2nd re-issue

THE

IMP

and

CHAMOIS

WORKSHOP MANUAL

ISSUED BY

ROOTES SERVICE DIVISION

COVENTRY · ENGLAND

WORLD EXPORTERS

ROOTES LIMITED · PICCADILLY · LONDON · ENGLAND

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NOTE

The Manufacturers reserve the right to alter specifications at any time without notice.

INDEX TO SECTIONS

ROOTES GENUINE PARTS

Rootes Genuine Parts are identical to the high quality Factory Parts installed in new Rootes vehicles, made by the same craftsmen, on the same machines.

A first class Parts service is available through a world-wide network of Rootes Dealers.

Always insist on Rootes Genuine Parts.

FOREWORD

Every possible care is taken during the manufacture of these cars to ensure that they leave the factory capable of giving many miles of trouble-free motoring. **Proper lubrication and maintenance are absolutely essential if satisfactory performance is to be maintained.** For details of the factory's recommendations, reference should be made to the owner's handbook supplied with the car.

When undertaking any repairs or overhaul it is essential that the unit to be worked on is cleaned and *kept clean* while the work progresses. Dirt is detrimental to the correct functioning of a vehicle and conducive to a high rate of wear.

INDEX

The various units and systems of the vehicle are dealt with in sections which are listed on page 3, each being distinguished by a reference letter. Each section thus referred to opens with a contents and index page, so that any particular operation may be picked out in the shortest possible time.

GENERAL DATA

Comprehensive information regarding dimensions, tolerances and weights is given at the beginning of the Manual.

ROOTES SPECIAL TOOLS

Certain service operations are greatly facilitated by the use of the specially designed tools manufactured by Messrs. V. L. Churchill & Co., London Road, Daventry, Northants., England. The use of these tools is described under the appropriate section headings.

DECENTRALIZED SERVICE

In order to provide the best possible service for owners, the dealer organisation throughout the world forms a link between the owner and the factory. All problems relating to the servicing of cars are dealt with through that organisation, dealers having behind them the backing of the factory service department.

Owners who require advice or information which is not dealt with in this workshop manual should direct their enquiries to their dealer. In all correspondence it is imperative that the full chassis number, including prefix and suffix letters is quoted and that reference is made to any previous correspondence. The chassis number, including the prefix and suffix letters, will be found stamped on a plate fixed to the left-hand side panel in the engine compartment.

The engine number will be found on the left-hand side of the cylinder block, immediately above the oil pressure switch. This information may be required for customs purposes.

FROST PRECAUTIONS

Important note: As the engine is constructed of aluminium alloy, anti-freeze to British Standards Specification 3150 must be used, otherwise serious damage may result (see Section "A"). The importance of taking proper precautions against damage by frost cannot be over-emphasized.

ROOTES CONCESSIONAIRE COMPANIES & REGIONAL OFFICES

AUSTRALIA

Rootes (Australia) Ltd.,
P.O. Box 100,
Port Melbourne, S.C.7,
VICTORIA, Australia.

CANADA.

Rootes Motors (Canada) Ltd.,
P.O. Box 174,
Station 'H',
TORONTO 13, Canada.

Rootes Motors (Canada) Ltd.,
25, St. James' Street,
Ville St. Pierre,
MONTREAL, P.Q., Canada.

Rootes Motors (Canada) Ltd.,
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BRUSSELS 4, Belgium.

Rootes Motors S.A.,
6, Rond Point des Champs Elysees,
PARIS 8, France.

Rootes Autos, S.A.,
12040, Rue du Commerce,
GENEVA, 1204, Switzerland.

Rootes Italia, S.p.A.,
Torre Velasca,
Piazza Velasca 5, MILAN, Italy.

Rootes Autos (Deutschland) GmbH,
4, DUSSELDORF-RATH,
Oberhausenerstrasse 17,
P.O. Box (Postfach) 171,
Germany.

Rootes Motors, A.B.,
Sveavengen 35-37,
STOCKHOLM, C. Sweden.

Rootes Espana S.A.,
Alcala 95 Piso 6,
MADRID 9, Spain.

FAR EAST

Rootes Limited,
Room 1003/4, Union House,
Chater Road,
HONG KONG.

Yamato Motor Co. Ltd.,
22-10 Minami-oi 6-Chome,
Shinagawa-Ku,
TOKYO, Japan.

MEXICO.

Refacciones Britannicas, S.A.,
Insurgentes Norte 514F,
MEXICO CITY,
Mexico 4, D.F.

MID. AFRICA.

Rootes (C.A.) (Pvt.) Ltd.,
P.O. Box 2382,
Burnley Road, Workington,
SALISBURY,
Rhodesia.

MIDDLE EAST.

The Rootes Group,
P.O. Box 2289,
BEIRUT,
Lebanon.

SOUTH AFRICA.

Stanley Motors Ltd.,
P.O. Box 7712,
Stanmot Building,
30, Eloff Street,
JOHANNESBURG,
Transvaal, Rep. of South Africa.

UNITED STATES OF AMERICA.

Rootes Motors Inc.,
42-32, Twenty First Street,
Long Island City 1,
NEW YORK, U.S.A.

Rootes Motors Inc.,
9830, West Pico Boulevard,
Los Angeles 35,
CALIFORNIA, U.S.A.

VENEZUELA.

Rootes Motors de Venezuela, S.A.,
Apartado 621,
VALENCIA,
Edo Carabobo, Venezuela.

Names and addresses of dealers in the different territories can be obtained from the above.

Telephone numbers are available in relevant local directories.

SCHEDULE OF FREE SERVICE

AFTER COMPLETING FIRST 500 MILES (800 KM.)

Cooling System

Fill to correct level. Do not overfill.

Engine

Check tightness of cylinder head (cold) to correct torque figures.
Check manifold nuts for tightness.
Examine engine for oil leaks and rectify as necessary.
Examine tension of fan belt and adjust as necessary.
Reset contact breaker gap.
Drain sump when hot and refill with new engine oil.
Check valve clearances and reset if necessary.

Clutch

Examine hydraulic system, including bleed screw, and correct any leaks.

Transaxle

Drain (when hot) and refill.

Front Suspension and Steering

Check the following for tightness:—

(*a*) Steering rack assembly fixing nuts.
(*b*) Steering arms securing nuts.
(*c*) Steering linkage ball joints and nuts.
(*d*) Steering column tube to floor bolts and bolts securing column inner coupling to rack.
(*e*) Suspension arm pivot bolts.
(*f*) Stub axle carrier inner bolts.
(*g*) Bolts securing front suspension bracket to body.

Check track rod ball pin to socket alignment and correct if necessary.
Check locknuts for tightness.
Examine hub bearings for smooth operation.
Check front hub endfloat and re-adjust if necessary.
Check front wheel "toe-in" and reset if necessary.

Rear Suspension

Check the following for tightness:—

(*a*) Suspension arms pivot bolts.
(*b*) Rear crossmember securing bolts.
(*c*) Drive shaft coupling bolts.

Shock Absorbers

Check fixing bolts for tightness.

Brakes	Examine bolts securing back plates for tightness and retighten as necessary. Check master cylinder reservoir fluid level. If low, examine for leakage and rectify. Top up as required. Make sure cap vent hole is clear. Check adjustment of brakes.
Electrical Equipment	Examine battery and top-up if necessary.
Road Test	Carry out brief road test and make necessary adjustments.

PROPRIETARY ARTICLES CLAIMS

Dealers should make all claims relative to the items in the following list direct to the manufacturers, in accordance with the addresses given.

Battery Cables Coil Control box (voltage control regulator) Distributor Generator Lamp bulbs Horn Flasher unit Lamps Starter Windscreen wiper	Joseph Lucas Ltd., Service Dept., Great Hampton Street, Birmingham.
Horn (Clear Hooter)	Clear Hooters Ltd., Bedworth, Warwickshire.
Instrument panel Petrol gauge Oil pressure gauge Water temperature gauge Speedometer and cable	S. Smith and Sons (M.A.) Ltd., North Circular Road, Cricklewood, London, N.W.2.
Fuel pump; air cleaner; heater blower	A. C. Delco, Dunstable, Beds.
Carburettor	Solex Ltd., 223-231, Marylebone Road, London, N.W.1.
Radio	S. Smith and Sons (Radiomobile) Ltd., North Circular Road, Cricklewood, London, N.W.2.

NOTE. In overseas markets an approach should be made to the proprietary manufacturers' local company or agency in the territory in which the vehicle operates.

GENERAL DATA

CONTENTS

GENERAL DATA

GENERAL DIMENSIONS

Wheelbase (All models)	6 ft. 10 in.	(208·3 cm)
Track—Front	4 ft. 1·1 in.	(124·6 cm)
—Rear	3 ft. 11·9 in.	(121·6 cm)
—Front (van)	3 ft. 11¾ in.	(121·3 cm)
—Rear (van)	3 ft. 10⅞ in.	(119·1 cm)
Overall length—Imp	11 ft. 7 in.	(352·7 cm)
—Chamois	11 ft. 9¼ in.	(357·7 cm)
—Van	11 ft. 9¼ in.	(357·7 cm)
Overall height (unladen)—Saloon	4 ft. 6½ in.	(138·4 cm)
—Van	4 ft. 11¼ in.	(151·1 cm)
Overall width (All models)	5 ft. 0¼ in.	(153 cm)
Ground clearance (laden)—Saloon	5½ in.	(14 cm)
—Van	6¾ in.	(17·1 cm)
Turning circle—Saloon	30 ft. 6 in.	(9·2 metres)
—Van	29 ft.	(8·8 metres)
Kerb weight (approx.)—Saloon	1540 lbs.	(698 kg)
—Van	1564 lbs.	(709·1 kg)
Towing capability (All models)	8½ cwt.	(431 kg)

CAPACITIES

Engine—including filter	5½ pints (6·6 U.S. pints; 3·1 litres)
Transaxle	4½ pints (5·5 U.S. pints; 2·5 litres)
Steering unit	½ pint (·7 U.S. pints; ·28 litres)
Cooling system (with heater)	11 pints (13·2 U.S. pints; 6·2 litres)
(less heater)	7¾ pints (10·5 U.S. pints; 4·2 litres)
Fuel tank	6 gallons (7·2 U.S. gallons; 27·2 litres)
Battery	32 amp.hr. 38 amp.hr. (certain export territories)

RUNNING-IN SPEEDS

0 to 500 miles (800 km)—Top	40 m.p.h. (64 kph)
—Third	30 m.p.h. (48 kph)
—Second	18 m.p.h. (29 kph)
—First	10 m.p.h. (16 kph)
500 miles (800 km) to 1,000 miles (1,600 km)—Top	60 m.p.h. (96 kph)
—Third	45 m.p.h. (72 kph)
—Second	27 m.p.h. (43 kph)
—First	15 m.p.h. (24 kph)

ENGINE—GENERAL

No. of cylinders	4
Stroke	2·377 in. (60·37 mm)
Bore—A grade	2·6769/2·6766 in. (67·99/67·98 mm)
—B grade	2·6772/2·6769 in. (68·00/67·99 mm)
—C grade	2·6775/2·6772 in. (68·01/68·00 mm)
Capacity—Standard bore	53·4 cu. in. (875 c.c.)
Compression—ratio—High (Saloon only)	10·0 : 1
—Low (Saloon and van)	8·0 : 1
Compression—pressure (HC)	185/200 lbs. sq. in. (13/14 kg. cm²)
Compression—pressure (LC)	175/190 lbs. sq. in. (12/13 kg. cm²)

PERFORMANCE

BHP gross	(L.C.) 36·9	(H.C.) 41·7	Developed at RPM	(L.C.) 4900 (H.C.) 4800
BHP nett	(L.C.) 34	(H.C.) 39		
Max. Torque lbs. ft. (kg.m)	(L.C.) 49 (6·7)	(H.C.) 52 (7·1)	Developed at RPM	2800
Max. BMEP lbs./sq. in. (kg./cm²)	(L.C.) 139 (19·2)	(H.C.) 147 (20·3)		

ROAD SPEED/ENGINE SPEED

Road speed at 1,000 engine r.p.m.

Gear	
Top ...	15·0 m.p.h. (24·1 kph)
Third ...	10·9 m.p.h. (17·5 kph)
Second ...	6·9 m.p.h. (11·1 kph)
First ...	3·7 m.p.h. (5·9 kph)
Reverse ...	4·4 m.p.h. (7·0 kph)

CYLINDER BLOCK (for torque loading figures see table at end of section)

Material ...	Aluminium with fixed cast iron liners
Max. oversize ...	·030 in. (·76 mm)

CYLINDER HEAD (for torque loading figures see table at end of section)

Material ...	Aluminium
Gasket—Type ...	Steel-asbestos-steel
Valve seat inserts int. fit ...	·0025/·0045 in. (·063/·114 mm)

VALVES

Position and operation ...	Overhead camshaft
Tappet clearance (cold) ...	·004/·006 in. (·10/·15 mm) Inlet ·006/·008 in. (·15/·20 mm) Exhaust
Timing—Inlet opens ...	6° B.T.D.C.
— „ closes ...	46° A.B.D.C.
—Exhaust opens ...	46° B.B.D.C.
— „ closes ...	6° A.T.D.C.
Head diameter (*Imp/Chamois Mk. I*)—Inlet ...	1·066/1·062 in. (27·07/26·97 mm)
—Exhaust ...	1·012/1·008 in. (25·70/25·60 mm)
Head diameter (*Imp/Chamois Mk. II & Van*)—Inlet ...	1·204/1·200 in. (30·58/30·48 mm)
—Exhaust ...	1·066/1·062 in. (27·07/26·97 mm)
Stem diameter—Inlet and exhaust ...	·2790/·2785 in. (7·07/7·06 mm)
Angle of valve seats ...	45°
Angle of valve faces ...	45°
Stem clearance in guide—Inlet and exhaust ...	·002/·003 in. (·05/·07 mm)
Valve length—Inlet and exhaust ...	3·194 in. (81·12 mm)
Valve spring—Type ...	Single
—Retention ...	Cup and split cotters
—Fitted length ...	1·18 in. (29·9 mm)
—Load fitted ...	31 lbs. (14 kgs)
Valve guides—Outside diameter ...	·502/·501 in. (12·75/12·72 mm)
—length (exhaust) ...	1.525 in. (38·72 mm)
—length (inlet) ...	1·463 in. (37·16 mm)
—Interference fit ...	·002/·0008 in. (·05/·02 mm)
—Fitted height above head (exhaust) ...	·45 in. (11·4 mm)
—Fitted height above head (inlet) ...	·39 in. (9·9 mm)

TIMING CHAIN

Type	Single-row roller
Pitch	·375 in. (9·5 mm) x 82 links
Roller diameter	·25 in. (6·3 mm)
Width	·225 in. (5·71 mm)

CAMSHAFT (for torque loading figures see table at end of section)

Position	Overhead
Number and type of bearings	3; steel shell white metal lined
Journal diameters—front, centre, rear	·9375/·9370 in. (23·81/23·79 mm)
Bearing internal diameters—front, centre, rear ...	·9395/·9375 in. (23·86/23·81 mm)
Bearing running clearance	·002/·0005 in. (·05/·01 mm)
End float	·007/·002 in. (·17/·05 mm)

CRANKSHAFT (for torque loading figures see table at end of section)

Balance	Integrally forged counterweights
Number and type of bearings	3; steel shell lead bronze, lead indium overlay
Diameter of main journals	1·875 in. (47·62 mm)
Diameter of crankpin	1·625 in. (41·27 mm)
End thrust	Washer on centre bearing
End float	·002/·01 in. (·05/·25 mm)
Main bearing running clearance	·0027/·001 in. (·067/·025 mm)
Big end running clearance	·0027/·001 in. (·067/·025 mm)

CONNECTING ROD (for torque loading figures see table at end of section)

Material	Steel forging
Type	"H" section
Big end bearings	Steel shell lead bronze, lead indium overlay
Big end bore (without bearings)	1·771/1·7705 in. (44·98/44·97 mm)
Big end, end float	·005 in. (·12 mm) minimum
Small end bearings	Bushed
Small end bore (bushed)—High grade	·6251/·6250 in. (15·877/15·875 mm)
—Low grade	·6250/·6249 in. (15·875/15·872 mm)

GUDGEON PIN

Type	Floating
Location	Circlips
Diameter—High grade	·6250/·6249 in. (15·88/15·87 mm)
—Low grade	·6249/·6248 in. (15·87/15·86 mm)
—Class of fit (in piston)	Hand push at 20°C (68°F)

PISTON

Type	Solid skirt (HC—flat top; LC—dished top)
Material	Aluminium alloy (LO-EX)
Length	2·049 in. (52·07 mm)
Rings—Compression	2
—Scraper	1
Compression height	1·050/1·045 in. (26·7/26·5 mm)
Max. permissible weight variation per set	4 drams (7 grms.)
Grade A	2·6758/2·6755 in. (67·965/67·957 mm)
B	2·6761/2·6758 in. (67·972/67·965 mm)
C	2·6764/2·6761 in. (67·980/67·972 mm)
D (service use only)	2·6767/2·6764 in. (67·987/67·980 mm)
Oversize available	·015 in. (·38 mm) and ·030 in. (·76 mm)
Piston skirt clearance (measured at right angles to gudgeon pin hole)	·0014/·0008 in. (·035/·020 mm)
Ring clearance (vertical clearance in groove)	·0035/·0015 in. (·088/·037 mm)
Ring gap (fitted) in A grade bore	·013/·008 in. (·33/·20 mm)
Max. permissible run-out	·003 in. (·076 mm)

FLYWHEEL

Ring gear interference	·016/·008 in. (·40/·20 mm)
Ring gear shrink fit temperature	200/220°C

LUBRICATION SYSTEM

Type	Pressure
Pump	Eccentric lobe
Pump drive	Gear on crankshaft
Normal pressure (hot)	50 lbs. in.^{2} (3·5 kg.cm^2)
Filter—Type	Full-flow
—Make	Tecalemit
—Capacity	1 pint (1·2 U.S. pints; ·57 litres)

FUEL SYSTEM

Pump—Type	Mechanical
—Location	Top of cambox
—Operation	Lever by eccentric on camshaft
—Pressure	1¼—2 lbs. in.^{2} (·08—·14 kg.cm^2)
Carburettor—Make	Solex
—Type	B30 P.I.H.T., B30 P.I.H.T.—2, B30 P.I.H.T.—3 or 30 P.I.H.—5

Settings	B30 P.I.H.T.	B30 P.I.H.T.—2	B30 P.I.H.T.—3	Mk.1 (HC) 30 P.I.H.—5	Mk.1 (LC) 30 P.I.H.—5	Mk.11 (HC & LC) 30 P.I.H.—5
Choke (Venturi) ...	22 mm	22 mm	20 mm	20 mm	20 mm	22 mm
Main jet	112·5	102 or 105	102	102	102	115
Econostat jet... ...	60	80	80	80	70	125
Pilot jet (slow running)	45	40	40	40	40	45
Pilot jet air bleed ...	100	90	140	140	140	140
Air correction ...	160	150	150	150	175	190
Progression holes ...	1 x 1·2	2 x 1·2	1 x 1·2 & 1 x 0·9	1 x 1·2 & 1 x 0·9	1 x 1·2 & 1 x 0·9	1 x 1·2 & 1 x 0·9
Needle valve seat ...	1·3 with 1 mm washer	1·6 with 1 mm washer	1·6 with 1 mm washer	1·6 with 1 mm washer	1·6 with 1 mm washer	1·6 with 1 mm washer
Fast idle gap	·7/·8 mm	·7/·8 mm	·7/·8 mm	·7/·8 mm	·7/·8 mm	·7/·8 mm
Air cleaner	Paper element	Paper element	Paper element	Paper element	Paper element	Paper element
Strangler control ...	Automatic	Automatic	Automatic	Manual	Manual	Manual

Jet setting differences with 'B'-post mounted air cleaner

Mk.I (LC)—Air correction 200
—Econostat jet 45

Mk.II (LC & HC)—Main jet 105
—Econostat jet ... ... Blank } Using Mk.I carburettor adapter elbow
—Pilot jet 40

Mk.II (LC & HC)—Main jet 105
—Air correction ... ... 170 } Using Mk.II carburettor adapter elbow
—Econostat jet 75
—Pilot jet 40

High altitude jet setting

Between 5,000 ft. (1,524 m) and 10,000 ft. (3,048 m)

With Mk.I high compression engines use a 165 correction jet and turn strangler coil housing 5 mm anti-clockwise to reduce tension on the strangler coil.

With Mk.I low compression engines use a 190 correction jet and an acceleration pump rod SK-3151, additionally, turn strangler coil housing 5 mm anti-clockwise to reduce tension on the strangler coil.

Note: If the engine is fitted with an export type air cleaner the main jet should be 100 whether the engine is to be run at normal or high altitudes.

COOLING SYSTEM

Type ...	Pump and fan
Pump ...	Centrifugal
,, drive ...	"V" belt from crankshaft pulley
Fan—No. of blades ...	9
—Diameter ...	9·94 in. (25·2 cm)
Thermostat—Opens at ...	77°C (170°F)/80°C (179°F)
Radiator—Relief valve ...	In filler cap, 4 lbs. in.² (·28 kg. cm²) (7lbs.in.²; ·49 kg.cm² from B.41/1003496 and B.42/1000101)
Drain tap location—Radiator ...	In bottom water tank
—Cylinder block ...	In right-hand side above oil filter
Fan belt—Depth ...	·31 in. (7·9 mm)
—Width at outside ...	·375 in. (9·5 mm)
—Angle of "V" ...	40°
—Outside length ...	43·62 in. (110·8 cm)

IGNITION SYSTEM

Type	Coil and distributor
Firing order	1, 3, 4, 2
Ignition control	Fully automatic—vacuum and centrifugal
Ignition timing (nominal) static	3° (3 mm) B.T.D.C.

The above ignition settings may need SLIGHT alteration to meet local fuel requirements. Such adjustments should be made by means of the distributor vernier control taking care not to over retard or over advance the ignition timing. The mm. dimension is measured on periphery of crankshaft pulley, before groove on pulley reaches pointer on timing cover on rotation of crankshaft.

Octane fuel range	10·0 : 1 use 95—97
	8·0 : 1 use 85—87

	High comp: Distributor R.P.M.	Distributor Degrees	*Low comp:* Distributor R.P.M.	Distributor Degrees
Ignition centrifugal advance	125-400	Start	200	Start
	500	1°—3°	500	1½°—3½°
	1000	4°—6°	1000	7½°—9½°
	3000	12°—14°	2000	13½°—15½°
Ignition vacuum advance	Hg" (of mercury)			
	4	0°—½°	2	0°—1°
	6½	1°—3°	5	3°—6°
	11	6½°—8½°	7	5°—8°
	15	7°—9°	12	6°—8°

Distributor—Maker's No.	25.D.4
—Despatch No.—High comp.	40905
—Low comp.	40968A
—Drive	Offset from oil pump
—Direction of rotation (viewed from above)	Anti-clockwise
—Contact breaker gap	·015 in. (·38 mm)
—Contact lever spring tension	18/24 ozs. (·51/·68 kg)
—Firing angles	0°, 90°, 180°, 270° ±1°
—Contacts closed period (cam dwell closed)	60° ±3°
Coil—Make	Lucas
—Type	HA. 12
Spark plugs—Make and type	Champion N9Y
—Gap	·025 in. (·63 mm)

CLUTCH

Make and type	Laycock diaphragm
Operation	Hydraulic
Driven plate—Diameter	5½ in. (13·97 cm)—Imp Standard (Up to B.429003750) Imp De luxe (Up to B.419093265) Chamois (Up to B.431009818)
	6¼ in. (15·9 cm) —Imp Standard (From B.429003751) Imp De luxe (From B.419093266) Chamois (From B431009819).
	—Imp Van (From first production)
—Compressed thickness ...	·298/·282 in. (7·56/7·16 mm)
Thrust bearing	Carbon ring
Free movement of withdrawal lever ...	None

TRANSAXLE (for torque loading figures see table at end of section)

Type	4 forward speeds and reverse
Synchromesh on	All forward gears
Final drive —Type	Hypoid bevel
—Ratio	4·857 : 1
Gear ratios —Top	·852 : 1
—Third	1·174 : 1
—Second	1·833 : 1
—First	3·417 : 1
—Reverse	2·846 : 1

Overall ratios—Top	4·138 : 1
—Third	5·702 : 1
—Second	8·905 : 1
—First	16·595 : 1
—Reverse	13·824 : 1
Adjustment—Output shaft and pinion	Shims
—Differential bearings	Screwed sleeves
—Crown wheel (backlash)	Screwed sleeves (·0055/·0035 in. [·139/·088 mm])
Bearings—Output shaft and pinion	Taper rollers
—Input shaft	Front, needle rollers; rear, ball
—Clutch shaft (into flywheel)	Oilite bush
—Differential assembly	Taper rollers
No. of teeth—Bevel pinion	7
—Crown wheel	34
Speedometer gears	See under Front Suspension
Filler/level plug location	Left-hand side

For road speed/engine speed r.p.m. figures, see tabulation on page 13

REAR HUBS AND DRIVE SHAFTS *(for torque loading figures see table at end of section)*

Drive shafts—Type	Solid shaft
—Joint	Universal
—Coupling	Rubber
Rear hub bearings	Ball

FRONT SUSPENSION (for torque loading figures see table at end of section)

Type	Independent coil (swing axle)

Spring	Early saloon models		Certain saloon models / Imp van
—Outer diameter	3·123 in. (7·9 cm)	[3·123 in.; 7·9 cm]	3·153 in. (8·0 cm)
—Static laden length	*7·56 in. (19·2 cm)*	*[7·84 in.; 19·9 cm]*	8·35 in. (21·21 cm)
—Static laden load (off car)	490 lbs. (222 kg)	[470/510 lbs.; 213/231 kg]	351/389 lbs. (159/176 kgs)
—Free length	10·07 in. (25·6 cm)	[10·35 in.; 26·3 cm]	9·94 in. (25·24 cm)

Wheel movement—Laden to rebound	3 in. (76·2 mm)—Saloon 1·7 in. (43·2 mm)—Van
—Laden to bump	3 in. (76·2 mm)—Saloon 3·9 in. (99·0 mm)—Van
Castor angle	10°±1° positive (On Gap Gauges. See Section F)
Camber angle (Unladen)	8°±1° positive (On Gap Gauges. See Section F)
King-pin inclination (Unladen)	3°±1° positive (On Gap Gauges. See Section F)
Ackerman angle—Inner and outer wheels	Nil (parallel steering)
Toe-in *at tyre tread*	$\frac{3}{16}$ in. $\pm\frac{1}{8}$ in. (4·7±3·1 mm) *equivalent to an angle between the wheels of 10′ to 50′.*
Speedometer drive (direct)	Pin in n/s hub cap to cam in hub
Hub bearings—Inner	Taper roller
—Outer	Taper roller
—End float	·0065/·003 in. (·165/·076 mm)
Shock absorbers—Make	Woodhead Munroe
—Type	Telescopic direct acting
—Mountings	Rubber bushed

STEERING (for torque loading figures see table at end of section)

Make ...	E.P. (Engineering Products)
Type ...	Rack and pinion
Turns lock to lock ...	$2\frac{5}{8}$
Total angular movement (steering lever) ...	70°
Adjustment—Pinion endfloat ...	Shims
—Rack and pinion (backlash) ...	Screw and locknut

REAR SUSPENSION

Type ...	Independent coil (trailing links)		
	Early saloon models	Certain saloon models	Imp van
Spring—Outer diameter ...	4·02 in. (10·2 cm)	[4·02 in.; 10·2 cm]	
—Static laden length ...	7·10 in. (18 cm)	[7·35 in.; 18·7 cm]	6·98 in. (17·7 cm)
—Static laden load (off car)	940 lbs. (426 kg)	[894/986 lbs.; 406/447 kg]	1276/1386 lbs. (578/628 kg)
—Free length ...	9·14 in. (23·2 cm)	[9·30 in.; 23·6 cm]	9·4 in. (23·8 cm)
Spring (Heavy duty)—Outer diameter ...	4·02 in. (10·2 cm)		
—Static laden length ...	7·60 in. (19·3 cm)		
—Static laden load (off car)	894/986 lbs. (406/447 kg)		
—Free length ...	9·45 in. (24 cm)		
Toe-in *at tyre tread* ...	$\frac{5}{16}$ in. (7·9 mm) $\pm\frac{1}{8}$ in. (3·1 mm) nominal—not adjustable		
Camber angle (Saloon)—unladen ...	$\frac{1}{2}^{\circ}\pm45'$ positive (not adjustable). See Section F		
(Van)—unladen ...	$1^{\circ}\pm45'$ positive		
Wheel movement—Laden to rebound (Saloon)	4 in. (101·6 mm)		
(Van) ...	4·2 in. (106·6 mm)		
—Laden to bump (Saloon) ...	3 in. (76·2 mm)		
(Van) ...	2·3 in. (58·4 mm)		
Shock absorbers—Make ...	Woodhead Munroe		
—Type ...	Telescopic direct acting		
—Mountings ...	Rubber bushed		

BRAKES (for torque loading figures see table at end of section)

Make ...	Girling
Type of system ...	Hydraulic
Front brakes (drum)—Material ...	Cast iron
—Diameter ...	8 in. (20·3 cm)
—Lining ...	Don 202 (Ferodo MS.3 on certain saloon models also van)
—Lining width ...	1·5 in. (38·1 mm)
Rear brakes (drum)—Material ...	Cast iron
—Drum diameter ...	8 in. (20·3 cm)
—Lining ...	Don 202 (Ferodo MS.3 on certain saloon models also van)
—Lining width ...	1·5 in. (38·1 mm)
Total lining area ...	75 sq. in. (483·8 cm²)
Adjustment location ...	Squared adjusters on back plates
Handbrake—Type ...	Ratchet and pawl
—Location ...	On floor between front seats
Access to master cylinder ...	In front luggage compartment

WHEELS AND TYRES

Wheels—Type	Pressed steel disc
—Size (Saloon)	12L x 4J or 4½J
(Van)	12H x 4J
—No. of studs	4
Tyres —Size (Saloon)	5·50x12 Dunlop C.41 or 155x12 Dunlop SP.41 (Tubeless)
(Van)	5·50 x 12 Dunlop Van G.72 nylon
—Rolling radius—Front	10·45 in. (26·54 cm)
—Rolling radius—Rear	10·57 in. (26·74 cm)
—Pressures—Front* (Saloon and unladen van)	18 lbs. in.^{2} (1·3 kg.cm^2)
—Pressures—Rear*† and spare (Saloon and unladen van)	30 lbs. in.^{2} (2·1 kg.cm^2)
Spare wheel location	Front luggage compartment
Lifting jack—Type	Scissors
Jacking location (Car)—Front	Central (below suspension front pivot)
—Rear	Each corner (pegs)
Jacking location (Garage)—Front	Central (below suspension front pivot)
—Rear	Central (below body rear crossmember)

* *(Saloon) For fast driving increase all pressures by 5 lbs. in.^{2} (·35 kg.cm^2).*
† *(Van) Increase rear tyre pressure by 15 lbs. in.^{2} (1·0 kg.cm^2) when fully laden.*

BATTERY

Make and type (Saloon)	Lucas BHNH 7/9A—32 amp. hr.
	Lucas 9A—38 amp. hr. (certain export territories)
(Van)	Lucas D-type—32 amp. hr.
System	Positive earth up to Series II
	Negative earth from Series II onwards
Voltage	12
Specific gravity reading	See Section N

GENERATOR

Make and type	Lucas C.40-1
Drive	"V" belt from pulley on crankshaft
Output control	Current voltage control
Brush spring tension	22/25 ozs. (·62/·71 kg)

CONTROL BOX

Make and type	Lucas RB340

STARTER

Make and type	Lucas M.35.G
Drive	Lucas "SB"
Control type...	Solenoid
Lock torque	7·7 lbs. ft. (1·06 kg.m) 330/350 amps @ 7·5/7·1 volts
Brush spring tension	30/34 ozs. (·85/·96 kg)

LIGHTING

System	Earth return
Type—Headlamp	F.700 Mk. 10
—Side and front flasher lamp	Lucas 717
—Rear number plate lamp	Lucas 719
—Stop/tail lamp	Lucas 692
—Rear flasher lamp	Lucas 691

LAMP BULBS AND LIGHT UNITS

Head (R.H.D.)	Light unit (5041043)
Head (L.H.D.)	Bulb (Lucas 410)
Head (France)	Bulb (Lucas 411)
Head (N. America)	Light unit (7105078)
Side	Lucas 989 12v. 6w. or Lucas 222 12v. 4w.
Stop and tail	Lucas 380 12v. 21/6w.
Front and rear flashing indicator	Lucas 382 12v. 21w.
Rear number plate	Lucas 207 12v. 6w.
Interior	Lucas 254 12v. 6w. (festoon)
Panel	Lucas 987 12v. 2·2w.
Headlamp main beam indicator	Lucas 987 12v. 2·2w.
Ignition warning	Lucas 987 12v. 2·2w.
Flashing indicator warning	Lucas 987 12v. 2·2w.
Oil pressure warning	Lucas 987 12v. 2·2w.

OTHER EQUIPMENT

Windscreen wiper—Make	Lucas
—Type	DR.3A
—Armature end play	·012/·008 in. (·3/·2 mm)
Horns—Make	Lucas
—Type	9H

TORQUE LOADING FIGURES

ENGINE

Cylinder head retaining bolts (tighten when cold)	36 lbs. ft. (5 kg.m)
Crankshaft (mains)	41 lbs. ft. (5·6 kg.m)
Con. rod (big-end)	18 lbs. ft. (2·4 kg.m)
Bell housing studs (engine to transaxle)	9 lbs. ft. (1·2 kg.m)
Camshaft bearing cap nuts	6 lbs. ft. (·8 kg.m)
Sparking plugs	14 lbs. ft. (1·9 kg.m)
Camshaft sprocket setscrew	19 lbs. ft. (2·6 kg.m)
Flywheel to crankshaft	32 lbs. ft. (4·4 kg.m)
Temperature switch body	20 lbs. ft. (2·7 kg.m)

All the following mounting studs should be torque loaded to 6 lbs.ft. maximum (·8 kg.m):-

Oil filter block	Timing cover to block
Water inlet	Sump
Water outlet	Manifold
Chain tensioner	Manifold clamp
Cylinder head	Cambox cover
Oil pump	Tappet block
Distributor	Fuel pump

All stud nuts should be torque loaded to — $\frac{1}{4}$ in. UNF 6 lbs.ft. (.8 kg.m)
— $\frac{5}{16}$ in. UNF 15 lbs.ft. (2.0 kg.m)

TRANSAXLE

Drain plug and filler plug	35 lbs. ft. (4·8 kg.m)		
Output shaft	45 lbs. ft. (6·2 kg.m)		
Input shaft	45 lbs. ft. (6·2 kg.m)		
Bevel pinion bearing pre-load (new bearings)	14/20 lbs. in. (·16/·23 kg.m)		
(spring balance reading)	9/12·5 lbs. (4/5·6 kg.)		
(old bearings)	7/10 lbs. in. (·08/·11 kg.m)		
(spring balance reading)	4·5/6·25 lbs. (2/2·8 kg.)		
Casing nuts—$\frac{1}{4}$ in. UNF	11 lbs. ft. (1·5 kg.m)	cold; 16 lbs. ft. (2·2 kg.m)	hot
—$\frac{5}{16}$ in. UNF	12 lbs. ft. (1·6 kg.m)	cold; 17 lbs. ft. (2·3 kg.m)	hot
Mounting cover bolts—$\frac{5}{16}$ in. UNF.	16 lbs. ft. (2·2 kg.m cold)		
Crown wheel to cage (bolts marked "W")	29 lbs. ft. (4·0 kg.m)		
(bolts marked "X")	40 lbs. ft. (5·5 kg.m)		
Differential flange nuts	145 lbs. ft. (20·0 kg.m)		
Differential shaft locknuts	130 lbs. ft. (18·0 kg.m)		
Bell housing nuts	25 lbs. ft. (3·5 kg.m)		
Clutch release lever nut	11 lbs. ft. (1.5 kg.m)		
Detent retaining plug	7 lbs. ft. (1·0 kg.m)		

FRONT SUSPENSION

King-pin carrier to wishbone—Horizontal	74 lbs. ft. (10·2 kg.m)
—Vertical	48 lbs. ft. (6·6 kg.m)
Wishbone pivot bolts	25 lbs. ft. (3·4 kg.m)
Suspension support bracket—Front	27 lbs. ft. (3·7 kg.m)
—Rear	27 lbs. ft. (3·7 kg.m)
Road wheel nut	48 lbs. ft. (6·6 kg.m)
Shock absorber to suspension	43 lbs. ft. (5·9 kg.m)
Suspension member to body	20 lbs. ft. (2·7 kg.m)
King-pin retainer nut	6 lbs. ft. (·8 kg.m) *Flat to be square with taper*
Front hub locknut	13 lbs. ft. (1·7 kg.m)

REAR HUBS & DRIVE SHAFTS

Rear hub nut	170 lbs. ft. (23·5 kg.m)
Rotoflex coupling bolts	34 lbs. ft. (4·7 kg.m)

STEERING

Steering unit attachment "U" bolt	14 lbs. ft. (1·9 kg.m)
Steering unit to track rod	37 lbs. ft. (5·1 kg.m)
Track rod ball joint...	20 lbs. ft. (2·7 kg.m)
Steering arm to stub axle	33 lbs. ft. (4·5 kg.m)
Inner column pinch bolt—¼ in. UNF (head not marked)	8 lbs. ft. (1.1 kg.m)
—¼ in. UNF (head marked with "V")	10 lbs. ft. (1.4 kg.m)
—$\frac{5}{16}$ in. UNF (through bolt)	13 lbs. ft. (1.7 kg.m)

BRAKES

Backplate to stub axle	14 lbs. ft. (1·9 kg.m)
Wheel cylinder to backplate	6 lbs. ft. (·8 kg.m)
Bleed screws	5 lbs. ft. (·7 kg.m)
Union nuts (male)	7 lbs. ft. (·9 kg.m)
Union nuts (female)	9 lbs. ft. (1·2 kg.m)

REAR SUSPENSION

Crossmember to body	27 lbs. ft. (3·7 kg.m)
Engine mounting to crossmember	27 lbs. ft. (3·7 kg.m)
Shock absorber to body	14 lbs. ft. (1·9 kg.m)
Shock absorber to suspension	25 lbs. ft. (3·4 kg.m)
Suspension pivot bolts	*43 lbs. ft. (5·9 kg.m)*

CLUTCH

Clutch to flyweel bolts	7 lbs. ft. (·9 kg.m)

COOLING

Fan cowl to water pump body	11 lbs. ft. (1·5 kg.m)

COOLING SYSTEM

SECTION A

CONTENTS

COOLING SYSTEM

DESCRIPTION

The coolant is maintained in circulation through the system by an impellor-type pump secured to the generator mounting bracket and positioned immediately in front of a nylon cooling fan. The pump is driven by a vee belt of rubber which also serves to drive the generator. Coolant is drawn into the pump from the bottom radiator tank through a short rubber hose, from where it is delivered to the engine cylinder block and thence to the cylinder head.

When the engine has attained its correct working temperature, a thermostat incorporated in the cooling system and situated in the cylinder head relieves, and permits the coolant to flow around the system where it returns direct to the radiator header tank.

The nylon cooling fan which is formed with a set number of blades, blows cooling air through the radiator gills, thereby reducing the cooling temperature; this being particularly necessary during periods of in-town driving or when the car is stationary with the engine idling.

Coolant temperature warning lamp

Certain Imp models are fitted with a coolant temperature warning system; this comprises a switch installed in the cylinder head adjacent to the thermostat housing, and is electrically connected to the oil pressure switch. Therefore, in the event of the coolant temperature becoming excessive (106±3°C), the temperature switch will operate and the oil warning lamp on the instrument binnacle will illuminate.

When the oil warning lamp illuminates, the vehicle must be stopped immediately and the cause investigated.

Refer also to Sections B and N of this publication.

By-pass junction

This unit has been introduced into the system to improve heater efficiency and simplify bleeding of the cooling system. It is mounted on the chassis sub-frame adjacent to the engine, and is basically a three-way junction, integrally constructed and incorporating a bleed valve.

The chassis number introduction points for the unit are as follows:—

Imp, De-luxe	B.419086306
Basic	B.429003215
Chamois	B.431003898

The unit is shown in Fig. 1 with bleeding tube attached.

DRAINING AND REFILLING THE SYSTEM

Draining the system

1. Move the heater control on the facia to hot (red) position if a heater is fitted.

2. Remove the radiator filler cap by turning it in an anti-clockwise direction.

   If the system is warm, place a rag over the filler cap and remove the cap gradually.

   If the system has become overheated do not attempt to remove the cap until the system has cooled to its operating temperature.

3. Open both drain taps; one located centrally on the bottom of the radiator, and the other on the right-hand side of the cylinder block adjacent to No. 1 cylinder.

Preparing the coolant

Using Rootes Inhibitor:
When an anti-freeze mixture is not used in the system, 7 fluid ounces ($\frac{1}{3}$ pint or 200 c.c.) of Rootes Coolant Inhibitor must be added to the water to maintain the system free from corrosion. The system must be cleansed and the inhibitor renewed at yearly intervals.

Using anti-freeze:
Only anti-freeze to British Standards Specification 3150 must be used. This should be added to the water in correct proportion without the addition of the Rootes Inhibitor. The exact quantity will depend upon climatic conditions, but the maker's advice in this respect should be accepted. Certain precautions are necessary when using anti-freeze; these are outlined in later paragraphs and should be strictly observed.

Refilling the system

1. Flush the system with clean cool water and close the drainage points.
2. Refill and bleed the system in the manner described in the following paragraphs.

Systems with a heater or by-pass junction will require bleeding; those without a heater will not require bleeding, except they incorporate a by-pass junction.

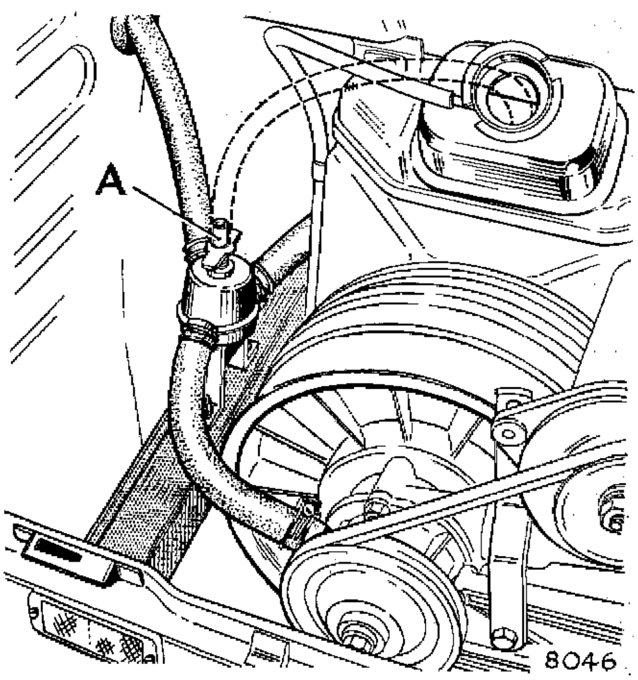


Fig. 1. *By-pass junction and method of bleeding system.*

BLEEDING THE SYSTEM

An important factor in maintaining the efficiency of the cooling system is to ensure that it is free from pockets of air. Hence it will be necessary to carry out the process of 'bleeding' when the system has been drained for any reason, or where the heater has become inefficient, and in cases where the level of the coolant has fallen below normal through lack of maintenance.

It is most important that the bleeding of the air from the system is carried out when the engine is cold, in order to take advantage of the closed thermostat condition. With the thermostat closed during the bleeding process, the coolant is directed to the remote parts of the system where the air is quickly expelled by the diverted pumping action.

Bleeding procedure for earlier models

Prior to the following chassis numbers:—

Imp, De-luxe	B.419086306
Basic	B.429003215
Chamois	B.431003898

The procedure is the same as given in the following paragraphs for vehicles fitted with a by-pass junction assembly, except that the bleeding tube must be fitted to the bleeder valve on the heater and be long enough to extend from this point to the radiator header tank. The part of the bleeding tube used at the header tank must be of transparent plastic material to allow observation of the coolant during the bleeding process.

Bleeding tube particulars:

Inside diameter	$\frac{3}{16}$ in. (4·8 mm.)
Length	14 ft. (4·25 m.)

Bleeding procedure for later models

From the following chassis numbers:—

Imp, De-luxe	B.419086306
Basic	B.429003215
Chamois	B.431003898

The bleeding is carried out with the aid of a short length of transparent plastic tubing connected to the bleed valve (A) on the by-pass junction assembly as shown in Fig. 1. The bleed valve (if fitted) on the heater matrix is not for use and must be kept closed at all times.

1. Close the drainage points and fill the system with coolant containing the recommended inhibitor or anti-freeze in correct proportion.

2. Fit suitable length of transparent plastic tubing to the bleed valve on the by-pass junction assembly, and place the free end into the radiator header tank, then open the bleed valve.

3. Move the heater control on the facia to hot (red) position, if a heater is fitted.

4. Start the engine and run it at approximately 2,000 r.p.m.

5. Top-up the system with coolant immediately the level in the radiator is seen to fall.

6. Maintain the system in the full condition by constantly topping-up until the last traces of air have issued from the bleeding tube.

7. Momentarily open the throttle to expel any trapped air, then close the bleed valve.

8. Stop the engine, remove the bleeding tube, and refit the radiator cap.

Bleeding tube particulars:

Inside diameter	$\frac{3}{16}$ in. (4·8 mm.)
Length	2 ft. (60 cm.)

Unsatisfactory results

In the event of failure to bleed air from the system after applying the recommended procedure, the following checks should be made:—

1. Inspect the system for leaks and tighten all connections.

2. Ensure that the heater control is operating the valve efficiently.

3. Inspect the heater hoses for kinking.

4. Ensure that the heater hoses are not restricted by foreign matter.

5. Ensure that the routing of the hoses to the heater connections is correct.

6. Check that the thermostat is to specification and working properly.

FAN BELT ADJUSTMENT

Refer to Section B of this publication.

THE THERMOSTAT (See Figs. 2 and 3)

The function of the thermostat is to check the flow of coolant through the system until such time as the predetermined temperature has been reached; this attained, the thermostat opens fully and permits coolant to flow around the system.

On starting the engine from cold, coolant is circulated around the cylinder block under influence from the pump impellor; additionally, coolant is also circulated through the passages in the cylinder head and the thermostat housing.

Until the coolant has attained the predetermined operating temperature (see General Data), the thermostat will remain closed, so that coolant is directed by way of a by-pass hose connected between an outlet on the cylinder head and an inlet on the pump body, where it is recirculated through the cylinder block and cylinder head.

As the coolant temperature increases above the predetermined opening figure of the thermostat, its valve will commence to unseat and permit coolant to pass into the radiator. This fresh circulation of coolant causes the pump impellor to draw from the bottom tank a supply at a greatly reduced temperature.

The engine coolant working temperature should not be permitted to exceed the figure given in the General Data.

To remove

Drain the cooling system in accordance with the instructions given under the appropriate heading.

Raise the car to a comfortable working height and remove the vertical metal shield positioned immediately in front of the cambox (5 cross-head screws).

The thermostat housing will now be visible at the front of the cylinder head, retained by two nuts, plain and spring washers. Remove the nuts and collect the washers; the housing can now be detached and the thermostat withdrawn from its seat in the cylinder head.

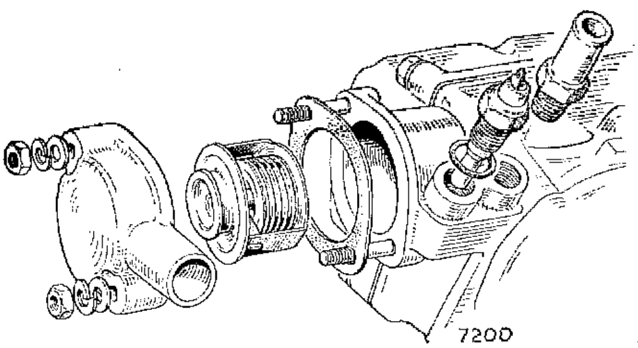


Fig. 2. *Bellows type thermostat and thermostat housing.*

To refit

Position a new or the original thermostat on its seat in the cylinder head, ensure that both the cylinder head and housing jointing faces are free from foreign matter then position a new gasket over the mounting studs and onto its seat.

Refit the thermostat housing and secure it in position with the two nuts, plain and spring washers.

Refill the cooling system in accordance with the instructions given under the appropriate heading.

Testing bellows type thermostat

Remove the thermostat from its housing in the manner previously described, then submerge the thermostat in water which is in the course of being treated to the working temperature. Additionally, place a thermometer in the heated water, so that at the precise moment the thermostat valve relieves, a reading can be recorded.

After starting to open within 2·2° to 2·8°C (4° to 5°F) of its specified opening temperature, the thermostat should be fully open within a further 5·6° to 6·7°C (10° to 12°F).

Testing wax type thermostat

Before deciding to fit a new thermostat, the suspect unit should be checked in the following manner:—

Examine the thermostat visually to ensure that the riveted or soldered joints are secure.

Ensure that the jiggle pin is in position and free to float.

Check that the rubber seal on top of the wax type element is not cracked or perished and that no wax is exuding from beneath it.

Fully immerse the thermostat in cold water, taking care not to allow it to touch the bottom or sides of the container. Suspend it from a fixed part of its structure in order not to interfere with its action of opening.

Raise the temperature of the water gradually to 2·2° or 2·8°C (4° or 5°F) above the specified opening temperature stamped on the thermostat, and hold it steady at this temperature for two or three minutes.

Continue to raise the temperature gradually to boiling point and again soak for the recommended period.

The thermostat should start to open within 2·2° to 2·8°C (4° to 5°F) of its specified temperature. At 98·9° to 100°C (210° to 212°F) it will be approximately $\frac{1}{4}$ in. (6·3 mm.) open, but will not reach its fully open position until several degrees above normal atmospheric boiling point.

When the valve has opened, ensure that its seating is clear of foreign matter. The valve must not be operated manually.

Remove the thermostat from the hot water and submerge it in cold water (at room temperature) to check that the valve re-seats securely within 15 to 20 seconds.

The wax-type thermostat is shown in Fig. 3. This new design supersedes the bellows type.

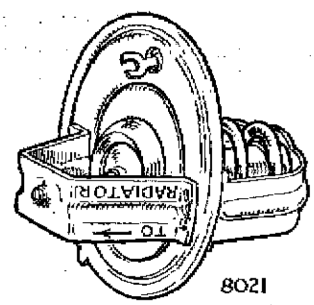
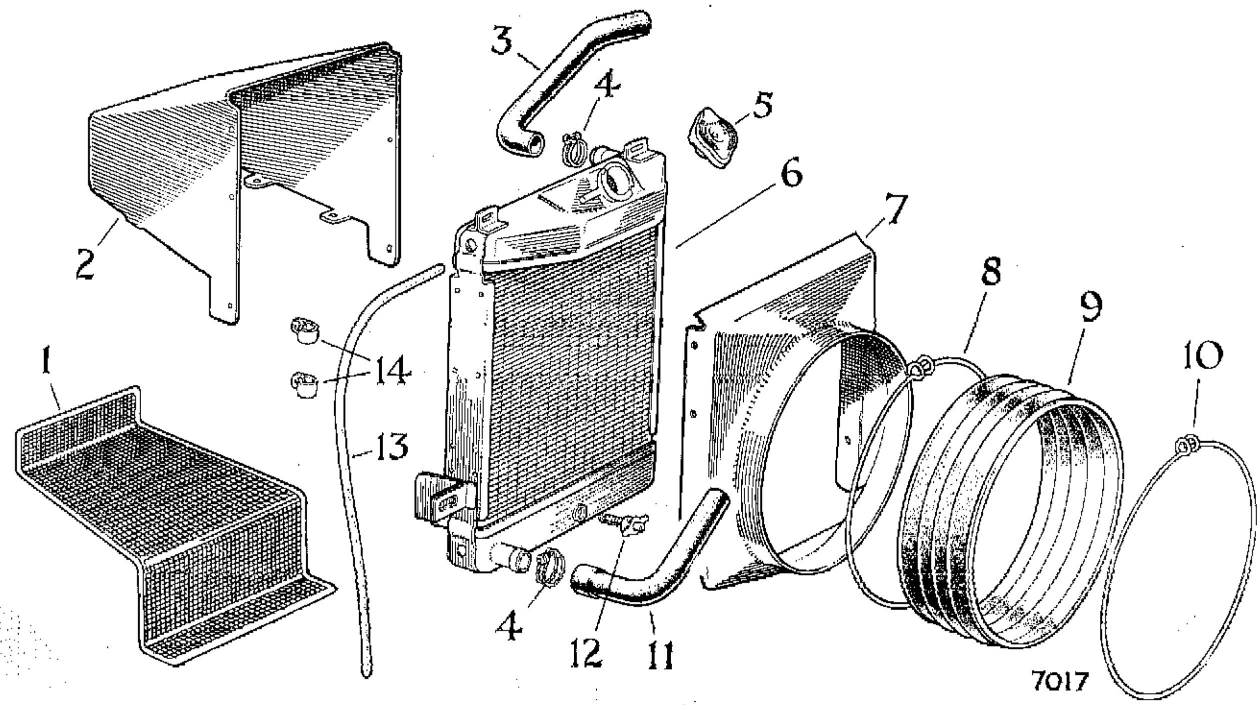


Fig. 3. *Wax-type thermostat.*



1. STONE GUARD
2. REAR COWL
3. RETURN HOSE
4. HOSE CLIP
5. RADIATOR FILLER CAP
6. RADIATOR
7. FRONT COWL
8. RUBBER SHROUD CLIP
9. RUBBER SHROUD
10. RUBBER SHROUD CLIP
11. RADIATOR TO PUMP HOSE
12. RADIATOR DRAIN TAP
13. OVERFLOW PIPE
14. OVERFLOW PIPE RETAINING CLIPS

Fig. 4. *Exploded view of radiator assembly*

THE RADIATOR (See Fig. 4)

The cooling radiator is of the gilled-type and is pressurised by means of the filler cap. The filler cap incorporates a spring-loaded pressure relief valve which is designed to retain a predetermined load (see General Data) over and above that of the atmospheric pressure within the system.

In the event of the pressure rising in excess of the predetermined figure, the spring-loaded valve is unseated and permits the additional pressure to be vented to atmosphere, by way of the overflow pipe attached at the neck of the filler orifice.

When the coolant temperature eventually subsides, atmospheric pressure is restored in the system as the result of a small relief valve, situated in the centre of the pressure relief valve unit, unseating to allow the equalising of pressure.

The object of raising the pressure within the system, is to raise the boiling point of the coolant and thereby minimise the risk of coolant loss brought about as the result of boiling.

Certain later models are fitted with a four-row gilled type radiator containing an anti-aeration baffle in the top tank. Systems with this radiator incorporate a no-loss overflow bottle which conserves the coolant in the system.

To remove

Open the engine compartment lid and remove the radiator filler cap ; this is necessary because the system is pressurised.

Drain the cooling system as explained under the appropriate heading.

Disconnect the feed and return hoses at the radiator, then slacken the innermost wire clip that secures the rubber shroud to the fan cowl.

Remove the three cross-head screws that retain the radiator stone-guard to the adjacent vertical panel.

Remove the three holding bolts, one each side of the radiator header tank and the other remaining bolt at the left-hand side of the block. The radiator can now be withdrawn from beneath the car.

If further dismantling is desirable, the stone guard and the two cowls can be detached after the removal of the cross-head screws.

IMPORTANT.—If the radiator is to be put into store, or set aside until eventual reassembly, stack in the vertical position, in order to avoid the possibility of sediment, which may be present in the bottom tank, from being transferred into the narrow-bore vertical tubes.

To refit

This is the reversal of the foregoing procedure for removal.

CLEANING THE COOLING SYSTEM

Periodically, the complete cooling system is to be cleaned by flushing through; this form of maintenance is particularly desirable, especially in areas where there is the non-availability of soft water.

Procedure

Drain the cooling system as previously described under the appropriate heading; additionally, remove the taps completely.

Should the engine still be hot after draining, wait until it has cooled sufficiently, then commence flushing the system with cool, clear water.

After this has fully drained, refit the taps and commence filling the system, as previously described, with a solution of cleaning compound (several reliable brands are available).

CAUTION.—It is important to drain the solution after the prescribed period of running; these instructions are to be found, in most instances, on the side of the solution container. The solution must not be allowed to contaminate the vehicle paintwork as its effect is likely to be injurious.

When the solution has been drained from the system, re-commence flushing through with a continuous flow of cool, clear water until it issues from the drain taps as clear as at the filling orifice.

Refill the cooling system as previously described, with coolant that befits the climate at the time.

Cleaning the radiator exterior

Periodically, the air spaces between the radiator gills must be cleaned of accumulated dust and other foreign particles, otherwise should a "choking" condition be allowed to remain too long the result will be one of excessive overheating.

The type of cleaning necessary will depend on the condition of the radiator exterior; therefore, in the event of the radiator gills becoming almost completely blocked, it would be far easier to remove the radiator in order that it can be submerged in a bath of very-hot water to which a mild detergent has been added.

Judiciously scrub the gills using a stiff bristle brush, NEVER a wire brush, working the detergent solution well into the matrix.

When all traces of grease and dirt have been dissolved, rinse the radiator with plenty of cool, clear water and finally dry between the gills, using a low air-pressure line.

If the condition of the radiator exterior is only mildly contaminated with road dust, it will only be necessary to use the low air-pressure line to clean out between the gills.

This is best carried out from behind the radiator itself, in which case, the stone guard will require removal to provide access.

After blowing through the radiator from the rear, transfer the air line to the fan side of the radiator and dispel dust particles which have accumulated within and around the fan cowl.

PRECAUTIONS AGAINST FROST DAMAGE

During the months of winter, it is strongly recommended that an anti-freeze compound is used in the cooling system. It is most important that, as the engine unit is constructed in aluminium alloy, anti-freeze to British Standards Specification 3150 is used, otherwise serious damage may result.

The exact proportions of anti-freeze to be used will depend entirely on the climatic conditions, therefore, the advice given by the manufacturers of the product should be accepted. A wall-chart is usually available, which details the correct proportions to suit any particular climate.

It is pointed out that, if anti-freeze is not used it is quite possible, due to the action of the thermostat, for the radiator to "freeze-up" whilst the vehicle is in motion, even though the radiator content was quite fluid when the engine was first started.

Prior to the use of anti-freeze solution, the cooling system is to be flushed through in the manner recommended under the heading of "Cleaning the cooling system".

It is essential that the cylinder head gasket is in good condition, additionally, the cylinder head bolts are to be checked for tightness by making sure that they are pulled down to the correct torque loading figure (See General Data).

Otherwise, should the anti-freeze solution be allowed to leak into the crankcase, the result is likely to be one of damage to the working parts.

Ensure that the hose clips are tight and that the water pump and thermostat housing are both secure; enough to prevent leakage.

To ensure adequate mixing, it is recommended that the anti-freeze solution and water are both measured in their correct proportions in entirely separate containers, then pour the water into the receptacle containing the anti-freeze, mix thoroughly and then commence filling the cooling system as previously instructed.

The anti-freeze solution is not subject to evaporation, therefore, unless leakage is apparent, 'topping-up' will constitute the addition of water only to bring the coolant to its correct level in the header tank.

Heaters

It is recommended that where a heater unit is installed, anti-freeze is used, because even when the cooling system has been drained, a small amount of water will remain in the heater unit and the connecting pipes. If this water freezes it is likely that the heater unit will be seriously damaged.

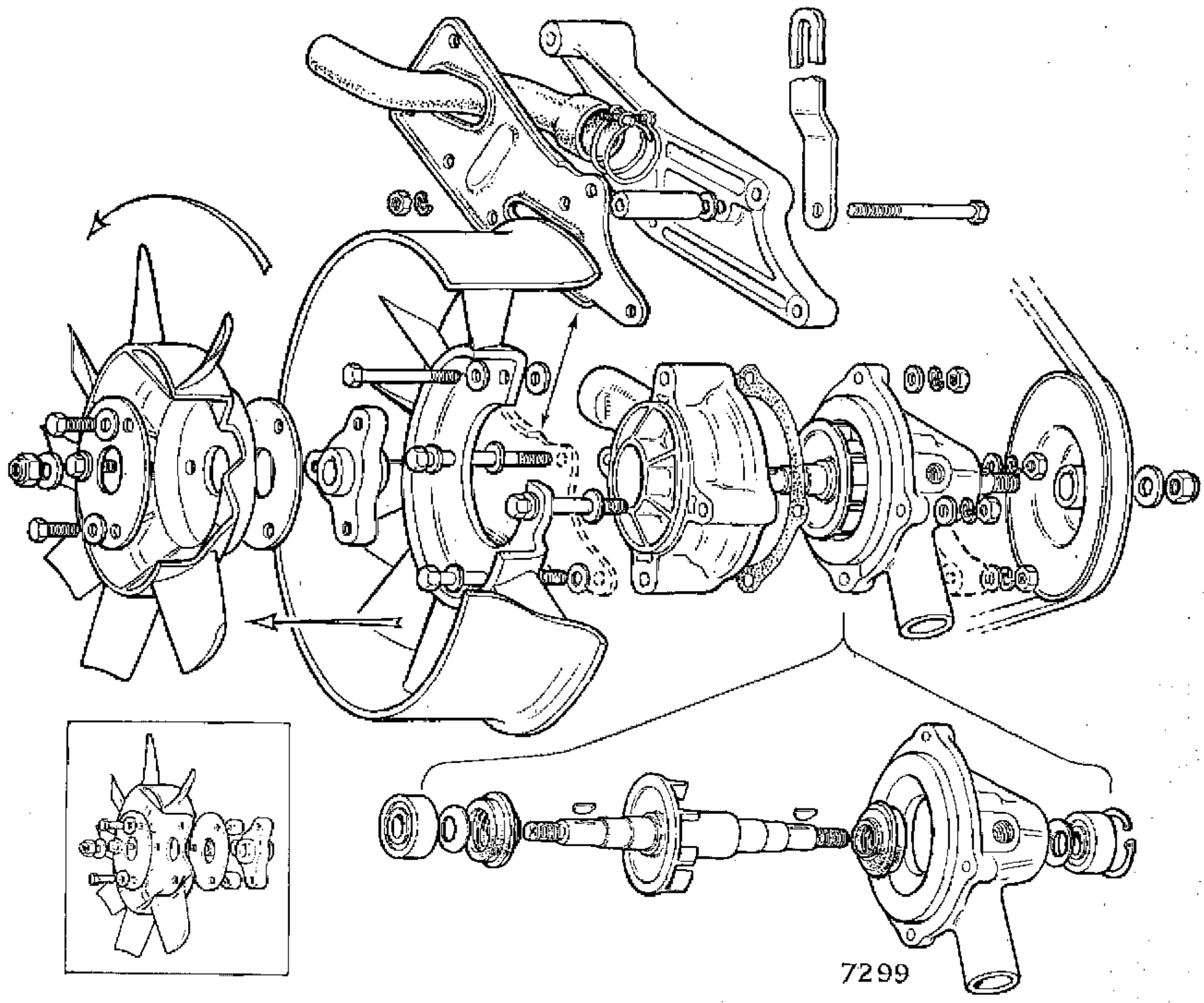


Fig. 5 *Exploded view of water pump and fan assembly (Inset shows early fan unit)*

COOLING FAN ASSEMBLY (See Fig. 5)

The cooling fan, which is of a plastic material, is formed with a set number of blades equally spaced around the periphery of a large hub. The fan is attached to a driving member by three bolts which is itself keyed on the end of the water pump drive spindle and secured to this member with a large nut and washer. A plastic cowl surrounds the cooling fan where its prime function is to direct cooling air straight to the fan via several vanes which are moulded integrally around the inner diameter of the cowl. From this point the cooling fan blows air through the radiator in order to maintain the cooling system at a greatly reduced temperature. especially when the vehicle is stationary or during in-town driving.

To remove

Remove the radiator filler cap and drain the coolant by opening both the bottom radiator tap and the cylinder block tap.

Slacken the generator holding bolts and remove the driving belt.

Slacken the nut on the bolt which secures the rubber-shroud retaining-clip surrounding the fan cowl and displace the clip so that it rests adjacent to the second clip of its type.

Remove the three generator holding bolts, having first disconnected the cables at the Lucar connections, and detach the generator unit.

Slacken the hose clips and detach the hoses from the cylinder block, radiator bottom tank and the water pump by-pass inlet connection.

Remove the three long bolts which retain the mounting bracket assembly to the cylinder block mounting bosses and remove the pump and fan assembly to the bench.

The cooling fan is detached after the three retaining bolts have been unscrewed from the tri-angularly shaped driving member; collect the three distance pieces, if fitted

To detach the fan cowl, remove the four long bolts which extend through the inlet and outlet bodies of the water pump.

To refit

This will be the reversal of the foregoing procedure for removal.

On re-assembly, it is important that the four spacing washers are inserted between the hub of the fan cowl and the outlet pump-body on the four bolts which pass through the water pump bodies.

On completion of assembly, refer to the appropriate paragraph which describes how "to refill" the cooling system.

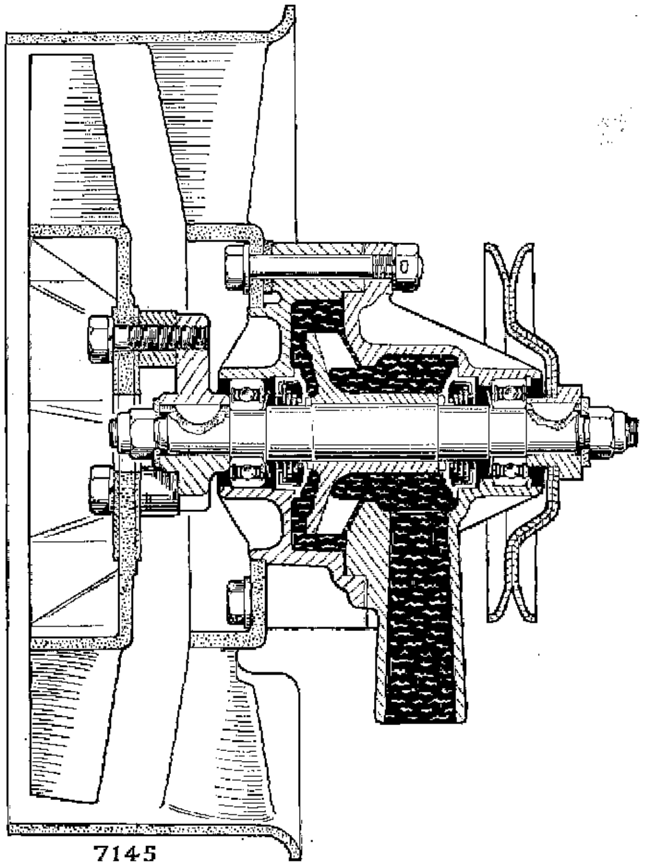


Fig. 6. *Sectioned view of water pump and fan assembly. (Early models)*

WATER PUMP ASSEMBLY (See Figs. 6 and 7)

The water pump is of the centrifugal impellor type, the impellor being mounted on a steel spindle which runs in two identical ball bearings, each of which is positioned on its own journal formed on the spindle. Adjacent to the inner face of each bearing is a dished washer; this acts as a thrower in the event of coolant finding its way past the carbon-faced spring-loaded seals positioned one at each end of the impellor.

At the bearing end of the inlet and outlet pump body a small hole is drilled in the casting which permits any coolant, which has seeped past the spring-loaded seals, to drain away and therefore, together with the dished thrower, the bearings are prevented from becoming saturated should any coolant seepage occur.

To remove

Remove the radiator filler cap and drain the coolant by opening both the bottom radiator tap and the cylinder block tap.

slacken the generator holding bolts and remove the driving belt.

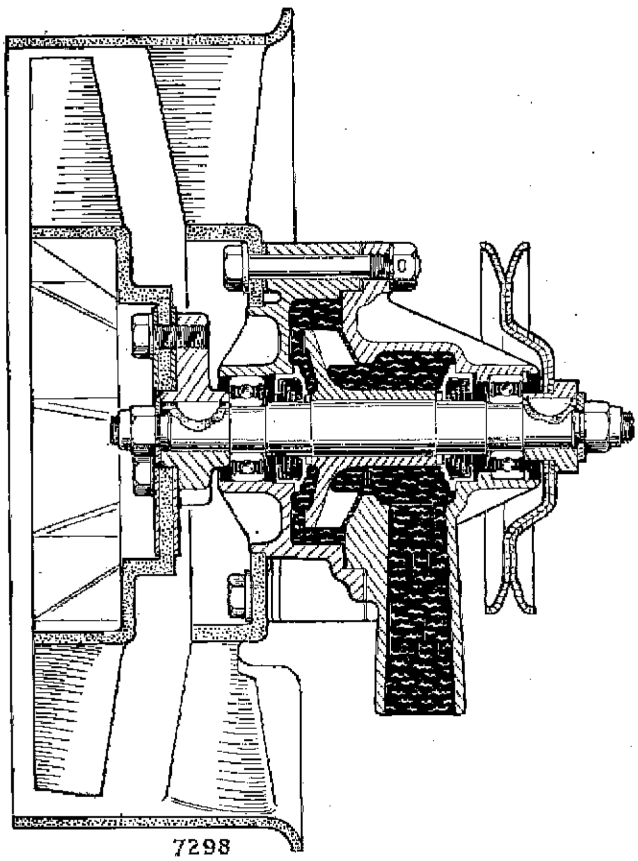


Fig. 7. *Sectioned view of water pump and fan assembly. (Later models)*

Slacken the nut on the bolt which secures the rubber-shroud retaining-clip surrounding the fan cowl and displace the clip so that it rests adjacent to the second clip of its type.

Remove the three generator holding bolts, having first disconnected the cables at the Lucar connections, and detach the generator unit.

Slacken the hose clips and detach the hoses from the cylinder block, radiator bottom tank and the water pump by-pass inlet connection.

Remove the three long bolts which retain the mounting bracket assembly to the cylinder block mounting bosses and remove the pump and fan assembly to the bench.

The cooling fan is detached after the three retaining bolts have been unscrewed from the tri-angularly shaped driving member; collect the three distance pieces, if fitted.

To detach the fan cowl, remove the four long bolts which extend through the inlet and outlet bodies of the water pump.

Unscrew the large nuts at each end of the impellor spindle and draw off the tri-angular driving member and the driving pulley from their respective keys.

Hold one half of the pump body steady and turn the opposite half, at the same time pulling one from the other.

Remove the sealing joint which is positioned between the inlet and outlet pump bodies.

If necessary, withdraw the two bearings and the two spring-loaded water seals.

No attempt must be made to dismantle the impellor from its driving spindle. Should either the impellor or the spindle become damaged it will be necessary to fit a new matched assembly.

To refit

Using new parts as found necessary, re-assemble the pump in the reverse order of dis-assembly. If either the pump impellor or driving spindle are in any way damaged, a new matched assembly must be fitted. Additionally, prior to assembling the two halves of the water pump body, coat both jointing faces with Shell Ensis Fluid 256, *this action prevents the possibility of corrosion and* facilitates dismantling when called for.

On re-assembly, it is important that the four spacing washers are inserted between the hub of the fan cowl and the outlet pump-body on the four bolts which pass through the water pump bodies. Additionally, torque load the four retaining nuts to the figure stated in General Data.

ENGINE

SECTION B

CONTENTS

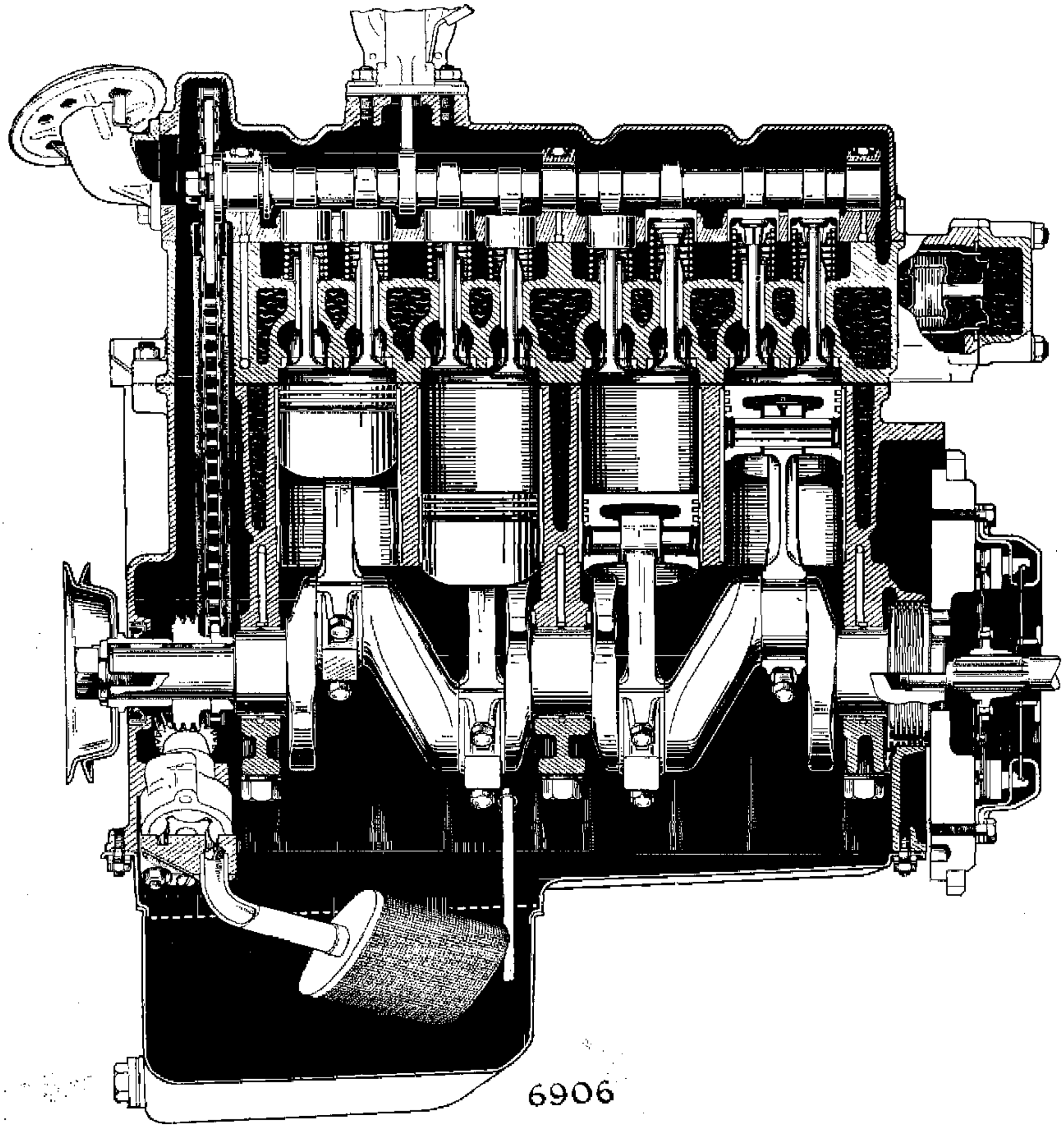


Fig. 1. *Engine—longitudinal section*

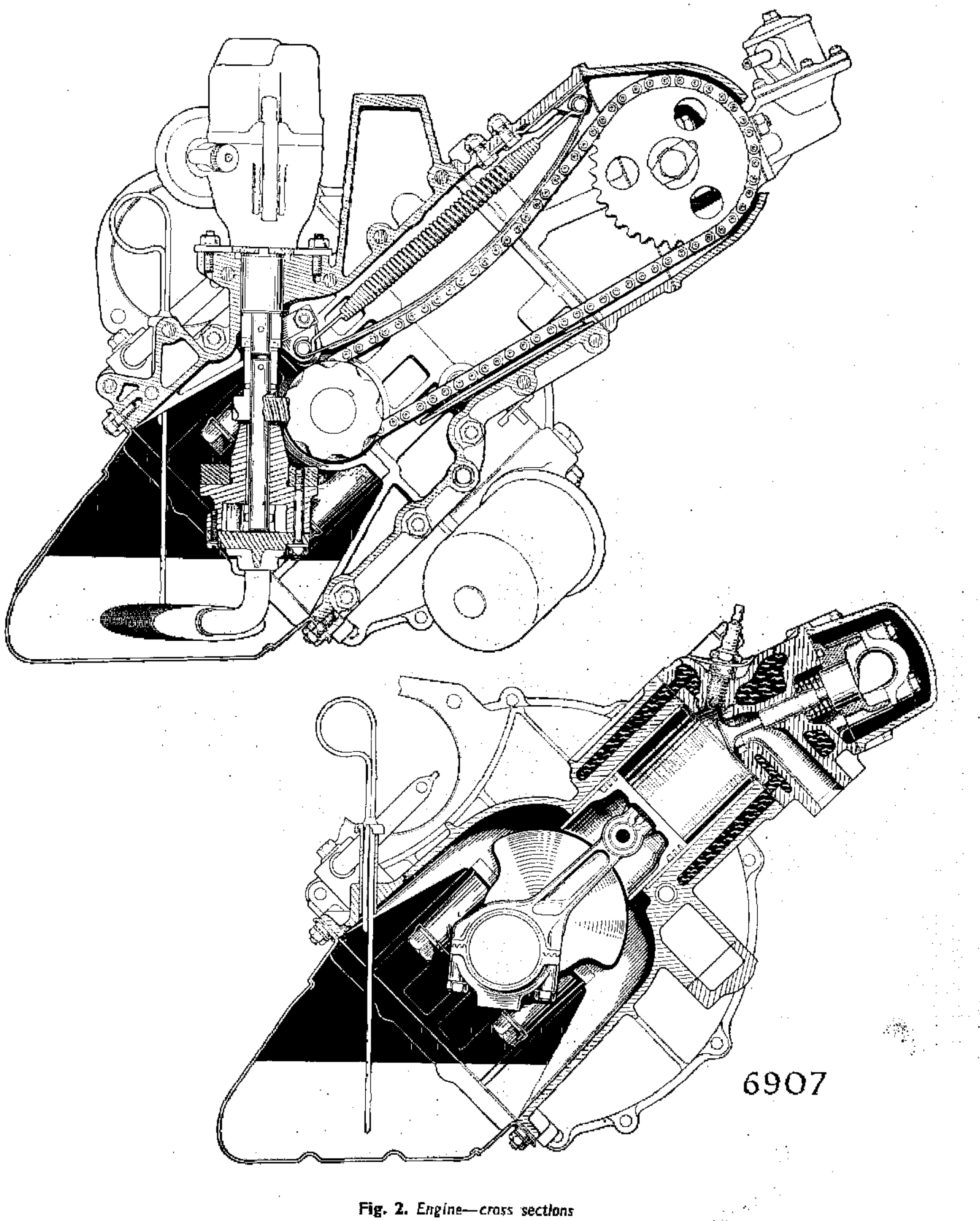


Fig. 2. Engine—cross sections

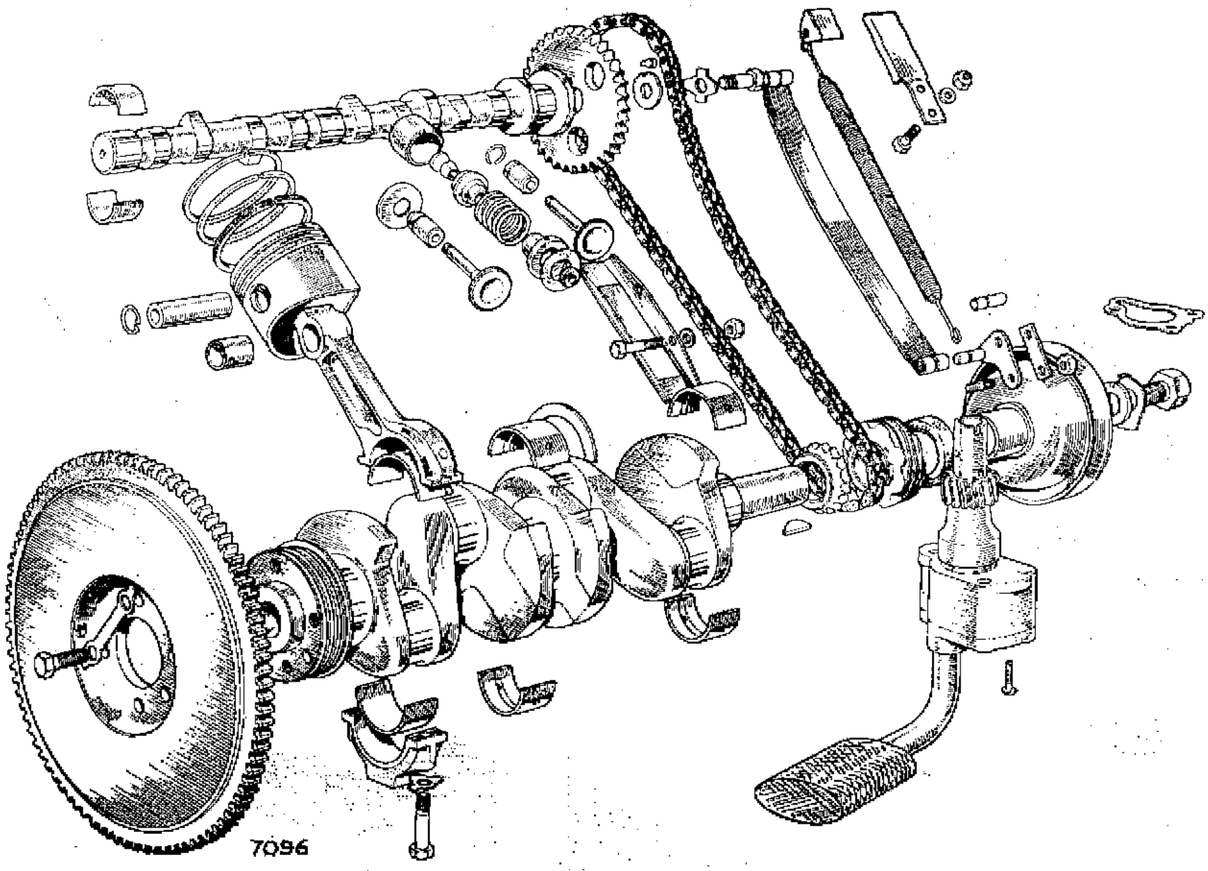


Fig. 3. *Exploded view of working parts*

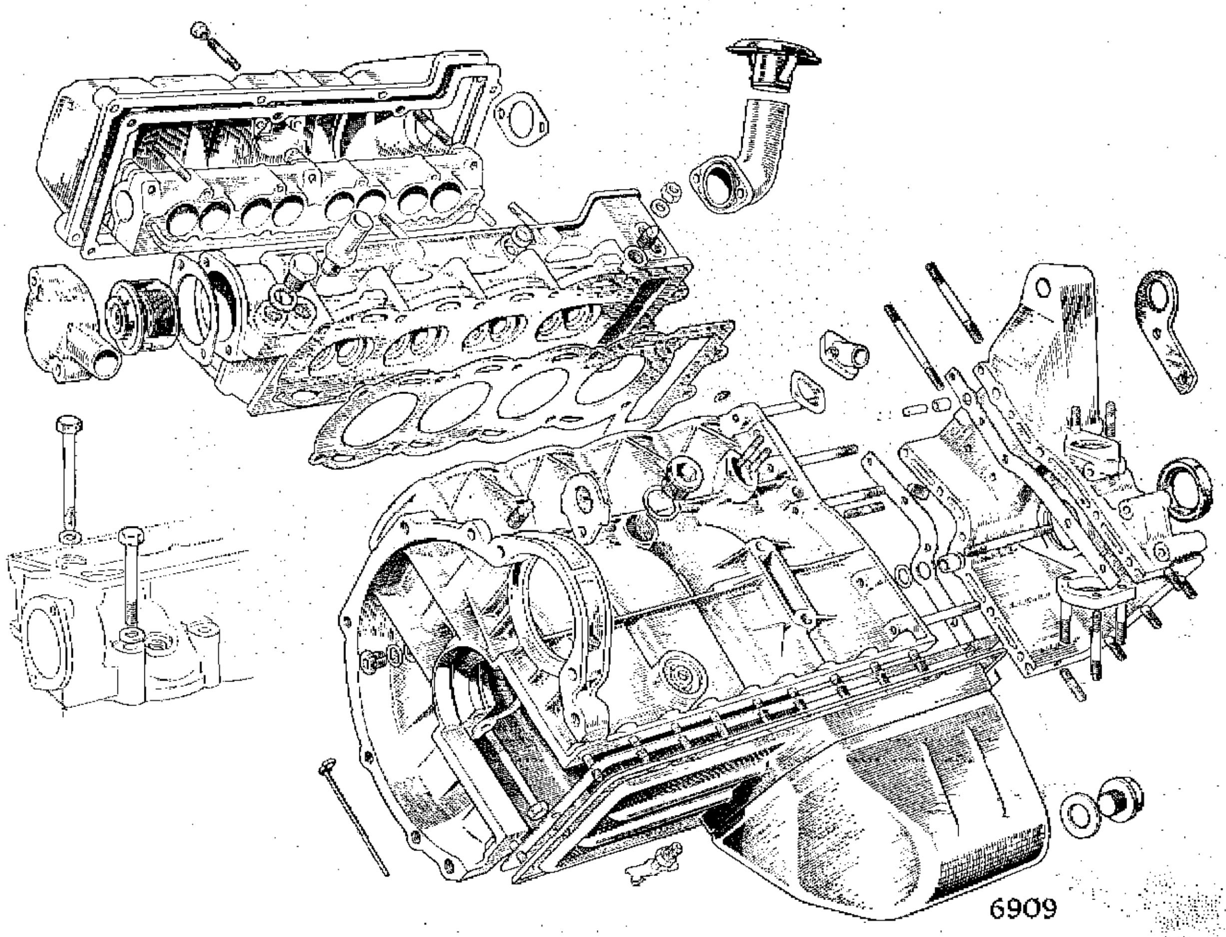


Fig. 4. *Cylinder block and associated parts*

ENGINE

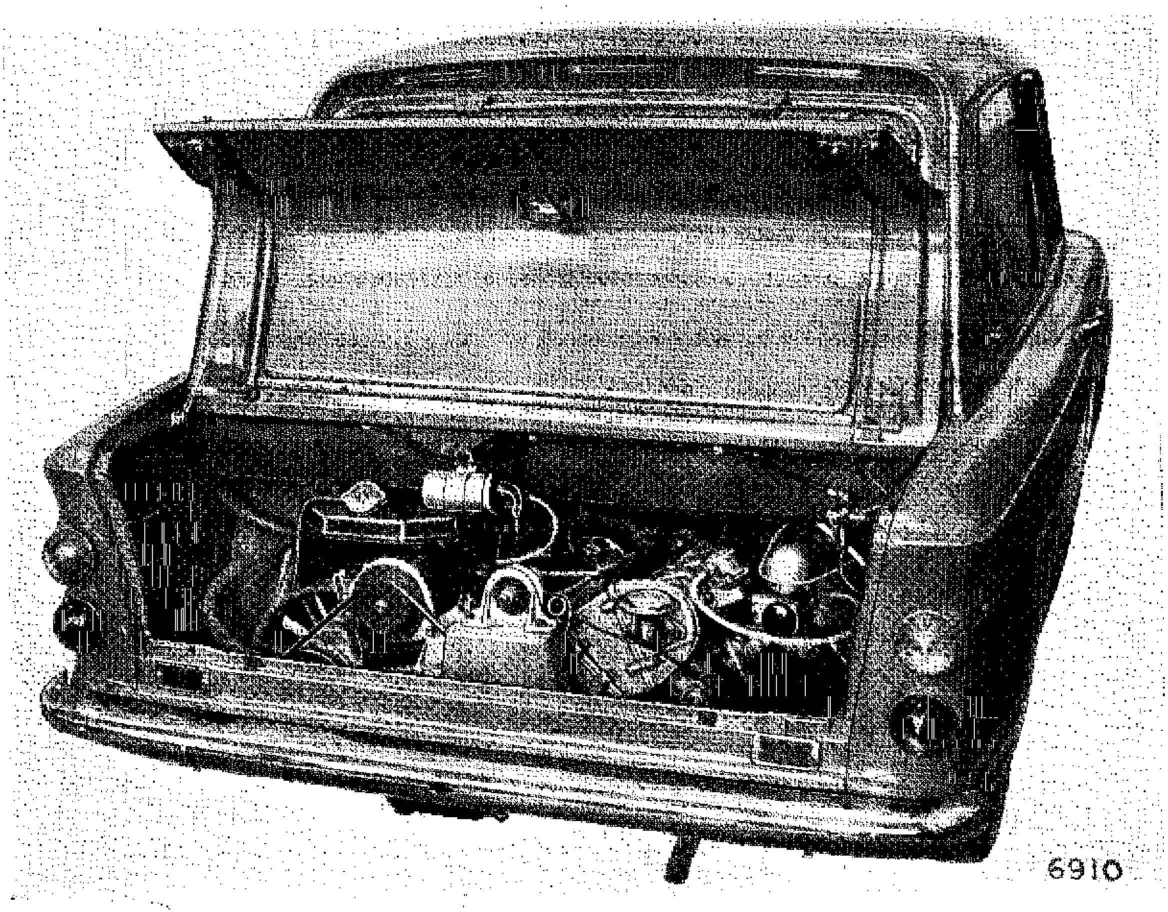


Fig. 5. *View of engine in car*

GENERAL DESCRIPTION

As shown in Fig. 5, the engine is situated at the rear of the car and is bolted directly onto the combined gearbox and rear axle unit. It is inclined at an angle of 45° from the vertical to reduce its overall height and to assist in keeping the centre of gravity as low as possible.

Engine details are shown in Figs. 1 to 4, and from these it will be seen that the valves are operated by an overhead camshaft.

The engine cylinders are numbered from the crankshaft pulley end of the engine, which makes No. 1 cylinder to be nearest when the engine compartment cover is raised.

The cylinder block, cylinder head, valve cover and timing case are pressure die cast in aluminium alloy which gives a considerable saving of weight. Cast iron cylinder liners are used. They are held in position while the cylinder block is pressure die cast around them and then form part of the cylinder block. They cannot be removed, but can be bored out to take oversize pistons.

The camshaft is driven by a single roller chain. The chain is tensioned by a spring loaded rubber faced blade which presses against its trailing side. A rubber faced rubbing plate is fitted adjacent to the driving side of the chain to prevent chain whip.

The eight tappets operate in a light alloy housing held by studs and nuts to the cylinder head. This housing also carries the three pairs of renewable steel backed white-metal camshaft bearings.

Valve clearances are adjusted by using tappet shims of selected thickness between the valve stem ends and the inside flat face of the tappets.

Retiming of the camshaft, after replacing the cylinder head, is a very simple operation as it has not been necessary to have a vernier type of adjustment between the camshaft flange and camshaft sprocket wheel.

The crankshaft is a steel forging and is statically and dynamically balanced after machining. It runs on three main bearings. Its end thrust loads are taken on two semi-circular thrust rings that are located on each side of the upper half of the centre main bearing.

The connecting rods are made from steel stampings and have serrated butting faces at 50° from the vertical to allow easy removal through the cylinder bores. The two big end bolts screw into the tops of the rod and are secured by tab washers. Phosphor bronze bushes are pressed into the little end bores of the rods and the gudgeon pins are retained in the piston by circlips at their outer ends.

Light alloy pistons are used. These are fitted with two compression rings and one oil control ring. The top compression ring is chromium plated.

A large capacity oil pump is driven at half engine speed by skew (cross helical) gears at the front end of the crankshaft.

The distributor takes its drive from offset slots in the end of the oil pump drive gear.

A ghosted view of the oil passages in the cylinder block and cylinder head are shown in Fig. 16.

Full particulars are given in the Data Section of engine power output, compression ratio, compression pressure, valve clearances, ignition timing and all other necessary settings and dimensions.

TORQUE SPANNER SETTINGS

THE CYLINDER HEAD BOLTS, MAIN BEARING FIXING BOLTS, AND OTHER BOLTS AND STUDS SCREW DIRECT INTO ADEQUATE LENGTHS OF THREADS IN THE ALLOY CASTINGS.

A VERY RELIABLE TORQUE SPANNER MUST ALWAYS BE USED WHEN TIGHTENING ALL BOLTS AND NUTS.

THE CORRECT TORQUE SPANNER SETTINGS ARE GIVEN AT THE END OF THE DATA SECTION.

GENERATOR

To adjust belt tension (See Fig. 6)

The generator is driven from the engine crankshaft pulley by the belt which drives the water pump and fan.

The belt is correctly tensioned when a total of 1 in. (25 mm) movement can be obtained on the longest run of the belt.

To adjust the tension, slacken the nuts and bolts at the bottom front and rear of the generator, the link locating bolt and the screw through the slot in the strap.

Move the generator about its bottom two fixing bolts until the correct tension is obtained, then retighten all bolts shown by arrows in Fig. 6.

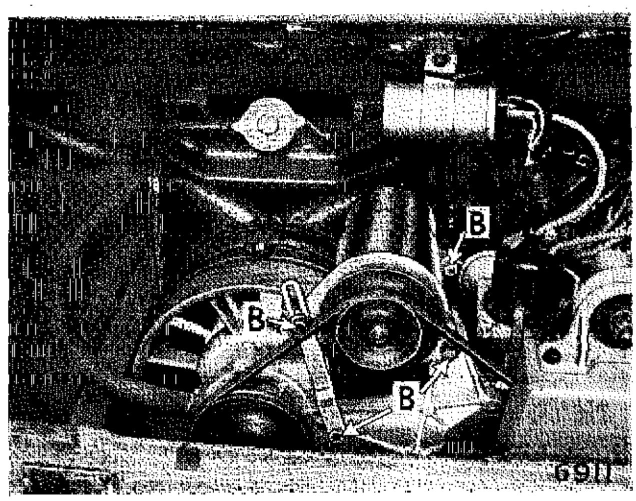


Fig. 6. *Generator driving belt adjustment points*

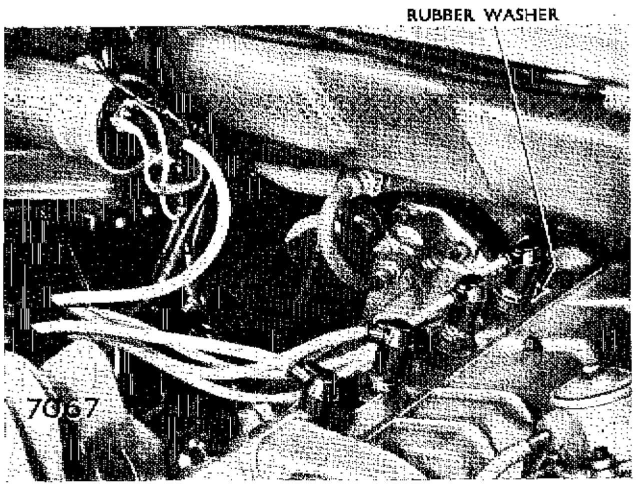


Fig. 7. *Sparking plugs in position*

SPARKING PLUGS

Examination and cleaning

Fig. 7 shows the sparking plugs in position in the cylinder head and Figs. 8 to 12 illustrate the various conditions in which sparking plugs are found on removal. These are as follows:—

NORMAL CONDITION—look for powdery deposits ranging from brown to greyish tan. Electrodes may be slightly worn. These are signs of sparking plugs used under normal conditions of mixed period of high speed and low speed driving. Cleaning and regapping of the sparking plugs is all that is required (See Fig. 8). White to yellowish powdery deposits usually indicate long periods of constant speed service. These deposits have no effect on performance if the sparking plugs are cleaned thoroughly, and the gaps reset at the recommended intervals. More frequent cleaning may be needed if the car is only used for short runs.

WORN CONDITION—This is illustrated in Fig. 9. Any spark plugs found in this condition should be replaced by the correct type given in the Data Section under IGNITION. A complete set should be fitted.

OIL FOULING—is usually identified by wet sludge deposits traceable to excessive oil entering the combustion chamber through worn rings and pistons, excessive clearances between intake valve guides and stems or worn bearings, etc. (See Fig. 10). Hotter sparking plugs may alleviate oil fouling temporarily, but in severe cases engine overhaul is called for.

PETROL FOULING—is usually identified by dry black fluffy deposits which result from incomplete combustion (See Fig. 11). Too rich an air-fuel mixture or faulty action of the automatic choke can cause incomplete burning.

In addition defective contact breaker points or H.T. cables can reduce voltage supplied to the sparking plug and cause misfiring. If fouling is evident in only a few cylinders, sticking valves may be the cause. Excessive idling, slow speeds or stop-and-go driving can also keep plug temperatures so low that normal combustion deposits are not burned off.

BURNED OR OVERHEATED sparking plugs are usually identified by a white, burnt or blistered insulator nose and badly eroded electrodes (See Fig. 12). Inefficient engine cooling and improper ignition timing can cause general overheating. If only a few sparking plugs are overheated, the cause may be uneven distribution of the coolant. Severe service, such as sustained high speed and heavy loads, can also produce abnormally high temperatures in the combustion chamber, which necessitates use of colder sparking plugs.

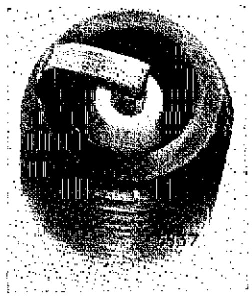


Fig. 8.
Normal condition

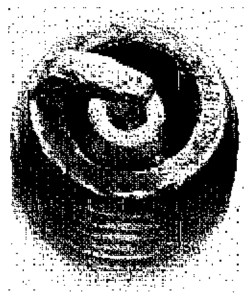


Fig. 9.
Worn condition

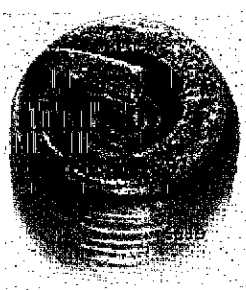


Fig. 10.
Oil fouling

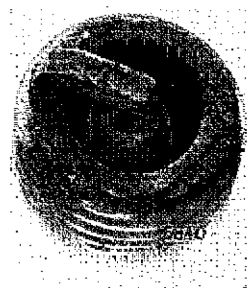


Fig. 11.
Petrol fouling

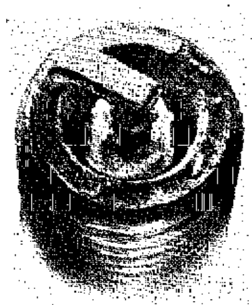


Fig. 12.
Burnt or overheated

To adjust and clean

The correct type of plug is given in the Data Section under "Ignition System".

Plugs should be removed and cleaned at the recommended intervals.

Before removing the sparking plugs, clean area around each plug with a dry brush, or compressed air, to ensure that nothing can enter the cylinders as the plugs are removed.

Large rubber washers are fitted to the sparking plug metal bodies to prevent small objects and dirt from collecting in the sparking plug recesses. See Fig. 7. The rubber washers should be renewed if necessary.

Sparking plugs should be loosened with a $\frac{7}{16}$ in. A.F. ring spanner and then run out with a suitable short box spanner. Plugs should be cleaned and tested in a pressure testing and dry abrasive cleaning machine especially designed for the purpose. After cleaning, the plug threads should be lightly wire brushed to remove any accumulation of carbon or abrasive material.

Before testing the sparking surfaces the electrodes should be filed lightly to remove all traces of burning and to restore flat parallel sparking surfaces. Gaps should then be set to the recommended figure given in the Data Section under "Ignition".

The gap setting of sparking plugs is very important and should be corrected by bending the earth (side electrode). Never attempt to bend the centre electrode as this will damage the insulator tip. A suitable combined gauge and setting tool is illustrated in Fig. 13.

A SMALL QUANTITY OF GRAPHITE GREASE SHOULD BE PUT ON EACH SPARKING PLUG THREAD BEFORE THE PLUGS ARE REPLACED.

When renewing plugs a complete set of the recommended type should be fitted.

IGNITION TIMING AND DISTRIBUTOR

The modern high compression engine is very sensitive to ignition timing. In the following paragraphs, detailed instructions are given of the various methods that can be used to obtain correct ignition timing. Incorrect ignition timing can cause rough running, bad idling, high fuel consumption and poor performance.

It is most important that the correct distributor is used when a replacement unit is fitted. The possibility of a wrong unit having been fitted previously in service must

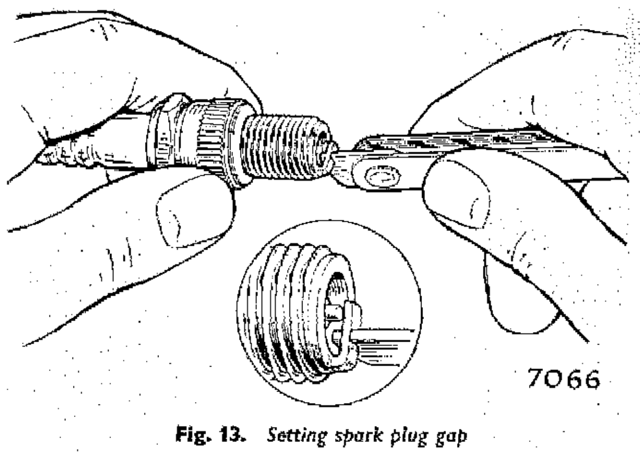


Fig. 13. *Setting spark plug gap*

not be overlooked. Distributors may be identified by the despatch number on the plate fitted on the side of the distributor. Correct despatch numbers are given in the Data Section under "Ignition System".

The distributor is driven by an extension of the oil pump spindle, the connection being made by an offset coupling to ensure correct replacement. The rotor revolves in an anti-clockwise direction viewed from above.

Two means of adjusting the timing are provided as shown in Fig. 14.

(*a*) A clamp screw mounted horizontally. This is the main adjustment, and when it is slackened the body of the distributor can be turned relative to the mounting plate.

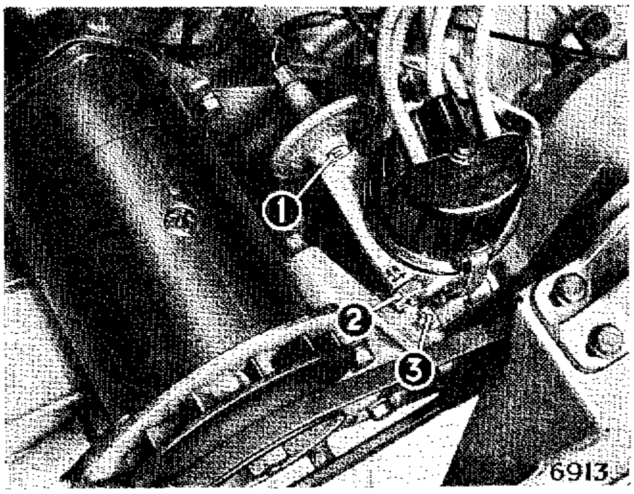
(*b*) The vernier control. This provides an easy means of making small adjustments to the ignition timing to give the best performance from a particular fuel, or to eliminate pinking when excessive carbon deposits have formed in the engine.

One complete turn of the knurled adjustment is equivalent to three crankshaft degrees, and one vernier division to four crankshaft degrees.

The knurled adjustment should be rotated clockwise to retard, and anti-clockwise to advance, as shown by the letters "R" and "A", cast on the distributor body close to, the knurled adjustment.

OWING TO THE CLOSE PROXIMITY OF THE FAN BELT CARE IS NEEDED WHEN ADJUSTING THE VERNIER CONTROL WHILE THE ENGINE IS RUNNING.

Before checking the ignition timing it is most important to see that the contact breaker point gap is correctly set.



1. VERNIER SCALE 3. DISTRIBUTOR CLAMP BOLT
2. VERNIER ADJUSTMENT

Fig. 14. *Distributor clamp bolt and vernier adjustment*

This will ensure that the correct ignition timing is obtained each time the contact breaker points are cleaned and correctly adjusted.

As the contact breaker point gap decreases through gradual wear of the moving point heel, the ignition timing becomes retarded. ·004 in. (10 mm) reduction of contact breaker point gap retards the ignition by approximately 2° of crankshaft movement. This is equal to half a division on the vernier control, which is enough to reduce engine performance noticeably.

Static ignition settings and contact breaker gaps are given in the Data Section under "Ignition System".

To check ignition timing

Fig. 15 shows the fixed T.D.C. pointer above the crankshaft pulley and the T.D.C. groove on the crankshaft pulley opposite to each other.

Rotate the engine in its running direction until the groove on the crankshaft pulley is the required distance before the fixed pointer above the pulley.

This distance which is given in the Data Section under "Ignition", corresponds to the number of degrees advance before T.D.C.

Set the vernier control to the midway position (2 divisions showing on scale).

Remove the distributor cap and connect a 12v. bulb between the L.T. terminal of the distributor and a good earth. With the battery connected and the ignition switched on, this bulb will light when the contact breaker points open.

Switch on the ignition.

Slacken the distributor clamp screw. If the bulb is alight rotate the body of the distributor anti-clockwise until the bulb goes out.

Apply light finger pressure to the rotor in a clockwise direction, turn the distributor body clockwise until the bulb just lights.

Tighten the distributor clamp screw.

Check the setting by turning the crankshaft two revolutions clockwise until the bulb again lights, observing the relative position of the pointer and groove in crankshaft pulley.

The groove on the crankshaft pulley must be the required distance before the fixed pointer. This distance is given in the Data Section under "Ignition". Switch off ignition, remove bulb, and refit all parts.

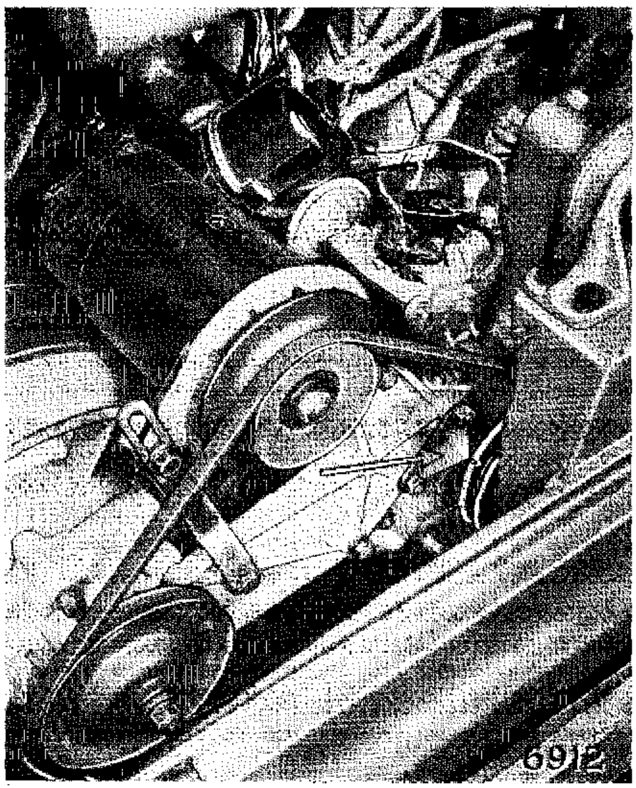


Fig. 15. *Engine top dead centre pointer and crankshaft pulley marking—see arrow*

STROBOSCOPIC TIMING LIGHT

The stroboscopic timing light provides a very rapid and convenient means of setting the ignition timing and checking the action of the centrifugal and vacuum advance action; provided its use is understood.

How the timing light operates

Correctly connected and with the engine running, the timing light gives a high intensity flash every time the contact breaker points open. When this light is directed onto the crankshaft pulley rim, the rim will appear to be stationary. The apparent distance between the groove on the crankshaft pulley rim and the fixed pointer above the pulley indicates the amount of ignition advance.

The advantages of a stroboscopic timing light are:

1. It is simple to use and portable.
2. The ignition timing can be checked quickly and set while the engine is running provided the engine speed can be set with a tachometer.
3. It enables a quick check to be made of the distributor centrifugal and vacuum automatic advance mechanism with the distributor in position, while the engine is running.

Precautions needed when using a stroboscopic timing light are:

1. A tachometer is needed to measure engine R.P.M. This is because the distributor centrifugal advance mechanism starts to operate just below idling speed, and the timing "seen" by a stroboscopic timing light, at idling speed, is slightly more advanced than the specific static ignition timing given in the Data Section under "Ignition". In consequence if the ignition timing were set to the static figure, with a stroboscopic timing light, it would usually be too retarded.

   CARE MUST BE TAKEN TO KEEP THE HANDS AND CLOTHING CLEAR OF THE GENERATOR AND WATER PUMP DRIVING BELT, WHEN USING THE TIMING LIGHT WHILE THE ENGINE IS RUNNING. ALSO, A PIECE OF SUITABLE METAL PIPE SHOULD BE PLACED ON THE SILENCER OUTLET PIPE TO DEFLECT THE EXHAUST GASES.

From this it will be seen that to set the ignition timing with a stroboscopic timing light the engine must be run at a known speed and the ignition timing for this speed checked with the stroboscopic light. A suitable engine speed for this is 1,000 R.P.M.

Checking ignition timing—with stroboscopic timing light

Reference to the ignition in the Data Section will show that the mean centrifugal advance is 2 distributor degrees at 500 distributor R.P.M. which is 4 crankshaft degrees at 1,000 crankshaft R.P.M. This information is used as follows when setting the ignition timing with a simple stroboscopic timing light:

1. Add the centrifugal advance for 1,000 R.P.M. crankshaft speed to the mean static ignition setting. This gives: 4° B.T.D.C.+3° B.T.D.C.=7° B.T.D.C.

2. 7° crankshaft movement is equivalent to a distance of 8 mm measured at the crankshaft pulley rim with a pair of dividers. Set a pair of dividers to 8 mm and mark this distance before the T.D.C. groove on the crankshaft pulley rim. Paint this position with a narrow white line. Also paint the tip of the fixed T.D.C. pointer. Quick drying white paint should be used.

   Note.—*When the stroboscopic timing light is used in conjunction with more elaborate test equipment it will not be necessary to mark the pulley, if the 7° advance can be checked by operating the advance measuring instrument, while using the timing light.*

3. Connect a tachometer and stroboscopic timing light to the engine and run it at speed of 1,000 R.P.M. WITH THE VACUUM ADVANCE PIPE DISCONNECTED FROM THE DISTRIBUTOR. The vacuum advance pipe must be removed, as under light throttle running at this speed there may be some advance movement in the vacuum advance unit.

4. Project the beam of the stroboscopic timing light onto the T.D.C. pointer on the timing case. The white line on the crankshaft pulley rim should appear opposite the T.D.C. pointer while the engine is running at 1,000 R.P.M. If necessary adjust the distributor to obtain this condition.

Checking the centrifugal advance action

Disconnect vacuum feed pipe, still observing the "stationary" line on the crankshaft pulley rim, gradually increase the engine speed. The distance between the line on the crankshaft pulley rim and the pointer on the timing case will increase, showing that the centrifugal advance mechanism has begun to operate over its speed range. Jerky movements of the timing line whilst accelerating or decelerating indicates sticky centrifugal advance mechanism.

Checking the vacuum advance action

The throttle should be opened to give an engine speed of 1,200 to 1,500 R.P.M. or until the vacuum connection drilling in the carburettor has been uncovered by the butterfly valve. With the engine running under these conditions, the vacuum connection of the distributor diaphragm should be alternately disconnected and reconnected whilst observing the line on the crankshaft damper rim. This should retard and advance as the end of the vacuum pipe is removed and refitted. Blockage of the vacuum feed pipe, vacuum feed hole, or jamming of the contact breaker point mounting plate, will prevent correct vacuum action.

DISTRIBUTOR

To remove and refit

Remove high tension leads from plug terminals, noting their positions. Disconnect high tension lead at coil. Disconnect low tension lead at distributor body. Disconnect vacuum pipe. Remove two setbolts securing the distributor to the timing cover and withdraw distributor.

Refitting is a reversal of the above, making sure that the distributor offset driving dogs engage properly.

To fit replacement distributor

Before refitting a replacement distributor, turn the engine so that the timing mark on the crankshaft pulley comes opposite to the fixed pointer above the crankshaft pulley. This brings the distributor driving slots in oil pump gear to the position illustrated in Fig. 23.

Install replacement distributor.

The distributor rotor is now adjacent to No. 1 H.T. connection in the distributor cap. No. 1 H.T. lead should be fitted to this connection and No. 1 cylinder spark plug and the other H.T. leads to give the correct firing order of 1, 3, 4, 2. No. 1 cylinder is the one nearest to the crankshaft pulley. The distributor rotor rotates in an anti-clockwise direction as seen when the distributor cap is removed.

Set the ignition timing by one of the methods previously described.

LUBRICATION

General description

The lubrication system and direction of the oil flow is shown in colour and by black arrows in Fig. 16.

Oil pressure is generated by an oil pump which is mounted below the distributor in the timing cover. The pump is driven by a gear on the crankshaft pulley end of the crankshaft.

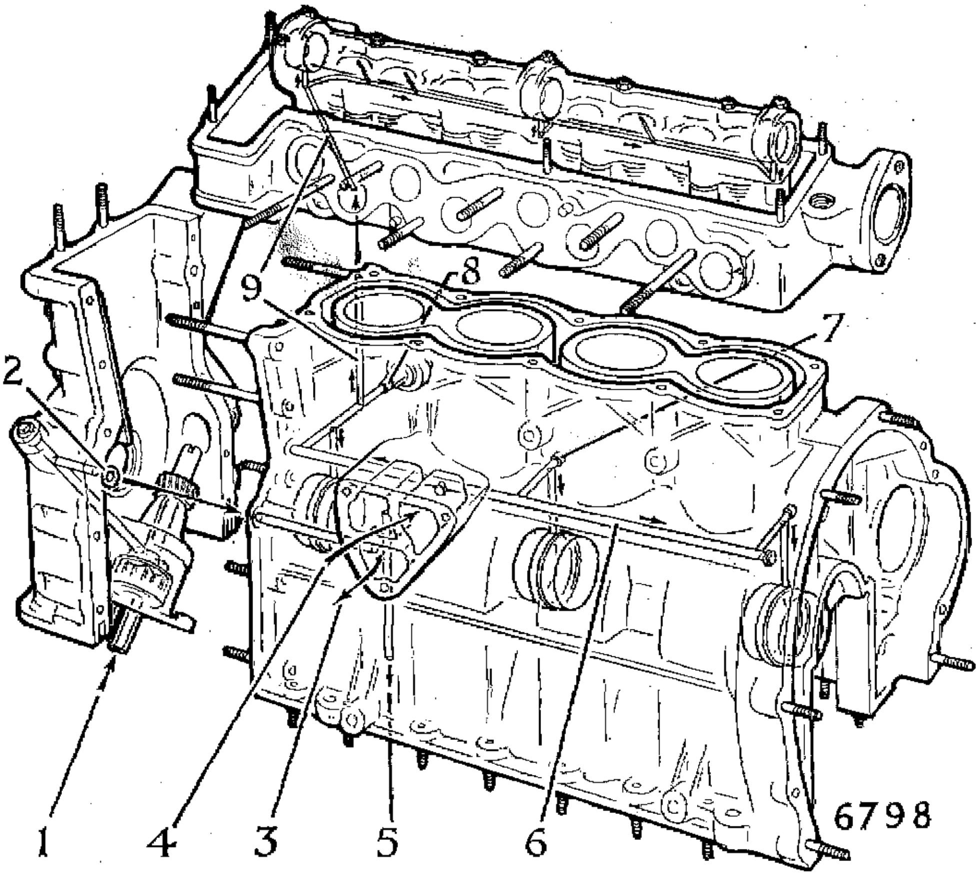
Oil is drawn from the sump through a submerged gauze filter, and is delivered by the oil pump to an internal passage way feeding to the full flow oil filter through which oil passes before it reaches the main oil gallery, on the filter side of the engine. From this gallery the oil is fed into the oil ways feeding to each main bearing, and to a single passage feeding up to the camshaft bearings and valve gear.

Drilled passages in the crankshaft allow oil to flow from the main bearings to the crankpins to lubricate the big end bearings. The cylinder walls, pistons and little end bearings are lubricated by the oil which leaves the bearings and thrown up by the rotating crankshaft.

The tappets are lubricated by oil that leaves the camshaft bearings and by separate holes that feed oil to the maximum thrust side of numbers 1, 2 and 6 tappets.

Oil drains from the valve gear into the timing case and lubricates the timing chain and driving sprockets.

A pressure relief valve, in the full flow oil filter body, controls the oil pressure and returns excess oil circulated by the pump direct to the sump.



1. OIL FEED TO PUMP FROM PUMP INTAKE GAUZE
2. RUBBER SEALING RING USED BETWEEN TIMING CHAIN COVER CASE AND CYLINDER BLOCK
3. OIL FEED TO FILTER
4. OIL FEED FROM FILTER
5. OIL DRAIN TO SUMP FOR OIL LEAVING OIL PRESSURE RELIEF VALVE
6. OIL FEED GALLERY TO MAIN BEARINGS
7. CONNECTION POINT USED WHEN FITTING OIL PRESSURE GAUGE
8. OIL PRESSURE WARNING LIGHT SWITCH CONNECTION POINT
9. OIL FEED TO CAMSHAFT BEARINGS AND VALVE GEAR

Fig. 16. *Oil ways in cylinder block and cylinder head*

FULL FLOW OIL FILTER

Description (See Figs. 17, 18 and 19)

The full flow oil filter is bolted to the side of the crankcase below the exhaust manifold. All oil delivered by the oil pump enters compartment "A" in the filter main body.

After a very fast idling speed the oil pump supplies oil at a greater quantity then can pass through the engine bearings and in consequence a high oil pressure builds up. This pressure is controlled by the non-adjustable relief valve; in the top of the filter body; to the figure given in the Data Section under "Lubrication". All excess oil delivered by the oil pump passes through the relief valve and returns to the engine sump through compartment "C".

All oil passing into the element casing flows through the element from its outside surface leaving the element and filter by the centre bore of the element and compartment "B".

The filter element bore is sealed at its two ends by joints that form part of the element. Separate joint rings are not used.

OIL PRESSURE RELIEF VALVE

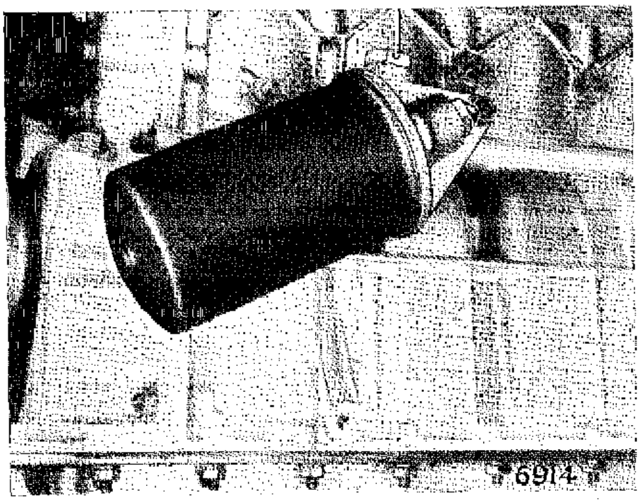
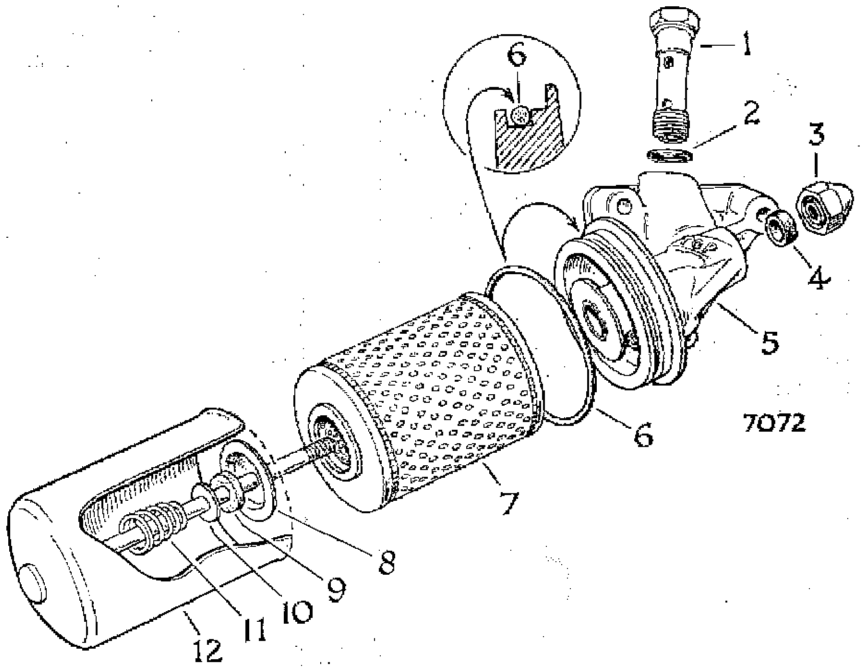


Fig. 17. *Oil filter and relief valve—position on engine*



1. RELIEF VALVE ASSEMBLY
2. RELIEF VALVE JOINT
3. FILTER CASE RETAINING NUT
4. RUBBER SEALING WASHER USED UNDER NUT
5. FILTER MAIN BODY
6. FILTER CASE "O" RING
7. FILTER ELEMENT
8. ELEMENT SUPPORT PLATE
9. FELT WASHER
10. STEEL WASHER
11. ELEMENT SUPPORT SPRING
12. FILTER CASE

Fig. 18. *Oil filter—exploded view*

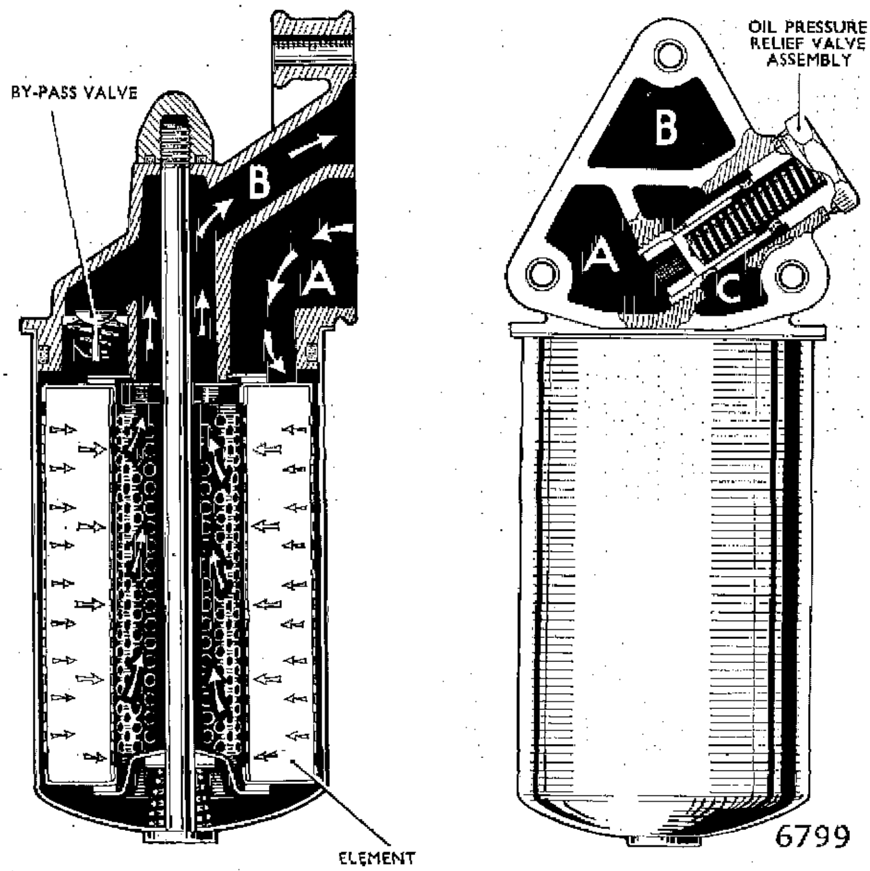


Fig. 19. *Oil filter—sectional views showing oil pressure-relief valve and by-pass valve*

Oil pressure relief valve (See Fig. 19)

The piston type relief valve is a complete assembly that cannot be dismantled. It screws into compartment "C" of the filter body and can be removed with a $\frac{13}{16}$ in. A.F. open end spanner. If it needs cleaning it is washed in paraffin and blown dry with clean compressed air, while the piston valve is held off its seat.

Filter by-pass valve (See Fig. 19)

A spring loaded valve, situated between compartments "A" and "B" opens to allow oil to reach the bearings and other vital parts should the oil filter become choked due to lack of regular servicing. A pressure difference of 8–13 lbs./sq. in. (·56–·91 kg. sq. cm.) between compartment "A" and "B" is needed before this valve opens.

Filter element—To renew (See Fig. 18)

The filter cannot be drained and a container should be placed under the filter before removing the filter casing to catch any oil that will be lost. This oil should be discarded.

Remove domed nut above the filter body.

Withdraw filter casing and remove element.

Clean out filter casing and renew joint ring (4) under the domed nut (3).

Check that the element support spring (11), steel washer (10), felt washer (9) and element support plate (8) are positioned on the through bolt as shown in Fig. 18. The felt washer (9) must be in good condition and not trapped between the through bolt and support plate. These parts must be assembled so that the element is supported by the spring as shown in Fig. 19 otherwise unfiltered oil will pass to the engine bearings.

Place the new element in the filter casing (12).

Replace casing and tighten the domed nut.

Add sufficient oil to the sump to replace oil lost while removing filter casing. Run engine and carefully check for oil leaks.

Recheck sump oil level.

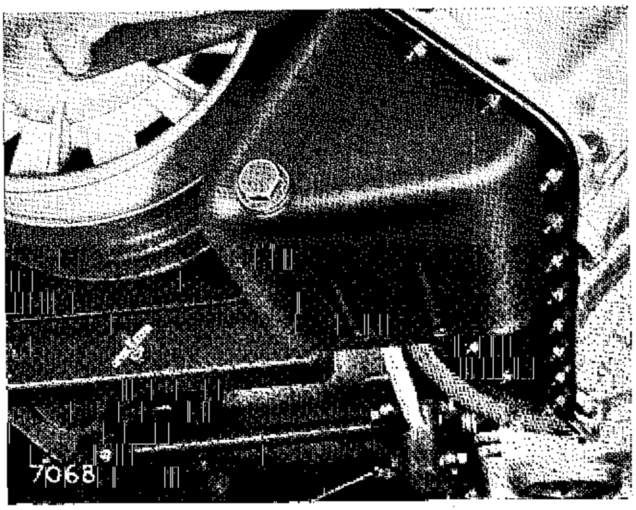


Fig. 20. *Oil sump and flywheel cover gauze*

REASON FOR LOW OIL PRESSURE

If the warning light comes on, or the oil pressure gauge (if fitted) shows a reduced oil pressure the reason may be:

Low oil level in sump.

Pressure relief valve not working properly.

Choked oil filter.

Worn main and big end bearings.

Worn oil pump.

Choked oil pump intake filter.

OIL SUMP—To remove and refit (See Fig. 20)

Drain sump.

Remove gauze guard over bottom of flywheel and the 24 $\frac{7}{16}$ in. A.F. nuts and spring washers holding sump to the cylinder block.

Remove sump and sump joint.

When replacing sump a new joint should be fitted.

OIL PUMP

Information on service replacement oil pumps is given on page 41.

Operation

A four-lobe rotor pinned to the pump spindle, drives a ring which has five internal lobes. The outer diameter of the ring rotates in the circular bore of the oil pump body; this bore is offset to the spindle axis. These parts are shown in Fig. 22.

The lobes run at a very close clearance. Their rotary movement creates constant suction to draw oil through the pump intake filter and delivers oil at a high pressure to the outlet gallery feeding to the oil filter.

The oil pump output, above a very fast idling speed, is greater than the rate at which oil can pass through the engine bearings. This causes a build up of oil pressure which is controlled by the oil pressure relief valve situated in the oil filter body.

Oil pump intake filter—To clean (See Fig. 21)

Whenever the sump is removed the opportunity should be taken to inspect this wire gauze filter.

Provided the recommended lubricating oil is used, and the external full flow oil filter element changed at the recommended intervals, the intake filter does not normally need cleaning.

If cleaning is needed the oil pump base must be removed. NO ATTEMPT MUST BE MADE TO REMOVE THE FILTER PIPE FROM THE OIL PUMP BASE.

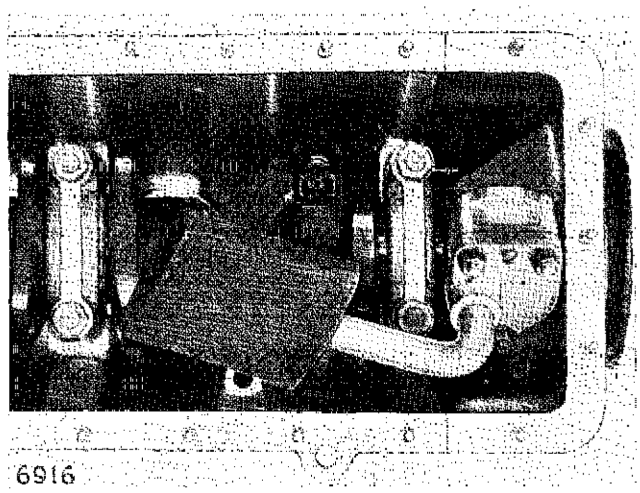


Fig. 21. *Oil pump intake filter*

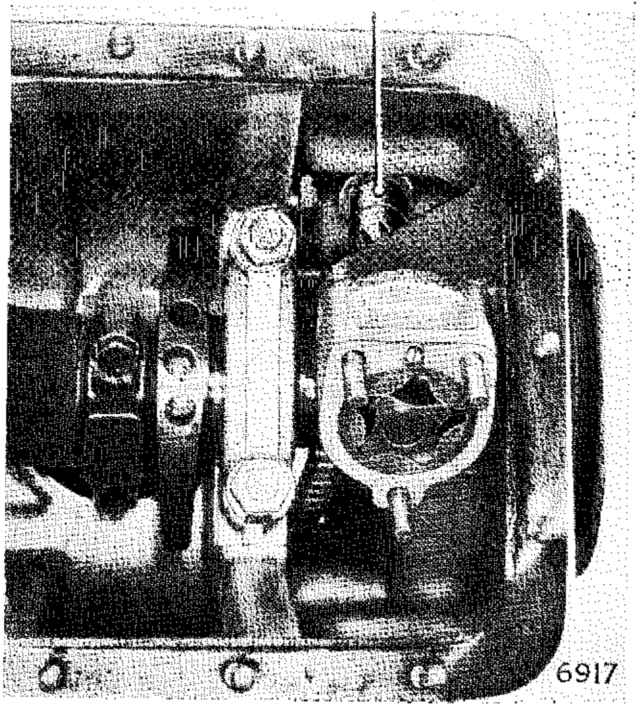


Fig. 22. *Oil pump with bottom cover and filter removed—position of pump drive at No. 1 TDC fixing*

Remove 4 $\frac{7}{16}$ in. A.F. nuts and 1 cheese head screw holding base to the pump body.

Remove oil pump base taking care to prevent the oil pump outer rotor from falling out.

Retain the oil pump outer rotor in position by replacing the cheese headed screw with a large washer under its head.

Wash the wire gauge in paraffin and blow it dry with clean compressed air.

When replacing the filter and oil pump base do not use any jointing compound or gasket between the oil pump body and base faces.

To remove (See Fig. 22)

Remove distributor cap and turn engine so that the groove in the crankshaft pulley lines up to the T.D.C. pointer when the distributor rotor is at No. 1 firing position. No. 1 cylinder is the one nearest to the crankshaft pulley.

There is no need to remove the distributor.

Remove the sump.

Remove the oil pump base and use the cheese headed screw and a large washer to prevent the pump outer rotor from falling out.

Note that the offset slot, in the pump gear extension, and the distributor drive tongue are at the position shown in Fig. 22.

Withdraw pump.

To replace

As the distributor takes its drive through an offset tongue engaged in an offset slot in the oil pump gear extension, correct ignition timing is dependent on the correct meshing of the oil pump driven gear to the driving gear on the crankshaft.

If the engine is not turned, after removing the oil pump, correct replacement is a reversal of the removal procedure and ensuring that the oil pump drive is in the position shown in Fig. 22.

If the engine has been turned after removing the oil pump, with the distributor left in position, it should be turned to No. 1 T.D.C. on the firing stroke and the distributor rotor turned to No. 1 firing. The pump can then be replaced so that its driven gear is engaged to obtain the condition shown in Fig. 22.

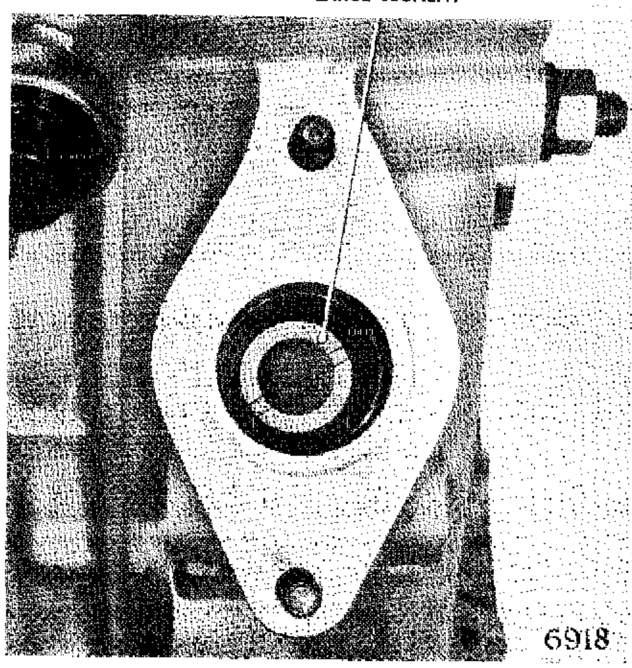


Fig. 23. *Position of oil pump drive for No. 1 TDC fixing*

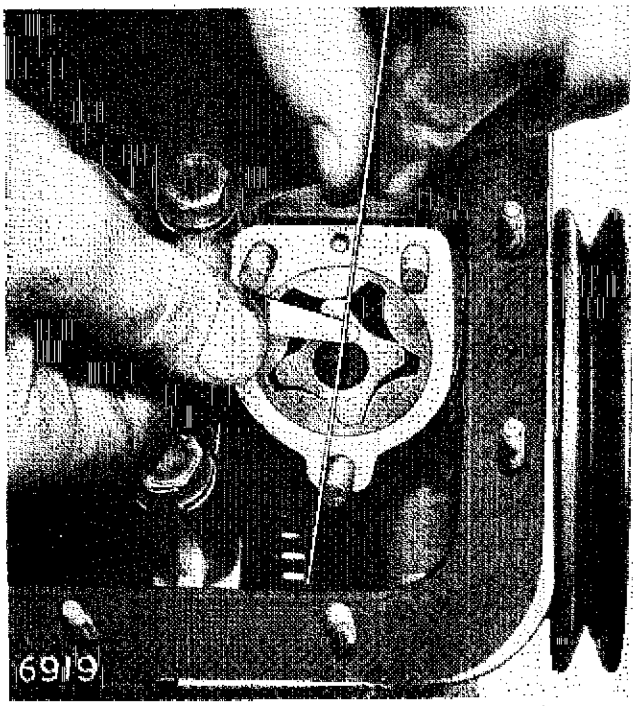


Fig. 24. *Checking oil pump rotor end clearance*

With the engine in a fully assembled condition, No. 1 firing stroke is found by removing No. 1 sparking plug and placing a thumb over the plug hole to feel when compression is occurring.

If the oil pump is replaced, with the distributor off the engine, its correct position for No. 1 T.D.C. is shown in Fig. 23.

A thin gasket is used between the oil pump body face, at the driving gear end, and the face against which the pump bolts on the timing case.

Replace the sump and refill with the correct grade of oil.

To check working clearances (See Figs. 24 to 26)

If necessary the oil pump working clearances can be checked with the pump in position, after removing the pump base plate. The following clearances should be checked:

End clearance between the inner and outer rotors and pump base. The maximum and minimum clearances are ·003 in. (·076 mm) and ·001 in. (·025 mm) when measured with a feeler and straight edge as illustrated in Fig. 24.

Side clearance between the top of the lobes on the inner and outer rotor as shown in Fig. 25. The maximum and minimum clearances are ·006 in. (·152 mm) and ·001 in. (·025 mm). New parts should be fitted if the maximum clearance is exceeded.

Clearance between the outside of the outer rotor and pump body must not be greater than ·008 in. (·20 mm) and not less than ·005 in. (·127 mm). Should the clearance found be above the maximum figure, a replacement pump should be fitted. See Fig. 26.

INLET AND EXHAUST MANIFOLDS

The inlet and exhaust manifolds are usually removed together with the carburettor on the inlet manifold. If the carburettor has been removed first, it is possible to remove the inlet manifold before removing the exhaust manifold.

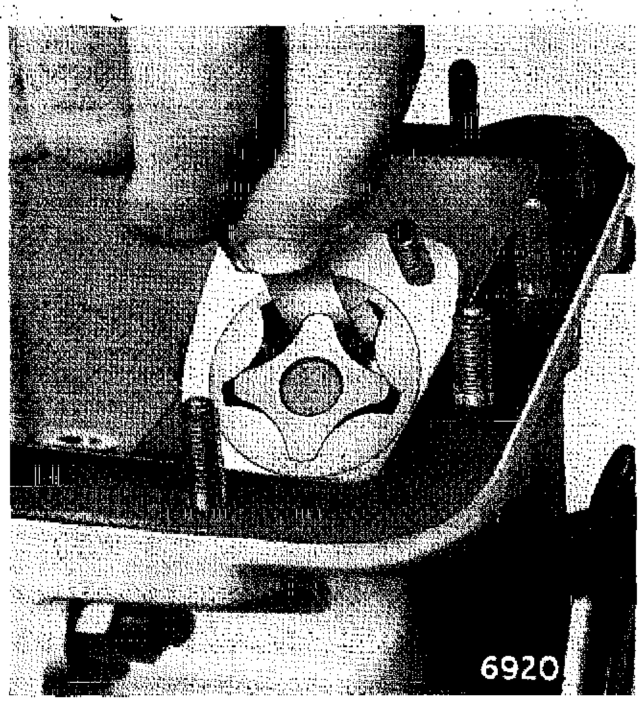


Fig. 25. *Checking oil pump rotor top clearance*

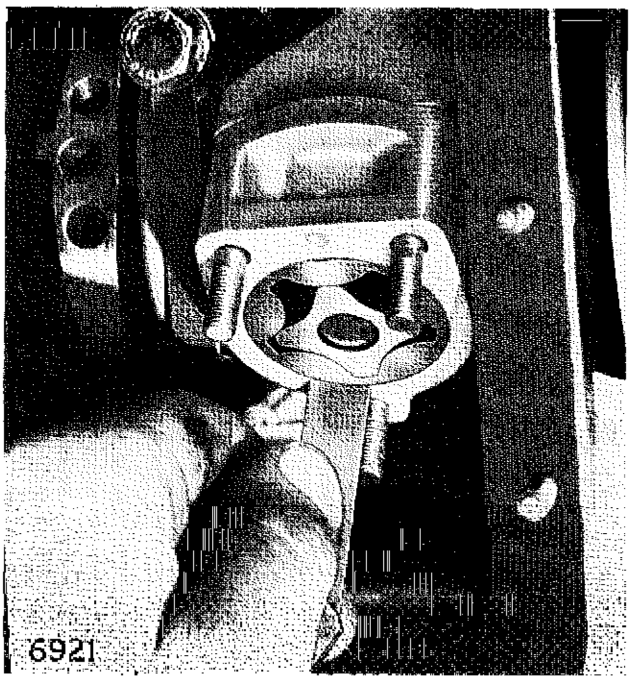


Fig. 26. *Checking oil pump rotor outer clearance*

To remove

Remove silencer by disconnecting its support bracket end and releasing its clamp on the exhaust manifold.

Unbolt the air cleaner support bracket from the inlet manifold. Release the clip on the carburettor intake and lift off air cleaner.

Remove filter cover wing nut and lift off filter top body.

Disconnect vacuum advance pipe at carburettor end.

Remove throttle air line from throttle operating cylinder on carburettor.

Remove seven ½ in. A.F. nuts and washers holding the exhaust manifolds to the cylinder head.

Remove two manifold holding clamps.

Lift off manifolds. The inlet manifold may now be lifted away from the exhaust manifold.

To refit

Replace manifold gasket on the cylinder head with a new one. Place exhaust manifold on the cylinder head using its extreme end fixing nuts to lightly hold the exhaust manifold in position. The nearest nut should be just finger tight and the farthest nut about half way on. This leaves the exhaust manifold in a position that will allow the easy fitting of the inlet manifold complete with carburettor.

Place inlet manifold in position making sure that the two copper pipes from the carburettor enter the two "U" tube ends protruding from the exhaust manifold.

Refit the two manifold clamps and lightly tighten to hold inlet manifold in place.

Refit the seven ½ in. A.F. nuts and washers and tighten these, and the two clamp nuts to the tightening torque given at the end of the Data Section under "Torque Loading".

Reconnect fuel feed pipe at pump, vacuum advance pipe to carburettor, throttle operating pipe and the air cleaner.

See Section C, under "Air Cleaner", for correct position to replace air intake pipe.

Refit silencer.

COMPRESSION PRESSURES

These should be taken when the engine is hot with all sparking plugs removed, and the throttle held fully open, at starter cranking speed.

A suitably cranked adaptor pipe will be needed to reach the forward cylinders.

An engine in good condition should give the compression pressures given in the Data Section under "Engine—General".

If the compression readings are below those given it will be advisable to remove the air cleaner top body from the carburettor and air cleaner element body. This will enable the position of the automatic choke valve and condition of the air cleaner element to be seen. If these items are satisfactory loss of compression indicates that the valves, and possibly the rings, are in need of attention.

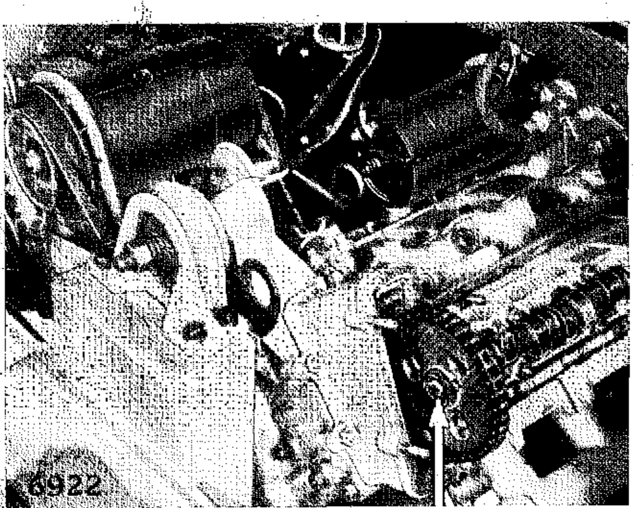


Fig. 27. *Camshaft sprocket fixing bolt*

CYLINDER HEAD—VALVE GEAR—AND TOP OVERHAUL

Valve cover—To remove and refit

Owing to the angle at which the engine is inclined a small amount of oil always remains in the valve gear, and if the valve cover is removed, this oil will run onto the manifolds and other engine parts. To prevent this the car should be raised and lowered before removing the valve cover; with the engine stationary, so that oil can drain from the valve gear into the timing chain compartment.

Remove air cleaner from carburettor. This is described in Section "C" under "Air Cleaner".

Disconnect fuel feed pipe to carburettor at fuel pump end.

Remove two $\frac{1}{2}$ in. A.F. nuts holding fuel pump to valve cover and remove fuel pump carefully noting number of joints between pump and cover. Tie pump up above engine to prevent fuel draining through pump.

Undo eight $\frac{7}{16}$ in. A.F. nuts. Remove the eight washers and lift off cover.

Replacement is a reversal of the removal procedure. A new joint should always be used under the cover and the fuel pump must be replaced with the same number of joints as these are used to control the fuel pump output pressure.

Cylinder head—To remove

If the cylinder head is being removed for the valves to be ground in, see page 28 under "Valve clearances—when to check".

Disconnect battery positive lead.

Remove radiator cap and drain radiator and cylinder block. The drain taps are situated in the radiator bottom tank and on the right-hand side of the cylinder block. They can be reached from under the back of the car.

Remove air cleaner from the carburettor. See Section C "Air Cleaner".

Disconnect and remove fuel pipe from pump to carburettor.

Remove two $\frac{1}{2}$ in. A.F. nuts holding fuel pump to rocker cover, lift out fuel pump and tie it to a convenient point to prevent fuel draining from the fuel tank. Very carefully note the number of joints between the fuel pump and rocker cover as these determine the fuel pump pressure.

Remove vacuum advance pipe from its connection on the carburettor and unbolt its clip from the position on the front of the rocker cover.

Remove valve cover.

Remove sparking plugs.

Bend back taps of the sprocket wheel fixing bolt locking plate. See Fig. 27.

Insert camshaft chain tensioner compressing tool R.G. 354 as shown in Figs. 28 and 40.

Block up timing case with clean lintless rag.

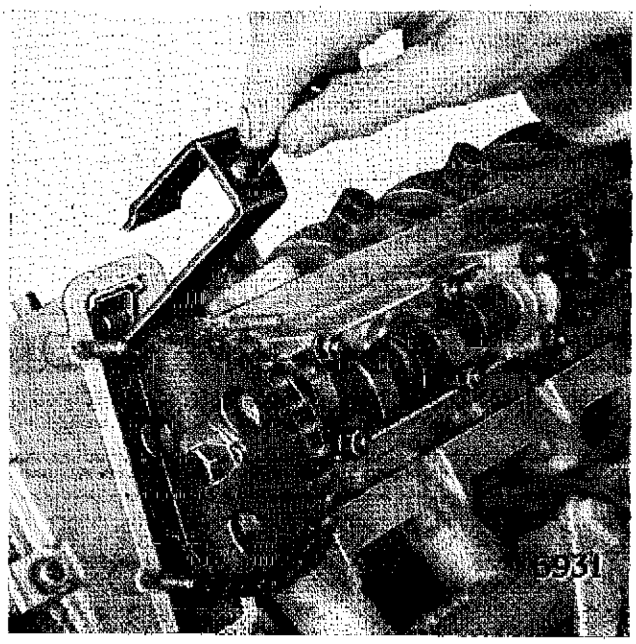


Fig. 28. *Inserting camshaft chain tensioner compressing tool RG354*

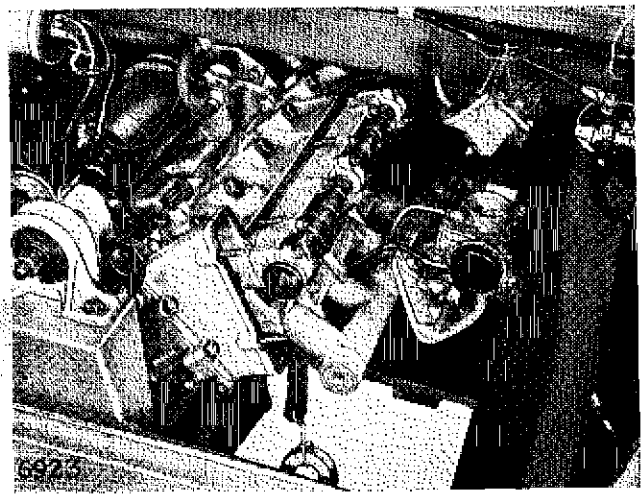
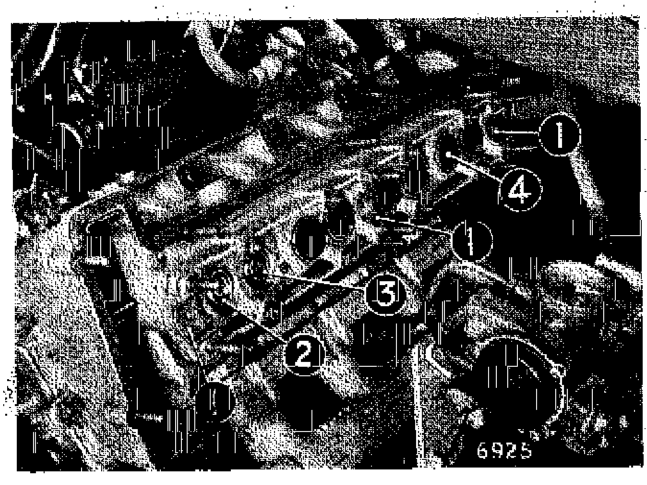


Fig. 29. *Position taken by timing chain after removing camshaft sprocket*

Remove the $\frac{9}{16}$ in. A.F. sprocket wheel fixing bolt and lift off sprocket wheel from camshaft, and clear from sprocket chain. There is no need to make any timing marks, but CARE SHOULD BE TAKEN TO ENSURE THAT THE DOWEL PEG IN THE CAMSHAFT FLANGE DOES NOT COME OUT AND FALL DOWN INTO THE CHAIN CASE. Tie a piece of string to the timing chain and attach a suitable weight to its free end, so that the chain hangs over the edge of its cover housing. See Fig. 29. If the chain falls into the timing case it can be picked up with a wire hook. It does not matter if the chain moves onto different teeth on the crankshaft sprocket.

Suitably mark the camshaft bearing caps to ensure that they can be refitted into their correct positions.



1. CAMSHAFT LOWER BEARINGS
2. VALVE CAP
3. TAPPET SHIM
4. TAPPETS

Fig. 30. *Camshaft removed*

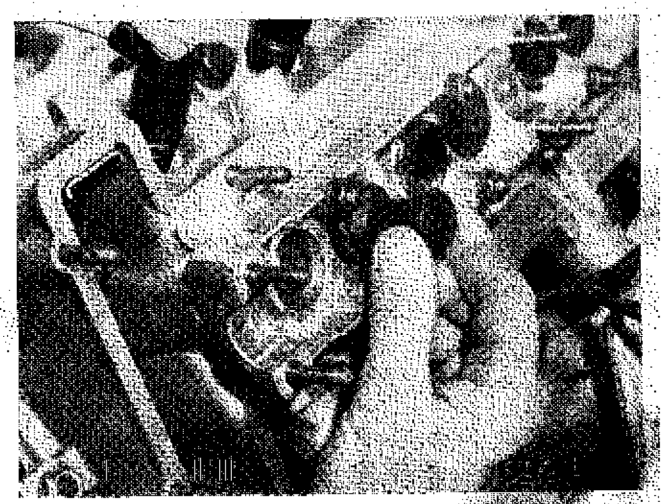


Fig. 31. *Lifting out tappets*

Remove camshaft by evenly and progressively releasing the camshaft bearing cap nuts. Ensure that no bearing shells fall out of the caps when they are lifted off. Lift out camshaft. (See Fig. 30).

Remove eight tappets and tappet shims, keeping each tappet and shim together, and noting the position in which each was taken—THIS IS IMPORTANT. Tappets can be lifted out with a valve grinding suction tool—RG361—as shown in Fig. 31.

Remove eight $\frac{7}{16}$ in. A.F. nuts and washers securing the tappet housing and lift off the housing.

Disconnect cylinder head outlet hose at its radiator end and the heater hoses, if fitted, at the rear of the cylinder head. (See Fig. 32).

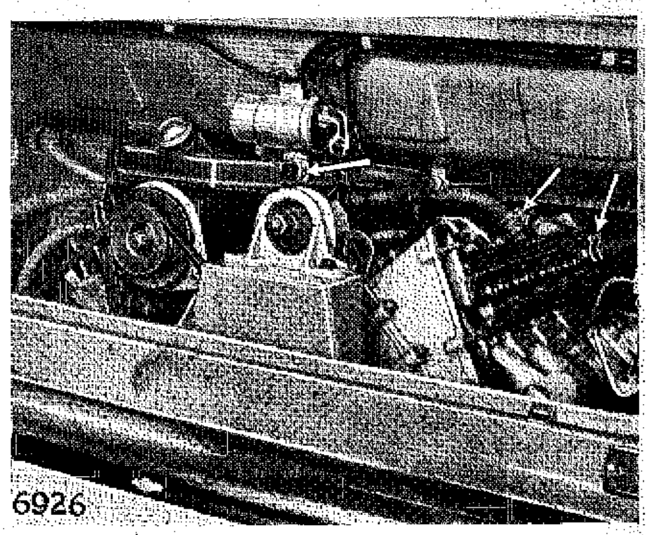


Fig. 32. *Positions for disconnecting water hoses*

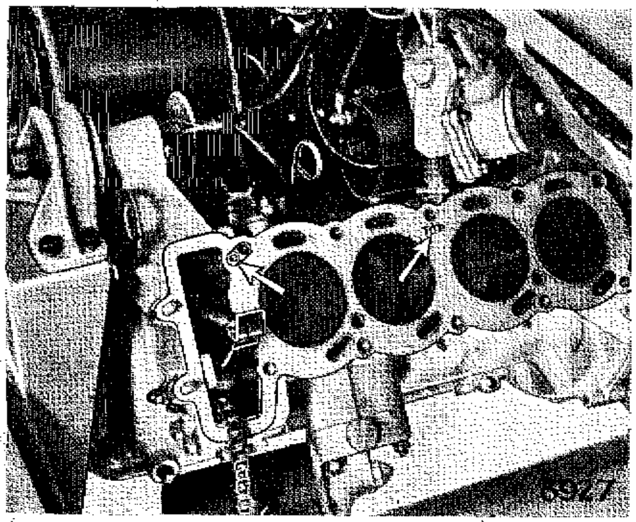


Fig. 33. *Positions of small sealing rubber ring and word TOP on cylinder head gasket*

Remove silencer by releasing its clamp connection on the exhaust manifold and disconnecting its fixing nut at the support bracket end.

Remove ten $\frac{9}{16}$ in. A.F. headed bolts and two $\frac{9}{16}$ in. A.F. nuts and washers and lift off cylinder head with manifolds and carburettor still attached.

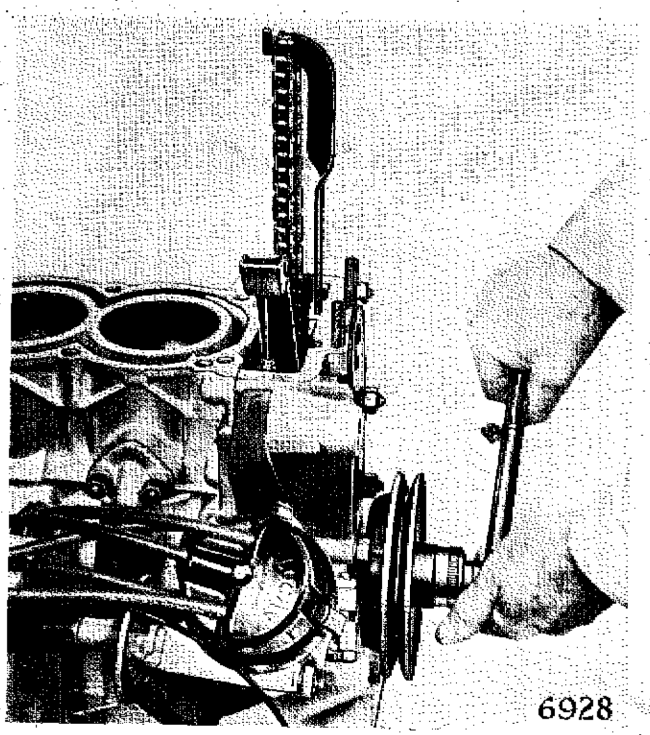


Fig. 34. *Timing chain support tool*

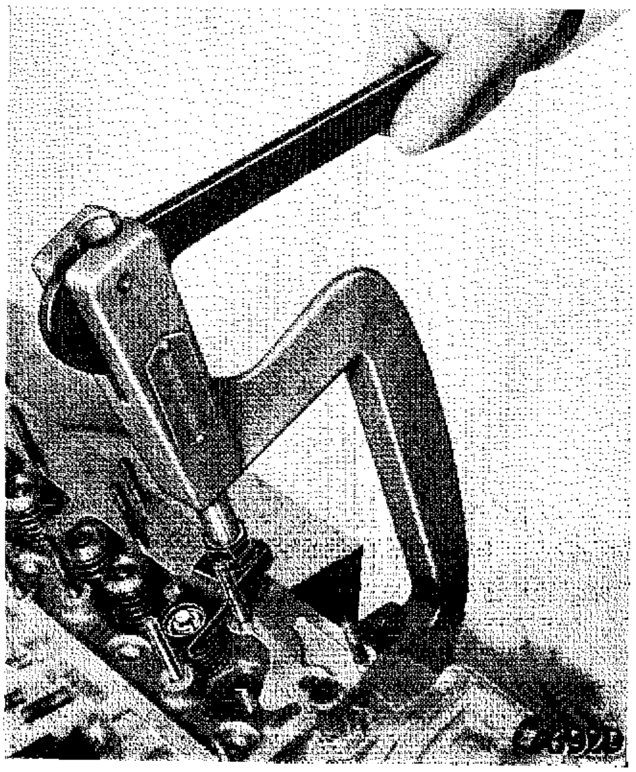


Fig. 35. *Valve spring compressor in use*

Remove the cylinder head gasket, TAKING CARE NOT TO LOSE THE SMALL RUBBER JOINT RING, WHICH SEALS THE OIL WAY TO THE VALVE GEAR. Tie this small joint ring to one of the cylinder head studs to prevent it being lost and to ensure that it is not forgotten when replacing the cylinder head. See Fig. 33.

Decarbonising

The engine can be turned when the timing chain is held finger tight and allowed to move over the finger, alternatively the chain may be supported with the Churchill tool—RG353—shown in Fig. 34.

Care is needed when scraping away carbon as both the piston and cylinder head are made in aluminium alloy.

Valves—To remove (See Figs. 35 and 36)

The valve springs can be compressed with the Churchill valve spring compressor R6513A fitted with the adaptor RG6513-3. Exhaust valve removal follows normal practice but in the case of the inlet valves rubber sealing

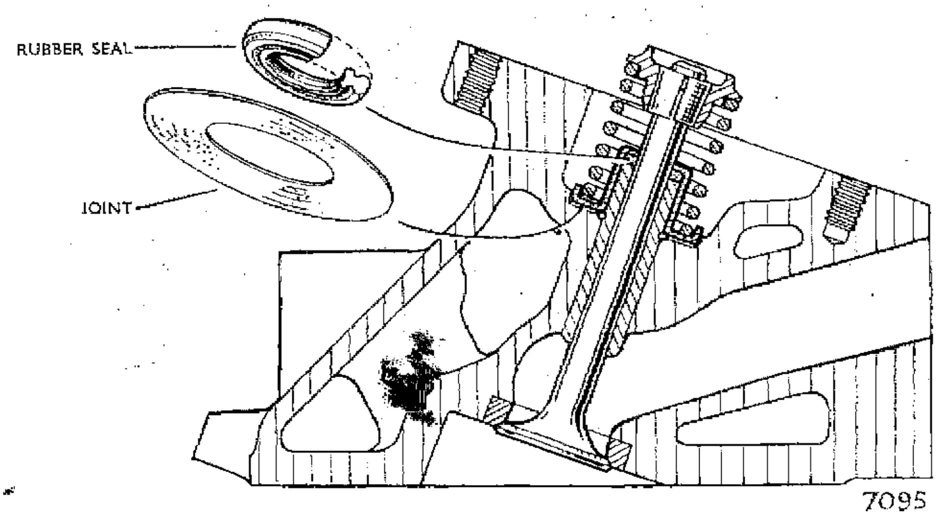


Fig. 36. *Inlet valve guide oil seal details*

rings are fitted between the steel caps on which the valve spring lower ends rest, and the top of the valve guides. Joints are also fitted between the bottom of each inlet valve cover and cylinder head.

The rubber seals and joints prevent oil being drawn down the inlet valve guides.

Examination of valves, valve guides, springs and seats

Valves

Valves that are in anyway suspect due to signs of stem wear, and pitting of valve head, should be renewed. Normal refacing is permissible.

Inlet valve seals and joints

The four inlet valve oil seals should be renewed. They can be fitted either way up. The joints should also be renewed.

Valve guides

Valve guide wear can be checked by trying a new valve for fit in the guide.

Stem clearance is given in the Data Section.

Valve springs

Valve springs. If possible the load required to compress the valve springs to their fitted heights should be checked. The required load and length to compress the springs is given in the Data Section under "Valves". The use of a dial type valve spring tester is strongly recommended.

An alternative method is to check the used valve springs by comparing them with new springs. Place them end to end on a long bolt and compress them in a hand press. Any loss will then be apparent as the weaker spring will close up first.

Valve springs should be renewed if the engine has covered a large mileage.

Valve seatings

Valve seatings may be refaced by normal valve seat cutters or by grinding. The latter is preferable.

Valve guides—To renew

The cylinder head must be heated to 200°C (390°F) for 30 minutes before the valve guide can be driven out with the Churchill brass drift RG357, which must be inserted at the valve seat end of the guide.

A circlip fits in a groove around the valve spring end of the guide and the guide position in the cylinder head is correct when the circlip comes against the cylinder head.

Valve guides MUST NOT be driven out of a cold cylinder head.

Before fitting a new guide a new valve guide circlip should be put on the guide making sure that it rests in the valve guide circlip groove.

New guides are driven into the cylinder head from its camshaft side after the cylinder head has been heated to 200°C (390°F). If the guide appears to be only a light driving fit a valve guide with a suitable oversize outer diameter should be fitted.

Valve guides must be finished reamed with a Churchill reamer RG358 to ·2810 in.-·2815 in. ($\frac{9}{32}$ in. reamer) after they have been driven into the cylinder head.

Before the new reamer is used for finishing a new valve guide it should be "BLUNTED" BY USING IT TO REAM A $\frac{9}{32}$ IN. DIAMETER HOLE THAT HAS BEEN DRILLED IN SOFT GREY CAST IRON. This will prevent it from chattering and ensure that a suitable finish is obtained.

The inlet valve guides are shorter and have a flat face at their top end.

Cylinder heads may be heated in a gas or electric oven having an external thermometer to read oven temperature. Local heating must of course be avoided.

Valve seat inserts—To remove

The inserts can be removed by boring out until the insert collapses. The machine depth stop should be set so that boring cannot quite reach the bottom face of the insert recess in the cylinder head.

Valve seat inserts—To replace

The inserts can only be fitted when the cylinder head has been uniformly heated to 200°C (390°F). The heating equipment previously described under "VALVE GUIDES —TO RENEW" should be used.

Check the valve seat recess diameter.

Select a suitable oversize valve seat insert and check its outside diameter.

Machine the cylinder head recess diameter to the best possible finish concentric to the valve guide centre so that the insert will have the correct interference fit given in the Data Section under "Cylinder Head".

Heat the cylinder head for [illegible] minutes from cold in an oven maintained at a temperature of 200°C (390°F).

Using a suitable tool drive the insert into its recess until it bottoms onto its recess bo[illegible]

The valve seat on the newly-fitted insert should be cut or ground at an angle of 45° to a width of ·05 in.-·06 in. (1·27 mm-1·52 mm). The seat must be concentric to within ·001 in. (·025 mm) of the valve guide bore.

Valves—To grind in

This operation will be satisfactory only if the valves and seatings are found to be in good condition after dismantling and examination, and there is no evidence of distortion or burning of the faces and heads of the valves. It is also necessary after new valves have been fitted, or seatings recut.

Place a small amount of fine grinding paste evenly around the face of the valve to be ground, not allowing it to get on the stem or other parts. Place the valve on its seating and by means of a suction grinding tool, rotate the valve from side to side through a few degrees only, using a light pressure. Frequently raise the valve and move round to a new position on its seating and continue grinding. (On no account should the valve be revolved through complete revolutions when grinding, or rings will be formed on the faces with detrimental effects.)

The grinding should be continued in this manner until a continuous but narrow seating has been obtained both on the valve and the seating. The seatings should not be more than ·070 in. (1·78 mm) in width.

After thoroughly cleaning off all traces of grinding paste from the valve and seating with a dry cloth, test by placing a small amount of engineers' marking on the seating and revolving the valve in place not more than about $\frac{1}{8}$ in. (3 mm) in each direction. A complete circle of marking should appear on both valve face and seating, indicating a good seal.

Valves—To replace

The valve stems should be given a thin coating of oil, and a new set of rubber seals should be fitted above the inlet valve guides. The rubber seals rest on top of the inlet valve guides and are fitted inside the steel caps in which the valve spring lower ends rest. The joints used below the inlet valve guide steel cover caps should also be renewed.

Cylinder head—To replace

If the valves have been refaced and ground in, the valve clearances should be checked and adjusted before replacing the cylinder head. They should also be rechecked after the cylinder head has been tightened down. Full details of checking and adjusting valve clearances are given in the following pages.

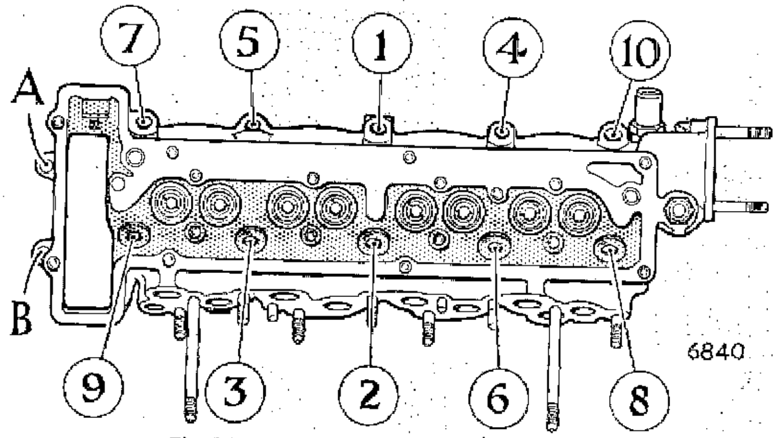


Fig. 37. *Cylinder head bolt tightening sequence*

A new gasket should be used. Gaskets are already varnished and no jointing compound should be put on them. The word TOP is stamped on the gasket upper face, and the gasket should be fitted with this face uppermost.

A NEW SMALL RUBBER JOINT RING THAT SEALS THE OIL FEED HOLE TO THE CAMSHAFT BEARINGS SHOULD BE PUT IN PLACE. A dummy stud can be used to locate the cylinder head gasket which tends to move away from its position due to the sloping position of the cylinder block face. The dummy stud should have a screwdriver slot in it, so that it can be removed after the cylinder head bolts locate the cylinder head and gasket.

Turn engine so that pistons are half-way down the cylinder bores. This is to allow the valves to open without touching the piston crowns when the camshaft is rotated for checking the valve clearances, before replacing the timing chain.

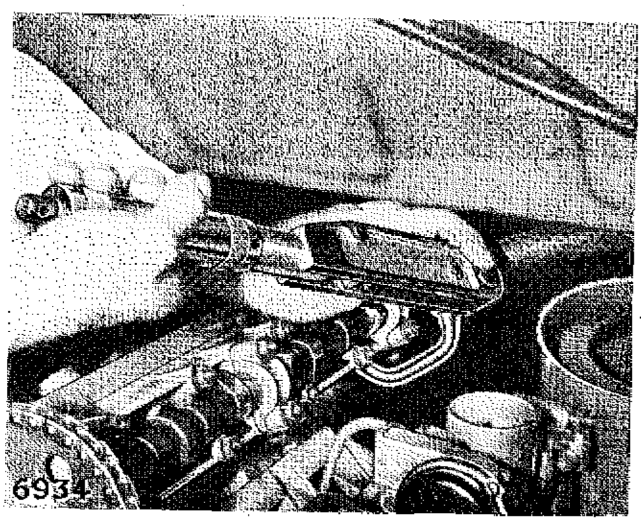


Fig. 38. *Churchill spanner RG355 for tightening cylinder head bolts with camshaft in position*

The cylinder head bolt threads MUST be dipped in Shell Enis 256 oil before the bolts are put in place.

Replace cylinder head and tighten cylinder head bolts 1 to 10 to correct torque given in the Data Section in the order shown in Fig. 37. The nuts A and B are tightened last of all to 15 lbs.ft. (2·07 kg.m).

The timing chain is fed through the cylinder head and allowed to lay over the cylinder head edge.

Replace tappet housing.

Replace tappet shims.

Replace tappets.

Replace the camshaft and camshaft sprocket wheel so that the camshaft can be turned for checking valve clearances.

Cylinder head bolt tightness should be rechecked when the engine is COLD after it has been thoroughly warmed up and allowed to cool off. The Churchill special spanner RG355, shown in use in Fig. 38, allows this to be done without removing the camshaft and tappet housing.

IMPORTANT NOTE

WHEN CHECKING CYLINDER HEAD BOLT TIGHTNESS EACH CYLINDER HEAD BOLT SHOULD BE SLACKENED OFF SLIGHTLY, AND RE-TIGHTENED TO THE CORRECT TORQUE, **ONE AT A TIME**, IN THE ORDER SHOWN IN FIG. 37. THIS ENSURES THAT EACH BOLT IS CORRECTLY TIGHTENED.

IF THIS IS NOT DONE SOME BOLTS MAY BE SO STIFF TO MOVE THAT A CORRECTLY SET TORQUE SPANNER MAY NOT BE ABLE TO CHECK THEM, IF THEIR TIGHTNESS IS JUST BELOW THE CORRECT TORQUE.

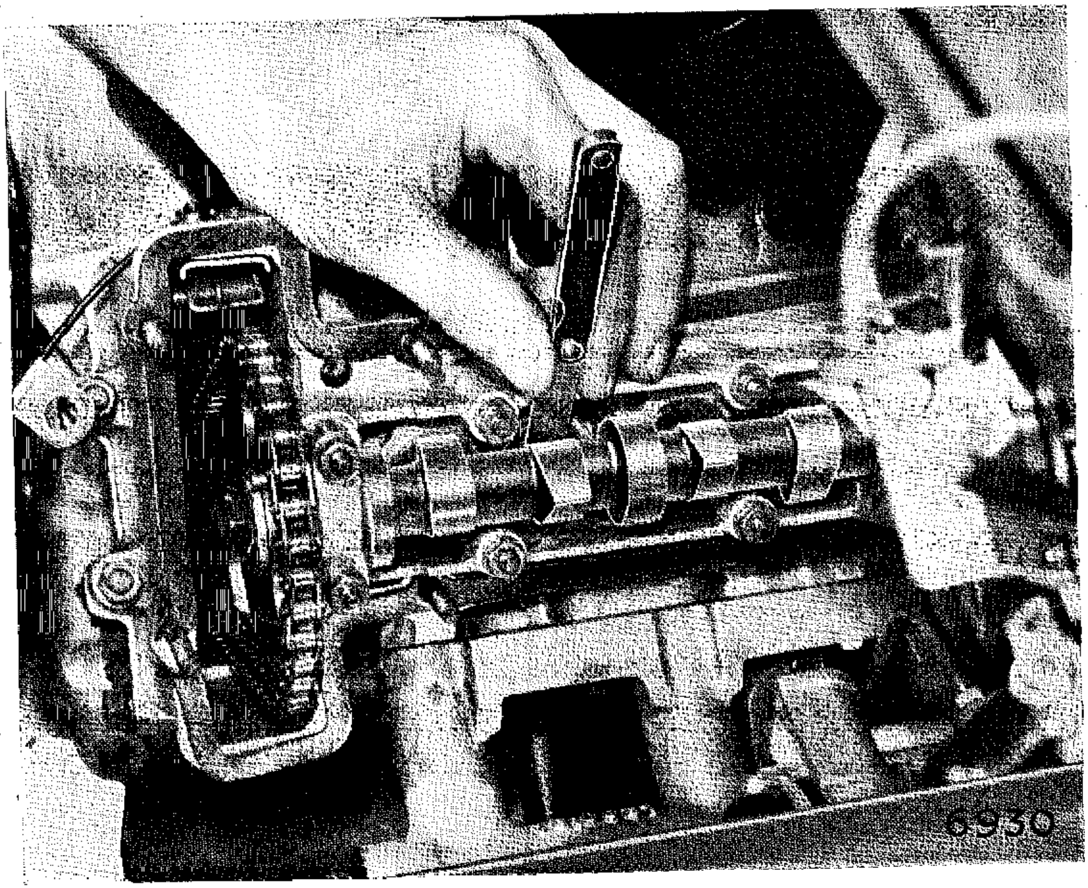


Fig. 39. *Checking tappet clearances*

Valve clearances—When to check (See Fig. 39)

The valve clearances are checked when the engine is COLD in any of the following circumstances.

1. During service, if required, after removing the valve cover.

2. Before removing the cylinder head for refacing the valves and seats for grinding in the valves.

   The clearances found are used to determine what to do with each valve. For instance a valve in good condition having too much clearance could be refaced to reduce its clearance and save changing its adjusting shim. Alternatively, a valve having insufficient clearance with one of the thinnest shims might need replacing, because, if it were refaced proper clearance would not be obtained.

3. Before replacing a cylinder head which has been reassembled after its valves have been ground in. This involves the temporary replacement of the tappet housing, tappet shims, tappets and camshaft.

4. After replacing a cylinder head on which the valve clearances have been corrected. This is a check to ensure that bolting the cylinder head down does not alter the valve clearances.

Valve clearances—How to check

Clearances are checked between the tappet flat face and the back of the cam, when the cam peak is pointing toward the centre of the valve cover, as shown in Fig. 39.

By starting with No. 1 cam and working in the following order all clearances can be checked in two complete revolutions of the crankshaft or one revolution of the camshaft.

Turn camshaft so that the following valve is fully open :—	Check clearance on :—
No. 4 Cyl. Exhaust valve	No. 1 Cyl. Exhaust valve
No. 3 „ Inlet valve	No. 2 „ Inlet valve
No. 2 „ Exhaust valve	No. 3 „ Exhaust valve
No. 4 „ Inlet valve	No. 1 „ Inlet valve
No. 1 „ Exhaust valve	No. 4 „ Exhaust valve
No. 2 „ Inlet valve	No. 3 „ Inlet valve
No. 3 „ Exhaust valve	No. 2 „ Exhaust valve
No. 1 „ Inlet valve	No. 4 „ Inlet valve

The engine may be rotated by using a suitable spanner on the crankshaft pulley bolt head, or by using a spanner to turn the water pump pulley nut while applying slight pressure on the inside of the lower longest run of the generator belt with a piece of blunt wood.

If the camshaft driving chain is disconnected the camshaft only is turned by temporarily replacing its driving sprocket. WHEN THIS IS DONE WITH THE CYLINDER HEAD IN POSITION, THE ENGINE MUST BE TURNED SO THAT THE PISTONS ARE HALFWAY DOWN THE CYLINDER BORES, TO PREVENT THE VALVES FROM HITTING THE PISTON CROWNS.

The maximum and minimum valve clearances are given in the Data Section under "Valves".

Valve clearances—how to adjust

Thick *ground steel tappet shims* are fitted between each valve stem and the inside face of each tappet. A suitable range of 25 tappet shims are available which increase in thickness in increments of ·001 in. (·025 mm) from a thickness of ·087 in. (2·21 mm) to ·111 in. (2·82 mm). The thickness of each shim is etched in inch dimension on one of its ground faces and the use of suitable thickness shims enables correct valve clearances to be obtained.

Any valve or valves having incorrect clearances will have to have their tappet shims changed.

Example—taken for a valve clearance of ·004 in.–·006 in.

Valve clearance too close.—A valve clearance of ·002 in. is found. This clearance is ·003 in. below the mean clearance of ·004 in.–·006 in. and would require replacing the existing shim with one ·003 in. thinner. For example if the existing shim were ·095 in. thickness it would be replaced by a shim of ·092 in. thickness.

Valve clearance too great.—A valve clearance of ·011 in. is found. This is ·006 in. above the mean clearance and would require replacing the existing shim with another ·006 in. thicker.

If the correct clearances cannot be obtained with the thinnest tappet shim, due to refacing the valve and its seat, the following procedure can be used before refitting the cylinder head.

1. The clearance should be checked with a new valve and if satisfactory the new valve should be ground in and its clearance adjusted with a suitable tappet shim.

2. Up to ·030 in. (·76 mm) may be ground off the valve stem end. The end of the stem must be ground perfectly square on a suitable precision grinder. This figure must not be exceeded as further grinding will remove all the hardened metal from the valve stem end. It might also make the tappet shim rest on its outer edge on the valve spring cap, before touching the valve stem end. This would cause serious fretting around the valve cotters and might lead to valve failure.

3. If the correct clearance cannot be obtained with a new valve the thinnest tappet shim may be reduced in thickness as required. Shims are hardened throughout and must be ground perfectly parallel on a suitable precision grinder. The minimum permissible thickness is ·062 in. (1·57 mm).

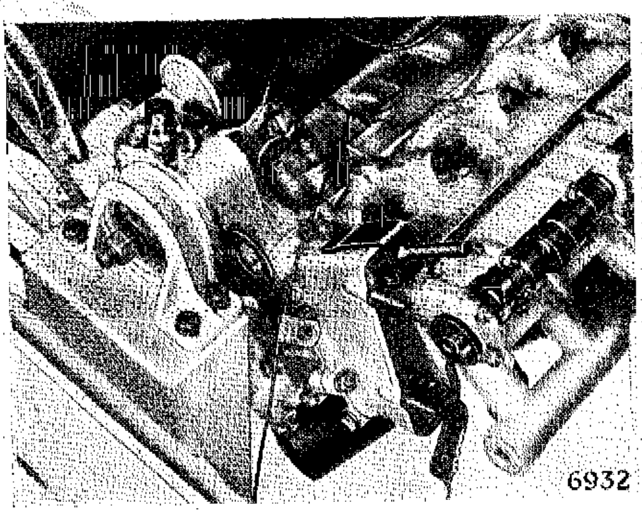


Fig. 40. *Camshaft position when engine is at No. 1 TDC firing—and timing chain tensioner compressing tool in position*

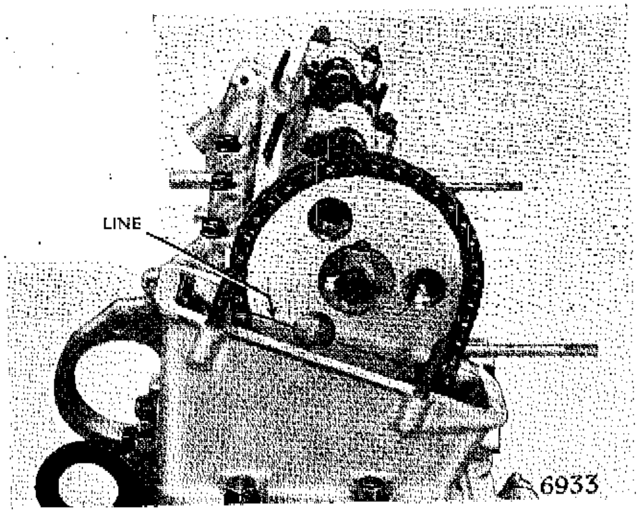


Fig. 41. *Camshaft sprocket marking line position for No. 1 TDC firing position*

Retiming camshaft—after refitting cylinder head

If the camshaft was put in position for checking tappet clearances, while the cylinder head was off of the engine, remove the camshaft, to prevent any open valves fouling the pistons, as the engine is turned to obtain No. 1 T.D.C. fixing position.

Turn the engine to T.D.C. so that the slot in the crankshaft pulley lines up to the pointer above the pulley with the distributor rotor adjacent to No. 1 cylinder plug lead position. No. 1 cylinder is the nearest to the crankshaft pulley. See Fig. 15.

Refit the camshaft so that No. 1 cylinder cam peaks are the same height from the cylinder head cover face. In this position No. 7 and 8 cams are holding No. 4 cylinder valves open slightly. See Fig. 40.

Refit the camshaft bearing caps and tighten their six $\frac{7}{16}$ in. A.F. nuts with a torque spanner to the correct torque loading figure given in the Data Section.

Place Churchill timing chain tensioner compressor RG354 in position. See Figs. 28 and 40. This tool allows easier replacement of the camshaft sprocket.

Place the camshaft sprocket in the timing chain so that the line on the sprocket is parallel to the timing cover top edge. This will allow the camshaft sprocket to be placed onto the camshaft flange dowel. See Fig. 41.

Place a new locking washer on the camshaft sprocket fixing bolt between the bolt head and thick washer. Refit the bolt and tighten it to the torque given in the "Torque Loading Figures" in the Data Section. Bend over tabs of locking washer.

Remove the timing chain tensioner compressing tool.

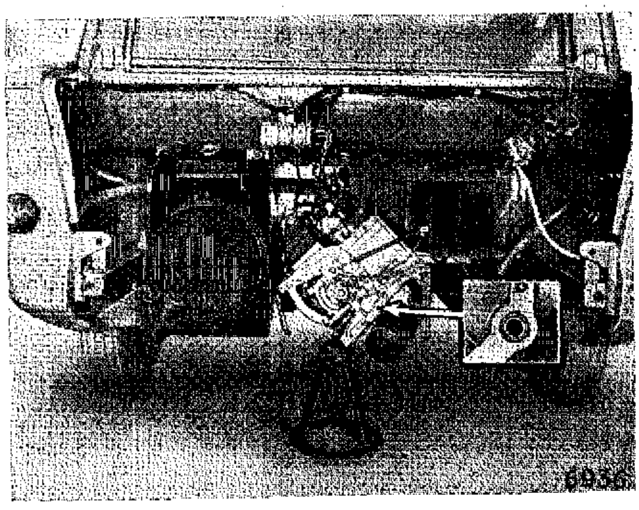


Fig. 42. *Timing cover removed showing oil passage rubber sealing ring in position*

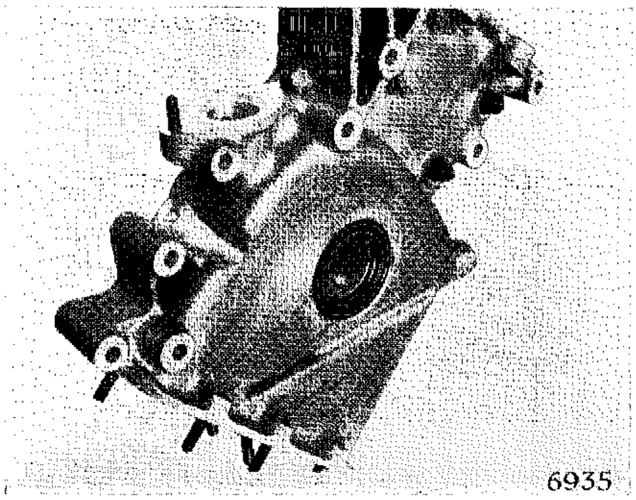


Fig. 43. *Timing cover with crankshaft pulley oil seal correctly fitted*

TIMING CHAIN COVER, TIMING WHEELS AND TIMING CHAIN AND CHAIN TENSIONER

Timing chain cover—To remove

Turn engine to No. 1 T.D.C. firing position and remove cylinder head.

Remove sump and support the weight of the engine as near to the rear end of the crankcase as possible.

Remove the car body rear crossmember by removing bumper fixing bolts and four $\frac{1}{2}$ in. A.F. bolts and two $\frac{1}{2}$ in. A.F. nuts. The battery should be removed to give access to off side (right-hand) bolts.

Remove water pump, fan assembly, crankshaft pulley and timing case fixing nuts.

Removing timing case drawing it backwards from the engine, noting that the distributor rotor turns from the four o'clock to the three o'clock position.

Note: ROUND RUBBER RING BETWEEN TIMING COVER CASE AND CYLINDER BLOCK. This ring seals the main oil gallery in its connection between the timing case and cylinder block. See Fig. 42.

Crankshaft pulley oil seal (See Fig. 43)

This seal may be removed without removing the timing cover, but this of course completely destroys it. New seals should be fitted with their contracting spring away from the outside of the cover.

Timing chain cover—To replace

This is the reversal of removal taking care to replace the rubber joint ring. New joints should be used and the distributor rotor set at the three o'clock position, before pushing the case into position.

Check ignition timing.

Timing chain tensioner (See Fig. 44)

This item may be removed by pushing downwards on the tensioner spring, to free the spring eye from the tensioner bottom mounting, and drawing the tensioner off.

Timing chain sprocket on crankshaft

This sprocket is easily withdrawn by a suitable puller

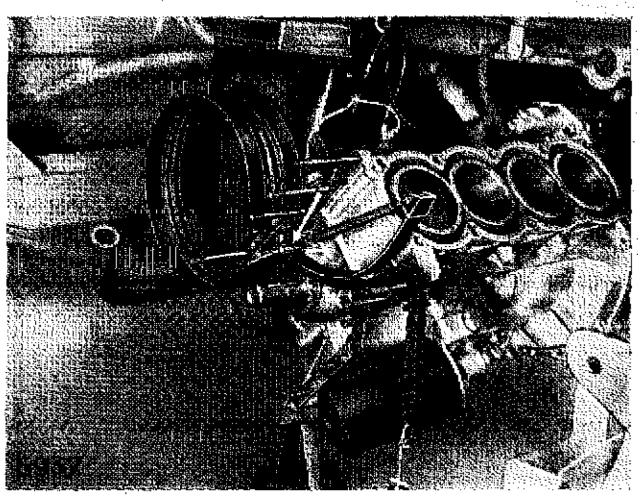


Fig. 44. *Timing chain tensioner ready to remove*

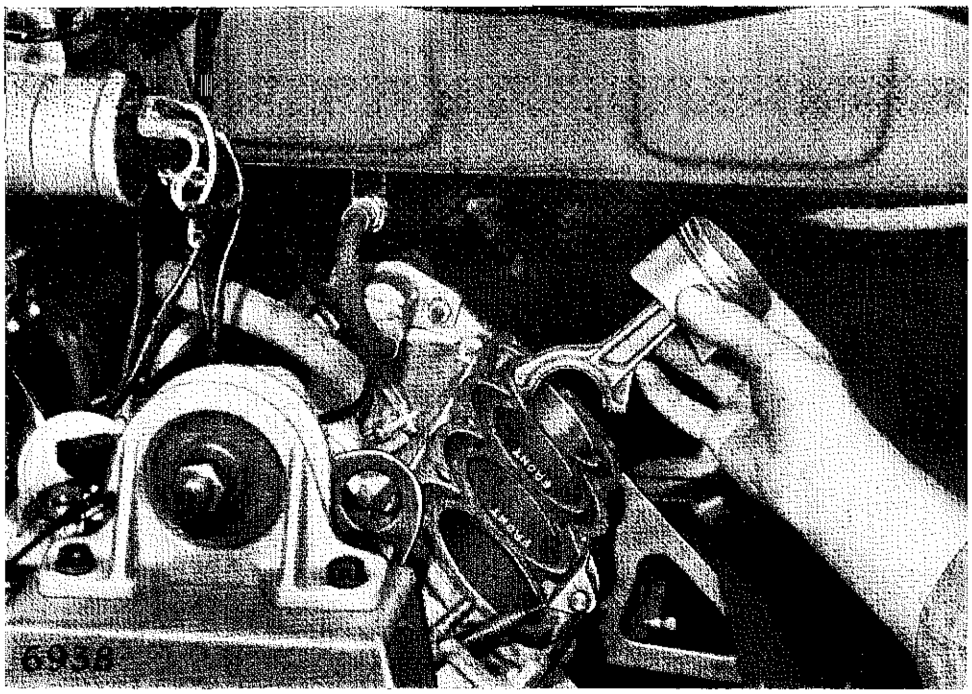


Fig. 45. *Removing No. 4 piston and connecting rod—and word FRONT stamped on piston crown*

CAMSHAFT

Camshaft removal, replacement and timing is described under removal and replacement of the cylinder head.

Camshaft bearings

Camshaft bearings are in separate halves. They are steel backed thin wall whitemetal bearings and may be renewed in pairs in a similar manner to other engine plain bearings. No fitting is required and the bearing cap and shells must not be filed.

PISTON AND CONNECTING ROD ASSEMBLIES

Pistons

Most engines are fitted with high compression pistons, but in some export territories engines are fitted with low compression pistons to meet the requirements of lower octane fuels.

High compression pistons are identified by their flat piston crown.

Low compression pistons have hollow crowns.

Fitting clearances are the same for all pistons.

Pistons and connecting rods—To remove (See Fig. 45)

Remove cylinder head.

Remove sump.

Remove connecting rod bolts and bottom half big end bearings. IDENTIFYING NUMBERS ARE STAMPED ON THE CONNECTING ROD AND CONNECTING ROD CAP AND COME TOWARDS THE DISTRIBUTOR SIDE OF THE ENGINE. See Fig. 52.

Push pistons up the cylinder bores and withdraw assemblies from above.

The big end caps must be reassembled to the same rods from which they were removed. Each complete connecting rod should be refitted to the same piston and cylinder bore from which it was removed.

Pistons and connecting rods—To refit

Check that the pistons and connecting rods are correctly assembled as shown in Fig. 46 then insert connecting rods and pistons into cylinder bores from above in the opposite manner to that detailed for removal, with the word FRONT ON THE PISTON CROWN TOWARDS THE CRANKSHAFT PULLEY END OF THE ENGINE.

To facilitate insertion of the pistons in the cylinders and to prevent piston ring breakage, a Churchill piston ring compressor should be used. This tool reference number is 38 U-2.

Tighten nuts to the correct torque given in the Data Section under "Connecting Rods".

Gudgeon pin—To remove

Remove circlip retaining gudgeon pin in position with circlip pliers. Scrape away any carbon which may have accumulated in the outer ends of the piston bosses to facilitate removal of the gudgeon pin.

Warm the assemblies, preferably in oil to about 50°C (120°F) and push out the gudgeon pins. Tight fitting gudgeon pins should not be driven out of cold pistons.

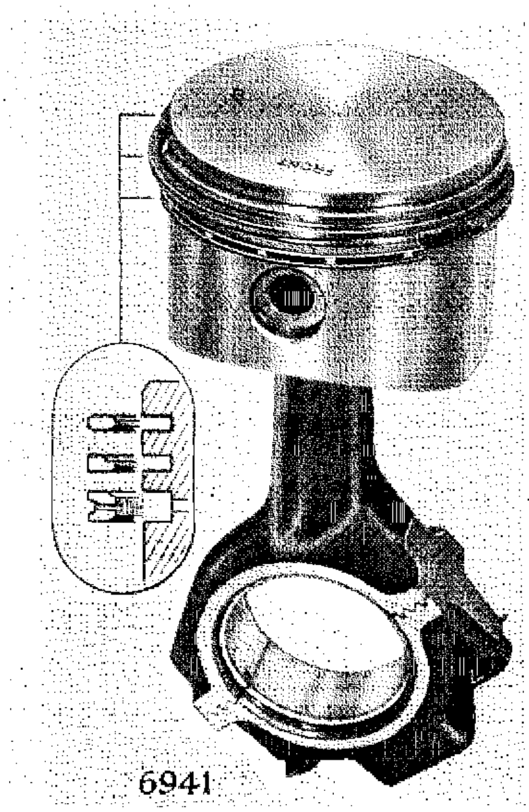


Fig.46. *Piston rings and piston and connecting rod correctly assembled*

Gudgeon pin—Fit

At room temperature of 21°C (70°F) the gudgeon pin should be a finger push fit in the piston and only just free in the connecting rod little end bush. It should be possible for the connecting rod to fall by its own weight when the piston and connecting rod assembly is held horizontal.

Gudgeon pins are classified into two grades, the dimensions of which are given in the Data Section under "Gudgeon Pins". Only the larger grade is available for service use.

Gudgeon pin—To refit

The original piston, gudgeon pin and small end bush may be used again, if the gudgeon pin is without shake, both in the piston bosses and in the small end bush.

The correct way of assembling the connecting rod to the piston is shown in Fig. 46.

The gudgeon pin retaining circlips should be renewed.

Big end bearings

Steel backed lead bronze bearings with lead indium overlay are fitted to all new engines and must be used as replacements. These bearings are able to carry greater loads than white metal bearings, but they are harder and small particles do not bed themselves into the bearing metal.

In consequence, scoring of the crankshaft big end journals will occur if abrasive particles reach the bearings. Regular oil changing and renewal of the filter element at the recommended mileages are therefore most important.

If necessary bearing shells may be renewed provided the crankshaft big end journals are not oval or scored.

Connecting rods

Owing to their shorter length these rods cannot be straightened. Any piston showing signs of misalignment should have its connecting rod changed.

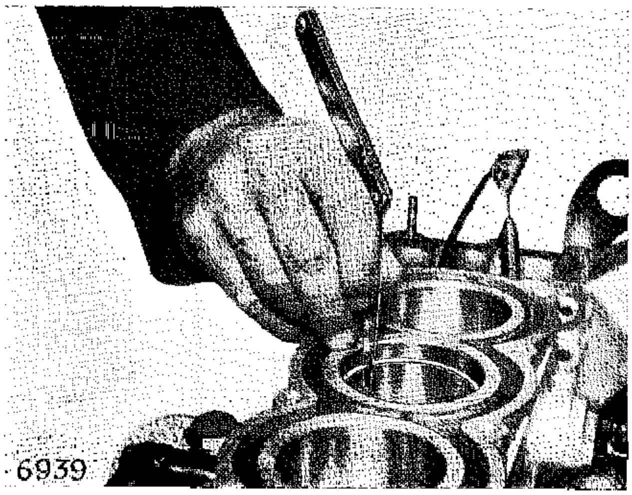


Fig. 47. *Checking piston ring gaps*

Little end bearings

The little end bearing bush in the upper end of the connecting rod can be renewed. After pressing in a new bush the bush must be reamed slightly undersize, and finished to size by honing, so that the gudgeon pin is free to turn while it is the closest possible fit.

The Delapena honing machine is recommended for honing the little end bush. This machine may be obtained from Delapena & Sons Ltd., Zona Works, Cheltenham, England. It is supplied with the necessary honing stones, honing fluid, and instruction booklet.

PISTON RINGS

Top compression ring (See Fig. 46)

This piston ring is chromium plated and may be fitted either way up when new. Where the need arises to fit new chromium rings to polished (part worn) bores, it will be necessary first to remove the glaze from the bores as otherwise these rings would never bed down properly.

The procedure to be adopted in such cases is as follows:—

Mask off the bottom of the cylinders to prevent any abrasive matter reaching the crankshaft or crankcase.

Make up a wooden dummy piston which will fit snugly into the bore with a piece of No. 1 or 1½ grade emery paper wrapped round it.

This dummy piston, with the emery cloth round it should then be inserted into each cylinder in turn and moved up and down the bore for about three minutes (each cylinder), at the same time rotating it first one way and then the other, until the entire cylinder wall is covered with crisscrossed abrasions.

Wash down the bores thoroughly and dry them out, ensuring that no foreign matter finds its way into the crankcase.

Second compression ring (See Fig. 46)

This ring is marked with the word BOTTOM on its lower face, which is the widest of the two faces. The upper face is narrower as there is a step on its inside edge. It must be fitted with the word BOTTOM toward the lower end of the piston.

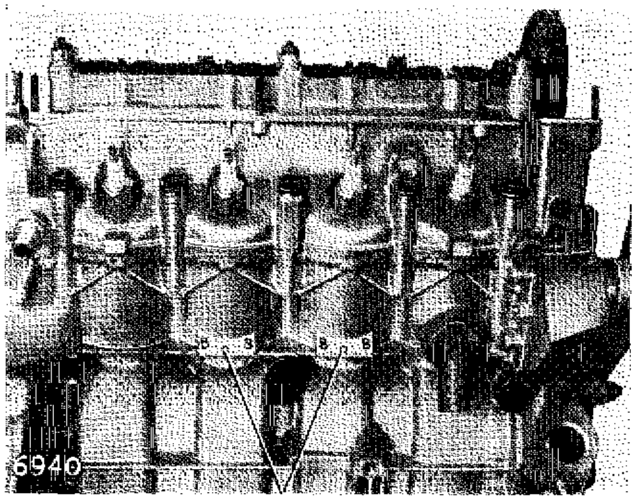
Oil control ring (See Fig. 46)

A single slotted oil control ring is used.

When new these piston rings may be fitted either way up.

Piston rings—To fit (See Fig. 47)

The correct ring gaps and vertical clearances are given in the Data Section under "Piston". Fit the rings to the cylinder bores and check the ring gaps with a feeler gauge.



CYLINDER GRADE LETTER

Fig. 48. *Position on cylinder block of cylinder bore grade letters*

With a feeler gauge check vertical clearance of the rings in the grooves.

Fit the rings to the pistons in such a way that the ring gaps are equally spaced out round the piston, and not in line with one another, making sure that the rings checked in No. 1 cylinder are fitted to No. 1 piston and so on. No. 1 cylinder is the cylinder nearest to the crankshaft pulley.

CYLINDER BLOCK

Piston and Cylinder bore grading (See Fig. 48)

Pistons and cylinder bores are graded into A, B and C grade diameters which are given in the Data Section under "Engine—General and Piston".

Piston grade letters are stamped on the piston crown and the cylinder bore grade letters on the two sloping bosses on the cylinder block, below the sparking plugs.

Correct piston fits are obtained on new engines when pistons are fitted to cylinders having the same grade letter as that stamped on the piston crown.

After a new engine has been run for a few hundred miles the cylinder grade letter size no longer applies because the running in process will result in a slight initial increase in cylinder bore diameter.

If a piston or pistons have to be changed under service conditions, the grading system is of considerable assistance and the following procedure should be used as follows:—

1. Check the cylinder bore diameter with a Mercer, or other dial type measuring gauge, after setting its zero reading, in a suitable ring gauge.

2. From the size obtained subtract the correct piston clearance given in the Data Section under "Piston" and from this size choose a suitable grade of piston.

Example

Bore size given by clock gauge 2·6773 ins.—·0011 ins. (piston skirt clearance) = 2·6762 ins.

Nearest piston size to 2·6762 ins. is C grade and this would be the piston to use.

To rebore and fit oversize pistons

The maximum oversize for reboring is given in the Data Section under "Cylinder Block". When reboring

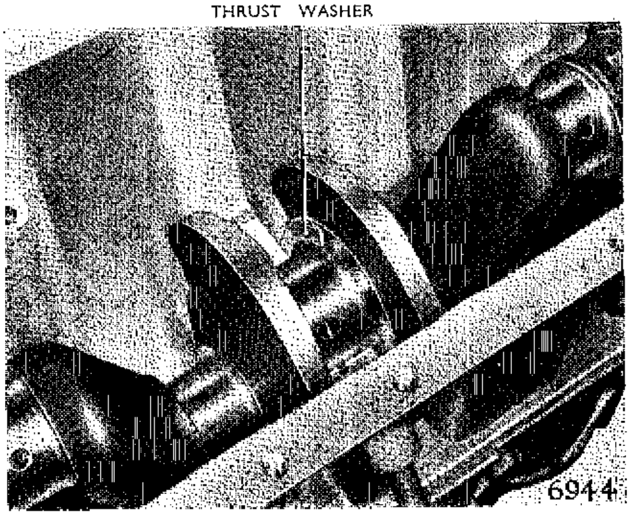


Fig. 49. *Installing crankshaft semi-circular thrust washer*

cylinders to suit oversize pistons, each bore is machined to the actual diameter of the piston to be fitted, plus the specified clearance in the bore.

The recommended bore finish is a "cross hatched" hone finish of 20-40 micro inches. This finish is equivalent to that obtained by thoroughly rubbing a used cylinder bore with partly worn No. 1 grade emery cloth to give a mat surface. The cutter of the boring machine should be set to bore the maximum diameter of the piston measured at the bottom of the piston skirt at a right angle to the gudgeon pin, plus its prescribed clearance in the cylinder bore less a small amount for honing.

It is advisable to regrind and reset the cutter after completing each cylinder bore.

The honing operation allows the bore size to be taken to the size that will allow the piston to be correctly fitted.

Bores must be parallel and round to within ·0003 in. (·07 mm). The use of a cylinder gauge such as a Mercer, used with a ring gauge, is recommended for taking measurements. Top, middle and bottom of each bore should be checked both in line and at right angles to the gudgeon pin axis.

Cylinder liners

The cylinder block cylinder bores cannot be machined out to take cylinder liners and no attempt should be made to carry out this operation.

Crankcase breather

This unit which contains a renewable filter element is held by a single bolt to the crankcase outside face just below the starter motor. A rubber joint ring is used between the breather body and crankcase.

These parts can be removed and replaced with the starter in position. The filter element should be stuck to the cover inside bottom face, with quick setting jointing compound, to keep it in place while refitting.

THE BREATHER OUTLET PIPE MUST ALWAYS POINT UPWARDS.

CRANKSHAFT

Main bearings

Steel backed lead bronze bearings with lead indium overlay are fitted to all new engines and must be used for replacements.

Main bearing shells may be changed without removing the crankshaft by following the normal practice of removing each main bearing cap separately and pushing its top main bearing shell around the crankshaft journal from the opposite side to its locating lip.

If a rear main bearing cap is found without locating dowels the engine must be removed to change the main bearings as it is not possible to replace undowelled rear main bearing caps correctly, without first removing the flywheel. The correct method of aligning undowelled rear main bearing caps is given under "Crankshaft—To replace".

Crankshaft end thrust (See Fig. 49)

Crankshaft end thrust is taken by two semi-circular steel thrust washers having bearing metal lined faces, with two vertical oil grooves across each face. The washers are fitted with their bearing lined faces towards the crankshaft thrust faces and may be removed by pushing them around the crankshaft centre journal after removing the sump and taking off the centre main bearing cap.

Endfloat can be checked by feeler gauges in the normal manner.

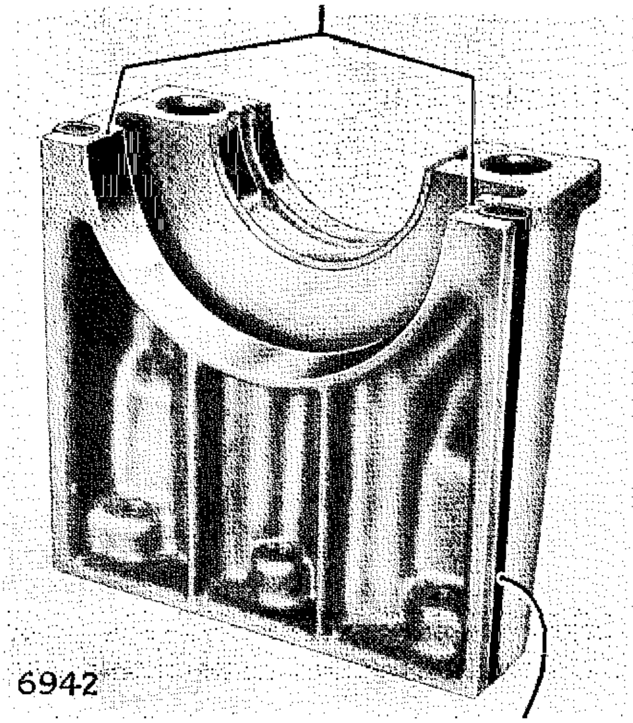


Fig. 50. *Rear main bearing cap oil seals and position to sparingly apply jointing compound*

Crankshaft—To remove

This can only be done after removal and stripping of the engine. Most of the stripping operations needed have already been described and are therefore not given in detail.

Remove cylinder head as it is not possible to remove the timing case before this is done. See cylinder head to remove.

Remove sump.

Remove timing chain cover.

Remove timing chain and chain tensioner.

Remove pistons and connecting rods.

If the engine performance and oil consumption are satisfactory the connecting rods and pistons should be pushed to the tops of the cylinder bores and left in this position.

This will save disturbing the piston rings.

Remove clutch.

Remove flywheel.

Remove main bearing caps and lift out crankshaft.

Any crankshaft having oval or scored journal or worn end thrust faces should be renewed.

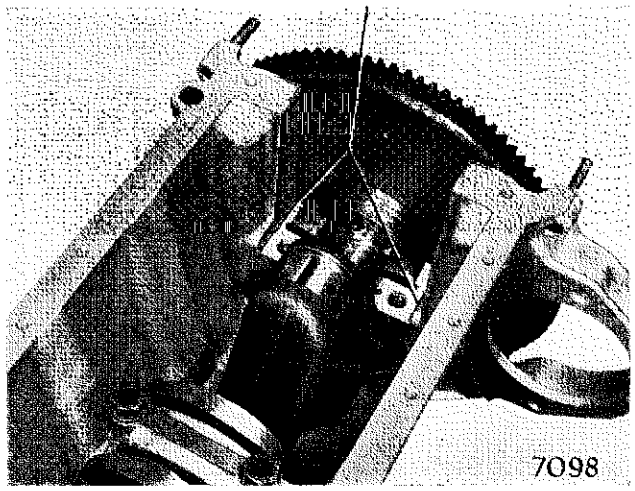


Fig. 51. *Places at which jointing compound is applied before fitting rear main bearing cap*

Crankshaft—To refit or replace

Check that the oilways are clear and free from black deposits, or preserving coating.

Two long round straight hard rubber joints with "club feet" are used each side of the rear main bearing cap. These joints are placed in the rear main bearing cap before it is fitted into position. They are used to prevent oil leaking along the sides or corners of the cap. See Fig. 50.

If there are any sharp edges on the cylinder block sump face, where it joins to the rear main bearing cap position, these joints may be cut as the rear main bearing is refitted This will cause an oil leak. Any sharpness of these edges must therefore be carefully removed before refitting the rear main bearing cap.

On engines where the rear main bearing cap is not located by dowels, it is important to check the alignment of the rear main bearing cap oil return thread machined bore to the similar bore in the cylinder block. This can be done by using feeler gauges to ensure that the same clearance exists all the way round the crankshaft oil return thread, between its bores in the rear bearing cap and cylinder block.

A thin smear of "Hylomar" which is a high grade non-setting jointing compound should be applied in the positions shown in Figs. 50 and 51. Jointing compound must be kept off of the crankshaft oil return bore or return thread on the crankshaft.

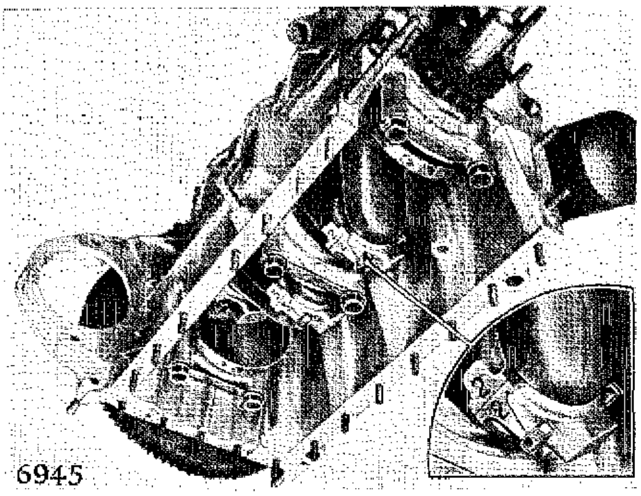


Fig. 52. *Locking plates and locking washers correctly fitted to main bearings and big ends*

NEW LOCKING PLATES, WASHERS AND JOINTS MUST BE USED WHEN REBUILDING THE ENGINE, WHICH IS CARRIED OUT IN THE REVERSE MANNER FOR DISMANTLING. See Fig. 52.

ALL BOLTS AND NUTS MUST BE TIGHTENED TO THE CORRECT TORQUE GIVEN IN THE DATA SECTION UNDER TORQUE LOADING FIGURES.

FLYWHEEL RING GEAR

The starter ring gear is a shrink fit onto the flywheel. If necessary it can be removed and a new ring gear fitted.

To remove

Using a suitable size drill, drill a hole nearly through the starter ring between the bottom of two of the gear teeth. Further deepen this hole with a drill ground to flatten the hole end. Split the ring gear with a sharp cold chisel and lift split gear ring off of flywheel.

To fit new ring gear

Be sure that the flywheel is clean and free from burrs.

The new ring gear must be heated in the following manner so that it is expanded enough to be put on the flywheel.

THE NEW RING GEAR MUST NOT BE HEATED BY A NAKED FLAME AS THIS MAY OVERHEAT IT. OVERHEATING WILL SOFTEN THE RING GEAR AND CAUSE RAPID WEAR OF ITS GEAR TEETH.

Heat the new gear ring, by suspending it from wire hooks in a container of clean engine oil which has been heated to 200°C. (392°F.), until the ring has attained the same temperature as the oil. See Fig. 53.

To eliminate the possibility of fire, keep the container covered by a metal lid to prevent the flame from reaching the surface of the oil.

Do not allow starter ring (or thermometer) to rest on bottom of container or a false temperature may result.

Lift the heated ring from the oil by means of the wire hooks and quickly wipe away surplus oil with a lintless rag.

Place the new ring in position on the flywheel WITH CHAMFERED SIDES OF TEETH TO THE CLUTCH SIDE OF THE FLYWHEEL.

Make sure that the ring is bedding against its locating face. On cooling, the ring will contract and thus firmly grip the flywheel.

FLYWHEEL CENTRE BEARING

To remove and refit

The clutch spigot bearing is a self-lubricating bush which is a press fit in the crankshaft end recess.

The bush may be removed by packing grease behind it and inserting a close fitting rod in the bush. A hammer blow on the end of the rod will then cause the bush to come out. *Before fitting, a new spigot bush should be soaked in engine oil for 24 hours, preferably at room temperature.* The new bush should be pressed into position until flush with the rear face of the crankshaft flange.

ENGINE

Removal procedure—cars

The engine can be removed leaving the transaxle unit in position or it can be removed with the transaxle attached. The method used will depend upon the work to be undertaken. If only the engine, or clutch, needs overhaul the *engine should be disconnected from the transaxle bell* housing and the transaxle left in position in the vehicle as shown in Fig. 54.

Removal procedure—vans

On vans the engine is removed and refitted with the transaxle attached. The correct procedure to follow is given on page 44.

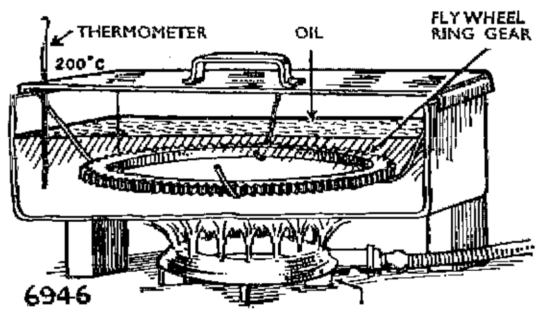


Fig. 53. *Heating starter ring gear*

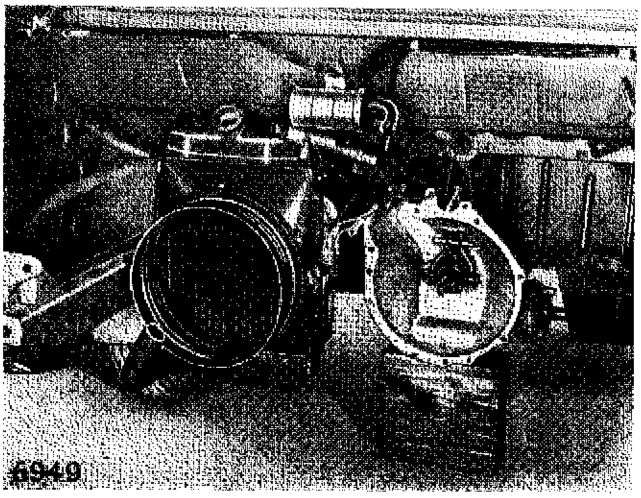


Fig. 54. *Engine removed leaving transaxle in position*

To remove engine—leaving transmission in vehicle

Drain radiator and cylinder block.

Remove battery.

Raise the rear end of the vehicle high enough to allow underneath bell housing nuts to be removed as these nuts are difficult to reach when the car is at floor level. Remove these nuts but leave the bottom nut lightly tightened. Lower vehicle.

Support underneath of transmission near to the engine as shown in Fig. 54.

Remove silencer by releasing its clamp bolt on the exhaust manifold and removing its support bracket.

Unbolt clutch operating cylinder to prevent possibility of straining its flexible hose. Tie the cylinder above and clear of the engine.

Place a trolley under engine to support engine weight over the whole of the sump flat face and the exhaust manifold outlet. Support should also be taken under the sump edge at the rear end of the sump. NO WEIGHT MUST BE TAKEN BY THE OIL FILTER. A suitable wheeled trolley made from slotted angle iron is shown in Fig. 55.

Remove rear bumper.

Remove body rear cross member by removing one nut and two bolts each side.

Disconnect water by-pass hose, intake hose, and outlet hose from water pump.

Loosen clip holding air duct hose to fan cowl.

Unbolt water pump support bracket from engine and remove water pump and fan as a complete assembly.

Disconnect electrical lead at starter motor, H.T. lead at ignition coil end, L.T. lead at distributor terminal and oil pressure warning light switch lead at switch end.

Remove starter motor.

Disconnect fuel feed pipe at carburettor end.

Disconnect fuel feed pipe to fuel pump or remove fuel pump and tie pump in a position above the engine. Note number of joints used between pump and valve cover. It is important to replace the pump with the same number of joints as these determine the pump output pressure.

Remove the air cleaner. This is not difficult if the following procedure is followed.

Remove air cleaner support bracket fixing bolt holding cleaner bracket to the inlet manifold lug.

Loosen clip at carburettor intake and lift off cleaner. This gives access to the wing nut. Remove wing nut, top body of cleaner, and filter element.

Remove air cleaner lower body past carburettor.

Remove air pipe from pneumatic throttle operating unit on carburettor.

Disconnect engine cooling system and heater hoses (if fitted) at the radiator top tank and far end of the cylinder head. The by-pass hose disconnected at its water pump end need not be taken off its cylinder head end as it can be withdrawn from behind the radiator.

Remove bell housing nuts behind the engine and after this the bottom nut previously left when removing the underneath nuts.

Draw engine away from transaxle.

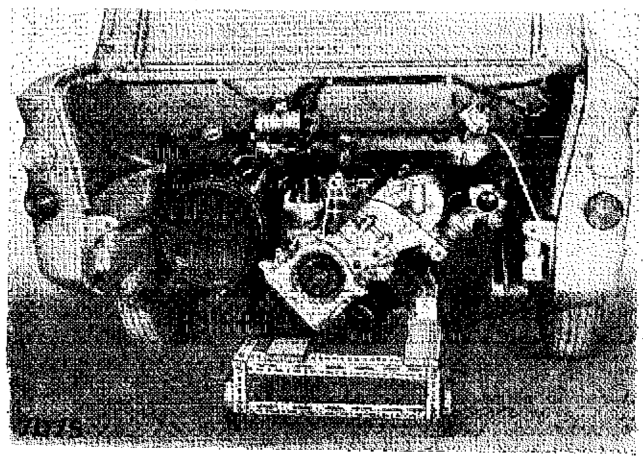


Fig. 55. *Removing engine leaving transaxle in position*

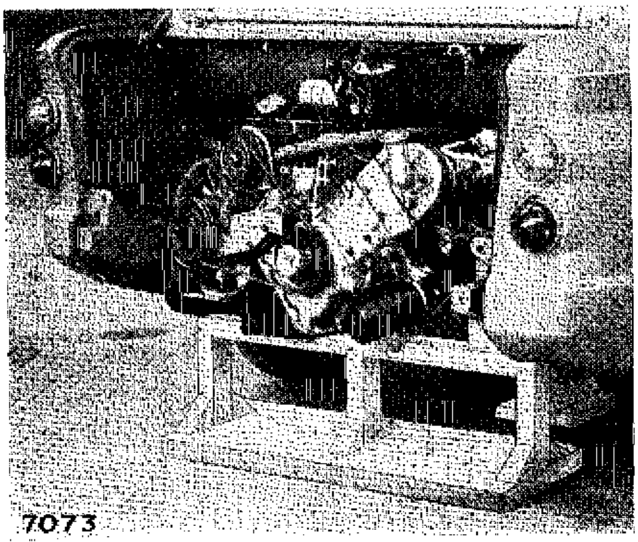


Fig. 56. *Engine and transaxle supported for removal*

To remove engine—with transaxle attached

This procedure differs from that used when removing the engine only. The work required to disconnect the actual transaxle unit from the vehicle is described in Section E under "To remove from vehicle", and should be carried out first. The work required to disconnect the engine is as follows:—

Drain radiator and cylinder block.

Disconnect battery.

Disconnect by-pass hose and intake hose from water pump.

Loosen clip holding air duct hose to fan cowl.

Disconnect electrical leads from generator, starter, distributor, coil, and oil pressure warning light switch.

Unbolt clutch hydraulic operating cylinder and tie cylinder clear of the engine.

Disconnect water outlet hose at radiator top tank connection and heater feed hose (if fitted) from the far end of the cylinder head. The by-pass hose that was disconnected at its water pump end should be withdrawn from behind the radiator and left connected to the cylinder head.

Disconnect fuel feed pipe to fuel pump or remove fuel pump, and air feed pipe from pneumatic throttle connection on carburettor operating unit.

Remove silencer and its support bracket.

Support engine and transaxle under sump, transaxle unit, and exhaust manifold end as shown in Fig. 56.

Remove bolt from engine rear mounting. This releases engine weight from vehicle causing the vehicle to rise and some adjustment of the supporting packing height may be needed to maintain reasonable alignment of the fan cowl to the radiator cowl.

Remove rear bumper.

Remove body rear cross member. This member is held in position by one nut and two bolts each side.

Push car forward clear of engine and transaxle assembly.

To replace engine—with or without transaxle attached

This is a reversal of the removal procedure. The following precautions should be taken:—

1. Care is needed to prevent damaging the connecting hose between the fan cowl and radiator cowl if the fan and water pump assembly has not been removed from the engine.
2. When refilling the cooling system the heater control lever (if fitted) should be in the "ON" position which is to the RED side.
3. The water, or anti-freeze solution level in the radiator should be checked after running, as some coolant is taken to fill the heater system (if fitted).
4. The engine should be filled with the correct grade and quantity of oil.

Rear flexible mounting—To renew

The engine rear mounting rubber is bonded inside a steel sleeve and can be pressed out of its housing with the Churchill tool RG 359.

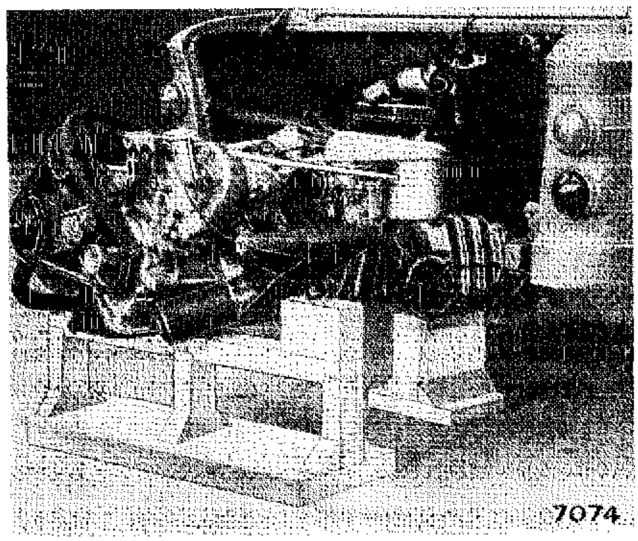


Fig. 57. *Engine and transaxle removed from vehicle by pushing vehicle forward*

ADDITIONAL INFORMATION

Oil pump driven and driving gears

The oil pump driven gear on the oil pump spindle, and the oil pump driving gear on the front end of the crankshaft must always be renewed together if either of these gears show signs of wear.

These gears are supplied in pairs. Separate gears are not supplied.

New gears should be carefully checked before fitting and any burrs removed with a fine oil stone. Before replacing the timing cover both gears MUST be lubricated with engine oil to prevent momentary dry operation before oil reaches the gears.

If, when the oil pump gear is correctly positioned on the existing pump spindle, the locating pin holes do not properly line up, a new pump with an undrilled spindle should be fitted.

The two fixing pin holes, in the driven gear, are drilled through on one side only on service replacement gears. These gears have to be finish drilled after correct positioning on the pump spindle, as described in the following paragraphs.

Service replacement oil pumps

The service replacement oil pump is supplied without the driven gear. Pumps with the driven gear already fitted must not be used for service purposes because this means running a new driven gear with the existing used or partly worn driving gear on the engine crankshaft. When a new oil pump is fitted the driven gear on the discarded pump should be removed and fitted to the replacement pump spindle; provided that it is fit for further use. If worn a new pair of gears should be fitted.

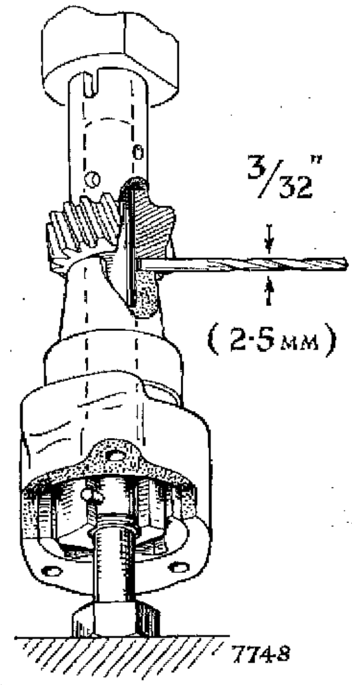


Fig. 58. *Method of positioning oil pump gear*

As shown in Fig. 58 the gear should be pressed onto the pump spindle until there is a gap of ·087 in.—·103 in. (2·21 mm.—2·60 mm.) to the pump body. This gap can be measured by using the shank of a $\frac{3}{32}$ in. or 2·5 mm. drill as a gauge.

While pressing on the gear the pump end cover must be removed and the END OF THE PUMP SHAFT MUST BE SUPPORTED as shown in Fig. 58. If this is not done the pin holding the inner rotor to the shaft may be partly sheared.

When the driven gear is correctly positioned on the pump spindle, the two holes needed for the gear fixing pins should be drilled with an $\frac{1}{8}$ in. drill using the existing holes as a guide for the drill.

After driving in the two fixing pins the ends of the pins should be riveted over.

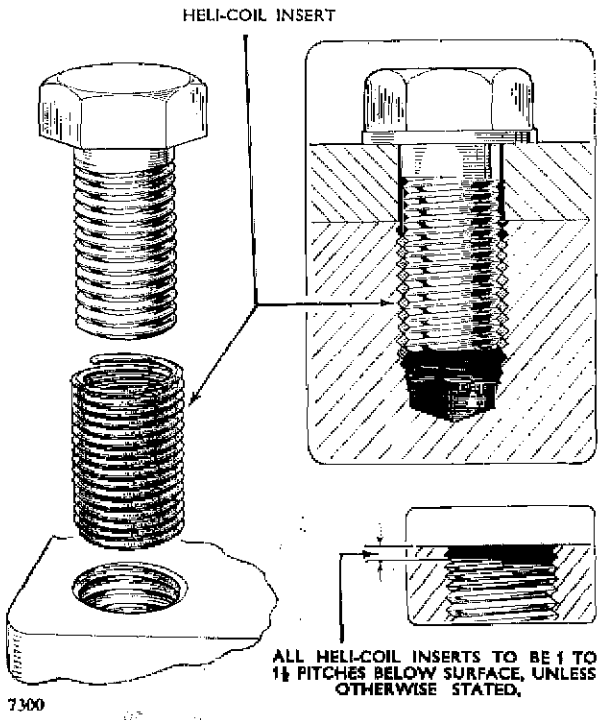


Fig. 59. *Heli-Coil insert details*

Reclamation of tapped holes in engine castings

The following information is provided for reclaiming damaged threads in the Engine aluminium castings, using the Heli-coil inserts.

When fitting Heli-coil inserts it is essential that the correct size insert is used as shown on the opposite page. All inserts must be positioned 1 to $1\frac{1}{2}$ pitches below the top face of the hole, except where otherwise stated. (See Fig. 59).

Two taps are required, a roughing tap and a finishing bottoming tap. When using the finishing tap it is important to ensure that the tap is run down to the specified depth and out again without backing off (i.e., do not reverse direction of tap until the bottom of the hole is reached). Always use a lubricant when tapping threads.

If a cylinder head bolt breaks off during removal of the cylinder head the piece remaining in the cylinder block can be drilled out using a drill guide sleeve in the cylinder head bolt hole.

A drill guide sleeve can be made from a $\frac{7}{16}$ in. dia. high tensile bolt, having at least 2 ins. of plain shank, by drilling a $\frac{1}{4}$ in. dia. hole through the centre of the bolt, after cutting off the threaded end. Drilling should be done in a lathe and it is most important that the hole is exactly central. This can be achieved by rotating the drill slowly, while it is supported in the lathe tailstock, so that the drill turns in the opposite direction to the bolt, as the bolt rotates in the lathe headstock chuck.

With the cylinder head still in position and using the drill guide sleeve in the hole from which the broken bolt was removed, drill a $\frac{1}{4}$ in. dia. pilot hole through the broken portion of the bolt, taking care not to drill into the cylinder block. Then remove the drill guide sleeve, and with the cylinder head still in position, drill out the broken bolt with a $\frac{3}{8}$ in. dia. drill.

Remove the cylinder head, tap out the hole and screw in the Heli-coil insert. In this instance DO NOT break off the Heli-coil insert tang.

All cylinder head bolt threads should be dipped in Shell Ensis 256 oil before replacement.

The opposite page gives full details of insert sizes, taps, inserting tools etc., and this information must be strictly adhered to for each application.

A list of tool kits available and their source of supply is given in Section S (Special Tools) Kit HISK 1 covers all engine (and transaxle) applications except the sparking plug insert kit. Kits HISK 2 to 13 cover the various individual applications.

Heli-coil, data, tools and inserts—engine

UNIT	*Area Affected*	*Drill Size*	*Thread Size and Finishing Tap Depth*	*Roughing Tap No.*	*Finishing Tap No.*	*Heli-Coil Insert No.*	*Inserting Tool No.*	*Tang Break off Tool No.*
Cylinder Block	Cylinder Head Face	3/8"	3/8 x UNC x 1·37"	6 CRU	6 CBB	1185–6C x 1 1/8	528–6	Do not break off tang
	Sump Face	1/4"	1/4 x 20 UNC x ·56"	4 CRU	4 CBB	3585–4CN x 3/8	3551–4	3580–4
	Clutch Housing Face	3/8"	3/8 x 16 UNC–Through	6 CRU	6 CBB	3585–6CN x 3/4	3551–6	3580–6
	Timing Cover Face*	5/16"	5/16 x 18 UNC–Through	5 CRU	5 CBB	3585–5CN x 5/8	3551–5	3580–5
	Chain Tensioner Bracket Face	1/4"	1/4 x 20 UNC x ·68"	4 CRU	4 CBB	3585–4CN x 3/8	3551–4	3580–4
	Main Bearing Cap Tappings	7/16"	7/16 x 14 UNC x 1·16"	7 CRU	7 CBB	3585–7CN x 7/8	3551–7	3580–7
	Oil Filter Face	5/16"	5/16 x 18 UNC x ·68"	5 CRU	5 CBB	3585–5CN x 15/32	3551–5	3580–5
	Breathing Tapping	5/16"	5/16 x 18 UNC–Through	5 CRU	5 CBB	3585–5CN x 15/16	3551–5	3580–5
	Dynamo Bkt. Face	3/8"	3/8 x 16 UNC x ·72"	6 CRU	6 CBB	3585–6CN x 9/16	3551–6	3580–6
	Water Inlet	1/4"	1/4 x 20 UNC x ·5"	4 CRU	4 CBB	1185–4CN x 1/4	528–4	1195–4
Timing Cover	Top Face	5/16"	5/16 x 18 UNC–Through	5 CRU	5 CBB	3585–5CN x 15/32	3551–5	3580–5
	Distributor Face	1/4"	1/4 x 20 UNC x ·5"	4 CRU	4 CBB	3585–4CN x 3/8	3551–4	3850–4
	Sump Face	1/4"	1/4 x 20 UNC x ·5"	4 CRU	4 CBB	3585–4CN x 3/8	3551–4	3580–4
	Oil Pump Face**	1/4"	1/4 x 20 UNC–Through	4 CRU	4 CBB	3585–4CN x 3/8	3551–4	3580–4
Cambox Cover	Petrol Pump Face	5/16"	5/16 x 18 UNC–Through	5 CRU	5 CBB	3585–5CN x 15/32	3551–5	3580–5
	Oil Filler Face	5/16"	5/16 x 18 UNC–Through	5 CRU	5 CBB	3585–5CN x 5/16	3551–5	3580–5
Cylinder Head	Cambox Cover Face	1/4"	1/4 x 20 UNC x ·4"	4 CRU	4 CBB	1185–4CN x 1/4	528–4	1195–4
	Tappet Block Face	1/4"	1/4 x 20 UNC x ·6"	4 CRU	4 CBB	3585–4CN x 3/8	3551–4	3580–4
	Manifold Face	5/16"	5/16 x 18 UNC x ·75"	5 CRU	5 CBB	3585–5CN x 15/32	3551–5	3580–5
	Thermostat Housing Face	5/16"	5/16 x 18 UNC–Through	5 CRU	5 CBB	3585–5CN x 15/32	3551–5	3580–5
	Sparking Plug Tappings	9/16"	14 mm. x 1·25 mm.–Through	525	521	1/2" Reach 644	542	Use Pliers
Tappet Block	Camshaft Bearing Cap Face		NOT RECOMMENDED					
Rear Main Cap	Sump Face	1/4"	1/4 x 20 UNC–Through	4 CRU	4 CBB	3585–4CN x 3/8	3551–4	3580–4
Induction Manifold	Petrol Drain Tapping	W	1/8 x 28 BSP x ·26"	2 PR	2 PB	1325–2CN x 3/16	PIP–2	Use Pliers
Water Pump	Water Inlet Body	21/32"	3/8 x 19 BSP–Through	6 PR	6 PB	1325–6CN x 9/16	PIP–6	Use Pliers

* Only to be applied to **short** stud tappings. ** Only to be applied to **one** Tapping.

Insert removal tools are available: For Inserts 1/8" to 3/8" inclusive Part No. 1227-6. For Inserts 7/16" to 1" inclusive Part No. 1227-16

ENGINE

Removal procedure—vans

The engine is removed with the transaxle attached using the following procedure.

1. Raise rear end of vehicle with a trolley jack under centre of body rear cross member and place stands under body sill just forward of rear wheels.

2. Drain cooling system and disconnect battery.

Working underneath

3. Disconnect gear shift coupling at transaxle end.

4. Disconnect earthing strap.

5. Remove two bolts holding two mounting rubbers under transaxle unit.

6. Disconnect both drive shafts from Rotoflex couplings.

7. Remove 3 drive screws at front, 4 No. 10 bolts at side and 2 drive screws at rear holding engine tray in position.

8. Slacken clip holding fan cowl rubber hose and roll hose onto radiator cowl.

Working above engine

9. Disconnect rear number plate illuminating lamps and remove rear bumper.

10. Disconnect leads from starter, coolant temperature pick up unit, coil terminals and generator.

11. Remove rear member lower fixing bolts.

12. Disconnect both water hoses from front end of cylinder head.

13. Unbolt clutch hydraulic cylinder and tie up cylinder clear of engine—do not disconnect hydraulic pipe.

14. Disconnect two water hoses from water pump.

15. Remove dipstick and its rubber from where it fits into the body apperture, but not from dipstick tube.

16. Disconnect engine oil filler hose from filler neck at body end.

17. Disconnect fuel feed pipe at fuel pump.

18. Disconnect choke and throttle cables.

19. Raise vehicle, remove stands placed under body sills and lower onto floor.

20. Using a suitable trolley stand, support engine/transaxle unit underneath.—A garage type creeper and wood blocks can be used.

21. Remove rear mounting bolt above centre of body rear member.

22. Remove body rear cross member.

23. Draw out engine/transaxle unit.

Refitting engine/transaxle unit

This is a reversal of the removal procedure. The following points should be noted.

1. The rear mounting bolt should be left loose until the Rotoflex coupling bolts have been fitted. This will allow maximum movement of the engine/transaxle unit needed while replacing the coupling bolts.

2. When refilling the cooling system follow procedure given in Section A "To refill and expel air".

3. Refill engine with recommended grade of oil (See Section P).

FUEL SYSTEM

SECTION C

CONTENTS

FUEL SYSTEM

FUEL PUMP

DESCRIPTION (See Fig. 1)

Fuel is drawn from the fuel tank by the AC Fuel Lift Pump which is driven by an eccentric on the engine camshaft.

Fuel enters by the inlet connection (19) and is delivered through the outlet connection (7).

The AC pump consists of two main bodies which clamp a diaphragm between their outer flanges.

The lower body assembly comprises a rocker arm (8) and link (11), both of which pivot on a pin (9) located in the body. Attached to the link is the pull rod incorporated in the diaphragm assembly (16). To protect the diaphragm from crankcase oil splash, an oil seal is located at the point in the lower body where the push rod passes through. A return spring (15) is interposed between the underside of the diaphragm and the lower body (12). This spring determines the pump output pressure. A further spring (10), is fitted between the rocker arm and the body for the purpose of ensuring that the rocker arm is in constant contact with the eccentric on the camshaft. Also incorporated in the AC fuel lift pump is the hand priming mechanism (13).

Assembled in the upper body are two valve assemblies (6 and 17), one being opened by suction, and the other by pressure. Both valves are held in position by a common retaining plate secured inside the upper body by two screws.

Both inlet and outlet valve assemblies are identical in construction and are renewable and interchangeable.

Also incorporated in the upper body is a filter gauze (5), which is held in position with a domed metal top cover (2) and gasket (1), which in turn is held by a centre screw (3) through the cover into the upper body (18).

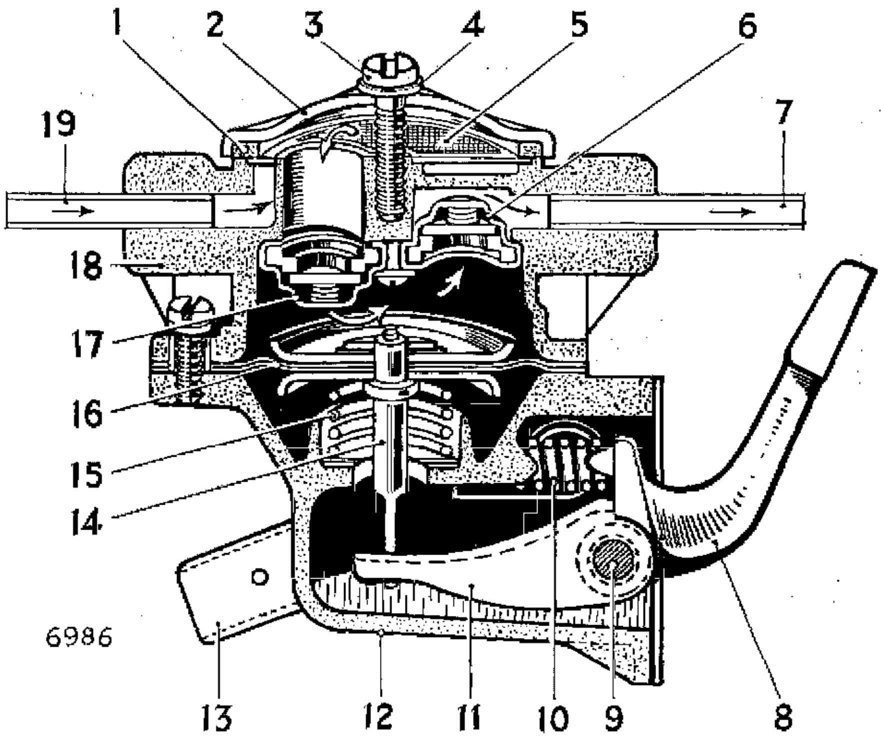


Fig. 1. Sectional view through fuel pump and filter

The priming lever (20) should only be removed if known to be defective, when a complete new hand priming assembly should be fitted on re-assembly. To remove, it is necessary to file off the riveted head of the pivot pin and tap it through the body.

INSPECTION AND OVERHAUL (See Fig. 2)

Thoroughly wash all parts in clean paraffin, ensuring that valves (9) are cleaned separately if being used again.

Check the diaphragm (12) for hardening or cracking and examine the lower extremity of the pull rod for wear, at its connection with the rocker arm link (14). Renew the diaphragm assembly if any of these signs are in evidence.

Check diaphragm return spring (26); if corroded or damaged, it should be replaced.

Visually check valve assemblies (9); if any doubt exists, replacement valves should be fitted. The two valves are identical and can be used for either application by changing their positions.

Examine the rocker arm (15) pad face for wear. Slight wear is permissible, but should not exceed a depth of ·010 ins. (·25 mm). Check rocker arm pin and link holes for wear, also underside of link (14) where diaphragm pull rod engages for wear.

Badly worn or damaged parts should be renewed.

Check rocker arm return spring (16).

Discard old oil seal (24) and gaskets.

Examine upper and lower bodies for cracks or damage. If either the diaphragm or engine mounting flanges are distorted, these should be lapped to restore their flatness.

Renew either if distortion is excessive.

TO RE-ASSEMBLE (See Fig. 2)

Where the hand primer mechanism has been removed, replace with new assembly, inserting pin through the lower body together with the priming lever. With the return spring in position, rivet over exposed end of pin.

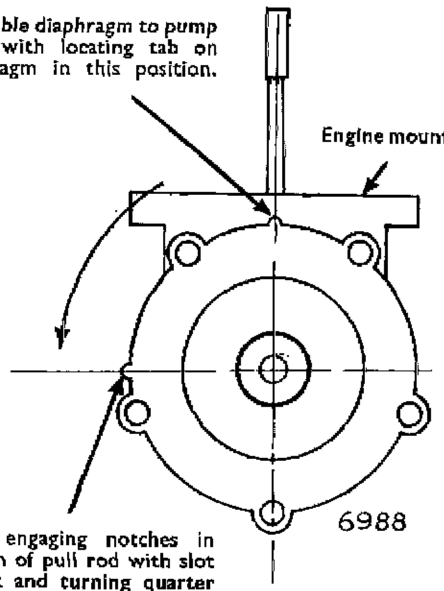


Fig. 3. *Fitting fuel pump diaphragm assembly*

Assembly of the rocker arm to the body assembly is carried out in the following order.

Assemble rocker arm (15), link (14) and spacing washers (13) onto rocker arm pin (18), place rocker arm return spring (16) into body and insert rocker arm (18) assembly into body of pump ensuring that the rocker arm return spring is properly engaged between locating "pips" on casting and rocker arm.

Tap two new pin retainers (17) into slots in the body and while holding the retainers hard against the rocker arm, pin punch over the end of the slots with a small pin punch to prevent retainers working loose.

Note: When refitting rocker arm pins, always use new service replacement retainers (17), coloured copper for identification. These are slightly shorter than the production type to allow for new staking.

Fit a new oil seal washer (24) and steel retaining washer (25) into the lower body, if required.

Place the diaphragm return spring in position over oil seal retaining washer.

Place the diaphragm assembly (12) over the spring (26), with the pull rod downwards, and with the locating tab on the diaphragm at the twelve o'clock position. Press down on the diaphragm at the same time turning the assembly to the left in such a manner that the slot on the pull rod will engage the fork in the link, ultimately turning the assembly a complete quarter of a turn to the left, which will place the pull rod in its correct working position in the link.

This will also permit the matching up of the holes in the diaphragm with those on the pump body flange and the tab will now be at nine o'clock position. (See Fig. 3.)

Place the new valve gasket (8) in the upper body round the valve ports.

Place a valve assembly (9) in the inlet port with spring facing outwards. (See Fig. 1.)

Fit the other valve (9) in the outlet port position with spring inside the port. (See Fig. 1.)

Refit the valve retainer plate (10) and tighten screws (11) until the tension in the retaining plate is taken up.

Refit filter gauze (5) in top of upper body (7), also domed top cover (3) with new cover gasket (4). Fit central holding screw (1) ensuring that fibre sealing washer (2) is between screw and cover.

The upper and lower bodies can now be fitted together as follows:—

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

Place the upper-half of the pump body into its correct position by aligning the scribed lines made on the two flanges prior to dismantling.

Replace the five securing screws (28) and spring washers (27) and tighten only until the heads of the screws just engage the washers.

Release the push rocker arm away from the pump so as to hold the diaphragm at the top of the stroke, and while so held, tighten the body screws diagonally and securely.

Important

After assembling in the manner described above, the edges of the diaphragm should be about flush with its two clamping flanges.

Any appreciable protrusion of the diaphragm indicates incorrect fitting in which case, special care should be taken in maintaining downward pressure on the rocker arm while the diaphragm screws are finally tightened.

CARBURETTOR

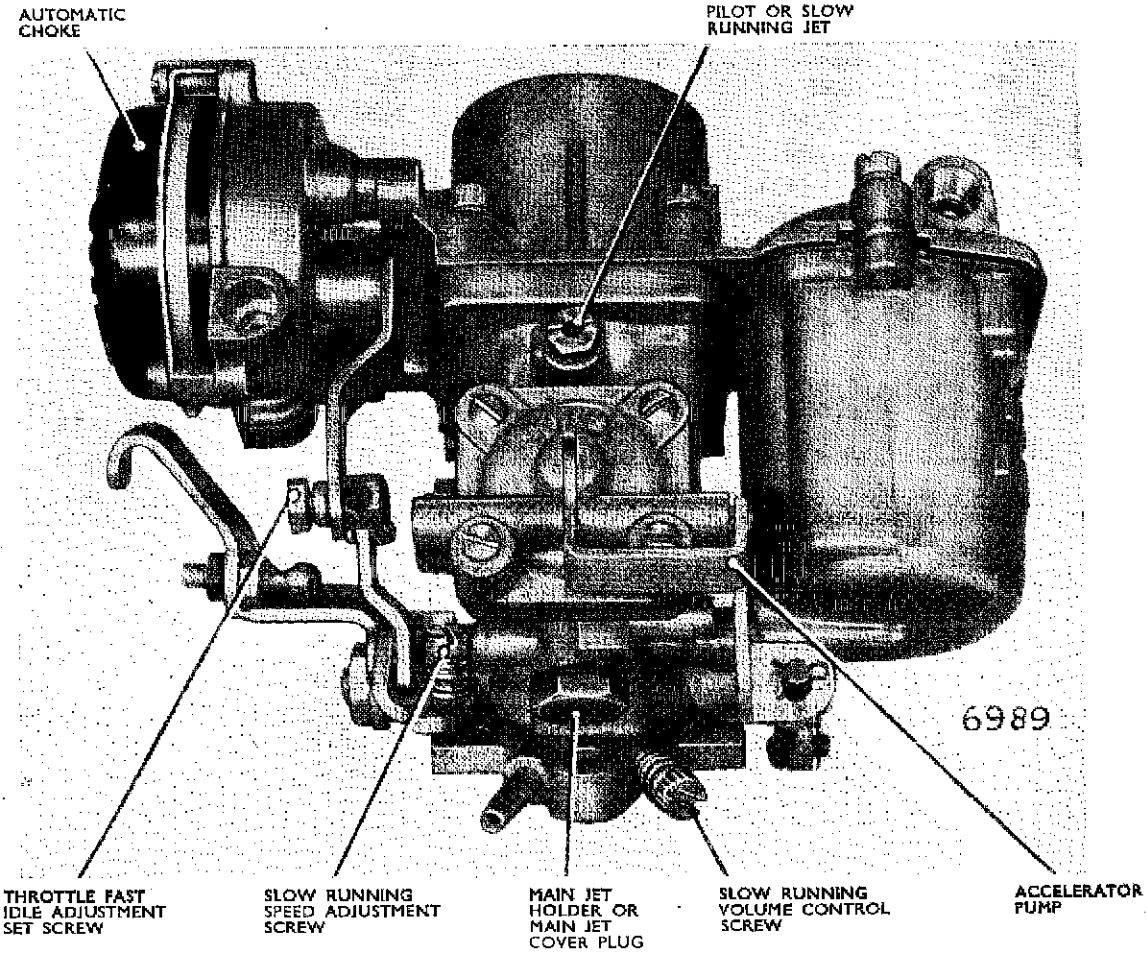


Fig. 4. *Solex B30 PIHT, B30 PIHT-2 and B30 PIHT-3 carburettors—position of various parts*

DESCRIPTION

Automatic choke (strangler) valves are fitted to all Solex PIHT carburettors. Manual operated choke (strangler) valves are fitted to all Solex PIH carburettors used on these cars.

These are all semi-downdraught carburettors having the following similar systems or circuits. Idling circuit, main spraying circuit, econostat circuit, and mechanically operated diaphragm type accelerator pump. These operate so that under all conditions of engine requirements, the carburettor provides the correct fuel/air mixture.

A schematic sectional view of the original PIHT carburettor is shown in the upper illustration of Fig. 5. The changes made on the PIHT-2 carburettor are shown in the lower left inset of Fig. 5. Further changes made on the PIHT-3 carburettor are shown in the lower right-hand inset of the illustration. These changes are incorporated in the PIH-5 carburettor; the first of these Solex carburettors used on these cars to have a manually operated choke (strangler) valve. The changes are also illustrated in Fig. 18.

NOTE. The choke tube used in PIHT-3 and PI-H5 carburettors has a cast in beak as shown in item 58A, Fig. 18.

The positions of the various carburettor parts are shown in Figs. 4, 5 and 6.

All data such as choke tube size, jet settings and drillings are given in the Data Section under "Fuel System". The different settings used for each carburettor should be carefully noted.

OPERATION

Fuel level (See Fig. 5)

The level of fuel in the float chamber is controlled by the slight rise and fall of the float (29), closing or opening the needle valve (17) to cut off or admit fuel as required.

The design of this mechanism ensures complete stability of the predetermined level and eliminates all need for routine checking. The float assembly must be replaced, in the event of damage, to ensure that the correct fuel level is maintained.

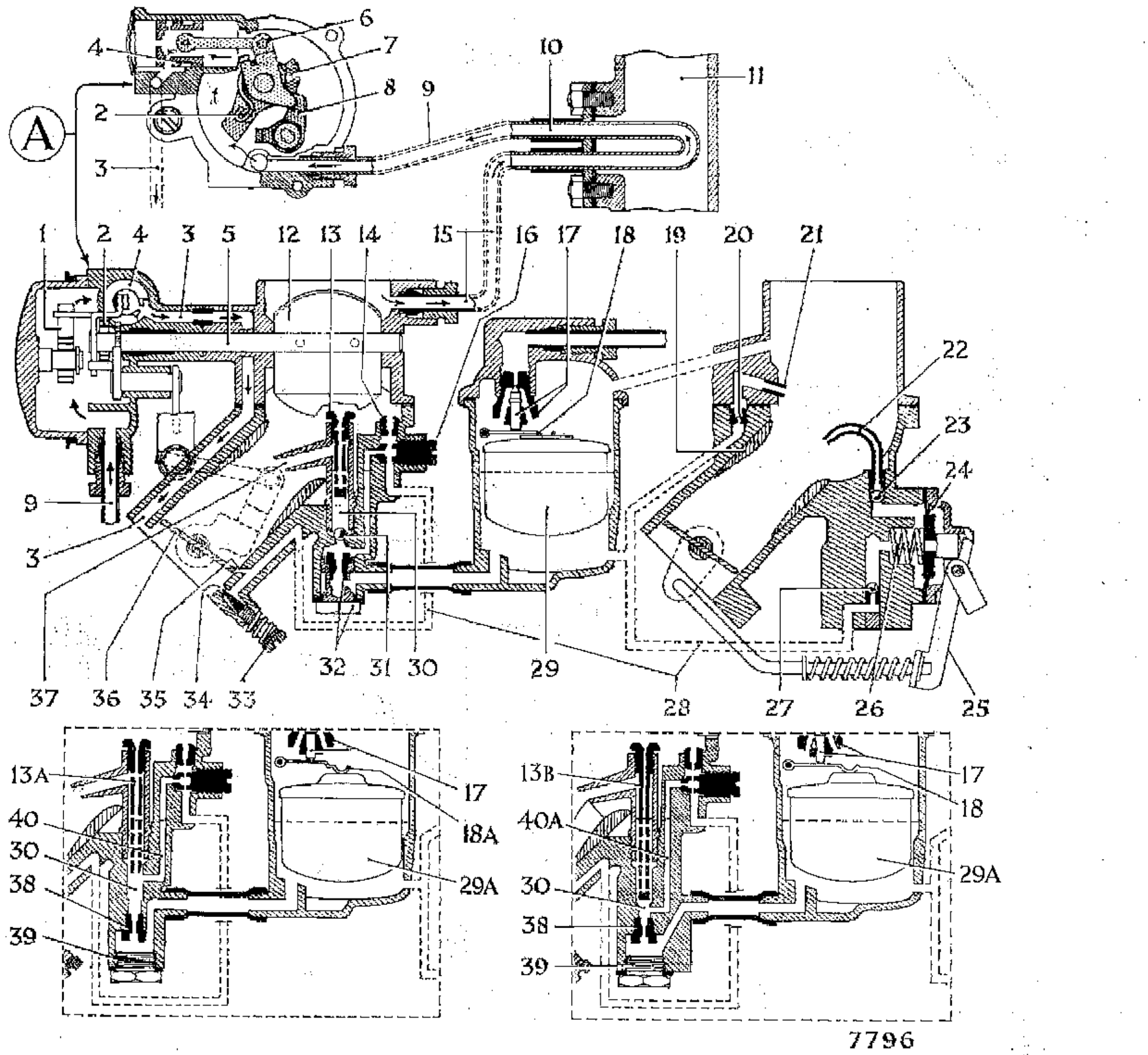


Fig. 5. *Carburettors—schematic sectional view—lower part of illustration shows differences. Arrows show cold air flow into "U" tube (10) and hot air flow from "U" tube through automatic choke mechanism into inlet manifold. A is cross section and end view of automatic choke mechanism.*

1. BI-METAL SPRING—LARGE—OPERATING CHOKE VALVE
2. BI-METAL SPRING—SMALL—OPERATING STEPPED CAM (7)
3. VACUUM FEED PASSAGE—THROUGH WHICH HEATED AIR FROM "U" TUBE (10) IS DRAWN
4. VACUUM KICK PISTON
5. CHOKE VALVE SPINDLE
6. LINK AND LEVER—CONNECTING VACUUM KICK PISTON (4) AND CHOKE VALVE SPINDLE (5)
7. STEPPED CAM
8. LEVER—USED TO OPEN THROTTLE TO FAST IDLE, OR TO OPEN CHOKE VALVE, WHEN PARTLY CLOSED, IF ACCELERATOR PEDAL IS MOVED HALF WAY OR BEYOND
9. HOT AIR FEED PIPE FROM "U" TUBE (10)
10. "U" TUBE—HEATED BY EXHAUST GASES
11. EXHAUST MANIFOLD
12. CHOKE (STRANGLER) VALVE
13. AIR CORRECTION JET AND EMULSION TUBE *B30 PIHT*
13A. AIR CORRECTION JET AND EMULSION TUBE *B30 PIHT-2*
13B. AIR CORRECTION JET AND EMULSION TUBE *B30 PIHT-3 and B30 PIH-5*
14. SLOW RUNNING JET AIR BLEED
15. COLD AIR FEED—TO "U" TUBE (10)
16. SLOW RUNNING (PILOT) JET
17. FLOAT NEEDLE VALVE AND SEATING
18. FLOAT LEVER ARM—ALL CARBURETTORS EXCEPT *B30 PIHT-2*
18A. FLOAT LEVER ARM—*B30 PIHT-2 only*
*19. CHOKE TUBE (VENTURI) *B30 PIHT and B30 PIHT-2 only*
20. ECONOSTAT JET
21. ECONOSTAT DISCHARGE TUBE
22. ACCELERATOR PUMP INJECTOR TUBE
23. ACCELERATOR PUMP DISCHARGE VALVE—ALSO CALLED ANTI-REVERSAL VALVE
24. ACCELERATOR PUMP DIAPHRAGM AND PLUNGER
25. ACCELERATOR PUMP OPERATING LEVER
26. DIAPHRAGM RETURN SPRING
27. ACCELERATOR PUMP NON-RETURN VALVE
28. INTERNAL PASSAGES IN CARBURETTOR BODY
29. FLOAT—*B30 PIHT*
29A. FLOAT—*ALL CARBURETTORS EXCEPT B30 PIHT*
30. MAIN WELL
31. MAIN WELL BALL VALVE—*B30 PIHT only*
32. MAIN JET AND HOLDER
33. SLOW RUNNING MIXTURE VOLUME CONTROL SCREW
34. SLOW RUNNING MIXTURE OUTLET
35. BY-PASS ORIFICE (PROGRESSION HOLE)
36. THROTTLE
37. MAIN SPRAYING ORIFICE
38. MAIN JET—*ALL CARBURETTORS EXCEPT B30 PIHT*
39. MAIN JET COVER PLUG
40. SLOW RUNNING (PILOT) JET FEED *B30 PIHT and B30 PIHT-2*
40A. SLOW RUNNING (PILOT) JET FEED *B30 PIHT-3 and B30 PIH-5*

* For B30 *PIHT-3* and B30 *PIH-5* see item 58A, Fig. 18.

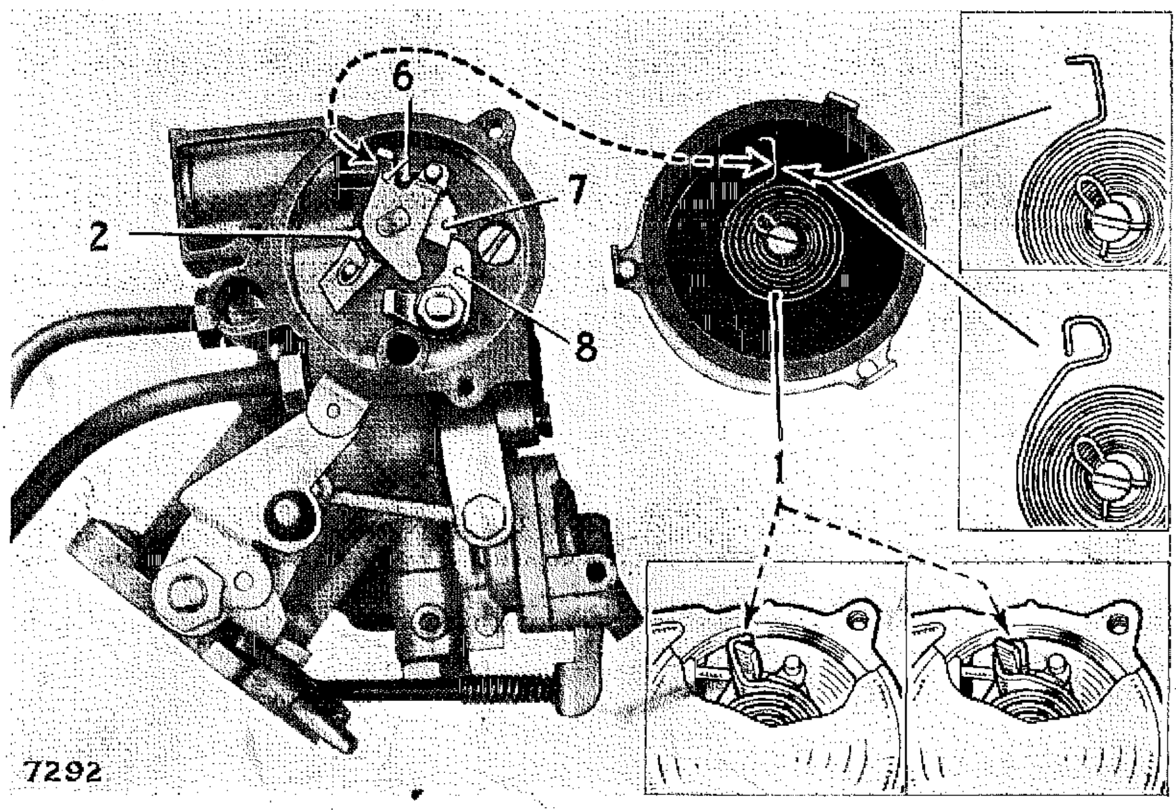


Fig. 6. *Automatic choke—various parts with reference numbers as Fig. 5—insets show bi-metal spring differences*

Automatic choke (See Figs. 5 and 6)

When the engine is cold a bi-metal "clock spring" (1), also shown in Fig. 6, closes the choke (strangler) valve (12). Another smaller bi-metal "clock spring" (2) rotates a stepped cam (7) to give the throttle (36) a suitable fast idle setting for cold starting.

The stepped cam (7), mentioned in the previous paragraph, can only give the correct throttle opening for cold starting AFTER THE ACCELERATOR PEDAL HAS BEEN FULLY DEPRESSED ONCE.

Directly the engine starts a small "vacuum kick" piston (4) opens the choke valve, against the closing torque imposed by the cold bi-metal spring (1), far enough to prevent over rich running. The vacuum feed to the vacuum kick piston (4) is through the passage way (3).

After the engine starts, inlet manifold depression draws air through the copper pipe (15) and the "U" tube (10) situated in the exhaust manifold (11). This air is heated by the hot exhaust gas passing over the "U" tube. It passes through the copper tube (9) into the compartment in which the two bi-metal springs are situated and then through a small hole in the vacuum kick piston crown (4) into the inlet manifold through the passage (3).

The heated air warms up the bi-metal springs (1) and (2) causing them to rotate and allow:—

(*a*) The vacuum kick piston (4) to open the choke valve (12) gradually to its full open position.

(*b*) The stepped cam (7) to move into a position that allows the throttle to return to the normal idling position from the fast idling position, after the throttle has been opened.

Fig. 7 shows the "U" tube (10) removed from the exhaust manifold and connected to the carburettor by the two copper pipes (15) and (9).

If the accelerator pedal is pressed half way down or beyond while the choke valve is closed, or only partly open, an internal lever (8) moves the lever (6) to open

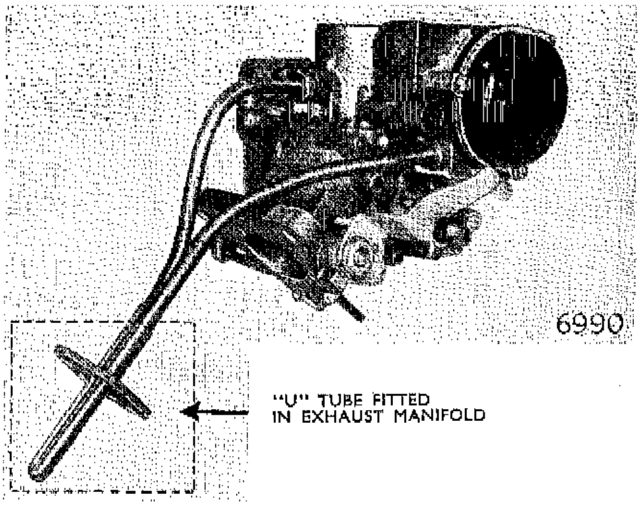


Fig. 7. *"U" tube used in exhaust manifold and connections to carburettor*

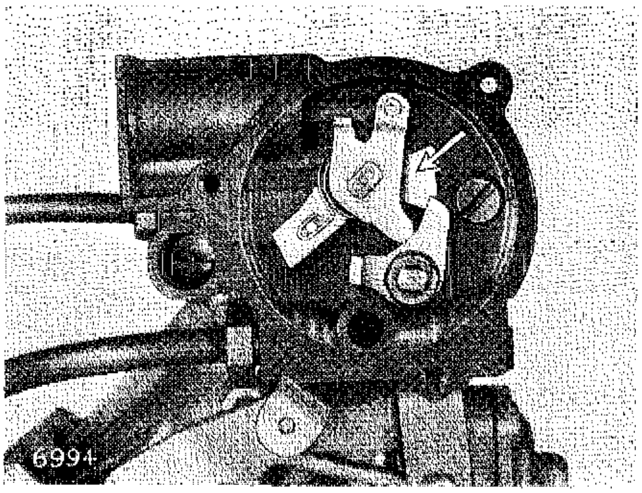


Fig. 9. *Fast idle stepped cam in moderate cold starting position*

the choke valve WHILE THE ACCELERATOR IS DEPRESSED. This prevents the engine from being supplied with too rich a mixture under cold drive away conditions.

Correct tensioning of the large bi-metal spring that controls the position of the choke valve is ensured by replacement of the cover, to which the inner coil of this spring is attached, so that the white dot or white line on its top edge is in the position shown in Fig. 14. This is most important.

The correct method of refitting the automatic choke cover is given under "Difficult starting from cold" on page 16.

More particulars of the automatic choke are shown in Figs. 7-13.

Manual choke (See Fig. 13A)

This choke (strangler) system is operated by a cable connected to a small lever situated in front of the gear change lever.

An external linkage connects the choke spindle lever to the throttle spindle so that the throttle is opened to the cold start fast idle position when the choke valve is closed. This linkage also allows the choke lever to be used as a hand throttle to increase the engine idling speed as needed, before the engine has warmed up, after cold starting.

The choke (strangler) valve is mounted on an offset spindle. This allows atmospheric pressure to open the choke valve, against its light return spring, so that enough

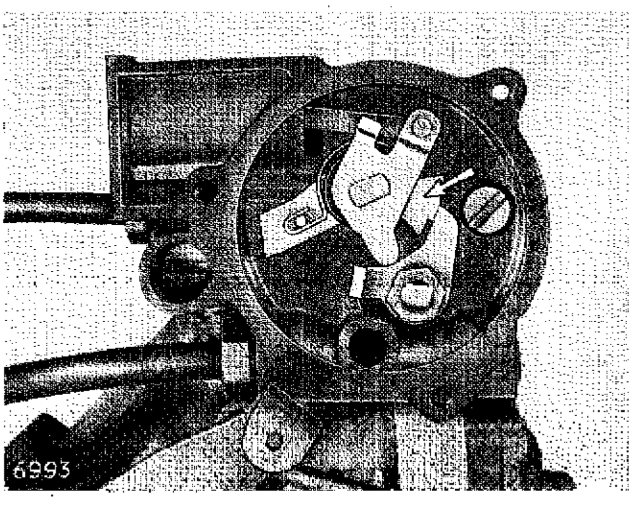


Fig. 8. *Fast idle stepped cam in very cold starting position*

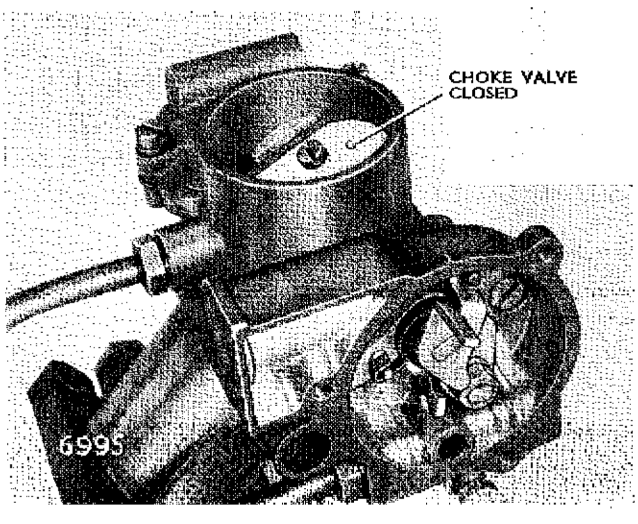


Fig. 10. *Choke valve in cold starting position—all conditions*

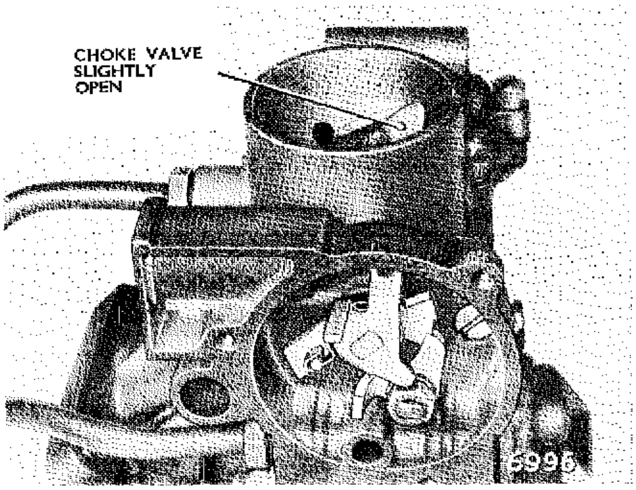


Fig. 11. *Automatic choke and choke valve immediately after starting*

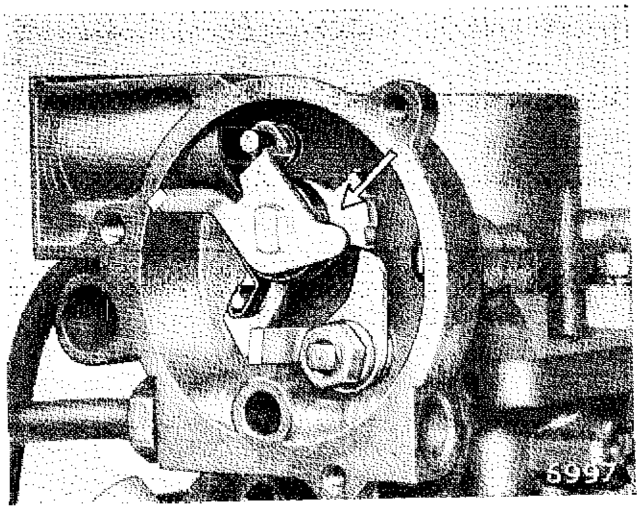


Fig. 12. *Fast idle stepped cam in normal hot running position*

air passes the valve to prevent the engine stalling, directly it starts from cold with the choke (strangler) valve closed. An adjustment is provided for the choke valve light return spring tension, so that the amount of choke valve opening can be controlled to meet extremely cold starting conditions.

Idling circuit (See Fig. 5)

This supplies, through the orifice (34), the mixture required for idling when the engine is warm. It also provides through the by-pass orifice (35) the mixture required when the throttle is first opened, but before it opens enough for the main spraying orifice to begin to discharge. The circuit is as follows, fuel is supplied from the well above the main jet and metered by the pilot jet (slow running jet) (16) the pilot jet air bleed (14) providing the emulsifying air. When idling, additional air passes through the by-pass orifice (35), the volume of the resultant mixture being controlled by the screw (33). On leaving the idling orifice (34) the mixture is further emulsified by air passing round the throttle (36), the latter being held slightly open by an adjustment screw. As the throttle is opened engine depression is directed to the by-pass orifice (35) which discharges additional mixture to meet engine requirements until the throttle (36) has been opened sufficiently for the main spraying system to come into operation.

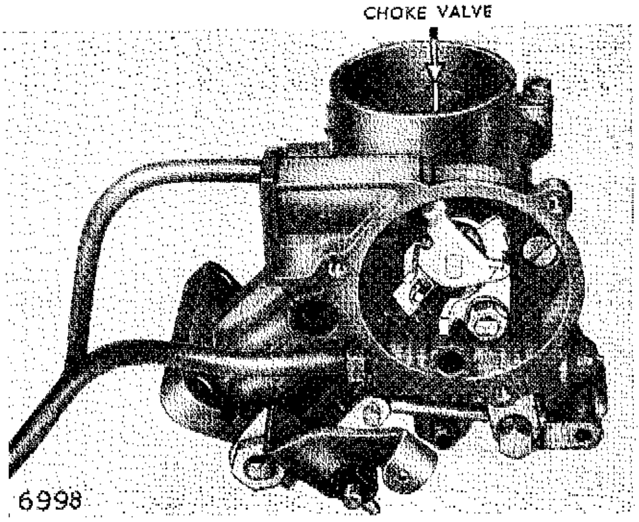


Fig. 13. *Automatic choke valve in hot running position*

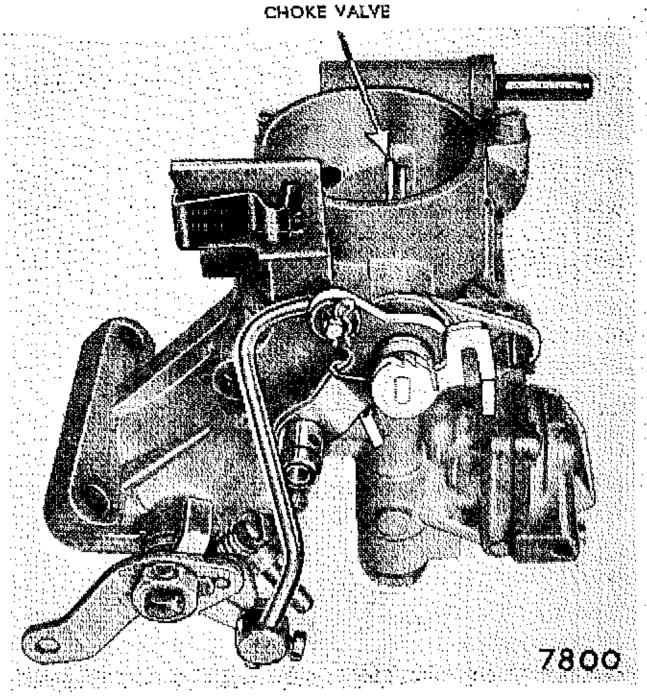


Fig. 13A. *Manual choke valve fully open*

Main spraying circuit (See Fig. 5)

As the throttle is opened further and air speed through the venturi (choke tube) (19) increases, depression on the spraying orifice (37) brings the main spraying system into operation.

Under this condition fuel flows from the float chamber and is metered by the main jet (32) or (38) before passing into the main spraying well (30) where it mixes with air metered by the air correction jet (13), the air entering the fuel stream by means of small holes in the emulsion tube below the air correction jet (13). From the main well the mixture finally discharges through orifice (37) into the main air stream. As engine speed increases the fuel level in the well (30) drops and uncovers the remaining holes in the emulsion tube. In this way additional air enters the fuel stream and corrects the output from the main jet according to engine speed and load requirements.

Accelerator pump (See Fig. 5)

The accelerator pump is mechanically operated and consists of the pump diaphragm (24) pump spring (26), and pump actuating lever (25) connected by a rod to a lever on the throttle spindle.

On depressing the accelerator pedal the movement of the pump operating lever (25) displaces the pump diaphragm (24) which forces fuel through the calibrated injector tube (22) into the main air stream thereby ensuring rapid, smooth acceleration.

A non-return valve (27) prevents fuel from returning to the float chamber when the diaphragm (24) is forcing fuel through the injector tube (22). An anti-reversal valve (23) above the pump unit prevents air from entering this system when the pump is drawing fuel from the float chamber.

Econostat circuit (See Fig. 5)

The econostat allows maximum economy to be maintained over the cruising range of the engine and at the same time provides accuracy of metering under full throttle conditions. It is non-mechanical in operation.

The system has a separate jet (20) that discharges fuel into the air intake at a point (21) above the choke tube (19). As the engine speed increases the discharge will take place only when depression inside the discharge tube (21) has become great enough to lift the fuel up to its inner end. The position of the tube (21) together with the effect of the depression existing in the air intake, determine the point at which the econostat comes into operation and the petrol jet (20) controls the rate at which fuel is supplied.

STARTING THE ENGINE

From cold—with automatic choke (See Fig. 5)

1. Fully depress the accelerator pedal once before operating the starter. This allows the small bi-metal spring (2) to move the stepped cam (7) so that it holds the throttle open to its correct position for starting, when the accelerator pedal is released.
2. Switch on the ignition and operate the starter. Do not move the accelerator pedal. The engine will start and run at fast idling speed. The car should be driven away as soon as possible.

From cold—with manual choke

Move the choke control lever backwards as far as possible from its normal position. Operate the starter. The engine should start immediately and continue to run at a fast idling speed. Move the choke control forward far enough to give even running, and as the engine warms up gradually return the choke control to its normal fully forward position.

When warm or hot

Do not "agitate" the accelerator pedal as this will cause the accelerator pump to inject neat fuel into the hot inlet manifold and make starting very difficult.

If the engine is still warm switch on the ignition and operate the starter without moving the accelerator pedal. Should the engine hesitate to start depress the accelerator pedal a short way, and release it when the engine starts.

If the engine is difficult to start when hot fully depress the accelerator while operating starter and release it directly the engine starts.

DIAGNOSIS OF FAULTS

Since the function of the carburettor is closely connected with other items of engine operation, troubles are sometimes difficult to trace and the carburettor is often blamed when it is not at fault.

Unless known to be in perfect condition, the following items should be checked before making carburettor adjustments:—

Ignition system

Check spark plug condition. Clean and set gaps.

Check condition and tightness of H.T. and L.T. leads.

Check condition and setting of contact breaker points and contact moving point spring tension.

Ensure that the centrifugal and vacuum advance mechanisms are working correctly.

Check ignition timing. Only small variations from the correct static timing are permissible.

Fuel system

Ensure that an adequate supply of fuel is being delivered to the float chamber.

Check that fuel pump output pressure is correct to the figures given under "Fuel System" in Data Section of this manual.

Examine induction manifold and carburettor flange for air leaks.

Ensure that air cleaner is fitted correctly and not restricting air supply to carburettor due to the element being dirty.

Compression

Check valve clearances and compressions.

Make sure valves are not sticking.

Exhaust system

Check that exhaust pipe has not become damaged or blocked.

If the carburettor has been proved faulty a systematic check should be carried out in order to locate the exact source of the trouble. Random adjustment on the carburettor is useless and harmful and must never be attempted. Figs. 5, 16 and 17 show the locations of jets and passageways.

Excessive fuel consumption (See Fig. 5)

Ensure that the complaint is genuine and not caused by heavy traffic conditions.

Check the whole fuel system for leakage particularly at the short plastic connector between the float chamber and carburettor main body.

Ensure that the carburettor is not flooding intermittently due to dirt under the needle valve or faulty needle valve, seat, or float. If the needle valve is suspect a new needle valve seat assembly or float should be fitted.

Check that main jet (32) is not loose in its holder, or the main jet (38) loose in the carburettor body.

Check that main jet (32) or (38) and air correction jet (13) (13A) or (13B) are to the sizes given in the Data Section.

Automatic choke

Check that the automatic choke is operating correctly. This is done by removing the air cleaner connection from the carburettor intake and watching the movement of the choke valve as the engine warms up from cold.

Directly the engine starts the choke valve (12) should open a small amount by the action of the vacuum kick piston (4). It should then gradually open to its full open position as the engine warms up, and remain in this position while the engine is hot.

As the engine cools down, after being stopped, the choke valve should gradually close and be fully closed when the engine becomes cold.

The short white or scribed line on the automatic choke black cover must be in the position shown in Fig. 14.

Incorrect positioning of the white line on the black cover, from its correct position, alters the action of the automatic choke.

The action of the automatic choke can be upset by insufficient hot air being drawn through the automatic choke heat chamber. This would be caused by serious air leaks in the hot air flow system which is shown by arrows in Fig. 5. Sticking of the vacuum kick piston (4) or choke spindle (5) will also prevent the choke valve from fully opening.

Manual choke

Check that the choke control mechanism is operating correctly and that the control cable is adjusted so that the choke (strangler) valve is fully open when the operating lever is in the fully forward position.

Check that the strangler valve return spring is anchored in the weak (normal) position shown in Fig. 13A. This does not apply when operating under extremely cold conditions.

Insufficient top speed

Check that the throttle is opening fully when the accelerator pedal is fully depressed from the driving position.

Incorrectly fitted carpets can prevent full pedal movement.

Check for fuel obstruction in the econostat circuit.

Change the air cleaner element if it is in any way suspect.

Check fuel supply to float chamber and pump output pressure.

Dirt from the fuel system can block up the fuel pump. Also a worn pump can reach a condition when it will not supply enough fuel for maximum engine output requirements.

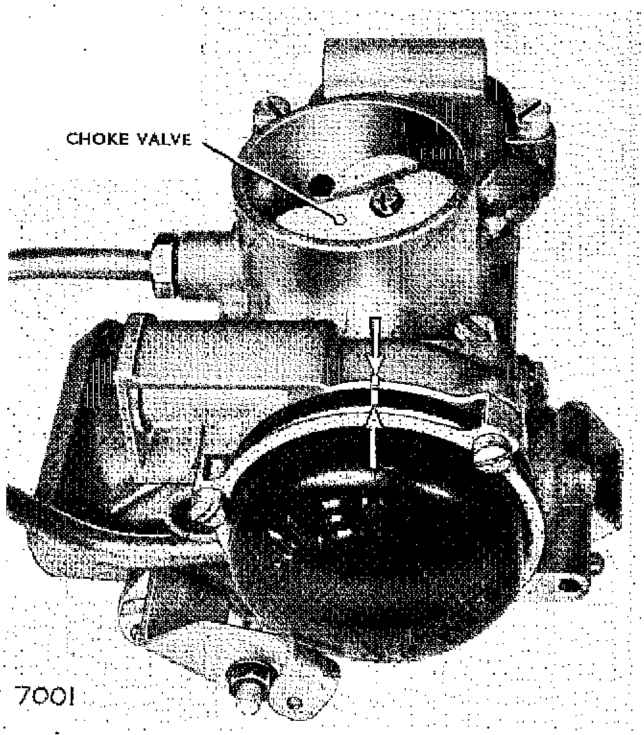


Fig. 14. *Automatic choke cover correctly replaced and choke valve in cold starting position*

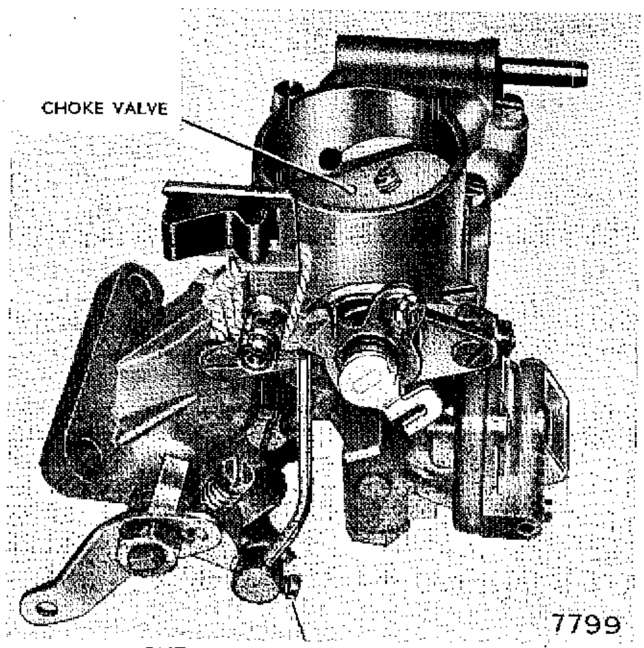


Fig. 14A. *Manual choke valve fully closed*

Faulty slow running (See Figs 4 and 5)

Ensure that slow running speed adjusting screw and mixture volume control screw are correctly set.

Check that the slow running (pilot) jet (16) is clear. This jet can be removed from the outside of the carburettor.

Ensure that the whole induction system is free from air leaks.

Check that the slow running mixture volume control screw (33) is not damaged or its securing position spring missing.

Flat spot at small throttle opening (See Fig. 5)

Adjust the idling speed to give smooth running just off the rich or "Hunting" condition.

Check the induction system for air leaks.

Ensure that vacuum advance pipe is correctly fitted to the carburettor, and that pipe is not damaged so that air is leaking into it. Although rare, it is possible for air to leak through a faulty vacuum advance unit diaphragm.

If a flat spot still exists check that the by-pass (progression hole (35) is clear.

Poor acceleration (See Fig. 5)

Check action of accelerator pump. Fuel must be delivered from the accelerator pump discharge tube whenever the throttle is opened. Dirt under either of the accelerator pump ball valves, or a stuck or missing ball valve will considerably reduce or prevent fuel output from the accelerator pump.

Incorrect replacement of the accelerator pump diaphragm return spring (26) prevents movement of the diaphragm and no fuel is discharged as the throttle is operated.

Difficult starting from cold (See Figs. 5, 6 and 14)

Check that fuel is being supplied to the carburettor.

Automatic choke

Remove air cleaner intake from the carburettor and check that choke valve is closing, and not sticking open when the engine is cold. The choke valve spindle should move quite freely and the valve lightly snap shut when the carburettor is cold, if the valve is opened by finger pressure.

Check that the white line, on the automatic choke hot chamber cover, is positioned to the raised edge on the carburettor body as shown in Fig. 14.

As shown by the insets in Fig. 6, two kinds of outer ends have been used on the large bi-metal spring, and the correct method of replacing the spring cover depends upon the type of spring fitted inside the cover.

If an unlooped ended spring is used, as shown in the upper right-hand inset of Fig. 6, the cover should be replaced so that its white line is at the 9 o'clock position, then turned in a clockwise direction to the position shown in Fig. 14, and the cover fixing screws tightened.

When a looped end spring is used the cover must be replaced so that the looped end fits over the lever on the end of the strangler spindle (5), as shown in the lower right inset of Fig. 6. The cover should then be turned to the position shown in Fig. 14, and its fixing screws tightened.

If the choke control cover is replaced incorrectly the choke valve may not close properly when the engine cools down, or the choke valve may not open quickly enough as the engine warms up after starting.

Choke valve sticking can of course be due to dirt and other causes that can make the spindle stiff to move.

Check fast idle gap setting. This is the amount of opening at the throttle valve when the highest step of the stepped cam is in operation. See under ADJUSTMENTS.

Manual choke

Check that the choke (strangler) valve is closing fully when the choke control is moved to the cold starting position. This can be done without removing the air cleaner by observing the movement of the short lever on the end of the choke valve spindle. The short lever should turn with the long lever, to which the operating cable is connected, as the long lever is moved to the full extent of its operating range. It should then be possible to move the short lever one sixth of a turn, in an anti-clockwise direction, and then release it so that the choke valve snaps shut by the action of the choke valve return spring on the spindle behind the spring.

Check the fast idle gap setting. This is the amount of throttle valve opening when the choke valve is fully closed. See under ADJUSTMENTS.

ADJUSTMENTS

There are only two adjustments. They are:—

1. Slow running speed and mixture strength to give correct idling.
2. Throttle fast idling position to give good starting under all cold conditions.

Slow running adjustment (See Fig. 15)

Adjust the slow running speed adjustment screw to give an engine idling speed of 750 R.P.M.

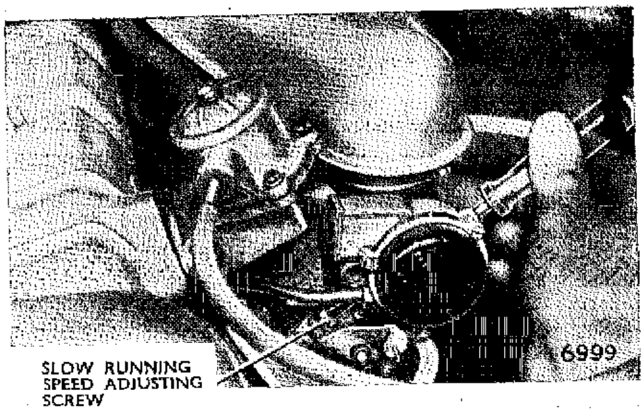


Fig. 15. *Adjusting slow running speed*

Unscrew the slow running mixture volume control screw in an anti clockwise direction until the engine begins to "hunt". Then adjust the screw in a clockwise direction until the engine runs smoothly.

If the engine speed is now too high reset the slow running speed adjustment screw. This may cause the engine to "hunt" slightly and a small alteration to the volume control screw may be required.

Fast idle position—for cold starting (See Figs. 4, 5 and 14A).

This adjustment must be very carefully made. The setting dimension has been arrived at by cold room tests.

Automatic choke

Remove carburettor from inlet manifold, as this adjustment cannot be made with the carburettor in position.

Remove the three screws holding the black cover over the automatic choke heat chamber.

Open the throttle so that the stepped cam (7) can be moved and held by a small rubber band so that its highest step is in operation.

Loosen off the set bolt, shown in Fig. 4, that locks the connecting link to the lever attached to the shaft operating the short lever (8).

Open the throttle to the fast idle setting given in the Data Section under Fuel System. The shank of a drill, or thin wire flattened to this dimension, should be inserted between throttle edge and throttle bore at a right angle to the centre of the throttle spindle. With the throttle held in this position, tighten the set bolt. Then check that the throttle opens the correct amount as the lever (8) rests against the top step of the stepped cam (7).

Manual choke

Remove carburettor from inlet manifold as this adjustment cannot be made with the carburettor in position.

Tie the choke (strangler) valve operating lever so that it has moved to the full extent of its travel as shown in Fig. 14A.

Slacken off the set screw in the brass trunnion on the lower end of the connecting rod between the choke operating lever and floating lever behind the throttle lever.

Open the throttle to the fast idle setting given in the Data Section under Fuel System for this type of carburettor. If a number drill with a shank diameter of this dimension is not available a piece of wire of this diameter, or slightly flattened to this dimension can be used as a throttle opening gauge. Insert the checking gauge between the throttle edge and throttle bore at right angles to the centre of the throttle spindle. With the throttle held in position, tighten the set screw in the brass trunnion on the throttle floating lever. Then check that the throttle opens the correct amount when the choke lever is operated to its full extent of movement.

Manual Choke valve return spring tension

The tension of this spring can be increased by moving its outer end; anti-clockwise, into one of the two extra anchorage slots in the short lever on the end of the choke valve spindle.

More tension is sometimes needed under very cold starting conditions. $-10°F$ ($23°C$).

REMOVAL

Disconnect the following items:—

Air cleaner.

Fuel pipe at fuel pump outlet.

Vacuum advance pipe at carburettor end.

Air pipe from throttle operating unit.

Three $\frac{7}{16}$ in. A.F. nuts and washers holding carburettor on inlet manifold.

The carburettor may now be lifted off complete with the unit that operates the throttle. This unit and its mounting plate may be removed from the carburettor by releasing its ball connection and the throttle return spring.

REFITTING

This is a reversal of the removal procedure, a new joint should be fitted between the inlet manifold flange and operating unit mounting bracket. The thick heat insulating joint is fitted between the carburettor flange and the mounting bracket.

CLEANING (See Figs. 5, 16 and 17)

Do not remove the carburettor top body from the main body, while the carburettor is in position on the engine, because it is difficult to replace its gasket without first removing the carburettor.

The carburettor can be cleaned quickly without removing it from the engine if the following procedure is carried out.

Remove the main jet holder (32) or main jet cover plug (39) below the carburettor with a $\frac{9}{16}$ in. A.F. box spanner. This will allow the float chamber and slow running system passageway to drain.

Using fuel pump priming lever pump a small quantity of fuel through the float chamber so that needle valve and seat are flushed through.

Remove main jet (32) from its holder, or the main jet (38) from the carburettor body with a small screwdriver; also remove slow running jet (pilot jet) (16) on the outside of the carburettor body. Blow through jets and inspect jet orifice to make sure that an obstruction, such as a fine hair, is not still remaining inside the jet.

Cleaning of the jets should be carried out by washing in petrol and blowing through with clean compressed air. Under no circumstances should wire be used, as this may have a detrimental effect on the calibration of the jets.

Replace jets (16) and (32) or (38). Also replace jet holder (32) and jet cover plug (39).

Remove two screws above float chamber. Slightly lower float chamber and move forward to withdraw float chamber from the short plastic tube that connects it to the carburettor body.

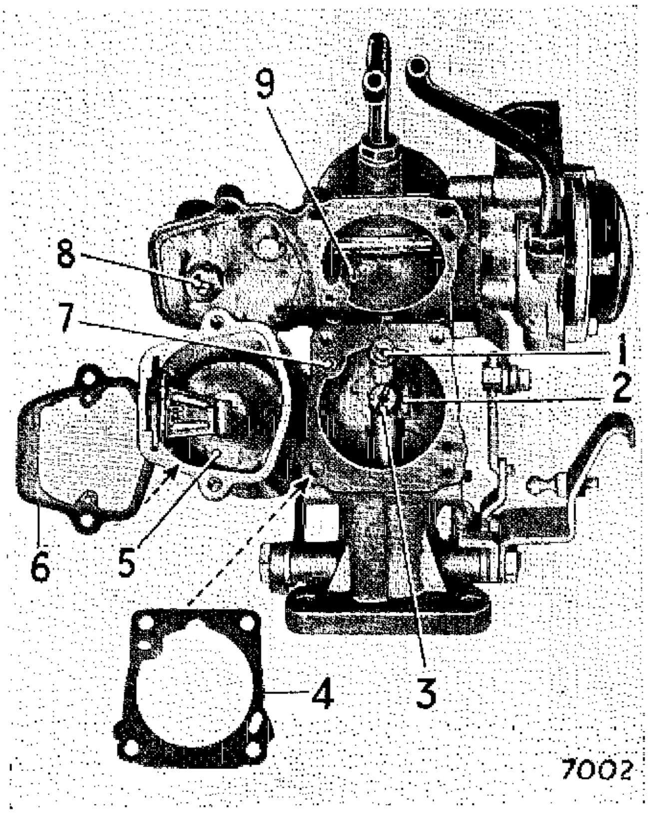
Remove spring, retaining float lever fulcrum pin in position.

Lift out fulcrum lever noting that the fulcrum lever is marked TOP to ensure correct assembly. Clean out float chamber.

When replacing the float chamber ensure that it fits up against its joint in the carburettor top body.

Operate the fuel pump priming lever to fill the carburettor and inspect float chamber to carburettor body plastic tube connections for fuel leakage. This can be done by holding a mirror under the carburettor.

If necessary the accelerator pump can be drained by loosening the four brass screws that hold the accelerator pump cover to the carburettor body. This will allow



1. SLOW RUNNING JET AIR BLEED
2. ACCELERATOR PUMP DISCHARGE TUBE
3. AIR CORRECTION JET
4. GASKET—USED BETWEEN TOP BODY AND MAIN BODY
5. FLOAT
6. GASKET—USED BETWEEN TOP BODY AND FLOAT CHAMBER
7. ECONOSTAT JET
8. FLOAT NEEDLE VALVE AND SEAT
9. ECONOSTAT DISCHARGE TUBE

Fig. 16. *Position of internal jets and parts*

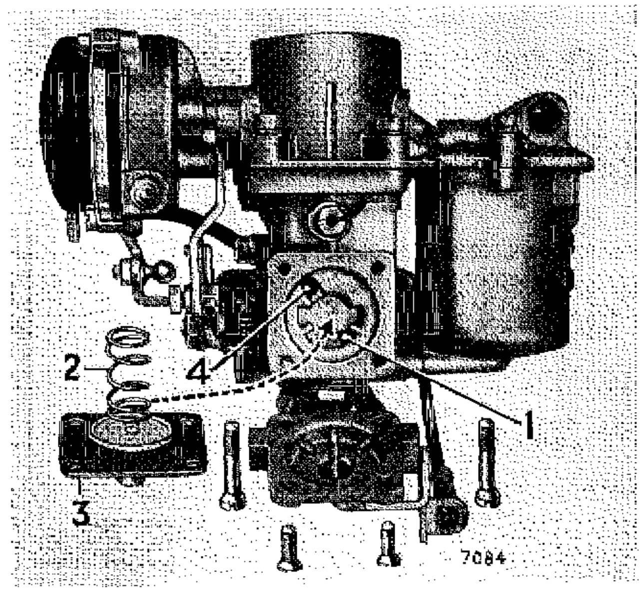
the pump cover to move outwards and fuel to drain out of the accelerator pump chamber when the diaphragm is carefully lifted from the main body.

In addition remove the fuel pump cover and filter. Clean fuel pump filter and fuel pump sediment chamber.

If it becomes necessary to remove the choke valve spindle (1) or (13), the two screws (4) securing the choke valve (5) in the spindle slot MUST be replaced with "Loctite" on their threads when replacing the spindle (See Fig. 18). "Loctite" is a special compound used to secure threads. It should also be used on the two throttle valve securing screws. It can be obtained under Part Number 5200444.

An exploded view of carburettor is shown in Fig. 18.

After refitting, check that the throttle opens fully when the accelerator pedal is fully depressed. On carburettors having manually operated choke valves check that the choke valve closes when the choke lever is moved over its operating range.



1. ACCELERATOR PUMP FEED DRILLING
2. ACCELERATOR PUMP DIAPHRAGM RETURN SPRING
3. ACCELERATOR PUMP DIAPHRAGM
4. ACCELERATOR PUMP DISCHARGE JET—OR DISCHARGE DRILLING

Fig. 17. *Accelerator pump—internal details*

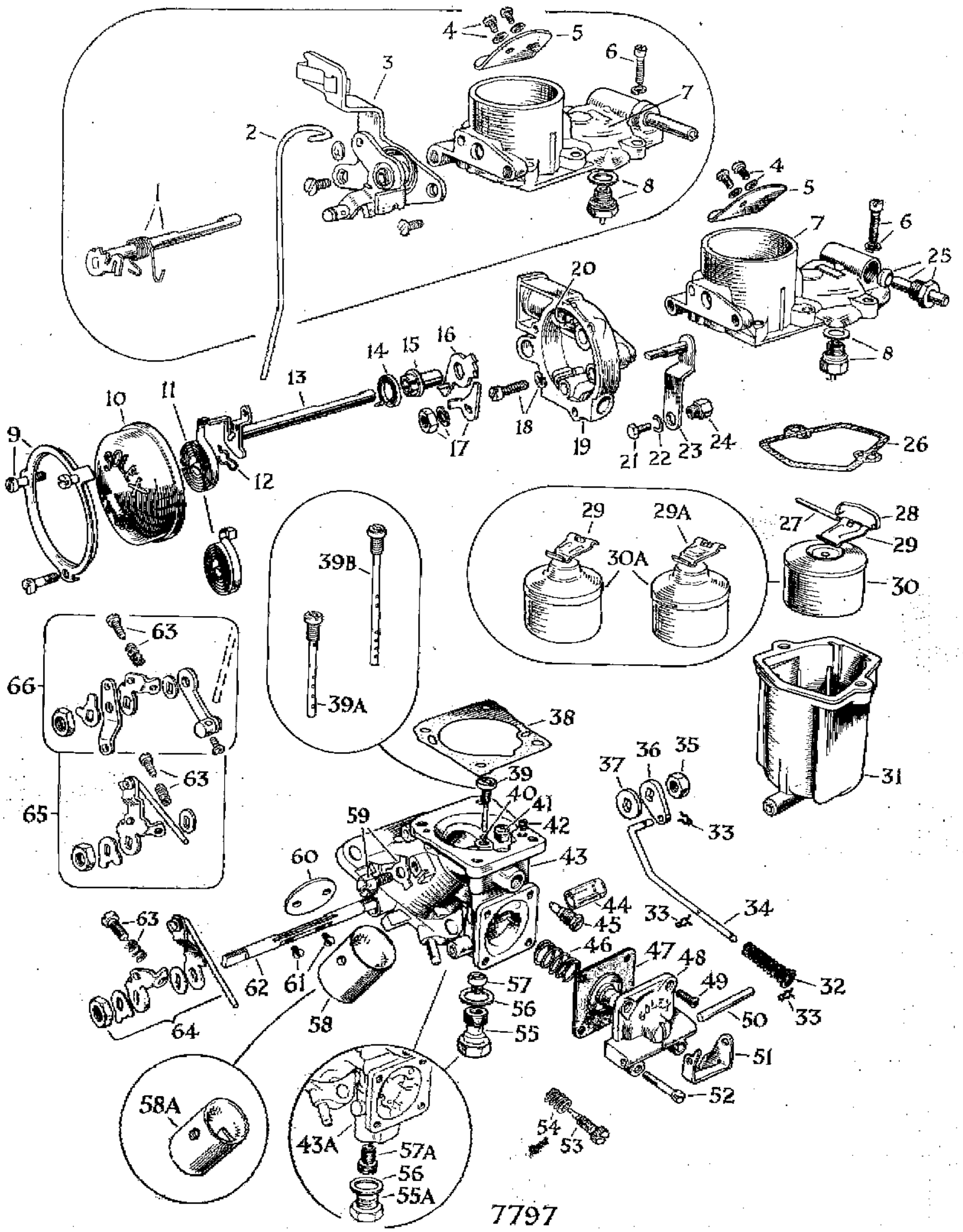


Fig. 18. *Solex B30 PIHT, B30 PIHT-2, B30 PIHT-3 and B30 PIH-5 carburettors—exploded view*

NOTE.— -2, -3 and -5 changes are shown surrounded with a black line.

CARBURETTOR PARTS (See Fig. 18).

1. Choke valve spindle and return spring—manual choke
2. Connecting link—choke to throttle
3. Manual choke linkage and cable bracket
4. Choke valve fixing screws and spring washers
5. Choke valve
6. Fixing screw—top body and float chamber cover
7. Top body and float chamber cover
8. Float needle valve assembly and washer
9. Fixing collar and screws
10. Bi-metal spring cover
11. Bi-metal spring—large
12. Spring clip
13. Choke valve spindle—automatic choke
14. Bi-metal spring—small
15. Strangler valve spindle bearing bush
16. Fast idle lever stepped cam
17. Fast idle short lever, fixing nut and washer
18. Automatic choke body fixing screws and spring washers
19. Automatic choke body
20. Vacuum piston link end (this connects to hole in lever on end of item 13)
21. Set screw for fast idle speed adjustment
22. Circlip
23. Fast idle long lever and spindle
24. Fast idle connecting rod pivot
25. Fuel inlet pipe, olive and union nut
26. Gasket—float chamber to top body
27. Float lever pivot pin
28. Retaining spring—float lever pivot pin
29. Float lever—*all carburettors except B30 PIHT-2*

29A. Float lever—*B30 PIHT-2 carburettor only*

30. Float—*B30 PIHT carburettor only*

30A. Float—*all carburettors except B30 PIHT*

31. Float chamber
32. Accelerator pump lever operating spring
33. Circlip
34. Accelerator pump operating rod
35. Nut—accelerator pump lever
36. Accelerator pump lever
37. Spacing washer
38. Gasket—carburettor top body to main body
39. Emulsion tube and air correction jet—*B30 PIHT*

39A. Emulsion tube and air correction jet—*B30 PIHT-2*

39B. Emulsion tube and air correction jet—*B30 PIHT-3 and B30 PIH-5*

40. Ball valve—main well—*B30 PIHT only*
41. Pilot jet air bleed
42. Econostat jet
43. Carburettor main body

43A. Carburettor main body difference—*all carburetters except B30 PIHT*

44. Plastic tube—float chamber to main body
45. Pilot (slow running) jet
46. Accelerator pump diaphragm return spring
47. Accelerator pump diaphragm
48. Accelerator pump body
49. Cover fixing screw—short
50. Accelerator pump pivot pin
51. Accelerator pump lever
52. Cover fixing screw—long
53. Slow running volume control screw.
54. Volume control screw spring
55. Main jet holder—*B30 PIHT only*

55A. Main jet cover plug

56. Main jet holder—or cover plug washer
57. Main jet—*B30 PIHT only*

57A. Main jet—*all carburettors except B30 PIHT*

58. Choke tube—*B30 PIHT and B30 PIHT-2*

58A. Choke tube—*B30 PIHT-3 and PIH-5*

59. Choke tube locating screw and locking washer
60. Throttle valve
61. Throttle valve fixing screws
62. Throttle spindle
63. Slow running speed adjustment screw and spring
64. Fast idle linkage—*B30 PIHT*
65. Fast idle linkage—*B30 PIHT-2 and B30 PIHT-3*
66. Fast idle linkage—*Manual choke carburettor*

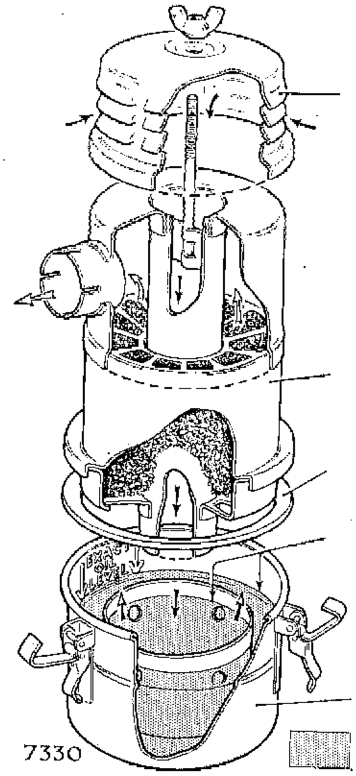


Fig. 18A. *Air cleaner—oil bath type*

AIR CLEANER—OIL BATH TYPE (See Fig. 18A)

Servicing Instructions

The intervals at which this type of cleaner is serviced depends entirely upon the operating conditions. After 500 miles (800 km) running the oil container, on the base of the unit, should be removed by releasing its quick action retaining clips. If the oil in the container is still clean and there is only a small amount of sediment in the bottom of the container, longer servicing periods are permissible. After cleaning the container it should be refilled to its oil level mark with the recommended grade of MULTIGRADE engine oil. Both container compartments should be filled. Ordinary oil should not be used as it may be too thick when cold.

The steel gauze above the oil pan should be inspected with a mirror while the oil container is removed. If the gauze is dirty the complete unit should be removed and the gauze washed in clean paraffin (kerosene) and allowed to drain dry. The steel gauze should also be cleaned at 6 months intervals.

The joint ring used above the oil container does not normally need replacement, but its condition should be checked before refitting the container.

If necessary the top cover should be removed and its air intake louvres cleaned.

AIR CLEANER—LARGE DRY ELEMENT TYPE (See Fig. 18B).

This cleaner has a larger element than the standard cleaner shown in Fig. 20. In some territories its inlet is connected to a hose that passes inside the body to an air intake grille in the right hand door post.

Servicing

Intervals for renewing the element are given in the owner's handbook. The element is used in a DRY condition and must never be oiled or washed in any fluid. More frequent attention may be needed under dusty operating conditions.

The element is removed by unscrewing the long through bolt wing nut head below the unit, and lifting off the filter top cover. Joint rings are used above and below the element as shown in Fig. 18B.

Care should be taken to ensure that a leak free joint is made at the carburettor intake. If necessary tape should be wound around the carburettor intake to make the connecting hose a good fit.

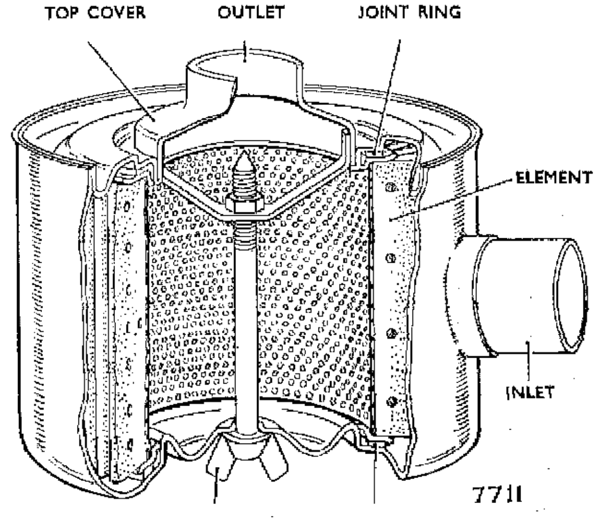


Fig. 18B. *Air cleaner—large dry element type*

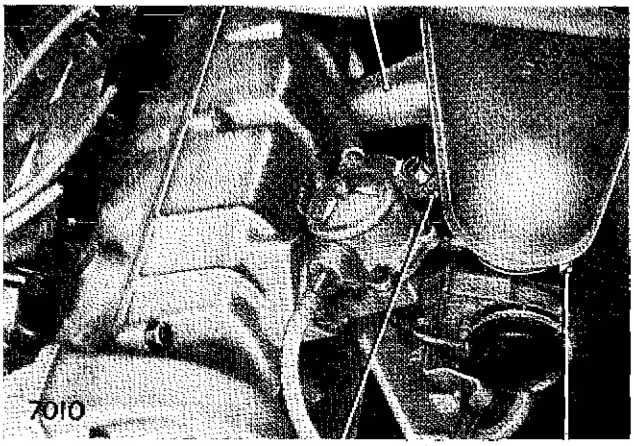


Fig. 19. *Correct position of air cleaner intake horn*

AIR CLEANER

AIR INTAKE TUBE POSITION

The air intake tube must ALWAYS point to the position shown in Fig. 19.

AIR CLEANER ELEMENT

To remove

The element can be removed by dismantling the unit in position without removing the carburettor provided the following procedure is used.

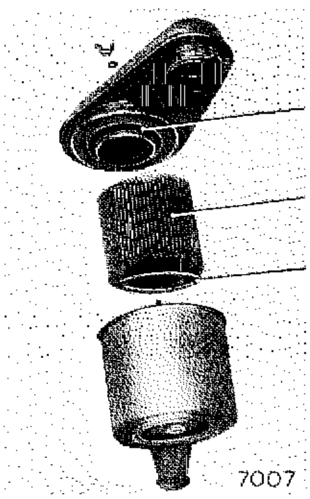


Fig. 20. *Air cleaner—exploded view*

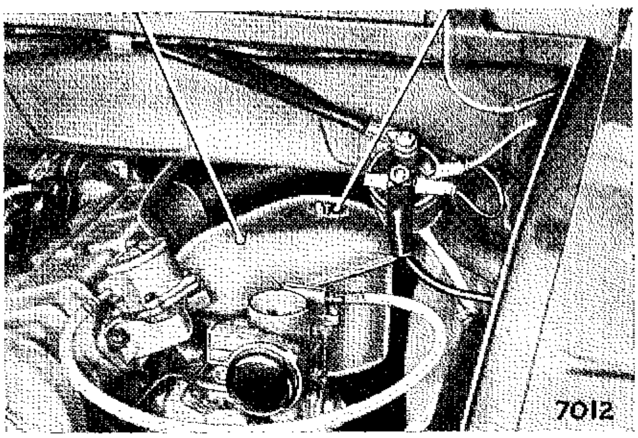


Fig. 21. *Position for removing and replacing air cleaner upper body*

1. Loosen clip holding filter upper body to the carburettor intake. See Fig. 19.

2. Remove the nut and washer from the fixing bolt holding the support bracket to the lug on the inlet manifold. Do not loosen bolt holding bracket to the centre of the filter body. See Fig. 19.

3. Lift cleaner upper body off the carburettor and turn it to the position shown in Fig. 21. This will give easy access to the wing nut securing the upper body. Remove wing nut and upper body.

4. Lift out element and clean out cleaner body. See Fig. 22.

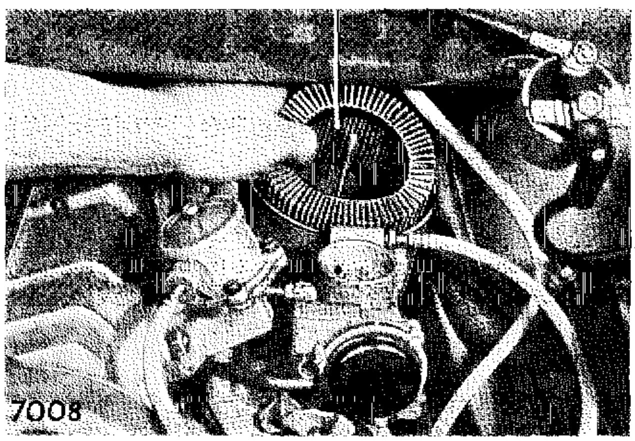


Fig. 22. *Removing air cleaner element*

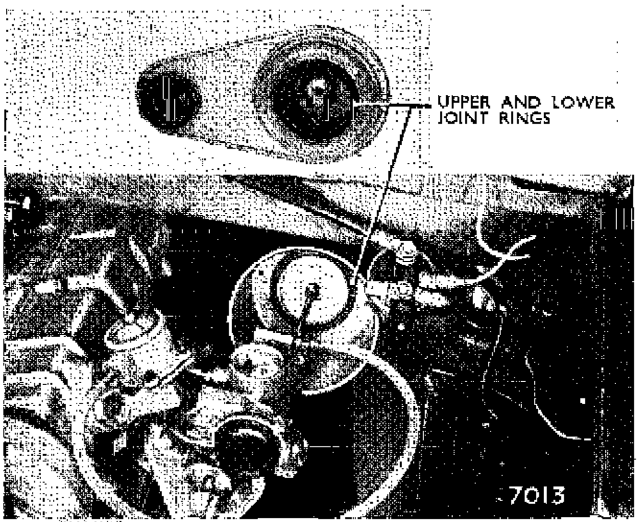


Fig. 23. *Correct positions for element sealing rings*

To renew

Elements are used in a DRY condition. They MUST NOT BE OILED.

Joint rings are used above and below the element as shown in Fig. 23. One fits over the raised bottom of the cleaner body, and the other on the lower face of the cleaner top body.

Check that the joint rings are in position.

Place element in position in the filter lower body.

After placing the lower body in the position shown in Fig. 21 replace the upper body and wing nut which should not be fully tightened.

Refit top body to carburettor intake and bracket to bolt on inlet manifold.

Tighten bolt, wing nut, and clip on carburettor intake after ensuring that the air intake tube points to the position shown in Fig. 19.

AIR CLEANER LOWER BODY—To remove

If necessary the lower body can be removed, after the element and top body have been taken away, by removing the battery, and fuel pipe at the carburettor end. This will allow the lower body to be taken out past the carburettor. See Fig. 24.

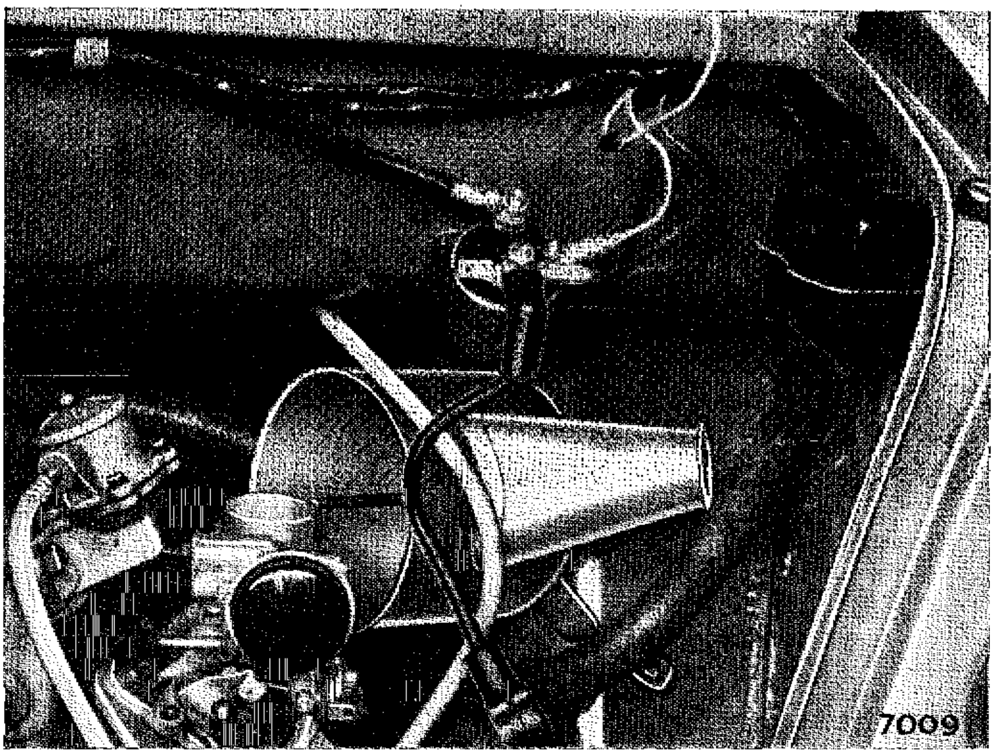
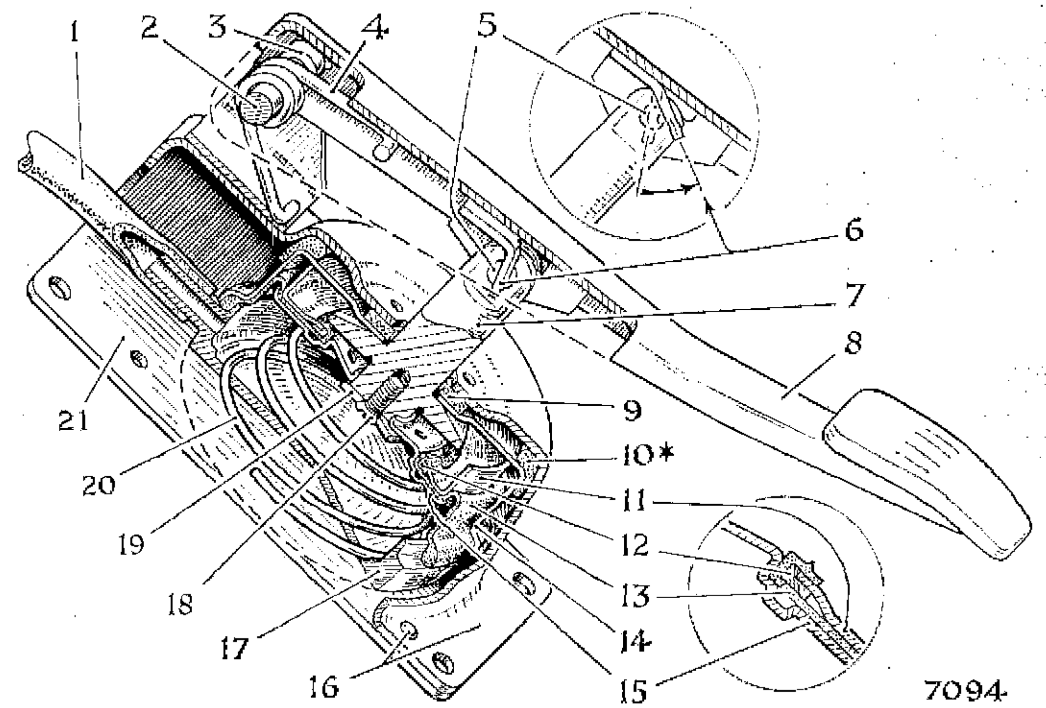


Fig. 24. *Removing element container*

PNEUMATIC OPERATION OF THROTTLE



1. PLASTIC AIR LINE
2. PEDAL PIVOT PIN—LONG
3. PEDAL BUSH—TWO USED
4. PEDAL RETURN SPRING
5. PIVOT PIN—SHORT
6. SHORT PIN RETAINING TAG
7. PISTON
8. ACCELERATOR PEDAL
9. DUST SEAL
*10. RUBBER CLAMPING RING—OR CIRCULAR SPRING RING
11. METAL CAP
12. NYLON LOCATING RING
13. RUBBER DIAPHRAGM
14. CYLINDER
15. SPRING RETAINER
16. RIVET AND COVER PRESSING
17. END CAP
18. COUNTERSINK SCREW-OR CIRCLIP
19. WASHER—OR CIRCLIP
20. DIAPHRAGM RETURN SPRING
21. BASE PLATE

Fig. 25. *Accelerator pedal unit.*

DESCRIPTION

The pneumatic throttle control consists of a carburettor throttle operating unit mounted below the carburettor which is connected by a plastic pipe line to the air displacer unit, below the accelerator pedal.

OPERATION (See Fig. 25)

When the accelerator pedal is depressed, a piston (7) connected to the accelerator pedal, closes the diaphragm atmospheric outlet and then displaces air by movement of the diaphragm (13) into the plastic air line (1) to the carburettor operating unit where it moves the operating unit diaphragm and piston. This movement is transferred to the carburettor throttle by a push rod connected by a spring loaded ball joint to the carburettor throttle lever.

When the accelerator pedal is released an external spring, attached to the carburettor throttle lever, returns the carburettor operating unit diaphragm and piston. At the same time the conical spring (20) within the displacer unit returns the diaphragm (13) to its original position. The piston (7) acts as an atmospheric valve by leaving its seating on the outside of the diaphragm which releases all air pressure in the entire system when the accelerator pedal reaches the upper limit of its travel.

SERVICE INSTRUCTIONS

These units are designed to last the life of the vehicle. Should the operation of either unit become suspect it should be replaced or the faulty part renewed.

The carburettor throttle operating unit is changed as a unit and cannot be dismantled.

The accelerator pedal and air displacer unit can be dismantled and new parts fitted.

THESE UNITS DO NOT REQUIRE LUBRICATION AND ANY ATTEMPT TO LUBRICATE THEM WILL RESULT IN SERIOUS DAMAGE FOR WHICH LIABILITY WILL NOT BE ACCEPTED BY THE MANUFACTURER.

ACCELERATOR PEDAL ASSEMBLY

To remove

The accelerator pedal and its air displacer unit are an assembly which can be removed by undoing the two $\frac{7}{16}$ A.F. bolts and two round head Phillips screws that hold it to the floor, and removing the plastic pipe that feeds air to the carburettor throttle operating unit.

To refit

This is a reversal of the removal procedure ensuring that the plastic air pipe is properly fitted to the air displacer unit.

AIR DISPLACER UNIT

To dismantle and reassemble (See Fig. 25)

Remove accelerator pedal assembly.

Disconnect the accelerator pedal from the piston by bending back one of its retaining tags (6) in the direction shown in the inset of Fig. 25 and removing pin (5).

Drill out four rivets (16) and remove assembly base plate (21).

Remove pedal diaphragm air displacer assembly.

Remove end cap and release diaphragm by removal of countersunk screw or by removal of circlip.

Remove dust seal (9) diaphragm (13) and locating ring (12).

Insert new diaphragm (13) ensuring that its locating ring (12) is fitted correctly with its spigot in the metal cap (11) into which the diaphragm is fitted, as shown by the inset in Fig. 25.

DO NOT OIL ANY OF THESE PARTS AT ANY TIME.

Replace spring retainer and secure with washer and countersunk screw or circlip.

Reassemble ensuring that diaphragm (13) bead is correctly located between the end cap (17) and cylinder (14) and check that diaphragm can move freely.

Replace rubber clamping ring (10) or circular spring ring if this is used instead.

Replace air displacer assembly into pedal housing with the dust seal (9) on the piston (7) and re-rivet base plate in position. There must be no gaps between the base plate and pedal housing when the unit has been re-riveted.

Re-connect accelerator pedal to piston by replacing the pin (5) and carefully bending back the retaining tag (6) so that it cannot come out.

ACCELERATOR PEDAL

To remove

Remove accelerator pedal unit from car.

Carefully bend one metal tag, in the direction shown in the inset of Fig. 25 inside pedal, to allow removal of the short pivot pin, securing the pedal to the pneumatic unit.

Remove circlips securing long pivot pin to unit casing.

Withdraw long pivot pin from its circular end and discard bushes, circlips and return spring.

To refit

Assemble new pedal, bushes, and return spring provided with new pedal.

Insert long pivot pin into unit casing. The pin can only be inserted in one direction as the flat on one end must locate in a similar shaped hole in the unit casing.

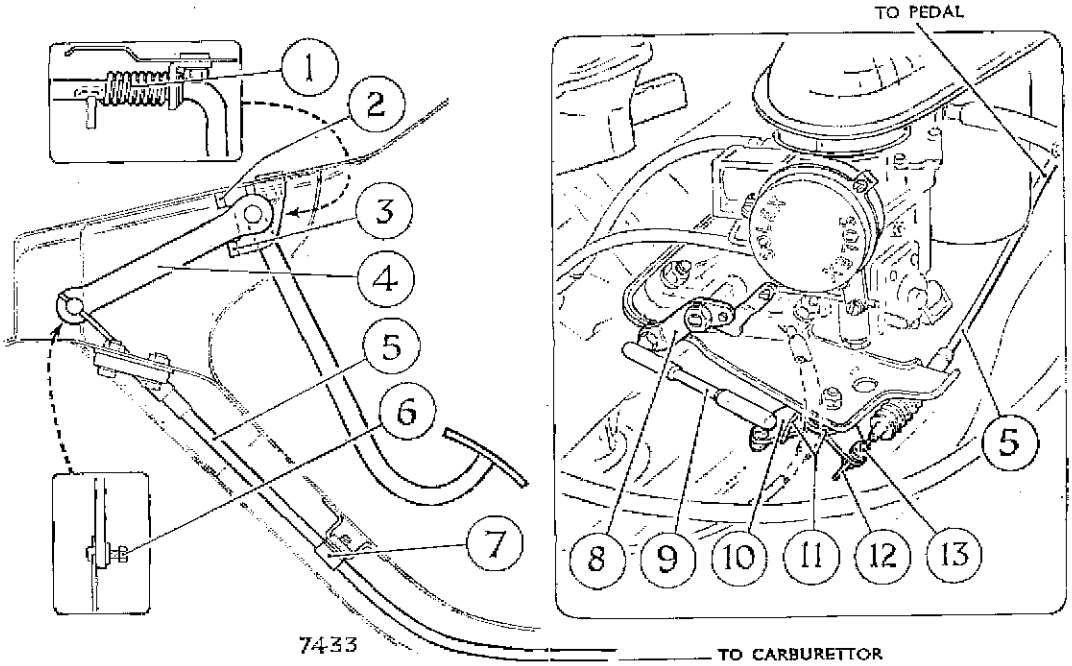


Fig. 26. *Cable operated throttle*

Line up pedal to the pivot hole in the pneumatic unit and insert short pivot pin.

Carefully bend metal tag on pedal so that the short pin is kept in position.

THROTTLE OPERATING UNIT

To remove

The operating unit mounting plate is fitted between the thin flange joint on the inlet manifold, and the thick heat insulating joint below the carburettor flange.

Release the wire clip and withdraw air pipe from operating unit.

Remove air cleaner top body from carburettor intake.

Disconnect fuel pipe and vacuum advance pipe from carburettor. Unbolt carburettor from inlet manifold and lift off carburettor.

Disconnect spring type ball joint connecting unit shaft to throttle lever. This will allow the operating unit to be taken away from the carburettor.

To refit

This is a reversal of the removal procedure. A new gasket should be fitted to the inlet manifold flange.

DO NOT OIL ANY PART OF THIS UNIT AT ANY TIME.

CABLE OPERATED THROTTLE

DESCRIPTION (See Fig. 26)

With this system a cable (5) connects the lever (4) on the accelerator pedal shaft to an intermediate cranked lever (10) mounted below the carburettor. The cranked lever (10) is connected to the carburettor throttle lever (8) by a short rod (9) with ball joints at each end.

The inner cable, which does not require lubrication, operates inside a water proof flexible outer cable. A light torsion spring (11) rotates the cranked lever (10) to close the carburettor throttle, when the accelerator pedal is released.

The accelerator pedal, pedal shaft, shaft lever and inner cable are returned by a heavy torsion spring (1) on the pedal end of the shaft. This arrangement leaves the cable lightly loaded during operation, as it only has to pull against the light torsion spring (11) on the cranked lever (10) and overcome the force needed to open the throttle from its idling position.

SERVICING INSTRUCTIONS

Inner cable—To adjust (See Fig. 26)

The cable can only be adjusted when the carburettor is HOT. This ensures that the normal hot idling speed is obtained whenever the accelerator pedal is released.

Check that the inner cable securing screw (6), at the cable trunnion on the accelerator pedal shaft lever, is correctly tightened. The cable trunnion must be held while checking the screw tightness.

Check and if necessary adjust the slow running speed when the engine is HOT as given under "Slow running adjustment" on page 17 of this section.

The cable securing screw (13) should be undone and the inner cable pulled backwards and the screw (13) tightened, holding its trunnion with a ⅜ A/F open end spanner.

Fully depress the acceleration pedal. The rod (9) between the cranked lever and the throttle operating lever (8) should open the throttle fully and then expand. This rod (9) is spring loaded and acts as a safety device to prevent damage to the cable and carburettor. Also check that the carburettor throttle lever (8) returns against its slow running stop screw when the accelerator pedal is released and that a slight slackness exists in the cable.

Cable—To renew (See Fig. 26)
Remove the cover over the cable front trunnion set screw (6) and disconnect the cable from this trunnion.

Disconnect the cable from its rear trunnion at the carburettor end.

Raise the car on a lift, or place it over a pit and remove the plate from the centre of the floor. This gives access to the cable fixing clips.

Release the cable fixing clip (7) and other fixing clips in floor tunnel.

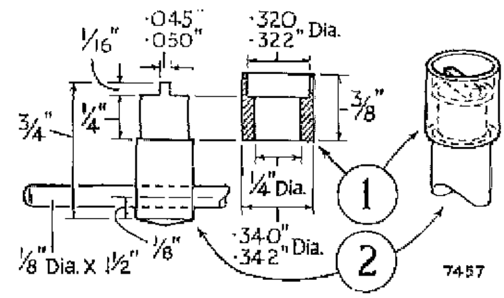
Remove cable by withdrawing it from its front abutment mounting and from the body hole where it passes into the engine compartment.

Fitting the replacement cable is a reversal of the foregoing procedure. The inner cable should be adjusted as described previously.

MAIN JET KEY, For Solex B30 PIHT-2 Carburettor

Details of a main jet key that can be made are given in Fig. 27. This key enables the main jet to be removed and replaced with the carburettor in position.

Item 1 and the tommy bar are made from mild steel. Item 2 is made from high carbon (silver) steel and its screwdriver end is suitably hardened and tempered. The diameter below the screwdriver end is made so that it is a light driving fit in Item 1.



·045 in. (1·15 mm)	1/16 in. (1·6 mm)
·050 in. (1·27 mm)	⅛ in. (3·2 mm)
·320 in. (8·13 mm)	¼ in. (6·4 mm)
·322 in. (8·18 mm)	⅜ in. (9·5 mm)
·340 in. (8·63 mm)	¾ in. (19·0 mm)
·342 in. (8·68 mm)	1½ in. (38·0 mm)

Fig. 27. *Main jet key for Solex B30 PIHT-2 carburettor*

FUEL TANK

To remove
Remove protective cover over the tank by bending back its retaining strips and withdrawing cover.

Disconnect lead from the Lucar terminal on the fuel tank gauge unit and insulate its terminal end.

Remove tank gauge unit and syphon fuel out of tank, or block up the fuel feed hole inside the fuel tank. This can be done through the hole from which the gauge unit is removed.

Disconnect fuel pipe at union below tank.

Release filler hose clip at filler end and air vent hose at upper end. Withdraw hoses.

Disconnect fuel pipe at union below fuel tank.

Remove five 7/16 in. A.F. bolts holding tank to body and lift out tank.

To replace
Place tank in position and connect the fuel pipe to its tank union before bolting tank in place. Then reconnect remaining items in the reverse order of removal.

CLUTCH

SECTION D

CONTENTS

CLUTCH UNIT

DESCRIPTION

A Laycock single dry plate diaphragm clutch is fitted. (See Fig. 1.)

The pressure on the driven plate is exerted by the diaphragm operating on the lugs of the pressure plate.

Operation of the withdrawal mechanism depresses the centre of the diaphragm and releases the pressure on the pressure plate.

By this method the diaphragm acts as both a release mechanism and for loading the pressure plate, and eliminates use of springs.

The operation and construction of the assembly is simplified, and a considerable reduction is made in the operating effort.

No adjustment is either provided for, or is necessary.

The release bearing used is entirely self lubricating.

Hydraulic withdrawal mechanism is employed, consisting of a master cylinder, directly connected to the pedal, with the fluid reservoir carried on the front of the luggage compartment, for ease of access (See Fig. 2).

The main hydraulic pipe runs from the master cylinder to the slave cylinder, which is connected by a push rod to the withdrawal lever.

Provision for bleeding the system is made on the slave cylinder (See Fig. 4).

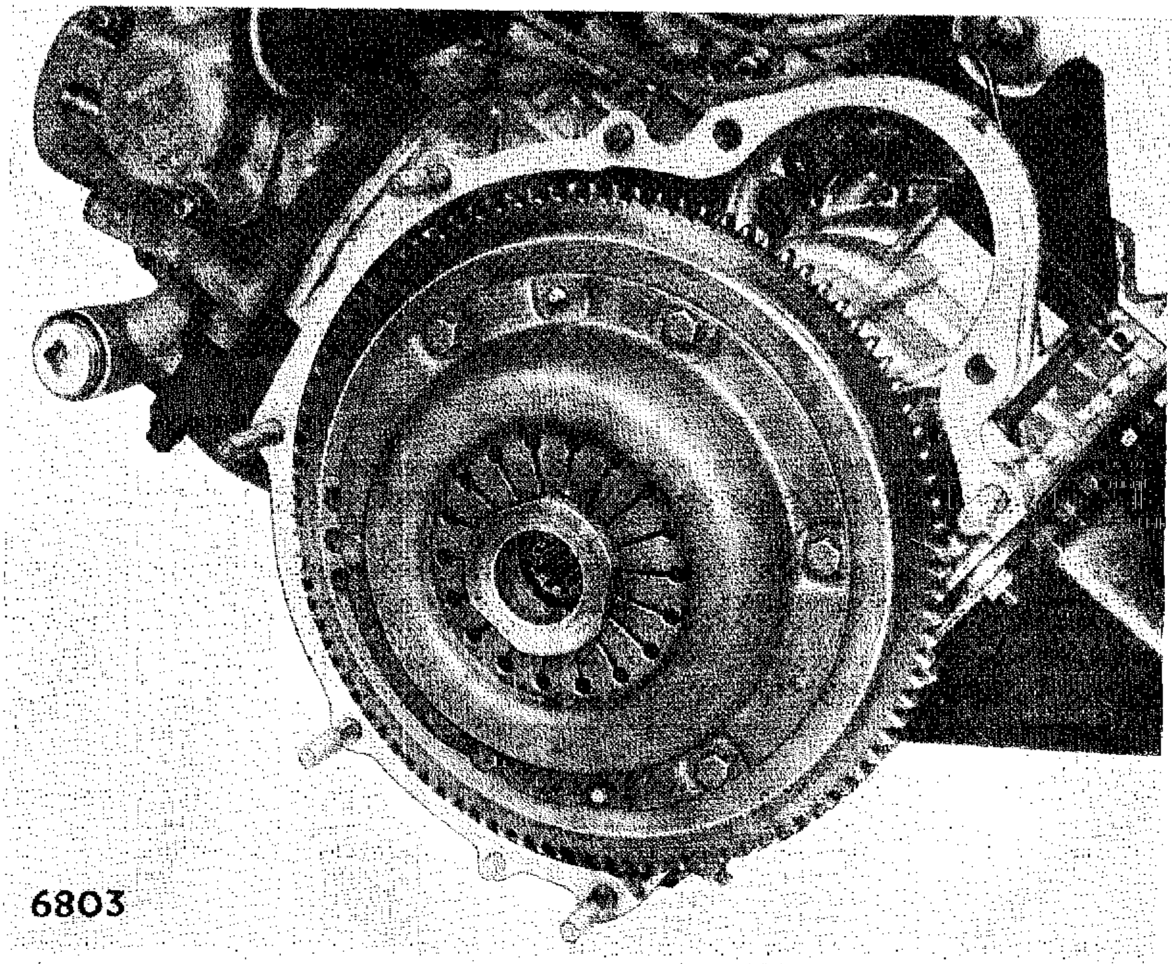


Fig. 1. *General view of clutch assembly*

MAINTENANCE

The only maintenance necessary is to ensure that the hydraulic system has an adequate supply of fluid, and should the pedal become spongy, the system must be bled.

Only the fluid specified in Section P of the Manual should be used.

GREAT CARE MUST BE TAKEN NOT TO SPILL FLUID ON THE PAINTWORK OF THE CAR DURING ANY OPERATIONS CARRIED OUT INVOLVING THE USE OF BRAKE FLUID.

Before removing the filler cap, situated on the front of the luggage compartment, for topping-up purposes, see that it is clean.

Cleanliness is particularly important when carrying out any servicing on the hydraulic system.

When replacing the filler cap ensure that the breather hole is not restricted, and that the sealing washer is in good order.

MASTER CYLINDER

Description (See Fig. 2.)

The unit is solely a master cylinder. The reservoir is carried on the front of the luggage compartment.

In front of the valve when the system is at rest, is a by-pass port which ensures that the system is maintained full of fluid at all times, and also allows for the expansion and contraction of the fluid due to temperature changes.

Should this port become choked, pressure will build up in the system.

To remove

To obtain access to the master cylinder, the petrol tank must first be removed. (See Section C of the Manual.)

With the tank removed disconnect the pipe from the reservoir at the master cylinder.

The fluid may be drained into a suitable container, or the pipe plugged by a rubber grommet.

Disconnect the main feed pipe from the cylinder.

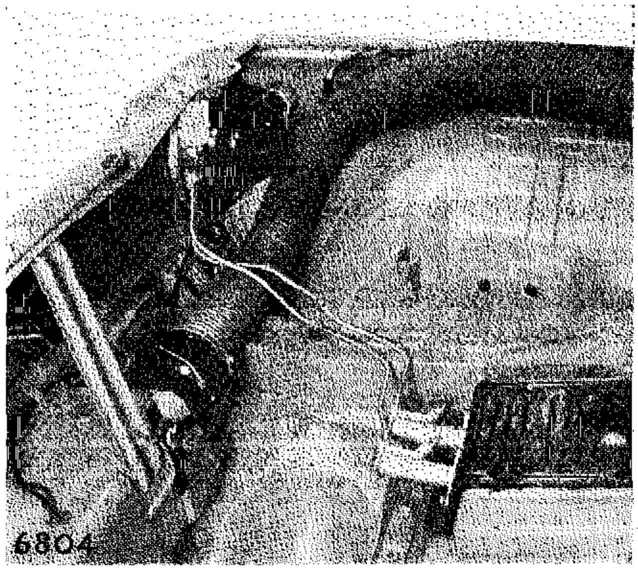


Fig. 2. *Master Cylinder Layout*

From inside the car, remove the split pin and washer and the clevis pin from the operating rod link and release the pedal.

Return now to the master cylinder, remove the two retaining bolts and the cylinder can be withdrawn.

To dismantle and re-assemble (See Fig. 3.)

Remove the cylinder from the car as described in the previous paragraph.

Great care must be taken to prevent the ingress of foreign matter into the system.

Remove the rubber boot and the operating rod.

With a pair of sharp nosed pliers, withdraw the circlip from the cylinder.

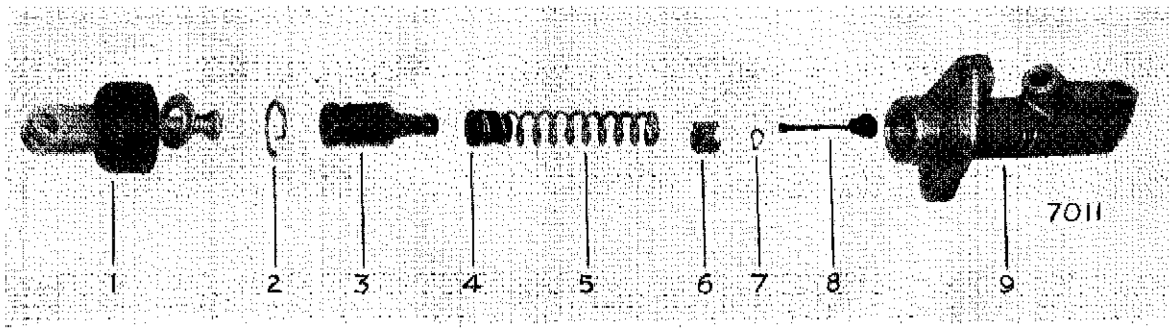


Fig. 3. *Exploded view of Master Cylinder*

Tap the cylinder on the palm of the hand, and the piston and spring assembly can be withdrawn. (See Fig. 3.)

The assembly can be separated by lifting the thimble leaf (4) over the shouldered end of the plunger (3). Depress the plunger spring (5) allowing the valve stem (8) to slide through the elongated hole in the thimble (4). Remove thimble, spring and valve complete. Detach the valve spacer (6) and spring washer (7). Examine all parts and replace as necessary.

To reassemble (See Fig. 3)

Locate the spring washer (7) under the valve head (8) and position the valve spacer (6) legs towards the valve head. Replace the spring (5) on the spacer (6) and fit the thimble (4). Compress the spring and engage the valve stem into the elongated hole in the thimble. Fit the thimble to the plunger, and engage the leaf with the plunger shoulder, locating the valve stem into the hole in the plunger.

Smear the assembly with the grease SUPPLIED IN THE KIT and insert into the cylinder, valve end first. Replace the push rod and dished washer (1), followed by the circlip (2), which must engage with the groove in the cylinder body (9). Replace the rubber dust cover.

When complete, refit the cylinder to the car, reconnect the pipes, fill and bleed the system. (See paragraph, "Bleeding the system".)

Refit the petrol tank.

SLAVE CYLINDER

Description (See Fig. 4)

The slave or operating cylinder is similar in principle to a wheel brake cylinder, and consists of the following parts:— A main body or cylinder assembly, inside which operate a piston, with a rubber cup, and a return spring. These are retained by a circlip and protected by a rubber cover.

A bleeder screw provides the only means of bleeding the hydraulic system.

The operating rod is connected to the withdrawal lever by a hollow rivet.

No adjustment is necessary or provided for, between the release bearing and the release lever, as the design of the slave cylinder maintains the clutch release bearing in light contact with the thrust pad when the clutch is in the fully engaged position.

Fig. 4. *General view of Slave Cylinder*

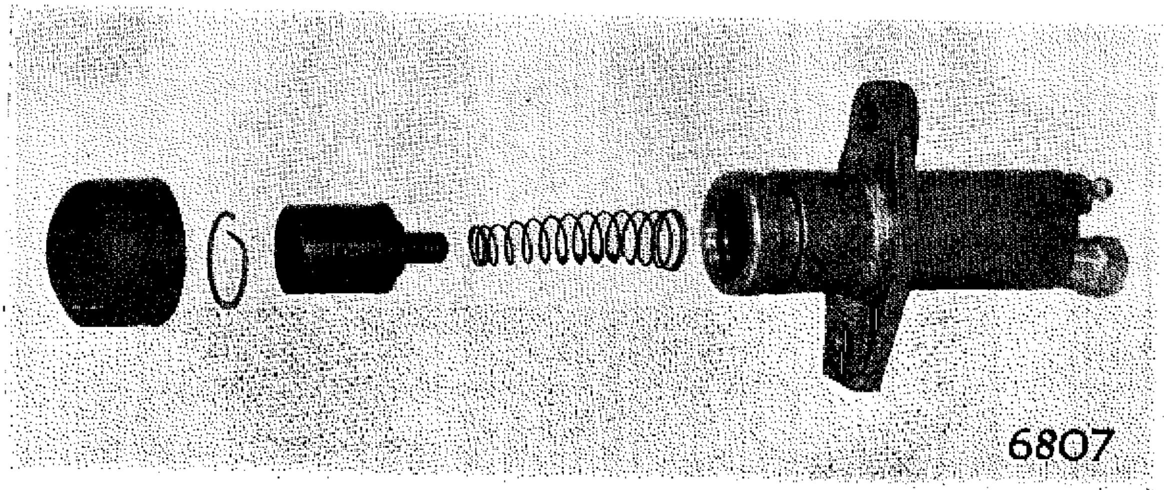


Fig. 5. *Exploded view of slave cylinder*

To remove and refit

To remove the slave cylinder, uncouple the flexible pipe from the slave cylinder and fasten to the car to prevent excess leakage of fluid.

Remove the two retaining bolts and nuts from the cylinder and detach from the clutch housing.

To refit, carry out the previous procedure in the reverse order.

When fitting is complete, bleed the system. (See paragraph "Bleeding the System".)

To dismantle and re-assemble

Remove the cylinder from the car as described in the previous paragraph.

Remove the rubber boot.

Withdraw the retaining circlip from the cylinder body, with a pair of sharp nosed pliers.

Tap the cylinder sharply on the palm of the hand, to eject the piston and spring assembly. (See Fig. 5.)

To re-assemble, insert the spring large end coils first, into the cylinder. (See Fig. 5.)

Insert the piston, locating the pin into the small end of the spring. Fit the circlip, making sure the circlip is seating correctly in the recess in the body of the cylinder.

Fit the rubber boot.

Refit the cylinder to the car and bleed the system.

Bleeding the system

Always keep a careful check on the fluid level during bleeding operations.

If air should enter the master cylinder from the reservoir, the complete operation must be repeated. Therefore, the following method is recommended:—

1. Fill the reservoir with a new supply of the recommended fluid. (See Section P.)

2. Attach a rubber tube to the bleeder screw on the slave cylinder (See Fig. 5) and submerge the other end in a small quantity of fluid contained in a glass jar.

3. Remove any floor covering which prevents a full stroke of the pedal. *This is most important.*

4. Slacken the bleed screw back $\frac{1}{2}$ to $\frac{3}{4}$ of a turn, then depress the clutch pedal with a succession of long and short rapid strokes, finally allowing the pedal to fly back to the stop, with the foot removed.

   Repeat this actuation of the clutch pedal, until the fluid pumped into the glass jar is free of air bubbles.

5. During the next downstroke of the pedal, tighten the bleed screw sufficiently to seat it firmly. Do not overtighten.

CLUTCH ASSEMBLY AND DRIVEN PLATE

To remove and refit (See Fig. 6)

See Section "B" to remove the engine from the car.

With the engine removed, proceed as follows:—

MARK THE UNIT AND FLYWHEEL TO ENSURE THAT THE BALANCE OF THE FLYWHEEL/CLUTCH ASSEMBLY IS NOT DISTURBED.

The clutch assembly is located to the flywheel by two $\frac{7}{32}$ in. (5·5 mm) dowels.

Unscrew the six holding bolts in rotation so that the pressure is evenly maintained on the unit until all the bolts are free, and the assembly can be lifted away.

On later models the assembly is of riveted construction and cannot be dismantled, but if faulty, must be replaced by a complete unit.

To dismantle the clutch

Normally this is not necessary, as, if the clutch is faulty in any way, it should be replaced as a complete assembly.

Should it be essential, proceed as follows:—

Mark all parts to ensure they are reassembled in the same relative position.

With the clutch face downwards on the bench.

1. Lift off cover pressing (Fig. 6A).
2. Remove retaining ring (B).
3. Lift out diaphragm spring (C).
4. Lift driving plate (D) off pressure plate (E).
5. Examine all parts, particular attention being paid to the following points:—
   (a) Excessive clearance between pressure plate lugs and the locating apertures in driving plate.
   (b) Heat discolouration, distortion or surface damage at pressure plate face.
   (c) Serious discolouration of diaphragm spring and its retaining ring resulting from overheating, consequent upon excessive slipping.
   (d) Wear on driven plate facings (F).

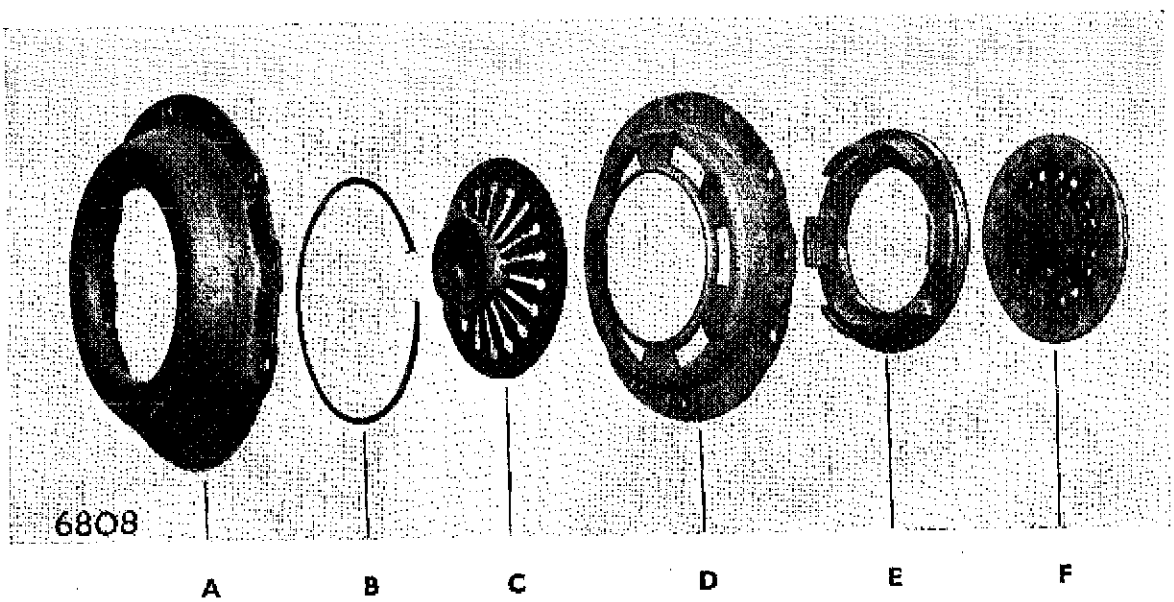


Fig. 6. *Exploded view of clutch assembly*

To reassemble clutch

1. Apply a trace of grease (preferably molydisulphide or zinc base), Shell Retinax AM, is suitable, to the sides of the pressure plate lugs, fulcrum points for the diaphragm spring on the pressure plate, driving plate, cover and also to the finger-tips where they enter the release tube. (See Fig. 6, A to E.)

2. Place pressure plate face-down on bench over a packing piece approximately $5\frac{1}{2}$ in. (14 cm) dia. and $\frac{1}{2}$ in. (12·5 mm) deep.

3. Fit driving plate over pressure plate, lugs protruding through apertures.

4. Fit diaphragm spring assembly, securing with the retaining ring. If the original diaphragm is fitted, ensure that it is located in the marked position. When fitting a new diaphragm (C) or a new pressure plate (E) the unit must be assembled and the diaphragm (C) depressed a few times, using a press and checked for run out with a clock gauge on the thrust pad. Reposition the diaphragm and check. Repeat until minimum run out is obtained. Maximum permissible run out on any clutch ·025" (·65 mm.) on the thrust pad.

   The cover (A) and driving plate (D) MUST NOT be interchanged but kept together as a set. When fitting the ring (B) it is important its "turned-up" ends are uppermost, and positioned midway between the pressure plate lugs. (See Fig. 6.) After fitting retaining ring press this firmly into each retaining groove.

5. Place cover in position lining up the "locating dimples" on the flange.

6. Reassemble clutch to flywheel using tool No. RG.374 to line up the spigot bearing and driven plate. This tool must not be removed until the clutch has been firmly bolted to the flywheel. (See Fig. 7.)

   When in position tighten evenly to a torque of 7 lbs./ft. (·8 kg.m).

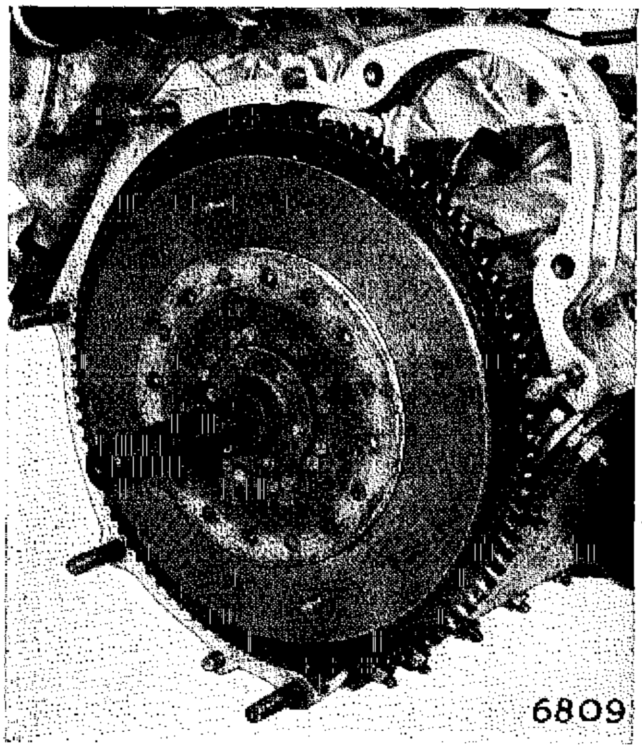


Fig. 7. *Locating Tool for centre plate*

TRANSAXLE

SECTION E

CONTENTS

TRANSAXLE

DESCRIPTION (See Fig. 1)

The gearbox and final drive gears are in a single unit, contained in an aluminium casing mounted forward of the engine unit.

The casing can be separated into four parts, mounting cover, gearbox casing, hypoid casing and clutch housing. The gearbox provides four forward speeds and reverse, with synchro mesh action on all forward gears. Gear change is by a floor mounted gear lever, which through a shaft actuates selector shafts and forks in the main casing. Hypoid final drive gears are employed, the shaft of the hypoid pinion being the gearbox output shaft.

Drive is transmitted from the clutch through a clutch shaft which is connected via a splined muff to the gearbox input shaft gear cluster. The two shafts are prevented from pulling apart by a stud screwed into the end of each shaft. The splined muff is retained by a circlip.

The gearbox input shaft gear cluster which is mounted uppermost in the casing is supported at the inner end on needle roller bearings and at the outer end on a ball race which is located in the casing by a circlip. A reverse wheel is splined to the outer end of the input shaft gear cluster and the assembly is secured by a nut.

Mounted below the input shaft gear cluster, and supported by taper roller bearings, is the combined gearbox output shaft and hypoid pinion. The shaft carries the driven gears and synchro hubs. The 1st, 2nd, 3rd and 4th driven gears are in constant mesh with the input shaft gear cluster, and are free to rotate on the gearbox output shaft when in the neutral position. The gears rotate on Oilite bronze bushes.

The 1st and 2nd speed synchro hub is splined to the gearbox output shaft, the 3rd and 4th synchro hub is keyed to the gearbox output shaft. A baulking ring is fitted between each gear wheel and synchro hub. A reverse wheel is splined to the outer end of the gearbox output shaft and the assembly is secured by a nut.

The axial position of the output pinion relative to the crown wheel is determined by shims between the casing and inner bearing

The position of the gears on the gearbox output shaft is determined by washers of selective thickness between the inner bearing and 1st speed wheel, between the 2nd and 3rd speed wheels and between the 4th speed wheel and the outer bearing.

A washer of selective thickness is also interposed at this point to control the bearing preload.

Three selector shafts (1st/2nd, 3rd/4th, and a Reverse) are located below the gearbox output shaft. Pinned to the 1st/2nd and 3rd/4th selector shafts is a selector fork. The selector shafts are actuated by a main selector. An interlock plate and roller prevents the engagement of two gears at once. A reverse idler wheel is mounted on a shaft in the end cover, and is actuated by a swinging lever connected to the reverse selector shaft.

The crown wheel and differential gears are supported on taper roller bearings in steel bearing housings in the hypoid casing.

Two short differential shafts are splined and held by circlips in the differential wheels at their inner ends, and are splined to differential shaft flanges and secured by clinch nuts at their outer ends.

Certain models have the circlips deleted, the differential shaft flanges are an interference fit and are pressed on to the shaft.

Initial production of this type will be identified by paint on the clinch nut, but in later production the clinch nut will be deleted, and the differential shaft will be level with the face of the flange.

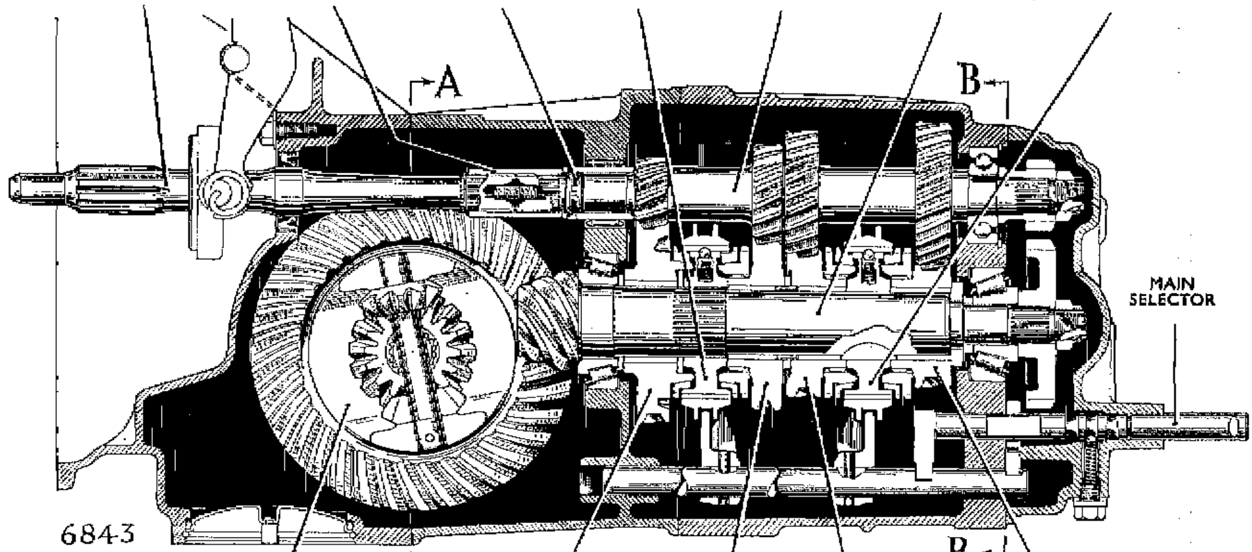
For full details of this assembly see Page 41.

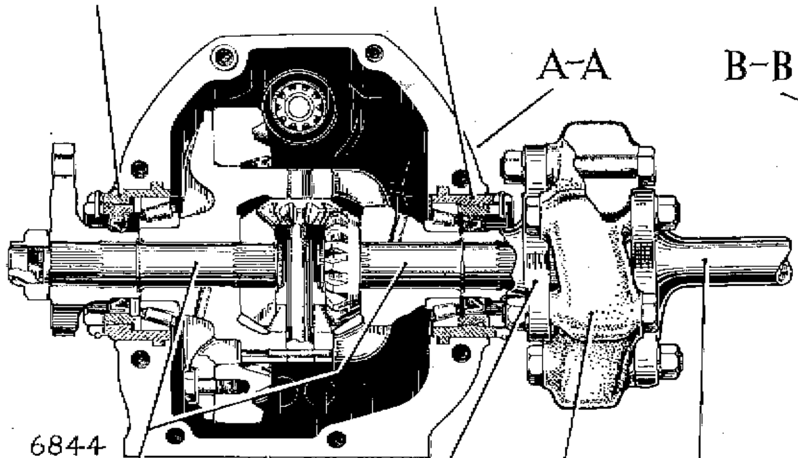
The crown wheel and differential assembly is adjustable for position laterally and for pre-load of the bearings, by the inner screwed sleeves which are locked by a wire ring.

OPERATION (See Fig. 2)

Movement of the gear lever across the neutral gate will rotate the main selector and interlock plate. The interlock plate is engaged in the grooves in the outer end of the selector shafts, preventing movement of the shafts. When the finger on the main selector is in engagement with the inner slot of a selector shaft, the recess in the interlock plate will allow that selector to be moved towards the gear position.

Drive will be engaged by positively connecting the selected gear to its synchro hub. This is achieved by the sliding sleeves which are actuated by the selector forks.





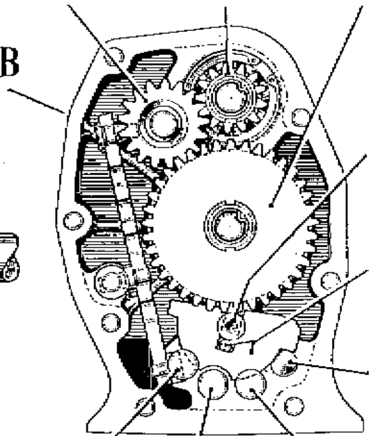


Fig. 1. *General layout of transaxle assembly*

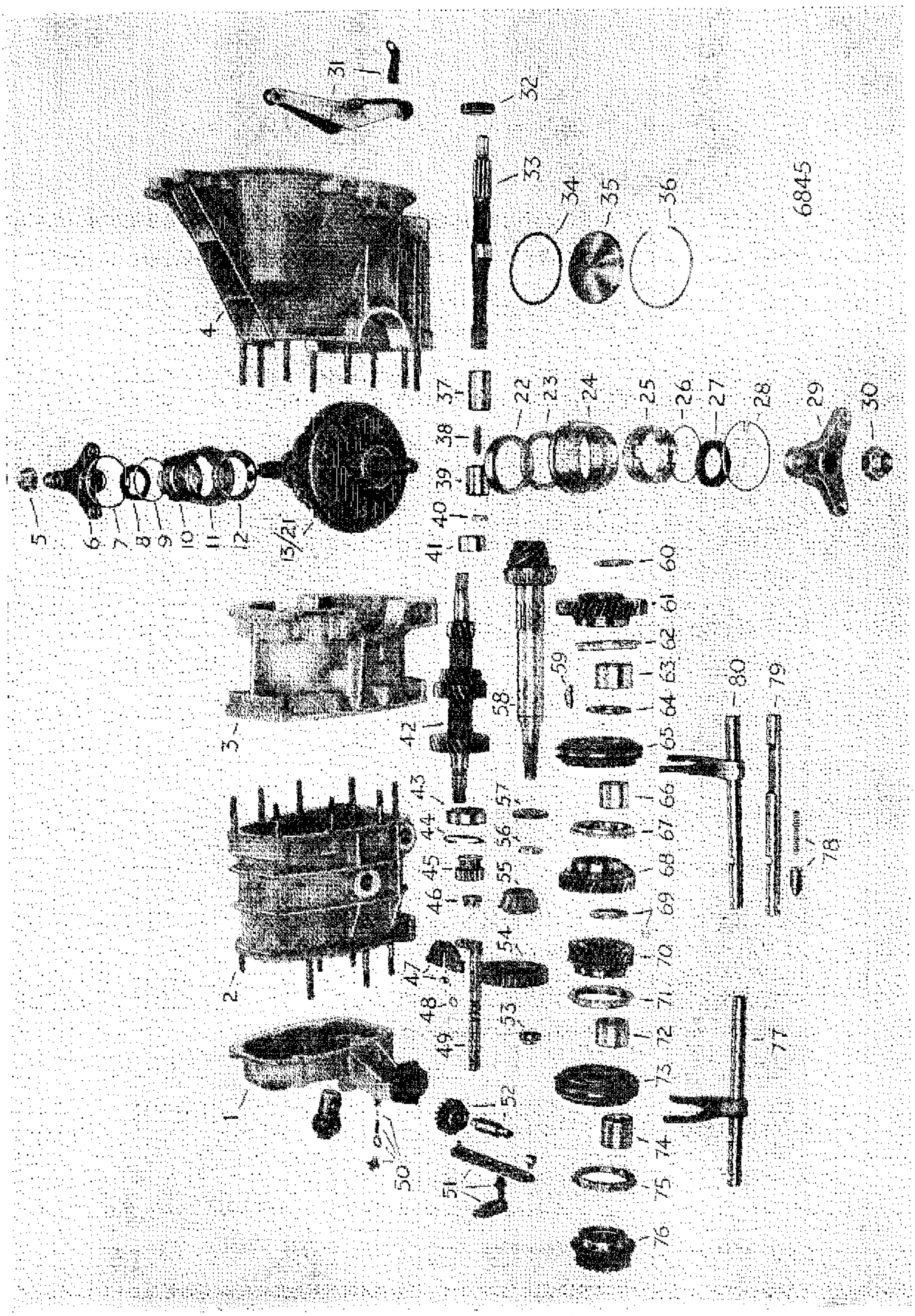


Fig. 2. *Exploded view of Transaxle assembly*

The synchro mesh action is as follows:— (See Fig. 3)

On each individual driven gear wheel (A) is a ring of clutch teeth (B) and a steel cone (C).

The sliding sleeve (D) has internal teeth in the bore which engage with the splined exterior of the synchro hub (E), and, when the gear is selected, with the clutch teeth (B) of the gearwheel. Between the synchro hub (E) and the gearwheel (A) is located a baulk ring (F), the bore of which is coned to fit the steel cone (C) of the gearwheel. The coned surface of the baulk ring is broken up by fine close pitched grooves, the effect of which is to cause rapid breakdown of the oil film when the two members come together.

On the outside of the baulk ring are teeth (C) which correspond with the clutch teeth (B) of the gear wheel and the sliding sleeve. On the side adjacent to the sliding sleeve (D) the teeth are chamfered at a specially determined angle, as also are the internal teeth (P) on the sliding sleeve (D). The baulk ring has three projections (J) which engage with the three slots in the hub member.

Three shifting plates (T) are positioned in the slots in the hub member. In each shifting plate is a spring loaded ball (K), and a spring (O) and cap (Q) being located in a drilling in the hub member beneath each shifting plate. The ball locates in the groove (R) in the bore of the sliding sleeve in the neutral position (See Fig. 4).

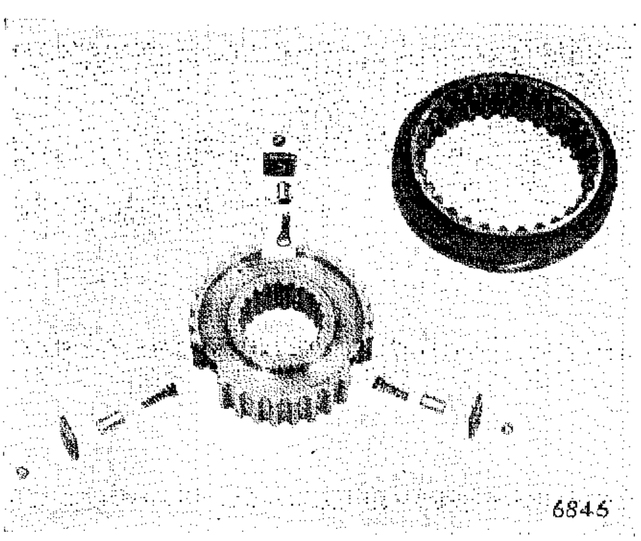


Fig. 3. *Exploded synchro hub*

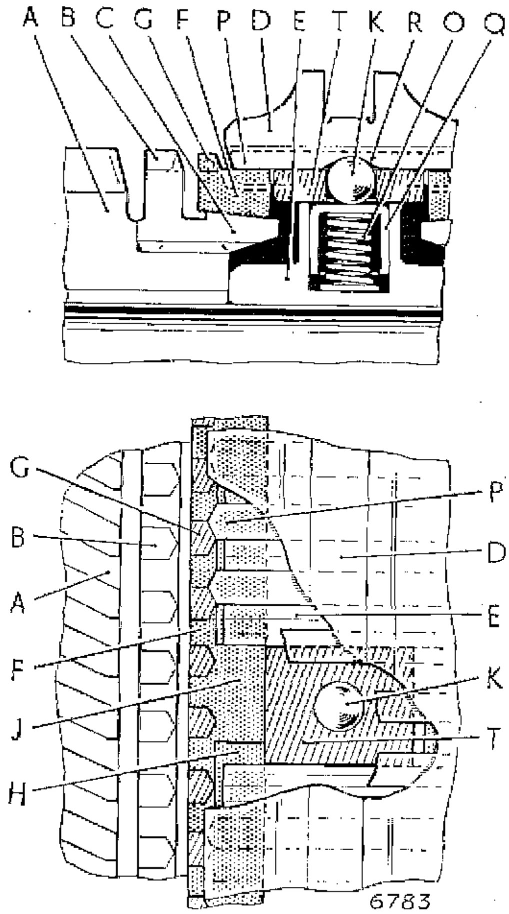


Fig. 4. *Details of synchro*

When pressure is applied to the gear lever the sliding sleeve will be moved, due to the action of the selector shaft and fork. This movement will move the shifting plates against the baulk ring and bring the baulk ring cone into light engagement with the gear wheel cone (C).

The gear wheel (A) will be rotating at a different speed from that of the hub (E) and the baulk ring will be dragged round by friction to the extent permitted by the clearance (H) between the projections on the baulk ring and the slots in the hub member.

Due to the design width of the projections on the baulk ring, the teeth on the baulk ring will now be out of register with those on the sliding sleeve by half a tooth width, so that the chamfered edges of the teeth bear upon each other.

Friction between the two coned surfaces will eventually cause them to rotate at the same speed.

The baulk ring will then be free of frictional drag and the chamfered teeth on the sliding sleeve, acting upon the chamfered teeth of the baulk ring will move the baulk ring out of the way, allowing unrestricted movement of the sliding sleeve into full engagement with the clutch teeth of the selected gear wheel.

Reverse gear will be engaged by moving the reverse idler wheel into mesh with the reverse wheels on the ends of the input and output shafts (See Fig. 5).

The reverse plunger must be depressed by the interlock plate before the main selector can engage with the reverse selector shaft.

Movement of the reverse selector shaft will actuate the swinging lever bringing the reverse idler wheel into engagement.

The gearbox assembly and hypoid assembly can be separated and dismantled as separate assemblies.

REMOVE AND REFIT TRANSAXLE

Remove transaxle from vehicle

The transaxle unit cannot be removed from the car separately, but must be taken out with the engine.

Place the car on a ramp or pit, or jack up on stands.

To drain the transaxle, remove the filler plug to release pressure, then carefully remove the drain plug. Take great care to avoid burns if the oil is hot.

Disconnect the gear operating shaft from the unit by releasing the lock tab on the retaining bolt, unscrew the bolt and remove.

Pull the gear lever fully backwards, i.e. in the 2nd or 4th gear position.

Ease the selector into the transmission unit, and separate the coupling and reset the selector to the neutral position.

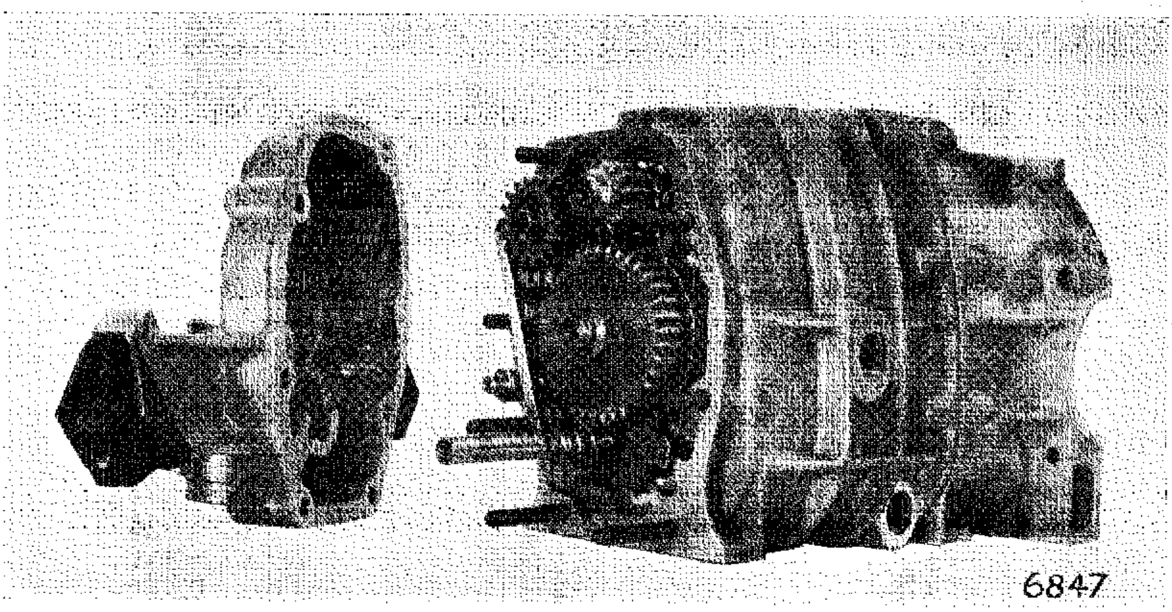


Fig. 5. *Reverse gear layout*

Details to make Coupling Clamps

Two clamps are required, each as follows:—

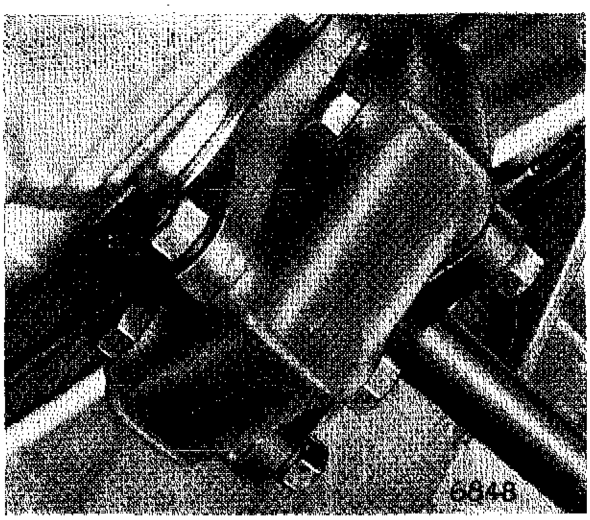
Obtain a piece of steel strip, 18 in. (45·5 cm) long, 1 in. (25·5 mm) wide and approx. $\frac{3}{32}$ in. (2·5 mm) thick.

Mark off 1 in. (25·5 mm) from each end and drill a $\frac{5}{16}$ in. (8 mm) hole mid-way between mark and each end.

Bend strap at right angle at each mark.

Wrap this strap around the coupling and bolt up tight, using a $\frac{5}{16}$ in. (8 mm) bolt, 2 in. (5·8 cm) long, threaded right down. (See Fig. 7.)

Fit coupling clamp or clamps and MARK THE ROTOFLEX COUPLING AND DIFFERENTIAL SHAFT FLANGES BEFORE REMOVING. IT IS IMPORTANT THAT THE COUPLING IS REFITTED IN EXACTLY THE SAME POSITION AS BEFORE, OR PREMATURE FAILURE OF THE COUPLING MAY OCCUR.



When fitting new coupling, pay special attention to the position of the coupling and fitting bolts in relation to the differential shaft flanges. The bolt inserts are offset, and must be assembled to the flanges in the correct manner, i.e. the longer boss to the flange, shorter side to the bolt head.

Fig. 6. *Drive shaft coupling*

Loosen and remove six nuts, withdraw bolts and remove coupling.

Leave clamps in position if couplings are to be refitted.

When the couplings are removed, attach the drive shaft to a convenient part of the body by means of a stout cord, leaving the shafts free to rotate, when the car is moved, later on.

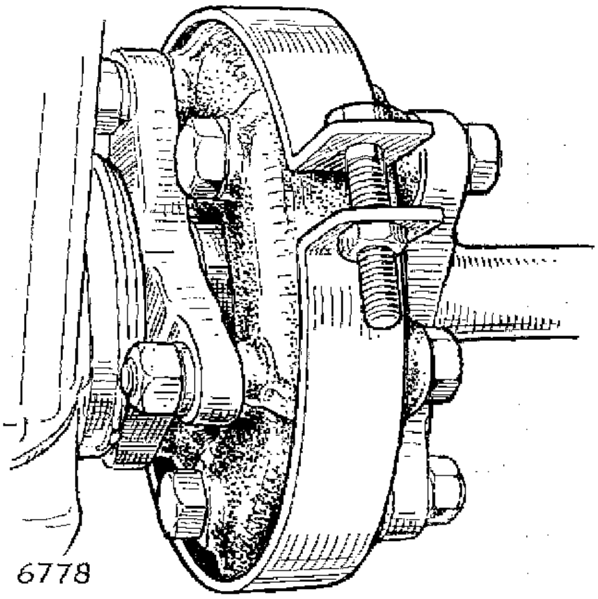


Fig. 7. *Details of coupling clamp*

Remove the two retaining bolts in the transmission bearers, and disconnect the earth strip.

Remove silencer.

The units must be supported under the sump, transaxle case and manifold outlet as shown in Fig. 8.

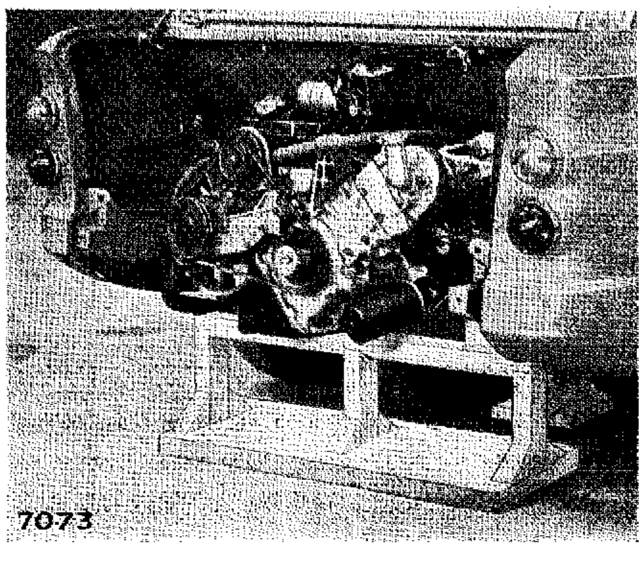


Fig. 8. *Engine and Transaxle supported for removal*

Remove the stands or jacks, or lower the ramp and support the engine and transaxle as shown in Fig. 9.

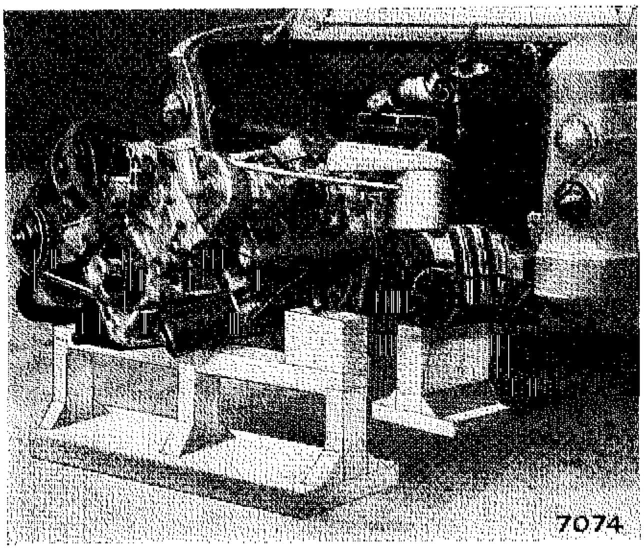


Fig. 9. *Engine and Transaxle removed*

Ensure that the car is positioned on its wheels with sufficient room to enable the car to be wheeled clear of the assembly, or vice versa.

Proceed as for removing engine with transaxle attached (See Section B).

When all the necessary stripping has been carried out, steady the assembly on its cradle, and wheel the car clear.

To remove from engine

Remove all the bell-housing bolts, and ease the transmission unit away from the engine.

KEEP THE WEIGHT OF THE TRANSMISSION UNIT EVENLY BALANCED DURING THIS OPERATION, AND DO NOT ALLOW THE UNIT TO HANG ON THE CLUTCH SHAFT, OR DAMAGE WILL BE CAUSED TO THE SHAFT AND THE CLUTCH UNIT.

To refit unit to engine

With a gear selected, fit the transmission unit to the engine rotating the flanges to assist the splines on the clutch shaft to engage the splines in the driven plate.

Press fully home, making sure the dowels in the bell-housing are located correctly.

Do not allow the unit to hang on the clutch shaft, or damage will be caused to the shaft and clutch unit.

Fit and tighten all bell-housing nuts to a torque as given in the General Data Section.

To refit to car

With the complete assembly on a suitable cradle, roll the car backwards on to the assembly and line up ready for installation.

NOTE: AT THIS STAGE TAKE CARE THAT THE OPERATING PUSH ROD ON THE CLUTCH LEVER IS FACING THE ENGINE (SEE FIG. 10). IF THE ASSEMBLY IS INSTALLED WITH THE ROD IN BEHIND THE CLUTCH LEVER, IT WILL BE IMPOSSIBLE TO LOCATE THE PUSH ROD IN THE SLAVE CYLINDER WITHOUT REMOVING THE WHOLE ASSEMBLY AGAIN.

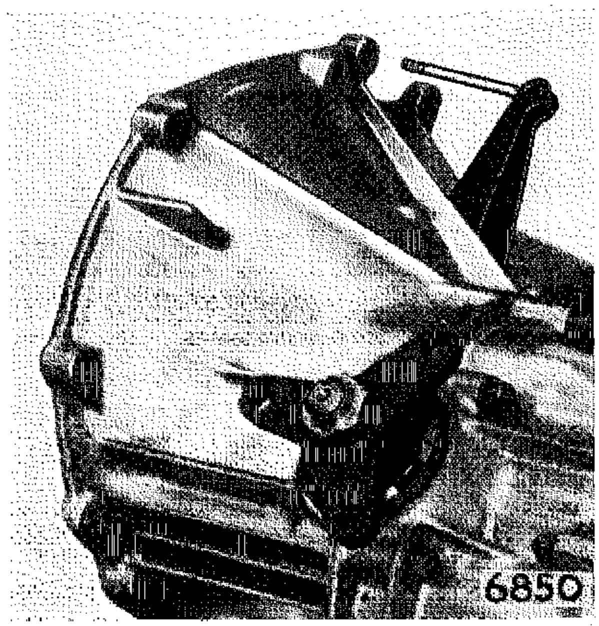


Fig. 10. *Clutch rod in position*

Having rolled the car back until contact is made with the transmission unit, weight must be applied to the rear of the car to compress the rear suspension and lower the car to the level of the unit. When this has been achieved, roll the car the necessary distance to align the transmission case rubber mounting with the bearer brackets on the underframe.

Release the weight on the car, and the mountings will locate into the bearers, held by the weight of the transmission unit. Locate and tighten the bolts in the bearers, reconnect the earth strap.

Fit the rear cross member to the car, and install the bolt in the Engine bearer.

The complete assembly is now installed in the car, and the fitting procedure for the Engine is as given in Section B of the Manual.

To fit transmission couplings

SHOULD NEW COUPLINGS BE FITTED, IT WILL BE FOUND THAT THEY ARE SUPPLIED IN A STATE OF COMPRESSION, AND SHOULD BE FITTED IN THIS CONDITION, REMOVING THE BANDS, WHEN THE COUPLINGS ARE FINALLY FITTED, AND TIGHTENED UP.

To fit the original couplings

If already compressed with a strap as given in the paragraph for removal of the transmission (See Fig. 7, Page 8), this will facilitate the operation.

Proceed as follows:—

Fit the three bolts to the coupling, in alternate holes, with the head of the bolt, to the short boss of the coupling. (See Fig. 6) and the coupling in its original position. (See Page 8.)

Now fit the coupling to the transmission flange, using the other three bolts, with the heads of the first three bolts towards the transmission casing.

These bolts are then fitted to the drive-shaft flanges and all bolts tightened to a torque as given in the General Data Section.

Attach the gear change operating shaft to the selector shaft in the transmission unit, line up the groove in the selector shaft with the hole in the operating shaft, fit the bolt, and locking tab, tighten the bolt and secure by turning over the locking tab.

Check hypoid and pinion bearings prior to dismantling

To decide if the existing bearings are fit for further service. Visual inspection and "feel" for roughness is insufficient. A check of remaining preload or endfloat must be made before dismantling. If hypoid or pinion bearings are found to have run with ·001 in. (·0254 mm) endfloat both bearings of the affected assemblies must be renewed.

To check hypoid bearings

Remove the clinch nuts (5) (Fig. 2) and discard.

Remove the drive flanges (6/29) to expose the inner and outer screwed sleeves (10/11–24/25).

Remove the retaining spring rings (7/28).

On the cage side note the position of the inner screwed sleeve slots in relation to the outer sleeve, and mark the position of one inner sleeve slot on the outer sleeve. (See Fig. 11A.)

Unscrew the inner sleeve about 135° (See Fig. 11B), and then screw in to **JUST** nip, using the special Churchill Tool No. RG373 with a 7 in. (18 cm) tommy bar. (See Fig. 11C.)

Fit drive flanges loosely and turn Diff. assembly and again test for nip.

Repeat this process five or six times or until no new nip position is obtained. This is known as true nip.

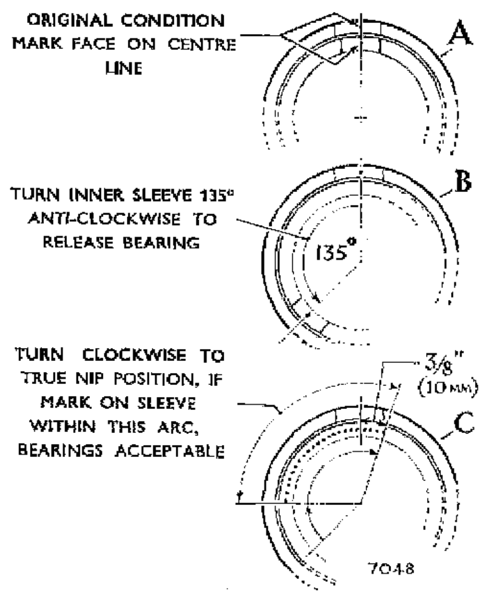


Fig. 11. *Screwed sleeve marking*

When the true nip position is found, check the marked inner sleeve slot relative to the marked outer sleeve.

If the vehicle has done over 2,000 miles (3,200 km), the bearings must be scrapped if the mark on the inner sleeve goes more than $\frac{3}{8}$ in. (9 mm) past the previous mark.

If $\frac{3}{8}$ in. (9 mm) or less, the bearings are serviceable, providing they pass the visual check. (See Fig. 11C.)

If vehicle has done less than 2,000 miles (3,200 km), the bearings can be refitted, subject to visual examination, and regardless of position of sleeve markings.

DO NOT at this stage apply any pre-load to the hypoid bearings but leave in the state of true nip.

Check gearbox bearings for wear

If necessary, clean off any rust from the exposed end of the main selector (49) to prevent damage to the bore in the mounting cover when removed.

Remove mounting cover (1. Fig. 2).

Remove reverse idler and lever (51), interlock plate and roller (47).

Remove input shaft locknut (46) by engaging two gears at once to lock the shaft using Tool No. RG367. Return to neutral when nut is unscrewed.

Remove reverse plunger and spring (78) and turn main selector (49) 90° clockwise.

Measure the torque required to turn the pinion shaft, using a spring balance and a length of cord or soft wire wound round the reverse gear as shown in Fig. 12. Note the reading on the balance as the reverse wheel is rotated by pulling on the balance.

If friction torque prior to dismantling is 1 lb. (·45 kg.) or less on scale, replace preload washer (56) with one ·002 in. (·05 mm) thinner and recheck friction torque.

If torque has definitely increased then bearings are serviceable, subject to a visual check for damage.

If there is no increase in torque, bearings must be scrapped.

If mileage of a new transaxle is 2,000 (3,200 km) or less, bearings may be used, subject to a visual check for damage,

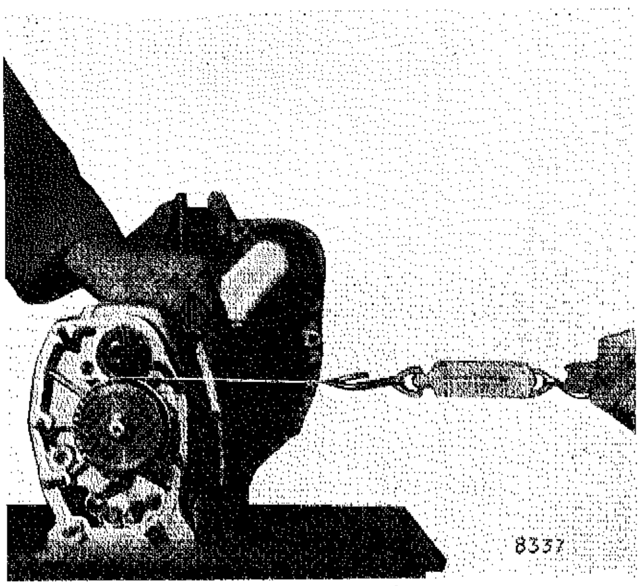


Fig. 12. *Taking torque reading*

With a new transaxle, if bearings are serviceable and no further dismantling is deemed necessary remove preload washer (NOT the 4th selective washer) and fit a graded thinner washer (See Page 19) to obtain correct torque of 4-6 lbs. (1·8-2·7 kg) on the balance scale.

Refit bearing and gear (55/54) and tighten the nut (53) progressively in three stages.

1st Stage: torque to 15 lbs./ft. (2·0 kg.m) (Fig. 13), rotate assembly and check preload. (See Fig. 12).

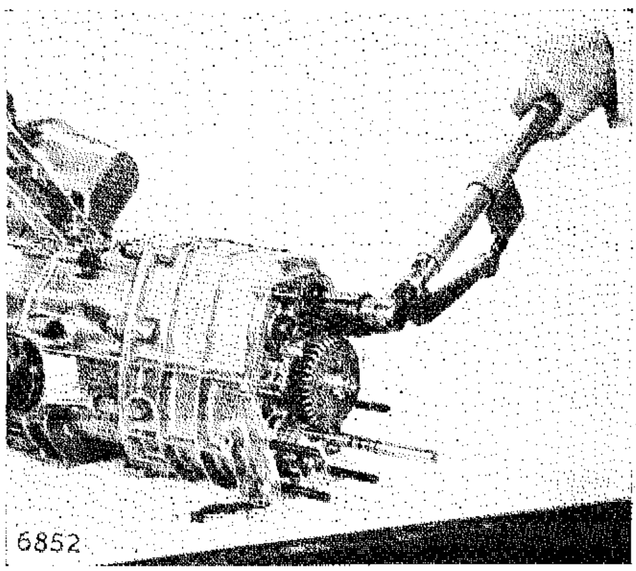


Fig. 13. *Applying torque to locknut*

2nd Stage: torque to 30 lbs./ft. (4·1 kg.m), rotate and test.

3rd Stage: torque to 45 lbs./ft. (6·2 kg.m), rotate and test.

If necessary try various sizes in washers to obtain the correct preload. It is essential that torqueing and testing is done in stages to avoid overloading the bearings and causing damage.

When correct preload is obtained, rotate the entire assembly. Provided there is no roughness of bearings, etc., continue to rebuild.

When the gearbox rebuild is complete and satisfactory, return to the Hypoid assembly.

Apply the required amount of preload to the Hypoid bearings by screwing in the cage side inner screwed sleeve (10) a further 90°; rotate the complete assembly to check for roughness, etc., and complete rebuild.

TO DISMANTLE TRANSAXLE

Remove hypoid assembly from gearbox

Remove the nuts (5/30) securing the differential shaft flanges, and pull the flanges (6/29) off the shafts.

Remove the spring ring (7/28) retaining the inner screwed sleeves (10/25) and slacken off the inner sleeves using the special tubular spanner RG373.

Remove the nuts securing the clutch casing (4) to the hypoid casing (3) and remove spring washers and plain washers.

Separate clutch casing from hypoid casing, ensuring that the hypoid assembly is supported.

Lift out the hypoid assembly. (See Fig. 14.)

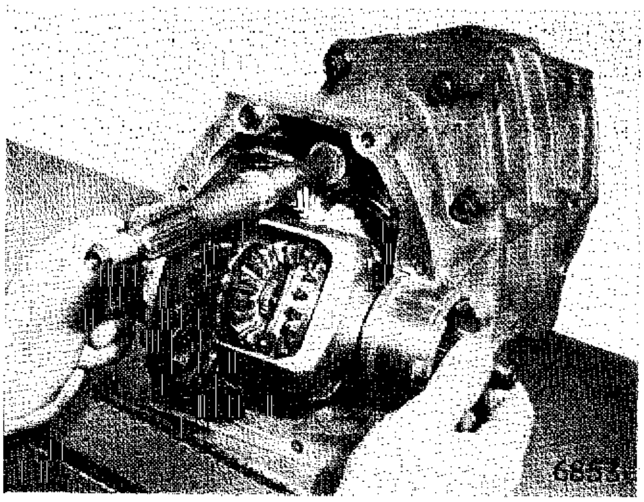


Fig. 14. *Lifting out hypoid assembly*

During dismantling and assembly the following points must be observed.

1. Absolute cleanliness is essential.
2. Care must be taken to avoid damage to the casings, especially on the abutting faces.
3. Use a liberal supply of clean oil on all moving parts when assembling.
4. Check all moving parts for freedom of movement.

To dismantle the gearbox

After carrying out bearing check proceed as follows:—

Lock gearbox in two gears and loosen reverse wheel nuts (46/53), using Tool No. RG367.

Re-engage neutral.

Remove circlip securing clutch shaft muff (37), slide muff back and unscrew shaft (33) as shown in Fig. 15.

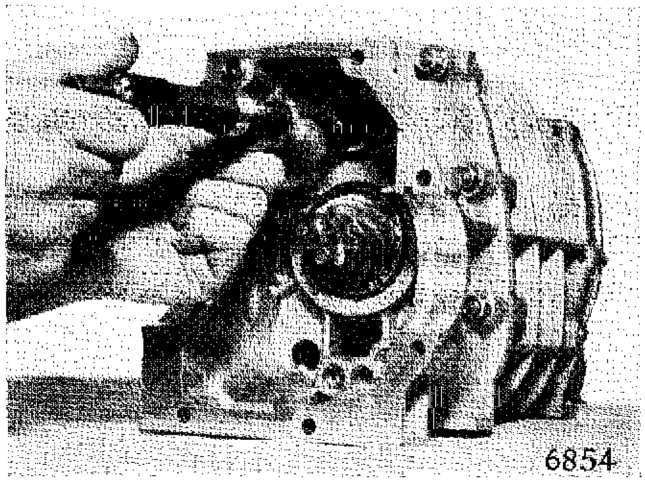


Fig. 15. *Unscrew clutch shaft*

Withdraw input shaft inner needle roller race (39) using special extractor Tool No. RG.368, as shown in Fig. 16.

Place casing on front face with 2 in. (5 cm) block under pinion head.

Remove nuts securing gearbox casing (2) to hypoid casing (3), and break seal between casings.

Remove reverse wheel nuts (46/53) and pull off the reverse gear and pinion (54/45).

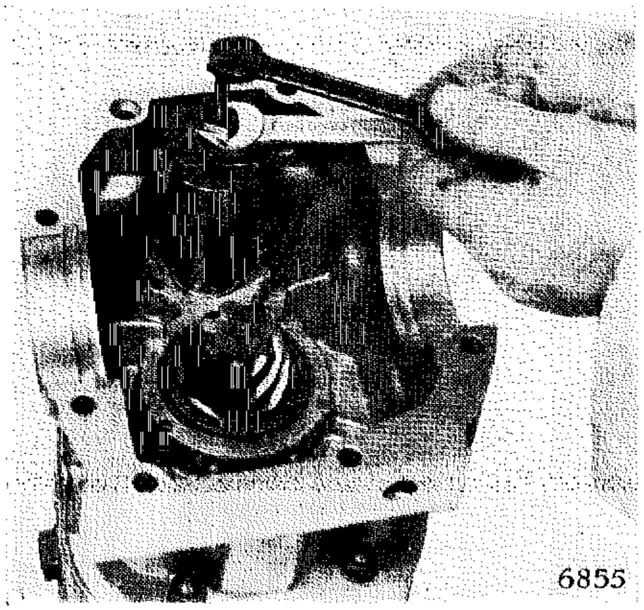


Fig. 16. *Extracting needle bearing inner race*

Remove 4th selective washer (57).

Remove 4th gear (76), baulk ring (75) and bush (74).

Mark all the baulk rings on the back face, and retain the baulk rings with their respective gears as matched sets.

Remove 3rd/4th synchro hub assembly (73) after fitting keepers, together with the 3rd/4th selector shaft and fork (77), as shown in Fig. 18.

Lift out the Output shaft tail bearing inner race (55) and remove preload washer (56).

Turn main selector (49) 90° clockwise (to clear all three selector shafts) and lift off the gearbox casing (2).

Lift out the input shaft cluster (42) as shown in Fig. 17.

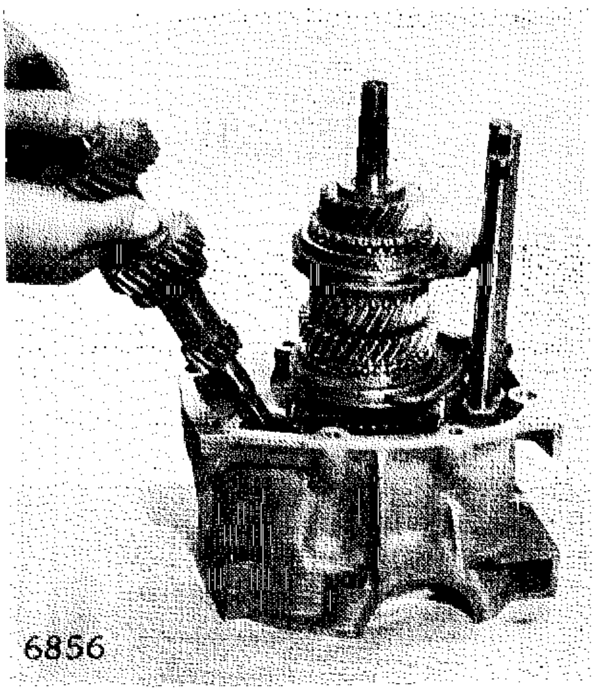


Fig. 17. *Removing input shaft cluster*

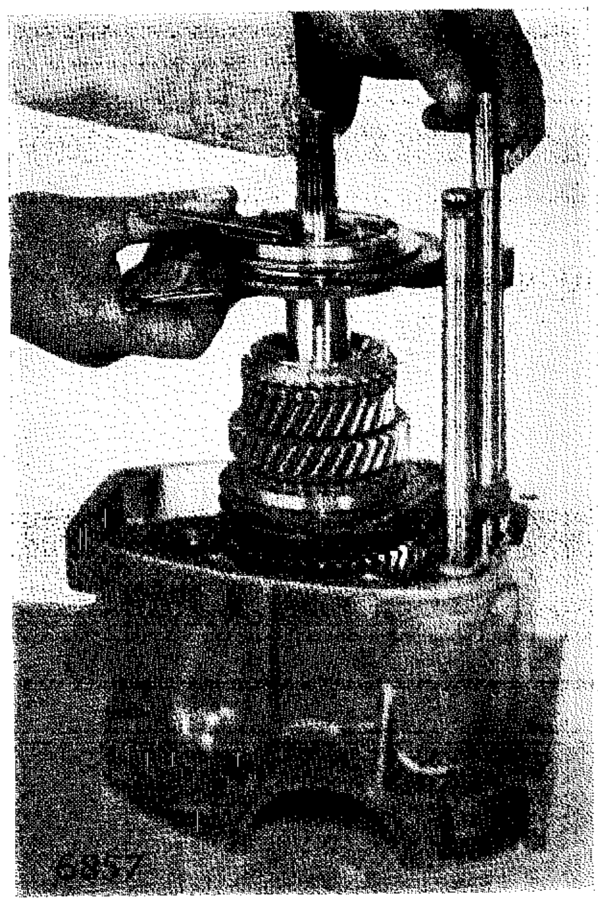


Fig. 18. *Remove/refit 3rd/4th synchro hub and selector*

Remove 3rd gear and baulk ring (70/71).

Extract key (59) from keyway in shaft.

Remove 3rd gear bush (72).

Pull out the two bush holding pins and remove 3rd (selective) washer (69).

Remove 2nd gear, bush and baulk ring (68/67/66).

Fit keepers and remove 1st/2nd hub assembly (65) together with the 1st/2nd selector shaft and fork (80) and reverse shaft (79), as shown in Fig. 19.

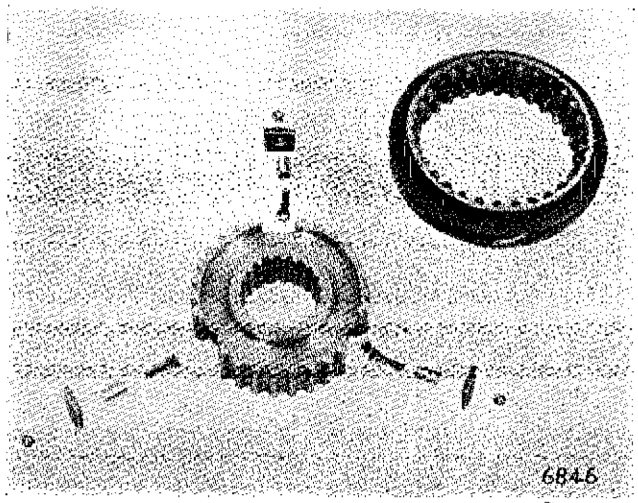


Fig. 20. *Exploded synchro hub*

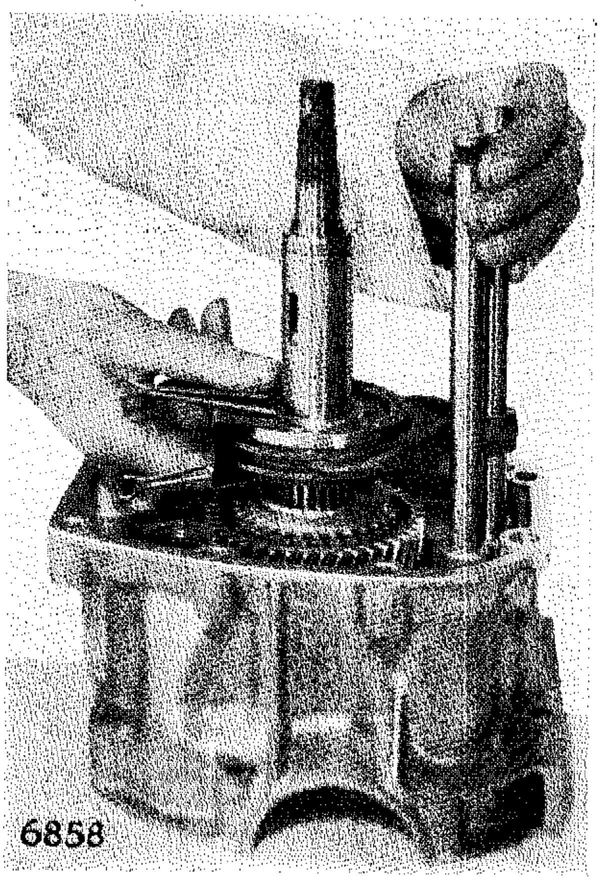


Fig. 19. *Remove/refit 1st/2nd synchro hub and selector*

Remove 2nd (non-selective) washer (64).

Remove 1st gear, baulk ring and bush (61/62/63).

Remove 1st selective washer (60).

Selector forks should not be removed from the selector shafts, but must be serviced as a complete assembly.

To dismantle the synchro hub assemblies, cover the assembly with a piece of cloth, and carefully slide off the sliding sleeve. The cloth will prevent the springs, caps, balls and plates from flying out and being lost. (See Fig. 20.)

To select shims for new pinion head bearing

To correctly position the pinion, relative to the crown wheel, shims of selective thickness are interposed between the bearing outer race and the casing. (See Fig. 21.)

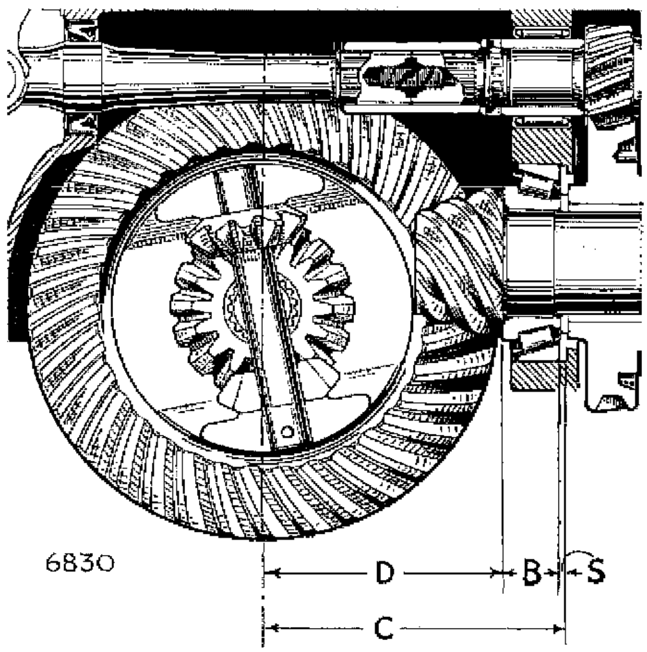


Fig. 21. *Dimensions for pinion shims*

This shimming is accurately set before the car leaves the factory, and should remain undisturbed as far as possible.

If the inner bearing is renewed, the following formula is given to calculate the thickness of shimming required.

S = C−(B+D). (See Fig. 21.)

Where S = thickness of shims (unknown).

C = distance between bearing shoulder in casing and crown wheel axis (by measurement).

B = abutment height of bearing (by measurement).

D = pinion setting distance, marked on pinion head.

To measure the distance between the bearing shoulder in the hypoid casing and the crown wheel axis (C) requires great accuracy and it is recommended that the special tool (RG365) be used.

Fit the dummy bearings and shaft into the clutch casing and the dummy pinion to the hypoid casing as shown in Fig. 22.

Nut the casings together, tightening the nuts to the torque of 12 lbs./ft. (1·66 kg.m).

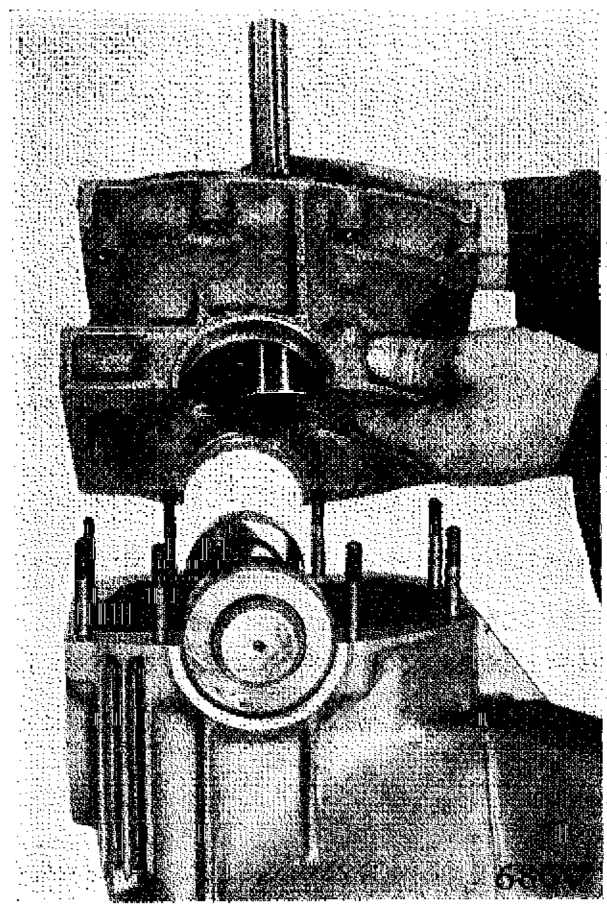


Fig. 22. *Fitting dummy pinion set*

Holding the dummy pinion head against the bearing shoulder and using feeler gauges through the inspection aperture in the clutch casing, measure the gap between the head of the dummy pinion and the dummy shaft. (See Fig. 23.)

The length of the dummy pinion head (2·991 in.) (76·2 mm) plus the radius of the dummy shaft (·813 in.) (20·65 mm) plus the measurement of the gap will equal the distance between the bearing shoulder in the casing and the crown wheel axis (C, Fig. 21). (See Example 1.)

Example 1

Length of dummy pinion head	=2·991 (75·97 mm) (standard).
Radius of dummy shaft	= ·813 (20·65 mm) (standard).
Gap between head and shaft	= ·005 (·127 mm) (feeler measurement).
Therefore C in this example	=3·809 (96·75 mm)

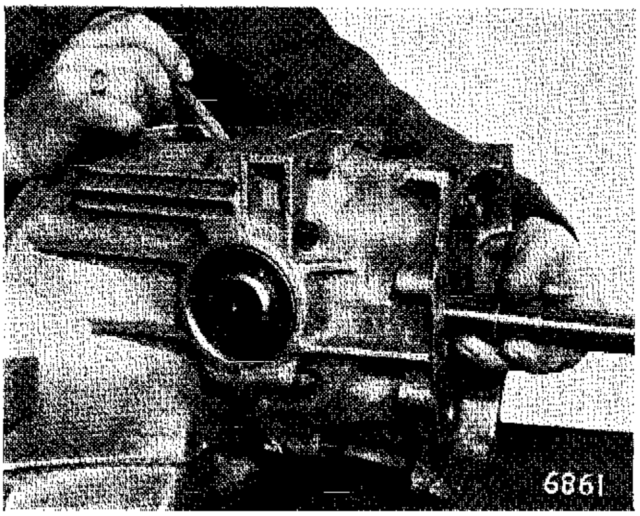


Fig. 23. *Feelers in pinion gap*

To measure the abutment height of the new bearing proceed as follows:—
(See Example 2)

A clock gauge is suitably mounted on a surface plate and set to zero on the abutment ring from Tool No. RG365.

A reading then taken on the bearing to be used gives the difference as shown in Fig. 24. Bearing must be well revolved during measurement.

Add this difference to the height of the gauge block (·705 in.) (17·9 mm). This block must be measured before use as the size can vary from ·703 in.–·709 in. (17·85–18·0 mm).

A bearing growth allowance of ·002 in. (·0508 mm) must be added.

To this measurement must be added the pinion setting distance (D) marked on pinion head. (See Example 3).

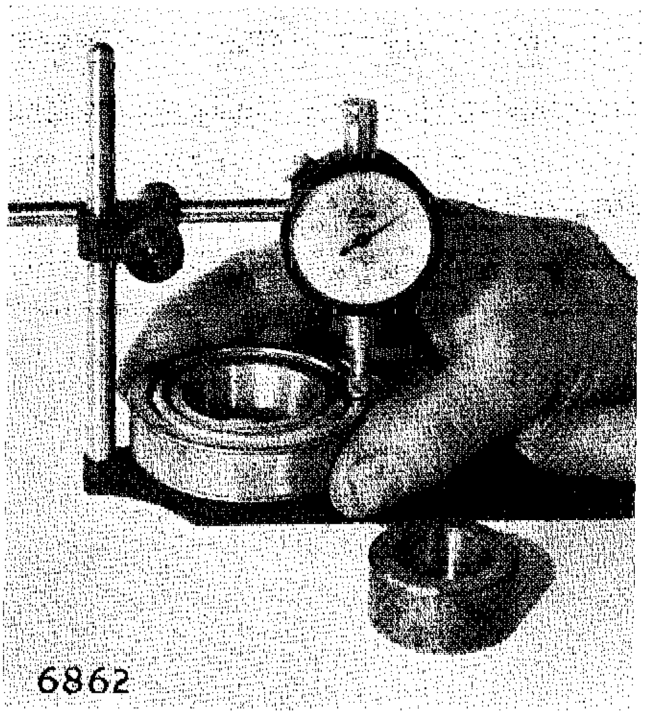


Fig. 24. *Measuring height of bearing*

Example 2

Bearing abutment height as follows:—

Height of gauge block	= 0·705 (17·9 mm)
Clock reading on bearing	= +0·003 (·0762 mm)
Bearing growth allowance	= +0·002 (·0508 mm)
Therefore B in this example	= 0·710 (18·03 mm)

Example 3

Bearing abutment height (Result of Example 2)	= 0·710 (18·03 mm)
Pinion setting distance (say)	= 3·080 (78·23 mm)
So (B+D)	= 3·790 (96·26 mm)

Shims required as follows:

Result of Example 1 (C)	= 3·809 (96·75 mm)
Less Result of Example 3 (B+D)	= 3·790 (96·26 mm)
So shimming (S)	= 0·019 (·49 mm)

To select shims for new pinion tail bearing

Shims are interposed between the pinion tail bearing outer race and the gearbox casing, to bring bearing dimensions within the range of preload washers.

Using a dial indicator, find the difference between the bearing inner cone length and the bearing abutment height. Make this dimension up to ·0355/·0335 in. (·901/·851 mm) using shims. (See Fig. 25.)

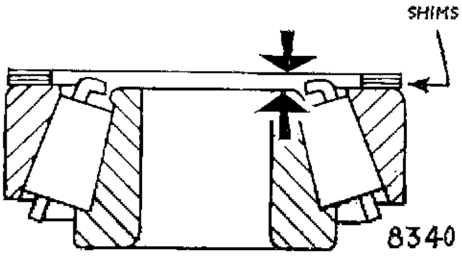


Fig. 25. *Tail bearing with shims*

Fitting new bushes

Bushes removed in service can be compared with new bushes as follows:—

Bushes to be scrapped if O/Dia. is ·001 in. (·025 mm) or more smaller than a new bush.

Bushes to be scrapped if the length is more than ·002 in. (·050 mm) shorter than new bush.

Bushes to be scrapped if slots are unduly distorted.

If bushes are tight on the shaft when removing or fitting, the bushes and shaft should be warmed in hot oil to 70°–80°C (158°–176°F).

To select correct thickness, 1st, 3rd and 4th (selective) washers

If the pinion bearings, synchro hubs or gear wheel bushes are renewed it will be necessary to re-select the correct thickness washers as follows:—

1st speed washer (60, Fig. 2)

Assemble the pinion head inner race, 1st speed wheel bush (63), 2nd (non-selective) washer (64), 1st/2nd synchro hub (65), and original 1st (selective) washer (60) to the dummy pinion shaft. Tool No. RG365.

Fit the plain abutment ring (Part of Tool No. RG365) and press it firmly down against the shoulder of the shaft. The selective washer should absorb any endfloat, but allow the bush to be revolved. (See Fig. 26.)

Re-select if necessary.

1st (selective) washer colour code

Part No.	Thickness	Colour code
7104156	·093/·091 (2·362/2·311 mm)	Red
7104157	·095/·093 (2·413/2·362 mm)	White
7104158	·097/·095 (2·463/2·413 mm)	Blue
7104159	·099/·097 (2·514/2·463 mm)	Yellow
7104160	·101/·099 (2·565/2·514 mm)	Black
7104161	·103/·101 (2·616/2·565 mm)	Green

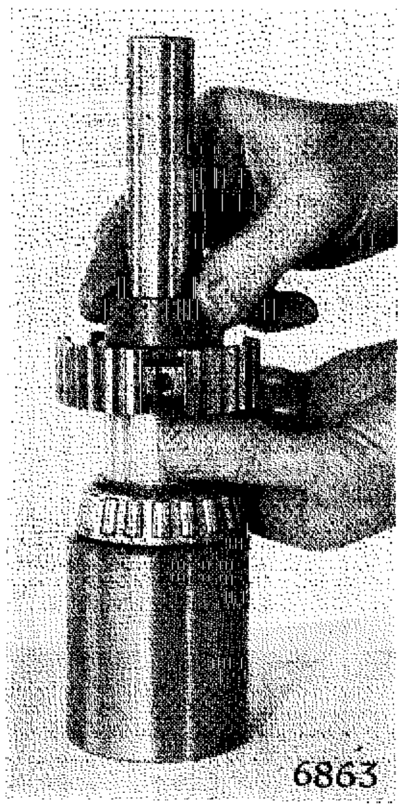


Fig. 26. *Select 1st speed (selective) washer*

3rd speed washer (69, Fig. 2)

Slide the tubular distance piece (part of Tool No. RG365) onto the dummy shaft abutting the shoulder.

Fit the 2nd and 3rd gear bushes (66/72) to the shaft and the original 3rd (selective) washer (69). Fit the plain abutment ring and press firmly down against the end of the tubular distance piece.

The selective washer should absorb any endfloat, but allow the bushes to be revolved. (See Fig. 27.)

Re-select if necessary.

3rd (selective) washer colour code

Part No.	Thickness	Colour code
7104190	·127/·125 (3·225/3·175 mm)	Red
7104191	·129/·127 (3·276/3·225 mm)	White
7104192	·131/·129 (3·327/3·276 mm)	Blue
7104193	·133/·131 (3·378/3·327 mm)	Yellow

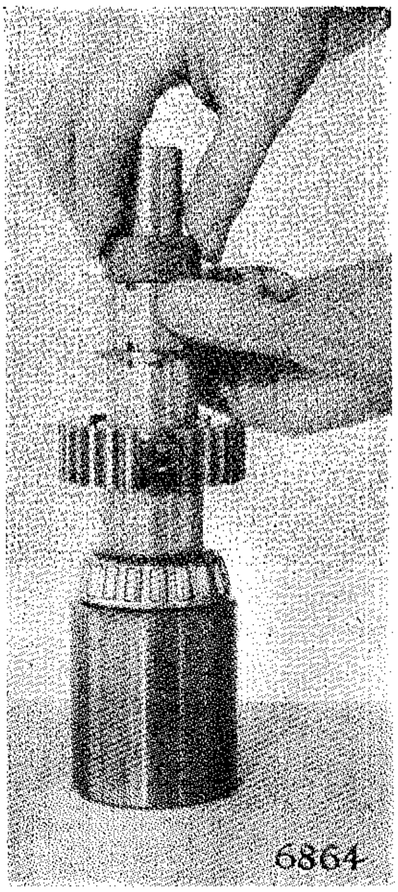


Fig. 27. *Select 3rd speed (selective) washer*

4th speed washer (57, Fig. 2)

This washer is selected during the assembly of the gearbox.

To fit new pinion bearings

Heat the hypoid and transmission casings to 95°–100°C (203°–212°F) in an oven, or in an emergency, by immersion in boiling water for approx. 15 mins.

Place the previously selected pinion head shims in the bearing recess in the hypoid casing (3). Using Tool Adaptor No. RG370, press in the outer race as shown in Fig. 28.

EXTREME CARE MUST BE TAKEN AT THIS STAGE TO SEAT THE BEARING WITHOUT STRAINING THE CASING, AS EXCESSIVE PRESSURE COULD FRACTURE THE HOUSING.

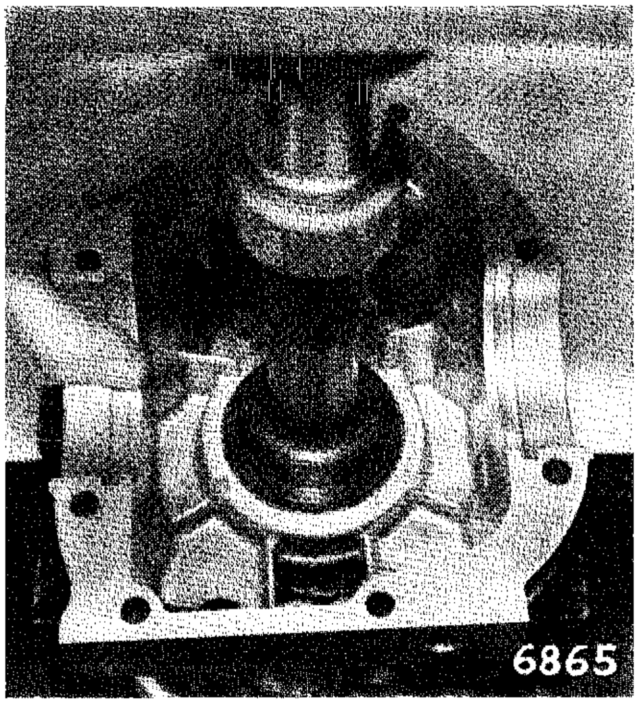


Fig. 28. *Fit pinion head bearing to casing*

Place the previously selected pinion tail bearing shims in the bearing recess in the gearbox casing and press in the tail bearing outer race as shown in Fig. 29 using Adaptor RG370.

Ensure that both bearing races are fully home.

Press the pinion head inner race on to the pinion shaft.

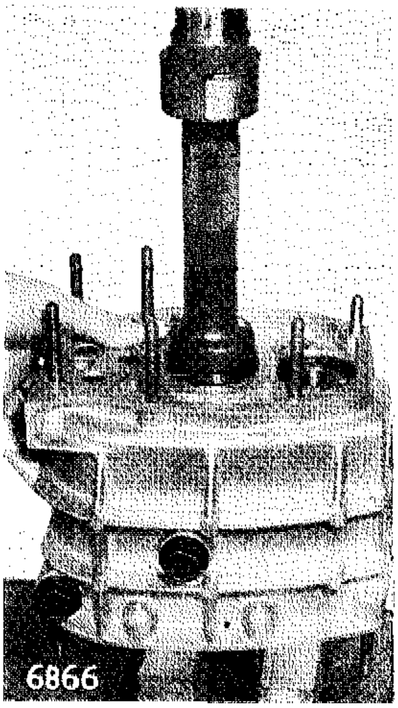


Fig. 29. *Fit pinion tail bearing*

To select correct pre-load washer (56, Fig. 2)

Place the pinion shaft into the hypoid casing and support on a 2 in. (5 cm) block.

Fit the gearbox casing to the hypoid casing and tighten the securing nuts to a torque of 12 lbs./ft. (1·66 kg.m).

Place the selective pre-load washer ·189 in.–·188 in. (4·80–4·77 mm) in thickness onto the pinion shaft.

Fit the tail bearing inner race, lightly oiled, and the reverse wheel (54).

Tighten securing nut (53) progressively to the torque given in General Data. It is important to tighten the nut progressively, rotating the pinion when tightening, also the shaft must be well rotated in both directions after the nut is fully tightened.

Measure the pre-load as previously described, and shown in Fig. 12.

The reading on the balance scale should be 9–12·5 lbs. (4–5·6 kg). for new bearings.

For original bearings, the reading shown should be 4–6 lbs. (1·8–2·7 kg.).

If readings are higher than this, fit the next thickest washer and re-check. If lower, fit the next thinnest washer and re-check. Repeat until reading on scale is within limits.

Pre-load (selective) washer colour code

Part No.	Thickness	Colour code
7104170	·190/·189 (4·826/4·80 mm)	Red
7104171	·189/·188 (4·80/4·77 mm)	White
7104172	·188/·187 (4·77/4·75 mm)	Blue (dark)
7104173	·187/·186 (4·75/4·72 mm)	Yellow
7104174	·186/·185 (4·72/4·699 mm)	Black
7104175	·185/·184 (4·699/4·673 mm)	Green
7104176	·184/·183 (4·673/4·648 mm)	Brown
7104177	·183/·182 (4·648/4·623 mm)	Grey
7104178	·182/·181 (4·623/4·597 mm)	Blue (light)
7104196	·181/·180 (4·597/4·57 mm)	Black & White
7104197	·180/·179 (4·57/4·546 mm)	Green & White
7104198	·179/·178 (4·546/4·52 mm)	Brown & White
7104199	·178/·177 (4·52/4·495 mm)	Grey & White
7104200	·177/·176 (4·495/4·47 mm)	Blue & White

To renew input shaft ball bearing (43, Fig. 2)

Remove the circlip (44).

The old bearing must be drifted out of the casing using a suitable mandrel.

The gearbox casing must be heated as previously described before pressing in the new bearing using Adaptor No. RG366 as shown in Fig. 30.

Fit new circlip.

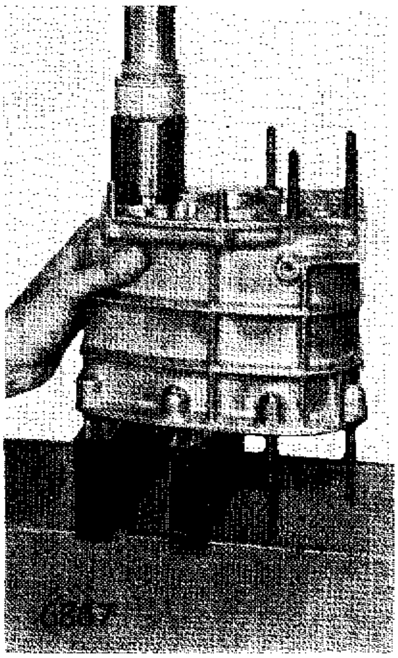


Fig. 30. *Fit input shaft ball bearing*

To renew input shaft needle roller bearing (41, Fig. 2)

The old bearing should be pressed out of the hypoid casing using RG369.

The hypoid casing must be heated as previously described.

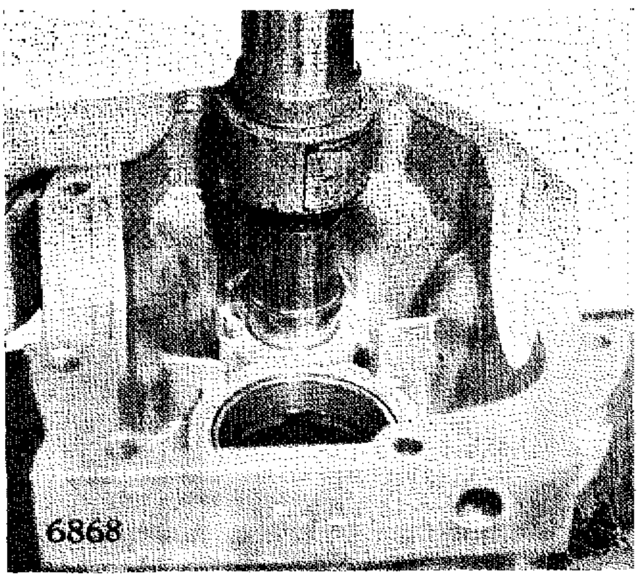


Fig. 31. *Fit needle bearing*

The marked end of the new bearing must face outwards on the hypoid side of the casing, and must be pressed in from this side, using the special mandrel (Tool No. RG369). (See Fig. 31.)

To re-assemble synchro hub assemblies (See Fig. 3)

Place the hub flat and insert the three springs with the caps into the three holes in the hub.

Carefully place the hub into the sliding sleeve, until restrained by the three caps.

Push each cap into its bore, against the pressure of the spring until located under the sliding sleeve.

Hold the assembly on its edge and position the sleeve, so that the holes in the plates are just exposed to receive the balls, and the caps in the hubs are half visible through the holes in the shifting plates.

Place a ball in one plate. Using a small screwdriver, depress the ball and push the plate and ball under the sleeve.

Do not change the position of the hub.

Repeat with the remaining two balls.

Carefully push in the hub until the balls locate in a groove in the sliding sleeve.

TO RE-ASSEMBLE GEARBOX

Use only Hylomar jointing compound and clean faces with carbon tetrachloride. DO NOT SCRAPE.

Assemble pinion shaft to hypoid casing and support pinion on 2 in. (5 cm) packing block.

Fit 1st (selective) washer (60, Fig. 2).

Fit 1st speed gear and bush (61/63).

Fit 1st speed baulk ring (62).

Fit 2nd (non-selective) washer (64).

The reverse selector shaft (79), 1st/2nd selector shaft (80) and the 1st/2nd synchro hub assembly (65) are fitted as a complete assembly. (See Fig. 19.)

Guide the two selector shafts into the holes in the hypoid casing as the synchro hub is fitted to the shaft. (See Fig. 19.) Make sure the lugs on the baulk ring engage with the slots in the hub.

Fit the 2nd gear, baulk ring and bush (68/67/66). The two small slots in the bush face upwards with one slot in line with the keyway in the shaft.

Fit the 3rd (selective) washer (69). Fit the two bush pegs through the washer and into the slots in the 2nd gear bush.

Fit the 3rd speed bush (72). The two small slots in the bush engage the two bush pegs. The large slot must be in line with the keyway.

Fit the key to the keyway in the shaft (59).

Fit the 3rd speed gear and baulk ring (70/71).

The 3rd/4th synchro hub (73) and the 3rd/4th selector shaft and fork (77) are fitted as an assembly.

Guide the selector shaft into the hole in the hypoid casing as the synchro hub is fitted to the shaft. (See Fig. 18.)

Make sure the lugs on the baulk rings engage with the slots in the hubs. Fit 4th speed baulk ring (75).

Fit the 4th speed bush (74). The slot in the bush engages with the key. If the pinion bearing, synchro hub, or gearwheel bushes have been renewed, it will be necessary at this stage to re-select the 4th (selective) washer (57), as follows:—

Fit the dummy 4th speed washer (part of Tool No. RG365) onto the shaft, place the previously selected pre-load washer on top, and then the bearing.

Keeping the pre-load washer pressed against the shoulder on the shaft, measure with feeler gauges, the clearance between the dummy washer and the pre-load washer (See Fig. 32).

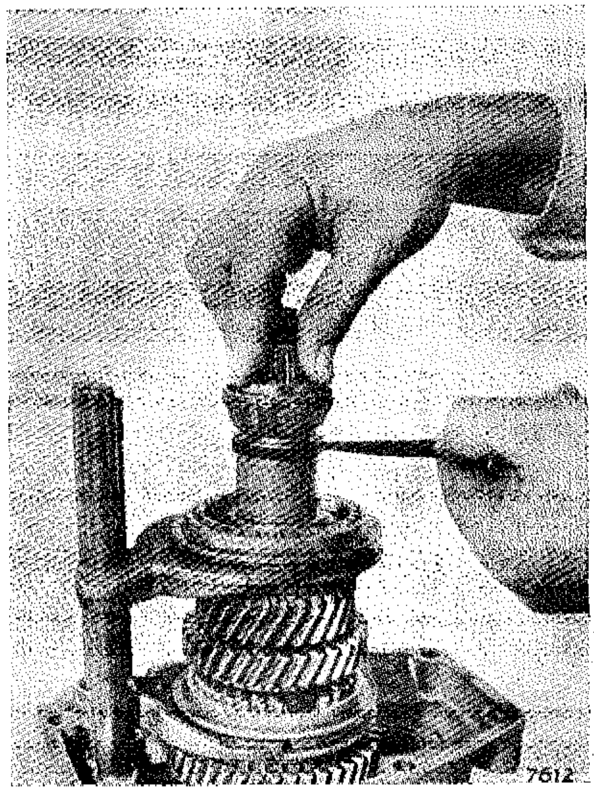


Fig. 32. *Re-select 4th speed washer*

Used bushes must be rebuilt with ·002 in.-·006 in. (·0508-·1524 mm) compression allowance (crush).

NEW bushes are fitted with ·006 in.-·010 in. (·1524-·2540 mm) compression allowance (crush).

The thickness of the washer required is equal to the size of the feeler, plus the thickness of the dummy washer (Part of Tool RG365), plus the crush amount.

NOTE. The size of the dummy washer must be checked before use, as the dimension can vary from ·198 in.-·202 in. (5-5·13 mm).

Select the correct washer from the table.

4th (selective) washer colour code

Part No.	Thickness	Colour code
7104163	·226/·224	Red
7104164	·224/·222	White
7104165	·222/·220	Blue
7104166	·220/·218	Yellow
7104167	·218/·216	Black
7104168	·216/·214	Green

Fit the 4th speed gear (76, Fig. 2) followed by the 4th (selective) washer (56).

Fit the input shaft gear cluster (42) with the tolerance ring (40) correctly fitted.

Push the main selector (49) through its bore in the gearbox casing.

Turn the rod so that the finger points away from the reverse plunger bore as shown in Fig. 33.

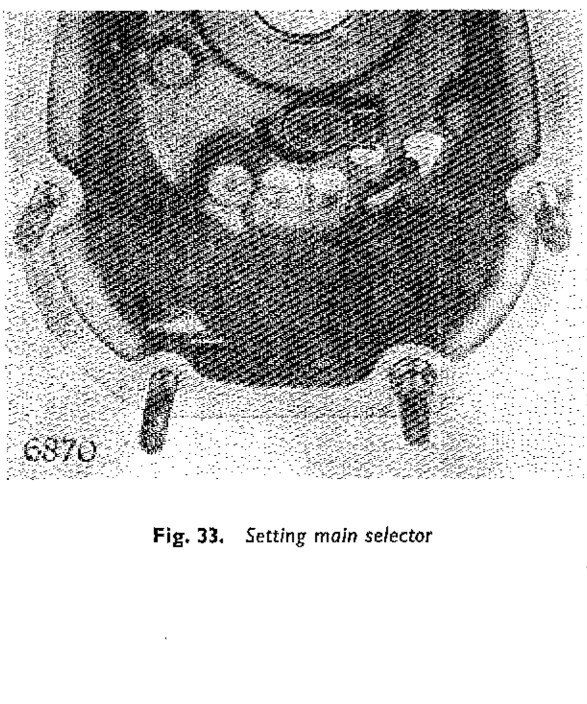


Fig. 33. *Setting main selector*

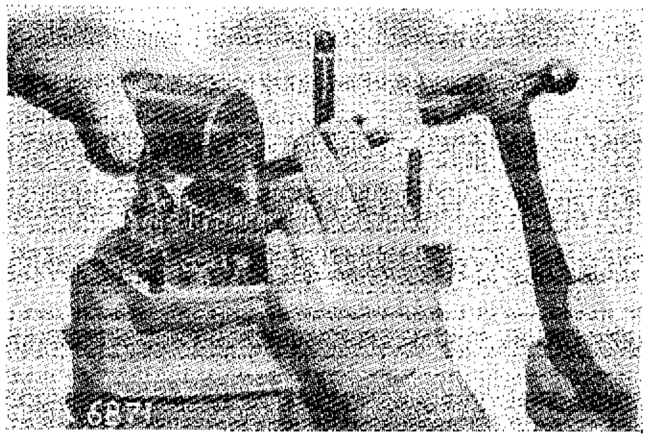


Fig. 34. *Peen reverse gear locknuts*

Coat the abutting faces of the gearbox and hypoid casings with Hylomar jointing compound.

Pass the gearbox casing cover over the gears. Fit the casings together with a plain washer beneath each nut, and torque to a figure of 12 lbs./ft. (1·66 kg.m).

Tighten studs through ring dowels first, and then continue evenly and diagonally.

Fit the selected pre-load washer as described previously. Place the tail bearing inner race over the pinion shaft.

Fit the reverse wheel (54) and a new nut (53).

Tighten progressively (as previously described) to the torque figure given in General Data rotating the shaft whilst doing so. (See Fig. 13.)

Engage two gears at once to lock the shaft, whilst tightening the nuts, but release the gears and rotate the assembly between such period of tightening a minimum of 3 stages.

Fit the reverse pinion (45) and new nut (46) to the input shaft. Tighten to a torque figure given in General Data.

Lock shaft by engaging two gears at once.

DO NOT FORGET to re-engage neutral when locking is completed. Peen the collar of each reverse gear nut into the slot of the shaft, using a blunt chisel shaped punch. (See Fig. 34.) THE SHAFT MUST BE SUPPORTED UNDERNEATH TO AVOID DAMAGE TO THE BEARINGS.

Press the inner race of the input shaft needle bearing (39) into place over the tolerance ring (40) using the special hand press. (Tool No. RG368.)

The two holes in the inner race **MUST** be towards the clutch end of the shaft.

Slide a new retaining circlip and the splined muff (37, Fig. 2) onto the clutch shaft.

Screw the clutch shaft (33) fully home into the input shaft and turn back one full spline.

Line up the splines on the shafts and push the muff into position. (See Fig. 15.)

Slide the circlip into the retaining groove making sure it is fully home.

Check that the end of the clutch shaft has a free up and down movement of at least ·10 in. (2·7 mm). *This is essential.*

Fit the hypoid assembly and adjust for backlash and pre-load as described in later paragraphs.

TO DISMANTLE HYPOID ASSEMBLY
(See Fig. 35)

Remove the hypoid assembly from the gearbox as previously described.

Slide the sleeve assemblies off the differential shafts (11/24, Fig. 35).

Using circlip pliers, remove the circlips (16) from the differential shafts (13).

Withdraw the shafts. (Discard the circlips and fit new on re-assembly.)

Remove crown wheel bolts and washers (21). (Discard the washers.)

Drive the crown wheel (19) off the differential casing (20) using a suitable punch through the bolt holes.

Tap out the pin (18) securing the differential cross pin (17) as shown in Fig. 36.

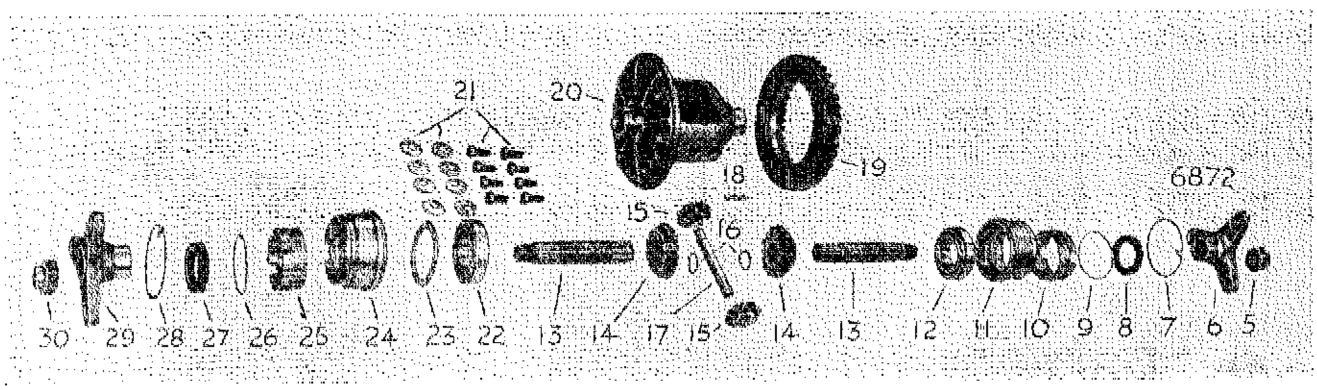


Fig. 35. *Hypoid assembly*

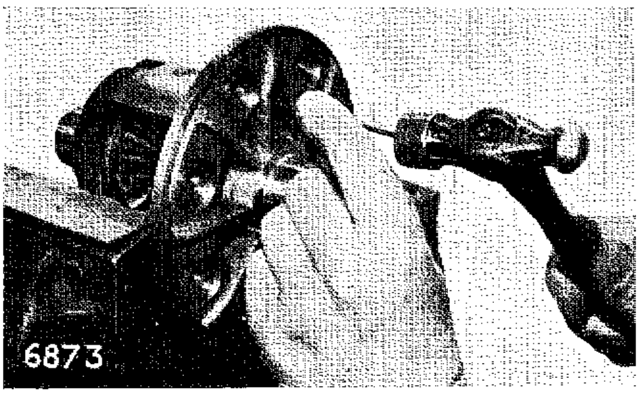


Fig. 36. *Tapping out cross pin locking peg*

Push out the cross pin.

Push out the differential gears (14/15) as a nest. (See Fig. 37.)

If necessary the inner races (12/22) on both sides of the hypoid may be removed, by chiselling the cages through, removing the rollers, and using an ordinary two-legged puller. (See Figs. 38, 39.)

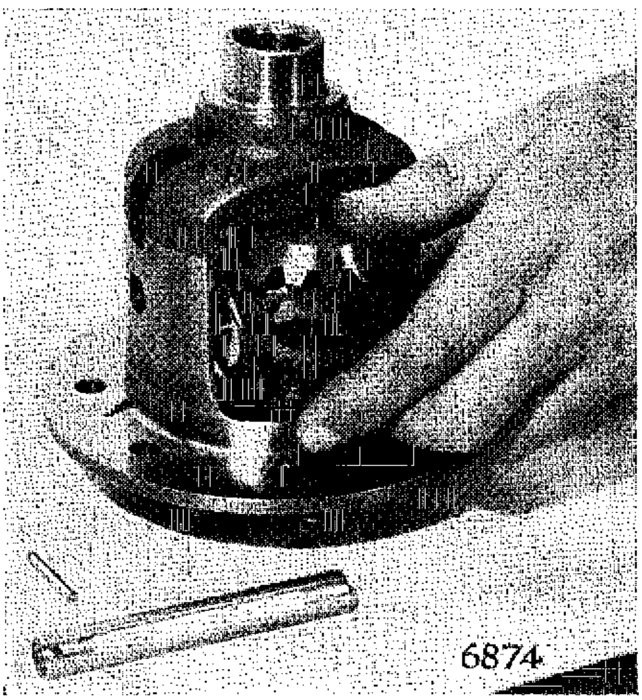


Fig. 37. *Remove/refit diff. gears*

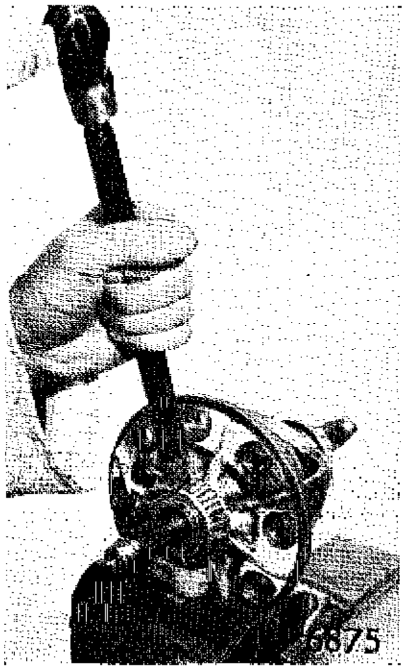


Fig. 38. *Chisel through cages*

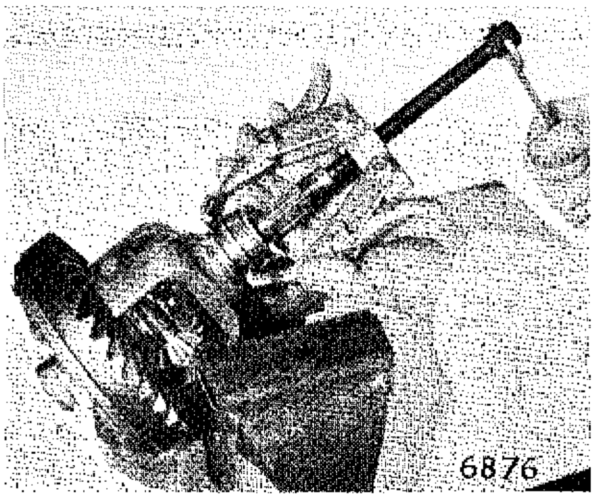


Fig. 39. *Using two-legged puller*

Remove the differential bearing outer races from the outer screwed sleeves (11/24) and abutment washer (23) from the larger (crown wheel) outer screwed sleeve (24).

Screw out the inner screwed sleeves (10/25) from the outer screwed sleeves (11/24).

TO RE-ASSEMBLE HYPOID ASSEMBLY

Insert the differential gears (14/15) into the differential casing (20) as shown in Fig. 37.

Push the cross pin (17) into the differential casing through the pinion gears, keeping the locking pin hole in line with the hole in the casing.

In all cases where the cross-pin (17, Fig. 35) has been removed from the differential casing, the cross-pin and the locking pin (18) must be replaced, using the cross-pin identified by a ·30 in. dia. pip at one end, and a Spirol locating pin. These two items must be fitted as a pair and are contained in the differential wheel and pinion set Part No. 7050027.

Drive in the locking pin (18) using a pin punch.

Heat the crown wheel in an oven (or immersion in boiling water for approx. 15 mins.) to a temperature of 70°C (158°F).

Using four spare gearbox studs as guides, fit the crown wheel to the casing. (See Fig. 40.)

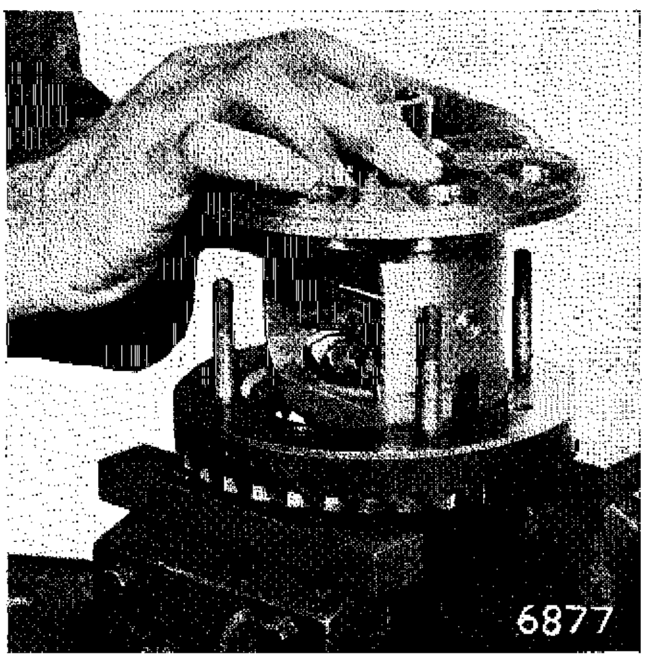


Fig. 40. *Fit crown wheel to case*

The crown wheel bolts are locked by special domed eccentric washers (21). (See Fig. 41.)

It is important that new washers are fitted correctly into the recesses in the casing with the dome upwards and the long side outwards.

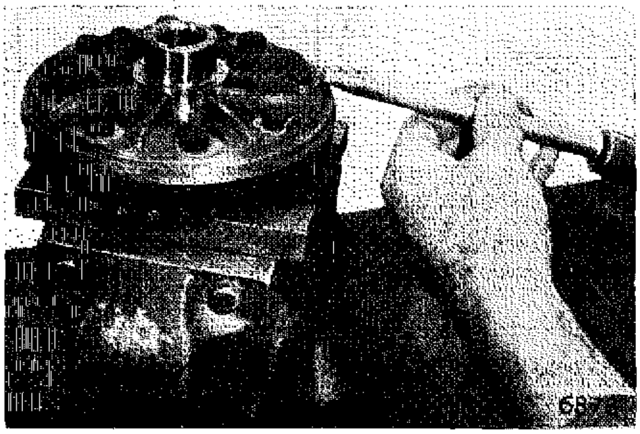


Fig. 41. *Locking crown wheel bolts*

Tighten the bolts to the torque figure given in General Data and tab the washers as shown in Fig. 41.

Check crown wheel with clock gauge. Maximum run out ·001 in. (·0254 mm).

If new bearings are to be fitted they should be pressed on using Tool No. RG363 shown in Fig. 42.

Push the differential shafts (13) into the bevel wheels (14) and fit new circlips (16).

Fit the abutment ring (23) and outer race to the large (crown wheel side) outer screwed sleeve (24).

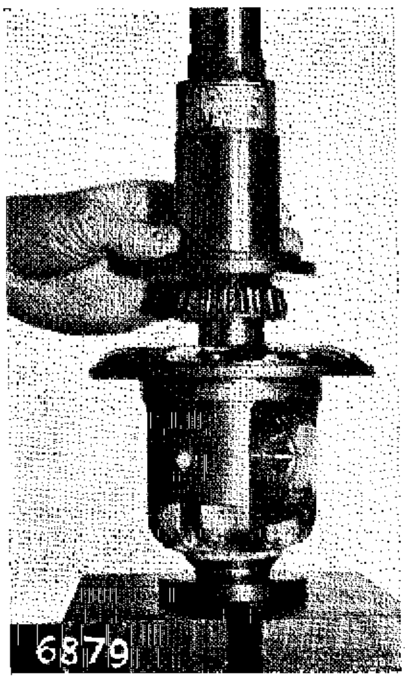


Fig. 42. *Fitting diff. bearings*

Press a new oil seal (8/27) into the inner screwed sleeve (10/25) using the special stepped mandrel (Tool No. RG366) as shown in Fig. 43.

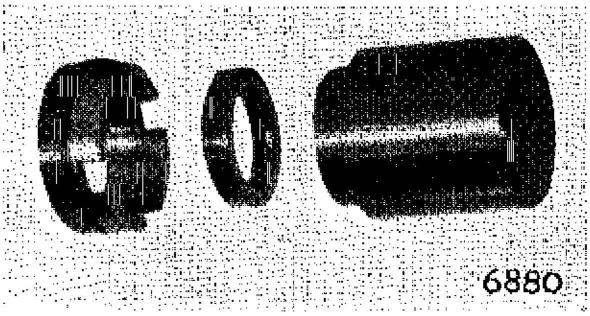


Fig. 43. *Tool for fitting hypoid oil seals*

Fit the "O" ring (9/26) into the recess on the inner screwed sleeve (10/25).

Screw the inner screwed sleeve (10/25) into the outer screwed sleeve (11/24).

The smaller (cage side) screwed sleeve assembly (8/9/10/11) is assembled in the same manner as the larger (crown wheel side) except there is no abutment ring fitted.

Place the sleeve assemblies on the bearings (the larger sleeve assembly on the crown wheel side).

Coat the abutting faces of the hypoid casing and the clutch casing with Hylomar jointing compound.

Fit the assembly to the hypoid casing making sure that the inner screwed sleeves are projecting approx. $\frac{1}{16}$ in. (1·5 mm) each side.

Fit the clutch casing to the hypoid casing and tighten the securing nuts finger tight. Screw the smaller bearing inner screwed sleeve (in future called cage side) in as far as possible, rotating the Hypoid assembly while doing so. This will expand the outer screwed sleeve outwards in the casing.

Tighten the casing securing nuts to a torque of 12 lbs./ft. (1·66 kg.m). Screw back the cage side inner screwed sleeve about one turn.

To adjust the crown wheel for backlash and pre-load of the bearings

Using the special tubular adjusting spanner (Tool No. RG373) adjust the larger bearing inner screwed sleeve (in future called the gear side) until there is ample backlash between the crown wheel and the pinion, and a slot in the inner sleeve is in line with a slot in the outer sleeve (See Fig. 44).

Mark these two slots.

Screw in the cage side inner screwed sleeve until the bearings are just contacted.

Loosely fit the drive flanges and spin the assembly.

Re-adjust the cage side inner screwed sleeve to contact the bearings. Repeat the spinning of the assembly and the tightening of the cage side inner screwed sleeve until no further tightening of the sleeve is required to contact the bearings.

If a pair of slots are not lined up on the cage side at this point move the gear side inner screwed sleeve round to a new pair of slots and find bearing contact again as previously described.

When this position is found, screw in the cage side inner screwed sleeve a further 90° minimum and line up two slots.

Mark these two slots.

Clamp a clock gauge to the clutch housing (See Fig. 45) with the stylus against the heel of the crown wheel teeth, as nearly in line with the direction of travel as possible, and loosely fit the drive flanges.

Fig. 44. *Adjusting inner screwed sleeve (RG373)*

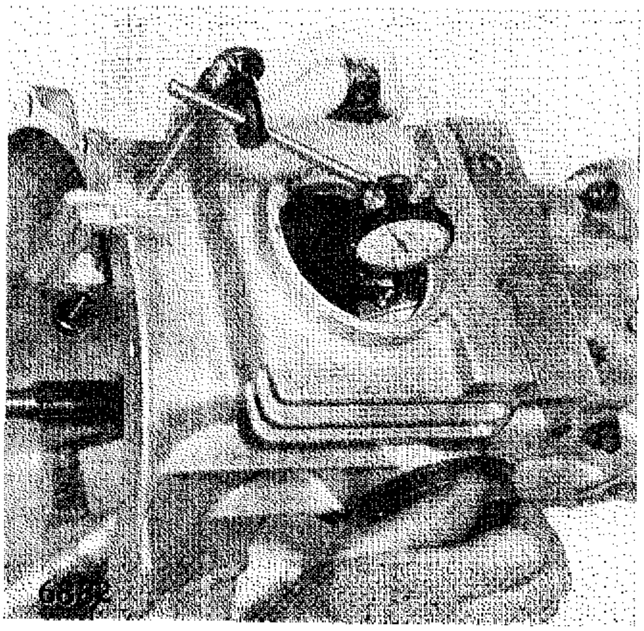


Fig. 45. *Set up clock gauge for backlash*

Check the backlash between the crown wheel and the pinion by rotating the flanges backwards and forwards together as shown in Fig. 45.

The pinion shaft must be held stationary.

This can be achieved by locking the reverse driven gear with the reverse idler gear against a casing stud.

Adjust to within ·0035 in.–·0055 in. (·0889–·1397 mm) of backlash by screwing each of the inner screwed sleeves exactly the same amount in the required direction.

If excessive backlash, screw cage side inner screwed sleeve out and gear side inner screwed sleeve in, exactly the same amount.

If insufficient backlash, screw gear side inner screwed sleeve out, and cage side inner screwed sleeve in exactly the same amount.

When correctly adjusted, the angles between the two previously marked slots on each side should be the same.

Backlash must be measured on at least four positions on the crown wheel.

As a final check of pinion and crown wheel positions, the teeth of the crown wheel should be painted with marking paste and the crown wheel rotated to obtain an impression of the pinion teeth.

Maximum run out on crown wheel ·001 in. (·0254 mm) measured with a clock gauge.

If correct, the markings on the crown wheel should be as shown in Fig. 47. Backlash as given should be measured at room temperature. If measured hot, backlash should be ·005 in.–·007 in. (·127–·178 mm).

Fit the spring rings to the screwed sleeves.

Fit the drive flanges and new locking nuts.

Tighten the nuts to the figure given in General Data and peen the collar of the nuts into the slots in the shafts, using a blunt chisel shaped punch. (See Fig. 46.)

The nut must be supported to prevent damage to the bearings.

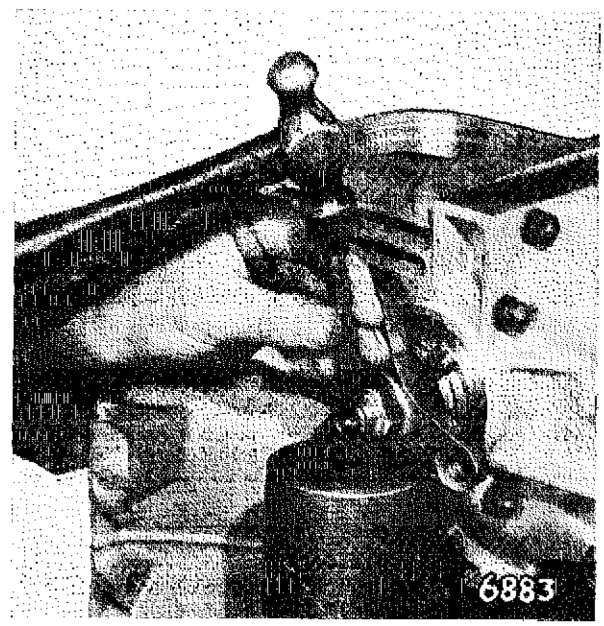
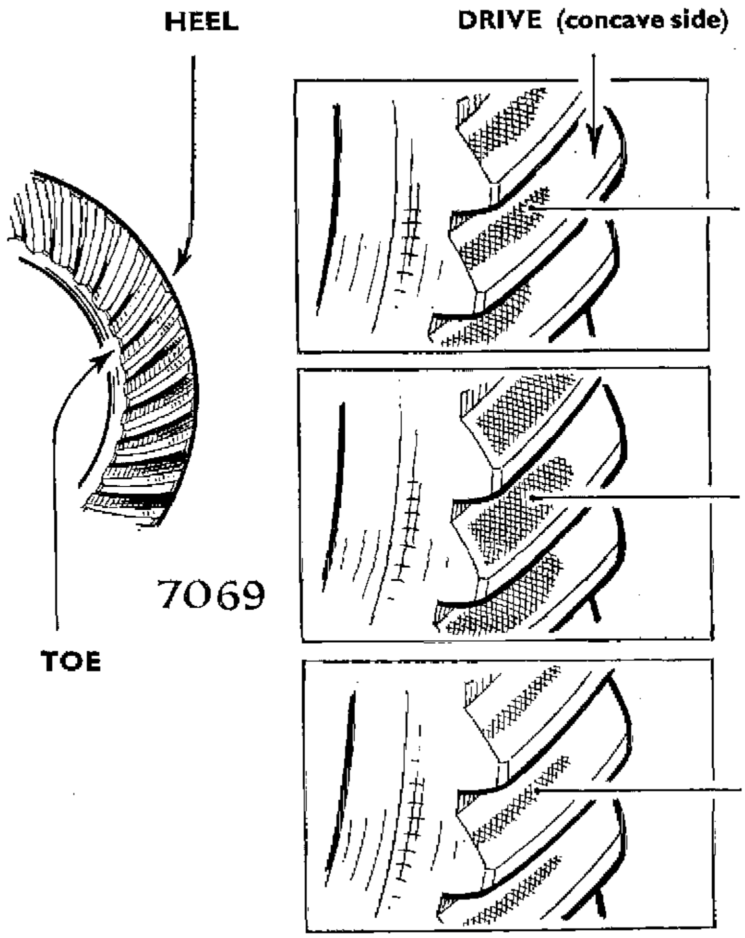


Fig. 46. *Peening drive flange nuts*



CORRECT MARKING

NOTE. This marking does not conform to the normally accepted "correct" marking as it includes an allowance for pinion movement at running temperature.

INCORRECT

Marking too wide and moved away from toe.
Pinion too far out of mesh.
Increase shims behind pinion head bearing.

INCORRECT

Marking too narrow.
Pinion too far into mesh.
Reduce shims behind pinion head.

Fig. 47. *Crown wheel tooth markings*

Fit the inspection cover "O" ring and lightly coat with oil as shown in Fig. 48. Push in the inspection cover and replace the spring ring.

Up to Chassis No. B41/1003731 De Luxe, B42/1000100 Basic, Fit Spring Ring No. 7104213. After these Chassis No's fit Spring Ring No. 7104220.

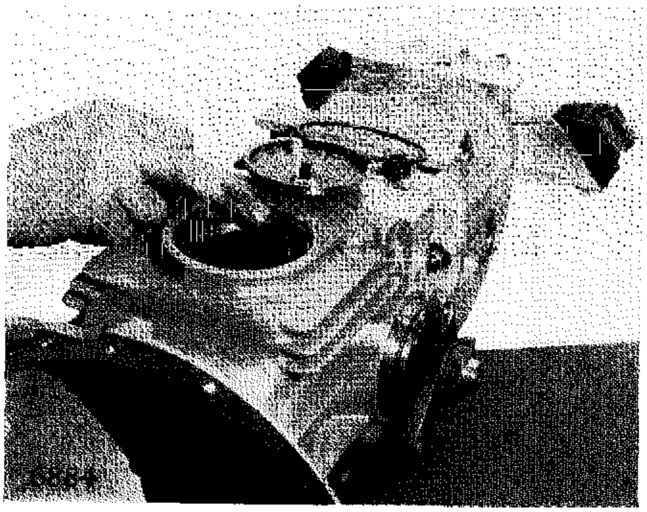


Fig. 48. *Fitting "O" ring*

Fit the reverse plunger and spring in the bore in the gearbox casing. (See Fig. 49.)

Fit the interlock plate and roller. (See Fig. 49.)

Fit the reverse lever assembly, holding the reverse idler wheel in the correct position. Fit idler wheel spindle.

Coat the joint face of the mounting cover with Hylomar jointing compound.

Fit the mounting cover.

Tighten the nuts diagonally and evenly all round, and torque to the figure given in General Data.

Should a check be carried out on casing nuts after a road test, and with the casing hot, nuts should be tested to a torque as given in General Data.

Insert the detent ball and spring in the mounting cover.

Fit the retaining plug and torque to the figure given in General Data.

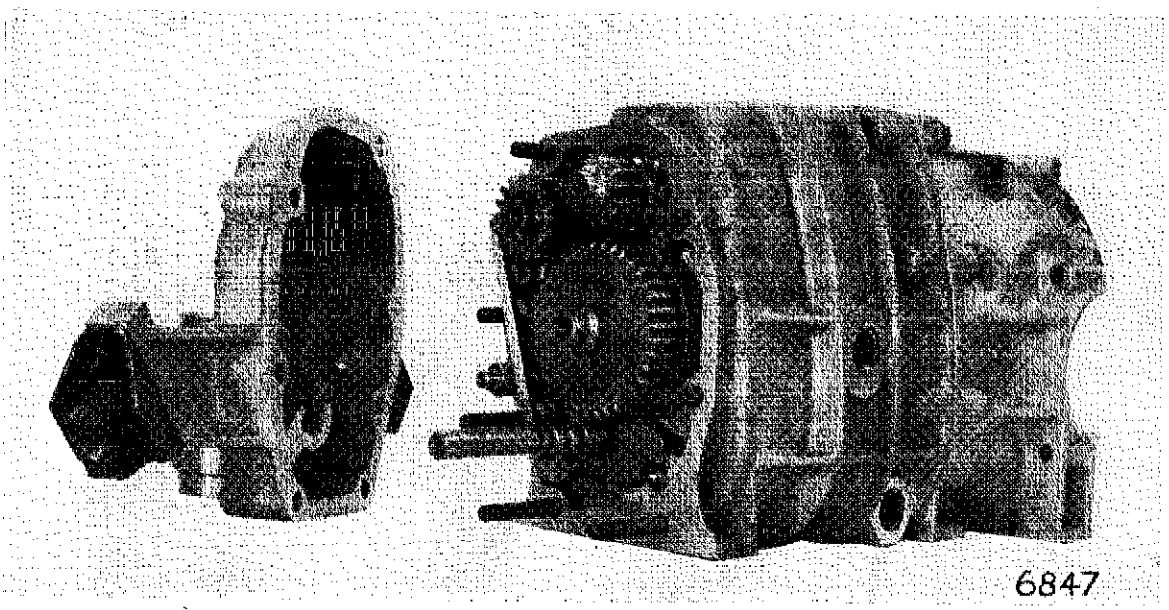


Fig. 49. *Interlock plate and reverse gear assembly*

TO REMOVE AND REFIT GEAR LEVER AND CONTROL SHAFT

Place the car on stands or a lift.

Remove the large plate on the underside of the car by unscrewing the eight retaining bolts.

Take note which is the front of the plate. This has a tongue which fits into the tunnel in the floor.

Disconnect the gear control shaft from the transmission unit by turning back the lock tab and removing the location bolt in the coupling.

From beneath the car remove the four bolts locating the gear lever assembly on the floor of the car. (See Fig. 51.)

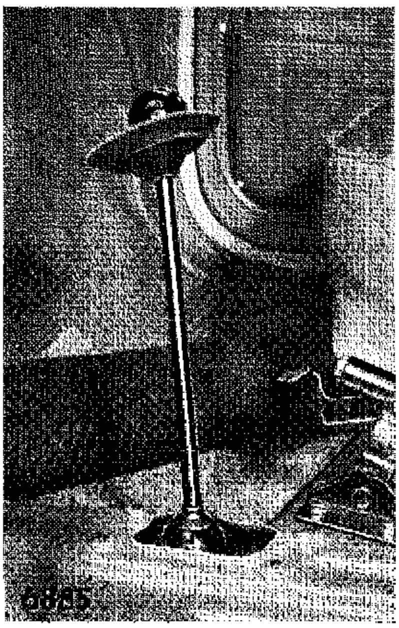


Fig. 51. *Floor mounting of gear lever*

The lever assembly and control shaft can then be removed by withdrawing the lever assembly downwards through the aperture in the floor.

To detach the control shaft from the gear lever assembly, remove the two small bolts situated in the assembly to the rear of the lever. (See Fig. 52.)

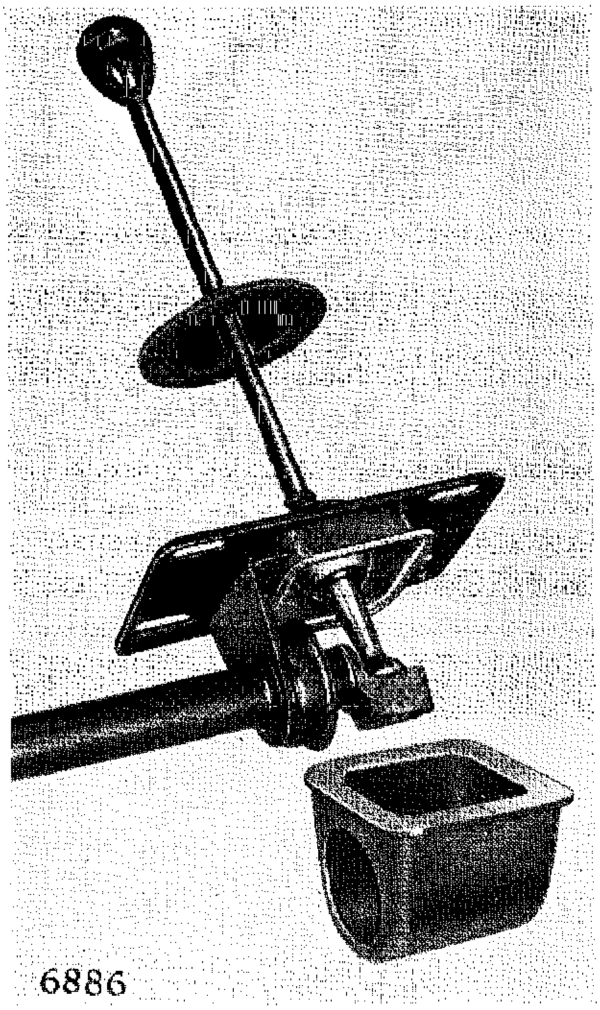


Fig. 52. *Gear lever assembly*

To re-assemble, carry out the reverse procedure.

NOTE. If the gear lever is removed, it must be refitted with the spring-loaded ball to the front of the car.

Ensure that the large rubber boot is fitted correctly to the flanges on the underside of the assembly.

When passing the lever through the floor aperture, push the round rubber draught excluder through also and position correctly when the assembly is finally fitted.

Adjust the gear lever setting as follows:—

Slacken off slightly the four locating bolts in the lever assembly. This will enable the assembly to move in the elongated holes in the retaining plate.

Set the lever vertical in the neutral position between the 1st and 2nd gear, and tighten the four bolts.

To remove the control shaft without removing the gear lever, lift the cover surrounding the lever and unscrew the two small bolts to the rear of the lever.

By pulling free the rubber boot under the floor, the control shaft may be pulled free of the lever.

Refitting is the reverse procedure.

Clean and lubricate Gear Change Control Shaft

Should the gear change lever become stiff during operation, investigate the control shaft where it passes through the rear nylon bearing. (See Fig. 52A.)

The control shaft should be carefully cleaned at this point, and greased with Shell Retinax 'A'.

It is not necessary to dismantle the mechanism to carry out this operation.

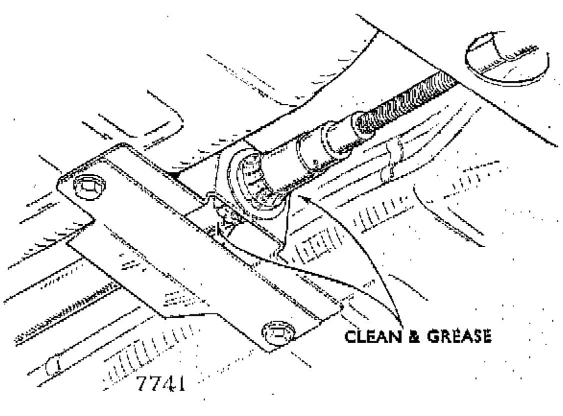


Fig. 52A. *Rear bearing, gearchange control shaft*

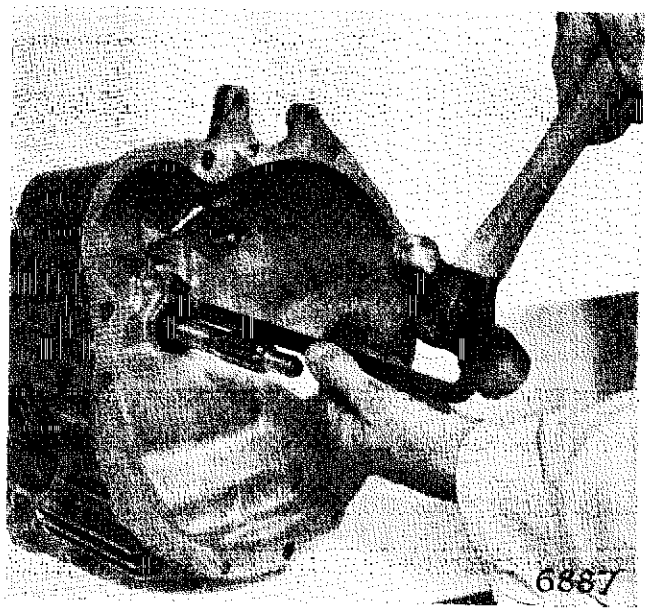


Fig. 53. *Remove clutch shaft oil seal*

TO RENEW OIL SEALS

Clutch shaft oil seal (See Fig. 53)

The clutch shaft oil seal can be renewed without dismantling the transmission unit, after the unit has been removed from the car. The unit should be at working temperature for removing the old seal.

Separate the transmission unit from the engine.

Release pressure from the unit by removing the filler plug slowly. Replace filler plug hand tight.

Remove the nut securing the release lever clip and remove the clip and release lever. (See Fig. 54.)

Insert the Tool No. RG384 between the clutch shaft and the oil seal.

Withdraw the oil seal by tapping against the handle of the tool. (See Fig. 53.)

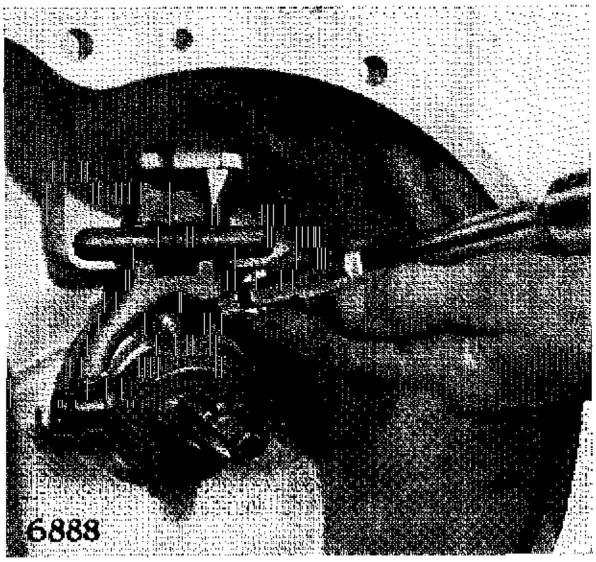


Fig. 54. *Remove/refit release lever*

The new oil seal inner diameter must be smeared with oil and the seal positioned on the tool RG372 so that the open end of the seal may still be seen. This ensures that the seal is fitted lip inwards.

RG372 protects the seal as it is passed over the clutch shaft splines and as it is gently tapped into position. (See Fig. 55.)

Fit the release lever and clip. Torque load to the figure given in General Data. (See Fig. 54.) A little Shell Retinax 'A' should be applied to the release trunnions and spring blade before fitting.

Top up the oil level, if necessary, and tighten filler plug to correct torque loading given in General Data.

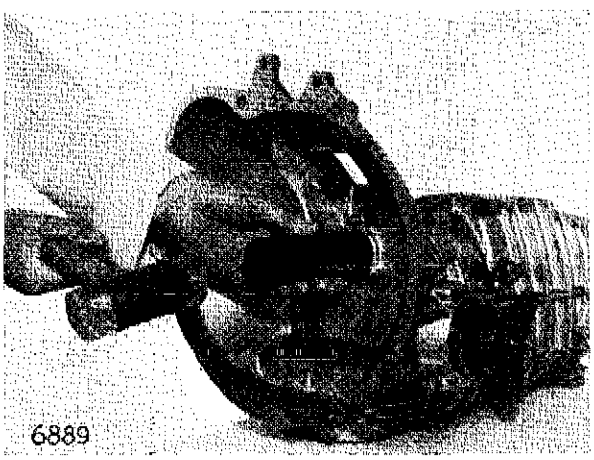


Fig. 55. *Fit clutch shaft oil seal*

Hypoid flange oil seals

The inner screwed ring MUST NOT be removed for oil seal renewal.

The hypoid flange oil seals can be renewed without removing the transmission unit from the car.

The unit should be at working temperature when removing the old seal.

Release pressure from the unit by removing the filler plug slowly. Replace filler plug hand tight.

To prevent loss of oil when the seal is removed, raise the vehicle at the appropriate side.

Remove the drive shaft and coupling from the differential shaft flange.

Be sure to mark the coupling and replace in exactly the same position relative to the differential shaft flange and drive shaft. (See page 8.)

Uncrimp and remove the nut securing the differential shaft flange (discard the nuts).

Pull off the differential shaft flange.

Remove the oil seal using Tool No. RG383. (See Fig. 56.)

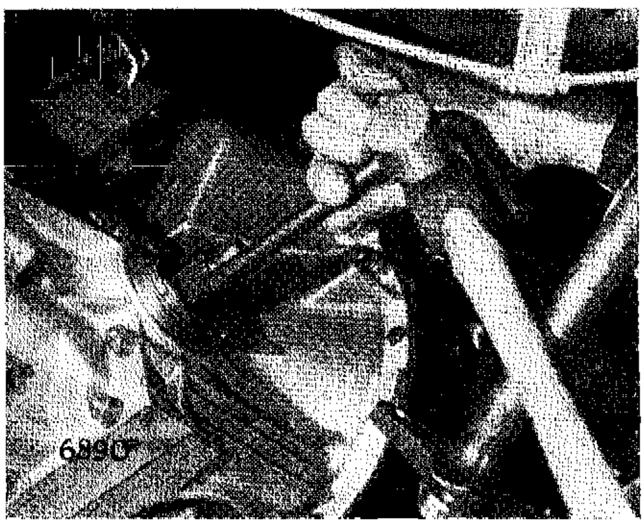


Fig. 56. *Remove hyphoid oil seal*

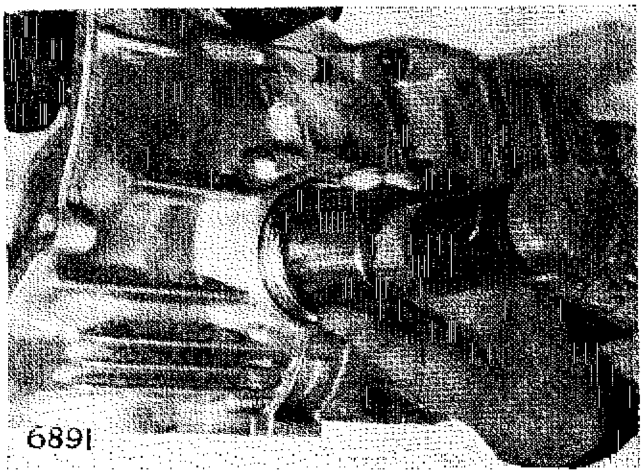


Fig. 57. *Fit hypoid oil seal*

Fit the new oil seal (lip inwards) over the differential shaft and into the inner screwed sleeve. The seal should be smeared with oil before fitting.

Using Tool No. RG366, tap the seal home into the screwed ring. (See Fig. 57.)

Refit the differential shaft flange and fit new nut.

Tighten the nut to the torque figure given in General Data and peen the collar of the nut into the slot in the shaft, using a blunt chisel shaped punch. Be sure to support the nut during this operation to avoid damage to the bearings.

Refit the drive shaft and coupling.

Top up oil level, if necessary, and tighten filler plug to the correct torque loading given in General Data.

REMOVE AND REFIT TRANSAXLE MOUNTINGS

Place the car on a lift or pit.

Check the wheels, and make sure the handbrake is in the "OFF" position.

Place a small jack under the transaxle casing, using a block of wood between the jack and the casing.

Remove the two retaining bolts in the mounting.

Jack up gently until the weight of the unit is taken off the mountings.

Loosen the nut on the bottom stud, which holds the mounting to the casing, and fit a locknut.

Lock the two nuts together, unscrew the stud and remove. Certain models are fitted with a set screw, in place of the stud.

The mounting may now be removed by adjusting the height of the jack, and by gentle leverage to compress the rubber, to allow the dowel on the mounting to be withdrawn from the top hole in casing.

To refit, enter the dowel first, lever the mounting into place, refit the stud, remove the locknut, fit the nut and spring washer and tighten up.

Lower the jack and allow the weight of the unit to position the mounting in the bracket.

Fit the retaining bolt.

RECLAMATION OF TAPPED HOLES IN TRANSAXLE CASINGS

This information is provided for reclaiming damaged threads in the transaxle aluminium casings, using Heli-coil inserts.

When fitting Heli-coil inserts, it is essential that the correct size insert is used, as given in the chart, page 35.

All inserts must be positioned 1 to 1½ pitches below the top face of the hole (see Fig. 58), except where otherwise stated.

Two taps are required, a roughing tap and a finishing, bottoming tap.

When using the finishing tap, it is important that the tap is run down to the specified depth and out again without backing off, i.e., do not reverse the direction of tap until the bottom of the hole is reached.

Always use a lubricant when tapping threads.

The chart gives full specifications for insert sizes, taps, inserting tools, etc., and the relevant information must be strictly adhered to for each application.

Refer to Section S for kit part numbers.

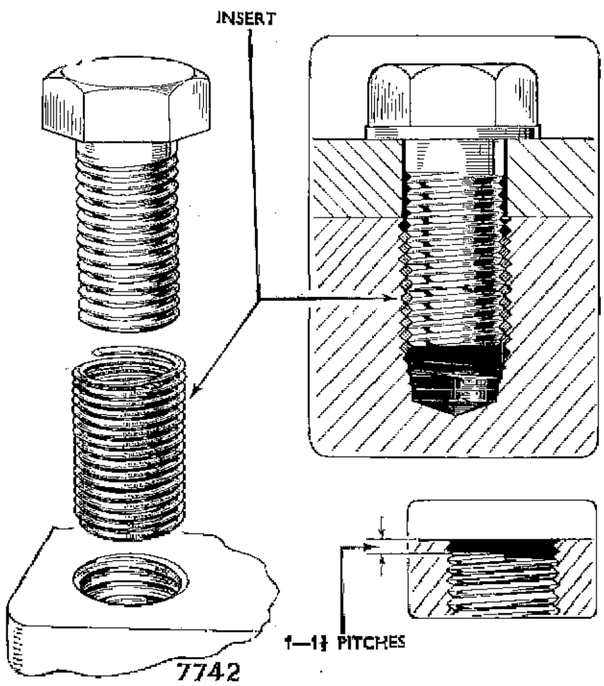


Fig. 58. *Heli-coil insert*

Unit	Area Affected	Drill Size	Thread Size and Finished Tap depth	Rough Tap No.	Fin. Tap No.	Heli-Coil Insert No.	Insert Tool No.	Tang Break-off Tool No.
Gearbox casing	Hypoid casing face	$\frac{5}{16}''$	$\frac{5}{16}''$ x 18 UNC x ·96″	5 CRU	5 CBB	3585–5CN x $\frac{5}{8}''$	3551–5	3580–5
	*Mounting cover	$\frac{5}{16}''$	$\frac{5}{16}''$ x 18 UNC x 1·00″	5 CRU	5 CBB	3585–5CN x $\frac{5}{8}''$	3551–5	3580–5
	Filler plug and Drain plug	$\frac{33}{64}''$	$\frac{1}{2}''$ x 14 BSP–through	8 PR	8 PB	1325–8CN x $\frac{1}{2}''$	PIP–8	Use pliers
	*Insert to be fitted to Dowel holes ·225″–·25″ deep from top face of hole.							
Clutch housing	†Hypoid casing face	$\frac{5}{16}''$	$\frac{5}{16}''$ x 18 UNC x 1·00″	5 CRU	5 CBB	3585–5CN x $\frac{5}{8}''$	3551–5	3680–5
	Clutch withdrawal lever clip stud	$\frac{5}{16}''$	$\frac{5}{16}''$ x 18 UNC x ·96″	5 CRU	5 CBB	3585–5CN x $\frac{5}{8}''$	3551–5	3580–5
	†Top dowel hole insert must be positioned ·225″–·25″ below top face of hole. Bottom dowel hole insert must be positioned ·275″–·30″ below top face of hole.							
Mounting cover	Mounting rubber face	$\frac{5}{16}''$	$\frac{5}{16}''$ x 18UNC–through	5 CRU	5 CBB	3585–5CN x $\frac{5}{8}''$	3551–5	3580–5

Insert removal tools are available: For inserts $\frac{1}{8}''$ to $\frac{3}{8}''$ inclusive. Part No. 1227-6.
For inserts $\frac{7}{16}''$ to 1·0″ inclusive. Part No. 1227-16.

TRANSAXLE FAULT FINDING AND RECTIFICATION

These transaxle fault finding and rectification pages are issued as a guide, and to give assistance in deciding what to look for and what steps to take to locate and rectify any particular fault.

It will be appreciated that different causes produce different effects, and it is impossible to provide the answers to all problems.

Refer to General Data for all Torque Loadings.

Draining transaxle unit

Unscrew filler plug first to release any pressure. If the unit is hot, take care to avoid being scalded by hot oil. 4½ pts. (2·5 litres) should be drained. If oil is black and quantities of 3½ pts. (1·9 litres) or less are obtained, the unit must be stripped to check bearings, bushes etc., for damage.

OIL LEAKS

Gear selector shaft

Remove any rust, and check for binding in the casing. Renew "O" ring and ensure that the protection sleeve is tight on the shaft, but free to move on the casing.

Casing leaks

Tighten nuts to correct torque and re-test. If the leak is still evident remove the unit from the vehicle and dismantle to the extent required to expose the suspect faces. Clean all exposed joint faces with carbon tetrachloride, and check for burrs, bruises, taking care not to damage the sealing faces. Using Hylomar jointing compound lightly cover all jointing faces and reassemble the unit, using Stag sealing compound at the stud adjacent to the drain hole.

Fit a new oil seal to the clutch primary shaft if this has been disturbed. Refill transaxle with the correct grade and quantity of oil. If a leakage is apparent from the end mounting cover, the reverse idler shaft should be checked to ensure that it is correct to specification. The correct length is 3·312 in. (3·33 cm.) maximum, and if the shaft length is found to be in excess of this figure, a replacement reverse idler shaft must be fitted.

Drain and filler plugs

Remove the plug and clean off any burrs on the plug or transaxle casing. Check for crossed or stripped threads. If damaged, a Helicoil insert should be used as described in this Manual. Refit the plug, using a new sealing washer, and tighten to the correct torque.

Detent plug

Check as for drain and filler plugs. If threads are damaged DO NOT attempt to rectify, but always renew the rear cover. Examine the plug sealing face on the inside of the mounting cover, and carefully remove any signs of damage, burrs, etc. Should it be necessary to reface the cover, take great care to remove the minimum amount of metal, otherwise the detent spring may become coil bound. Should this condition occur, a steel washer, Part No. 9067241 must be fitted between the existing sealing washer and the head of the plug. Coat the steel washer on both sides with Hylomar jointing compound.

Replace the detent ball and spring and tighten the plug to the specified torque figure.

Clutch shaft oil seal

Always renew oil seal, as the face may be worn, even if it is not obvious. Remove and check shaft for damage to sealing areas. If damaged, the shaft must be replaced.

Differential flange nut and oil seal

First try tightening flange nut to correct torque. Change oil seal. Check flange sealing face for damage, and renew flange if suspect. If oil is leaking past the nut, check the depth of the counterbore at the flange chamfer. If deeper than ·040 in. (1·0 mm.) the flange may be trapped between the differential cage and the nut, instead of between the differential shaft shoulder and the nut, and the oil will seep out. Change the flange for one with a shallower counterbore. Always replace the nut and seal flange chamfer and nut face with Hylomar. Tighten nuts to correct torque.

Inspection cover

Remove the inspection cover and "O" ring and examine the Hypoid casing for burrs, or foreign matter. When refitting cover a new "O" ring Part No. 9107099 should be used.

Inner and outer screwed sleeve

Remove differential shaft flanges, inspection cover, and split the hypoid casing. Remove crown wheel and pinion together with the screwed sleeves. Replace the inner screwed sleeve oil seal. Examine the differential shafts in the oil seal bearing area. If damaged, replace the shaft. Fit replacement "O" rings between the inner and outer sleeves. Fit a replacement clutch oil seal.

Prior to reassembly, coat the hypoid casing faces with Hylomar jointing compound, and ensure that the outer sleeve casing area is adequately covered.

When fitting the differential shaft flanges, carefully coat the inner cone seating with Hylomar jointing compound, taking care not to get the compound on the oil seal faces.

Torque all nuts to the correct figure.

General

While the transaxle is separated from the engine, the opportunity should be taken to examine the bolts securing the flywheel to the crankshaft, and the plug at the end of the oil gallery (behind the flywheel). Oil leaks from both these sources, can be dealt with by sealing the threads with Wellseal jointing compound.

GEAR CHANGE

'Notchy' change

Detent tube loose, or incorrectly assembled. Change rear cover. Check that the tube in the new cover protrudes approximately ·015 in. (·38 mm.) into the counterbore. This may be ascertained by sighting through the selector shaft bore, and seeing that the end of the tube is nearly level with the bottom face of the main part of the bore, but not above it. Check tightness of bolt securing gear change flexible coupling to selector shaft.

Check that the cross pin in the gear lever ball is not off centre.

Sticky across gate

Interlock plate too thick, or boss in end cover too shallow. Loosen off end cover nuts. If gearchange now free, then either of these conditions apply. Measure the interlock plate, and if any part is ·2495 in. (6·33 mm.) or more, it is too thick, and must be changed for one below this limit.

If the interlock plate is below this limit, then the end cover is at fault and must be changed. If still no cure, the "O" ring groove in the main selector shaft may be too shallow. Remove the "O" ring and recheck. If a cure is effected, change the selector. Check also for a bent selector shaft.

1st gear baulk

Heavy pressure required to engage 1st gear while moving, but engagement easy when stopped. Examine 1st gear and baulk ring, change if suspect, but in any case, stone the rear edge of the gear synchro cone as shown in the illustration (Fig. 59). Check for worn baulk rings. Lightly lap the baulk ring on to the gear cone. With the baulk ring pressed on to gear cone, there should exist a minimum of gap of ·025 in. (·63 mm.) between the baulk ring and the face of the gear. If less than this, the baulk ring is worn or oversize and must be changed.

This check applies to all the baulk rings in the box.

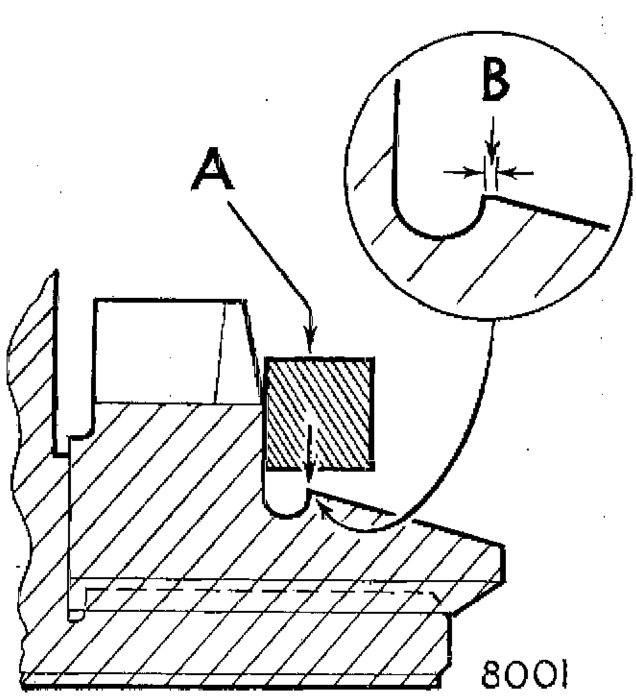


Fig. 59. *Use stone (A) to remove peak of cone at (B).*

Difficult to engage 1st/2nd gears

Very high engagement force, but if the lever is held away from the reverse stop, becomes easier. Replace interlock plate, reverse plunger and main selector.

'Notchy' across gate

Gear selector shaft and fork not in correct relationship with milled slots. Change shaft and fork assembly.

Reverse plunger sticks in or reverse latch too hard

Bore in casing too rough, plunger has sharp edges. Plunger may be undersize, or profile distorted. Polish bore, check diameter of plunger against others in stock if not distorted. Replace if necessary. Interlock plate too thin. Check against others in stock and replace with one at least ·001 in. (·025 mm.) thicker.

Jumping out of gear

Replace the offending driven gear, bush, synchro hub/sleeve assembly including Woodruff key if 3rd/4th gear and selector fork assembly, with new parts.

If 3rd/4th gear, check also for hub being a sloppy fit on pinion shaft. If pinion shaft badly scored, or worn ·0005 in. (·012 mm.) or more on diameter, change crown wheel, differential ouput shaft, and Woodruff key. Check that the detent mechanism in the gearbox mounting cover is satisfactory. If the other selector fork assembly and synchro hub/sleeve assembly show signs of wear, replace these also.

No drive in all gears

Muff coupling adrift/broken

Remove differential flanges and spring rings from screwed sleeves, and slack off inner screwed sleeves. Remove clutch housing and fit new oil seal. The muff coupling may have moved off the input shaft due to the circlip not seating correctly in the groove. The cause may be that the needle bearing is not fully home in the housing. Check this if circlip will not seat, and *only if absolutely necessary* is it permissible to support very solidly the reverse gear end of the input shaft, and lightly tap home the inner sleeve of the needle bearing.

May also be caused by insufficient radial movement of clutch shaft. Screw the shaft fully home then slacken back at least one spline. With the muff coupling and circlip fitted, the spigot end of the clutch shaft should have at least ·10 in. (2·7 mm.) up and down movement.

No drive in 3rd or 4th gears

Check 3rd and 4th gears on input shaft. Gears may be rotating on shaft. Change input shaft.

Too much travel across gate

Check for control shaft coupling failing in torsion, or clamp slipping on selector. Tighten pinch bolt or replace coupling as necessary.

Difficult selection, all gears

Check that the rear bearing of the gearchange tube is clean and greased, and the shaft is free in the nylon bush. If satisfactory check selector shaft for binding against the side of the casing bore. If selector is binding clean rust from selector shaft, remove rear cover, and bore out the seven stud holes to 23/64 in. (9·1 mm.) to permit better alignment of the cover to shaft. Check shaft for truth. Renew "O" ring. Coat all mating faces with Hylomar jointing compound. If still not satisfactory check for oversize synchro dog teeth, tight synchro hubs and sleeves, burrs on components or incorrectly assembled detent tube. Replace defective parts.

Difficult selection, 1st gear

Check 1st gear dog teeth, if burred—replace 1st gear. Remove the top edge of the cone by stoning carefully all the way round (See Fig. 59). This must be done whether a new gear or the old gear is used.

No gear obtainable

Check for bent selector, or seized bushes. Check for security of selector fork on shaft. Detent ball may be jammed and/or detent tube moved. Replace defective parts.

Rattle under light load

May be clutch push rod rattle caused by lazy piston in the slave cylinder. When rattle occurs check push rod for looseness, and if loose change the slave cylinder. If satisfactory check clutch for excessive run out. Max. permissible run-out ·025 in. (·63 mm.) on thrust pad face. If excessive replace clutch assembly.

May also be muff coupling rattle. Check for eccentric stud holes in clutch and input shafts. Slide back muff and line up shafts to minimise eccentricity. Check for muff circlip adrift.

In both these cases refer to the instructions under the heading "Muff coupling adrift/broken" with particular attention to the last two paragraphs.

Seizure

If any bushes are seized, check for low oil level, and oil discolouration, (See first paragraph under **"OIL LEAKS"**). If satisfactory, check for shallow keyway in differential output shaft, by ensuring that the hub is able to pass freely over the key, when in position on the shaft. If the hub fouls the key, then the keyway is too shallow, and the shaft must be changed.

May be caused by the bushes not being clamped during assembly, due to oversize chamfers in synchro hubs, 4th speed and preload washers. Replace all damaged and suspect parts.

This last item is most unlikely, but may be the answer to an obscure seizure.

End float on pinion and hypoid bearings

Most likely caused by faulty assembly. In the case of the pinion bearings, check preload washer chamfers, and also the radius on the corner of the preload washer corner on the shaft. Ensure that the preload washer is able to seat fully on the shoulder, and not be held off by a foul with the corner radius. Hypoid bearing end float can be caused by sticky screwed sleeves giving a false 'nip' position.

General notes

After removing the combined engine and transaxle unit from the vehicle, the greatest care must be exercised when dividing the two units. The transaxle must not be allowed to hang on the primary shaft in the clutch centre plate, otherwise the plate will be damaged. It is equally important that the same care be taken during reassembly.

Remember that absolute cleanliness at all times is essential, when undertaking repairs to this unit.

Check all new parts for cleanliness, remove any burrs or swarf which may be lodged in oil holes etc., and remove all sharp edges from gears, synchro cones etc., by careful stoning.

THE VAN TRANSAXLE

The van transaxle part No. 7050133 may be identified by a band of dark blue paint on the gear case from the top down to the level plug. This indicates that the transaxle is fitted with specially hardened

Reverse pinion 7104293
and Reverse idler gear 7104295.

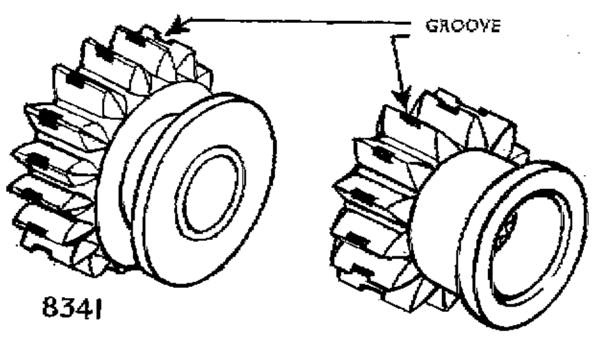


Fig. 60. *Identification of reverse idler gear and pinion*

These reverse gears may be identified by the groove cut in each of the gears, See Fig. 60. These harder gears are used with reverse gear part No. 7104091 which is NOT to the same harder specification and so carries no groove.

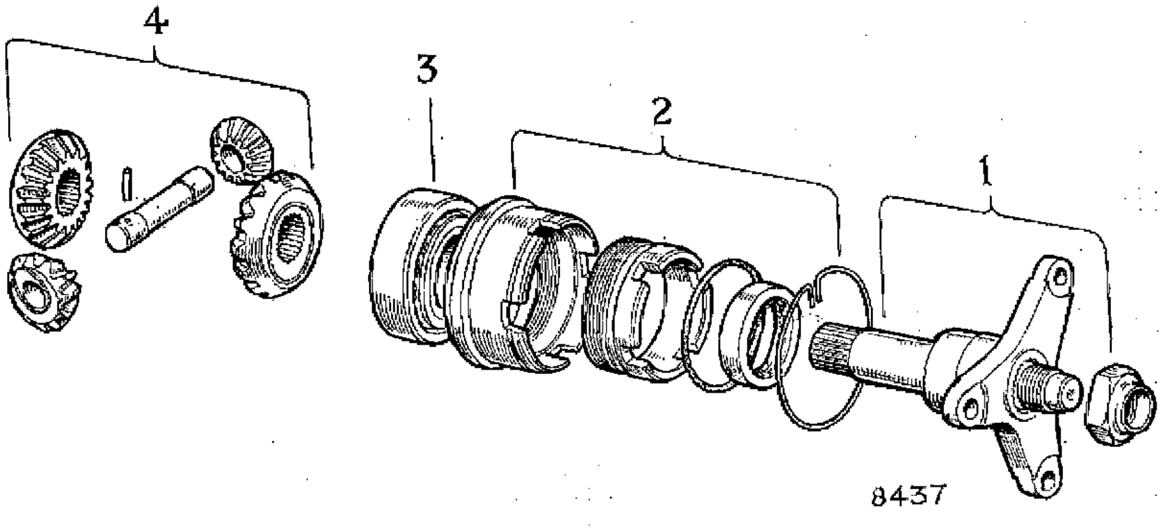
The harder idler gear and pinion may be used as replacements for earlier idler gear and pinion if replaced as a pair, but the earlier parts MUST NOT BE USED in a van transaxle.

ADDITIONAL INFORMATION

Interference fit differential shaft flanges

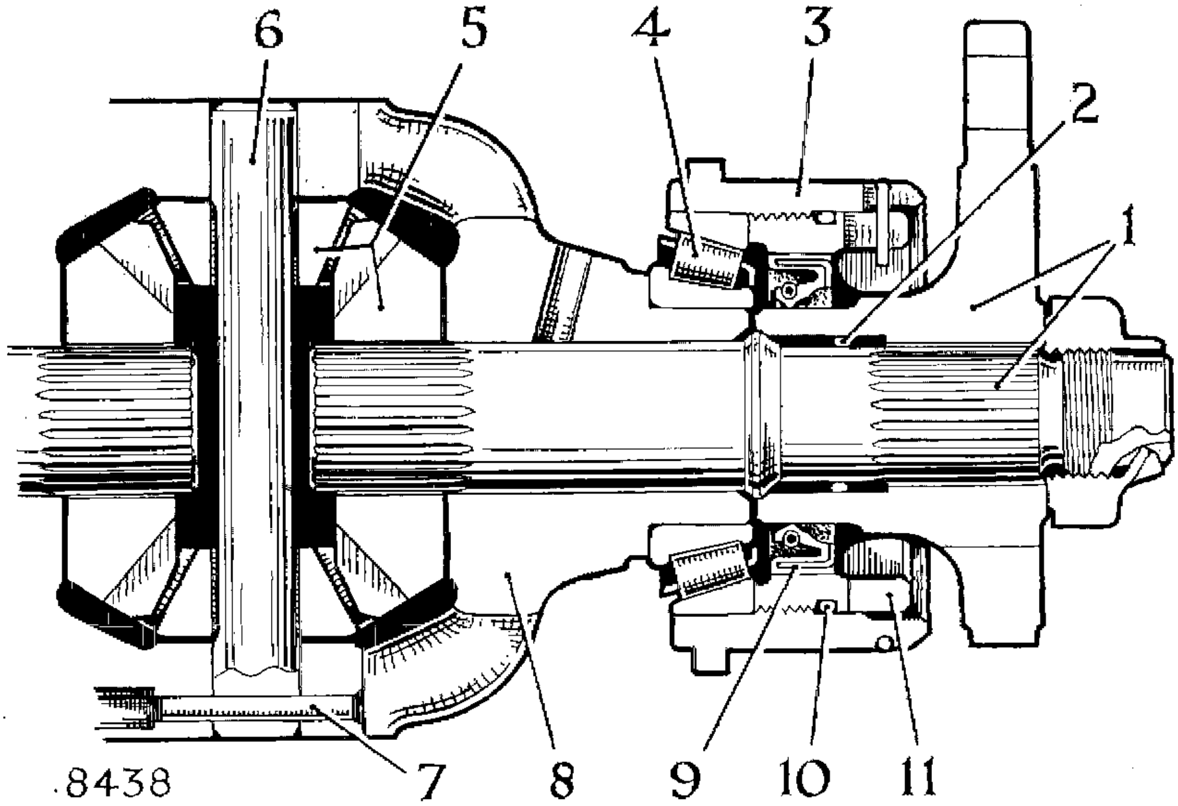
With this type of flange/shaft assembly, the inner circlip is deleted.
Identification is by paint on the clinch nut, but in later production the clinch nut is deleted, and the end of the shaft is level with the face of the flange.
Once fitted together, the flange is not detachable from the shaft and will, therefore, be serviced as a complete assembly.
For those fitted with a clinch nut, it will not be necessary to remove the clinch nut for any reason whatever.
The assembly is interchangeable with all existing units, and will replace the older type in service.

NOTE. To prevent the flange/shaft assembly being pulled, or falling from the unit if the rubber couplings are disconnected or the unit is removed from the car for any reason it is important that a Transaxle fitted with interference type flanges MUST have the flanges wired to the casing.
The instructions given on Page 32 of this Section for the hypoid flange oil seals must be strictly adhered to, but to remove the flange/shaft assembly, it is only necessary to withdraw it from the casing.
It must be further noted that during re-building, the hypoid oil seals in the inner screwed sleeves MUST be fitted last, after all adjustments are made, as constant removal and refitting of the differential shafts during these operations could damage the oil seal faces.



1. DIFFERENTIAL FLANGE/SHAFT ASSEMBLY
2. SCREWED SLEEVE ASSEMBLY
3. BEARING
4. DIFFERENTIAL GEARS AND CROSS PIN ASSEMBLY

Fig. 61. *Exploded view of drive flange/shaft assembly*



1. DIFFERENTIAL FLANGE/SHAFT ASSEMBLY
2. 'O' RING
3. OUTER SCREWED SLEEVE
4. BEARING
5. DIFFERENTIAL GEARS
6. DIFFERENTIAL CROSS PIN
7. LOCKING PIN
8. DIFFERENTIAL CASING
9. OIL SEAL
10. 'O' RING
11. INNER SCREWED SLEEVE

Fig. 62. *Sectional view of drive flange/shaft assembly*

FRONT SUSPENSION

SECTION F

CONTENTS

FRONT SUSPENSION

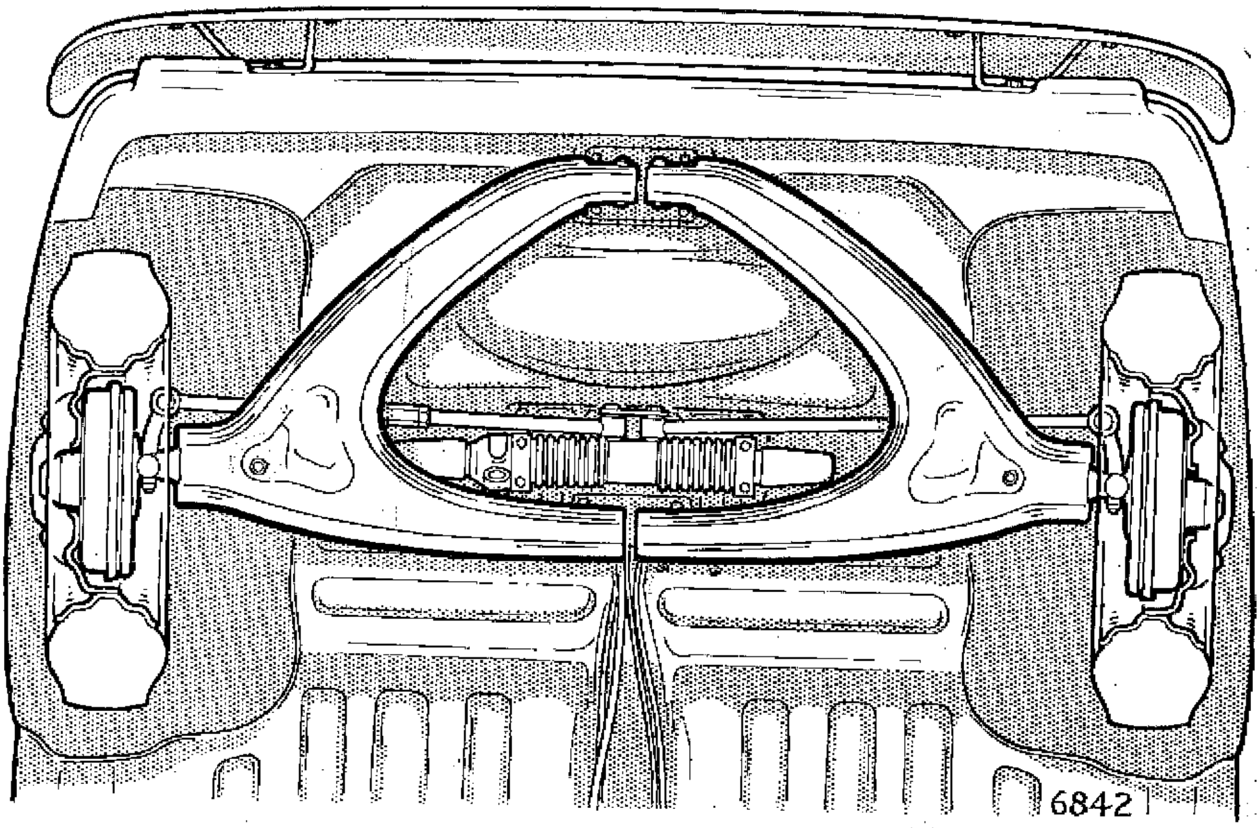


Fig. 1. *View of front suspension from beneath the car*

DESCRIPTION (See Fig. 1)

The front suspension is of the coil spring and wishbone type with king pin mounted stub axles to form a swing axle with parallel steering.

The inner ends of the wishbones have pressed in metal and rubber bonded bushes and pivot in front and rear brackets attached to the floor assembly of the car.

Road shocks are absorbed by coil springs which are controlled by telescopic shock absorbers situated inside the coil springs and located between brackets in the front wheel arches and on the outer end of the wishbones adjacent to the hub and king pin assemblies.

The camber, castor and king pin inclination angles are all built in and no adjustment is needed or provided. Front wheel alignment is set by ADJUSTING THE LENGTH OF THE RIGHT HAND TRACK ROD of the steering unit.

The steering unit is mounted on the front section of the rear support bracket.

MAINTENANCE

Maintenance checks will be required at regular intervals as given in the "Owner's Handbook" or "Owner's Service Book" and will include the following:

i. Checking the security of the bolts in the wishbone pivots, suspension brackets, king pin carriers and shock absorber mountings.

ii. Checking the alignment of the track rod ball sockets and the tapered ball pins.

iii. Checking front hub endfloat.

iv. Checking front wheel alignment.

v. Lubricating stub axle king pins.

vi. Repacking front hub bearings with grease.

vii. Checking the rubber bushes of the shock absorbers and wishbone pivots for damage and deterioration.

STEERING ALIGNMENT SETTINGS AND OPERATIONS

The following paragraphs give instructions for checking and correcting front wheel alignment (toe-in) followed by checking camber, castor and king pin inclination angles.

To avoid inaccuracies the car is not weighted down to the static laden height but lifted up onto gap gauges to a particular height as described under "Preparations of the Car".

TOOLS AND APPLIANCES

There are many types of tools for checking the front suspension but in every instance it is important that the manufacturers' instructions are carefully observed.

The following tools will be required:

i. Front Wheel Alignment Gauge.

ii. Camber, Castor and King Pin Inclination Gauges including front wheel turntable gauges and rear wheel ramps.

REGARDLESS OF THE TYPE OF TOOL USED IT IS IMPERATIVE TO OBSERVE THE INSTRUCTIONS GIVEN UNDER "PREPARATION OF THE CAR".

GAP GAUGES

Front: 11·00 in. (27·9 cm.) 1 off. Cars and Van.

Rear: 10·30 in. (26·2 cm.) 2 off. Cars only.

Rear: 11·50 in. (29·2 cm.) 2 off. Van only.

When the car is mounted on turntable gauges and wooden ramps, the thickness of these must be added to the above dimensions.

The gap gauges can be made locally from a 2 in. × 3 in. (50 × 76 mm.) wooden batten and cut squarely to the dimension required; they should be labelled whether their use is with or without the turntable gauges and wooden ramps.

The 2 in. (50 mm.) wide section on the upper end of the front gap gauge is reduced to ½ in. (12·7 mm.) wide by a downward and inclined saw cut. Thus, the gap gauge will fit accurately within the swaged section of the front suspension wishbones beneath the pivot bolts.

The 3 in. (76 mm.) wide section on the upper end of each of the two rear gap gauges, is reduced to 1·0 in. (25 mm.) wide by a downward and inclined saw cut. Thus, each gap gauge will fit accurately beneath the suspension arm and within the bracket on the rear crossmember.

The front gap gauge is positioned beneath the front or rear pivot bolts in the inner ends of the front suspension wishbones.

The rear gap gauges are positioned one beneath each outer pivot bolt in the two rear suspension arms and within the pivot bolt brackets attached to the rear crossmember.

PREPARATION OF THE CAR

The car must be standing on perfectly level ground or shop floor.

The tyres must have the same amount of wear and be inflated to the normal running pressures.

The front hub bearings must have the correct amount of endfloat, see under "Front Suspension—General Data Section".

The front wheels must be checked for "run-out", see under "Checking Wheel and Tyre Run-Out—Wheels and Tyres, Section L". Depending on the type of checking gauge in use, the points of maximum "run-out" are positioned so they are clear of the contact points of the checking gauge.

Keep the front wheels in the straight ahead position and gently roll the car forward until the front wheels are on the turntable gauges and the rear wheels on the wooden ramps, the latter will keep the car in a level plane. Stop the car without the application of the brakes so the free condition of the turntable gauges is not disturbed.

Lock all four wheels by blocking the brake foot pedal in the down position.

Lift up the front of the car approximately 1 in. (25 mm.) and position the front gap gauge beneath the pivot bolts in the front or rear inner ends of the two wishbones so it is equi-distant under the end of each wishbone.

Lift up each rear corner of the car approximately 1 in. (25 mm.) and position the rear gap gauges (upper cut-away section towards the rear of the car), one beneath each outer pivot bolt in the rear suspension arms and between the forks of the pivot bolt brackets attached to the rear crossmember.

CAMBER ANGLE

Camber angle is the angle of inclination of the front wheel from the vertical when viewed from the front. Outward inclination at the top of the wheel is termed "positive" while inward inclination is termed "negative".

The camber angle is built into the front suspension and cannot be adjusted but must be checked in the event of accident damage to ensure the angle is within the specified figure.

When the camber angle is outside the specified limits, the front suspension assembly must be dismantled and each detail examined for wear and accidental damage.

To check

1. Prepare the car, see under "Preparation of Car".

2. Apply a suitable camber angle checking gauge to the wall of the tyre and check the camber angle, taking care to follow the manufacturer's instructions avoiding any front wheel run-out which should be positioned horizontally and the bulge in the tyre above its point of contact with the ground. Note the gauge reading.

3. Carry out the same procedure with the opposite front wheel and make a note of the camber angle.

4. If the camber angles are incorrect, the front suspension must be dismantled and each detail examined for wear and accidental damage.

FRONT WHEEL ALIGNMENT (TOE-IN)

Front wheel alignment is the setting of the front wheels so that the distance between the front of the wheels is less than that at the rear.

The correct wheel alignment (toe-in) is given in the "General Data Section".

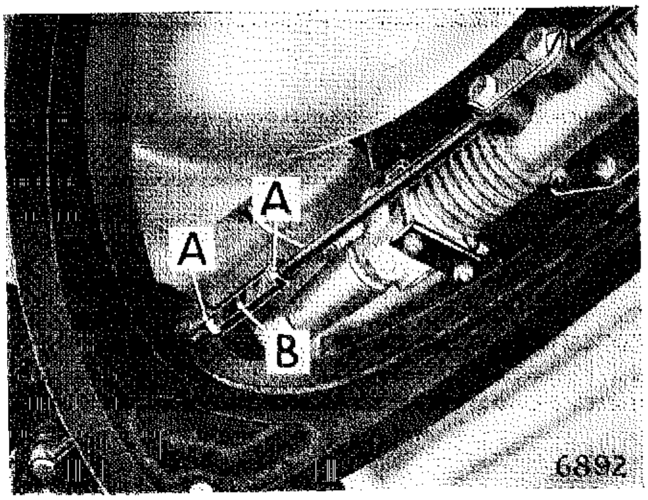


Fig. 2. *The adjustable right-hand track rod*

A. LOCKNUTS

B. CENTRE PIECE

To check and adjust (See *Fig.* 2)

1. Ensure that the front tyres have the same amount of wear, are inflated to the fully loaded pressure; the front wheels have attained their normal running attitude, they are in the straight ahead position and the car is standing on a perfectly level floor.

2. Check the front wheel alignment (toe-in) with a suitable gauge following the manufacturer's instructions and avoiding any tyre run-out which should be positioned vertically.

3. If the alignment is found to be incorrect, slacken the locknuts on the right hand track rod while holding the centre piece steady.

4. Rotate the centre piece in the appropriate direction until the correct alignment is obtained.

5. Lock the centre piece with the locknuts ensuring the right hand ball pin is centrally disposed in its socket.

CASTOR ANGLE

Castor angle is the angle of inclination of the king pin centre line from the vertical when viewed from the side. Rearward inclination at the top from the centre line is termed "positive" while forward inclination is termed "negative".

The castor angle is built into the front suspension and cannot be adjusted but must be checked in the event of accidental damage to ensure the angle is within the specified figure.

When the castor angle is outside the specified limits, the front suspension assembly must be dismantled and each detail examined for wear and accidental damage.

To check

1. Prepare the car. See under "Preparation of Car".

2. Roll the car forward, the front wheels onto turntable gauges and the rear wheels onto blocks or ramps of the same thickness as the turntable gauges. It is important that the front wheels remain in the normal running attitude and the car is kept level while it is standing on the turntable gauges; apply the handbrake.

3. Apply a suitable castor angle checking gauge to the wall of the tyre and check the castor angle, taking care to follow the manufacturer's instructions, avoiding any front wheel "run-out" which should be positioned horizontally and the bulge in the tyre above its point of contact with the ground. Note the gauge reading.

4. Carry out the same procedure with the opposite front wheel and make a note of the castor angle.

5. If the castor angles are incorrect, the front suspension must be dismantled and each detail examined for wear and accidental damage.

KING PIN INCLINATION

King pin inclination is the angle the king pin centre line is inclined inward from the vertical when viewed from the front.

The king pin inclination angle is built into the front suspension and cannot be adjusted. It remains correct providing the camber angle is correct but must be checked in the event of accidental damage to ensure the angle is within the specified figure. The relationship between the king pin inclination and camber angles is such that the king pin inclination angle will alter as the camber angle alters. The check is carried out in conjunction with camber and castor angle checks.

When the king pin inclination angle is outside the specified figure, the front suspension assembly must be dismantled and each detail examined for wear and accidental damage.

To check

1. Check the camber angle, see under "Camber Angle—To check", if this angle is found to be incorrect the front suspension must be dismantled and each detail examined for wear and accidental damage.

2. When the camber angle is correct apply a suitable king pin inclination checking gauge to the wall of the tyre and check the king pin inclination angle, taking care to follow the manufacturer's instructions, avoiding any front wheel "run-out" which should be positioned horizontally and the bulge in the tyre above its point of contact with the ground. Note the gauge reading.

3. Carry out the same procedure with the opposite front wheel and make a note of the king pin inclination angle.

4. If the king pin inclination angle is incorrect, the front suspension must be dismantled and each detail examined for wear and accidental damage.

ACKERMAN ANGLES (Toe-out on turns)

The steering of the car is parallel and therefore ACKERMAN ANGLES DO NOT EXIST and no useful purpose is served by checking.

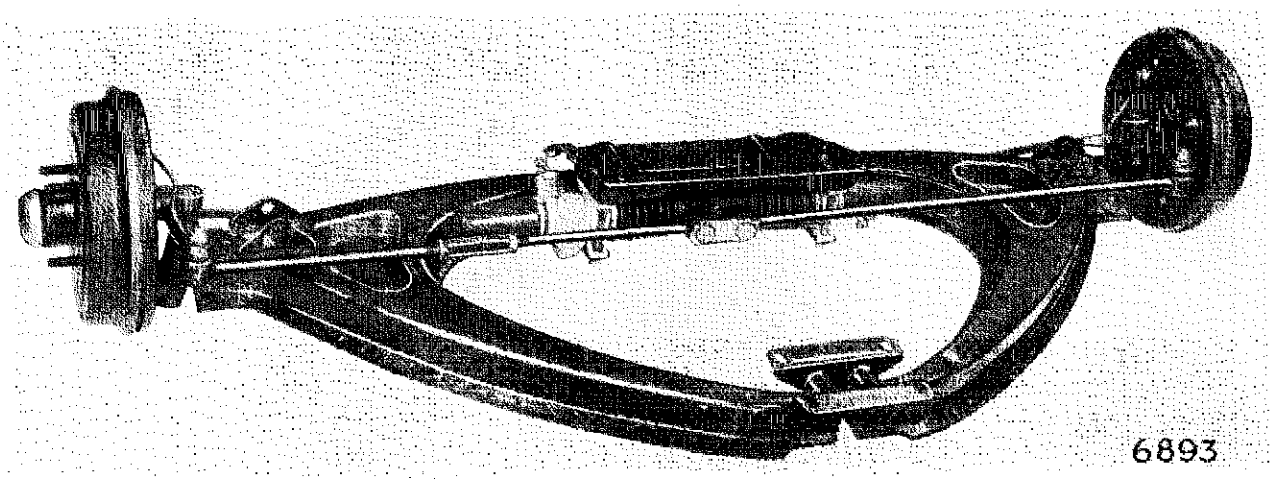


Fig. 3. *The front suspension assembly removed from the car*

FRONT SUSPENSION ASSEMBLY

To remove and refit (See Fig. 3)

1. Apply the handbrake, jack up the front of the car and SUPPORT ON STANDS POSITIONED UNDER THE OUTSIDE FLOOR RIB AND APPROXIMATELY 2 TO 3 FEET (0·6 TO 0·9 METRES) BEHIND THE FRONT WHEEL ARCH.

2. Remove both front wheels.

3. Disconnect the rigid hydraulic brake pipe from the flexible hose mounted in a bracket beneath the front wheel arch and detach the flexible hose from the bracket; see "Brakes, Section K".

4. Identify the lower end of the inner steering column to the splined pinion of the steering unit to facilitate refitting; remove the pinch bolt and detach the column by lifting up the steering wheel approximately 2 in. (50 mm).

5. Withdraw the speedometer cable from the inside face of the left hand stub axle by withdrawing a screw and forked plate, taking care to collect the rubber washer positioned between the metal end of the outer casing and the stub axle. See Fig. 5.

6. Detach the front and rear support brackets from the floor assembly by withdrawing four bolts and washers from the front bracket, four bolts and washers from the floor inside the car after the floor covering has been rolled back and lower the brackets down by withdrawing four bolts and washers from the front edge of the rear bracket beneath the car.

7. Take the weight of the suspension assembly using a trolley jack and A STOUT PLANK OF WOOD, positioning the latter transversely under the two wishbones and so the jack pad is towards rear edge of the plank of wood.

8. Detach the two lower ends of the shock absorbers from the brackets on the top face of the wishbones by removing two nuts, bolts and washers.

9. Lower the suspension assembly down, easing the speedometer cable through the right hand side of the rear bracket and remove the suspension assembly from beneath the car on the trolley jack.

10. The two front springs and shock absorbers can be removed from the wheel arch brackets by detaching the upper mountings of the shock absorbers and controlling the expansion of the spring.

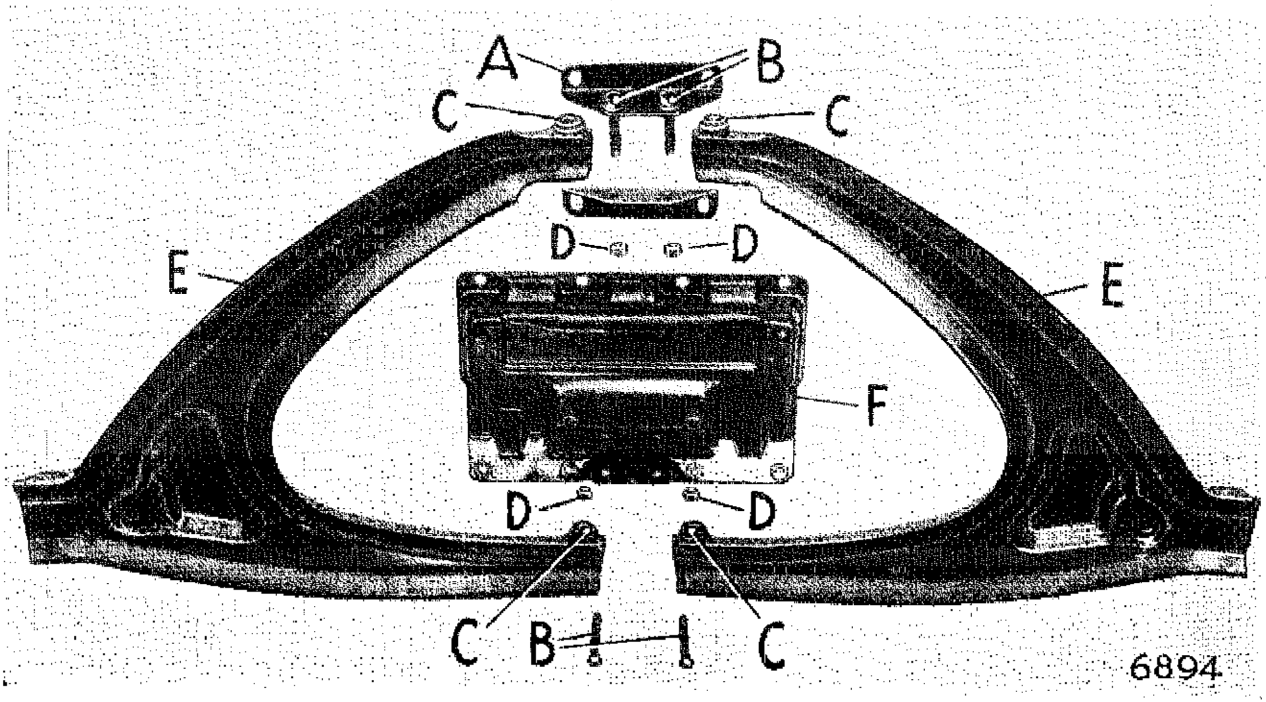


Fig. 4. *Exploded view of front suspension wishbones and brackets*

A. FRONT BRACKET
B. PIVOT BOLTS
C. METAL AND RUBBER BONDED BUSHES
D. SPECIAL LOCKING NUTS
E. WISHBONE
F. REAR BRACKET

11. Refitting is the reverse of the removal sequence but particular attention must be given to the following:—

    i. THE FORWARD EDGE OF THE REAR SUPPORT BRACKET IS ATTACHED TO THE FLOOR ASSEMBLY FIRST, followed by the rear edge from inside the car and then the front support bracket; the bolt holes in the latter are elongated to accommodate any build up of manufacturing tolerances.

    ii. THE RUBBER WASHER ON THE END OF THE SPEEDOMETER OUTER CASING IS NOT OMITTED.

    iii. The hydraulic system is bled of air see "Brakes, Section K".

    iv. The nuts and bolts which secure the wishbones to the front and rear support brackets and the shock absorbers to the outer ends of the wishbones are fully tightened only when the weight of the car is on the roadwheels.

To dismantle and reassemble (See Fig. 4)

1. Detach the outer ends of the two track rods from the steering levers by removing a nut from each ball pin and using a suitable extractor, RG284.

2. Remove the steering rack unit from the rear support bracket by removing four nuts and washers, two reinforcing plates and bridge pieces from the two "U bolts"; collect two more bridge pieces from beneath the rack unit and withdraw the two "U" bolts from the support bracket.

3. Withdraw the hub and king pin assemblies from the outer ends of the wishbones by removing two nuts, bolts and washers each and drifting the king pin carriers out of the wishbone pressings.

4. Detach the two wishbones from the front and rear support brackets by removing two nuts and bolts each, see under "Inner Wishbone Attachment".

5. Reassembly is the reverse of the dismantling sequence but particular attention must be given to the following:—

    i. The rear support bracket is offered up so the edge having the weld-nuts is towards the rear and the heads of the wishbone pivot bolts are also towards the rear.

    ii. THE NUTS OF THE FOUR WISHBONE PIVOT BOLTS ARE IF NECESSARY RENEWED see under "Inner Wishbone Attachment" and THEY ARE FULLY TIGHTENED ONLY WHEN THE WEIGHT OF THE CAR IS ON THE ROADWHEELS.

    iii. The hub and king pin assemblies are fitted to the wishbones so the steering arms point forwards.

    iv. The steering rack unit is fitted to the front of the rear support bracket but the "U" bolts are left slack until the steering column has been secured to the splined shaft.

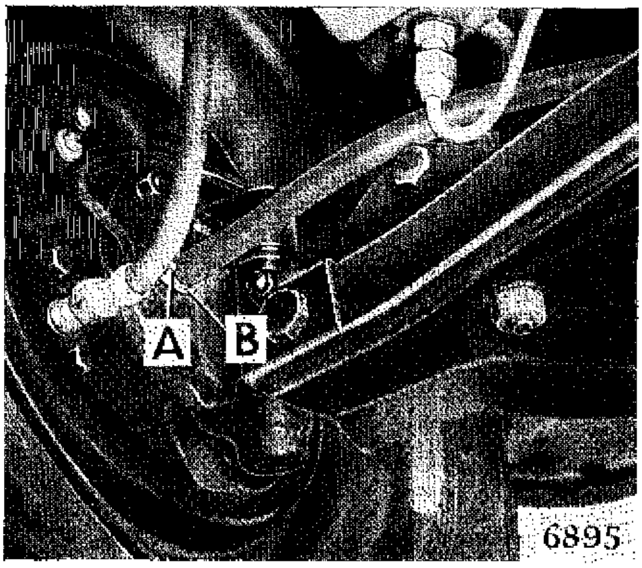


Fig. 5. *Speedometer drive to left-hand front wheel*

A. RETAINING BOLT

B. FORKED PLATE WITH RUBBER WASHER BENEATH

SPEEDOMETER DRIVE (See Figs. 5 & 6)

The speedometer drive is taken off the left-hand front wheel. The inner cable of the flexible speedometer drive is fed through the hollow centre of the stub axle and connects with a cam fitted beneath the hub dust cap. A peg pressed into the dust cap completes the drive, thus the inner cable of the flexible speedometer drive rotates with the hub.

The outer cable of the flexible speedometer drive abuts to the inside face of the stub axle.

To remove and refit

1. Prise off the nave plate and hub dust cap from the left hand front wheel and withdraw the speedometer cam from the centre of the stub axle.

2. Detach the outer cable from the inside face of the stub axle by withdrawing a screw and a forked plate, taking care to collect the rubber washer positioned between the metal end of the outer casing and the stub axle.

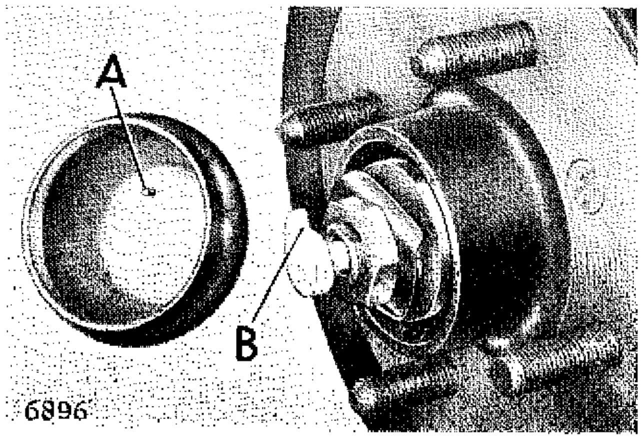


Fig. 6. *Speedometer drive in left-hand front hub*

A. PEG IN HUB DUST CAP

B. SPEEDOMETER CAM

Refitting is the reverse of the removal sequence, but particular attention must be given to the following:—

Should the speedometer driving peg in the left-hand hub dust cap become loose, a new replacement must be fitted after closing the hole in the dust cap slightly with light blows of a round nosed hammer.

HUB ASSEMBLY

To remove and refit (See Fig. 7)

1. Apply the handbrake, jack up the front of the car and remove the appropriate front wheel.

2. Remove the brake drum by slackening off all brake shoe adjustment and withdrawing a countersunk screw.

3. Prise off the hub dust cap and in the instance of the left hand front wheel withdraw the speedometer cam from the centre of the stub axle.

4. Release the tabwasher and remove the locknut followed by the tab-washer, the adjusting nut and "D" washer from the stub axle.

5. Pull the hub off the stub axle and remove the inner cone of the outer taper bearing; the inner cone of the inner taper bearing can be removed by prising out the grease seal. The outer races of both taper bearings can be drifted out of the hub shell as necessary. When the grease seal has worn a groove in the stub axle distance piece, the latter must be chiselled off and a replacement pressed on.

6. Refitting is the reverse of the removal sequence but particular attention must be given to the following:—

   i. Pack the hub and inner cone assemblies with grease of the correct grade, see "Section P". The amount required is one cap-full distributed evenly within the hub shell.

   THE HUB DUST CAP WHEN FITTED DOES NOT CONTAIN GREASE.

   ii. The hub endfloat is set as described under "Front Hub Adjustment".

   iii. Ensure the speedometer cam is not omitted and the hub dust cap having a small peg in its inside face is fitted to the left hand front wheel.

FRONT HUB ADJUSTMENT

It is essential that the end-float of the front hub bearings is correct. To obtain the correct condition, the following procedure must be observed. THIS IS IMPORTANT.

When the hub is being reassembled only the instructions given in the centre paragraphs need be followed.

1. Apply the handbrake and jack up the front of the car until the front wheel is clear of the ground.

2. Remove the nave plate and hub dust cap.

3. Release the tab-washer and remove the lock-nut from the stub axle followed by the tab-washer.

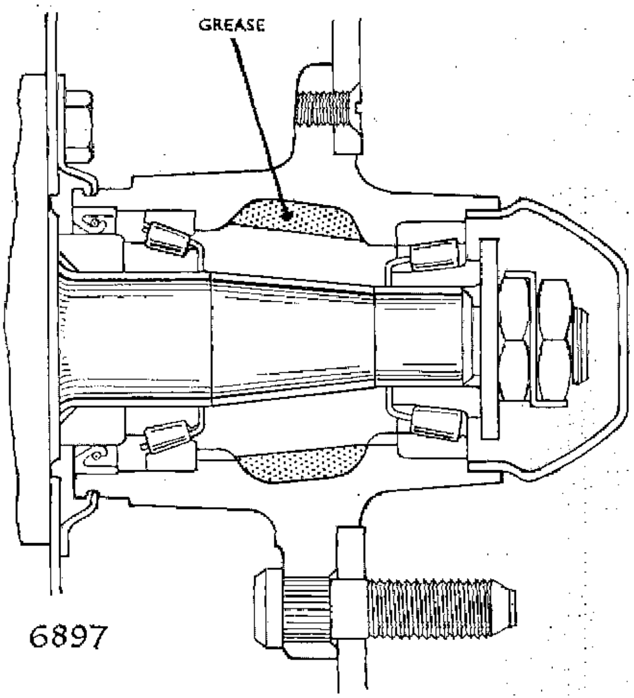


Fig. 7. *Sectional view of front hub showing correct level of grease*

4. Apply a torque wrench to the adjusting nut, spin the front wheel and tighten the adjusting nut simultaneously to a torque loading of 4½ lbs ft. (0·6 kg.m)

5. Slacken off the adjusting nut, two and a half to three flats and spin the front wheel, remove torque wrench.

6. Fit the tabwasher to the stub axle followed by the locknut and tighten the locknut to the torque given in the "General Data Section".

7. Check the endfloat with a dial test indicator when, if new bearings have been fitted, it will correspond with the endfloat given in the "General Data Section". IF THIS CHECK IS MADE BEFORE THE LOCKNUT IS TIGHTENED A FALSE READING WILL BE OBTAINED.

8. When the hub endfloat is outside the figures given, the adjusting nut must be reset, the locknut tightened and the endfloat again checked with the dial test indicator.

9. Refit the hub dust cap to the hub. DO NOT FILL THE HUB DUST CAP WITH GREASE.

10. Refit the nave plate, and lower the car to the ground.

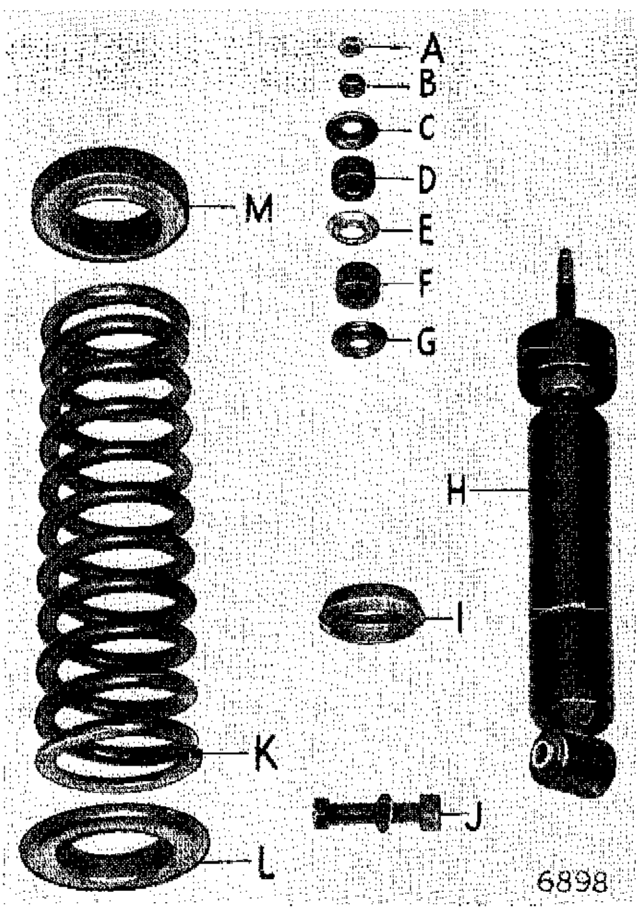


Fig. 8. *Exploded view of front spring and shock-absorber assembly*

A. LOCKNUT

B. NUT

C. CUPWASHER
D. RUBBER BUSH } FITTED ABOVE WHEEL ARCH BRACKET
E. CUP WASHER

F. RUBBER BUSH } FITTED BELOW WHEEL ARCH BRACKET
G. CUP WASHER

H. SHOCK ABSORBER

I. COLLETS POSITIONING LOWER SPRING SEAT

J. LOWER SECURING DETAILS

K. FRONT SPRING

L. LOWER SPRING SEAT

M. UPPER SPRING SEAT

FRONT SPRING AND SHOCK ABSORBERS

The low *periodicity coil springs*, fitted to the front suspension have two square ground ends and therefore they can be fitted either way up.

Damping action is provided by telescopic type shock absorbers fitted centrally within the coil springs.

The upper ends of the shock absorbers are attached to brackets, one under each wheel arch and the upper ends of the coil springs abut to the underside of the same wheel arch bracket.

The lower ends of the coil springs are accommodated in spring pans located on each shock absorber body by split collets while the lower ends of the shock absorbers are attached to brackets welded on the wishbones.

To reduce the transmission of road surface noises, rubber bushes are fitted between the wheel arch brackets and the upper ends of the front-springs and also at the upper and lower ends of the shock absorbers.

To check front spring height

Full details of the loadings and lengths for checking the front springs on a test rig are given in the "General Data Section".

A check with the front springs in position can be made by loading the car to the static laden condition and measuring the height of the wishbone pivot bolts above the ground. See Principal underframe dimensions in Section O.

To remove and refit (See Fig. 8)

1. Apply the handbrake, jack up the front of the car and remove the appropriate front wheel.

2. Support the wishbone from below and detach the upper end of the shock absorber from the wheel arch bracket by removing a locknut, a second nut, rubber bush and two cup washers.

3. Remove the front spring and shock absorber complete from the wishbone bracket by removing the nut, bolt and washer, then lowering the jack to control the expansion of the spring.

4. Lift the front spring and upper spring seat upward off the top of the shock absorber body. Raise the lower spring seat. Remove the two split collets and withdraw the lower spring seat from the lower end of the shock absorber.

5. Refitting is the reverse of the removal sequence but particular attention should be given to the following:

   i. The lower spring seat is fed on the lower end of the shock absorber, lip side first.

   ii. The split collets are fitted in the circular groove of the shock absorber body so the shallower taper is towards the spring seat. A smear of grease will facilitate assembly.

   iii. The upper spring seat is fitted so the metal face is towards the spring.

   iv. The lower shock absorber bolt is not fully tightened until the weight of the car is on the road wheels.

Testing by hand

When there is any question of the suspension not being adequately damped, other factors together with the shock absorbers should be considered, these are: front springs and tyre pressures.

If a shock absorber does not function satisfactory, an indication of its condition can be obtained by carrying out the following check:—

1. Remove the shock absorber from the car, see under "FRONT SPRING AND SHOCK ABSORBER—To remove and refit". Position vertically in a vice by gripping the eye end between two pieces of wood.

2. Grip the piston rod at the upper end of the shock absorber firmly with the hands and move the rod up and down. The presence of air is usually indicated by a lack of resistance or a "springy" feel at the beginning of the stroke. If this is apparent, the shock absorber should be left in the vertical position for a few minutes to allow the air bubbles to collect at the top of the pressure chamber.

3. A few short strokes from the fully compressed position followed by a few slow full strokes should remove all air from the pressure chamber.

   Moderate and even resistance throughout the outward and inward strokes should be felt after expelling the air. If, the resistance is slight or erratic and free movement cannot be eliminated, then the shock absorber should be renewed.

It is difficult to form an adequate opinion of the true operational condition of a shock absorber by hand testing. The slow speed of the hand test only partially operates the "bleed" setting within the shock absorber and as a large part of the front spring control depends on the high pressure or high speed setting which can only operate while the shock absorber is in service. A new shock absorber may appear to be weak when operated by hand, but this should not always be taken as evidence of a fault.

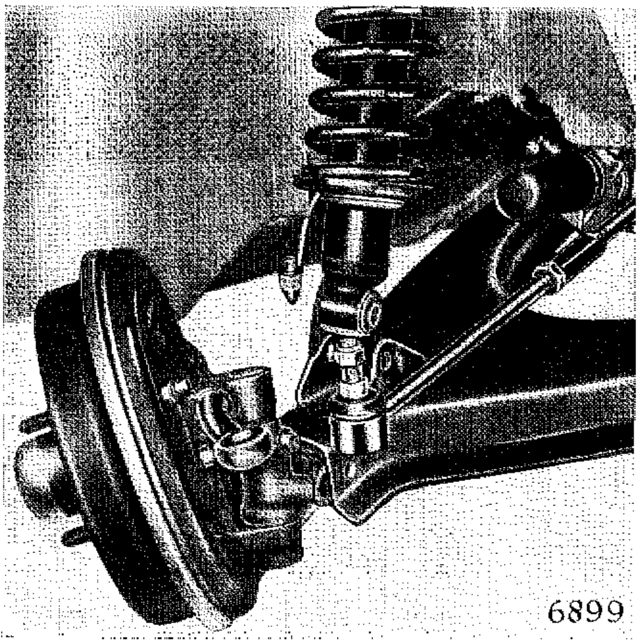


Fig. 9. *Method of removing hub and king pin assembly from outer end of wishbone*

HUB AND KING PIN ASSEMBLY

To remove and refit (See Fig. 9)

1. Apply the handbrake, jack up the front of the car and remove the appropriate front wheel.

2. Disconnect the rigid hydraulic brake pipe from the flexible hose mounted in the bracket beneath the front wheel arch and detach the flexible hose from the bracket. See "Brakes, Section K".

3. Detach the lower end of the shock absorber from the bracket on the top face of the wishbone by removing a nut, bolt and washer.

4. In the instance of the left-hand hub and king pin assembly, withdraw the speedometer cable from the inside face of the stub axle by removing a screw and forked plate, taking care to collect the rubber washer positioned between the metal end of the outer casing and stub axle.

5. Detach the outer end of the track rod from the steering lever by removing a nut from the ball pin and using a suitable extractor, RG284.

   Withdraw the hub and king pin assembly from the outer end of the wishbone by removing two nuts, bolts and washers, drifting the king pin carrier out of the wishbone pressing with a brass drift.

6. Refitting is the reverse of the removal sequence but particular attention must be given to the following:

   i. The rubber washer on the end of the speedometer outer casing is not omitted.

   ii. The hydraulic system is bled of air, see "Brakes, Section K".

   iii. The front wheel alignment (toe-in) is checked. See under "Front Wheel Alignment (Toe-In)—To Check and Adjust".

KING PIN AND BUSHES

The king pin and bushes can be renewed without removing the brake back plate assembly from the car. In this particular instance the rigid and flexible pipes of the brake system are left undisturbed, thus there will be no necessity to bleed the brake hydraulic system of air during the refitting sequence.

To renew

1. Withdraw the hub assembly from the stub axle. See under "Hub Assembly—To remove and refit", but there is no necessity to remove the grease seal or bearing from the hub shell.

2. Support the wishbone from below.

3. Remove the brake back plate from the stub axle by withdrawing three bolts, nuts and washers and SUSPEND NEARBY WITHOUT STRAINING THE FLEXIBLE HOSE.

4. Detach the outer end of the track rod from the steering lever by removing a nut from the ball pin and using a suitable extractor, using RG284.

5. Remove the welch washers from the upper and lower faces of the two stub axle bosses by collapsing them inward with light hammer and drift blows on their domed centres.

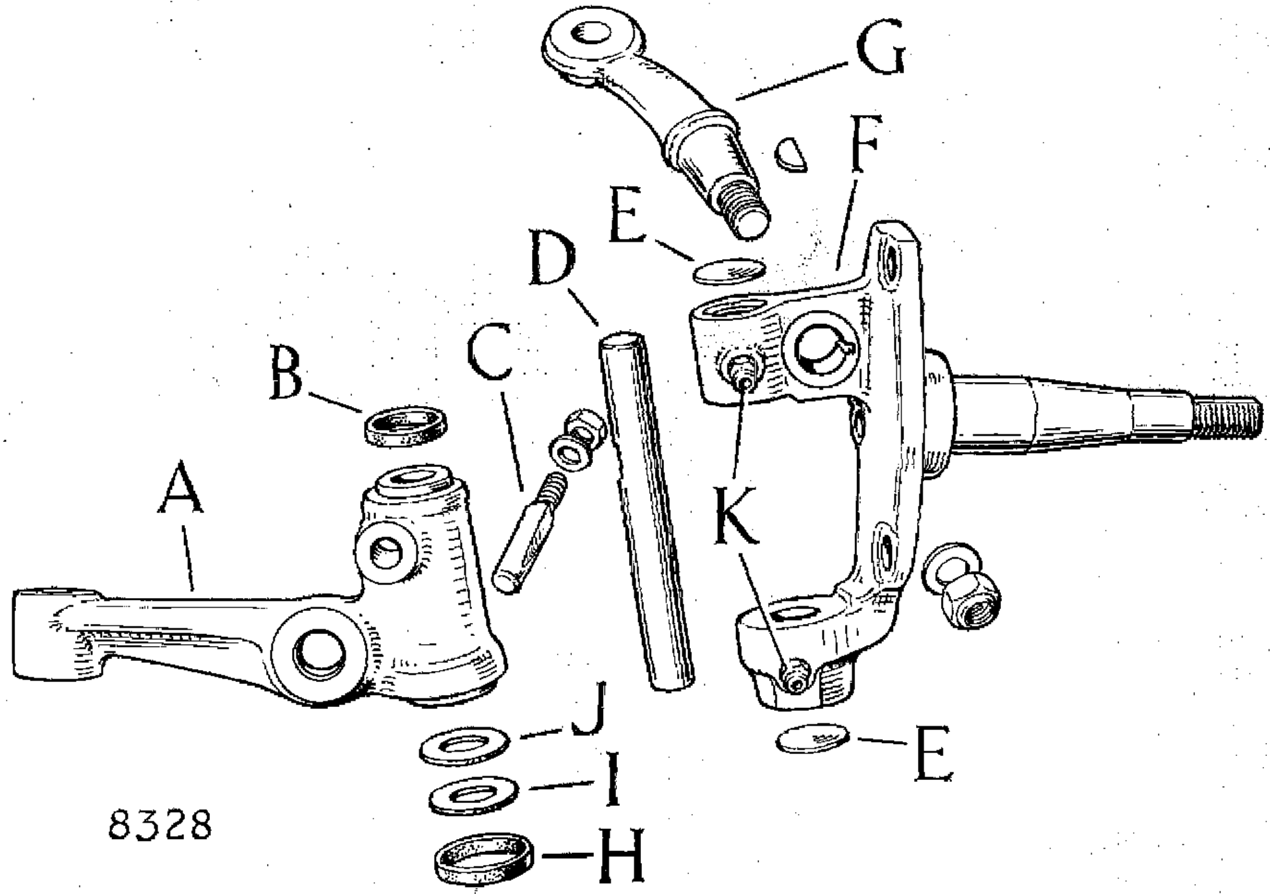


Fig. 10. *Exploded view of king pin and stub axle*

A. KING PIN CARRIER
B. SMALL SEALING RING
C. COTTER PIN
D. KING PIN
E. WELCH WASHER
F. STUB AXLE
G. STEERING ARM AND LOCATING KEY
H. LARGE SEALING RING
I. P.T.F.E. WASHER
J. BEARING WASHER
K. LUBRICATORS

6. Drift the cotter pin from the king pin carrier by removing the nut and washer and using a soft nosed drift. When difficulty is experienced, remove the carrier assembly from the wishbone and use a workshop press.
7. Remove the stub axle, large and small sealing rings, P.T.F.E. and bearing washers from the king pin carrier by drifting out the king pin from the stub axle and king pin carrier. See Para. 6.
8. When necessary, identify and drift the steering arm and key from the stub axle by removing a nut and washer and using soft a nosed drift.
9. When fitted, remove the lubricators from the stub axle bosses.
10. To avoid distorting the two stub axle bosses when renewing the bushes abut their inner faces to the press bed and press the worn bushes from the stub axle bosses individually using Churchill tool No. RG.385, see Fig. 11.
11. Press the two new bushes into each stub axle individually using Churchill tool No. RG.385 see Fig. 12 and when lubricators are fitted, ensure that the hole in the bush aligns with the lubricator tapping, refit the lubricators. IT IS IMPORTANT THAT THE BEARING SURFACE OF THE BUSHES IS NOT DAMAGED and the breather holes in the stub axle bosses are unobstructed.

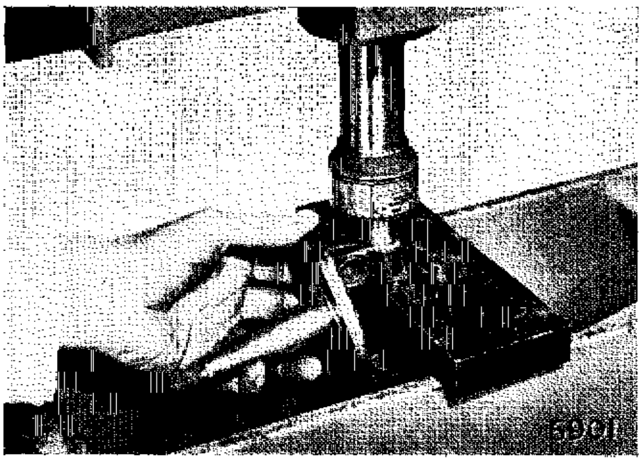


Fig. 11. *Ejecting worn king pin bush from lower lug of the swivel pin with RG385*

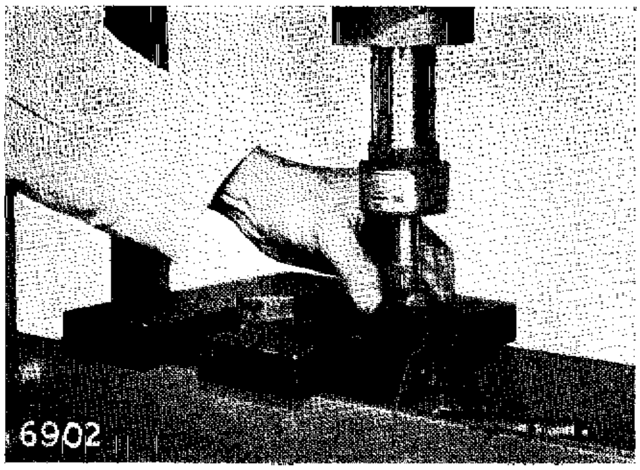


Fig. 12. *Pressing in the king pin bush so its inner end becomes flush with the inside face of the lugs with RG385. Do not disturb the P.T.F.E. surface of the bush*

12. Refitting is the reverse of the removal sequence but particular attention must be given to the following:

    i. Ensure that the king pin is free from burrs, lubricate the king pin, bushes and washers with Shell Spirax 140 E.P. Oil; fit the king pin so the cotter pin flat aligns with the hole in the king pin carrier, i.e., shorter distance upwards.

    ii. Fit the smaller sealing rings to the top of the king pin carrier and the larger sealing ring to the bottom, a smear of grease will facilitate this operation.

    iii. Position the P.T.F.E. washer, darker face downwards, above the bearing washer and fit both between the bottom boss of the stub axle and the king pin carrier.

    iv. Fit the cotter pin from the rear, drive home and secure with the nut and washer, seal both ends with shellac.

    v. Refit the welch washers, see under "Welch Washers" and seal with shellac.

    vi. Refit the steering arms so they point forward and inward.

    vii. Check the front wheel alignment, see under "Front Wheel alignment (toe-in)—To check and adjust".

WELCH WASHERS

When refitting king pins to the stub axle it will be necessary to fit new welch washers (sealing discs) in the outer face of each stub axle boss.

The welch washers should be expanded into position by striking the domed centre, taking care not to collapse it inwards.

Stake the stub axle boss in four places to provide additional retention and seal with shellac.

KING PIN BUSHES (See Figs. 11 and 12)

THE KING PIN BUSHES ARE PRE-FINISHED AND HAVE A POLY TETRA FLUORO ETHYLENE (P.T.F.E.) BEARING SURFACE WHICH REQUIRES NO LUBRICATION IN SERVICE, BUT SHOULD BE LUBRICATED WITH SHELL RETINAX "A" GREASE DURING REFITTING OR REASSEMBLY.

IT IS IMPORTANT THAT THE BEARING SURFACE IS NOT DISTURBED IN ANY WAY. WHEN REFITTING THE KING PIN, IT IS ESSENTIAL TO ENSURE THAT IT IS FREE FROM ALL BURRS.

When the king pin bushes are being fitted, press them in so that the inner ends become flush with the inner faces of the two stub axle bosses. The use of the Churchill tool No. RG.385 is strongly recommended.

When lubricators are fitted, ensure that the hole in each bush aligns with the lubricator tapping in each stub axle boss and the breather hole in the front of each boss is unobstructed.

WISHBONES

The wishbones are fabricated from metal pressings welded together to form a hollow sectioned construction. The king pin carrier of the steering knuckle, included in the hub and king pin assembly, is fitted in the hollow outer end.

The pivot points at the inner ends of the wishbones are spaced widely apart to give maximum rigidity and to reduce the transmission of road surface noise metal and rubber bonded bushes are pressed into each pivot. The centres of the four pivot points are parallel to the centre line of the car, thus a swing axle is formed.

The wishbones are attached to two support brackets mounted across the centre of the car, while the outer ends are attached to the lower extremities of the front spring and shock absorber assemblies mounted in the front wheel arches, thus each complete independent front suspension unit is formed.

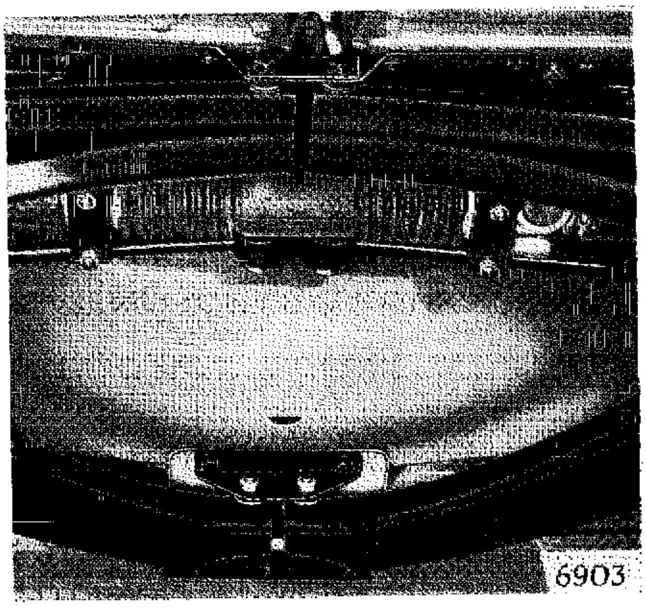


Fig. 13. *Under view showing inner ends of wishbones, pivot bolts and support brackets*

To remove and refit

1. Remove the hub and king pin assembly but do not disconnect the rigid and flexible brake hydraulic pipes. See under "Hub and King Pin Assembly—To remove and refit". Stand the brake and hub assembly nearby without straining the flexible hose.

2. Identify the lower end of the inner steering column to the splined pinion of the steering unit to facilitate refitting. Remove the pinch bolt and detach column by lifting up the steering wheel approximately 2in. (50 mm).

3. Slacken off the two nuts securing the pivot ends of the wishbones to the front and rear support brackets.

4. Detach the front and rear support brackets from the floor assembly by withdrawing four bolts and washers from the front bracket, four bolts and washers from the floor inside the car after the floor covering has been rolled back and lower the brackets down by withdrawing four bolts and washers from the front edge of the rear bracket beneath the car.

5. Detach the wishbone from the front and rear support brackets by removing two nuts and bolts. See under "Inner Wishbone Attachment".

6. Refitting is the reverse of the removal sequence, but particular attention must be given to the following:

   i. The nuts of the wishbone pivot bolts are renewed. See under "Inner Wishbone Attachment", and these together with the lower shock absorber bolt are not fully tightened until the weight of the car is on the road-wheels.

   ii. The front wheel alignment (Toe-in) is checked. See under "Front Wheel Alignment (Toe-in)—To check and adjust".

INNER WISHBONE ATTACHMENT (See Fig. 13)

The nuts fitted to the pivot bolts at the inner ends of the wishbones are a special locking type with nylon inserts in their bodies.

These nuts can be re-used providing the threads and nylon inserts are in good condition and the inserts have not lost their locking properties.

The efficiency of the lock can be checked by running the nuts on the bolts by hand and if in good condition, resistance to their travel along the thread will be experienced. When little or no resistance is evident, they should be renewed.

These nuts are only fully tightened when the weight of the car is on the road-wheels.

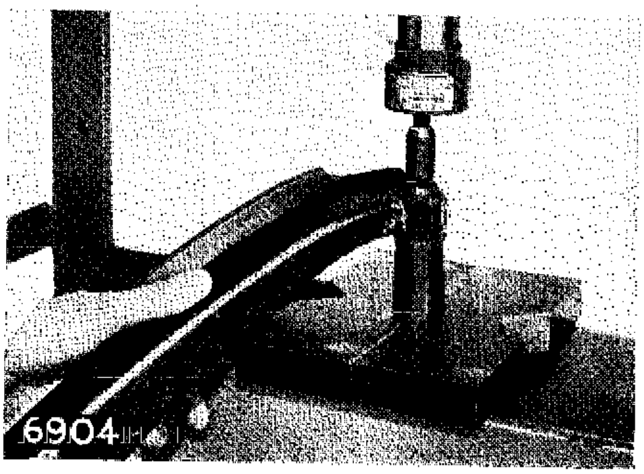


Fig. 14. *Pressing out the metal and rubber bonded bush from the wishbone into the support tube using the smaller diameter spigot of the RG386 tool*

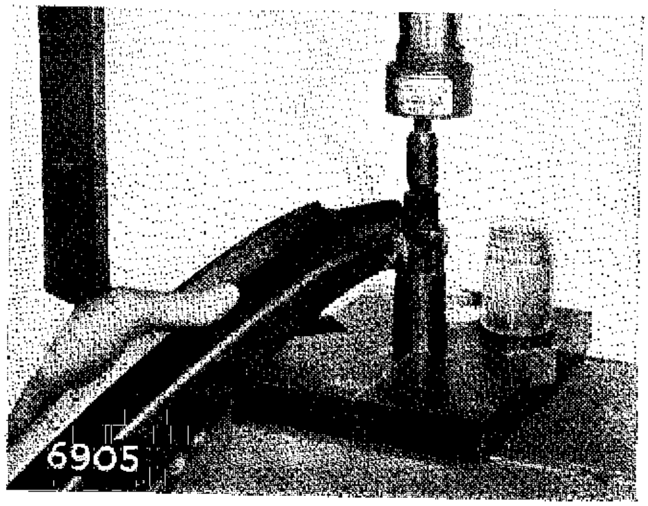


Fig. 15. *Pressing the metal and rubber bonded bush into the wishbone using the smaller diameter spigot of the RG386 tool*

WISHBONE BUSHES (See Figs. 14 and 15)

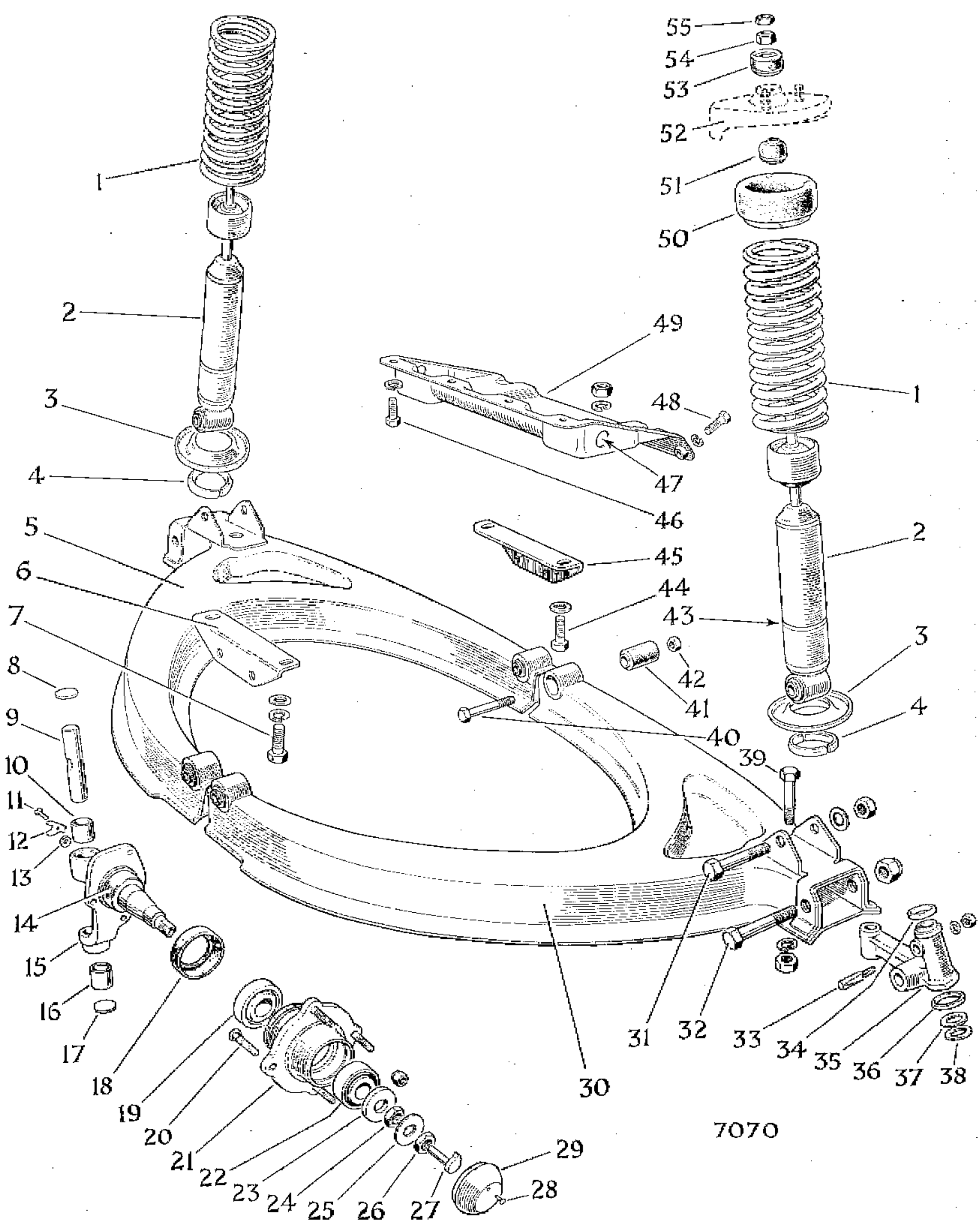
To renew

The metal and rubber bonded wishbone bushes are pressed into the two pivots in each wishbone pressing so the centre metal bush is central within the wishbone pressing. They will only require renewing at very infrequent intervals and the use of the special tool RG386 is strongly recommended.

These bushes are pressed into the wishbone with constant pressure so the travel of the bush is continuous until the bush is central within its housing. If the travel of the bush ceases, difficulty will be experienced in restarting it due to the recovery of the surrounding rubber. Fitting will be facilitated if the rubber is lubricated with water or soft soap.

Fig. 16. *Exploded view of front suspension*

1. FRONT SPRING
2. SHOCK ABSORBER
3. LOWER SPRING SEAT
4. SPLIT COLLETS
5. RIGHT HAND WISHBONE
6. REAR SECTION OF FRONT BRACKET
7. FRONT BRACKET BOLT
8. UPPER WELCH WASHER
9. KING PIN
10. P.T.F.E. BUSH BEARING
11. SPEEDOMETER CABLE RETAINING SCREW
12. SPEEDOMETER CABLE RETAINING FORK
13. RUBBER WASHER
14. PRESSED-ON DISTANCE PIECE
15. STUB AXLE
16. P.T.F.E. BUSH BEARING
17. LOWER WELCH WASHER
18. GREASE SEAL
19. INNER ROLLER BEARING
20. WHEEL STUD
21. HUB SHELL
22. OUTER ROLLER BEARING
23. "D" WASHER
24. ADJUSTING NUT
25. TABWASHER
26. LOCKNUT
27. SPEEDOMETER CAM
28. SPEEDOMETER DRIVING PEG
29. HUB DUST CAP
30. LEFT HAND WISHBONE
31. SHOCK ABSORBER BOLT
32. STUB AXLE CARRIER BOLT
33. COTTER PIN
34. SMALL SEALING RING
35. STUB AXLE CARRIER
36. LARGE SEALING RING
37. BEARING WASHER
38. P.T.F.E. WASHER
39. STUB AXLE CARRIER BOLT
40. WISHBONE PIVOT BOLT
41. WISHBONE PIVOT BUSH
42. SPECIAL LOCKING NUT
43. SPLIT COLLET LOCATING GROOVE
44. FRONT SECTION BRACKET BOLT
45. FRONT SECTION OF REAR BRACKET
46. REAR BRACKET BOLT
47. SPEEDOMETER CABLE APERTURE
48. REAR BRACKET BOLT (INSIDE CAR)
49. REAR BRACKET
50. UPPER SPRING SEAT
51. SHOCK ABSORBER BUSH AND CUP WASHER
52. SHOCK ABSORBER UPPER BRACKET
53. SHOCK ABSORBER BUSH AND CUP WASHERS
54. SHOCK ABSORBER NUT
55. SHOCK ABSORBER LOCK NUT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REAR HUBS and DRIVE SHAFTS

SECTION G

CONTENTS

REAR HUBS and DRIVE SHAFTS

DESCRIPTION (See Fig. 1)

The drive is transmitted from the transaxle unit to the hubs by open drive shafts.

Each shaft is secured to the Hypoid flanges by a flexible rubber coupling and to the hub shaft by a needle roller type universal joint.

The hub shaft rotates in the hub housing on two ball races.

The outer race is located against a shoulder in the housing and retained by the brake backing plate.

The inner race is located by a distance tube between the two bearings and a flange on the hub shaft.

An oil seal is positioned inboard of the inner race.

The hub is splined to the hub shaft and secured by a nut and washer.

REPLACEMENT DRIVE SHAFTS

Mark I Cars prior to Chassis No. B.411000340

When a drive shaft or hub shaft is to be replaced both hub shaft and drive shaft must be renewed together as the new parts will be of different lengths to those of the original equipment.

Mark I Cars and Mark II Home Cars

Drive shafts are $\frac{7}{8}$ in. (22 mm) diameter and after Chassis No. B.411000340 replacement does not involve the hub shaft. One inch shafts (see below) may be used in replacement on these cars. If these cars are tuned for sports purposes then 1 in. (25·4 mm) drive shafts must be fitted on both sides.

Mark II Export Cars and Van

Drive shafts are 1 in. (25·4 mm) diameter and these vehicles must always be fitted with 1 in. replacement shafts.

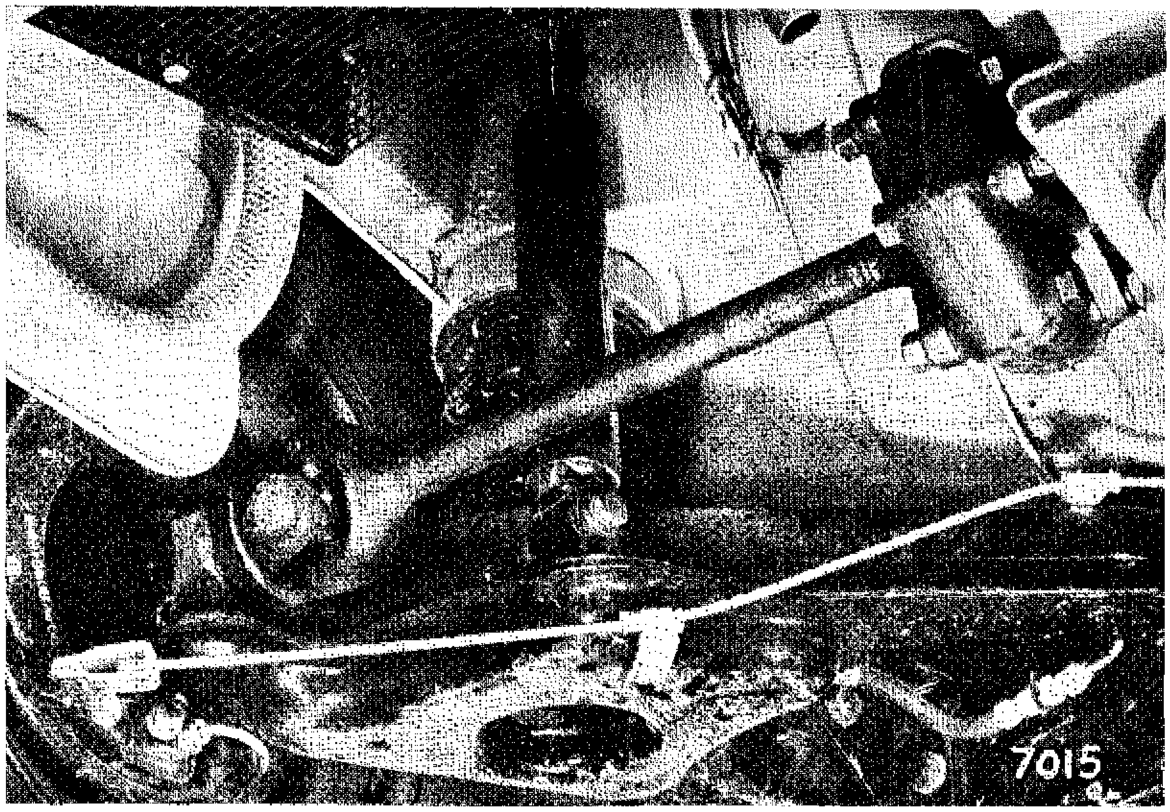


Fig. 1. *General view of drive shaft assembly*

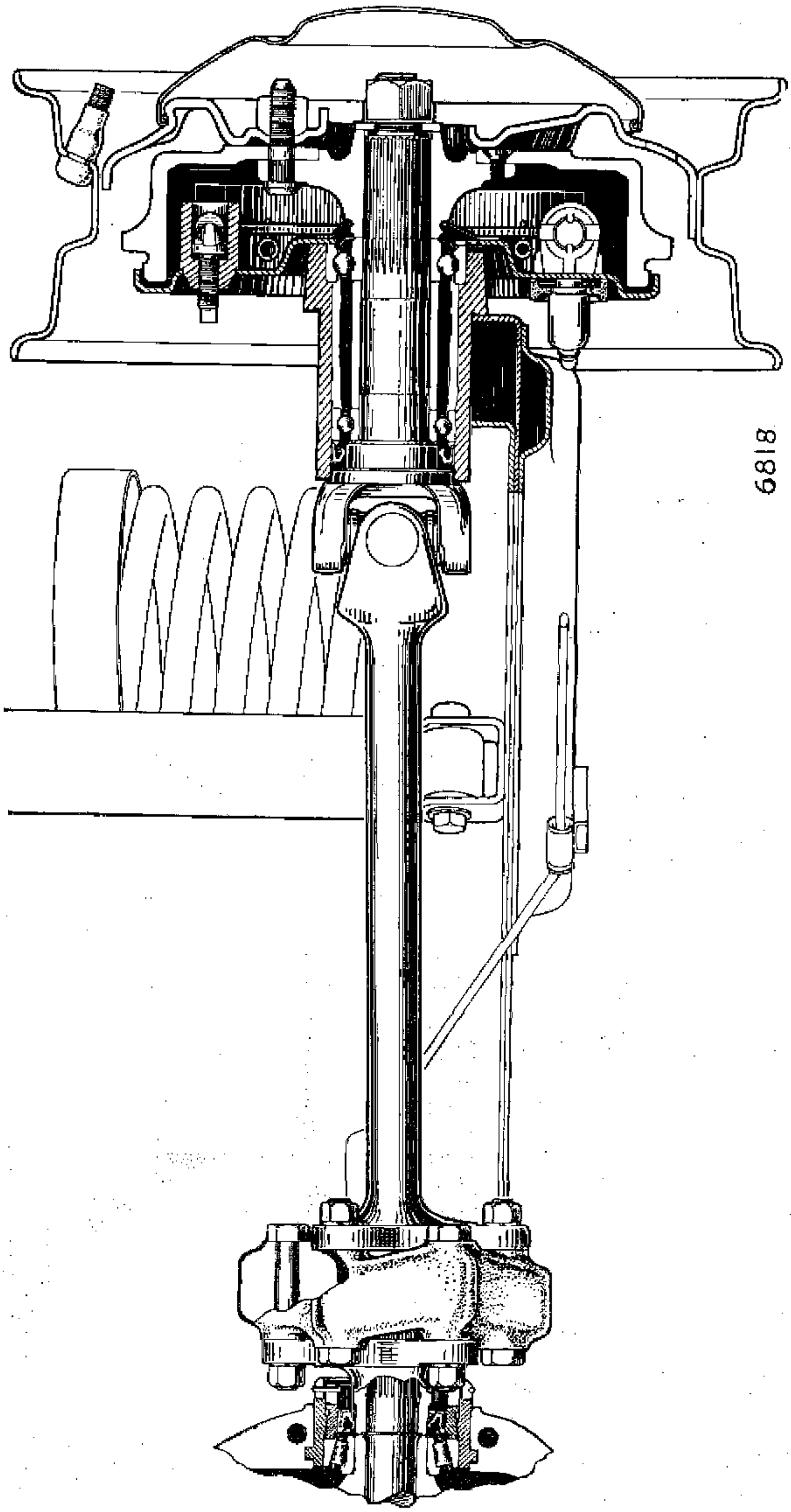


Fig. 2. *Sectional view of rear hub and drive shaft assembly*

DRIVE SHAFT FLEXIBLE COUPLING

To remove

A CLAMP FITTED TO THE COUPLING before commencing removal greatly assists the operation.

Details of the construction will be found in Section E for removing the transaxle unit.

After fitting the clamp, slacken off the six bolts through the coupling, and remove the nuts and washers.

Mark the Rotoflex coupling and flanges before removing. It is important that the coupling is refitted in exactly the same position as before, or premature failure of the coupling may occur.

Remove the three bolts retaining the coupling to the drive shaft flange.

Retain the clamp until the coupling is refitted.

Rotate the road wheel to enable the drive shaft flange to be detached from the coupling.

Now pull the coupling off the transaxle flange.

To refit

Fit the three bolts to the coupling in alternate holes, WITH THE HEAD OF THE BOLT TO THE SHORT BOSS of the coupling. (See Fig. 3.)

Now fit the coupling to the transaxle flange, using the other three bolts, with the heads of the first three bolts towards the transaxle casing. (See Fig. 3.)

These bolts are then fitted to the drive shaft flanges, and all bolts tightened to a torque as given in the General Data Section.

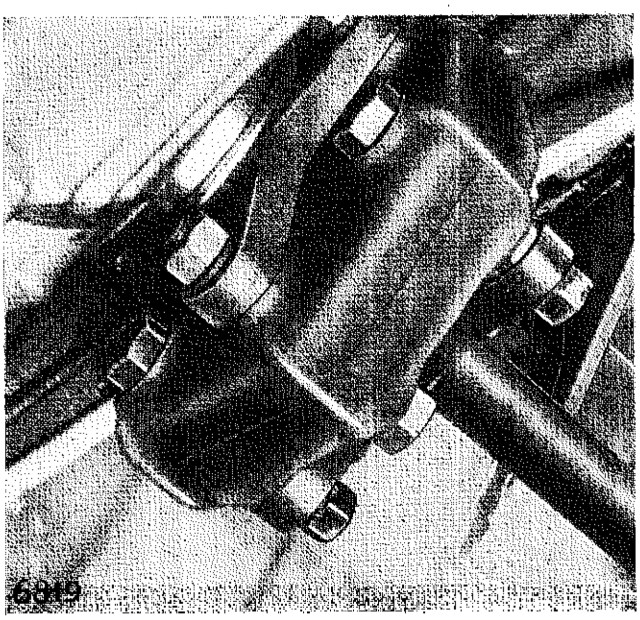


Fig. 3. *View of Rotoflex coupling*

When the fitting is completed remove the clamps from the couplings.

REAR HUB

To dismantle

Jack up the rear of the car and support on stands.

Fit a clamp to the drive shaft coupling and tighten up.

Disconnect the drive shaft at the rubber coupling by removing the three bolts securing the coupling to the drive shaft flange.

Remove the road wheel.

Disconnect the handbrake cable and hydraulic brake pipe from the brake backing plate. Protect the connections against the ingress of foreign matter.

Remove the set screw securing the brake drum and remove the drum.

Untab and remove the hub nut and washer using Tool No. RG.188C/3 to hold the hub. (See Fig. 4.)

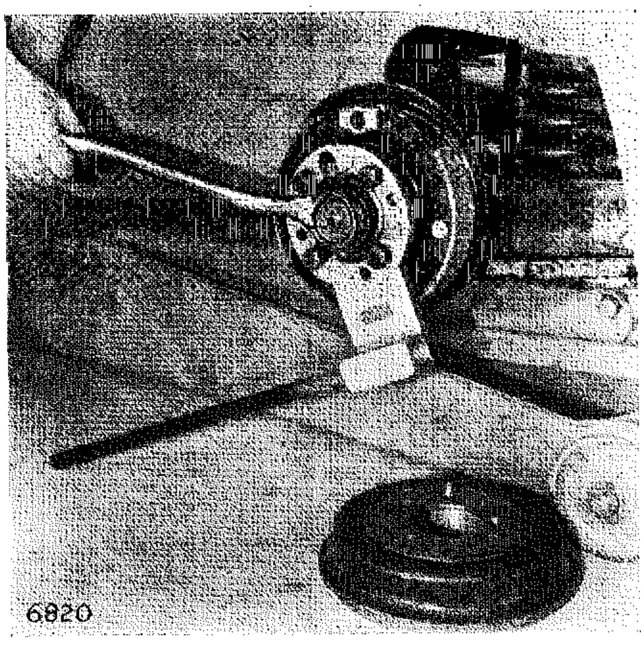


Fig. 4. *Rear hub locking plate in position*

Pull off the hub.

Remove the bolts securing the backing plate to the hub housing, and remove the backing plate.

Using a soft headed mallet, drive the shaft out of the hub housing, supporting the shaft at the inner end.

The inner bearing and oil seal should be detached with the shaft.

Using a soft drift, drive the outer bearing out of the hub housing.

Remove the inner bearing from the shaft.

Remove the oil seal from the shaft. (See Fig. 5.)

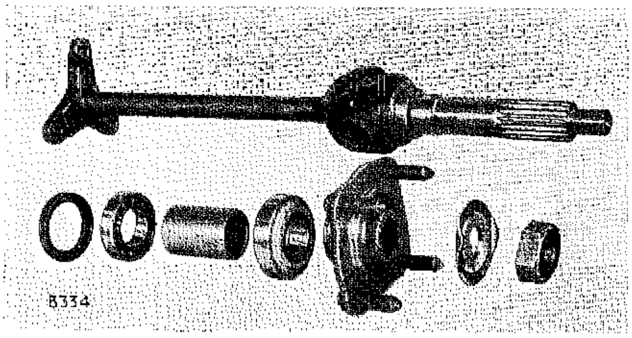


Fig. 5. *Exploded view of rear hub and drive shaft assembly*

REAR HUB

To reassemble (See Fig. 6)

Place the oil seal on the stepped collet of Tool No. RG.379. The oil seal must butt against the flange and the lip of the seal must face towards the hub.

Place the inner bearing on the stepped collet of the Tool No. RG.379 abutting the flange.

Fit the bolt through the stepped collet and place on it the distance sleeve from the hub.

Pass the bolt of Tool No. RG.379 through the hub housing from the inner end, aligning the inner bearing with the housing aperture.

Fit the outer race and collet of Tool No. RG.379 to the bolt, aligning the outer bearing with the aperture in the housing.

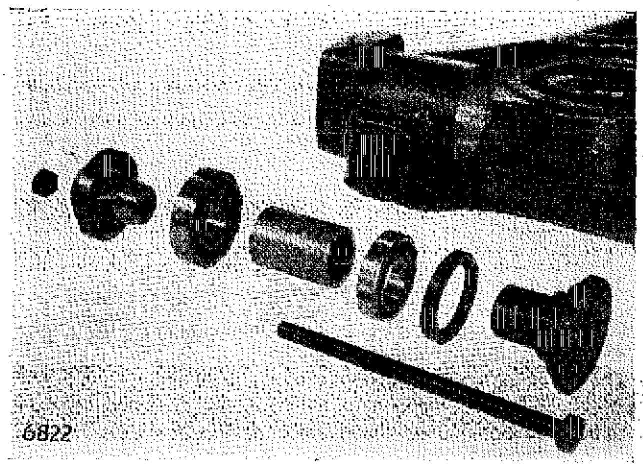


Fig. 6. *Rear hub showing assembly of Tool No. RG.379*

Fit the nut to the bolt and tighten, pulling the bearing into position as shown in Fig. 7.

Remove the bolt and collets.

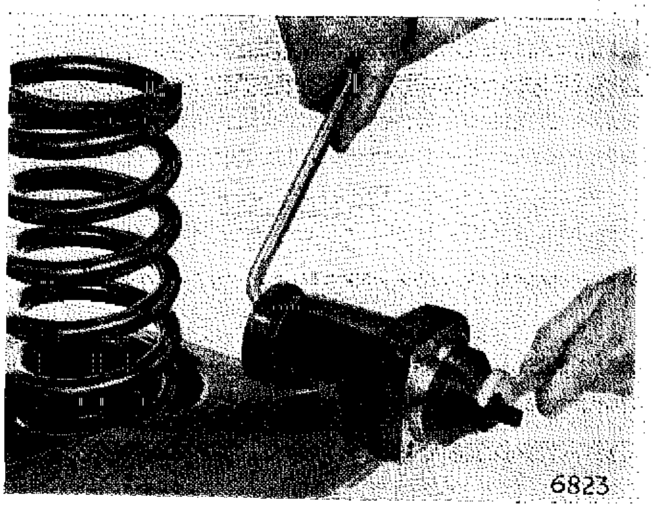


Fig. 7. *Using tool RG.379 to assemble rear hub*

Pack the hub with Shell Retinax "A" grease to a capacity not exceeding 30 c.c. (See Fig. 8.)

As a guide, the front hub dust cap if removed and filled with grease is approximately correct.

Fit the brake backing plate.

Pass the drive shaft through the bearings from the inner end.

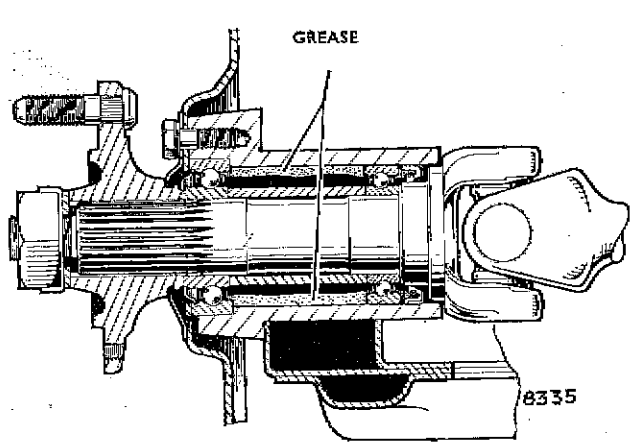


Fig. 8. *Pack rear hubs with grease*

Fit the tubular collar from Tool No. RG.379 over the outer end of the shaft and fit the washer and nut. (See Fig. 9.)

Tighten the nut, pulling the shaft through the bearings.

Remove the nut and tubular collar, and fit the hub, washer and nut.

Tighten the nut to the torque loading given in General Data and secure with the lock washers, using Tool No. R.188C/3. (See Fig. 4.)

Fit the brake drum and securing screw, couple up the handbrake linkage and hydraulic pipe.

Reconnect the drive shaft coupling to the drive shaft flange and remove the clamp.

Adjust the brake shoes and bleed the brakes.

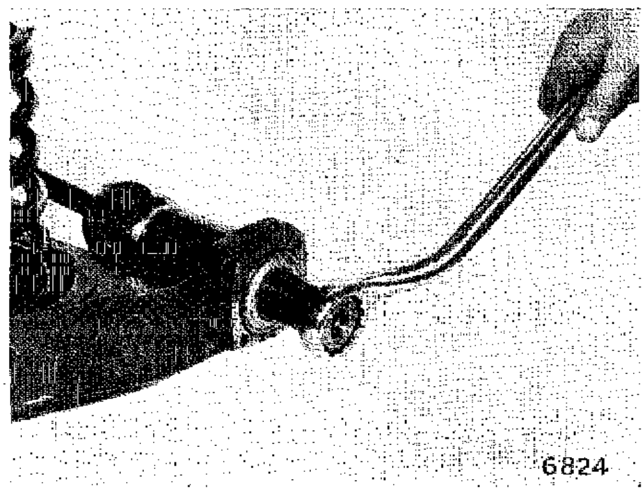


Fig. 9. *Fitting drive shaft to rear hub*

UNIVERSAL JOINTS

To dismantle (See Fig. 10)

The needle bearing type universal joints are so designed that correct assembly is a very simple matter, no hand fitting or special tools being required.

Individual parts of the needle roller bearing assemblies should not be renewed singly. If replacements are found to be necessary, the complete set of bearing parts comprising:— journal complete with gaskets and retainers, needle bearing assemblies and snap rings, should be fitted.

The journal and needle bearing assemblies are the only parts subject to wear after prolonged service, and when it becomes necessary to replace these for any reason the work should be carried out as follows:—

Remove snap rings by pinching together with a pair of pliers. If a ring does not snap out of the groove, remove enamel from the yoke holes and tap the end of the bearing assembly lightly, which will relieve pressure against the ring.

Holding the joint in one hand, tap gently with a piece of copper or copper hammer on the radius of the ear of the yoke.

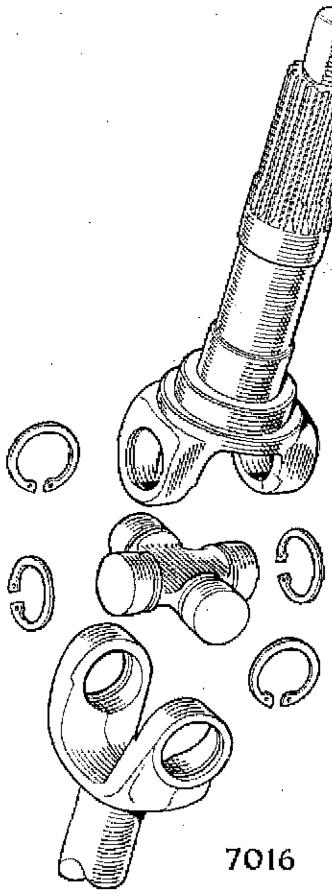


Fig. 10. *Exploded view of Universal joint*

The needle bearing assembly will gradually emerge and can finally be removed with the fingers. Be sure to hold the assembly in a vertical position and when free remove roller bearing housing from the bottom side so as to avoid dropping the needle rollers.

Repeat this operation for the opposite bearing.

Support the two exposed journal pegs on lead blocks (to protect ground surface) and tap the ears of the flange yoke to remove the race.

Reverse assembly and repeat the operation.

Wash all parts in petrol or paraffin.

If parts are not worn, repack with Retinax "A". Make sure that the joints of all channels are filled with lubricant. With the rollers in position fill the race about one-third full. Should any difficulty be encountered when assembling the needle roller, smear the wall of the housing with vaseline. Install the new gasket retainers on the journal assembly. The journal shoulders should be coated with shellac or other suitable jointing prior to fitting retainers so as to ensure a good oil seal.

UNIVERSAL JOINTS

To reassemble (See Fig. 10)

Insert journal in flange yoke holes.

Using a soft, round drift, with flat face, about $\frac{1}{32}$" (·79 mm.) smaller in diameter than the hole in the yoke tap the bearing assembly into position.

Repeat this operation for the other three assemblies.

Fit new snap rings and be sure that these are firmly located in the grooves.

When assembled, if a joint appears to bind, tap the lugs lightly with a wooden mallet, which will relieve pressure of the bearing assembly on the end of the journal.

It is essential that no play exists between the roller races and the bores of the yokes. If the yoke cross-holes have worn oval, the yoke must be replaced.

In the case of the inner yokes renewal can only be effected by fitting a new drive shaft, since this yoke is part of the drive shaft.

REAR SUSPENSION

SECTION H

CONTENTS

REAR SUSPENSION

DESCRIPTION (See Fig. 1)

Independent rear suspension is employed. Each side unit consisting basically of a pressed steel trailing arm assembly with a hub housing at the rear end and two bushed pivot eyes at the forward ends.

A sub frame with four pivot brackets is bolted to the rear underbody, and each trailing arm assembly is pivoted to this by two bolts fitted through the pivot brackets and the pivot eyes.

A coil spring is positioned vertically between each trailing arm, and the rear under-body, and a telescopic type shock absorber is secured at one end to the trailing arm, and the other end to the under-body.

Bump and rebound stops are incorporated in the shock absorbers.

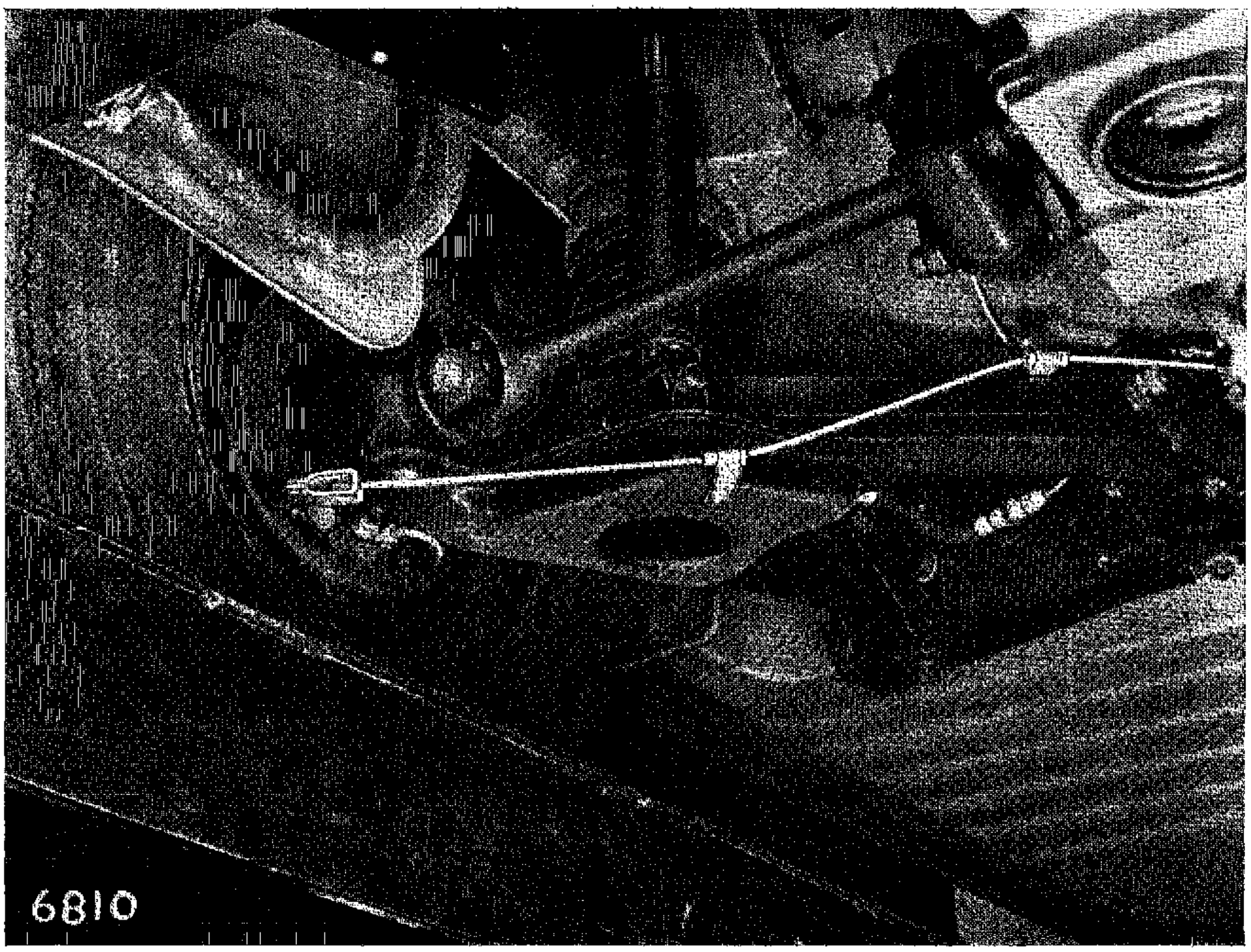


Fig. 1. *General view of rear suspension (left side)*

REAR SUSPENSION COIL SPRING

To remove

Jack up and put the car on stands.

Place a small hydraulic jack under the suspension, just behind the brake backing plate, in order to take the tension off the coil spring.

FIT THE CLAMP ROUND THE TRANSMISSION COUPLING and tighten. (See Section E for details of clamp.)

Mark the Rotoflex coupling and flanges before removing. It is important that the coupling is refitted in exactly the same position as before, or premature failure of the coupling may occur.

Remove the three bolts holding the drive shaft flange to the coupling and release the drive shaft.

Remove the road wheel.

Disconnect the handbrake cable from the backing plate.

Remove the bolt retaining the shock absorber to the suspension arm.

Lower the jack until the suspension is fully extended and remove the jack.

The suspension will now hang on the two front pivot brackets, and the coil spring assembly can be removed.

Certain models are fitted with a rubber packing piece between the spring and the suspension arm.

Certain models are fitted with a longer spring.

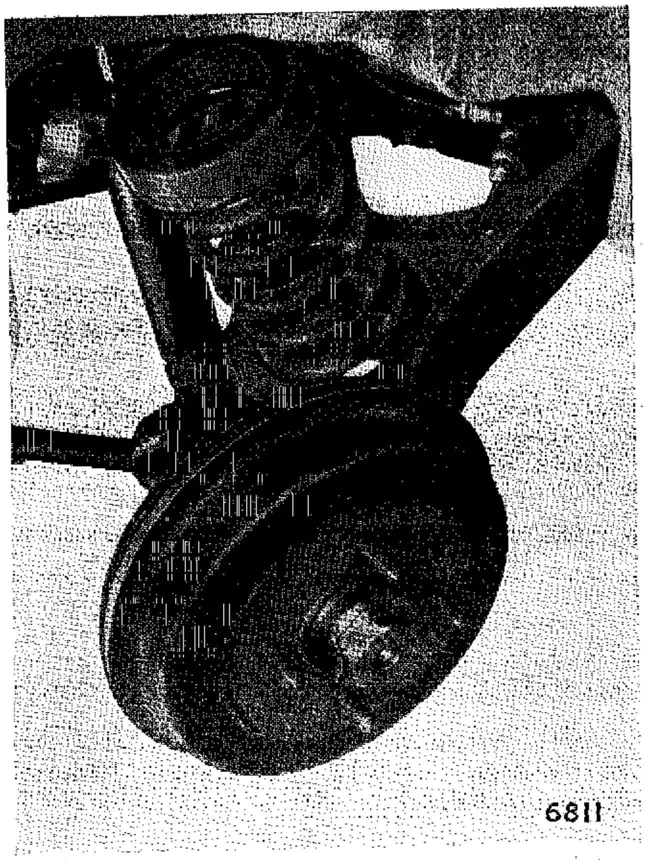


Fig. 2. *Coil spring removed from body*

The method of checking which spring is fitted, is by removing the spring from the car, according to the instructions given in this Section, and measuring the free length of the spring. (See General Data.)

Should the car be fitted with short springs without packing, a long spring may be used as a replacement, PROVIDING a packing piece is fitted between the spring and the suspension arm on the other side.

If the car already has packing pieces fitted, then fit the longer spring on the one side, retaining the packing piece on the other side only.

When fitting a packing piece, ensure that it is fully seated in the suspension arm, and that the spring is located correctly in the packing piece.

To refit

Fit the rubber cap to the coil spring.

Cap, bump stop and locator plates on the van only.

The spring is reversible, but the cap must always go to the top.

Insert the coil spring into the housing in the suspension arm.

Press the top of the spring into the housing in the body of the car.

Place the small hydraulic jack beneath the suspension, and jack up.

Make sure that the top rubber cap is properly seated in the housing without distortion, and that the spring is bedded fully home at both ends.

With the suspension jacked up to the normal load position, locate the shock absorber into the mounting in the suspension arm and fit the bolt.

Refit the drive shaft flange to the coupling, tighten the bolts to the torque loading given in General Data, and remove the clamp.

Remove the small jack from beneath the suspension.

Reconnect the handbrake cable.

Refit the road wheel and remove the stands.

REAR SUSPENSION

To remove

Refer first to the section for "Removing Rear Suspension Coil Spring".

Remove the guide brackets holding the handbrake cable to the suspension arm.

Disconnect the flexible brake pipe from the bracket on the cross member, and protect the pipes from dirt.

With the spring removed, support the suspension arm, and remove the two bolts in the front pivots.

The complete assembly (See Fig. 3.) can now be lifted away.

The procedure for checking camber angles on the rear suspension will be found under Section F of this Manual.

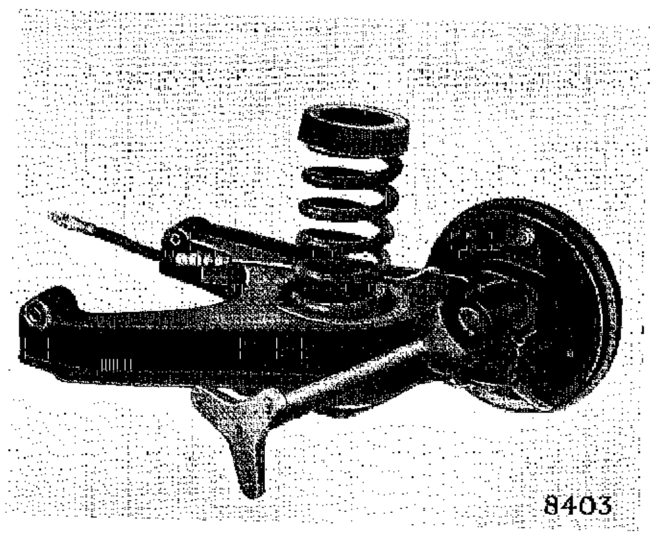


Fig. 3. *Complete assembly removed (right side)*

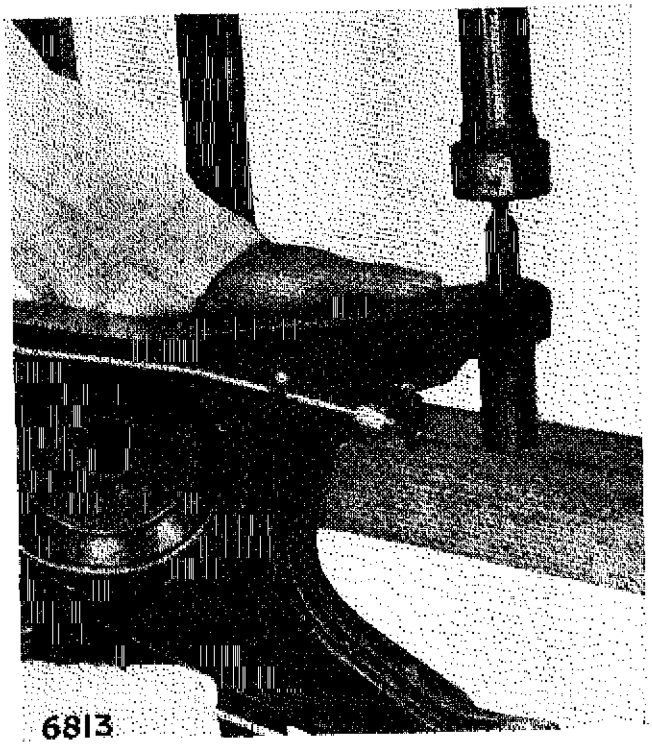


Fig. 4. *Pressing out pivot bush*

To refit

This is a reversal of the procedure for removal.

For all torque loading figures refer to General Data Section.

It must be remembered that when the suspension is refitted, the brakes **MUST** be bled.

PIVOT BUSHES

To remove

To remove the suspension assembly, see previous paragraph.

Using Tool No. RG386 (See Fig. 4), place the assembly on a press and press out the pivot bushes.

PIVOT BUSHES

To refit

Place the assembly on a press (See Fig. 5).

Ensure the new bush is in line with the boss on the assembly and press into position.

NOTE. The new bush must be lubricated before being pressed into place, and a lubricant such as "Teepol" should be utilised.

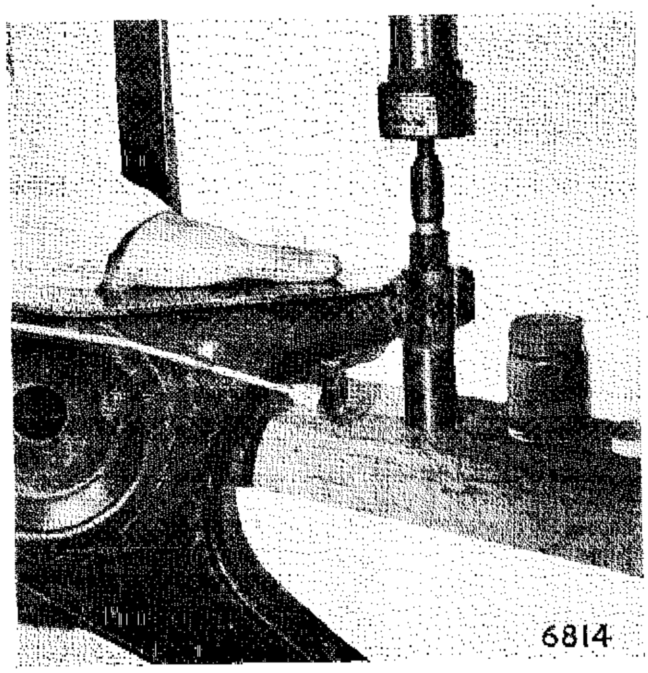


Fig. 5. *Pressing in new pivot bush*

STEERING GEAR

SECTION J

CONTENTS

STEERING GEAR

DESCRIPTION (See Figs. 1 and 2)

Steering is effected by a separate column assembly, a rack and pinion steering unit with two track rods of equal length making the connection between the steering unit and the steering arms included in the two stub axle assemblies.

The steering column is mounted on the floor of the car and supported by a bracket beneath the instrument facia. The inner column is attached to the splined end of the steering pinion at the lower end and supported at the opposite end by a bush in the top end of the outer column.

Mounted on the steering column is the direction indicator pawl unit which is actuated by a "striker" within the column and cancels any direction signal that might have been given as the steering wheel returns to the straight ahead position.

The rack and pinion steering unit is mounted on the rear support bracket of the front suspension beneath the front of the car. The two track rods operating the steering are attached directly to the steering rack at inner ends and the steering arms included in the stub axle assemblies at the outer ends.

The length of the right-hand track rod is adjustable for the purpose of setting front wheel alignment (toe-in).

ROUTINE MAINTENANCE

Maintenance checks will be required at regular intervals as given in the "Owner's Service Book" or "Owner's Handbook" and will include the following:

i. Checking the alignment of the track rod ball joint sockets and tapered ball pins.
ii. Checking the security of the steering columns, steering unit, track rod ball joints and steering arms.
iii. Checking the steering unit for oil leakage.

STEERING WHEEL

The steering wheel is of the horizontal two spoke dished type and mounted on the upper end of the inner column by a taper, parallel splines and secured by a nut. There are 36 parallel splines, thus a 10° variation in steering wheel position is available.

An oblong shaped motif is mounted in the top of the steering wheel centre and its own centre blends with the two horizontally positioned spokes.

To remove and refit

1. Prise the motif from the centre of the steering wheel and collect the two spring clips from the motif or, on certain cars, the two holes in the steering wheel hub.

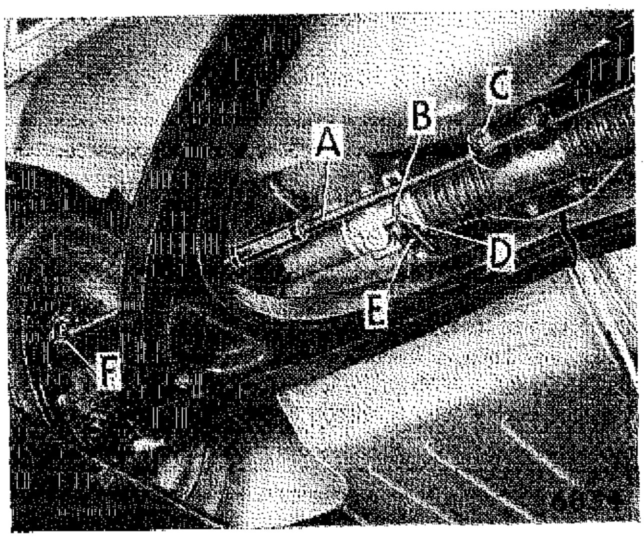


Fig. 1. *Underneath view of right hand side of steering layout*

A ADJUSTABLE TRACK ROD
B "U" BOLT
C TRACK ROD BOLT
D LOWER BRIDGE PIECE
E REINFORCING PLATE
F BALL JOINT

2. Remove the steering wheel nut from the inner column.
3. Identify the position of the steering wheel to the inner column to facilitate re-fitting; remove the steering wheel from the inner column. Hammer blows are forbidden as the inner column pinch bolt and steering unit pinion can sustain damage.
4. Re-fitting is the reverse of the removal sequence, but particular attention must be given to the following:

   i. The steering wheel is fitted according to the identification marks on the steering wheel and inner column.

   ii. When a replacement steering wheel or the original steering wheel is being fitted to a new inner column, position the front wheels in the straight ahead attitude by setting them parallel to the rear wheels. Offer up the steering wheel so the two spokes are horizontal (sighted to the instrument binnacle) and lower, for right-hand drive cars, onto the nearest spline in an anti-clockwise direction but, for left-hand drive cars, in a clockwise direction.

   iii. Fit the two spire clips to the short underside edges of the motif or, on later cars, in the oblong shaped holes in the steering wheel centre and press the motif home.

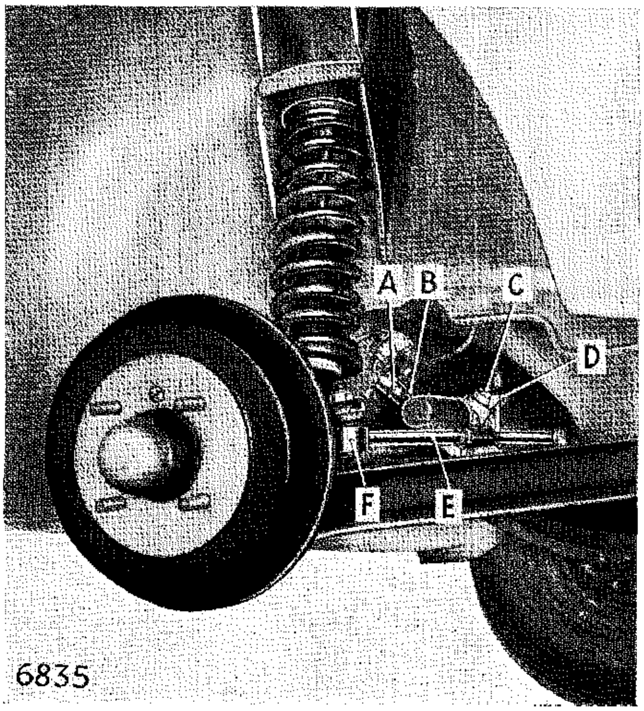


Fig. 2. *Right hand front view of right hand drive steering layout*

A	INNER COLUMN	B	PINCH BOLT
C	DAMPER PAD ADJUSTING SCREW	D	UPPER BRIDGE PIECE
E	ADJUSTABLE TRACK ROD	F	BALL JOINT

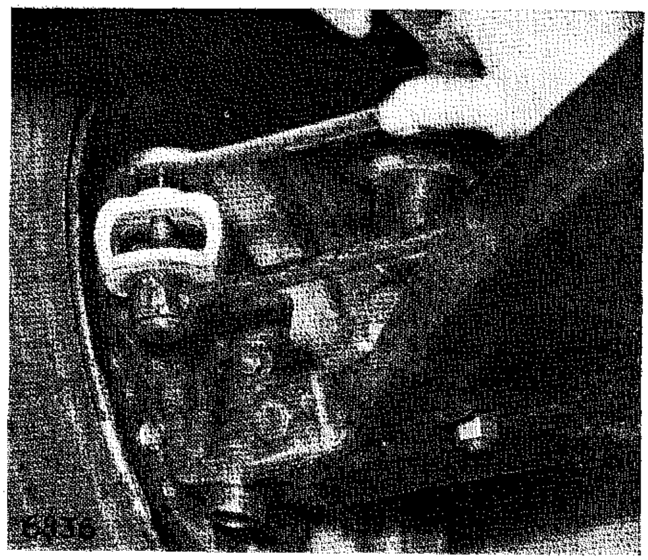


Fig. 3. *The track rod being removed with special tool RG.284, after the ball pin nut has been removed*

STEERING UNIT

The rack and pinion steering unit is mounted on the rear support bracket of the front suspension beneath the car.

The steering unit consists of a steering rack housed in a die cast aluminium body. The steering rack has skew cut teeth and mates with a pinion gear fitted at one side of the body, according to the drive of the car. A groove machined in the steering rack directly opposite the skew teeth accommodates the tongue of the plastic damper which eliminates any backlash that may develop between the rack and pinion. A bush bearing, pressed into the body at the opposite end to the pinion, supports the plain end of the steering rack. Pinion endfloat is controlled by the disposition of shims between the mounting flange of the upper pinion bearing and the body.

A convolute cover in the centre of the body and two conical covers, one at each end, make the steering unit oil and weather tight.

Movement of the steering wheel causes the pinion to rotate and move the steering rack along inside the body. The movement of the rack is transferred to the front wheels by the two track rods attached directly to the steering rack and the steering arms included in the stub axle assemblies.

Movement of the steering rack is limited by two metal bushes incorporated in the convolute cover contacting the ends of the slot cast in the steering unit body. These two bushes accommodate the bolts which secure the inner ends of the track rods to the steering rack.

To remove and refit (See Figs. 1, 2 and 3)

1. Apply the handbrake and jack up the front of the car.
2. Detach the pawl unit from the steering column by withdrawing two screws and washers and a clip, stow away on the parcel tray.
3. Slacken off the two nuts on the binnacle bracket "U" bolt, roll the floor covering aside and withdraw the two bolts and washers from the outer column flange followed by the pinch bolt and washer from the bottom end of the inner column beneath the car floor.
4. Detach the inner column from the steering unit pinion by lifting and sliding the outer column through the binnacle "U" bolt approximately 2 in. (50 mm.). IT IS INADVISABLE TO LIFT THE INNER COLUMN

ALONE as subsequent cancelling of the direction signals can be impaired.

When difficulty is experienced, examine the bottom end of the inner column and steering unit pinion for corrosion and free the steering unit from the suspension member by slackening off the four nuts on the steering unit "U" bolts.

5. Detach the two ball joints from the steering arms by removing the nuts from the tapered ball pins and using a suitable extractor, Churchill tool No. RG.284.

6. Detach the steering unit from the suspension member by removing four nuts, washers, two reinforcement plates, lower bridge pieces from the "U" bolts and collecting the upper bridge pieces after the steering unit has been removed.

   When it is necessary to renew the "U" bolts, the suspension member and the front suspension brackets must be detached from the floor assembly.

7. Manoeuvre the steering unit complete with the two track rods from beneath the car through the wishbones.

8. Re-fitting is the reverse of the removal sequence but particular attention must be given to the following:

   i. The curved bridge pieces are fitted above and below the steering unit accommodating its cylindrical shape and offered up to the "U" bolts so the four threaded shanks locate the grooves in the steering unit and then followed by the reinforcement plates, raised edges first and the four nuts "nipped" up finger tight.

   ii. To ensure the correct fitting and alignment of the inner column and steering unit pinion, see under "Inner column attachment".

   iii. The convolute and conical covers must be renewed when they show any signs of damage or deterioration, see under "Convolute and Conical Covers—To remove and refit".

   iv. Ensure that the steering unit contains its full compliment of oil.

   v. When refitting the pawl unit ensure that the cable is uppermost and the pawl, which protrudes through its fitting face, is situated centrally in the most vertical aperture of the outer column.

   vi. The front wheel alignment is checked and set. See under "Front Wheel Alignment—To check and adjust", in the "Front Suspension, Section F".

CONVOLUTE AND CONICAL COVERS

The convolute cover, fitted to the centre section of the steering unit, is corrugated to permit the lateral travel of the two track rods. The attachment bolts of the two track rods pass through metal inserts incorporated in the convolute cover and these also act as travel stops.

The two conical covers, fitted one to each end of the steering unit, are of such a depth that they accommodate the lateral travel of the steering rack as it protrudes from the steering unit body when the steering approaches the full lock position.

The convolute and conical covers are secured to the steering unit body by metal clips and make the unit oil and weather tight.

When either or both the convolute and conical covers need renewing it is necessary to remove the steering unit complete with track rods from the car so the steering unit can be refilled with oil.

To remove and refit

1. Remove the steering unit complete with track rods from the car, see under "STEERING UNIT—To remove and refit"; clean off all road dirt.

2. Remove the conical cover(s) from the steering unit by releasing the metal clips and trapping any escaping oil in a drip tray.

3. Remove the two track rods from the steering unit by releasing the lock plate, withdrawing two bolts, strut plate and prising the extended metal bushes of the track rods from the convolute cover.

4. Slide the convolute cover off the steering unit from the opposite end to the pinion by releasing the metal clips and trapping any escaping oil in a drip tray.

5. Refitting is the reverse of the removal sequence but particular attention must be given to the following:

   i. The conical cover at the pinion end is left until the steering unit has been filled with lubricant.

   ii. The metal clips securing the convolute and conical covers are tightened to give an oil and weather tight joint.

   iii. The steering unit is filled with lubricant, see under "To refill—Oil".

To refill—Oil

As some replacement steering units are supplied dry and after one has been reassembled it must be filled with ½ pint (·3 litre) of the recommended grade of oil, see under "Recommended Lubricants—Section P".

When a leak is observed, the steering unit must be removed from the car, the cause of the leak rectified, refilled and then refitted.

1. Remove the steering unit complete with track rods from the car, see under "STEERING UNIT—To remove and refit".

2. Examine the convolute and conical covers for leaks; clean off all road dirt and tighten the metal clips of the convolute and conical covers opposite the pinion end or renew the covers as necessary, see under "CONVOLUTE AND CONICAL COVERS—To remove and refit".

3. Remove the conical cover from the pinion end of the steering unit by slackening the metal clips; drain off the oil content.

4. Position the steering unit and track rods vertically, pinion end upwards; refill the unit with the correct quantity of the recommended lubricant, see under "RECOMMENDED LUBRICANTS, Section P".

5. Fit the conical cover to the steering unit and tighten the metal clips to give an oil and weather tight seal.

6. Refit the steering unit complete with track rods to the car, see under "STEERING UNIT—To remove and refit".

TRACK RODS

The left and right hand track rods are of fixed and adjustable lengths respectively, the latter being used to set front wheel alignment (toe-in). The ball joints and metal/rubber bonded bushes at the outer and inner ends are a press fit in their respective ends; only the rubber bushes in the inner ends can be renewed.

To remove and refit

1. Remove the steering unit complete with track rods from the car, see under "STEERING UNIT—To remove and refit".

2. Remove the two track rods from the steering unit by releasing the lock plate, withdrawing two bolts, strut plate and prising the extended metal bushes of the track rods from the convolute cover.

3. Drain off the oil content.

4. Refitting is the reverse of the removal sequence but particular attention must be given to the following:

   i. The adjustable track rod is fitted to the right hand side of the steering unit.

   ii. The steering unit is refilled with the correct quantity of lubricant, see under "CONVOLUTE AND CONICAL COVERS—To refill—Oil".

   iii. Ensure the two track rods are aligned parallel to the centre line of the steering unit before fully tightening the track rod bolts.

RECONDITIONED STEERING UNITS

In the event of a steering unit becoming unserviceable, it is strongly recommended that it is renewed by fitting a reconditioned unit exchanged under the service replacement scheme. Should circumstances make this impracticable, the following dismantling sequence is given.

The rubber convolute and conical covers are available as replacement parts, thus when they are observed to be damaged or have otherwise deteriorated, they can be renewed after removing the steering unit but without dismantling it, see under "Convolute and Conical Covers—To remove and refit".

To dismantle and re-assemble (See Fig. 3)

1. Remove the two track rods from the steering unit by releasing the lock plate, withdrawing two bolts, strut plate and prising the extended bushes of the track rods from the convolute cover.

2. Remove the two conical covers from the body, followed by the convolute cover after releasing four metal clips and trapping any escaping oil in a drip tray.

3. Withdraw the damper screw and locknut from one side of the body followed, on certain steering units, by a sealing ring and prise out the closure cap from the opposite side of the body.

4. Remove the upper bearing, shim pack and paper joints from the pinion by withdrawing two bolts and washers or, on certain steering units, two nuts and washers.

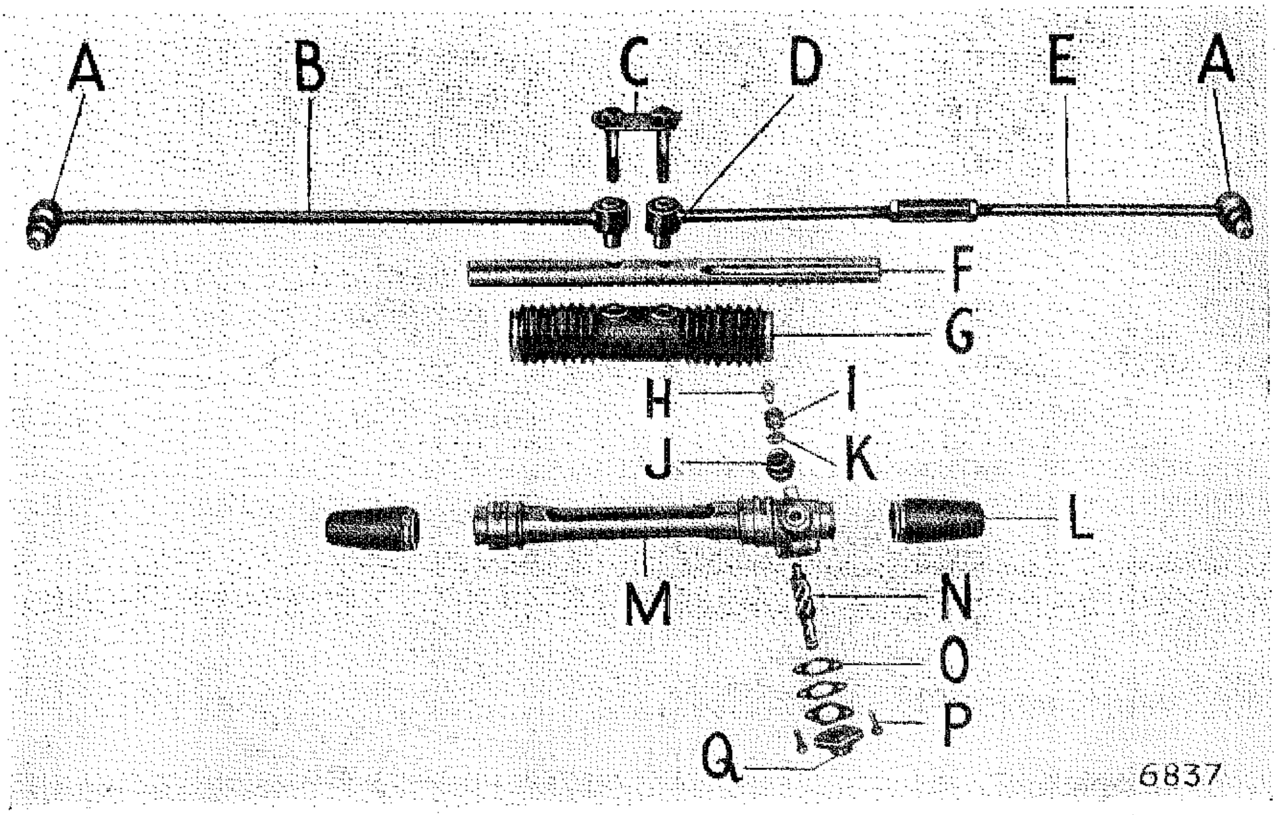


Fig. 4. *Exploded view of rack and pinion steering unit*

A	BALL JOINT
B	LEFT HAND TRACK ROD
C	TRACK ROD BOLTS
D	EXTENDED METAL BUSH
E	ADJUSTABLE TRACK ROD
F	STEERING RACK
G	CONVOLUTE COVER
H	DAMPER PAD ADJUSTING SCREW
I	DAMPER PAD SPRING
J	DAMPER PAD
K	DAMPER PAD WASHER
L	CONICAL COVER
M	BODY
N	SPLINED PINION AND THRUST WASHER
O	SHIMS
P	BOLT AND WASHER OR STUD AND NUT
Q	PINION UPPER BEARING

5. Apply pressure to the steering rack against the damper spring and withdraw the pinion and thrust washer from the body; it is important that the thrust washer is removed at this juncture for it will foul and possibly damage the damper pad while the latter is being removed.

6. Still applying pressure to the steering rack against the damper spring, move the rack into the body until its end is clear of the damper pad; withdraw the damper pad, washer and damper spring through the closure cap aperture.

7. Withdraw the steering rack from the pinion end of the body, thus the steering rack teeth will not score the bush in the opposite end of the body.

8. Reassembly is the reverse of the dismantling sequence but particular attention must be given to the following.

   i. When either of the studs are loose or have been renewed, they must be tightened to a torque of 3·5 lbs. ft. (50 kg. cm.).

   ii. All parts are assembled with a liberal coating of the recommended oil, see under "Recommended Lubricants, Section P".

   iii. Any paper joints, included in the original shim pack, must be discarded and replaced with metal shims. Before the shim pack is fitted, each shim must be coated with jointing compound; similarly the rim of the closure cap is also coated with jointing compound.

   iv. The thrust washer, flat face downwards, pinion and upper bearings are fitted to the empty body without the shim pack. The oil film is broken and the pinion seated by gently tapping the splined end with a mallet. Measure the gap between the upper bearing flange and the body, select a shim pack ·001 to ·004 in. (·02 to ·10 mm.) THICKER than the measured gap with a preference for the lower limit. The upper bearing pinion and thrust washer are now removed from the body.

   v. The steering rack is fed into the body, plain end first, so the groove aligns with the damper screw tapping; the damper spring, washer and pad are fitted and compressed so the steering rack can be moved outwards from the pinion end when its groove will accommodate the tongue of the damper pad.

   vi. Partially position the thrust washer, flat face downwards, on its seat and insert the pinion; while applying pressure to the steering rack against the damper spring, the thrust washer will move fully onto its seat as the pinion goes home. Fit the shim pack and upper bearing, tighten the nuts to a torque of 3 lbs. ft. (42 kg. cm.).

   vii. The bolt heads of the metal bands securing the convolute and conical covers are positioned vertically downward and behind the body when the steering unit is in the fitted position, the centre line of the pinion is inclinded rearward approximately 40°; the conical cover at the pinion end is left slack until the track rods have been fitted and the steering unit filled with oil.

   viii. Fit the damper screw, seal, washer and locknut and set the damper pad endfloat by traversing the rack to its tightest spot, tightening the damper screw until it contacts the washer and slacken off the damper screw and locknut $\frac{1}{2}$ a flat to obtain ·003 in. (·08 mm.) damper pad endfloat. Hold the damper screw steady while tightening the locknut to a torque of 3.5 lbs. ft. (50 kg. cm.). The closure cap is pressed in, recessed side first, until it becomes flush with the body.

   ix. Check that the starting torque to rotate the pinion to the full lock position in both directions does not exceed 14 lbs. in. (15 kg. cm.).

   x. The adjustable track rod is fitted to the right hand side of the steering unit, both track rods are set parallel to the centre line of the steering unit and the bolts tightened to the torque given in the "General Data Section".

   xi. The steering unit is filled with oil through the pinion end and the conical cover refitted, see under "To refill—oil".

   xii. The steering unit is stored flat with the pinion pointing upwards, thus minimising oil leakage.

STEERING COLUMN

The steering column is separate from the rack and pinion steering unit. The lower end of the inner column is supported on the pinion of the steering unit by splines and a pinch bolt while the upper end is supported by a bush at the top end of the steering column. The steering wheel is mounted on the inner column by a taper, parallel splines and a nut.

The outer column is mounted on the floor inside the car by a flange and supported by a bracket protruding from below the instrument binnacle.

Mounted on the steering column above the instrument binnacle bracket is the direction indicator pawl unit. The pawl unit is actuated either by the spring driver clip mounted directly on the inner column or the same clip within a driver bush; the latter being situated between the inner and outer columns and will cancel any direction signals as the steering wheel returns to the straight ahead position. The presence of the striker bush can be ascertained by a metal dowel in the outer column on the opposite side to the pawl unit.

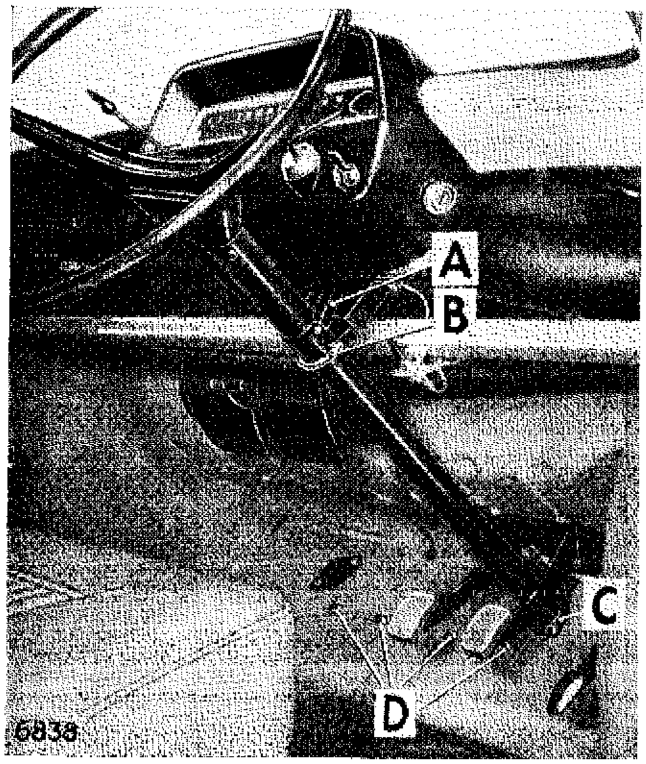


Fig. 5. *View of steering column inside car*

A PAWL UNIT B "U" BOLT
C OUTER COLUMN FLANGE D REAR SUPPORT BRACKET BOLTS

To remove and refit (See Fig. 5)

1. Detach the pawl unit from the steering column by withdrawing two screws, washers and a clip; stow away on the parcel tray.

2. Remove the steering wheel, see under "Steering wheel—To remove and refit"; fit a worm drive hose clip on the inner column to abut to the outer column.

3. Lift the outer and inner columns simultaneously from the car floor after detaching the outer column from the binnacle bracket and floor by removing two nuts, washers, "U" bolt and bridge piece, and two bolts and washers respectively. Remove the inner column from the steering unit pinion by withdrawing the pinch bolt, when difficulty is experienced, examine the bottom end of the inner column and steering unit pinion for corrosion and free the steering unit in the suspension member by slackening off the four nuts on the steering unit "U" bolts.

4. Store the steering columns so the inner column will not become displaced from within the outer as subsequent cancelling of the direction signals can be impaired.

5. Refitting is the reverse of the removal sequence but particular attention must be given to the following:

   i. To ensure the correct fitting and alignment of the inner column and steering unit pinion observe the sequence given under "Inner column attachment".

   ii. Refit the pawl unit, see under "Direction indicator pawl unit—To remove and refit".

   iii. Refit the steering wheel, see under "Steering wheel—To remove and refit".

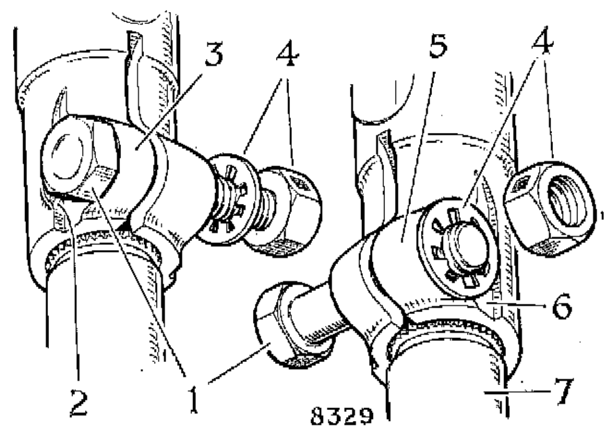


Fig. 6. *Showing the attachment of the inner column to the steering unit pinion*

1. THROUGH BOLT
2. SHOULDER TO LOCK BOLT HEAD
3. THINNER LUG
4. WASHER AND "WEDGLOK" NUT
5. THICKER LUG
6. SPOT FACE FOR NUT
7. STEERING UNIT PINION

Inner column attachment

Two methods of securing the inner column to the steering unit pinion, employing three types of details, have been used and are as follows:

1. A $\frac{1}{4}$ in. UNF pinch bolt and washer having an unmarked head.

2. A $\frac{1}{4}$ in. UNF pinch bolt and washer having a "V" marked on its head, this bolt permitted an increased tightening torque.

3. A $\frac{5}{16}$ in. UNF through bolt, washer and "Wedglok" nut; these details permitted a greater tightening torque. See Fig. 6.

The shank of these bolts locate a groove formed in the splines of the steering unit pinion but on certain steering units this groove is not concentric, thus any resulting misalignment of the spring driver clip or bush and the outer column aperture must be eliminated before the direction indicator pawl unit is refitted.

To ensure the correct column and steering unit pinion alignment proceed as follows:

1. Clean and examine the splines of the steering unit pinion and the inner column for damage and corrosion. When there is any doubt as to the good condition of these splines, the component must be renewed.

2. Protect the splines from corrosion by applying a liberal coating of Shell Retinax "A" Grease.

3. When necessary, free off the steering unit in the suspension member by slackening off the four nuts on the "U" bolts.

4. Lower the inner and outer columns simultaneously onto the steering unit pinion and floor respectively, these columns must not be permitted to separate as the cancelling of the direction signals can be impaired. The inner column may need rotating a short distance to align the pinch bolt hole to the groove in the steering unit pinion when the groove is not concentric, to facilitate assembly the top of the steering unit pinion is chamfered immediately above the groove. Fit the pinch bolt details to the inner column as follows:

   i. Types 1 and 2, the pinch bolt and washer is fed through one lug of the inner column so it picks up the thread in the opposite lug.

   ii. Type 3, the through bolt is fed through the thinner lug of the inner column when the bolt head becomes captive. A new "Wedglok" nut and washer must always be fitted. See Fig. 6.
   Tighten the pinch bolt details to the torque given in the "General Data Section".

5. Secure the outer column to the car floor with two bolts and washers and finally to the binnacle bracket with the "U" bolt, bridge piece, washers and nuts.

6. Fully tighten the four nuts on the steering unit "U" bolts by diagonal selection to the torque given in the "General Data Section".

7. Turn the steering from lock to lock to ensure no foul exists between the inner column attachment details and the suspension member, should a foul exist it must be cleared by filing.

8. Any inaccuracies in the position of the gap between the two lugs of the spring driver clip or bush, as viewed through the top aperture in the outer column, is corrected by resetting the position of the spring driver clip or bush, see under "Resetting the driver clip or bush".

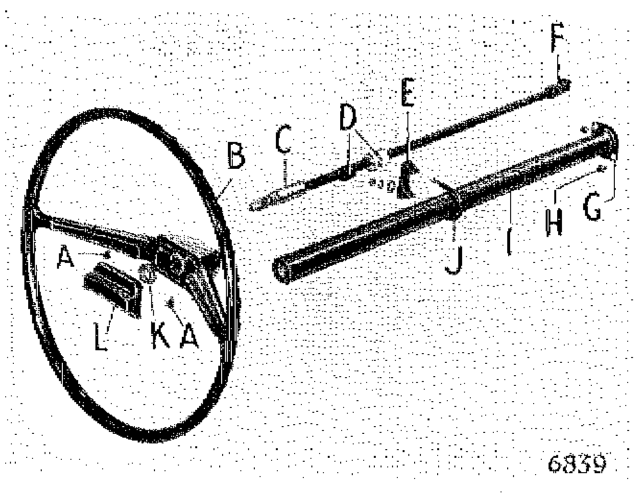


Fig. 7. *Exploded view of steering column*

A	SPIRE NUT	B	STEERING WHEEL
C	INNER COLUMN	D	SPRING DRIVER CLIP
E	BRIDGE PIECE	F	SPLINED COUPLING
G	MOUNTING FLANGE	H	BOLT AND WASHER
I	OUTER COLUMN	J	"U" BOLT
K	STEERING WHEEL NUT	L	MOTIF

To dismantle and re-assemble (See Fig. 7)

1. Withdraw the inner column through the flanged end of the outer; no useful purpose is served by removing the spring driver clip from the inner column.

2. When fitted, withdraw the driver bush through the flanged end of the outer column by removing the metal dowel.

3. Eject the bush from the top of the outer column when it is seen to be well worn; see under "Steering column bush bearing—To remove and refit".

4. Refitting is the reverse of the removal sequence but particular attention must be given to the following:

   i. The driver bush is fed into the flanged end of the outer column, lugs end first, until the circumferential groove aligns with the dowel drilling; fit a new dowel.

   ii. Ensure that the top edge of the spring driver clip is $7\frac{7}{8}$ in. (20.0 cm.) or $7\frac{1}{4}$ in. (18.5 cm.) when used with or without the driver bush respectively.

   iii. When the driver bush is fitted, position the inner column vertically so the lugs are to the left hand side. Position the two lugs of the driver bush, inside the inner column, one in each aperture and the metal dowel in the six o'clock position. Feed the outer column onto the inner, flanged end first, until $2\frac{3}{4}$ in. (7 cm.) of inner column protrudes through the top of the outer column and fit a worm drive hose clip to the inner column to maintain this protrusion. Ensure that the driver bush rotates with the inner column; when failure is observed, the inner column must be withdrawn and the spring driver clip repositioned as it has failed to locate the axial groove inside the driver bush. See Fig 8.

DIRECTION INDICATOR SWITCH, AND PAWL UNIT

The direction indicator switch protrudes from the instrument facia and any direction signal that is given is cancelled automatically by the pawl unit mounted on the steering column, providing the steering wheel has moved more than 30° from the straight ahead position in the direction of the given signal.

The pawl unit is situated between the instrument binnacle bracket and the instrument binnacle. A pawl which protrudes through the fitting face of the pawl unit, adopts a position between the two raised lugs of the spring driver clip on the inner column or the two lugs of the driver bush when the steering is in the straight ahead position.

When fitted, the driver bush is situated between the inner and outer columns and located by a metal dowel pressed in the outer column. The internal diameter of the driver bush has a large axial groove to accommodate the raised lugs of the spring driver clip thus, the driver bush will rotate with the inner column.

When a direction signal is given and providing the steering wheel is moved more than 30° towards the given signal, one raised lug on the spring driver clip will trip past the pawl of the pawl unit. If a driver bush is fitted, movement of the spring driver clip is transferred to the driver bush when the corresponding lug on the upper face of the driver bush will actuate the pawl in a similar manner. As the steering wheel returns to the straight ahead position, the lug on the spring driver clip or bush will engage the pawl of the pawl unit and cancel the direction signal.

Two pawl units have been used and they are not interchangeable but can be identified by the size of the pawl protruding through the fitting face. The pawl unit having the large pawl is used with the spring driver clip and the unit having a smaller pawl is used with the driver bush which is the only one available for replacement purposes. When it is necessary to renew a pawl unit having a long pawl, the outer column must be modified and a driver bush fitted.

To remove and refit

1. Detach the pawl unit from the steering column by removing two screws, washers and a clip; the length of its cable will permit the pawl unit to be stowed in the parcel tray.

2. Refitting is the reverse of the removal sequence but particular attention must be given to the following:—

   i. The front wheels are positioned in the straight ahead attitude by setting them parallel to the rear wheels and the position of the gap, between the two lugs of the spring driver clip or bush, set midway in the uppermost aperture with a rod fed through either aperture in the outer column.

   ii. Ensure that the cable is uppermost and the pawl which protrudes through the fitting face of the pawl unit is situated centrally in the most vertical aperture of the outer column. On certain cars, a "pip" in the clip of the pawl unit will locate a drilling in the outer column.

Resetting the spring driver clip or bush

When the spring driver clip or bush are correctly aligned the gap between the two lugs is, when the front wheels are in the straight ahead position, central within the top aperture in the outer column whether left or right hand drive. Any misalignment can be corrected as follows:

1. Remove the pawl unit from the steering column by withdrawing two screws, washers and a clip, stow away on the parcel tray.

2. Move the steering so the gap between the two lugs of the spring driver clip or bush appears central within the top aperture in the outer column.

3. Observe the position of the front wheels and using a rod or similar tool hold the spring driver clip or bush stationary and move the steering to set the front wheels in the straight ahead position.

4. Refit the pawl unit, see under "Direction indicator pawl unit—To remove and refit".

To fit driver bush to existing cars (Fig. 8)

1. Remove the steering column from the car, see under "Steering column—To remove and refit", withdraw the inner column from the flange end of the outer.

2. Drill a $\frac{5}{32}$ in. (3.9 mm.) diameter hole in the outer column 5·45 in. (13·8 cm.) from its top end and opposite to but a little below the "land" between the two pawl unit apertures. The size of the drilling is IMPORTANT (·154 to ·158 in.; 3·9 to 4·0 mm.) to obtain the necessary interference fit for the metal dowel.

3. Relieve all burrs inside the outer column around the drilling and the two apertures to prevent fouling the driver bush.

4. Feed the driver bush into the flanged end of the inner column, lugs end first, until the circumferential groove aligns with the drilling in the outer column and retain by pressing the metal dowel into the drilling.

5. The spring driver clip on the inner column is moved downward until its top edge is $7\frac{7}{8}$ in. (20.0 cm.) from the top end of the inner column. Reassemble the steering column, see under "Steering Column—To dismantle and reassemble".

6. Refit the steering column to the car, see under "Steering Column—To remove and refit". The inner column is now 90° removed from its original position and the steering wheel must be refitted accordingly.

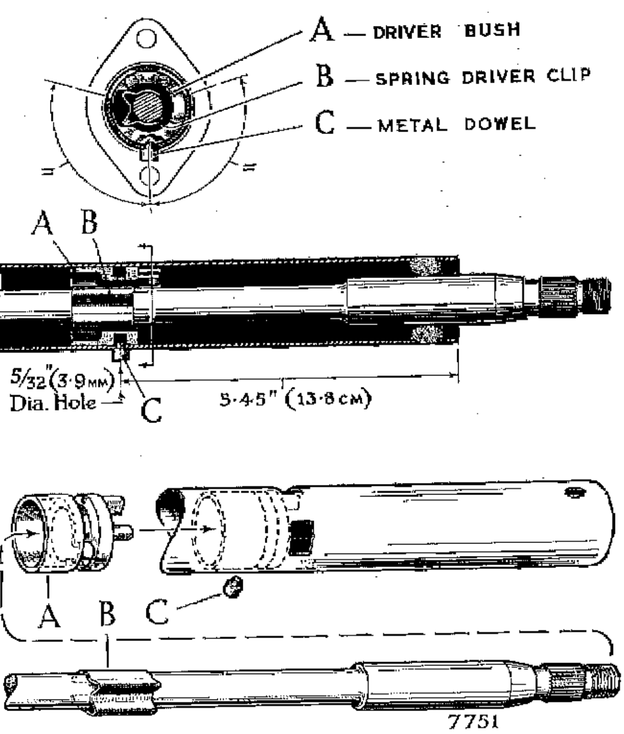


Fig. 8. *Showing location of dowel drilling and striker bush*

7. The original pawl unit is discarded and one having a shorter pawl fitted, see under "Direction Indicator Switch and Pawl Unit—To remove and refit".

STEERING COLUMN BUSH

The bush which supports the top end of the inner column, is positioned by spigots moulded in its outer circumference locating drillings in the outer column.

Two types of bushes have been fitted and they are as follows:

i. A metal and rubber bonded bush having a nylon sleeve was fitted to early cars and can be recognised by its flush fitting with the top of the outer column.

ii. A one piece bush fabricated from "Polyvon" is fitted to later cars and can be recognised by its sunken fit with the top end of the outer column.

Lubrication

The steering column bush is lubricated during initial assembly and periodical lubrication is unnecessary. In service, should ever the need for lubrication arise the chamfer in the top face of the bush is packed with petroleum jelly.

To remove and refit

1. Remove the steering column from the car, see under "Steering Column—To remove and refit" and withdraw the inner column from the flange end.

2. Lay the top end of the outer column flat on the bench so one bush spigot is uppermost.

3. Using a blunt tool press first one spigot and then the other, into and upward, out of the outer column.

4. Refitting is the reverse of the removal sequence but particular attention must be given to the following:

   i. The early metal and rubber bonded bush bearing is fitted, metal insert end first, when its end face will become flush with the top end of the outer column; the later bush will finish below the top end of the outer column.

   ii. Lubricate the bush, see under "Lubrication".

   iii. Reassemble the steering column, see under "Steering Column—To dismantle and reassemble".

STEERING UNIT WITH BALL BEARING PINION

To dismantle and reassemble

1. Remove the two track rods from the steering unit by releasing the lock plate, withdrawing two bolts, strut plate and prising the extended rubber bushes of the track rods from the convolute cover.

2. Remove the two conical covers from the body, followed by the convolute cover by releasing four metal clips and trapping the escaping oil in a drip tray.

3. Slacken off the damper screw and locknut a full turn and prise the closure cap from the opposite side of the body.

4. Remove the cover plate, paper joint and shim pack from the top of the pinion housing by detaching two nuts and washers, prise the sealing ring from inside the cover plate when it is well worn.

5. Move the rack so it becomes clear of the pinion and withdraw the pinion and top ball race assembly from

the body; remove and discard the top ball race assembly from the pinion when it is well worn.

6. Withdraw the damper pad, pressure plate and belleville washers through the closure cap aperture; hold the locknut and remove the damper screw by applying a screwdriver, through the closure cap aperture to its slotted inner end, remove the locknut, washer and seal from outside the body.

7. Withdraw the rack through the pinion end of the body, thus the rack teeth will not score the bush in the opposite end of the body.

8. When it is necessary to remove the pinion bottom ball race assembly, heat the body around that area and the ball race assembly will drop out when the body is "turned over" and the pinion end tapped on a wooden block.

9. Reassembly is the reverse of the dismantling sequence but particular attention must be given to the following:

   i. When either of the studs are loose or have been renewed, they must be tightened to a torque of 3·5 lbs. ft. (50 kg. cm.).

   ii. All parts are reassembled with a liberal coating of the recommended oil, see under "Recommended Lubricants, Section P".

   iii. The pinion ball race assemblies are a light press fit on the pinion and in the body.

   iv. Preload the pinion bearings ·000 to ·002 in. (·00 to ·05 mm.) by pressing the pinion and top ball race assembly into the empty body followed by the original shim pack and cover plate but without a paper joint and breaking the oil film by gently tapping its splined end with a mallet; measure the gap between the cover plate and body, calculate the thickness of the shim pack to produce the specified preload and the thickness of one paper joint, remove the cover plate, shim pack and top ball race assembly from the body.

   v. The rack is fed into the body plain end first, so the groove aligns with the damper screw tapping and until the end is just clear of the damper pad housing.

   vi. Locate the pressure plate followed by two belleville washers, with their raised centre edges together, inside the damper pad with a smear of grease.

   vii. Coat the paper joint with a non-hardening sealing compound, fit beneath the end cover and secure with two nuts tightened to a torque of 3·5 lbs. ft. (50 kg. cm.); coat the edge of the closure cap similarly and press in, recessed side first until it becomes flush with the body.

   viii. The bolt heads of the metal bands securing the conical and convolute covers are positioned vertically downward and behind the body when the steering unit is in its fitted position, the centre line of the pinion is inclined rearward approximately 40°, the conical cover at the pinion end is left slack until the track rods have been fitted and the steering filled with oil.

   ix. Check the starting torque to rotate the pinion to the full lock position in both directions does not exceed 14 lbs. in. (15 kg. cm.).

   x. The adjustable track rod is fitted to the right hand side of the steering unit and both track rods are set parallel to the centre line of the steering unit and the bolts tightened to the torque given in the "General Data Section".

   xi. The steering unit is filled with oil through the pinion end and the conical cover fitted, see under "To refill—oil".

   xii. The steering unit is stored flat with the pinion pointing upwards, thus minimising oil leakage.

BRAKES

SECTION K

CONTENTS

BRAKES

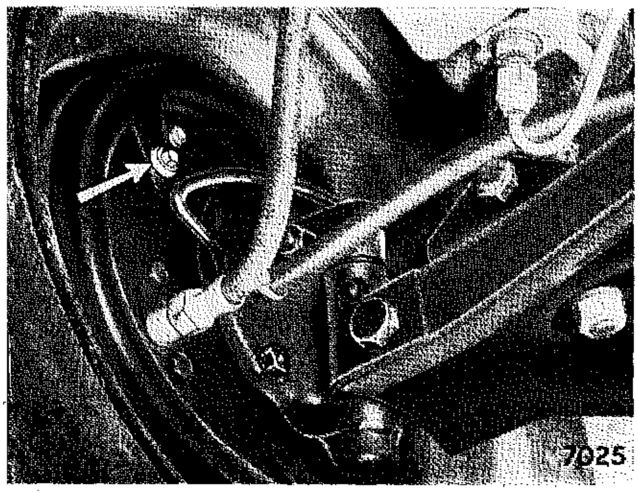


Fig. 1. *Location of one brake shoe adjuster of the front brake, the second adjuster is diametrically opposite*

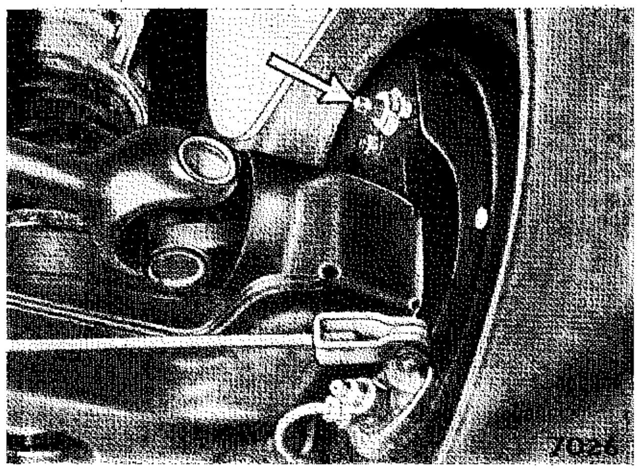


Fig. 2. *Location of the brake shoe adjuster of the rear brake*

DESCRIPTION

Girling two leading shoe drum brakes are fitted on the front wheels and leading and trailing shoe drum brakes are fitted on the rear wheels.

All four brakes are hydraulically operated by pressure generated in the master cylinder by application of the brake foot pedal.

The handbrake operates on the rear brakes only by two independent cables.

MAINTENANCE

BRAKE LININGS

Brake linings should be examined for wear at regular intervals and the linings renewed when they have worn down to rivet level.

Front brake shoe adjustment (See Fig. 1)

There are two snail cam adjusters in each front brake, one for each shoe and each must be adjusted separately.

1. Jack up the front of the car so the front wheels are clear of the ground.
2. Turn back (anti-clockwise) both adjusters, situated on the outside of the brake back plate, until they are in the fully retracted position.
3. Turn one adjuster clockwise until the brake shoe is hard against the brake drum and slacken back two clicks, when the wheel should rotate freely.
4. Repeat with the second adjuster and the second front brake.
5. Lower the car and remove the jacks.

Rear brake shoe adjustment (See Fig. 2)

There is one adjuster in each rear brake with two links forming the abutment for the brake shoes. Each rear brake is adjusted individually and automatically adjusts the handbrake.

1. Chock the front wheels, release the handbrake and jack up the rear of the car.
2. Turn the adjuster situated on the outside of the brake back plate clockwise until the brake shoes are hard against the brake drum and slacken back two clicks when the wheel should rotate freely.
3. Repeat with the second rear brake.
4. Lower the car, remove the jacks, apply the handbrake.

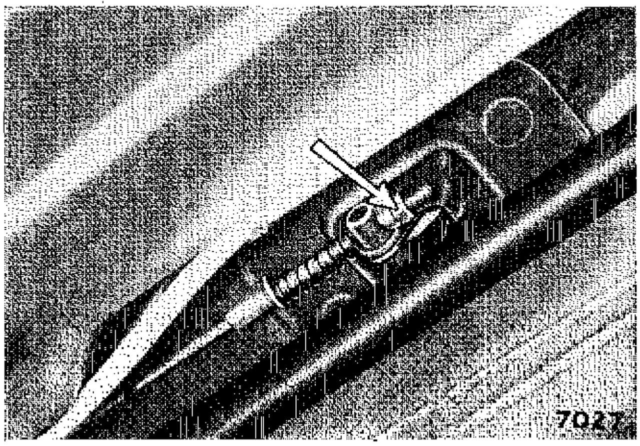


Fig. 3. *Location of the right-hand brake cable adjuster, the left-hand adjuster is on the opposite side of the handbrake lever*

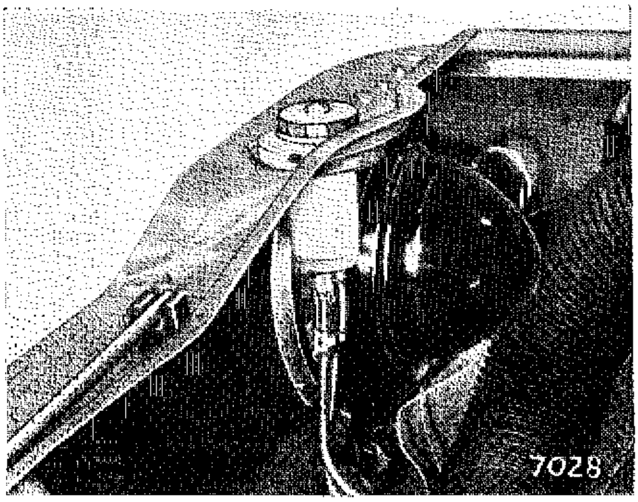


Fig. 4. *Location of the fluid reservoir*

Handbrake adjustment (See Fig. 3)

Adjustment of the rear brakes will automatically adjust the hand brake. If, however, it is found that with the rear brakes in correct adjustment, excessive handbrake free travel is obtained, adjust the handbrake as follows:—

1. Chock the front wheels, release the handbrake and jack up the rear of the car.

2. Lock both rear brakes by means of the adjusters situated in each brake back plate.

3. Remove the plate from the centre of the floor assembly beneath the car by withdrawing eight bolts and washers.

4. Set the length of each cable individually to remove all slack by tightening the nut on the threaded end of the cable while holding the cable end steady with a second spanner on the smaller hexagon a short distance from the front end.

5. Refit the plate so the end having the upturned tongue is towards the front of the car.

6. Re-adjust the rear brakes, see under "REAR BRAKE SHOE ADJUSTMENT".

FLUID LEVEL (See Fig. 4)

The fluid level in the master cylinder reservoir must be checked at regular intervals and should be kept up to the division inside the reservoir.

When the fluid level drops suddenly it indicates the existence of a leak and an immediate investigation must be carried out so the fault can be rectified.

Use only the specified type of brake fluid for replenishment purposes, see under "RECOMMENDED LUBRICANTS, SECTION P". Care must be taken not to spill any fluid on the car body as it is injurious to paintwork.

Dirt must not be allowed to enter the hydraulic system. The area around the top of the reservoir, together with the filler cap and utensils used during any topping up must be perfectly clean.

1. Clean the filler cap and the area around the top of the fluid reservoir situated in the front right-hand corner of the luggage compartment.

2. Unscrew the filler cap from the reservoir and top up to the division inside the reservoir with *NEW* fluid.

3. Ensure the breather holes in the filler cap are unobstructed and refit the cap.

FRONT BRAKES

DESCRIPTION (See Fig. 5)

The front brake assembly has two leading shoes which are operated by two single acting wheel cylinders situated diametrically opposite one another and connected by a bridge pipe.

The leading or toe end of the brake shoes are expanded by the pistons of the wheel cylinders and the abutments at the trailing ends of the brake shoes are angled to a precise degree, thus the brake shoes will slide as they expand and a more efficient use is made of the whole lining area.

The combination of wheel cylinder piston thrust and the effort induced by the rotating drum impinges on the angled abutment causing an outward movement of the brake shoe at the abutment or heel end similar to that of the leading or toe end. Thus the pressure over the lining area becomes equal, increasing the braking efficiency, equalising wear and temperature over the whole lining area.

Steady posts and leaf springs, fitted through the brake back plate and each brake shoe web, hold the brake shoes against the platforms pressed in the back plate, thus *obviating any loss of brake shoe travel due to tilting.*

Pull off springs are fitted between each brake shoe, adjacent to the wheel cylinder body and the brake back plate.

FRONT BRAKE SHOES

Always fit factory lined replacement brake shoes and new pull off springs. The brake shoes have the correct type of lining and are ground accurately to size, thus ensuring an easy and quick bed-in to the brake drums.

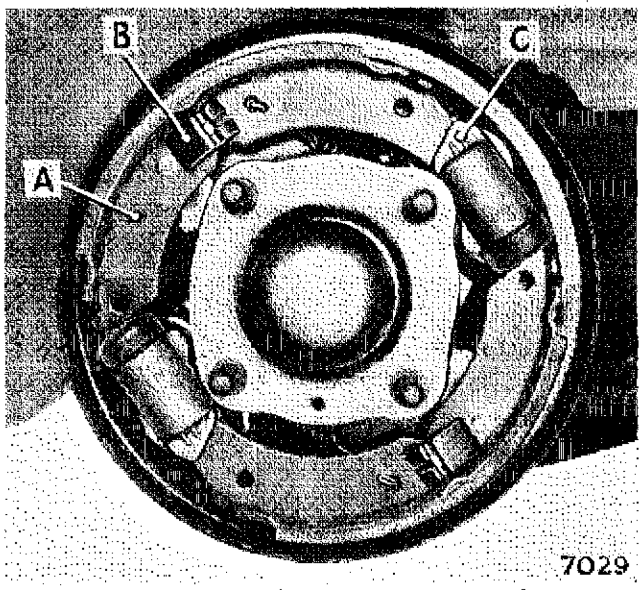


Fig. 5. *Right-hand front brake assembly*

A. TOE END OF BRAKE SHOE
B. LEAF SPRING OF STEADY POST
C. ANGLED ABUTMENT OF WHEEL CYLINDER BODY

To remove and refit (See Fig. 5)

1. Apply the handbrake, jack up the front of the car and remove the roadwheel.

2. Remove the brake drum from the hub by slackening off both brake shoe adjusters and withdrawing a countersunk screw.

3. Remove the leaf springs and steady posts from the brake shoe and back plate by holding the head of the post while compressing the leaf spring and sliding it sideways.

4. Lift the brake shoe from the slot in the wheel cylinder body and disconnect the pull off spring from the back plate.

5. Repeat the previous two operations with the second brake shoe and apply rubber bands to each wheel cylinder to retain the piston within the wheel cylinder body.

6. Refitting is the reverse of the removal sequence but particular attention must be given to the following:—

   i. Lightly smear the slot in the wheel cylinder body with Girling White Brake Grease.

   ii. The pull off springs are fitted behind the brake shoe web using the holes adjacent to the steady posts. The open ends of the steady post leaf springs are fitted towards the end of the pull off springs. When fitting new replacement brake shoes always fit new pull off springs.

   iii. Adjust the brake shoes, see under "FRONT BRAKE SHOE ADJUSTMENT", but when new replacement brake shoes have been fitted slacken off the adjusters one more click each to allow for lining expansion and revert to normal adjustment after a short mileage.

FRONT BRAKE BACK PLATE

The front brake back plate is a steel pressing suitably shaped to support the wheel cylinders, steady posts and brake shoes. The back plate is mounted on the stub axle by three nuts and bolts. When necessary it can be detached without disconnecting the hydraulic system, movement being permitted by the flexible hose attached to the wheel cylinder situated behind the stub axle.

To remove and refit (See Fig. 5)

1. Apply the handbrake, jack up the front of the car and remove the roadwheel.

2. Remove the brake drum from the hub by slackening off both brake shoe adjusters and withdrawing a countersunk screw.

3. Remove the front hub from the stub axle, see under "FRONT SUSPENSION, SECTION F".

4. Detach the back plate complete with brake shoes and wheel cylinders from the stub axle by withdrawing three bolts, nuts and washers; suspend nearby without straining the flexible hose.

   When it is necessary to remove the back plate from the car, disconnect the flexible hose at the wheel arch bracket, see under "FLEXIBLE HOSE—To remove and refit—Front".

5. Refitting is the reverse of the removal sequence, but particular attention must be given to the following:—

   i. The endfloat of the front hub is set, see under "FRONT SUSPENSION—SECTION F".

   ii. The brake shoes are adjusted, see under "FRONT BRAKE SHOE ADJUSTMENT".

   iii. When the back plate has been removed from the car, bleed the brake system of air, see under "BLEEDING THE HYDRAULIC SYSTEM".

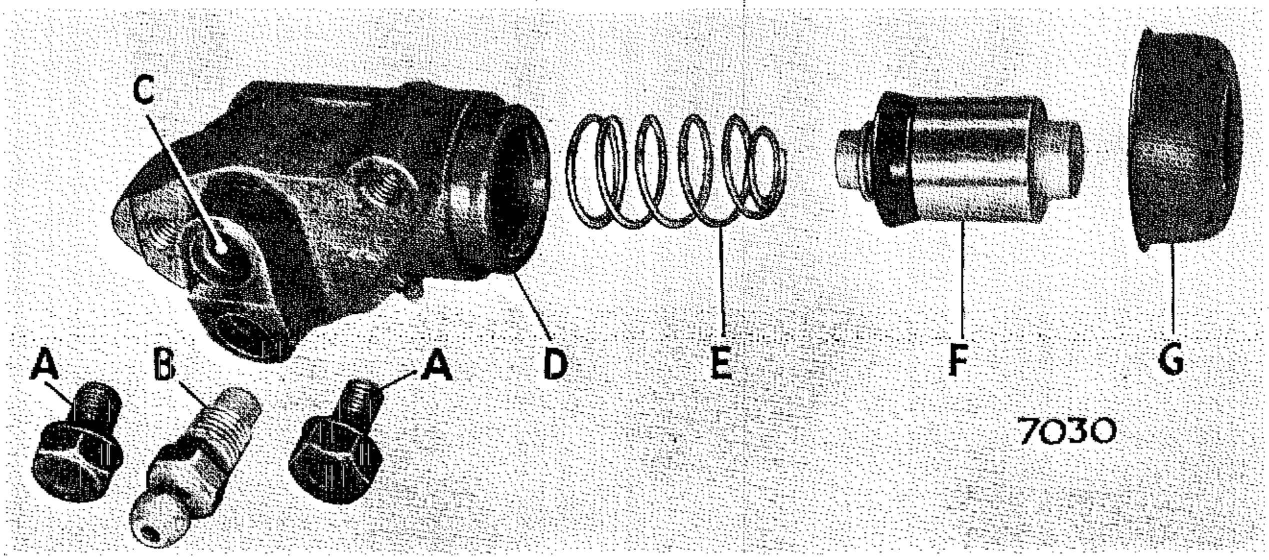


Fig. 6. *Exploded view of front wheel cylinder.*

A. BOLT AND WASHER
B. BLEED SCREW
C. BRIDGE PIPE PORT
D. WHEEL CYLINDER BODY
E. PISTON SPRING
F. PISTON AND SEAL
G. DUST COVER

FRONT WHEEL CYLINDERS (See Fig. 6)

The front wheel cylinder consists of an alloy body housing, a spring, seal and piston. The piston end is protected by a rubber dust cover. The body is slotted and the slot angled to accommodate the heel end of the second brake shoe, but the head of the piston is plain.

A return spring is fitted under the piston to ensure it is kept in contact with the toe end of the brake shoe, when the brakes are off.

The wheel cylinders are mounted rigidly on the back plate, fore and aft of the stub axle and connected to one another by a bridge pipe. The rearmost wheel cylinder is connected to the pressure side of the master cylinder and the bleed screw is fitted to the foremost wheel cylinder.

To remove and refit

1. Remove the brake shoes from the back plate, see under "FRONT BRAKE SHOES—To remove and refit".
2. Remove the foremost wheel cylinder from the back plate by releasing the union nut of the bridge pipe, trapping any escaping fluid in a drip tray and removing the two bolts and washers.
3. Remove the rearmost wheel cylinder from the back plate by releasing the union nut of the bridge pipe, detaching the flexible hose, see under "FLEXIBLE HOSE—To remove and refit—Front", trapping any escaping fluid in a drip tray and removing two bolts and washers.
4. Refitting is the reverse of the removal sequence, but particular attention must be given to the following:—

   i. Ensure the lower end of the inclined abutment slot in the wheel cylinder body is towards the centre of the back plate.

   ii. The bridge pipe is fitted between the inner tappings of the two wheel cylinders and the bleed screw is fitted to the front tapping of the foremost wheel cylinder.

iii. The flexible hose is fitted to the rear tapping of the rearmost wheel cylinder.

iv. The front brake shoes are adjusted, see under "FRONT BRAKE SHOE ADJUSTMENT".

v. The brake system is bled of air, see under "BLEEDING THE HYDRAULIC SYSTEM".

To dismantle and reassemble (See Fig. 6)

1. Remove the rubber band and dust cover from the piston end of the wheel cylinder.

2. Remove the bleed screw, eject the piston, seal and spring from the wheel cylinder body by applying low pressure air to the tappings in the wheel cylinder body.

3. Detach the spring from the inner end of the piston and remove the tapered seal.

4. Reassembling is the reverse of the dismantling sequence but particular attention must be given to the following:—

   i. The tapered seal is fitted to the piston with a liberal coating of Girling Brake Fluid, and the wider end of the taper away from the head of the piston. See under "GIRLING SERVICE KITS".

   ii. The spring is fitted to the spigotted end of the piston.

   iii. Insert the piston assembly inside the cylinder body with a liberal coating of Girling Brake Fluid or Red Rubber Grease, exercising care not to damage the fine edge of the seal. See under "GIRLING SERVICE KITS".

   iv. Retain the piston inside the wheel cylinder body with a rubber band.

REAR BRAKES

DESCRIPTION (See Fig. 7)

The rear brakes incorporate leading and trailing brake shoes operated by a single wheel cylinder which is able to slide in the back plate. Adjustment for lining wear is effected by a screw type adjuster situated diametrically opposite the wheel cylinder at the top of the back plate.

The brake shoes are supported by platforms pressed into the back plate and spring loaded steady posts keep the shoes at right angles to the brake drum. The brake shoes are linked together by two pull off springs attached to the brake shoe webs on the side nearest the back plate.

As hydraulic pressure is applied, the wheel cylinder piston moves the leading brake shoe outward to the brake drum. As the brake shoe contacts the drum further movement of the piston causes the wheel cylinder body to slide in the back plate and moves the trailing brake shoes into contact with the brake drum. When the hydraulic pressure is released, the pull off springs return the brake shoes and the wheel cylinder pistons to rest position when the rotation of the brake drum will centralise the brake shoes and wheel cylinder in the back plate.

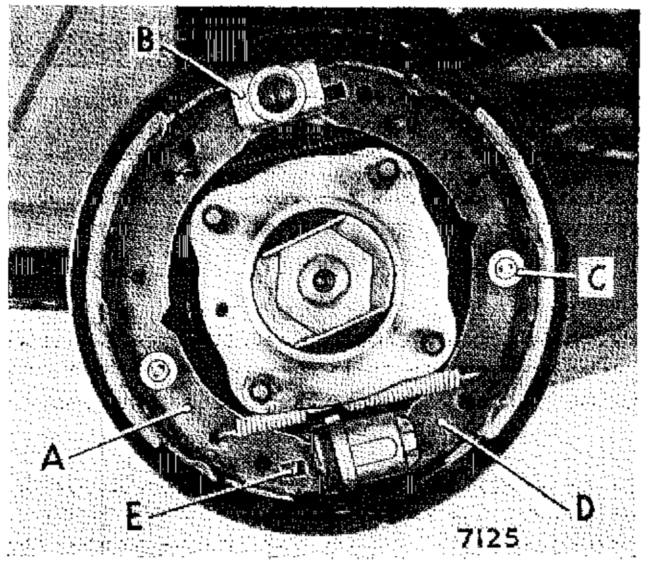


Fig. 7. *Right-hand rear brake assembly*

A. LEADING BRAKE SHOE
B. BRAKE SHOE ADJUSTER
C. SLOTTED WASHER OF STEADY POST
D. TRAILING BRAKE SHOE
E. TIP OF HANDBRAKE LEVER

REAR BRAKE SHOES

Always fit factory lined replacement brake shoes and new pull off springs. The brake shoes have the correct type of lining which is ground accurately to size, thus ensuring an easy and quick bed-in to the brake drums.

To remove and refit (See Fig. 7)

1. Chock the front wheels, release the handbrake, jack up the rear of the car and remove the rear wheel.

2. Remove the brake drum from the hub by slackening off the brake shoe adjuster and withdrawing a countersunk screw.

3. Remove the slotted washer, coil spring and steady post from the brake shoe by holding the head of the post on the outside of the back plate, depressing and rotating the slotted washer 90° against the pressure of the coil spring; repeat with the steady post of the second brake shoe.

4. Identify the ends of the pull off springs to the holes in the brake shoe webs and remove the heel end of the leading (rearmost) brake shoe from the slot in the adjuster and remove the toe end from the lever of the wheel cylinder just above the piston.

5. The tension of the pull off springs is now released and the trailing (foremost) brake shoe can be removed from the slots in the brake adjuster and wheel cylinder body.

6. Apply a rubber band to the wheel cylinder to retain the piston within the wheel cylinder body.

7. Refitting is the reverse of the removal sequence but particular attention must be given to the following:—

   i. Lightly smear the slots in the wheel cylinder and adjuster links with "Girling White Brake Grease".

ii. When fitting new brake shoes also fit new pull-off springs; fit the springs according to the identification marks.

The single coil spring is fitted inside the brake shoe webs adjacent to the brake shoe adjuster using the inner of the two holes and so the tips of the springs locate in the outer holes.

The double coiled spring is fitted outside the brake shoe webs adjacent to the wheel cylinder with the longer coil hooked onto the trailing brake shoe and both ends using the outer of the two holes.

iii. Adjust the brake shoes, see under "REAR BRAKE SHOE ADJUSTMENT", but when new replacement brake shoes have been fitted, slacken off the adjuster one more click to allow for lining expansion and revert to normal adjustment after a short mileage.

BRAKE SHOE ADJUSTER (See Fig. 7)

The brake shoe adjuster has a light alloy body which is bolted rigidly to the back plate and houses two sliding links. The outer end of the links is slotted to accommodate the tail end of the brake shoes and the inner ends are inclined to mate with the four flats on the conical head of the hardened steel wedge, the axis of which is set at right angles to the two links.

The shank of the wedge is threaded and the end which protrudes through the back plate has a squared head. By rotating the squared head of the wedge in a clockwise direction, the two links are forced apart and the fulcrum point of both brake shoes expanded thus bringing the lining surface nearer to the brake drum.

To remove and refit (See Figs. 2 and 7)

1. Remove the brake shoes from the back plate, see under "BRAKE SHOES—To remove and refit".
2. Identify and withdraw the two links from the adjuster and remove the adjuster body from the back plate by removing two nuts and washers.
3. The wedge can be removed from the body by rotating it clockwise so the squared head passes through the body.
4. Refitting is the reverse of the removal sequence but particular attention must be given to the following:—

   i. The two links are returned to the original positions.

   ii. The inclined faces and the slots of the links are lightly smeared with Girling White Grease.

REAR BRAKE BACK PLATE

The rear brake back plate is a steel pressing suitably shaped to support the brake shoe adjuster, steady posts, sliding wheel cylinder and the brake shoes. The back plate is mounted on the rear bearing housing by four nuts and bolts but it cannot be removed unless the hydraulic system is disconnected at the wheel cylinder.

To remove and refit

1. Chock the front wheels, release the handbrake, jack up the rear of the car and remove the roadwheel.
2. Remove the brake drum from the hub by slackening off the brake shoe adjuster and withdrawing a countersunk screw.
3. Detach the handbrake cable from the wheel cylinder lever by discarding the split pin, removing the plain and spring washers and withdrawing the clevis pin from the fork end.
4. Disconnect the hydraulic pressure pipe from the wheel cylinder by releasing the union nut and trapping any escaping fluid in a drip tray.

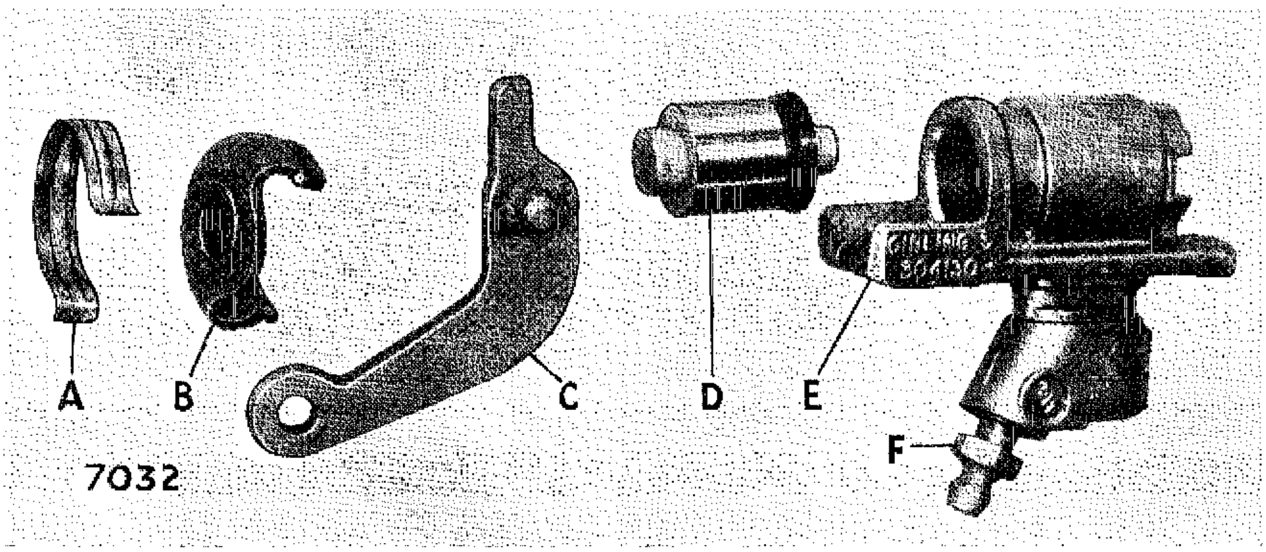


Fig. 8. *Exploded view of rear brake cylinder*

A. METAL CLIP
B. DUST COVER
C. HANDBRAKE LEVER
D. PISTON AND SEAL
E. WHEEL CYLINDER BODY
F. BLEED SCREW

5. Withdraw the hub from the drive shaft by releasing the tabwasher and removing the nut.

6. Remove the back plate from the bearing housing by withdrawing four bolts, nuts and washers.

7. Refitting is the reverse of the removal sequence, but particular attention must be given to the following:—

   i. The hydraulic system is bled of air, see under "BLEEDING THE HYDRAULIC SYSTEM".

   ii. The brake shoes are adjusted, see under "REAR BRAKE SHOE ADJUSTMENT".

REAR WHEEL CYLINDERS (See Fig. 8)

The rear wheel cylinder consists of an alloy body housing, a seal, piston and protected by a rubber dust cover which is retained by a metal clip. The body is slotted to accommodate the heel end of the trailing brake shoe but the head of the piston is plain.

The body adjacent to the head of the piston is built up to form a pivot for the lever of the handbrake. The longer and outer end of the lever is attached to the brake cable while the short end locates an aperture in the toe end of the brake shoe.

The wheel cylinder is freely mounted in the back plate thus facilitating the centring of the brake shoes and held in its slot by spring and retaining plates fitted onto the neck of the wheel cylinder as it protrudes through the back plate.

To remove and refit

1. Remove the brake shoes from the back plate, see under "BRAKE SHOES—To remove and refit".

2. Detach the handbrake cable from the lever by discarding the split pin, removing the plain and spring washers and withdrawing the clevis pin.

3. Remove the pressure pipe from the wheel cylinder by releasing the union nut and trapping any escaping fluid in a drip tray.

4. Remove the lever from the wheel cylinder by easing the dust cover aside, withdrawing the retaining plate and manoeuvring the lever pivot from between the wheel cylinder body and the back plate; the removal of the retaining plate will allow sufficient clearance.

5. Withdraw the wheel cylinder through the back plate by removing the spring plate and dust cover.

6. Refitting is the reverse of the removal sequence, but particular attention must be given to the following:—

   i. Ensure the wheel cylinder body has complete freedom of movement within the back plate slot—THIS IS IMPORTANT. The piston points towards the rear of the car.

   ii. Position the wheel cylinder in the back plate and slide the spring plate, open end first, from the lever end; feed the drilled end of the lever through the slot in the back plate and manoeuvre the pivot between the wheel cylinder and back plate, fit the dust cover and retaining plate so the open end is towards the lever and engage the "pips" of the spring plate. Confirm that the wheel cylinder slides within the back plate. Fit new split pins to the rear ends of the brake cables.

   iii. Adjust the rear brake shoes, see under "REAR BRAKE SHOE—ADJUSTMENT".

   iv. Check the handbrake adjustment, see under "HANDBRAKE ADJUSTMENT".

   v. Bleed the brake system of air, see under "BLEEDING THE HYDRAULIC SYSTEM OF AIR".

To dismantle and reassemble (See Fig. 8)

1. Remove the rubber band from the wheel cylinder, follow with the dust cover by releasing the metal clip.

2. Withdraw the bleed screw, eject the piston and seal from the body by applying low pressure air to the tappings in the wheel cylinder body.

3. Remove the tapered seal from the piston.

4. Reassembling is the reverse of the dismantling sequence, but particular attention must be given to the following:—

   i. The tapered seal is fitted to the piston with a liberal coating of Girling Brake Fluid, and the wider end of the taper away from the head of the piston. See under "GIRLING SERVICE KITS".

   ii. Insert the piston and seal inside the wheel cylinder body with a liberal coating of Girling Brake Fluid or Red Rubber Grease, exercising care not to damage the fine edge of the seal. See under "GIRLING SERVICE KITS".

   iii. Retain the piston inside the wheel cylinder with a rubber band.

HYDRAULIC SYSTEM

BLEEDING THE HYDRAULIC SYSTEM

Bleeding or expelling air from the hydraulic system is not a maintenance operation and should only be necessary when a portion of the hydraulic system has been disconnected or when the fluid level in the reservoir has fallen so low that air has entered the system.

Always keep a careful check on the fluid level during bleeding since it is most important that a high level is maintained. Should air enter the master cylinder from the reservoir the complete operation must be repeated.

1. When fitted, destroy all vacuum in the servo unit by repeated operation of the brake pedal, NEVER start the engine before bleeding of the system has been completed.
2. Ensure that all hydraulic connections are secure and the master cylinder reservoir is filled to a high level; this level must be maintained during the complete operation.
3. Slacken off the four front brake shoe adjusters and fully tighten the two rear brake shoe adjusters; this will reduce the fluid space in the wheel cylinder bodies.
4. Remove the rubber cap from the bleed screw of the left hand rear wheel cylinder, fit the bleed tube and immerse the free end of the tube in a glass vessel containing a small quantity of brake fluid.
5. Remove any floor covering that prevents a full stroke of the brake pedal; with the assistance of another person slacken off the bleed screw $\frac{1}{2}$ to $\frac{3}{4}$ of a turn and depress the brake pedal a succession of long and short rapid strokes and then allow the brake pedal to fly back to its stop with the foot removed. Actuate the brake pedal in this manner until the brake fluid entering the glass vessel is free from air bubbles and then tighten the bleed screw on the next downward stroke to the torque given in "General Data".
6. Remove the bleed tube and glass vessel from the bleed screw and refit the rubber cap.
7. Repeat the three previous operations with the right hand rear bleed screw followed by the left and right hand front bleed screws respectively.
8. Readjust the front and rear brake shoes, see under their respective headings earlier in this Section.
9. Top up the master cylinder reservoir to the correct level and refit the filler cap, ensuring its seal is in good condition and the air vent is unobstructed, as any blockage will cause the brakes to bind.

Bleed screws

The front and rear wheel cylinders have conical ended bleed screws which bed onto a seat formed in the bottom of the bleed screw tapping.

The bleed screws must never be overtightened since their threads may become stripped. Use only short spanners and tighten the bleed screws to the torque given in "General Data".

BRAKE PIPE RUN

The fluid reservoir is connected by a short length of rubber hose and a metal pipe to the feed port at the front end of the brake master cylinder mounted in the floor of the luggage compartment.

The master cylinder pressure pipe from the side of the cylinder passes through the floor of the luggage compartment to the front connection of a four-way connector attached to the underside of the floor adjacent to the right-hand front wheel arch.

The left- and right-hand side connections are connected by rigid pipes and flexible hoses to the rear-most wheel cylinders mounted in the back plate of the two front brakes. The junctions of the flexible hoses and metal pipes are supported in brackets welded to the bottom and rearward extremities of both wheel arches.

The rear connection of the four-way connector is connected to the front of a second four-way connector at the rear of the car by a metal pipe which is attached to the centre swaging of the floor assembly.

The left- and right-hand side connections are connected by metal pipes and flexible hoses to the wheel cylinders mounted low in the back plate of the two rear brakes. The flexible hoses are positioned between two metal pipes to accommodate the rise and fall of the rear suspension arms, the ends of the flexible hoses are mounted in brackets, one on the rear main crossmember and a second on the swinging arms of the rear suspension.

Bending metal pipes

Two diameters of metal pipes are used and are as follows:

Supply. From fluid reservoir to master cylinder—$\frac{1}{4}$ in. diameter with $\frac{7}{16}$ in. 20 T.P.I. UNF. union nuts.

Feed. From master cylinder to servo unit, when fitted, and the wheel cylinders—$\frac{3}{16}$ in. diameter with $\frac{3}{8}$ in. 24 T.P.I. UNF. union nuts.

Should the metal pipes be supplied in straight lengths, they must be shaped to follow the form of the original. In the event of the original being damaged beyond usefulness a master must be made up from a length of heavy gauge maleable wire and then using this as a pattern.

The new straight pipe can easily be shaped with the fingers or on a pipe shaping "dolly", but in its absence a piece of pipe, of similar diameter to the radius of the shape required, can be used. To assist in forming the shape adjacent to the ends of the new pipe length, a three- or four-way connector can be screwed onto the union to provide a better grip.

Union nuts

The union nuts must never be overtightened since their threads may become stripped. Use only short spanners, and tighten the union nuts to the torque given in "General Data".

FLEXIBLE HOSES

To accommodate the constantly changing position of the front suspension wishbones and rear suspension arms whilst the car is moving, flexible hoses are used to connect the pressure pipes to the front wheel cylinders and the metal pipes of the rear wheel cylinders.

They should be examined at regular intervals for chafing, general deterioration and leakage. When there is any doubt concerning the condition of the flexible hose it should be renewed. Should a hose become blocked, it must never be cleared by probing but renewed.

All flexible hoses must be renewed every three years.

To remove and refit—Front

1. Grip the hexagon of the flexible hose adjacent to the support bracket with one spanner and detach the pressure pipe on the opposite side by releasing the union nut with a second spanner.

2. Still holding the hexagon, petach the flexible hose from the support bracket by removing a nut and washer.

3. Remove the flexible hose from the wheel cylinder by applying a spanner to the hexagon at that end and permitting the entire length of flexible hose to rotate.

4. Refitting is the reverse of the removal sequence, but particular attention must be given to the following:—

   i. It is essential that the flexible hose is fitted to the wheel cylinder first.

   ii. The second end of the flexible hose is fitted to the support bracket and set to clear all obstructions that may cause chafing by positioning the hexagon with one spanner while fitting the securing nut and metal pipe with other spanners.

   iii. The brake system is bled of air, see under "BLEEDING THE HYDRAULIC SYSTEM".

To remove and refit—Rear (See Fig. 9)

1. Grip the hexagon of the flexible hose adjacent to the support bracket on the rear suspension main cross-beam with one spanner and detach the metal pressure pipe on the opposite side by releasing the union nut with a second spanner.

2. Still holding the hexagon, detach the flexible hose from the support bracket by removing a nut and washer.

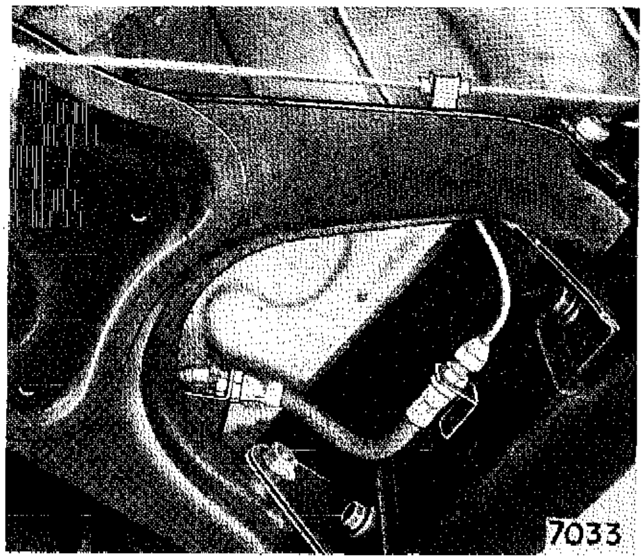


Fig. 9. *Location of rear flexible hose*

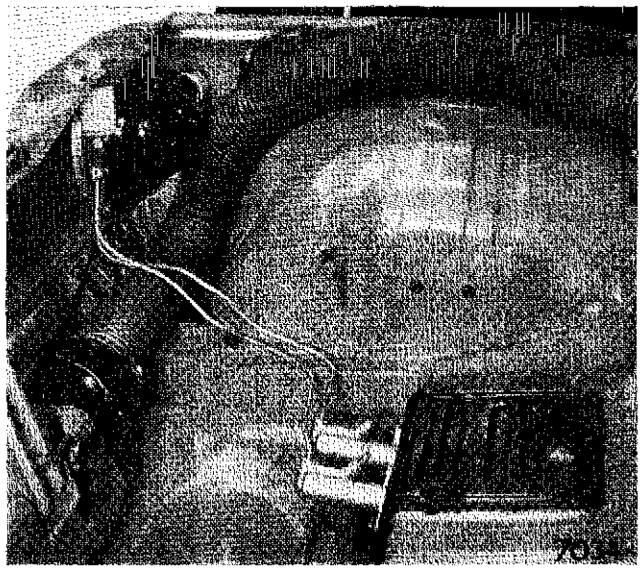


Fig. 10. *Master cylinders and feed pipe: the petrol tank has been removed*

3. Repeat the two previous operations at the other end of the flexible hose.

4. Refitting is the reverse of the removal sequence, but particular attention must be given to the following:—

   i. The second end of the flexible hose is fitted to the support bracket and set to clear all obstructions that may cause chafing by positioning the hexagon with one spanner while fitting the securing nut and metal pipe with other spanners.

   ii. The brake system is bled of air, see under "BLEEDING THE HYDRAULIC SYSTEM".

FLUID RESERVOIR (See Fig. 10)

The remote type fluid reservoir is mounted in the front right-hand corner of the luggage compartment just inboard of the headlamp. It is fabricated from a plastic translucent plastic material and halved down the centre by a division, the left- and right-hand divisions being connected to the clutch and brake master cylinders respectively.

Two lengths of rubber hose and metal pipes connect the ports in the base of the fluid reservoir to the feed ports of the master cylinders. The metal pipes are clipped to the front wheel arch in the bottom of the luggage compartment by welded tongues.

To remove and refit (See Fig. 10)

1. Detach the two rubber hoses from the ports in the base of the fluid reservoir by releasing the metal bands and trapping the escaping fluid in a drip tray.

2. Remove the fluid reservoir from the front right-hand corner of the luggage compartment by removing two bolts, nuts and washers.

3. Refitting is the reverse of the removal sequence, but particular attention must be given to the following:—

   i. The brake system is bled of air, see under "BLEEDING THE HYDRAULIC SYSTEM".

   ii. The clutch system is bled of air, see under "BLEEDING THE CLUTCH in CLUTCH-SECTION D".

MASTER CYLINDER (See Fig. 10)

The master cylinder is fitted to a mounting plate which in turn is mounted in the floor of the luggage compartment beneath the petrol tank. It is connected to the fluid reservoir by the feed port in the front end of the body and to the wheel assemblies by the pressure port in the side of the body. It can be identified as the one having the two lines cast into its body.

The master cylinder has an alloy body with a highly polished cylinder bore and contains the centre valve and piston assembly. The centre valve consists of a spring thimble, piston return spring, valve spacer, spring washer, centre valve and seal; this assembly is attached to the shouldered end of the piston by a spring leaf in the thimble. A push rod assembly which is connected to the foot pedal consists of a push rod, dished washer and rubber dust cover is held in the open end of the body by a circlip. The dished washer acts as a pedal stop.

When pressure is applied to the foot pedal, the piston moves down the cylinder bore and the piston return spring which abuts to the centre valve closes the valve to the feed port cutting off the supply of fluid from the reservoir. Continued movement of the piston forces the fluid out through the pressure port, in the side of the body, to the wheel assemblies and also keeps the centre valve hard on its seat.

On the return stroke, the piston moves back along the cylinder bore and with the final movement of the piston lifts the centre valve off its seat and allows the free flow of fluid between the master cylinder and reservoir.

To remove and refit (See Fig. 10)

1. Remove the petrol tank from the bottom of the luggage compartment, see under "PETROL TANK—To remove and refit, FUEL SYSTEM—SECTION C".
2. Disconnect the feed and pressure pipes from the master cylinder by releasing the union nuts and trapping any escaping fluid in a drip tray.
3. Detach the push rod from the foot pedal by discarding the split pin and withdrawing the clevis pin and washer.
4. Remove the master cylinder from the bracket by withdrawing two bolts and washers.
5. Refitting is the reverse of the removal sequence, but particular attention must be given to the following:—
   i. A new split pin is fitted when attaching the push rod to the foot pedal.
   ii. The brake system is bled of air, see under "BLEEDING THE HYDRAULIC SYSTEM".

Girling service kits

Girling service kits, containing the necessary rubber seal(s) and a tube of Girling Red Rubber Grease, are available. The appropriate Service Kit must always be obtained when any seal(s) need renewing and fitted as follows:—

1. When the master or wheel cylinder has been dismantled, the bore and internal parts of the cylinder must be cleaned with Girling Cleaning Fluid and allowed to dry off.
2. Examine the cylinder bore and piston, when they are smooth to the touch with no corrosion, score marks or ridges, the new seal can be fitted; but when there is any doubt as to their condition, a new replacement cylinder must be obtained.
3. Fit the seal to the piston or valve with a liberal coating of Girling Brake Fluid giving particular attention to the position of the lip face, normally towards the fluid supply.
4. Smear the piston with Girling Red Rubber Grease and insert into the cylinder bore, exercising care not to damage or fold back the fine edge of the seal.
5. Smear the inside edge of the dust cover also with Girling Red Rubber Grease, fit to the cylinder body and secure with a metal clip as necessary.

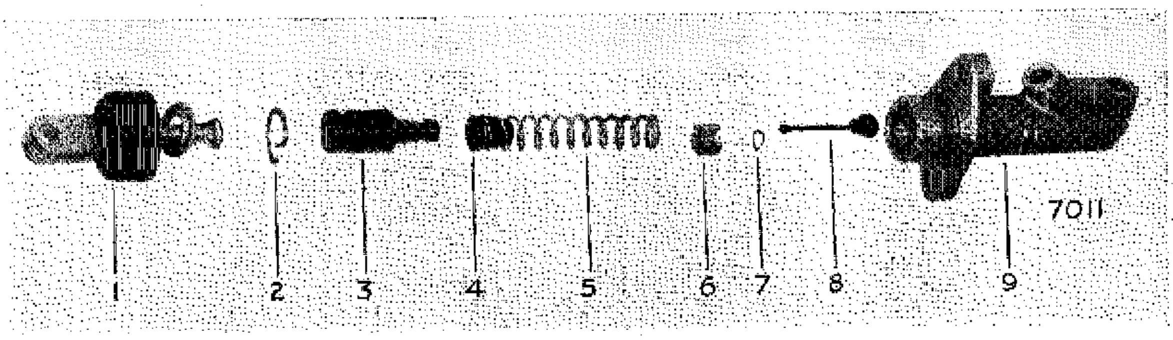


Fig. 11. *Exploded view of brake master cylinder*

1. PUSH ROD
2. CIRCLIP
3. PISTON AND SEAL
4. THIMBLE
5. PISTON RETURN SPRING
6. VALVE SPACER
7. SPRING WASHER
8. CENTRE VALVE AND SEAL
9. MASTER CYLINDER BODY

To dismantle and reassemble (See Fig. 11)

1. Ease the dust cover from the piston rod end of the body.

2. Withdraw the push rod assembly from the body by releasing the circlip in the open end of the cylinder bore.

3. Eject the piston and centre valve assembly from the cylinder bore by applying low pressure air to the inlet port.

4. Detach the centre valve from the piston by easing the leaf of the thimble from the shouldered end of the piston.

5. Remove the thimble and piston return spring from the stem of the centre valve by compressing the return spring and passing the small end of the valve stem through the key hole shaped aperture in the thimble.

6. Withdraw the valve spacer and spring washer from the centre valve and ease the seal from the opposite side.

7. Ease the seal from the shouldered end of the piston.

8. Reassembling is the reverse of the dismantling sequence but particular attention must be given to the following:—

   i. All parts must be meticulously cleaned and re-assembled in equally clean conditions.

   ii. The seal is fitted to the centre valve, flat face first, with a liberal coating of brake fluid.

   iii. The spring washer is fitted to the valve stem, domed face first, followed by the valve spacer so its "legs" encase the spring washer and the seal.

   iv. The thimble is fed into the piston return spring and both fitted to the valve stem, return spring first and located centrally on the valve spacer; the return spring is compressed until the end of the valve stem can be locked in the keyhole shaped aperture in the thimble.

   v. The tapered seal is fitted to the shouldered end of the piston, flat face first and with a liberal coating of brake fluid.

   vi. The piston is fitted to the thimble of the centre valve assembly and both positively locked together by pressing the thimble leaf down behind the shoulder of the piston.

   vii. Smear the piston with Girling Red Rubber Grease and feed the centre valve and piston assembly into the master cylinder, centre valve first, exercising care not to damage the fine edge of the seal and so the thimble leaf will be uppermost when the master cylinder is in its fitted position, thus the air between the piston and thimble will rise as the hydraulic system is bled of air.

   viii. Smear the inside of the dust cover with Girling Red Rubber Grease and ensure that the circlip, which secures the push rod assembly is fully engaged in its groove inside the open end of the master cylinder.

HANDBRAKE

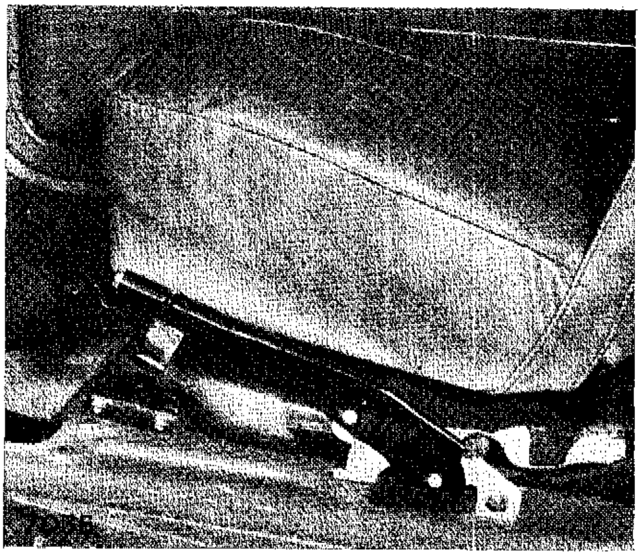


Fig. 12. *Location of handbrake lever*

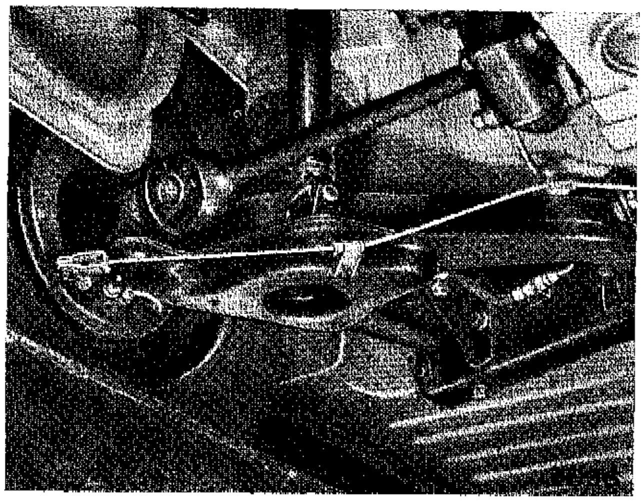


Fig. 13. *The handbrake cable run on the left-hand rear suspension arm, the right-hand side is symmetrically opposite*

DESCRIPTION (See Figs. 12 and 13)

The handbrake operates on the rear wheels only and consists of a hand lever, situated between the two front seats, two cables and two levers incorporated, one in each wheel cylinder. The cables, which run through slides incorporated in the main cross-beam and attached to the two arms of the rear suspension, connect the hand lever with the levers pivoting in each wheel cylinder where the tip of the lever locates the nose end of the leading brake shoe of each brake (See Fig. 7).

Application of the handbrake tensions the cables and the wheel cylinder levers move the leading brake shoes outward to the brake drums; further movement of the wheel cylinder levers causes the wheel cylinder bodies to slide in the back plates and move the trailing brake shoes into contact with the brake drums.

When the handbrake is released the pull off springs return the brake shoes to the rest position and when the car moves off the rotation of the brake drums centralises the brake shoes and wheel cylinders within the brake drums and back plate respectively.

HANDBRAKE CABLES (See Fig. 13)

To remove and refit

1. Chock the front wheels and release the handbrake.

2. Remove the rear end of one cable from the wheel cylinder lever, by discarding the split pin, removing the plain and spring washers and withdrawing the clevis pin; repeat with the second cable as necessary.

3. Detach the cable and brackets from the rear suspension arm by withdrawing two bolts each or by drilling out the hollow rivets and cutting the tack weld as necessary. In the instance of riveted brackets, it is advantageous to remove the rear suspension arm from the car. Repeat with the second cable as necessary.

4. Remove the plate from the centre of the floor assembly beneath the car by withdrawing eight bolts and washers.

5. Withdraw the threaded end of the cable from one side of the handbrake lever by removing one nut, a spring and washer; repeat with the second cable as necessary (See Fig. 3).

6. Withdraw the cable rearward through the slide incorporated in the main crossmember of the rear suspension adjacent to the front end of the transaxle assembly; repeat with the second cable as necessary.

7. Refitting is the reverse of the removal sequence, but particular attention must be given to the following:—

   i. The front and rear brackets are secured to the top and bottom faces of the rear suspension arm respectively using the same type of attachment as the original. When using hollow rivets make a tack weld between the rear edge of the front bracket and the top face of the rear suspension arm.

   ii. The threaded end of the cable(s) are fed through the crossbeam slide from the rear but they are not attached to the handbrake lever until the rear ends have been fitted to the wheel cylinder levers and the brackets to the rear suspension arms. Fit new split pins to the rear ends of the brake cables.

   iii. The washer followed by the spring are fitted to the threaded end of the handbrake cable(s) and then fed through the boss of the handbrake lever.

   iv. The handbrake is adjusted, see under "HANDBRAKE ADJUSTMENT".

   v. The plate is fitted so the end having the up-turned tongue is towards the front of the car.

HANDBRAKE LEVER (See Fig. 12)

To remove and refit

1. Chock the front wheels and release the handbrake.

2. Remove the plate from the centre of the floor assembly beneath the car by withdrawing eight bolts and washers.

3. Withdraw the threaded ends of the two handbrake cables from the lower end of the handbrake lever by removing one nut, a spring and washer from each (See Fig. 3).

4. Remove the handbrake lever from between the two seats by moving the floor covering to one side, releasing the grommet and removing two nuts and washers.

5. Refitting is the reverse of the removal sequence, but particular attention must be given to the following:—

   i. The washer followed by the spring are fitted to the threaded end of the handbrake cables and then fed through the boss of the lever.

   ii. The handbrake is adjusted, see under "Handbrake Adjustment".

   iii. The plate is fitted so the end having the upturned tongue is towards the front of the car.

PEDAL ASSEMBLY

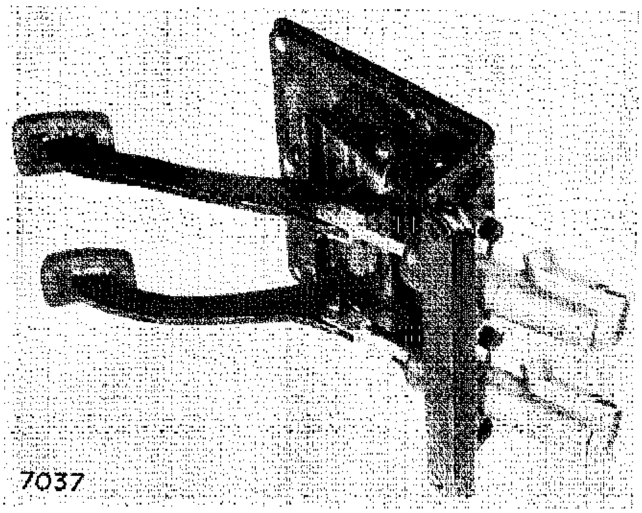


Fig. 14. *The pedal assembly with master cylinders attached*

DESCRIPTION (See Fig. 14)

The pedal assembly is of the pendulum type being attached to a spindle mounted in a stepped bracket which in turn is fitted to the floor of the luggage compartment according to the drive of the car.

The brake and clutch master cylinders fitted to the vertical face of the step and the master cylinder push rods are attached to the levers of the pedal a short distance from the spindle. The pedal stops are incorporated inside the master cylinders.

To remove and refit (See Figs. 10 and 14)

1. Remove the petrol tank from inside the luggage compartment, see under "Petrol Tank, To remove and refit, FUEL SYSTEM—SECTION C".
2. Disconnect the feed and pressure pipes from the brake and clutch master cylinders by releasing the four union nuts and trapping any escaping fluid in a drip tray.
3. Remove the pedal assembly complete with the two master cylinders from the floor of the luggage compartment by withdrawing seven bolts and washers.
4. Detach the two master cylinder push rods from the pedal lever by discarding the split pin and withdrawing the clevis pin and washer; remove the two master cylinders from the pedal bracket by withdrawing two bolts each.
5. Refitting is the reverse of the removal sequence, but particular attention must be given to the following:—
   i. The master cylinder having the two raised lines case in the body will identify the brake master cylinder.
   ii. New split pins are used to secure the master cylinder push rod clevis pins.
   iii. The brake system is bled of air, see under "BLEEDING THE HYDRAULIC SYSTEM".
   iv. The clutch system is bled of air, see under "BLEEDING THE CLUTCH SYSTEM in CLUTCH —SECTION D".

To dismantle and reassemble (See Fig. 14)

1. Detach the inner leg of each tension spring from the pedal levers by easing the hooked end from each lever with a pair of pliers.
2. Remove the two pedals and tension springs from the bracket by detaching the circlip from the left-hand end of the spindle and withdrawing the spindle from the right-hand side of the bracket.
3. Reassembling is the reverse of the dismantling sequence, but particular attention must be given to the following:—
   i. The right-hand tension spring is fitted to the fulcrum of the brake pedal so its outer end will hook round the right-hand flange of the bracket but the inner leg of the spring is left clear of the pedal lever.
   ii. The spindle is fed through the bracket and brake pedal from the right-hand side, "D" shaped end first so the flat on the spindle aligns with the flat in the left-hand side of the bracket.
   iii. The left-hand tension spring is fitted to the left-hand side of the clutch pedal in a similar manner and the circlip is fitted to the protruding left-hand end of the spindle.
   iv. The inner ends of the tension springs are hooked round the pedal levers.

Renewing the fluid

The fluid in the brake and clutch hydraulic systems must be renewed every twelve months.

1. Pump the old fluid from the brake hydraulic system by slackening off the bleed screw furthest from the master cylinder $\frac{1}{2}$ to $\frac{3}{4}$ of a turn and when the fluid changes to air retighten the bleed screw. Proceed with the next furthest and finish at the bleed screw nearest the master cylinder in a similar manner. Discard all the old fluid.

2. Repeat the previous operation with the clutch hydraulic system but in this instance there is only one bleed screw.

3. Refill the master cylinder reservoir with the recommended fluid, see under "Recommended Lubricants"—Section P and bleed both hydraulic systems of air, see under "Bleeding the hydraulic system" in this Section and "Bleeding the system" in Section D.

Flushing the hydraulic system

When the master cylinder reservoir has become contaminated with an incorrect fluid both hydraulic systems must be immediately flushed out and refilled with fresh fluid of the recommended type.

Should ever the contamination be caused by a mineral oil, in addition to flushing, the flexible hoses, the seals in the brake and clutch hydraulic units and the stop light switch must be renewed.

1. Pump all the old fluid from the brake hydraulic system by slackening off the bleed screw furthest from the master cylinder $\frac{1}{2}$ to $\frac{3}{4}$ of a turn and when the fluid changes to air retighten the bleed screw. Proceed with the next furthest and finish at the bleed screw nearest the master cylinder. Discard all the old fluid.

2. Repeat the previous operation with the clutch hydraulic system but in this instance there is only one bleed screw.

3. Fill the master cylinder reservoir with Girling Cleaning Fluid and pump out through each brake and clutch bleed screw. Continue to replenish the master cylinder reservoir until at least a quart (1.1 litres) has passed through each bleed screw. Discard all the old fluid.

4. When necessary, remove all flexible hoses and brake and clutch hydraulic units; dismantle, clean and fit new seals. Blow out the pipes with dry compressed air and refit, together with new flexible hoses and a new stop light switch. See under "Seals in the hydraulic units".

5. Refill the master cylinder reservoir with the recommended fluid, see under "Recommended Lubricants"—Section P and bleed both hydraulic systems of air, see under "Bleeding the hydraulic system" in this Section and "Bleeding the system" in Section D.

Seals in the hydraulic units

The seals in the hydraulic units must be renewed every three years and also whenever the brake and clutch hydraulic systems have been contaminated with a mineral oil.

The most satisfactory method of seal renewal is to replace the existing hydraulic units with Replacement Service Units available through the spares channels; however should this procedure be impracticable Service Kits, containing the seals and when necessary tubes of lubricants, are available.

WHEELS AND TYRES

SECTION L

CONTENTS

WHEELS AND TYRES

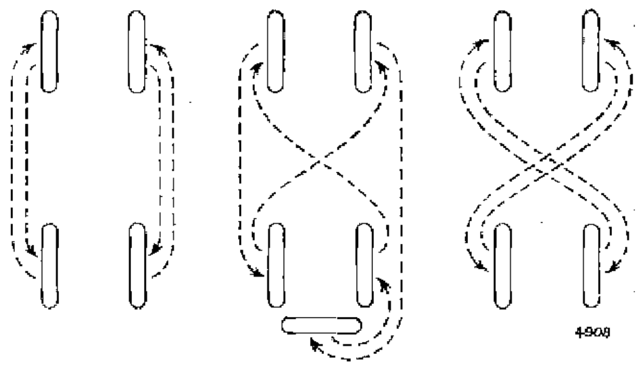


Fig. 1. *Three different ways of interchanging the wheels and tyres to even up tyre wear*

MAINTENANCE

Jacking up the car

When removing the wheels it is recommended that the jack supplied with the car is used. At the front, the jack head is positioned on the centre line of the car, immediately in front of the spare wheel well, under both front pivots of the front suspension wishbones. At the rear, the jack head locates a spigot protruding beneath each end of the detachable rear cross member.

If a garage type of jack is employed, the previously described front jacking point is used, but at the rear, the jack head is positioned on the centre line of the car, beneath the detachable rear cross member immediately under the extreme rear engine mounting.

Repositioning tyres

Tyres complete with rims should be interchanged at regular intervals. Fig. 1 shows three different ways of carrying out this change.

Diagonal interchanging between left-hand front and right-hand rear and between right-hand front and left-hand rear provides the most satisfactory first change because it reverses the directions of rotation. Subsequent interchanging of front and rear tyres should be as indicated by their appearance with the object of keeping the wear on all the treads even and uniform.

Inflation pressures

Tyres should be examined regularly, preferably once a week for loss of pressure. Pressures should be checked when the tyres are cold, such as after standing overnight, and not when they have attained normal running temperatures. Do not over-inflate, and do not reduce pressures which have increased owing to altered temperature.

The correct inflation pressures are given in the General Data Section.

Tyre damage

Tyres should be examined at regular intervals for small objects embedded in the treads, such as flints and nails; also for cuts and penetrations, and for damage due to impacts with kerbs, etc.

Minor injuries confined to tread rubber, such as from small pieces of glass or road dressing material, require no attention other than the removal of the objects. More severe tread cuts and wall rubber damage require vulcanised repairs.

Injuries which extend into or through the fabric, except clean nail holes, seriously weaken the tyre. Satisfactory repair necessitates new fabric being built in and vulcanised. This requires expensive plant equipment and should be undertaken by a tyre repair specialist or by the tyre maker.

Small holes in the tread, such as nail holes, in tubeless tyres can be repaired efficiently by means of rubber plugs which are contained in the Dunlop "Reddiplug" Repair Kit. Full instructions for their use are included with the kit.

Oil and grease

Oil and grease should be removed by using petrol sparingly. If oil or grease on the tyres results from over-lubrication or defective oil sealing, suitable corrective action should be taken.

Uneven tyre wear

All tyres should be examined at regular intervals for uneven wear.

CAUSES AND RECTIFICATION OF UNEVEN TYRE WEAR

The causes of uneven tyre wear are often difficult to diagnose individually; it is advisable, in such cases, to check all the following points:—

(*a*) Tyre pressures (see under "Maintenance").

(*b*) Brake freedom and drum balance, shoe settings, drum condition and trueness.

(*c*) Front wheel alignment (see Section F).

(*d*) Front wheel camber angles (see Section F).

(*e*) Play in hub bearings. Adjustment is described in Section F under the heading "Front Hub Adjustment".

(*f*) Play in steering joints. See Sections F and J for the renewal procedure.

(*g*) Wheel lift and wobble. On a truly mounted and revolving wheel the difference between the high and low points measured at any location on either tyre seat (Fig. 2 at "A") should not exceed 0·050 in. (1·0 mm). The lateral variation measured on the vertical inside face of the flange (Fig. 2 at "B") should not exceed 0·050 in. (1·0 mm). The positions "C" and "D" may be used when the tyre is mounted on the rim.

(*i*) Balance of the wheel and tyre assemblies. The tyres should be checked for both static and dynamic balance (see under "Tyre and Wheel Balance").

(*j*) Condition of road springs and shock absorbers (see Sections F and H).

Irregular wear may be caused in addition by the local road conditions, such as from a combination of steep camber, abrasive surfaces and frequent hills and bends. Driving methods may also be involved; thus with all the above points properly checked, uneven wear may still be experienced. The only solution in such cases is to regularly reposition the wheels and tyres as described under "Maintenance".

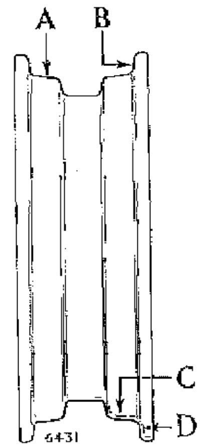


Fig. 2. *Rim lift and wobble. "A" and "B" indicate the check points to be used on a rim but points "C" and "D" can be used when the tyre is mounted*

Wear characteristics

Certain faults which cause uneven tyre wear produce easily recognisable wear characteristics. With knowledge of these characteristics, the fault may often be quickly diagnosed and the rectification procedure considerably reduced.

Incorrect tyre pressure

Tyre distortion due to persistent under-inflation causes rapid wear on the shoulders and leaves the centre standing proud. Over-inflation has the opposite effect, *i.e.*, excessive wear on the centre tread leaving the shoulders standing proud.

Misalignment of the front wheels

The tyre tread having been scrubbed off laterally is caused by wheel misalignment. An upstanding sharp fin on the edge of each pattern rib is a sure sign of misalignment.

With minor misalignment, probably aggravated by road camber, the ribs may have sharp edges instead of upstanding fins.

Fig. 3. *Fin and feather wear due to extreme wheel misalignment.*

CHECKING WHEEL AND TYRE RUN-OUT

When preparing the car for a suspension or steering check, the wheels and tyres must be checked first for "run-out".

During the suspension or steering checks, the points of "run-out" are positioned well away from the contact points of any gauges that may be in use.

When checking camber, castor or king pin inclination, set the points of "run-out" horizontally and when checking front wheel alignment, set the points of "run-out" vertically.

1. Jack up the wheel to be checked for "run-out".
2. Spin the wheel while holding a piece of chalk close to the wall of the tyre.
3. Move the chalk progressively nearer the tyre until it makes contact with any "run-out".
4. Mark the centres of the "run-out" with a cross.
5. Lower the car to the ground but before making any suspension or steering checks, roll the car forwards and backwards to position the wheels in their normal running attitude.

NYLON TYRES

Nylon tyres may develop temporary flatting after standing for some time and cooling off, following a long run during which high temperatures have been reached.

These flat spots can be run out quite quickly but it may be necessary to approach the speeds and temperatures which have led to the flatting. For example, flats on tyres which have developed after a long fast run may be difficult to remove if the car is then used for local "pottering" especially if the weather has become colder and wetter.

Before balancing nylon tyres it is desirable to ensure that these flats have been fully run out, otherwise a false balance may be obtained.

TYRE AND WHEEL BALANCE

In the interests of smooth riding, precise steering and high stability, all tyres are balance checked to pre-determined limits. Coloured spots may be found on one bead indicating the lightest part of the tyre, which should be fitted near to the valve.

Where balance weights have been fitted to the wheel rims, it is advisable to detach them before tyre removal to avoid the possibility of their inadvertently falling inside the tyre. If the same tyre is to be refitted, the positions and amounts of these balance weights as well as the position of the tyre on the wheel should be marked with chalk on the rim, so that the subsequent replacement may restore the original balance as far as possible.

The original degree of balance is not necessarily maintained in service, as it may be affected by uneven tread wear, by cover repairs, or by tyre removal and replacement. Normal wear of moving parts may also render the car more sensitive to unbalance.

Rebalancing of tyre and wheel assemblies should be carried out with the aid of approved equipment capable of measuring both static and dynamic balance.

Dunlop "SP" or Radial Ply Tyres

On cars fitted with Dunlop "SP" or radial ply tyres, the roadwheels must be balanced every 10,000 miles (16,000 kms.), or every 5,000 miles (8,000 kms.) if operated for continuous high speed driving.

RIMS AND DUNLOP "SP" OR RADIAL PLY TYRES (Fig. 4)

Dunlop "SP" tyres are fitted to later cars as original equipment and **always on $4\frac{1}{2} \times 12$ rims**, a wide section rim.

As Dunlop "SP" or any other radial ply tyres must **not be fitted** to the 4J x 12L rims, which were original equipment on earlier cars, it is imperative that before this type of tyre is fitted, the rim width is measured to ensure that it is of the **wider** type.

A cross section view of both rims is given in the illustration and shows the wider rim for the Dunlop "SP" or radial ply tyre at "A".

TYRES—REMOVAL AND REFITTING (Fig. 4)

Two types of rims have been used and they are as follows:—

A. The wider $4\frac{1}{2} \times 12$ rim, fitted to later cars. When a tyre is fitted, this rim can be recognised by the inclined side face of the rim well on the "non-valve" side. Tyres must always be removed and refitted from the "non-valve" side when the smaller bead seat, marked by a "star" in the illustration, will facilitate both operations.

B. The 4J x 12L rim, fitted to earlier cars. When a tyre is fitted, this rim can be recognised by the rim well having symmetrical side faces. Tyres must always be removed and refitted from the "valve" side when the smaller bead seat, marked by a "star" in the illustration, will facilitate both operations.

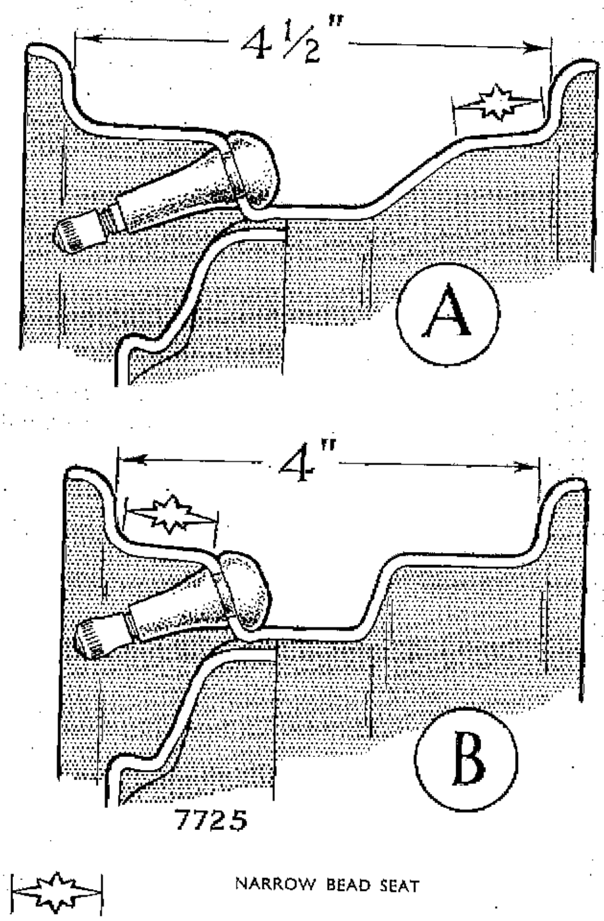


Fig. 4. *A cross section view of the rims showing where the width is measured and the side having the narrow bead seat from which side the tyre must always be removed and refitted.*

A. **The wider $4\frac{1}{2} \times 12$** *rim which* **must always be used** *when* **Dunlop** *"SP" or radial ply tyres are fitted.*
The narrower bead seat is seen on the "non-valve" side and it is from this side that the tyre must be removed and refitted.

B. **The 4J x 12L** *rim to which* **only** *the Dunlop "C41 Gold Seal" or similar tyre must be fitted.*
The narrower bead seat is seen on the "valve" side and it is from this side that the tyre is removed and refitted.

WHEEL TRIM DISCS

A wheel trim disc is fitted to each of the four roadwheels and therefore must be removed from the roadwheel before the spare is fitted. The wheel trim disc is held on by the nave plate and has a hole for the tyre valve.

To remove and refit

1. Remove the nave plate from the roadwheel by inserting a screwdriver between its edge and the wheel, lever off using the rim as a fulcrum.

2. Ease the wheel trim disc off the three nave plate studs and the tyre valve.

3. Refitting is the reverse of the removal sequence and a smear of grease on the three nave plate studs will facilitate the fitting of the nave plate.

CHOICE OF TYRES

Only the type of tyre fitted as original equipment should be used for replacement purposes.

However, should different tyres be required because the car is being consistently used for special work, such as high speed or cross country motoring, careful thought concerning their choice cannot be over-emphasized.

As tyres can sometimes alter the ride and the characteristics of the car, it is recommended that the Technical Department is consulted to ensure that the most suitable type of tyre is chosen.

ELECTRICAL EQUIPMENT

CONTENTS

ELECTRICAL SYSTEM

Years of experience have proved Lucas electrical equipment to be very reliable and efficient. Periodical maintenance, however, must not be neglected if the best results are to be obtained from the system.

If trouble is experienced with any of the electrical equipment it is important that the exact source is quickly located by following an orderly course of investigation. Random probing among units of the system is useless and often incurs much unwarranted expense without locating the true source of trouble.

Trouble in the system can generally be immediately localised to a particular unit of the system by its very nature. Further localisation, in order to trace its exact source within the faulty unit, should then be carried out by following the series of testing operations laid down under the appropriate section.

It is important to note, however, that these **tests cannot be satisfactorily carried out unless the equipment recommended is available.** Further, it will be seen that special equipment is needed for dismantling and reassembling some units of the system and **should this equipment not be available dismantling must not be attempted.**

It is recommended that the fullest use is made of the very extensive Lucas Service System. New units and reconditioned exchange units are always available at these Service Depots.

The electrical system is a 12 volt earth return type employing positive earth polarity on earlier models, and negative earth polarity from first production of Imp II, Chamois II, and Van. It can be broken down into the following units:—

1. Battery.
2. Generator and control box.
3. Starter and starter switch.
4. Ignition system (coil, distributor and plugs).
5. Lamps, switches, direction indicators, windscreen wipers, etc.

We have tested and recommend the Avo Model 12 (obtainable from Avo Ltd., 92–96 Vauxhall Bridge Road, London, S.W.1) which has been specially designed for automotive use and enables a wide range of checking operations to be carried out with a single instrument.

BATTERY

DESCRIPTION

BHNH7/9A and BHNH9A Types

These batteries are fitted to earlier Imp and Chamois models. They are the "clean-top" design incorporating a one piece cell lid with separate screw-type vent plugs. The design provides for tapered terminal posts to which is fitted in service lead diecast female tapered connectors with self-tapping fixing screws.

'D' Type

This type of battery is fitted to the Imp II, Chamois II, and Van from first production. The design also includes a one piece cell lid but with a manifold one piece venting system to replace the separate screw-type vent plugs.

The manifold venting system gives an enlarged gassing area, minimises acid spray and simplifies the topping-up of the battery, making servicing easier. The battery has 'L' shaped bolt-holed terminal posts to which is fitted in service eyelet cable connectors.

MAINTENANCE

Battery maintenance consists mainly of regular inspection and servicing.

1. Keep the battery and its surroundings clean and dry. Give particular attention to the top of the battery to prevent electrical leakage between the terminals.

2. Remove the vent plugs or battery manifold and see that the vent holes are clear.

3. Check the electrolyte level and top up, when necessary. The correct level is just to the top surface of the separator guard. Do not over-fill or acid will escape through the vent holes with detrimental effect to the connections and adjacent parts of the car.

   The use of a Lucas battery filler will be found helpful in this topping-up process, as it ensures that the correct electrolyte level is automatically obtained and also prevents distilled water being spilled over the top of the battery.

   Distilled water should always be used for topping-up. In an emergency, however, drinking water, clean rainwater or melted snow may be used. The following waters must not be used: salt water, chlorinated water, chemically softened water or stagnant water.

   CAUTION—Never use a naked light when examining a battery, as the mixture of oxygen and hydrogen given off by the battery when on charge, and to a lesser extent when standing idle, can be dangerously explosive.

   If a battery is found to need an excessive amount of topping-up, the cause should be sought. If an excessive charge is suspected, check the regulator setting. If one cell in particular is at fault, examine the container for cracks.

   Never transfer electrolyte from one cell to another.

4. With the diecast type of connector no corrosion difficulties arise. When fitting the connectors to the battery, first smear the inside of the tapered hole of the connector with silicone grease and push on the connector by hand.

   Insert the self-tapping screw and tighten with medium pressure only; fill in the recess around the screw head with more silicone grease. If the connectors are fitted dry, and driven home with too much force, they will be difficult to remove at a later date.

5. Examine the earth connection to ensure that it is clean and free from rust or corrosion.

TESTING

Measure the specific gravity of the electrolyte in each cell in turn, with a hydrometer. The reading given by each cell should be approximately the same; if one cell differs appreciably from the others, an internal fault in the cell is indicated. This will probably be confirmed by the heavy discharge test described later.

The appearance of the electrolyte drawn into the hydrometer when taking a reading gives a useful indication of the state of the plates; if it is very dirty, or contains small particles in suspension, it is possible that the plates are in a bad condition.

Check the specific gravity of the electrolyte (See Fig. 1) as an indication of the state of charge of the battery, using a hydrometer.

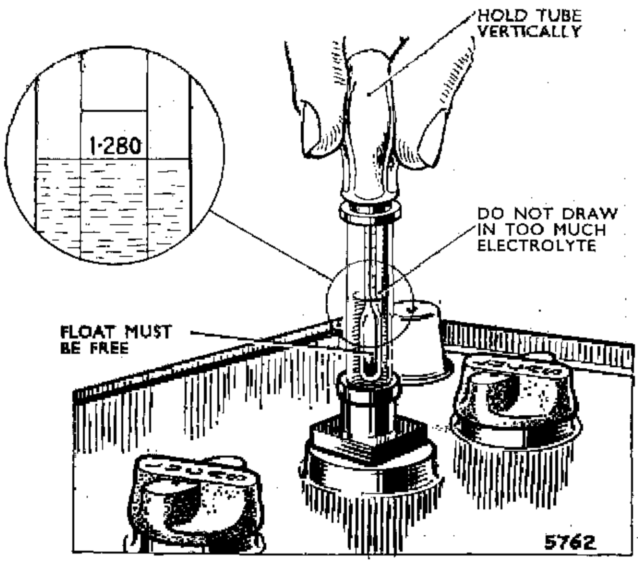


Fig. 1. *Taking hydrometer readings, take readings at eye level*

The specific gravities and their indications are as follows:—

Climate ordinarily below 26·7°C. (80°F.)

Cell fully charged	1·270—1·290
Cell half charged	1·190—1·210
Cell fully discharged	1·110—1·130

Climate ordinarily above 26·7°C. (80°F.)

Cell fully charged	1·210—1·230
Cell half charged	1·130—1·150
Cell fully discharged	1·050—1·070

The specific gravity of electrolyte varies with its temperature. The figures quoted are for an electrolyte temperature of 15·6°C. (60°F.). If the electrolyte temperature is above 15·6°C. (60°F.) add ·002 to the hydrometer reading for each 2·8°C. (5°F.) rise to obtain true specific gravity. Similarly ·002 must be deducted from the hydrometer reading for each 2·8°C. (5°F.) below 15·6°C. (60°F.).

The temperature must be that actually indicated by a thermometer immersed in the electrolyte and not the surrounding atmospheric temperature.

If the level of the electrolyte is so low that a hydrometer reading cannot be taken, no attempt should be made to take a reading after adding distilled water until the battery has been on charge for at least thirty minutes. NEVER transfer electrolyte from one cell to another.

If the car is out of use for any length of time the battery should not be allowed to run down or to remain in a discharged condition. It should be recharged about every fortnight from an independent electric supply.

Heavy discharge test

A heavy discharge test is a timed on-load voltage check applied separately to each cell of the battery.

Prior to testing, the battery must have been off charge for several hours and each cell must be at least 70% charged, having a minimum electrolyte density of 1·230 s.g. in climates normally below 26·7°C. (80°F.) or 1·160 s.g. in hotter climates. The correct size of tester for use on car batteries is one having an element rated at between 150 and 160 amperes.

It is important to use only a suitably rated tester.

A cell in good condition will be one that will maintain a constant voltage reading of between 1·2 and 1·5 volts for a period of 10 seconds, whilst the prongs of the tester are pressed on to adjacent cell interconnectors. A weak cell will show a rapidly falling voltage. If all the cells appear weak, this could indicate that the battery is merely discharged but otherwise healthy.

Remember that if the battery is subjected to heavy loads (*i.e.*, long periods of night parking with lights on) without suitable opportunities for recharging, a low state of charge is only to be expected. A fault in the dynamo or regulator, or neglect during a period out of commission, may also be responsible for any trouble.

RECHARGING FROM AN EXTERNAL SUPPLY

If tests indicate that the battery is discharged, but is otherwise in good condition, it should be re-charged, either on the vehicle by a period of daytime running or on the bench from an external supply. If the latter, the battery should be charged until the specific gravity and voltage show no increase over three successive hourly readings. During the charge the electrolyte must be kept level with the top of the separator guard by the addition of distilled water. Re-charge rates are as follows:—

BHNH7/9A	Batteries (32 ampere-hour)	3 amps.
BHNH9A	Batteries (38 ampere-hour)	3·5 amps.
D type	Batteries (32 ampere-hour)	3 amps.

Do not allow the temperature of the electrolyte to exceed the maximum permissible temperature during charging, *i.e.*,

Climates below 26·7°C. (80°F.)	37·8°C. (100°F.)
Climates above 26·7°C. (80°F.)	48·9°C. (120°F.)

A battery in which all cells show a general falling off in efficiency will often respond to the process known as "cycling". This process consists of fully charging the battery as described above, and then discharging it by connecting to a lamp board, or other load at the same rate. The battery should be capable of providing this current for at least 7 hours before it is fully discharged, as indicated by the voltage of each cell falling to 1·8. If the battery discharges in a shorter time, repeat the "cycle" of charge and discharge.

Boost charging

Before boost charging a battery or carrying out arc welding on the vehicle, isolate the battery from the system by disconnecting both its terminals. This is to avoid damage to transistorized equipment which may be in the system.

PREPARING NEW BATTERIES FOR SERVICE

Batteries for the home market are normally supplied dry and uncharged; in this event the instructions in paragraphs (*a*) should be followed.

Batteries for export markets are supplied "dry-charged". Before fitting to the vehicle the battery must be filled with acid as described in paragraphs (*b*); no initial charging is necessary, although, if time permits a short freshening charge is advantageous.

Preparation of electrolyte

Electrolyte of the specific gravity given below is prepared by mixing distilled water and concentrated sulphuric acid, usually of 1·840 S.G.

The mixing must be carried out either in a lead-lined tank or in suitable glass or earthenware vessels. Slowly add the acid to the water, stirring with a glass rod. Never add the water to the acid as the resulting chemical reaction causes violent and dangerous spurting of the concentrated acid. The approximate proportion of acid and water are indicated in the following table.

Climates normally below 27°C. (80°F.)

Add one part (by volume) of acid of 1·840 specific gravity to 3·2 parts (by volume) of pure distilled water to obtain a final specific gravity of 1·260 at 15·5°C. (60°F.) acid temperature.

Climates normally above 27°C. (80°F.)

Add one part (by volume) of acid of 1·840 specific gravity to 4·3 parts (by volume) of pure distilled water to obtain a final specific gravity of 1·210 at 15·5°C. (60°F.) acid temperature.

Heat is produced by the mixture of acid and water, and the electrolyte should be allowed to cool before taking hydrometer readings—unless a thermometer is used to measure the actual temperature, and a correction applied to the reading as previously described—and before pouring the electrolyte into the battery.

Batteries should not be filled with acid until they are required for initial charging. The following table gives the acid required to fill one cell.

Battery type:	*Acid for one cell:*
BHNH7/9A	$\frac{2}{3}$ pint (380 cc.)
BHNH9A	$\frac{3}{5}$ pint (340 cc.)
D type	$\frac{3}{4}$ pint (400 cc.)

(*a*) UNCHARGED BATTERIES

Filling the cells

The temperature of the acid, battery and filling-in room must not be below 0°C. (32°F.). Carefully break the seals in the filling holes and half fill each cell with electrolyte of the appropriate specific gravity. Allow the battery to stand for at least six hours, in order to dissipate the heat generated by the chemical action of the acid on the plates and separators, and then add sufficient electrolyte to fill each cell to the top of the separator guard. Allow to stand for a further two hours and then proceed with the initial charge.

Initial charge

The initial charging rate is 2 amperes for BHNH7/9A batteries, 2·5 amperes for BHNH9A batteries and 2 amperes for D type batteries. Charge at this rate until the voltage and specific gravity readings show no increase over five successive hourly readings. This will take from 40 to 80 hours, depending on the length of time the battery has been stored before charging.

Some harmless frothing may occur during the first few hours; this can be minimised by a reduction in the charging current. Conversely, frothing will be increased if the specified charging rate is exceeded.

Keep the current constant by varying the series resistance of the circuit, or the generator output. **This charge should not be broken by long rest periods.** If, however, the temperature of any cell rises above the permissible maximum, the charge must be interrupted until the temperature has fallen at least 5·5°C. (10°F.) below that figure.

Throughout the charge, the electrolyte must be kept level with the top of the separator guard by the addition of acid solution of the same specific gravity as the original filling-in acid, until specific gravity and voltage readings have remained constant for five successive hourly readings. If the charge is continued beyond that point, top-up with distilled water.

At the end of the charge carefully check the specific gravity in each cell to ensure that, when corrected to 15·6°C. (60°F.), it lies within the specific limits. If any cell requires adjustment, some of the electrolyte must be syphoned off and replaced either by distilled water or by acid of the strength originally used for filling-in, depending on whether the specific gravity is too high or too low.

Continue the charge for an hour or so to ensure adequate mixing of the electrolyte and again check the specific gravity readings. If necessary, repeat the adjustment process until the desired reading is obtained in each cell. Finally, allow the battery to cool and syphon off any electrolyte above the tops of the separator guard.

(*b*) "DRY-CHARGED" BATTERIES

Electrolyte of the appropriate specific gravity, either 1·260 or 1·210, is prepared as previously described.

Filling the cells

Whilst these batteries leave the factory in the fully "dry-charged" condition, they may slowly lose some charge in storage. In view of this, the following filling instructions must be carefully observed:—

With the acid, battery and room temperature between 15·5—37·7°C. (60—100°F.), remove the vent plugs and fill (in one operation) each cell to the separator guard or, when applicable, to the coloured marker line.

Measure the temperature and specific gravity of the electrolyte in each of the cells. Allow to stand for 20 minutes and then re-check the specific gravity and temperatures of the electrolyte in each cell.

The battery is then ready for service, *unless* the above checks show the electrolyte temperature to have risen by more than 5·5°C. (10°F.), or the specific gravity to have fallen by more than 10 "points" (·010 S.G.).

In this event, it will be necessary to re-charge the battery at the appropriate re-charge rate until the specific gravity values remain constant for three successive hourly readings and all cells are gassing freely.

During charging, keep the electrolyte in each cell level with the separator guard by adding distilled water—not acid.

GENERATOR

MODEL C40—1

GENERAL

The generator is a shunt-wound, two-pole, two-brush machine, arranged to work in conjunction with a Lucas regulator unit. A fan, integral with the driving pulley, draws cooling air through the generator, inlet and outlet holes being provided in the end brackets of the unit.

The armature is supported at the drive end in a ball race bearing and at the commutator end in a porous bronze bush.

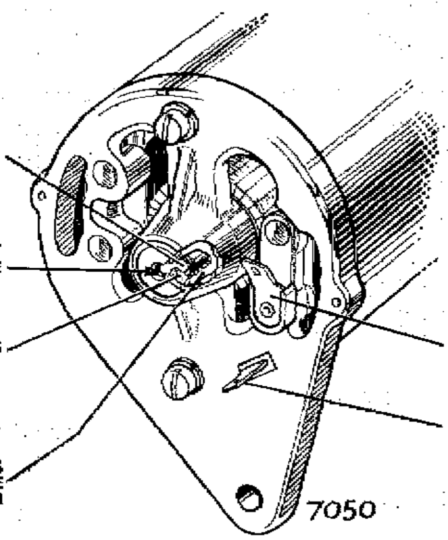


Fig. 2. *Generator lubrication and terminal connections*

ROUTINE MAINTENANCE

Lubrication

Every 5,000 miles or every six months, whichever occurs first, inject a few drops of Shell X-100, 30 engine oil into the hole marked "OIL" at the end of the commutator bearing housing (See Fig. 2). A felt ring located in the housing will absorb the oil and act as a reservoir.

Inspection of brushgear

Every 24,000 miles, the generator should be removed from the engine and the brushgear be inspected in the manner described in later paragraphs under Servicing.

Belt adjustment

Inspect the driving belt occasionally and, if necessary, adjust the tension by following the procedure described in Section "B". The machine must be properly aligned following an adjustment, otherwise undue strain will be thrown on the generator bearings.

PERFORMANCE DATA

The figures covering the design and performance of the generator are given in General Data, to which reference should be made when carrying out any test.

TESTING

Testing in position to determine condition of generator

In the event of charging trouble, adopt the following procedure to locate the cause.

1. Inspect the driving belt and adjust if necessary (See Section B).

2. Check the Lucar connections on the commutator-end bracket. The larger connector carries the main generator output, the smaller connector the field current (See Fig. 2).

3. Switch off all lights and accessories, pull off the connectors from the terminals of the generator and connect the two terminal blades with a short length of wire.

4. Start the engine and set to run at normal idling speed.

5. On vehicles with positive earth, clip the negative lead of a moving coil type voltmeter, calibrated 0–20 volts, to one generator terminal and the positive lead to a good earthing point on the yoke.
   On vehicles with negative earth, make the voltmeter connections in reverse order.

6. Gradually increase the engine speed, when the voltmeter reading should rise rapidly and without fluctuation. Do not allow the voltmeter reading to reach 20 volts, and do not race the engine in an attempt to increase the voltage. It is sufficient to run the generator up to a speed of 1,000 r.p.m. If the voltage does not rise rapidly and without fluctuation the unit must be dismantled for internal examination.

   Excessive sparking at the commutator in the above test indicates a defective armature which should be renewed.

If a radio suppression capacitor is fitted between the output terminal and earth, disconnect this capacitor and re-test the generator before dismantling. If a reading is now given on the voltmeter, the capacitor is defective and must be renewed.

If the generator is in good order, remove the link from between the terminals and restore the original connections.

SERVICING

To dismantle (See Fig. 3)

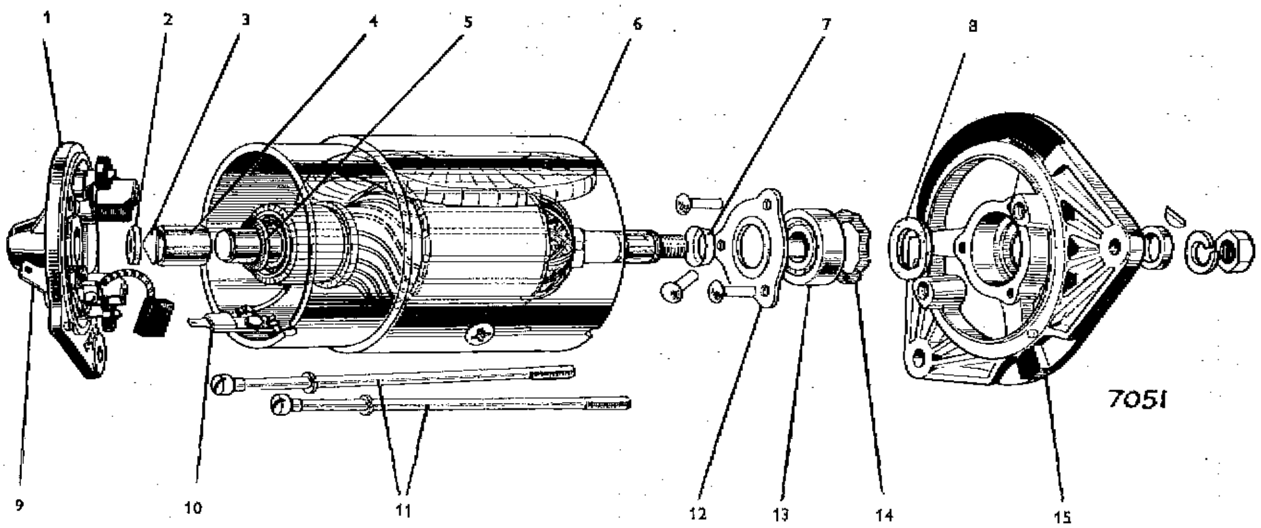
1. Take off the driving pulley and Woodruff key.

2. Unscrew and withdraw the two through bolts (11).

3. Withdraw the commutator-end bracket (1) from the yoke (6).

4. Lift the driving-end bracket and armature assembly from the yoke. Take care not to lose the fibre thrust washer (5) from the commutator-end of the shaft.

5. The driving-end bracket, which on removal from the yoke has withdrawn with it the armature and armature shaft ball-bearing, need not be separated from the shaft unless the bearing is suspected and requires examination, or the armature is to be renewed; in this event the armature should be removed from the end bracket by means of a hand press.



1. COMMUTATOR-END BRACKET
2. FELT RING
3. FELT RING RETAINER
4. BRONZE BUSH
5. FIBRE WASHER
6. YOKE
7. RETAINING CUP
8. FELT RING
9. TERMINAL 'D'
10. TERMINAL 'F'
11. THROUGH BOLTS
12. BEARING RETAINER
13. DRIVE-END BEARING
14. CORRUGATED WASHER
15. DRIVE-END BRACKET

Fig. 3. *Exploded view of generator*

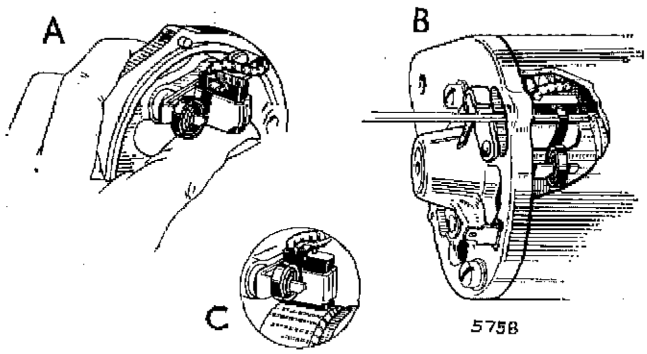


Fig. 4. *Assembling end bracket and brushes to generator*

Brushgear (checking with yoke removed)

1. Lift the brushes up into the brush boxes and secure them in that position by placing the brush springs against the sides of the brushes as shown in Fig. 4(A).

2. Fit the commutator-end bracket over the commutator and release the brushes.

3. Hold back each of the brush springs and move the brush by pulling gently on its flexible connector. If the movement is sluggish, remove the brush from its holder and ease its sides by lightly polishing on a smooth file. Always refit brushes in their original positions. If the brushes are badly worn, new brushes must be fitted and bedded to the commutator. The minimum permissible length of brush is $\frac{9}{32}$ in. (7 mm.).

4. Test the brush spring pressures by means of a spring scale held radially to the commutator (See Fig. 5).

   These pressures should be 30 oz. (·85 kg.) maximum when exerted on a new brush, and 13 oz. (·36 kg.) minimum on a brush worn to $\frac{9}{32}$ in. (7 mm.). Both pressures should be measured and new springs fitted if the tension is low.

Commutator (See Fig. 6)

Whilst the C40 generator was designed to accommodate a commutator of moulded construction, production also includes machines having commutators of the fabricated type. Moulded commutators are recognisable by the exposed end which is quite smooth, unlike that of the fabricated type from which a metal roll-over and an insulating cone protrude.

Clean the commutator with a petrol-moistened cloth and inspect its surface. If the commutator is in good condition, the surface will be smooth and free from pits or burned spots. If pits or burned spots are in evidence, carefully polish with a strip of fine glass-paper while rotating the armature—never use emery paper.

If the foregoing procedure proves ineffective, the commutator should be re-skimmed.

Moulded commutator

A moulded commutator can be re-skimmed but not undercut during service. Care must be exercised to ensure that the finished diameter is not less than 1·43 in. (3·64 cm.). The process of re-skimming comprises rough turning and diamond turning—in that order.

Whether or not rough turning is carried out depends upon the severity and unevenness of wear which has taken place. If a moulded commutator cannot be completely cleaned-up without going below the specified diameter, the armature must be renewed.

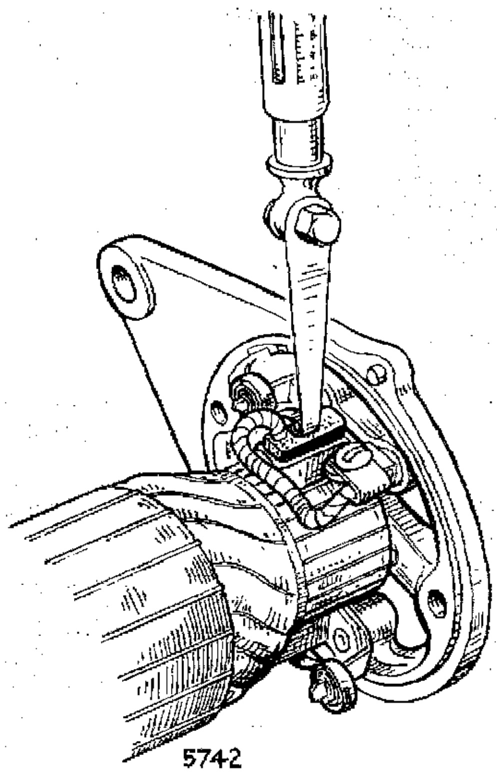


Fig. 5. Testing brush spring tension

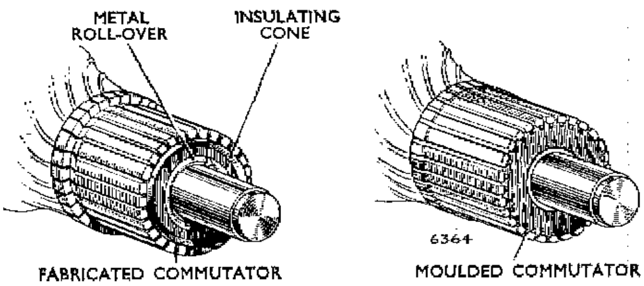


Fig. 6. *Fabricated and moulded commutator types*

Fabricated commutator

To remedy a badly worn fabricated commutator, undercut the insulators between the segments to a depth of $\frac{1}{32}$ in. (·79 mm.), then take a light skim cut with a very sharp tool (preferably diamond tipped).

If a non-diamond tipped tool is used for machining, the commutator should afterwards be lightly polished using a very fine glass-paper, NEVER emery cloth.

Armature

The troubles which may develop in armatures in service may be classified as short circuits, open circuits, and earthed circuits. The usual causes of these troubles and the methods of testing the armature are described in the following paragraphs.

Before proceeding with any test, clean the armature and remove the drive end bracket by pressing the shaft out of the end bracket bearing.

Short circuit test:

Discolouration of any one or two coils, and blackening of two or more commutator segments is a sign of a short circuit. The usual causes are as follows:—

1. Carbon or copper dust having become lodged between the commutator segments.
2. Solder particles getting behind the commutator.
3. An overload, resulting in excessive heating, causing the insulation to break down.
4. The insulation becoming damaged.

Place the armature in a Growler as shown in Fig. 7. Energise the Growler and hold a narrow piece of steel strip over the top of the armature in line with the shaft. Slowly revolve the armature, keeping the steel strip in the same position.

If a short circuit exists, the steel strip will be heavily attracted towards the slot containing the faulty coil. If the attraction is particularly heavy, switch off the Growler quickly, otherwise the coil may be entirely burnt out.

Remember that a coil is wound in two slots, so that on turning the armature further, a second faulty slot will be found.

Open circuit test:

An open circuit as the term implies, is a break in the armature windings. This defect is characterised by violent sparking at the commutator segments between which the open circuit occurs. Open circuits can occur at the commutator segments or in the armature winding, the more usual causes being:—

1. Overloading, causing excessive heating and melting out of the solder from the commutator risers.
2. Vibration sufficient to break the commutator connections.
3. Poor conections which have become oxidised.
4. An earth or short circuit burning open the winding.
5. A mechanical defect causing the armature to rub on some inside part of machine.

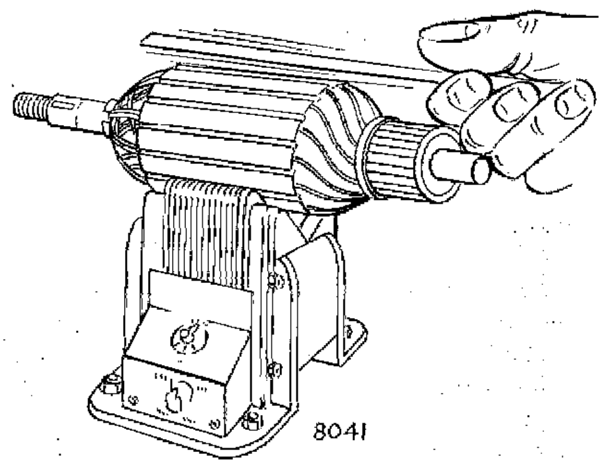


Fig. 7. *Armature short circuit test in Growler*

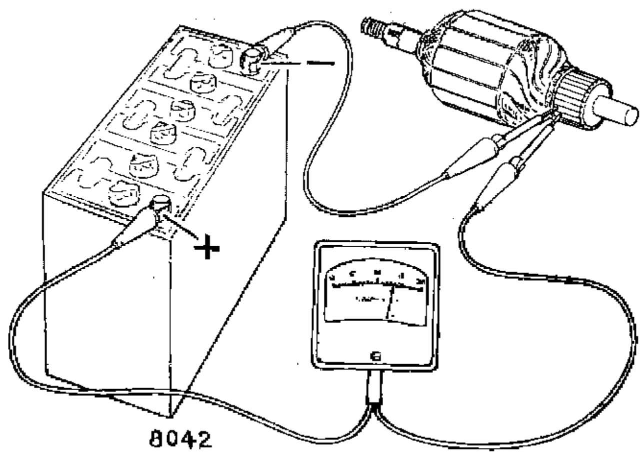


Fig. 8. *Armature open circuit test*

Using a 12 volt battery and a voltmeter with test prods, make the connections shown in Fig. 8. Place the voltmeter test prods on each pair of adjacent commutator segments in turn and note the voltmeter readings. If the armature is in good order, all readings will be similar, but if between any pair of segments a low or zero reading is obtained, one or more adjacent coils are open circuited.

Earthed circuit test:

An earthed circuit in the armature is caused by a breakdown in the insulation which will allow a passage of current to the generator frame. Such a breakdown can be attributed to one or more of the following defects:—

1. Dirt and carbon dust collecting behind the commutator risers.

2. The armature rubbing the field pole-faces, causing the laminations to rub into the armature wires.

3. By the laminations of the armatures becoming loose and rubbing into the armature wires.

4. Overheating due to the machine having been run on an open circuit.

Using a 12 volt battery, voltmeter and test prods, make the test connections shown in Fig. 9. Keep one test prod in contact with the end of the armature shaft, and place the other on each commutator segment in turn.

There should be no voltmeter readings. Any segment on which a reading is obtained will be connected to the armature coil nearest an earth fault.

An alternative method is to use a test lamp instead of a voltmeter—the lamp will glow if there is an earth.

Field coils

Measure the resistance of the field coils without removing them from the generator yoke, by means of an ohmmeter connected between the field terminal and the yoke. The field resistance is 6 ohms.

If an ohmmeter is not available, connect a 12 volt d.c. supply between the field terminal and the generator yoke, with an ammeter in series. The ammeter reading should be approximately 2 amperes. Zero reading on the ammeter, or an "infinity" ohmmeter reading, indicates an open circuit in the field winding.

If the current reading is much more than 2 amperes, or the ohmmeter reading is much below 6 ohms, this is an indication that the insulation of one of the field coils has broken down.

In either event, unless a substitute generator is available, the field coils must be renewed. To do this, carry out the procedure outlined as follows:—

1. Drill out the rivet securing the field coil terminal assembly to the yoke, and remove the insulating sleeve from the terminal blade.

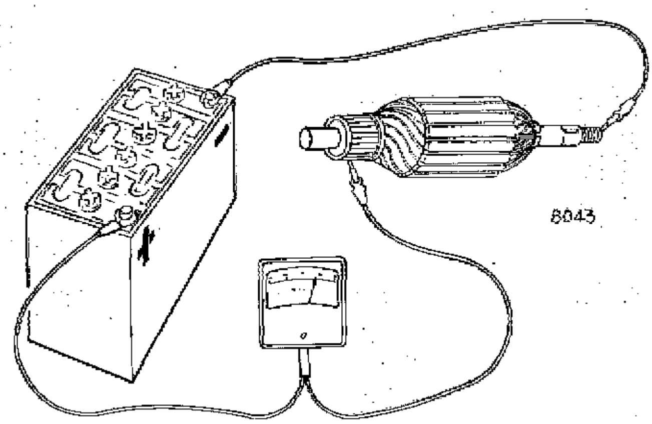


Fig. 9. *Armature earthed circuit test*

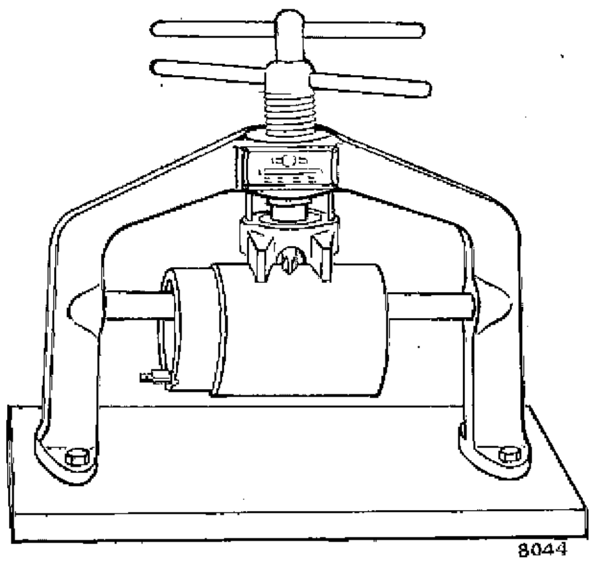


Fig. 10. *Pole-shoe screwdriver*

2. Unsolder the terminal blade and earthing eyelet.

3. Remove the insulation piece which is provided to prevent the junction of the field coils from contacting the yoke.

4. Mark the yoke and pole shoes so that the latter can be fitted in their original positions.

5. Unscrew the two pole shoe retaining screws by means of a pole-shoe screwdriver as shown in Fig. 10.

6. Draw the pole shoes and coils out of the yoke and lift off the coils.

7. Fit the new field coils over the pole shoes and place them in position inside the yoke. Take care to ensure that the taping of the field coils is not trapped between the pole shoes and the yoke.

8. Locate the pole shoes and field coils by lightly tightening the fixing screws.

9. Fully tighten the screws by means of the pole-shoe screwdriver.

10. Solder the terminal blade and earthing eyelet to the appropriate coil ends.

11. Refit the insulating sleeve and re-rivet the terminal assembly to the yoke.

12. Refit the insulation piece behind the junction of the two coils.

Bearings

Bearings which are worn to such an extent that they will allow side movement of the armature shaft must be renewed.

To renew the bearing bush in the commutator-end bracket, proceed as follows:—

1. Remove the old bearing bush from the end bracket. The bush can be withdrawn with a suitable extractor.

2. Withdraw and clean the felt retainer and the felt ring.

3. Insert the felt ring and felt ring retainer in the bearing housing, then press the new bearing bush into the end bracket, using a self extracting tool of the type and in the manner illustrated in Fig. 11, the fitting or mandrel portion being of ·5924 in. (15·046 mm.) diameter and highly polished.

   To withdraw the pin after pressing the bush fully home, turn the nut against the sleeve whilst gripping the squared end of the fitting pin.

Porous bronze bushes must not be reamed after fitting, or the porosity of the bush may be impaired.

Before fitting the new bearing bush, it should be allowed to stand for 24 hours completely immersed in engine oil; this will allow the pores of the bush to be filled with lubricant.

The procedure for renewing the ball bearing at the driving end is as follows:—

1. Drill out the rivets which secure the bearing retaining plate to the end bracket, and remove the plate (See Fig. 3).

2. Press the bearing out of the end bracket, and remove and clean the corrugated washer and felt ring.

3. Before fitting the replacement bearing, see that it is clean and pack it with high melting point grease.

4. Place the felt ring and corrugated washer into the bearing housing in the end bracket.

5. Locate the bearing in the housing and press it home.

6. Fit the bearing retaining plate by inserting new rivets from the pulley side of the bracket, and opening the rivets by means of a punch to secure the plate rigidly in position.

To reassemble

1. Fit the drive end bracket to the armature shaft. The inner journal of the bearing must be supported by a tube approximately 4 in. (10 cm.) long, $\frac{1}{8}$ in. (3 mm.) thick, and $\frac{5}{8}$ in. (1·6 cm.) internal diameter. Do not use the drive end bracket as a support for the bearing whilst fitting the armature.

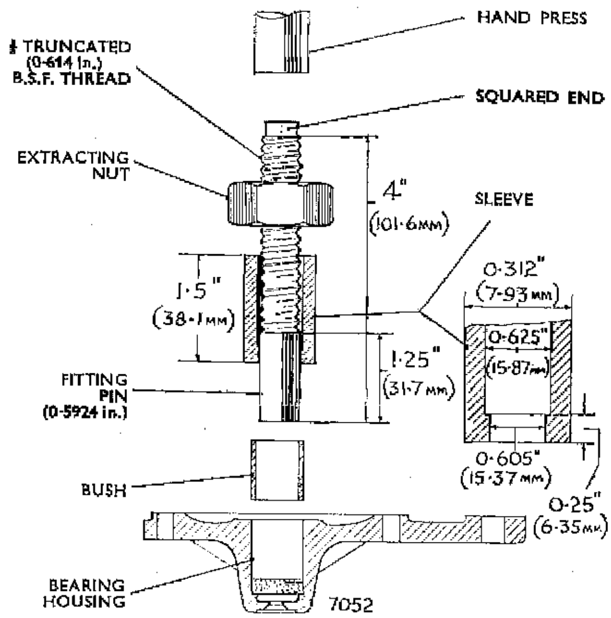


Fig. 11. *Fitting porous bronze brush*

2. Fit the yoke to the drive end bracket.

3. Push the brushes into the brush boxes and secure them in that position by positioning each brush spring against the side of its brush.

4. Fit the fibre thrust washer(s) and commutator end bracket to the yoke so that the dowel on the bracket locates with the groove in the yoke. Take care not to trap the brush connectors.

5. Insert a thin screwdriver through the ventilator holes adjacent to the brush boxes and gently lever the spring arms until the brushes locate correctly on the commutator (see "B", Fig. 4).

6. Refit the two through bolts, pulley spacer and shaft key.

7. Refit the driving pulley.

8. After reassembling lubricate the commutator end bearing.

GENERATOR RE-POLARIZATION

A replacement generator (dynamo) of the type described in this Section is suitable for use on either positive or negative earth systems, provided it is polarized to suit the vehicle's electrical system after fitting.

To do this, fit the generator to the vehicle but do not at this stage connect the cables to the "D" and "F" terminals.

Determine which battery terminal is earthed on the vehicle and then temporarily connect a jumper lead to the battery positive terminal (for negative earth systems) or negative terminal (for positive earth systems).

Flick the other end of the jumper lead several times against terminal "F", this serves to re-polarize the generator.

The temporary connection can now be removed and the original cables connected to terminals "D" and "F".

CONTROL BOX

MODEL RB340

DESCRIPTION

The control box is an electro-magnetically operated three-bobbin unit operating on the current-voltage system of generator output regulation, which provides a more efficient utilisation of generator capacity.

The unit comprises two separate vibrating armature regulators and a cut-out relay, one regulator being responsive to changes in current and the other to voltage. Toothed adjustment cams which can be operated by a special tool, provide a means of adjusting the electrical settings.

Preliminary checking of charging circuit

Before disturbing any electrical adjustments, examine as under to ensure that the fault does not lie outside the control box:—

1. Inspect the generator driving belt. This should be just taut enough to drive without slipping.
2. Inspect the wiring of the charging circuit and carry out continuity tests between the generator, control box and ammeter.
3. Check earth connections, particularly that of the control box.
4. Check the battery by substitution or with an hydrometer and a heavy discharge tester.
5. Check the generator by disconnecting the generator cables and linking the larger generator terminal "D" to the smaller terminal "F" and connecting a first grade moving coil 0—20 voltmeter between this link and earth and running the generator up to about 1000 r.p.m. when a rising voltage should be shown.
6. In the event of reported undercharging, ascertain that this is not due to low mileage.

VOLTAGE REGULATOR

Open circuit settings

Ambient Temperature	*Voltage Setting*
10°C. (50°F.)	14·9—15·5
20°C. (68°F.)	14·7—15·3
30°C. (86°F.)	14·5—15·1
40°C. (104°F.)	14·3—14·9

Method of adjustment (See Fig. 12)

Checking and adjustment should be completed as quickly as possible in order to avoid errors brought about by heating of the operating coil.

1. Withdraw the cables from control box terminal blades "B".

   If the ignition switch is fed from terminal "B", it will be necessary to join the ignition and battery feeds together with a "jumper" lead, to enable the engine to be started.

2. Connect a first grade 0—20 moving-coil voltmeter between control box terminal "D" and a good earthing point.

   A convenient method of making this connection is to withdraw the ignition warning light feed from control box terminal "WL" and to clip the voltmeter lead of the appropriate polarity to the small terminal blade thus exposed—this terminal being electrically common with terminal "D".

3. Start the engine and run the generator at 3000 r.p.m.
4. Observe the voltmeter pointer.

The voltmeter reading should be steady and lie between the appropriate limits given, according to the temperature. An unsteady reading may be due to unclean contacts. If the reading occurs outside the appropriate limits, an adjustment must be made. In this event, continue as follows:—

5. Stop the engine and remove the control box cover.
6. Re-start the engine and run the generator at 3000 r.p.m.
7. Using the correct tool, turn the voltage adjustment cam until the correct setting is obtained—turning the tool clockwise to raise the setting or anti-clockwise to lower it.
8. Check the setting by stopping the engine and then again raising the generator speed to 3000 r.p.m.
9. Restore the original connections and refit the cover.

CURRENT REGULATOR

On-Load setting

The current regulator on-load setting is equal to the maximum rated output of the generator, which is 22 amperes.

Method of adjustment (See Fig. 12)

The generator must be made to develop its maximum output, whatever the state of charge of the battery might be at the time of setting. The voltage regulator must therefore be rendered inoperative, and this is the function of the bulldog clip used in keeping the voltage regulator contacts together.

1. Remove the control box cover.
2. Using a bulldog clip, short out the voltage regulator contacts.
3. Withdraw the cables from control box terminal blades "B".
4. Using a suitable "jumper" lead, connect the cables previously removed to the load side of a first grade 0 to 40 moving coil ammeter.
5. Connect the other side of the ammeter to one of the control box terminal blades "B".

   It is important to ensure that terminal "B" carries only this one connection. All other load connections (including the ignition coil feed) must be made to the battery side of the ammeter.
6. Start the engine and run the generator at 4500 r.p.m.
7. Observe the ammeter pointer.

   The ammeter pointer should be steady and indicate a current of 22 amperes. An unsteady reading may be due to unclean contacts. If the reading is too high or too low, an adjustment must be made. In this event, continue as follows:—
8. Using the correct tool, turn the current adjustment cam until the correct setting is obtained—turning the tool clockwise to raise the setting or anti-clockwise to lower it.
9. Switch off the engine, restore the original connections and refit the control box cover.

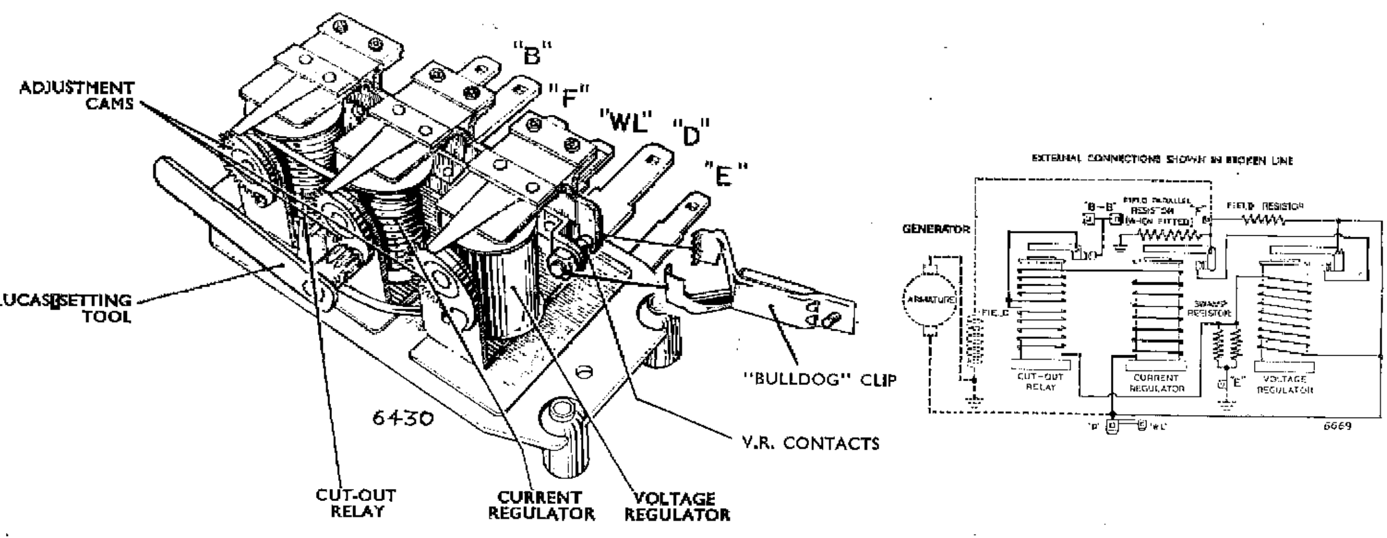


Fig. 12. Current-voltage control box and internal wiring diagram

CUT-OUT RELAY

Electrical Settings

Cut-in Voltage:—	12·6—13·4
Drop-off Voltage:—	9·3—11·2

Method of cut-in adjustment (See Fig. 12)

Checking and adjusting should be completed as rapidly as possible to avoid errors due to heating of the operating coil.

1. Connect a first-grade 0 to 20 moving-coil voltmeter between control box terminal "D" and a good earthing point.

   A convenient method of making this connection is to withdraw the ignition warning light feed from control box terminal "WL" and to clip the voltmeter lead of appropriate polarity to the small terminal blade thus exposed—this terminal being electrically common with terminal "D".

2. Start the engine and slowly increase its speed.

3. Observe the voltmeter pointer.

The voltage should rise steadily and then drop slightly at the instant of contact closure. The cut-in voltage is that which is indicated immediately before the pointer drops back and should occur between the limits given under the heading of Electrical Settings.

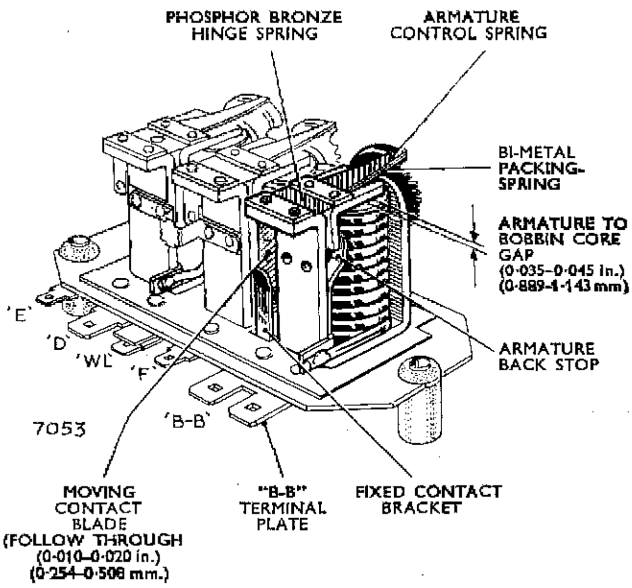


Fig. 13. *Air gap (or mechanical settings) of cut-out relay*

If the cut-in occurs outside those limits, an adjustment must be made.

In this event reduce engine speed to below cut-in value and continue as follows:—

4. Remove the control box cover.

5. Using the correct tool, turn the cut-out relay adjustment cam a small amount in the appropriate direction, turning the tool clockwise to raise the setting or anti-clockwise to lower it.

6. Repeat the above checking procedure until the correct setting is obtained.

7. Switch off the engine, restore the original connections and refit the cover.

Method of drop-off adjustment

1. Withdraw the cables from control box terminal blades "B".

   If the ignition switch is fed from terminal "B" it will be necessary to join the ignition and battery feeds together with a suitable "jumper lead", to enable the engine to be started.

2. Connect a first-grade 0 to 20 moving coil voltmeter between control box terminal "B" and earth.

3. Start the engine and run up to approximately 3000 r.p.m.

4. Slowly decelerate and observe the voltmeter pointer. Opening of the contacts, indicated by the voltmeter pointer dropping to zero, should occur between the limits given under the heading of Electrical Settings. If the drop-off occurs outside these limits, an adjustment must be made. In this event, continue as follows:—

5. Stop the engine and remove the control box cover.

6. Adjust the drop-off voltage by carefully bending the fixed contact bracket. Reducing the contact gap will raise the drop-off voltage; increasing the gap will lower the drop-off voltage.

7. Retest and, if necessary, re-adjust until the correct drop-off setting is obtained.

   This should result in a contact "follow through" or blade deflection of between ·010 and ·20 in. (·254 and ·508 mm.).

8. Restore the original connections and refit the cover.

ADJUSTMENT OF AIR GAP SETTINGS

(See Fig. 13)

Air gap settings are accurately adjusted during production of the control box and should require no further attention. If the original adjustments have been disturbed, it will be necessary to reset as described under the following heading.

Armature-to-Bobbin core gaps of Voltage and Current Regulators

1. Using the correct tool, turn the adjustment cam to the point giving minimum lift to the armature tensioning spring, *i.e.* by turning the tool to the full extent anti-clockwise.

2. Slacken the adjustable contact locking nut and screw back the adjustment contact.

3. Insert a flat steel feeler gauge of ·045 in. thickness (1·143 mm.) between the armature and the copper separation on the core face, taking care not to turn up or damage the copper shim. The gauge should be inserted as far back as the two rivets heads on the underside of the armature.

4. Retaining the gauge in position and pressing squarely down on the armature, screw in the adjustable contact until it just touches the armature contact.

5. Retighten the locking nut and withdraw the gauge.

6. Carry out the electrical setting procedure.

Contact "Follow-through" and Armature-to-Bobbin core gap of Cut-out Relay

1. Press the armature squarely down against the copper separation on the core face.

2. Adjust the fixed contact bracket to give a "follow-through" or blade deflection of the moving contact of between ·010 and ·020 in. (·254 and ·508 mm.).

3. Release the armature.

4. Adjust the armature back stop to give a core gap of between ·035 and ·045 in. (·889 and 1·143 mm.). Check the cut-in and drop-off voltage settings.

CLEANING CONTACTS

Regulator contacts

To clean the voltage or current regulator contacts, use fine carborundum stone or silicon carbide paper followed by methylated spirits (denatured alcohol).

Cut-out relay contacts

To clean cut-out relay contacts, use a strip of fine glass paper—never carborundum stone or emery cloth.

STARTER MOTOR

MODEL M 35G

GENERAL

The starter motor is a four-pole, four-brush machine having an extended shaft to carry the engine engagement gear or starter drive. This motor is controlled by a solenoid switch mounted above the battery and operated by the ignition key on the side of the instrument panel. In an emergency or for testing purposes, the solenoid can be operated by hand by pressing the rubber cap covering the plunger.

ROUTINE MAINTENANCE

Periodically remove the cover band from the starter motor and carry out the following procedure:—

1. Check that the brushes move freely in their holders by holding back the brush springs and pulling gently on the flexible connectors. (See Fig. 14). If movement is sluggish, remove the brush from its holder and clean its sides with a fluffless petrol-moistened cloth. Replace the brush in its original position. *Brushes which are worn to less than $\frac{5}{16}$ in. (8mm.) in length must be renewed.*

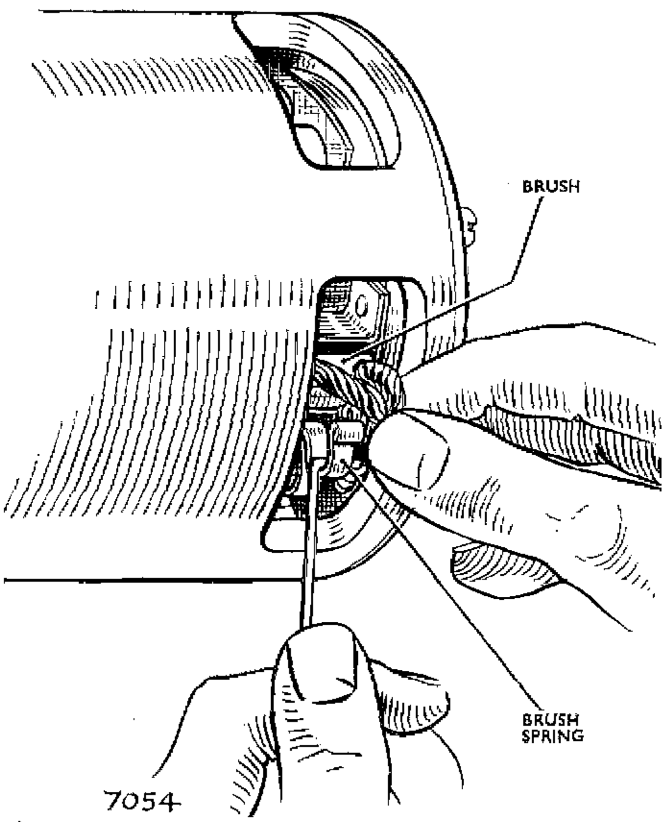


Fig. 14. *Checking free movement of carbon brushes*

2. Check the tension of the brush springs using a spring scale. (See Fig. 15). The correct tension is 30 to 34 oz. New springs must be fitted if tension is low.

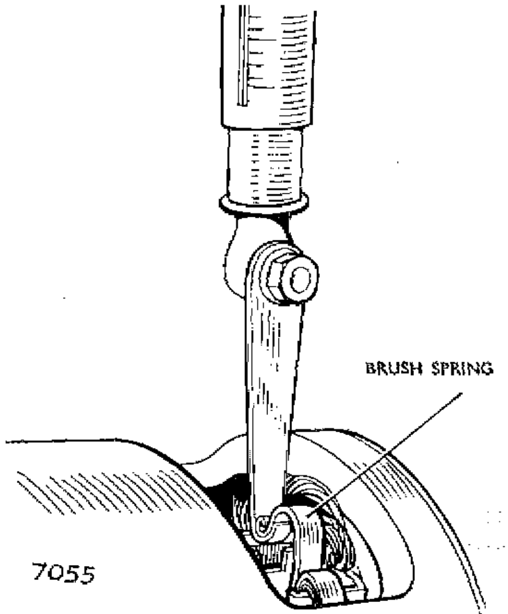


Fig. 15. *Checking brush spring tension*

3. The commutator must be clean and have a polished appearance. If necessary, clean by pressing a fine dry cloth against it while the starter is turned by applying a spanner to the squared extension of the shaft. Access to the squared shaft is gained by removing the thimble-shaped metal cover. If the commutator is very dirty, moisten the cloth with petrol.

4. Keep all electrical connections clean and tight. Any which may have become dirty must be cleaned and the contacting surfaces lightly smeared with petroleum jelly.

SERVICING

Testing in position

1. If the starting motor does not operate or fails to crank the engine when the starting button is used, switch on the lamps (or connect a moving coil 0 to 20 voltmeter between the battery terminals) and again operate the starter.

   The lamps dim (or the voltmeter reading falls appreciably) but the motor does not crank the engine.

2. This may be caused by the starter drive pinion being jammed in mesh with the engine flywheel. The pinion can usually be freed by removing the cap and applying a spanner to the squared extension of the shaft at the commutator end. It is advisable to remove the starter motor from the engine and inspect the starter drive.

3. Sluggish action of the starter motor may be due to a discharged battery. Check by disconnecting the existing cables and reconnecting the motor to a battery known to be fully charged.

   If the starter motor now gives normal cranking of the engine the vehicle battery must be examined.

   If the starter motor still does not operate satisfactorily, it must be removed from the engine and the starting motor and starter drive examined.

The lamps do not dim (or the voltmeter reading remains unaffected) and the motor does not crank the engine

1. Check by means of a voltmeter or battery-voltage test lamp that the circuit up to the supply terminal on the motor is in order.

   If no voltage is indicated (or the test lamp does not light), check the circuit from battery to motor via the starter switch. Ensure that all connections are clean and tight. If the switch is found to be faulty, a replacement must be fitted. A reading of battery voltage (or the test lamp lighting with full brilliance) at the supply terminal indicates that the starting motor has an internal fault and must be removed from the engine for examination.

2. If the motor operates but does not crank the engine, the starter drive is in need of cleaning or may have developed some other fault. In either event the motor must be removed from the engine.

Starter cranking circuit test

The most convenient method of testing the circuit is by taking voltage drop readings, using a low range voltmeter. This procedure will locate any excessive resistance due to poor connections or bad cables, which would prevent the delivery of the normal amount of current to the starter motor.

For the purpose of the test, it will be necessary to disconnect the contact breaker lead from the ignition coil to prevent the engine starting. Before carrying out the test, ensure that the battery is in good condition and fully charged.

Voltage drop readings (Negative earthed vehicles)

1. Using a low range voltmeter, connect the negative lead of the voltmeter to the starter terminal, and the positive lead to the positive terminal of the battery. Operate the starter switch and note the voltmeter reading.

2. Connect the positive lead of the voltmeter to the starter commutator end bracket, and the negative lead to the negative terminal of the battery. Operate the starter switch and again note the voltmeter reading.

The sum of these two readings must not exceed ·5 volt. The procedure is the same for vehicles with positive earth, except that the voltmeter connections must be made in reverse order.

An unduly high reading means that there is excessive resistance in the starter circuit, in which event each part of the circuit should be checked in turn with particular attention to the solenoid switch connections and all earth connections including the engine bonding strip.

On completion of the test, restore the original ignition connections.

Starter cranking voltage test

This test should be made after any defects previously located have been corrected. It is a valuable test because it gives an indication of the power absorbed in the starter, and also determines whether sufficient voltage is available to operate the ignition system when the starter motor is in operation.

1. Disconnect the contact breaker lead from the ignition coil to prevent the engine starting.
2. Using a zero to 20 range voltmeter, connect the positive lead of the voltmeter to the starter main terminal and the negative lead to an earth point on the starter mounting bracket. (This applies to vehicles with negative earth. For vehicles with positive earth, make the voltmeter connections in reverse order.)
3. Close the starter switch to crank the engine for a few seconds, and note the voltmeter reading.

The starter motor should crank the engine at a good rate of speed, and the voltage reading should be not less than 9·5 volts. On completion of the test, restore the original ignition connections.

Measuring light running current (on bench)

Secure the starter motor in a vice, then connect the motor in series with a starter switch, a zero to 600 range ammeter, and a 12 volt battery in good condition and fully charged.

Use heavy duty starter cable in the circuit, and utilise a fixing lug on the starter motor as an earthing point. Operate the switch and note the reading on the ammeter.

The motor should run at a high speed, and the light running current should be 45 amperes.

While the starter motor is running at speed, examine the brushgear and commutator for undue sparking or excessive brush movement.

Removing the starter motor from the engine

1. Disconnect the earth terminal on the battery to avoid any danger of short circuits.
2. Remove the heavy cable from the starter motor.
3. Remove the mounting bolts and withdraw the starter motor from the engine.

Dismantling the starter motor (See Fig. 16)

1. Remove the cover band, hold back the brush springs and lift the brushes from their holders.
2. Remove the nuts from the terminal post which protrudes from the commutator-end bracket.
3. Unscrew the two through bolts from the commutator-end bracket and remove the commutator-end bracket from the yoke.
4. Remove the drive-end bracket with armature and drive from the starter motor yoke.
5. If it is necessary to remove the drive-end bracket from the armature it can be slid off after the drive has been dismantled.

Bench inspection

After the starter motor has been dismantled, the individual items must be examined in the following manner.

Brushgear

Where necessary, the brushes and brush-holders must be cleaned using a clean fluffless petrol-moistened cloth.

To prevent damage to the commutator, brushes must be renewed when worn to $\frac{5}{16}$ in. (8 mm.) length.

To renew the brushes, proceed as follows:—

Insulated brushes

Cut off the original brush flexible $\frac{1}{8}$ in. (3·17 mm.) from the aluminium.

Clean up and tin the original resistance-brazed joint.

Open out the loop of the new brush flexible.

Tin the loop, taking extra care not to allow any solder to run towards the brush.

Place the original joint within the loop.

Squeeze-up the clips and solder.

Providing the necessary equipment is available for refitting and tightening of the pole shoes, the above operations will be found easier to carry out if the field coils are removed from the yoke.

Earth brushes

1. Unsolder the brush flexible from the clip located beneath the brush box mounting. Open up the clip, insert the new flexible, squeeze up the clip and re-solder.

   The brushes are pre-formed so that pre-bedding to the commutator is unnecessary.

2. Check the brush spring tension using a spring scale as previously instructed.

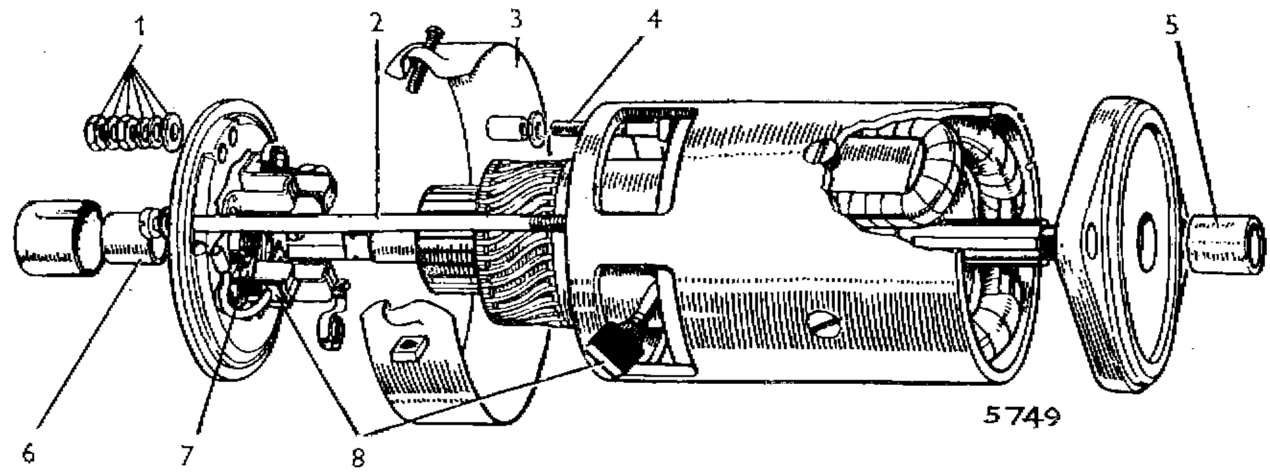
   Check the tension of any new spring and ensure that it makes contact with the centre of the brush top.

Commutator

1. A commutator in good condition will be smooth and free from pits and burned spots.

2. Clean the commutator with a petrol-moistened cloth. If this is ineffective, carefully polish with a strip of fine glass paper, while rotating the armature. To remedy a badly worn commutator, dismantle the starter drive and remove the armature from the end bracket.

3. Mount the armature in a lathe, rotate at a high speed and take a light cut with a very sharp tool,



1. TERMINAL NUTS AND WASHERS
2. THROUGH BOLT
3. COVER BAND
4. TERMINAL POST
5. BEARING BUSH (DRIVE END)
6. BEARING BUSH (COMMUTATOR END)
7. BRUSH SPRINGS
8. BRUSHES

Fig. 16. *Exploded view of starter motor*

Do not remove any more metal than is necessary. Finally polish with very fine glass paper.

The insulators between the commutator segments MUST NOT BE UNDERCUT.

Armature

1. Check for lifting commutator segments and loose turns in the armature winding. These may be due to the starter motor having remained engaged while the engine is running, thus causing the armature to be rotated at excessive speed.

   A damaged armature must always be renewed—no attempt should be made to machine the armature core or to true a distorted armature shaft. An indication of a bent shaft or a loose pole shoe may be given by scored armature laminations.

2. An armature can be tested for open circuits, short circuits, and earthed circuits, by following the procedure described in earlier paragraphs for the generator.

Field coils

Continuity test (See Fig. 17)

1. Connect a battery and light bulb in series with two pointed probes.
2. If the lamp fails to light in the following test, an open circuit in the field coils is indicated and the defective coils must be renewed.
3. When the probes are placed on the brush tappings, the bulb should light.
4. Lighting of the lamp does not necessarily indicate that the field lighting coils are in order. It is possible that a field coil may be earthed to a pole shoe or to the yoke.

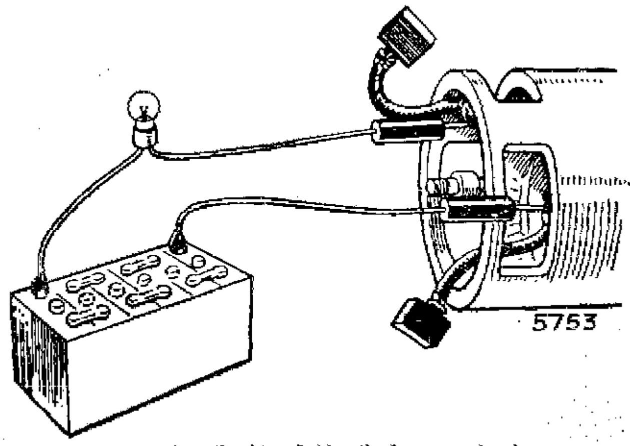


Fig. 17. *Checking field coils for open circuit*

Insulation tests (See Fig. 18)

1. Connect an ohm meter or a 110-volt A.C. test lamp between the terminal post and a clean part of the yoke. Lighting of the test lamp or a low ohmic reading indicates that the field coils are earthed to the yoke and must be renewed.

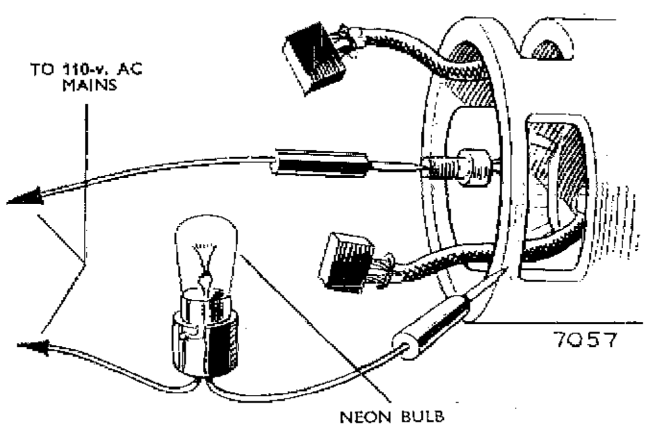


Fig. 18. *Field coil insulation test*

2. Again using the 110-v. test lamp, check the soundness of the insulation on the two insulated brush boxes. (See Fig. 19.)
3. Wipe clear from the boxes all dust and dirt before testing in this fashion.

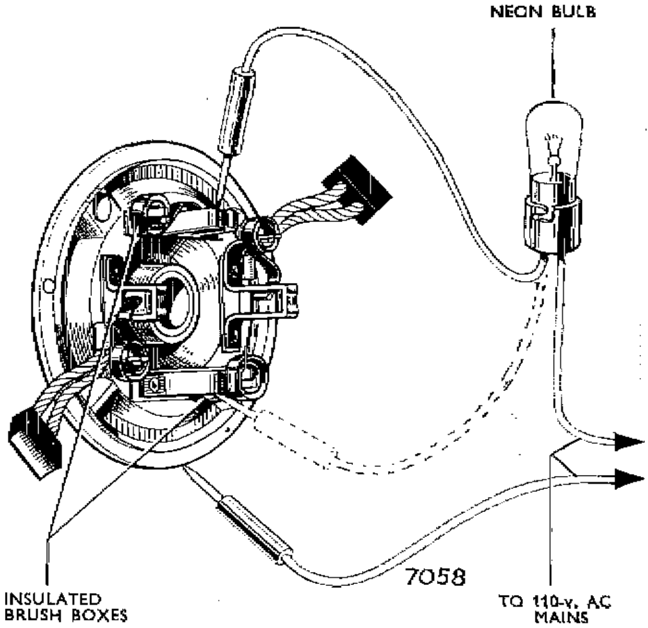


Fig. 19. *Brush-box insulation test*

Fitting new field coils; proceed as follows:—

1. Unscrew the four pole-shoe retaining screws using a pole-shoe screwdriver.

2. Remove the insulation piece which is fitted to prevent the inter-coil connectors from contacting with the yoke. Mark the yoke and pole shoes in order that they may be refitted in their original positions.

3. Draw the pole shoes and coils out of the yoke and lift off the coils.

4. Fit the new field coils over the pole shoes and place them in position inside the yoke. Ensure that the taping of the field coils is not trapped between the pole shoes and the yoke.

5. Locate the pole shoes and field coils by lightly tightening the fixing screws.

6. Refit the insulation piece between the field coil connections and the yoke.

7. Finally, tighten the screws by means of the pole-shoe screwdriver.

Bearings

Bearings which are worn to such an extent that they will allow excessive side play of the armature shaft must be renewed.

To renew the bearing bushes proceed as follows:—

1. Press the bearing bush out of the end bracket.

2. Press the new bearing bush into the end bracket using a shouldered, highly polished mandrel of the same diameter as the shaft which is to fit in the bearing. Porous bronze bushes must not be opened out after fitting, or the porosity of the bush may be impaired.

3. Before fitting a new porous bronze bearing bush it should be completely immersed for 24 hours in clean thin engine oil. On occasions of urgency this period may be shortened by heating the oil to 100°C. (212°F) for two hours, then allowing to cool before removing the bearing bush.

Starter drive

1. The pinion and barrel is permanently retained during manufacture by rolling the four projecting lugs at the trailing edge of the barrel over the four notches of the control nut. This assembly cannot be dismantled for subsequent re-assembly. When necessary the complete barrel assembly (and, preferably, the screwed sleeve) must be renewed.

2. The pinion must move freely along the splined sleeve. If there is any dirt or foreign matter on the sleeve, the starter drive must be washed in petrol or paraffin and a light film of machine oil smeared on it.

Re-assembly of the starter motor (See Fig. 16)
This is, in the main, a reversal of the procedure outlined for dismantling the starter.

DISTRIBUTOR

MODEL 25D4

GENERAL

Mounted on the distributor driving shaft, immediately beneath the contact breaker, is a centrifugally operated timing control mechanism. It comprises a pair of spring-loaded governor weights, linked by lever action to the contact breaker cam. At low engine speeds, the spring force maintains the cam in a position in which the spark is slightly retarded. Under the centrifugal force imparted by higher engine speeds, the governor weights swing out against the spring pressure to advance the contact breaker cam, and thereby the spark, to suit engine conditions at the greater speed.

Vacuum-operated timing control is also provided, designed to give additional advance under part-throttle conditions. The inlet manifold of the engine is in direct communication with one side of a spring-loaded diaphragm. This diaphragm is linked to the contact breaker plate and rotates the contact breaker heel about the cam, thus advancing the spark for part-throttle operating conditions. There is also a micrometer adjustment for making fine alterations in timing to allow for changes in running conditions, e.g., state of carbonisation change of fuel, etc. The H.T. brush in the distributor cover is of composite construction, the centre portion being made of resistive compound and the ends of softer carbon. The resistive portion gives a measure of radio interference suppression. Under no circumstances must a short non-resistive brush be used as a replacement for the longer resistive brush.

Special "Cold Starting" ignition for North America
The ignition coil is a 7-volt unit, and during normal running the excess voltage is dropped across a ballast resistor in series with the coil primary windings. For starting, an additional contact on the solenoid starter switch shorts out the ballast resistor, thus ensuring that the terminal voltage, and hence the performance, of the coil at this time remains practically unaffected by the drop in battery voltage. As soon as the engine starts, and the solenoid switch is opened, the ballast resistor is automatically reconnected into the primary circuit.

ROUTINE MAINTENANCE

(See Figs. 20 and 21)

In general, lubrication, cleaning and contact breaker adjustment constitute normal maintenance procedure.

Lubrication

Take great care to prevent oil or grease getting on or near the contacts. Add a few drops of clean thin engine oil (SAE.30) through the aperture at the edge of the contact breaker base to lubricate the centrifugal timing control. Apply one drop of clean thin engine oil to the top of the contact breaker pivot post. Lightly smear the cam with lubricant as specified. Lift off the rotor arm and apply to the spindle a few drops of clean thin machine oil to lubricate the cam bearing. It is not necessary to remove the exposed screw since it affords a clearance to permit the passage of oil. Refit the rotor arm, locating carefully its moulded projection in the keyway in the spindle and pushing it on as far as it will go.

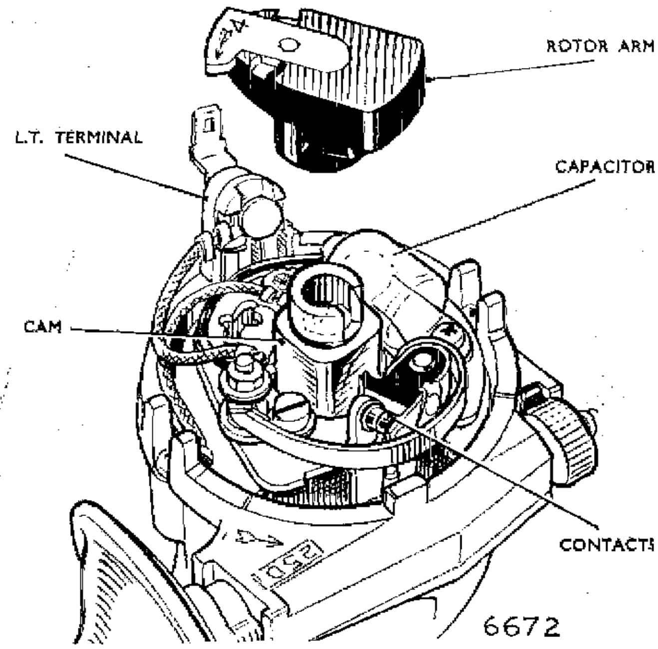


Fig. 20. *Distributor assembly with cover removed*

Cleaning

Thoroughly clean the moulded distributor cover, inside and out, with a soft dry cloth, paying particular attention to the spaces between the metal electrodes. Ensure that the carbon brush moves freely in its holder.

Examine the contact breaker. The contacts must be quite free from grease or oil. If they are burned or blackened, clean them with very fine carborundum stone or emery cloth, then wipe with a petrol-moistened cloth.

Cleaning is facilitated by removing the contact breaker lever. To do this, remove the nut, insulating piece and connections from the post to which the end of the contact breaker spring is anchored. The contact breaker lever may now be removed from its pivot. Before refitting the contact breaker, smear the pivot post with clean thin machine oil or light grease.

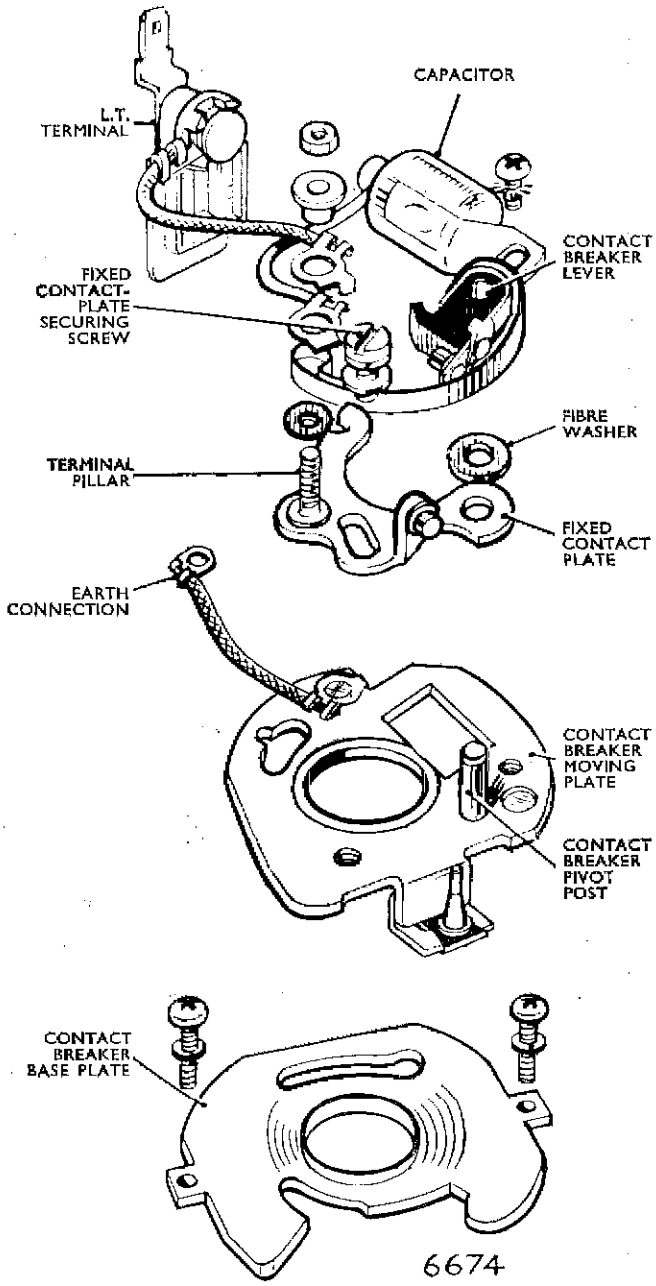


Fig. 21. *Exploded view of contact breaker assembly*

Contact Breaker Adjustment

Check the contact breaker setting. Turn the engine until the contacts show the maximum opening, that is when the operating heel is on the highest point of the cam. The gap between the contacts should measure 0·015 in (·38 mm.). If the measurement is incorrect, keep the engine in the position giving maximum opening, slacken the screw securing the fixed contact plate and adjust its position to give the required gap. Tighten the screw. Recheck the setting for other positions of the engine giving maximum opening.

Performance information

(See General Data).

SERVICING

Before starting to test, make sure that the battery is not fully discharged as this will often produce the same symptoms as a fault in the ignition circuit.

Testing in position to locate cause of uneven firing

Run the engine at a fairly fast idling speed.

If possible, short circuit each plug in turn with the blade of an insulated screwdriver or a hammer head placed across the terminal to contact the cylinder head.

Short-circuiting the plug in the defective cylinder will cause no noticeable change in the running note. On the others, however, there will be a pronounced increase in roughness.

If short-circuiting the sparking plugs is not possible, due to their being fitted with shrouded cable connectors, remove each plug connector in turn. Again, removal of the connection to the defective cylinder will cause no noticeable change in the running note, but there will be a definite increase in roughness when the other plugs are disconnected. Having thus located the defective cylinder, stop the engine and remove the cable from the sparking plug terminal.

Restart the engine and hold the cable end about $\frac{3}{16}$ in. (5 mm.) from the cylinder head. If sparking is strong and regular, the fault lies with the sparking plug, and it should be removed, cleaned and adjusted, or a replacement fitted.

If, however, there is no spark, or only weak irregular sparking, examine the cable from the plug to the distributor cover. Renew the cable if the insulation is cracked or perished.

Clean and examine the distributor moulded cover for free movement of the carbon brush. (See Fig. 22). If a replacement brush is necessary, it is important that the correct type is used. If tracking has occurred, indicated by a thin black line between two or more electrodes or between one of the electrodes and the body, a replacement distributor cover must be fitted.

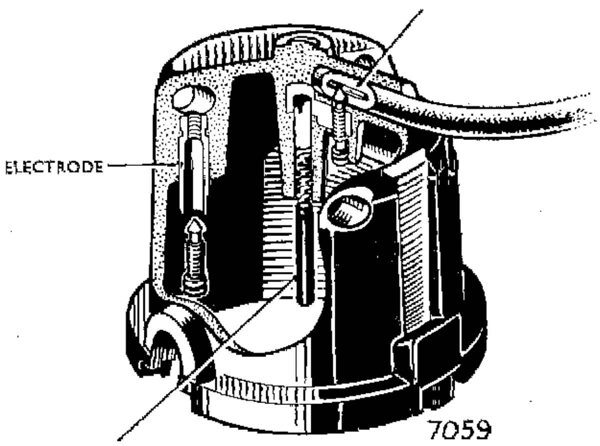


Fig. 22. *Distributor cover and H.T. leads*

Testing in position to locate cause of ignition failure

Spring back the clips and remove the moulded cover. Lift off the rotor. Without disturbing the wiring, connect a 0–20 voltmeter between the "C.B" terminal of the coil and a good earthing point. The engine will normally have stopped with the contacts closed—if so, separate the contacts with a piece of clean card. Switch on the ignition when a reading of battery voltage should be shown on the voltmeter. If no reading is given proceed as in (i) below. Remove the card from between the contacts when the voltmeter reading should drop to zero. If the battery voltage reading persists, or the reading drops, but not to zero volts, proceed as in (ii), column two.

Low Tension Circuit Fault Location

(*i*) *No reading in voltmeter test with contacts separated*

Transfer the voltmeter lead from the "CB" to "SW" terminal of the coil. If a reading is now shown disconnect the cable from the coil "CB" terminal and re-connect the voltmeter lead from "SW" to "CB". No reading will indicate a faulty coil while a reading of battery voltage means that the contact breaker insulation or the capacitor is faulty.

(*ii*) *Voltmeter reading with contacts closed*

If a reading of battery voltage is obtained, transfer the voltmeter lead from the coil "CB" terminal to the distributor L.T. terminal. If this results in the reading dropping to zero then the coil-to-distributor cable is faulty, while a continued reading of battery voltage means that the contacts are not "making". If, however, the voltmeter still shows a low reading when so connected this indicates high resistance between the contact breaker mating surfaces. Clean or renew the contacts.

High Tension Circuit

If the low tension circuit is in order, remove the high tension cable from the centre terminal of the distributor cover. Switch on the ignition, the contacts being closed. Flick open the contacts while the high tension lead from the coil is held about $\frac{3}{16}$ in. (5 mm.) from the cylinder block. If the ignition equipment is in good order, a strong spark will be obtained. If no spark occurs, a fault in the circuit of the secondary winding of the coil is indicated and the coil must be replaced.

If sparking occurs in the above test, but apparent ignition failure persists, test the rotor arm by substitution.

The high tension cables must be carefully examined, and renewed if the rubber insulation is cracked or perished, using 7 mm. neoprene-covered rubber ignition cable. To fit cable to the ignition coil or the distributor cover, pass the cable through the knurled moulded terminal, bare about $\frac{1}{4}$ in. (6 mm.) of the end of the cable, thread the wire through the brass washer (removed from the original cable) and bend back the strands. Finally screw the moulded terminal into the coil moulding.

The cable leads from the distributor to the sparking plugs must be connected in the correct firing order.

Dismantling (See Fig. 23)

When dismantling, carefully note the positions in which the various components are fitted, in order to ensure their correct replacement on reassembly. The tongue of the driving dog is offset; note the relation between it and the rotor electrode and maintain this relation when reassembling the distributor.

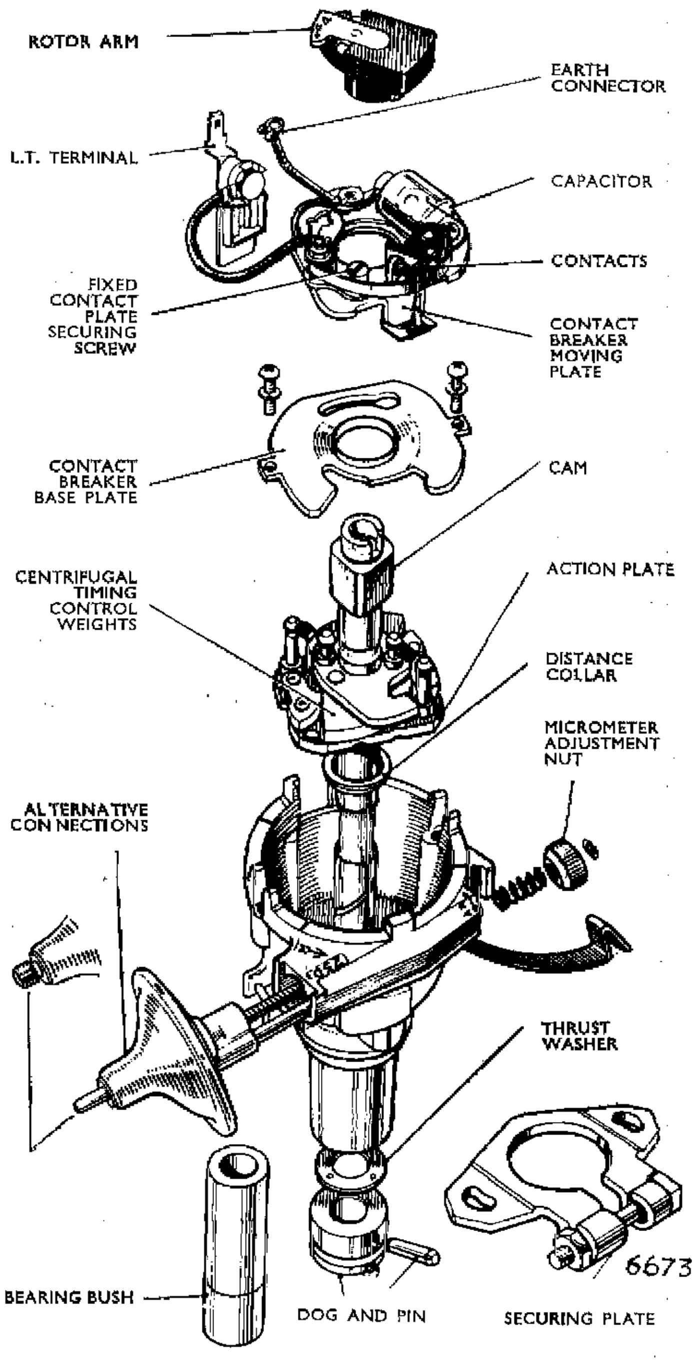


Fig. 23. *Exploded view of distributor*

Note—The amount of dismantling necessary will obviously depend on the repair required. Spring back the securing clips and remove the moulded cover. Lift the rotor arm off the spindle. Disconnect the vacuum unit link to the contact breaker moving plate and remove the two screws at the edge of the contact breaker baseplate. The contact breaker assembly, complete with external terminal, can now be lifted off (see (i)). Remove the circlip on the end of the micrometer timing screw, and turn the micrometer nut until the screw and the vacuum unit assembly are freed. Take care not to lose the ratchet and coil type spring located under the micrometer nut. The complete shaft assembly, with centrifugal timing control and cam foot can now be removed from the distributor body (see (ii) below) on knocking out the dog securing pin.

(i) *Contact breaker*

To dismantle the assembly further, remove the nut, insulating piece and connections from the pillar on which the contact breaker spring is anchored. Lift off the contact breaker lever and the insulating washers beneath it. Remove the screw securing the fixed contact plate, together with the spring and plain steel washers, and take off the plate. Withdraw the single screw securing the capacitor. Dismantle the contact breaker base assembly by turning the base plate clockwise and pulling to release it from the contact breaker moving plate.

(ii) *Shaft and Action Plate*

When dismantling the centrifugal timing control mechanism it is important that it is carried out in the order described below otherwise damage to the springs may result. Carefully lift off the springs, withdraw the screw inside the cam and take off the cam and cam foot. The weights can now be lifted off. Note that a distance collar is fitted on the shaft beneath the action plate.

Bearing Replacement

The bearing bush is of sintered copper-iron and is stepped having the larger diameter extending $\frac{3}{4}$ in. (19 mm.) in length from the bottom of the bush. Prepare the new bush for fitting by allowing it to stand completely immersed in clean medium viscosity (SAE.30–40) engine oil for at least 24 hours. In cases of extreme urgency, this period of soaking may be lessened by heating the oil to 100°C. for 2 hours, then allowing the oil to cool before removing the bush. The following procedure must be closely followed when fitting a replacement bearing bush:—

(*a*) Using a shouldered mandrel of appropriate diameter, press out the worn bush from the body end.

(*b*) Insert the replacement bush from the drive end, with the smaller bush diameter as the leading part. The bush will be a push fit until the larger diameter comes into contact with the shank. With the mandrel in position, the bush is then to be pushed fully in with steady pressure, using a press vice or similar method. When in place, the bush must be a tight fit, flush with the shank at the drive end with a slight protrusion at the top end.

(c) Drill the shaft drain hole, carefully removing any fragments of metal.

(*d*) Insert the shaft and action plate assembly, with clean engine oil applied to the shaft. Make sure that there is no fraze around the hole in the shaft through which the driving dog securing pin is inserted. If the shaft is tight in the bearing when fitted, tap lightly at the drive end and withdraw the shaft. Again insert the shaft, and repeat the operation as long as any tightness exists. It is important that the shaft is free to rotate without binding.

(e) Run the shaft and body in a test rig or lathe for about 15 minutes, re-lubricate the shaft with clean engine oil and reassemble the distributor.

Note—Under no circumstances is the bush to be overbored by reaming or any other means since this will impair the porosity and thereby the effective lubricating quality of the bush.

Reassembly (See Fig. 23)

The following instructions assume that **complete** dismantling has been undertaken.

(i) Place the distance collar over the shaft, smear the shaft with clean engine oil, and fit it into its bearing.

(ii) Refit the vacuum unit into its housing and refit the spring, milled adjusting nut and securing circlip.

(iii) Reassemble the centrifugal timing control weights, cam and cam foot to the shaft. Fit the cam securing screw, then engage the springs with the cam foot pillars.

(Ensure that the springs are not stretched or damaged.)

(iv) Before reassembling the contact breaker base assembly, lightly smear the base plate with clean engine oil or light grease. Fit the contact breaker moving plate to the contact breaker base plate and secure using a reversal of the dismantling procedure. Refit the contact breaker base into the distributor body. Engage the link from the vacuum unit. Insert the two base plate securing screws, one of which also secures one end of the contact breaker earthing cable.

(v) Refit the capacitor. Place the fixed contact plate in position and secure lightly with the securing screw. One plain and one spring washer must be fitted under the securing screw.

(vi) Place the insulating washers, etc., on the contact breaker pivot post and on the pillar on which the end of the contact breaker spring locates. Refit the contact breaker lever and spring.

(vii) Slide the terminal block into its slot.

(viii) Thread the low tension connector and capacitor eyelets on to the insulating piece, and place these on the pillar which secures the end of the contact breaker spring. Refit the washer and securing nut.

(ix) Set the contact gap to 0·015 in. (·38 mm.) and tighten the fixed contact plate securing screw.

(x) Refit the rotor arm, locating the moulded projection in the rotor arm with the keyway in the shaft, and pushing fully home. Refit the moulded cover.

Replacement Contacts

If the contacts are so badly worn that replacement is necessary, they must be renewed as a pair and not individually. The contact gap must be set to 0·015 in. (·38 mm.), after the first 500 miles' running with new contacts fitted, the setting must be checked and the gap reset to 0·015 in. (·38 mm.). This procedure allows for the initial "bedding-in" of the heel.

LAMPS

HEADLAMPS (F.700 Mk. 10)

Two headlamps are employed each incorporating the Sealed Beam light unit of 7 in. (177·8 mm.) diameter. The light unit is of "all glass" construction with an internally aluminised glass reflector which is fused to the front lens.

The two filaments, one for "main" beam and the other for "dipped" beam, are installed with absolute care and precision before they are finally sealed in the gas-filled chamber which comprises the light unit. The fact that the light unit is completely sealed, ensures that the reflecting surface is protected to the extent of producing continual reflective efficiency without deterioration.

In the event of headlamp failure and should the cause not be traced to loose or broken connections, the fault will be in the light unit itself, in which case the light unit will require renewal.

To remove the Sealed Beam unit (See Fig. 24)

Raise the luggage compartment hood and remove the two screws and nuts which retain the headlamp assembly to the body fairing. Swing the lamp away from the fairing and slacken the clamping screw on the swivel bracket at the base of the lamp assembly.

Disconnect the cables at the snap connectors and remove the lamp assembly to the bench.

Remove the three rim retaining screws; the Sealed Beam unit can then be withdrawn and detached from the slotted connector-plug.

Beam adjustment (See Fig. 24)

Each headlamp is provided with two adjusting screws, the adjusting screw (1) provides adjustment in the vertical plane whilst the adjusting screw (8) provides adjustment in the lateral plane.

This type of sealed headlamp is so designed that adjustment can be accurately undertaken using a spirit-level type beam setter. Three glass "aiming pads" take the form of projections moulded integral with and around the outer front edge of the lamp glass, where their purpose is to provide a reference plane for beam aiming.

It is desirable to use a reputable brand of spirit-level type headlamp aligner if the best standards of accuracy and speed are to be obtained. Advice is available on application to the Rootes Group Development Section at Coventry, in respect of all factory approved equipment.

Should a spirit-level type beam setter not be available, the use of an optical-type beam setter can be employed providing it is of the type (Lucas No. 571119).

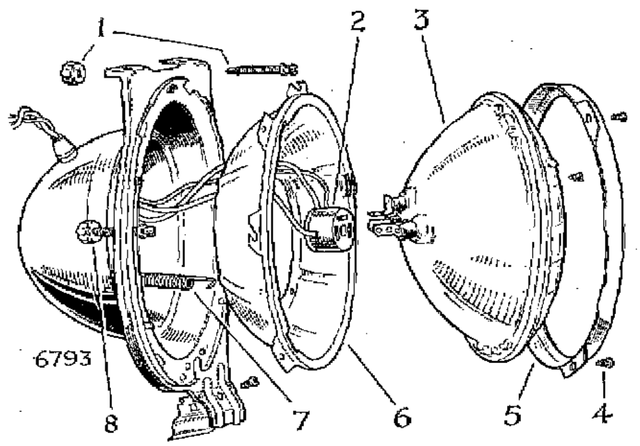


Fig. 24. *Exploded view of headlamp*

KEY TO FIG. 24

1. VERTICAL ADJUSTMENT SCREW AND KNOB
2. SLOTTED CONNECTOR-PLUG
3. SEALED BEAM LIGHT UNIT
4. RIM RETAINING SCREW
5. FRONT RIM
6. SEATING RIM
7. TENSIONING SPRING
8. LATERAL ADJUSTING SCREW AND KNOB

If the use of neither type of beam setter is available, a fair degree of accuracy can be attained by the use of an aiming board (See Fig. 25) which is positioned at a distance of 25 ft. (7·62 m.) from the front of the vehicle and parallel with the rear axle—the floor being flat and level with the base of the aiming board.

Using the aiming board method, proceed as follows:—

1. Ensure that the car is parked (handbrake on) on level ground.
2. Ensure that the front of the car is parallel with the aiming board which is to be positioned at a distance of 25 ft. (7·62 m.) from the car.
3. Either load the car with two adults or simulate this load by adding weights to the car.

4. Clean the glass of one lamp.

5. Adjustment is to be commenced at one lamp; mask the remaining lamp.

6. Turn the adjusting screws anti-clockwise to their full extent.

7. With the lamp illuminated in the **main beam** condition, turn the adjusting screws clockwise as necessary until the required setting is achieved.

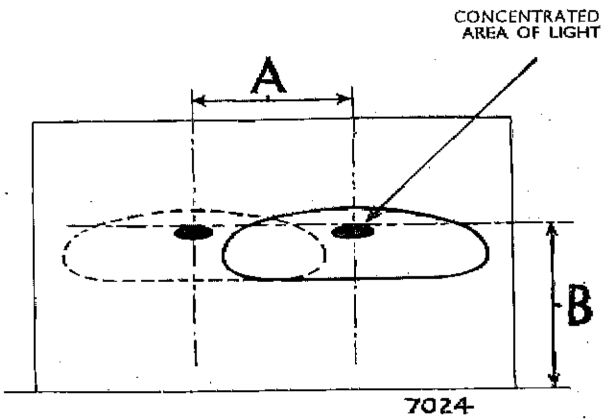
8. Remove the mask from the remaining lamp and mask the lamp which has been set.

9. Clean the glass of the lamp.

10. Turn the lamp adjusting screws anti-clockwise to their full extent.

11. With the lamp illuminated in the **main beam** turn the adjusting screws clockwise as necessary until the required setting is achieved.

12. Re-check the setting of both lamps.



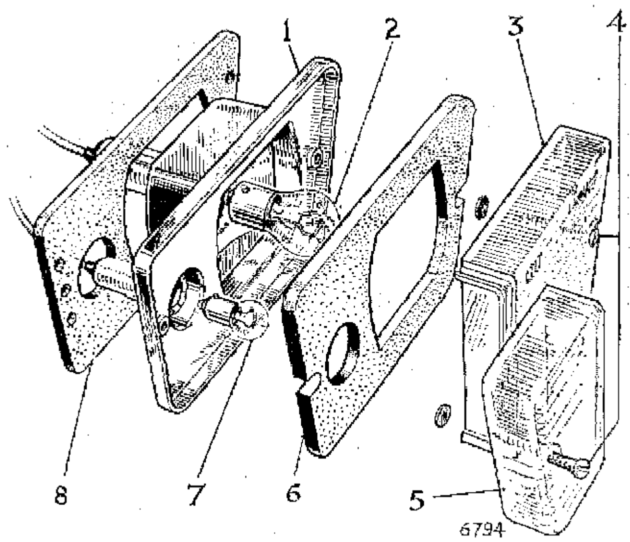
A—DISTANCE BETWEEN HEADLAMPS CENTRE
B—HEIGHT OF HEADLAMP ABOVE GROUND

Fig. 25. *Headlamp alignment*

SIDE LAMPS AND FRONT FLASHER BULBS

(See Fig. 26)

To renew a defective bulb, remove the two screws and detach the white and amber lenses. Renew the defective bulb(s) and refit the lenses, making sure that the rubber seal is correctly located; secure the lenses with the two screws.



KEY TO FIG. 26

1. SIDE/INDICATOR LAMP BODY
2. INDICATOR LAMP BULB
3. AMBER LENS
4. LENS RETAINING SCREWS
5. CLEAR LENS
6. LENS RUBBER SEAT
7. SIDELAMP BULB
8. LAMP BODY RUBBER SEAT

Fig. 26. *Side lamps and front flasher bulbs*

STOP/TAIL AND REAR FLASHER LAMPS

(See Fig. 27)

To renew a defective bulb, remove the two screws which retain the amber or the red lens.

To detach the lamp unit, remove two nuts at the rear of the lamp (collect the plain and spring washers), disconnect the cable(s) at the snap connector(s) and withdraw the lamp unit.

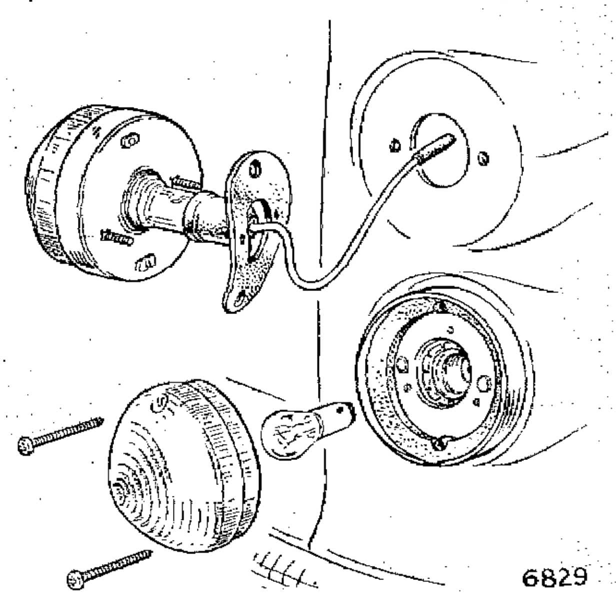


Fig. 27. *Exploded view of stop/tail and rear flasher lamps*

STOP LAMP SWITCH UNIT

The stop lamps are operated by a hydraulic switch in the brake fluid pipe line. The actual location of the switch is on the underside of the floor at the left-hand side of the transmission case. No provision is made for the overhaul of this unit, therefore, it must be renewed as a unit when it becomes defective.

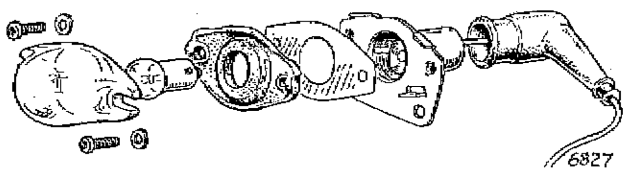


Fig. 28. *Rear number plate lamp*

REAR NUMBER PLATE LAMP (See Fig. 28)

To gain access to the bulb for renewal, remove the two screws that secure the glass dome and lift it off the sponge rubber seat. After the bulb has been renewed refit the glass dome onto its sponge rubber seat and secure the whole with the two screws. To detach the lamp body, remove the two nuts and bolts which secure it to the platform mounted on the engine hood; disconnect the red cable at the single snap connector and feed the cable through the grommet lined hole in the structure of the engine hood.

DIRECTION INDICATOR SIGNALS

Direction Indicators

The correct operation of direction signals requires that the flasher filament in the lamp bulbs (depending on the position of the switch) flash intermittently whether or not the headlamps, parking lamps, tail lamps or stop lamps are "on".

A correctly operating direction signal will be indicated by a regular intermittent flashing of the green pilot lamp located on facia panel. If, when the direction indicator is switched on, the warning (or pilot) lamp does not flash in the usual manner but remains unlit, first check that this is not due to filament failure in either the front or rear lamp on that side. This can be checked by turning the switch to the opposite side—if the pilot lamp now flashes, the circuit is in order and bulb replacement is indicated. On the other hand, if the pilot lamp still does not flash, inspect the indicator lamps. If these are working normally, failure of the pilot lamp bulb is indicated. If, however, the indicator lamps are not functioning, it will be necessary to proceed to check the wiring and flasher unit.

The efficiency of the flasher unit may be readily checked by fitting a known substitute.

The inoperative flasher lamp bulbs should be checked for a burned-out filament. Where it is found that neither lamp has a burned-out filament the wiring between the defective lamp and indicator switch must be checked.

The flasher unit is located inside the car and is attached to the underside of the facia. No servicing of the flasher is required, and where this unit breaks down in service it must be renewed.

Operation of Flasher Unit (See Fig. 29)

This unit depends for its operation on the linear expansion of a piece of wire which becomes heated as current flows through it.

The actuating wire controls the movement of a spring-loaded main armature hinged to a central steel core and carrying the moving member of a pair of contacts ("A", Fig. 29).

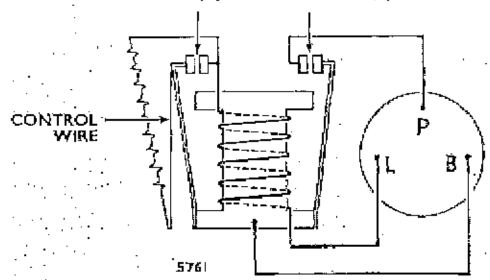


Fig. 29. *Internal connections of flasher unit*

As current flows from terminal "B" to terminal "L" and the lamps *via* the actuating wire and an additional ballast resistor, the wire heats up and expands.

This allows the main armature to move inwards towards the core, closing contacts "A" and short-circuiting the ballast resistor and actuating wire, so that full voltage is applied to the indicator lamps, which now illuminate.

The increased electromagnetic attraction due to full lamp current now flowing through the coil wound on the core, holds the armature firmly so that the contacts are fully closed. It also attracts the pilot or secondary armature to the core, closing contacts "B" and illuminating the pilot lamp.

Since the actuating wire is by-passed when the main contacts are closed, the wire cools and contracts. Eventually, the tension of the contracting wire is sufficient to overcome the electromagnetic attraction and the hinge spring force, resulting in contacts "A" being separated, the lamps being extinguished, and the pilot armature being released.

This sequence of operations continues until the indicator switch is returned to the OFF position.

The pilot lamp on the facia panel will not flash unless sufficient current to light the filaments in front flasher lamp and rear flasher lamp is passing through the windings of the electro-magnet to close contacts (B). The flashing pilot lamp, therefore, gives the driver a clear indication that the direction signals are working correctly. It will be noted that in order to maintain the desired rate of flashing (British Ministry of Transport regulations, 60–120 per minute) the filaments of the front and rear lamps are "pre-heated" *via* the resistance wire during "out" period of the flash.

HORN

MODEL 9H

Lucas Windtone Horn (Fig. 30)

The horn operates on the principle of a resonating air column vibrated by means of a diaphragm which is actuated electro-magnetically by a self-interruptory circuit. The tonal quality of the horn is adjusted to give its best performance before leaving the manufacturers, consequently, it should require no further attention until it has given a long period of service. However, in the event of the horn failing to sound satisfactorily, the cause can be diagnosed and rectified as follows:—

WARNING—Do not dismantle the horn beyond the instructions given in the following paragraphs and on no account is the central locknut or slotted stem to be disturbed on this model horn.

Maintenance

If the horn suddenly fails to sound after operating normally the cause is unlikely to be in the horn itself. First ensure that the cause is not due to such defects as a loose or broken connection in the horn wiring circuit. Failure of the horn to perform correctly can be attributed to either a discharged battery, faulty or loose connections or loose mounting bolts; check and remedy as found necessary. If on inspection these points are found to be in order, it is possible that the horn requires adjustment.

Adjustment

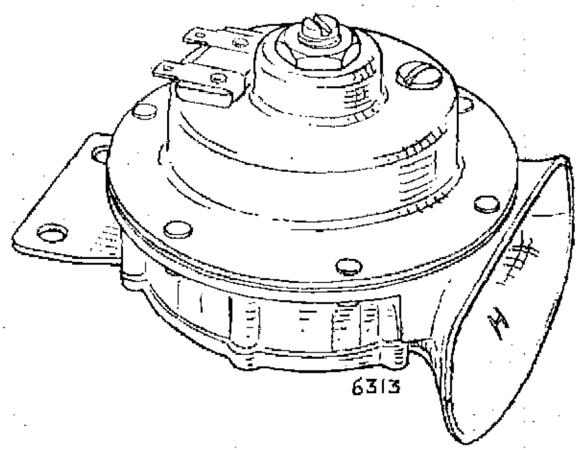
Where there is an additional horn fitted, disconnect one whilst carrying out adjustment on the other, at the same time ensuring that the current supply cable does not come into contact with any part of the vehicle metalwork. Adjustment does not in any way alter the pitch of the note but merely takes up wear of the moving parts.

If a horn fails to sound after making an adjustment release the horn lever immediately. If a horn is removed from the vehicle for the purpose of carrying out adjustment, it is to be held firmly in a vice by the mounting bracket so that the best results in sound are obtained.

Method (i) Adjustment is provided by either a plain or a serrated screw which is located adjacent to the horn terminals. Rotate this screw in an anti-clockwise direction until the horn just fails to sound, then rotate it in the reverse direction for one quarter turn.

Method (ii) If a first grade 0–10 moving coil ammeter is available, connect it in series with the horn. A 9H model horn in correct adjustment will pass 3·0 to 3·5 amperes.

Rotate the adjusting screw in a clockwise direction in order to increase the current and in the reverse direction to reduce it until the best performance is obtained within the stated current range.



The model 9H horn

Fig. 30. *Lucas windtone horn*

CLEAR HOOTER HORN, Model F725 (Fig. 31)

These horns are a riveted assembly and, therefore, cannot be dismantled. If the horns are removed from the vehicle for the purpose of tonal adjustment, they are to be held firmly in a vice by the mounting bracket so that the best results in sound are obtained.

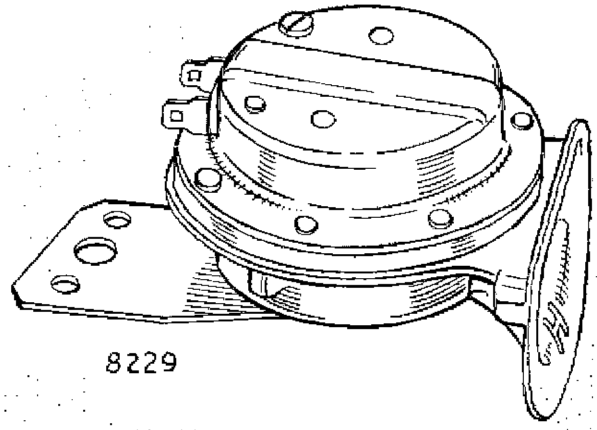


Fig. 31. *Clear Hooter model F725 horn*

Sound—loss of volume

Normally this condition is caused by insufficient current being drawn by the defective horn in which case the adjusting screw is to be rotated slowly clockwise until the volume of sound is restored, then rotate the adjusting screw slowly anti-clockwise to the point where the volume of sound is just maintained. At no time should the operating current exceed 3·5 amperes.

Intermittent operation

Usually this cause can be attributed to that of maladjustment or the presence of foreign matter between the contact points. In this instance the adjusting screw is to be rotated slowly in a clockwise direction for almost one half turn. Should the horn fail to sound after carrying out this adjustment, the screw is to be rotated in the reverse direction until the horn operates at the correct volume, which should occur within 180 degrees either side of the original setting.

Complete failure of sound

In the event of a complete failure, examine the appropriate fuse (if fitted) and the electrical connections in the horn circuit for security and carry out a voltage check to establish whether the correct voltage is available at the horn terminals.

If it was observed that a gradual deterioration in volume was apparent before the failure then the instructions outlined under the heading "Sound—loss of volume" are to be carried out.

Should the horns have been operating satisfactorily prior to a sudden failure, the horn circuit is to be checked in order to establish the current capacity, should this be in excess of 3·5 amperes, the adjusting screw is to be rotated slowly in an anti-clockwise direction until the horns are restored to their correct volume of sound.

If the current capacity is less than that specified the adjusting screw is to be rotated slowly in the reverse direction until the correct volume is obtained.

WINDSCREEN WIPER

MODEL DR3A

General description (See Fig. 32)

The Lucas windscreen wiper comprises an electric motor and gearbox driving a cable rack mechanism which transmits power to the wheelbox spindles and so to the wiper arms and blades. Rotation of the motor armature is converted to reciprocating motion in the cable rack by means of a single-stage worm and nylon gear, the motor end of the cable rack being coupled to the crank pin on the gear through a cross-head and connecting rod in the gearbox.

A self-switching feature ensures that the arms and the blades return automatically to the edge of the screen before stopping, irrespective of their positions at the instant of switching off. This is effected by means of a limit switch in the gearbox, its action being controlled by the crankpin. For the greater part of each cycle, the limit switch contacts are closed, providing an alternative earth return path for the motor current. Each time the blades reach the edge of the windscreen at which they are normally parked when the wipers are not being used, the limit switch opens. Thus, when the control switch is OFF, the motor continues to run until the blades reach their parked position.

Maintenance

The gearbox, cable rack and wheelboxes are greased during manufacture and need no periodic lubrication. Efficient wiping is dependent upon having a clean windscreen and wiper blades in good condition. Oil, tar spots or other foreign deposits should be removed from the screen with methylated spirits. Silicone and wax polishes must not be allowed to contaminate the windscreen or the wiper elements. Worn or perished wiper elements are easily removed for renewal.

SERVICING

Failure to operate or poor performance

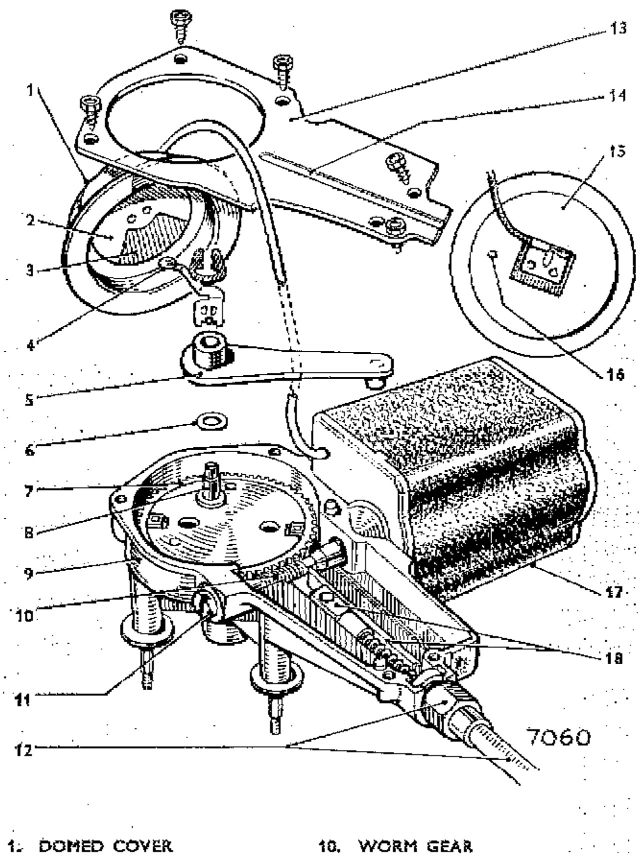
If the windscreen wiper fails to operate, or gives poor performance, the fault may be either electrical or mechanical, therefore, to locate the cause, proceed as follows:—

Measure the supply voltage:

Using a first grade moving-coil voltmeter, measure the voltage between the supply terminal at the motor and a good earthing point, with the control switch ON. For a motor operating normally, this will be approximately 11·5 volts.

If there is a zero voltage reading, check the switch, cables and connections.

If there is low voltage reading, *i.e.* appreciably below 11·5 volts, excessive current flow in the motor is indicated, caused by either an internal fault or excessive mechanical loading in the cable rack transmission.



1. DOMED COVER
2. LIMIT SWITCH FIXED CONTACT
3. INSULATED SECTOR
4. LIMIT SWITCH MOVING CONTACT
5. CONNECTING ROD
6. PEN-STEEL WASHER
7. FINAL GEAR
8. CRANK PIN
9. GEARBOX
10. WORM GEAR
11. ARMATURE END-PLATE ADJUSTING SCREW
12. PROTECTIVE TUBING AND SECURING NUT
13. GEARBOX COVER
14. CENTRAL GROOVE
15. PLAN VIEW OF DOMED COVER
16. SETTING PIP
17. MOTOR
18. CROSS-HEAD AND GUIDE CHANNEL

Fig. 32. *Exploded view of wiper motor gearbox*

Measure light running current and speed:

Disconnect the cable rack at the gearbox; to do this, first mark the position of the domed limit switch cover with relation to the gearbox cover. Withdraw the four self-tapping screws which secure the gearbox cover and lift off the cover. Take off the spring clip which secures the connecting rod on the crankpin, also removing the rotating limit switch; the connecting rod can now be lifted off.

Connect a first grade moving-coil ammeter in the motor supply cable and measure the light running current. Also observe the operating speed by counting the speed of rotation of the final gear. The light running current should not exceed 3·4 amperes, and the gear speed should be between 44 to 50 r.p.m. (after running for 60 seconds). If the motor does not run, or the light running current and speed are not as stated, an internal fault in the motor is indicated; a new motor must be fitted, or the existing motor removed for further examination.

Check cable rack, tubing and wheelboxes:

If the light running current and speed are correct, then the cause of the trouble most probably lies in the cable rack transmission.

The maximum permissible force required to move the cable rack in its protective tubing, should be not more than 6 lb. (2·7 Kg.). This can be checked while the cable rack is disconnected from the gearbox. First take off the arms and blades, then hook a spring balance into the hole in the crosshead into which the pin on the connecting rod is normally fitted. Withdraw the rack with the balance, noting the force required.

Binding of the rack can be attributed to kinked or flattened tubing, or to faulty installation. Any badly kinked or flattened tubing must be renewed. Any curves of less than 9 inches (23 cm.) radius must be reformed. The cable rack must be well lubricated with grease.

When the cable rack is removed, check the wheelboxes for looseness, misalignment or binding of the spindle, and rectify or renew as found necessary.

Reconnecting cable rack:

This is a reversal of the procedure outlined above, taking care to refit the domed limit switch cover in its original position. Ensure that the hexagon nut which secures the tubing to the gearbox is not cross-threaded.

To remove and refit wiper motor

The wiper motor is mounted on the left hand front wheel arch. Disconnect the battery. Remove the fibre-board cover protecting the wiper motor. Withdraw the three Lucar leads from the motor terminals. Disconnect the cable rack transmission as previously described. Remove the three set screws which secure the motor mounting plate. The motor can now be lifted from its position. To refit, reverse the procedure for removal and refit the displaced earth cables on the mounting plate.

To remove and refit wiper arms (See Fig. 33)

Before refitting wiper arms after removal, ensure that the wheelbox spindles are in the correct parking position, by switching on the motor and then switching off and waiting for them to come to rest at the end of a stroke. Fit the arms and blades to the serrated driving drums on the wheelbox spindles at the correct parking angle until the retaining clip snaps over the end of the drum. Switch ON and note the arc of wipe. If necessary, the position of the arms can be adjusted by removing and re-engaging them in the appropriate position, the pitch of the driving drum serrations being 5°. Do not attempt to turn the arms on the spindles, but press back the retaining clip and withdraw the arms from the driving drums.

Limit switch adjustment

The correct working of the limit switch is obtained when the setting pip on top of the domed cover is in line with (in a position either nearest to or furthest from) the central groove in the gearbox cover. Parking of the blades in the opposite extreme position can be effected by slackening the four gearbox cover screws and rotating the limit switch cover through 180°.

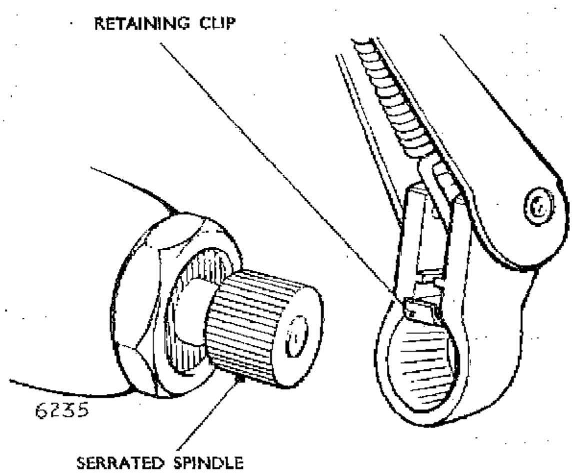


Fig. 33. *Wiper blade and adjustment*

INSTRUMENTS

INSTRUMENT ILLUMINATION AND WARNING LAMPS

The bulb holders for instrument illumination and warning lamps are a push fit in the back of the instrument binnacle. Access can be gained for bulb renewal from beneath the instrument binnacle.

INSTRUMENTS

To remove and refit

Access to the instruments is obtained by removing the instrument binnacle, full details of which is contained in Section O, together with special instructions for refitting.

SWITCHES

If a heater blower unit is installed, the switch, positioned adjacent to the heater control quadrant, is easily removed when necessary by first detaching the cable from the snap retainer and then removing the locking nut securing the switch to the sub-panel.

The remaining switches are all built into the binnacle, and are removed as follows:—

The switch for the Flashing Direction Signals and the Horn are operated by the same lever which is positioned on the right-hand front face of the instrument binnacle; this lever is removed only after the binnacle has been removed, it will then be seen that the switch is retained by two bolts.

The switch for Headlamp Dipping and Headlamp Flashing is positioned on the left-hand front face of the binnacle and is removed in a similar manner to the switch previously mentioned.

The two other switches on the binnacle, one for operating the Windscreen Wiper motor and the other for Side-lamps/Headlamps are each positioned outboard of the two larger switch levers and are removed after the locking rings recessed into the front face of the binnacle have been unscrewed.

The ignition switch, positioned on the extreme right-hand side of the instrument binnacle, is retained by a locking ring which is accessible at the front of the switch.

Courtesy lamp switches

These switches are mounted on the lower part of the body 'A' posts on certain models. Their action automatically illuminates the interior courtesy lamp when the doors are being opened. The switches being of integral construction must be renewed when faulty as they cannot be repaired.

To remove a switch, undo the two self-tapping fixing screws, withdraw the switch, and disconnect the cable. Refitting is a reversal of the removal procedure, but make sure the cable is securely connected and the switch is effectively earthed through its fixing screws.

Headlamp flasher switch operation

The headlamp dipping switch also incorporates the switch for flashing the headlamps, this is achieved by moving the lever 10° anti-clockwise and in so doing an insulated spring-loaded plunger, operated by the inner end of the lever, is depressed to make switch contact so that both headlamps illuminate and will remain so until the lever is released. On releasing the lever, the switch will return to the OFF position (or the lever to the mid-position) under the influence of its spring and the headlamps will extinguish.

In countries where the headlamp flasher operates on the main beam it is inadvisable to use the flasher continuously when the headlamps are already in the dipped condition, as the excess heat generated by both filaments will greatly lessen the life of the lamp units.

When the headlamp flasher system is functioning correctly, each application of the switch lever in the appropriate direction will illuminate both headlamps. Should any one headlamp fail to illuminate, a check is to be made to ensure that the connections to the headlamp are secure; if on inspection the connections are found to be satisfactory, the suspect lamp unit is to be changed for one that is known to be serviceable.

In the event of both headlamps failing to illuminate when the switch is operated, the circuit from the headlamp flasher and dipping switch, is to be checked. If after test the switch is found defective, it must be renewed as the switch cannot be repaired.

FLOOR MOUNTED DIPPING SWITCH

Vehicles for North America do not have the combined binnacle-mounted headlamp dipping and headlamp flasher switch, instead a floor-mounted headlamp dipping switch is fitted.

FUEL AND TEMPERATURE INDICATORS

The bimetal resistance equipment for fuel contents and temperature indication consists, in each case, of an indicator head and transmitter unit connected to a common voltage stabilizer.

In both applications the indicator head operates on a thermal principle, using a bimetal strip surrounded by a heater winding and the transmitter unit is of a resistance type.

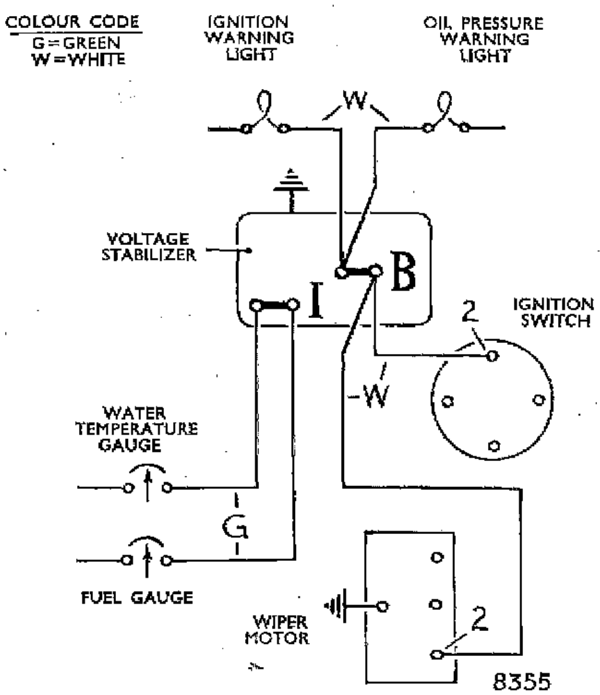
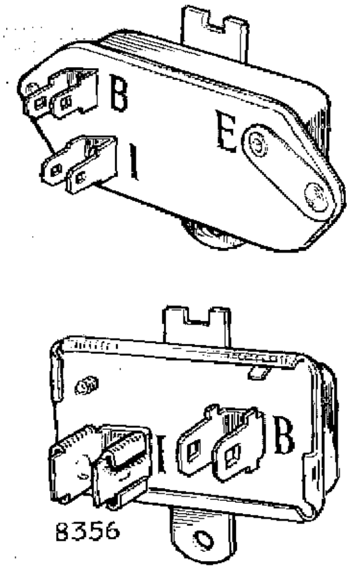


Fig. 34. *Instrument connections to voltage stabilizer*



SERVICING PRECAUTIONS

Ensure that the cables from the instruments are connected to their proper terminals on the stabilizer.

Ensure that the stabilizer is mounted with its securing lug set vertically and the fixing hole downwards.

Ensure that the stabilizer is effectively earthed through its mounting lug.

Failure to observe the precautions will result in inaccurate instrument readings.

Fig. 35. *Two types of voltage stabilizer to be found in service*

Instrument voltage stabilizer (See Figs. 34 and 35)

The system by which the equipment functions is voltage sensitive and the voltage stabilizer which serves both indicators is necessary to ensure a constant supply of a predetermined voltage to the equipment. The stabilizer is situated behind the instrument panel.

The mean voltage between terminal "I" and earth is 10 volts. Renew the stabilizer if faulty, and observe the servicing precautions.

COOLANT TEMPERATURE WARNING LIGHT

Certain models are fitted with a coolant temperature warning system, this comprises a switch, installed in the cylinder head adjacent to the thermostat housing, which is electrically connected to the oil pressure switch, therefore, in the event of the coolant temperature becoming excessive (106±3°C.) the temperature switch will operate and the oil warning light on the instrument binnacle will illuminate.

CAUTION—When the oil warning light illuminates, the vehicle must be halted immediately so that the reason can be investigated. Refer also to Sections A and B.

LOCATION AND REMEDY OF FAULTS

STARTER MOTOR TROUBLE

Symptoms	Possible Causes	Remedy
Starter motor lacks power or fails to turn engine	**Stiff engine, indicated by inability to turn by hand.**	Locate and remedy cause of stiffness.
	If engine can be turned by hand then trouble may be due to:—	
	Battery discharged.	Start by hand. Charge battery either by a long period of day-time running or from independent electrical supply.
	Broken or loose connection in starter circuit.	See that connections to battery, starter and starter switch are tight, and that cables connecting these units are not damaged.
	Starter commutator or brushes dirty.	Clean.
	Brushes worn, or not fitted correctly.	Replace worn brushes. See that brushes "bed" correctly.
	Starter pinion jammed in mesh with flywheel.	Rotate squared end of starter shaft with spanner.
Starter operates, but does not crank engine	**Pinion of starter drive does not engage with flywheel, due to dirt on screwed sleeve.**	Clean sleeve with paraffin.
Starter pinion will not disengage from flywheel when engine is running	Starter pinion jammed in mesh with flywheel.	Rotate squared end of starter shaft with spanner.

CHARGING TROUBLE

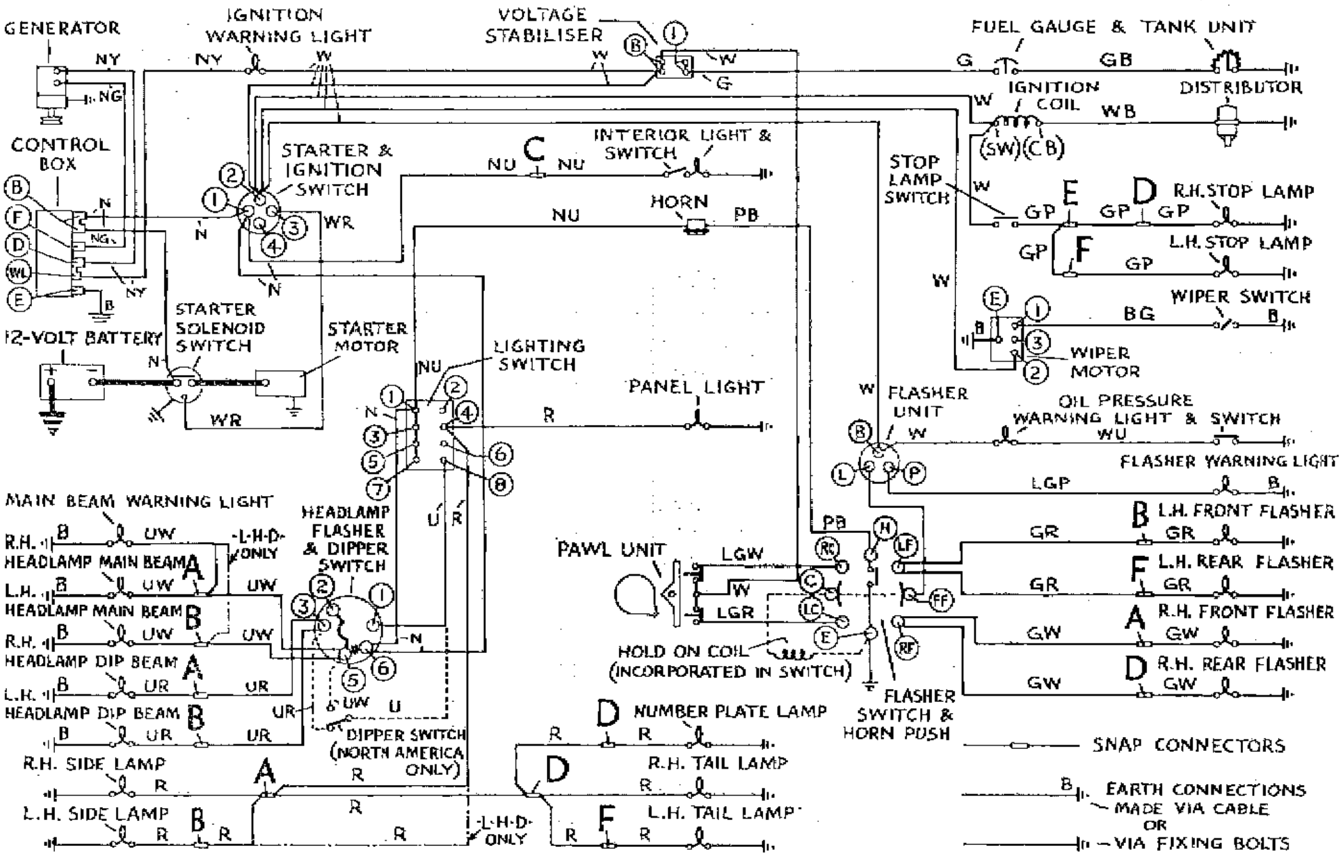
Symptoms	Possible Causes	Remedy
Battery in low state of charge, shown by lack of power when starting. (Hydrometer reading less than 1·200)	**Generator not charging when running at about 20 m.p.h. with no lights in use.** Due to:—	
	Broken or loose connection in generator circuit, or regulator not functioning correctly.	Examine charging and field circuit wiring. Tighten loose connection or replace broken lead. Particularly examine battery connections. Examine regulator.
	Commutator greasy or dirty.	Clean with soft rag moistened in petrol.
	Giving low or intermittent output, when car is running steadily in top gear. Due to:—	
	Generator belt slipping.	Adjust belt (see Section B).
	Loose or broken connections in generator circuit.	Examine charging and field circuits wiring. Tighten loose connections or replace broken lead. Particularly examine battery connections.
	Brushes greasy or dirty.	Clean with soft rag moistened in petrol.
	Brushes worn or not fitted correctly.	Replace worn brushes. See that brushes "bed" correctly.
	Regulator not functioning correctly.	Examine regulator.
Battery overcharged, shown by burnt-out bulbs and very frequent need for "topping up". Hydrometer readings high.	**Giving high output.** Due to:—	
	Regulator not functioning correctly.	Examine regulator.

IGNITION TROUBLE

Symptoms	Possible Causes	Remedy
Engine will not fire	Test if coil sparks by removing lead from centre distributor terminal and hold it about $\frac{3}{16}$ in. away from some metal part of the chassis while engine is turned over. If sparks jump gap regularly the coil and distributor are functioning correctly.	Examine the sparking plugs, and if these are clean and the gaps are correct, the trouble is due to carburettor, petrol supply, etc.
	If the coil does not spark, the trouble may be due to any of the following causes:— **Fault in low tension wiring.** Indicated by (1) No ammeter reading when engine is slowly turned and ignition switch is on; or (2) No spark occurs between the contacts when quickly separated by the fingers when the ignition is switched on.	Examine all cables in ignition circuit and see that all connections are tight. See that battery terminals are secure.
	Dirty or pitted contacts.	Clean contacts with fine carborundum stone or fine emery cloth and afterwards with a cloth moistened with petrol.
	Contact breaker out of adjustment. Turn engine until contacts are fully opened and test gap with gauge.	Adjust gap to correct setting.
Engine misfires	**Dirty or pitted contacts**	Clean contacts with fine carborundum stone or fine emery cloth and afterwards with a cloth moistened with petrol.
	Contact breaker out of adjustment. Turn engine until contacts are fully opened and test gap with gauge.	Adjust gap to correct setting.
	Remove each sparking plug in turn, rest it on the cylinder head, and observe whether a spark occurs at the points when the engine is turned. Irregular sparking may be due to dirty plugs or defective high tension cables. If sparking is regular at all plugs, the trouble is probably due to engine defects.	Clean plugs and adjust the gaps to the figure stated in General Data under the heading 'Ignition'. Renew any lead if the insulation shows signs of deterioration or cracking. Examine the carburettor, petrol supply, etc.

WIRING DIAGRAM

IMP Mk I



COLOUR CHART	
R	RED
W	WHITE
Y	YELLOW
N	BROWN
G	GREEN
U	BLUE
P	PURPLE
B	BLACK
LG	LIGHT GREEN

COMBINED BINNACLE-MOUNTED HEADLAMP FLASHER & DIPPER SWITCH IS REPLACED BY A FLOOR-MOUNTED DIPPER SWITCH FOR NORTH AMERICA EXPORT. IN THIS INSTANCE, THE UW AND UR CABLES FROM THE HEADLAMPS WHICH ARE NORMALLY CONNECTED TO THE HEADLAMP FLASHER AND DIPPING SWITCH, ARE JOINED BY IN-LINE CONNECTORS AND THE N LEADS WHICH CONNECT AT TERMINAL SIX OF THIS SAME SWITCH, ARE DELETED.

7362

SNAP CONNECTOR LOCATIONS

A — On right-hand front wing valance beneath glass-fibre moulding.

B — On left-hand front wing valance beneath glass-fibre moulding.

C — Above parcel shelf on extreme right-hand side.

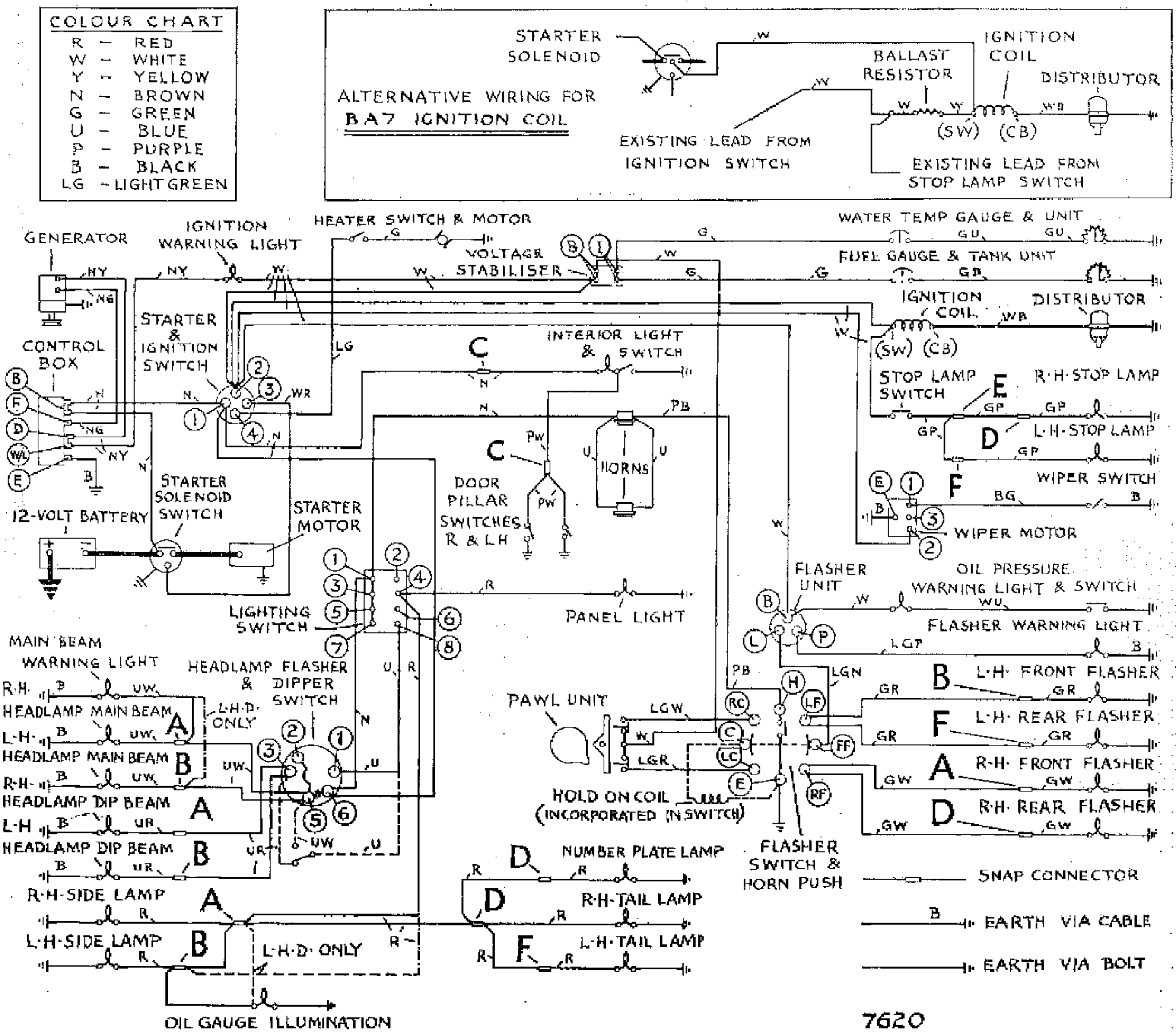
D — In engine compartment at right-hand side.

E — In engine compartment, central above power unit.

F — In engine compartment at left-hand side.

WIRING DIAGRAM

CHAMOIS Mk I



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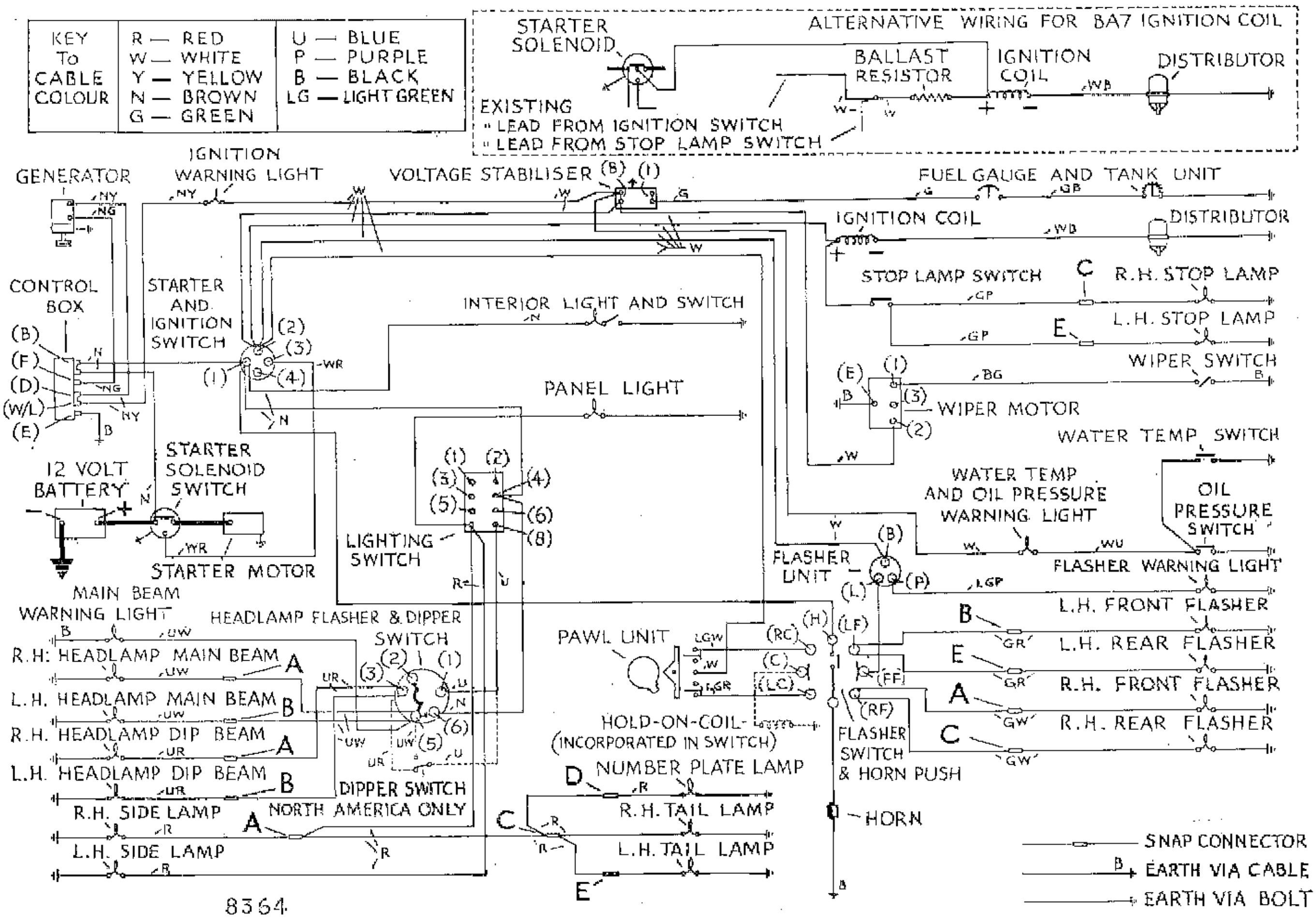
COMBINED BINNACLE-MOUNTED HEADLAMP FLASHER & DIPPER SWITCH IS REPLACED BY A FLOOR-MOUNTED DIPPER SWITCH FOR NORTH AMERICA EXPORT. IN THIS INSTANCE, THE UW AND UR CABLES FROM THE HEADLAMPS WHICH ARE NORMALLY CONNECTED TO THE HEADLAMP FLASHER AND DIPPING SWITCH, ARE JOINED BY IN-LINE CONNECTORS AND THE N LEADS WHICH CONNECT AT TERMINAL SIX OF THIS SAME SWITCH, ARE DELETED.

For snap connector locations refer to page 40

WIRING DIAGRAM

IMP Deluxe Mk II, IMP Basic Mk II



SNAP CONNECTOR LOCATIONS

A — On right-hand front wing valance beneath glass-fibre moulding.

B — On left-hand front wing valance beneath glass-fibre moulding.

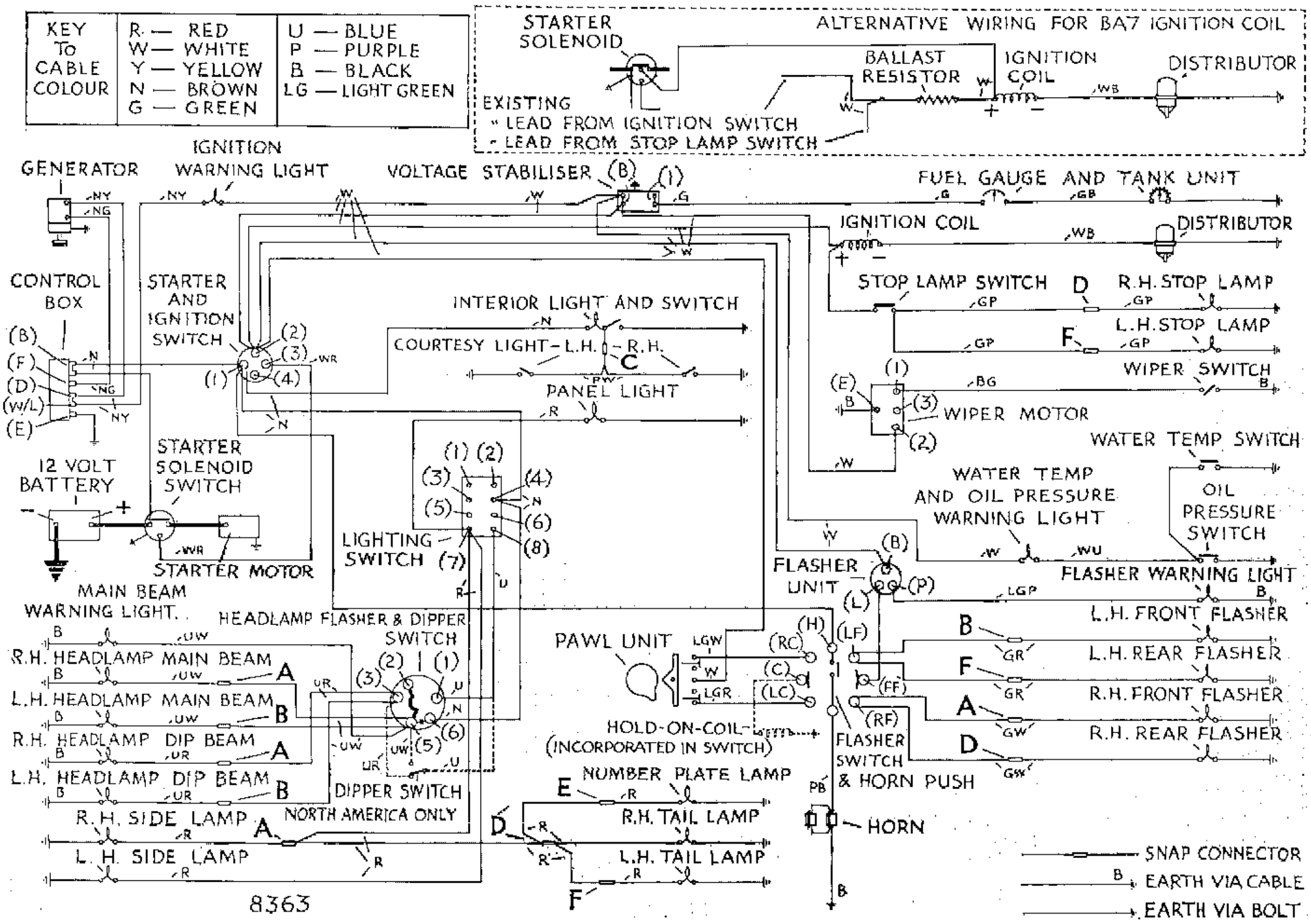
C — In engine compartment at right-hand side.

D — Central in engine compartment lid.

E — In engine compartment at left-hand side.

WIRING DIAGRAM

IMP Super Mk II



SNAP CONNECTOR LOCATIONS

A — On right-hand front wing valance beneath glass-fibre moulding.

B — On left-hand front wing valance beneath glass-fibre moulding.

C — Above parcel shelf on extreme right-hand side.

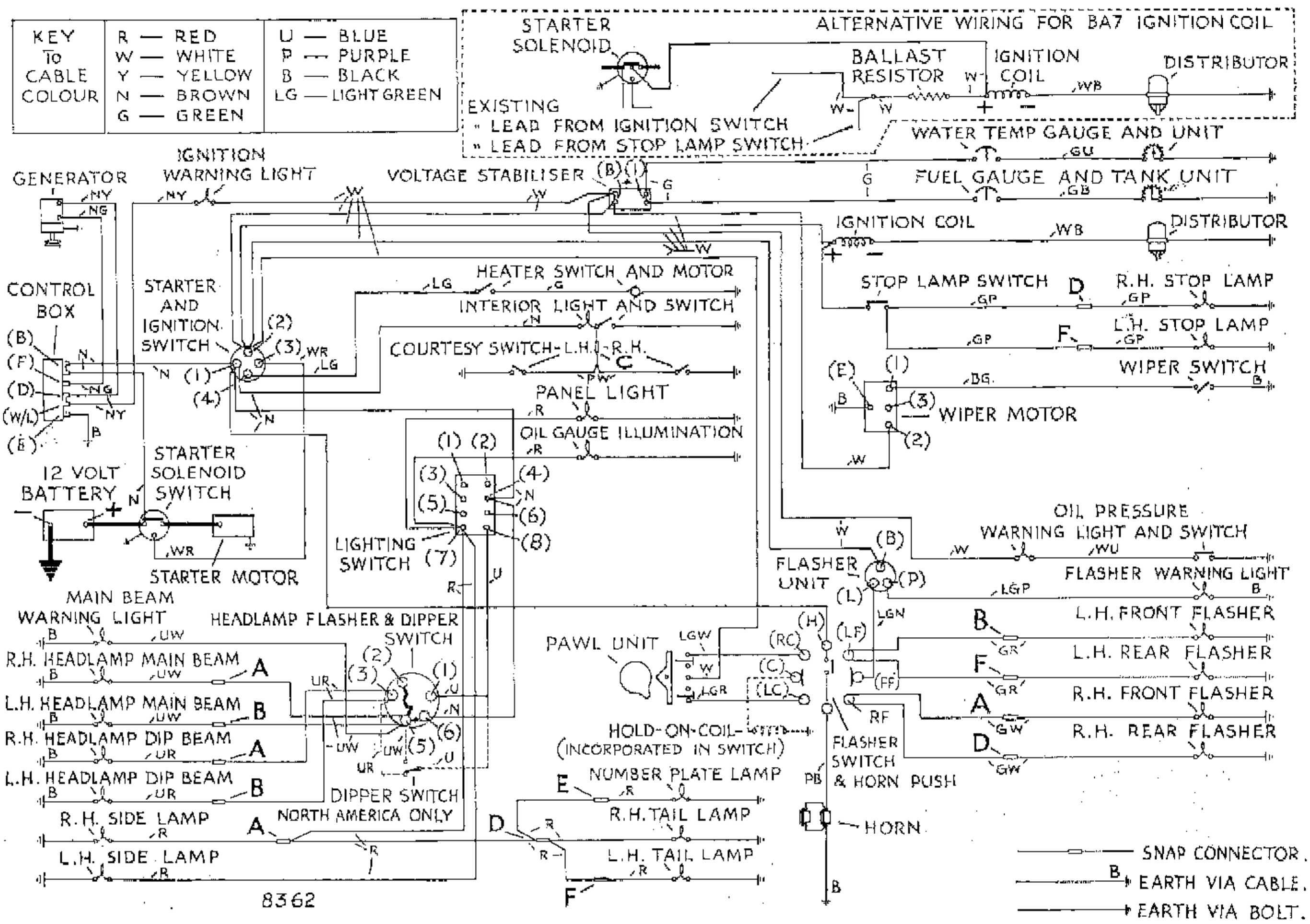
D — In engine compartment at right-hand side.

E — Central in engine compartment lid.

F — In engine compartment at left-hand side.

WIRING DIAGRAM

CHAMOIS Mk II



SNAP CONNECTOR LOCATIONS

A — On right-hand front wing valance beneath glass-fibre moulding.

B — On left-hand front wing valance beneath glass-fibre moulding.

C — Above parcel shelf on extreme right-hand side.

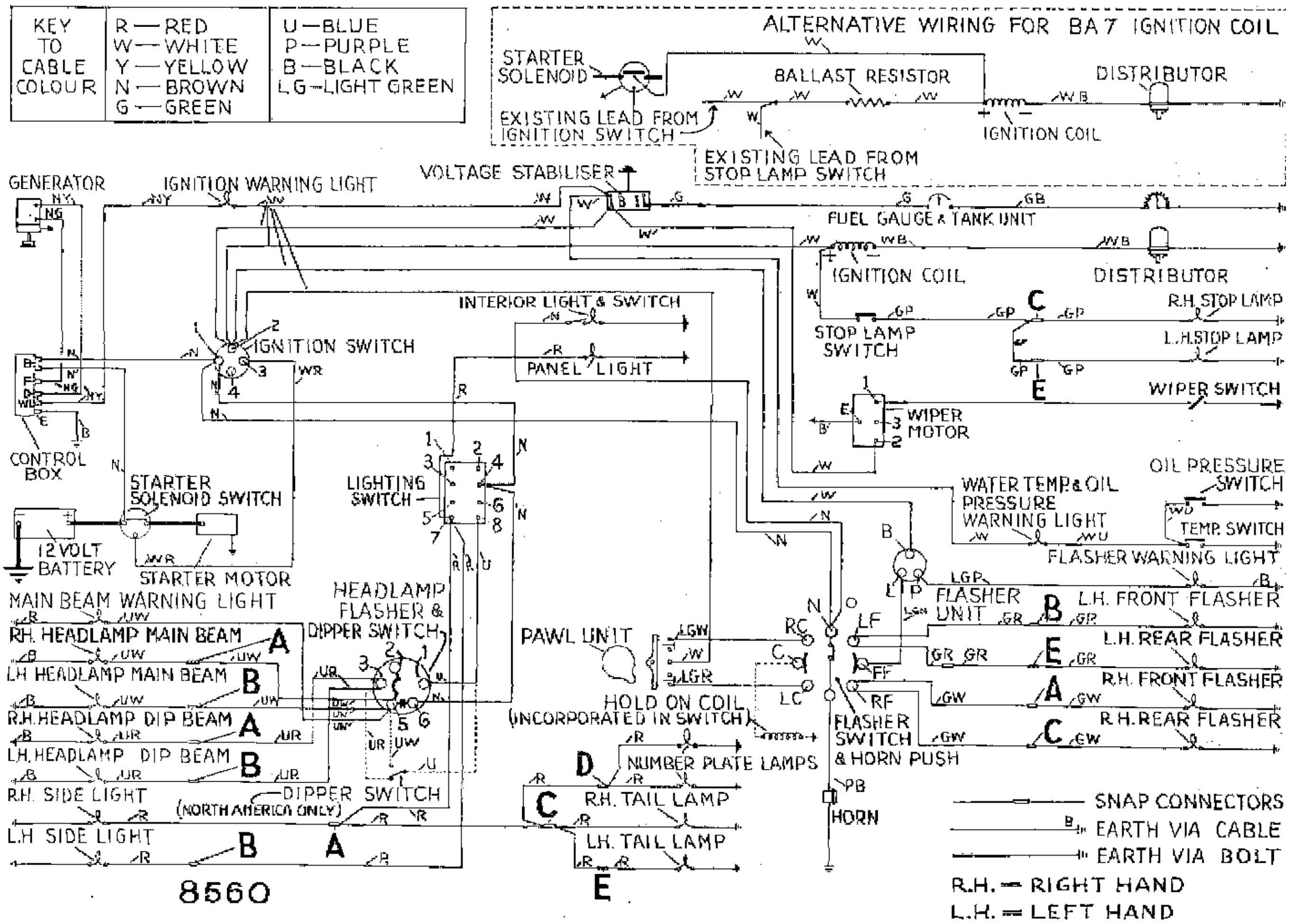
D — In engine compartment at right-hand side.

E — Central in engine compartment lid.

F — In engine compartment at left-hand side.

WIRING DIAGRAM

IMP VAN



SNAP CONNECTOR LOCATIONS

A — On right-hand front wing valance beneath glass-fibre moulding.

B — On left-hand front wing valance beneath glass-fibre moulding.

C — In engine compartment at right-hand side.

D — Central behind rear bumper.

E — In engine compartment at left-hand side.

COMBINED HEADLAMP FLASHER AND DIPPER SWITCH IS REPLACED BY A SINGLE DIPPER SWITCH FOR NORTH AMERICA EXPORT WITH CABLES UR AND UW JOINED BY AN IN-LINE CONNECTOR. CONNECTIONS TO TERMINALS 3 AND 5 ON THE HEADLAMP FLASH-AND-DIP SWITCH ARE REVERSED FOR ALL LEFT-HAND-DRIVE EXPORT EXCEPT NORTH AMERICA SPECIFICATION. AND FOOT DIP-LEAD FROM LIGHTING SWITCH TERMINAL 4 TO HEADLAMP FLASH SWITCH DELETED.

BODY

SECTION O

CONTENTS

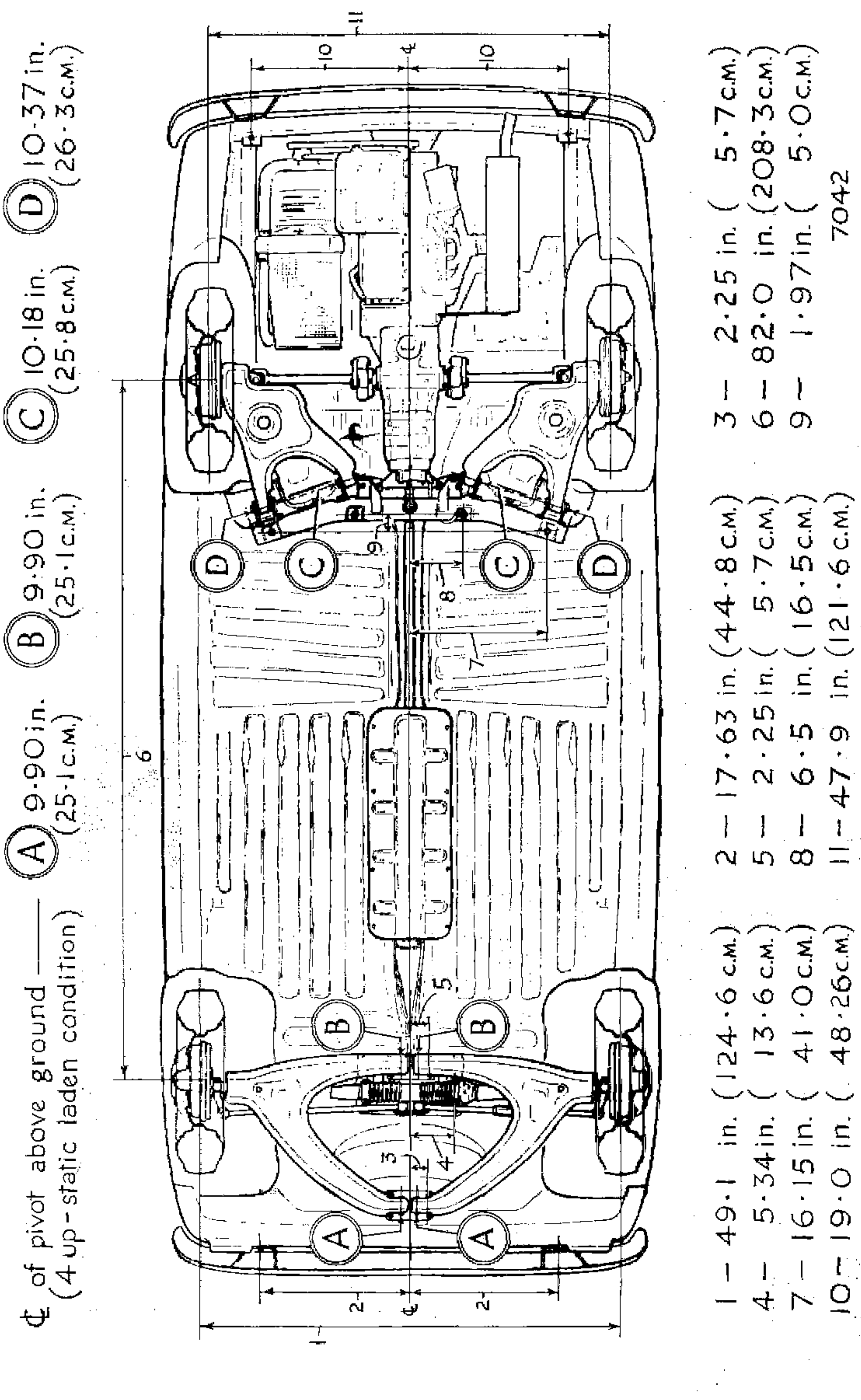


Fig. 1. *Principal underframe dimensions*

BODY

WINDSCREEN

The services of two operators are required to carry out the removal and refitting procedure of the windscreen, one working inside the car and one from the outside. The windscreen is retained in position by means of a rubber weatherstrip around the periphery. No other form of fixing is used, but the contacting surfaces are treated with "Seelastik" sealing compound during assembly.

"Seelastik" is obtainable from Expandite Ltd., Chase Road, London, N.W.10, England.

To remove

Disconnect the battery and remove the wiper arms, interior lamp, and rear view mirror. The "Seelastik" seal formed during original assembly of the weatherstrip to the body must be broken. The use of a small screw-driver from which all sharp edges have been removed, or suitable wedge-shaped pieces of hardwood are recommended. Care should be taken when using either method to keep the tip of the implement under the lip of the weatherstrip, otherwise damage to paintwork or interior trim may well result.

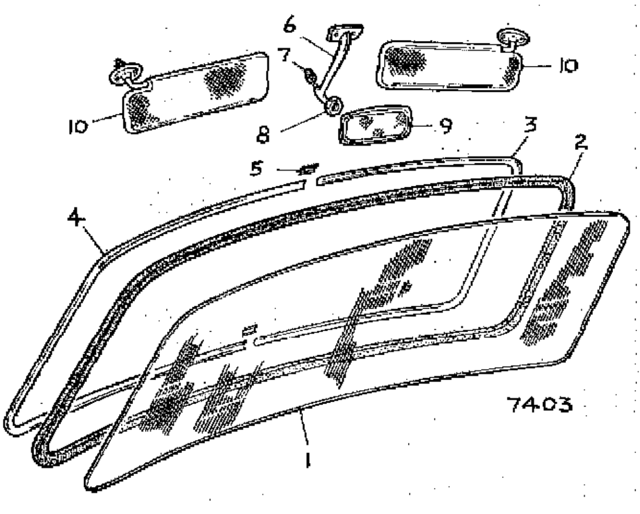


Fig. 2. *Windscreen components*

1. GLASS	6. STEM
2. WEATHERSTRIP	7. BUFFER
3. MOULDING R/H	8. NUT
4. MOULDING L/H	9. MIRROR
5. CLIP	10. SUN VISOR

Apply hand pressure to one of the lower corners and force the windscreen outwards. The second operator (outside the car) can then support the glass as it is released.

With the windscreen assembly on a felt-covered bench (to avoid scratching the glass), remove the beading (3 and 4 of Fig. 2) by releasing the cover plates (5 of Fig. 2), then freeing the beading from the retaining lips in the weatherstrip.

Remove the weatherstrip from the windscreen.

To refit (Fig. 4)

Remove all traces of old sealing compound from the windscreen and the weatherstrip.

Assemble the weatherstrip to the windscreen, ensuring that it is square at the corners and flush to the glass throughout its entire length.

The windscreen must be completely clean before applying "Seelastik", otherwise an effective seal will not be obtained.

Apply a ribbon of "Seelastik" to the outer faces of the weatherstrip which are in contact with the windscreen.

For this operation a special gun is obtainable from Expandite, Ltd., who also supply full instructions for using the gun. In the absence of such a gun, an adaptor in the form of a piece of piping with a flattened end could be fitted to a lubrication gun which has a screw type plunger.

Place either of the beadings on the weatherstrip and, commencing at one end, insert the beading into the weatherstrip. Fit the remaining beading in a similar manner. Fit the cover plates to the beading by simply snapping them into position.

Cut a piece of strong cord of a length considerably greater than the periphery of the windscreen. The use of thin string should be avoided as this will cut the rubber

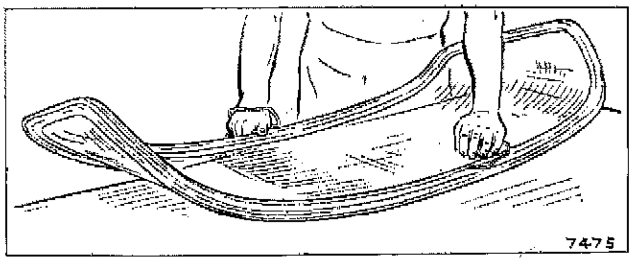


Fig. 3. *Inserting cord into weatherstrip*

Insert the cord into the inner channel of the rubber (Fig. 3) with the aid of a piece of small diameter pipe through which the cord passes, so that the loose ends are near to the centre lower edge. Ensure that the flange of the aperture in the body is clean and free from grease. Apply a coating of "Seelastik" to the outer channel of the weatherstrip which will be in contact with the flange of the aperture of the body. Carefully align the windscreen assembly to the body aperture, and after passing the ends of the cord into the interior of the car, press the assembly into the aperture in the body from the exterior of the car. Starting at the bottom, work the lip of the weatherstrip over the aperture flange by pulling the ends of the cord. Pull out this cord completely.

Excessive pressure should not be used when fitting laminated screens.

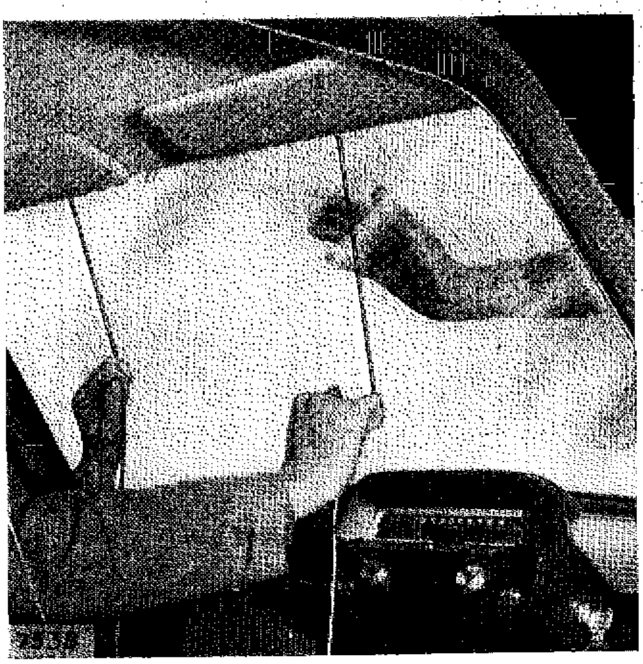


Fig. 4. *Windscreen fitting*

Remove excess sealing compound with a rag slightly dampened with petrol or white spirit.

Refit rear mirror, interior lamp, and the wiper arms. Reconnect the battery.

BACKLIGHT (REAR SCREEN) (Fig. 5)

To remove

Support the backlight with a suitable sling in the fully open position.

The backlight stay lower end supports (backlight aperture) should be marked for correct re-assembly before removing the two retaining screws (1) from each side. If the stay supports are not marked, and are turned inadvertently before re-assembly, the centre hinge point of the stays will foul the backlight when in the closed position.

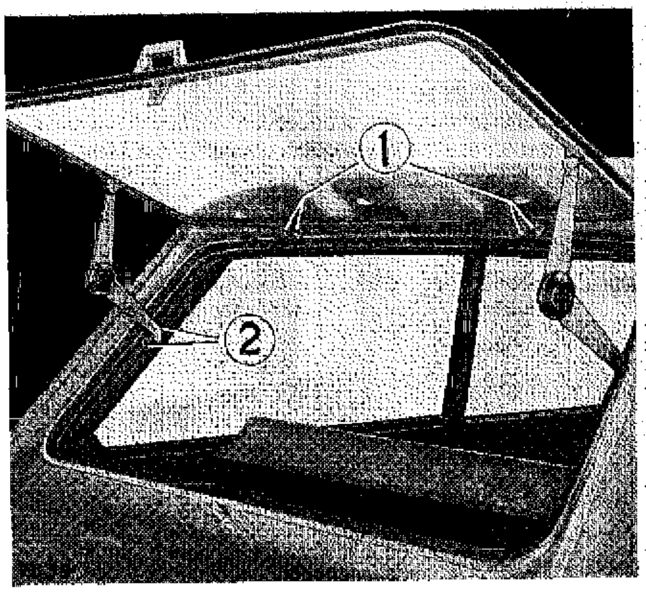


Fig. 5. *Backlight removal procedure*

Remove the two setscrews (2) with their washers from each backlight hinge.

With backlight assembly on a felt-covered bench (to avoid scratching the glass), pull off the weatherstrip from the lower side edges to gain access to the screws securing the lower, to the upper portion, of the backlight aperture panel, and remove the two screws from each side.

Using a wooden block, tap off the lower portion of the panel and pull out the glass.

To refit

Refitting is a reversal of the removal procedure, except that when refitting the glass into the backlight aperture panel, it will be of assistance to use a silicone based grease on the rubber glazing strip for ease of assembly.

INTERIOR DOOR HANDLES

To remove (Fig. 12)

Turn the escutcheon (30 or 35) so that the radial groove in its face is parallel with the dowel hole in the handle (31 or 33). This will expose the retaining pin (29 or 34).

With an awl, tap out the retaining pin securing the handle to its spindle.

Remove the handle and its escutcheon from the spindle.

To refit

Slide the escutcheon on to its spindle. Slip the handle on to its spindle, matching its position with the handle on the opposite door. Insert the pin into the hole in the spindle, force it home, and allow the escutcheon to return over the handle shank.

DOOR TRIM PAD

To remove

Remove interior door handles.

Remove the screws which retain the door pockets to the inner door panel (fitted to de-luxe models only).

Remove the screws which retain the trim pad at its lower edges and pull off the pad with an upward (to clear the window regulator and door lock remote control handle spindles) and downward movement, from its retaining tongue at the door waist.

To refit

When refitting, enter the top edge of the trim pad into its retaining tongue at the door waist before attempting to relocate the remainder of the pad.

DOOR WINDING WINDOW

To remove (Fig. 6)

Remove interior handles and trim pad.

Withdraw screws (6) and remove bottom stop bracket.

Remove both the inner and outer waist seals from the lower edge of the window aperture.

Remove the window regulator (see page 8) and free the operating arm from its location in the glass channel (camplate). Lower the window to the bottom of the door.

With the window in the bottom of the door, gently ease the front glass run channel away from the window.

Turn the window inside the door so that its lower edge (with camplate attached) is towards the lock shut edge of the door. Pull the window up, and out of the door through its own operating aperture.

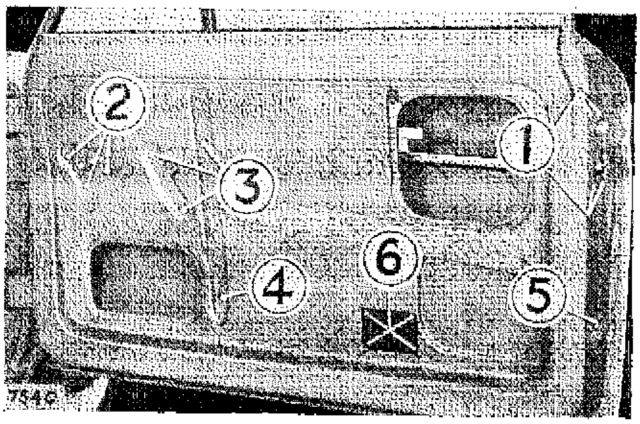


Fig. 6. *General view of door with trim pad removed*

To refit

Re-assembly is a reversal of these instructions except that, the inner and outer waist seals should be fitted after the window has been replaced in the door and turned to its correct position, but before the window regulator arm is fitted in its location.

It is pointed out that the use of a flat piece of sheet metal about $\frac{1}{16}$ in. (1·5 mm) x $\frac{1}{2}$ in. (12·7 mm) x 4 in. (10 cm) turned up at one end to form a hook, will greatly facilitate the replacement of the small clips which retain both the inner and outer waist seals at the lower edge of the window aperture.

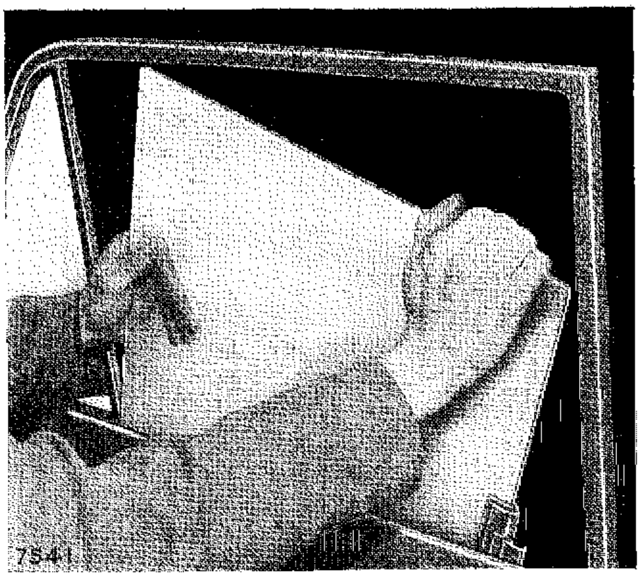


Fig. 7. *Removing or refitting door winding window*

DRAUGHTLESS VENTILATOR (De-luxe models)

The ventilator can only be removed when in the open position, otherwise its retaining stop will be across the operating aperture of the ventilator, thus preventing its removal.

To remove (Fig. 6)

Remove the door winding window.

The ventilator is now held by two screws located at the upper forward and the lower forward edge. Access to both screws is from the leading edge of the door frame.

After the removal of the retaining screws, grasp the ventilator by the rear top edge and pull towards the window aperture, freeing the lower swivel bracket at the same time.

To refit

Reverse the above instructions.

FIXED LIGHT GLASS (Standard models)

To remove

The removal procedure is almost identical to that for the "Draughtless ventilator" except that there are no screws retaining the light to the door. It is held simply by its glazing rubber and the winding window front glass run channel.

It is recommended that the front glass run channel is removed with the ventilator assembly.

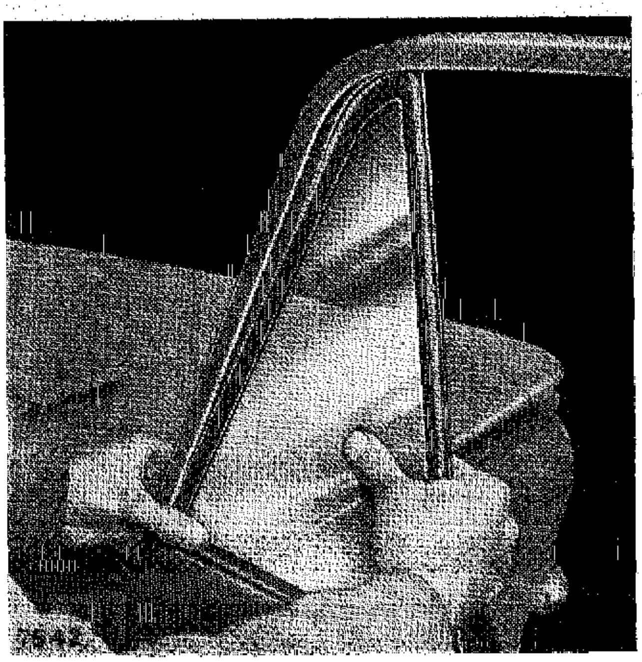


Fig. 8. *Refitting fixed light glass*

REAR QUARTER GLASS

As with the windscreen, the services of two operators are required, one working inside the car and one from the outside of the car. The quarter glasses are retained by means of rubber weatherstrips around their periphery.

To remove

Commencing at the top edge of the glass and working from inside the car, lever the lip of the weatherstrip over the flange of the body, at the same time hand pressure must be applied to the glass.

The use of a small screwdriver from which all sharp edges have been removed, or suitable wedge-shaped pieces of hardwood are recommended as levers. Care should be taken when using either method to keep the tip of the implement under the lip of the weatherstrip, otherwise damage to paintwork or interior trim, may well result.

Remove the weatherstrip from the quarter glass.

Fig. 9. *Fitting rear quarter glass*

To refit (Fig. 9)

Remove all traces of old sealing compound from the quarter glass and weatherstrip.

Apply a ribbon of "Seelastik" to the outer faces of the weatherstrip which are in contact with the glass.

Assemble the weatherstrip to the glass ensuring that it is square at the corners and flush to the glass throughout its entire length.

Cut a piece of strong cord of a length considerably greater than the periphery of the quarter glass. Insert this cord into the inner channel of the rubber (Fig. 3) so that the loose ends are near to the centre lower edge.

Ensure that the flange of the aperture in the body is clean and free from grease. Apply a coating of "Seelastik" to the outer channel of the weatherstrip which will be in contact with the flange of the aperture in the body.

Press the assembly into the aperture from outside the body, after passing the loose ends of the cord into the interior of the car.

Starting at the bottom, work the lip of the weatherstrip over the aperture flange by pulling the ends of the cord. Pull out this cord completely.

Remove excess sealing compound with a rag slightly dampened with petrol or white spirit.

WINDOW REGULATOR

To remove (Fig. 10)

Remove interior handles and trim pad.

Temporarily, replace the winding window handle and lower the window to approximately the halfway position, and support with a block of wood.

Remove the screws (1) securing the regulator to the inner door panel. (See also item 3 of Fig. 6.)

Slide the operating arm from its location in the bottom channel (camplate) and remove the regulator from the door.

To refit

Reverse these instructions when refitting.

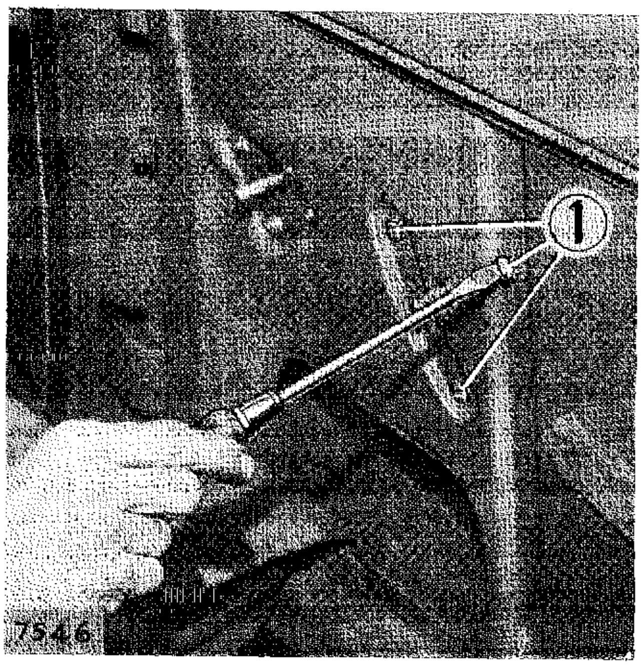


Fig. 10. *Window regulator removal*

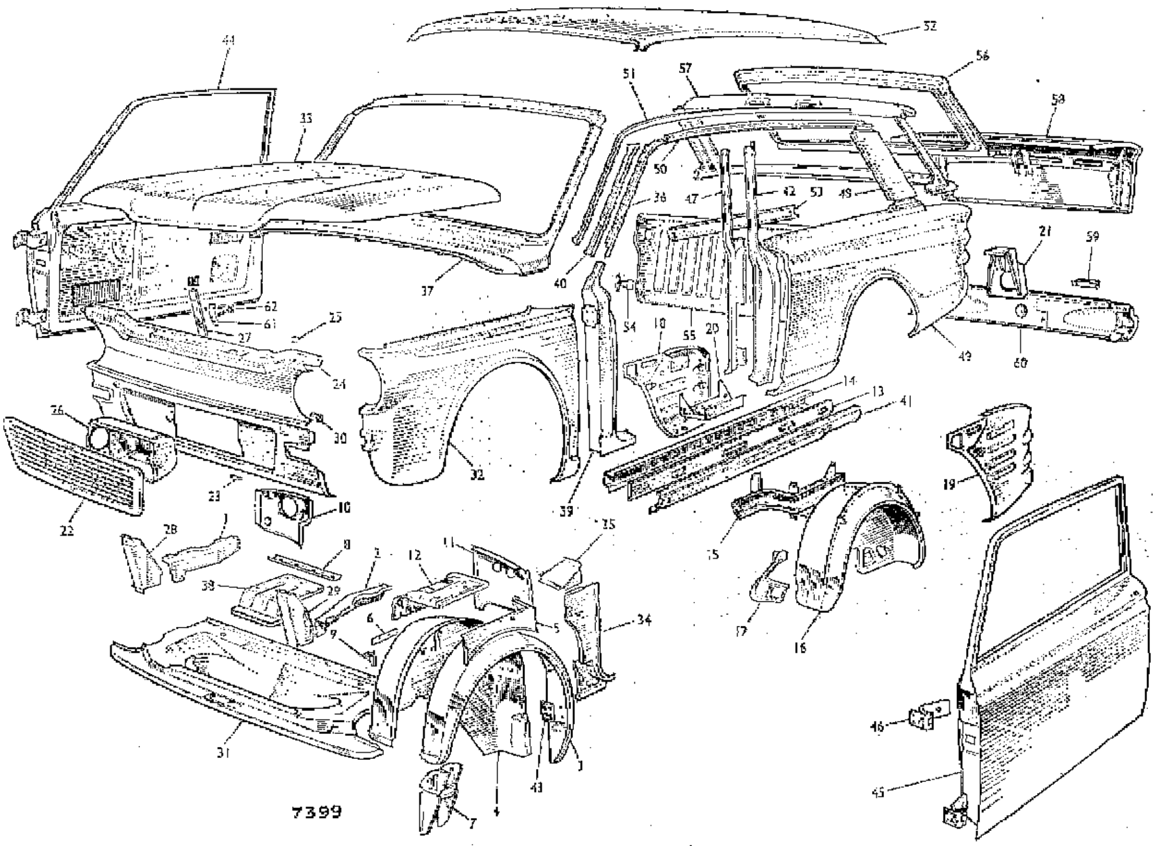


Fig. 11. *Body shell and panels*

1. FRONT LONGITUDINAL MEMBER R/H
2. FRONT LONGITUDINAL MEMBER L/H
3. FRONT WHEELARCH OUTER PANEL
4. FRONT WHEELARCH INNER PANEL
5. FRONT CLOSING PANEL
6. REINFORCEMENT PLATE
7. FRONT SPRING REINFORCEMENT PANEL
8. REINFORCEMENT CHANNEL
9. FUEL TANK SUPPORT BRACKET
10. DASH OUTER PANEL R/H
11. DASH OUTER PANEL L/H
12. DOUBLING PANEL
13. SILL DUCTING PANEL
14. SILL INNER PANEL
15. REAR LONGITUDINAL MEMBER
16. REAR WHEELARCH
17. REINFORCEMENT PANEL
18. ENGINE COMPARTMENT SIDE PANEL R/H
19. ENGINE COMPARTMENT SIDE PANEL L/H
20. BATTERY CRADLE
21. ENGINE MOUNTING BRACKET
22. GRILLE PANEL
23. RETAINING BRACKET
24. GRILLE SURROUND PANEL
25. BONNET STAY BRACKET
26. AIR INTAKE BOX
27. BRACE
28. FRONT BUMPER BRACKET R/H
29. FRONT BUMPER BRACKET L/H
30. HEADLAMP PIVOT BRACKET
31. SPARE WHEEL FLOOR PANEL
32. FRONT WING PANEL
33. BONNET PANEL
34. DASH SIDE PANEL
35. CLOSING PANEL
36. "A" POST UPPER PANEL
37. WINDSCREEN APERTURE PANEL
38. COVERPLATE
39. "A" POST LOWER PANEL
40. "A" POST FINISHER PANEL
41. SILL OUTER PANEL
42. "B" POST PANEL
43. ATTACHMENT PLATE
44. DOOR R/H
45. DOOR L/H
46. DOOR HINGE
47. "B" POST FINISHER PANEL
48. UPPER REAR QUARTER PANEL
49. LOWER REAR QUARTER PANEL
50. CANTRAIL PANEL
51. DRIP MOULDING PANEL
52. ROOF PANEL
53. QUARTERLIGHT FINISHER
54. PIVOT BRACKET (REAR SQUAB)
55. REAR SQUAB PANEL
56. BACKLIGHT APERTURE PANEL
57. BACKLIGHT APERTURE FINISHER PANEL
58. ENGINE COMPARTMENT LID
59. ENGINE COMPARTMENT LID LOCK BRACKET
60. REAR LOWER PANEL
61. CLAMP PLATE } SPARE WHEEL
62. SCREW }

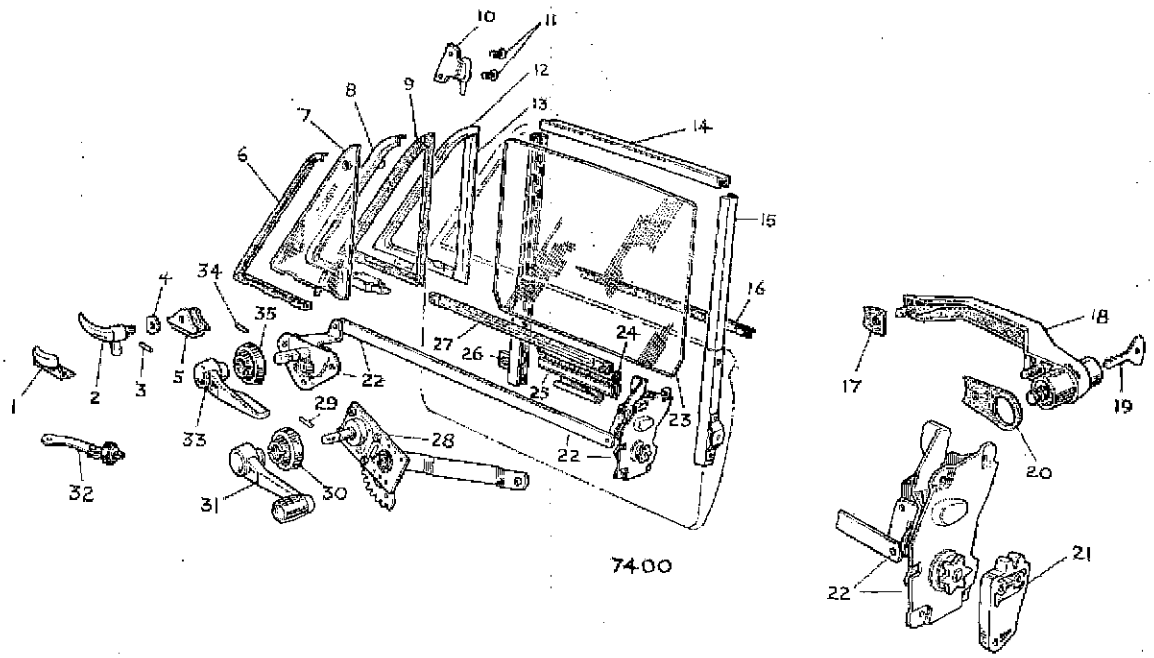


Fig. 12. *Door glasses and mechanism*

1. CATCH STRIKER
2. LOCKING HANDLE
3. PIN
4. WAVY WASHER
5. LOCKING HANDLE BRACKET
6. GLAZING RUBBER
7. VENTILATOR GLASS
8. INNER FRAME
9. WEATHERSTRIP
10. TOP PIVOT
11. SCREW
12. OUTER FRAME
13. CENTRE CHANNEL
14. GLASS RUN CHANNEL (TOP)
15. GLASS RUN CHANNEL (REAR)
16. WAIST OUTER SEAL
17. FRONT SEATING WASHER
18. EXTERIOR HANDLE
19. KEY
20. REAR SEATING WASHER
21. STRIKER
22. DOOR LOCK AND REMOTE CONTROL ASSEMBLY
23. GLASS
24. GLAZING RUBBER
25. GLASS CHANNEL AND CAMPLATE
26. GLASS RUN CHANNEL (FRONT)
27. WAIST INNER SEAL
28. WINDOW REGULATOR
29. PIN } WINDOW REGULATOR
30. ESCUTCHEON } WINDOW REGULATOR
31. HANDLE } WINDOW REGULATOR
32. CHECK LINK
33. HANDLE } REMOTE CONTROL
34. PIN } REMOTE CONTROL
35. ESCUTCHEON } REMOTE CONTROL

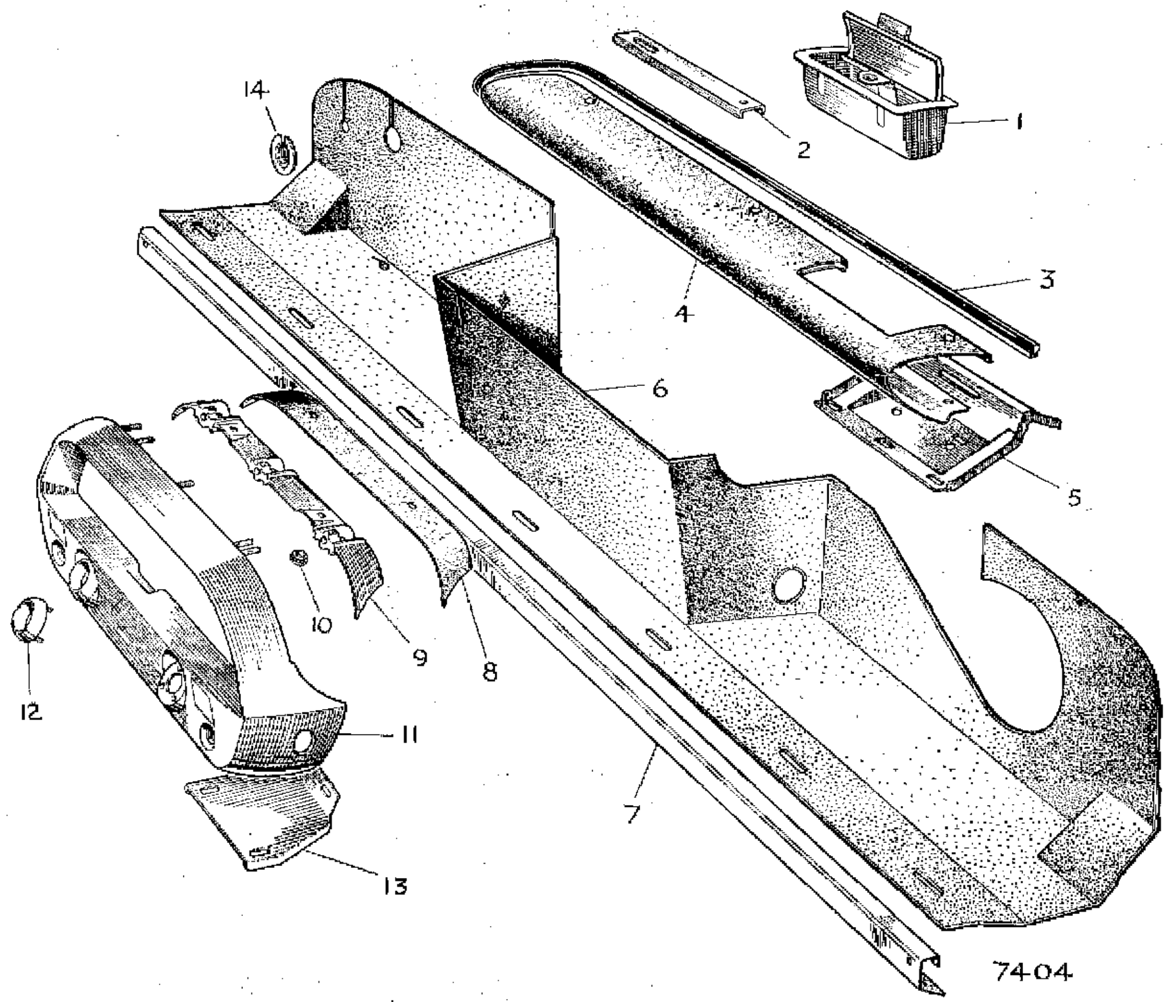


Fig. 13. *Facia components*

1. ASHTRAY
2. STAY
3. FINISHER
4. FILLER PANEL
5. BRACKET
6. PARCEL TRAY
7. PARCEL TRAY RAIL
8. BACK COVER
9. REAR EXTENSION
10. FIXING BUSH
11. INSTRUMENT BINNACLE
12. BEZEL
13. STAY
14. WASHER

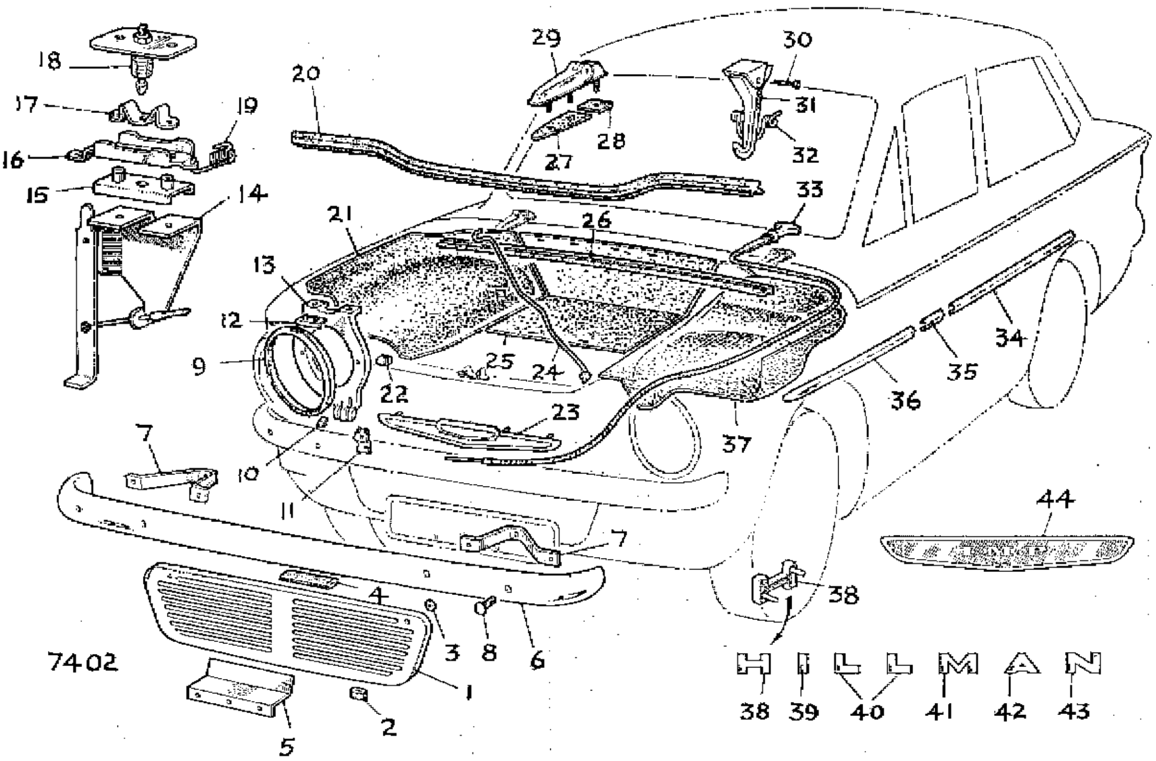


Fig. 14. *Front end fittings*

1. GRILLE PANEL
2. COVER
3. WASHER
4. INSTALLATION STRIP
5. NUMBER PLATE HANGER
6. BUMPER BLADE
7. BACK BAR
8. BOLT
9. SEAL
10. WASHER
11. CLIP
12. STOP BRACKET
13. YOKE
14. BRACKET
15. SUPPORT SLIDER
16. CATCH SLIDER
17. STRIKER PLATE
18. STRIKER
19. SPRING
20. BONNET FRONT SEAL
21. WHEELARCH COVER R/H
22. RETAINER
23. NAME BADGE SURROUND
24. BONNET STAY
25. LINING PANEL
26. BONNET REAR SEAL
27. SEATING WASHER (FRONT)
28. SEATING WASHER (REAR)
29. HINGE
30. CLEVIS PIN
31. SAFETY HOOK
32. SPRING
33. CONTROL CABLE
34. DOOR MOULDING
35. SCUTTLE MOULDING
36. BONNET MOULDING
37. WHEELARCH COVER L/H
38. "H"
39. "I"
40. "L"
41. "M"
42. "A"
43. "N"

38.–43. NAME LETTERS

44. NAME BADGE CENTRE

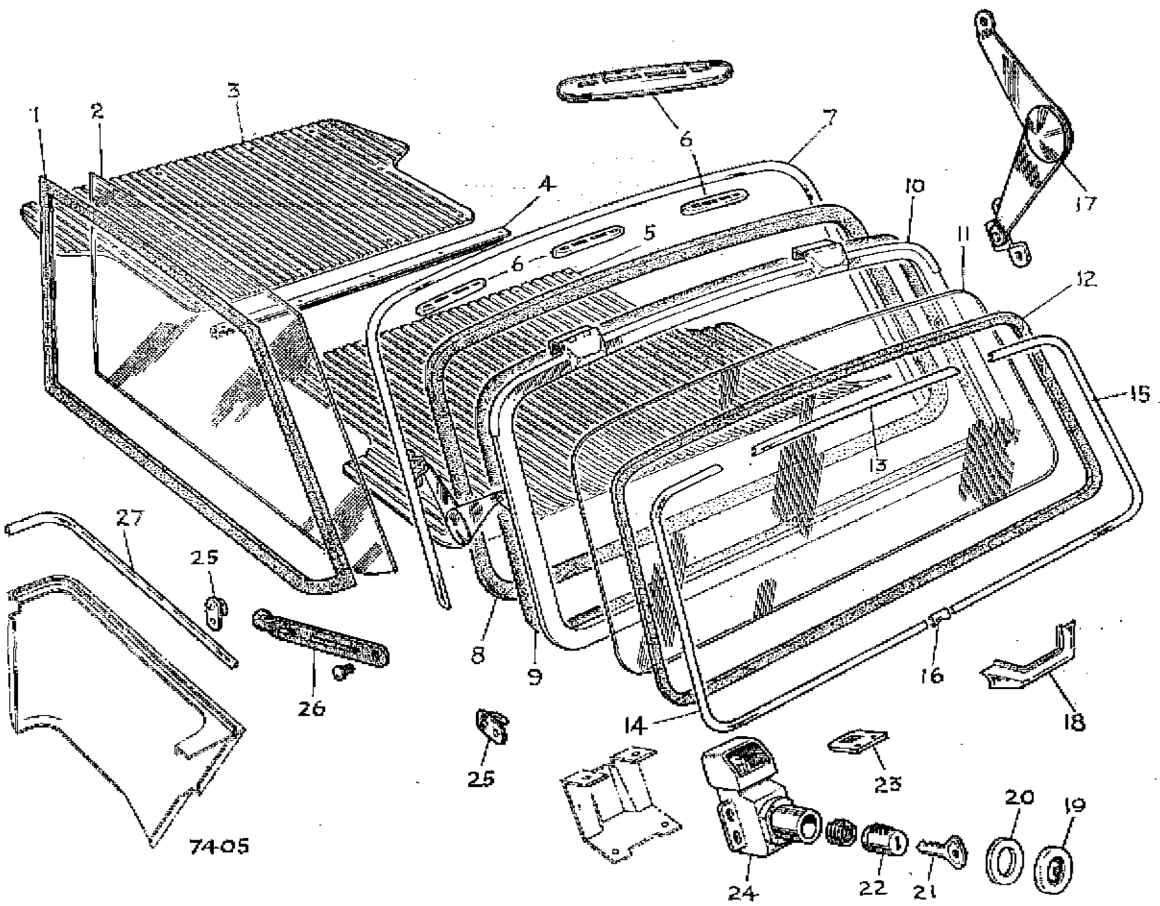


Fig. 15. *Rear end fittings*

1. WEATHERSTRIP
2. GLASS
3. SQUAB PANEL MAT
4. FINISHING STRIP
5. REAR LUGGAGE FLOOR MAT
6. FINISHER
7. FINISHER
8. WEATHERSTRIP
9. WEATHERSTRIP
10. BACKLIGHT UNIT
11. GLASS
12. GLAZING RUBBER
13. TOP MOULDING
14. SIDE MOULDING L/H
15. SIDE MOULDING R/H
16. COVER PLATE MOULDING
17. STAY
18. HANDLE
19. BEZEL
20. WASHER
21. KEY
22. BARREL
23. STRIKER PLATE
24. BACKLIGHT LOCK
25. HOOK
26. STRAP
27. FINISHER

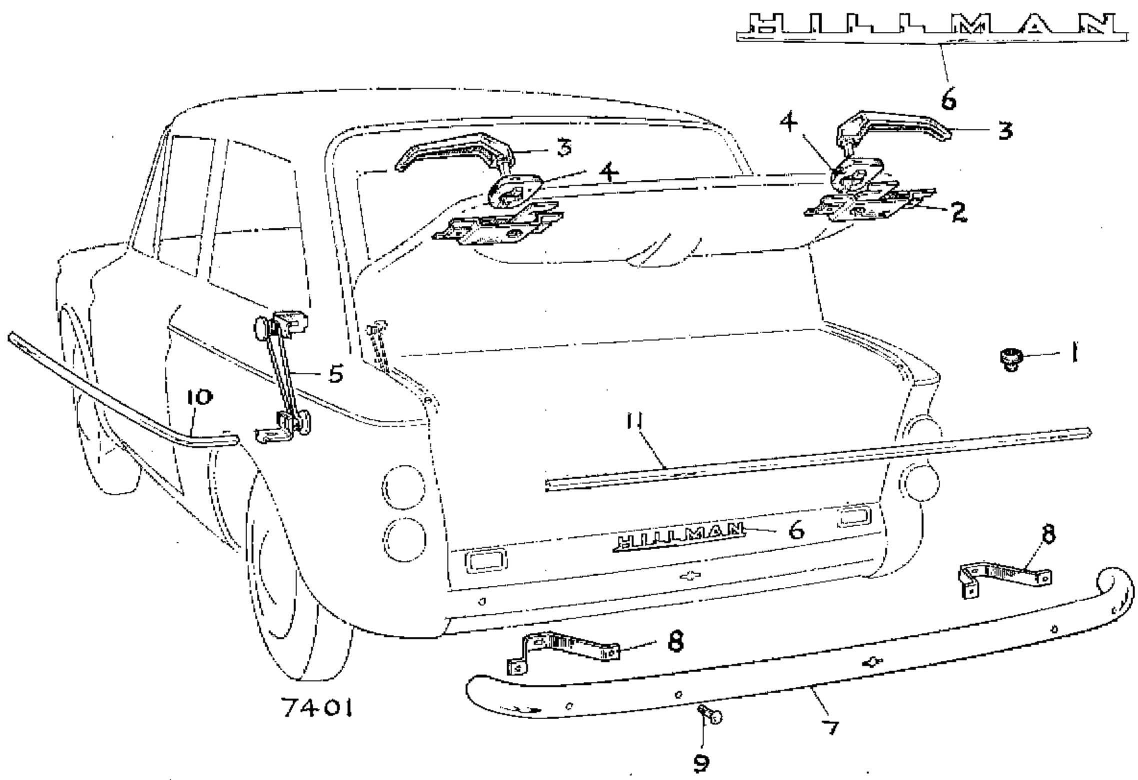


Fig. 16. *Engine compartment lid fittings*

1. BUFFER
2. LOCK ASSEMBLY
3. HANDLE
4. ESCUTCHEON
5. STAY
6. REAR NAME BADGE
7. REAR BUMPER
8. BACK BAR
9. BOLT
10. REAR QUARTER MOULDING
11. ENGINE COMPARTMENT LID MOULDING

FRONT SEAT

To remove

Upon removal of the seat assembly retaining bolts (both front corners of the seats), the assembly is free to be removed from the car.

Refitting is a reversal of these instructions.

FRONT SEAT TRIM

To remove

Remove the seat as an assembly, and turn over so that the underside is uppermost.

Release the clips retaining the trim to both the cushion and the squab, easing the lower corners of the squab trim from their locations, pull the trim from the frame in an upward motion.

Take care when refitting that the trim clips do not tear the trim.

REAR SEAT

To remove

Cushion

Simply lift up the forward edge of the cushion from the front retaining valance, whereupon the cushion can be removed.

Squab

Remove the setscrews which retain the pivots to the wheelarches.

Care must be taken when removing these screws that the trim of the squab is not damaged.

When replacing the squab pivot retaining setscrews, the threads should be treated with "Seelastik" as a precaution against the ingress of water.

PARCEL TRAY

To remove

Remove the steering column (see Section J).

Remove the heater control (if fitted), (see Section R).

Disconnect the speedometer drive cable (see Section N).

Free the bonnet release handle with its grommet from their locations.

Remove the four screws (two at each end) which retain the tray and take out the tray.

FACIA

To remove

Instrument binnacle

Disconnect the battery at the positive (earth) terminal.

Two bolts retain the binnacle to the facia rail; access to these bolts can be gained from beneath the binnacle when it will be seen that the bolts are positioned one at each side of the binnacle frame. A support stay is fixed to the underside of the binnacle frame and attached to the facia support bracket by two bolts.

On removal of the four bolts the binnacle can be withdrawn enough to detach the cables from the instruments and switches.

When detaching cables, make a note of their colour and positions (see wiring diagram in Section N) for reference when re-assembling.

If it is not already incorporated, the modified support stay on the lower edge of the binnacle, must be fitted. This new support stay can be identified by the addition of a gusset on its upper face. It is obtainable through the normal parts channels under Part No. 7200565/6 R.H.D. and L.H.D. respectively.

The new support stay was fitted into current production from B.41 1019406 de-luxe models, and B.42 1000183 basic models.

Before refitting the instrument binnacle, a facia finisher (in the form of a rubber gasket), should be fitted, particularly if rattles are emanating from between the facia rail and the instrument binnacle.

The facia finisher (Part No. 7200537 L/H and 7200538 R/H) must be fitted with its widest leg (the one with the large hole in it) towards the centre line of the car, and with the deeper flange on the edge of the finisher towards the driver.

Use Dunlop adhesive S.758 for attaching the finisher to the facia rail.

Facia filler panel

To remove the filler panel (passenger side of the car), simply prise up the tops of the spire caps at the top forward edge of the panel, and remove the screws thus exposed. On some early models, pegs into rubber-lined sockets are used for the retention of the filler panel. The panel is free to be removed after taking out the ashtray. Some cars may be fitted with screws along the lower forward edge of the filler panel.

Before refitting the facia filler panel, it is recommended that the new facia finisher (described under instrument binnacle) is fitted. The finishing strip (3 of Fig. 13) will have to be discarded.

To refit

Refitting of both the instrument binnacle and the facia filler panel is a reversal of the removal instructions, except that the new spire caps (Part No. 7200461) should be used for the top retaining screws of the facia filler panel where these are used.

FACIA RATTLES

Facia stiffener

If, when the instrument binnacle is grasped between the hands and an attempt is made to rock it in a vertical plane, there is any tendency of movement, the facia stiffener (Part No. 7200721) must be fitted. The fitting of this stiffener is quite simple, but care should be taken that the electrical harness is not damaged when drilling the front hole (some bodies already have a cage-nut fitted) for the retaining screw on the underside of the facia rail. The rear hole for the stiffener is existing in the rear outer edge of the instrument binnacle.

Ignition/starter switch

If it is suspected that rattles are evident between the switch body and the lock barrel, it is recommended that either, one or two washers (depending on type), are fitted against the bottom shoulder of the lock barrel.

Two types of washer are available under Part No's. 7102487 sponge rubber, and 7102434 plastic.

A further point which will assist in the elimination of rattles from this source is the addition of MS.4 silicone based grease to the lock barrel. This grease will also lubricate the wards of the lock.

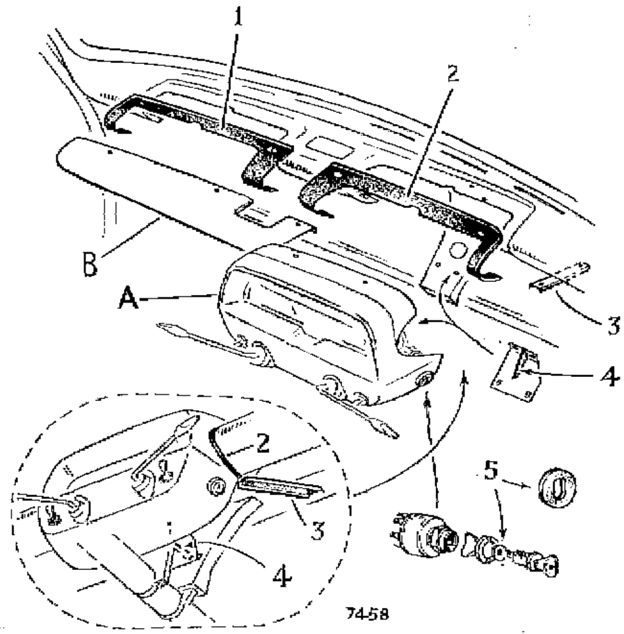


Fig. 17. *Facia rattles rectification*

1. FACIA FINISHER, L/H
2. FACIA FINISHER, R/H
3. FACIA STIFFENER
4. SUPPORT STAY
5. IGNITION/STARTER SWITCH WASHER
A. INSTRUMENT BINNACLE
B. FACIA FILLER PANEL

BODY SEALS

To remove

Door

The combined door seal and furflex piping is retained by small concealed metal tags within the seal itself. When removing, simply pull off.

Bonnet panel

The front bonnet seal is retained by two small clips, similar in shape to trim clips; the rear bonnet seal is retained by lips formed in the rubber itself. When removing either seal, simply pull off.

To refit

When refitting the door seal it may be necessary to tap the furflex piping with a block of wood to ensure that the seal is fully home in its location.

HEADLINING

To remove

Disconnect the battery at the positive (earth) terminal, and remove the interior lamp, rear view mirror, and wiper arms.

Remove the windscreen.

Release the combined door seal and furflex piping from above the door apertures to expose the edges of the headlining.

Remove the rear quarter glasses.

Remove the trim pad from above the backlight (rear screen) aperture by releasing the concealed spring-in clips with a broad-bladed knife (or similar tool). The clips will remain still attached to the pad as the pad is released.

Release the edges of the headlining from the windscreen, rear quarter glasses, and door aperture upper body flanges. All edges are secured to the flanges in production with an adhesive solution.

The lining is now supported by the listing rails only, of which there are four. Remove the front listing rail by springing the ends inwards to release them from the cantrails.

Continue to release the remaining listing rails in a similar manner.

Support the headlining and free its rear end from above the backlight aperture in the following manner.

The rear end of the headlining is stitched to a fibre-board fillet panel. This fillet panel is located in a pre-formed pocket in the rear and underside of the roof panel.

Feel for one end of the lower side edges, insert a 6 in. rule (or a flexible knife blade) under the side edge, and release the panel by drawing the tool along the edge of the roof pocket.

To refit

If the services of two operators are available it will be easier and more expedient than if only one operator is fitting the lining. In order that the lining will conform to the inside shape of the roof, listing rails of different contours are used, the ends of which are coloured to aid identification, and the position of which MUST be observed when removing the lining so as to ensure correct re-assembly.

Clean off all traces of old adhesive from the body aperture flanges.

Before fitting the new lining, apply a suitable adhesive to the apertures and allow it to become nearly dry.

Reverse the removal procedure by starting to refit the lining at the rear end and working towards the front of the vehicle.

Before refitting the fibre-board fillet with the lining attached, the fillet MUST be doubled back on to the right side of the lining, otherwise, as tension is applied to the lining during the fitting procedure, the fillet will simply be pulled out of its location.

Note: If the felt anti-drum material has been removed for any reason, when replacing, it must be fitted as far to the rear as possible, otherwise the fibre-board fillet on the rear end of the headlining, even though doubled back on to itself (see above paragraph), will pull out as there will be excessive clearance between the fillet and the underside of the roof panel.

DOORS

Lubrication

Hinge pins and door locks must be lubricated at regular intervals.

When oiling the door locking mechanism the windows should be fully wound up, and after oiling, the doors should be left open for as long as possible, otherwise, since some oil is bound to be wasted, it may flow out of the drain holes and possibly into the interior of the car.

The wards of the lock should be lubricated by applying a small amount of Shell Silicone Compound to the key which is then inserted into the lock in the normal manner. Operate the lock a few times, withdraw the key, and wipe off the surplus compound.

The push-button of the exterior handles is lubricated from the outside.

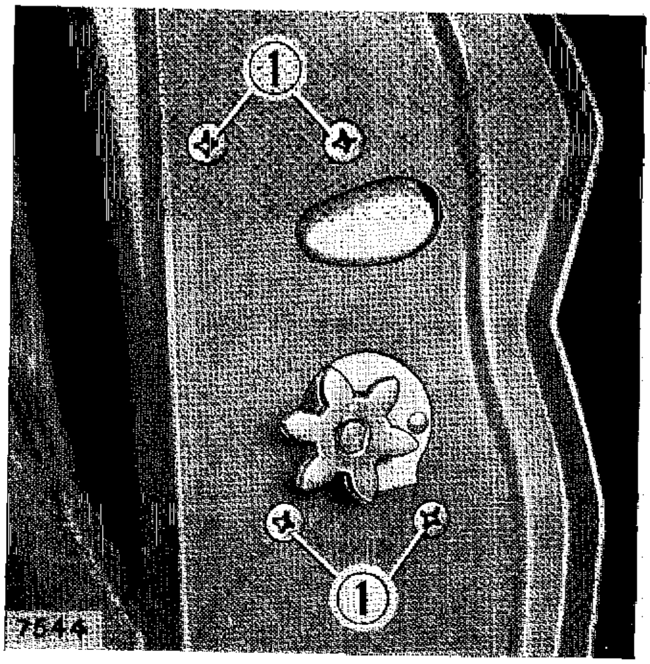


Fig. 18. *Door lock attachment*

DOOR LOCK

To remove (Fig. 18)

Remove interior handles and trim pad.

Remove the lock remote control securing screws with their washers (2 of Fig. 6), and the lock securing set-screws (1).

Take out the combined door lock and remote control through one of the apertures in the inner door panel.

Replacement is a reversal of these instructions.

EXTERIOR DOOR HANDLE

To remove

Remove interior handles and trim pad.

From inside the door casing, remove the nuts and washers which retain the handle to the door. Take care not to misplace the seating washers (17 and 20 of Fig. 12) between the exterior handle and the outer door panel.

To adjust

On the reverse side of the push-button is a plunger held by a locknut.

The correct clearance between the plunger head and the lock contactor should be $\frac{1}{32}$ in. (·79 mm) and must be checked when the handle is attached to the door, through the aperture in the inner door panel.

When adjusting, simply rotate the plunger bolt in or out as required after releasing the locknut, finally tightening the locknut when the desired clearance has been attained.

To refit

Reverse the removal procedure, not forgetting the two seating washers between the exterior handle and the outer door panel.

DOOR STRIKER UNIT

To remove (Fig. 19)

It is not necessary to disturb this component other than to fit a replacement, or to make adjustments.

In this case, remove the three securing screws (1).

To refit

Attach the striker unit to the door pillar. Shut door and then adjust if necessary.

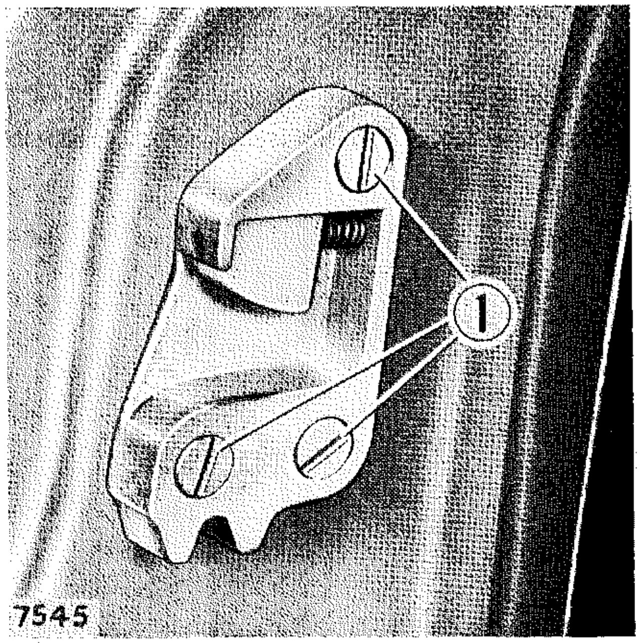


Fig. 19. *Door lock striker unit*

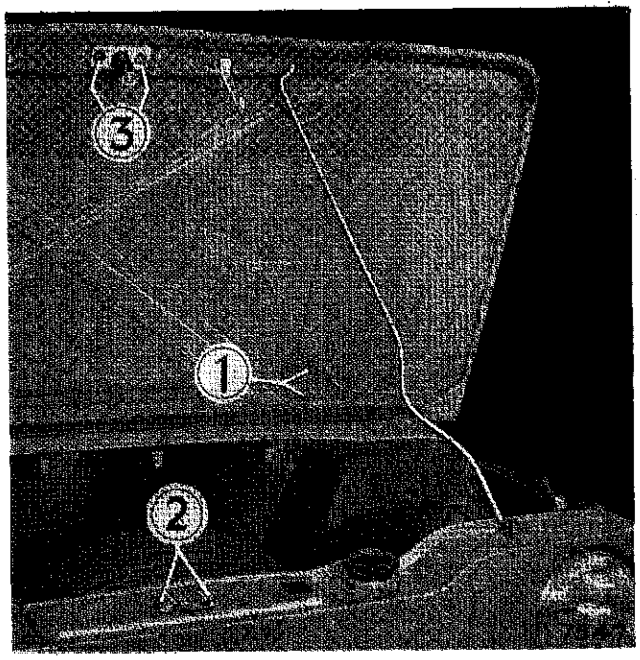


Fig. 20. *Bonnet attachment*

BONNET

To remove (Fig. 20)

Support the bonnet in the open position with a suitable sling. The bonnet prop is not sufficient for this purpose to guarantee that the paintwork will not be damaged.

Remove the two nuts (1) with their respective washers from each rear edge of the bonnet, whereupon the bonnet is free to be removed after disengaging the prop.

Refit by reversing this procedure.

BONNET LOCK

To remove (Fig. 20)

Disconnect the front (lower end) of the control cable where it is retained at the remote control bracket. Take out the two setscrews (2) with their washers which retain the bonnet lock striker plate to the bonnet lock platform.

The bonnet lock striker assembly is retained by two setscrews and washers (3).

When refitting, do not adjust the remote control cable so that it is too tight and constantly under tension.

BONNET OPENING (Fig. 21)

If the bonnet is inadvertently closed while the bonnet release mechanism is disconnected, the bonnet can be opened in the following manner.

Remove the front grille, and from inside the aperture, push out the large grommet (1) from its location.

Operate the remote control bracket (2) to open the bonnet by pulling (or pushing) towards the left hand side.

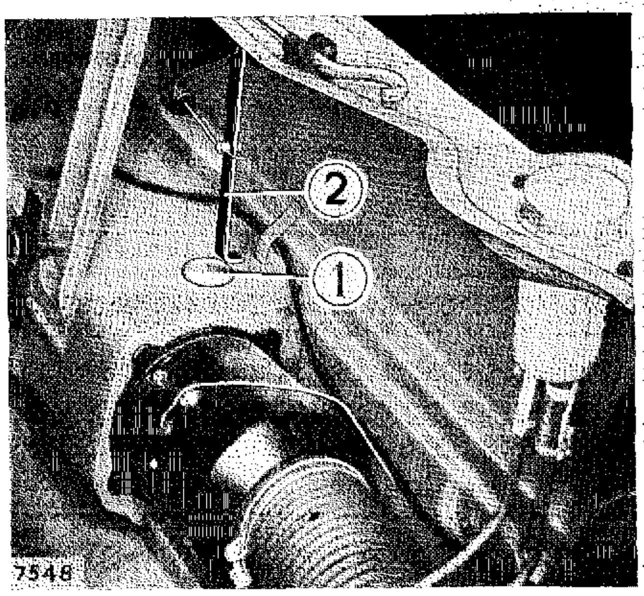


Fig. 21. *Bonnet opening*

ENGINE COMPARTMENT LID

To remove (Fig. 22)

Open the lid to its fullest extent, and remove the two nuts (1) with their washers from each hinge.

The lid is now supported against the backlight; take care when removing that the paintwork, or the backlight, is not damaged.

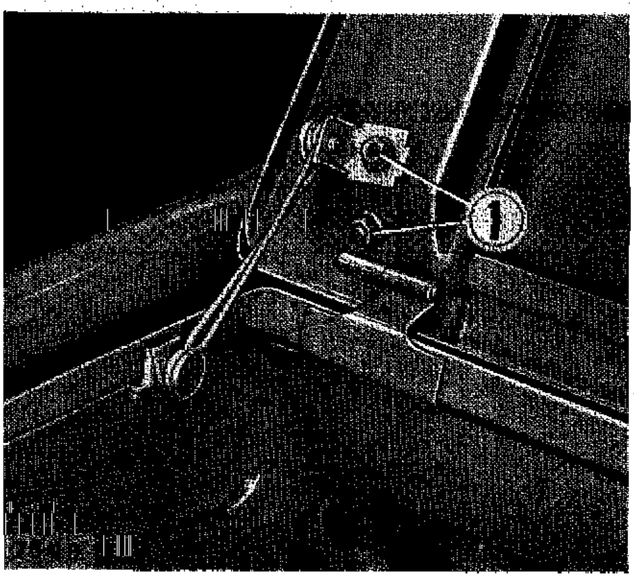


Fig. 22. *Engine compartment lid attachment*

ENGINE COMPARTMENT LID LOCKS

To remove (Fig. 23)

Remove the locknut and nut (1) retaining the exterior handle to the lock assembly. It will be found that some exterior handles are only retained by one nut.

Remove the screws with their shakeproof washers (2) retaining the lock assembly to the lid reinforcement panel.

Reverse these instructions when refitting.

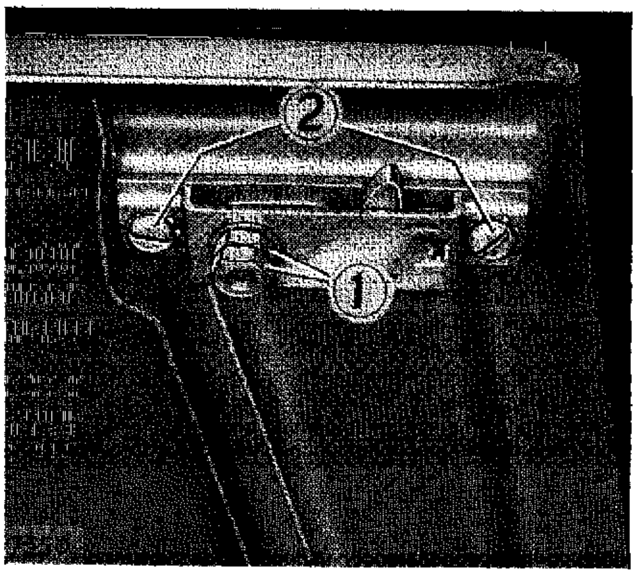


Fig. 23. *Engine compartment lid locks*

BACKLIGHT (REAR SCREEN) LOCK

To remove (Fig. 15)

Remove bezel (19), with its sealing washer (20), by lifting and straightening the tags from the underside.

From the interior face of the backlight, remove the four screws with their shakefroof washers which retain the lock assembly (24) to the body.

Reverse the above procedure when refitting.

FRONT GRILLE

To remove

Two screws only at the top side edges retain the grille in its location.

Remove the screws, allow the grille to fall forward from its top edge, then, lift the grille up and out of its retaining brackets in the grille surround panel.

Reverse these instructions when refitting.

FRONT AND REAR BUMPERS

The bumpers can either be removed complete with their mounting brackets, or without.

To remove

Front (Fig. 14)

The bumper (6) can be removed complete with its back bars (7), or without.

If the first method is adopted, remove the setscrew with its spring and plain washers from each back bar attachment point to the body.

In the latter method, remove the two bolts, spring and plain washers, and nuts from each back bar attachment to the bumper.

Rear (Fig. 16)

The rear bumper is removed in an identical manner to the front bumper.

Reference should of course be made to the correct illustration for the item numbers.

REAR LOWER CROSSMEMBER

To remove

Remove the rear bumper.

Before attempting to remove the crossmember, the engine MUST be supported as detailed in Section B.

From inside the wheel valances adjacent to the rear lamps, remove the four setscrews (two each side) with their washers, and the two nuts adjacent to the lock catches (one at each side) with their washers, and release the crossmember.

Reverse the above procedure when refitting.

NAME BADGES

To remove

Simply pull off the badges or name letters from their front faces.

To refit

When replacing any of the name badges, or letters, simply push home from their front faces. Renew any of the retaining clips where necessary.

BODY MOULDINGS

To remove

Bonnet sides

The side mouldings are retained by clips along their entire length, but with the addition of a pop-rivet (which must be drilled out) at the end.

Ease up the lower flange of the moulding from its clips with a piece of wood sharpened at one end (or a small screwdriver) and pull the moulding away from the body.

Doors

The door mouldings are retained in an identical fashion as the bonnet side mouldings.

Rear quarter mouldings

These mouldings are retained in a similar fashion to the items detailed above, except that, no pop-rivets are used; special fasteners which are simply pulled off from their reverse sides are used in their stead.

Engine compartment lid moulding

This moulding is retained by clips along its entire length, no other form of fixing being used.

Ease up the lower flange of the moulding in a similar manner to that detailed under "Bonnet Sides", and pull the moulding away from the panel.

To refit

When refitting any of the body mouldings, reverse all the foregoing instructions, fitting new pop-rivets where necessary.

Where plastic clips have been used, these MUST be replaced with new items.

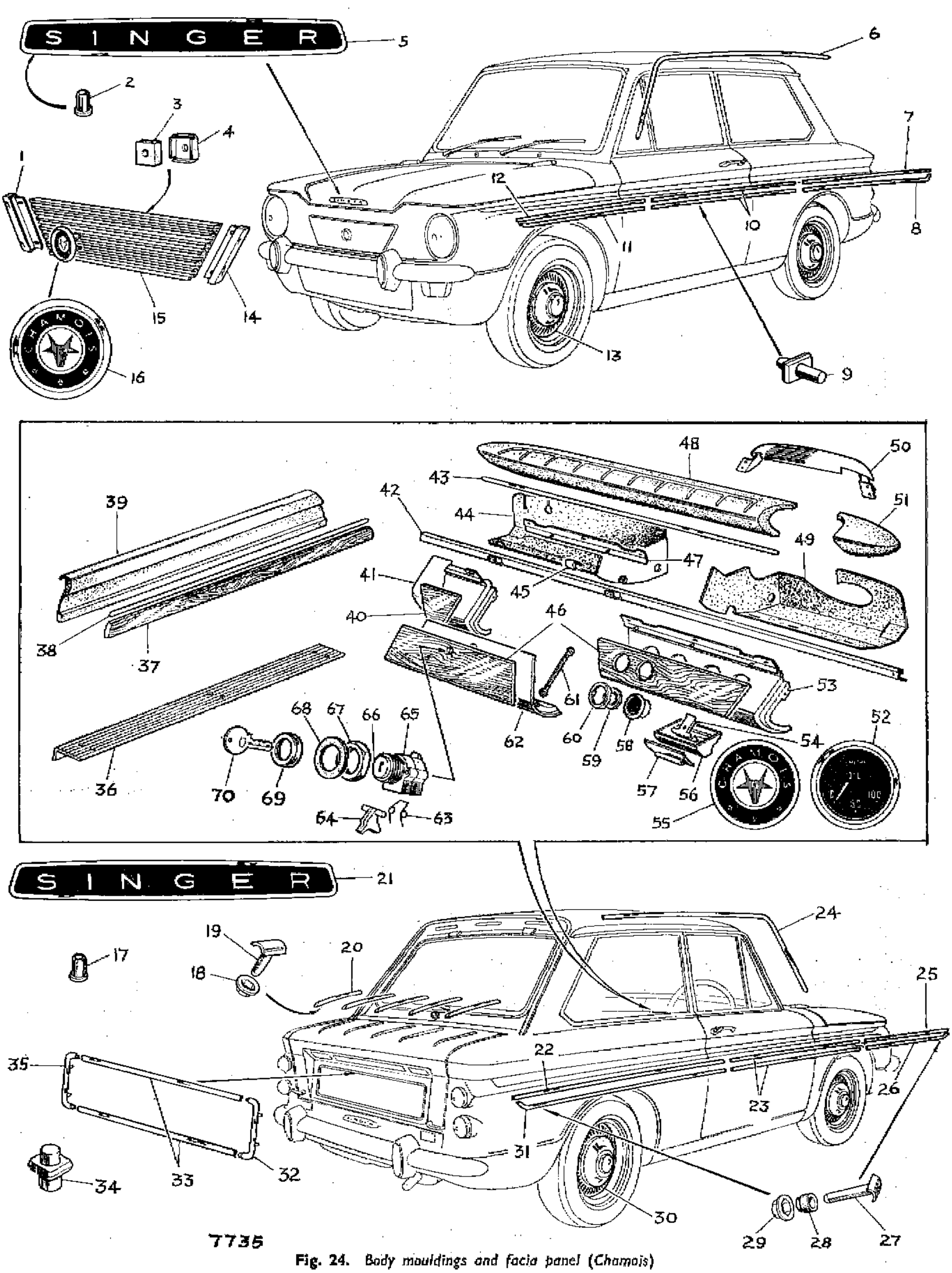


Fig. 24. *Body mouldings and facia panel (Chamois)*

CHAMOIS

Front grille

15	GRILLE PANEL
1 & 14	END CAPPINGS
16	NAME BADGE (CHAMOIS)
3	RUBBER SEAL
4	FIXING BRACKET AND NUT

Exterior fittings

5	BONNET NAME BADGE	
2	FRICTION BUSH-BADGE TO BONNET	
6 & 24	DRIP MOULDING FINISHERS	
7 & 22	MOULDING—UPPER	REAR QUARTER
8 & 31	MOULDING—LOWER	REAR QUARTER
9	CLIP—MOULDING TO DOORS	
10 & 23	DOOR MOULDINGS	
11 & 26	MOULDING—LOWER	FRONT WING
12 & 25	MOULDING—UPPER	FRONT WING
27	STUD	MOULDINGS TO WINGS
28	SEALING BUSH	MOULDINGS TO WINGS
29	THREAD CUTTING FASTENER	MOULDINGS TO WINGS
13	RIMFINISHERS	

Engine compartment lid

18	THREAD CUTTING FASTENER
19	STUD
20	RUBBING RAILS
17	FRICTION BUSH
21	REAR NAME BADGE
32, 33 & 35	MOULDINGS—NO. PLATE SURROUND
34	RETAINER—SURROUND MOULDING TO LID

Facia

40	WOOD CAPPING
41	FACIA END PANEL
42	PARCEL TRAY RAIL
43	FACIA MOULDING
44	PARCEL TRAY N/S
45	STRIKER—GLOVE BOX LOCK
46	WOOD CAPPING SET—CENTRE PANEL AND GLOVE BOX
47	CLOSING STRIP—GLOVE BOX
48	FACIA CRASH ROLL
49	PARCEL TRAY O/S
50	BACK COVER—INSTRUMENT BINNACLE
51	FACIA CRASH ROLL END
52	OIL GAUGE
53	FACIA CENTRE PANEL
54	STUBBER
55	PLAQUE (CHAMOIS)
56	ASHTRAY
57	FRONT PLATE
58	OIL GAUGE
59 & 60	BEZEL—PLAQUE
61	CHECK STRAP
62	GLOVE BOX LID
63	SPRING
64	BELL CRANK LEVER
65	LOCK ASSEMBLY
66	LOCK BODY
67	NUT
68	FIBRE WASHER
69	BEZEL
70	KEY

Doors

36	TREAD PLATE
37	WOOD CAPPING
38	MOULDING—WAIST FINISHER
39	WAIST FINISHER

FACIA

To Remove

Open the glove box to obtain access to the two wing nuts retaining the long section of the padded facia crash roll. (48, Fig. 24.)

Remove the two wing nuts, and pull off the crash roll.

The remaining small section of the crash roll (51), is retained by one wing nut, accessible from underneath.

The facia moulding (43) must be removed by sliding sideways off the retaining clips.

Remove the heater control by releasing the two screws located in the front of the bracket.

Withdraw the ashtray (56) by depressing the stubber spring (54) in the centre of the ashtray, and pulling outwards.

Remove the two bolts on each side to release the binnacle.

This will enable the panel (53) to be released by removing the retaining screws from the rail (42) and disconnecting the oil gauge (58) and blower switch (not shown).

To remove the binnacle completely, it will be necessary to disconnect the instruments and wiring.

Make sure to identify all wires to enable them to be replaced in their correct positions.

The glove box check straps (61) are pliable plastic, and may be disconnected from the facia panel by prising the studs out of the panel.

The glove box lid (62) can be dismounted by removing the hinge fixing screws from beneath the parcel tray rail (42).

Should the glove box lid lock require dismantling, unscrew the large nut on the inside of the lid, and when the lock body is free in the lid, unscrew the bezel ring (69) and withdraw the lock assembly from the lid.

GLOVE BOX LID LOCK (Fig. 25)

Remove the two screws in the lock body and withdraw the lock bolt (A), bridge piece (D), spring (B) and bell crank lever (C).

When reassembling, the following assembly sequence is recommended:—

Before fitting the bolt (A), the loop of the spring (B) and the leg of the bell crank lever (C) must be located in the slot in the bolt.

The bridge piece (D) must now be pushed downwards and retained against the spring so that the bolt is in position over it. The outer cover can now be secured over the bolt by its two screws.

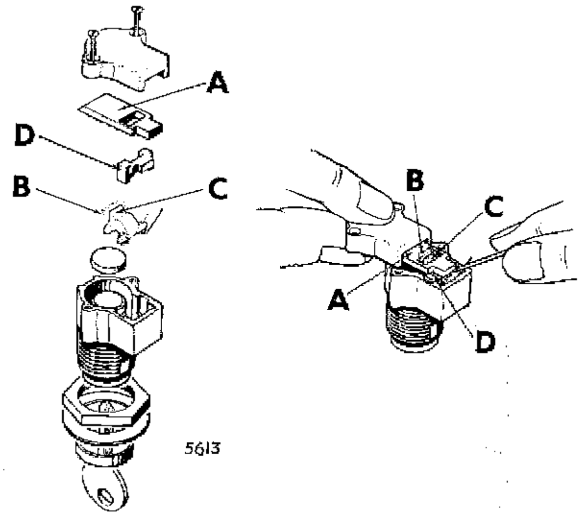


Fig. 25. *Glove box lock assembly*

Check the operation of the lock before re-fitting to the lid.

To fit the lock to the glove box lid, proceed as follows:—

Screw the large nut (67) right down on the threaded portion of the lock body (65).

Fit the fibre washer (68) over the nut, and pass the threaded portion of the lock body through the hole in the glove box lid from the inside.

Screw the chrome bezel ring (69) down until the ring forms a neat bezel on the end of the lock body.

Do not use tools on this ring, or the chrome and glove box lid veneer may be damaged.

Tighten the lock from the inside by the gentle use of a spanner on the nut.

Do not overtighten, or the glove box veneer may crack or split.

IMP VAN

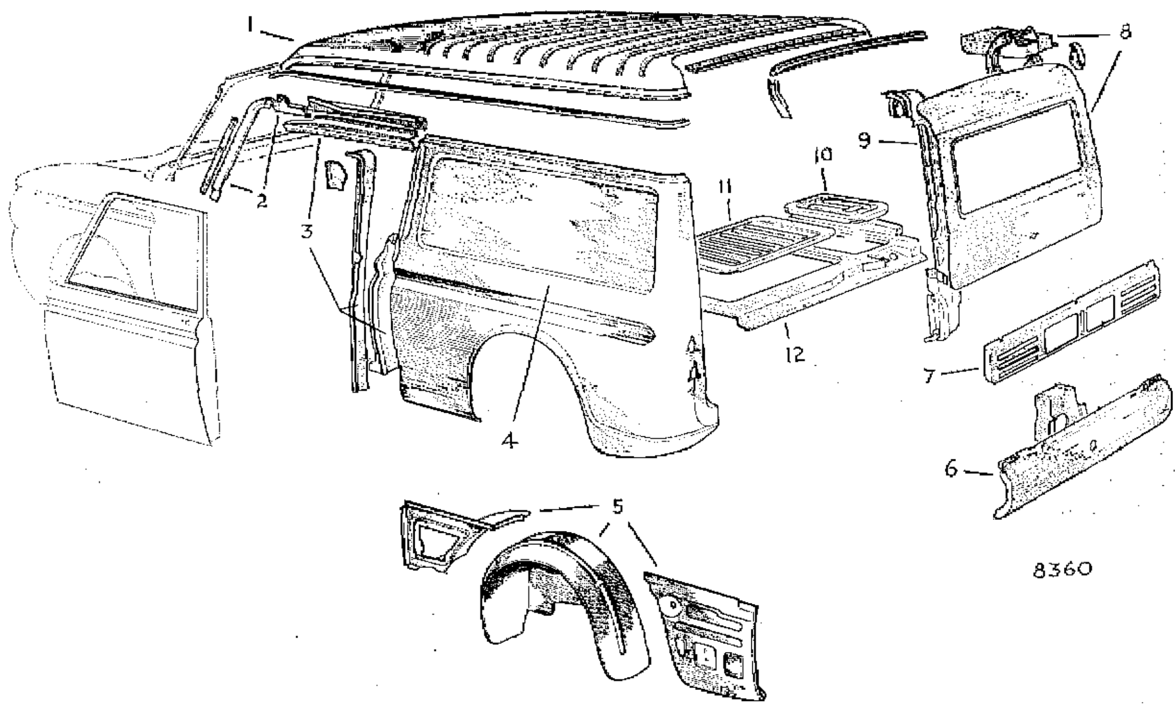


Fig. 25. *Imp Van body shell*

1. ROOF PANEL REINFORCEMENT PIECES AND DRIP PANELS
2. 'A' POST PANEL PIECES
3. 'B' POST PANEL PIECES
4. TONNEAU SIDE PANEL
5. WHEEL ARCH ASSEMBLY
6. REAR LOWER CROSS MEMBER
7. FILLER PANEL
8. REAR DOOR ASSEMBLY
9. REAR PILLAR SUPPORT
10. BATTERY COVER
11. ENGINE HATCH COVER
12. REAR FLOOR ASSEMBLY

REAR DOOR

To remove

This requires the services of two operators, one to assist by holding the door in position during the removal and refitting of the hinge retaining screws.

Any one of three methods can be used according to requirements:—

(a) *Door only.* Open the door and mark the position of the hinge relative to the door.
Remove the Phillips screws (A), two on each side, and remove the door.

(b) *Door and hinge brackets.* Open the door, remove the three retaining screws and nuts (B) on each side of the hinge brackets and remove the door.

(c) *Door and hinges complete.* Open the door, remove the two nuts located at the rear of the hinge unit (C).
Remove the two Phillips screws underneath the unit (D).
Repeat for the opposite side, and remove the door and hinges complete.

To refit

(a) Offer up the door, fit the screws (A) to each side, reset the hinges to the original markings and tighten the screws.
Check the fit and operation of the door.

(b) Fit the door to the hinges by re-fitting the three screws (B) on each side and just nip the nuts. Do not tighten fully.
Close the door gently, taking great care not to foul the roof edge with the inner top edge of the door. The screw holes are elongated to enable the door to be adjusted on the hinges until a correct fit in the body aperture is obtained.
With the assistance of the second operator, hold the door shut in position, then from inside the van tighten the screws fully.
Check the fit and operation of the door.

(c) Refitting is a reversal of the removal operations.
Check the fit and operation of the door.

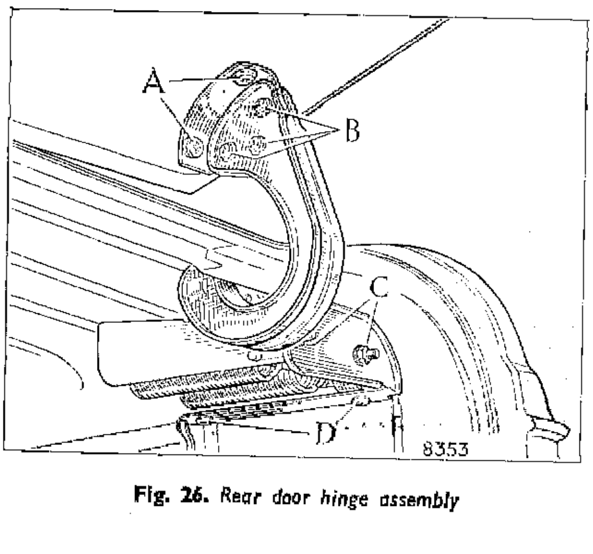


Fig. 26. *Rear door hinge assembly*

HINGE UNIT

To remove

Open the door and remove the two Phillips screws (A). Remove the two nuts located at the rear of the unit (C). Remove the two Phillips screws underneath the unit (D) and withdraw the unit complete.

To refit

Refitting is the reversal of the removal procedure, but the setting of the door must be checked as given in (b) "Refitting the door".

REAR DOOR LOCK

To remove
Remove the retaining screws beneath the handle.
From inside the door, remove the circlip at the end of the spindle and withdraw the handle and spindle assembly.
Remove the escutchion and seating washer.

To refit
Refitting is a reversal of the removal procedure.
Check the fit of the location plate to the striker block before finally tightening the screws.

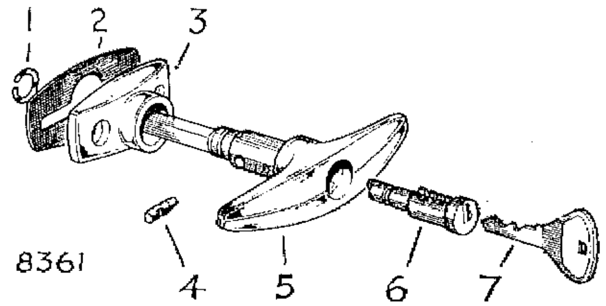


Fig. 27. *Rear door lock assembly*

1. CIRCLIP
2. SEATING WASHER
3. ESCUTCHEON
4. LOCKING BOLT
5. HANDLE AND SPINDLE ASSEMBLY
6. LOCKING BARREL
7. KEY

REAR DOOR GLASS

To remove and refit
The removal and refitting instructions for the rear door glass are the same as those given for removing and refitting Windscreen.

FILLER PANEL (Number plate mounting plate)

To remove
Remove the three screws located in the top edge of the panel and lift off.

To refit
Hold the panel in place, fit and tighten the three screws.

ENGINE HATCH COVER

The hatch cover is located by two metal tongues at the forward edge which fit into two slots in the floor. The cover is retained by three fasteners in the rear edge of the cover.

To remove
Using a screwdriver or coin, rotate the three fasteners half a turn anti-clockwise, lift the hatch and remove.

To refit
Place the hatch in position over the floor aperture, locate the two tongues in the holes provided in the edge of the floor and lower the hatch into place.
Lock the fasteners by pressing down and rotating half a turn clockwise.

BATTERY COVER

To remove
Using a screwdriver or coin, rotate the fastener at the rear of the cover half a turn anti-clockwise, and lift the cover by the small plate provided.

To refit
Place the cover in position over the battery, locate the tongue at the front of the cover into the hole provided in the floor.
Press the cover down into place and lock by turning the fastener half a turn clockwise.

RECOMMENDED LUBRICANTS

SECTION P

CONTENTS

RECOMMENDED LUBRICANTS

ENGINE

Where prevailing climatic temperature is:—

SUMP (OIL PAN)	Above 20°C. (68°F.)	Shell Super Motor Oil or Shell X-100 30
	27° to —7°C. (80°F. to 20°F.)	Shell Super Motor Oil or Shell X-100 20W
	0° to —18°C. (32°F. to 0°F.)	Shell X-100 10W or Shell X-100 Multigrade 5W20
	Below —15°C. (5°F.)	Shell X-100 Multigrade 5W20

For continuous high speed driving use Shell Super Motor Oil or Shell X100 40 if the Multigrade oil is not available. This is particularly important during the warm weather.

Upper Cylinder Lubricant ... ... Shell Upper Cylinder Lubricant

DISTRIBUTOR

Shaft and Cam bearing. Contact breaker pivot. Automatic timing (Spark) control ... ... Engine Oil

Cam Profile ... ... Shell Retinax A

GENERATOR ... ... Engine Oil

BATTERY TERMINALS ... ... Silicone Grease

STEERING UNIT ... ... Shell Spirax 80 E.P.

TRANS-AXLE ... ... Shell Spirax 80 E.P.
Where prevailing climatic temperature is below —15°C. (5°F.) ... ... Shell Spirax 75 E.P.

FRONT WHEEL HUB BEARINGS ... ... Shell Retinax A

REAR WHEEL HUB BEARINGS (If dismantled) ... ... Shell Retinax A

BRAKE AND CLUTCH FLUID RESERVOIR ... ... Girling Brake Fluid to S.A.E. Spec. 70R.3

BODY

Hinges, Locks, Catches ... ... Engine Oil

Important

There is no need to use additives with any of the specified lubricants as those additives considered necessary have already been included during blending. It should be specially noted that, under no circumstances, should additives of any kind be used in the trans-axle unit.

SEALS AND BEARINGS

SECTION Q

CONTENTS

SYNTHETIC RUBBER OIL SEALS

The efficiency of a unit is dependent upon its oil seals. It is therefore expedient to treat oil seals with the utmost care.

Storage

Ideally, seals should be stored in a dust free atmosphere at a temperature of between 10–21°C. Pressure must never be allowed to bear on the lips of the seals since this will cause distortion. It is particularly important to remember this when storing seals for long periods.

Fitment

Before assembly, seals should be carefully examined and wiped with a cloth moistened with clean oil to remove any foreign matter. If the lip of the seal is damaged, even by the slightest scratch, it should be discarded. Below is given the normal method of fitting a synthetic rubber seal.

1. Examine the shaft on which the seal is to be fitted for roughness or burrs, especially along the edges of keyways, screw threads or splines over which the seal must be passed.

2. Inspect the housing in which the seal is to be inserted for roughness, etc. The leading edge of the housing should be slightly chamfered to provide a lead-in for the seal.

3. Smear the lips of the seal with clean grease.

4. Insert the seal, lip side towards the oil, into the housing **before** fitting the shaft. Where this is not possible, extra care should be taken not to damage the lip of the seal on the shaft. Ensure that the seal enters the housing recess "squarely".

In cases where the surface of the shaft over which the lip of the seal must pass is liable to cut the lip, it is good practice to use a fitting sleeve with a lead-on taper having an internal diameter a few thousandths of an inch greater than the shaft. Where a sleeve is not available, a sheet of shim steel (or shim copper) should be wrapped around the shaft, and then smeared with grease.

When passing the seal along the shaft, or entering the shaft in the seal as the case may be, a slight twisting movement should be employed to reduce the risk of damaging the lip.

IMPORTANT. The seal should at no time during the assembly of the component, be allowed to support the weight of the shaft or housing, since this will cause the seal to be distorted.

Metal cased seals

The fitting instructions given above apply equally to metal cased seals. However, metal cased seals cannot usually be inserted into the housings with ease. For this reason, a press fitted with a suitable ram adapter must be used. The diameter of the ram should be fractionally less than the outside diameter of the seal. Where a press is not available, the seal may be fitted with the aid of a short length of metal tube whose diameter is slightly less than the outside diameter of the seal. By means of gentle hammer blows applied uniformly around the edge of the tube, the seal may be driven into place. Under no circumstances should the hammer blows be applied directly to the seal casing.

It is recommended that the outside edge of the seal is lightly coated with jointing compound before entering it into the housing.

NEEDLE ROLLER BEARINGS

Fitment

Do not wipe the grease from the outside of needle bearing. Keep needle bearings clean.

Use an arbor press, do not hammer against end of bearing. The bearing should always be pressed in using the special mandrel. The shoulder on which will have a concave face, so as to avoid pressing on the inner edges of the lip of the needle bearing.

Place the end of the needle bearing which is stamped against the shoulder of the mandrel, the unstamped end of the needle bearing will lead into the housing bore.

TAPERED ROLLER BEARINGS

The bearing is in two parts. The outer part is known as the "outer race" or "cup", and fits in the housing. The inner part is known as the cone assembly, and consists of rollers secured in a "cage" to the "inner race" or "cone". The cone fits on the shaft. As a general rule the outer races are a drive fit into their housings and the cones a drive fit onto their shafts. Where bearings are adjustable, either the cone or outer race is made a push fit.

Removal

Unnecessary dismantling is to be avoided since dismantling is apt to cause deterioration of the components. Bearings which are a drive fit should only be removed when renewal is necessary.

Cups and cones should always be removed with a suitable extractor. Remember that the claw of the extractor should bear on the cone, not the cage. Removal will be assisted if the shaft is first lubricated with oil.

If the outer race is to be removed, a suitable press or extractor must always be used.

IMPORTANT. On no account should a heavy blow or force of any kind be applied to one race to remove the other. Such a force will be transmitted through the rollers and cause indentations in the tracks, resulting in reduced bearing life and noisy running.

Cleaning

The bearing should be cleaned meticulously, using petrol, white spirit, or flushing oil. Chemical degreasers are not recommended. A good quality brush will assist in removing the worst of the foreign matter. The bearings should then be left to soak in clean solvent.

Bearings should under no circumstances be cleaned by blowing out with a high pressure air line after they have been degreased. This practice causes flats to develop where the rollers or balls skid on the casing and materially reduces the useful life of the bearings.

After cleaning bearings should be filled with fresh oil, as exposure to atmosphere causes rapid corrosion.

If new bearings are to be fitted, providing that they have been kept in their wrappings, no cleansing will be required.

Inspection

The general condition of a bearing may be checked to a certain extent by listening to the sound it produces when running. This may be accomplished by placing an ear against the handle of a screwdriver, the other end of which is firmly pressed against the bearing housing. If, for instance, a whistling sound is heard, lack of lubrication is indicated; a rumbling noise is usually due to pitted bearings or dirt. Sometimes it is not practical to check the noise of a bearing when running, as in the case of the front hub bearings. Removal and careful inspection is then the only course to take. On inspection, certain types of defect such as cracks, etc., may become immediately evident. Other faults, however, may not be so obvious. Listed below are common faults of the latter type.

Flaking—On removing the bearings, the tracks of both races should be examined for flaking. Since the track of the cone is not normally visible, this track can only be checked by "feeling" for any roughness when the cage and rollers are rotated slowly by hand. The bearing must be absolutely free from dirt since it is virtually impossible to feel the difference between flaking and grit. If flaking is apparent on either track the bearing must be renewed.

Wear—Precise measurement of wear on tapered roller bearings is not normally a practical service operation. Reference should be made to the manufacturers of the bearing if, for special reasons, this should be deemed necessary. An assessment of how much wear has taken place can be made by examination of the rollers and races. A track with a dull grey "lapped" appearance has suffered abrasive wear probably due to fine particles of dirt within the bearing. Experience will enable one to determine whether the wear is such that the bearing should be scrapped. In cases of doubt, renew. The cage should also be examined for signs of undue wear, cracking, or distortion. If such defects are discovered, the complete bearing must be renewed.

Discolouration—As a rule, discolouration indicates that the bearings have at one time become excessively hot, the cause of which should be investigated. Excessive pre-load and lack of or unsuitable lubrication are common causes. It should be remembered that a light brown stain may merely be an oil stain.

Refitting

Before refitting the bearing, the shaft and housing should be thoroughly cleaned, then smeared lightly with grease.

If the cup has been removed, a press with a suitable adapter must be used to refit it. Ensure that the cup enters the housing squarely and that it is pressed right home against the abutment shoulder. The cone assembly should be fitted with the aid of a press and adapter or a short length of metal tube whose bore diameter is slightly greater than the diameter of the shaft, and whose outside diameter is less than the internal diameter of the cage. With the tube resting on the cone, the roller assembly may be pressed into place.

HEATING AND VENTILATION

(If fitted)

SECTION R

CONTENTS

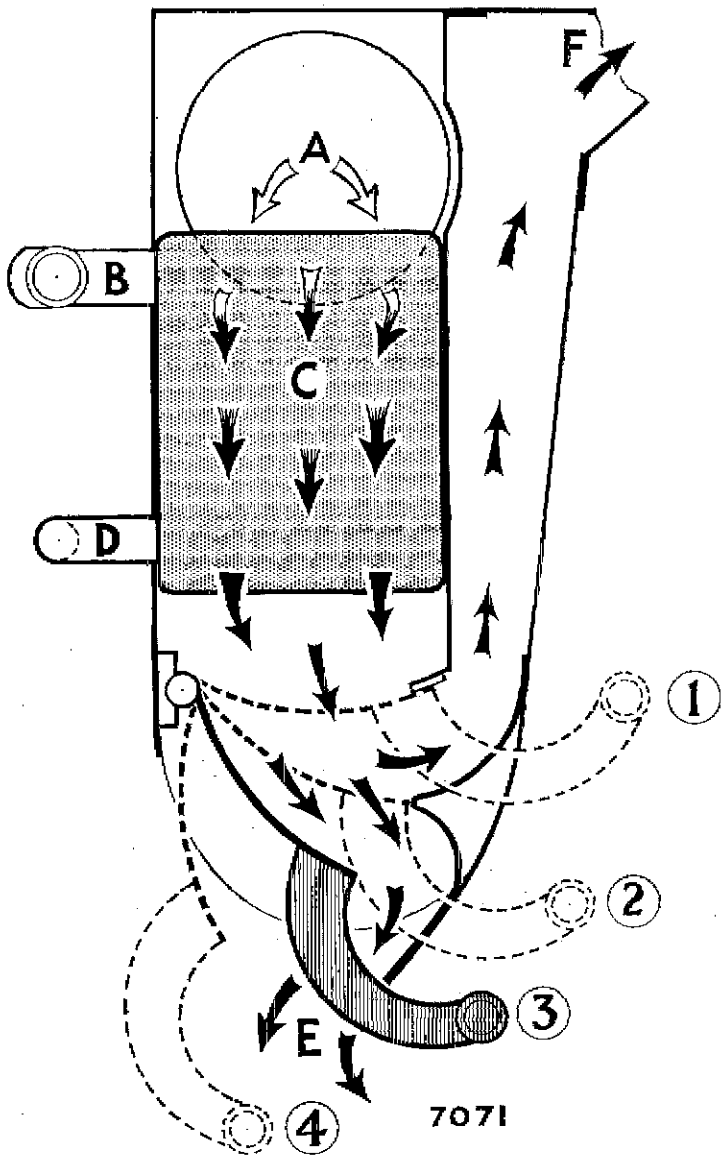


Fig.1. *Schematic section of heater*

KEY TO FIG. 1

A AIR INLET	D WATER INLET PIPE
B WATER OUTLET PIPE	E AIR TO CAR
C HEATER ELEMENT	F AIR TO SCREEN

AIR DISTRIBUTION CONTROL

1 OFF (UPPERMOST)	3 AIR TO SCREEN AND CAR
2 AIR TO SCREEN	4 AIR TO CAR (LOWEST)

DESCRIPTION

The heater will deliver hot or cold fresh air to either the windscreen or the car interior or a proportion to both. The blower (if fitted) greatly increases the amount of air fed into the heater.

Hot water from the engine cooling system is fed into the heater. The supply is regulated by means of a cable actuated water valve mounted on the bulkhead; the control, "Car heat", being mounted on the facia.

"Car heat" control.—This has two main positions: "Blue" (cold or off), and "Red" (hot); any intermediate position will give a control of heat according to the setting of the lever.

The supply hose is routed from the cylinder head via the right-hand rear wheel-arch and body sill ducting to the front wheel-arch and so to the water valve. The return hose is routed in the opposite direction via the left-hand sill ducting and rear wheel-arch to the radiator bottom tank or by-pass junction (if fitted).

As the heater is above the level of the cooling system it is necessary to bleed after filling. On early cars the bleed valve is fitted at the heater outlet pipe (see Fig. 5). On later models the bleed valve will be fitted into the engine cooling system.

Whenever bleeding is necessary, ALWAYS REFER TO SECTION "A", for the appropriate instructions.

The heater distribution control has four positions:—

1. "OFF" (uppermost).
2. SCREEN.
3. SCREEN and CAR.
4. CAR (lowest).

} See Fig. 1.

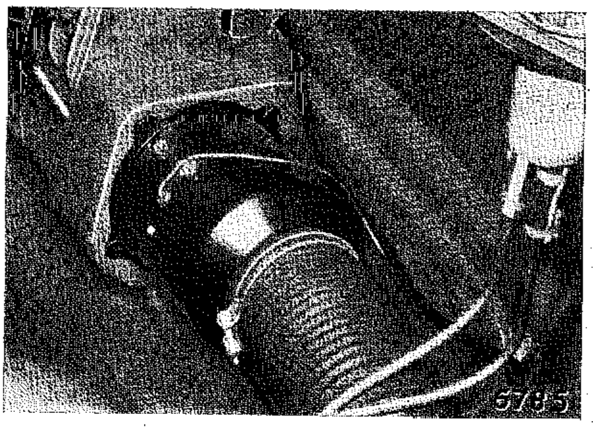


Fig. 2. *Blower unit and air hose*

BLOWER

To remove and refit (See Figs. 2 and 3)

Disconnect battery.

Disconnect air hose at the blower end. (Fig. 2.)

Remove grille panel.

Remove the four nuts with spring washers; these are located inside the plenum chamber (See Fig. 3), and withdraw the blower complete with filter gauze.

Release the cable from the harness clips, disconnect at blower switch and withdraw into the luggage compartment.

Refitting is a reversal of the above operations. Ensure that the gauze is clean.

Reconnect battery, start clock (if fitted) and test blower.

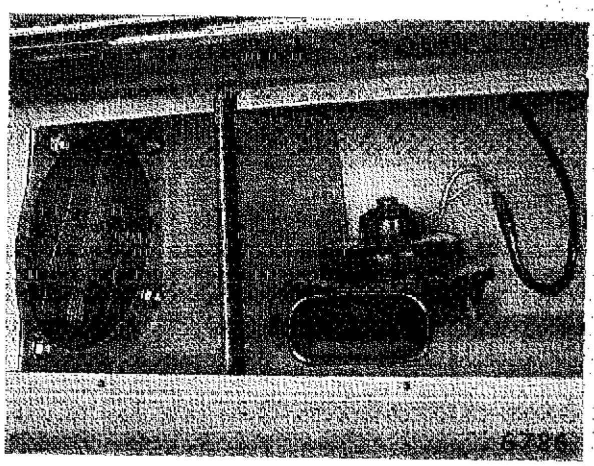


Fig. 3. *Plenum chamber, blower securing nuts and filter gauze*

HEATER

To remove and refit (See Figs. 4 and 5)

The operations given below are for IMP. To remove the heater from the CHAMOIS model it is necessary first to remove the instrument panel on which the heater control is mounted together with the ashtray and oil pressure gauge—See Sections "O" and "N".

Disconnect battery.

Remove the luggage compartment, bulkhead trim and open bleed valve (if fitted).

Set control to "HOT" (Red).

Drain cooling system (save anti-freeze if used).

Disconnect upper hose and remove bleed valve.

Disconnect lower hose.

Release control cable at water valve.

Undo water valve union nut, remove the two "Phillips" screws and water valve assembly.

Loosen the hexagon nut on the built-in stud which secures the Polythene air inlet pipe (if fitted) to the bulkhead.

Remove auxiliary instrument panel (if fitted).

Disconnect blower switch (if fitted).

Remove parcel shelf (see Section O).

Loosen the two screws which secure the Polythene air inlet pipe (if fitted) to the bulkhead. (The air inlet pipe is left loose and not removed.)

Certain models will have a continuous air hose fitted between the air box (or blower) and the heater air inlet. This hose may be compressed sufficiently to allow it to be withdrawn from the heater casing.

Remove heater control assembly (IMP).

Remove the control lever knob—screw off.

Remove the control from its mounting bracket—two screws, and withdraw control complete with cable.

Remove mounting bracket and escutcheon—three set screws and three screws.

Remove the three screws with plain washers which secure the demist manifold to the facia stiffener panel. To do this, remove both the crash roll (see Section O) and the instrument panel (see Section N).

Remove three set screws which secure the heater to the bulkhead, remove the heater unit by easing the left-hand side down first and withdraw the heater to the left away from the air inlet pipe.

Refitting is a reversal of the above operations. The air inlet pipe is entered into the heater as it is refitted and the flange is finally tightened after the heater is in position. Offer the heater unit into position with the right-hand side up first.

Set control lever to "HOT" (Red).

Refill the cooling system, bleed and top up with the engine running. (See also Section "A".)

Reconnect battery, start clock (if fitted), warm up engine and check heater operation. Re-bleed if necessary and refit trim.

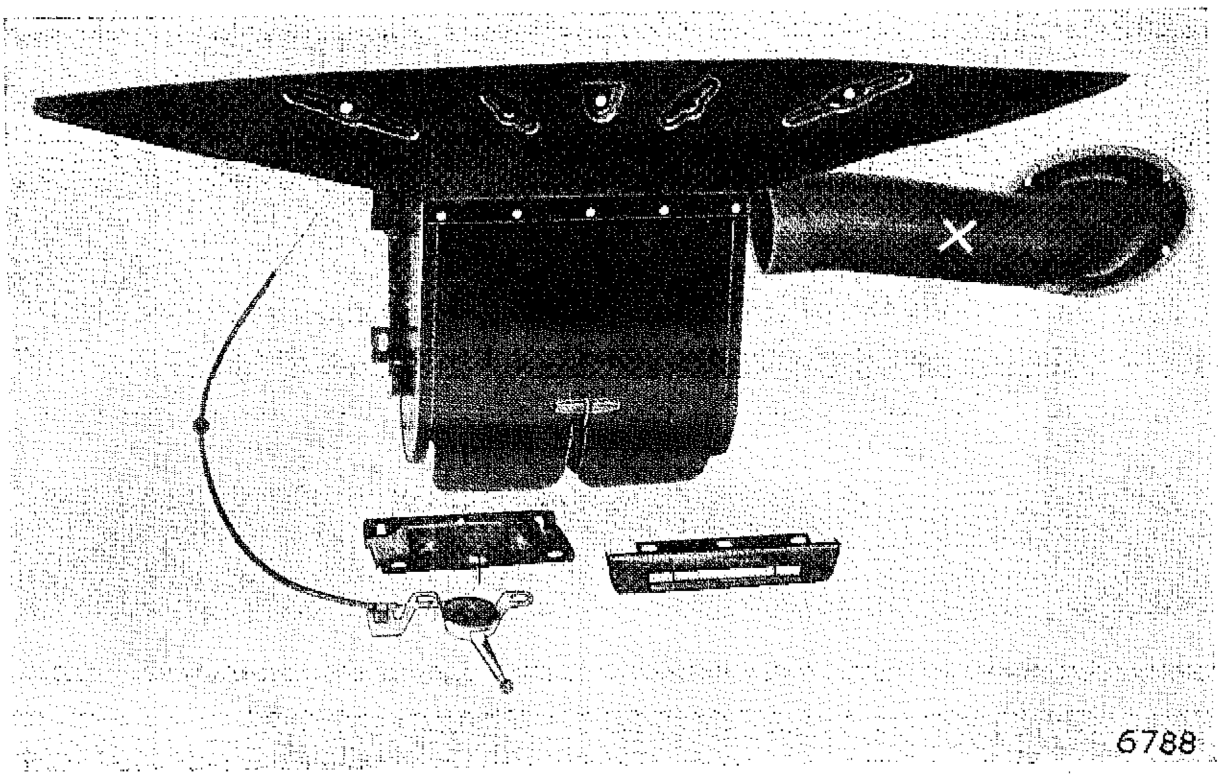


Fig. 4. *Heater assembly, control and air inlet pipe "X" (if fitted)*

"CAR HEAT" CONTROL

To remove and refit (See Figs. 4 and 5)

Remove luggage compartment bulkhead trim.

Release inner and outer cable at the water valve.

Remove auxiliary instrument panel (if fitted). (See Section "N".)

Remove control lever knob—screw off.

Remove two screws securing control to mounting bracket and withdraw control complete with cable.

Refitting is a reversal of the above operations. If the cable is removed from the control, when refitting ensure that the outer cable end is flush with the clamp.

WATER VALVE

To remove and refit (See Fig. 5)

Remove luggage compartment bulkhead trim and open bleed valve. Set control to "HOT" (Red).

Drain cooling system to below the level of the heater unit.

Release inner and outer cable and disconnect the inlet hose.

Undo union nut and remove water valve securing screws.

Refitting is a reversal of the above operations.

Refill cooling system, bleed heater if necessary and top up with engine running. (See Section A.)

Refit trim.

HEATER HOSE

To remove and refit (See Fig. 5)

The heater inlet hose is routed from the cylinder head over the rear right-hand wheel-arch, under the rear quarter pocket, through the body sill box-section, up the front wheel-arch into the luggage compartment.

The outlet hose is routed from the heater in the opposite direction on the left-hand side of the car to the radiator bottom tank.

Disconnect battery.

Set control lever to "HOT" (Red).

Remove luggage compartment, bulkhead trim.

Open bleed valve and drain cooling system. Save anti-freeze if used.

Disconnect inlet hose at water valve and remove clip.

Disconnect outlet hose at heater and remove clip.

Unclip hoses.

Disconnect inlet hose at cylinder head and remove clip.

Disconnect outlet hose at base of radiator or by-pass junction and remove clip.

Remove rear quarter trim pad—three screws (one concealed by rear mat)—and the felt at rear of wheel-arch.

Remove rear pocket bottom trim pad.

Remove the rear hose grommet and feed the hose into the inside of the car.

Release the hose from the wheel-arch clips and pass the hose through from the wheel-arch area into the pocket.

Now remove the front wheel-arch A-post trim to reveal the hose run. Remove the grommet and feed the front end of the hose into the car.

Blow out any residual water from the hose.

By means of masking or insulation tape attach a long length of cord to the front end of the heater hose.

With assistance carefully withdraw the hose from front to rear.

Refitting is a reversal of the above operations. It is recommended that French Chalk be liberally applied to the hose and at each end of the sill duct before refitting. *Retain hoses as shown in Fig. 5.*

Reconnect battery, start clock (if fitted), refill cooling system, bleed the heater and top up with engine running. (See Section A.)

Refit the trims.

HEATER MATRIX

To remove and refit

Remove heater unit.
See Heater—To remove and refit.

Partially release the foam to gain access to pop-rivets.

Remove five self-tapping screws which secure the matrix cover plate to the heater body. Now drill out the twelve pop-rivets and remove cover plate.

Remove matrix and clean out heater casing.

Refitting is a reversal of the above operations. If a pop-rivet tool is not available, suitable self-tapping screws should be used when refitting the matrix cover plate. Apply sealing compound to all heater casing joints.

ADJUSTMENTS AND RECTIFICATION

When investigating faulty operation of the heating and ventilation system, it is recommended that the following points be checked:—

1. Water valve—control cable adjustment.
2. Heater hose—for kinking and correct run.
3. Elimination of air locks.
4. Thermostat.
5. Possible blockage of heater matrix.
6. Correct alignment of demist manifold to facia apertures.

Water Valve

Remove luggage compartment centre trim. Set heater control lever to "Cold" (blue) and ease back $\frac{1}{8}$ in. (3 mm.); now get an assistant to hold the lever in this position.

Release the trunnion screw ("A" in Fig. 5), move the water valve lever to the fully closed position (i.e. towards the right-hand side of the car) and re-tighten the trunnion screw.

Check action of control for full movement in each direction without slack and also to ensure that the water valve closes fully when the control lever is set at "Cold" (blue).

Thermostat

If suspect—remove thermostat and check for correct sealing and operation. See also Section "A" and General Data.

Kinking of heater hose and run

Check that the inlet and outlet hoses are free from kinks, especially where they pass through the cutout below the rear pocket into the rear quarter area. Check to ensure that each hose is properly retained UNDER each clip on the bulkhead. If necessary refit as shown at "B" and "C" in Fig. 5.

Elimination of airlocks

See Section "A".

Blockage of heater matrix

If items 1—4 above are in order and heater output is down, the flow capacity of the matrix should be checked:—

Remove luggage compartment centre trim.

Disconnect heater outlet hose (upper).

Connect a length of rubber hose to the outlet pipe and secure with a clip. Place the free end of this hose into a container that will accept one gallon of coolant.

Remove radiator cap.

Have available one gallon of coolant or anti-freeze solution for topping up radiator. (An assistant will be required.)

Start engine and run at 2000 r.p.m. If heater matrix is free of obstruction a circulation rate of one gallon in 30 seconds will be obtained.

NOTE: It is imperative that the header tank level is maintained during this test.

Demist manifold alignment.

To align the demist manifold nozzles with the facia apertures, add packing washers (Part No. 9067012) as required between the demist manifold and the brackets.

On completion of tests refit hoses and trim.

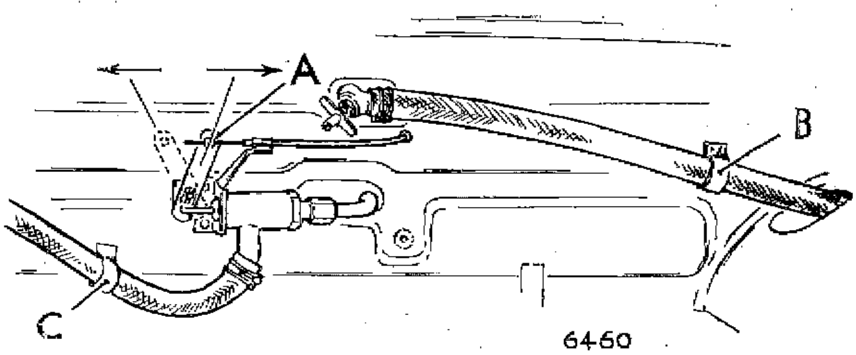


Fig. 5. *Cable adjustment, bleed valve (early cars) and correct method of retaining hoses*

VAN HEATER (If fitted)

Differences

The heater installation is similar to that on the other models. The van body construction is different at the rear quarter-wheel arch area. When removing and refitting the heater the following operations are additional to those already detailed under:—

1. Heater—to remove and refit:

Remove engine and battery access panels. Remove auxiliary instrument panel (if fitted) and disconnect the instruments.

2. Heater hose—to remove and refit:

Remove engine and battery access panels. Removal of the small quarter trims (these are located in the lower quarter under the front position of the rear floor), will provided access when routing the heater hose.

It will be found easier to withdraw the hose from the rear to the front and refit from front to rear.

SPECIAL TOOLS

SECTION S

CONTENTS

SPECIAL TOOLS

Obtainable from:

V. L. CHURCHILL & CO. LTD.
London Road,
Daventry,
Northamptonshire, England.

Always look at the sub-section 'General Tools' in addition to the sub-section in which you are interested.

Engine

RG.354	Timing chain tensioner retainer
RG.355	Cylinder head bolt wrench
RG.357	Valve guide remover/replacer
RG.359	Rear engine mounting bush remover/replacer
RG.6513A	Valve spring compressor
RG.6513A-3	Valve spring compressor adapter
D.143T	Tappet remover

Clutch

RG.372	Clutch shaft oil seal replacer
RG.374	Clutch plate centraliser
RG.384	Clutch shaft oil seal remover

Transaxle

RG.363	Differential small bearing replacer, adapter
RG.365	Differential gear assembly jig
RG.366	Differential oil seal and input shaft ball bearing replacer
RG.373	Differential adjusting nut wrench
RG.377	Universal joint $\frac{1}{2}$ in. A.F.

Transaxle—*continued*

RG.383	Differential oil seal remover
RG.4221B-8	Differential large bearing replacer, adapter
RG.367	Reverse gear and pinion nut wrench
RG.368	Needle bearing sleeve remover/replacer
RG.369	Needle bearing remover/replacer
RG.370	Pinion bearing cup replacer adapters
1414	Synchro hub retainer clips (pair)

Hubs and drive shafts

RG.379	Rear hub bearing assembly tool
RG.188C/3	Rear hub securing plate, can be made from RG.188D

Front and Rear suspension

RG.386	*Front and rear suspension arm bush remover/replacer*

Steering

RG.385	Swivel pin bush remover/replacer
RG.284	Steering arm taper pin remover

General tools

RG.387	Torque wrench, 6-40 lb./ft.
No. 12	Torque wrench, 20-100 lb./ft.
No. 13	Torque wrench, 50-170 lb./ft.
APES	Convertor $\frac{1}{2}$ in. socket x $\frac{3}{8}$ in. plug
ESHP	Convertor $\frac{1}{2}$ in. socket x $\frac{3}{4}$ in. plug
HB.1500	$\frac{3}{4}$ in. socket, $1\frac{1}{2}$ in. AF
RG.358	Valve guide reamer, $\frac{9}{32}$ in.
—	Salter No. 3 pocket balance, 0-25 lb.
56	Puller, differential bearings
550	Driver handle
1602	Baty dial indicator set

Torque wrenches in daily use should be checked at intervals, not exceeding three months, to ensure that accuracy is maintained.

Bore ring gauges are available from:—

COVENTRY GAUGE AND TOOL CO. LTD.,
Fletchamstead,
Coventry, England.

64947013 Girling shoe horn, available from:

GIRLING LIMITED, SALES AND SERVICE,
Birmingham Road,
West Bromwich,
Staffordshire, England.

HELI-COIL SCREW THREAD REPAIR KITS

Special Heli-Coil screw thread repair kits and parts are obtainable from:—

Armstrong Patents Co. Ltd.,
Eastgate,
Beverley,
Yorkshire, England.

COMPREHENSIVE KIT PART NO.	SINGLE SIZE KITS PART NO.	SIZE	TYPE	QUANTITY WITH KIT	INSERTS PART NO.
HISK 1	HISK 2	$\frac{1}{4}$ in. UNC	Standard	12	1185–4CN x $\frac{1}{4}$ in.
	HISK 3	$\frac{1}{4}$ in. UNC	Screwlock	12	3585–4CN x $\frac{3}{8}$ in.
	HISK 4	$\frac{5}{16}$ in. UNC	Screwlock	12	3585–5CN x $\frac{5}{16}$ in.
	HISK 5	$\frac{5}{16}$ in. UNC	Screwlock	12	3585–5CN x $\frac{15}{32}$ in.
	HISK 6	$\frac{5}{16}$ in. UNC	Screwlock	12	3585–5CN x $\frac{5}{8}$ in.
	HISK 7	$\frac{3}{8}$ in. UNC	Standard	36	1185–6C x $1\frac{1}{8}$ in.
	HISK 8	$\frac{3}{8}$ in. UNC	Screwlock	12	3585–6CN x $\frac{9}{16}$ in.
	HISK 9	$\frac{3}{8}$ in. UNC	Screwlock	12	3585–6CN x $\frac{3}{4}$ in.
	HISK 10	$\frac{7}{16}$ in. UNC	Screwlock	12	3585–7CN x $\frac{7}{8}$ in.
	HISK 11	$\frac{1}{8}$ in. BSP	Standard	12	1325–2CN x $\frac{3}{16}$ in.
	HISK 12	$\frac{3}{8}$ in. BSP	Standard	12	1325–6CN x $\frac{9}{16}$ in.
	HISK 13	$\frac{1}{2}$ in. BSP	Standard	12	1325–8CN x $\frac{1}{2}$ in.

All above kits contain the necessary roughing taps, finishing bottoming taps, inserting tools and tang break off tools where applicable.

Screwlock type heli-coils are for use in applications where later removal is not anticipated, i.e., for studs, etc.

Printed in England by
WARWICK PRINTING COMPANY LTD,
WARWICK

Tachometer Fittment.

Positive earth.

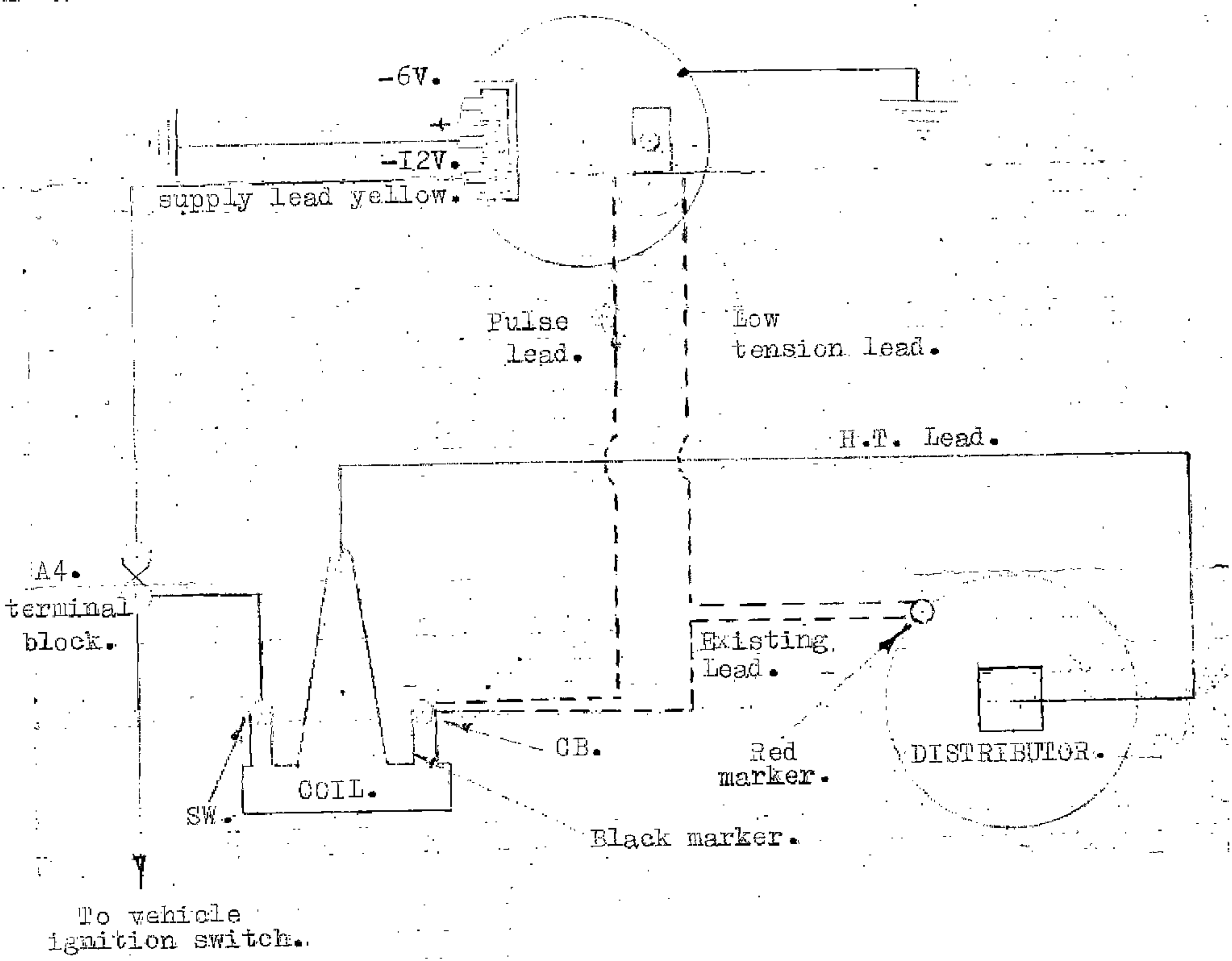
Remove the lead connecting the contact breaker terminal CB on the ignition coil to the contact breaker terminal on the engine distributor.
Connect the black lead to the CB terminal on the ignition coil and the red lead to the terminal on the engine distributor.
Determine the vehicle battery voltage and cut the yellow lead to the required length and connect from the appropriate terminal i.e. -I2 V. or -6 V. located at the rear of the tachometer and thence to the A4. terminal on the vehicle terminal block or to a switched fused circuit. It is most important to determine the correct voltage and exercise care in selecting the appropriate instrument terminal as incorrect connection will damage the movement within. From the centre terminal on the tachometer marked "x" connect the ballance of the yellow lead and earth the instrument to a suitable point on the engine frame. Finally connect the lead from the bulb holder to a suitable point in the exsisting instrument illumination circuit. Ensure that the instru-ment case is properly earthed, making a seperate earthing connection if necessary.

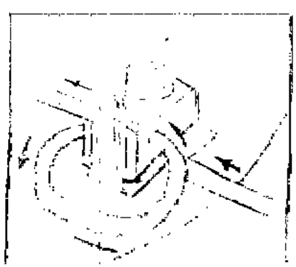
Negative earth.

Impulse lead :- Red lead to the ignition coil terminal, the black lead to the engine distributor terminal.
Electrical supply :- The lead from -I2 V. or -6 V. terminal to earth. The lead from "x" terminal to A4 terminal or a suitable fused circuit.

Important.

If it should be necessary to adjust the length of the white pulse lead on either side of the plastic moulding at the rear of the instru-ment, do not remove the white lead, but make any adjustment by moving the lead through the block as indicated in the scetch. If a longer overall length of lead is required, a further length of type I4/OIO wire may be added, but it is important to make a secure and clean connection.


-6V.
+
-12V.
supply lead yellow.
Pulse lead.
Low tension lead.
H.T. Lead.
A4. terminal block.
Existing Lead.
CB.
Red marker.
DISTRIBUTOR.
COIL.
SW.
Black marker.
To vehicle ignition switch.



FITTING INSTRUCTIONS

for

HILLMAN IMP ENGINE COMPARTMENT LID LOCK

Open the lid and detach the rear number plate lamp wire at the snap connector located in the top right-hand corner of the compartment.

Remove the two bolts at each side which hold the lid to the hinges, and remove the lid. Place the lid upside down on a bench, preferably cloth covered to avoid scratching the paintwork.

The lock assembly is mounted on the lid as shown at "A", therefore the marking out and drilling must be carried out on the inside of the lid, as shown at "B".

Measure across the engine compartment lid and mark off the exact centre line, as shown at "B".

Take the stiffening plate provided in the kit and mark off the centre line of the plate. Using this plate as a template, place it as shown in "B" with the centre line on the plate in line with the centre line marked on the lid, and with the plate in contact with the lid flange.

The pear shape of the hole MUST BE AS SHOWN when viewed from inside the lid, as placed on the bench.

Mark the shape and position of the hole on the lid, drill and cut out, using a file to fit the lock to the lid. Great care must be taken not to scratch the paintwork, and to avoid buckling the metal by too great a use of force when cutting out the hole.

Assemble the locking unit to the lid as shown at "A". Ensure that the tongue of the lock is in the correct position when fitted, i.e. vertical when locked.
Note that the key can only be removed in the locked position.

The engine compartment lid may now be refitted to the car.
Do not forget to include the lid stay bracket when bolting up the hinges.

Reconnect the rear number plate lamp wire.

To fit the locking bracket to the engine mounting plate, proceed as shown in "C".

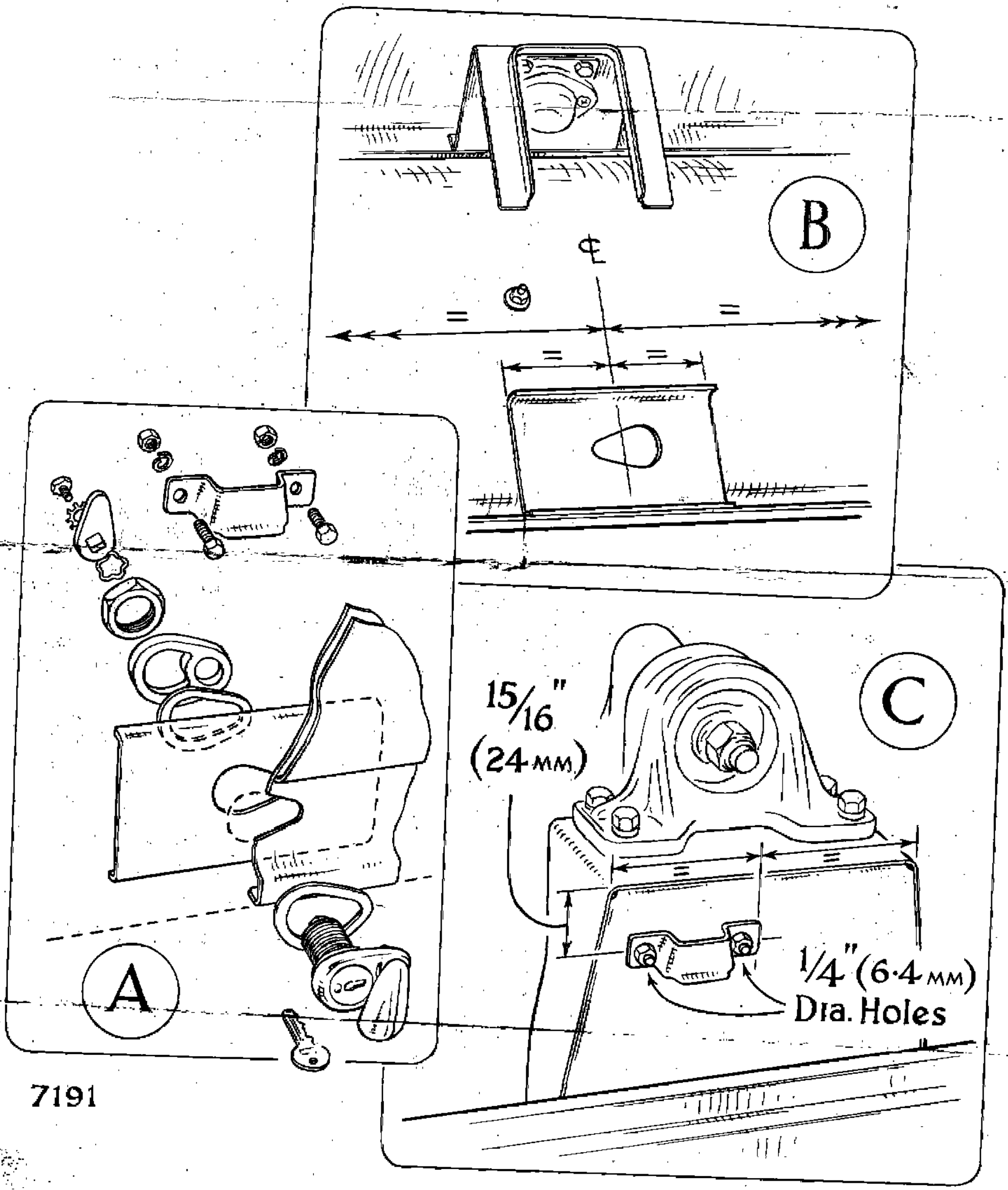
Mark off the centre line of the engine mounting plate, vertically.
Now mark off a horizontal line 15/16" (24 mm) from the top of the mounting plate, bisecting the vertical centre line.

Place the locking bracket with the two bolt holes centrally on the horizontal line, and the edge of the locking bracket on the centre line of the mounting plate, as shown at "C".

Mark off the two holes and drill with a 1/4" (6 mm) drill.

Push the two bolts through from inside the engine mounting bracket, with the wider section of the lock plate recess downwards (see "C").
Fit nuts and washers and tighten up.

Should any minor adjustment be desired, the holes in the engine mounting bracket may be elongated with a round file, but normally this should not be necessary.



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