REAR AXLE. Top up if necessary to the filler plug level with oil to Ref. B.

(7) STEERING TIE-ROD BALL JOINTS (2 nipples). Give three or four strokes of a gun filled with lubricant to Ref. C.

(8) SWIVEL AXLES AND SUSPENSION LOWER JOINTS (6 nipples). Give three or four strokes of a gun filled with lubricant to Ref. C.

(9) PROPELLER SHAFT (2 nipples). Give three or four strokes of a gun filled with lubricant to Ref. C.

(10) HAND BRAKE CABLE (1 nipple). Give three or four strokes of a gun filled with **grease** to Ref. C.

(11) HAND BRAKE COMPENSATOR LEVER (1 nipple). Give three or four strokes of a gun filled with lubricant to Ref. C.

(12) HAND BRAKE LINKAGE JOINTS. Lubricate with an oilcan filled with oil to Ref. D.

(13) CLUTCH, BRAKE, AND THROTTLE JOINTS. Lubricate with an oilcan filled with oil to Ref. D.

(14) CARBURETTERS. Top up damper assembly reservoirs with oil to Ref. D.

EVERY 3,000 MILES (4800 Km.)

(15) ENGINE. Drain off the old oil and refill with fresh oil to Ref. A.

EVERY 6,000 MILES (9600 Km.)

(16) 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. Lightly smear the cam with grease to Ref. C.

(17) OIL FILTER. Wash the bowl in fuel and fit a new element.

(18) GEARBOX. Drain off the old oil and refill with fresh oil to Ref. A.

(19) REAR AXLE. Drain off the old oil and refill with fresh oil to Ref. B.

(20) WATER PUMP. Remove the plug and add a few drops of S.A.E. 140 oil; replace the plug.

(21) FRONT HUBS. Remove the front hub discs and prise off the grease-retaining caps from the ends of the hubs. Fill the caps with **grease** to Ref. C and replace securely.

EVERY 12,000 MILES (19200 Km.)

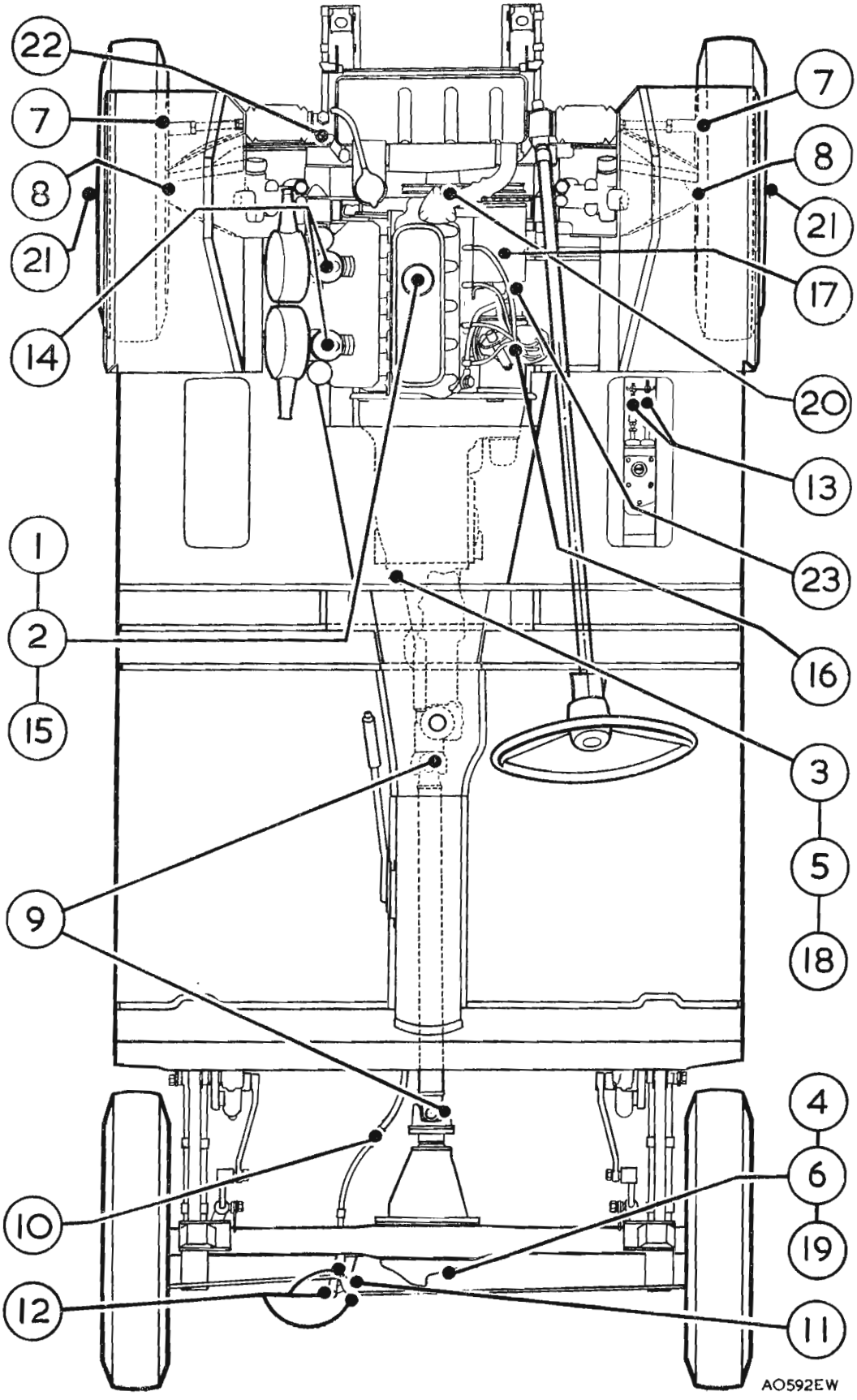
(22) STEERING-RACK. Apply the grease gun filled with oil to Ref. B to the nipple on the steering rack and give 10 strokes only.

(23) DYNAMO. Unscrew the lubricator cap, remove the felt pad and spring, and half-fill the cup with **grease** to Ref. C.

MULTIGRADE MOTOR OILS

In addition to the lubricants recommended in this Manual we approve the use of the multigrade motor oils produced by the oil companies shown in our publications for all climatic temperatures unless the engine is in poor mechanical condition.

LUBRICATION CHART



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