SPRITE and MIDGET

Workshop Manual

A B.M.C. Service Publication

BMC SERVICE

WORKSHOP MANUAL

SPRITE

Marks II and III

MIDGET

Marks I and II

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INTRODUCTION

This Manual has been prepared to provide service operators with the necessary information for the correct maintenance and repair; it 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 pages and illustrations are numbered consecutively within each Section, and the Section title and letter are shown at the top of each page.

Maintenance items within the Sections should be carried out at the intervals specified in the Passport to Service or Driver's Handbook.

CONTENTS

Getting the Best from your Car

(Compression ratios 8·9:1 and 9:1)

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

When fitted with H.C. engine (*compression ratios* 8·9 : 1 *and* 9 : 1)

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 98 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 necessary to use Super grade fuels in the 100-octane range unless Premium fuels of minimum 98-octane Research are available.

When fitted with L.C. engine (*compression ratios* 8·1 : 1 *and* 8·3 : 1)

Premium fuels of minimum 93-octane Research up to 97-octane are required, with preference to 95/97.

Super grade fuels in the 100-octane range can be used if preferred.

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 at regular intervals.

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 check and adjustment of the distributor points specified in Section B. After adjusting the contact breaker gap to the correct setting (see **'GENERAL DATA'**) 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

(948 c.c.)

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: High	9 : 1.
Low	8·3 : 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.).
Torque (H.C.)	52·8 lb.ft. (7·3 km. g.m) at 3000 r.p.m.

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	1·1875 in. (30·16 mm.).
End-clearance	·002 to ·003 in. (·051 to ·076 mm.).
End-thrust	Taken by thrust washers at centre main bearing.
Diametrical clearance	·001 to ·0025 in. (·025 to ·063 mm.).
Undersizes	—·010 in., —·020 in., —·030 in., —·040 in., (—·254 mm., —·508 mm., —·762 mm., —1·02 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 ·056 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.).

GENERAL DATA—*continued*

(948 c.c.—*continued*)

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

Seat angle: Inlet and exhaust	45°.
Head diameter: Inlet	1·151 to 1·156 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	·312 in. (7·925 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 (cold)	·012 in. (·305 mm.); ·015 in. (·381 mm.) for competition work.
Valve rocker bush bore (reamed)	·5630 to ·5635 in. (14·30 to 14·31 mm.).

Valve timing

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.
Closes	45° A.B.D.C.
Exhaust valve: Opens	51° B.B.D.C.
	21° A.T.D.C.
Valve rocker clearance: timing	·029 in. (·74 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 of 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.).

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	1·62425 to 1·62475 in. (41·256 to 41·369 mm.).
Rear	1·3745 to 1·3750 in. (34·912 to 34·925 mm.).
Clearance	·001 to ·002 in. (·025 to ·051 mm.).

GENERAL DATA—*continued*

(948 c.c.—*continued*)

ENGINE LUBRICATION SYSTEM

Oil pump

Type	Eccentric rotor or vane type.
Relief pressure valve operates	60 lb./sq. in. (4·2 kg./cm.²).
Relief valve spring: Free length	2·859 in. (72·63 mm.).
Fitted length	2·156 in. (54·77 mm.).

Oil filter

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

Oil pressure

Normal running	30 to 60 lb./sq. in. (2·1 to 4·22 kg./cm.²).
Idling (minimum)	10 to 25 lb./sq. in. (·7 to 1·7 kg./cm.²).

TORQUE WRENCH SETTINGS

Cylinder head nuts	40 lb. ft. (5·5 kg. m.).
Main bearing set screws	60 lb. ft. (8·3 kg. m.).
Connecting rod 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.).
Front hub nuts	25 to 65 lb. ft. (3·4 to 8·9 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.).
Needles	Standard V3. Rich V2. Weak GX.
Piston spring	Light blue.

Fuel pump

Make and type	A.C. 'Y' type. Mechanical.
Delivery rate	40 pints/hr. (48 U.S. pints/hr., 22·8 litres/hr.).
Delivery pressure	1·5 to 2·5 lb./sq. in. (·105 to ·175 kg./cm.²).

Air cleaners

Type	Paper element.

COOLING SYSTEM

Type	Pressurized radiator. Thermo-siphon, pump- and fan-assisted.
Thermostat setting	65 to 70° C. (149 to 158° F.).
Blow-off pressure	7 lb./sq. in. (·49 kg./cm.²).

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. (·36 to ·40 mm.).
Static ignition setting: High compression	4° B.T.D.C.
Low compression	1° B.T.D.C.

GENERAL DATA—*continued*

(948 c.c.—*continued*)

CLUTCH

Type	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.

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	8·085 : 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	¾°.	Static unladen condition.
Castor angle	3°.	
King pin inclination	6¾°.	
Toe-in	0 to ⅛ in. (0 to 3·175 mm.).	
Steering lock angle of outer wheel with inner wheel at 20°	18½°.	

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.

REAR SUSPENSION

Type	Quarter-elliptic.
Spring details: Number of leaves	15.
Thickness of leaves	5 at 5/32 in. (3·97 mm.), 10 at ⅛ in. (3·18 mm.).
Width of leaves	1¾ in. (44·45 mm.).
Working load	375 lb. (170 kg.).
Free camber	3 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)	26¼ in. (66·6 cm.).
Diameter	1¾ 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.
Maximum output	19 amps.
Field coil resistance	6·1 ohms ± 5%.
Control box	Lucas RB106.
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 3,000 r.p.m. dynamo speed):	
Open-circuit setting at 20° C. (68° F.)	16·0 to 16·6 volts.

For ambient temperatures other than 20° C. (68° F.) the following allowances should be made to the above setting:

For every 10° C. (18° F.) above 20° C. (68° F.) subtract ·1 volt.

For every 10° C. (18° F.) below 20° C. (68° F.) 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	6¾ in. × 1¼ 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).
Tyre pressures—for sustained speeds in excess of 80–85 m.p.h. (129–136 km.p.h.) increase pressure to: Front	24 lb./sq. in. (1·69 kg./cm.²).
Rear	26 lb./sq. in. (1·83 kg./cm.²).

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 DATA—*continued*

(948 c.c.—*continued*)

GENERAL DIMENSIONS

Wheelbase	6 ft. 8 in. (2·03 m.).
Overall length	11 ft. 5⅝ in. (3·49 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.) (static unladen condition).
Rear	3 ft. 8¾ in. (1·14 m.).
Vehicle weight (dry)	1,400 lb. (635 kg.).

WEIGHTS OF COMPONENTS

Engine	246 lb. (111·5 kg.).
Gearbox	44 lb. (19·95 kg.).
Axle	83 lb. (37·64 kg.).

GENERAL DATA
(1098 c.c.)

The following information is applicable to the 1098-c.c.-engined car and should be used in conjunction with the preceding specification for the 948-c.c.-engined car.

ENGINE

Type	10CG.
Bore	2·543 in. (64·58 mm.).
Stroke	3·296 in. (83·72 mm.).
Capacity	67 cu. in. (1098 c.c.).
Compression ratio	8·9 : 1 (or 8·1 : 1).
Capacity of combustion chamber (valves fitted)	1·8 cu. in. (28·2 c.c.).
Valve operation	Overhead by push-rod.
Oversize bore: 1st	+·010 in. (·254 mm.).
Max.	+·020 in. (·508 mm.).
Torque	H.C. 62 lb.ft. (8·6 kg.m.) 3250 r.p.m. L.C. 61 lb.ft. (8·4 kg.m.) 3250 r.p.m.

Main bearings

Length	$1\frac{1}{16}$ in. (27 mm.).

Pistons

Type	Solid skirt.
Clearances: Bottom of skirt	·0005 to ·0011 in. (·013 to ·028 mm.).
Top of skirt	·0021 to ·0037 in. (·053 to ·094 mm.).
Oversizes	+·010 in., +·020 in. (+·254 mm., +·508 mm.).

Piston rings

Compression: Type: Top ring	Plain, internally chamfered (chrome-faced).
Second and third rings	Tapered.
Width: Top ring	·062 to ·0625 in. (1·575 to 1·587 mm.).
Second and third rings	·0615 to ·0625 in. (1·558 to 1·587 mm.).
Thickness	·106 to ·112 in. (2·69 to 2·84 mm.).
Clearance in groove	·002 to ·004 in. (·051 to ·102 mm.).
Oil control: Type	Slotted scraper.
Thickness	·106 to ·112 in. (2·69 to 2·84 mm.).

Gudgeon pin

Type	Fully floating.
Fit in piston	Hand push fit.

Valves

Head diameter: Inlet	1·213 to 1·218 in. (30·81 to 30·94 mm.).

TORQUE WRENCH SETTINGS

Rocker bracket nuts	25 lb. ft. (3·4 kg. m.).
Sump to crankcase	6 lb. ft. (·8 kg. m.).
Cylinder side covers	2 lb. ft. (·28 kg. m.).
Timing cover—$\frac{1}{4}$ in. UNF. bolt	6 lb. ft. (·8 kg. m.).
Timing cover—$\frac{5}{16}$ in. UNF. bolt	14 lb. ft. (1·9 kg. m.).
Water pump	17 lb. ft. (2·3 kg. m.).
Water outlet elbow	8 lb. ft. (1·1 kg. m.).
Oil filter	16 lb. ft. (2·2 kg. m.).
Oil pump	9 lb. ft. (1·2 kg. m.).
Manifold to cylinder head	15 lb. ft. (2·1 kg. m.).
Rocker cover	4 lb. ft. (·56 kg. m.).
Crankshaft pulley nut	70 lb. ft. (9·6 kg. m.).
Distributor clamp bolt: Fixed nut type	50 lb.in. (·576 kg.m.).
Fixed bolt type	30 lb.in. (·345 kg.m.).

Suspension and steering

Steering lever to hub bolts	30 to 35 lb. ft. (4·1 to 4·8 kg. m.).
Steering-wheel nut	41 lb. ft. (5·76 kg. m.).
Road wheel nuts	60 to 63·5 lb. ft. (8·3 to 8·7 kg. m.).
Disc to hub	40 to 45 lb. ft. (5·5 to 6·2 kg. m.).
Front swivel hub to calliper	45 to 50 lb. ft. (6·2 to 7 kg. m.).

GENERAL DATA—*continued*

(1098 c.c.—*continued*)

FUEL SYSTEM

Carburetters

Needles: Standard	GY.
Weak	GG.
Rich	M.
Piston spring	Blue.

COOLING SYSTEM

Thermostat setting	
Standard	82° C. (180° F.)
Hot climates	74° C. (165° F.).
Cold climates	88° C. (190° F.).

IGNITION SYSTEM

Distributor	25D4.
Vacuum advance starts	4 in. Hg (101·6 mm. Hg).
Vacuum advance maximum	13 in. Hg (330·2 mm. Hg).
Centrifugal advance starts	400 r.p.m. (distributor).
Centrifugal advance maximum	15 to 17° at 2,750 r.p.m. (distributor).
Dwell angle	60±3°.
Static ignition setting: High compression	5° B.T.D.C.
Low compression	3 to 5° B.T.D.C.
Stroboscopic timing	8° B.T.D.C. at 600 r.p.m. (engine).

CLUTCH

Diameter	7¼ in. (184 mm.).
Pressure springs	6.
Colour	Red.
Damper springs	4.
Colour	Maroon/light green.

GEARBOX

Ratios: Reverse	4·120 : 1.
Overall ratios: Reverse	17·32 : 1.

ELECTRICAL EQUIPMENT

Battery	Lucas N9 or NZ9.
Dynamo	Lucas C40/1.
Maximum output	22 amps.
Field coil resistance	6·0 ohms.
Control box	Lucas RB 106/2

BRAKES

Type	Lockheed hydraulic; disc front, drum rear; leading and trailing shoes.

Front

Disc diameter	8·25 in. (209·5 mm.).
Pad area (total)	18 sq. in. (116·1 cm.²).
Swept area (total)	135·28 sq. in. (871 cm.²).
Lining material	Ferodo DA3.
Minimum pad thickness	1/16 in. (1·59 mm.).

Rear

Drum diameter	7 in. (177·8 mm.).
Lining dimensions	6·68 in. × 1·25 in. × ·187 in. (169·8 mm. × 37·5 mm. × 4·75 mm.).
Swept area (total)	55 sq. in. (342 cm.²).
Lining material	Ferodo AM8.

GENERAL DIMENSIONS

Track: Front	3 ft. $9\frac{5}{16}$ (1·16 m.) (static unladen condition).
Rear	3 ft. $8\frac{3}{4}$ in. (1·14 m.)
Vehicle weight (dry)	1,466 lb. (665 kg.).

WEIGHTS OF COMPONENTS

Engine	253 lb. (114·7 kg.).

GENERAL DATA

SPRITE (Mk. III) and MIDGET (Mk. II)

The following information is applicable to the Sprite (Mk. III) and Midget (Mk. II) and should be used in conjunction with the preceding specifications.

ENGINE

Torque	H.C. 65 lb.ft. (8·9 kg.m.) at 3500 r.p.m. L.C. 64 lb.ft. (8·8 kg.m.) at 3250 r.p.m.

Crankshaft

Main journal diameter	2·0005 to 2·0010 in. (50·79 to 50·80 mm.).

FUEL SYSTEM

Carburetters

Needles	Standard AN. Rich H6. Weak GG.

Fuel pump

Make and type	S.U. (electrical) Type AUF200.
Delivery rate	56 pints/hr. (67 U.S. pints/hr., 32 litres/hr.).
Delivery pressure	2·5 to 3·0 lb./sq. in. (·17 to ·21 kg./cm.²).

REAR SUSPENSION

Type	Semi-elliptic.
Spring details: Number of leaves	5.
Thickness of leaves	$\frac{11}{64}$ in. (4·37 mm.).
Width of leaves	$1\frac{1}{2}$ in. (38·10 mm.).
Working load	375 lb. (170 kg.).
Free camber	4·437 (112·7 mm.).

TYRES

Tyre pressures—for sustained speeds in excess of 80–85 m.p.h. (129–136 km.p.h.) increase pressure to:

Front	22 lb./sq. in. (1·55 kg./cm.²).
Rear	24 lb./sq. in. (1·69 kg./cm.²).

WEIGHTS

Vehicle weight (dry)	1,490 lb. (676 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.

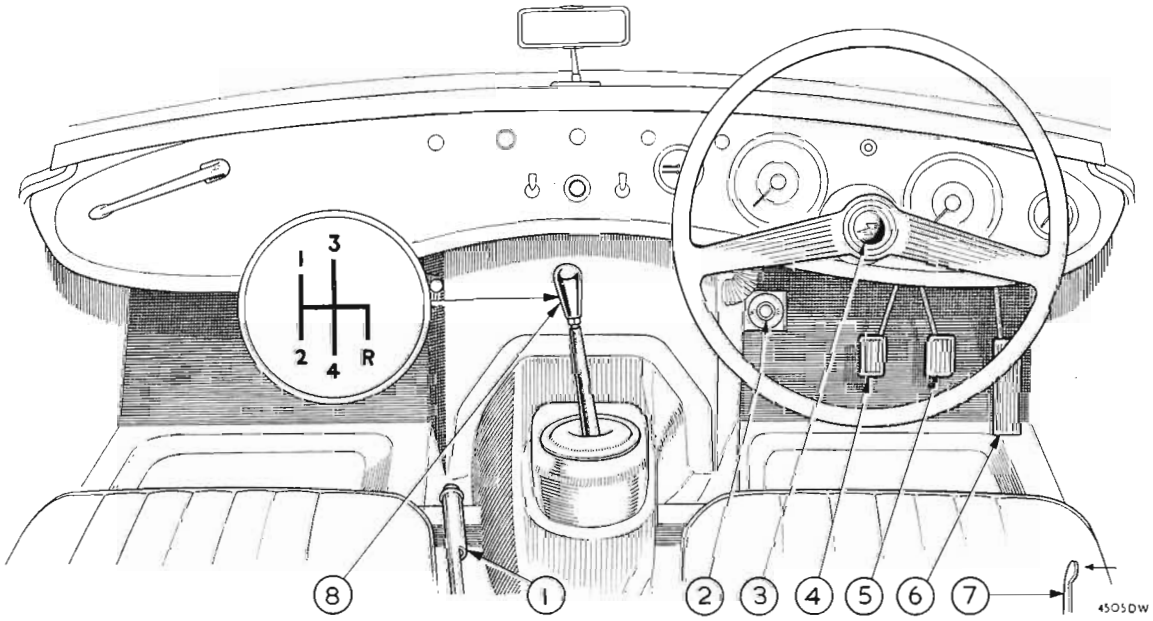
Pedals

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 horn

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 extra 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')

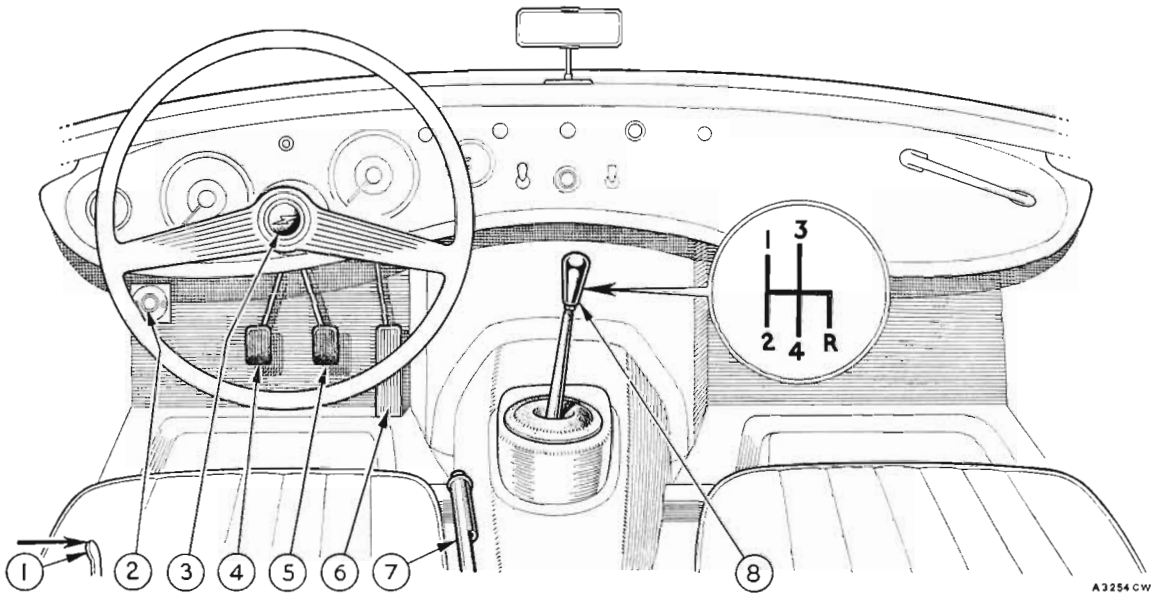
Pull out the control to its limit when starting the engine from cold. Return the control to its normal running position (pushed right in) as soon as possible after starting the engine.

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)

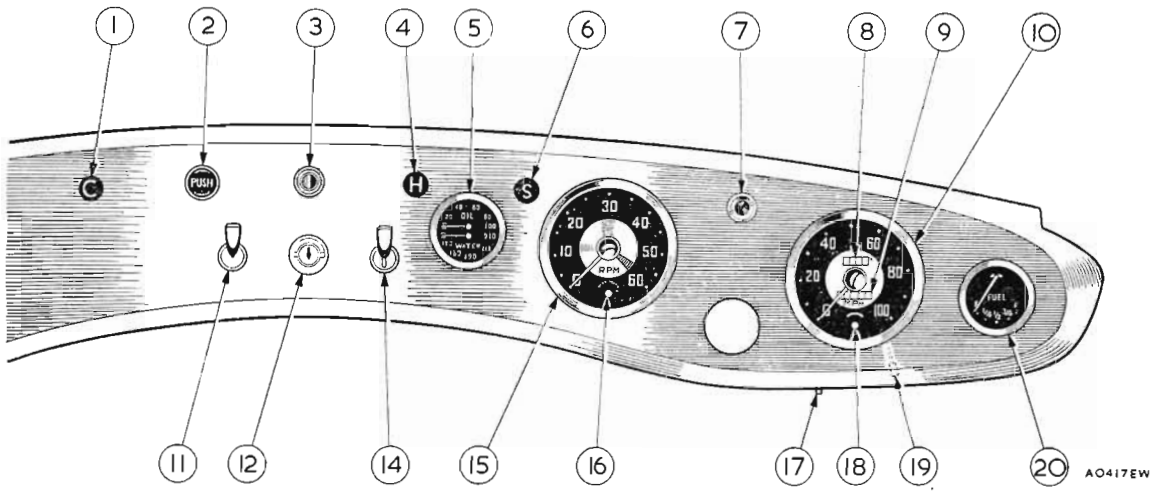
The heating and demisting system is provided for two purposes: (*a*) heating the interior of the car, (*b*) demisting and defrosting the windshield.

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 30 to 60 lb./sq. in. (2·1 to 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

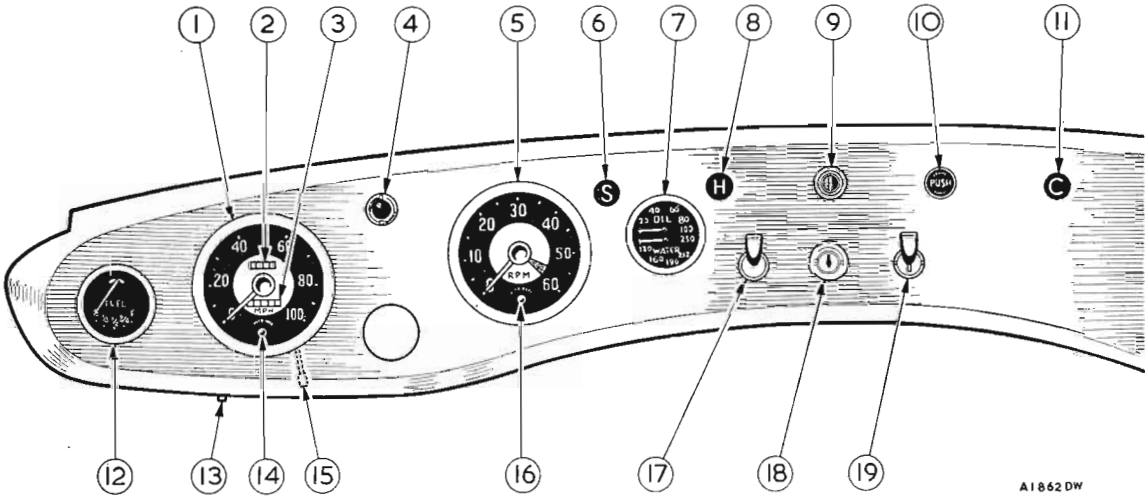
The headlamp main beam warning light is in the lower half of the speedometer dial. Coloured dark red to avoid dazzle, the warning lamp glows when the headlamps are in the raised position and is extinguished when the beams are dipped for approaching traffic.

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.

The warning lamp immediately above the steering-wheel flashes green when the direction indicators are operated.

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. Starter switch control.
7. Oil pressure and water temperature gauge.
8. Heater switch.
9. Direction indicator switch.
10. Windshield washer control.
11. Choke 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—Austin-Healey, etc.

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

The third letter indicates the type of body—2-seat 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

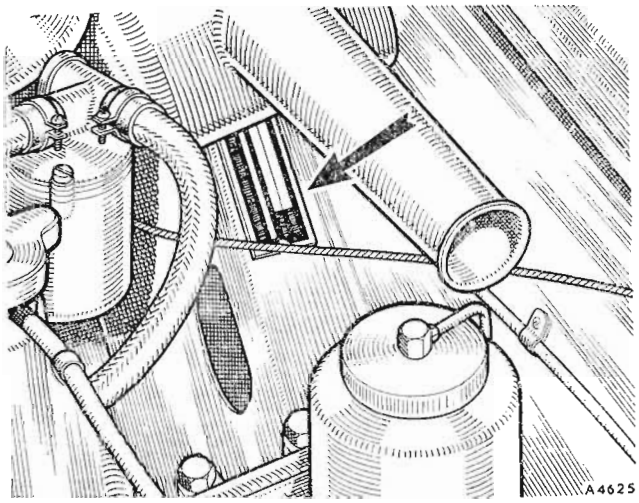
A—Ambulance	J—Convertible	P—Hard-top	T—4-seat Tourer
C—Chassis	K—Truck	Q—Chassis and Cab	U—Pick-up
D—Coupé	L—Hire Car	R—Chassis and Scuttle	V—Van
E—G.P.O. Engineers	M—Limousine	S—4-door Saloon	W—Dual-purpose
G—G.P.O. Mail	N—2-seat Tourer	2S—2-door Saloon	X—Taxi
H—Hearse			

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

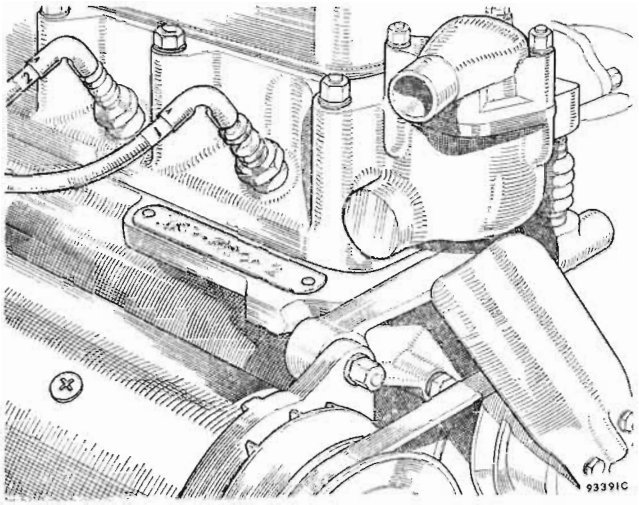
5th Prefix (used when vehicles differ from standard R.H.D.)—L—Left-hand drive.

LOCATION OF MAJOR COMPONENT SERIAL NUMBERS

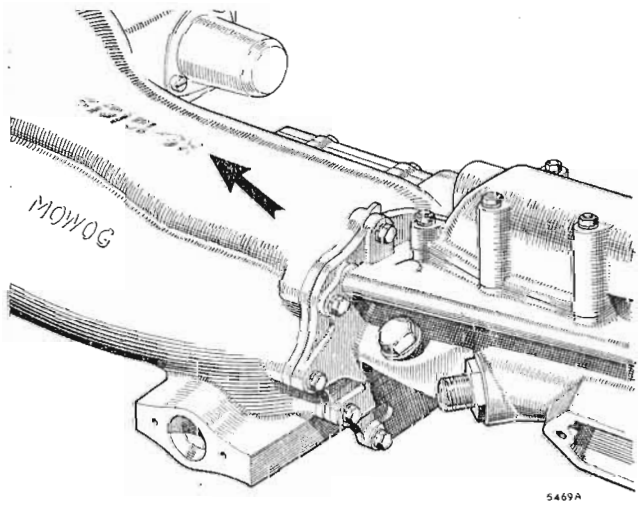
The car and engine numbers must always be quoted in communications between the customer and Dealer and the Dealer and the Company. The registration number is of no assistance and is not required.



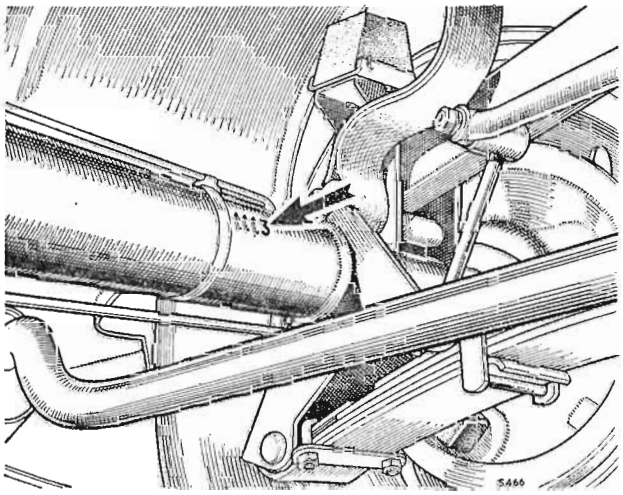
Car (Chassis) Number. This is stamped on a plate mounted on the left-hand inner wheel arch valance under the bonnet



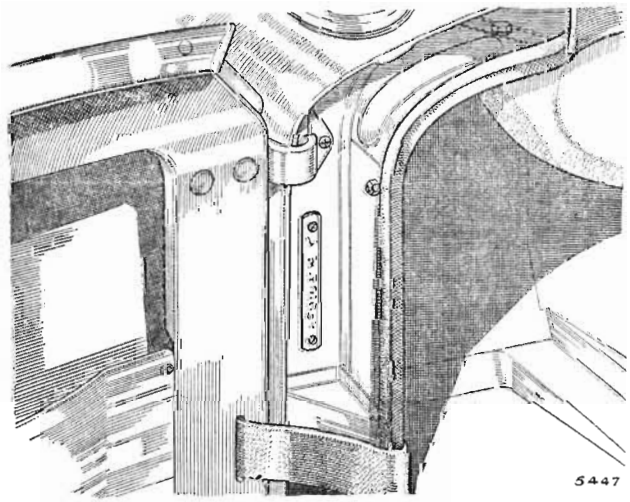
Engine Number. This is stamped on a plate secured to the right-hand side of the cylinder block above the dynamo



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

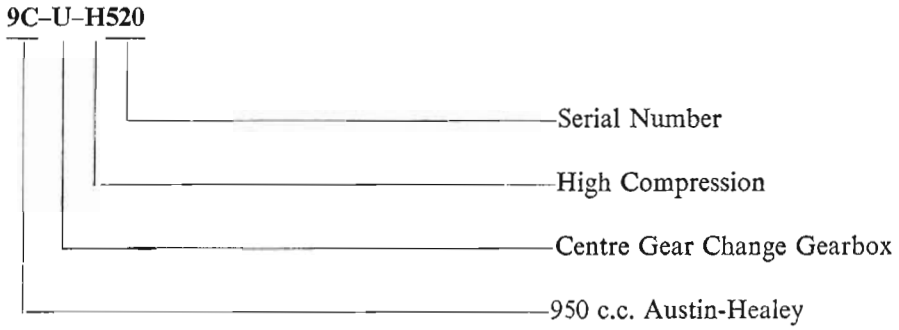
2nd Prefix Group—Gearbox and ancillaries

- 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.

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 inadvertently 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 1½ pints (·85 litre)	Quantity 2 pints (1·14 litres)

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.

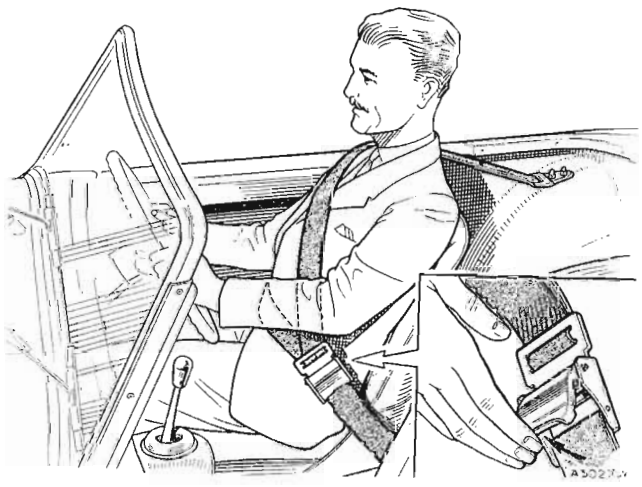
B.M.C. SEAT BELTS

General description

Seat belts are available from B.M.C. Service Ltd. as an accessory. Attachment points have been incorporated in the body construction.

When in use the long belt passes from the wheel arch downwards across the chest to the sill with the buckle tongue approximately at its centre. The short belt from the tunnel is adjusted so that the buckle is located just in front of the hip, and the tongue on the long belt is pushed into the buckle until it clicks in the locked position. The long belt is then adjusted so that the wearer is held firmly but comfortably in the seat. For quick release it is only necessary to lift up the buckle lever approximately 90°, which immediately frees the wearer.

Take care to stow the long belt in such a way that you are not tripped when getting out of the car.



The illustration shows the position of the seat belt when correctly worn

MAINTENANCE ATTENTION

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

ALL MATERIALS CHARGEABLE TO THE CUSTOMER

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.
Check battery and top up to correct level.

3,000 miles (4800 km.) service

1. *Engine*
   Top up carburetter piston dampers.
   Lubricate carburetter controls.
   Check fan belt tension.
   Check water level in radiator and top up if necessary.

2. *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.

3. *Body*
   Lubricate door hinges, door locks, bonnet lock operating mechanism, and safety catch.
   Lightly smear striker plates with suitable grease.

4. *Electrical*
   Check battery and top up to correct level.

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

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

6,000 miles (9600 km.) service

1. *Engine*
   Top up carburetter piston dampers.
   Lubricate carburetter controls.
   Check fan belt tension.
   Check radiator water level and top up if necessary.
   Check valve rocker clearances, and adjust if necessary.

2. *Ignition*
   Check functioning of automatic retard and advance mechanism.
   Lubricate all distributor parts as necessary.
   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. *General*
   Check rear road spring anchorage bolts.

5. *Body*
   Lubricate door hinges, door locks, bonnet lock operating mechanism, and safety catch.
   Lightly smear striking plates with suitable grease.

6. *Electrical*
   Check battery cell specific gravity readings and top up to correct level.
   Lubricate dynamo bearing.
   Check all lamps for correct functioning.

7. *Lubrication*
   Change oil in engine, gearbox, and rear axle.
   Fit new oil filter element.
   Lubricate all nipples (except steering rack and pinion).

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

9,000 miles (14400 km.) service

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

12,000 miles (19200 km.) service

1. *Engine*
   Remove carburetter suction chambers and pistons, clean, reassemble, and top up dampers.
   Lubricate carburetter controls.
   Check valve rocker clearances, and adjust if necessary.
   Fit new air cleaner paper elements.
   Check fan belt tension.
   Lubricate water pump sparingly.

2. *Ignition*
   Check functioning of automatic retard and advance mechanism.
   Lubricate all distributor parts as necessary.
   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, and top up if necessary.

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

6. *General*
   Check rear road spring anchorage bolts.

7. *Body*
   Lubricate door hinges, door locks, bonnet lock operating mechanism and safety catch.
   Lightly smear striker plates with suitable grease.

8. *Electrical*
   Check battery cell specific gravity readings and top up to correct level.
   Lubricate dynamo bearing.
   Check all lamps for correct functioning.
   Check headlight beam setting, and reset if necessary.

9. *Lubrication*
   Drain and flush out engine, and refill with fresh oil.
   Fit new oil filter element.
   Change oil in gearbox and rear axle.
   Lubricate all nipples.
   Lubricate steering rack and pinion.

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

24,000 miles (38400 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.

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 element.
   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 (38400 km.) service

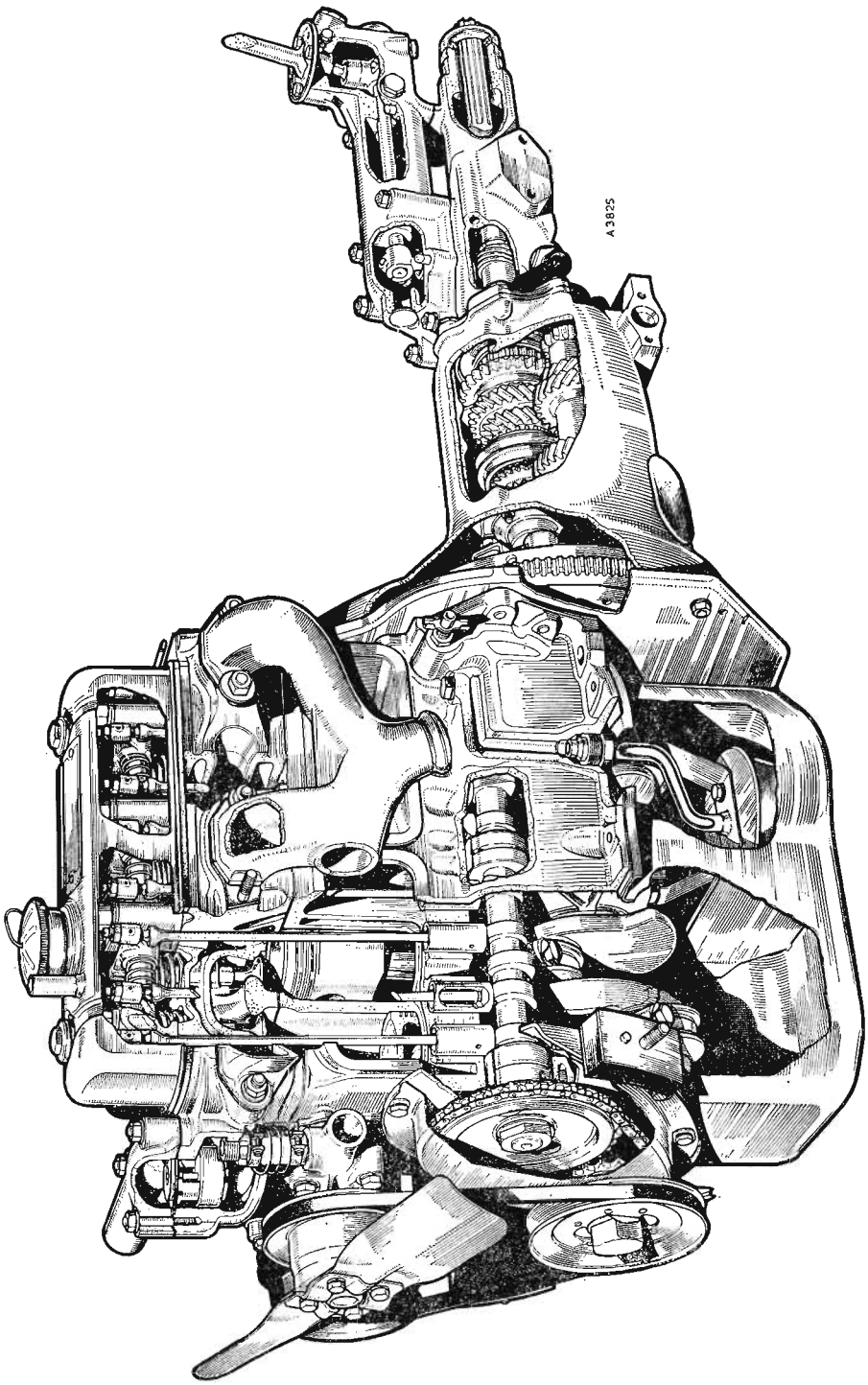
Carry out the **12,000 miles (19200 km.) service,** except engine-flushing, with the following addition:

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

SECTION A

THE ENGINE

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 a fan are 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 on early cars are clamped to the connecting rods, which have renewable, steel-backed, lead-bronze or copper-lead bearings with lead-indium surfaces. On later cars the gudgeon pins are of the fully floating type.

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

LUBRICATION

Checking the engine oil level

Inspect the oil level in the engine, and top up if necessary to the 'MAX' or 'FULL' mark on the dipstick. The oil filler cap is on the top of the engine valve cover and is released by turning it anti-clockwise.

Changing the engine oil

Drain the oil from the engine by removing the drain plug on the right-hand side of the engine sump.

The oil will flow more readily if drained when the engine is hot; allow at least 10 minutes for draining before replacing the plug

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

Changing the engine oil filter

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.

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.

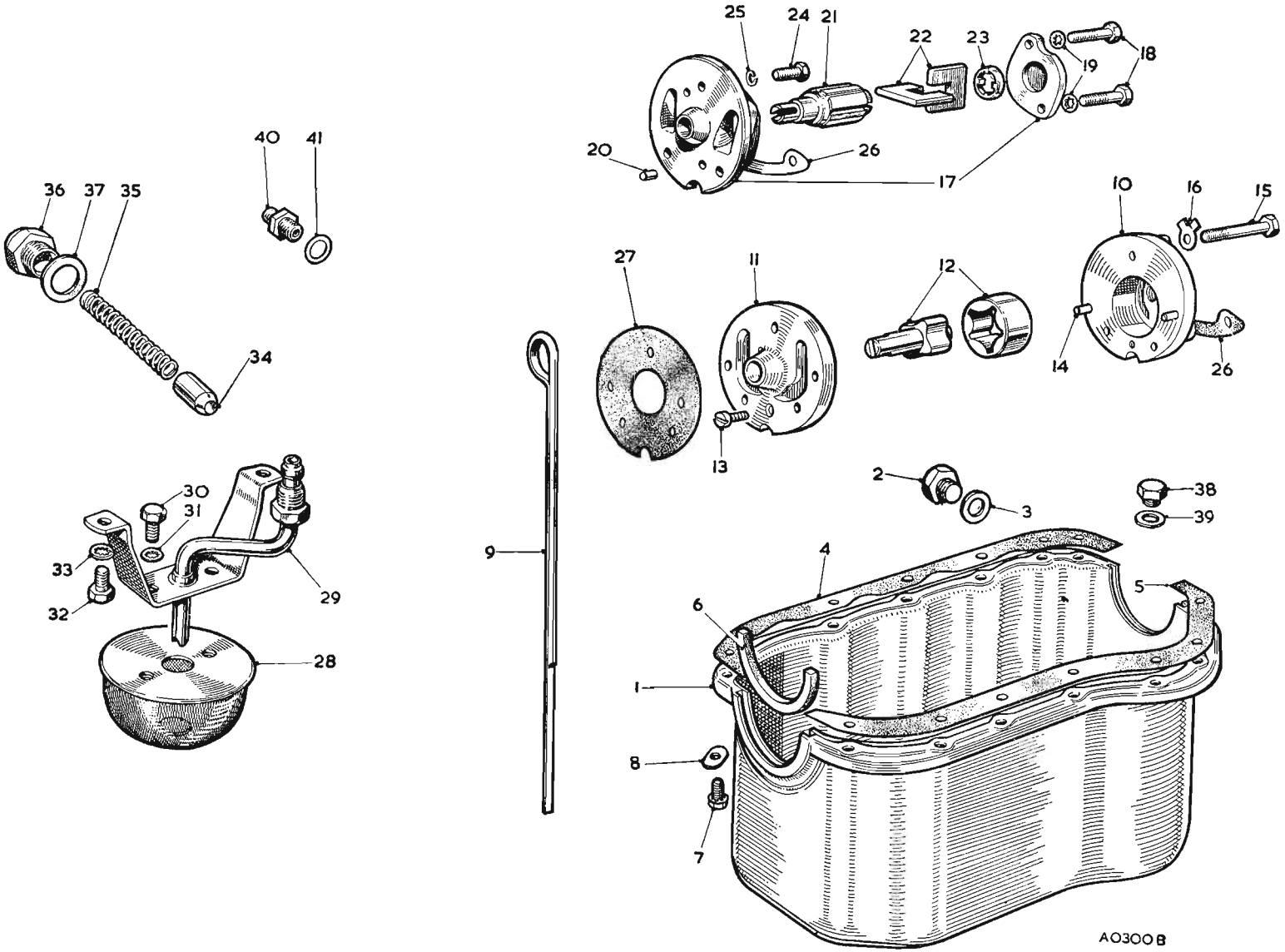
Continuous cold running and the unnecessary use of the mixture control are often the causes of oil dilution by petrol (gasoline) and a consequent fall off in pressure.

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 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).

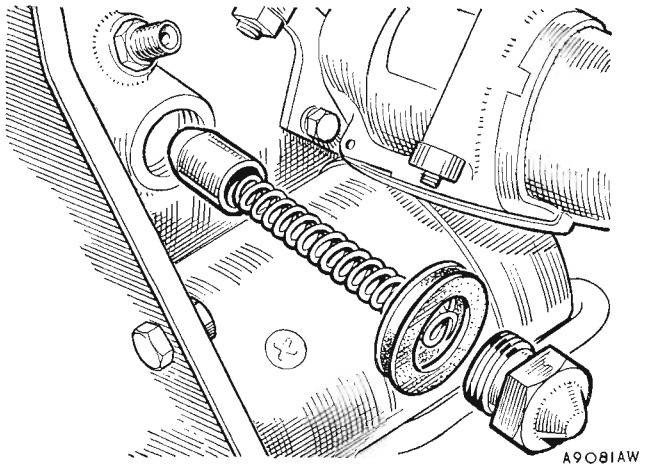


Fig. A.1
The location of the oil pressure relief valve

The 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 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 18G 69 and the spring checked by measuring its length; to give the required relief pressure see **'GENERAL DATA'.**

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.

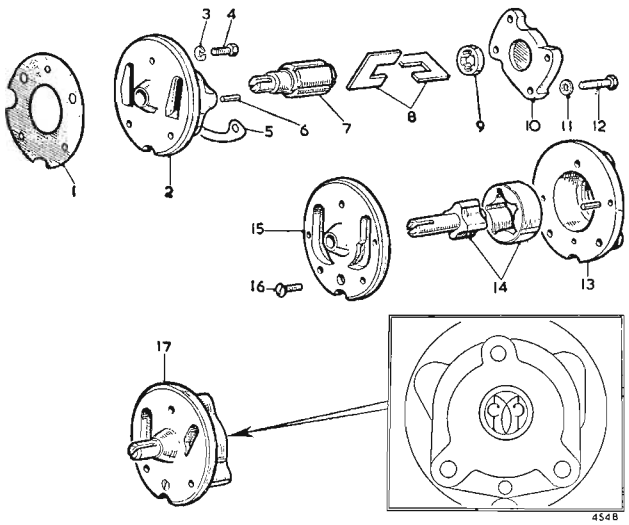


Fig. A.2
The three types of oil pump which may be fitted

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.

Concentric (Engineering) Ltd.

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

Release the rocker shaft bracket securing nuts and the 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 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 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.

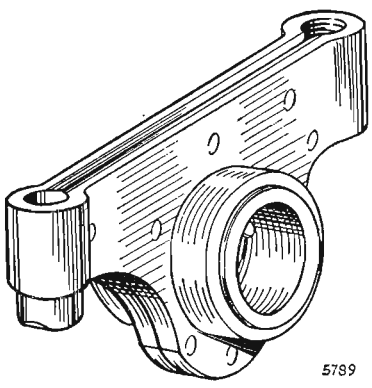


Fig. A.3

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

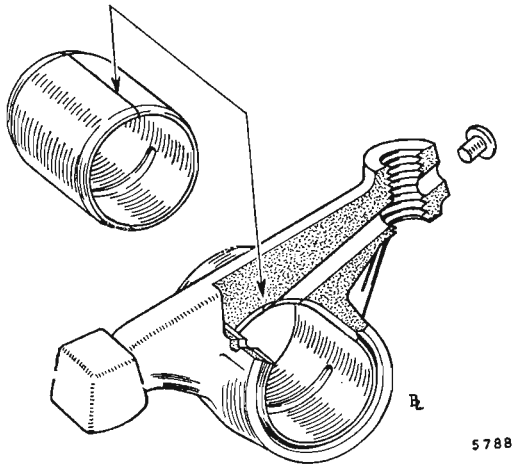


Fig. A.4

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 manifold and the rocker cover.

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 original 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.

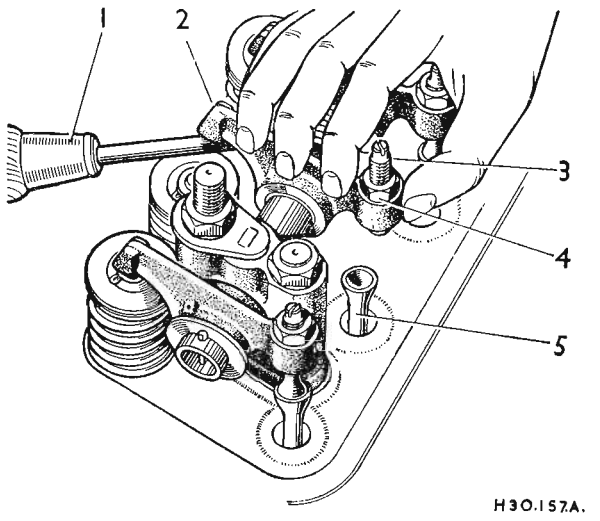


Fig. A.5

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 not be undertaken. When bushes become worn new rocker assemblies must be fitted.

Forged type

To rebush, the use of special Service tools 18G 226 and 18G 226 A 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. 5C 2436) 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

Remove the air cleaners as detailed in Section D.6. 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.

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

Remove the bonnet.

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.

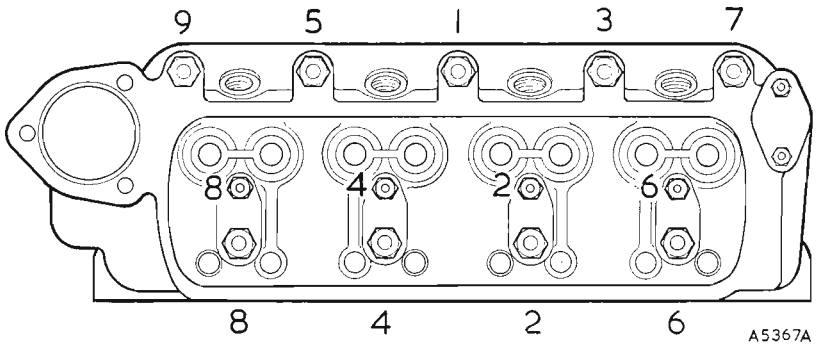


Fig. A.6

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 external cylinder head holding nuts at the same time. Withdraw the push-rods, keeping them in order of removal.

The cylinder head may now be removed.

NOTE.—To facilitate breaking the cylinder head joint tap each side of the head with a hammer, using a piece of wood interposed to take the blow. 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 the 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.

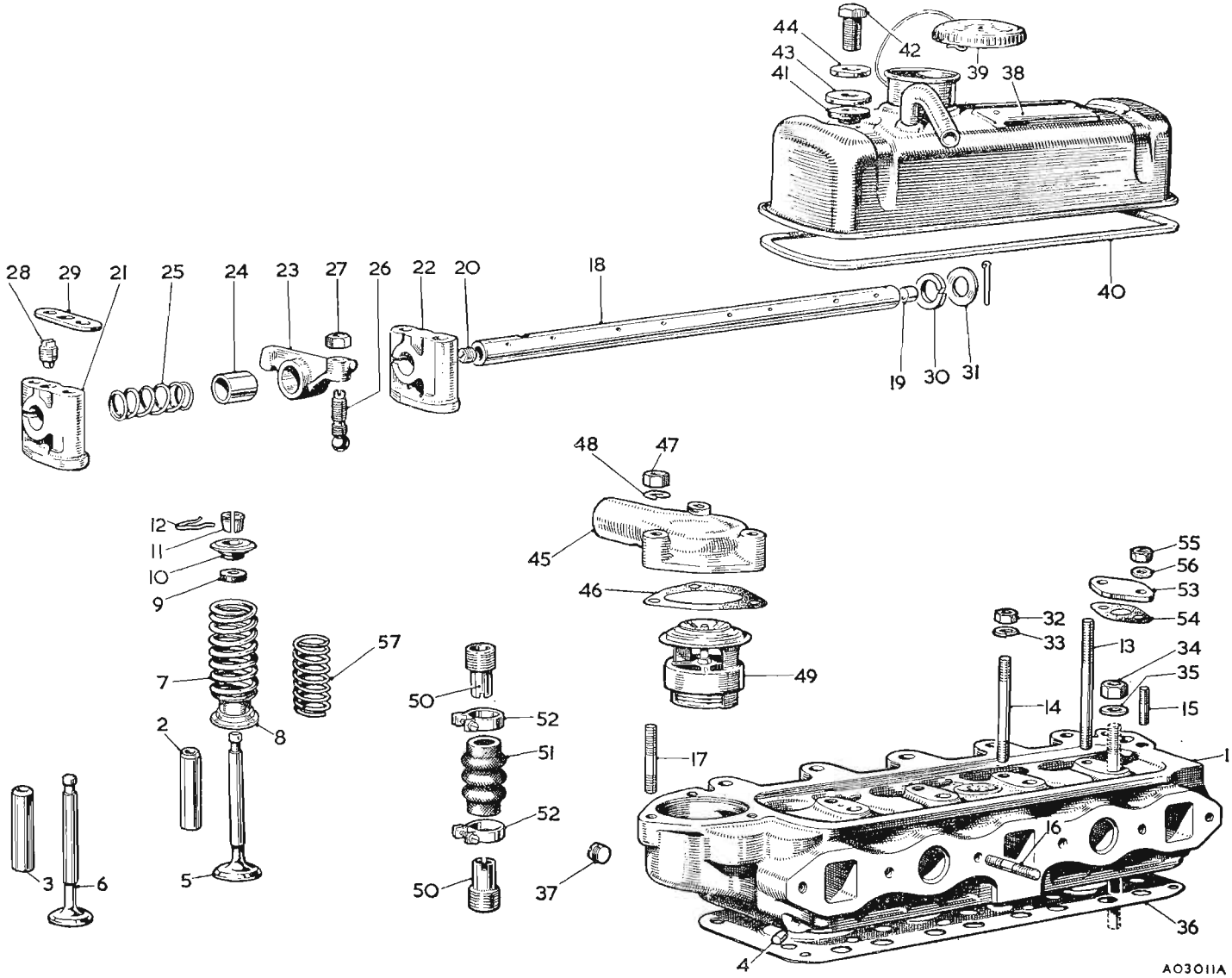
If special equipment is not available scrape the carbon deposit from the piston crowns, cylinder block, and cylinder head, using a blunt scraper.

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.

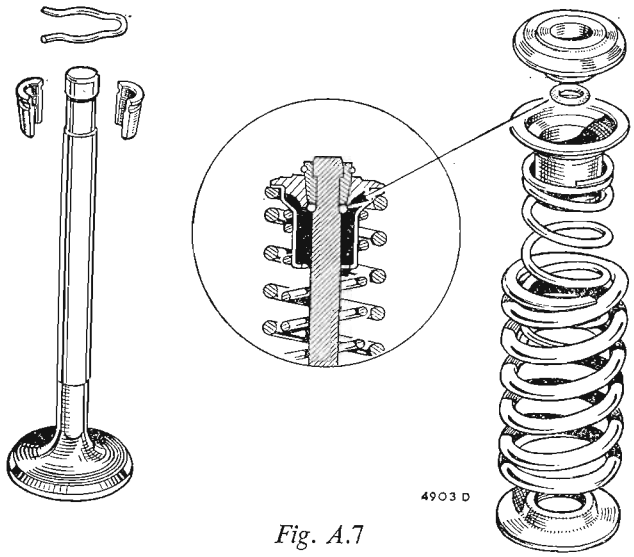


Fig. A.7

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 Service cutting tools. 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 should be used to prepare the valve seat surface for any recutting that may be necessary. Narrowing cutters should be used to restore the valve seats to the original standard.

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.

A light coil spring placed under the valve head will assist considerably in the process of grinding. The valve should be ground to its seat with a semi-rotary motion and occasionally allowed to rise by the pressure of the light coil spring. This assists in spreading the paste evenly over the valve face and seat. 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.

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.

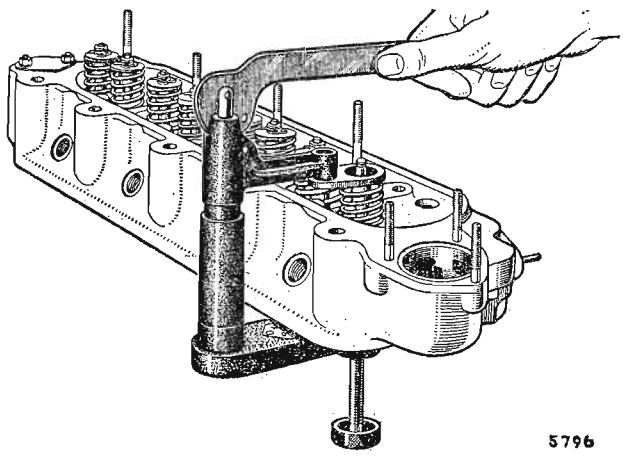


Fig. A.8

Compressing a valve spring, using the special compressing tool 18G 45

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).

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 and any necessary adjustments made.

The engine has been designed to run with a valve rocker clearance of ·012 in. (·305 mm.) and performance will be impaired if this is changed.

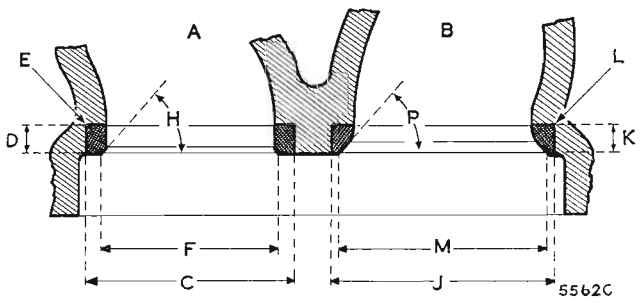


Fig. A.9

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.).
H.	45°.	P.	45°.

(1098-c.c. engines as above except)

J. 1·3075 to 1·3085 in. (33·178 to 33·203 mm.).
M. 1·1435 to 1·1635 in. (29·045 to 29·553 mm.).

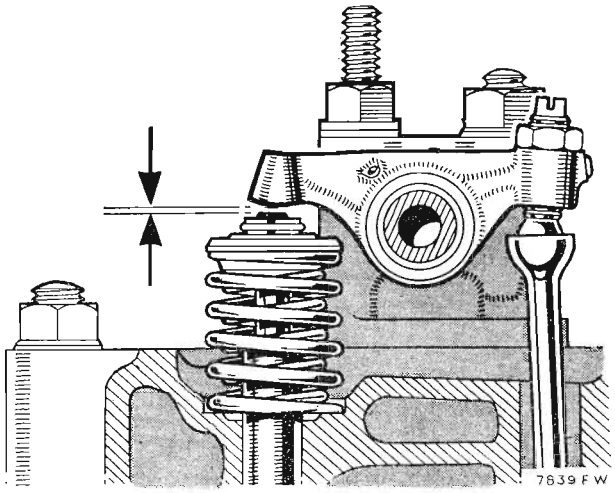


Fig. A.10

The clearance between the valve stem and the valve rocker indicated above must be ·012 in. (·305 mm.) with the enigne cold

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

Section A.19

DISTRIBUTOR DRIVING SPINDLE

Removing

Remove the distributor as detailed in Section B.7.

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

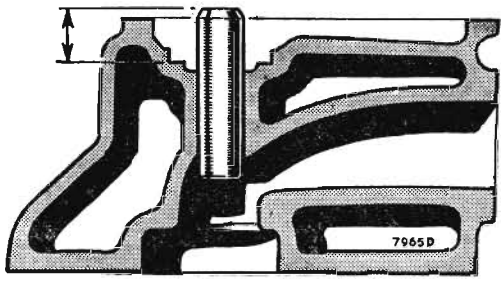


Fig. A.11

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

opening) No. 1 piston is at the top of its compression stroke. If the engine is set so that the groove in the crankshaft pulley is in line with the largest 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 two 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.7 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. 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 18G 139 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 300 to 400° C. (572 to 752° F.), indicated by a light-blue surface colour. If this temperature is exceeded the temper of the teeth will be affected. The use of a thermostatically controlled furnace is recommended. Place the heated ring on the flywheel with the lead of the ring teeth towards the flywheel register. The expansion will allow the ring to be fitted without force by pressing or tapping it lightly until the ring is hard against its register.

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

Section A.22

TIMING COVER

Removing

Drain the cooling system as described in Section C. Remove the radiator (see Section C). Release but do not remove the dynamo attachment bolts and lift off the fan belt. Tap back the tab on the crankshaft pulley nut locking washer. Remove the pulley nut, using Service tool 18G 98, 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, using Service tool 18G 134 together with adaptor 18G 134 D. A new cover gasket should also be fitted.

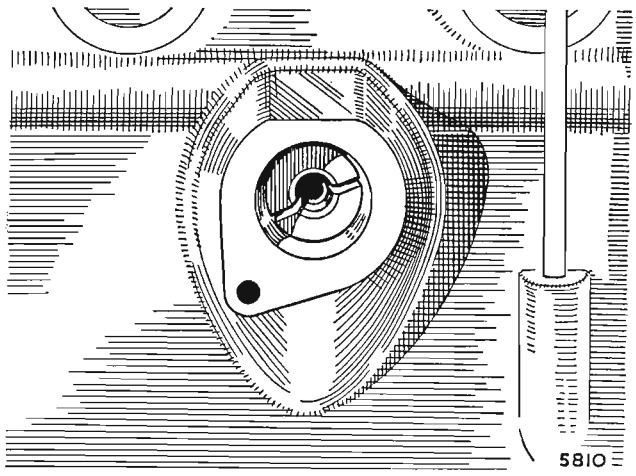


Fig. A.12

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

Ensure the oil thrower behind the crankshaft pulley is fitted with the face marked 'F' away from the engine.

Fill the annular groove between the lips of the oil seal with grease and use Service tool 18G 1044 to centralize the oil seal on the crankshaft.

NOTE.—The early type front cover and oil thrower must be used together. When refitting; ensure the oil thrower is fitted with its concave side facing away from the engine. Use Service tool 18G 138 to centralize the rubber seal on the crankshaft or use the crankshaft pulley as follows:—

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.

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

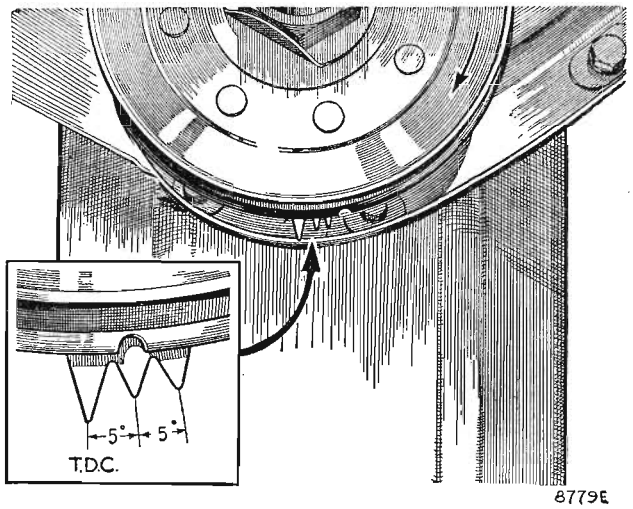


Fig. A.13

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

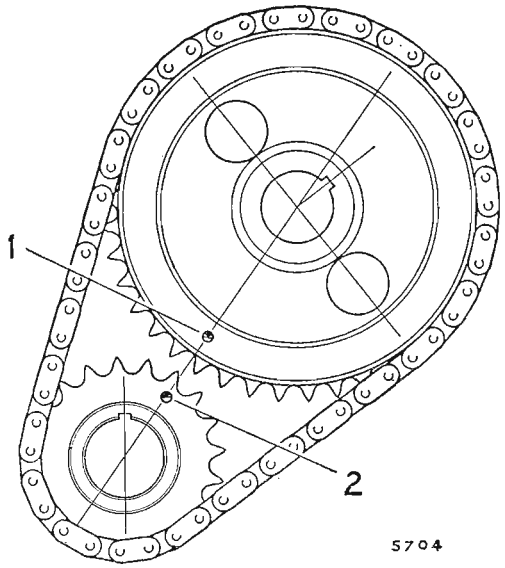


Fig. A.14

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

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; with the face marked 'F' or the concave side (early type) away from the engine, and the remaining components as detailed in Section A.22.

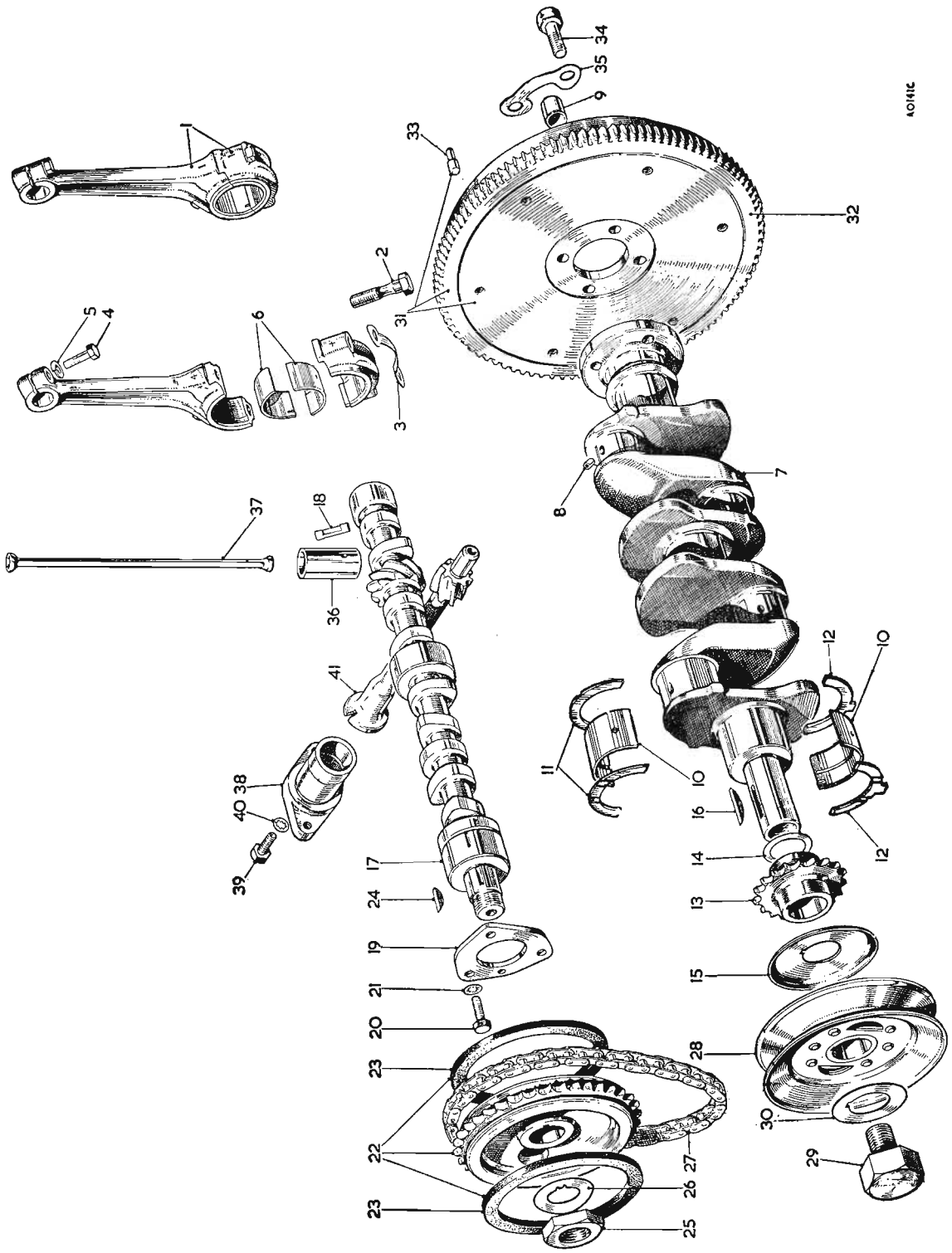
Section A.24

VALVE TIMING

Set No. 1 cylinder inlet valve clearance to ·029 in. (·74 mm.) with the engine cold, and then turn the crankshaft until the valve is about to open. The indicator groove in the flange of the crankshaft pulley should then be opposite the centre pointer (this indicates 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 ·012 in. (·305 mm.) when the timing check is completed (engine cold).

THE ENGINE INTERNAL COMPONENTS



KEY TO THE ENGINE INTERNAL COMPONENTS

No.	*Description*
1.	Connecting rod cap.
2.	Cap bolt.
3.	Lock washer for bolt.
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

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).

Remove the distributor assembly (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.

Camshaft bearings

If the camshaft bearing clearances are excessive new bearings must be fitted. Steel-backed white-metal bearings are used, and removing and refitting are facilitated by the use of a special camshaft liner removing and replacing tool. New bearings must be reamed to give the correct running clearance (see **'GENERAL DATA').**

Removing the liners

Centre

Insert the pilot adaptor 18G 124 K into the camshaft liner front bore from the inside of the block and the adaptor 18G 124 B into the centre liner from the rear, small end first.

With the body of the tool positioned on the centre screw, pass the screw through the pilot adaptor and the adaptor in the centre liner.

Place the slotted washer on the flat at the rear of the centre screw and insert the tommy-bar into the screw behind the slotted washer.

Tighten up the wing nut to withdraw the liner.

Front and rear

Insert the small end of the adaptor 18G 124 K into the camshaft front liner from the inside of the cylinder block, thread the body of the tool onto the centre screw, and pass the screw through the adaptor from the front of the block. Place the slotted washer on the flat at the rear of the centre screw and insert the tommy-bar into the centre screw behind the slotted washer.

Tighten up the wing nut to withdraw the worn liner.

The rear liner is withdrawn by the same method, using the adaptor 18G 124 M and withdrawing the liner from the rear of the block.

Replacing the liners

Line up the oil holes in the liners and the cylinder block and make certain that they remain correctly positioned during the whole operation.

Front and rear

Place the new liner on the smallest diameter of the adaptor 18G 124 K and insert the adaptor into the camshaft front liner bore from the inside of the block, largest diameter first.

Thread the body of the tool onto the centre screw and pass the screw through the adaptor located in the front liner from the front of the block.

Position the larger of the two 'D' washers on the centre screw with the cut-away portion turned away from the butt joint of the liner: this joint **must** be covered by the washer.

Place the slotted washer on the flat at the rear of the centre screw and insert the tommy-bar into the screw behind the slotted washer.

Tighten the wing nut to pull the liner squarely into position.

The rear liner is replaced by the same method, using the adaptor 18G 124 M and pulling the liner into position from the rear of the block. The 'D' washer **is not** to be used when refitting a rear liner.

Centre

Insert the pilot adaptor 18G 124 K into the camshaft front liner from the inside of the block.

Place a new liner on the small end of the adaptor 18G 124 B and position the adaptor in the centre liner bore from the rear, largest diameter first.

With the body of the tool positioned on the centre screw insert the screw through the pilot adaptor and the adaptor in the centre liner bore.

Position the larger 'D' washer on the centre screw with the cut-away portion turned away from the butt joints of the liner; this joint must be covered by the washer.

Place the slotted washer and the tommy-bar in the centre screw and tighten up the wing nut to pull the liner into position.

Reaming the liners

It is essential that the cutter flutes are kept clear of swarf at all times during the cutting operation, preferably with air-blast equipment. The cutter should be withdrawn from the liner half-way through the cut and the swarf removed from the cutter and the liner.

Feed the reamer very slowly and keep the cutters dry.

The arbor should be lightly lubricated before assembling the cutters and pilots. All oilways should be thoroughly cleaned when the cutting operations have been completed.

Front and rear

Insert the taper pilots 18G 123 AT and 18G 123 BA into the centre and rear liners respectively.

Place the parallel pilot 18G 123 AQ on the arbor, followed by the cutter 18G 123 AN.

Thread the arbor through the front and centre liners, fit the cutter 18G 123 AP on the arbor, and thread the arbor through the taper pilot in the rear liner.

Secure the cutters and pilots in their respective positions; 18G 123 AN is located in No. 10 and 18G 123 AP is located in No. 7 on the arbor.

The cutter for the front liner will cut first with the arbor piloting in the centre and rear liners. The cutter for the rear liner will follow with the arbor piloting in the front and centre liners. Clear away all the swarf before the plain pilot is allowed to enter the front liner.

When the cut in the rear liner is finished, free the cutters and withdraw the arbor.

Centre

Set up for the second part of the operation by inserting the pilots 18G 123 BC and 18G 123 BB in the front and rear liners.

Thread the arbor through the pilot in the front liner and place the cutter for the centre liner on the arbor. Thread the arbor through the centre liner and the pilot located in

the rear liner. Secure the cutter and pilots in position; 18G 123 B is located in No. 7 position on the arbor.

Ream the centre liner, release the cutter, and withdraw the arbor.

Refitting

Refitting is the reverse of the removal procedure.

Section A.26

PISTONS AND CONNECTING RODS (Early Cars)

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.

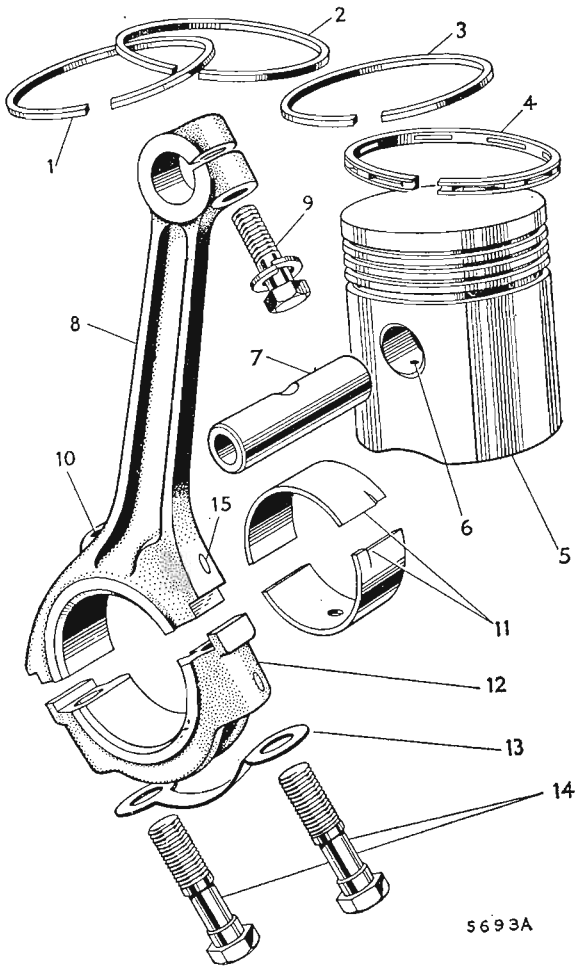


Fig. A.16

A piston and connecting rod 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 bearings.
12. Connecting rod cap.
13. Lock washer.
14. Bolts.
15. Connecting rod and cap marking.

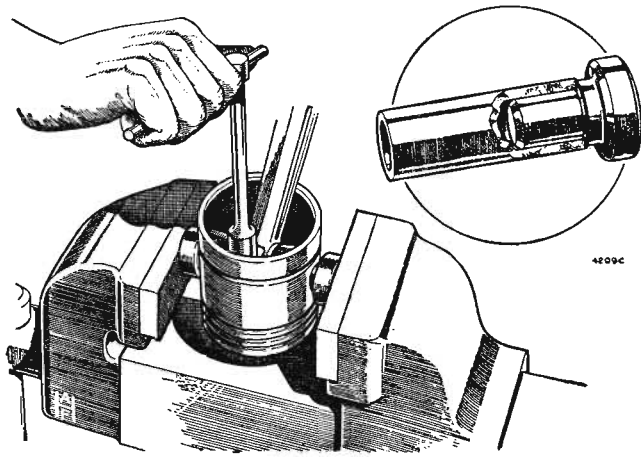


Fig. A.17

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

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.

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 staggered at 90° 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.

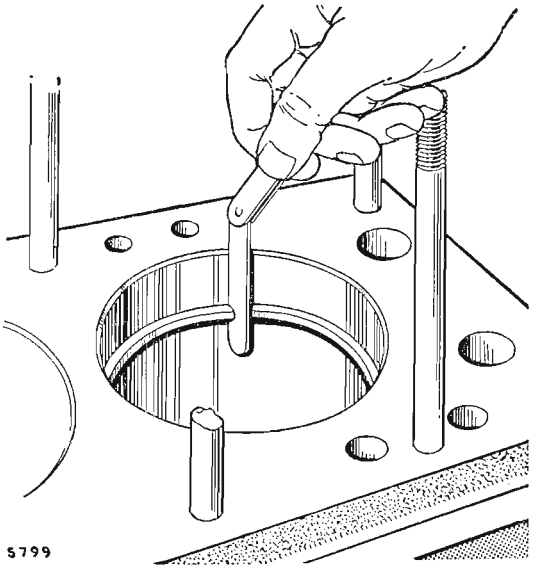


Fig. A.18

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 given in **'GENERAL DATA'.**

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.

The cylinder bore glazing should be removed before fitting new rings to a worn cylinder bore.

Section A.28

PISTON SIZES AND CYLINDER BORES
(Early Cars)

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

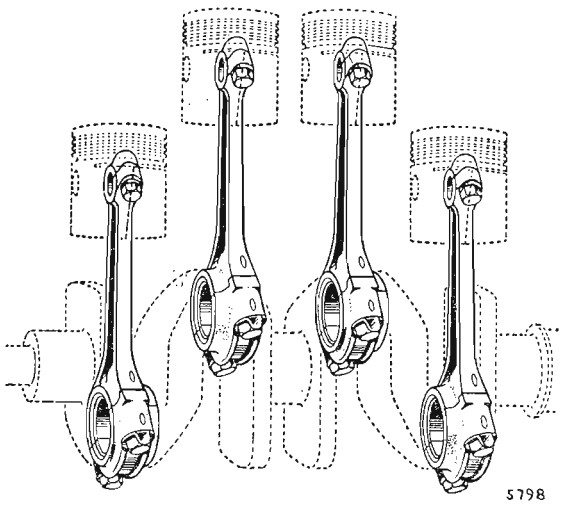


Fig. A.19

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 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 Hylomar Jointing Compound 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 bolts (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.

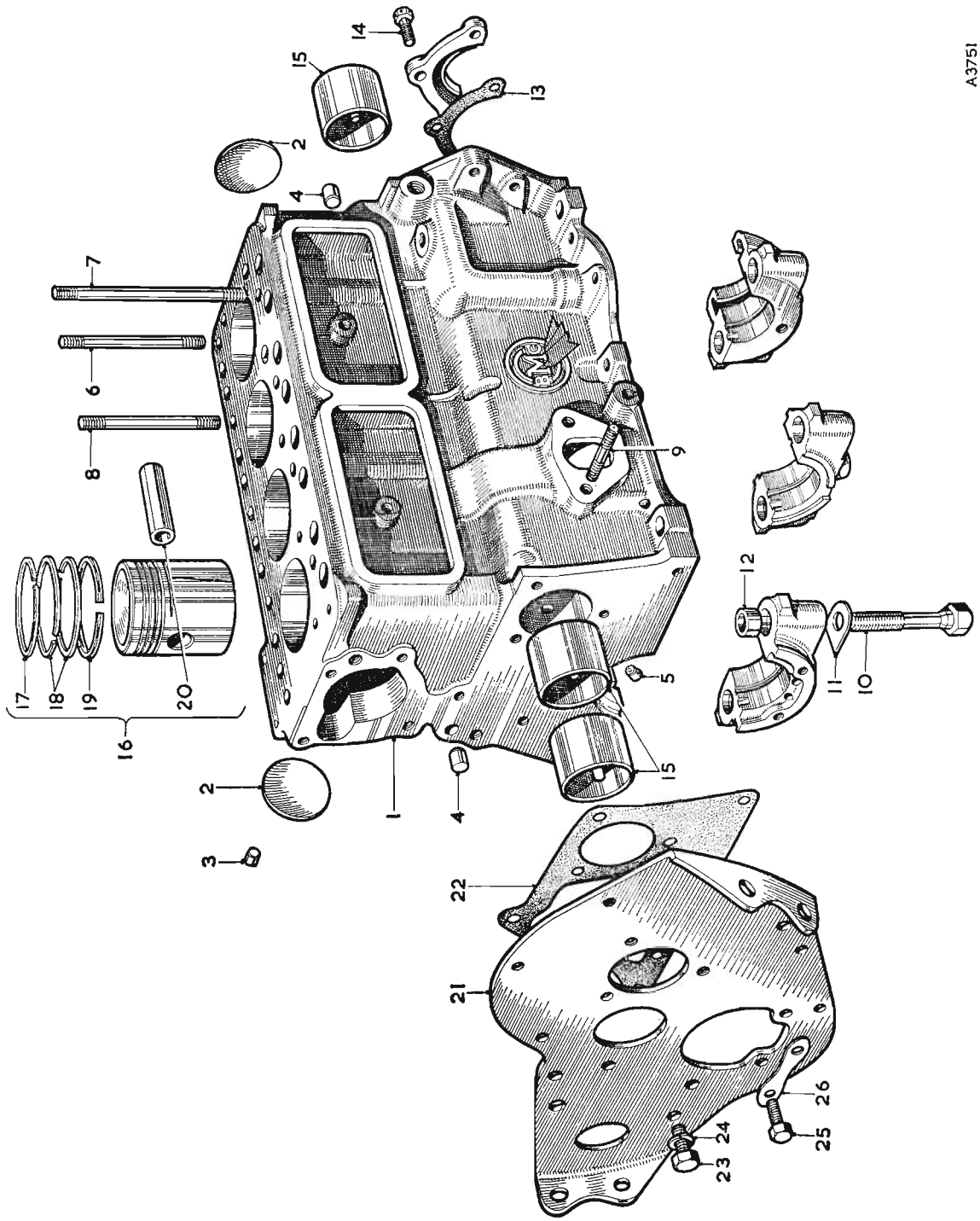
Remove the engine from the vehicle as detailed in Section A.31. Dismantle the engine and remove the cylinder head studs. If liners have not previously been fitted the bores must be machined and honed to the dimensions given in the table below.

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.

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.)	2A 784	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.)
'A' (1098 c.c.)	12G 164	2·64075 to 2·64125 in. (67·076 to 67·088 mm.)	2·64325 to 2·64400 in. (67·139 to 67·158 mm.)	·002 to ·00325 in. (·05 to ·08 mm.)	2·542 to 2·5435 in. (64·566 to 64·605 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.

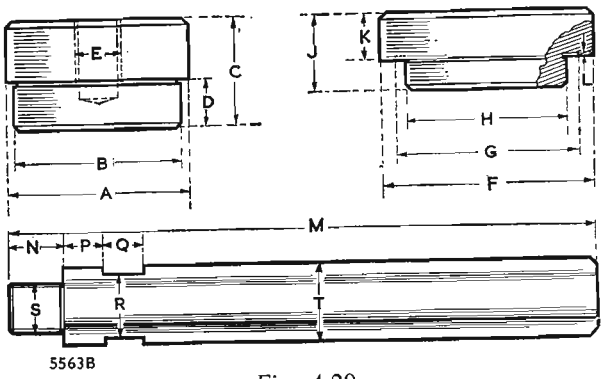


Fig. A.20

Cylinder liner pilots should be made to the above dimensions from case-hardening steel and case-hardened. The pilot extension should be made from 55-ton hardening and tempering steel hardened in oil and then tempered at 550° C. (1,020° F.)

	948-*c.c. engine*	1098-*c.c. engine*
	Pressing-out pilot	Pressing-out pilot
A.	$2\frac{37}{64}{}^{+\cdot005}_{-\cdot000}$ in. (65·48 $^{+\cdot127}_{-\cdot000}$ mm.).	$2\frac{5}{8}{}^{+\cdot005}_{-\cdot000}$ in. (66·68 $^{+\cdot127}_{-\cdot000}$ mm.).
B.	2·465$^{+\cdot000}_{-\cdot005}$ in. (62·61 $^{+\cdot000}_{-\cdot127}$ mm.).	2·537$^{+\cdot000}_{-\cdot005}$ in. (64·44$^{+\cdot000}_{-\cdot127}$ mm.).
C.	$1\frac{3}{4}$ in. (44·45 mm.).	$1\frac{3}{4}$ in. (44·45 mm.).
D.	$\frac{3}{4}$ in. (19·05 mm.).	$\frac{3}{4}$ in. (19·05 mm.).
E.	$\frac{3}{4}$ in. B.S.W. thread.	$\frac{3}{4}$ in. B.S.W. thread.
	Pressing-in pilot	Pressing-in pilot
F.	3 in. (76·20 mm.).	$3\frac{1}{16}$ in. (77·79 mm.).
G.	$2\frac{5}{8}$ in. (66·68 mm.).	$2\frac{11}{16}$ in. (67·26 mm.).
H.	2·455$^{+\cdot000}_{-\cdot005}$ in. (62·35$^{+\cdot000}_{-\cdot127}$ mm.).	2·515 $^{+\cdot000}_{-\cdot005}$ in. (63·88$^{+\cdot000}_{-\cdot127}$ mm.).
J.	$1\frac{1}{4}$ in. (31·75 mm.).	$1\frac{1}{4}$ in. (31·75 mm.).
K.	$\frac{3}{4}$ in. (19·05 mm.).	$\frac{3}{4}$ in. (19·05 mm.).
L.	·015 in. (·38 mm.).	·015 in. (·38 mm.).
	Pilot extension	Pilot extension
M.	$14\frac{1}{2}$ in. (36·83 cm.).	$10\frac{1}{2}$ in. (26·67 cm.).
N.	$\frac{7}{8}$ in. (22·22 mm.).	$\frac{7}{8}$ in. (22·22 mm.).
P.	$\frac{5}{8}$ in. (15·87 mm.).	$\frac{5}{8}$ in. (15·87 mm.).
Q.	$\frac{5}{8}$ in. (15·87 mm.).	$\frac{5}{8}$ in. (15·87 mm.).
R.	1 in. (25·4 mm.) flats.	1 in. (25·4 mm.) flats.
S.	$\frac{3}{4}$ in. B.S.W. thread.	$\frac{3}{4}$ in. B.S.W. thread.
T.	$1\frac{1}{4}$ in. (31·75 mm.).	$1\frac{1}{4}$ in. (31·75 mm.).

Pressing in new liners

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

Each liner must be machined to the dimensions given 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 tachometer unit (drive type) 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 front 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 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.

Section A.33

PISTONS AND CONNECTING RODS (Later Cars)

Should the piston or connecting rod suffer damage or the small-end bush require renewal, the pistons and connecting rods are supplied as matched sets only. Therefore, under no circumstances should the small-end bush, piston, or connecting rod be renewed separately.

Removing and refitting

See Section A.26.

Dismantling

The gudgeon pins are fully floating; remove the two circlips locating each pin and press the pins out. It is essential that the piston assemblies should be replaced in their own bores and fitted the same way round: they should be marked to facilitate this.

Reassembling

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

Section A.34

PISTON SIZES AND CYLINDER BORES (Later Cars)

In production, piston and connecting rod assemblies are fitted by selective assembly.

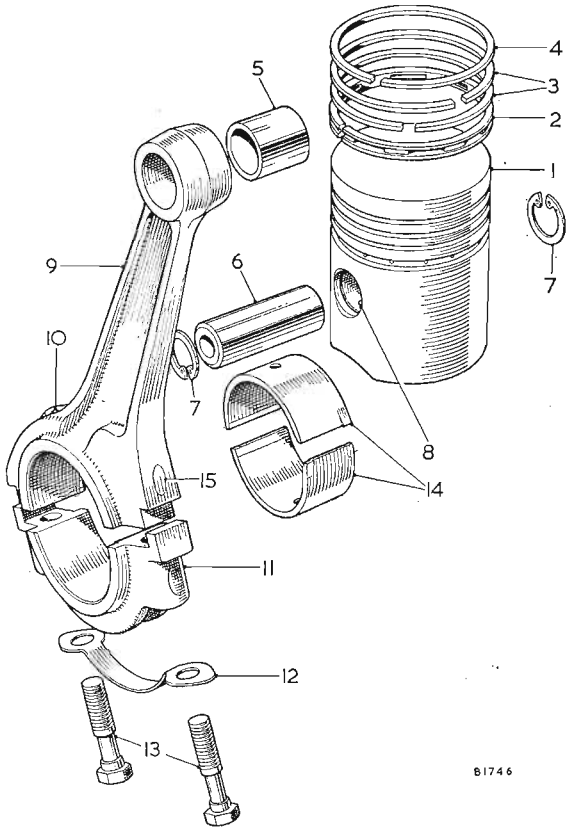


Fig. A.21

Piston and connecting rod

1. Piston
2. Piston ring—scraper.
3. Piston rings—taper.
4. Piston ring—parallel.
5. Small-end bush.
6. Gudgeon pin.
7. Circlip.
8. Gudgeon pin lubricating hole.
9. Connecting rod.
10. Cylinder wall lubricating jet.
11. Connecting rod cap.
12. Lock washer.
13. Bolts.
14. Connecting rod bearings.
15. Connecting rod and cap marking.

In addition to the standard piston and connecting rod assemblies there is a range of two oversize piston and connecting rod assemblies available for Service purposes.

Piston marking	*Suitable bore size*	*Metric equivalent*
STANDARD	2·5424 to 2·5447 in.	64·576 to 64·635 mm.
OVERSIZE		
+·010 in. (·254 mm.)	2·5524 to 2·5547 in.	64·830 to 64·889 mm.
+·020 in. (·508 mm.)	2·5624 to 2·5647 in.	65·084 to 65·143 mm.

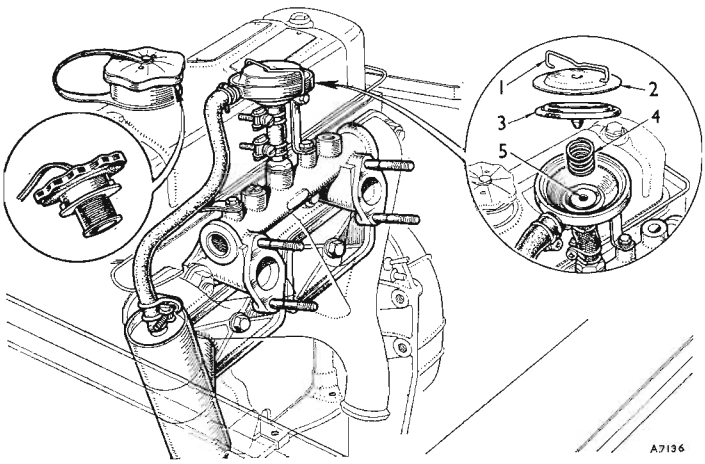


Fig. A.22

Closed-circuit breathing arrangement: (Inset) oil filler cap with combined air filter and the breather control valve.

1. Retaining clip.
2. Cover.
3. Diaphragm.
4. Spring.
5. Control orifice.

Section A.35

CRANKCASE CLOSED-CIRCUIT BREATHING

In order to conform to the air pollution regulations in certain countries crankcase fumes are directed into the induction manifold via the tappet chamber and a non-return valve on the manifold. A filter element is included on the rocker cover and in the oil filler cap.

Servicing

Remove the spring clip and lift out the diaphragm and top control spring. Clean all parts thoroughly and flush in methylated spirits. Examine the valve interior, the control orifice, the diaphragm, and the control needle. If the diaphragm is punctured, fit a new one. Reassemble the valve taking care to locate the spring centrally under the diaphragm.

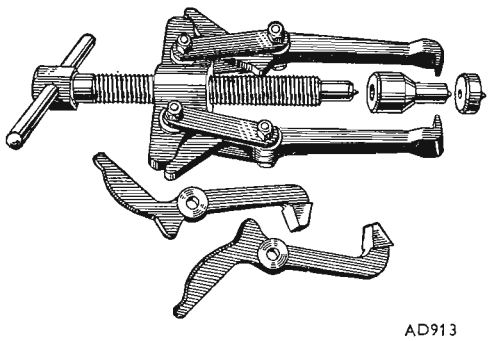
NOTE.—Solvents such as Trichlorethylene, Cresol, Acetone, and Benzene are not recommended for cleaning as they will damage the diaphragm and the backfire-valve seat.

(*For* **'SERVICE TOOLS'** *see page A. 27*)

SERVICE TOOLS

18G 2. Crankshaft Gear, Pulley, and Propeller Shaft Flange Remover

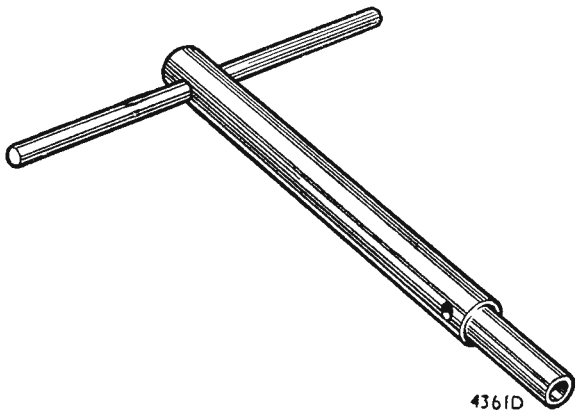
A multipurpose tool, with alternative legs readily interchangeable: one pair has thin flat ends designed for removing crankshaft gears and propeller shaft and bevel pinion flanges, the other pair has tapered ends suitable for fan pulley grooves other than later-type models fitted with narrow-section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



18G 2

18G 27. Valve Seat Cotter and Pilot Handle

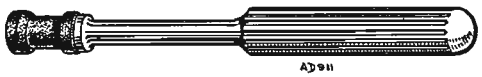
For use with pilot 18G 167 D, cutters 18G 167, 18G 167 C, 18G 167 B, and glaze breaker 18G 167 A.



18G 27

18G 29. Valve Grinding-in Tool

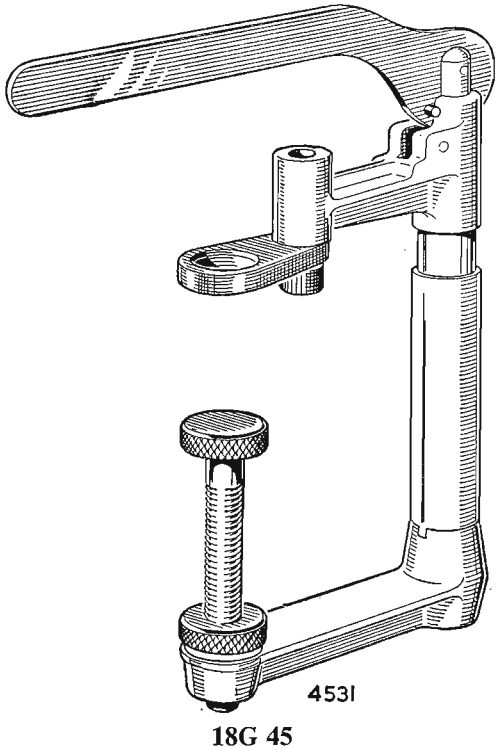
A metal handle complete with a detachable suction pad. For the Sprite (Mk. II) and Midget use alternative suction pad 18G 29 B.



18G 29

18G 45. Valve Spring Compressor

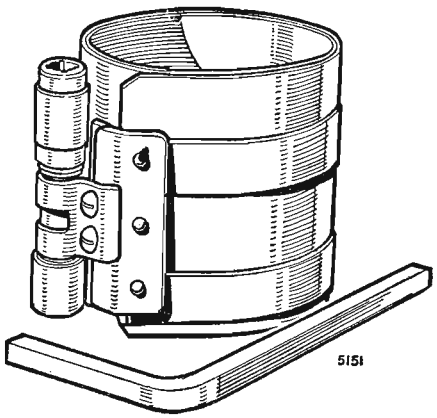
This tool is designed for o.h.v. engines. It has a cam and lever action and screw adjustment. The adaptor ring is shaped to facilitate the fitting of cotters.



18G 45

18G 55 A. Piston Ring Clamp

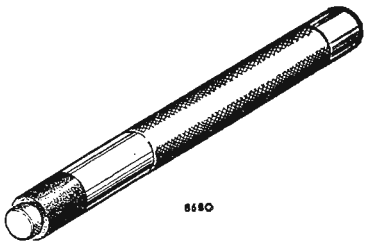
Designed to cover a wide range of pistons, it is easy to operate and will compress the strongest piston ring, making assembly to the bore a quick and easy operation.



18G 55 A

18G 69. Oil Pump Relief Valve Grinding-in Tool

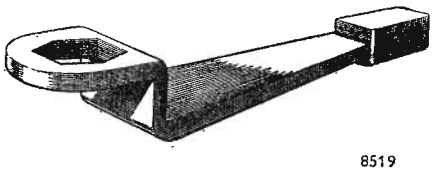
Designed to facilitate the removal and grinding in of the engine oil relief valve. Tightening the set screw when inserted into the hollow oil relief valve expands the rubber plunger, which ensures that the tool is a tight fit.



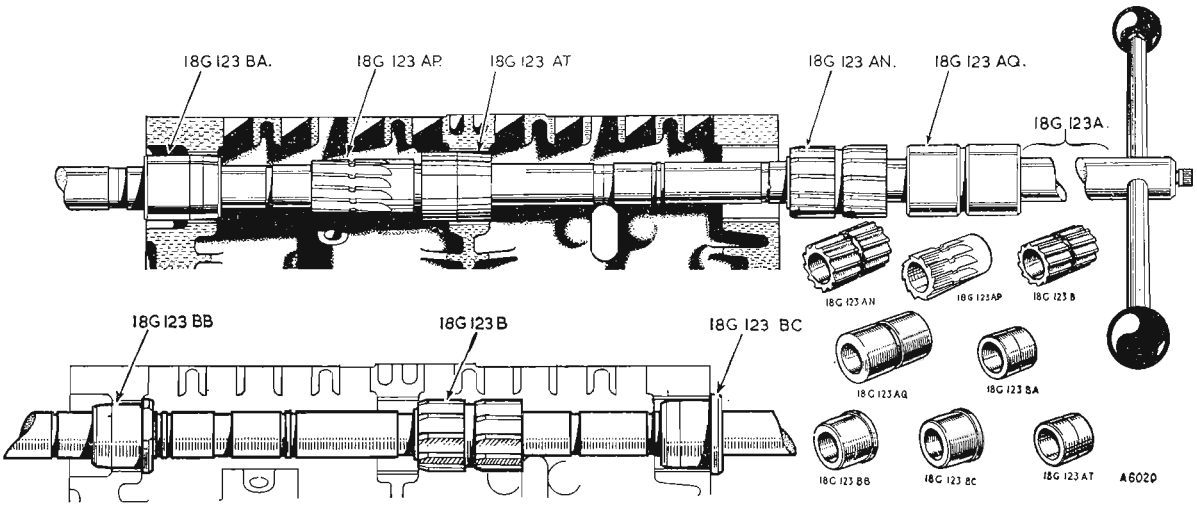
18G 69

18G 98. Nut Spanner

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



18G 98



18G 123 A. Camshaft Liner Reamer

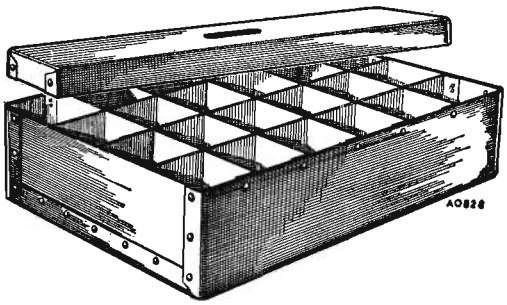
This equipment is essential when reconditioning cylinder blocks, otherwise camshaft liners cannot be reamed in line, and in consequence the clearance between the camshaft journal and liner will be incorrect. Full instructions for using the equipment will be supplied with each basic tool.

CUTTERS
18G 123 AN, 18G 123 AP,
18G 123 B

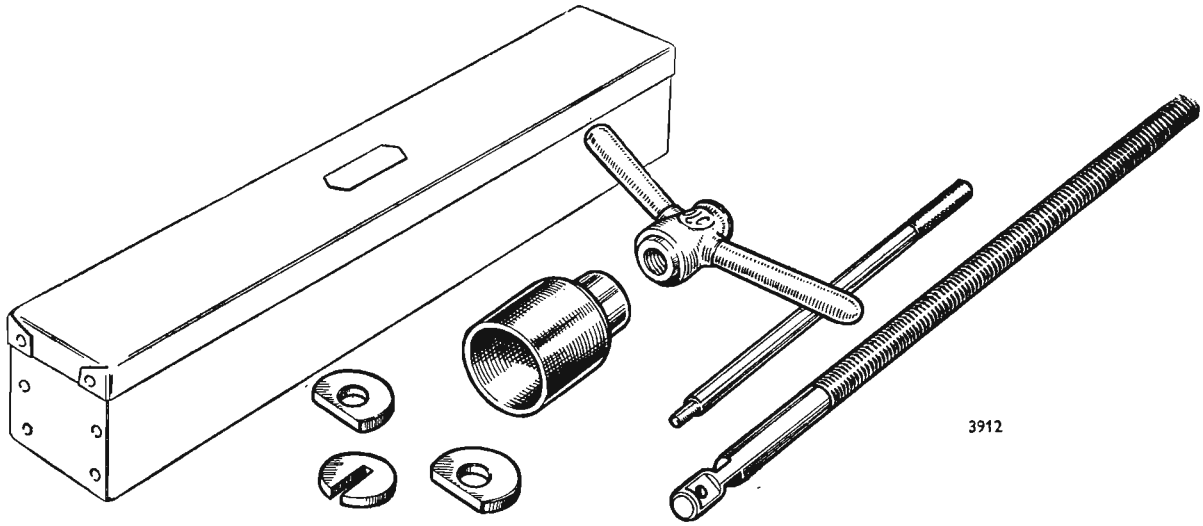
PILOTS
18G 123 AQ, 18G 123 AT,
18G 123 BA, 18G 123 BB,
18G 123 BC

18G 123 AL. 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.



18G 123 AL



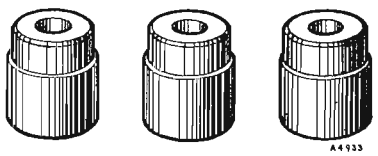
18G 124 A

18G 124 A. Camshaft Liner Remover and Replacer (basic tool)

The equipment consists of a basic tool 18G 124 A and various adaptors (supplied separately) for different types of engine. 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.

18G 124 K, 18G 124 B, and 18G 124 M. Camshaft Liner Remover Adaptors

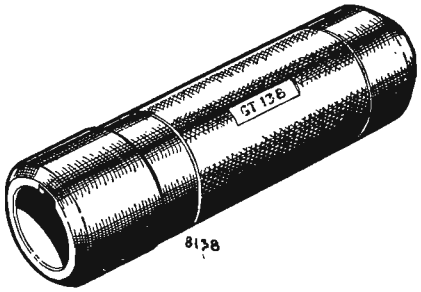
For use with 18G 124 A.



18G 124 K, 18G 124 B, 18G 124 M

18G 138. Crankshaft Gear, Pulley, and Propeller Shaft Flange Replacer

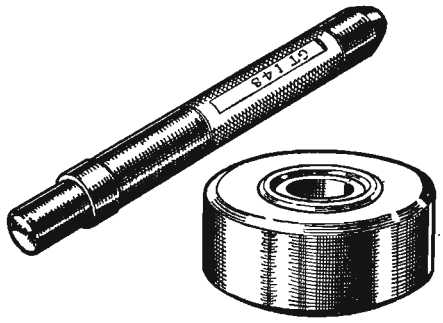
This tool is used for driving on the crankshaft gear and for lining up the timing cover.



18G 138

18G 148. 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.

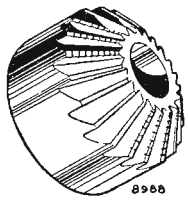


8154

18G 148

18G 167. Valve Seat Finishing Cutter

Use with pilot 18G 167 D and handle 18G 27.

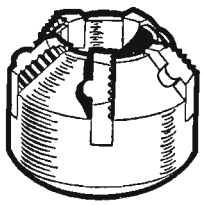


8988

18G 167

18G 167 A. Valve Seat Glaze Breaker

For use with pilot 18G 167 D and handle 18G 27.

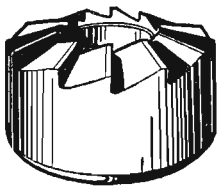


9165

18G 167 A

18G 167 B. Valve Seat Narrowing Cutter—Top

Designed to enable seats to be maintained at their original dimensions. Use with pilot 18G 167 D and handle 18G 27. These cutters must not be used on hardened valve seat inserts—the inserts must be renewed.

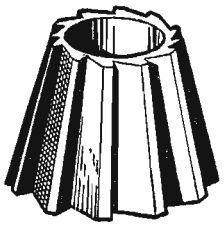


9021B

18G 167 B

18G 167 C. Valve Seat Narrowing Cutter—Bottom

Use with pilot 18G 167 D and handle 18G 27.



9021A

18G 167 C

18G 167 D. Valve Seat Cutter Pilot

For use with glaze breaker 18G 167 A, cutters 18G 167, 18G 167 B, 18G 167 C, and handle 18G 27.

18G 167 D

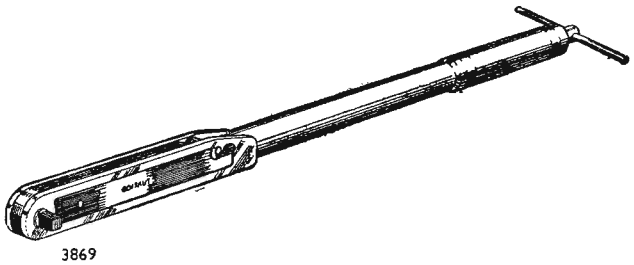
18G 187. Radiator Reverse-flush Adaptors

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.

18G 187

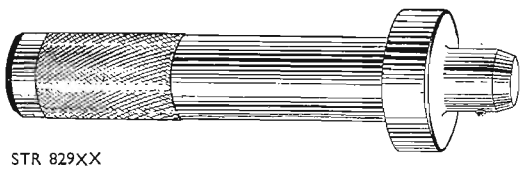
18G 372. Torque Wrench—30 to 140 lb. ft. (4·15 to 19·4 kg. m.)

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.



18G 372

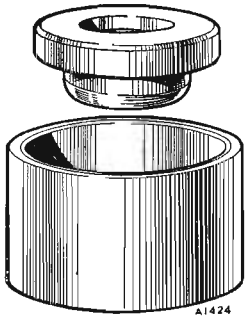
18G 134 Bearing and Oil Seal Replacer (basic tool)



18G 134

18G 134 BD Timing Case Oil Seal Replacer Adaptor

The fitting of the timing case oil seal must be carried out with extreme care use with basic tool 18G 134.



18G 134 BD

SECTION B

THE IGNITION SYSTEM

GENERAL DESCRIPTION

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

The ignition coil, which is mounted 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.

Section B.1

LUBRICATION

Distributor

Cam bearing

Lift the rotor off the top of the spindle by pulling it squarely and add a few drops of oil 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; if this is not available, clean engine oil may be used.

Automatic timing control

Carefully add a few drops of oil through the hole in the contact breaker base through which the cam passes.

Do not allow the oil to get on or near the contacts. Do not over-oil.

Section B.2

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.3

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 (see **'GENERAL DATA'**).

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.

(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.

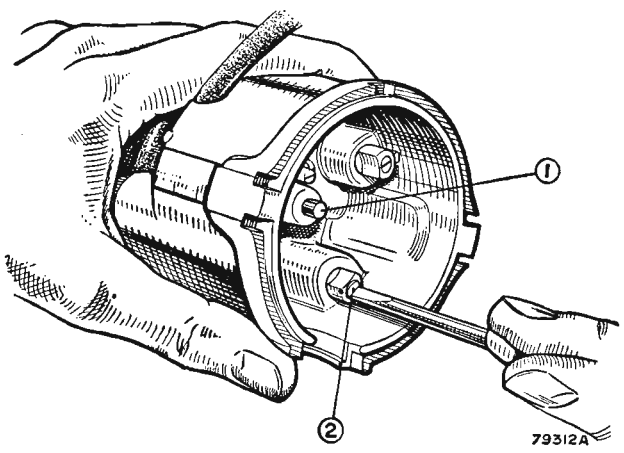
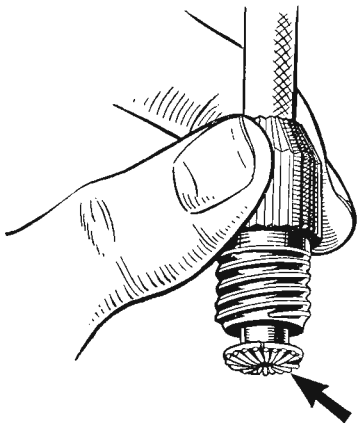


Fig. B.1

The method of connecting high-tension leads

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



O825HW

Fig. B.2

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

(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.4

HIGH-TENSION CABLES

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

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

If the leads are at any time removed from the cap, the holes which receive them should be filled with Silicone grease. Cut the new cables to the required length, push them completely home, and tighten the securing screws, watching in the process that the displaced surplus grease exudes evenly all round the leads to form a perfect seal. Care should be taken to leave an adequate surplus on the surface of the cap at the lead entry point.

Wipe the inside and outside of the moulded distributor cap with a soft dry cloth, taking care not to disturb the

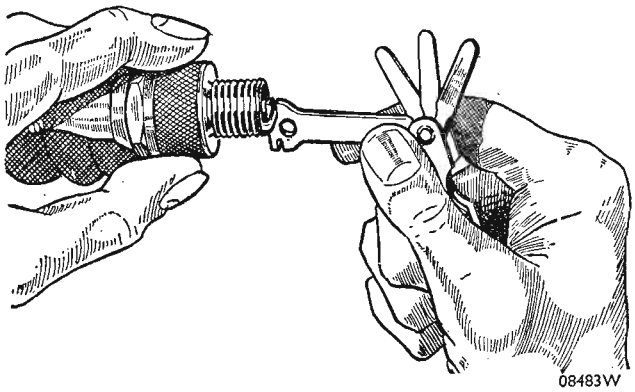


Fig. B.3

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

seals of water-repellent Silicone grease at the points of entry of the ignition cable leads into the cap. Adequate sealing is vital since otherwise water may in extreme circumstances penetrate into the cap down the outside of the leads and cause ignition failure.

Section B.5

SPARKING PLUGS

Service procedure

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

Disconnect the ignition cables from all sparking plugs. Loosen the sparking plugs about two turns anti-clockwise, using the 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 are 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 regular 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 or slow speeds 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 sparking 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. (·127 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.6

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.

Turn the crankshaft until the contact breaker points are fully opened and check the gap with a gauge (see **'GENERAL DATA'**). 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.

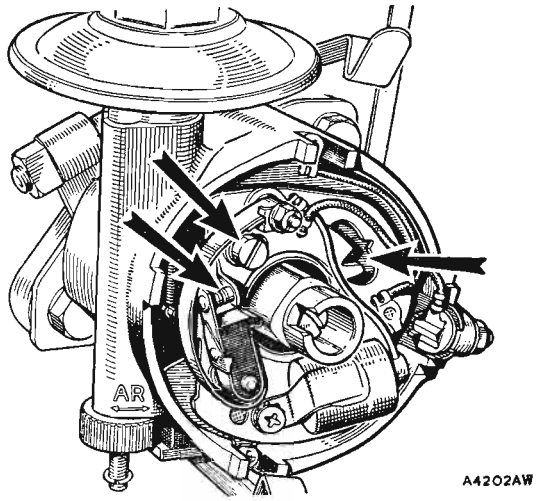


Fig. B.4

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.7

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

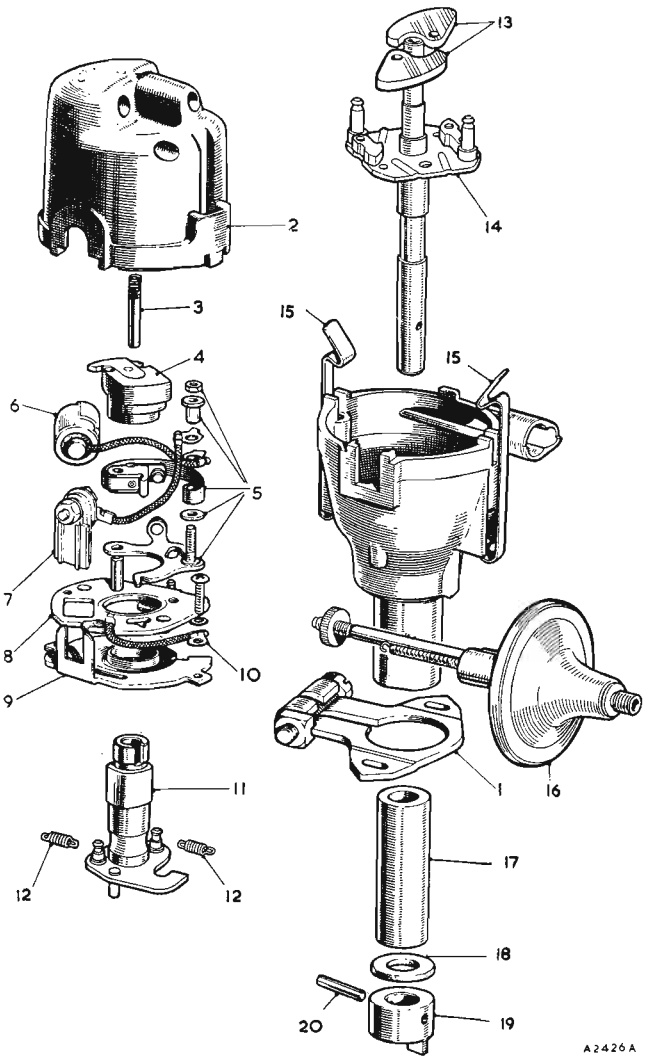


Fig. B.5

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. Parallel pin.

unhook the flexible actuating link connected to the contact breaker plate.

The following procedure is necessary if the distributor is to be completely stripped.

Before dismantling, make a careful note of the positions in which the various components are fitted in order that they may be replaced correctly.

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 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.

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 and the offset drive dog at the driving end of the spindle to ensure that the timing is not 180° out when the cam is reassembled.

Take out the cam retaining screw, remove the automatic advance springs, and remove the cam.

Take out the centrifugal weights.

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

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.

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.

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

Reassembling

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

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 (see **'GENERAL DATA'**).

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.8 should be undertaken to reset the distributor.

Section B.8

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

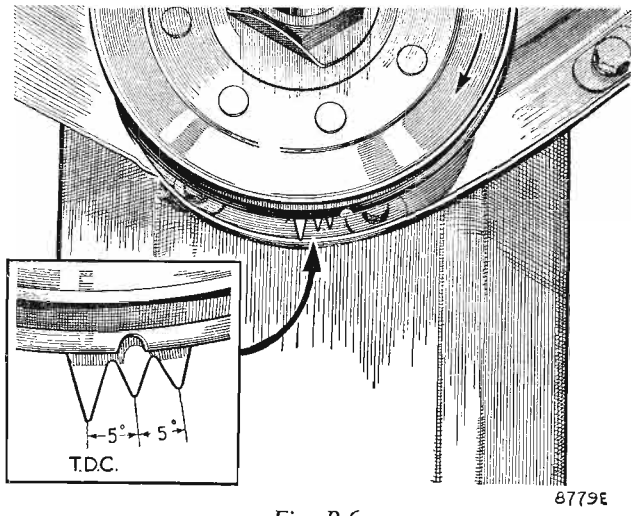


Fig. B.6

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

camshaft and crankshaft wheels. Nos. 1 and 4 pistons are now at T.D.C. Set the micrometer adjustment on the distributor in its central position. The crankshaft should now be rotated to obtain its correct position.

Set the contact breaker points (see **'GENERAL DATA'**) when in their position of maximum opening. Insert the distributor into its housing, and engage the driving 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 the correct torque tightness (see **'GENERAL DATA'** in order 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 induction manifold this should be disconnected before attempting the timing check, otherwise engine timing will be set retarded.

Section B.9

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.8.

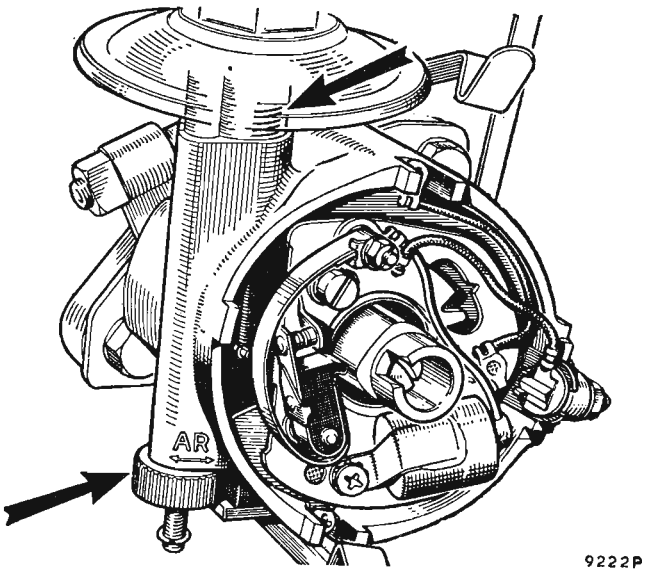


Fig. B.7

Showing the adjustment nut and the vernier scale

Section B.10

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

GENERAL DESCRIPTION

The cooling system is pressurized, 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.

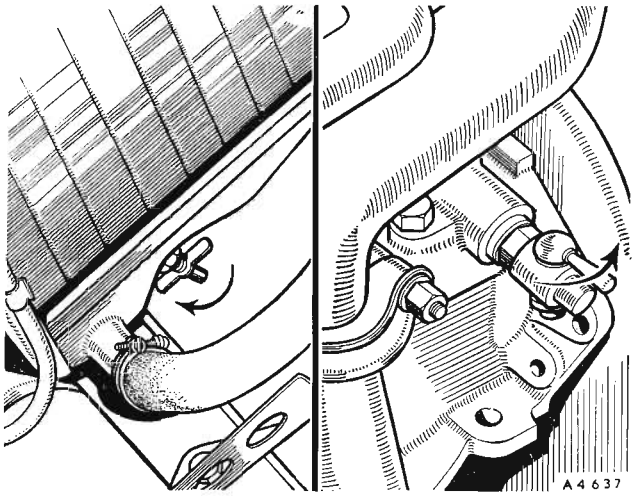


Fig. C.1

(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

LUBRICATION

Water pump

Remove the plug from the water pump casing and refill the aperture with lubricant. Do not subject the pump to pressure lubrication, otherwise lubricant will be forced past the bearings onto the face of the carbon sealing ring and will impair its efficiency.

Section C.2

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.3

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 efficient 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.5 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 18G 187 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.4

THERMOSTAT

Removing

Drain the cooling system (Section C.3). 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 the temperature given under **'GENERAL DATA.'** 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.5

RADIATOR

Removing

Drain the cooling system (see Section C.3). 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.6

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. Push the dynamo down, release the belt from the crankshaft pulley, and remove the belt.

Section C.7

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.3 and C.5.

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.

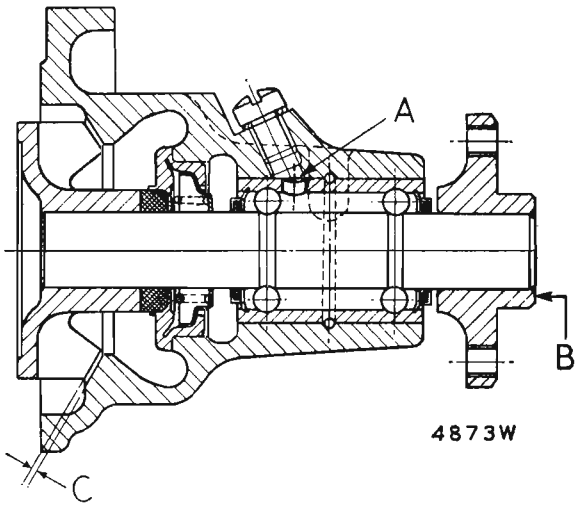


Fig. C.2

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.* (C) *is a clearance of* ·020 *to* ·030 *in.* (·508 *to* ·762 *mm.*)

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.8

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 C.9

FROST PRECAUTION

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.

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

Only anti-freeze of the ethylene glycol or glycerine type is suitable for use in the cooling system. We recommend owners to use Bluecol Anti-freeze (non-corrosive) in order to protect the cooling system during frosty weather and reduce corrosion to a minimum. We also approve the use of any anti-freeze which conforms to Specification B.S.3151 or B.S.3152.

Before adding anti-freeze mixture to the radiator it is advisable to clean out the cooling system thoroughly by swilling out the passages with a hose inserted in the filler cap while keeping the drain taps open.

Anti-freeze can remain in the cooling system for two years provided that the specific gravity of the coolant is checked periodically and anti-freeze added as required. Specialized equipment is necessary to check the specific gravity, which can be obtained from the anti-freeze manufacturer.

After the second winter, drain the system and flush out. Refill with fresh water or the recommended anti-freeze solution.

Only top up when the cooling system is at its normal running temperature, in order to avoid losing anti-freeze due to expansion.

Make sure that the cooling system is water-tight, examine all joints, and replace any defective rubber hose with new.

The correct quantities of anti-freeze for different degrees of frost resistance are given in the table below.

Absolute safe limit		*Commences freezing at*		*Solution* (%)	*Quantity of anti-freeze required*
° *C.*	° *F.*	° *C.*	° *F.*		
−19	−3	−9	16	20	2 pts. (2·4 U.S. pts., 1·1 litres)
−26	−15	−13	9	25	2½ pts. (3·0 U.S. pts., 1·42 litres)
−33	−28	−16	3	30	3 pts. (3·6 U.S. pts., 1·71 litres)

Warning

When a heater unit is fitted an anti-freeze solution must be used in the cooling system since no provision is made for draining the heater.

SECTION D

THE FUEL SYSTEM

GENERAL DESCRIPTION

The fuel system comprises a fuel tank mounted below the luggage compartment, an A.C. 'Y' type mechanically operated fuel pump, and twin S.U. HS2 semi-down-draught automatic expanding choke-type carburetters.

The level of the fuel in the tank is registered electrically by a meter on the instrument panel.

The air cleaner fitted to the carburetters has a renewable paper-element filter to trap road dust and other harmful matter from the air before it reaches the carburetters.

Section D.1

LUBRICATION

Carburetter dampers

Unscrew the cap from the top of each suction chamber and refill the hollow piston rod with thin engine oil until the level is ½ in. (13 mm.) from the top. Under no circumstances must heavy-bodied lubricant be used. Failure to lubricate the piston damper will cause piston flutter and reduce acceleration.

Section D.2

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.3

FUEL TANK GAUGE UNIT

Remove the fuel tank as described in Section D.2.

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.4

FUEL PUMP

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.

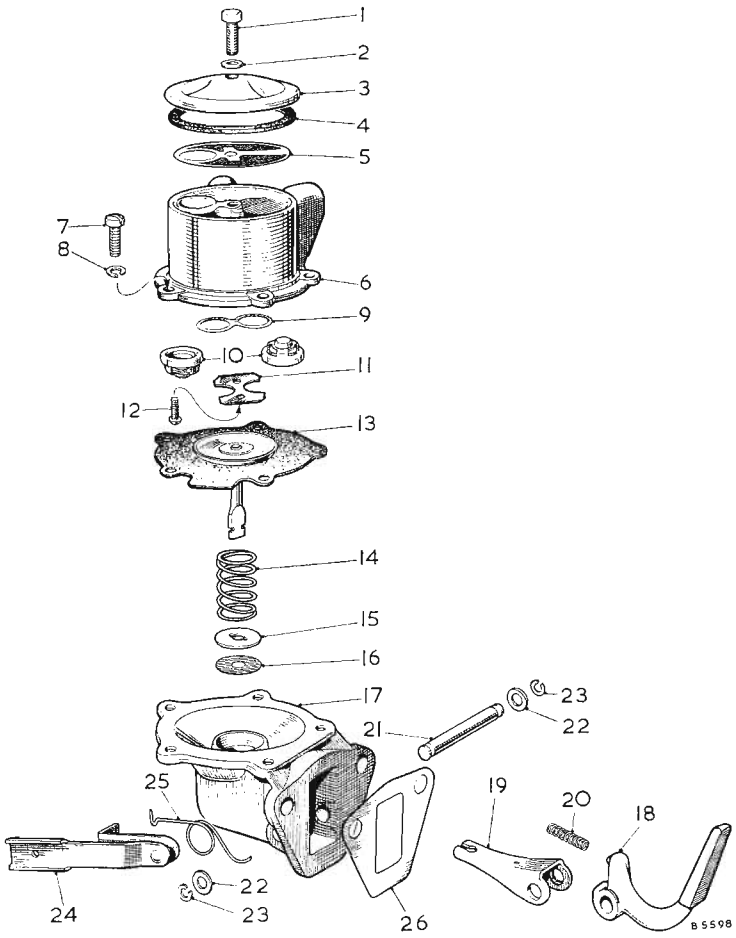


Fig. D.1

The A.C. 'Y' Type Fuel Pump Components

1. Cover screw.
2. Gasket
3. Filter cover.
4. Filter cover gasket.
5. Filter gauze.
6. Upper casting.
7. Screw.
8. Lock washer.
9. Valve gasket.
10. Valve assembly.
11. Valve retainer.
12. Screw.
13. Diaphragm.
14. Spring
15. Metal washer.
16. Fabric washer.
17. Pump body.
18. Rocker arm.
19. Rocker arm link.
20. Rocker arm spring.
21. Rocker arm pin.
22. Washer.
23. Clip.
24. Priming lever.
25. Spring.
26. Gasket.

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.

Remove the securing screws, valve plate, inlet and delivery valve assemblies, and gasket.

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 retaining circlip and washer from either side permits the rocker arm pivot pin to be drawn out, which in turn will release the rocker arm, connecting link, washers, 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. (6·1 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. (14·3 mm.) indicates correct assembly, whereas one of $\frac{8}{16}$ in. (4·8 mm.) proves that the assembly is unsatisfactory.

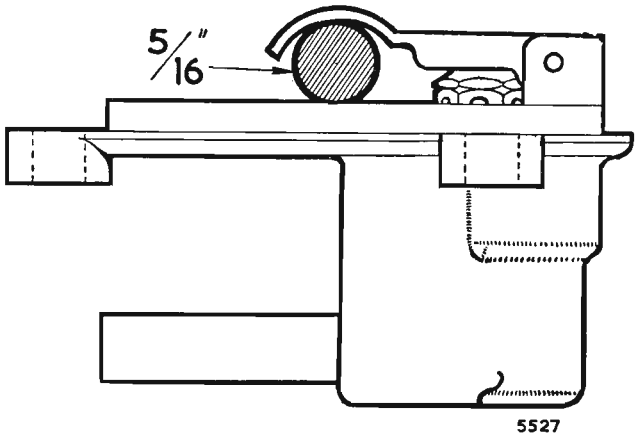


Fig. D.3

The method of checking the correct adjustment of the hinged lever (early cars)

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 marks made on the flanges before dismantling, and refit.

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.

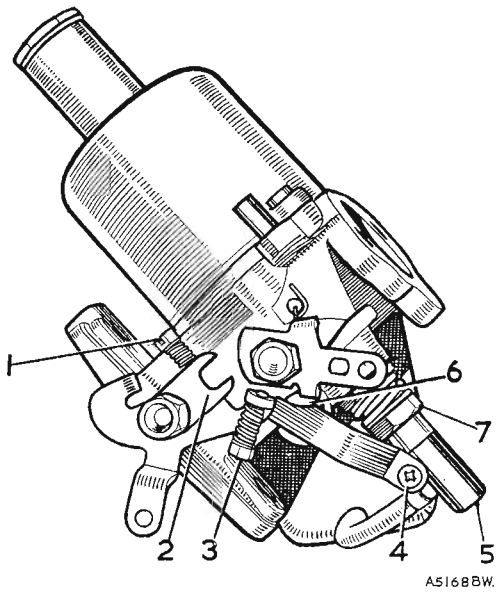


Fig. D.2

The HS2-type carburetter

1. Throttle adjusting screw.
2. Butterfly operating fork.
3. Fast-idle adjusting screw.
4. Jet link securing screw.
5. Jet head.
6. Float-chamber securing nut.
7. Jet adjusting nut.

Section D.5

CARBURETTERS

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

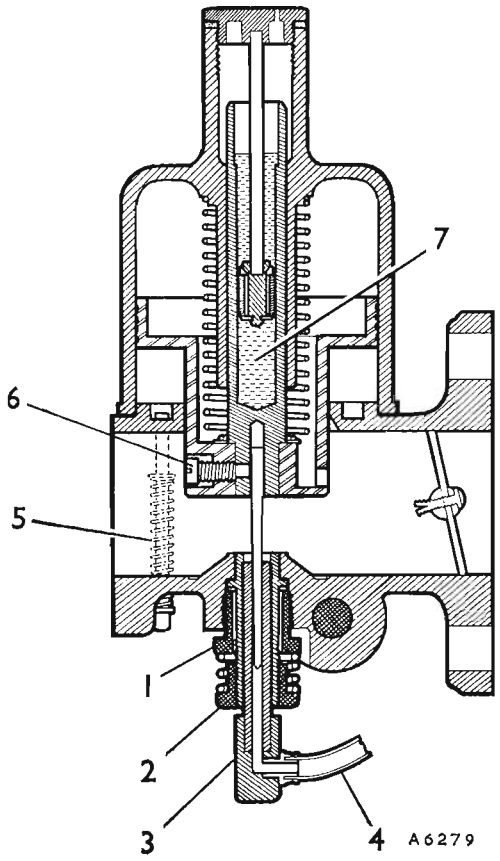


Fig. D.4

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. Needle securing screw.
7. Piston damper oil well.

except the piston rod. A sticking piston can be ascertained by removing the piston damper and lifting the piston with a pencil or similar instrument; the piston should come up quite freely and fall back smartly onto the jet bridge 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 one of the carburetters

Should this be suspected, 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 breather 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 pipe 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 adjustment and synchronization

When the engine is fully run in the slow running may require adjustment. This must only be carried out when the engine has reached its normal running temperature.

As the needle size is determined during engine development, tuning of the carburetters is confined to correct idling setting. Slacken the actuating arms on the throttle spindle interconnection. Close both throttles fully by unscrewing the throttle adjusting screws, then open each throttle by screwing down each idling adjustment screw one turn.

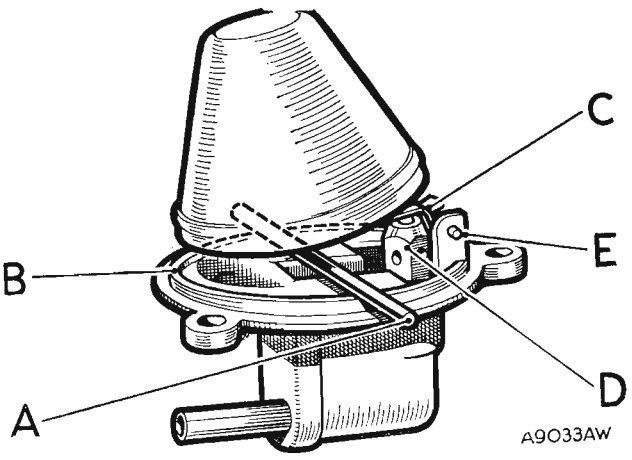


Fig. D.5

The method of checking the correct adjustment of the float lever (later cars)

A. $\frac{1}{8}$ to $\frac{3}{16}$ in. (3·18 to 4·76 mm.).
B. Machined lip.
C. Angle of float lever.
D. Float needle and seat assembly.
E. Lever hinge pin.

Remove the pistons and suction chambers and disconnect the choke control cable. Screw the jet adjusting nuts until each jet is flush with the bridge of its carburetter, or as near to this as possible (both jets being in the same relative position to the bridge of their respective carburetters). Replace the pistons and suction chamber assemblies and check that the pistons fall freely onto the bridge of the carburetters (by means of the piston lifting pins). Turn down the jet adjusting nut two complete turns (12 flats).

Restart the engine, and adjust the throttle adjusting screws to give the desired idling speed by moving each throttle adjusting screw an equal amount. By listening to the hiss in the intakes, adjust the throttle adjusting screws until the intensity of the hiss is similar on both intakes. This will synchronize the throttles.

When this is satisfactory the mixture should be adjusted by screwing each jet adjusting nut up or down by the same amount until the fastest idling speed is obtained consistent with even firing. During this adjustment it is necessary that the jets are pressed upwards to ensure that they are in contact with the adjusting nuts.

As the mixture is adjusted the engine will probably run faster, and it may therefore be necessary to unscrew the throttle adjusting screws a little, each by the same amount, to reduce the speed.

Now check the mixture strength by lifting the piston of the front carburetter by approximately $\frac{1}{32}$ in. (1 mm.), when:

(1) If the engine speed increases, this indicates that the mixture strength of the front carburetter is too rich.
(2) If the engine speed immediately decreases, this indicates that the mixture strength of the front carburetter is too weak.
(3) If the engine speed momentarily increases very slightly, then the mixture strength of the front carburetter is correct.

Repeat the operation at the rear carburetter, and after adjustment re-check the front carburetter, since both carburetters are interdependent.

When the mixture is correct the exhaust note should be regular and even. If it is irregular, with a splashy type of misfire and colourless exhaust, the mixture is too weak. If there is a regular or rhythmical type of misfire in the exhaust beat, together with a blackish exhaust, then the mixture is too rich.

Throttle linkage

The throttle on each carburetter is operated by a lever and pin, with the pin working in a forked lever attached to the throttle spindle. A clearance between the pin and fork must be maintained when the throttle is closed and the engine at rest to prevent any load from the accelerator linkage and return springs being transferred to the throttle butterfly and spindle.

To set this clearance: with the throttle shaft levers free on the throttle shaft, put a ·012 in. (·3 mm.) feeler between the throttle shaft stop at the top and the carburetter heat shield. Move the throttle shaft lever downwards until the lever pin rests lightly on the lower arm of the fork in the carburetter throttle lever. Tighten the clamp bolt of the throttle shaft lever at this position. When both carburetters have been dealt with, remove the feeler. The pins on the throttle shaft levers should then have clearance in the forks.

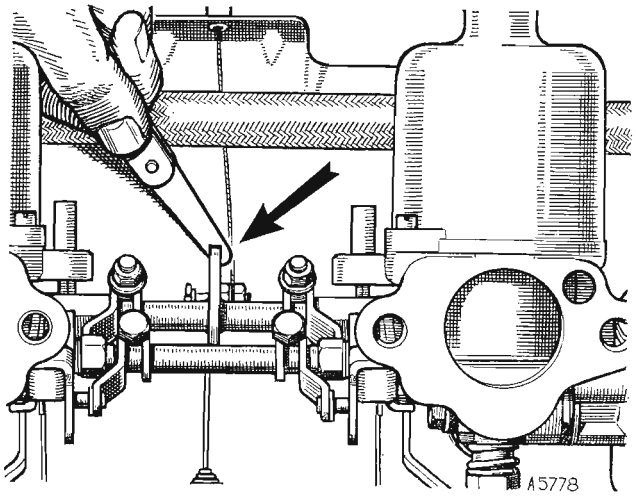


Fig. D.6

The feeler between the throttle shaft stop and the carburetter heat shield

Reconnect the choke cable, ensuring that the jet heads return against the lower face of the jet adjusting nuts when the choke control is pushed fully in.

Pull out the mixture control knob on the dash panel until the linkage is about to move the carburetter jets (a minimum of $\frac{1}{4}$ in. or 6 mm.) and adjust the fast idle adjusting screws to give an engine speed of about 1,000 r.p.m. when hot.

Float-chambers

The position of the hinged 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 round bar between the hinged lever and the machined lip of the float-chamber lid. The end of the lever should just rest on the bar (see Fig. D3. or D.5) 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.

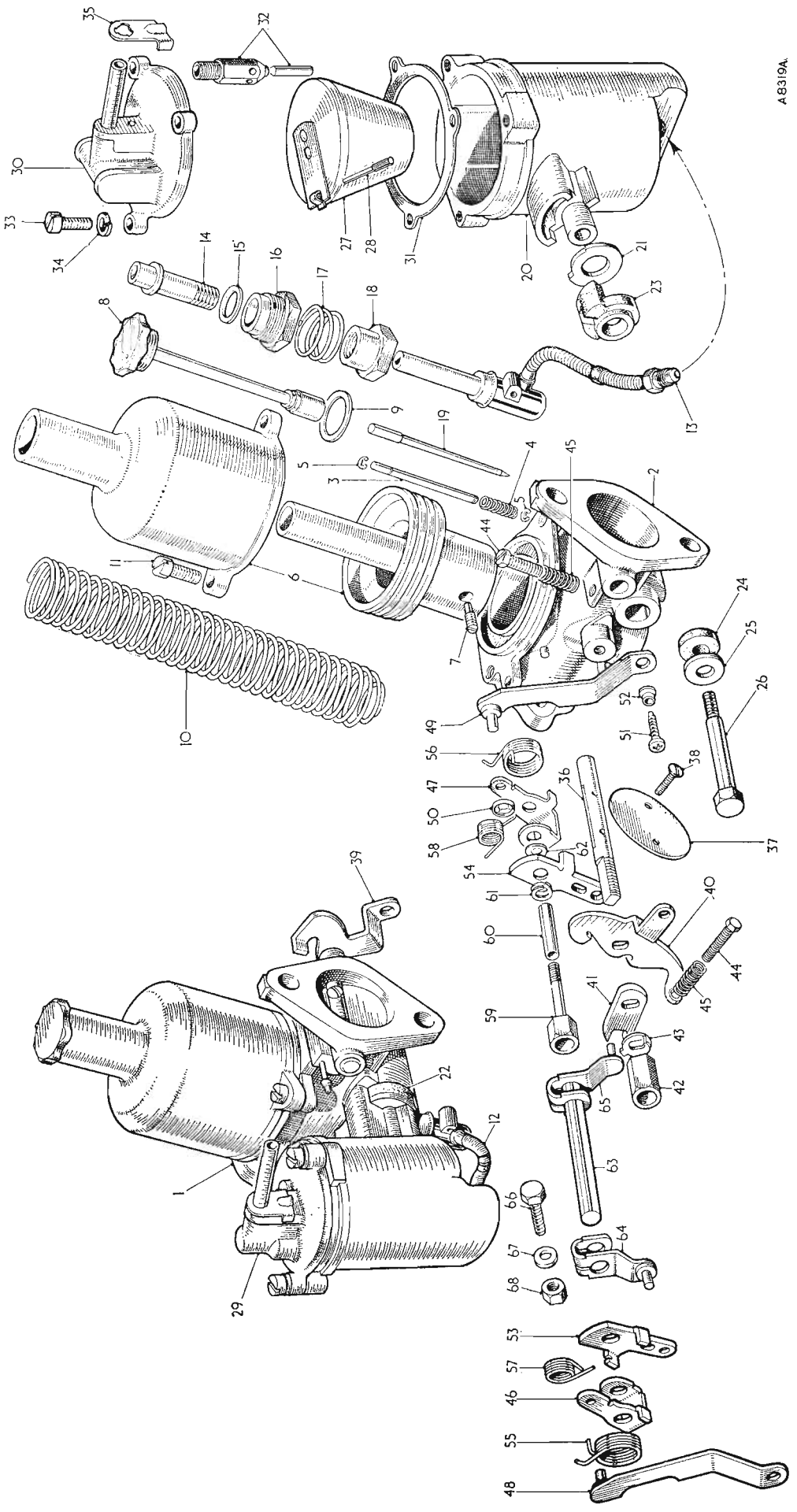
Do not bend the shank, which must be perfectly flat and at right angles to the needle when it is on its seating.

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— thatis, with the jet adjusting nut (2, Fig. D4.) 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.

THE CARBURETTER COMPONENTS



KEY TO THE CARBURETTER COMPONENTS

No.	Description
1.	Carburetter body (left).
2.	Carburetter body (right).
3.	Piston lifting pin.
4.	Spring.
5.	Circlip.
6.	Piston chamber assembly.
7.	Screw.
8.	Cap and damper assembly.
9.	Fibre washer.
10.	Piston spring.
11.	Screw
12.	Jet assembly (left carburetter).
13.	Jet assembly (right carburetter).
14.	Bearing.
15.	Washer.
16.	Screw.
17.	Spring.
18.	Screw.
19.	Needle.
20.	Float-chamber.
21.	Support washer.
22.	Rubber grommet (left carburetter).
23.	Rubber grommet (right carburetter).
24.	Washer (rubber)
25.	Washer (steel).
26.	Bolt.
27.	Float assembly.
28.	Lever pin.
29.	Float-chamber lid (left carburetter).
30.	Float-chamber lid (right carburetter).
31.	Washer.
32.	Needle and seat assembly.
33.	Screw.
34.	Spring washer.
35.	Baffle plate.
36.	Throttle spindle.
37.	Throttle disc.
38.	Screw.
39.	Throttle return lever (left carburetter).
40.	Throttle return lever (right carburetter).
41.	Lost motion lever.
42.	Nut.
43.	Tab washer.
44.	Throttle screw stop.
45.	Spring.
46.	Pick-up lever (left carburetter).
47.	Pick-up lever (right carburetter).
48.	Link (left carburetter).
49.	Link (right carburetter).
50.	Washer.
51.	Screw.
52.	Bush.
53.	Cam lever (left carburetter).
54.	Cam lever (right carburetter).
55.	Pick-up lever spring (left carburetter).
56.	Pick-up lever spring (right carburetter).
57.	Cam lever spring (left carburetter).
58.	Cam lever spring (right carburetter).
59.	Bolt.
60.	Tube.
61.	Spring washer.
62.	Distance piece.
63.	Jet rod.
64.	Lever and pin assembly (left carburetter).
65.	Lever and pin assembly (right carburetter).
66.	Bolt.
67.	Washer.
68.	Nut.

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.4) 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.

Needles

Remove the piston and suction chamber assembly. Slacken the needle clamping screw, extract the needle and check its identifying mark (see GENERAL DATA). Refit the correct needle ensuring that the shoulder on the shank is flush with the piston base.

Removing

Remove the air cleaners as detailed in Section D.6. 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.

Refitting

Reverse the removal procedure when refitting. 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.

Section D.6

AIR CLEANERS

Removing

Disconnect the breather pipe from the front air cleaner.

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 at regular intervals.

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

Refitting

Refitting is a reversal of the removal procedure.

SECTION Da

THE FUEL SYSTEM

The information given in this Section refers specifically to the Sprite (Mk. III) and Midget (Mk. II) and must be used in conjunction with Section D

GENERAL DESCRIPTION

The fuel system is the same as that used on earlier cars, with the exception of the pump which is an S.U. AUF 200 electrically operated diaphragm type.

Section Da.1

FUEL PUMP

Removing and Refitting

The pump is situated beneath the luggage compartment on the right-hand side. For removal: disconnect the battery earth lead and detach the earth and supply leads from the terminals on the pump.

Disconnect the inlet, outlet, and vent pipe connections.

Remove the two bolts securing the pump bracket to the rear foot-well panel.

When replacing, ensure that the outlet is vertically above the inlet port, i.e. the inlet and outlet nozzles are horizontal.

Also ensure a good earth connection.

Dismantling

Contact breaker

(1) Remove the insulated sleeve, terminal nut, and connector together with its shakeproof washer. Remove the tape seal (if fitted) and take off the end-cover.

(2) Remove the condenser (if fitted) from its clip, unscrew the 5 B.A. screw which holds the contact blade to the pedestal. This will allow the washer, the long-coil lead, and the contact blade to be removed.

Coil housing and diaphragm

(3) Unscrew the coil housing securing screws, using a thick-bladed screwdriver to avoid damaging the screw heads.

(4) Remove the earthing screw.

(5) The coil housing may now be removed from the body. Next, remove the diaphragm and spindle assembly by taking hold of the diaphragm and unscrewing it anti-clockwise until the armature spring pushes the diaphragm away from the coil housing. It is advisable to hold the housing over the bench so that the 11 brass rollers will not fall on the floor. The diaphragm and its spindle are serviced as a unit and should not be separated.

Pedestal and rocker

(6) Remove the end-cover seal washer, unscrew the terminal nut, and remove the lead washer; this will have flattened on the terminal tag and thread, and is best cut away with cutting pliers or a knife. Unscrew the two 2 B.A. screws, holding the pedestal to the coil housing, remove the earth terminal tag together with the condenser clip (if fitted). Tip the pedestal and withdraw the terminal stud from the terminal tag. The pedestal may now be removed with the rocker mechanism attached.

(7) Push out the hardened steel pin which holds the rocker mechanism to the pedestal.

Body and valves

(8) Unscrew the two 2 B.A. screws securing the spring clamp plate holding the inlet and outlet nozzles. Remove the nozzles, filter, and valve assemblies.

Inspection

If gum formation has occurred in the fuel used in the pump, the parts in contact with the fuel will have become coated with a substance similar to varnish. This has a strong stale smell and may attack the neoprene diaphragm. Brass and steel parts so affected can be cleaned by being boiled in a 20 per cent. solution of caustic soda, dipped in a strong nitric acid solution, and finally washed in boiling water. Light alloy parts must be well-soaked in methylated spirits and then cleaned.

(1) Clean the pump and inspect for cracks, damaged joint faces, and threads.

(2) Examine the plastic valve assemblies for kinks or damage to the valve plates. They can best be checked by blowing and sucking with the mouth.

(3) Check that the narrow tongue on the valve cage, which is bent over to retain the valve and to prevent it being forced out of position, has not been distorted but allows a valve lift of approximately $\frac{1}{16}$ in. (1·6 mm.).

(4) Examine the valve recesses in the body for damage and corrosion; if it is impossible to remove the corrosion, or if the seat is pitted, the body must be discarded.

(5) Ensure that the coil housing vent tube is not blocked.

(6) Clean the filter with a brush and examine for fractures, renew if necessary.

(7) Examine the coil lead tag for security and the lead insulation for damage.

(8) Examine the contact breaker points for signs of burning and pitting; if this is evident, the rocker assembly and spring blade must be renewed.

(9) Examine the pedestal for cracks or other damage, particularly to the narrow ridge in the edge of the rectangular hole on which the contact blade rests.

(10) Examine the non-return vent valve in the end-cover (if fitted) for damage, ensure that the small ball valve is free to move.

(11) Examine the diaphragm for signs of deterioration.

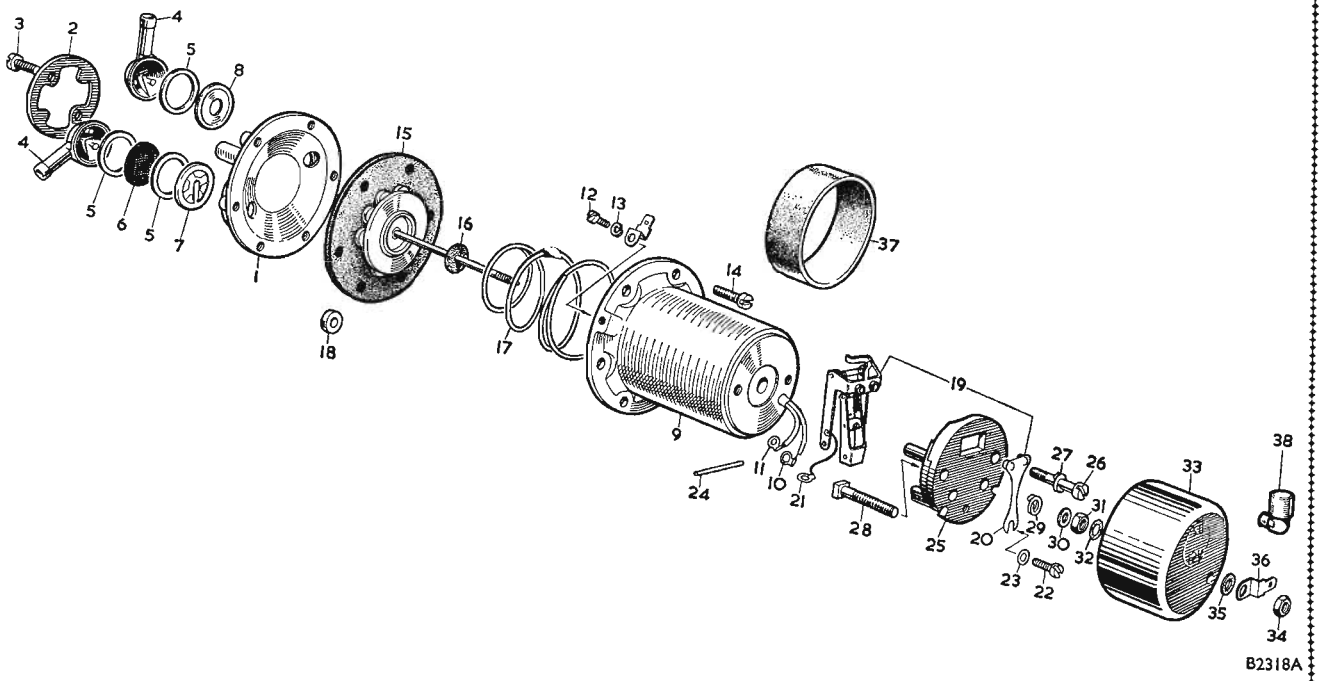
(12) Renew the following parts: all fibre and cork washers, gaskets and 'O' section sealing rings, rollers showing signs of wear on periphery, damaged bolts and unions.

Reassembling

Pedestal and rocker

NOTE.—The steel pin which secures the rocker mechanism to the pedestal is specially hardened and must not be replaced by other than a genuine S.U. part.

THE FUEL PUMP COMPONENTS



No.	*Description*
1.	Body.
2.	Spring clamp plate.
3.	Screw.
4.	Nozzle—inlet/outlet.
5.	Sealing washer.
6.	Filter.
7.	Valve—inlet.
8.	Valve—outlet.
9.	Housing—coil.
10.	Tag—5 B.A. terminal.
11.	Tag—2 B.A. terminal.
12.	Screw—earth.
13.	Washer—spring.
14.	Screw—housing to body.
15.	Diaphragm assembly.
16.	Impact washer.
17.	Spring.
18.	Roller.
19.	Rocker and blade.
20.	Blade.
21.	Tag—2 B.A. terminal.
22.	Screw for blade.
23.	Washer—dished.
24.	Spindle for contact breaker.
25.	Pedestal.
26.	Screw—pedestal to housing.
27.	Washer—spring.
28.	Screw for terminal.
29.	Washer—spring.
30.	Washer—lead—for screw.
31.	Nut for screw.
32.	Spacer—nut to cover.
33.	Cover—end.
34.	Nut for cover.
35.	Washer—shakeproof.
36.	Connector—Lucar.
37.	Packing sleeve.
38.	Non-return valve.

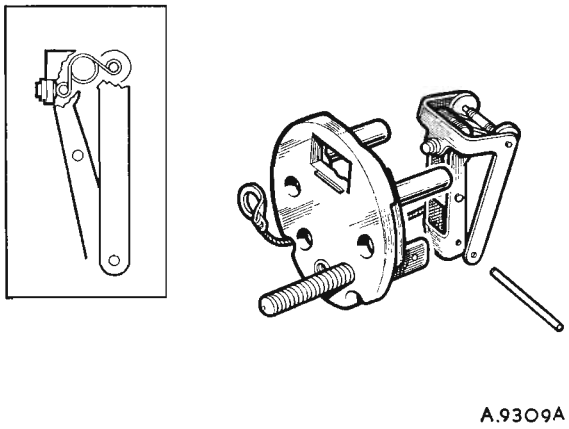


Fig. Da.1

Fitting the rocker assembly to the pedestal: (inset) the correct position of the centre toggle spring after assembly

(1) Invert the pedestal and fit the rocker assembly to it by pushing the steel pin through the small holes in the rockers and pedestal struts. Then position the centre toggle so that, with the inner rocker spindle in tension against the rear of the contact point, the centre toggle spring is above the spindle on which the white rollers run.

This positioning is important to obtain the correct 'throw-over' action; it is also essential that the rockers are perfectly free to swing on the pivot pin and that the arms are not binding on the legs of the pedestal. If necessary, rockers can be squared-up with a pair of long-nosed pliers.

(2) Assemble the square-headed 2 B.A. terminal stud to the pedestal, the back of which is recessed to take the square head.

(3) Assemble the 2 B.A. spring washer and put the terminal stud through the 2 B.A. terminal tag, then fit the lead washer and the coned nut with its coned face to the lead washer. (This makes better contact than an ordinary flat washer and nut.) Tighten the 2 B.A. nut, and finally add the end-cover seal washer.

(4) Assemble the pedestal to the coil housing by fitting the two 2 B.A. pedestal screws, ensuring that the spring washer on the left-hand screw (9 o'clock position) is between the pedestal and the earthing tag.

(5) Tighten the screws, taking care to prevent the earthing tag from turning, as this will strain or break the earthing flex. Do not overtighten the screws or the pedestal will crack.

Do not fit the contact blade at this stage.

Diaphragm assembly

(6) Place the armature spring into the coil housing with its larger diameter towards the coil.

(7) Before fitting the diaphragm, make sure that the impact washer is fitted to the armature (this is a small neoprene washer that fits in the armature recess). Do not use jointing compound or dope on the diaphragm.

(8) Fit the diaphragm by inserting the spindle in the hole in the coil and screwing it into the threaded trunnion in the centre of the rocker assembly.

(9) Screw in the diaphragm until the rocker will not throw over; this must not be confused with jamming the armature on the coil housing internal steps.

(10) Fit the 11 brass centralizing rollers by turning back the diaphragm edge and dropping the rollers into the coil recess. The pump should be held in the left hand, rocker end downwards, to prevent the rollers from falling out.

On later-type rocker mechanisms with adjustable fingers fit the contact blade and adjust the finger settings as described under those headings, then carefully remove the contact blade.

(11) Holding the coil housing assembly in the left hand, in an approximately horizontal position, push the diaphragm spindle in with the thumb of the right hand, pushing firmly but steadily. Unscrew the diaphragm, pressing and releasing with the thumb of the right hand, until the rocker just 'throws over'. Now turn the diaphragm back (unscrew) to the nearest hole and again four holes (two-thirds of a complete turn).

(12) Press the centre of the armature and fit the retaining fork at the back of the rocker assembly. This is done to prevent the rollers from falling out when the coil housing is placed on the bench, prior to fitting the body, and is not intended to stretch the diaphragm before tightening the body screws.

Body components

(13) Inlet and outlet valves are identical assemblies and are held in position in the one-piece body casting by a steel spring clamp plate, secured by two 2 B.A. screws. This plate also secures the inlet and outlet nozzles, including the filter, all of which are arranged to be accessible from the outside of the pump. This inlet recess is deeper than the outlet to allow for the filter and extra washer.

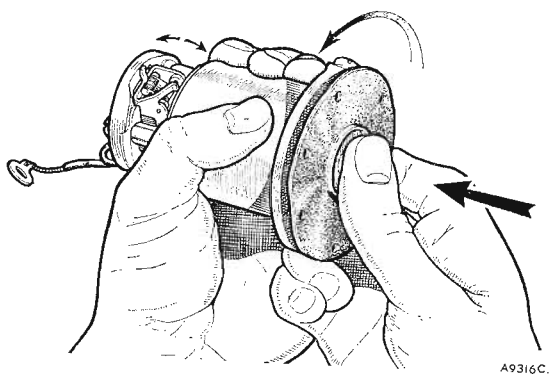


Fig. Da.2

Unscrew the diaphragm until the rocker just throws-over

(14) Place the outlet valve assembly, tongue side uppermost, in the recess marked 'outlet', place a joint washer on top of the valve assembly, and complete by adding the outlet nozzle.

(15) Place the inlet valve assembly, tongue side downwards, in the recess marked 'inlet', follow this with a joint washer, then the filter, dome side upwards, then another joint washer, completing the assembly with the inlet nozzle.

(16) Take care that both assemblies rest down evenly into their respective recesses. Position the nozzles as required, place the clamp plate on top, and tighten down firmly on to the body with the two 2 B.A. screws.

Body attachment

(19) Offer up the coil housing to the body—ensure correct seating between them.

(20) Line up the six securing holes, making sure that the cast lugs on the coil housing are at the bottom, insert the six 2 B.A. screws finger-tight. Fit the earthing screw with its Lucar connector.

(21) Remove the roller-retaining fork carefully, making sure that the rollers retain their position; a displaced roller will cut the diaphragm. It is not necessary to stretch the diaphragm before tightening the securing screws.

(22) Tighten the securing screws in sequence as they appear diametrically opposite each other.

Contact blade

(23) Fit the contact blade and coil lead to the pedestal with the 5 B.A. washer and screw.

(24) Adjust the contact blade so that the contact points on it are a little above the contact points on the rocker when the points are closed; also, that when the contact points make or break, one pair of points wipe over the centre-line of the other in a symmetrical manner. As the contact blade is provided with a slot for the attachment screw, some degree of adjustment is possible.

(25) Tighten the contact blade attachment screw when the correct setting is obtained.

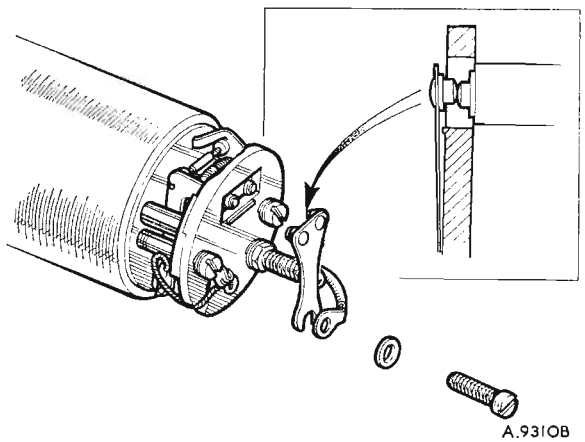


Fig. Da.3

Setting the correct relative position of blade and rocker contact points

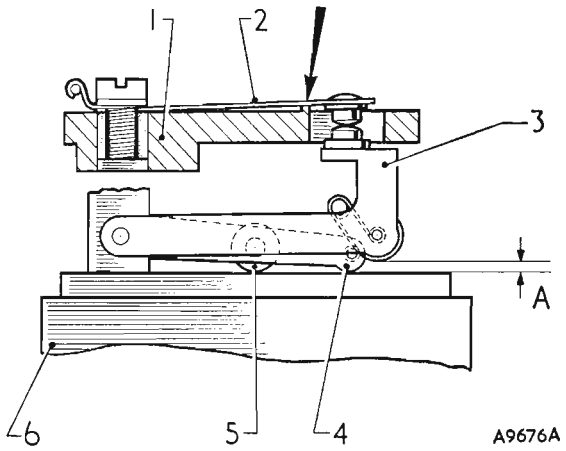


Fig. Da.4

The contact gap setting on earlier-type rocker assemblies

1. Pedestal.
2. Contact blade.
3. Outer rocker.
4. Inner rocker.
5. Trunnion.
6. Coil housing.

A = ·030 in. (·8 mm.).

Contact gap setting

(26) Check that when the outer rocker is pressed on to the coil housing, the contact blade rests on the narrow rib or ridge which projects slightly above the main face of the pedestal. If it does not, slacken the contact blade attachment screw, swing the blade clear of the pedestal, and bend it downwards a sufficient amount so that when repositioned it rests against the rib lightly; over-tensioning of the blade will restrict the rocker travel.

Earlier-type rocker assemblies

(27) Check the gap between the points indirectly by carefully holding the contact blade against the rib on the pedestal without pressing against the tip. Then check if a ·030 in. (·76 mm.) feeler will pass between the fibre rollers and the face of the coil housing. If necessary, the tip of the blade can be set to correct the gap.

Modified rocker assemblies

(28) Check the lift of the contact blade tip above the top of the pedestal with a feeler gauge, bending the stop finger beneath the pedestal, if necessary, to obtain a lift of ·035+·005 in. (89·1+3 mm.).

(29) Check the gap between rocker finger and coil housing with a feeler gauge, bending the stop finger, if necessary, to obtain a gap of ·070+·005 in. (1·8+·13 mm.).

End-cover

(30) Ensure that the end-cover seal washer is in position on the terminal stud, fit the bakelite end-cover, secure with the brass nut, fit the terminal tag or connector, and insulated sleeve.

(31) The pump is now ready for test.

Fault diagnosis

1. *Suspected fuel feed failure*

Disconnect the fuel line at the carburetter and check for flow.

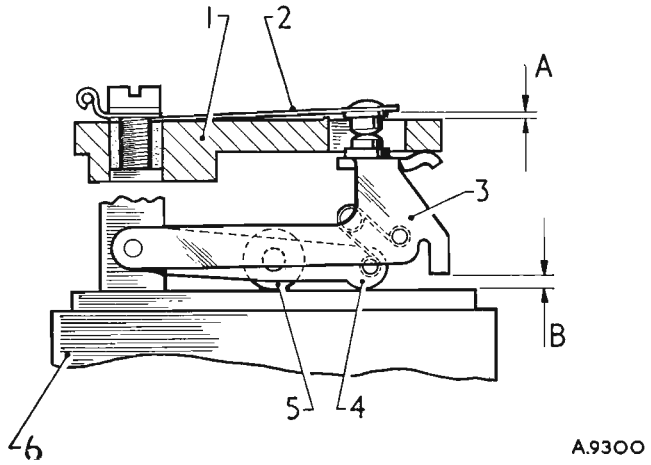


Fig. Da.5

The rocker finger settings on modified rocker assemblies

1. Pedestal.
2. Contact blade.
3. Outer rocker.
4. Inner rocker.
5. Trunnion.
6. Coil housing.

A = ·035 in. (·9 mm.). B = ·070 in. (1·8 mm.).

(*a*) If normal, examine for obstructed float-chamber needle seating or gummed needle.

(*b*) If normal initially, but diminishing rapidly and accompanied by slow pump operation, check for correct tank venting by removing the filler cap. Inadequate venting causes a slow power stroke, with resultant excessive burning of contact points.

(*c*) If reduced flow is accompanied by slow operation of the pump, check for any restriction on the inlet side of the pump, such as a clogged filter, which should be removed and cleaned. In the case of reduced flow with rapid operation of the pump, check for an air leak on the suction side, dirt under the valves, or faulty valve sealing washers.

(*d*) If no flow, check for:

(i) *Electrical supply*

Disconnect the lead from the terminal and test for an electrical supply.

(ii) *Faulty contact points*

If electrical supply is satisfactory the bakelite cover should be removed to check that the tungsten points are in contact. The lead should then be replaced on the terminal and a short piece of bared wire put across the contacts. If the pump then performs a stroke the fault is due to dirt, corrosion, or mal-adjustment of the tungsten points.

(iii) *Obstructed pipeline between fuel tank and pump*

The inlet pipe should be disconnected; if the pump then operates, trouble is due to a restriction in the pipeline between the pump and the tank. This may be cleared by the use of compressed air after removing the fuel tank filler cap. It should be noted, however, that compressed air should not be passed through the pump, as this will cause serious damage to the valves.

(iv) *Faulty diaphragm action*

If the previous operations fail to locate the trouble, stiffening of the diaphragm fabric or abnormal friction in the rocker 'throw-over' mechanism is to be suspected. To remedy these faults, the coil housing should be removed and the diaphragm flexed a few times, taking care not to lose any of the 11 rollers under it. Prior to reassembly, it is advisable to apply a little thin oil to the 'throw-over' spring spindles at a point where they pivot in the brass rockers. The diaphragm armature assembly should then be assembled and set in accordance with the instructions given under that heading.

2. *Noisy pump*

Air leaks. If the pump is noisy in operation, an air leak at one or other of the suction lines may be the cause. Such a leak may be checked by disconnecting the fuel pipe from the carburetter and allowing the pump to discharge into a suitable container with the end of the pipe submerged. The emission of continuous bubbles at this point will confirm the existence of an air leak. The fault should be rectified by carrying out the following procedure:

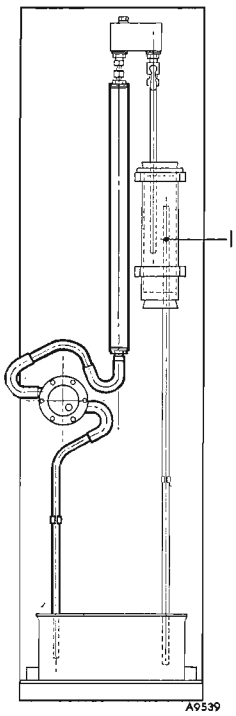


Fig. Da.6

A checking rig for the fuel pump is obtainable from the S.U. Carburetter Co. Ltd.

(1) The $\frac{5}{32}$ in. (4 mm.) dia. hole is 2 in. (50 mm.) below the top of the pipe.

(*a*) Check that all connections from the fuel tank to the pump are in good order.

(*b*) Check that the inlet union is tight.

(*c*) Check that the coil housing securing screws are well and evenly tightened. Air leaks on the suction side cause rapid operation of the pump and are the most frequent cause of premature failure.

3. *Pump operates without delivering fuel*

If the pump operates without delivering fuel the most likely causes are:

(*a*) A serious air leak on the suction side, or,
(*b*) Foreign matter lodged under one of the valves, particularly under the inlet valve.

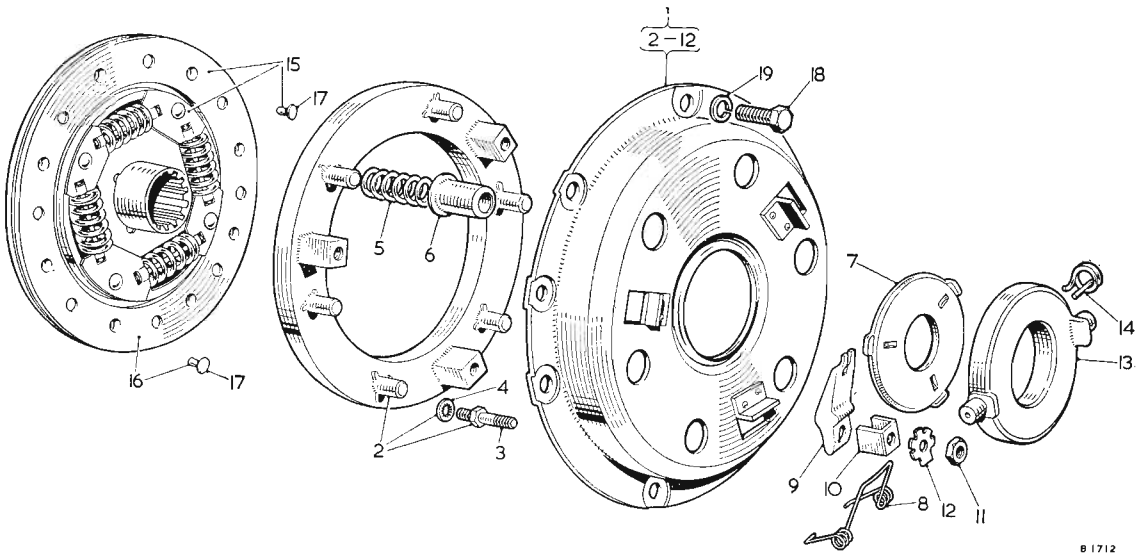
To remedy (*a*) see para. 2 above.

To remove any foreign matter lodged under the valves these should be removed for cleaning.

SECTION E

THE CLUTCH

THE CLUTCH COMPONENTS
(Early Cars)



No.	*Description*
1.	Cover assembly.
2.	Pressure plate.
3.	Pressure plate stud.
4.	Washer.
5.	Thrust spring.
6.	Thrust spring cup.
7.	Thrust plate.
8.	Thrust plate retainer.
9.	Release lever.
10.	Release lever bearing plate.
11.	Nut.
12.	Tab washer.
13.	Release bearing and cap assembly.
14.	Bearing retainer.
15.	Driven plate.
16.	Linings.
17.	Rivets.
18.	Set screw.
19.	Washer.

SECTION E

THE CLUTCH

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.

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.

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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.

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Section E.1

CLUTCH
(Early Cars)

Removing

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

Dismantling

The clutch tool 18G 99 A 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 the particular clutch and place them in position on the base plate.

Position the clutch on the three spacing washers so that the holes in the clutch cover align with the tapped holes in the base plate with the release levers as close to the spacing 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.

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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.

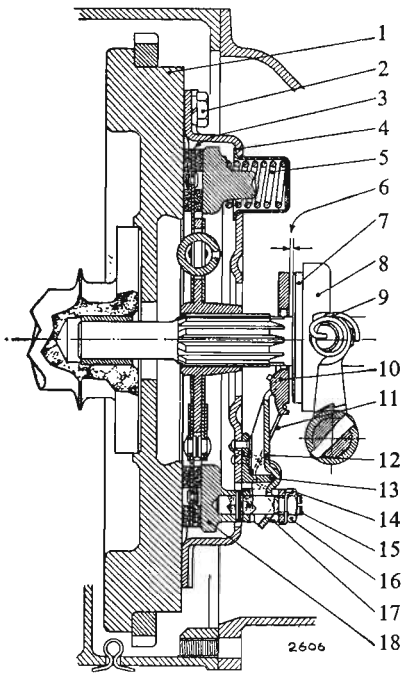


Fig. E.1

The clutch unit in section (early cars)

1. Flywheel.
2. Holding screw.
3. Driven plate.
4. Cover.
5. Thrust spring.
6. Clearance ·0625 in. (1·58 mm.).
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.

Reassembling

Parts not being replaced by new ones must be refitted in their original positions.

Reassembly is the reverse of the dismantling procedure.

Adjusting the clutch

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. 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 18G 139 for clutch centralization.

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.

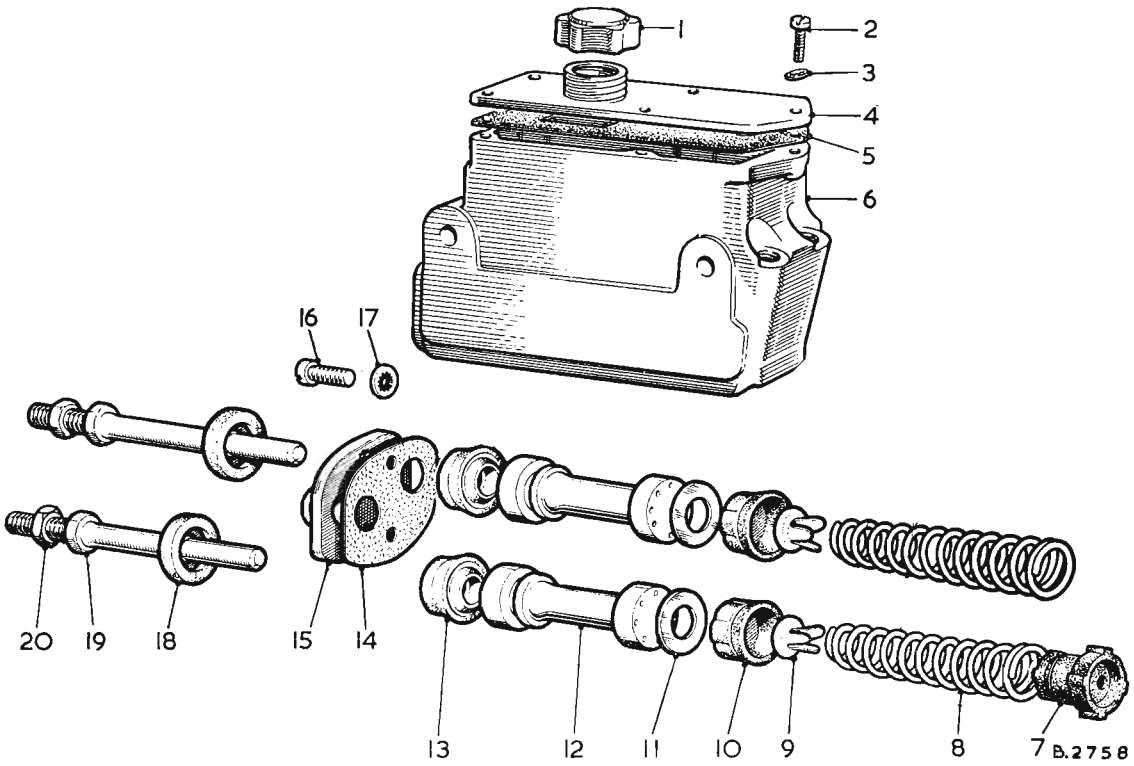


Fig. E.2

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 (brake bore only).
8. Return spring.
9. Spring retainer.
10. Main cup.
11. Piston washer.
12. Piston.
13. Secondary cup.
14. Gasket.
15. Boot fixing plate.
16. Fixing washer.
17. Shakeproof washer.
18. Boot.
19. Push rod.
20. Push rod adjuster.

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, spring, push-rod, and bleeder screw.

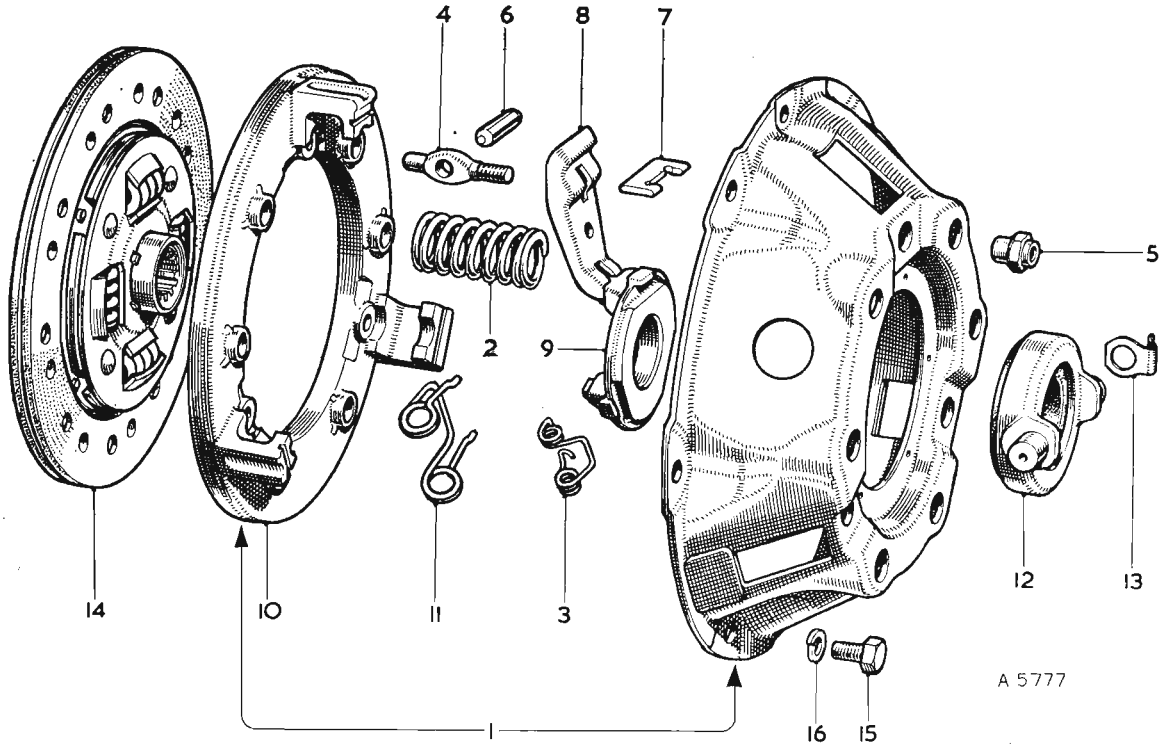
Removing

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.

THE CLUTCH COMPONENTS
(Later Cars)



No.	*Description*	*No.*	*Description*	*No.*	*Description*
1.	Clutch assembly.	7.	Strut.	12.	Release bearing.
2.	Thrust spring.	8.	Release lever.	13.	Retainer.
3.	Release lever retainer.	9.	Bearing thrust plate.	14.	Driven plate assembly.
4.	Eyebolt.	10.	Pressure plate.	15.	Clutch to flywheel screw.
5.	Eyebolt nut.	11.	Anti-rattle spring.	16.	Spring washer.
6.	Release lever pin.				

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.

Section E.5

CLUTCH
(Later Cars)

Removing

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

Dismantling

The clutch tool 18G 99 A proves 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.

Consult the code card to determine the correct spacers for the particular clutch. Place the spacers on the base plate in the positions indicated on the code card and place the clutch on the spacers. Screw the actuator into the central hole in the base plate and press the handle to clamp the clutch. Screw the set bolts firmly into the base plate. The clutch can now be compressed or released as required.

Compress the clutch with the actuator and remove the adjusting nuts gradually to relieve the load of the thrust springs. Lift the cover off the clutch and carry out whatever additional dismantling may be necessary.

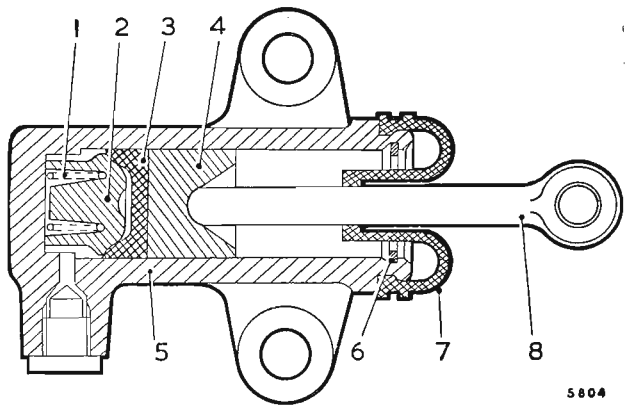


Fig. E.3

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.

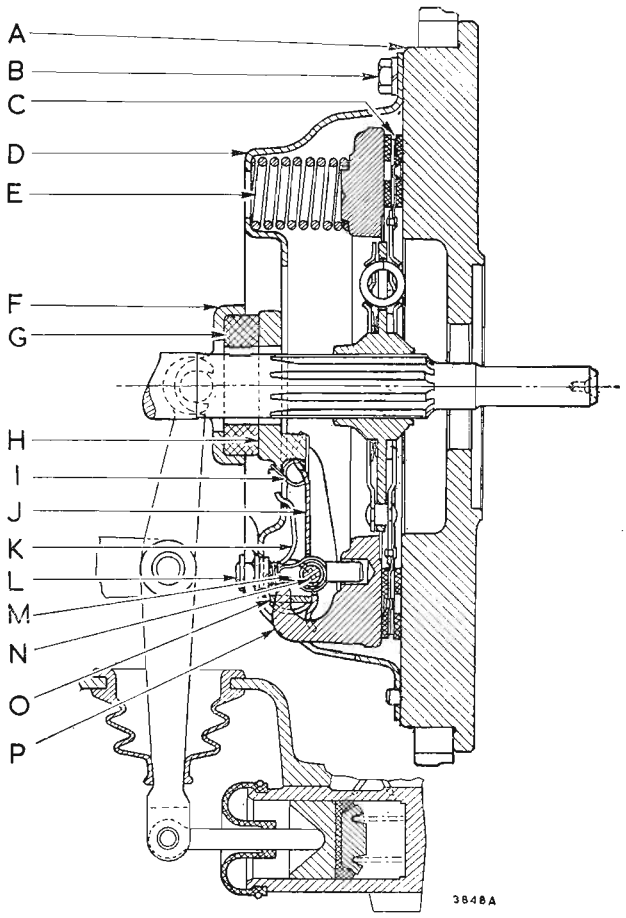


Fig. E.4

A section through the clutch (later cars)

A. Flywheel
B. Securing bolt.
C. Driven plate.
D. Clutch cover.
E. Thrust coil spring.
F. Release bearing cup.
G. Graphite release bearing.
H. Release plate.
I. Lever retainer spring.
J. Release lever.
K. Anti-rattle spring.
L. Adjusting nut.
M. Eyebolt.
N. Floating pin (release lever).
O. Strut.
P. Pressure plate.

Reassembling

Parts not being replaced by new ones must be refitted in their original positions.

Reassembly is the reverse of the dismantling procedure.

Adjusting the clutch

See end of Section E.1.

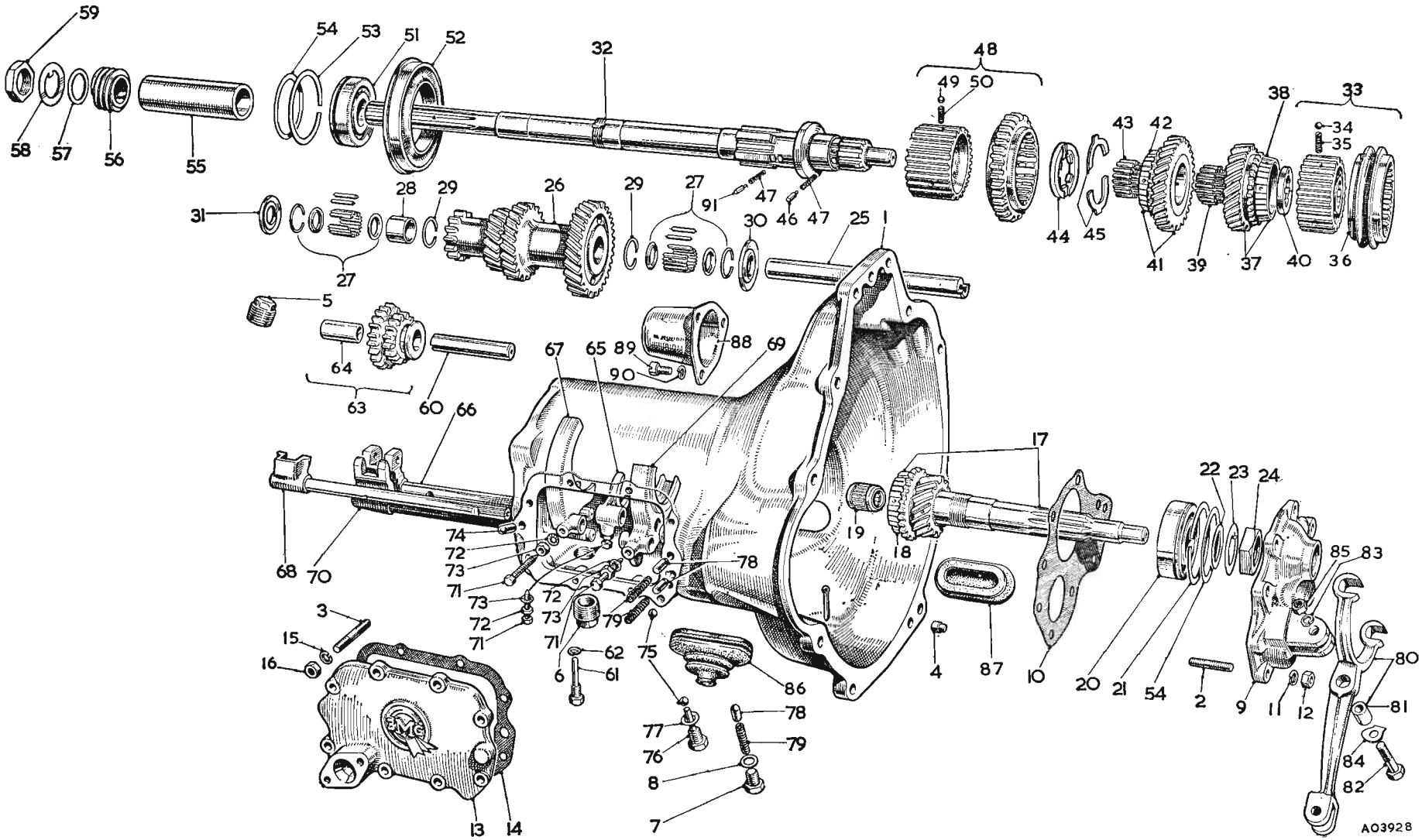
Refitting

Refitting is a reverse of the removal procedure. Use Service tool 18G 139 for clutch centralization.

SECTION F

THE GEARBOX

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.	Washer.
46.	Peg for locking collar.
47.	Springs for pegs.
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.
91.	Peg for locking collar.

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

LUBRICATION

The combined lubrication filler and lever plug situated on the gearbox extension is reached by lifting the floor covering from inside the car and removing the rubber plug on the left-hand side of the gearbox cover. The oil must be level with the bottom of the filler hole. The drain plug is situated on the bottom of the gearbox casing.

Section F.2

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.2). 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 and remove the speedometer pinion sleeve with a box spanner from the left-hand side of the gearbox rear extension, 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. Unscrew and remove the bolt and lock washer.

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 set screws 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 use 18G 471 for shaft alignment, see Section F.5, 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. (·15 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.

Shims are also available in thicknesses of ·004 in. (·10 mm.) and ·010 in. (·25 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.

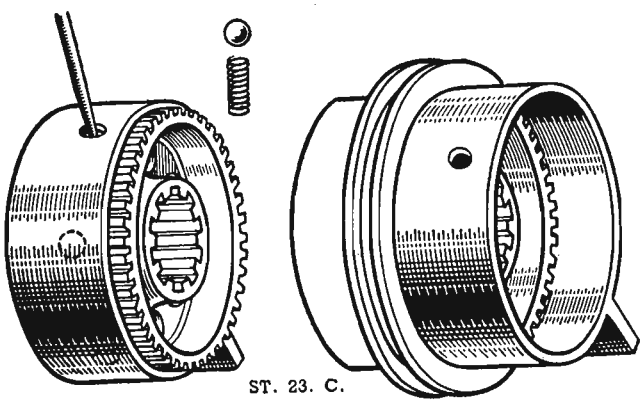


Fig. F.1

Using Service tool 18G 144 to assemble the spring-loaded balls to a coupling sleeve and synchronizer

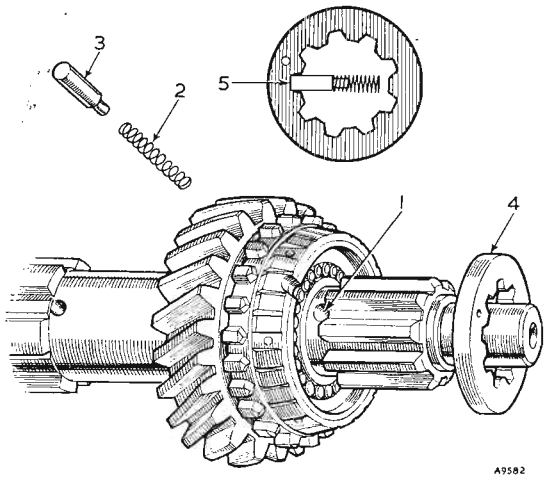


Fig. F.2

Securing the third motion shaft gears

1. Hole in shaft for locking plunger.
2. Spring.
3. Locking plunger.
4. Locking washer.
5. Locking washer with plunger engaged.

Refitting

Refitting is the reverse of the dismantling procedure.

Section F.3

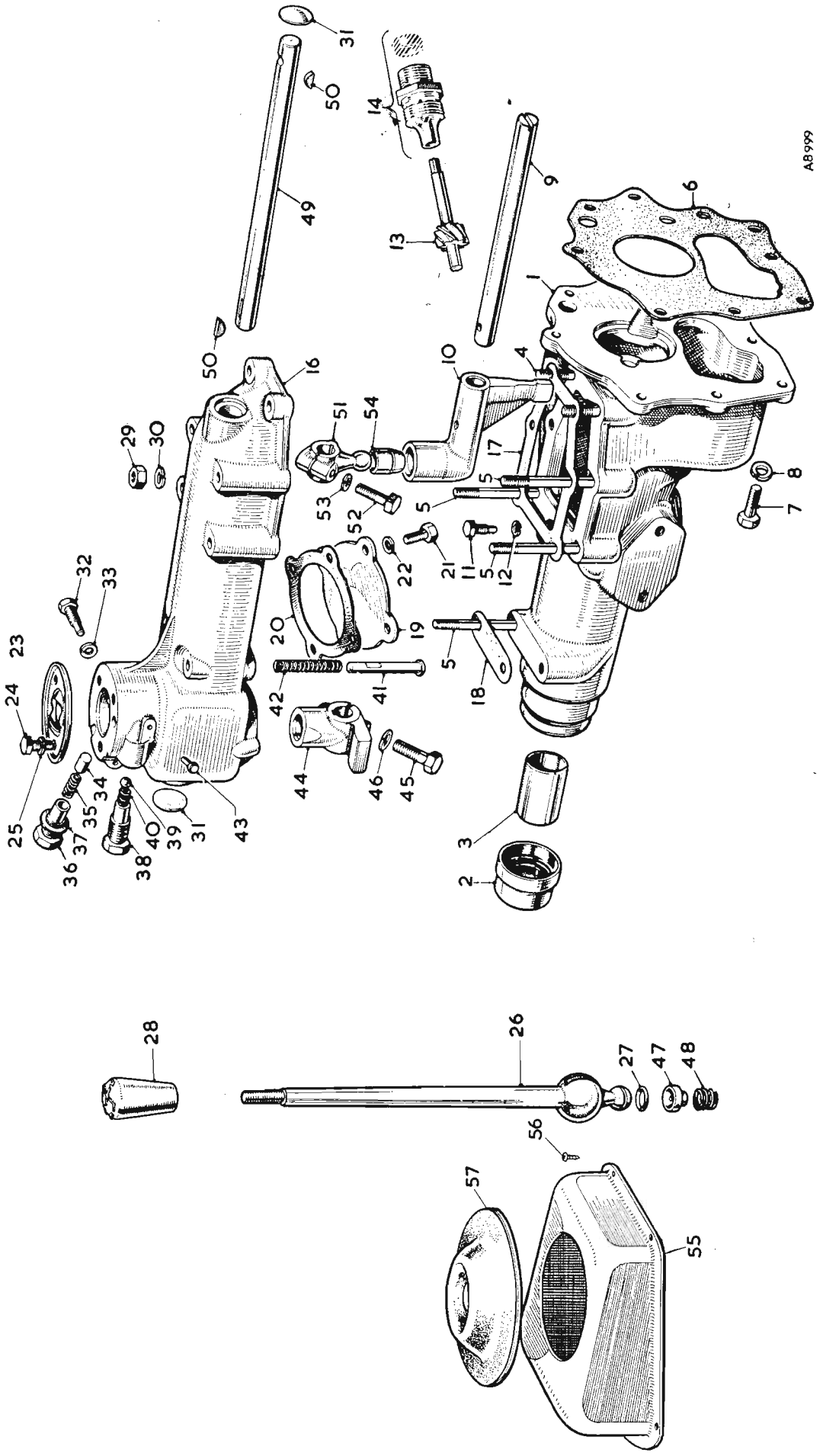
THIRD MOTION SHAFT

Dismantling

Remove the third and fourth speed synchronizer assemblies. Depress the spring-loaded plunger which locks the front splined ring at the end of the third motion shaft. 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. The third speed gear has needle-roller bearings.

At the other end of the shaft knock back the locking washer and unscrew the securing nut. The lock washer, washer, 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 the housing. Draw the first speed gear and

THE REAR EXTENSION COMPONENTS



KEY TO THE REAR EXTENSION COMPONENTS

No.	*Description*
1.	Rear extension.
2.	Oil seal.
3.	Sliding joint bush.
4.	Extension short stud.
5.	Extension long stud.
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.
16.	Remote control casing.
17.	Extension front joint.
18.	Extension rear joint.
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.	Stud 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.
55.	Remote control cover.
56.	Screw.
57.	Grommet.

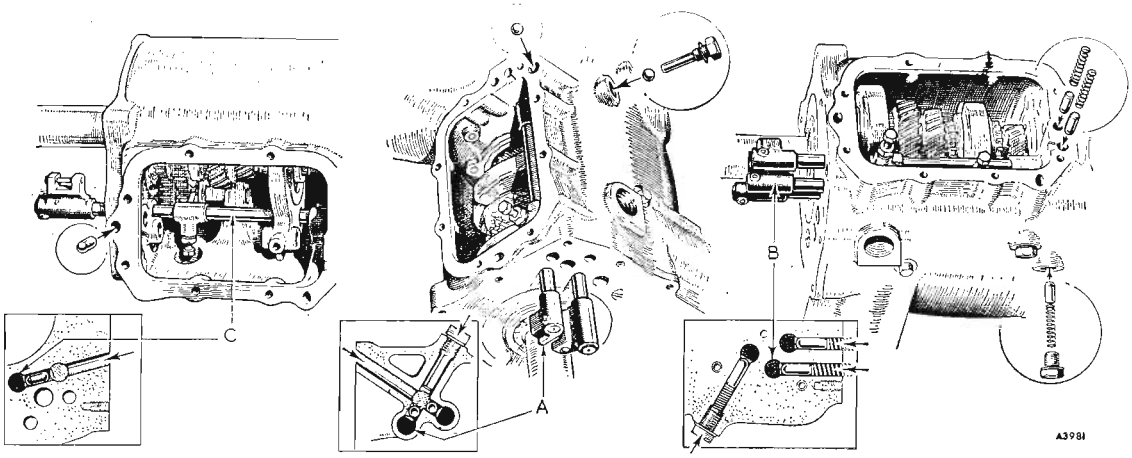


Fig. F.3

The location and correct assembly of the selector locking balls, plungers and springs

A. First and second gear fork rod in place (gearbox upside-down). B. Third and fourth gear fork rod in place.

C. Reverse gear fork rod in place.

synchronizer assembly off the shaft. Depress the spring-loaded plunger which locks the rear splined ring at the end of the third motion shaft. Turn the ring so that one of its splines covers the plunger and slide the splined ring off the shaft. Remove the plunger and spring and lift the two halves of the washer for the splined ring off the shaft. Slide the second speed gear off the shaft, taking care to retain the needle rollers.

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 flanged end of the housing so that the spring ring end of the bearing is trailing. Assemble the needle rollers on the shaft and fit the second speed gear. Place the two halves of the washer for the splined ring on the shaft behind the second speed gear. Ensure that the two halves of the washer are assembled with the locking pegs registered in the correct position in the splined ring. Assemble the spring and plunger in the hole in the shaft and refit the splined ring. Slide the first speed gear and synchronizer assembly onto the shaft with the protruding end of the synchronizer towards the bearing. Press the bearing and its housing onto the shaft so that the flange of the bearing housing (when fitted) is towards the rear of the shaft. Refit the distance piece, speedometer drive, plain washer, lock washer, and locknut in position.

From the opposite end of the shaft assemble the needle-roller bearing and refit the third speed gear assembly. Place the spring and plunger in the hole in the shaft and refit the splined ring. Slide the third and fourth speed synchronizer onto the shaft with the boss on the synchronizer hub, away from the splined ring.

Section F.4

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.5

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. Use Service tool 18G 471 for layshaft gear alignment.

Section F.6

GEAR SYNCHRONIZING CONES
(Early Cars)

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 121·1° C. (250° F.) 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 hole 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.4.

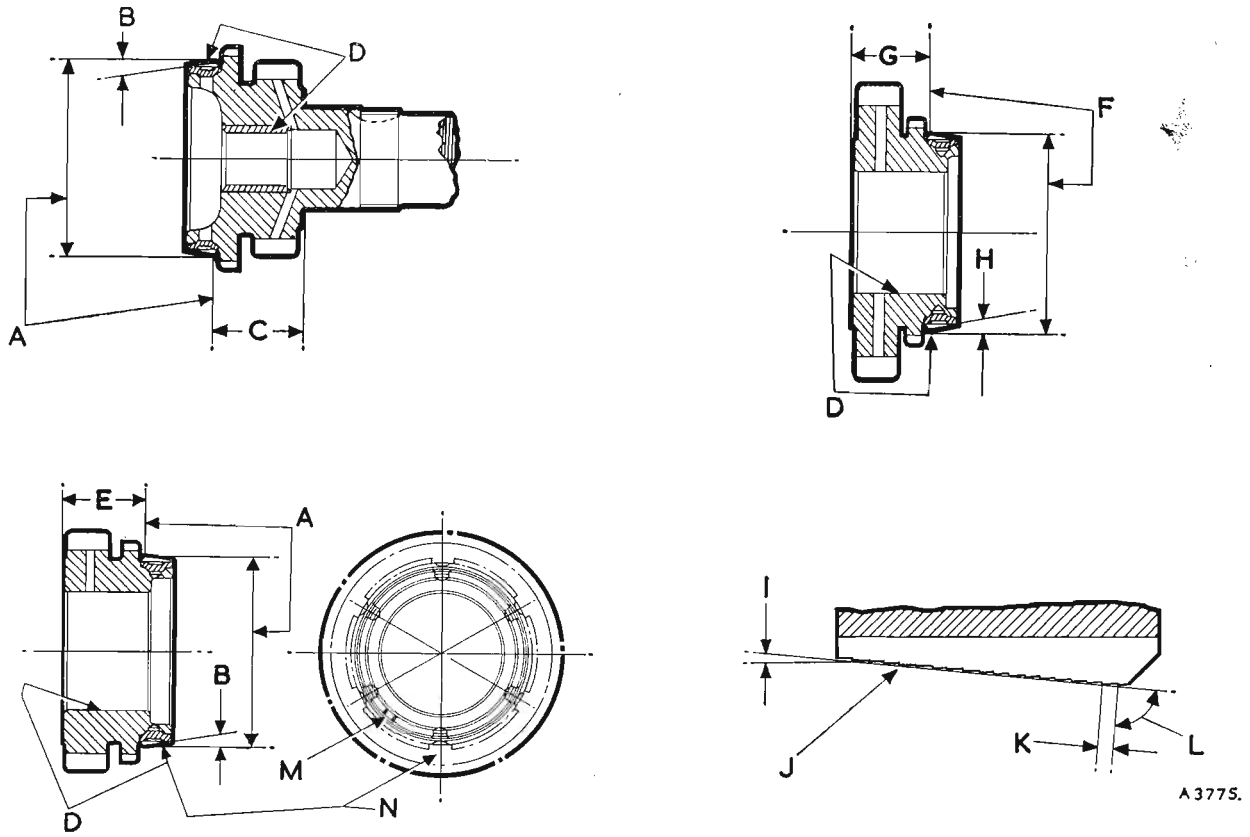


Fig. F.4

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 centre line of holes and spaces in cone in line.

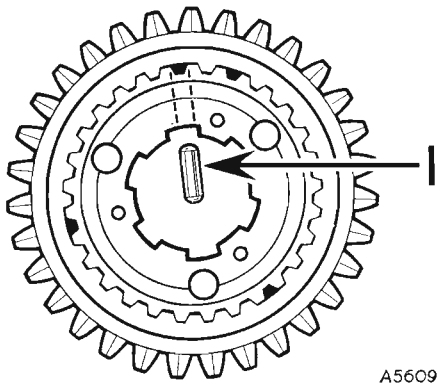


Fig. F.5

The first and second speed gear assembly, showing the gear and hub correctly assembled (later cars). The plunger is shown at (1)

Section F.7

THIRD MOTION SHAFT
(Later Cars)

Dismantling and reassembling

The dismantling and reassembling sequences are the same as detailed in Section F.3 except that the second and third/top gear synchronizers are fitted with baulk rings (see Fig. F.6).

NOTE.—Should the first and second speed gear assembly have been dismantled, the correct position of the gear on the hub when reassembling is most important. Should the gear be incorrectly assembled on the hub, selection of first gear will be impossible.

When reassembling the gear to the hub ensure that the plunger in the hub aligns with the cut-away tooth in the gear assembly (see Fig. F.5).

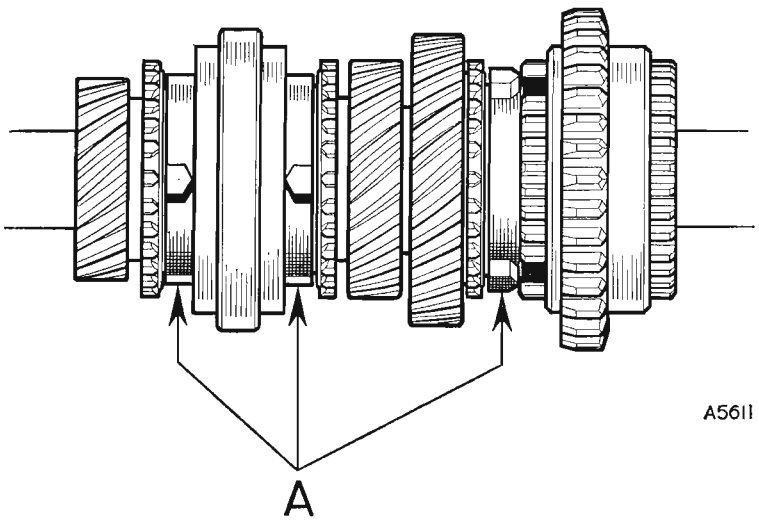


Fig. F.6

The mainshaft, showing (A) *the baulk rings (later cars)*

(*For* **'SERVICE TOOLS'** *see page F.11*)

SERVICE TOOLS

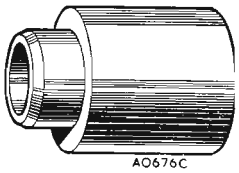
18G 134. Bearing and Oil Seal Replacer (basic tool)

For use with 18G 134 B, 18G 134 C, 18G 134 L, and 18G 134 Q.

18G 134

18G 134 L. Gearbox Rear Oil Seal Replacer Adaptor

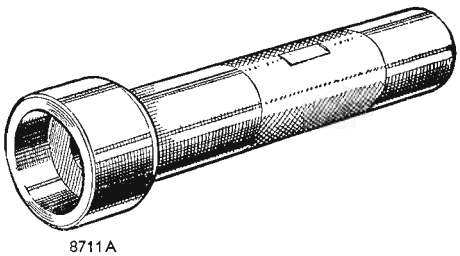
For replacement of gearbox extension oil seals. Use with handle 18G 134.



18G 134 L

18G 140. 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.



18G 140

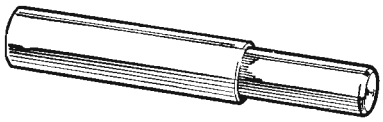
18G 144. Synchromesh Assembly Ring

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

18G 144

18G 194. Needle-roller Bearing Replacer

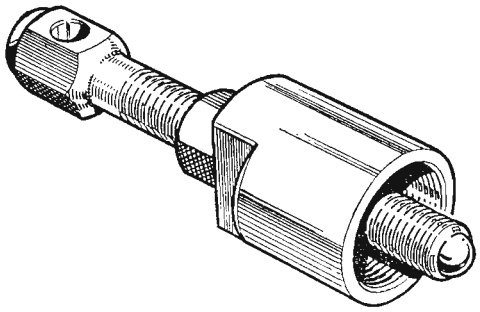
The replacement of needle-roller bearings in the laygear is greatly speeded up by the use of this replacing tool. It can also be used to fit the spring ring after the rollers have been fitted.



18G 194

18G 389. Gearbox Rear Oil Seal Remover (basic tool)

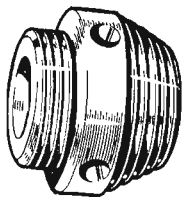
This basic tool, together with the appropriate adaptor, is essential for removing the gearbox extension oil seal easily and without damage to the extension.



18G 389

18G 389 A. Gearbox Rear Oil Seal Remover Adaptor

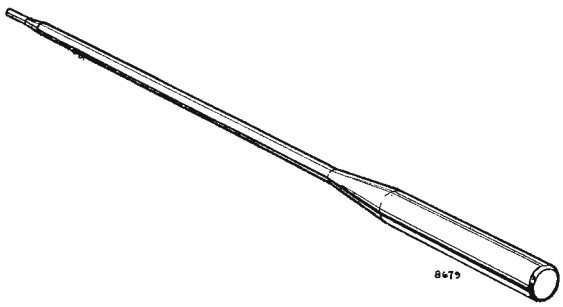
Use with basic tool 18G 389.



18G 389 A

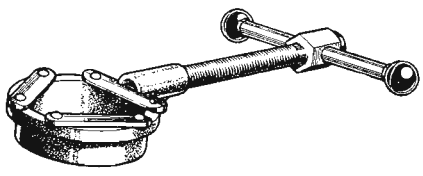
18G 471. Dummy Layshaft

The fitting of a layshaft to the laygear is simplified by the use of this tool.



18G 471

18G 488. Gearbox Oil Seal Clinching Tool



18G 488

SECTION G

THE PROPELLER SHAFT

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.

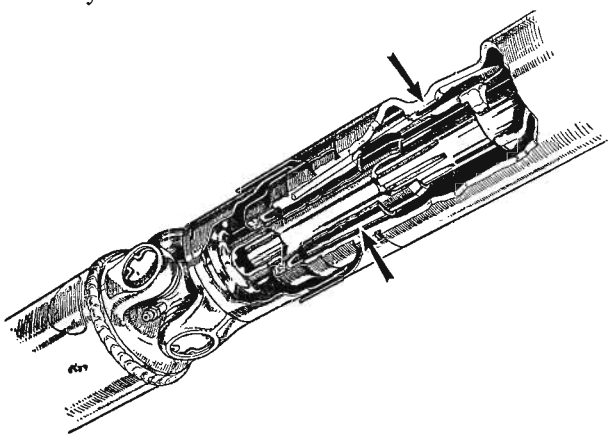


Fig. G.1

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

Section G.1

LUBRICATION

The needle-type universal joint at each end of the propeller shaft is provided with a nipple which should receive two or three strokes at regular intervals with a gun filled with lubricant. 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.

Section G.2

PROPELLER SHAFT

Removing

Mark the flange and disconnect the propeller shaft from the rear axle. Remove it from the vehicle over the axle assembly and to the left-hand side of the differential casing.

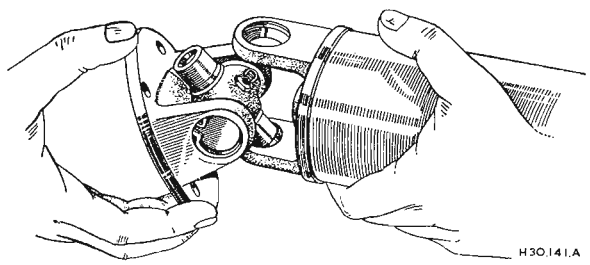


Fig. G.2

Separating the joint

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.

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.

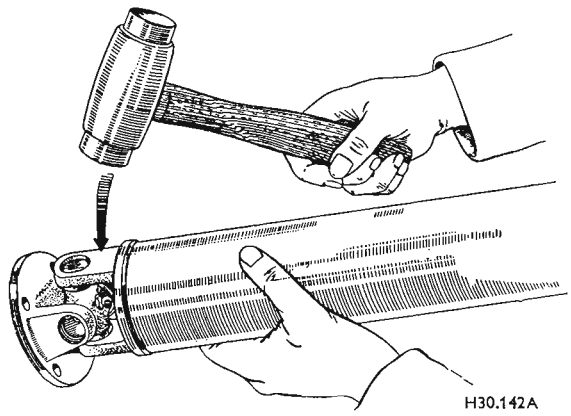


Fig. G.3

Tapping the joint to extract the bearing

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. Assemble the needle rollers in the bearing races. 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.

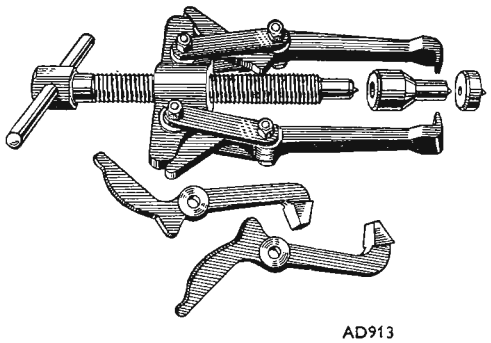
Refitting

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.

SERVICE TOOLS

18G 2. Crankshaft Gear, Pulley, and Propeller Shaft Flange Remover

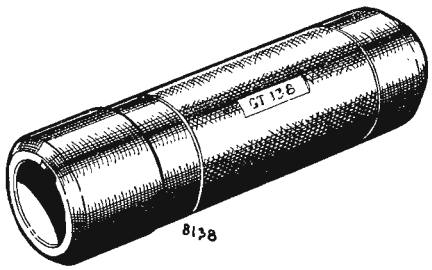
A multipurpose tool with alternative legs readily interchangeable: one pair has thin, flat ends designed for removing crankshaft gears and propeller shaft and bevel pinion flanges, the other pair has tapered ends suitable for fan pulley grooves other than the later-type models fitted with narrow-section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



18G 2

18G 138. Crankshaft Gear and Pulley Replacer

The bevel pinion flange can also be replaced with this tool.

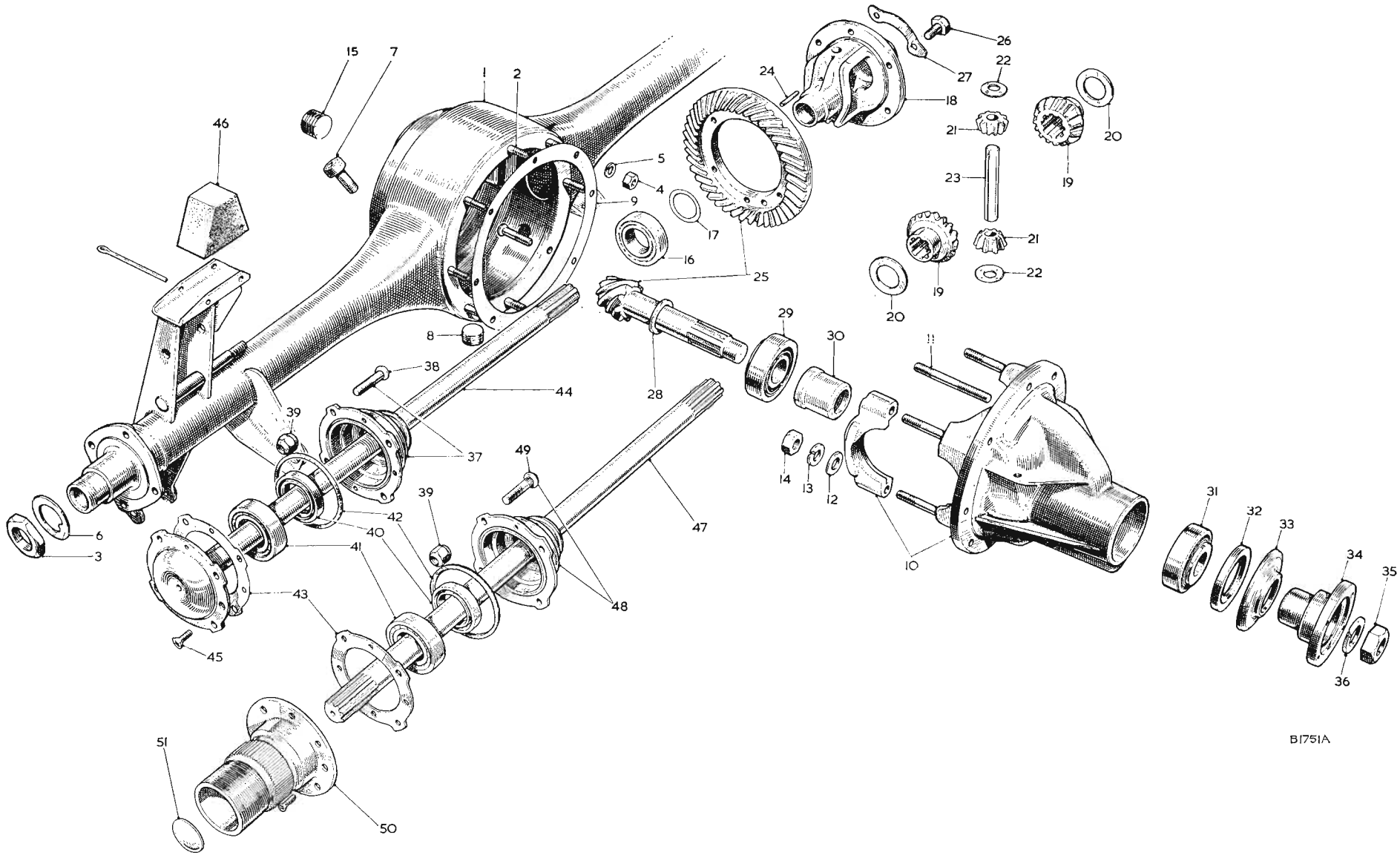


18G 138

SECTION H

THE REAR AXLE AND REAR SUSPENSION

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.
47.	Axle shaft.
48.	Hub assembly.
49.	Wheel stud.
50.	Hub extension.
51.	Welch plug.

Nos. 47–51: Wire wheels only.

GENERAL DESCRIPTION

The rear axle is of the three-quarter-floating type incorporating hypoid final drive reduction gears. 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. The position of the pinion in relation to the crown wheel when being adjusted must be kept within the maker's figure limits. 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

LUBRICATION

The combined filler and level plug situated on the rear axle casing is reached from beneath the rear of the car. The oil must be level with the bottom of the filler hole. The drain plug is situated on the bottom of the rear axle casing.

Section H.2

AXLE UNIT

Removing

Raise the vehicle by placing a jack under the differential housing and support the body. Remove the wheels.

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.3

AXLE SHAFTS

Removing

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

Release the handbrake and back off the brake shoes adjusters.

Disc wheels

Remove the brake drum locating screws and tap the drums off the hubs.

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.

Wire wheels

Remove the nuts securing the drum to the hub and tap the drums off the hub. Remove the retaining screws securing the hub extension flanges to the hubs. Withdraw the hubs extensions and axle shaft. Should the paper washer be damaged, it must be renewed when reassembling.

Refitting

Reverse the removal procedure when refitting.

Section H.4

HUBS

Removing

Remove the wheel drum, and the axle shaft as described in Section H.3.

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 the Service tool 18G 146.

Refitting

Before refitting, repack the hub bearings with grease.

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. (·2 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 18G 14 (lip towards the bearing) before the bearing is inserted.

The hub is then drifted onto the axle casing with Service tools 18G 134 and 18G 134 Q. Continue to assemble to the reverse of the removal procedure.

Section H.5

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 18G 34 A 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 18G 372) 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.6

DIFFERENTIAL ASSEMBLY

Removing

Remove the axle shafts as detailed in Section H.3.

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 18G 47 C together with 18G 47 M. 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

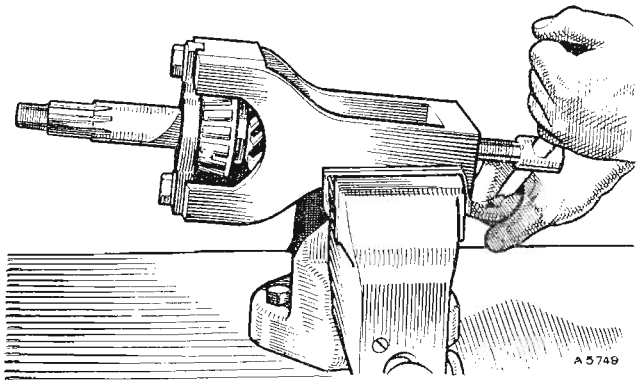


Fig. H.1

Refitting the inner race of the pinion rear bearing, using tool 18G 285. *This tool is also used to remove the race*

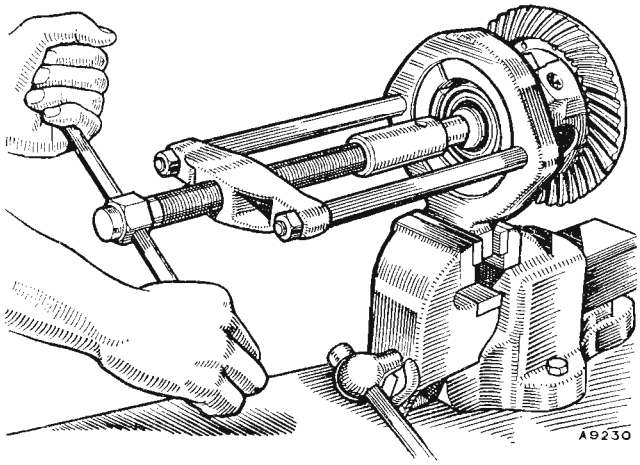


Fig. H.2

Remove the differential bearings, using remover 18G 47 C *with adaptor* 18G 47 M

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 18G 264 with adaptors 18G 264 D and 18G 264 E.

Slide off the pinion sleeve and the shims; withdraw the rear bearing inner race from the pinion shaft with Service tool 18G 285, notingthe spacing washer against the pinion head. Withdraw the rear bearing outer race with Service tool 18G 264 and adaptor 18G 264 E.

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 18G 191 and 18G 191 A.

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 18G 134 and 18G 134 Q.

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.

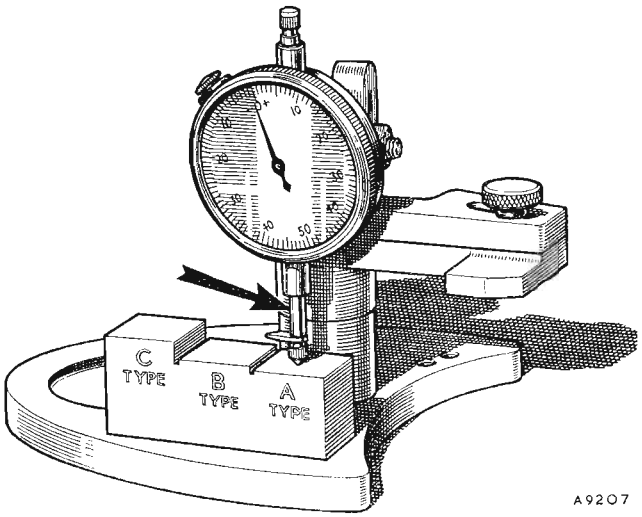


Fig. H.3

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, oil seal, and universal joint flange.

NOTE.—The pinion bearing distance piece is of the collapsible type. That is to say, when the pinion nut is tightened to the correct torque spanner reading of 135 to 140 lb. ft. (18·69 to 19·4 kg. m.) the distance piece collapses to give the correct bearing preload of 11 to 13 lb. in. (·126 to ·149 kg. m.). It will only perform this function

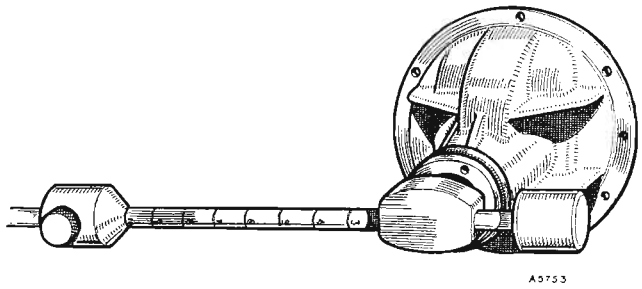


Fig. H.4

Checking the bevel pinion bearing preload (Service tool 18G 207)

once. Thus, when the pinion is reassembled a new distance piece must be fitted.

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 18G 207, to ensure the pinion bearing preload does not exceed 13 lb. in. (·15 kg. m.). When the nut is correctly tightened it should provide a pinion bearing preload of 11 to 13 lb. in. (·13 to ·15 kg. m.). 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.

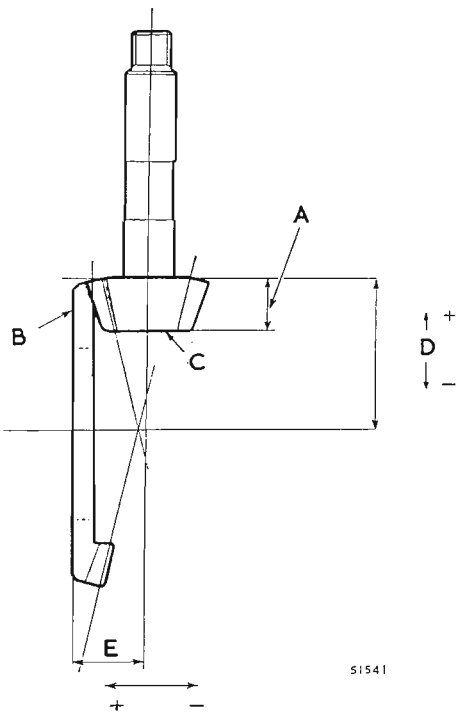


Fig. H.5

Crown wheel and pinion markings

A. Pinion head thickness. Max. —·007 in. (—·178 mm.).
B. Crown wheel marked here.
C. Pinion marked here.
D. Pinion mounting distance. Max. ±·004 in. (±·102 mm.).
E. Crown wheel mounting distance. Max. ±·005 in. (±·127 mm.).

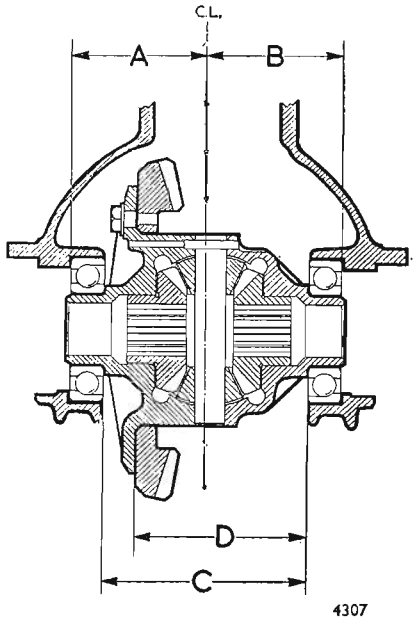


Fig. H.6

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 18G 191 A. 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.

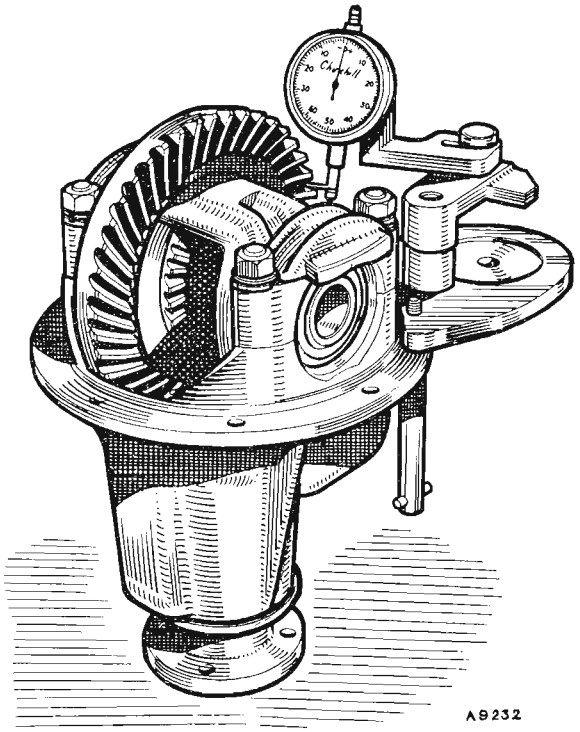


Fig. H.7

Checking crown wheel to pinion backlash (Service tools 18G 191 *and* 18G 191 *A)*

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

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 correct figure for the backlash to be used with any particular crown wheel and pinion is etched on the rear face of the crown wheel concerned and must be adhered to strictly.

A movement of ·002 in. (·05 mm.) shim thickness from one side of the differential 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.7

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.

NOTE.—Tighten the spring bolts when the normal working load has been applied to the springs.

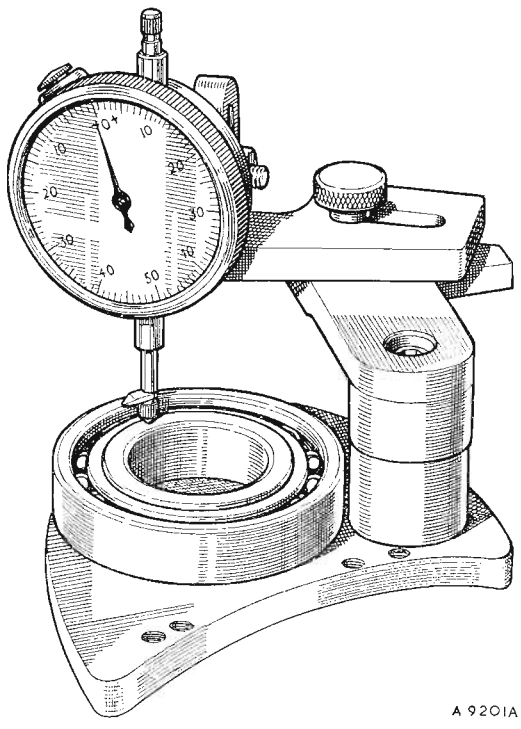


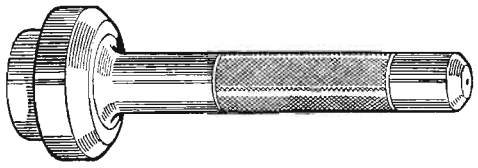
Fig. H.8

Checking differential bearing width with Service tools 18G 191 *and* 18G 191 *A*

SERVICE TOOLS

18G 14. Rear Hub Oil Seal Replacer

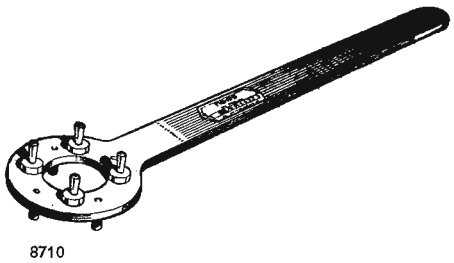
This replacer is contoured to the exact shape of the oil seal and bevelled at its leading edge to facilitate insertion of the seal and fitting without damage.



18G 14

18G 34 A. Bevel Pinion Flange Wrench

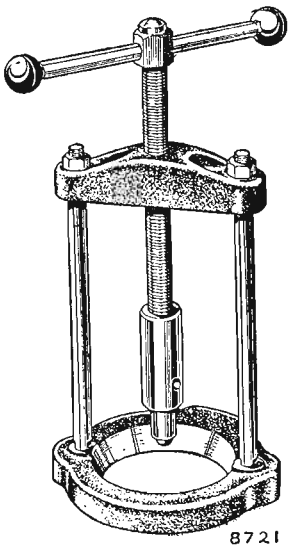
The two sets of tapered pins on this tool ensure that it will hold the propeller shaft flange against rotation while the flange nut is released or tightened on semi-floating or three-quarter-floating axles.



18G 34 A

18G 47 C. Differential Bearing Remover (basic tool)

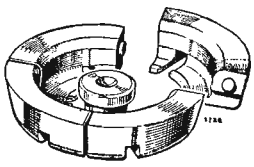
A standardized basic tool; with various adaptors it will cover several models.



18G 47 C

18G 47 M. Differential Bearing Remover Adaptor

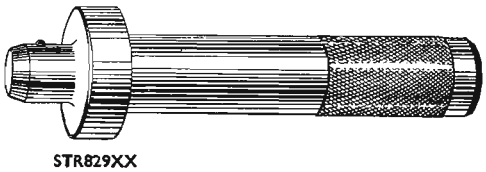
For use with 18G 47 C.



18G 47 M

18G 134. Bearing and Oil Seal Replacer (basic tool)

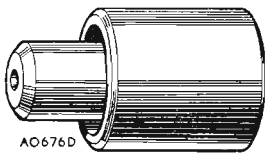
A detachable handle designed for use with the appropriate adaptors.



18G 134

18G 134 Q. Rear Hub Replacer and Adaptor

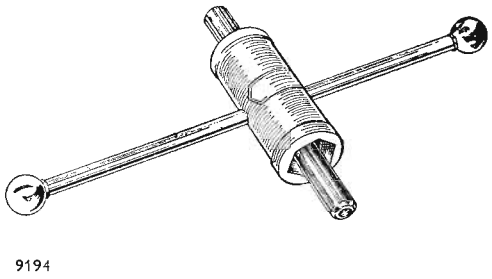
Use with handle 18G 134.



18G 134 Q

18G 152. Rear Hub Nut Spanner

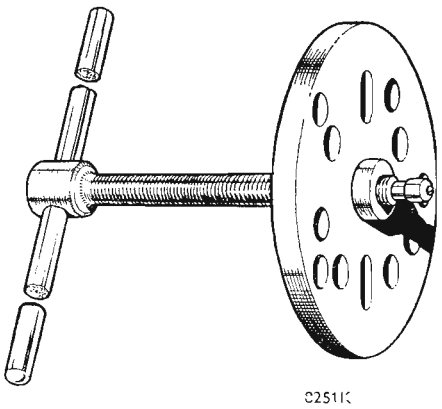
A reinforced tubular spanner complete with tommy-bar designed to pilot in the axle tube with the axle shaft withdrawn.



18G 152

18G 304. Front and Rear Hub Remover (basic tool)

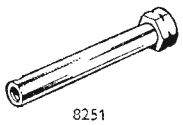
The remover 18G 304 is a basic tool for use with various adaptor bolts supplied separately, Screw the two adaptor bolts 18G 304 F onto the wheel studs and insert the thrust pad into the axle tube. The rear hub can then be removed by screwing up the centre screw against the thrust pad.



18G 304

18G 304 F. Bolt Adaptor

For use with basic tool 18G 304.



18G 304 F

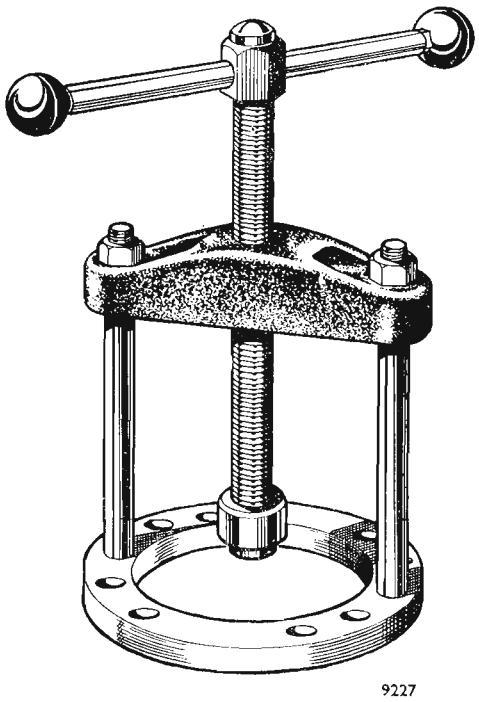
18G 304 H. Hub Remover Thrust Pad

For use with basic tool 18G 304.

18G 304 H

18G 146. Front and Rear Hub Remover

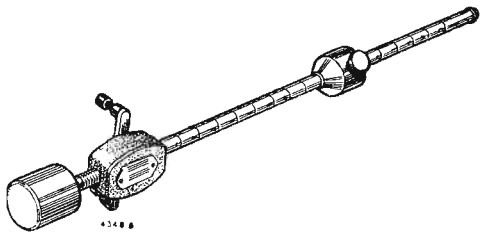
The thrust pad supplied with the tool is for use only when removing the rear hubs.



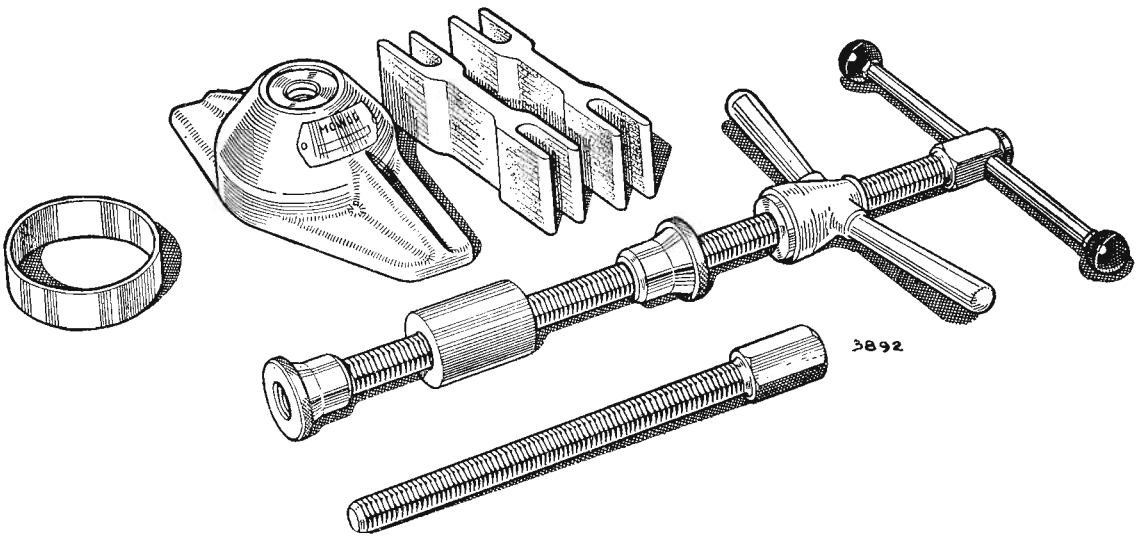
18G 146

18G 207. 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.



18G 207



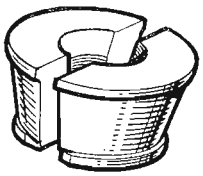
18G 264

18G 264. 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 18G 274 D, 18G 264 E.

18G 264 D. Bevel Pinion Bearing Outer Race Remover Adaptor

For use with basic tool 18G 264.



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18G 264 D

18G 264 E. Bevel Pinion Bearing Outer Race Remover Adaptor

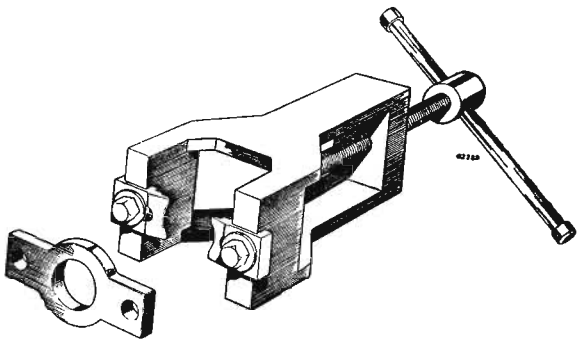
For use with basic tool 18G 264.

9154A

18G 264 E

18G 285. Bevel Pinion Bearing Inner Race Remover and Replacer

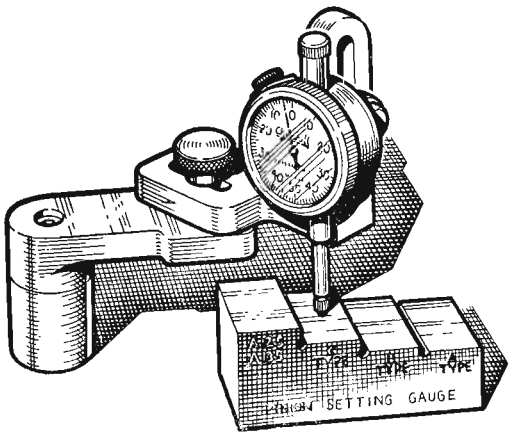
A tool which is essential when withdrawing or replacing the inner bearing race of the pinion shaft.



18G 285

18G 191. Bevel Pinion Setting Gauge

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



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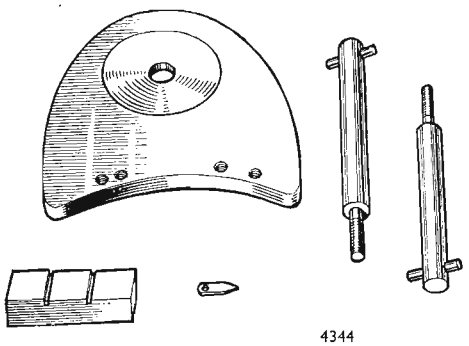
18G 191

18G 191 A. Differential Bearing Gauge

This gauge used with the component parts of 18G 191 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.



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18G 191 A

SECTION Ha

THE REAR AXLE AND REAR SUSPENSION

The information given in this Section refers specifically to the Sprite (Mk. III) and Midget (Mk. II) and must be used in conjunction with Section H

GENERAL DESCRIPTION

The rear axle is the same as that used on earlier cars. Suspension is by rubber-mounted semi-elliptic leaf springs and the shackles are fitted with rubber bushes of the flexing type.

Section Ha.1

AXLE UNIT

Removing

Raise the vehicle by placing a jack under the differential housing and support the body. Remove the wheels.

Remove the down pipe, silencer, and exhaust pipe (see Section A).

Keeping the jack in this position, release each check strap at its axle location.

Release each damper arm from its connecting linkage. Disconnect the brake cable at the cable adjuster. Unscrew the nuts and remove the bolts securing the propeller shaft flange to the axle pinion flange (see Section G). Disconnect the hydraulic brake pipe at the main union just forward of the differential housing. Remove the 'U' bolt securing nuts. Ascertain that the weight of the axle is fully on the jack, unscrew and remove the rear shackle pins.

Refitting

Reverse the removal procedure.

NOTE.—Before tightening the spring bolts it is essential that the normal working load be applied to the springs so that the flexing rubber bushes are deflected to an equal extent in both directions during service. Failure to take this precaution will inevitably lead to early deterioration of the bushes.

Section Ha.2

SPRINGS

Removing

Raise the vehicle by placing a jack under the differential housing and support the body. Ascertain that the weight of the axle is fully on the jack and that the springs are in the fully unloaded position. Remove the wheels. From within the car remove the set screws securing the front anchor bracket to the rear of the body foot-well.

From beneath the car remove the two front bracket securing set screws. Remove the four 'U' bolt securing nuts and the damper anchorage plate. Remove the rear shackle nuts, pins, and plates and lift out the spring assembly.

Refitting

Remove the axle check strap to assist fitting the 'U' bolts. Tighten the spring bolt when the normal working load has been applied to the spring.

Reverse the removal procedure.

EDITOR'S NOTES

H. The Rear Axle and Rear Suspension

Hubs

Appropriate hub and gear pullers may be substituted if the suggested service tools are not available. The object is to remove or install the part in question without damaging it.

Careful use of a soft-faced hammer and appropriate drifts can be very often substituted for suggested driving tools.

Differential assembly, dismantling

Any disassembly of the differential unit involving the replacement of parts will require that the necessary clearances be reset. This job requires very specialized tools and the ability to use them in the manner indicated. Unless the proper equipment is available, it is advisable to leave this work to a properly equipped shop. An improperly set differential assembly will be noisy and will wear quickly.

An arbor press and suitable adaptors may be used in place of the recommended bearing removal and installation tools.

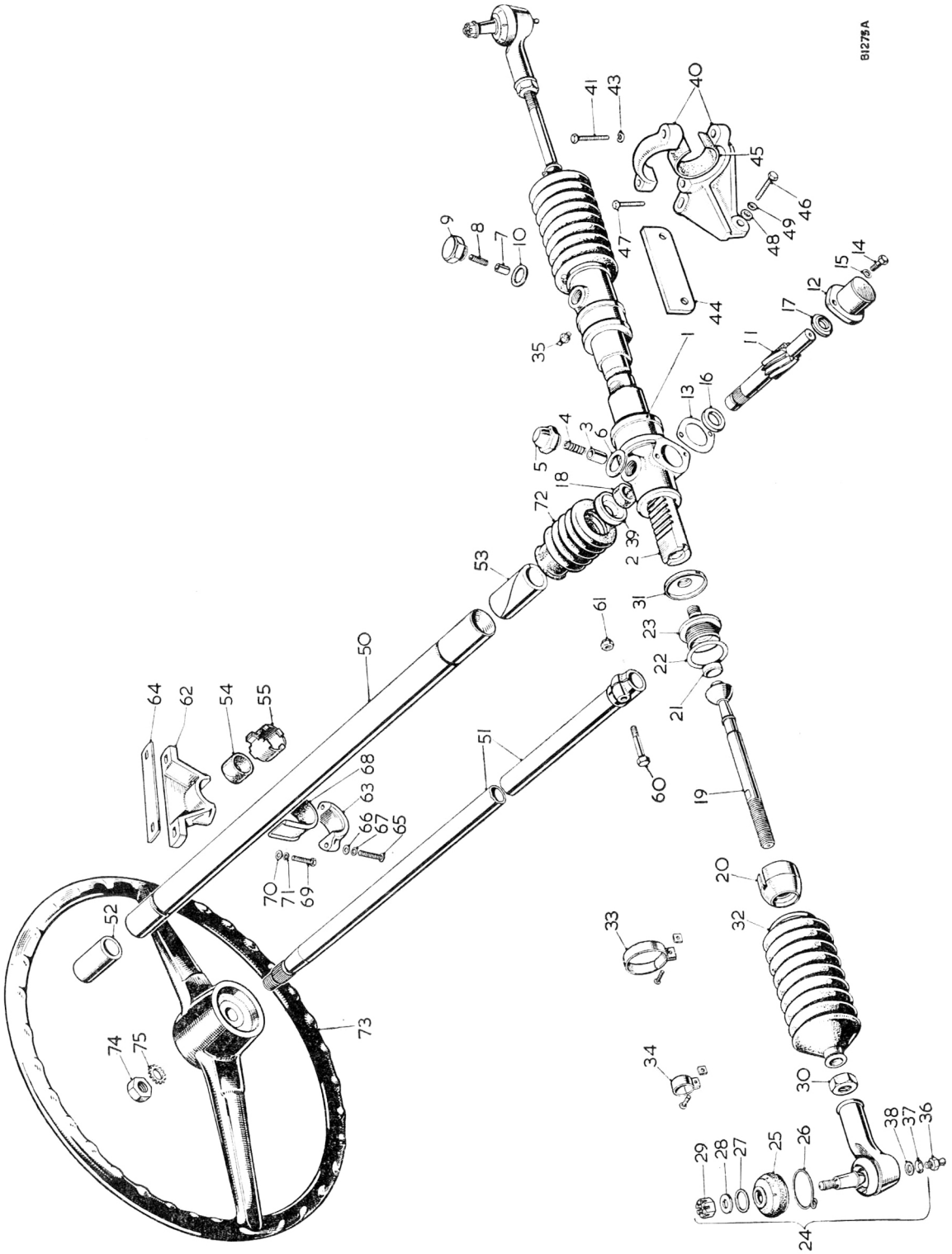
Pinion bearing preload

An inch-pound torque wrench may be used in place of Service tool 18G207 for measuring the pinion bearing preload.

SECTION J

THE STEERING GEAR

THE STEERING GEAR COMPONENTS



KEY TO THE STEERING GEAR COMPONENTS

No.	*Description*
1.	Rack housing.
2.	Rack.
3.	Damper pad.
4.	Damper pad spring.
5.	Damper pad housing.
6.	Shim.
7.	Secondary damper pad.
8.	Secondary damper spring.
9.	Secondary damper housing.
10.	Housing washer.
11.	Pinion.
12.	Pinion tail bearing.
13.	Shim.
14.	Set screw.
15.	Spring washer.
16.	Pinion thrust washer (top).
17.	Pinion thrust washer (bottom).
18.	Pinion seal.
19.	Tie-rod.
20.	Bell housing (female).
21.	Ball seat.
22.	Shim.
23.	Ball housing (male).
24.	Ball socket assembly.
25.	Boot.
26.	Clip.
27.	Ring.
28.	Plain washer.
29.	Nut.
30.	Locknut.
31.	Lock washer.
32.	Seal.
33.	Clip (inner).
34.	Clip (outer).
35.	Lubricator.
36.	Lubricator.
37.	Dished washer.
38.	Fibre washer.
39.	Retainer.
40.	Bracket and cap assembly.
41.	Set screw.
43.	Spring washer.
44.	Seating.
45.	Packing.
46.	Set screw.
47.	Set screw.
48.	Plain washer.
49.	Spring washer.
50.	Outer column.
51.	Inner column tube.
52.	Felt bearing (top).
53.	Felt bearing (bottom).
54.	Felt bearing (bottom).
55.	Clip.
60.	Bolt.
61.	Nut.
62.	Bracket.
63.	Bracket cap.
64.	Shim.
65.	Set screw.
66.	Plain washer.
67.	Spring washer.
68.	Seating.
69.	Set screw.
70.	Plain washer.
71.	Spring washer.
72.	Draught excluder.
73.	Steering-wheel.
74.	Nut.
75.	Shakeproof washer.

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.

Section J.1

LUBRICATION

The lubrication nipple provided at the left-hand side of the rack housing (right-hand side on left-hand-drive cars) is accessible when the bonnet is raised. Apply a gun filled with lubricant and give 10 strokes only at regular intervals.

Section J.2

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.3

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 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 18G 562 to unscrew the nut.

Refitting

Refitting of the steering-column assembly is the reverse of the removal procedure. Use Service tool 18G 562 when tightening the steering-wheel nut.

Section J.4

STEERING-RACK AND PINION

Removing

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 slotted nuts from the ball pins and detach the tie-rod ball joint from the swivel arm, using Service tool 18G 313.

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.

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 18G 313.

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 18G 313 together with 18G 312. The shims and ball seats are now free to be removed: ensure that the shims are kept to their respective sides.

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.

The ball joints linking the tie-rods to the rack must be a reasonably tight sliding fit without play. Any adjustment required is carried out by varying the thickness of shims fitted beneath the ball joint cap seating. The shims are available in thicknesses of ·002, ·003, ·005, and ·010 in. (·05, ·08, ·13, and ·25 mm.). When correctly adjusted, the ball housing must be locked in three places with the flange of the lock washers.

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. Excessive end-float of the pinion is rectified by the fitting of shims. By means of a dial gauge placed at the end of the pinion shaft, check the end-float of the shaft, which should be between ·002 and ·005 in. (·05 and ·13 mm.). The shims are available in thicknesses of ·003, ·005, and ·010 in. (·08, ·13, and ·25 mm.). Replace the ball joint locknuts and joint assemblies in approximately their original positions, referring to the figures recorded when the rack was dismantled. To replace and adjust the rack damper, position the plunger in the cap and replace the cap. Screw down the cap until it is just possible to rotate the pinion shaft by drawing the rack through its housing. With a feeler gauge measure the clearance between the hexagon of the damper cap and its seating in the rack housing (Fig. J.2). After obtaining a figure, add ·002 to ·005 in (·05 to ·13 mm.) to arrive at the correct thickness of shims which must be placed beneath the damper cap. Shims are available in thicknesses of ·003 and ·010 in. (·08 and ·25 mm.). Remove the damper cap and plunger. Fit the spring beneath the plunger and assembly with the required number of shims to give the stated clearance. Fit a new pinion shaft oil seal and pump 10 fl. oz. (·28 litre) approximately of oil into the rack housing through the nipple provided.

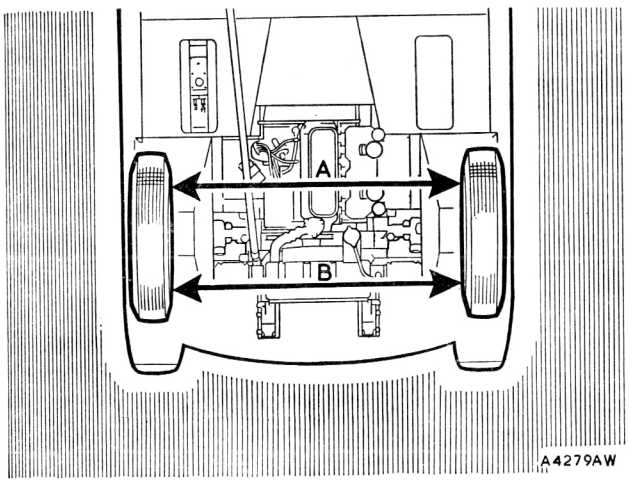


Fig. J.1

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

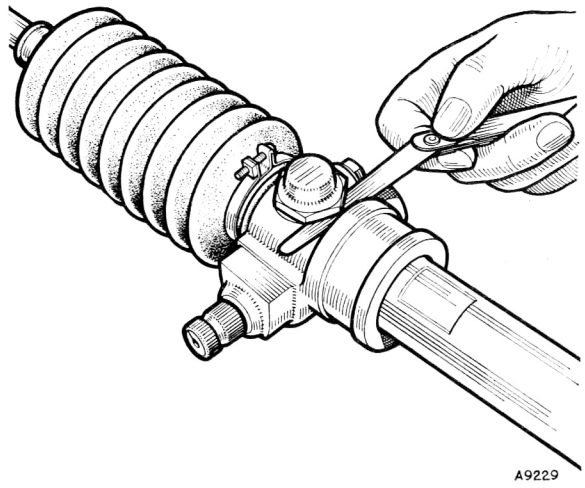


Fig. J.2

Checking the adjustment of the damper cap

Refitting

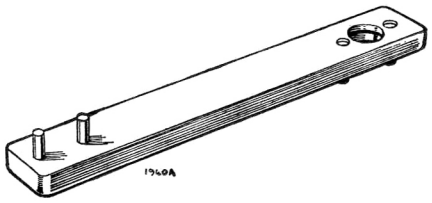
Refitting is the reverse of the removal procedure, except that the bolts securing the housing to its mounting brackets should not be fully tightened until the assembly has been replaced. This method of assembly will ensure that the steering-rack pinion is in correct alignment with the column. Finally,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

(*For* **'SERVICE TOOLS'** *see page J.6*)

SERVICE TOOLS

18G 312. Steering Tie-rod Pin Spanner

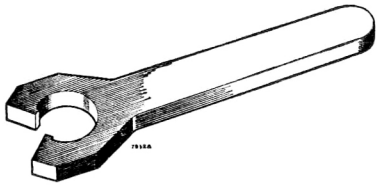
This tool is designed for use with the special 'C' spanner 18G 313 for dismantling the steering tie-rod ball housing. In use it is clamped in a vice and the pins of the spanner are engaged with the holes in the housing. Use the spanner 18G 313 to unscrew the housing cap.



18G 312

18G 313. Steering Tie-rod 'C' Spanner

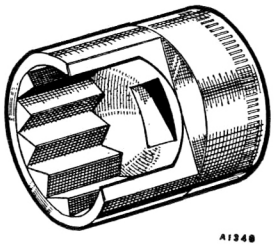
Designed to engage the shallow splines of the steering-rack ball housing cap and remove it without damage.



18G 313

18G 562. Steering-wheel Nut Spanner

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

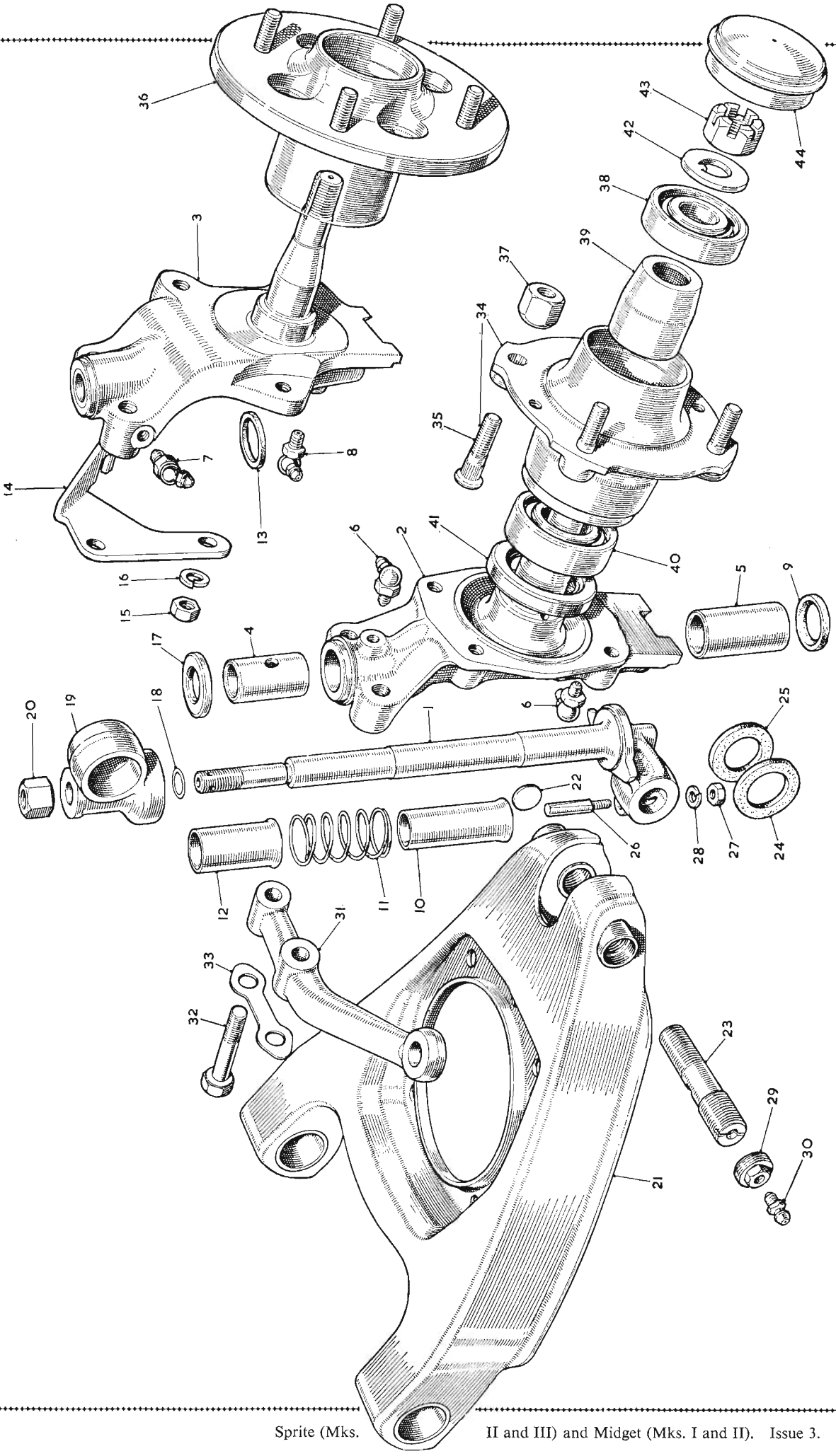


18G 562

SECTION K

THE FRONT SUSPENSION

THE FRONT SUSPENSION COMPONENTS



KEY TO THE FRONT SUSPENSION COMPONENTS

No.	*Description*
1.	Swivel pin.
2.	Swivel axle assembly.
3.	Swivel axle assembly.
4.	Bush (top).
5.	Bush (bottom).
6.	Lubricator.
7.	Lubricator.
8.	Lubricator.
9.	Sealing ring.
10.	Dust excluder tube (bottom).
11.	Dust excluder spring.
12.	Dust excluder tube (top).
13.	Sealing ring.
14.	Brake hose lock plate.
15.	Nut.
16.	Spring washer.
17.	Thrust washer.
18.	Adjustment washer.
19.	Suspension trunnion link.
20.	Nut.
21.	Lower link.
22.	Plug.
23.	Fulcrum pin.
24.	Ring (large).
25.	Ring (small).
26.	Cotter pin.
27.	Nut.
28.	Spring washer.
29.	Screwed plug.
30.	Lubricator.
31.	Steering lever.
32.	Set screw.
33.	Lock washer.
34.	Hub assembly.
35.	Wheel stud.
36.	Hub assembly.
37.	Nut.
38.	Outer hub bearing.
39.	Bearing distance piece.
40.	Inner hub bearing.
41.	Oil seal.
42.	Retaining washer.
43.	Nut.
44.	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

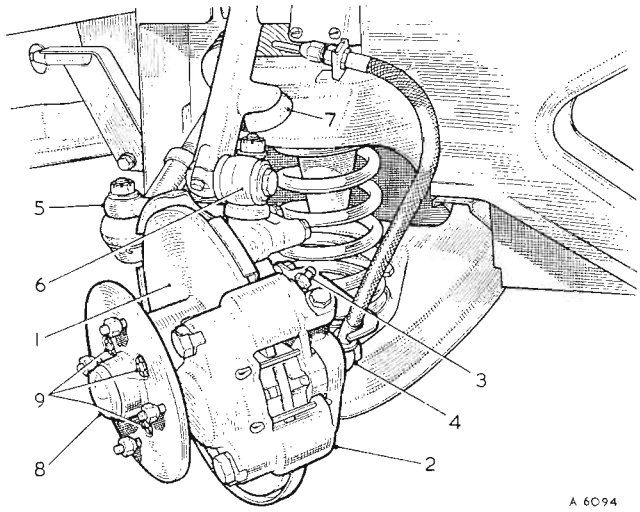


Fig. K.1

Front suspension (later cars)

1. Brake disc.
2. Calliper assembly.
3. Bleeder screw.
4. Calliper fluid connector.
5. Steering lever.
6. Suspension trunnion link.
7. Rebound buffer.
8. Retaining cap.
9. Brake disc to hub securing bolts.

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

LUBRICATION

A lubricating gun filled with lubricant should be applied to each of the eight nipples and three or four strokes given at regular intervals. 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.

Section K.2

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.3

FRONT SUSPENSION ASSEMBLY

Removing

Raise the car and remove the wheel and coil spring (see Section K.4). Disconnect the steering side-tube from the steering-arm by withdrawing the split pin and removing the slotted 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 slotted 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 (early cars). Remove the hub assembly as described in Section K.5 or K.6.

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 slotted 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. [·2 mm.] and ·012 in. [·3 mm.] shims available) onto the swivel pin, followed by the trunnion with its bore towards the hub when it is fitted. Tighten the slotted 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 slotted 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 slotted nut till the notch is in line with the clamp bolt hole in the damper arm, split-pin the slotted nut, and tighten the clamp bolt onto its shakeproof washer.

Refit the coil spring (Section K.4). Replace the wheel and lower the car. The block can now be removed from under the hydraulic damper arm.

Section K.4

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

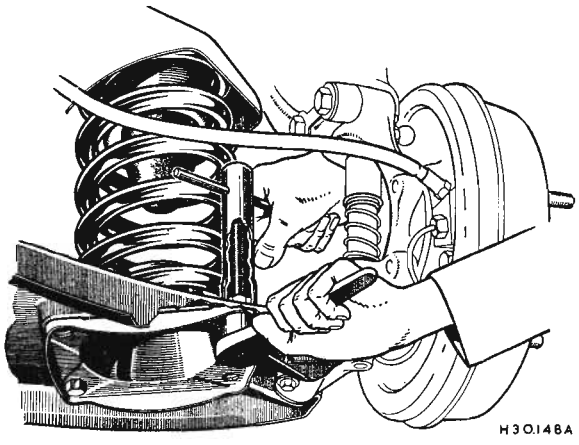


Fig. K.2

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

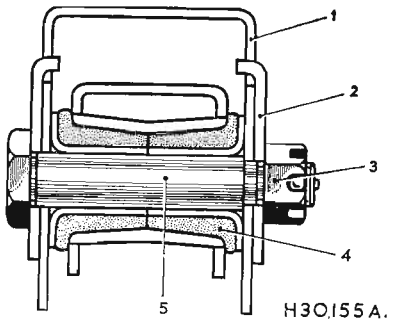


Fig. K.3

Lower link mounting (inner end)

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

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 18G 153 (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.

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.5

FRONT HUBS
(Early Cars)

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 the Service tool.

Should the inner bearing remain on the swivel axle, it should be carefully extracted, using Service tools 18G 8 and 18G 8 P. 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 distance piece can be tapped out, using Service tool 18G 260 together with 18G 260 A. Similarly, the inner bearing and oil seal can be detached by drifting them off from the other side of the hub, using Service tools 18G 260 and 18G 260 B.

Refitting

Pack the bearings and the cavity between them with grease.

Surplus grease must be removed after the hub has been fitted, to allow for expansion, and in no circumstances should grease be put into the retaining cap.

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 18G 134 together with adaptors 18G 134 B and 18G 134 C.

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

Using Service tool 18G 7, refit the hub assembly on the swivel axle.

Fit the washer and nut. Tighten the nut to the torque wrench reading given in 'GENERAL DATA'.

Section K.6

FRONT HUBS (Later Cars)

Removing

Raise the car to a workable height.

Remove the road wheel and disconnect the brake calliper assembly as in Section M. Support the calliper assembly—do not allow it to hang on the hydraulic hose. Remove the split pin and nut and pull off the hub casing and disc assembly, using Service tool 18G 304 and adaptor 18G 304 B.

Brake disc removing and refitting

Remove the securing set screws and remove the hub from the disc assembly.

Refitting is a reversal of the removal procedure. Should the maximum run-out at the outer periphery of the braking surface exceed ·006 in. (·152 mm.) after fitting, the disc must be removed and repositioned on the hub.

Refitting

Pack the bearings and the cavity between them with grease.

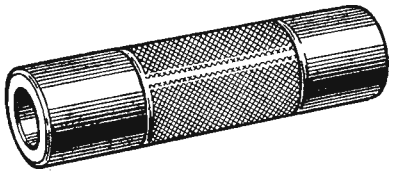
Surplus grease must be removed after the hub has been fitted, to allow for expansion, and in no circumstances should grease be put into the retaining cap.

Refitting is a reversal of the removal procedure. Ensure that the bearings are fitted with their side marked 'THRUST' adjacent to the bearing spacer.

(*For* **'SERVICE TOOLS'** *see page K.7*)

SERVICE TOOLS

18G 7. Front Hub Outer Bearing Remover



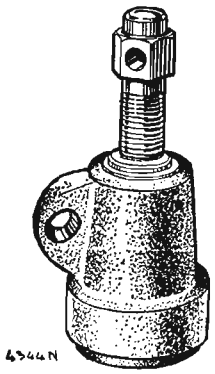
43 '6F

18G 7

18G 8. 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.

Use in conjunction with adaptor 18G 8 P.

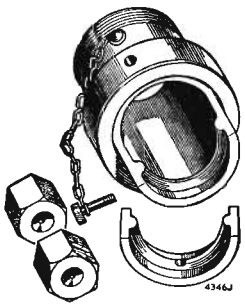


4344N

18G 8

18G 8 P. Front Hub Bearing Inner Race Remover Adaptor

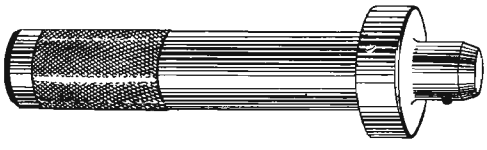
Used with hub remover 18G 8, 18G 2, or any other suitable two-legged extractor; a peg and chain is included to retain the locking ring and half-ring when not in use.



4346J

18G 8 P

18G 134. Bearing and Oil Seal Remover and Replacer (basic tool)



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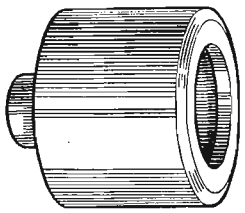
18G 134

18G 134 B. Front Hub Outer Bearing Replacer Adaptor
For use with 18G 134.

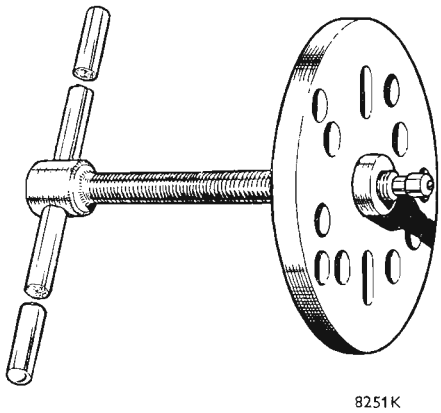
18G 134 C. Front Hub Inner Bearing Replacer Adaptor
For use with 18G 134.



18G 134 B

18G 134 C

18G 304. Front and Rear Hub Remover (basic tool)
The remover 18G 304 is a basic tool for use with various adaptor bolts supplied separately. Screw the two adaptor bolts 18G 304 F onto the wheel studs and insert the thrust pad into the axle tube. The rear hub can then be removed by screwing up the centre screw against the thrust pad.



18G 304

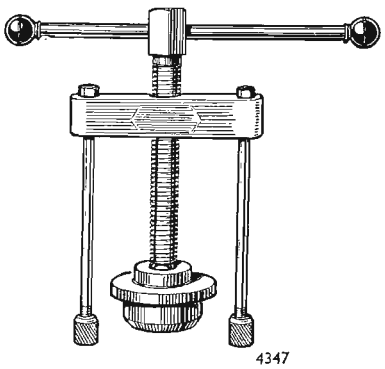
18G 304 F. Bolt Adaptor
For use with basic tool 18G 304.

18G 304 F

18G 304 H. Hub Remover Thrust Pad
For use with basic tool 18G 304.

18G 304 H

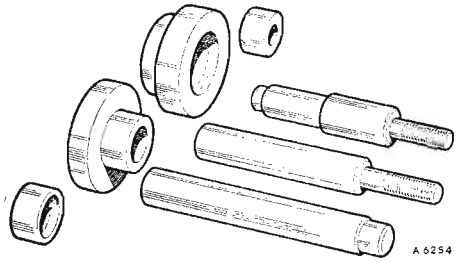
18G 153. Front Suspension Spring Compressor
The spring compressor thrust pad is ball-mounted to assist in lining up the spring and spring seat.



18G 153

18G 154 A. Swivel Axle Bush Remover and Replacer

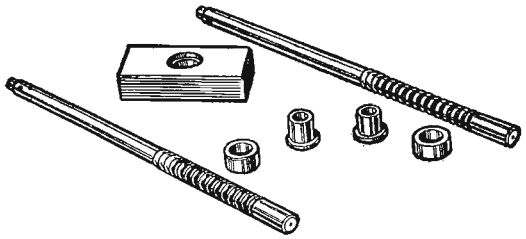
This tool enables the swivel axle bushes to be removed and fitted without the distortion which would occur if an improvised drift were used. The shoulder of the driver is recessed to prevent the split bushes from opening when being pressed into position. The tool is designed for use with a press.



18G 154 A

18G 155. 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 18G 154.



18G 155

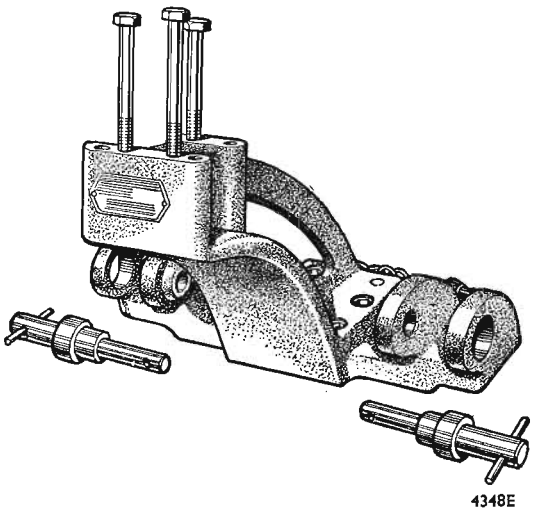
18G 155 A. Swivel Axle Bush Broach Guide

For use with 18G 155.

18G 155 A

18G 253. Front Suspension Assembly Fixture

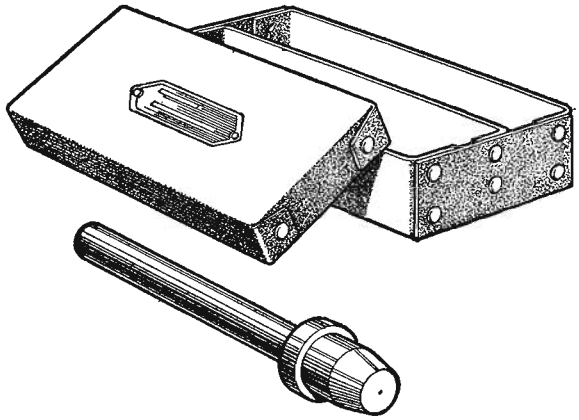
Designed to serve the dual purpose of accurately assembling a front suspension unit for fitting as a replacement to a vehicle, and also as a means of checking a unit suspected of damage or misalignment.



18G 253

18G 260. 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.



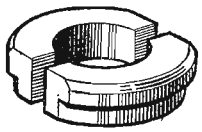
18G 260

18G 260 A. Front Hub Bearing Outer Race Remover Adaptor

For use with 18G 260 to remove the outer race of the outer bearing.

18G 260 B. Front Hub Bearing Outer Race Remover Adaptor

For use with 18G 260 to remove the outer race of the inner bearing.

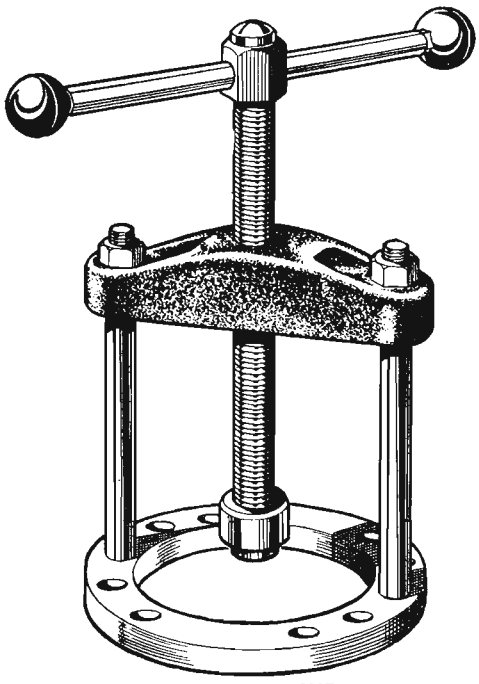


18G 260 A

18G 260 B

18G 146. Front and Rear Hub Remover

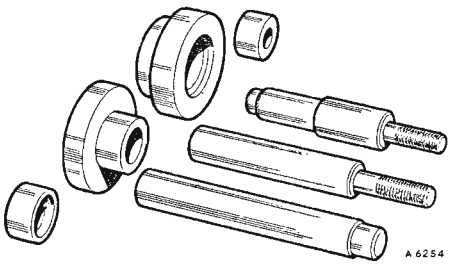
The thrust pad supplied with the tool is for use only when removing the hubs.



18G 146

18G 1006 Swivel Axle Remover and Replacer

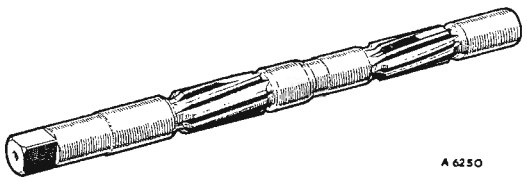
For the correct removal and replacement of the swivel axle bushes. 1098 c.c. engined cars.



18G 1006

18G 1006A Swivel Axle Bush Reamer

To ream swivel axle bushes to the correct size. 1098 c.c. engined cars.



18G 1006A

SECTION L

THE HYDRAULIC DAMPERS

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.

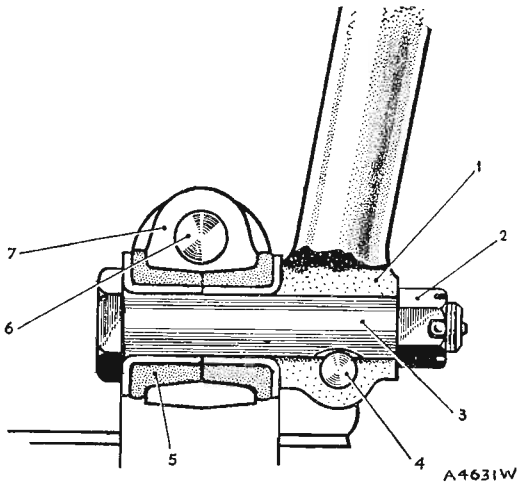


Fig. L.1

Trunnion link/damper arm assembly

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

Section L.1

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 to 4 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 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.

Section L.2

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 slotted 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.

Section L.3

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.

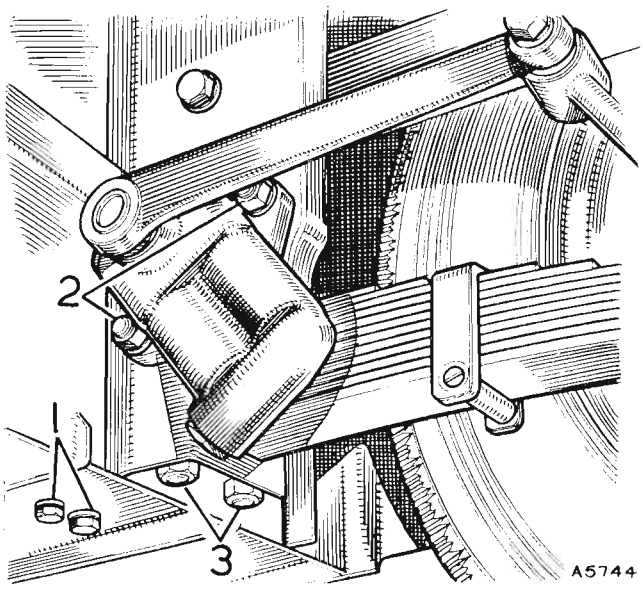


Fig. L.2

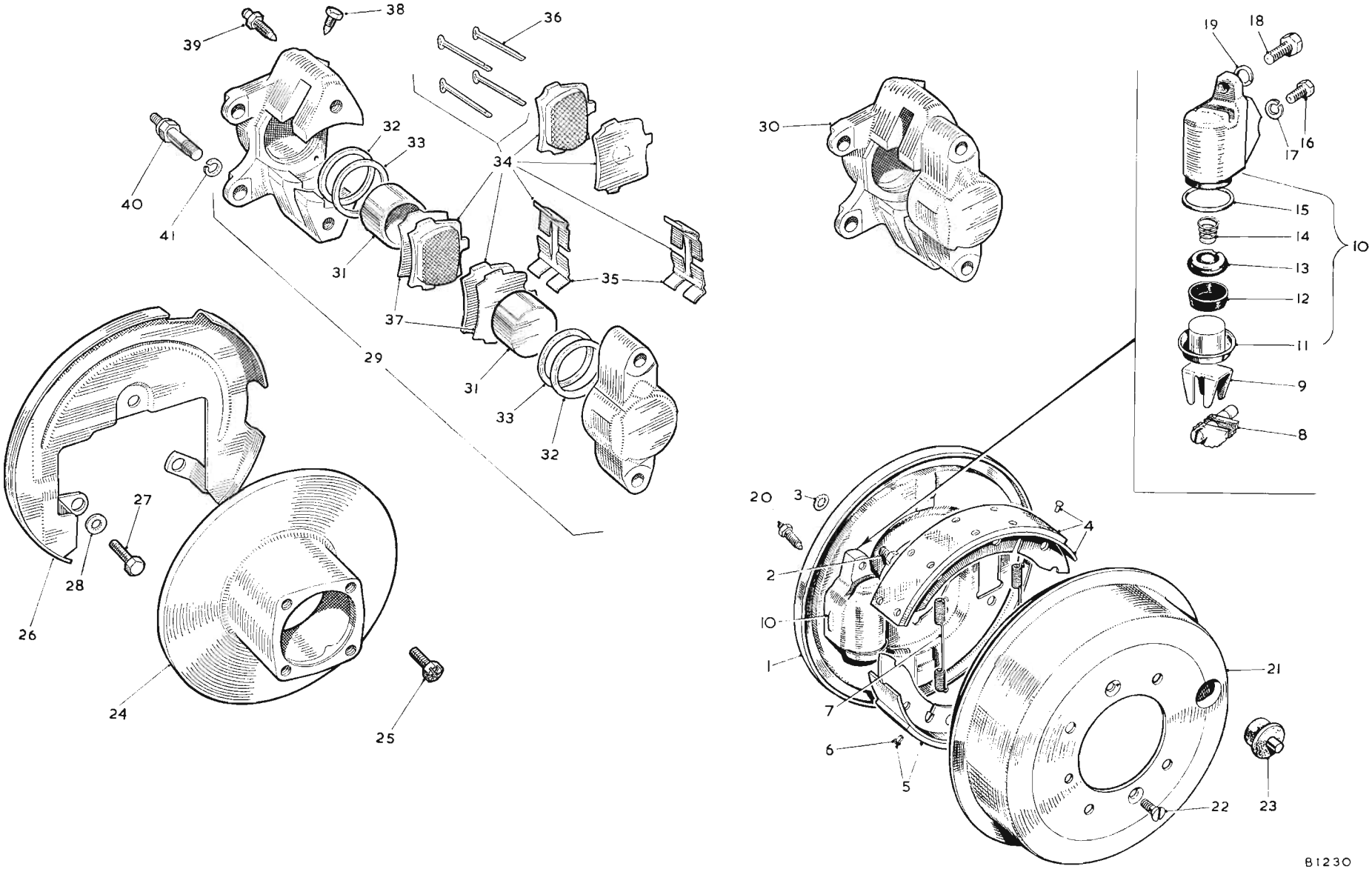
Rear spring mounting

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

SECTION M

THE BRAKING SYSTEM

THE FRONT BRAKE COMPONENTS



KEY TO THE FRONT BRAKE COMPONENTS

No.	*Description*
1.	Brake-plate.
2.	Set screw.
3.	Shakeproof washer.
4.	Brake-shoe assembly.
5.	Liner with rivets.
6.	Rivet.
7.	Pull-off spring.
8.	Micram adjuster.
9.	Mask.
10.	Wheel cylinder assembly.
11.	Piston with dust cover.
12.	Cup.
13.	Cup filler.
14.	Spring.
15.	Sealing ring.
16.	Set screw (small).
17.	Spring washer.
18.	Set screw (large).
19.	Spring washer.
20.	Bleeder screw.
21.	Brake-drum.
22.	Set screw.
23.	Plug.
24.	Brake disc.
25.	Set screw.
26.	Dust cover.
27.	Set screw.
28.	Shakeproof washer.
29.	Calliper unit assembly—L.H.
30.	Calliper—L.H.
31.	Piston.
32.	Inner seal.
33.	Dust seal and retainer.
34.	Pad assembly.
35.	Pad retaining spring.
36.	Split cotter pin.
37.	Pad shim.
38.	Plug.
39.	Bleed screw.
40.	Calliper mounting bolt.
41.	Spring washer.

GENERAL DESCRIPTION
(Early Cars)

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

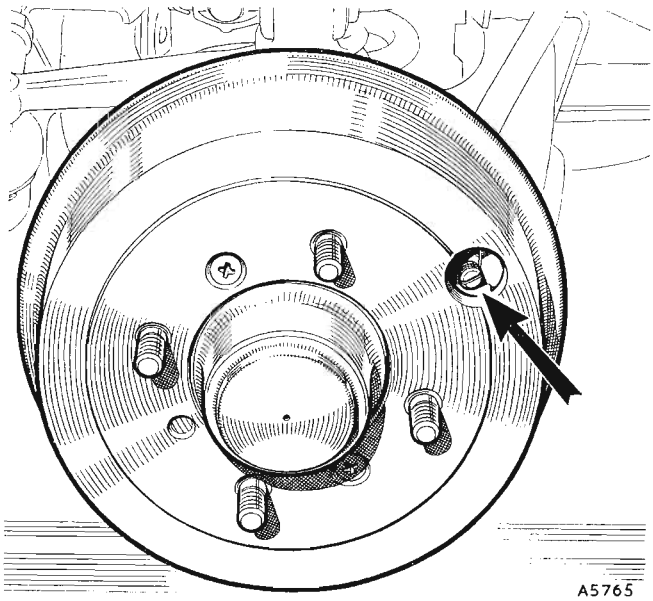


Fig. M.1
Showing a front brake-drum with one of the brake-shoe adjusters

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.

GENERAL DESCRIPTION
(Later Cars)

The front brakes are of the rotating disc and rigidly mounted calliper type, each calliper containing two friction pad assemblies between which the disc rotates. The friction pads are applied to the disc by means of two pistons operated by hydraulic pressure, and are automatically retracted when the hydraulic pressure is released. Wear on the friction pads is taken up automatically and no adjustment is necessary.

When the friction pads require renewal they are readily detachable without removing the calliper from its mounting.

Fluid pressure generated in the master cylinder by the application of the brake pedal enters the mounting half of the calliper and passes through internal fluid passages to the rim half, thus exerting equal pressure on both operating pistons simultaneously and bringing the friction pads into contact with the disc faces.

The pistons are sealed by means of a rubber seal fitted to the mouth of the bore of each half of the calliper to prevent moisture and dirt from entering, and are also sealed by a rubber seal fitted in a groove in each calliper bore to prevent fluid leakage.

The fluid seals grip the outer diameter of the pistons tightly.

When the brakes are applied outward movement of the piston and fluid pressure tend to force the seal out of its groove. As the pressure is released the seal returns to its original position, and in doing so moves the piston backwards slightly to provide a running clearance between the friction pads and the disc. As the pads wear the piston will move farther outwards to compensate for the wear, thus eliminating the need for manual adjustment.

The rear brakes are of the internal-expanding type with one leading and one trailing shoe in each assembly. Pressure on the pedal expands the shoes in the drums hydraulically, and when the pressure is released return springs retract them onto their stops on the expander units.

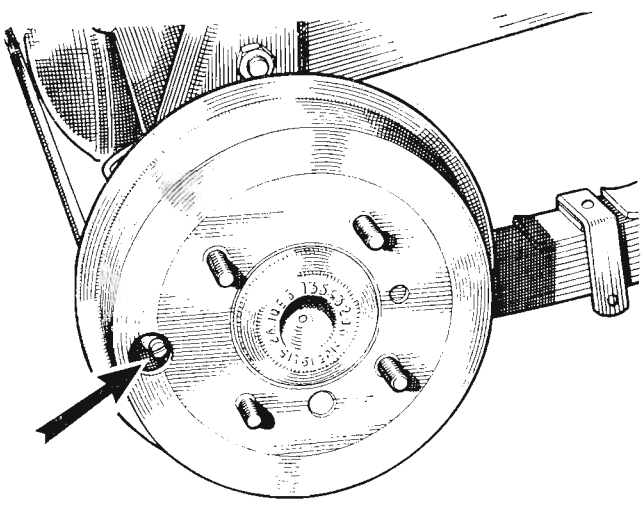


Fig. M.2
Showing rear brake-shoe adjuster

Section M.1

MAINTENANCE
(Early Cars)

Periodically examine the quantity of brake fluid in the master cylinder. The level should be kept ¼ in. (6·5 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 SUPER HEAVY DUTY 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.

Lubrication

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 at regular intervals with a gun filled with lubricant.

The hand brake cable nipple located just forward of the rear axle must receive three or four strokes at regular intervals with a gun filled with lubricant.

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.

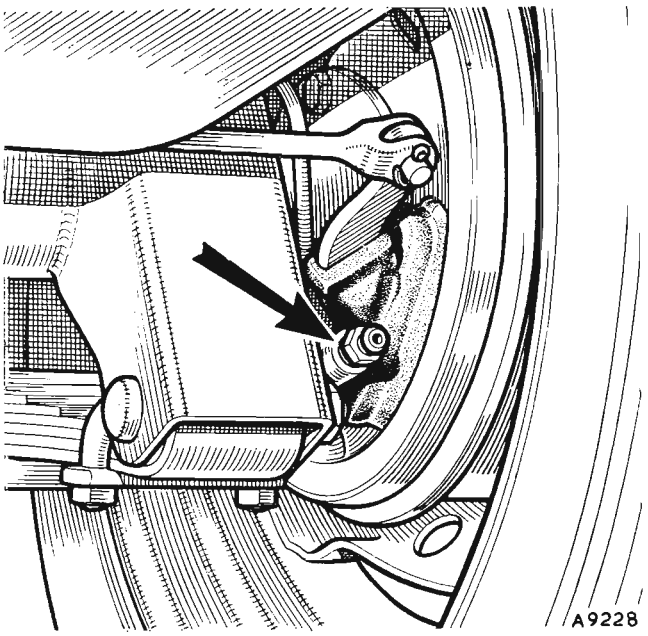


Fig. M.3

Illustrating a rear brake bleed nipple

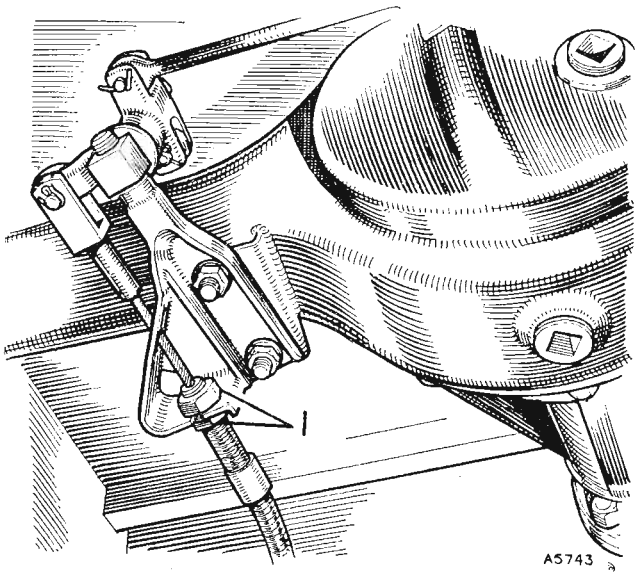


Fig. M.4

Shows location of hand brake cable adjustment (1) *on the rear axle*

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 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

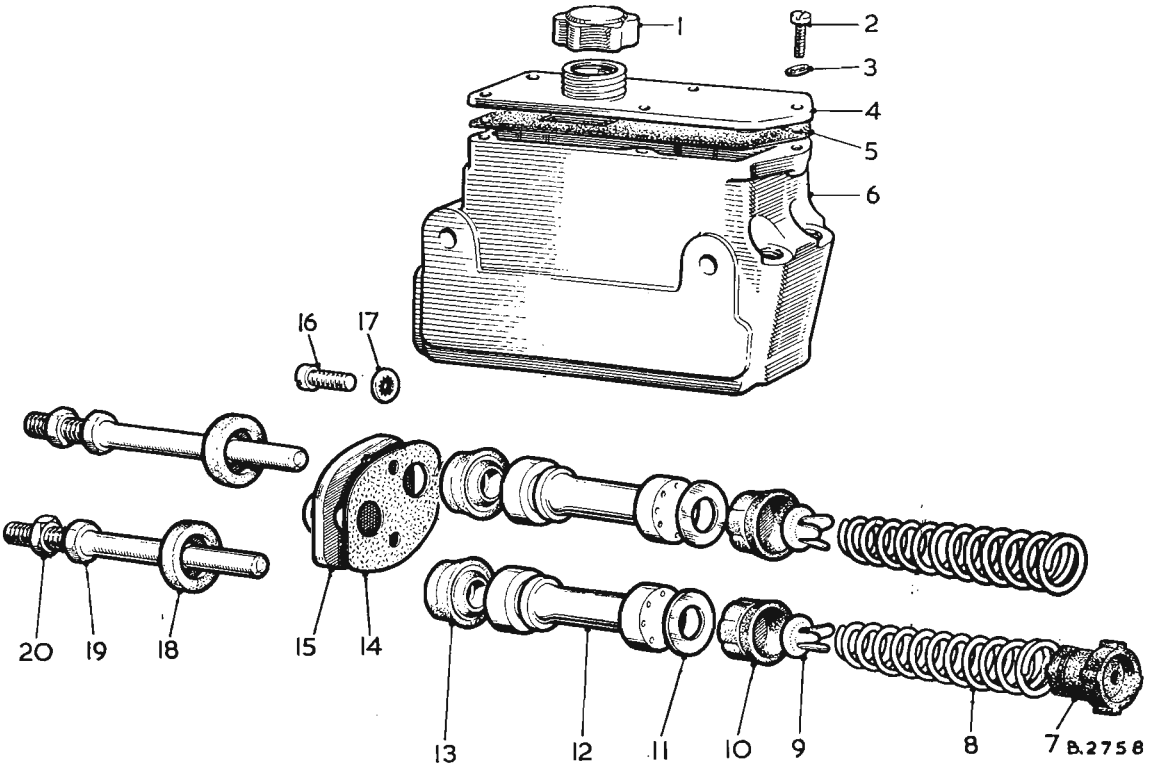


Fig. M.5

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 (Brake bore only).
8. Return spring.
9. Spring retainer.
10. Main cup.
11. Piston washer.
12. Piston.
13. Secondary cup.
14. Gasket.
15. Boot fixing plate.
16. Fixing washer.
17. Shakeproof washer.
18. Boot.
19. Push rod.
20. Push rod adjuster.

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).

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, tighten 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 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.

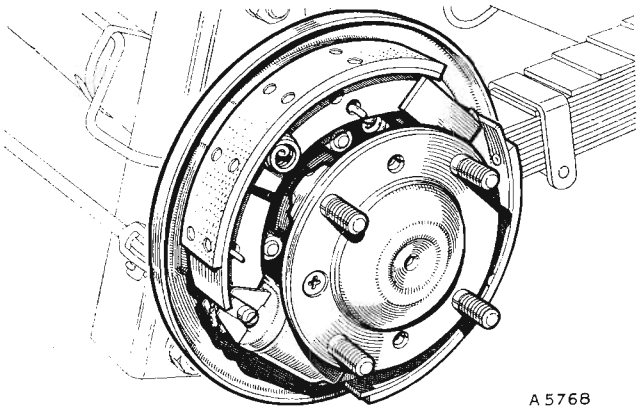


Fig. M.6

The rear brake assembly

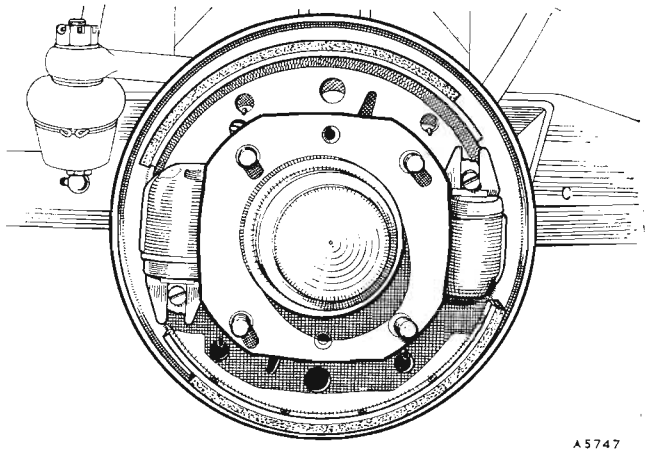


Fig. M.7

The front brake assembly

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.

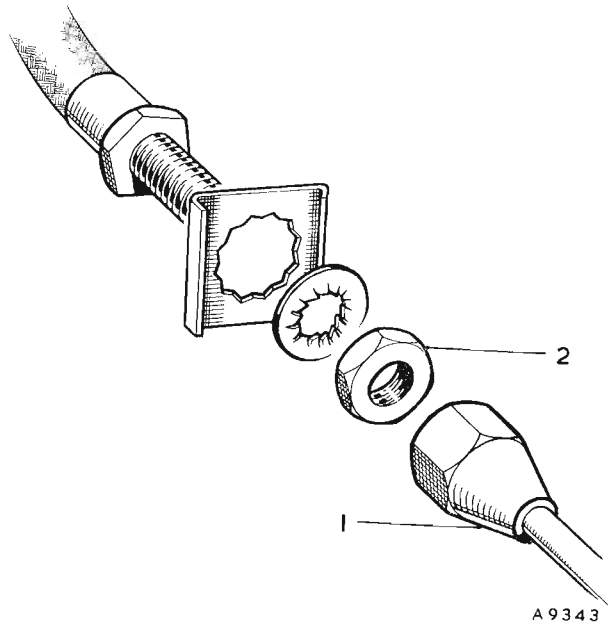


Fig. M.8

The union nut (1) *is the one which must be first unscrewed to release the flexible hose from the pipeline. The attachment nut* (2) *can then be removed*

Refitting

When refitting reverse the removal procedure.

Section M.7

FRONT BRAKE ASSEMBLIES (Early Cars)

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.3.

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 (Early Cars)

Removing

Remove the wheel, drum, and axle shaft as described in Section H.3. Remove the hub assembly (see Section H.4).

Disconnect the hydraulic pipe from the wheel cylinder and the hand brake lever rod, both situated at the backplate.

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 M.11

BRAKE PEDAL CLEARANCE

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 M.12

MAINTENANCE
(Later Cars)

Periodically examine the quantity of brake fluid in the master cylinder. The level should be kept $\frac{1}{4}$ in. (6·5 mm.) below the bottom of the filler neck, but not higher. The necessity for frequent topping up is an indication of a leak in the system which should at once be traced and rectified.

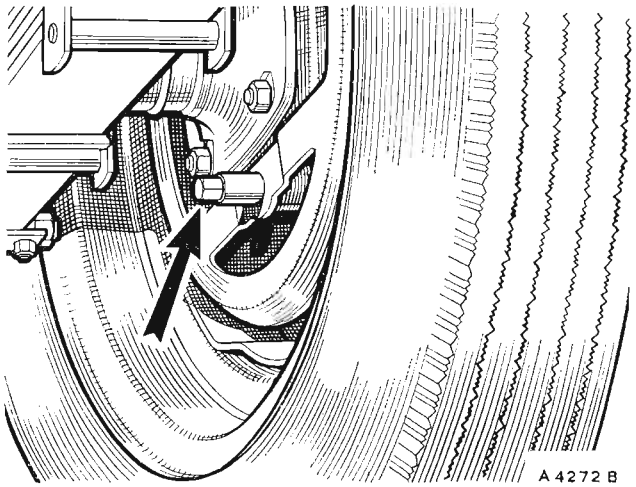


Fig. M.9

One square-headed brake adjusting bolt is provided on each rear brake-plate

Adjust the rear brake-shoes to compensate for wear of the linings. The need for this is shown by the pedal going down almost to the floorboards before solid resistance is felt.

In order to maintain peak braking efficiency and at the same time obtain maximum life from the front brake friction pads they should be examined periodically, and if one pad has more wear than the other their operating positions should be changed over.

IMPORTANT.—Serious consequences may result from the use of incorrect fluids. Replenish with LOCKHEED DISC BRAKE FLUID. Do not use any substitute as this will seriously affect the working of the system.

When climatic temperatures are below −34° C. (−30° F.) the systems should be drained and refilled with Lockheed Super Heavy Duty Brake Fluid or a fluid conforming to Specification S.A.E. 70.R3.

Lubrication

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 at regular intervals with a gun filled with lubricant.

The hand brake cable nipple located just forward of the rear axle must receive three or four strokes at regular intervals with a gun filled with lubricant.

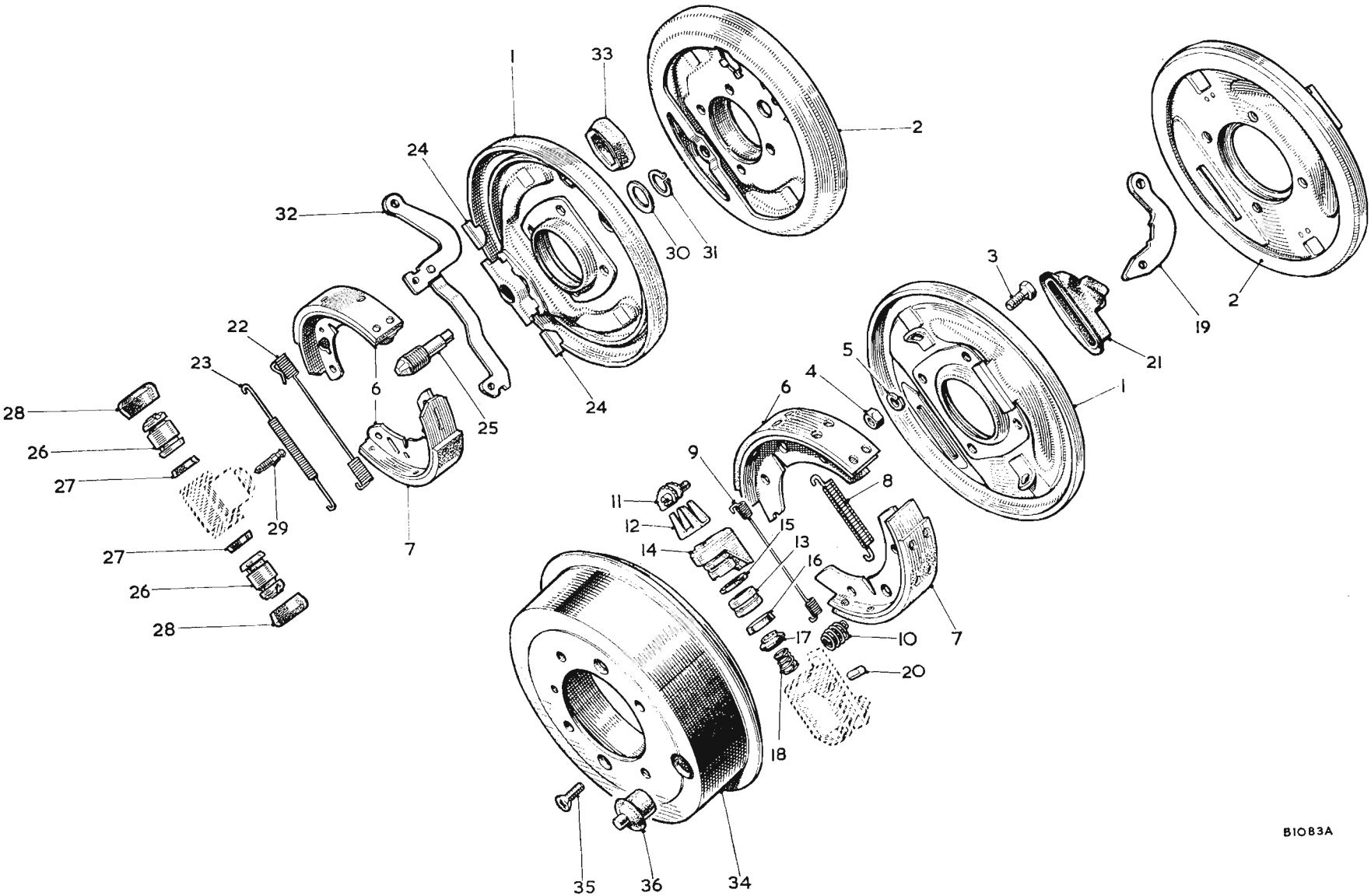
Section M.13

FRONT BRAKE ASSEMBLIES
(Later Cars)

Renewing friction pads

Jack up the car and remove the road wheel. Depress the pad retaining spring and withdraw the retaining split

THE REAR BRAKE COMPONENTS



KEY TO THE REAR BRAKE COMPONENTS

No.	*Description*
1.	Brake-plate—R.H.
2.	Brake-plate—L.H.
3.	Set screw.
4.	Nut.
5.	Spring washer.
6.	Brake-shoe assembly.
7.	Liner with rivets.
8.	Shoe return spring (abutment end).
9.	Shoe return spring (cylinder end).
10.	Steady spring.
11.	Adjuster assembly.
12.	Mask adjuster.
13.	Piston.
14.	Piston with dust cover.
15.	Seal.
16.	Cup.
17.	Cup filler.
18.	Spring.
19.	Hand brake lever.
20.	Pivot pin.
21.	Boot.
22.	Shoe return spring (cylinder end).
23.	Shoe return spring (adjuster end).
24.	Tappet.
25.	Wedge.
26.	Piston.
27.	Seal.
28.	Boot.
29.	Bleeder screw.
30.	Belleville washer.
31.	Circlip.
32.	Hand brake lever.
33.	Boot.
34.	Brake-drum.
35.	Set screw.
36.	Plug.

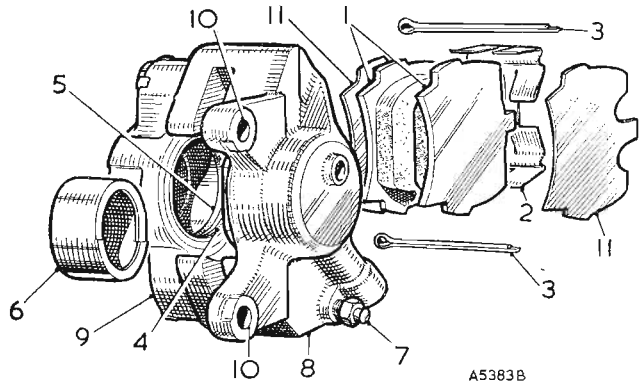


Fig. M.10

The front brake calliper components

1. Friction pads.
2. Pad retaining spring.
3. Retaining pin.
4. Piston dust seal.
5. Piston fluid seal.
6. Piston.
7. Bleeder screw.
8. Calliper (mounting half).
9. Calliper (rim half).
10. Calliper mounting point.
11. Anti-squeak shims.

pins. Remove the spring and withdraw the friction pads and anti-squeak shims from the calliper, using a slight rotational movement to assist removal. It may be necessary to use a pair of pointed-nose pliers for this operation.

Thoroughly clean the exposed face of each piston and ensure that the recesses in the calliper which receive the friction pad assemblies are free from rust and grit. Press each piston back into the calliper. Whilst this is being done the fluid level in the master cylinder will rise, due to fluid being displaced by the pistons. It may be necessary to siphon off any surplus from the master cylinder to prevent the fluid from overflowing.

Check that the relieved face of each piston is correctly positioned and fit the new friction pad assemblies into the calliper.

Fit the anti-squeak shims between the piston and friction pad.

Ensure that the pad assemblies are free to move easily in the calliper recesses. Remove any high-spots from the pad pressure plate by filing carefully.

Refit the retaining spring in position, press down the spring, and insert the split pins. If the retaining springs show any signs of damage or loss of tension, new springs must be fitted.

After fitting new friction pads operate the brake pedal several times to adjust the brake. Top up the master cylinder if necessary.

Removing and dismantling a calliper

Disconnect the brake fluid supply hose.

Remove the nuts securing the hose retaining plate to the calliper assembly.

Unscrew and remove the studs securing the calliper to the stub axle and withdraw the calliper. Depress the pad retaining spring and withdraw the retaining split pins. Remove the friction pads and anti-squeak shims and clean the outside of the calliper, making sure that all dirt and traces of cleaning fluid are completely removed.

Reconnect the brake fluid supply hose and support the calliper to avoid straining the hose.

Clamp the piston in the mounting half of the calliper and gently apply the foot brake. This operation will force the piston in the rim half of the calliper to move outwards. Continue with gentle pressure on the foot pedal until the piston has emerged sufficiently for it to be removed by hand. Have a clean receptacle ready to catch the fluid as the piston is removed.

With a suitable blunt-nosed tool remove the fluid seal from its groove in the bore of the calliper, taking great care not to damage the bore of the calliper or the seal retaining groove.

The dust seal retainer can be removed by inserting a screwdriver between the retainer and the seal and gently prising the retainer from the mouth of the calliper bore. The rubber seal can then be detached.

Remove the clamp from the mounting-half piston. To remove the mounting-half piston from the calliper it is necessary first to refit the rim-half piston, and thereafter the procedure is as previously detailed.

When cleaning out the calliper it is essential that only methylated spirit or the correct Lockheed brake fluid be used as a cleaning medium. Other types of cleaning fluid may damage the internal rubber seal between the two halves of the calliper.

Brake discs

Follow the procedure detailed in Section K.6 for the removal of the brake disc. Should the maximum run-out at the outer periphery of the braking surface exceed ·006 in. (·152 mm.) after fitting, the disc must be removed and repositioned on the drive shaft splines.

Reassembling

Coat a new fluid seal with Lockheed Disc Brake Lubricant, making sure that the seal is absolutely dry before so doing, and ease the seal into its groove with the fingers until it is seating correctly in the groove.

Slacken the bleeder screw in the calliper one complete turn. Coat the piston with Lockheed Disc Brake Lubricant and locate the piston squarely in the mouth of the bore with the cut-away portion of the piston face correctly positioned downwards.

Press in the piston until approximately $\frac{5}{16}$ in. (8 mm.) of the piston is protruding from the bore. Take great care to prevent the piston tilting during this operation. If the dust seal and retainer have been previously removed, take a new, perfectly dry dust seal, coat it with Lockheed Disc Brake Lubricant, and fit the seal into its retainer. Position the seal assembly on the protruding portion of the piston with the seal innermost, ensuring that the assembly is square with the piston. Press home the piston and seal assembly with the clamp. Retighten the bleeder screw.

The mounting-half piston is dealt with in the same manner as described for the rim-half piston. The rubber hose must be disconnected to allow the clamp to be used and the bleeder screw must be slackened.

Reconnect the hose and secure the calliper to the stub axle. Do not depress the brake pedal. Fit the friction pad assemblies, together with their retaining springs and split pins, and bleed the system.

After bleeding operate the brake pedal several times to adjust the brake.

Section M.14

REAR BRAKE ASSEMBLIES (Later Cars)

Brake-shoe adjustment

As the brake linings wear, the pedal will travel nearer to the floorboards before the brakes are applied. When the travel becomes excessive the brake-shoes must be adjusted to bring the linings closer to the brake-drum.

One common adjuster controlling the adjustment of both the leading and trailing brake-shoes is located on the back of each rear brake backplate.

Jack up the car and turn the adjuster screw in a clockwise direction until the brake-drum is locked, then slacken the screw until the drum rotates without rubbing.

Repeat this adjustment on the other rear road wheel.

Removing the rear wheel cylinder assembly

Jack up the car, remove the road wheel, and thoroughly clean the brake backplate.

Disconnect the flexible fluid supply hose as detailed in Section M.10.

Unscrew and remove the bleed screw. Remove the circlip from the cylinder boss protruding through the backplate. Remove the brake drum as described in Section H.3. Remove the brake-shoes and extract the cylinder.

Examining the rear wheel cylinder assembly

Remove the dust seals from the ends of the cylinder and extract both pistons. The rubber piston seals should be removed and new seals fitted by using the fingers only.

Do not clean the rubber parts with anything other than the correct Lockheed brake fluid. All traces of petrol (gasoline), etc., used for cleaning metal parts must be removed before reassembly.

Refitting the rear wheel cylinder assembly

The procedure for refitting a rear wheel cylinder is a reversal of the removal sequence. In addition, attention must be given to bleeding the hydraulic system and adjusting the brake-shoes.

Removing rear shoes

Chock the front road wheels and set the hand brake in the 'off' position.

Jack up the car and remove the road wheel.

Remove the brake drum as described in Section H.3.

Note the position in which the pull-off springs are fitted and remove the shoes and springs.

NOTE.—Do not press the brake pedal with the shoes removed from the backplate.

Refitting rear shoes

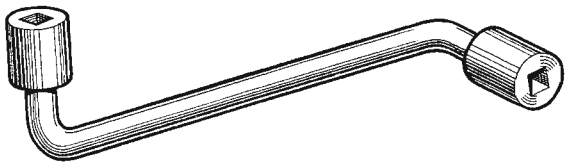
Refitting is a reversal of the above procedure; make sure that the pull-off springs are anchored in their correct holes in the shoe web and that the brake-shoes register correctly in the slotted end of the brake wheel cylinder piston and in the adjuster tappets.

(*For* **'SERVICE TOOLS'** *see page M.14*)

SERVICE TOOLS

18G 619. Brake Adjusting Spanner

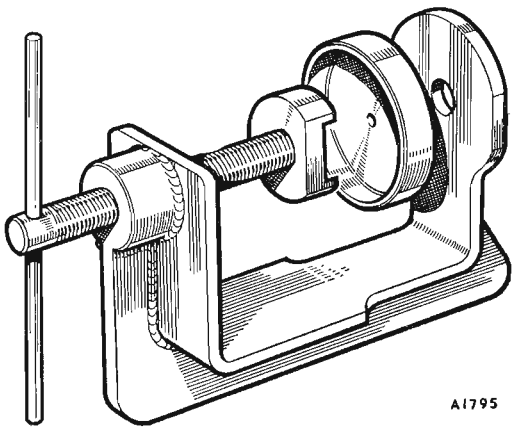
The use of this spanner obviates damage to the adjusters, enables the brakes to be adjusted more speedily and effectively, and removes the possibility of damaged knuckles and fingers.



18G 619

18G 590. Disc Brake Piston Resetting Tool

Designed to reset the pistons when renewing the disc brake friction pads, this tool will also be found invaluable, when servicing the callipers, to hold one piston in position while removing the other piston by means of hydraulic pressure generated in the master cylinder.



18G 590

SECTION N

THE ELECTRICAL SYSTEM

GENERAL DESCRIPTION

The 12-volt electrical equipment incorporates compensated voltage control for the charging circuit. The positive earth system of wiring is employed.

The battery is 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

LUBRICATION

Dynamo

On early cars unscrew the lubricator with the felt pad and half-fill with lubricant at regular intervals. On later cars add two drops of lubricant at regular intervals in the lubricating hole in the centre of the rear end bearing plate.

Section N.2

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 27° *C.* (80° *F.*)

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 27° *C.* (80° *F.*)

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 16° C. (60° F.). If the temperature of the electrolyte exceeds this ·002 must be added to hydrometer readings for each 3° C. (5° F.) rise to give the true specific gravity. Similarly, ·002 must be subtracted from hydrometer readings for every 3° C. (5° F.) below 16° C. (60° F.).

The readings of all the cells should be approximately the same. If one cell gives a reading very different from the rest it may be that the electrolyte has been spilled or has leaked from the cell or there may be an internal fault. 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 4·0 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 4·0 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 27° C. (80° F.) .. 38° C. (100° F.)
For climates above 27° C. (80° F.) .. 49° C. (120° F.)

If this temperature is reached the charge should be suspended to allow the temperature to fall at least 6° C. (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 retaining screws sufficiently to prevent the cables from moving on the terminal posts when tested by hand, but do not overtighten.

Section N.3

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 micro 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.4. The specific gravity of the filling electrolyte depends on the climate in which the battery is to be used.

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 16 and 38° C. (60 and 100° F.). If the battery has been stored in a cool place it should be allowed to warm up to room temperature before filling.

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 (4·0 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 1·260 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.4

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 1·840 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:

	To obtain specific gravity (corrected to 16° C. [60° F.])	*Add 1 vol. of acid of 1·840 S.G. (corrected to 16° C. [60° F.])*
For climates	*of*	*to*
Below 27° C. (80° F.)	1·260	3·2 volumes of water
Above 27° C. (80° F.)	1·210	4·3 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 0° C. (32° F.).

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 48 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 27° C. (80° F.) .. 38° C. (100° F.),
For climates above 27° C. (80° F.) .. 49° C. (120° F.),

the charge must be interrupted until the temperature has fallen at least 5·5° C. (10° F.) 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 16° C. (60° F.) 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.5

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.6).

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.

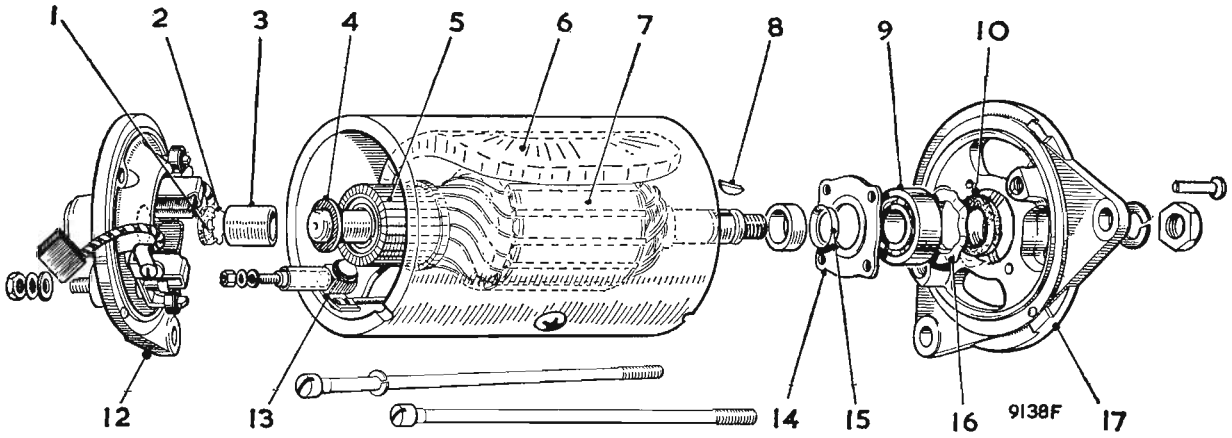


Fig. N.1

The windowless yoke dynamo (C39 type)

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.) (C39 type), $\frac{1}{4}$ in. (6 mm.) (C40/1 type).

Test the brush spring tension, using a spring scale. The tension of the springs when new is 18 to 26 oz. (510 to 737 grs.) (C39 type), 22 to 25 oz. (624 to 709 grs.) (C40/1 type). In service it is permissible for this value to fall to 15 oz. (425 grs.) 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.

Some commutators fitted to the C40/1 dynamos are of the moulded type and may be re-skimmed to a minimum diameter of 1·45 in. (36·8 mm.).

The undercut must conform to the following dimensions:

Width	·040 in. (1·016 mm.).
Depth	·020 in. (·508 mm.).

It is important that the sides of the undercut clear the moulding material by a minimum of ·015 in. (·381 mm.).

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.

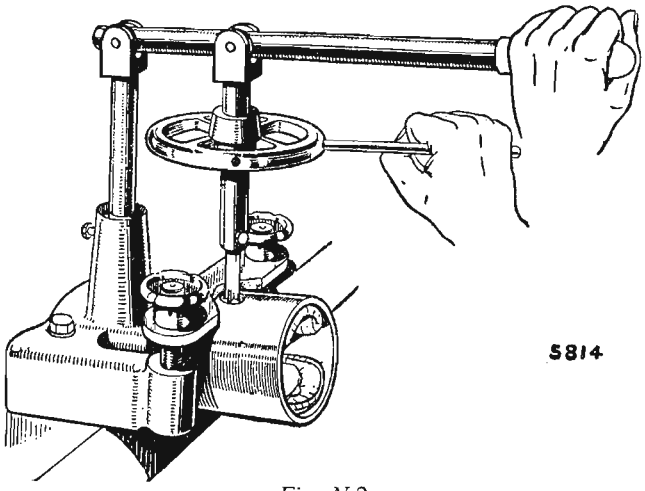


Fig. N.2

Using a wheel-operated screwdriver to remove the pole-shoe screws

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.

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 $\frac{5}{8}$ in. (15·87 mm.) 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 100° C. (212° F.) 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 (C39 type only), 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

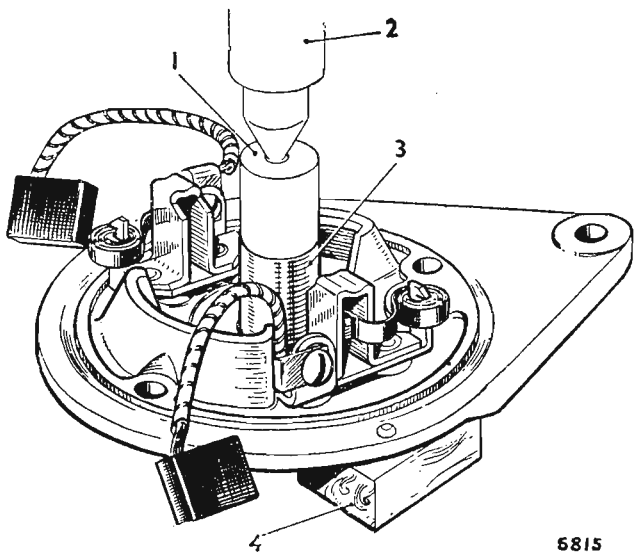


Fig. N.3

The method of pressing in the commutator end bracket bush

1. Shouldered mandrel.
2. Hand press.
3. Bearing bush.
4. Support block.

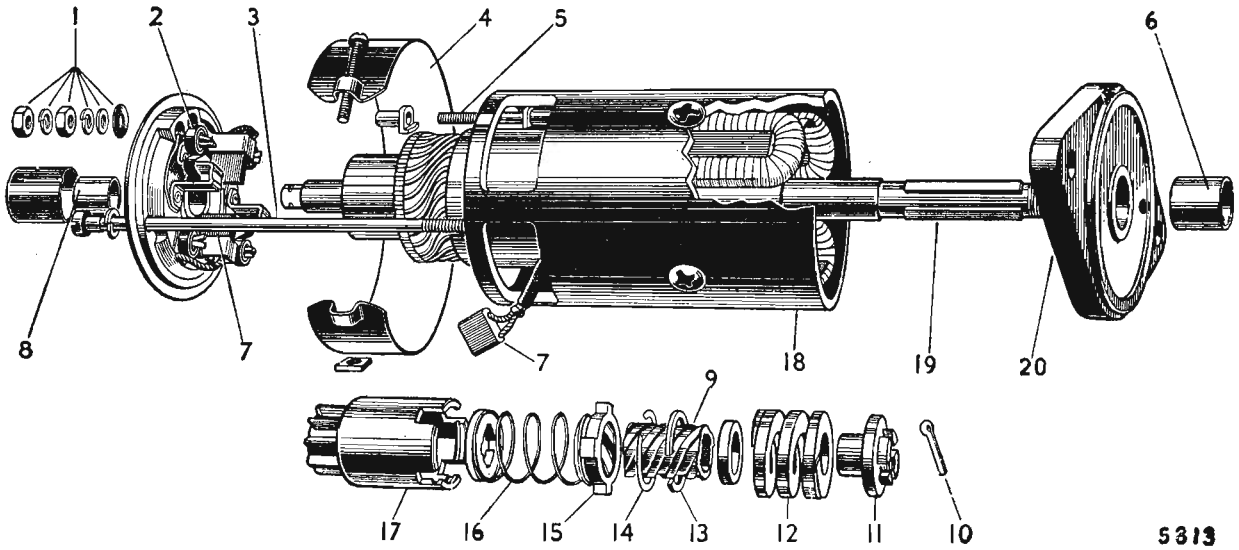


Fig. N.4

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.

similar tool when the end bracket is assembled to within about ½ 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.

Section N.6

STARTER

Testing on vehicle when starter is not operating

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.

Manœuvre 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.

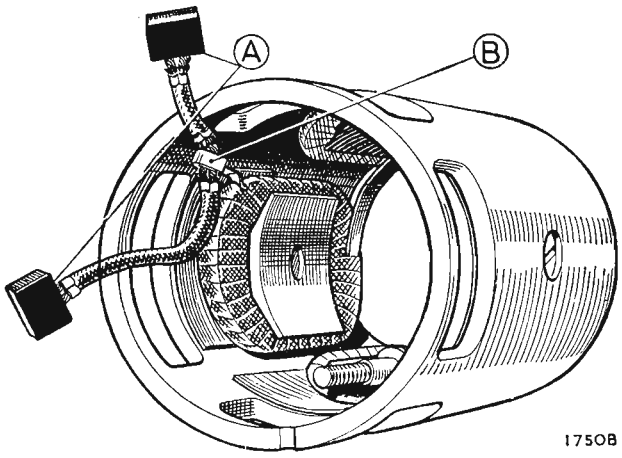


Fig. N.5

The starter brush connections

A. Brushes. B. Tapping on field coils.

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.

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 and drive assembly.

Servicing

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.

On earlier cars remove the split pin, unscrew the nut (R.H. thread), and take off the main springs.

On later cars compress the spring and extract the circlip.

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

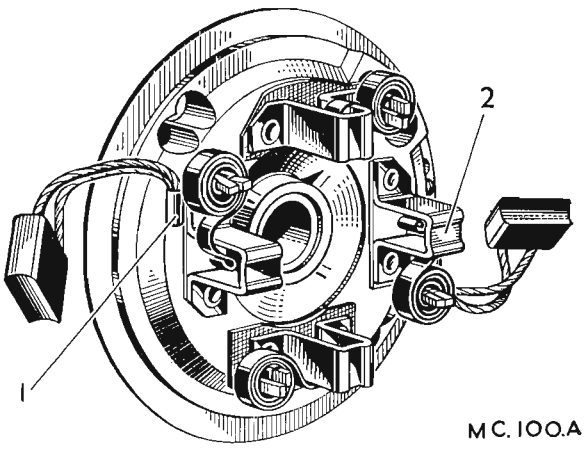


Fig. N.6

Commutator end bracket

1. Terminal eyelet. 2. Brush holder.

commutator due to the starter being engaged while the engine is running and causing the armature to be rotated at an excessive speed. A damaged armature must in all cases be renewed—no attempt should be made to machine the armature core or to true a distorted armature shaft.

Bearings

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.7

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

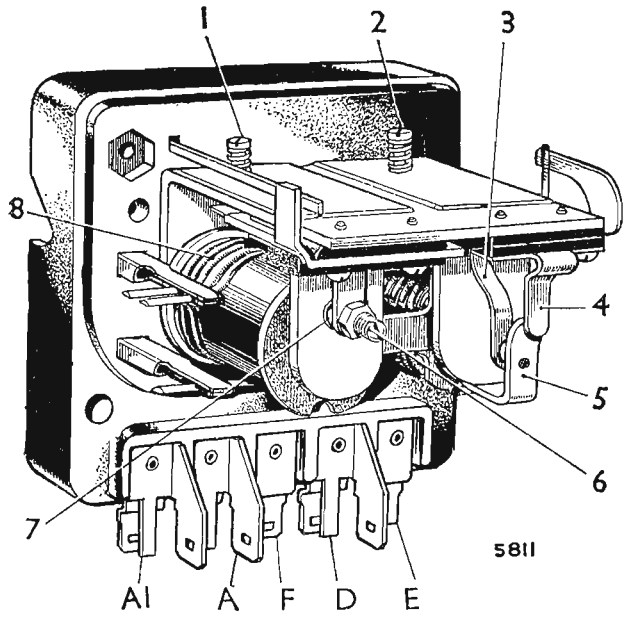


Fig. N.7

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.

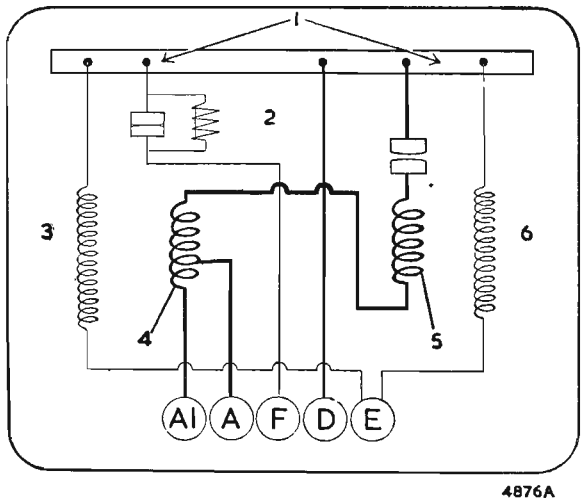


Fig. N.8

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.

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.

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.

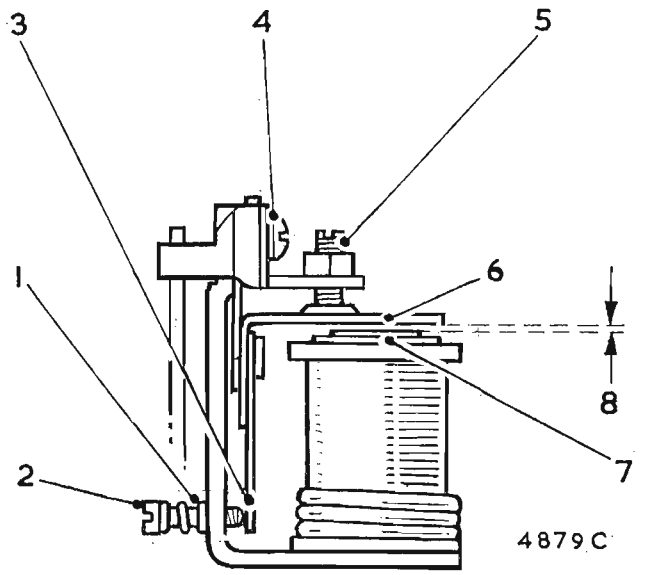


Fig. N.9

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.
8. ·015 in. (·38 mm.).

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.

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) (Fig. N.9) 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.

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 until it is well clear of the armature tension spring.

Insert a ·015 in. (·4 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.

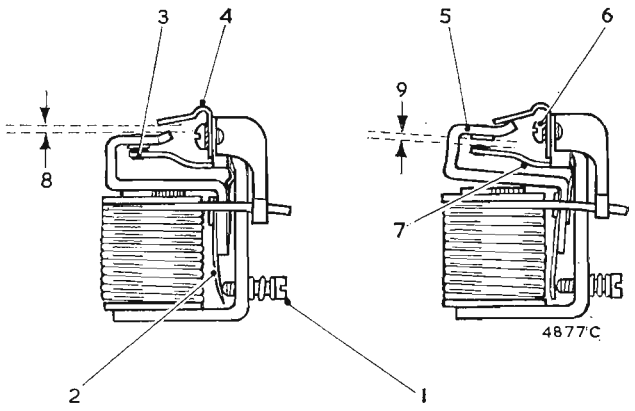


Fig. N.10

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.).

Adjustment of the drop-off voltage is effected by carefully bending the fixed contact blade. If the cut-out does not operate there may be an open circuit in the wiring of the cut-out and regulator unit, in which case the 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. (·6 to 1·0 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. (·25 to ·50 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.8

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.9

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.

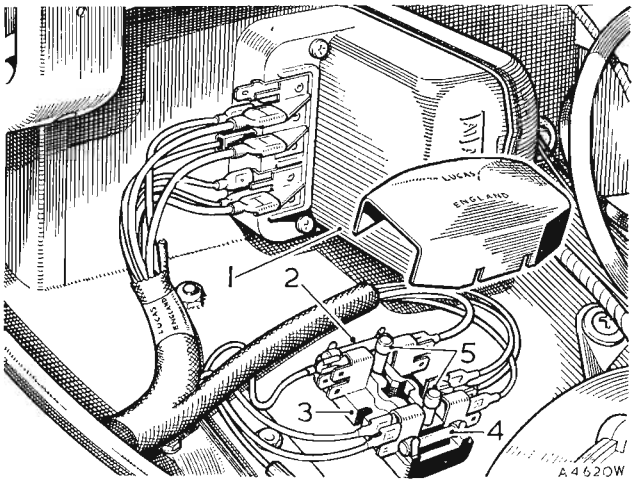


Fig. N.11

Regulator and fuse unit

1. Regulator cover.
2. AUX. IGN. fuse (35-amp.).
3. Fuse block.
4. AUX. fuse (35-amp.).
5. Spare fuses.

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.

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.

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. 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.10

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.

Check the appropriate fuse.

Switch on the ignition.

Check with a voltmeter between the flasher unit terminal 'B' (or '+') and earth that battery voltage is present.

Connect together flasher unit terminals 'B' (or '+') 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.11

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 to ·012 in. (·20 to ·30 mm.).

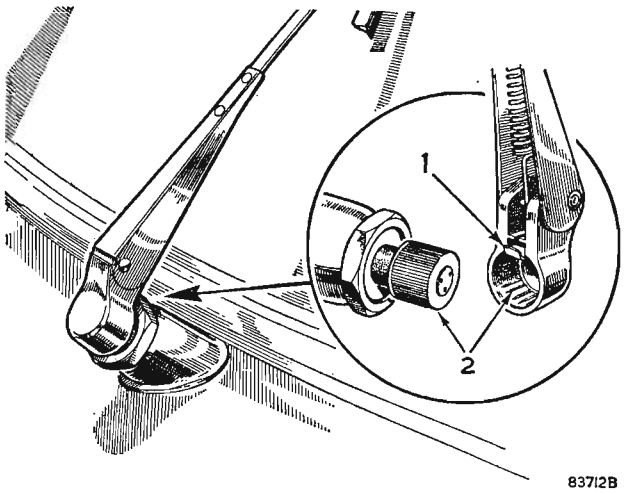


Fig. N.12

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.

Removing the motor, gearbox, and wheelboxes

The motor and gearbox is located beneath the passenger's side of the fascia panel and is mounted on a bracket secured to the bulkhead panel by three set screws and nuts.

The cable rack connected to the cross-head in the gearbox passes through outer casings which connect the gearbox to the first wheelbox and the first wheelbox to the second wheelbox.

Remove the fascia panel, Section R and Ra.

Disconnect the wiper arms, the electrical connections from the motor, and the outer cable from the gearbox housing. Remove the three nuts securing the motor to the bulkhead panel and withdraw the motor, and cable rack.

Slacken the cover screws in each wheelbox and remove the cable rack outer casings.

Remove the nut, front bush, and washer from the front of each wheelbox and remove the wheelbox together with the rear bush and spindle tube from beneath the fascia panel.

Replacement is a reversal of the removal sequence, but ensure that the wheelboxes are correctly lined up and that the cable rack engages the gear and spindle assemblies.

Dismantling the motor

Withdraw the four screws securing the gearbox cover and remove the cover.

Withdraw the connectors 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.

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.

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.

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, worm, and final gear shaft
Grease liberally.

Cable rack and wheelboxes
Grease liberally.

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 a m 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.

Operate the wiper control to ensure that the arms 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

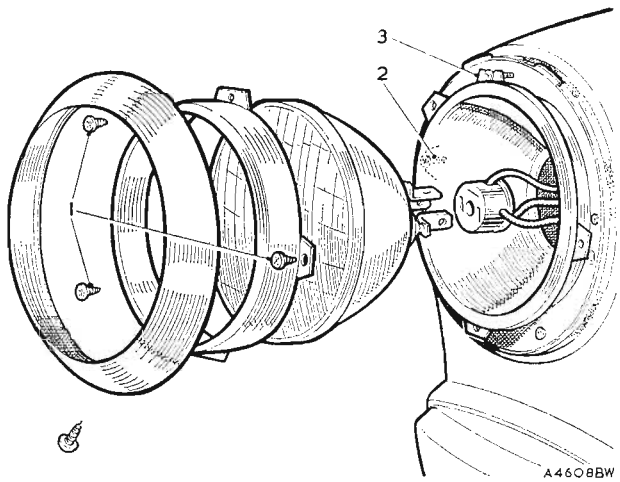


Fig. N.13

The U.K. sealed-beam headlamp

1. The light unit securing screws.
2. The light beam horizontal adjustment screw.
3. The light beam vertical adjustment screw.

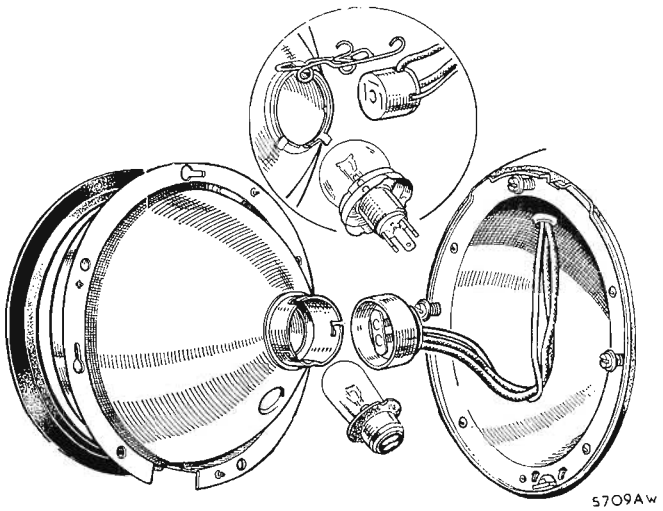


Fig. N.14

The L.H.D. (except Europe and North America) headlamp light unit, with the European-type bulb and socket arrangement inset

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.

Section N.12

HEADLAMPS

U.K. and North American types

Headlamps fitted to vehicles operating on the U.K. or North American markets are of the sealed-beam type and the light units are serviced as complete assemblies only.

Removing the light unit (U.K. type)

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.

Refitting the light unit (U.K. type)

Refit the three-pin plug to the rear of the light unit. Place the light unit in the back-shell, ensuring that the registers moulded on the rear edge of the unit engage in the slots in the back-shell. Replace the light unit rim and refit the securing screws.

Fit the rear top edge of the lamp rim over the two raised sections of the back-shell, press downwards and inwards and refit the retaining screw.

Beam-setting (U.K. 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 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

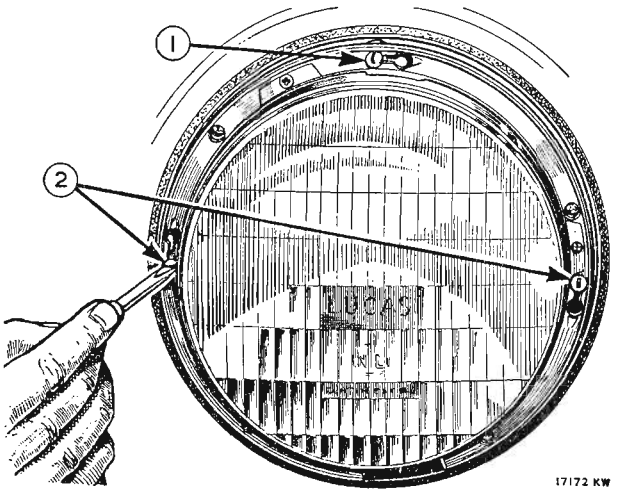


Fig. N.15

The headlamp setting screws

1. Vertical setting adjusting screw.
2. Horizontal setting adjusting screws.

using the adjustment screw on the right-hand side of the lamp.

Removing the light unit (North American type)

Remove the retaining screw from the bottom face of the lamp rim, lift the bottom of the rim forwards and upwards and detach the rim. Slacken the three Phillips screws securing the light unit retaining rim and turn the rim anti-clockwise to remove, supporting the lens of the light unit at the same time. Pull off the three-pin plug from the rear of the light unit.

Refitting the light unit (North American type)

Refit the three-pin plug to the rear of the light unit. Place the light unit in the back-shell, ensuring that the registers moulded on the rear edge of the unit engage in the slots in the back-shell. Replace the light unit rim so that the large diameters of the three slotted holes pass over the heads of the three retaining screws, press the rim firmly inwards and rotate the rim clockwise to the full extent of the slotted holes. Retighten the securing screws.

Fit the rear top edge of the lamp rim over the two raised sections of the back-shell, press downwards and inwards and refit the retaining screw.

Beam-setting (North American 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.

L.H.D. (except Europe and North America) and European types

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 (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.

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 (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.

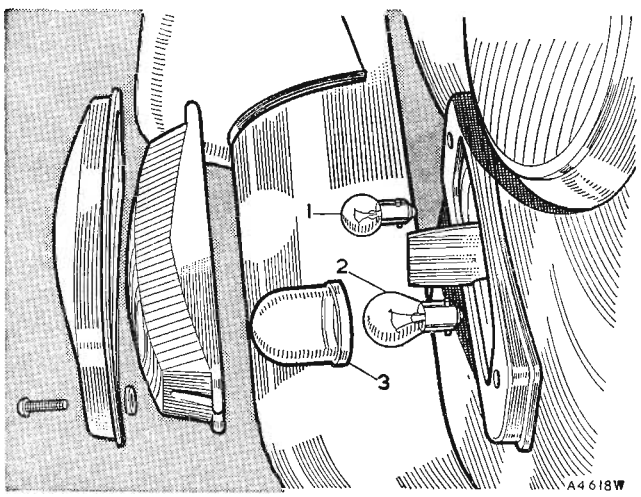


Fig. N.16

The side and direction indicator lamp

1. Sidelamp bulb.
2. Direction indicator bulb.
3. Amber direction indicator bulb cover.

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).

Bulb replacement (L.H.D. except Europe and North America)

Access to the bulb is obtained in the same manner as that described for European-type headlamps. Twist the back-shell anti-clockwise and pull it off. The bulb can then be withdrawn from its holder.

Beam-setting (L.H.D. except Europe and North America)

These beams are set in the same way as the European-type headlight beams.

Section N.13

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 countries where the lighting regulations require amber flashing indicators.

Refitting is a direct reversal of the removal procedure.

Section N.14

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.17.

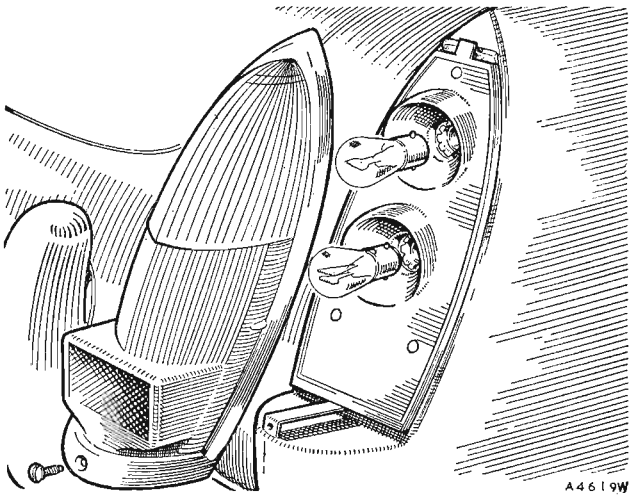


Fig. N.17

The tail, stop, and direction indicator lamps

Section N.15

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.16

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

Section N.17

REPLACEMENT BULBS

	Volts	*Watts*	*B.M.C. Part No.*
Headlamps—L.H.D. except North America and Europe	12	50/40	BFS 415
Headlamps—Europe except France	12	45/40	BFS 410
Headlamps—France only	12	45/40	BFS 411
Sidelamps	12	6	BFS 989
Sidelamps, direction indicator lamps—North America and Italy	12	6/21	BFS 380
Direction indicator lamps (front)	12	21	BFS 382
Direction indicator lamps (rear)	12	21	BFS 382
Tail and stop lamps	12	6/21	BFS 380
Number-plate illumination lamp	12	6	BFS 989
Panel and warning lights	12	2·2	BFS 987

in the lamp body withdrawn. When refitting the glass to the body make certain that it is seating correctly over the sealing rubber.

Section N.18

HORN AND HORN-PUSH

Removing the horn

Remove the horn bracket to body securing nuts, spring washers, and set screws. Disconnect the horn leads and remove the horn assembly.

Maintenance

If the horn fails to operate, or operates unsatisfactorily, first carry out the following external checks.

Examine the cables of the horn circuit, renewing any that are badly worn of chafed. Ensure that all connections are clean and tight and that the connecting nipples are firmly soldered to the cables.

Check that the bolts securing the horn brackets are tight and that the horn body does not foul any other fixtures.

Check the current consumption, which should be 3 to 3½ amps. when the horn is operating correctly.

After making a thorough external check remove the horn cover and examine the cable connections inside the horn. Examine the contact breaker contacts. If they are burnt or blackened clean them with a fine file, then wipe with a petrol-moistened cloth.

Refitting

Refitting is a reversal of the removal procedure.

Removing the horn-push

When removing the horn-push it is a simple operation of levering the complete assembly out of the steering-wheel with a screwdriver. Take care not to damage the bakelite surround.

Refitting

When refitting ensure that the brass contact strip is in line with the live contact in the steering-wheel assembly.

Section N.19

SWITCHES

NOTE.—In all cases when removing switches the battery terminals should be disconnected.

Lighting, direction indicator, and windshield wiper

Removing

In all of the above cases disconnect the Lucar connectors, unscrew the fixing nut, and remove the switch assembly complete with its 'D'-shaped locking washer.

Refitting

Refitting is a reversal of the removal procedure.

Ignition

Removing

Disconnect the Lucar connectors, unscrew the fixing nut, and remove the switch assembly complete with its 'D'-shaped locking washer.

Dismantling

To remove the locking barrel from the switch body insert the key and turn the switch to the 'ignition on' position to align the barrel-retaining plunger with the small hole in the switch body. Using an awl, depress the plunger and withdraw the barrel complete with key.

Reassembling and refitting

Reverse the dismantling and removing procedure.

Starter

Removing

Disconnect the battery leads from the switch terminals.

Remove the switch-operating cable by slackening the lock screw on the connecting sleeve and pulling the wire out of the sleeve. Remove the locknut from the threaded sleeve of the switch and withdraw the switch assembly from its mounting bracket.

Refitting

Refitting is a reversal of the removal procedure.

Headlight dipper

Removing

Remove the dipping switch to bracket securing screws and withdraw the switch assembly.

Disconnect the cables from the switch connectors and remove the switch assembly. Switches are serviced as complete units only.

Refitting

Reverse the removal procedure.

Panel

Removing

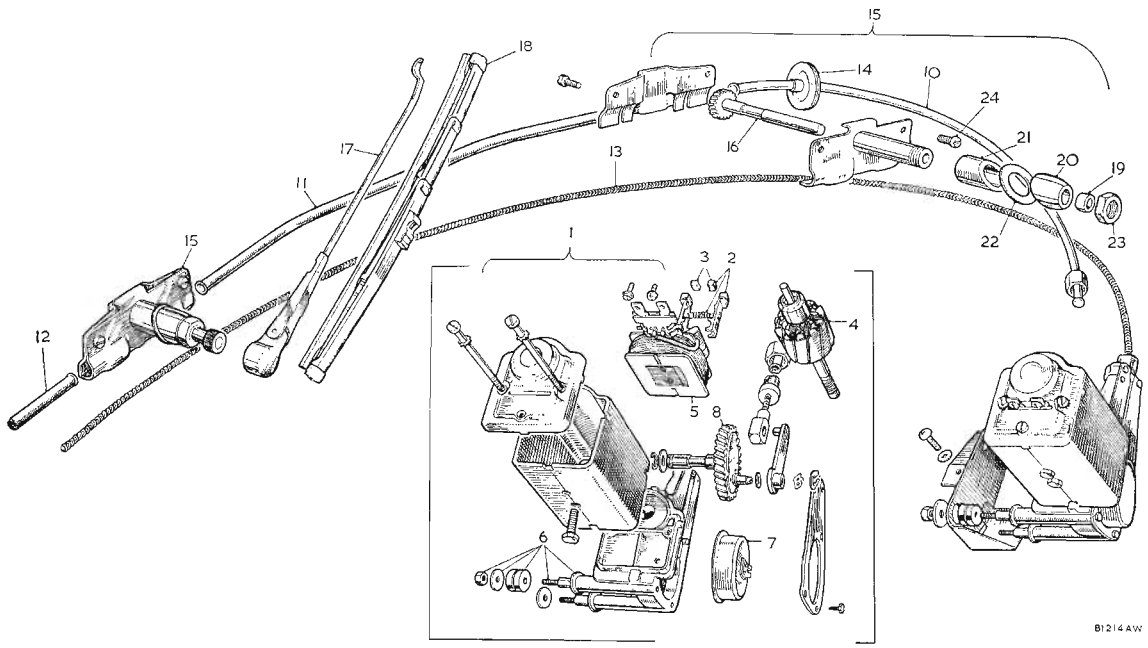
Remove the securing screws and withdraw the switch assembly.

Disconnect the cables from the switch connectors and remove the switch assembly.

Refitting

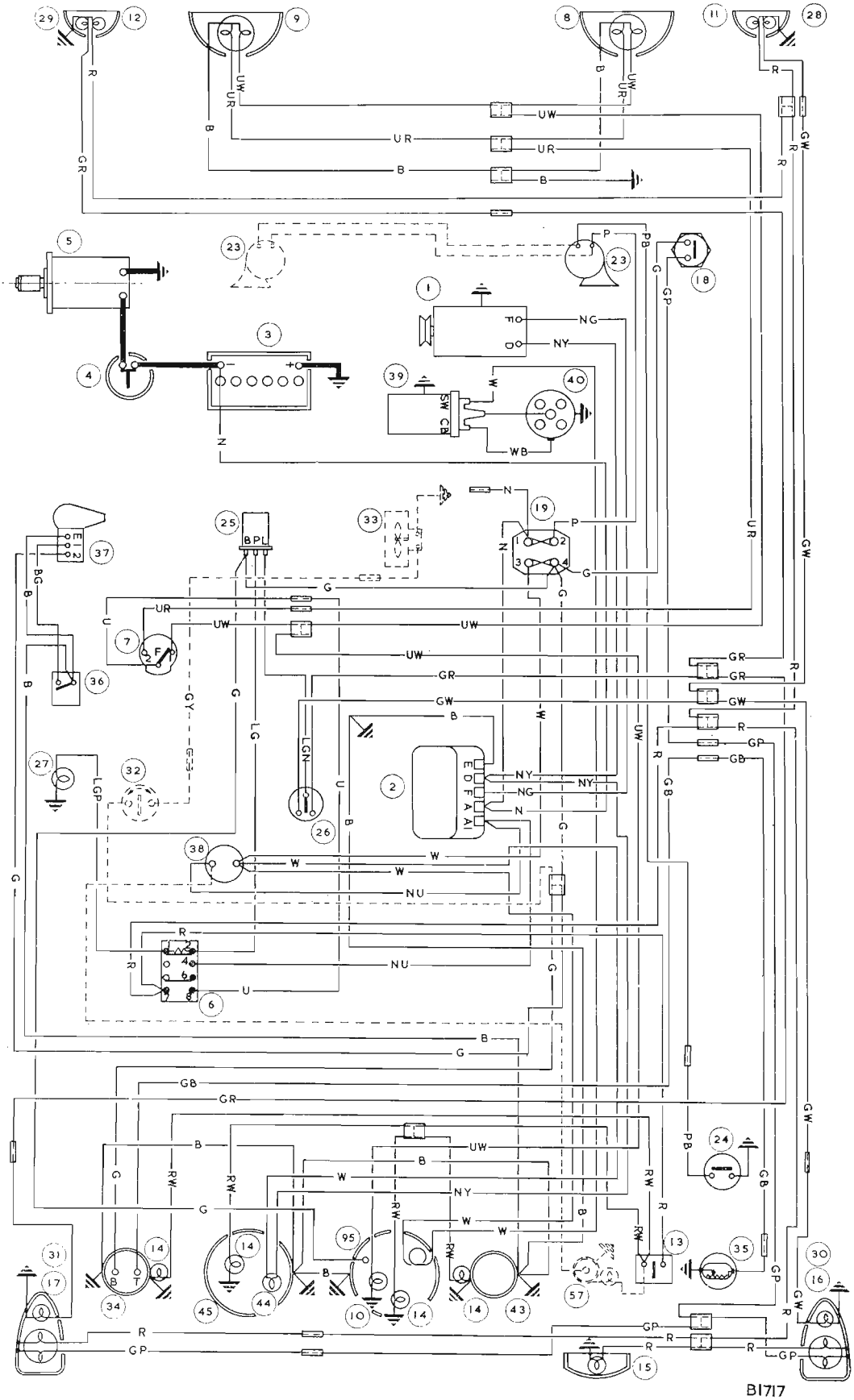
Reverse the removal procedure.

THE WINDSHIELD WIPER COMPONENTS



No.	*Description*
1.	Windshield wiper motor.
2.	Brush gear.
3.	Brush.
4.	Armature.
5.	Field coil.
6.	Fixing parts.
7.	Parking switch.
8.	Gear and shaft.
10.	Motor to wheelbox outer casing.
11.	Wheelbox to wheelbox outer casing.
12.	Wheelbox extension outer casing.
13.	Cross-head and rack assembly.
14.	Grommet.
15.	Wheelbox.
16.	Spindle and gear.
17.	Wiper arm.
18.	Wiper blade.
19.	Rubber tube spindle.
20.	Front bush.
21.	Rear bush.
22.	Rubber washer.
23.	Nut.
24.	Cover screw.

WIRING DIAGRAM



KEY TO THE WIRING DIAGRAM

No.	*Description*
1.	Dynamo.
2.	Control box.
3.	Battery—12-volt.
4.	Starter switch.
5.	Starter motor.
6.	Lighting switch.
7.	Headlamp dip switch.
8.	Headlamp—R.H.
9.	Headlamp—L.H.
10.	Main-beam warning lamp.
11.	Sidelamp—R.H.
12.	Sidelamp—L.H.
13.	Panel lamps switch.
14.	Panel lamps.
15.	Number-plate illumination lamp.
16.	Stop and tail lamp—R.H.
17.	Stop and tail lamp—L.H.
18.	Stop lamp switch.
19.	Fuse unit.
23.	Horn (twin horns when fitted).*
24.	Horn-push.
25.	Flasher unit.
26.	Direction indicator switch.
27.	Direction indicator warning lamp.
28.	Front flasher lamp—R.H.
29.	Front flasher lamp—L.H.
30.	Rear flasher lamp—R.H.
31.	Rear flasher lamp—L.H.
32.	Heater or fresh-air motor switch.*
33.	Heater or fresh-air motor.*
34.	Fuel gauge.
35.	Fuel gauge tank unit.
36.	Windscreen wiper switch.
37.	Windscreen wiper motor.
38.	Ignition switch.
39.	Ignition coil.
40.	Distributor.
43.	Oil pressure gauge.
44.	Ignition warning lamp.
45.	Speedometer.
57.	Cigar-lighter.*
95.	Tachometer (impulse) (later cars).

NOTE.—All items marked (*) fitted as optional extras—circuits shown dotted on page N.20.

SECTION Na

THE ELECTRICAL SYSTEM

The information given in this Section refers specifically to the Sprite (Mk. III) and Midget (Mk. II) and must be used in conjunction with Section N

Section Na.1

SWITCHES

Direction indicator switch

Removing

Disconnect the battery. Remove the set screws securing the two halves of the cover and disconnect the snap connections beneath the column. Remove the set screws securing the switch to the column and lift away the assembly.

Refitting

Reverse the removal procedure.

Horn switch

Removing

Disconnect the battery. Press the horn switch and turn anti-clockwise to remove.

Refitting

Reverse the removal procedure.

Ignition and starter switch

Removing

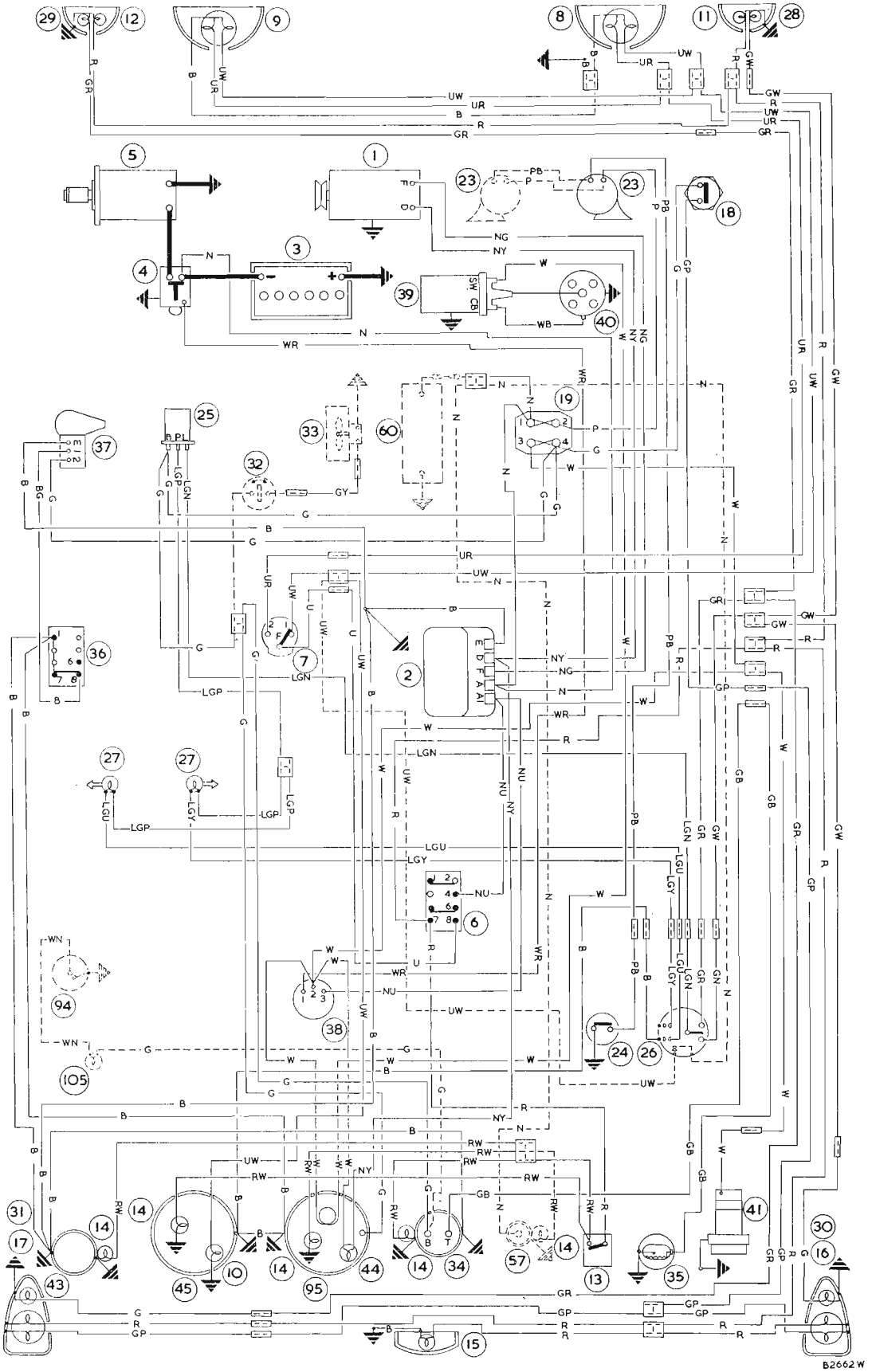
Disconnect the battery. Remove the bezel ring with Service tool 18G 671. Disconnect the leads and pull the switch from the rear of the instrument panel.

Refitting

Reverse the removal procedure.

WIRING DIAGRAM

WIRING DIAGRAM



KEY TO THE WIRING DIAGRAM

1. Dynamo.
2. Control box.
3. Battery (12 volt).
4. Starter solenoid.
5. Starter motor.
6. Lighting switch.
7. Headlight dip switch.
8. R.H. headlamp.
9. L.H. headlamp.
10. Main-beam warning light.
11. R.H. sidelamp.
12. L.H. sidelamp.
13. Panel light switch.
14. Panel lights.
15. Number-plate illumination lamp.
16. R.H. stop and tail lamp.
17. L.H. stop and tail lamp.
18. Stop light switch.
19. Fuse unit (35 amps.).
23. Horn (twin horns when fitted).
24. Horn-push.
25. Flasher unit.
26. Direction indicator switch.
27. Direction indicator warning lights.
28. R.H. front flasher lamp.
29. L.H. front flasher lamp.
30. R.H. rear flasher lamp.
31. L.H. rear flasher lamp.
32. Heater or fresh-air motor switch (when fitted).
33. Heater or fresh-air motor (when fitted).
34. Fuel gauge.
35. Fuel gauge tank unit.
36. Windscreen wiper switch.
37. Windscreen wiper motor.
38. Ignition/starter switch.
39. Ignition coil.
40. Distributor.
41. Fuel pump.
43. Oil pressure gauge.
44. Ignition warning light.
45. Speedometer.
57. Cigar lighter (illuminated).
60. Radio.
94. Oil filter switch.
95. Tachometer.
105. Lubrication warning light.

CABLE COLOUR CODE

N. Brown	P. Purple	W. White
U. Blue	G. Green	Y. Yellow
R. Red	L.G. Light green	B. Black

When a cable has two colour code letters the first denotes the main colour and the second denotes the tractor colour.

SECTION O

THE WHEELS AND TYRES

(TUBELESS TYRES)

TYRE MAINTENANCE

Even tyre wear is promoted by changing the positions of the tyres on the car periodically. The spare tyre should be brought into use with the others.

Attention should be paid to the following points with a view to obtaining the maximum mileage from the tyres.

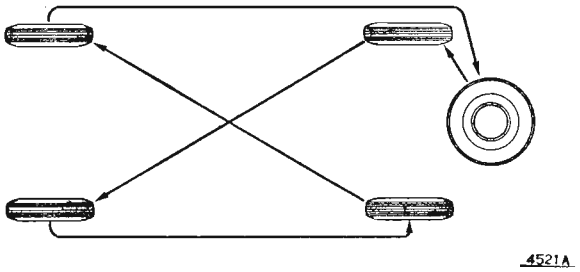


Fig. O.1

Interchange the road wheels diagonally, bringing the spare wheel into use

Test the pressures of the tyres 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 fault. 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. (180 mm.) length of $\frac{1}{2}$ in. (13 mm.) steel bar or 13 S.W.G. steel tubing. Using a letter 'S' (8·8 mm.) drill, in one end drill a hole to a depth of approximately $\frac{5}{8}$ in. (15·9 mm.).

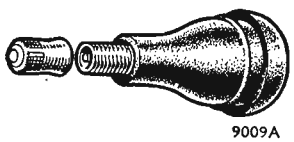


Fig. O.2

Valve for a tubeless tyre

Obtain a brass 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. (13 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.

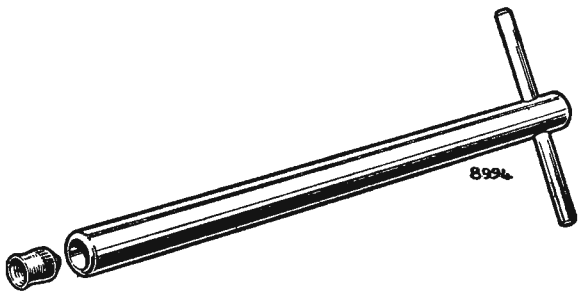


Fig. O.3

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; for the correct torque figure see **'GENERAL DATA'.**

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 **NOT BE DAMAGED.**

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. Lever the cover edge over the rim of the wheel, using two levers at intervals of 6 in. (150 mm.) apart. Continue working round the wheel until the cover on one side is completely free.

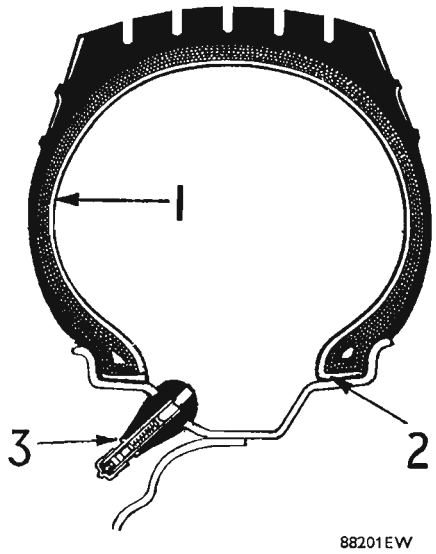


Fig. O.5

A section through a tubeless tyre

1. Air-retaining liner. 2. Rubber air seal.
3. Rubber-sealed valve.

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. The following instructions are of great importance.

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.

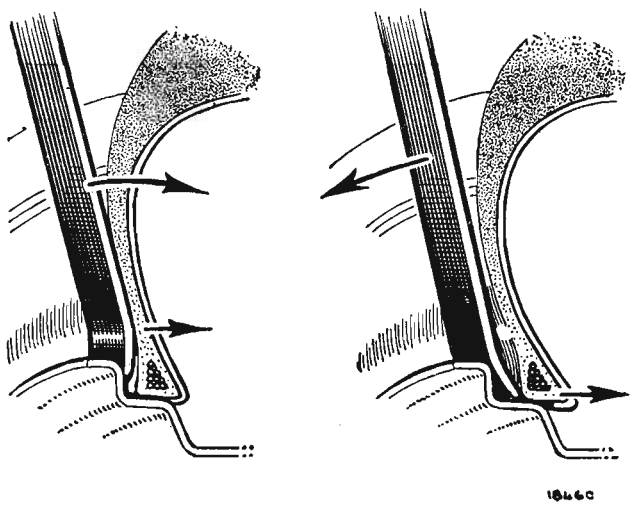


Fig. O.4

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

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 grease.** Mount the tyre on the 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 line with the valve position.

Before inflation bounce the crown of the tyre on the ground at various points to snap home the beads of the tyre against the rim of the wheel and provide a partial seal.

With the wheel in an upright position inflate the tyre. If a seal cannot be obtained at the first rush of air bounce the tyre again with the air-line attached. In cases of difficulty apply a tourniquet of strong cord around the circumference of the tyre and tighten. When a seal is obtained inflate until the beads are completely forced against both rim flanges. Remove the air-line, insert the valve interior, and inflate to 50 lb./sq. in. (3·52 kg./cm.^{2}) for testing.

Allow the tyre to stand for a few minutes so that any free air trapped between the flange and the bead clinch

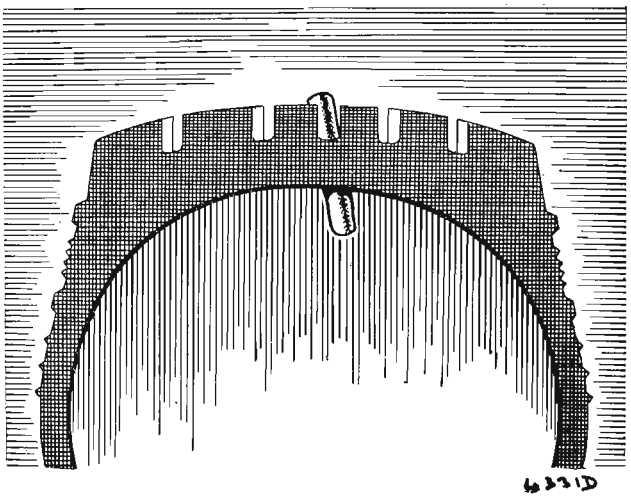


Fig. O.6

The plug inserted in the tyre and cut off to the correct length

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.—Inflate the tyre to the correct pressure before refitting the wheel.

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. Examine the tyres and 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.

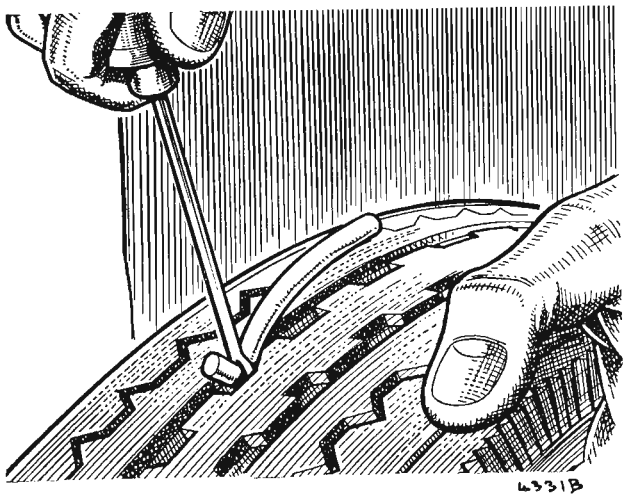


Fig. O.7

Inserting the plug and needle through a hole in the tyre

WHEEL AND TYRE BALANCE

Unbalance in wheel and tyre assemblies may be responsible for various effects such as wheel wobble, abnormal wear of tyres and suspension parts, vibration in the steering or, in extreme cases, in the whole car. If any of these faults develop, for which no other cause can be found, wheel and tyre balance should be checked and corrected according to instructions supplied by the manufacturer of the balancing machine.

When wheels are to be re-balanced it is essential that the weight of the car be removed from the tyres as soon as possible after a run so that temporary flat spots do not form on the tyres. Nylon tyres are particularly prone to this and re-balancing with the tyres in this condition is pointless.

SECTION P

LUBRICATION

Correct lubrication of any piece of mechanism is of paramount importance, and in no instance is it of greater importance than in the correct choice of lubricant for a motor-car engine. Automobile engines have different characteristics, such as operating temperatures, oiling systems, size of oilways, clearances, and similar technicalities, and the use of the correct oil is therefore essential.

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 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	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 20W	Energol S.A.E. 20W	Zero Filtrate 20	Sternol W.W. 20

E UPPER CYLINDER LUBRICANT

All conditions	Duckham's Adcoid Liquid	Castrollo	Esso Upper Cylinder Lubricant	Mobil Upperlube	Shell Upper Cylinder Lubricant	Energol U.C.L.	Filtrate Petroyle	Sternol Magikoyl

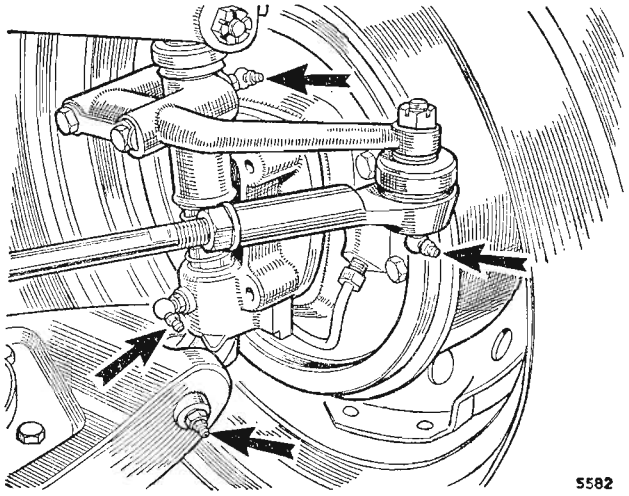


Fig. P.1

The four steering gear nipples on the left-hand wheel assembly

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

3,000 MILES (4800 Km.) SERVICE

Carry out the instructions detailed in Section P.2 and then continue with the following.

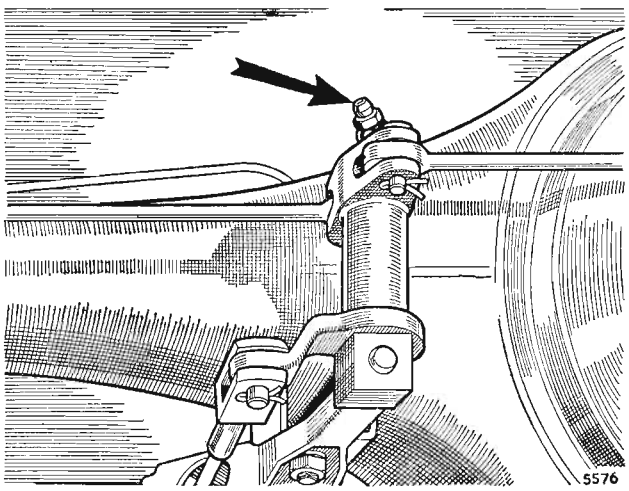


Fig. P.2

The arrow indicates the brake compensator lubricating nipple

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 two needle-type universal joints at each end of the propeller shaft are provided with nipples which

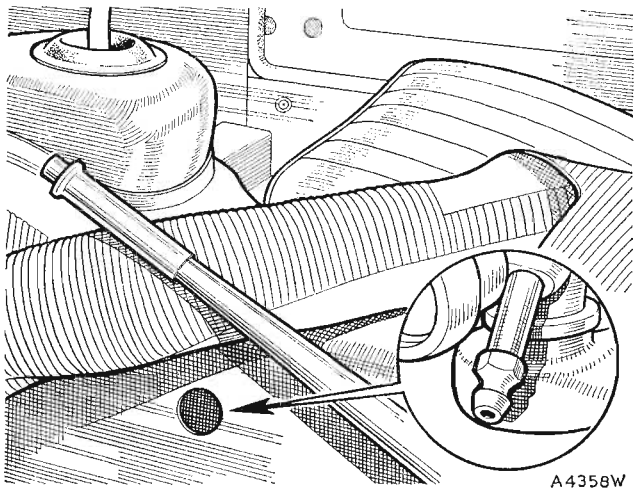


Fig. P.3

The lubricating nipple for the front universal joint. The sliding joint is lubricated from the gearbox

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.

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).

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).

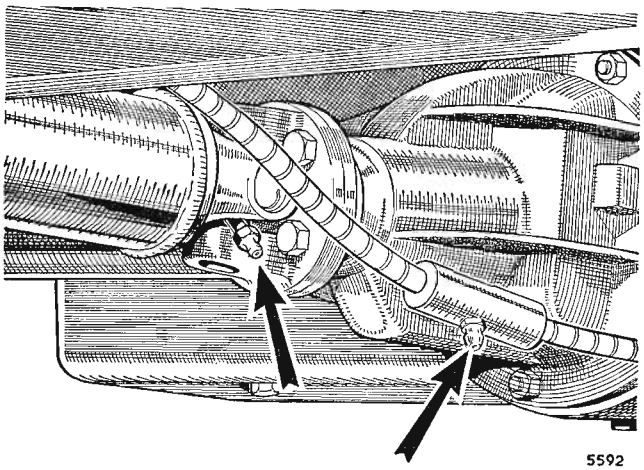


Fig. P.4

The arrows indicate the rear universal joint and hand brake cable lubricating nipples

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.

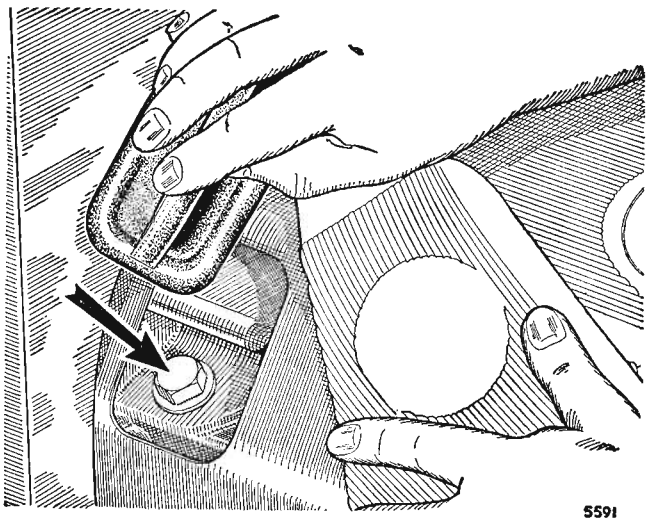


Fig. P.5

The gearbox oil level and filler plug

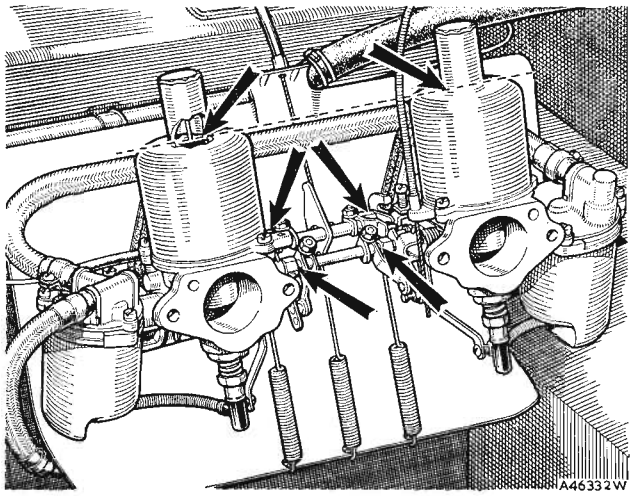


Fig. P.6

Top up the carburetter dampers to the level shown and lubricate each of the throttle linkage joints indicated

CARBURETTER CONTROLS

Using an oil to Ref. D (page P.2), lubricate lightly all carburetter linkages.

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.

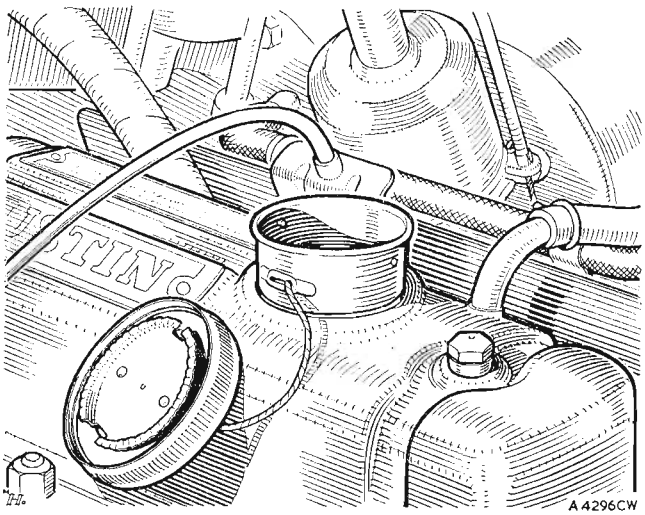


Fig. P.7

The oil filler cap

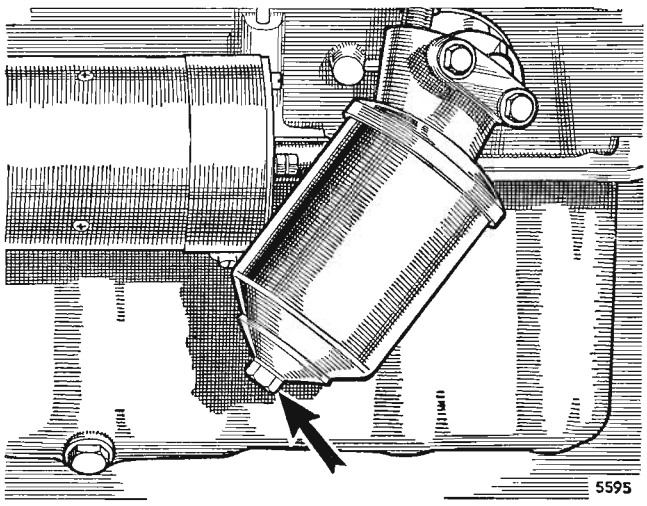


Fig. P.8
Indicated by the arrow is the centre-securing bolt for the engine oil filter

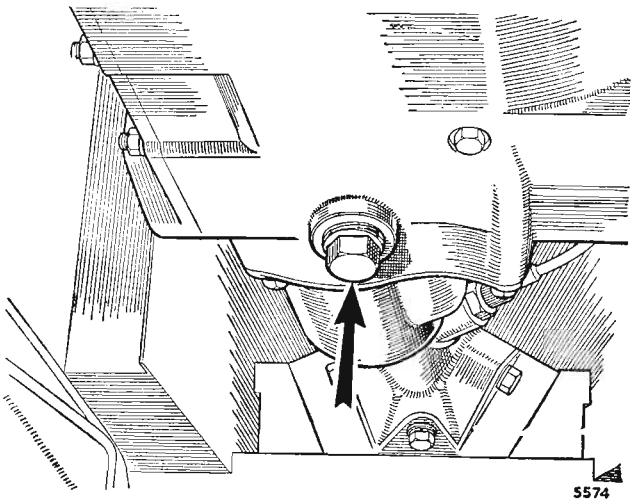


Fig. P.10
The gearbox drain plug

Section P.4

6,000 MILES (9600 Km.) SERVICE

Carry out the instructions detailed in Section P.3 except those under 'GEARBOX' and 'REAR AXLE' and continue with the following.

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.

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.

Approximately 1·5 pints (1·8 U.S. pints, ·85 litre) of oil are required to refill the axle.

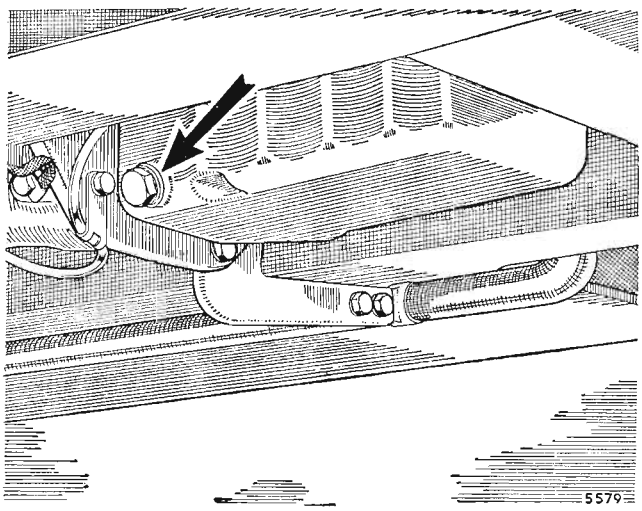


Fig. P.9
The engine sump drain plug

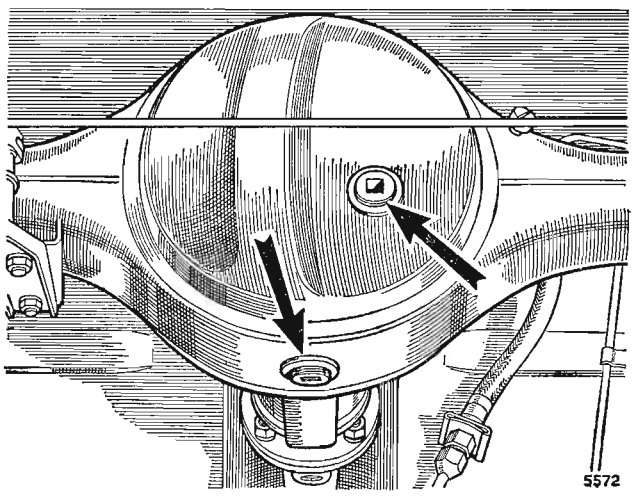


Fig. P.11
The rear axle oil filler and drain plugs

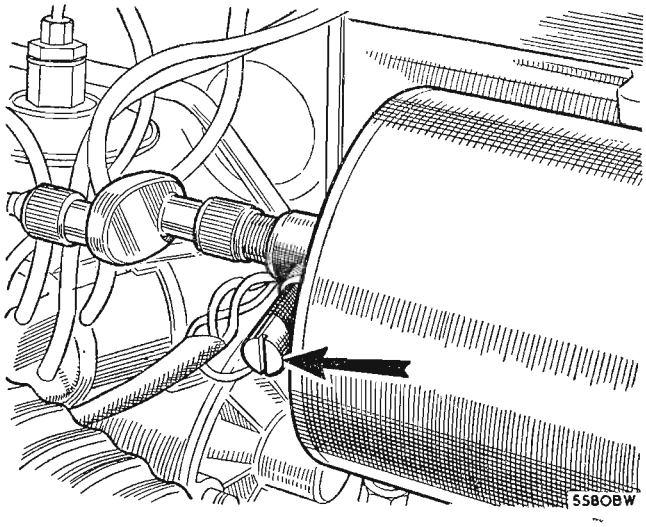


Fig. P.12

The dynamo lubricator cap

DYNAMO

Unscrew the lubricator, withdraw the felt pad and half-fill the lubricator with grease to Ref. C.

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.

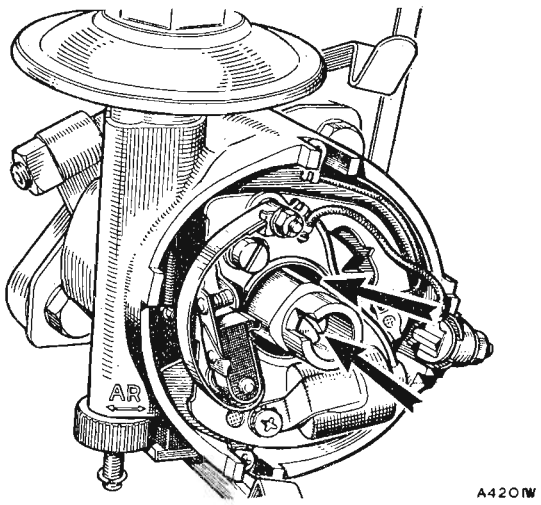


Fig. P.13

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

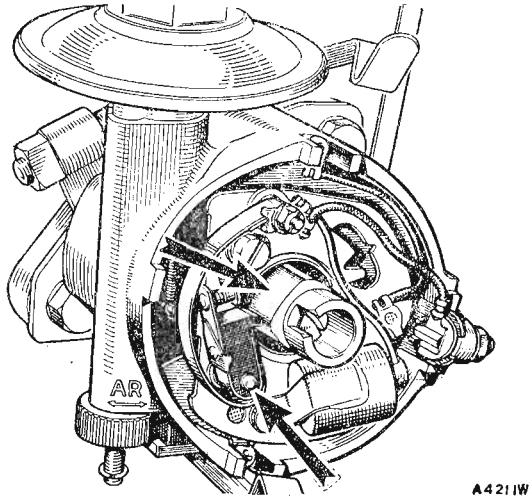


Fig. P.14

The moving contact pivot pin and the automatic timing control mechanism should receive a few spots only of thin engine oil

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 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.

Section P.5

12,000 MILES (19200 Km.) SERVICE

Carry out the instructions detailed in Section P.3 and P.4 and proceed with the following.

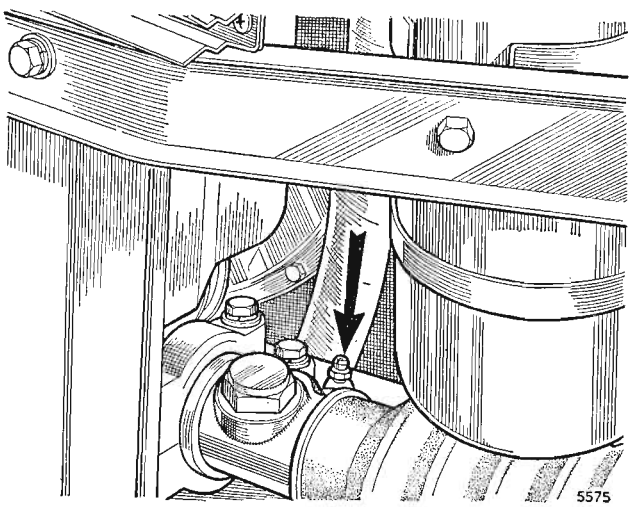


Fig. P.15

The arrow indicates the position of the steering-rack oil nipple

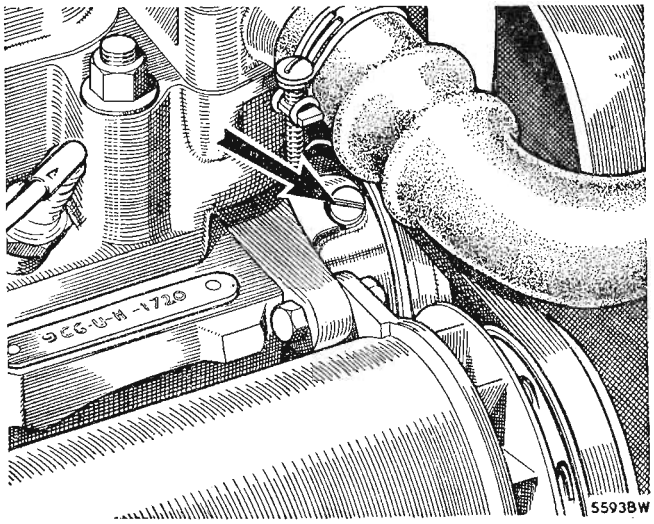


Fig. P.16
The water pump grease plug

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.

WATER PUMP

Remove the water pump oiling plug on the water pump casing and add a small quantity of S.A.E. 140 oil. The oiling of the pump must be done very sparingly, otherwise oil will flow past the bearings onto the face of the carbon sealing ring and impair its efficiency.

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.**

SECTION R

THE BODY

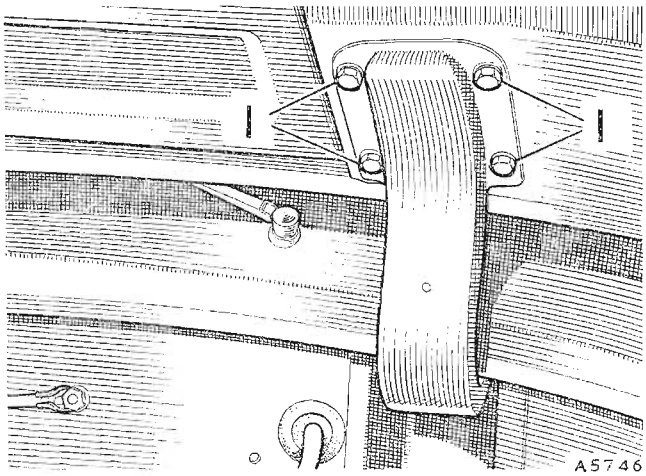


Fig. R.1

The bonnet to hinge securing set screws are shown at (1)

Section R.1

BODYWORK

Coachwork

Regular care of the body finish is necessary if the new appearance of the car exterior is to be maintained against the effects of air pollution, rain, and mud.

Wash the bodywork frequently, using a soft sponge and plenty of water containing a mild detergent. Large deposits of mud must be softened with water before using the sponge. Smears should be removed by a second wash in clean water, and with the sponge if necessary. When dry, clean the surface of the car with a damp chamois-leather. In addition to the regular maintenance, special attention is required if the car is driven in extreme conditions such as sea spray, or on salted roads. In these conditions and with other forms of severe contamination an additional washing operation is necessary, which should include underbody hosing. Any damaged areas should be immediately covered with paint and a complete repair effected as soon as possible. Before touching-in light scratches and abrasions with paint thoroughly clean the surface. Use petrol/white spirit (gasoline/hydrocarbon solvent) to remove spots of tar or grease.

The application of B.M.C. Car Polish is all that is required to remove traffic film and to ensure the retention of the new appearance.

Bright trim

Never use an abrasive on stainless, chromium, aluminium, or plastic bright parts and on no account clean them with metal polish. Remove spots of grease or tar with petrol/white spirit (gasoline/hydrocarbon solvent) and wash frequently with water containing a mild detergent. When the dirt has been removed polish with a clean dry cloth or chamois-leather until bright. Any slight tarnish found on stainless or plated parts which have not received regular washing may be removed with B.M.C. Chrome Cleaner. An occasional application of mineral light oil or grease will help to preserve the finish, particularly during winter, when salt may be used on the roads, but these protectives must not be applied to plastic finishes.

Windshield

If windshield smearing has occurred it can be removed with B.M.C. Screen Cleaner.

Interior

Clean the carpets with a stiff brush or vacuum cleaner, preferably before washing the outside. The upholstery, carpets, and roof lining may be treated with B.M.C. 2-way Cleaner applied with a damp cloth and a light rubbing action. The best result will be obtained on carpets if the solution is applied with a soft brush.

A razor blade will remove transfers from the window glass.

Coachwork repairs

The specially designed body jack 18G 308 B is an essential item when rectifying any misalignment of the body construction.

With the addition of a suitable oxy-acetylene outfit any type of mono-construction repair can be effected.

Preservative on Export cars

Certain cars leaving the factory are sprayed with a wax preservative to safeguard their body finish. The wax can be removed by the following procedure. Wash the waxed surfaces liberally with water to remove dirt. To soften the wax apply white spirit, either by using a spray and wiping off with mutton-cloth, or by using the cloth dipped in white spirit.

Polish the body with clean dry mutton cloth.

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.

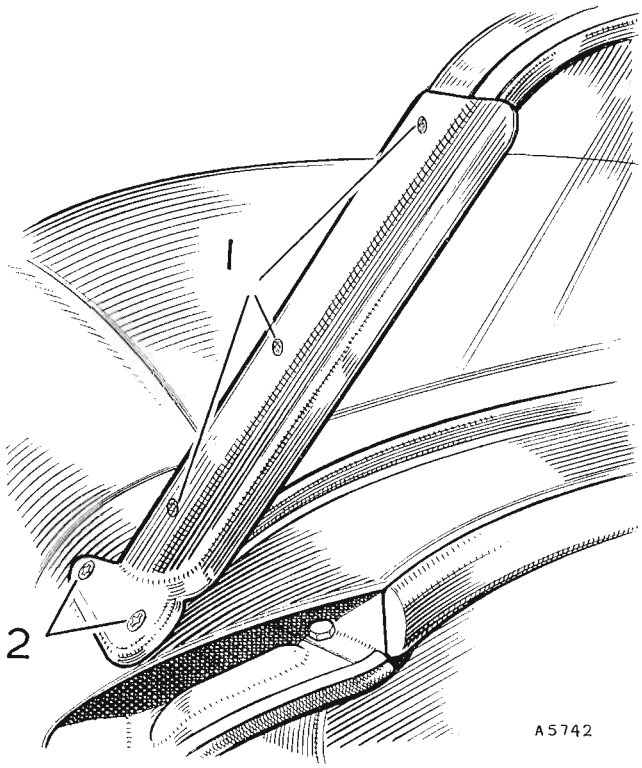


Fig. R.2

Windshield pillar

1. Pillar to body screws. 2. Windshield to pillar screws.

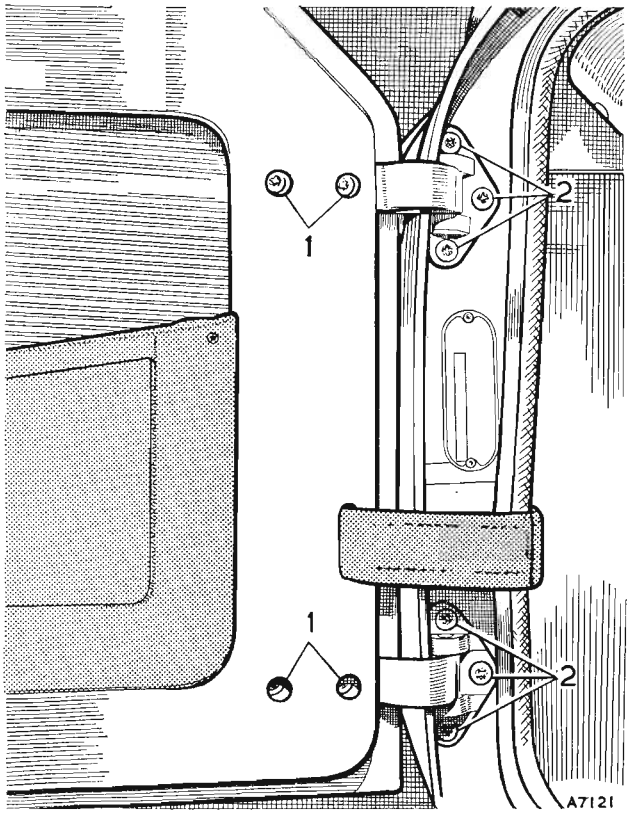


Fig. R.3

Hinge screws

1. Door to hinge screws. 2. Hinge to pillar screws.

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.

Refitting

Reverse the removal procedure.

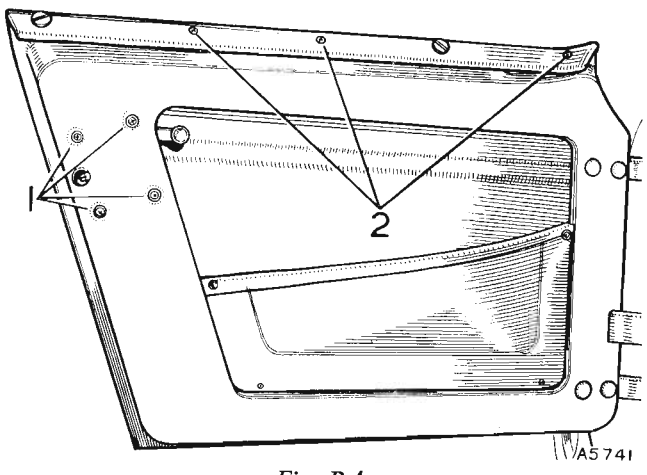


Fig. R.4

The top moulding and door lock fixings

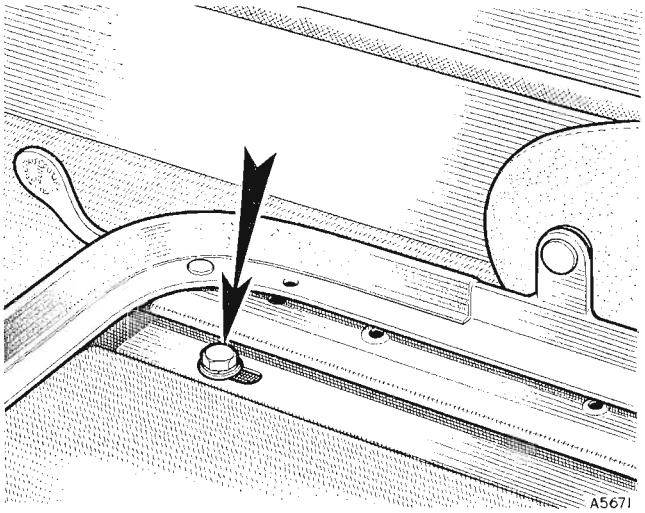


Fig. R.5
Seat frame securing points

Sidescreens

Each sidescreen has two clamping brackets at its base which are held by two large-headed set screws at the door top moulding.

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

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.

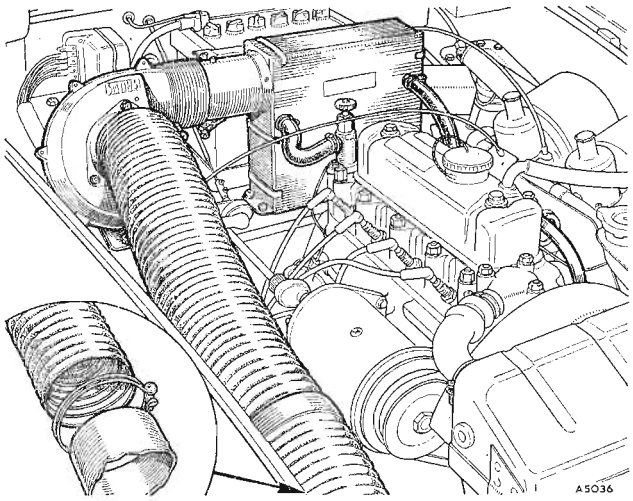


Fig. R.6

Showing the correct location of the heater and inset is the heater blower induction pipe connection at the radiator wing valance

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 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.

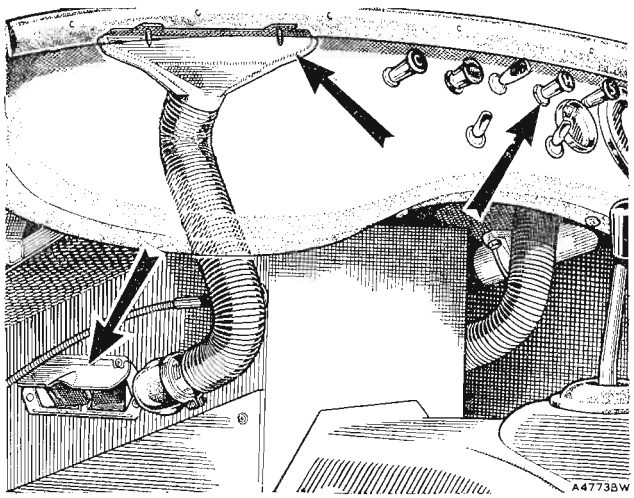


Fig. R.7

The heater blower control on the fascia, the interior heating control doors and the demisting duct

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 only anti-freeze of the ethylene glycol type incorporating the correct type of corrosion inhibitor is suitable, and owners are recommended to use Bluecol 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.10

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.8.

This tool 18G 603 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.8 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.

Section R.11

B.M.C. SEAT BELTS

Fitting

Rear wheel arch

Remove the domed nuts and plain washers. Fit the belt bracket, spring washers, and domed nuts in position on the wheel arch mounting studs.

Sill

It will be found necessary to cut the sill trim board covering to expose the 1 in. (25·4 mm.) dia. hole. Assemble the belt bracket, anti-rattle washer (concave face to

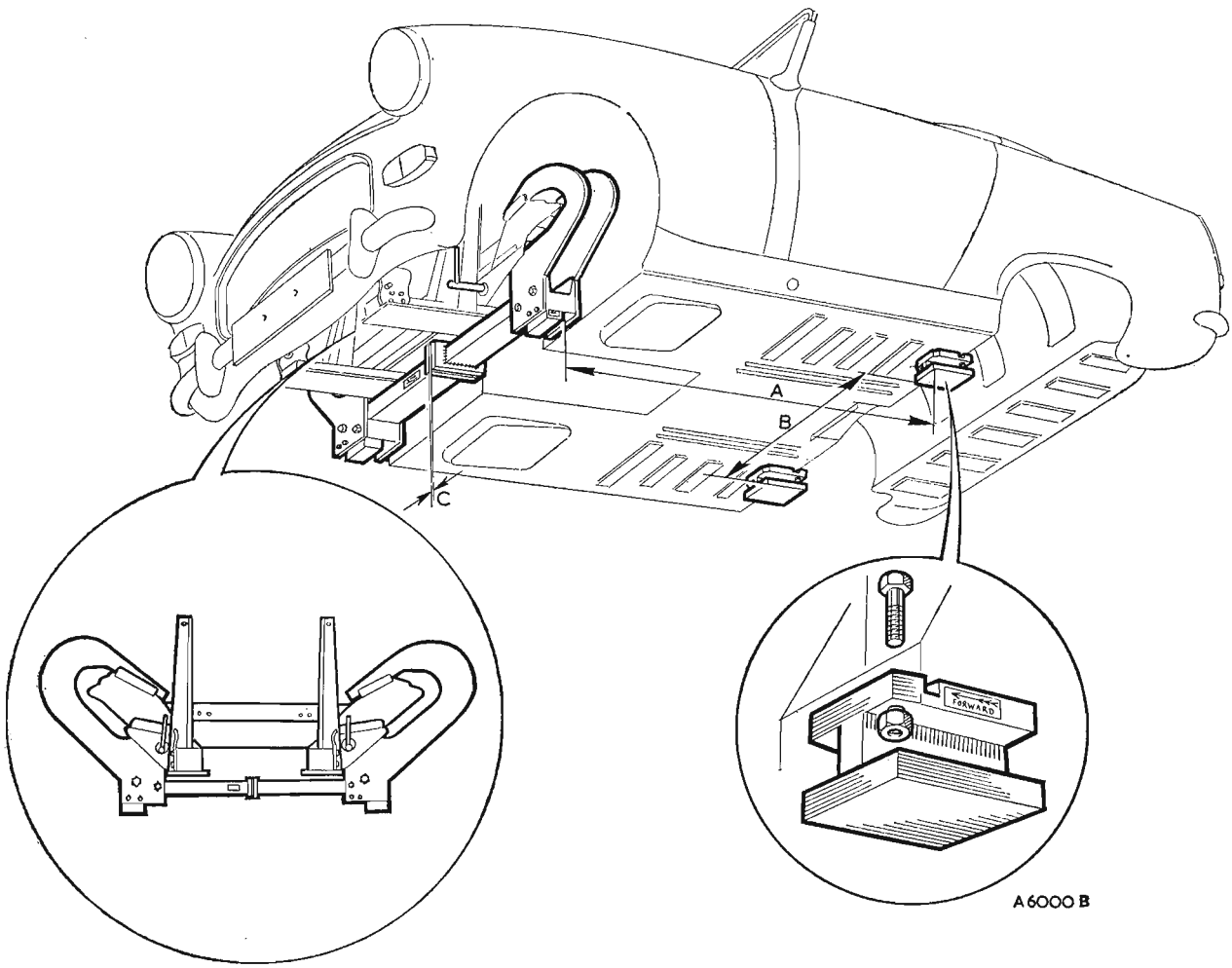


Fig. R.8

A. 63·250 in. (1606·55 mm.). B. 31·75 in. (806·45 mm.). C. ·250±·0625 in. (6·34±1·59 mm.).

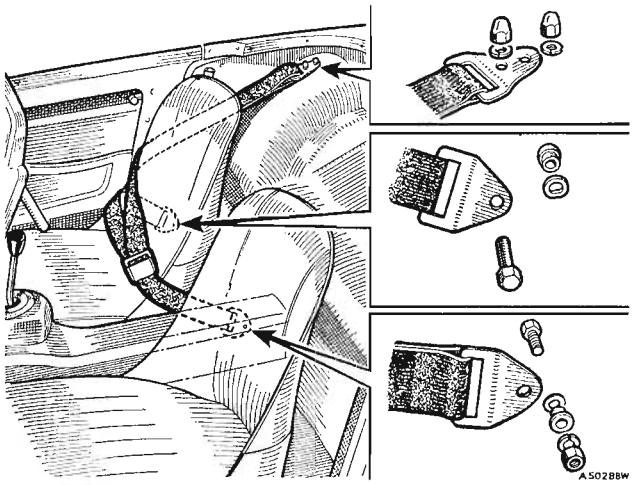


Fig. R.9

The seat belt attachment points and fittings

bracket), and distance piece (shouldered end towards the sill) on to the set screw. Assemble to the sill fixing, ensuring that the belt bracket faces forward along the centre-line of the car.

Propeller shaft tunnel

Remove the rubber plug and cut a 1 in. (25 mm). dia. hole in the carpet to coincide with the hole in the tunnel. Assemble the belt bracket, anti-rattle washer (concave face to bracket), and distance piece (shouldered end towards the tunnel).

Assemble to the tunnel fixing, ensuring that the belt bracket faces rearwards along the centre-line of the car. Position the spring washer and nut on the inside of the tunnel.

Removing

When removing the seat belt reverse completely the fitting instructions.

Section R.12

STRIKERS

Removing

Mark the position of the striker on the door pillar to assist when refitting. Remove the setscrews securing the striker to the door pillar and lift away the assembly.

Refitting

Reverse the removal procedure.

Section R.13

LUGGAGE COMPARTMENT LID

Removing

Remove the setscrews securing the hinges to the lid and lift off the assembly.

Refitting

Reverse the removal procedure.

Section R.14

LUGGAGE COMPARTMENT LOCK

Removing

Remove the nuts securing the lid handle to the lid and the setscrews and nuts securing the locking plate to the lid and lift away the assembly.

Refitting

Reverse the removal procedure.

(*For* **'PAINT REFINISHING INSTRUCTIONS'** *see page R.8*)

(*For* **'SERVICE TOOLS'** *see page R.19*)

Section R.15

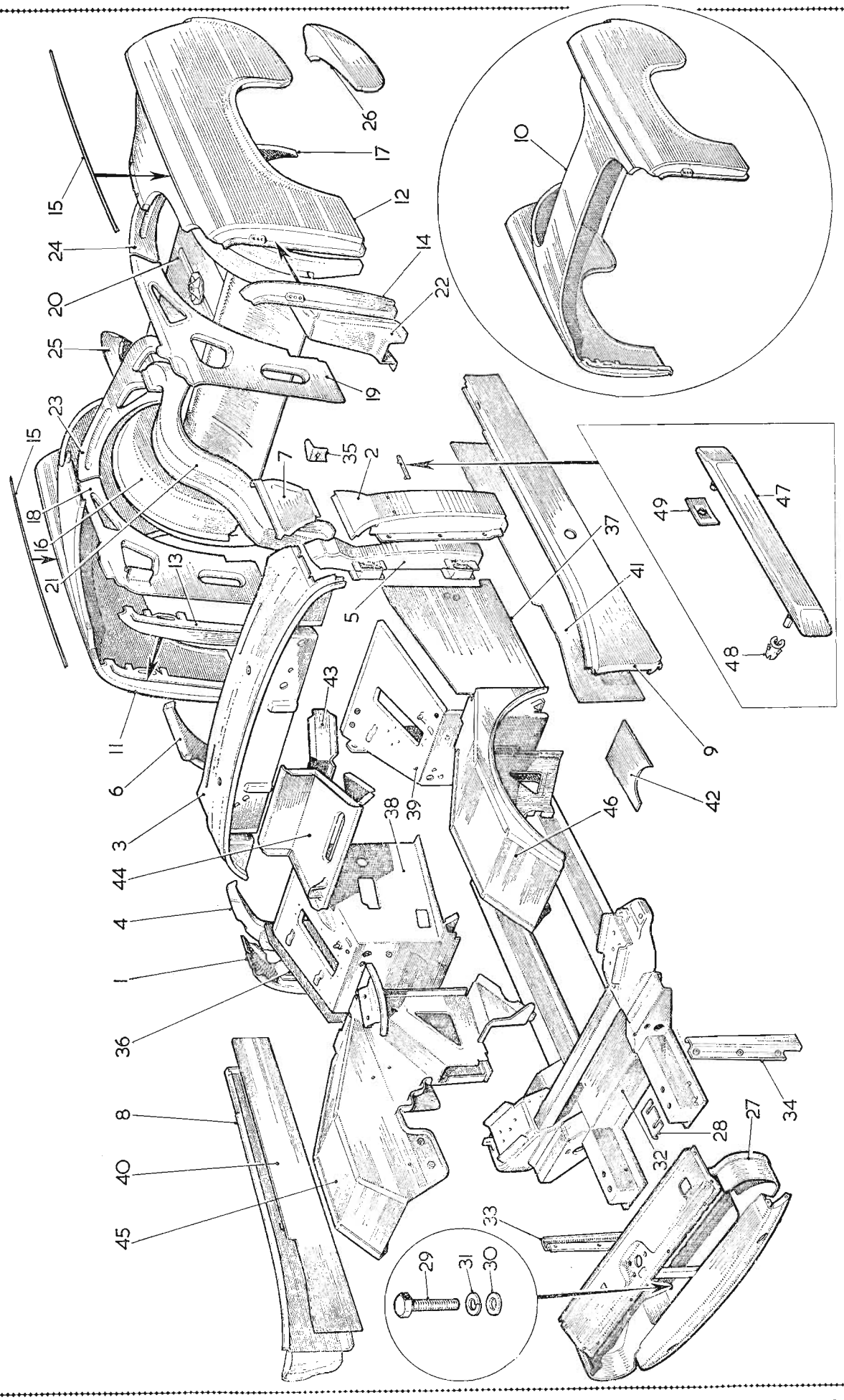
PAINT REFINISHING INSTRUCTIONS

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.

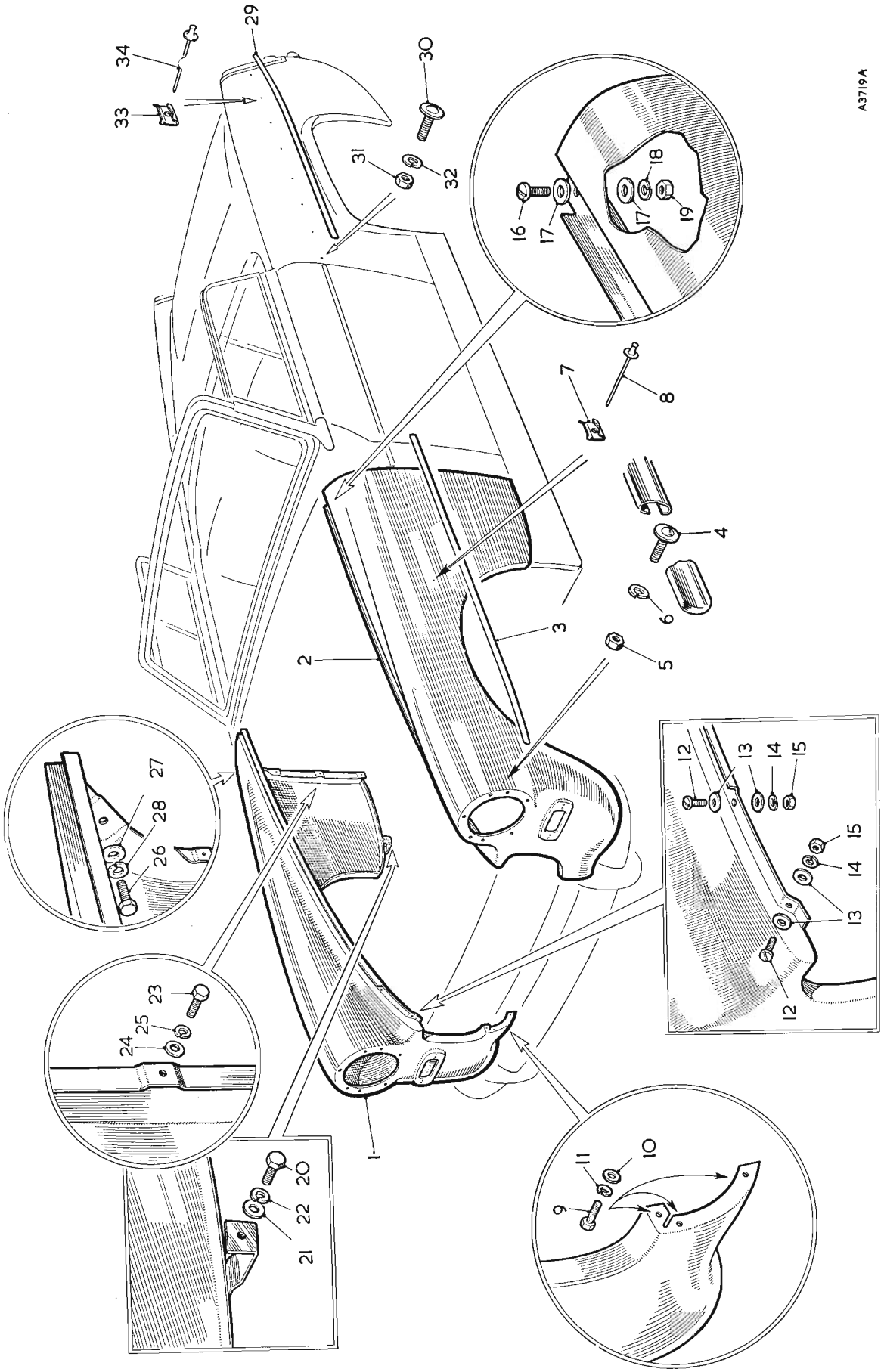
THE BODY SHELL COMPONENTS



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.

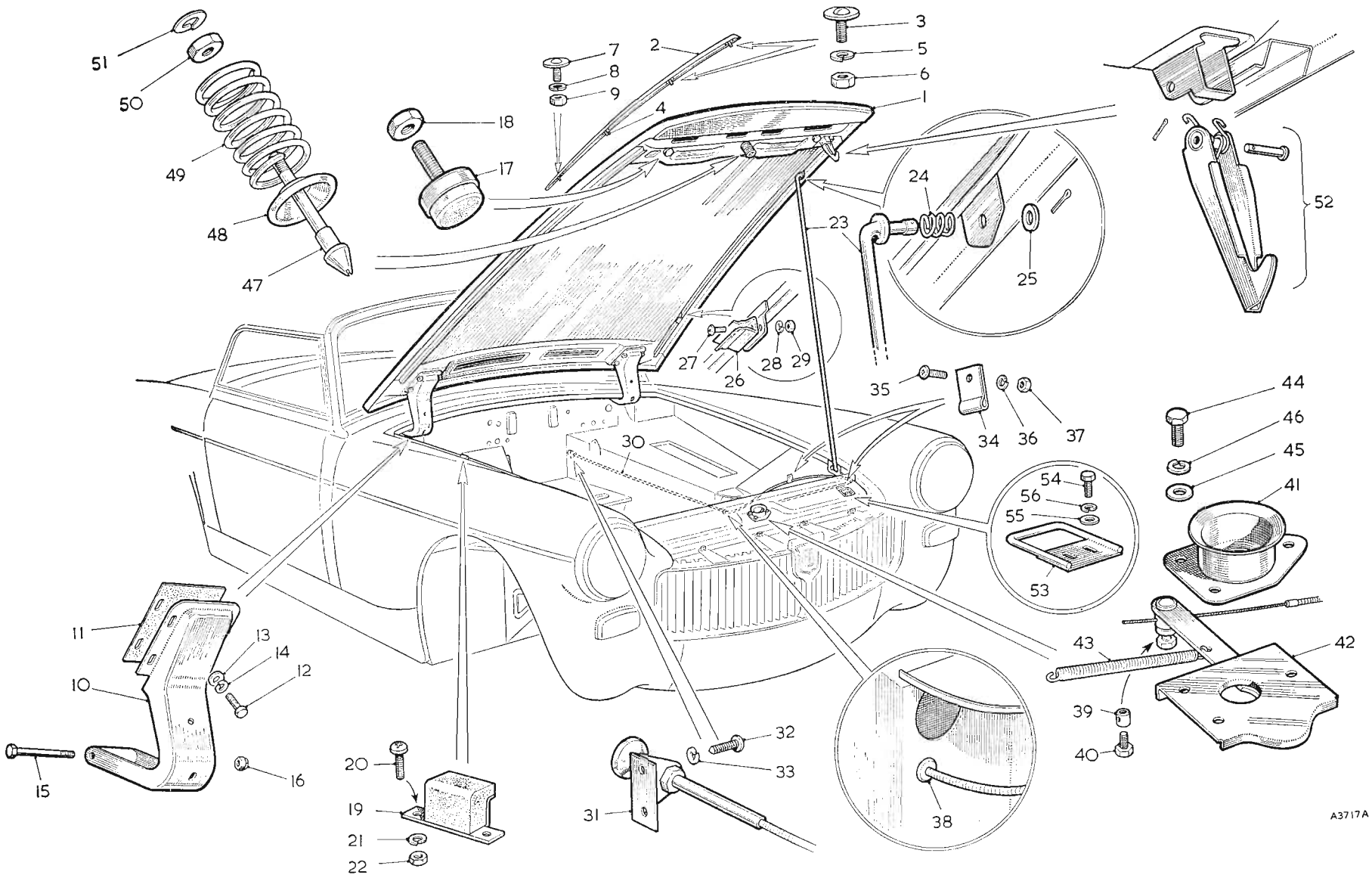
THE WING COMPONENTS



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.

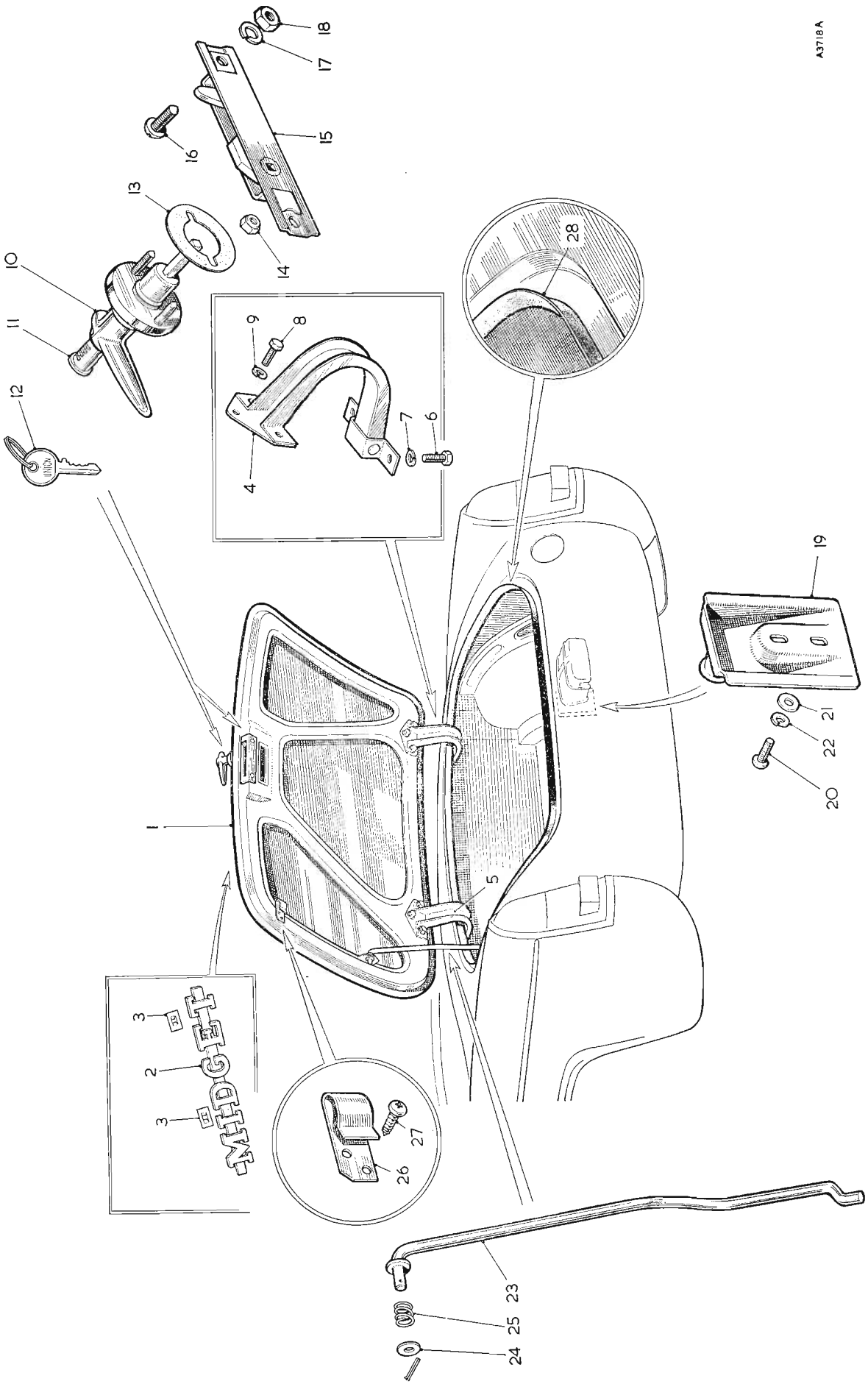
THE BONNET ASSEMBLY COMPONENTS



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

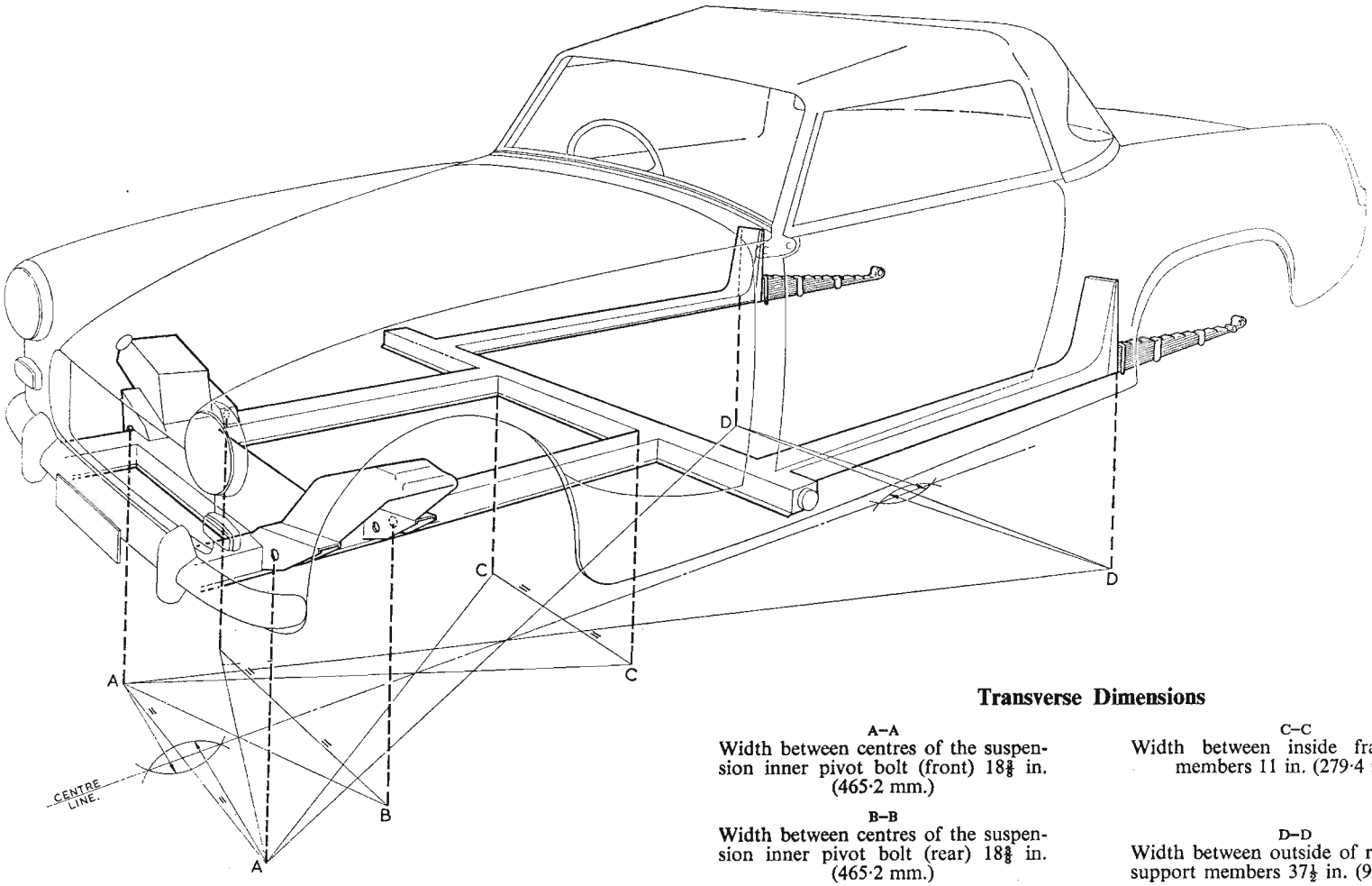


KEY TO THE BOOT LID COMPONENTS

No.	*Description*
1.	Boot lid assembly.
2.	'Midget' or 'Sprite' 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.

Section R.16

HORIZONTAL ALIGNMENT CHECK



Transverse Dimensions

A–A
Width between centres of the suspension inner pivot bolt (front) 18⅜ in. (465·2 mm.)

B–B
Width between centres of the suspension inner pivot bolt (rear) 18⅜ in. (465·2 mm.)

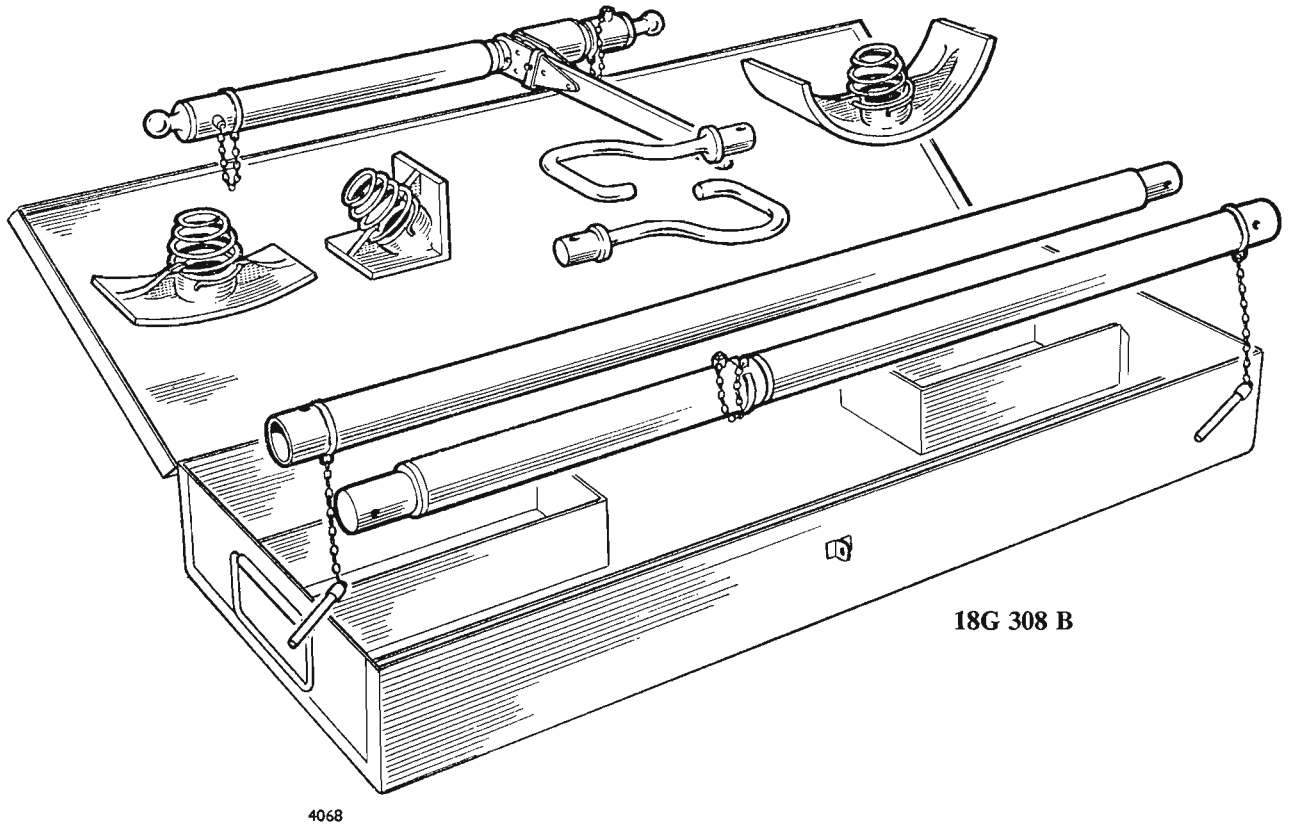
C–C
Width between inside frame side-members 11 in. (279·4 mm.)

D–D
Width between outside of rear spring support members 37½ in. (952·1 mm.)

A preliminary check of the alignment can best be carried out by the system of diagonals and measurement checks from points projected onto a level floor by means of a plumb-bob.

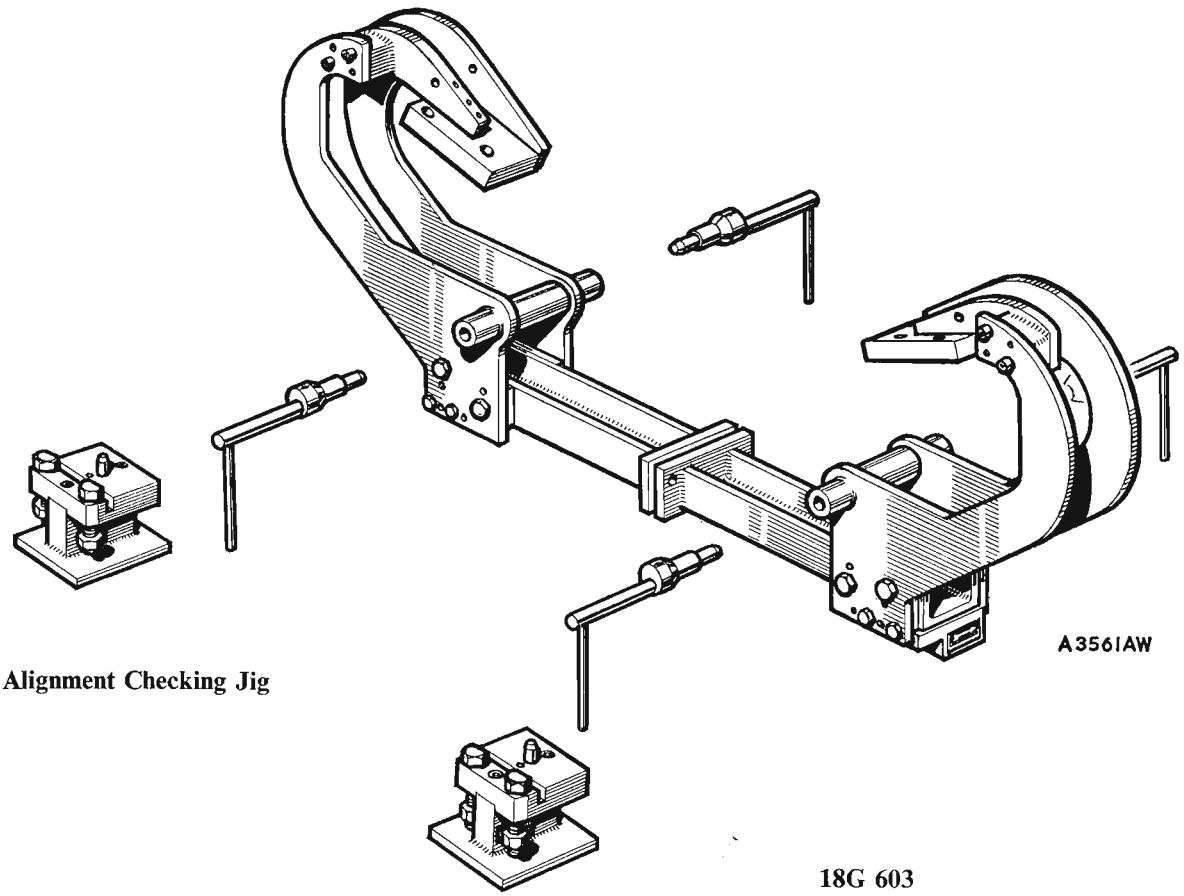
A centre-line can then be established by means of a large pair of compasses and any deviation from correct alignment will be evident by failure of the diagonals to intersect on the centre-line or by considerable deviations in the measurements.

SERVICE TOOLS



18G 308 B. Body Jack and Case

For use when correcting misalignment on all-steel bodies.



18G 603 Body Alignment Checking Jig

KEY TO THE BOOT LID COMPONENTS

No.	*Description*
1.	Boot lid assembly.
2.	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.

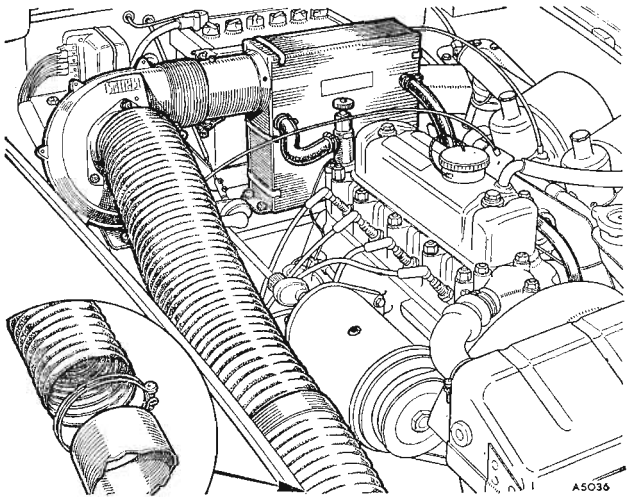


Fig. R.22

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

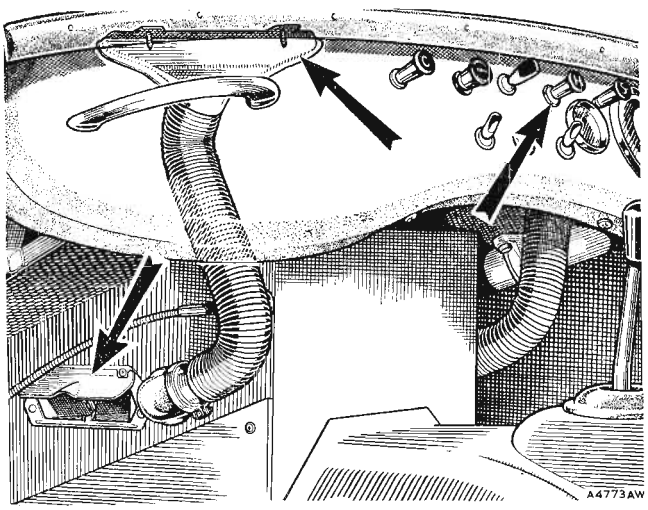


Fig. R.23

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 jigs section are marked FORWARD to enable easy and correct positioning.

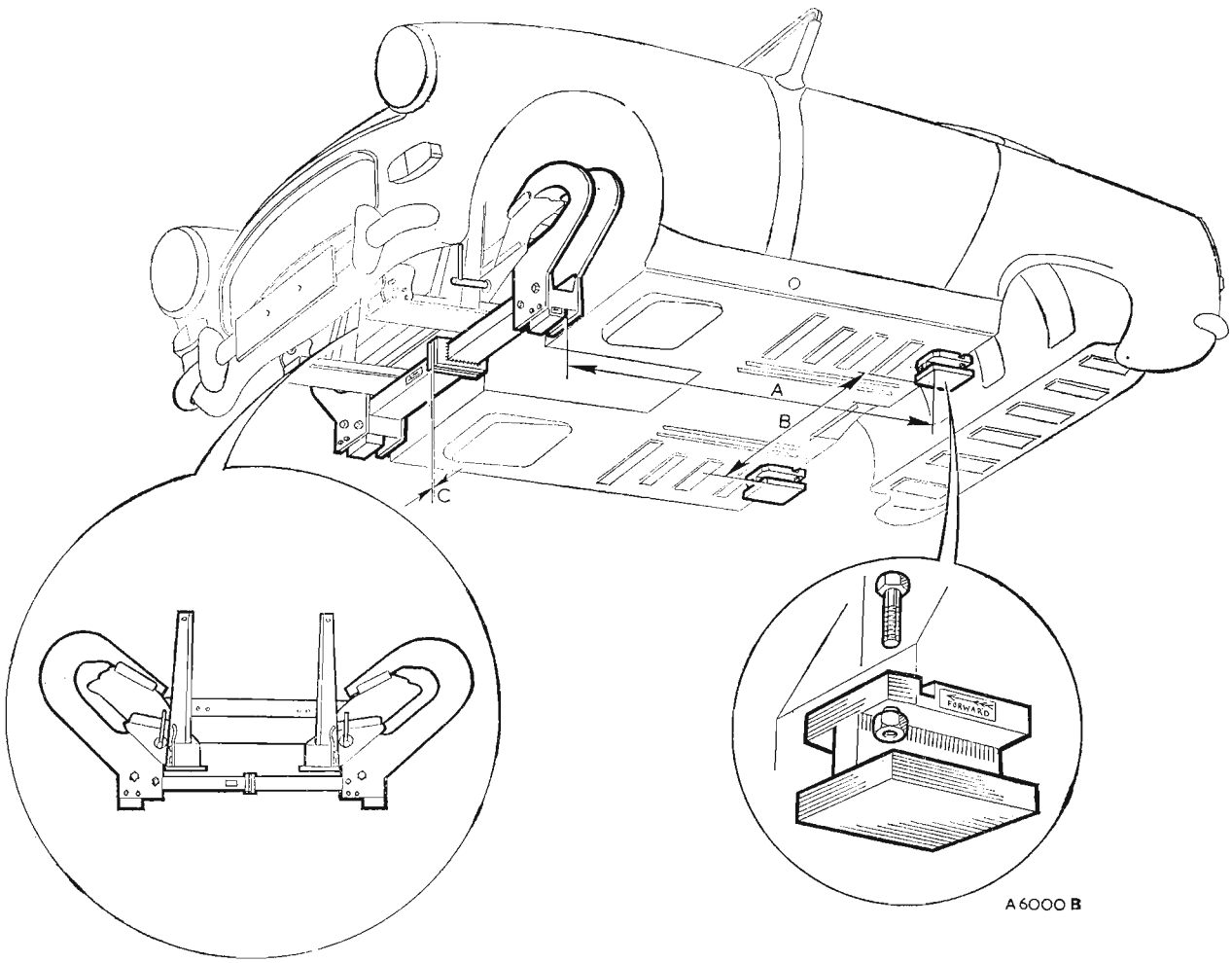


Fig. R.24

A. 63·250 in. (1606·55 mm.). B. 31·75 in. (806·45 mm.). C. ·250±·0625 in. (6·34±1·59 mm.).

Section R.16

B.M.C. SEAT BELTS

Fitting

Rear wheel arch

Remove the capped nuts and plain washers. Fit the belt bracket, spring washers, and capped nuts in position on the wheel arch mounting studs.

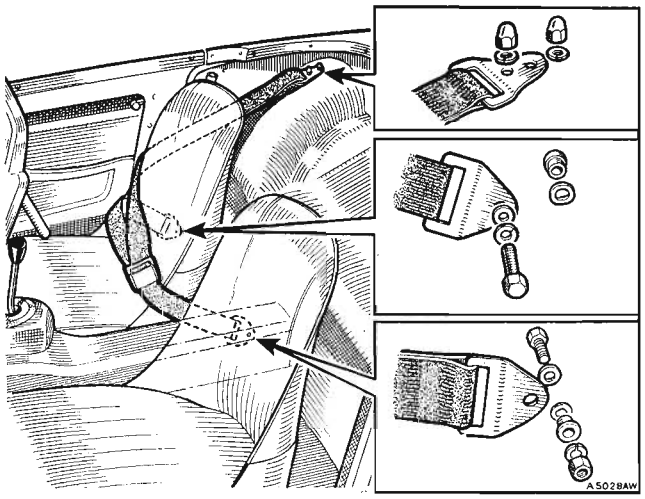


Fig. R.25

The seat belt attachment points and fittings

Sill

It will be found necessary to cut the sill trim board covering to expose the 1 in. (25·4 mm.) dia. hole. Assemble the spring washer, plain washer, belt bracket, anti-rattle washer (concave face to bracket), and distance piece (shouldered end towards the sill) onto the set screw. Assemble to the sill fixing, ensuring that the belt bracket faces forward along the centre-line of the car.

Propeller shaft tunnel

Remove the rubber plug and cut a 1 in. (25·4 mm.) dia. hole in the carpet to coincide with the hole in the tunnel. Assemble the plain washer, belt bracket, anti-rattle washer (concave face to bracket), and distance piece (shouldered end towards the tunnel).

Assemble to the tunnel fixing, ensuring that the belt bracket faces rearwards along the centre-line of the car. Position the spring washer and nut on the inside of the tunnel.

Fitting should only be carried out by an Authorized Austin Distributor or Dealer.

Removing

When removing the seat belt reverse completely the fitting instructions.

LUBRICATION CHART

KEY TO LUBRICATION CHART

DAILY

(1) ENGINE. Inspect oil level, and top up if necessary with oil to Ref. A.

EVERY 3,000 MILES (4800 Km.)

(2) ENGINE. Drain off the old oil and refill with fresh oil to Ref. A.

(3) GEARBOX. Top up if necessary to the filler plug level with oil to Ref. A.

(4) REAR AXLE. Top up if necessary to the filler plug level with oil to Ref. B.

(5) STEERING TIE-ROD BALL JOINTS (2 nipples). Give three or four strokes of a gun filled with lubricant to Ref. C.

(6) SWIVEL AXLES AND SUSPENSION LOWER JOINTS (6 nipples). Give three or four strokes of a gun filled with lubricant to Ref. C.

(7) PROPELLER SHAFT (2 nipples). Give three or four strokes of a gun filled with lubricant to Ref. C.

(8) HAND BRAKE CABLE (1 nipple). Give three or four strokes of a gun filled with grease to Ref. C.

(9) HAND BRAKE COMPENSATOR LEVER (1 nipple). Give three or four strokes of a gun filled with lubricant to Ref. C.

(10) CARBURETTERS. Top up the damper assemblies with oil to Ref. D. Lubricate the throttle control linkage with oil to Ref. D.

EVERY 6,000 MILES (9600 Km.)

(11) OIL FILTER. Wash the bowl in fuel and fit a new element.

(12) GEARBOX. Drain off the old oil and refill with fresh oil to Ref. A.

(13) REAR AXLE. Drain off the old oil and refill with fresh oil to Ref. B.

(14) DISTRIBUTOR. Lubricate all parts as necessary.

(15) DYNAMO. Unscrew the lubricator cap, remove the felt pad and spring, and half-fill the cup with grease to Ref. C.

EVERY 12,000 MILES (19200 Km.)

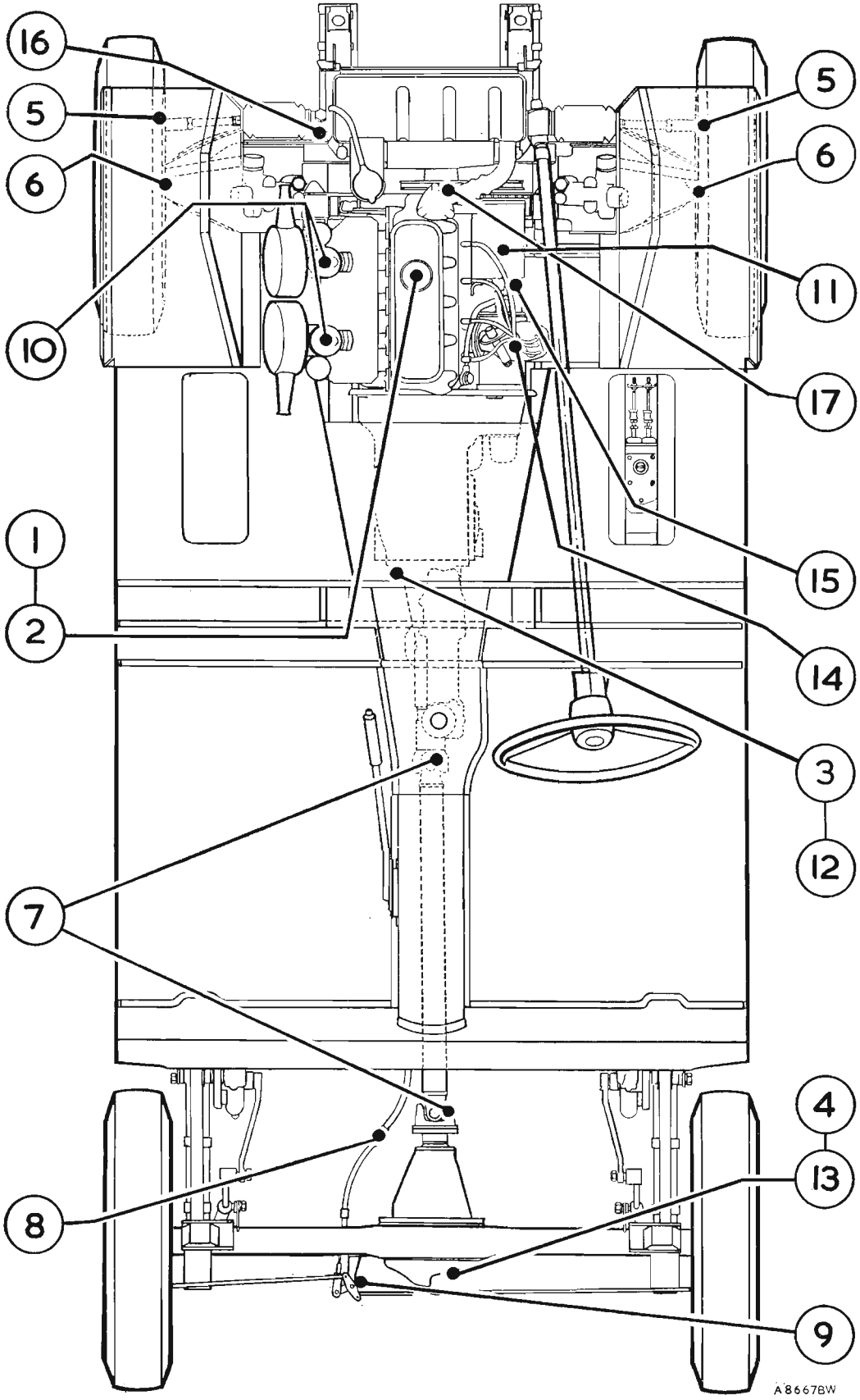
(16) STEERING-RACK. Apply the grease gun filled with oil to Ref. B to the nipple on the steering gearbox and give 10 strokes only.

(17) WATER PUMP. Lubricate sparingly 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



RECOMMENDED LUBRICANTS

RECOMMENDED MONOGRADE LUBRICANTS

	A				B		C	D	E
Component	Engine			Gearbox	Rear Axle and Steering Gear		All Grease Points	Oilcan and Carburetter	Upper Cylinder Lubrication
Climatic conditions	**Tropical and temperate down to 0° C. (32° F.)**	**Extreme cold down to −12° C. (10° F.)**	**Arctic consistently below −12° C. (10° F.)**	**All conditions**	**All conditions down to −12° C. (10° F.)**	**Arctic consistently below −12° C. (10° F.)**	**All conditions**	**All conditions**	**All conditions**
BP	Energol S.A.E. 30	Energol S.A.E. 20W	Energol S.A.E. 10W	Energol S.A.E. 30	Energol E.P. S.A.E. 90	Energol E.P. S.A.E. 80	Energrease L. 2	Energol S.A.E. 20W	Energol U.C.L.
SHELL	Shell X—100 30	Shell X—100 20W	Shell X—100 10W or Rotella 10W	Shell X—100 30	Shell Spirax 90 E.P.	Shell Spirax 80 E.P.	Shell Retinax A	Shell X—100 20W	Shell Upper Cylinder Lubricant
FILTRATE	Filtrate Medium 30	Filtrate Zero 20/20W	Filtrate Sub-Zero 10W	Filtrate Medium 30	Filtrate Hypoid Gear 90	Filtrate Hypoid Gear 80	Filtrate Super Lithium Grease	Filtrate Zero 20/20W	Filtrate Petroyle
STERNOL	Sternol W.W. 30	Sternol W.W. 20	Sternol W.W. 10	Sternol W.W. 30	Ambroleum E.P. 90	Ambroleum E.P. 80	Ambroline L.H.T.	Sternol W.W. 20	Sternol Magikoyl
DUCKHAM'S	Duckham's NOL Thirty	Duckham's NOL Twenty	Duckham's NOL Ten	Duckham's NOL Thirty	Duckham's Hypoid 90	Duckham's Hypoid 80	Duckham's L.B. 10 Grease	Duckham's NOL Twenty	Duckham's Adcoid Liquid
CASTROL	Castrol X.L.	Castrolite	Castrol Z	Castrol X.L.	Castrol Hypoy	Castrol Hypoy Light	Castrolease L.M.	Castrolite	Castrollo
ESSO	Esso Extra Motor Oil 20W/30	Esso Extra Motor Oil 20W/30	Esso Motor Oil 10	Esso Extra Motor Oil 20W/30	Esso Gear Oil G.P. 90	Esso Gear Oil G.P. 80	Esso Multipurpose Grease H	Esso Extra Motor Oil 20W/30	Esso Upper Cylinder Lubricant
MOBIL	Mobiloil A	Mobiloil Arctic	Mobiloil 10W	Mobiloil A	Mobilube G.X. 90	Mobilube G.X. 80	Mobilgrease M.P.	Mobiloil Arctic	Mobil Upperlube

RECOMMENDED MULTIGRADE LUBRICANTS

	A and D
Component	Engine/Gearbox, Oilcan, and Carburetter
Climatic conditions	**All temperatures above —17·8° C. (0° F.)**
MOBIL	Mobiloil Special
BP	B.P. Energol Visco-Static
SHELL	Shell X—100 Multigrade 10W/30
FILTRATE	Filtrate 10W/30 Multigrade
STERNOL	Sternol Multiplic
DUCKHAM'S	Q 5500
CASTROL	Castrolite*
ESSO	Esso Extra Motor Oil 20W/30*

Approval is also given to Duckham's Q 20/50.
* For temperatures below —12° C. (10° F.) use the S.A.E. 10W/30 grade oil. This is available in markets where such low temperatures prevail.

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IMPORTANT

The enclosed pages constitute a complete reprint of the Sprite Mk. II and Midget Workshop Manual. Remove the existing text from your M.G. Midget or Austin-Healey Sprite Mk. II binder and insert the reprinted pages.

Destroy the original text to avoid confusion.

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