HORNET and ELF

Workshop Manual

A B.M.C. SERVICE PUBLICATION

The Riley Car Club of New Zealand Inc.
Riley
LIBRARY
BOOK No.147
Historian.RileyCCNZ@gmail.com

Original supplied by
Brian Baker.

HORNET and ELF

WORKSHOP MANUAL

Quote Part No. AKD 4062 C when ordering this publication

BMC SERVICE LIMITED
a Subsidiary of The British Motor Corporation Limited
COWLEY, OXFORD, ENGLAND

Telephone: Oxford 77777
Telegrams: BMCSERV. Telex. Oxford
Telex: BMCSERV. Oxford 83145 and 83146
Overseas Cables: BMCSERV. Telex. Oxford. England

PRINTED IN ENGLAND

© THE BRITISH MOTOR CORPORATION LIMITED, 1966

Reproduced in 2017 for: The Riley Car Club of New Zealand Inc. - Book No.174 ELF Workshop Manual AKD 406C 1966.

INTRODUCTION

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

The early pages contain general data relating to these cars.

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

References to right or left hand in this book are made when viewing the vehicle from the rear.

CONTENTS

GENERAL DATA

ENGINE

Type	8WR.
Number of cylinders	4.
Bore	2·478 in. (62·94 mm.).
Stroke	2·687 in. (68·26 mm.).
Capacity	51·7 cu. in. (848 c.c.).
Firing order	1, 3, 4, 2.
Compression ratio	8·3 : 1.
Capacity of combustion chamber (valves fitted)	1·49 cu. in. (24·5 c.c.).
Valve operation	Overhead by push-rod.
B.M.E.P.	128 lb./sq. in. (9 kg./cm.²) at 2,900 r.p.m.
Torque	44 lb. ft. (6·08 kg. m.) at 2,900 r.p.m.
●Compression pressure	150 lb./sq. in. (10·5 kg./cm.²).
Engine idle speed (approx.)	500 r.p.m.●
Oversize bore: 1st	+·010 in. (·254 mm.).
Max.	+·040 in. (1·016 mm.).

CRANKSHAFT

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

CONNECTING RODS

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

PISTONS

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

PISTON RINGS

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

GUDGEON PIN

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

VALVES AND VALVE GEAR

Valves

Seat angle: Inlet	45°.
Exhaust	45°.
Head diameter: Inlet	1·093 to 1·098 in. (27·76 to 27·89 mm.).
Exhaust	1·000 to 1·005 in. (25·40 to 25·53 mm.).
Stem diameter: Inlet	·2793 to ·2798 in. (7·096 to 7·109 mm.).
Exhaust	·2788 to ·2793 in. (7·081 to 7·096 mm.).
Valve lift	·285 in. (7·24 mm.).
Valve stem to guide clearance: Inlet	·0015 to ·0025 in. (·038 to ·064 mm.).
Exhaust	·002 to ·003 in. (·051 to ·076 mm.).
Valve rocker clearance: Running	·012 in. (·305 mm.) (cold).
Timing	·019 in. (·48 mm.).
Timing markings	Dimples on timing wheels, marks on flywheel.
Chain pitch and number of pitches	$\frac{3}{8}$ in. (9·525 mm.). 52.
Inlet valve: Opens	5° B.T.D.C.
Closes	45° A.B.D.C.
Exhaust valve: Opens	40° B.B.D.C.
Closes	10° A.T.D.C.

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

VALVE GUIDES

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

VALVE SPRINGS

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

TAPPETS

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

CAMSHAFT

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

ENGINE LUBRICATION SYSTEM

Oil pump

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

Oil filter

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

Oil pressure

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

TORQUE WRENCH SETTINGS

Cylinder head stud nuts	40 lb. ft. (5·5 kg. m.).
Connecting rod big-end bolts	35 lb. ft. (4·8 kg. m.).
Main bearing set screws	60 lb. ft. (8·3 kg. m.).
Flywheel centre-bolt	110 to 115 lb. ft. (15·2 to 15·9 kg. m.).
Gudgeon pin clamp screws	25 lb. ft. (3·4 kg. m.).
Rocker bracket nuts	25 lb. ft. (3·4 kg. m.).
Transmission case to crankcase	6 lb. ft. (·8 kg. m.).
●Transmission drain plug	40 to 50 lb. ft. (5·5 to 6·9 kg. m.).●
Cylinder side cover	2 lb. ft. (·28 kg. m.).
Second type—deep pressed cover	5 lb. ft. (·7 kg. m.).
Timing cover $\frac{1}{4}$ in. UNF. bolts	6 lb. ft. (·8 kg. m.).
Timing cover $\frac{5}{16}$ in. UNF. bolts	14 lb. ft. (1·9 kg. m.).
Water pump	17 lb. ft. (2·3 kg. m.).
Water outlet elbow	8 lb. ft. (1·1 kg. m.).
Oil filter	16 lb. ft. (2·2 kg. m.).
Oil pump	9 lb. ft. (1·2 kg. m.).
Manifold to cylinder head	15 lb. ft. (2·1 kg. m.).
Rocker cover	4 lb. ft. (·56 kg. m.).
Crankshaft pulley nut	70 lb. ft. (9·6 kg. m.).
Transmission case studs—$\frac{3}{8}$ in. dia. UNC.	8 lb. ft. (1·1 kg. m.).
Transmission case studs—$\frac{5}{16}$ in. dia. UNC.	6 lb. ft. (·8 kg. m.).
Transmission case stud nuts—$\frac{3}{8}$ in. UNF.	25 lb. ft. (3·45 kg. m.).
Transmission case stud nuts—$\frac{5}{16}$ in. UNF.	18 lb. ft. (2·5 kg. m.).
Bottom cover set screws—$\frac{1}{4}$ in. dia. UNC. (change speed tower)	6 lb. ft. (·8 kg. m.).
1st motion shaft nut	150 lb. ft. (20·7 kg. m.).
3rd motion shaft nut	150 lb. ft. (20·7 kg. m.).
Flywheel housing bolts and stud nuts	18 lb. ft. (2·5 kg. m.).
Set screw—driving strap to flywheel	16 lb. ft. (2·2 kg. m.).
Set screw—clutch spring housing to pressure plate	16 lb. ft. (2·2 kg. m.).

Final drive

Driven gear to differential cage	60 lb. ft. (8·3 kg. m.).
Drive shaft flange nuts	70 lb. ft. (9·6 kg. m.) (and align to next split pin hole).
End cover bolts (differential housing)	18 lb. ft. (2·5 kg. m.).

Suspension and steering

●Steering-column/rack pinion clamp bolt	8 to 9 lb. ft. (1·1 to 1·2 kg. m.).●
Steering lever to hub bolts	35 lb. ft. (4·8 kg. m.).
Steering lever ball joint nut	20 to 24 lb. ft. (2·77 to 3·32 kg. m.).
Steering knuckle ball pin bottom nut	35 to 40 lb. ft. (4·8 to 5·5 kg. m.).
Steering knuckle ball pin top nut	35 to 40 lb. ft. (4·8 to 5·5 kg. m.).
Steering knuckle ball pin retainer	70 lb. ft. (9·6 kg. m.).
Front hub nut (drive shaft)	60 lb. ft. (8·3 kg. m.).
Rear suspension stub axle nut	60 lb. ft. (8·3 kg. m.) (align to next slot).
Front suspension upper arm pivot pin nut	26 to 28 lb. ft. (3·6 to 3·87 kg. m.).
Steering-wheel nut	41 lb. ft. (5·76 kg. m.).
Road wheel nuts	38 to 43 lb. ft. (5·25 to 5·94 kg. m.).

FUEL SYSTEM

Carburetter

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

Fuel pump

Make and type	S.U. electric. SP and AUF 201.
Delivery rate	56 pints/hr. (67·2 U.S. pts./hr. 28·44 litres/hr.).
Delivery pressure	2½ to 3 lb./sq. in. (·18 to ·21 kg./cm.²).

AIR CLEANER

Type	Paper element.

COOLING SYSTEM

Type	Pressurized radiator, thermo-siphon, thermostat control, pump- and fan-assisted.
Thermostat setting: Standard	82° C. (180° F.).
Cold climates	88° C. (190° F.).

IGNITION SYSTEM

Sparking plugs	Champion N5.
Size	14 mm.
Plug gap	·025 in. (·625 mm.).
Coil	LA12.
Distributor	25D4.
Distributor contact points gap	·014 to ·016 in. (·36 to ·40 mm.).

	Premium fuel distributor	*Regular (Commercial) fuel distributor*
Auto advance commences at	600 r.p.m. (engine).	1,250 r.p.m. (engine).
Maximum advance	30–34° at 3,400 r.p.m.	22–26° at 5,000 r.p.m.
Vacuum advance	10° at 13 in. (330·2 mm.) mercury.	16° at 11 in. (279·4 mm.) mercury.

Static ignition timing	T.D.C.
Stroboscopic ignition timing	3° B.T.D.C. at 600 r.p.m. (engine).

CLUTCH

BMC	Single dry plate.
Diameter	7·125 in. (180·9 mm.).
Facing material	Wound yarn.
Pressure springs	6.
Colour	Red spot.
Damper springs	Nil.

Diaphragm spring clutch

Make	Borg and Beck.
Diameter	7⅛ in. (18 cm.).
Facing material	Wound yarn.
Damper springs	Nil.
Diaphragm spring colour code	Brown.

GEARBOX

Number of forward speeds	4.
Synchromesh	Second, third, and fourth gears.
Ratios: Top	1·0 : 1.
Third	1·412 : 1.
Second	2·172 : 1.
First	3·627 : 1.
Reverse	3·627 : 1.

Overall ratios: Top	3·765 : 1.
Third	5·317 : 1.
Second	8·176 : 1.
First	13·657 : 1.
Reverse	13·657 : 1.
Speedometer gear ratio	6/17.

STEERING

Type	Rack and pinion.
Steering-wheel turns—lock to lock	2⅓.
Steering-wheel diameter	15¾ in. (40 cm.).
Camber angle	1° positive to 3° positive.
Castor angle	3°.
Swivel hub (king pin) inclination	9° 30′.
Toe-out	1/16 in. (1·6 mm.).
●Lock angle: outer wheel at 20°, inner wheel	23°.●

With vehicle in an unladen condition.

SUSPENSION

Early models, 1961–1964	Rubber cone spring.
Later models 1964 onwards	Hydrolastic suspension.
Front	Levers of unequal length.
Rear	Trailing radius arms.
Toe-in	⅛ in. (3·18 mm.).
Camber	1° positive.
Fluid capacity	4 pints (5 U.S. pints, 2·27 litres).
●Fluid pressure: Early models (unladen)	263 lb./sq. in. (18·49 kg./cm.²).
Later models (unladen)	282 lb./sq. in. (19·74 kg./cm.²).
(Car Nos. given in Section H.10)●	
Radius arm bushes (reamed bore)	·8125 to ·8130 in. (20·63 to 20·65 mm.).

HYDRAULIC DAMPERS (Rubber suspension only)

Type: Front and rear	Tubular telescopic.

DRIVE SHAFTS

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

DIFFERENTIAL

Ratio	3·765 : 1. (64/17).

ELECTRICAL EQUIPMENT

System	12-volt, positive earth.
Charging system	Compensated voltage control.
Battery	Lucas BLT7A, BLTZ7A, BT7A, BTZ7A.
Capacity: BLT7A, BLTZ7A	34 amp.-hr. at 20-hr. rate.
BT7A, BTZ7A	43 amp.-hr. at 20-hr. rate.
Starter motor	Lucas M35G.
Dynamo	Lucas C40.
●Maximum output	22 amps. at 2,250 r.p.m.
Cut-in speed	1,450 r.p.m. at 13·5 volts.●
Control box	Lucas RB106/2.
Cut-out: Cut-in voltage	12·7 to 13·3.
Drop-off voltage	8·5 to 11·0.
Reverse current	5·0 amps. (max.).

Regulator (at 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.

GENERAL DATA—*continued*

BRAKES

Type	Lockheed hydraulic, drum, single leading shoe.
Drum size	7 in. (17·8 cm.) diameter.
Lining dimensions: Front or rear	6·75 in. × 1·25 in. (17·14 cm. × 3·17 cm.).
Lining area: Front or rear	33·75 sq. in. (217·7 cm.²).
Lining material	Don 202.

WHEELS

Type: Ventilated disc	3·50B × 10.

TYRES

Size	
Standard	5·20—10 tubeless.
Optional (Radial ply)	145—10 tubeless.
Pressures:	
Standard—normal conditions	Front 24 lb./sq. in. (1·7 kg./cm.²).
	Rear 22 lb./sq. in. (1·55 kg./cm.²).
fully loaded	Front and rear 24 lb./sq. in. (1·7 kg./cm.²).
Optional (Radial ply), all conditions:	Front 28 lb./sq. in. (1·97 kg./cm.²).
	Rear 26 lb./sq. in. (1·83 kg./cm.²).

CAPACITIES

Transmission casing (including filter)	8½ pints (10·2 U.S. pints, 4·8 litres).
Cooling system: Including heater	6¼ pints (7·5 U.S. pints, 3·5 litres).
Without heater	5¼ pints (6·3 U.S. pints, 3 litres).
Fuel tank	5½ gallons (6·6 U.S. gallons, 25 litres).
Steering rack	⅓ pint (·44 U.S. pint, ·2 litre).

GENERAL DIMENSIONS

Wheelbase	6 ft. 8$\frac{5}{32}$ in. (2·036 m.).
Overall length	10 ft. 8¾ in. (3·27 m.).
Overall width	4 ft. 7½ in. (1·41 m.).
Overall height	4 ft. 5 in. (1·35 m.).
Ground clearance	6$\frac{5}{32}$ in. (15·6 cm.).
Turning circle	31 ft. 7 in. (9·63 m.).
Track: Front	47$\frac{7}{16}$ in. (1·205 m.).
Rear	45⅞ in. (1·164 m.).
Kerbside weight—Elf (Rubber suspension models)	1,466 lb. (665 kg.).
Elf (Hydrolastic suspension models)	1,456 lb. (660·4 kg.).
Hornet (Rubber suspension models)	1,423 lb. (645·4 kg.).
Hornet (Hydrolastic suspension models)	1,449 lb. (657·2 kg.).
Dry weight—Elf (Rubber suspension models)	1,408 lb. (638 kg.).
Elf (Hydrolastic suspension models)	1,416 lb. (642·3 kg.).
Hornet (Rubber suspension models)	1,362 lb. (618 kg.).
Hornet (Hydrolastic suspension models)	1,403 lb. (636·4 kg.).
Maximum permissible towing weight (suitable for 1 in 8 gradient in bottom gear)	8 cwt. (406·4 kg.).

WEIGHTS OF COMPONENTS

Engine and transmission assembly	333 lb. (151 kg.).
Flywheel	15½ lb. (7 kg.).
Wheel with tyre	16¾ lb. (7·5 kg.).

GENERAL DATA—*continued*

(MARK II)

The following information is applicable to the Mark II and should be used in conjunction with the preceding specification.

ENGINE

Type	9WR.
Number of cylinders	4.
Bore	2·543 in. (64·588 mm.).
Stroke	3·00 in. (76·2 mm.).
Capacity	60·96 cu. in. (998 c.c.).
Compression ratio	8·3 : 1.
B.M.E.P.	130 lb./sq. in. (9·14 kg./cm.²) at 2,700 r.p.m.
Torque	52 lb. ft. (7·28 kg. m.) at 2,700 r.p.m.
●Compression pressure	150 lb./sq. in. (10·5 kg./cm.²).
Engine idle speed (approx.)	500 r.p.m.●
Oversize bores: 1st	+·010 in. (·254 mm.).
2nd	+·020 in. (·508 mm.).

CRANKSHAFT

Main bearings

Material	Steel-backed copper-lead; thin wall.
Running clearance	·001 to ·0027 in. (·025 to ·069 mm.).

CONNECTING RODS

Big-end bearings

Material	Steel-backed copper-lead; thin wall.
Bearing length	·875 in. (22·22 mm.).

PISTONS

Type	Solid skirt.
Clearance: Bottom of skirt (pressure face)	·0005 to ·0011 in. (·013 to ·028 mm.).
Oversizes: 1st	+·010 in. (·254 mm.).
2nd	+·020 in. (·508 mm.).

PISTON RINGS

Compression: Top	Plain, chrome-faced.
Second and third	Tapered.
Width	·0620 to ·0625 in. (1·574 to 1·588 mm.).
Thickness (all rings)	·106 to ·112 in. (2·692 to 2·835 mm.).

GUDGEON PIN

Type	Fully floating, with circlip location.
Fit	Hand push fit.

VALVES AND VALVE GEAR

Valves

Throat diameter: Inlet	·969 in. (24·61 mm.).
Exhaust	·908 in. (23·06 mm.).
Valve lift	·28 in. (7·14 mm.).

CAMSHAFT

Journal diameters: Front	1·6655 to 1·666 in. (42·304 to 42·316 mm.).
Centre	1·62275 to 1·62325 in. (41·218 to 41·231 mm.).
Rear	1·3725 to 1·3735 in. (34·862 to 34·887 mm.).
End-float	·003 to ·007 in. (·076 to ·178 mm.).

Bearings: number and type	3. Steel-backed white metal.
Inside diameter (reamed in position): Front	1·667 to 1·6675 in. (42·342 to 42·355 mm.).
Centre	1·6245 to 1·6255 in. (41·261 to 41·287 mm.).
Rear	1·3748 to 1·3755 in. (34·914 to 34·937 mm.).
Running clearance	·001 to ·002 in. (·025 to ·051 mm.).

FUEL SYSTEM

Carburetter

Needle	Standard GX. Rich M. Weak GG.

IGNITION SYSTEM

●Coil	Lucas LA12.
Resistance at 20° C. (68° F.): primary winding	3·2 to 3·4 ohms (cold).
Distributor	Lucas 25D4.
Rotation of rotor arm	Anti-clockwise.
Contact point gap setting	·014 to ·016 in. (·35 to ·40 mm.).
Condenser capacity	·18 to ·24 mF.
Cam closed period	60°±3°.
Cam open period	30°±3°.
Automatic advance	Centrifugal and vacuum.
Serial number	40931E.
Automatic advance commences*	600 r.p.m.
Maximum advance*	26° at 5,000 r.p.m.
Vacuum advance: Commences	5 in. (12·7 cm.) Hg.
Ends	11 in. (27·9 cm.) Hg.
Decelerating check*	24° at 5,000 r.p.m. 18° at 3,400 r.p.m. 8° at 1,300 r.p.m. 2° at 900 r.p.m.
Timing marks	Dimples on timing wheels, marks on flywheel.
Static ignition timing	5° B.T.D.C. (91-octane fuel and above [Research Method]).
Stroboscopic ignition timing*	8° B.T.D.C. at 600 r.p.m.

* Crankshaft degrees and r.p.m.

Sparking plugs	Champion N5.
Size	14 mm., ¾ in. (19 mm.) reach.
Gap	·025 in. (·625 mm.).●

CLUTCH

Pressure springs—colour	Black enamel with white spot.
Diaphragm spring colour code	Light green.

BRAKES

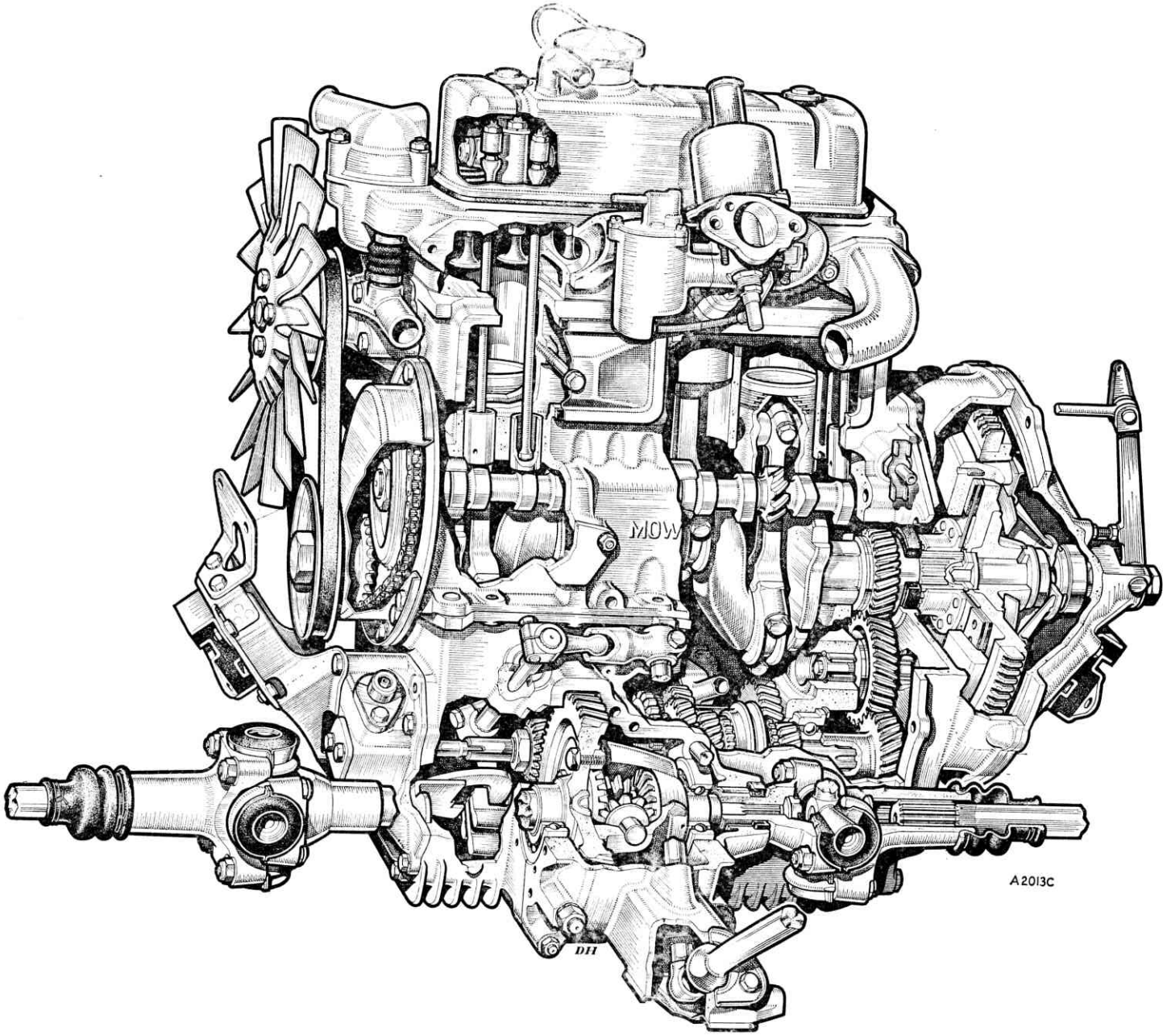
Front

Type	Lockheed hydraulic; two-leading-shoe.
Lining dimensions	6·75×1·5 in. (17·14×3·18 cm.).
Lining area (total)	40·5 sq. in. (261·29 cm.²).
Lining material	Don 202.

SECTION A

THE ENGINE

THE POWER UNIT AND SYNCHROMESH TRANSMISSION ASSEMBLY



GENERAL DESCRIPTION

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

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

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

Pistons are fitted with two compression rings and one slotted oil control ring. The gudgeon pins are clamped in the connecting rods in the Mk. I engine and are fully floating in the Mk. II engine. The connecting rods have renewable steel-backed big-end bearings with lead-indium- or lead-tin-plated surfaces.

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

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

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

The oil pressure gauge in the instrument panel is connected by a pipe to the rear end of the main oil gallery.

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.

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 rear right-hand side of the transmission casing. Draining is preferable when the engine is hot as the oil will flow more readily in this condition; allow at least 10 minutes for draining before replacing the plug. Models fitted with a differential pressure switch on the filter head will give an indication that an oil change is required when a warning light in the instrument panel appears and continues to glow and when the engine is running at or above idling speed. Both the engine oil and the filter element must be changed as soon as possible within a maximum of the next 300 miles (500 km.).

Changing the engine oil filter

Unscrew the central retaining bolt to release the oil filter bowl and element. Clean the filter bowl in fuel and fit the correct replacement element. Ensure that the felt or rubber sealing washer is in good condition and a snug fit to the central retaining bolt. The internal seating must be fitted in the order shown in the illustration (Fig. A.1).

Fit a new filter bowl sealing ring in the filter head location recess. Insert the new element into the bowl and refit the assembly to the filter head, rotate the bowl while tightening the retaining bolt to ensure correct location of the bowl to the filter head. The filter assembly on later engines has four lugs in the filter head to ensure correct location. Check for signs of leakage immediately the engine is started.

NOTE.—Disconnect the battery before commencing work on the filter.

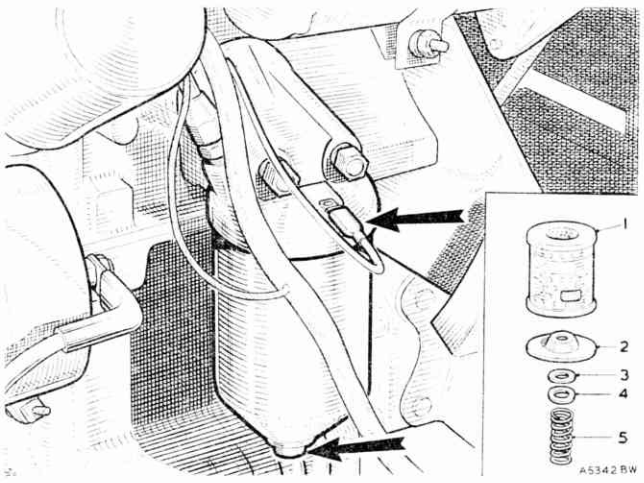


Fig. A.1

The engine oil filter, showing the warning light pressure differential switch and filter retaining bolt

1. Filter element.
2. Seating plate.
3. Seating washer.
4. Steel washer.
5. Spring.

Section A.2

OIL PRESSURE

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

(1) That there is an adequate supply of the correct grade oil in the transmission casing.
(2) That there is no air leakage at the pump pick-up union on the suction side of the pump and that the oil pump is not worn and is functioning correctly. See Section A.24 for oil pump removal and dismantling.
(3) That the strainer in the transmission casing is clean and not choked with sludge.
(4) That the bearings to which the oil is fed under pressure have the correct working clearance. Should the bearings be worn and the clearances excessive, the oil will escape more readily from the sides of the bearings, particularly when the oil is warm and becomes more fluid.

The points mentioned can all cause a drop in pressure.

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

NOTE.—The automatic relief valve in the lubrication system deals with any excessive oil pressure when starting from cold. When hot, the pressure drops as the oil becomes more fluid. Details of the relief valve are given in Section A.3.

Section A.3

OIL PRESSURE RELIEF VALVE

The non-adjustable oil pressure relief valve is situated at the rear right-hand side of the cylinder block and is held in position by a domed hexagon nut and sealed by a folded copper washer. The relief valve spring maintains a valve cup against a seating machined in the cylinder block to provide an extra return passage for the oil should the pressure become excessive.

The valve cup should be examined to ensure that it is seating correctly and that the spring has not lost its tension. The cup can be removed and ground into its seating with Service tool 18G 69 and the spring checked by measuring its length (see **'GENERAL DATA'**). Fit a new cup and spring if necessary.

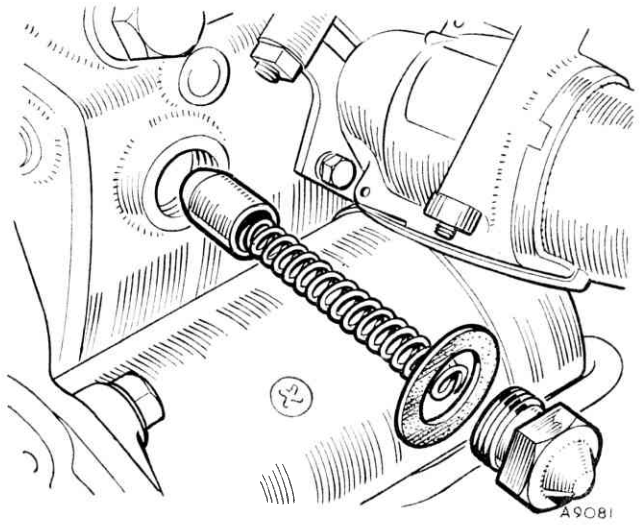


Fig. A.2
The oil pressure relief valve

Section A.4

CARBURETTER AND AIR CLEANER

Removing

Disconnect the breather hose from the rocker cover, remove the air cleaner retaining butterfly nut, and lift off the air cleaner.

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

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

Refitting

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

Section A.5

EXHAUST SYSTEM

Slacken off the exhaust pipe to manifold clamp, and release the pipe from its fixing point (see Fig. A.10) on the gear change extension and from the two locations on the rear sub-frame.

Refitting

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

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

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

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

With the engine still wedged in this position insert sufficient slip packings to fill the gap between the transmission casing lug and the pipe support stay. Insert the bolt and tighten up at this point.

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

Section A.6

EXHAUST MANIFOLD

Removing

Remove the carburetter and air cleaner as detailed in Section A4. Slacken off and release the exhaust pipe clamp. Remove the six nuts and washers securing the manifold to the cylinder head; withdraw the manifold.

Refitting

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

Section A.7

VALVE ROCKERS

Removing

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

Remove the air cleaner as in Section A.4.

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

Slacken the eight rocker shaft bracket fixing nuts and the five external cylinder head stud nuts gradually, a turn at a time, in the order shown in Fig. A.3, until all the load is released.

NOTE.—The five external cylinder head fixing nuts must be slackened at the same time as the rocker shaft securing nuts, and in the order given in Fig. A.3, otherwise distortion may take place and result in water finding its way into the cylinder bores and the transmission casing.

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

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

Dismantling

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

Reassembly

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

Refitting

Refitting is a reversal of the removal procedure, with special emphasis on the tightening of the rocker bracket and cylinder head stud nuts; these must be tightened in the order shown in Fig. A.3 and to the torque wrench figure given under **'GENERAL DATA'.**

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

Section A.8

VALVE ROCKER BUSHES

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

Section A.9

CYLINDER HEAD

Removing

Drain the cooling system. If anti-freeze mixture is in use it should be drained into a suitable clean container.

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

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

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

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

Remove the suction advance pipe clip from its fixture on the thermostat housing. Remove the heater hose from the control valve, which is situated at the rear of the cylinder head.

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

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

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

The cylinder head may now be removed.

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

Refitting

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

Insert the push-rods, replacing them in the positions from which they were taken. Replace the rocker assembly and securing nuts and fit the nuts finger-tight. Tighten all 13 nuts gradually, a turn at a time, in the order given in Fig. A.3.

Whenever the head has been disturbed or the valves have been ground in or otherwise disturbed it is necessary to check the valve clearances as in Section A.15. These,

of course, will be finally adjusted after the engine has been completely reassembled and run for a short period.

Replace the inlet and exhaust manifold.

Attach the heater hose to the heater control valve and refit the suction advance pipe to its fixing point on the thermostat housing.

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

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

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

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

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

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

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

Refit the bonnet.

Section A.10

DECARBONIZING

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

Withdraw the valves as described in Section A.11.

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

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

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

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

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

Section A.11

VALVES

Removing

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

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

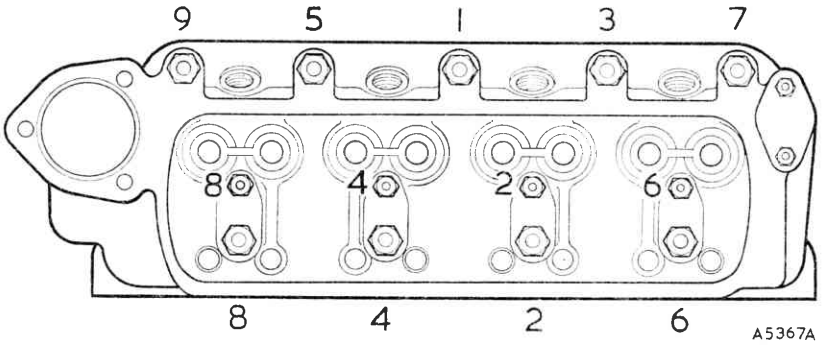


Fig. A.3

The order of slackening and tightening the cylinder head retaining nuts

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

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

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

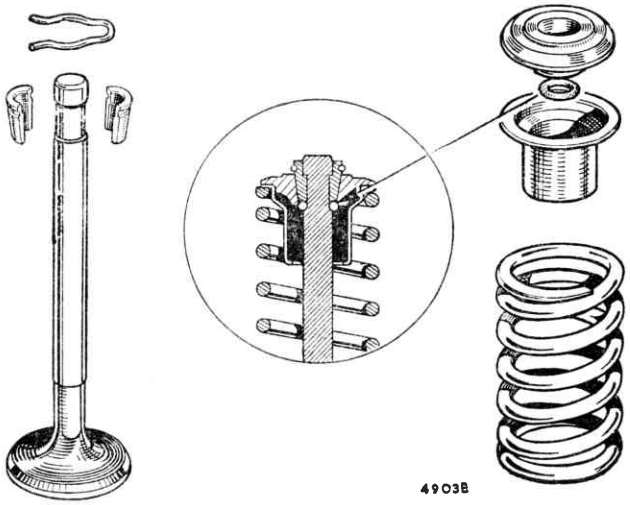


Fig. A.4

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

Refitting

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

Section A.12

VALVE-GRINDING

Remove the valves as in Section A.11.

Each valve must be cleaned thoroughly and carefully examined for pitting. Valves in a pitted condition should be refaced with a suitable grinder or new valves should be fitted. Stamp any new valve with the number of the seat 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 illustrated at the end of Section A. These tools will save lengthy and wasteful grinding in. When using a cutting tool take care to remove only as much metal as necessary to ensure a true surface. Worn valve seats usually have a glass-hard surface, and the glaze breaker illustrated should be used to prepare the valve seat surface for any recutting that may be necessary. Narrowing cutters should be used to maintain the valve seats to their correct dimensions.

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

A light coil spring placed under the valve head will assist considerably in the process of grinding. The valve should be ground to its seat with a semi-rotary motion

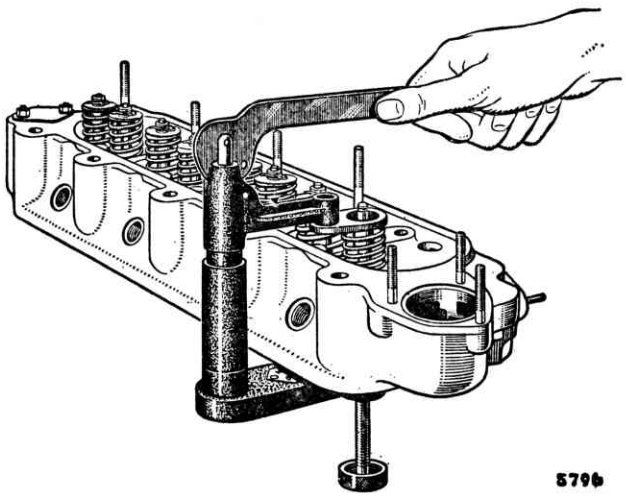


Fig. A.5

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

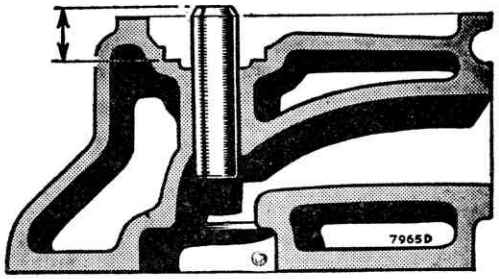


Fig. A.6

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

and occasionally allowed to rise by the pressure of the light coil spring. This assists in spreading the paste evenly over the valve face and seat. It is necessary to carry out the grinding operation until a dull, even, 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.11 for details of valve refitting.

Section A.13

VALVE GUIDES

Removing

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

Remove the appropriate valve and spring as in Section A.11. Rest the cylinder head with its machined face downwards on a clean surface and drive the valve guide downwards into the combustion space with a suitable-sized drift. This should take the form of a hardened-steel punch $\frac{7}{16}$ in. (11 mm.) in diameter and not less than 4 in. (10 cm.) in length, with a locating spigot $\frac{9}{32}$ in. (7·1 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 mm.) above the machined surface of the valve spring seating (see Fig. A.6).

Section A.14

TAPPETS

Removing

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

Remove the manifold (see Section A.6).

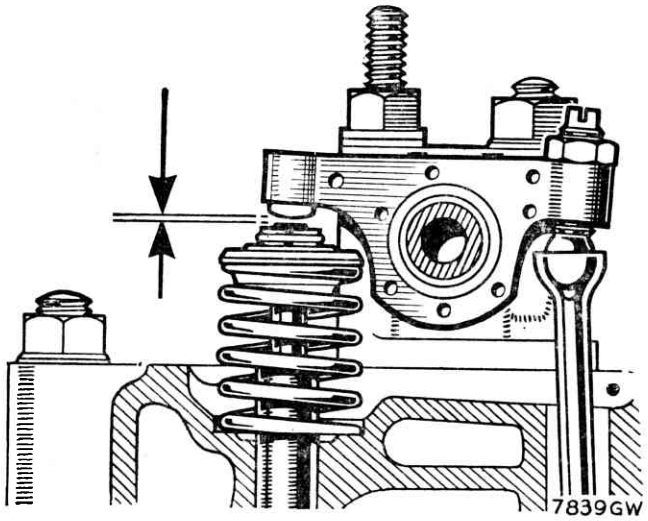


Fig. A.7

●*Check the clearance between the valve stem and the valve rocker as indicated above*●

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

Fitting

Refitting is a reversal of the removal sequence.

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

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

Section A.15

VALVE ROCKER ADJUSTMENT

●Adjust at the periods recommended in the Passport to Service or Driver's Handbook.

Adjustment

(1) Remove the rocker cover.

(2) Remove the sparking plugs, engage top gear and push the car forward, or jack up one side of the front suspension and rotate the road wheel to turn the crankshaft.

(3) Rotate the crankshaft until the valve being checked has its tappet resting opposite the peak on the camshaft, i.e. valve is completely closed. This cannot be observed accurately, therefore if checking is carried out according to the adjustment chart, this will avoid turning the crankshaft more than is necessary. The valve rocker clearance is given in **'GENERAL DATA'.**

(4) Hold the adjusting screw against rotation while slackening the locknut, insert the feeler gauge and turn the adjustment screw until the gauge is a sliding fit (see Fig. A.7), tighten the locknut and recheck the clearance.

(5) Refit the rocker cover with a new joint washer if necessary, refit the sparking plugs and lower the car if jacked up.●

Adjust	No.	1	rocker	with	No.	8	valve	fully	open
,,	,,	3	,,	,,	,,	6	,,	,,	,,
,,	,,	5	,,	,,	,,	4	,,	,,	,,
,,	,,	2	,,	,,	,,	7	,,	,,	,,
,,	,,	8	,,	,,	,,	1	,,	,,	,,
,,	,,	6	,,	,,	,,	3	,,	,,	,,
,,	,,	4	,,	,,	,,	5	,,	,,	,,
,,	,,	7	,,	,,	,,	2	,,	,,	,,

Section A.16

DISTRIBUTOR DRIVING SPINDLE

Removing

Remove the distributor as detailed in Section B.6.

Take out the screw securing the distributor housing to the cylinder block and carefully withdraw the housing to avoid damage to the 'O' ring seal (later models only).

Screw a $\frac{5}{16}$ in. UNF. bolt approximately $3\frac{1}{2}$ in. (9 mm.) long into the tapped end of the distributor drive spindle and withdraw the spindle.

Refitting

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

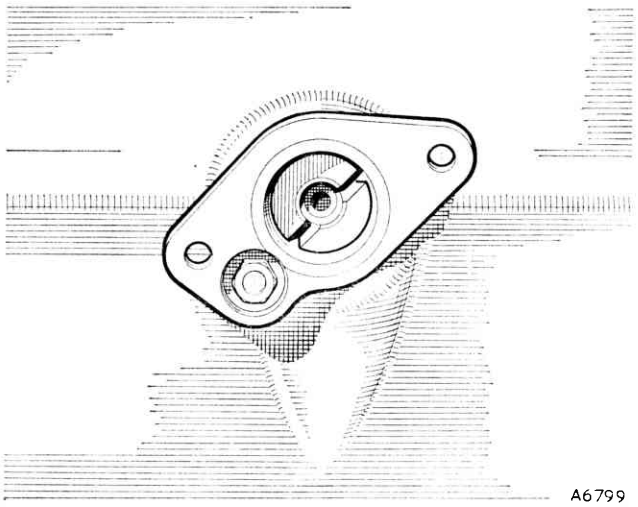


Fig. A.8

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

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

Remove the bolt from the gear and insert the distributor ensuring that the 'O' ring seal, if fitted, is not damaged. Secure the housing with the special screw and washer, and ensure that the head of the screw does not protrude above the face of the housing.

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

Section A.17

FLYWHEEL AND CLUTCH

Removing

Disconnect the leads from the starter solenoid switch, extract the two mounting screws, and remove the switch from the flywheel housing.

Remove the starter as in Section N.5.

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

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

Remove the exhaust pipe clamp, the radiator cowling steady bracket, and disconnect the engine steady from the cylinder block.

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

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

Tap back the locking washers, undo the three retaining nuts and remove the clutch thrust plate from the pressure spring housing.

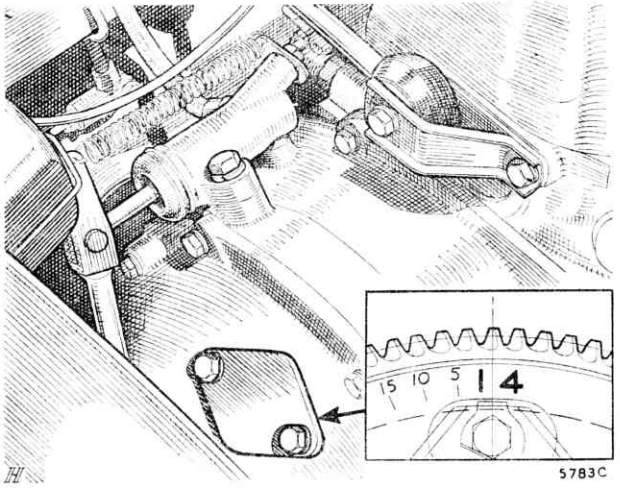


Fig. A.9

The timing marks on the flywheel can be seen with the aid of a mirror after removing the inspection cover. T.D.C. position is indicated by the mark '1/4'. Marks giving 5°, 10°, and 15° B.T.D.C. are also provided

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

Knock up the locking washer and slacken off the flywheel retaining screw three or four threads. Use service tool 18G 304 together with adaptor set 18G 304 M to break the flywheel away from its seating on the taper of the crankshaft.

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

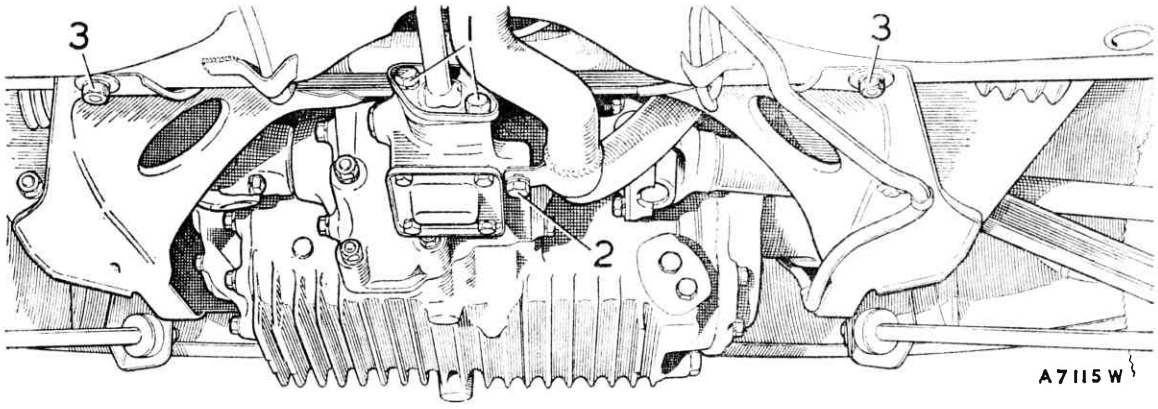


Fig. A.10

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

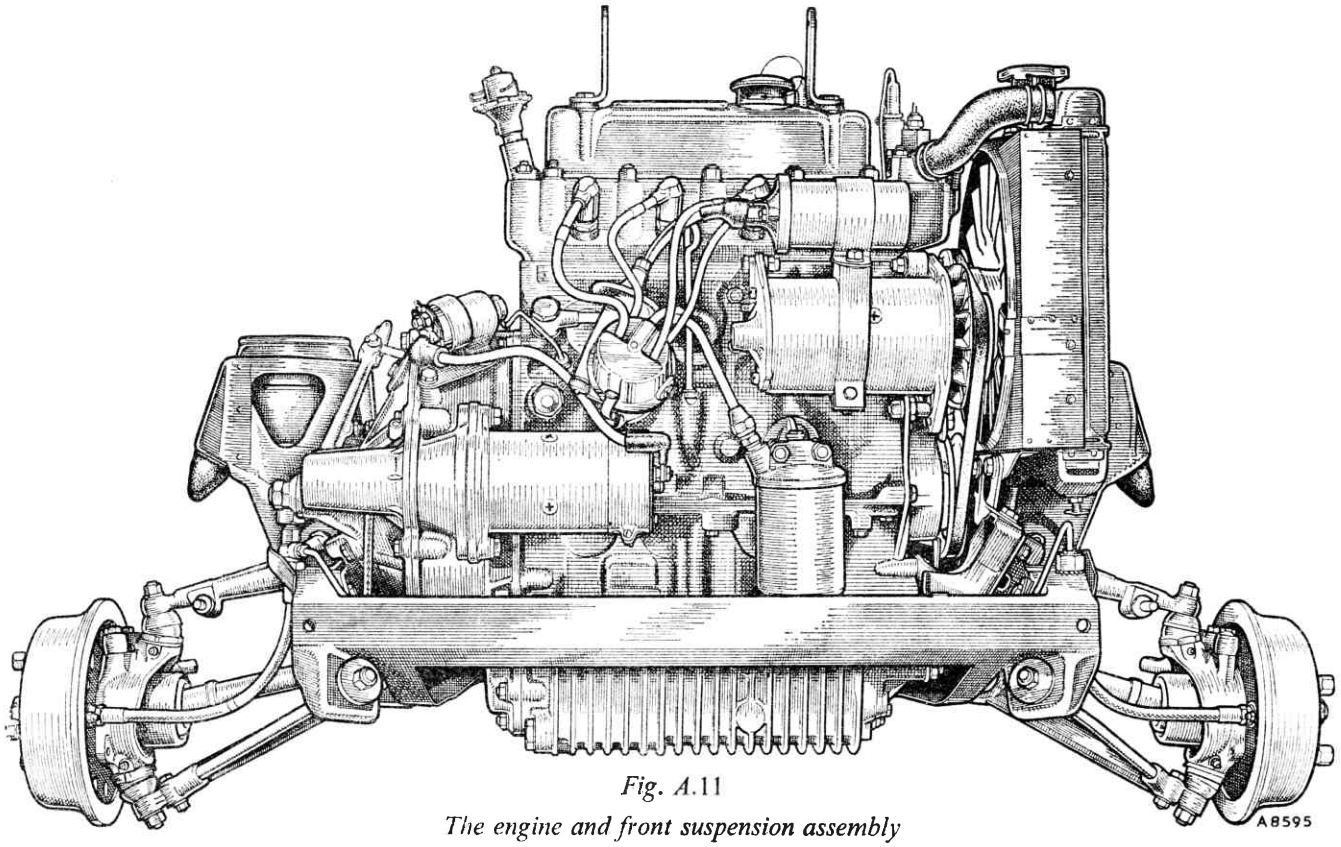


Fig. A.11
The engine and front suspension assembly

removal operation to prevent oil from this source wetting the clutch facings.

Screw the three studs from the adaptor set into the flywheel through the recessed holes in the clutch spring housing. Fit the plate of tool 18G 304 over the three studs and screw the nuts onto the studs, screwing them down evenly so that the plate remains parallel with the flywheel. Insert the short centre screw and withdraw the flywheel. Remove the extractor immediately the taper is broken.

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

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

Refitting is a reversal of the removal procedure.

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

Later Mk. I engines and all Mk. II engines have non-lubricated bushes in the crankshaft primary gear, and the flywheel oil seal is not fitted.

The crankshaft primary gear splines should be lightly wiped with Duckham's MB grease.

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

Section A.18

FRONT SUB-FRAME AND ENGINE ASSEMBLY

Removing

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

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

Detach the earth lead from the battery.

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

Disconnect the heater inlet and outlet hoses.

Remove the carburetter as in Section A.4.

Disconnect the oil pressure gauge pipe at the rubber connector on the engine.

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

Remove the speedometer cable from the speedometer.

Elf

Open the glovebox lids and pull back the glovebox trimming covering the sides of the instrument panel. This trimming is held in position at this point by a snap fastener located at its top rear corner.

Remove the Phillips screw retaining the speedometer to the bracket on either side of the instrument panel. Press the speedometer forwards until the knurled cable retaining nut is accessible from under the bonnet. Unscrew the nut and detach the cable from the speedometer.

Hornet

The knurled cable retaining nut is accessible from under the bonnet. Unscrew the nut and detach the cable from the speedometer.

Elf and Hornet

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

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

Support the body with suitable slings underneath each front wing.

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

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

Remove the telescopic dampers (rubber suspension models only).

Remove the steering rack ball end retaining nuts and release the joint with Service tool 18G 1063.

Depressurize and evacuate the models fitted with Hydrolastic suspension, Section H.8, and disconnect both hoses.

Support the engine beneath the transmission casing.

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

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

Removing engine from sub-frame

Drain the oil from the transmission casing.

Disconnect the drive shafts at the differential.

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

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

Refitting

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

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

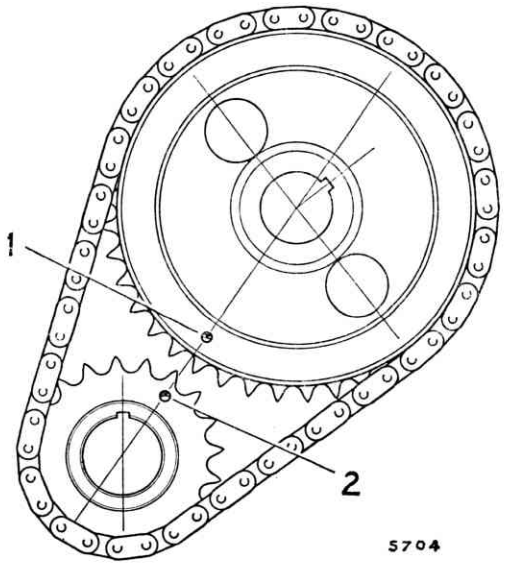


Fig. A.12

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

Tighten the steering-arm ball joint nut to the correct torque loading (see **'GENERAL DATA'**).

Bleed the hydraulic brake system when reassembly is completed.

Section A.19

TIMING COVER

Removing

Remove the radiator as in Section C.3.

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

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

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

Refitting

Reverse the removal procedure when refitting the cover.

The oil seal in the cover must be renewed if it shows signs of damage or deterioration. Use Service tool 18G 134 with adaptor 18G 134 BD. A new cover gasket should also be fitted.

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

When refitting the cover it is important to ensure that the seal is centralized on the crankshaft and Service tool 18G 138 is available for the purpose.

If a rubber seal is fitted to the cover fill the annular groove between the lips with grease.

In the absence of the tool, the crankshaft pulley can be used as follows.

Lubricate the hub of the pulley and push it into the seal, at the same time turning it to avoid damaging the felt or the lips of a rubber seal. Slide the pulley onto the shaft with the keyway in line with the key in the crankshaft. Turn the cover as necessary to align the set screw holes with those in the crankcase taking care not to strain the cover against the flexibility of the seal; insert

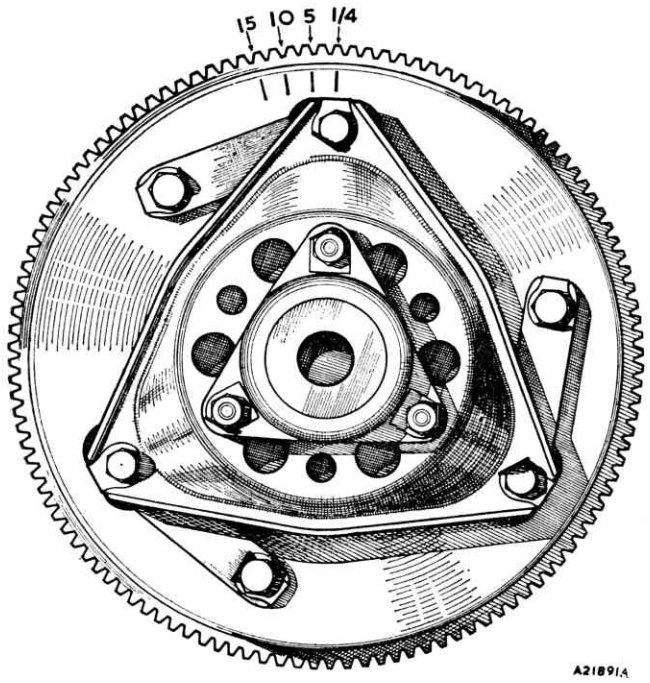


Fig. A.13

The flywheel and clutch assembly, showing the position of the 15°, 10°, *and* 5° *B.T.D.C. and the* 1/4 *T.D.C. markings*

the cover set screws and tighten up. Refit and tighten the pulley securing screw and locking washer.

Section A.20

TIMING GEARS

Removing

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

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

The camshaft and crankshaft chain wheels may now be removed, together with the timing chain, by easing 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 found when dismantling unless new camshaft or crankshaft components have been fitted which will disturb the alignment of the two gear wheels. To determine the thickness of washers required place a straight-edge across the sides of the camshaft wheel teeth and measure with a feeler gauge the gap between the straight-edge and the crankshaft gear.

When replacing the timing chain and gears set the crankshaft with its keyway at T.D.C. and the camshaft with its keyway approximately at the one o'clock position as seen from the front. Assemble the gears into the timing chain with the two marks on the gear wheels opposite to each other, as in Fig. A.12. 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.

Refit the early type oil thrower concave side forward or the later type thrower with the face marked 'F' facing forward. Reassemble the remaining components as detailed in Sections A.19 and A.44.

Section A.21

VALVE TIMING

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

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

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

Section A.22

FLYWHEEL HOUSING

Removing

Remove the engine as in Section A.34.

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

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

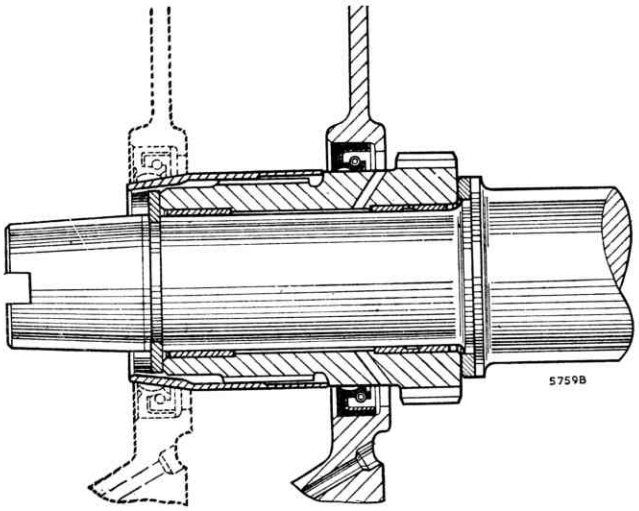


Fig. A.14

●*The Service tool* 18G 1043 *positioned over the clutch splines of the crankshaft primary gear to prevent damage to the lip of the oil seal*●

Extra care must be taken when withdrawing the housing to avoid damaging the lips of the oil seal on the clutch plate splines of the crankshaft primary gear. The sleeve shown in Fig. A.14 must be pushed over the gear splines and held firmly in this position while the housing is withdrawn.

Refitting

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

●Fit the crankshaft primary gear inner thrust washer with its chamfered bore against the crankshaft flange.

Check the primary gear running clearance as detailed in Section A.38.

Thoroughly clean the joint faces of the cylinder block, transmission casing, and the flywheel housing. Fit a new joint washer as supplied by BMC Service Ltd.; this is most important.

Renew the crankshaft primary gear oil seal if it shows signs of damage or oil leakage, using Service tool 18G 134 and adaptor 18G 134 BC. This operation requires great care. The oil seal can also be renewed without removing the housing or draining the engine/transmission unit (see Section A.45). Damaged seals can be detected by careful examination of the sealing knife edge. If the engine has covered a large mileage new seals should be fitted as a matter of routine. Pack the first motion shaft bearing rollers with grease to prevent them falling out of position as the housing is being refitted. Fit Service tool 18G 1043 over the splines of the primary gear to prevent damage to the red silicon rubber oil seal (see Fig. A.14). The earlier protector sleeve 18G 570 **must not** be used with the silicon rubber seal.●

The lips of the oil seal must be lubricated before using the Service tool.

The two pilot bars supplied as part of each tool set should be screwed into the two bottom tapped holes in the crankcase to pilot the housing into position and take the weight off the lip of the seal.

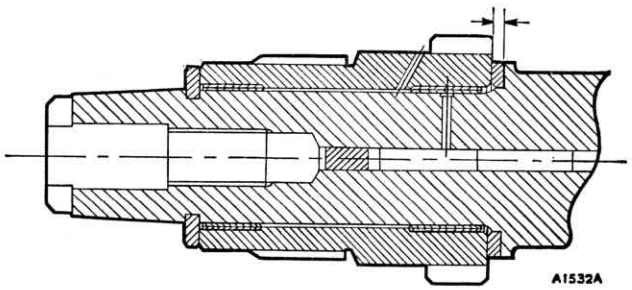


Fig. A.15

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

When gap is	*Use washer thickness*	*Part No.*
·1295 to ·1315 in. (3·27 to 3·34 mm.)	·125 to ·127 in. (3·17 to 3·22 mm.)	22A 83
·1315 to ·1335 in. (3·34 to 3·39 mm.)	·127 to ·129 in. (3·22 to 3·27 mm.)	22A 238
·1335 to ·1345 in. (3·39 to 3·42 mm.)	·129 to ·131 in. (3·27 to 3·32 mm.)	22A 239

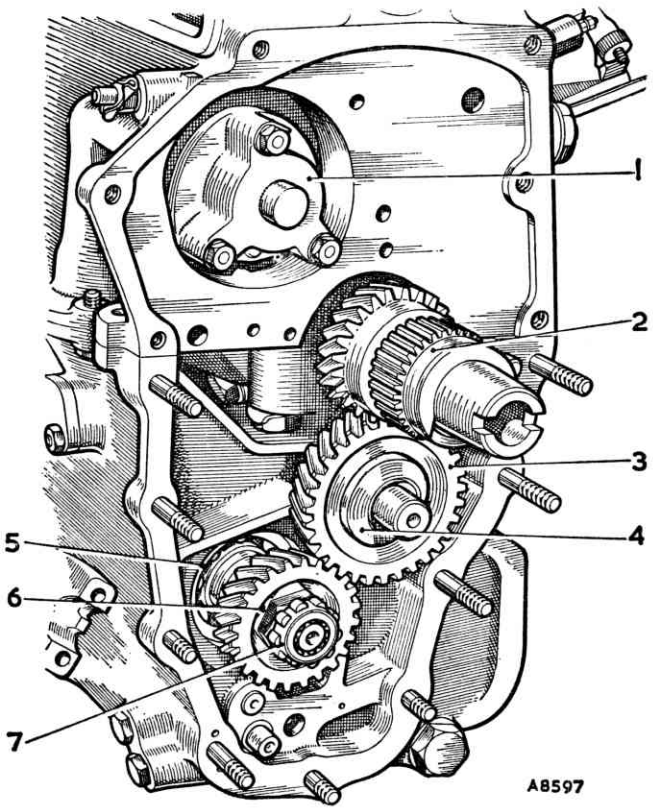


Fig. A.16

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

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

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

The flywheel housing bolts and stud nuts should be tightened to the correct torque tightness (see **'GENERAL DATA'**). This degree of tightness gives the desired compression of the gasket to obtain a compressed thickness of ·030 in. (·76 mm.). There is a small cut-away in the housing gasket which enables a feeler gauge to be inserted between the two machined faces to check that the gasket has been compressed to its correct thickness.

Section A.23

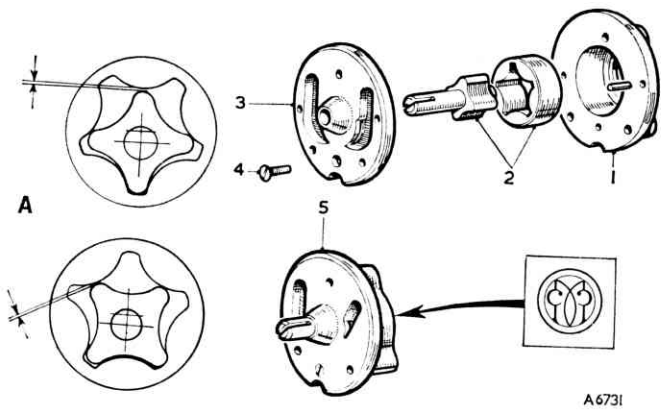
TRANSMISSION

Removing

Remove the engine as detailed in Section A.34.

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

Remove the two screws retaining the lower radiator mounting bracket to the engine mounting.



●*Fig. A.17*

Two types of oil pump which may be fitted to this engine. 'A' indicates the lobe positions for checking clearances

Hobourn-Eaton
1. Body
2. Shaft and rotor.
3. Cover.
4. Screw—cover to body.

Concentric (Engineering) Ltd.
5. Pump (serviced as an assembly only).

Remove the starter motor.

Remove the flywheel housing as in Section A.22.

Withdraw the 10 set screws and 2 nuts from the flange of the transmission case, taking due note of the length of the screws and the position in which the shorter screws are fitted. Lift the engine with suitable lifting equipment to separate the engine from the transmission case.

Details of dismantling are given in Section F.1.

Refitting

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

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

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

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

Ensure that the front bearing cork oil seal, or the moulded rubber type seal as fitted to later engines remains correctly positioned as the engine is being lowered onto the casing.

Section A.24

OIL PUMP

●

Removing

(1) Remove the engine as detailed in Section A.34.

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

(3) Bend back the lock washers, remove the bolts securing the pump to the crankcase, and withdraw the pump.

Dismantling and reassembling (Hobourn-Eaton)

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

(5) Install the rotors in the pump body.

(6) Place a straight-edge across the joint face of the pump body, and measure the clearance between the top face of the rotors and the underside of the straight-edge. The clearance should not exceed ·005 in. (·127 mm.). In cases where the clearance is excessive this may be remedied by removing the two cover locating dowels and lapping the joint face of the pump body.

(7) Install the rotors in the pump body and measure the clearance between the rotor lobes when they are in the position shown in Fig. A.17. If the clearance is in excess of ·006 in. (·152 mm.) the rotors must be renewed.

(8) Reassembly is a reversal of the dismantling procedure.

(9) After reassembling check the pump for freedom of action.●

Refitting

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

Section A.25

CAMSHAFT (Mk. I)

Removing

Remove the engine as detailed in Section A.34.

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

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

Withdraw the push-rods, remove the tappet covers, and lift out the tappets (Section A.14).

●Remove the distributor driving spindle as in Section A.

Remove the distributor as in Section B.●

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

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

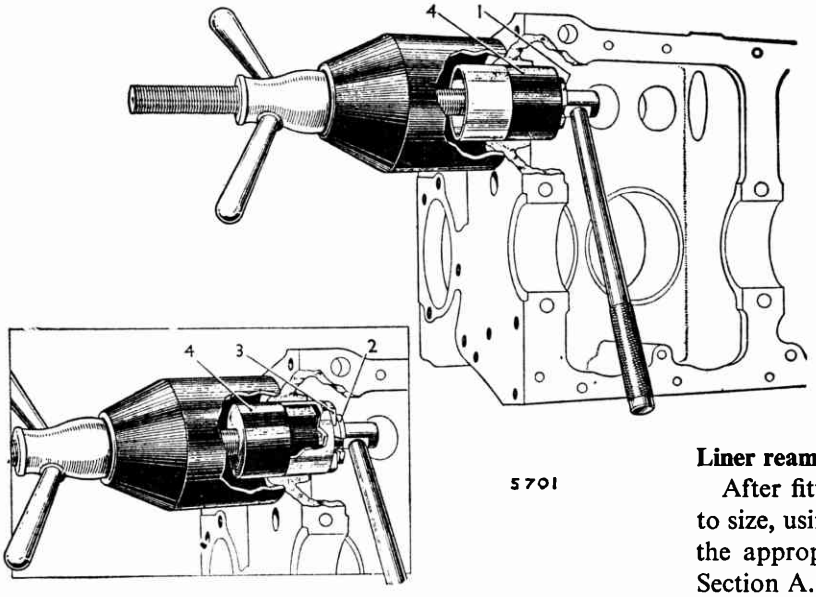


Fig. A.18

Removing a camshaft front liner, using adaptor 18G 124 K in conjunction with Service tool 18G 124 A. Inset shows the bearing being replaced

1. 'C' washer.
2. 'C' washer.
3. 'D' washer.
4. Adaptor 18G 124 K.

Removing a liner

A worn liner can be removed and a new liner pulled into the cylinder block with Service tool 18G 124 A together with adaptor 18G 124 K.

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

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

Liner fitting

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

Liner reaming

After fitting a new front liner it must be line-reamed to size, using Service tool 18G 123 A in conjunction with the appropriate pilots and cutter shown at the end of Section A.

Fit the pilots 18G 123 AH and 18G 123 AJ into the centre and rear camshaft bearing bores, push the cutter onto the arbor of tool 18G 123 A, and locate it in position No. 8. A peg retained in the centre groove of the cutter by a spring clip will locate in the arbor to hold the cutter in the desired position. The cutter is made up of a combined roughing and finishing cutter, and care must be taken to ensure that it is placed on the arbor with the relieved flutes of the roughing cutter to enter the liner first.

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

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

NOTE.—The cutter must not be brought through the reamed hole on the arbor.

Refitting

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

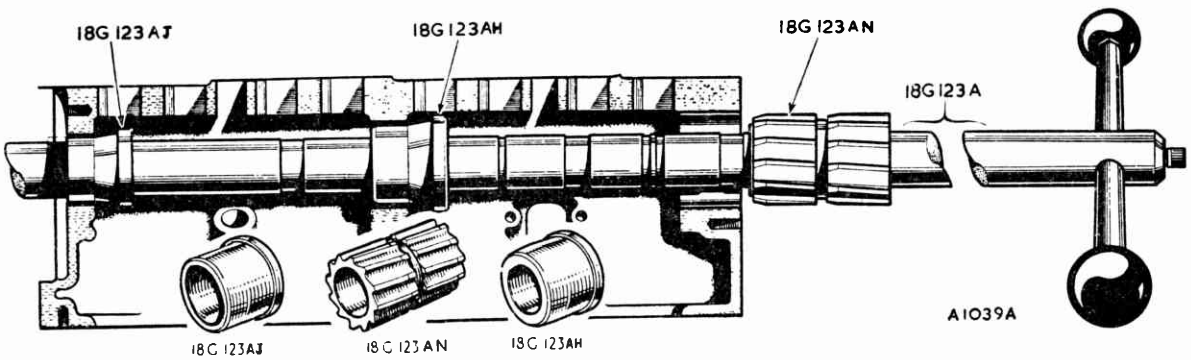


Fig. A.19

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

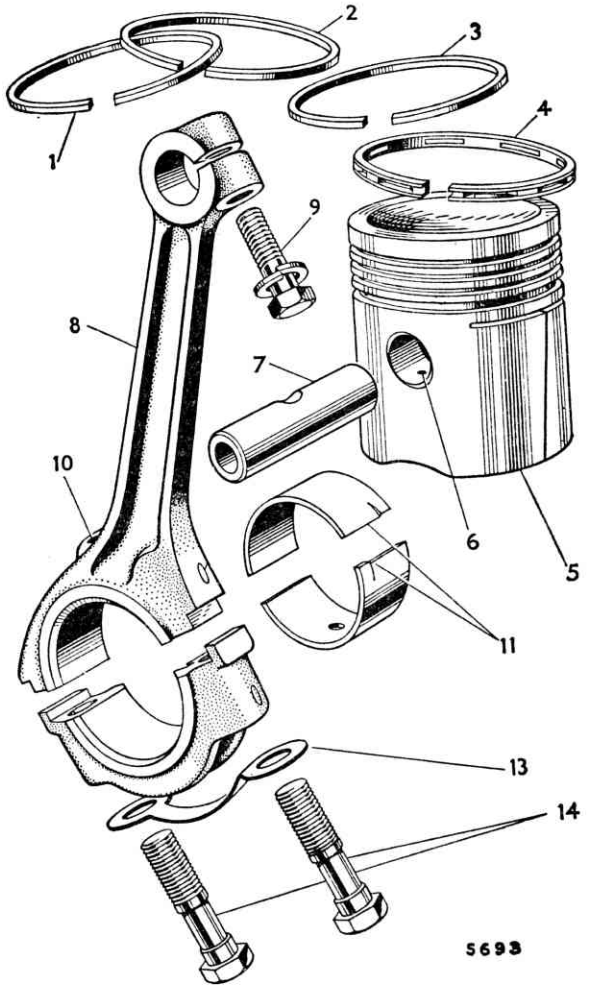


Fig. A.20

A connecting rod and piston assembly (Mk. I)

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

Section A.26

PISTONS AND CONNECTING RODS (Mk. I)

Removing

Drain the transmission casing and external oil filter.

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

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

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

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

Dismantling

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

Before the piston and gudgeon pin can be dismantled from the connecting rod it is necessary to remove the clamp screw. To enable the assembly to be held in a vice for this operation without damage, special holding plugs should be inserted in each end of the gudgeon pin (see Fig. A.21).

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

Reassembling

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

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

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

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

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

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

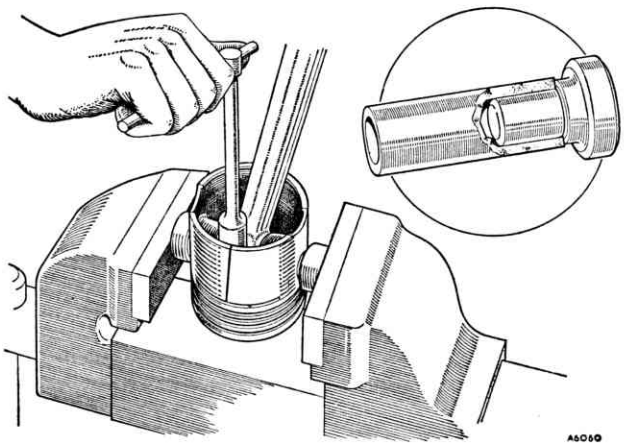


Fig. A.21

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

Refitting

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

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

Refit the big-end bearings in their original positions.

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

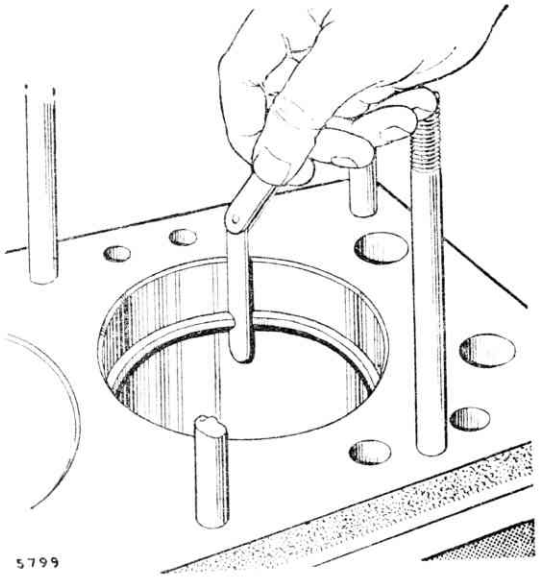


Fig. A.23
Checking the piston ring gap

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. Care must be taken not to remove any metal or side-play between the ring and the groove will result, with consequent excessive oil consumption and loss of gastightness.

The cylinder bore glazing should be removed before fitting new rings to a worn cylinder bore, using equipment specially designed for this purpose.

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. (2·5 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.

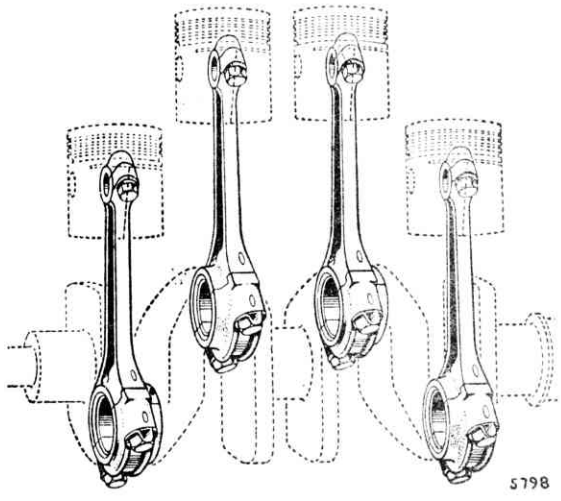


Fig. A.22
The correct assembly of connecting rods to the pistons and crankshaft

Section A.28

PISTON SIZES AND CYLINDER BORES (Mk. I)

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. (·5 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 main bearings. The end-float is controlled by a thrust washer fitted on both sides of the centre main bearing.

Removing

Drain the transmission casing and external oil filter.

Remove the engine as in Section A.34.

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

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

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

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

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

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

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

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

Inspecting

Inspect the crankcase main journals and crankpins for wear, scores, scratches, and ovality. If necessary, the crankshaft may be reground to the minimum limit 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 fuel or paraffin (kerosene). When clean, inject a thin 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 cap, and **on no account should they be filed to take up wear or to reduce running clearance.**

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

Refitting

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

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

Section A.30

CRANKSHAFT PRIMARY GEAR
(Lubricated Bushes)

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

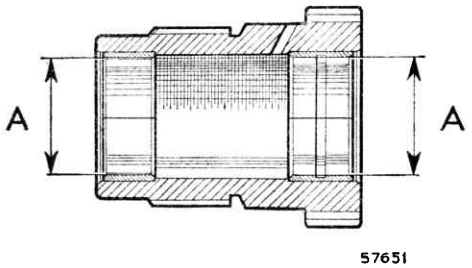


Fig. A.24

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

Should the bushes fitted to the bore of the gear become worn, they can be removed and new bushes pressed into position. Burnish-ream in line to the dimensions given in Fig. A.24.

When refitting, make certain that the correct running clearance of ·003 to ·006 in. (·08 to ·15 mm.) is maintained between the inner face of the 'C' washer and the primary gear. If the clearance is outside these limits, select and fit the appropriate washer from the size range shown under the caption to Fig. A.15.

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

Section A.31

VALVE SEAT INSERTS (Mk. I)

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.25. Each insert should have an interference fit of ·0025 to ·0045 in. (·063 to ·114 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.25. Normal valve-grinding may be necessary to ensure efficient valve-seating.

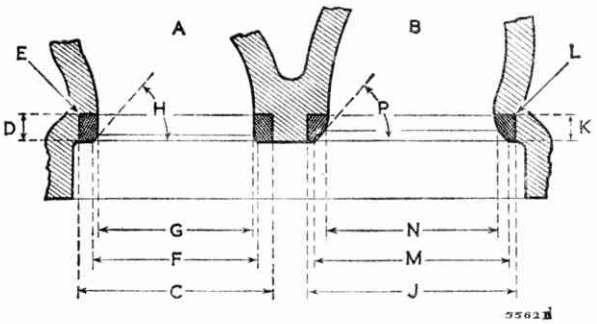


Fig. A.25

Valve seat machining dimensions (Mk. I)

Exhaust (A)	Inlet (B)
C. 1·124 to 1·125 in. (28·55 to 28·58 mm.).	J. 1·187 to 1·188 in. (30·16 to 30·17 mm.).
D. ·186 to ·188 in. (4·72 to 4·77 mm.).	K. ·186 to ·188 in. (4·72 to 4·77 mm.).
E. Maximum radius ·015 in. (·38 mm.).	L. Maximum radius ·015 in (·38 mm.).
F. 1·0235 to 1·0435 in. (25·99 to 26·50 mm.).	M. 1·0855 to 1·1055 in. (27·58 to 28·07 mm.).
G. ·906 to ·912 in. (23 to 23·152 mm.).	N. 1·000 to 1·006 in. (25·4 to 25·55 mm.).
H. 45°.	P. 45°.

Section A.32

FLYWHEEL STARTER RINGS

To remove the old starter ring from the flywheel flange split the ring gear with a cold chisel, taking care not to damage the flywheel. Make certain that the bore

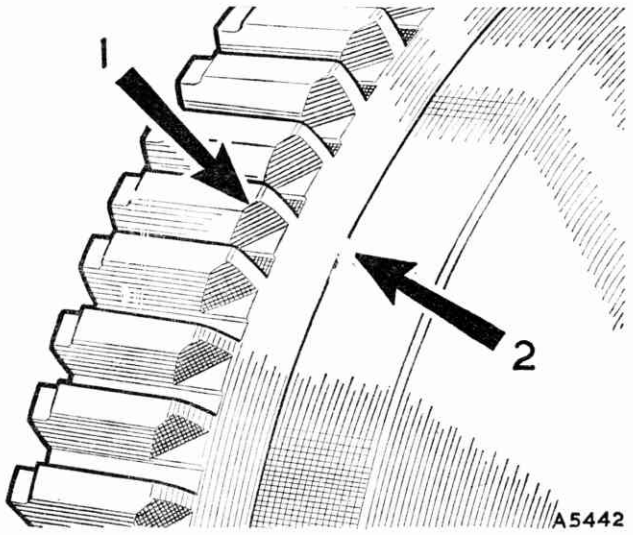


Fig. A.26

The starter ring showing the lead on the teeth (1) *facing towards the flywheel register* (2)

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. Do not exceed this temperature, otherwise the temper of the teeth will be affected. The use of a thermostatically controlled furnace is recommended. Place the heated ring on the flywheel with the lead of the ring teeth 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.33

CYLINDER LINERS

Should the condition of the cylinder bores be such that they cannot be cleaned up to accept standard oversize pistons, dry cylinder liners can be fitted. This operation may be carried out by the use of specialized proprietary equipment or with a power press using pilot adaptors to the dimensions shown in Fig. A.27. The press must be capable of 3 tons (3048 kg.) pressure to fit new liners and 5 to 8 tons (5080 to 8128 kg.) to remove old liners.

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

Removing worn liners

Place the cylinder block face downwards on suitable wooden supports on the bed of the press, making sure

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*
Mk. I (848 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.)
Mk. II (998 c.c.)	12G 164	2·64075 to 2·64125 in. (67·076 to 67·099 mm.)	2·64325 to 2·644 in. (67·139 to 67·158 mm.)	·002 to ·00325 in. (·05 to ·08 mm.)	2·542 to 2·5435 in. (64·571 to 64·608 mm.)

that there is sufficient space between the block and the bed of the press to allow the worn liner to pass down. Insert the pilot in the bottom of the liner and carefully press the liner from the bore.

Pressing in new liners

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

Each liner must be machined to the dimensions given in the accompanying table after pressing into position.

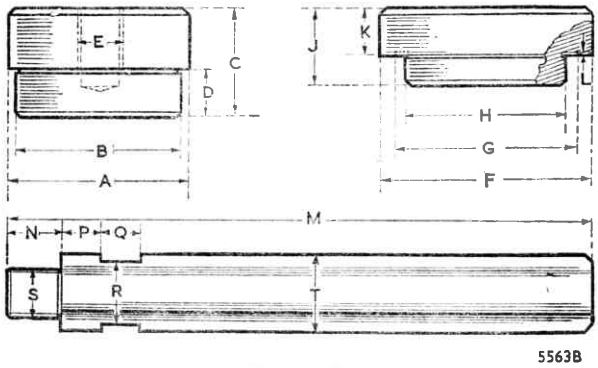


Fig. A.27

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.)

Pressing-out pilot (Mk. I)

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

Pressing-in pilot (Mk. I)

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

Pressing-out pilot (Mk. II)

A. $2\frac{5}{8}$ $^{+\cdot005}_{-\cdot0}$ in. (66·68 $^{+\cdot127}_{-\cdot0}$ mm.).
B. 2·537 $^{+\cdot0}_{-\cdot005}$ in. (64·44 $^{+\cdot0}_{-\cdot127}$ mm.).
C. $1\frac{3}{4}$ in. (44·45 mm.).
D. $\frac{3}{4}$ in. (19·05 mm.).
E. $\frac{3}{4}$ in. B.S.W. thread.

Pressing-in pilot (Mk. II)

F. $3\frac{1}{16}$ in. (77·79 mm.).
G. $2\frac{11}{16}$ in. (69·26 mm.).
H. 2·515 $^{+\cdot0}_{-\cdot005}$ in. (63·88 $^{+\cdot0}_{-\cdot127}$ mm.).
J. $1\frac{1}{4}$ in. (31·75 mm.).
K. $\frac{3}{4}$ in. (19·05 mm.).
L. ·015 in. (·38 mm.).

Pilot extension (Mks. I and II)

M. $10\frac{1}{2}$ in. (26·67 cm.).
N. $\frac{7}{8}$ in. (22·22 mm.).
P. $\frac{5}{8}$ in. (15·87 mm.).
Q. $\frac{5}{8}$ in. (15·87 mm.).
R. 1 in. (25·4 mm.) flats.
S. $\frac{3}{4}$ in. B.S.W. thread.
T. $1\frac{1}{4}$ in. (31·75 mm.).

Section A.34

ENGINE REMOVAL
(Without Sub-frame)

The engine can be removed through the bonnet aperture, leaving the sub-frame in the body. This operation is greatly facilitated if a pit is available.

Removing

Disconnect the earth lead from the battery, drain the water from the engine and radiator, and remove the bonnet.

Remove the fresh-air heater motor, if fitted, and disconnect the controls.

When no pit is available put the rear wheels on blocks, support the body either side near the jacking points at a sufficient height to enable work to be carried out under the car. Put a support under the front of the front sub-frame at its centre.

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

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

Disconnect the exhaust system from its fixing point on the transmission casing.

Remove the nuts from the 'U' bolts securing the universal joints to the differential drive flanges and extract the 'U' bolts.

Remove the right-hand front wheel and disconnect the tie-rod end from the steering lever.

Disconnect the top and bottom swivels from the suspension arms and partly withdraw the hub and drive shaft on the right-hand side only.

Place a support under the hub assembly to prevent damage to the hydraulic hose.

Disconnect the heater hoses and the electrical connections on the coil, dynamo, distributor, and temperature gauge element. Remove the starter cable from the starter motor terminal, unscrew the screws retaining the starter solenoid switch bracket to the flywheel housing, and lower the switch complete with cables to the ground clear of the engine.

Disconnect the plug leads from the plugs, the lead from the coil, and remove the distributor cap. Disconnect and remove the horn. Slacken the retaining clip and pull off the rubber oil gauge pipe connector.

Disconnect the accelerator and choke cables and remove the carburetter (Section A.4).

Remove the screw securing the engine earth strap to the right-hand wing valance, and unscrew and detach the speedometer cable from the back of the instrument as described in Section A.18.

Release the clutch slave cylinder return spring, unscrew the two slave cylinder securing screws, withdraw the slave cylinder from the push-rod, and secure the cylinder to the engine bulkhead clear of the engine.

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

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

Remove the valve rocker cover and cover gasket.

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

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

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

NOTE.—Where a pit is available it will not be necessary to raise the car on supports, but the right-hand side must be supported to withdraw the drive shaft.

Refitting

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

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

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

Section A.35

ENGINE MOUNTINGS

Removing

Left-hand mounting

Remove the radiator as in Section C.3.

Support the engine to take the weight off the mountings.

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

Right-hand mounting

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

Refitting

Refitting is a reversal of the removal procedure.

Section A.36

FIRST MOTION SHAFT OUTER RACE

Removal

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

Use Service tool 18G 617 A to remove the outer race from the housing. Dismantle the tool by removing the threaded centre holding pin, operating nut, washer, and outer sleeve. Insert the centre assembly of the tool into the race so that the lips of the collet register evenly under the lower edge of the race. Tighten the adjusting nut to expand the collet into the race. **Do not overtighten.** Refit the outer sleeve, washer, operating nut, and the holding pin. Hold the centre of the tool by the holding pin and tighten down the operating nut to withdraw the race from the housing.

This operation may also be carried out using Service tool 18G 617 B with the sleeve from the original Service tool 18G 617.

Refitting

When refitting an outer race expand the flywheel housing as previously described and position the race squarely in the mouth of the bore of the housing with the flywheel housing resting on a flat wooden surface. Using the driver portion of Service tool 18G 617 A, gently drift or press in the race until the top edge is just sufficiently clear of the ring groove to enable the spring ring to be refitted.

Refit the spring ring and lightly oil the race.

Section A.37

CAMSHAFT BEARINGS (Mk. II)

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 the special camshaft liner removing and replacing tool, Service tool 18G 124 A, together with the appropriate adaptors. New bearings must be reamed to give the correct running clearance (see **'GENERAL DATA'**), and the use of the special camshaft liner reamer tools is essential.

Removing the centre liner

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.

Removing the front and rear liners

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 camshaft liners

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

Front and rear liners

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. Adaptor 18G 124 K is positioned in the front liner to act as a pilot.

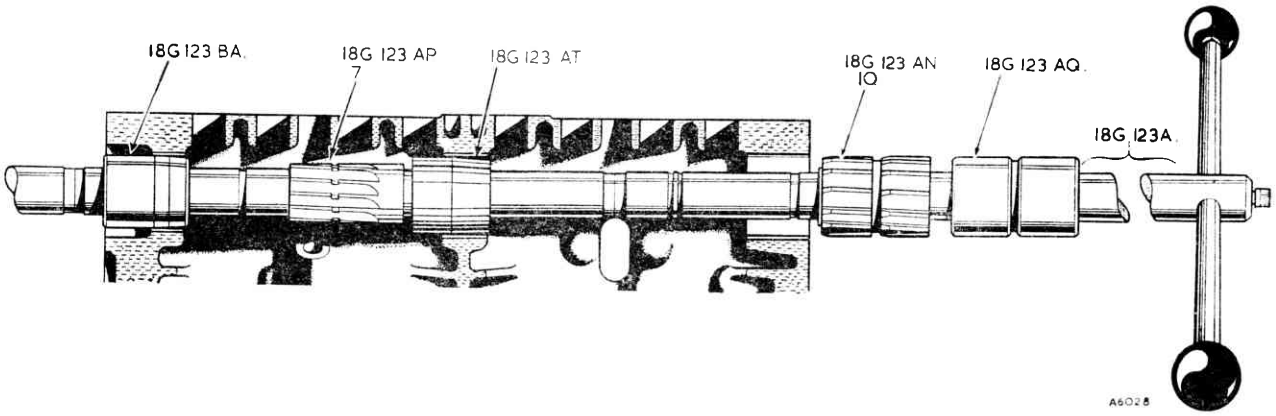


Fig. A.28

The camshaft reaming tool with the pilots and reamers positioned to ream the front and rear liners

Centre liner

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 camshaft liners

IMPORTANT.—It is essential that the cutter flutes are kept clear of swarf at all times during the cutting operations, preferably with air-blast equipment. The cutter should

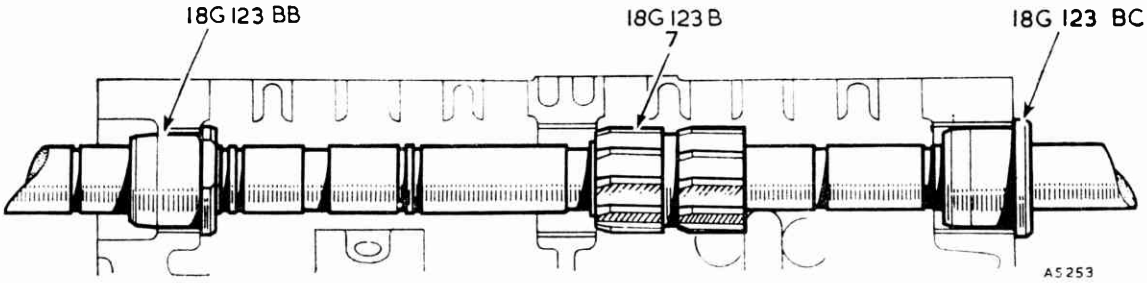


Fig. A.29

The camshaft liner reamer and pilots in the correct position for reaming the centre liner

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 liners

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 liner

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 18G 123 B 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.

Section A.38

CRANKSHAFT PRIMARY GEAR (Non-lubricated Bushes)

Follow the flywheel housing removal procedure given in Section A.22 to gain access to the primary gear. Extract the retaining 'C' washer and backing washer and withdraw the gear from the crankshaft, together with the front and rear thrust washers.

When refitting, make certain that the correct running clearance of ·0035 to ·0065 in. (·008 to ·164 mm.) is maintained between the inner thrust washer and the primary gear. If the clearance is outside these limits, select and fit the appropriate washer from the size range shown under the caption to Fig. A.30.

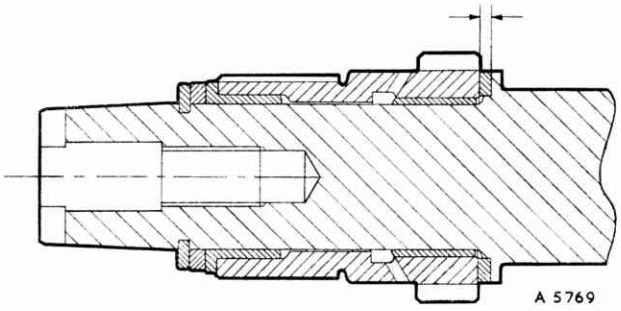


Fig. A.30

The correct running clearance at the gap indicated must be obtained by fitting the appropriate thrust washer

When gap is	*Fit washer thickness*
·1175 to ·119 in. (2·875 to 3·025 mm.).	112 to ·114 in. (2·848 to 2·898 mm.).
·119 to ·121 in. (3·025 to 3·076 mm.).	·114 to ·116 in. (2·898 to 2·949 mm.).
·121 to ·123 in. (3·076 to 3·127 mm.).	·116 to ·118 in. (2·949 to 3·00 mm.).
·123 to ·125 in. (3·127 to 3·18 mm.).	·118 to ·120 in. (3·00 to 3·05 mm.).

Section A.39

PISTONS AND CONNECTING RODS (Mk. II)

Should the piston or connecting rod suffer damage or the small-end bush require renewal, the piston 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

Remove the pistons and connecting rods as described in Section A.26.

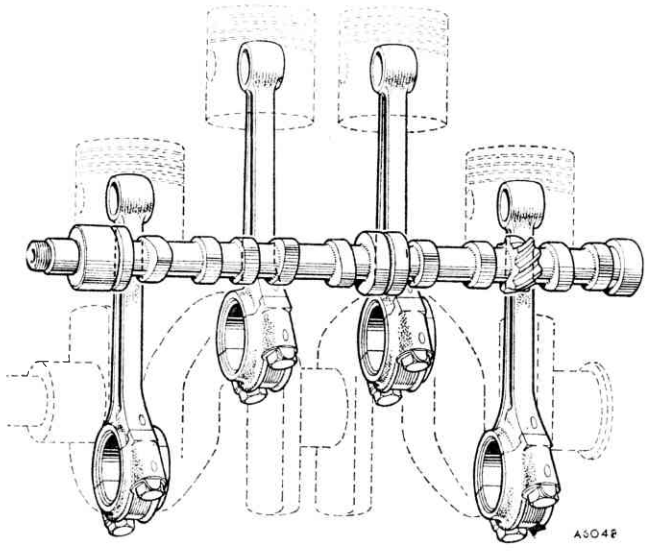


Fig. A.31

The correct assembly of the connecting rods and pistons to the crankshaft

Dismantling

The gudgeon pins are fully floating; remove the two circlips locating each pin and push the pins out. It is essential that the piston assemblies should be replaced in their own bores and fitted in their original positions; 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.

Refitting

Replacement of the piston and connecting rod is a direct reversal of the removing procedure, but the piston ring gaps should be set at 90° to each other.

It is essential that each connecting rod and piston assembly should be replaced in its own bore and fitted in its original position.

Refit the big-end bearings in their original positions.

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

Section A.40

PISTON SIZES AND CYLINDER BORES (Mk. II)

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

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

In addition to the standard piston and connecting rod assemblies there is a range of two oversize piston and connecting rod assemblies 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. (·50 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 piston and connecting rod assemblies differing in size from those removed during dismantling, ensure that the size of the piston fitted is stamped clearly on the top of the cylinder block alongside the appropriate cylinder bore (see Fig. A.32).

Piston and connecting rod assemblies are supplied in the sizes indicated in the following table:

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.

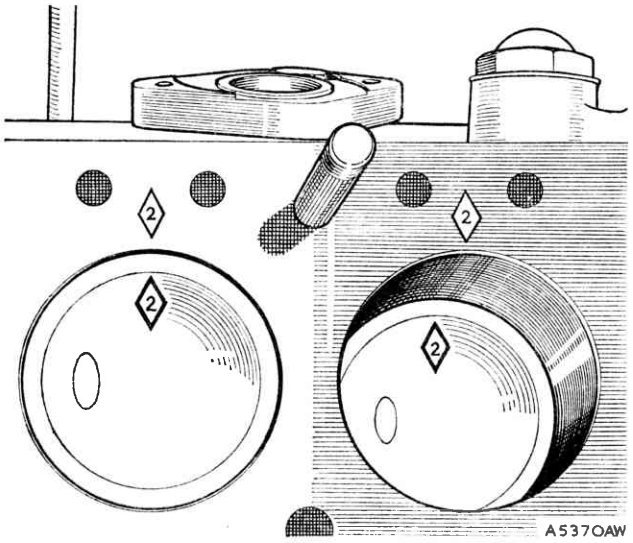


Fig. A.32

The pistons are marked on their crowns with a figure enclosed in a diamond to indicate their size grading, which should correspond with the similar size stamped on the cylinder block adjacent to the bores. Oversize pistons also have their oversize dimensions stamped on the crown of the piston

Section A.41

VALVE SEAT INSERTS (Mk. II)

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.33. 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.33. Normal valve-grinding may be necessary to ensure efficient valve-seating.

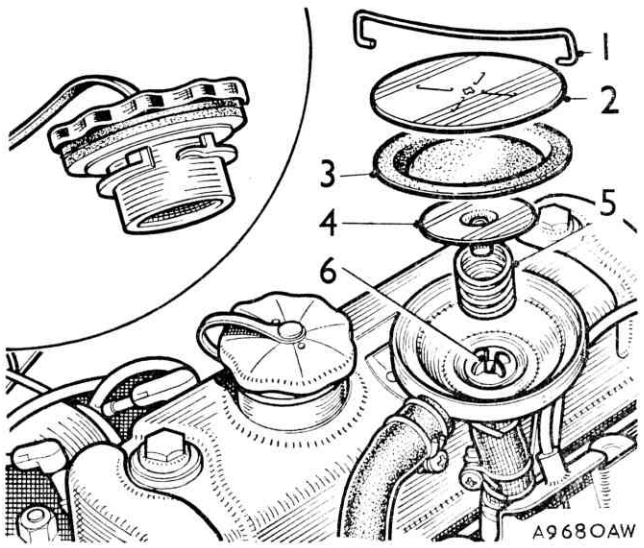
Section A.42

●CRANKCASE CLOSED-CIRCUIT BREATHING (When fitted)

Fresh air enters the engine through two holes and a filter in the filler cap on the rocker cover. The air then passes to the crankcase down the push-rod drillings. The crankcase fumes leave the engine through a breather outlet pipe on the front engine side cover. Oil droplets and mist are trapped in an oil separator before the fumes pass through a breather control valve and to the intake manifold, thus providing closed-circuit crankcase breathing.

Testing

With the engine at normal running temperature, run it at idling speed. Remove the oil filler cap. If the valve is functioning correctly the engine speed will increase by approximately 200 r.p.m. as the cap is removed, the change in speed being audibly noticeable. If no change in speed occurs, service the valve as follows.



●*Fig. A.34*

The crankcase closed-circuit breathing installation. (Inset) the oil filler cap filter

1. Retaining clip.
2. Cover.
3. Diaphragm.
4. Metering needle.
5. Spring.
6. Cruciform guides.●

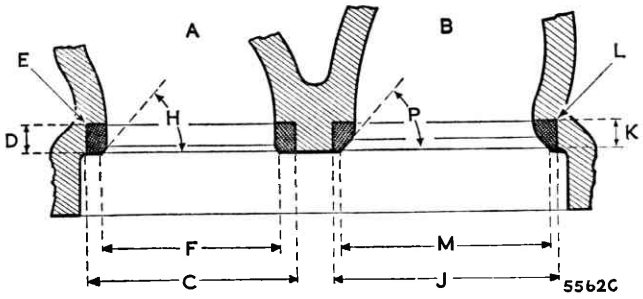


Fig. A.33

Valve seat machining dimensions (Mk. II and III)

	Exhaust (A)	*Inlet* (B)
C.	1·124 to 1·125 in. (28·55 to 28·58 mm.).	J. 1·3075 to 1·3085 in. (33·21 to 33·23 mm.).
D.	·186 to ·188 in. (4·72 to 4·77 mm.).	K. ·186 to ·188 in. (4·72 to 4·77 mm.).
E.	Max. radius ·015 in. (·38 mm.).	L. Max. radius ·015 in. (·38 mm.).
F.	1·0235 to 1·0435 in. (25·99 to 26·50 mm.).	M. 1·1435 to 1·1635 in. (29·045 to 29·553 mm.).
H.	45°.	P. 45°.

Servicing

The crankcase breather unit should be serviced at the periods recommended in the Driver's Handbook or the Passport to Service.

Oil filler cap

(1) Remove the combined oil filler cap and breather filter and fit a replacement at the recommended servicing period.

Breather control valve

(2) Remove the spring clip and dismantle the valve.
(3) Clean all metal parts with solvent (trichlorethylene, fuel, etc.). If deposits are difficult to remove, immerse in boiling water before applying the solvent. Do not use an abrasive.
(4) Clean the diaphragm with detergent or methylated spirits.
(5) Replace components showing signs of wear or damage.
(6) Reassemble the valve, ensuring the metering needle is in the cruciform guides and the diaphragm is seated correctly.

NOTE.—The 1st type valve assembly (without the cruciform guides) is serviced as an assembly.●

Section A.43

FLYWHEEL AND CLUTCH (Diaphragm spring clutch)

Removing

(1) Remove the engine as detailed in Section A.34.
●(2) Remove the clutch cover.●
(3) Mark the pins and the cover to ensure refitting in their original position.
(4) Slacken the three clutch driving pins evenly to release the spring pressure. Replace the pins as

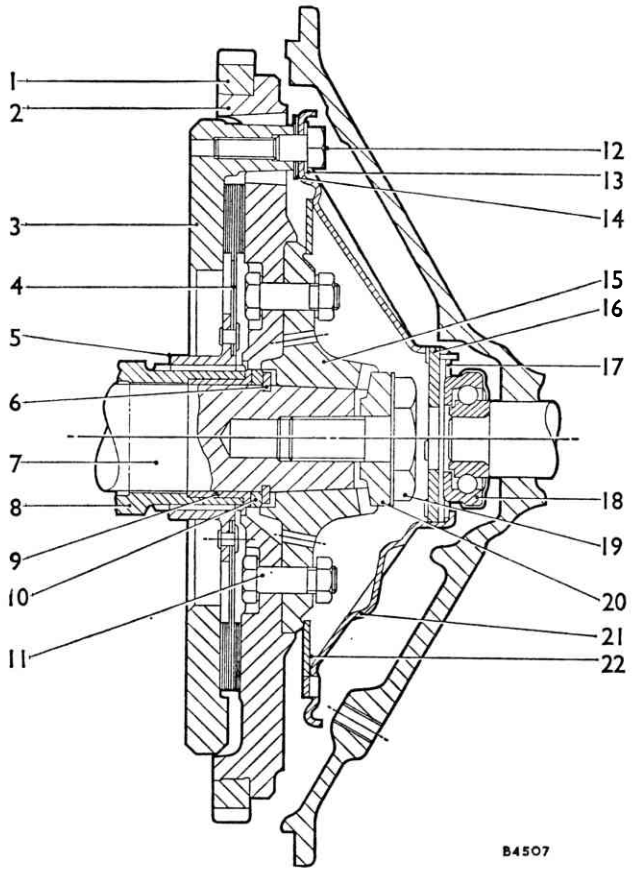


Fig. A.35

A section through the flywheel and diaphragm clutch assembly

1. Starter ring.
2. Flywheel.
3. Pressure plate.
4. Driven plate.
5. Driven plate hub.
6. Circlip.
7. Crankshaft.
8. Crankshaft primary gear.
9. Primary gear bearing.
10. Thrust washer.
11. Flywheel hub bolt.
12. Driving pin.
13. Lock washer.
14. Driving strap.
15. Flywheel hub.
16. Thrust plate.
17. Plate retaining spring.
18. Thrust bearing.
19. Flywheel screw.
20. Keyed washer.
21. Cover.
22. Diaphragm spring.

they are removed one at a time with three $\frac{5}{16}$-in. UNF. × 2 in. studs to prevent the pressure plate moving out of alignment.

(5) Remove the cover and spring assembly.

(6) Bring Nos. 1 and 4 pistons to T.D.C. to prevent the primary gear 'C' washer falling and being wedged behind the flywheel. With the crankshaft in any other position this could happen and result in damage as the flywheel is withdrawn.

(7) Knock up the locking washer and slacken the flywheel retaining screw three or four threads.

(8) Use service tools 18G 304 with adaptor set 18G 304 N (cadmium plated) to remove the flywheel.

NOTE.—The black screws from set 18G 304 M must not be used on the diaphragm clutch.

(9) Screw the three adaptor screws into the flywheel and fit the plate of tool 18G 304 over the screws with the retaining nuts screwed on evenly to keep the plate parallel with the flywheel.

(10) Screw the centre bolt of adaptor set 18G 304 N through the plate of tool 18G 304. Hold the flywheel from turning and tighten the centre bolt against the flywheel retaining screw until the flywheel is released from the crankshaft taper.

(11) Unscrew and remove the flywheel retaining screw and keyed washer and withdraw the flywheel.

Inspection

(12) Inspect the cover for elongation of the driving pin holes.

(13) Inspect the driving pins for ridging and wear; fit three new pins if any are worn.

(14) Inspect the driving straps; fit three new ones if any are worn.

Refitting

Reverse the removal instructions and carry out the following:

(15) If the driving straps have been removed from the flywheel ensure that the spacing washers are fitted between the straps and the flywheel face.

(16) Make certain Nos. 1 and 4 pistons are at T.D.C. to prevent the primary gear 'C' washer falling out of position.

(17) Locate the cover and spring assembly with the clutch balance mark 'A' adjacent to the 1/4 timing mark on the flywheel (see Fig. E.2). Fit the driving pins in their original positions tightening each a turn at a time by diametrical selection to the torque figure given in **'GENERAL DATA'.**

(18) Tighten the flywheel retaining screw to the torque figure given in the **'GENERAL DATA'** and tap up the locking washer.

Section A.44

TIMING COVER

(Modified timing cover and oil thrower)

A modified timing cover and oil thrower is fitted to later engines.

All modified components must be used together if required for earlier engines.

Note the following when replacing or refitting:

(1) The oil thrower must be fitted with the face marked 'F' away from the engine.

(2) The oil seal is fitted from inside the cover, using Service tool 18G 134 and adaptor 18G 134 BD.

(3) When refitting the cover ensure that it is centralized on the crankshaft, using Service tool 18G 1044.

(4) Lightly lubricate the oil seal and refit the crank shaft pulley.

Section A.45

PRIMARY GEAR OIL SEAL REPLACEMENT

Removing

(1) Remove the engine as in Section A.34.

(2) Remove the flywheel and clutch (Section A.17 [Coil spring type] or Section A.43 [Diaphragm spring type]).

(3) Remove the primary gear 'C' washer.

(4) Screw the centre bolt of Service tool 18G 1068 securely into the crankshaft.

(5) Pull the primary gear outwards as far as possible Pass the body of Service tool 18G 1068 over the centre bolt until the groove in the primary gear is visible inside the tool body. Fit the two half collets of the tool into the groove on the gear and unscrew the winged nut anti-clockwise to withdraw the primary gear and oil seal clear of the housing.

Refitting

(6) Lubricate the new oil seal completely, and using protector sleeve Service tool 18G 1043 over the primary gear, fit the oil seal onto the gear.

(7) Ensure that the primary gear thrust washer is correctly positioned on the crankshaft shoulder and fit the primary gear onto the crankshaft making sure that the gear teeth are starting to engage with the idler gear.

(8) Check also that the oil seal, whilst contacting the flywheel housing bore, is still seated on the sealing surface of the gear.

(9) Pass the body of Service tool 18G 1068 over the crankshaft and screw the winged nut down the centre bolt until the base of the tool contacts the lip of the housing bore. The seal is then correctly fitted.

(10) Remove the Service tool and refit the flywheel and clutch.

(11) Refit the engine as in Section A.34.

Section A.46

FLYWHEEL RETAINING SCREW THREAD

The flywheel retaining screw thread in the end of the crankshaft is not Standard Whitworth but is Whitworth form:

Diameter $\frac{5}{8}$ in. 16 T.P.I. $1\frac{1}{16}$ in. full thread.

If it is found necessary to clean up the thread, the operation must be confined to **cleaning up.** This thread is highly stressed and must always be up to full size.

Section A.47

GEAR CHANGE REMOTE CONTROL ASSEMBLY (Mk. III Models)

Removal

(1) Remove the front floor covering, the gear lever knob, and the rubber gaiter.

(2) From beneath the car, remove the securing screws and nuts from the extension rear support bracket (see Fig. A.36).

(3) Remove the four bolts securing the extension to the transmission casing and detach the extension.

Dismantling

(4) Remove the rubber dust cover, and slacken the lever locating pin.

(5) Remove the screws securing the change speed lever retainer and withdraw the lever, retainer, and spring.

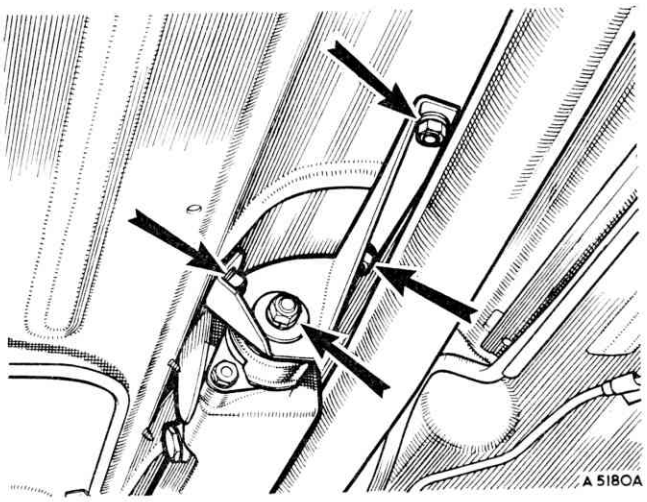


Fig. A.36

The gearbox extension support bracket securing bolts and the nut securing the bracket to the rubber mounting

(6) Lift out the distance piece and spring flange.
(7) Remove the remote control shaft damper assembly and the screw securing the remote control shaft to the primary shaft lever. Withdraw the shaft and the lever from the housing.

Inspection

Clean and examine all components for wear, and fit new parts as required.

Reassembly

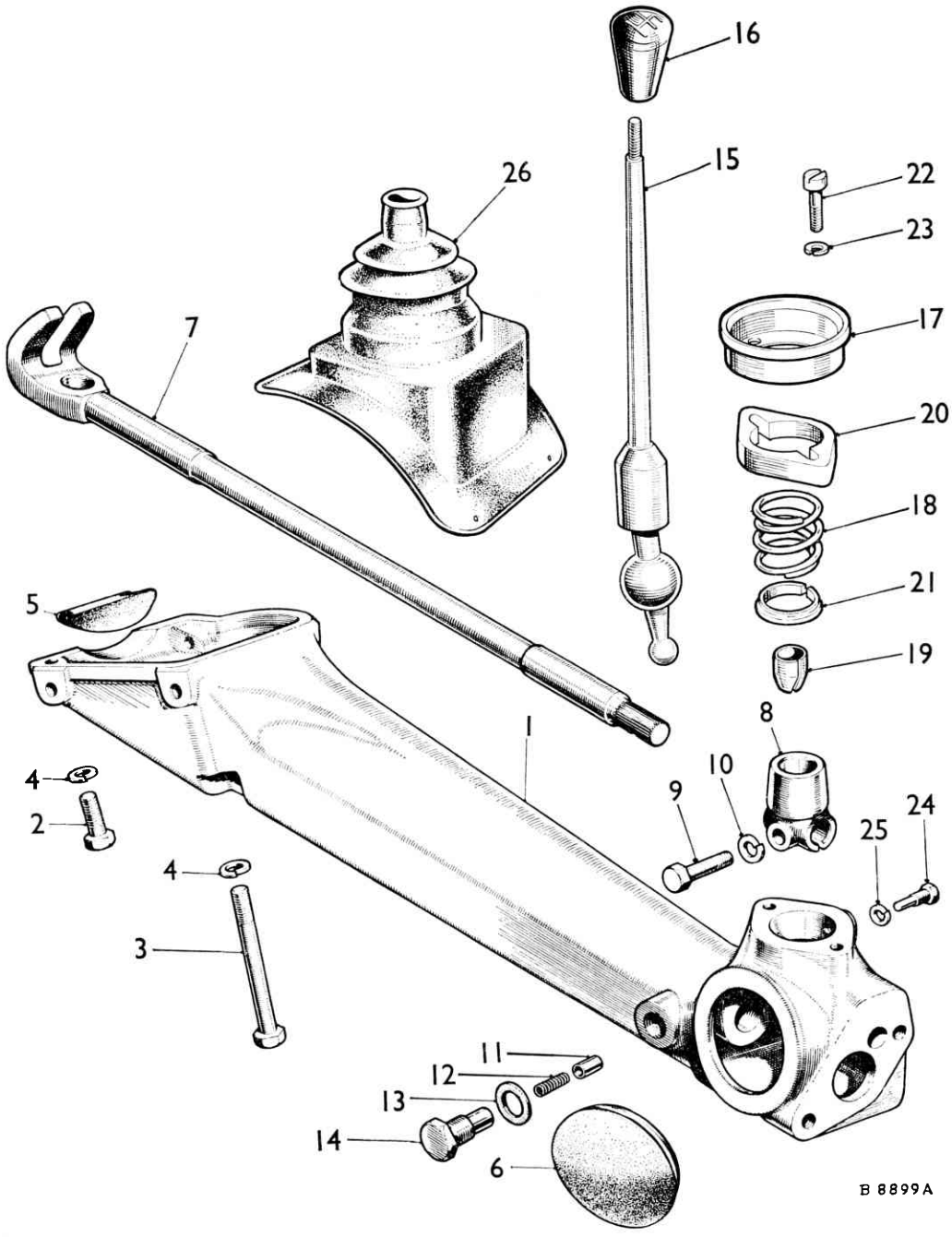
(8) Reassemble all components in the reverse order of dismantling. Lubricate the operating surfaces of all components with grease.

Refitting

(9) Reverse the removal procedure, ensuring that the rubber plug is correctly located between the extension and the transmission casing.

(*For* **'SERVICE TOOLS'** *see page A.30*)

GEARCHANGE REMOTE CONTROL COMPONENTS

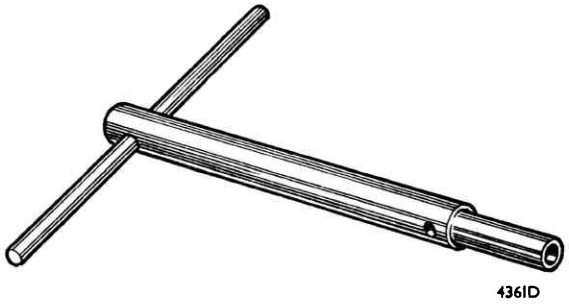


No.	*Description*
1.	Housing.
2.	Securing screw—short.
3.	Securing screw—long.
4.	Spring washers.
5.	Rubber plug.
6.	Rubber dust cover.
7.	Primary shaft.
8.	Primary shaft lever.
9.	Lever—screw.
10.	Spring washer.
11.	Damper plunger.
12.	Plunger spring.
13.	Washer.
14.	Cap nut—spring retainer.
15.	Change speed lever.
16.	Lever knob.
17.	Retainer.
18.	Spring.
19.	Bush—split.
20.	Distance piece.
21.	Flange.
22.	Screw—retainer to housing.
23.	Spring washer.
24.	Locating pin.
25.	Spring washer.
26.	Gaiter—change speed lever.

SERVICE TOOLS

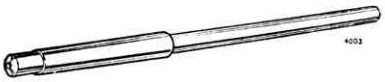
18G 27. Valve Seat Cutter Handle

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



18G 27

18G 167 D. Valve Seat Cutter Pilot



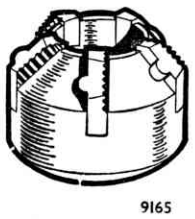
18G 167 D

18G 167. Valve Seat Finishing Cutter

18G 167 A. Valve Seat Glaze Breaker

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

18G 167



18G 167 A

18G 167 B. Valve Seat Narrowing Cutter—Top

18G 167 C. Valve Seat Narrowing Cutter—Bottom

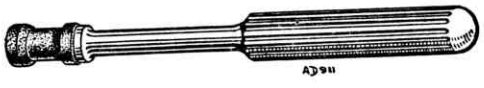
These narrowing cutters will enable the valve seats to be maintained at their original dimensions. See **'GENERAL DATA'.**

18G 167 B

18G 167 C

18G 29. Valve Suction Grinder

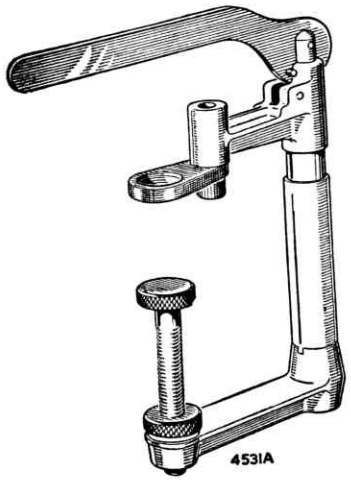
A metal handle complete with a detachable rubber suction pad (18G 29 A). An additional pad (18G 29 B) is required for use with this model.



18G 29

18G 45. Valve Spring Compressor

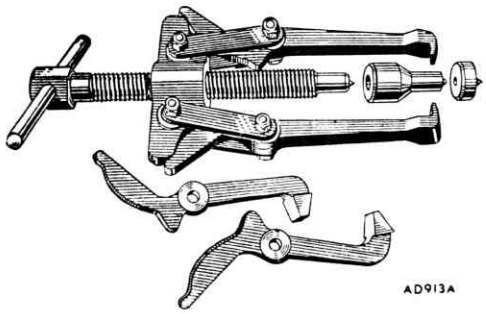
This tool is designed with a cam and lever action which is both positive and speedy. The adaptor ring is specially shaped to facilitate the removal and replacement of split collets. Screw adjustment is also provided.



18G 45

18G 2. Crankshaft Gear and Pulley Remover

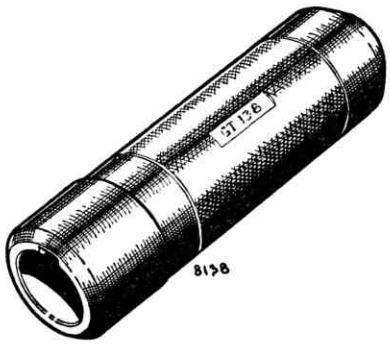
A multipurpose tool with alternative legs readily interchangeable: one pair with thin flat ends designed to remove the crankshaft gear, and the other pair with tapered ends suitable for pulley grooves.



18G 2

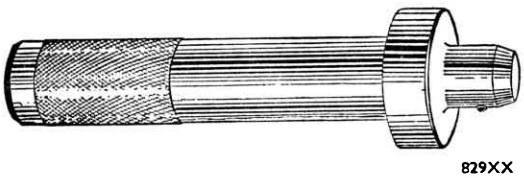
18G 138. Crankshaft Gear and Pulley Replacer

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



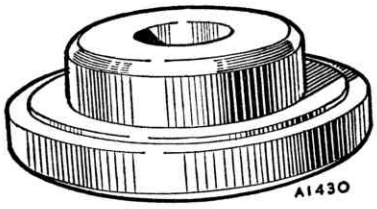
18G 138

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



18G 134

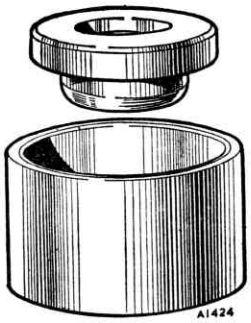
18G 134 BC. Crankshaft Primary Gear Oil Seal Replacer Adaptor



18G 134 BC

18G 134 BD. Timing Case Oil Seal Replacer Adaptor

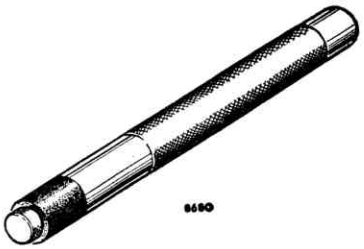
The fitting of the primary gear and timing case oil seals to their respective positions must be carried out with extreme care. Both the handle (Part No. 18G 134) and adaptors (Part Nos. 18G 134 BC and 18G 134 BD) must be used to ensure that the seals are fitted to their respective positions correctly and without damage.



18G 134 BD

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

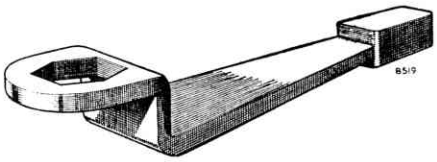
Designed to facilitate the removal and grinding in of the engine oil release valve. Tightening the set screw will expand the rubber plunger to ensure that the tool is a tight fit when inserted into the hollow oil release valve



18G 69

18G 98. Shock Spanner

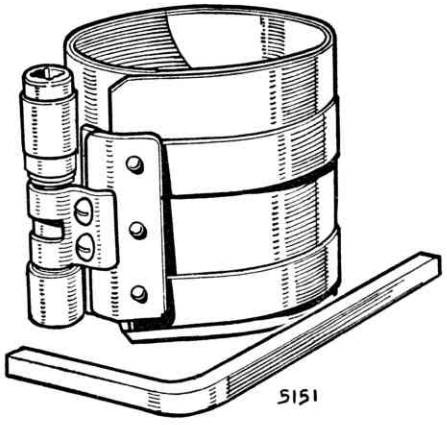
A shock-type spanner designed to remove the crankshaft pulley screw without having to lock the crankshaft by improvised means, which invariably damages the engine components.



18G 98

18G 55A. Piston Ring Compressor

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

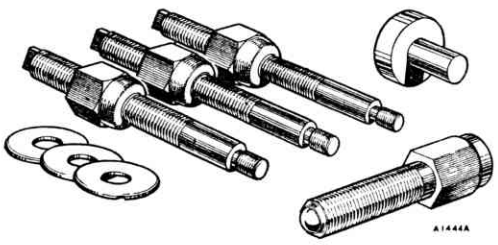


18G 55 A

18G 304 M. Flywheel and Clutch Remover Adaptor

These adaptors are for use with basic tool 18G 304 (shown at the end of Section K) to remove the flywheel from the crankshaft. The three identical screws must be screwed through the plate of this tool into the flywheel and the fourth screw used to replace the centre screw of the tool.

Do not use the three black adaptor screws on cars fitted with a diaphragm spring clutch.

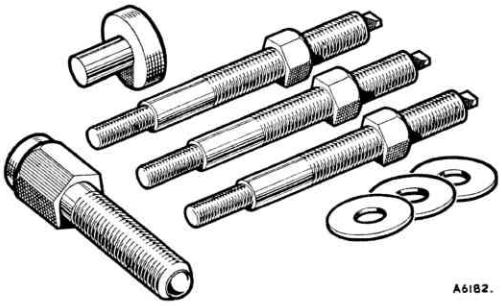


18G 304 M

18G 304 N. Flywheel and Clutch Remover Adaptors

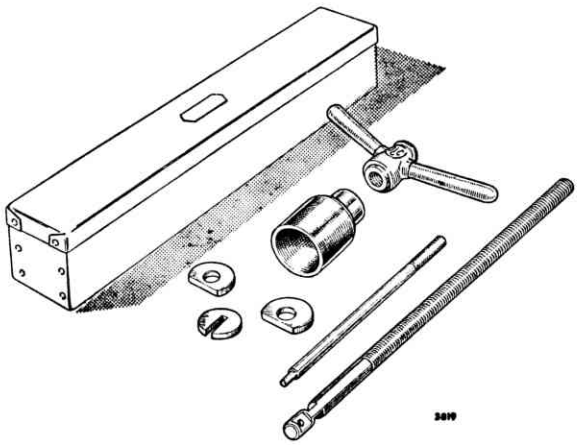
A set of adaptors which must be used when pulling a flywheel fitted with a diaphragm clutch. Use with tool 18G 304.

Do not use these adaptor screws on cars fitted with coil pressure spring clutch assemblies.



18G 304 N

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

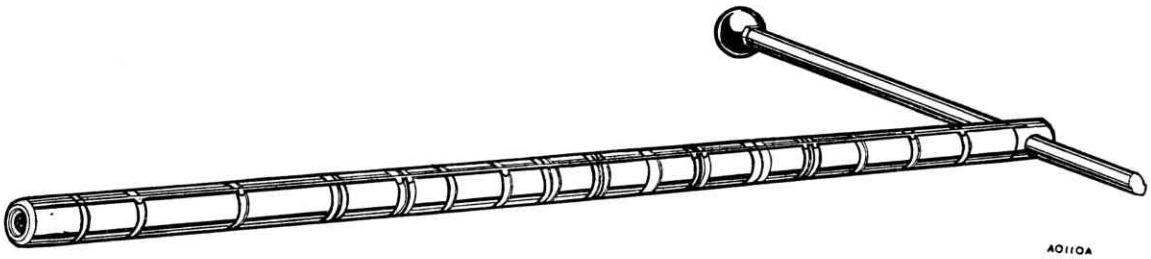


18G 124 A

18G 124 K. Camshaft Liner Remover Adaptor

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

18G 124 K



18G 123 A

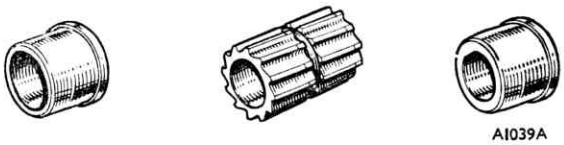
18G 123 A. Camshaft Liner Reamer (basic tool)

18G 123 AH. Camshaft Liner Reamer Pilot—Centre

18G 123 AJ. Camshaft Liner Reamer Pilot—Rear

18G 123 AN. Camshaft Liner Reamer Cutter

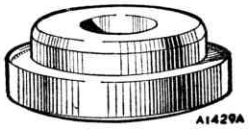
This equipment is essential when reconditioning cylinder blocks, otherwise camshaft liners cannot be reamed in line, and in consequence the clearance between the camshaft journal and the bearing will be incorrect.



18G 123 AJ 18G 123 AN 18G 123 AH

18G 134 BH. Flywheel and Front Hub Oil Seal Replacer Adaptor

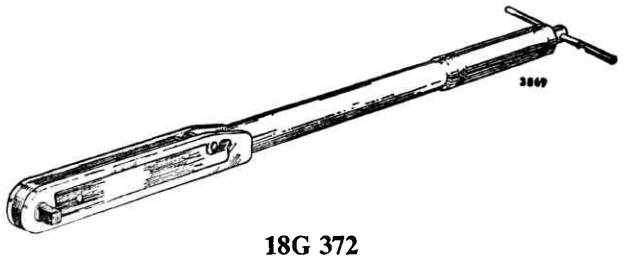
For the correct and easy replacement of the flywheel oil seal. Use in conjunction with handle (Service tool 18G 134).



18G 134 BH

18G 372. Torque Wrench—30 to 140 lb. ft. (4 to 20 kg. m.)

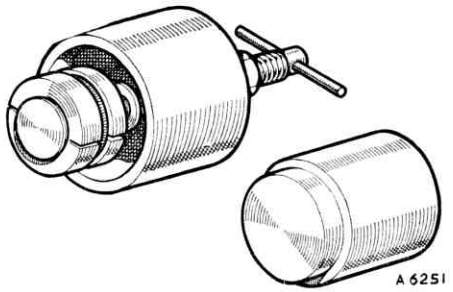
A universal torque wrench for use with standard sockets. This tool is essential if the recommended torque figure for cylinder head stud nuts is not to be exceeded.



18G 372

18G 617 A. Flywheel Housing Bearing (First Motion Shaft) Outer Race Remover/Replacer

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

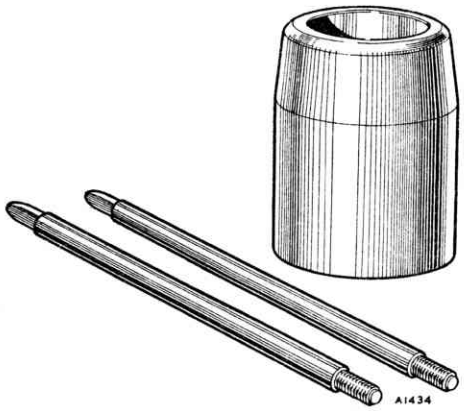


18G 617 A

18G 1043. Crankshaft Primary Gear Oil Seal Protector Sleeve

For use when fitting the flywheel housing to prevent the clutch splines on the crankshaft primary gear damaging the oil seal. This tool **must** be used for assembly when a red silicon rubber oil seal is fitted.

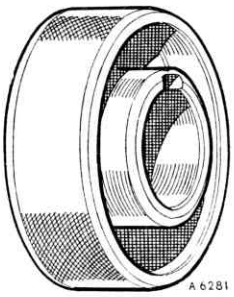
The earlier Protector Sleeve 18G 570 **must not** be used with the silicon rubber seal. The two pilot studs must be screwed into the two bottom tapped holes in the cylinder block.



18G 1043

18G 1044. Engine Front Cover Centralizer

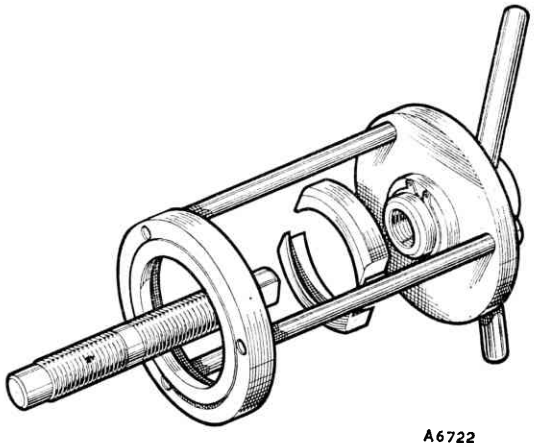
For use when fitting the modified timing cover and oil thrower to centralize the cover on the crankshaft.



18G 1044

●18G 1068 Remover/Replacer—Primary Gear Oil Seal

This tool enables the primary gear oil seal to be removed and refitted without draining the engine or removing the flywheel housing.●



18G 1068