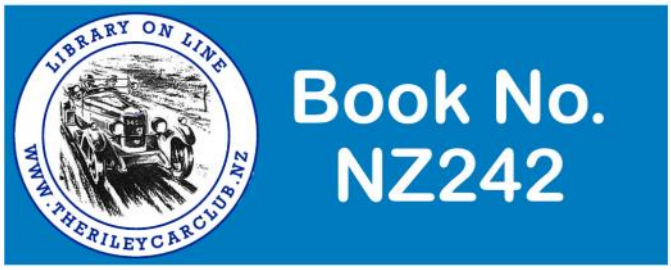
P. OLYSLAGER MOTOR MANUALS 74

BMC 1600

ADO 38 from 1961

Austin A60
Morris Oxford VI
MG Magnette IV
RILEY 4/72
Wolseley 16/60



Handbook for the

BMC 1600

ADO 38

AUSTIN A60
MORRIS OXFORD VI
MG MAGNETTE IV
RILEY 4/72
WOLSELEY 16/60

PIET OLYSLAGER MSIA MSAE

Second impression 1971

Contents

SPECIAL NOTE

Although every care is taken to ensure accuracy and completeness in compiling this book, no liability can be accepted for damage, loss or injury caused by any errors or omissions in the information given.

Preface

THIS MANUAL is intended to supplement (not to replace) the instruction book issued with the car by the manufacturer. It contains more detailed information on the maintenance and repair of BMC 'Farina' range (ADO.38) cars, without being, or pretending to be, a fully comprehensive workshop manual.

The first sections of the book contain general information essential for both owner driver and mechanic. They give full details about the models covered so that the reader does not have to refer to many different publications in order to find correct model designations, serial numbers, major modifications, prices, dimensions, lubrication, maintenance and other information.

The section 'Repair Data' has been compiled and presented on the assumption that the reader knows something about repair work. Elementary procedures have therefore been omitted and the space has been devoted to more advanced information. Readers who are not qualified to carry out repairs and adjustments are strongly advised to leave them to official BMC dealers or distributors whose mechanics possess special equipment and are fully informed about the latest modifications and design changes. Often it will be more economical to replace a component by either a new or a factory-reconditioned unit rather than attempt to repair it. In all cases of doubt it will pay to consult a dealer.

All the important dimensions, tolerances and other specifications are presented in convenient tabular form at the end of the book, followed by an engine fault finding chart.

PIET OLYSLAGER, MSIA, MSAE

Fig. 1. Austin A60 'Cambridge' model A/HS9 Saloon, 1963-67

Fig. 2. Austin A60 'Countryman' A/HW9 Estate Car, 1964 version

BMC 1600
ADO 38
from 1961

AUSTIN A60
MORRIS OXFORD VI
MG MAGNETTE IV
RILEY 4/72
WOLSELEY 16/60

General

INTRODUCTION

The BMC ADO.38 range of cars with 1622 cc engine, popularly known as the 'Farina' series, was introduced in early October 1961 to replace the 1489 cc ADO.9 range which had been in production since late 1958. Two basic body shells, styled by Pininfarina, are used, namely a four-door saloon and a four-door Estate Car. The Estate Cars are only available as Austin and Morris, and are designated 'Countryman' and 'Traveller' respectively.

The MG and Riley versions have twin carburettors and higher power outputs than the other models.

Technical modifications as compared with the preceding ADO.9 models include increased cylinder bore and larger valves, availability of Borg-Warner model 35 automatic transmission, detail improvements to the bodywork, increased track and wheelbase, and a restyled facia panel for the Austin version. The Austin A60 and the Morris Oxford Series VI are also available with a 1489 cc BMC diesel engine giving 40 bhp at 4000 rpm. This engine is not covered in this manual.

Summary of models:

Austin A60:
Model A/HS9 'Cambridge' four-door Saloon and De Luxe Saloon
Model A/HW9 'Countryman' four-door Estate Car

These models were announced on 11 October 1961, replacing A55 Mark II models A/HS8 and A/HW8 respectively, which had been introduced on 16 January 1959 and 28 September 1960 respectively.

Morris Oxford Series VI:
Model M/HS6 'Oxford' four-door Saloon and De Luxe Saloon
Model M/HW6 'Traveller' four-door Estate Car

These models were announced on 12 October 1961, replacing Oxford Series V models M/HS1 and M/HW5 respectively, which had been introduced in March 1959 and September 1960 respectively.

MG Magnette Mark IV:
Model G/HS2 'Magnette' four-door Saloon

This model was announced on 12 October 1961, replacing the Magnette Mark III model G/HS1, which had been introduced in February 1959.

Fig. 3. Morris 'Oxford' Series VI, model M/HS6 Saloon, 1961-63

Fig. 4. Morris 'Traveller' Series VI, model M/HW6 Estate Car, 1961-63

Riley 4/72:
Model R/HS3 '4/Seventy-Two' four-door Saloon

This model was announced on 12 October 1961, replacing the 4/68 model R/HS1, which had been introduced in April 1959.

Wolseley 16/60:
Model W/HS3 'Sixteen-Sixty' four-door Saloon

This model was announced on 12 October 1961, replacing the 15/60 model W/HS1, which had been introduced in December 1958.

NOTE: If a car is fitted with left-hand drive, the letter L is added to the model identification symbol. For explanation of symbols see under Chassis Number on page 7.

DESCRIPTION

The ADO.38 is an improved version of the ADO.9 range. Its lifespan of almost ten years of full-scale production with only minor changes to its basic design certainly indicates that this car, which is of thoroughly conventional design and construction, has proved to be a very acceptable straightforward and reliable medium-class motor car.

The engine is a four-cylinder overhead-valve BMC 'B' Series unit, originally of 1489, later of 1622cc cubic capacity. The transmission comprises a conventional single dry plate clutch, four-speed gearbox (synchromesh on second, third and top only) and a hypoid rear axle. Borg-Warner model 35 three-speed automatic transmission is optionally available on all 1622cc models. See page 84 for description.

Front suspension is independent, using coil springs and wishbones of unequal length. At the rear, the rigid rear axle is attached to semi-elliptic leaf springs. Lever-type shock absorbers are used front and rear.

Brakes are Girling hydraulic drum type all round. The parking brake operates on the rear wheels. The steering gear is of the worm and peg type.

The body and the chassis are built together to form a unitary mono-construction. All models feature four forward-hinged doors. The Estate Cars also have a 'split' tail gate, opening horizontally.

For modifications and further technical specifications see pages 7 and 16.

No commercial vehicles have been produced utilising the ADO.9 and 38 styling. Current half-ton Austin and Morris vans and pick-up trucks still have the styling of the Austin A55 'Cambridge' Mark I although some face-lifting has taken place since their first introduction in February 1957. The Morris versions became available in October 1962. From September 1963 they have been fitted with the 1622cc engine. Their basic technical specification resembles that of the ADO.9 and 38 range.

IDENTIFICATION

Engine number: The engine number is stamped on a metal plate fixed to the cylinder block, on the right hand side. The number is prefixed by the engine model symbol, e.g. 16AMW–U–H–12345. The prefix presents, in code, the power unit specification and is divided into three groups, indicating (1) engine capacity and model, (2) type of gearbox and ancillary equipment, and (3) the compression ratio.

Fig. 5. MG 'Magnette' Mark IV, model G/HS2 Saloon, 1963-67

Fig. 6. Riley '4/Seventy-Two', model R/HS3 Saloon, 1963-67

Prefix Group 1 (a number and one to three letters): 16AC—Austin and Morris half-ton commercial (Van, Pick-up), 16AMW—Austin A60, Morris Oxford Series VI, Wolseley 16/60, 16C—ditto with Lucas 11AC alternator, 16GE—MG Magnette Mark IV (twin carburettors), 16RA—Riley 4/72 (twin carburettors).

Prefix Group 2 (one or two letters for each ancillary fitted): U—Central gear change, Fr—Distributor for regular (commercial) fuel, Rc—Borg-Warner '35' automatic transmission.

Prefix Group 3 (one letter, indicating compression ratio): H—High, L—Low, D—Diesel.

Chassis serial number or Car number: This number is located on a plate mounted on the bulkhead, in the engine compartment. The number is prefixed by the model identification symbol (as listed under 'Summary of Models' on page 3) HS=Saloon, HW=Estate Car. Suffix L denotes left-hand drive.

Chassis serial numbers (*approximate, for guidance only*):

	Austin A60		*Morris Oxford*		*MG*	*Riley*	*Wolseley*
	Saloon	*Estate*	*Saloon*	*Estate*	*Magnette*	*4/72*	*16/60*
October 1961*:	101	8351	79301	8501	16801	11101	24801
January 1962:	7060	9770	84980	9755	17615	11785	26505
January 1963:	64130	15100	111815	14710	20915	14740	35270
January 1964:	121950	121960	136230	20600	23370	17100	45390
January 1965:	165200	163500	161440	26875	25983	19250	54430
January 1966:	195230	195830	179070	31955	28650	21600	63265
January 1967:	223211	222122	196738	36449	30336	23120	70281

*Starting serial numbers, actual production commenced just preceding this date of introduction.

Gearbox number (manual transmission): This number is stamped on the gearbox-casing, to the left of the combined dipstick and filler plug.
Automatic transmission (Borg-Warner '35'): The automatic transmission identification and serial number is stamped on a plate attached to the left-hand side of the casing.
Rear axle number: This number is stamped on the rear of the axle tube on the left-hand side adjacent to the suspension rebound rubber.

MODIFICATIONS

NOTE: For reasons of comparison, the main differences between the ADO.38 and the preceding ADO.9 models are also included here. For modifications of a purely technical nature see Repair Data (page 23 onwards).

1961 (62 models)
As compared with the preceding ADO.9 models, the following major changes were made:

Single-carburettor engine (*Austin, Morris, Wolseley*):

The power output was increased to 61 bhp (net) at 4,500rpm (63bhp gross) and the cubic capacity enlarged to 1,622cc by increasing the cylinder bore to 76·2mm, giving a piston area of 28·3sq in.

Fig. 7. Wolseley 'Sixteen-Sixty', model W/HS3 Saloon, 1963-67

Larger valves, modified pistons, piston pins (gudgeon pins), connecting rods and crankshaft.

The engine develops 9% more torque than the preceding model, the figures being 90ft lb at 2,100rpm, instead of 82·5ft lb at the same engine speed. Advantage of this has been taken to reduce engine speed in relation to road speed by 5·5%, which raises the road speed at 1,000rpm to 16·62mph instead of 15·63mph.

Twin-carburettor engine (MG and Riley):

The power output was increased to 68bhp (net) at 5,000rpm and the cubic capacity enlarged to 1,622cc by increasing the cylinder bore to 76·2mm, giving a piston area of 28·3sq in. Larger valves with double valve springs, modified pistons, piston pins (gudgeon pins), connecting rods, and crankshaft.

The torque was increased from 82 to 89ft lb at 2500rpm. Advantage of this was taken to reduce engine speed in relation to road speed by 5·5%, which puts the road speed at 1,000rpm to 16·62mph instead of 15·63mph.

Exhaust, all models: The silencing system was revised, and now has double expansion chambers.

Transmission, all models: Three gear change options, viz. four-speed gearbox with either floor-mounted or (Austin and Morris only) steering column mounted gear lever, and 'three-speed' Borg-Warner model '35' automatic transmission. The floor mounted gear lever is an improved version of the previous type. The Borg-Warner automatic transmission consists of a hydraulic torque converter providing a fluid connection between the engine and the gearbox which has a planetary gear set providing three forward ratios and one reverse. For a more detailed description of this transmission, see page 84.

The final drive ratio was changed from 4·55:1 to 4·3:1, which steps up the effective gearing (see under Technical Specifications on page 17).

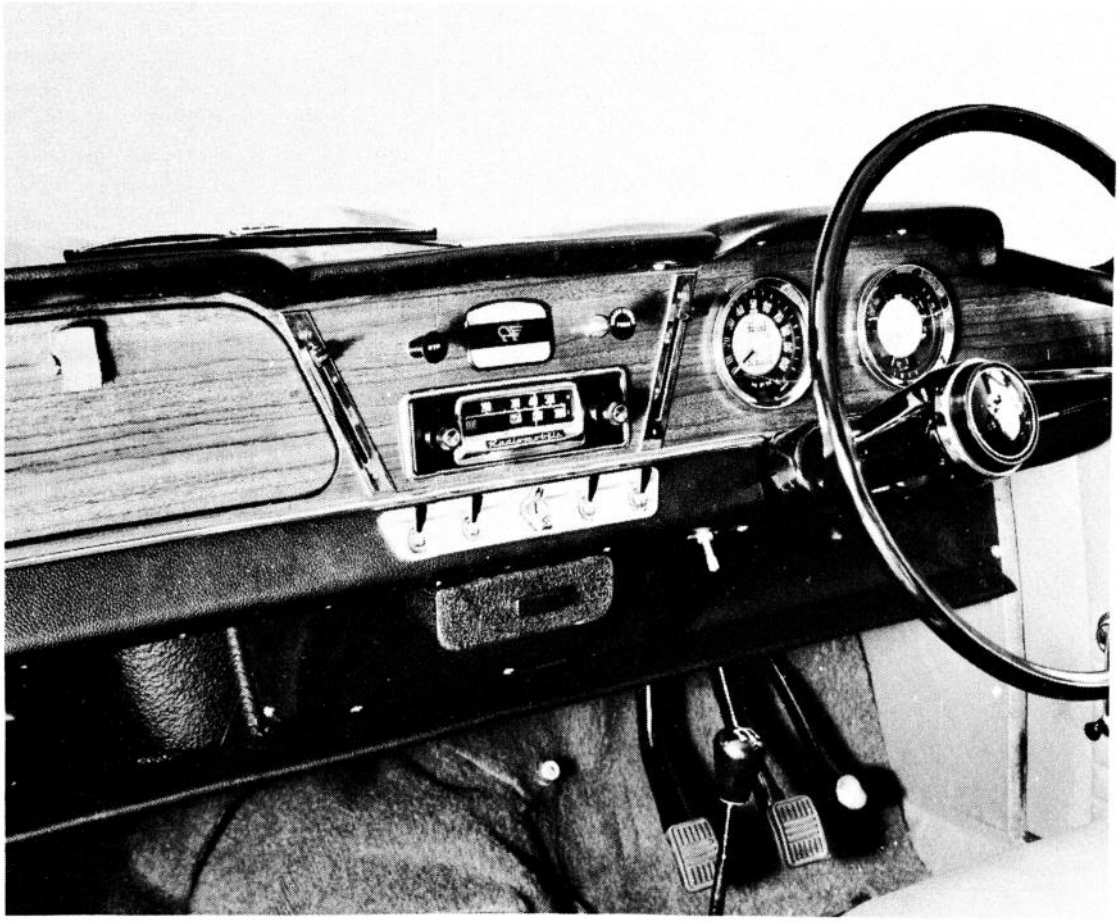


Fig. 8. Austin A60 instruments and controls

On the Estate Car models the final drive gear ratio was raised from 4·875:1 to 4·55:1, giving a rather lower gearing than the saloon to compensate for the extra weight and load. Shortly afterwards, however, the gear ratio was brought into line with that of the Saloon (4·3:1).

Suspension and wheels, all models: The suspension was modified to improve ride and stability. Stronger Armstrong Heavy Duty shock absorbers were fitted, in addition to rear springs with increased deflection, a stabilizer bar at the rear and an anti-roll bar at the front. Stability was further improved by widening the track and lengthening the wheelbase. At the front this was achieved by mounting the existing suspension units on a cross member which is wider than the previous design and at the rear by displacing the (now wider) axle rearwards by one inch. The combination of reduced roll resistance at the rear, and increase at the front, together with the introduction of the anti-roll bar, has increased comfort over bad roads and provided a more powerful understeer characteristic. Wheel rim size was changed from 4½ to 4in.

The Estate Cars have stiffer rear suspension than the saloon to cope with the extra payload.

Steering, all models: Lower steering gear ratio; turning circle 37ft.

Bodywork, Austin: Both the front and rear end of the saloon were redesigned. Changes were made to the radiator grille and emblem, bumpers and overriders, body

Fig. 9. Morris 'Oxford' front compartment and facia

side mouldings, rear wings and rear lamp clusters. The facia panel was restyled completely. It has an imitation walnut finish. Revised window winders and re-styled seating and door trim. The slight lengthening of the wheelbase resulted in more comfort for the rear passengers by providing additional space for seating forward of the wheel arches. The 'Countryman' Estate Car retained the same rear end styling as the preceding A55 Mk II model.

Bodywork, Morris: Redesigned front and rear end on Saloon models. Modified radiator grille, bumpers and overriders, rear wings and rear lamp clusters. Improved front seat adjustment details. Revised window winding mechanism. Re-styled seating and door trim. Rear bumper overriders now fitted to standard and De Luxe saloon. The 'Traveller' Estate Car retained the same rear end styling as the preceding Series V model.

Bodywork, MG and Riley: Improved front seat adjustment details and rear compartment space. No external modifications.

Bodywork, Wolseley: Redesigned tail end. Modified (shorter) rear bumpers, overriders, body side mouldings, and tail lamp clusters.

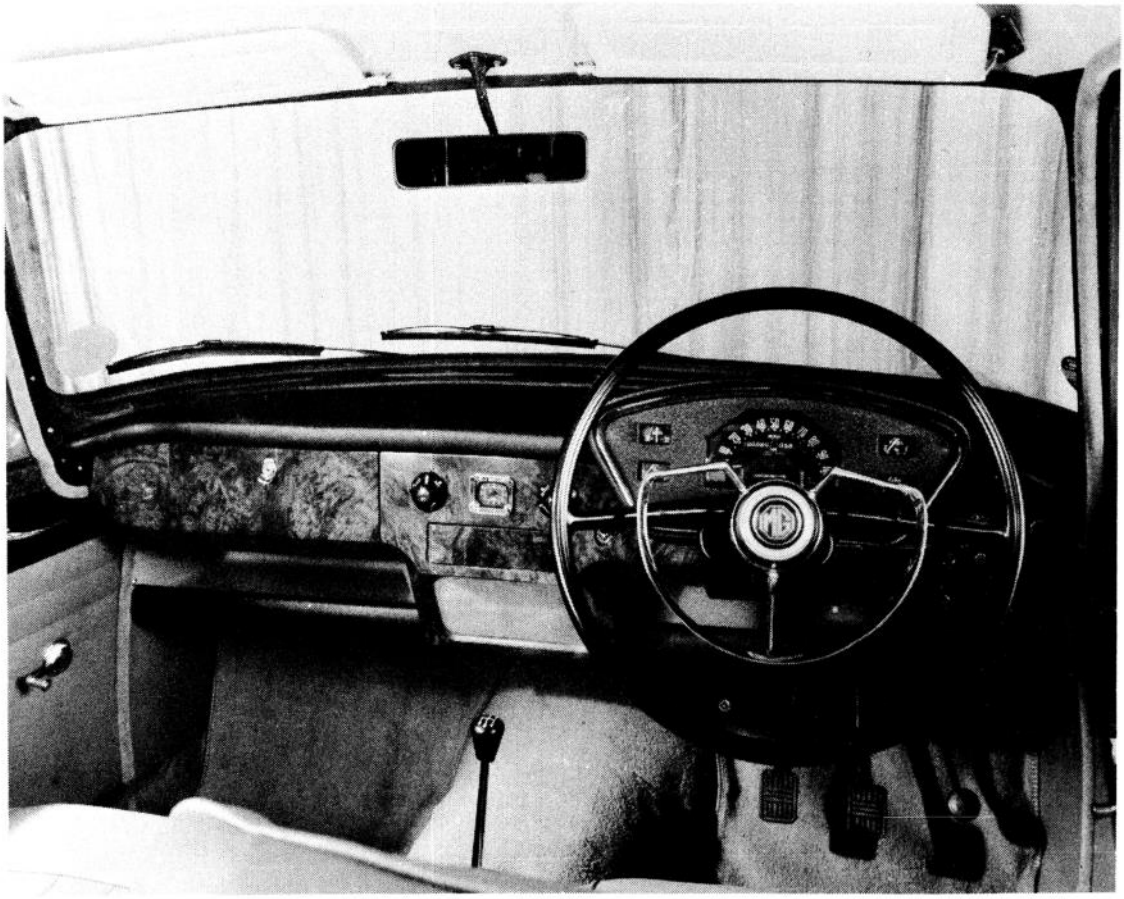


Fig. 10. MG 'Magnette' instruments and controls

Electrical equipment, all models: Sealed-beam headlamps. SU model SP electrical fuel pump.

Dimensions, all models: Wheelbase increased from 8ft 3$\frac{3}{16}$in to 8ft 4$\frac{1}{4}$in; track increased at front from 4ft $\frac{9}{16}$in to 4ft 2$\frac{5}{8}$in, at rear from 4ft 1$\frac{7}{8}$in to 4ft 3$\frac{3}{8}$in.

1962: New improved rear springs were introduced on the saloon models in June and on the Estate Cars in November. In October, duo-tone paint finish, wheel discs (embellishers) and windscreen washers became standard equipment on all saloon models. The wheel trims were fitted as standard on the Estate Cars as from November. Divided bench front seats became standard equipment on certain models, with one-piece bench type as optional extra. In December the Morris saloon was fitted with an interior illumination in the luggage compartment.

1963: A stronger fan belt was fitted on all models as from June. Balanced brake drums were introduced in production in July.

1964 (1965 models): The 1965 models were introduced in September 1964, featuring a new propeller shaft with lip seals and pre-packed universal joint bearings which obviate the need for regular greasing. Steering control was improved by fitting a new mounting for the steering box. The column was mounted lower. New sun visors of the crushable type were introduced and so was a plastic-framed safety type rear view mirror.

1965-66: No major modifications were introduced during this period.

Fig. 11. Riley '4/72' front compartment and facia

PRICES

UK prices are home retail ex-works prices for DeLuxe models (where applicable), inclusive of purchase tax and to the nearest £1. Prices in brackets are for models with automatic transmission:

	October 1961	*November 1962*	*January 1963*	*September 1964*	*March 1965*	*November 1966*
Austin A60						
Cambridge Saloon:	884 (983)	756 (838)	756 (838)	757 (839)	772 (854)	785 (869)
Countryman E.C.:	978 (1077)	828 (910)	828 (910)	829 (911)	844 (927)	859 (943)
Morris Oxford VI						
Oxford Saloon:	898 (997)	765 (848)	765 (848)	766 (849)	782 (864)	795 (879)
Traveller E.C.:	993 (1092)	838 (920)	838 (920)	839 (921)	854 (936)	869 (952)

Fig. 12. Wolseley '16/60' front compartment and facia

	October 1961	*November 1962*	*January 1963*	*September 1964*	*March 1965*	*November 1966*
MG Magnette IV Magnette Saloon:	1059 (1158)	892 (974)	892 (974)	893 (975)	900 (982)	916 (999)
Riley 4/72 Saloon:	1088 (1187)	916 (998)	916 (998)	917 (999)	921 (1003)	937 (1020)
Wolseley 16/60 Saloon:	993 (1092)	837 (920)	837 (920)	838 (921)	853 (936)	868 (952)

INSTRUMENTS AND CONTROLS

The facia panels differ from model to model, as Figs. 8 to 12 show. Switches on most models are clearly labelled and therefore need no further explanation. The Riley 4/72 is provided with a revolution indicator (tachometer), driven off the camshaft. The MG and Riley versions have an ammeter. All models have an oil pressure and water temperature gauge. The bonnet (hood) lock control knob is situated under the facia panel, except on later Austin and Morris models, where the lock is released by a lever at the front of the car.

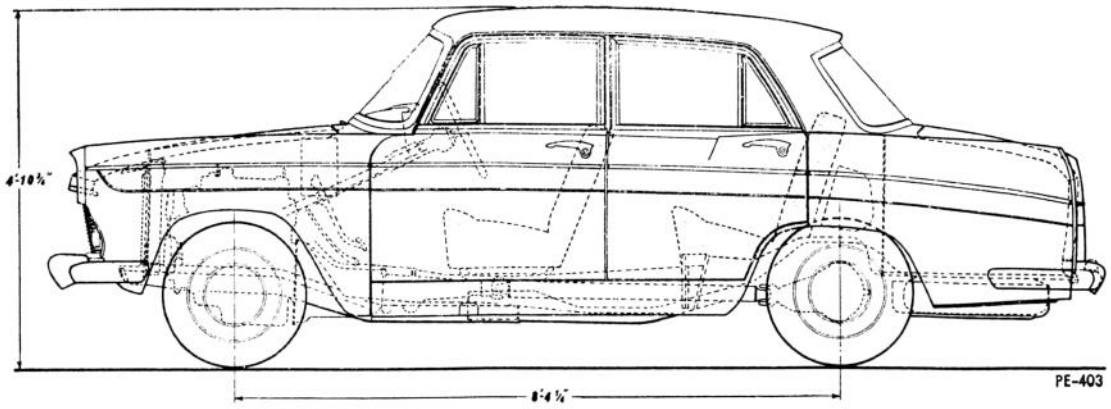


Fig. 13. BMC ADO.38 Saloon, general arrangement, typical (Austin shown)

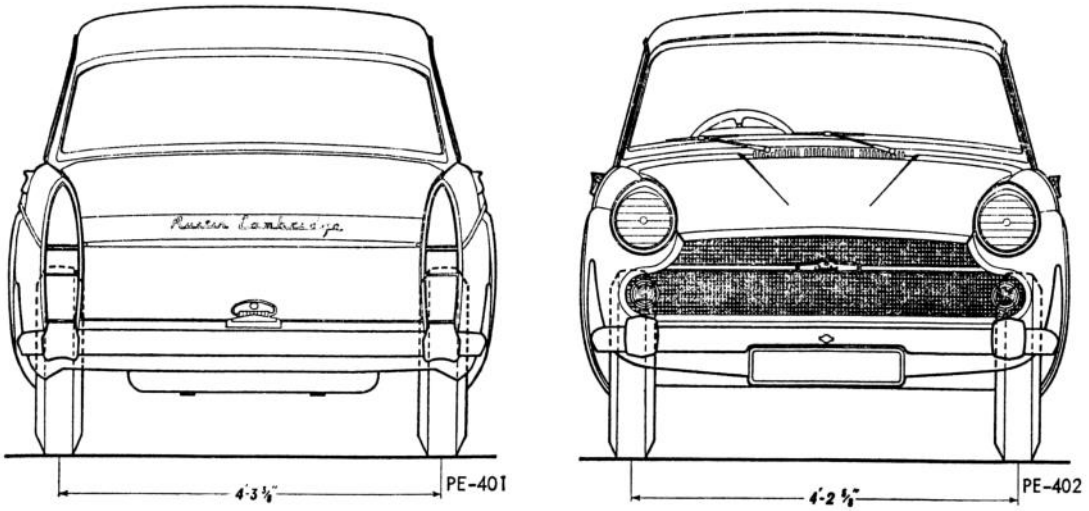


Fig. 14. BMC ADO.38, front and rear elevation, typical (Austin shown)

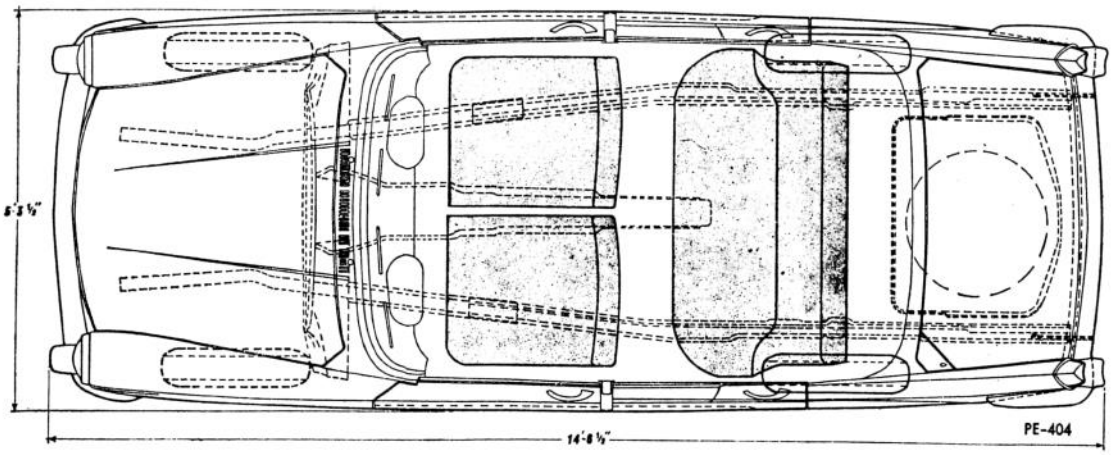


Fig. 15. BMC ADO.38, plan view, typical (Austin shown)

Dimensions and Weights

EXTERIOR DIMENSIONS

	Austin/Morris/Wolseley	*MG/Riley*	*Estate Cars*
Wheelbase:	100¼in	100¼in	100¼in
Track, front:	50 5/8in	50 5/8in	50 5/8in
Track, rear:	51 3/8in	51 3/8in	51 3/8in
Overall length:	174½in	178 1/8in	177½in
Overall width:	63½in	63½in	63½in
Overall height:	58 7/8in	58 7/8in	59 5/8in
Ground clearance (unladen):	6½in	6½in	6½in
Turning circle:	37ft	37ft	37ft

INTERIOR DIMENSIONS

	Saloons	*Estate Cars*
Pedal to front of seat (maximum):	20in	20in
Steering wheel to seat:	6 in*	6in*
Steering wheel to seat back-rest (maximum):	18in†	18in†
Height over front seat:	37½in	37½in
Maximum adjustment of front seat:	4½in	5in
Depth of front seat:	18in	18in
Height of front seat back-rest:	20in	20in
Front seat back-rest to rear seat (maximum):	14in	15in
Height over rear seat:	34½in	35in
Height of rear seat:	14½in	17in
Depth of rear seat:	18in	19½in
Height of rear seat/back-rest:	21in	18¼in
Height of luggage compartment:	23 7/8in	35½in‡
Width of luggage compartment:	57¼in	50 3/8in
Depth of luggage compartment:	31in	39 (61⅜‡) in
Width of front door opening:	34in	34in
Width of rear (side) door opening:	26in	26in
Width of rear door opening:	—	41in

*Later models 5½in. †Later models 16½in. ‡Maximum, with seat folded.

WEIGHTS

	Kerbside (approx)	*GVW*	*Distribution* front/rear*
Austin Cambridge:	2471lb	3330lb	52/48
Countryman:	2612lb	3476lb	49·5/50·5
Morris Oxford:	2483lb	3330lb	53·6/46·4
Traveller:	2604lb	3476lb	49·4/50·6
MG Magnette:	2513lb	3337lb	55/45
Riley 4/72:	2513lb	3337lb	55/45
Wolseley 16/60:	2472lb	3337lb	53/47

Maximum permissible towing weight (for 1 in 8 gradient in bottom gear): 2240lb.
*At Kerbside weight, in %.

Technical Specifications

ENGINE

	Single carb.	*Twin carb.*
Series designation:	BMC 'B'	
Model designation:	16AMW, 16C*	16GE, 16RA**
Application:	Austin, Morris, Wolseley	MG, Riley
Type:	four-stroke petrol, in line, water-cooled	
Number of cylinders:	four	
Valve arrangement:	overhead, pushrod-operated	
Bore and Stroke (in):	3·00×3·5	
(mm):	76·2×88·9	
Cubic capacity (cu in):	99·5	
(cc):	1622	
Compression ratio, high	8·3:1	
low	7·2:1	N.A.
Maximum bhp at rpm, gross, 8·3 C.R.:	63 at 4500	71 at 5000
7·2 C.R.:	58 at 4500	N.A.
net, 8·3 C.R.:	61 at 4500	68 at 5000
7·2 C.R.:	56 at 4500	N.A.
Maximum bmep at rpm (lb/sq in),		
8·3 C.R.:	138 at 2100	136 at 2500
7·2 C.R.:	128 at 2000	N.A.
Maximum torque at rpm (ft lb),		
8·3 C.R.:	90 at 2100	89 at 2500
7·2 C.R.:	83 at 2000	N.A.
Mean piston speed at max. bhp (ft/min):	2625	2915
Top gear mph at 1000 rpm:	16·62	
Carburettor(s), make and model:	SU HS2	SU HD4
number	one	two

* Later – 16KAMW, 16AA, 16CA, 16CB. ** Later – 16 GF.

TRANSMISSION

Manual Transmission	
Clutch, type:	sdp 8-in
make and model:	Borg & Beck A6–G
Gearbox, type:	4F1R (s/m on 2nd, 3rd and top)
Gear ratios to 1, first gear:	3·636
second gear:	2·214
third gear:	1·374
top gear:	1·000
reverse:	4·755
Final drive, type:	hypoid
gear ratio to 1:	4.30 or 4.55*

	4·30:1 final drive	*4·55:1 final drive**
Overall gear ratios to 1, first gear:	15·64	16·55
second gear:	9·52	10·08
third gear:	5·91	6·25
top gear:	4·30	4·55
reverse:	20·45	21 64

*Estate cars, late 1961: Austin Countryman up to Car No A/HW9–8663, Morris Traveller up to Car No. M/HW5–8739

Automatic Transmission (optional)

Make and type:	Borg-Warner Model '35', hydraulic torque converter and planetary gear train providing three forward ratios and reverse.
Control:	selector on steering column (LDNRP)
Transmission ratios to 1, first	2·39
second	1·45
third	1·00
reverse	2·09
Final drive:	hypoid, ratio 4·30 to 1

CHASSIS

Chassis construction:	Unitary body-cum-chassis
Suspension, front:	independent with wishbones, coil springs and torsion bar stabilizer
rear:	semi-elliptical leaf springs
Shock absorbers, front and rear:	Armstrong hydraulic, lever type
Steering gear, type:	cam and peg
ratio to 1, early models:	14–12–14
later models:	15–13½–15
wheel diameter:	17·0in
number of turns, from lock to lock:	2·9
Wheels, type:	ventilated steel disc, 4-stud fixing
rim size:	4J×14
Tyres, type and size,	
Saloons, standard:	5·90–14 Dunlop tubeless
optional	165–14 Dunlop SP
Estate Cars, standard	5·90–14 HD Dunlop tubeless
optional	165–14 Dunlop SP
Tyre pressures:	see pages 21–22
Brakes, make and type:	Girling hydraulic drum brakes
front:	two leading shoes
rear:	single leading shoe
dimensions, drum diameter:	9in
linings, front	8·625×2·5in
rear	8·625×1·75in
lining area, front:	86·25sq in
rear;	60·4sq in
lining material:	Ferodo AM.3

ELECTRICAL EQUIPMENT

Electrical system:	12 volts
Battery:	Lucas, 12 volts
Capacity at 20-hr rate:	models BT9A, BTZ9A: 58 Ah models BTHA, BTZHA: 72 Ah
Earthing:	positive
Ignition:	coil

THEORETICAL ROAD SPEEDS

(*Road speeds in mph, piston speeds in ft/min*)

Austin, Morris, Wolseley

	rpm	*1st gear*	*2nd gear*	*3rd gear*	*top gear*	*mean piston speed*
(*a*)	1000	4·57	7·50	12·09	16·62	583
(*b*)	2100	9·60	15·75	25·39	34·90	1224
(*c*)	4500	20·56	33·75	54·40	74·79	2625

(*b*)=engine rpm at maximum torque.
(*c*)=engine rpm at maximum power.

MG, Riley

	rpm	*1st gear*	*2nd gear*	*3rd gear*	*top gear*	*mean piston speed*
(*a*)	1000	4·57	7·50	12·09	16·62	583
(*b*)	2500	11·42	18·75	30·22	41·55	1457
(*c*)	5000	22·85	37·50	60·45	83·10	2915

(*b*)=engine rpm at maximum torque.
(*c*)=engine rpm at maximum power.

PERFORMANCE FIGURES

NOTE: These figures are approximate and should be considered to be fair averages.

	Austin, Morris, Wolseley	*MG, Riley*
Maximum speed:	82mph	88mph
Cruising speed:	65mph	70mph
Cruising range:	250miles	250miles
Speed in gears (max.) first	25mph	25mph
second	40mph	45mph
third	63mph	70mph
Fuel consumption, approx.	25mpg	25mpg

Lubrication and Maintenance

Running-in period (first 500 miles): During the first 500 miles do not exceed 45mph in top gear or corresponding speeds in lower gears. After this period the speeds may be progressively increased. Maximum speeds must not be maintained for long periods. Avoid long periods of idling and avoid over-revving the engine; change down to a lower gear (if manual gearbox fitted) and avoid fierce acceleration.

GENERAL DATA

Engine: Sump capacity, including filter 7½ Imp. pints (9 US pints).
Oil viscosity, all temperatures above — 12°C (10°F): SAE 20W/50
— 18° to −7°C (0°–20°F): SAE 10W/30 or 10W/40
below — 18°C (0°F): SAE 5W/20 or 5W/30
Oil dipstick: at right-hand side of engine.

Oil filter: Full-flow replaceable-element type. Fit new filter element at every engine oil change. Unscrew the central bolt and remove the filter bowl, extract the filter element and clean the bowl in petrol. Refit with a new element and sealing ring and ensure that the sealing ring is correctly positioned before tightening the fixing bolt. Fill casing up with oil before reinstallation, during which the head of the fixing bolt should be firmly held against the bottom of the casing. The oil capacity of the filter is 1¼ Imp. pint (1·5 US pint). BMC Part No. for element: 8G683 (AC AC32A, Fram CH814PL, Purolator MF.21A/1 (felt element: CE.176A), Tecalemit FG2471).

Air cleaner: Either a dry type or oil-bath type air cleaner may be fitted. The oil-bath type should be serviced at 3000-mile intervals. After removing the filter assembly, take out the filter gauze, wash it in petrol or paraffin. Drain and let it dry before replacing. Clean the filter bowl and refill with fresh oil (as for engine) up to the level mark. Maintenance of the dry type is confined to renewing the paper element at 12,000-mile intervals.

Carburettor(s): At regular intervals (at least at every 3000-mile service) the oil level in the damper dashpot(s) should be checked and topped up if necessary. Unscrew and remove each damper unit and pour oil into the hollow piston rod until the level is ½in from the top. It is advisable from time to time to clear the suction chamber(s) and piston(s). Dismantle and clean the main inside bore of the suction chamber and the outside diameter of the piston with a clean rag moistened in fuel. Reassemble with a few spots of thin oil on the piston rod only. Refill damper reservoir. Use engine oil SAE 10W/30.

Water pump: To lubricate the water pump, remove the plug from the housing and inject a small quantity of lithium-base multi-purpose grease. Do not over lubricate.

Cooling system: Capacity, with heater: 9½ Imp. pints (11·5 US pints). The extra capacity of the heater is ½ pint. The system is pressurized and care should be taken when removing the filler cap. A thermostat is fitted in the water outlet of the cylinder head. The drain cock for the radiator is situated at the left-hand side of the radiator bottom tank; the drain cock for the cylinder block is located on the right-hand side of the engine, at the rear. Owing to its location the heater cannot be drained by these two drain cocks.

In winter, when freezing conditions are encountered, anti-freeze should be used, especially if a heater is fitted. Use at least 2 Imp. pints (2·4 US pints) of anti-freeze, which should be of the ethylene glycol type incorporating the correct type of corrosion inhibitor. The anti-freeze should conform to specifications B.S. 3151 or B.S. 3152. Do not use this solution in the windscreen washer system.

Steering box: The filler plug is situated on top of the casing. Clean area around the plug before removing it. The correct oil level is flush with the bottom of the filler hole. Top-up if necessary with gear oil SAE 90EP; below −12°C (10°F) SAE 80EP.

Steering idler box: Top-up if necessary with gear oil. Oil recommendations as for steering box. Clean area around plug before removing it.

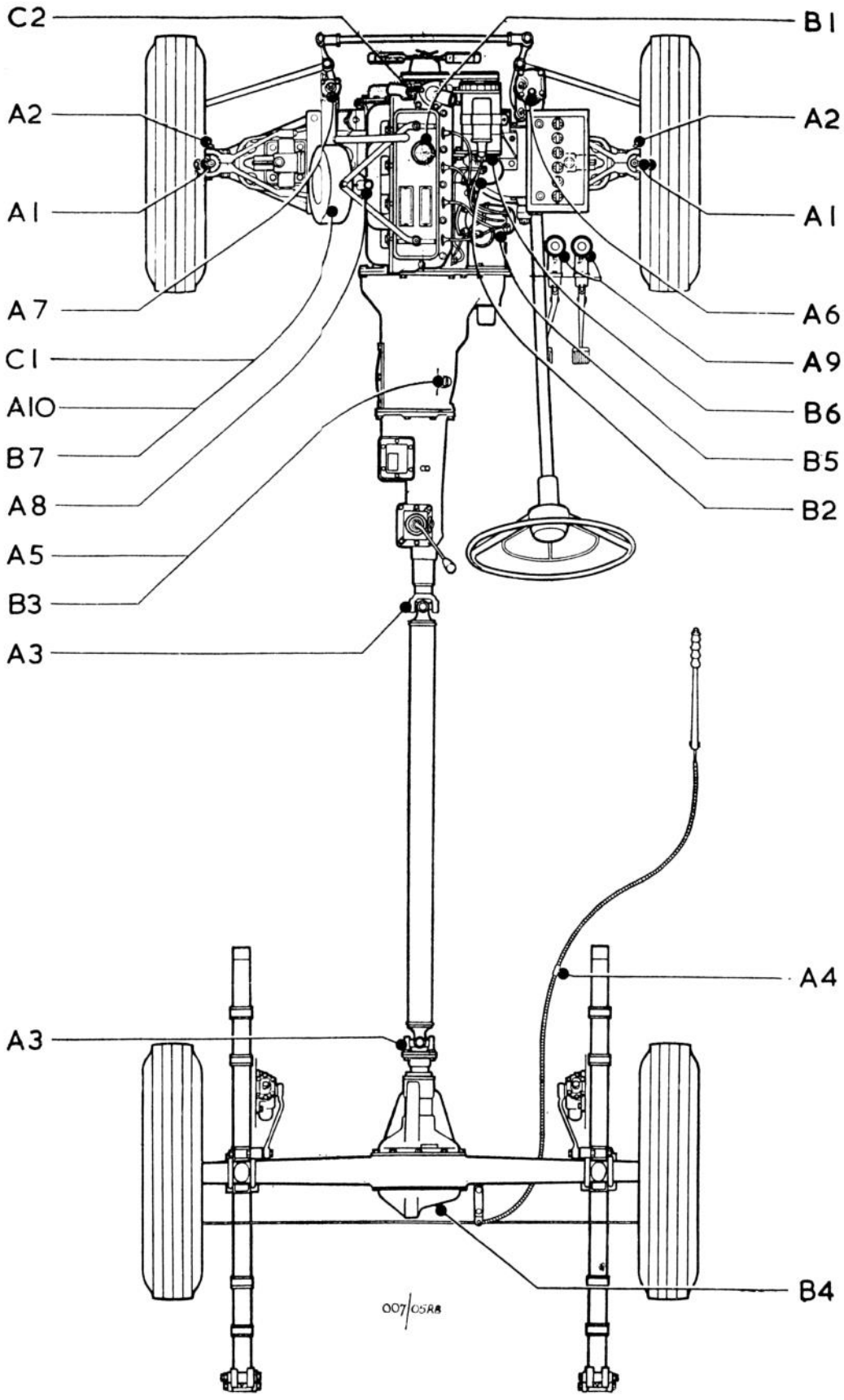


Fig. 16. Lubrication chart

Gearbox: To reach the combined dipstick and filler plug, lift the covering on top of the gearbox and remove the rubber cover from the aperture in the floor. Clean area around dipstick before removing it. Top up if necessary to 'HIGH' mark on dipstick with engine oil (as for engine sump). Current recommendations do not call for periodic oil changes.
Oil capacity: 4½ Imp. pints (5·5 US pints).

Automatic transmission (Borg-Warner, if fitted)

Fluid capacity: 11 Imp. pints (13·2 US pints), including 5¼ Imp. pints (6 US pints) in torque converter.
Recommended fluid: Automatic Transmission Fluid Type A, Suffix A.
Filler tube: The filler tube with breather is on the right-hand side of the transmission and extends into the engine compartment, just forward of the bulkhead.
Dipstick: The dipstick is located in the filler tube. The difference between the 'LOW' and 'HIGH' marks is 1 Imp. pint (1·2 US pints).
Checking fluid level and topping up—every 3000 miles.

NOTE: Scrupulous cleanliness is essential during this procedure. Drive the car on to a level surface with engine and transmission at normal running temperature. Select position 'P' and allow the engine to idle for two minutes. With the engine still idling in 'P', withdraw the dipstick from the filler tube and wipe it with a clean, lint-free cloth or paper. Insert the dipstick again and withdraw it immediately. If necessary add fluid to bring the level to the 'HIGH' mark. Do not overfill. Frequent need for topping-up indicates leakage, which should be rectified immediately in order to prevent damage to the transmission.

Rear axle/differential: The combined oil filler and level plug is located on the rear side of the axle housing. Clean area around plug before removing it and top-up if necessary to bottom of filler plug aperture, with gear oil SAE 90 EP; below 10°F (−12°C) SAE 80 EP.

Do not overfill; after topping-up allow time for any surplus oil to run out, should too much have been injected. The oil drain plug is at the bottom of the housing.
Oil capacity: 2·25 Imp pints (2·7 US pints).

Grease nipples: There are seven or nine grease nipples according to the model, and their location can be found on the lubrication chart diagram (Fig. 16). The two grease nipples on the propeller shaft universal joints are only fitted on models produced up to September 1964. When lubricating the steering swivels, it is best to jack the front wheels clear of the ground as the grease is then able to penetrate properly around the pivot bushes.

Brake and clutch system: The brake and clutch hydraulic cylinder supply reservoirs are located at the steering column side of the engine compartment. They should be topped-up to half an inch below the bottom of the filler cap if necessary. Use Castrol Girling Brake and Clutch Fluid (works recommendation), or, alternatively, a fluid conforming to specification SAE 70 R3.

TYRES

Tyre size, Saloons	5·90–14	165–14 (Optional)
Estate Cars	5·90–14 HD	,,
Tyre pressures (cold; lb/sq in)		
Saloons, front	23	24
rear	25	26

Estate Cars, normal, front	20	24
rear	24	26
fully laden, front	22	26
rear	32	36

ROUTINE MAINTENANCE

Daily: Check engine oil level, fuel tank, lights, tyres.

Weekly: Check tyre pressures, cooling system, battery electrolyte.

A. Every 3000 Miles or 3 months

A1 to A4 incl.: lubricate with grease gun:

A1. Swivel pins (4 nipples, jack up front wheels).
A2. Lower suspension arm outer pivots (2 nipples).
A3. Propeller shaft universal joints (2 nipples, if fitted).
A4. Parking brake cable (1 nipple).
A5. Automatic transmission (if fitted): check fluid level, top up if necessary.
A6. Steering box: check oil level, top up if necessary.
A7. Steering idler box: check oil level, top up if necessary.
A8. Carburettor(s): top up dashpot(s) with engine oil, lubricate linkage joints with engine oil.
A9. Brake and clutch fluid reservoirs: check fluid level, top up if necessary.
A10. Air cleaner, oil bath type (M.G. Magnette IV, Riley 4/72): clean gauze element and refill bowl with fresh engine oil.

Automatic transmission selector linkage: lubricate.
Brake system: check for leaks; adjust brakes if necessary.
Headlights: check beam setting.

B. Every 6000 Miles or 6 months

B1. Engine sump: drain (when hot) and refill.
B2. Engine oil filter: clean housing and renew element.
B3. Gearbox (manual): check oil level, top up if necessary.
B4. Rear Axle/Differential: check oil level, top up if necessary.
B5. Ignition distributor: remove rotor and apply a few drops of engine oil on screw thus exposed, one drop on breaker arm pivot and a few drops on the automatic advance mechanism through gap round cam spindle. Lightly smear cam profile with grease or oil.
B6. Generator: lubricate rear bearing with engine oil.
B7. Air cleaner (dry type): clean paper element cautiously (earlier recommendation).

Bodywork: lubricate door locks, hinges, catches, etc., with a few drops of engine oil. Valve clearances, automatic advance mechanism, contact breaker points, spark plugs, fan belt, fuel pump filter, automatic transmission selector, lights, battery specific gravity, front wheel alignment: check and if necessary clean and/or adjust.

C. Every 12,000 miles or 12 months

C1. Air cleaner (dry type): replace paper element.
C2. Water pump (if plug fitted): lubricate sparingly with grease (remove plug).

Crankcase closed breathing system (if fitted): change oil filler cap, clean breather valve.

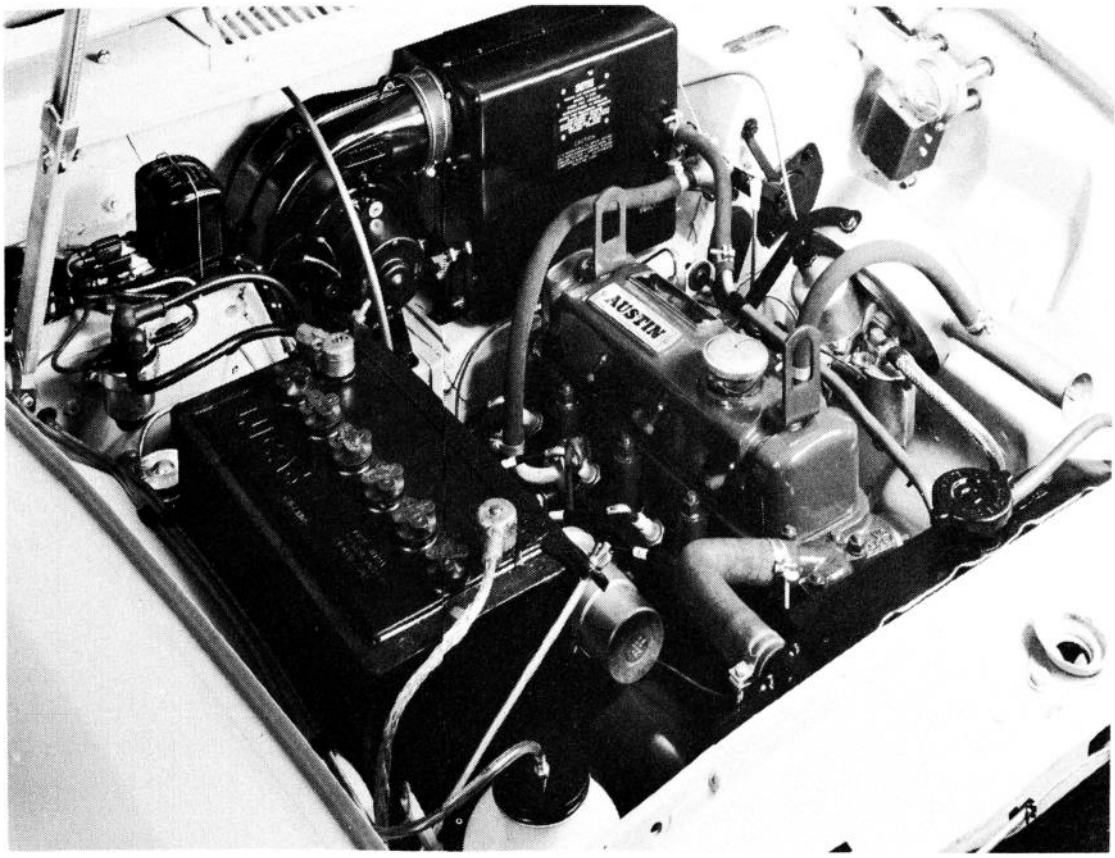


Fig. 17. Typical under-bonnet view (Austin shown)

Spark plugs: renew.
Steering mechanism and suspension: check moving parts for wear.
Brake system: inspect and blow out drums with compressed air.
Rear road springs: check seat bolts.

NOTE: Drain, refill and bleed hydraulic brake system every 24,000 miles or 18 months. Overhaul complete system every 40,000 miles or 3 years.

Repair Data

Repairs are best performed by authorized BMC dealers who possess the necessary experience and special tools. These data were compiled from the official Workshop Manuals and other publications, supplied through the courtesy of The British Motor Corporation Limited, Cowley, Oxford, and Longbridge, Birmingham, England.

ENGINE

Description: 1622cc water-cooled four-cylinder in line four-stroke petrol engine with push-rod operated ohv mechanism, built in unit with clutch and gearbox and mounted longitudinally in the front of the vehicle by means of three flexible rubber mountings.

The engine can be removed from the vehicle, leaving the gearbox in place.

The pressurized engine cooling system incorporates a radiator, placed transversely in front of the engine, a thermostat of the bellows-type and an impeller-type

water pump carrying a four-bladed fan, which is driven in tandem with the generator by a V-belt from the crankshaft pulley; V-belt adjustment is obtained in the conventional manner by loosening the generator mountings and pivoting it away from or toward the engine as necessary.

A relief valve is incorporated in the radiator filler cap which controls the pressure in the system at approximately 7lb/sq in. The thermostat is housed in the cooling water outlet pipe flange on the forward end of the cylinder head and serves to provide quick engine warm-up when starting from cold and to maintain the required engine operating temperature under all circumstances.

The cast-iron cylinder head, incorporating the ohv mechanism, is attached to the cylinder block by means of studs and stud nuts, and is fitted with replaceable valve guides and valve seat inserts.

The valves on Austin, Morris and Wolseley models are fitted with single valve springs and are kept in place in the conventional BMC manner by means of semi-circular valve keys, which are secured by hairpin type circlips. MG and Riley engines have double valve springs. The stems of the valves are fitted with 'O'-ring type oil seals which prevent oil entering the combustion chamber by the vacuum created when the pistons are on the induction stroke.

The hollow steel valve rocker shaft is attached to the cylinder head by means of four detachable valve rocker shaft supports; the cast-iron valve rockers are assembled on the valve rocker shaft; each valve rocker is thrust against its adjacent rocker shaft support by the action of light spacing springs. Each valve rocker is fitted with a spherical stud and locking nut to adjust the valve rocker to valve stem clearance in the conventional manner.

The action of the camshaft is transmitted to the overhead valve mechanism by means of solid steel valve pushrods and chill-cast valve tappets of the 'barrel' type. The cast steel camshaft is situated in the left hand side of the crankcase and runs in three replaceable steel-backed bearing bushes, lined with white metal. The camshaft end-thrust is taken by a thrust plate between the timing chain sprocket and No. 1 bearing journal face; the thrust-plate, serving as a camshaft locating flange, is secured to the crankcase front mating face by means of three screws. The camshaft is driven from the crankshaft by means of an endless Duplex roller chain. The steel camshaft sprocket is secured to the camshaft by means of a heavy central nut; the crankshaft sprocket is keyed to the crankshaft; its correct lateral position in relation to the camshaft sprocket is obtained by one or more adjustment shims, stacked behind the sprocket.

Chain flutter and vibration is checked by a Reynolds-type hydraulic chain tensioner, which forces a heat-resisting rubber slipper against the chain by the action of the engine oil pressure. The camshaft is provided with a machined skew-gear between the centre and rear bearing journals and from this helix the rotor-type oil pump, situated in the lower crankcase, is driven by means of a short intermediate drive shaft with a corresponding skew-gear. The camshaft also drives the ignition distributor by means of a separate drive shaft. The spigoted ends of the drive shafts run in bearing bores machined directly into the crankcase.

The counterbalanced crankshaft runs in three replaceable steel-backed bearing half-shells, lined with copper-lead; crankshaft lateral thrust and end-float is checked by means of semi-circular steel-backed thrust washers, lined with white-metal; these thrust washers are fitted on both sides of the crankshaft centre main bearing cap and bearing web. The main bearing shells are available in standard and several undersizes.

The I-beam section connecting rods have big ends fitted with replaceable steel-backed bearing shell inserts, lined with copper-lead; the bearing shells are available in standard and several undersizes. At the little end, each connecting rod is fitted with a pinch bolt, which secures the hollow steel piston pin, making the use of piston pin securing circlips in the piston bore unnecessary. The split-skirt-type pistons carry three compression rings and one slotted oil control ring each, all fitted above the offset piston pin bore in the piston.

The full-pressure engine lubrication system comprises a rotor-type oil pump with bolted-on wire gauze pick-up strainer in the lower crankcase, a detachable oil sump, an externally mounted full-flow oil filter unit with replaceable element, and a plunger-type oil pressure relief valve in the rear left-hand side of the crankcase. The relief valve is non-adjustable. The oil filter unit has a built-in pressure relief valve, which opens to allow excess oil to escape if a clogged filter element should make normal filtration impossible and cause excessive pressure build-up; in this case, the filter unit is automatically by-passed and the engine components are then lubricated with unfiltered oil; this condition is indicated by an oil-pressure drop of between 10–15lb/sq in below the normal oil pressure. The oil pump lifts the oil from the sump through the oil strainer and forces it via the oil pressure relief valve and an external pipe on the right-hand side of the crankcase to the full flow oil filter. From the oil filter, the oil is delivered to the main oil gallery, which is a large diameter longitudinal drilling in the crankcase. From the main oil gallery the three main bearings receive their oil. The connecting rod bearings are lubricated in the usual way, the second and third connecting rod bearings receiving oil from the centre main bearing and the first and fourth connecting rod bearings from the front and rear main bearings respectively.

From the front main bearing oil is fed to the front camshaft bearing. The transfer drilling in the crankcase feeds the oil from the front camshaft bearing to the timing chain tensioner, thus lubricating the timing chain and sprockets.

From the centre camshaft bearing, oil is fed to a low-pressure oil gallery in the left-hand side of the crankcase; oil from this gallery lubricates the oil pump drive shaft.

The rear camshaft bearing is lubricated by oil from the rear main bearing. From the rear camshaft bearing, oil under reduced pressure is fed to the hollow rear rocker shaft support and into the hollow valve rocker shaft. Each valve rocker is provided with two oil holes, one squirt hole for the valve stem top and the valve springs, the other for the pushrod ball cup. Oil flowing down from the cylinder head lubricates the valve pushrods and tappets on its way back to the sump. The connecting rod big end bearings are drilled for additional cylinder wall lubrication; the piston pins are lubricated by splash. The fuel system of the Austin, Morris and Wolseley models comprises a rear mounted fuel tank, an electrically operated SU fuel pump and a semi-downdraught SU type HS2 carburettor with air cleaner assembly. The carburettor on these models is mounted on the inlet manifold, which is a separate casting, bolted to the cast iron exhaust manifold forming a so-called 'hot-spot'. On MG and Riley models, twin SU type HS4 semi-downdraught carburettors are fitted to a separate aluminium alloy inlet manifold. The separate cast iron exhaust manifold differs in design from the manifold on single carburettor engines. Single carburettor engines are fitted with a dry type or oil bath type air cleaner. The dry type air cleaner incorporates a replaceable paper filter element, whereas the oil bath type air cleaner element can be washed out. On twin carburettor engines a larger air cleaner is fitted on top of the valve rocker cover. To the air

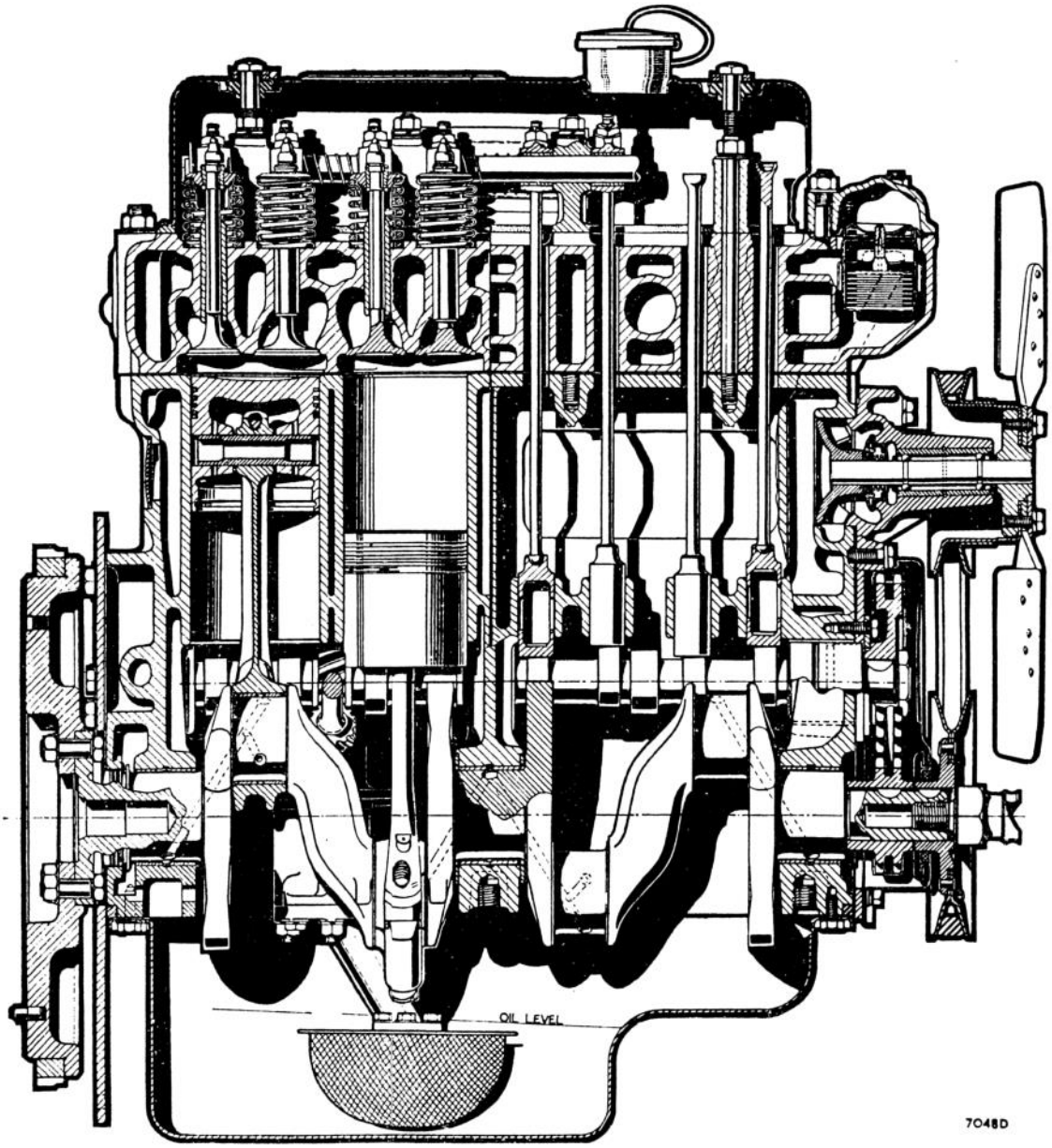


Fig. 18. Engine, longitudinal section (*published by courtesy of BMC Service Ltd*)

intakes of the carburettors a one-piece aluminium alloy air inlet duct is fitted having a large central opening which connects with the oil bath type air cleaner duct.

Crankcase ventilation is obtained by means of a road-draught tube; this is a tube fitted to the rearmost tappet cover or engine side plate, the lower end of the tube protruding underneath the car; the atmospheric depression prevailing beneath the moving car is used to draw crankcase fumes from the engine.

In some export countries the use of a closed or positive crankcase breathing system is compulsory to meet air-pollution regulations. Cars exported to these countries are fitted with such a system, in which the fumes are directed into the air cleaner via a tube connected to the rear of the tappet cover. A regulator valve installed on the inlet manifold regulates the amount of air drawn out, proportional to the engine speed. Cars fitted with this breathing system have a different oil filler

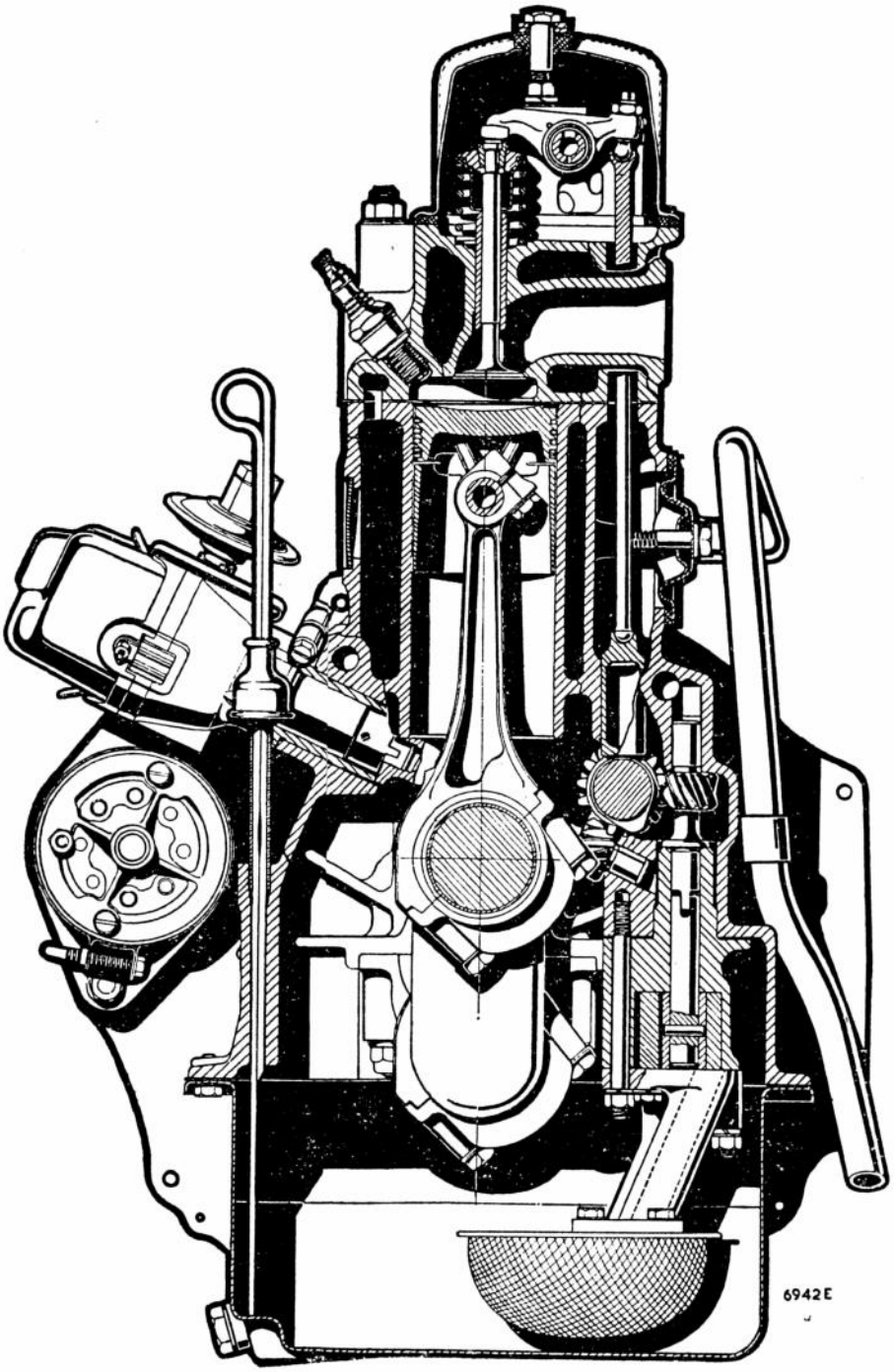


Fig. 19. Engine, cross-sectioned view (*published by courtesy of BMC Service Ltd*)

cap on the valve rocker cover; this cap has a built-in wire gauze filter, through which purified air is drawn into the system.

Power unit, removal and installation: The engine/transmission assembly can be removed as a single unit or together with the front suspension unit, the latter procedure may prove easier in the case of severe accident damage.

Removal of power unit only:

(1) Remove the bonnet from its hinges, disconnect the battery leads and remove the battery together with its support platform.

(2) Drain the engine and gearbox oil and drain the cooling system. Remove the air cleaner and carburettor assembly.
(3) Disconnect the radiator hoses and remove the radiator; disconnect all electrical connections at the wing valances prior to removing the radiator bridge piece.
(4) Disconnect the oil pressure pipe from its adaptor and remove the vacuum line from the support clip under the cylinder head attaching nut. Disconnect the heater hoses.
(5) Disconnect the wiring at the starter motor, the generator, the ignition distributor and coil. On MG and Riley models, disconnect the tachometer drive cable.
(6) Disconnect the water temperature gauge cable at the front of the cylinder head. Drop the exhaust down pipe by releasing its retaining clip at the manifold flange.
(7) On models fitted with a floor type gear lever, remove the rubber dust excluder from around the lever, remove the circlip from the remote control housing and withdraw the gear shift lever.
(8) On cars fitted with steering column gear lever, detach the selector control rod and the shift lever rod from their levers on the gearbox.
(9) From the clutch hydraulic slave cylinder pushrod remove the clevis pin and detach the cylinder, tying it clear and out of the way. Do not disconnect the hydraulic hose or bleeding will be necessary upon re-installation.
(10) Disconnect the speedometer drive cable at the gearbox; mark the position of the propeller shaft rear universal joint flange in relation to the final drive pinion flange and disconnect the coupling. Completely remove the propeller shaft.
(11) Place a rope sling around the engine so that when lifting the power unit will be at a sharp angle with the car. Take the weight of the engine in the tackle and check that all wiring, hose and control connections have been disconnected.
(12) Unscrew the engine front mounting bolts and nuts and remove the engine front mountings. Support the gearbox with a jack and remove the rear cross member from the underbody.
(13) Detach the engine stabilizer rod from its rubber mounting on the gearbox extension housing and unscrew the bolts securing the gearbox mounting rubbers to the cross member.
(14) Remove the jack from under the car; carefully hoist the unit and remove it from the car, taking care not to damage the gearbox extension housing.

Power unit installation: Installation is a direct reversal of the removal procedure; attention should be paid to the following:

Once the engine has been installed, determine the amount of gap between the engine and its mountings after having rocked the engine, allowing it to settle. There should now be a definite gap between each front mounting and the engine; if necessary adjust by installing shims; shims for this purpose are available in two thicknesses: 0·036 and 0·048in.

Removal of power unit together with front suspension: Proceed as outlined in the above paragraph until item 10; then carry on as follows:
(1) Disconnect the parking brake connection at its bracket. Detach the hydraulic brake pipes at their unions on the wing valance and remove the steering track rods from their respective levers.
(2) Support the gearbox on a trolley jack and unscrew the four nuts securing the suspension unit to the car underbody. Remove the bolts securing the gearbox cross member to the underbody.

(3) Attach a suitable tackle to the front of the car and lift the body; the complete suspension unit with engine and gearbox can now be removed from under the car.

Installation of power unit together with front suspension: Installation is a reversal of the removal operation. After installation, do not forget to bleed the brake system.

Dismantling the engine: After having removed the engine unit from the vehicle and separated it from the gearbox, dismantling is effected as follows:

First strip the engine of its ancillary equipment such as the distributor, the external oil filter unit and pipe, the water pump, the inlet and exhaust manifold, the generator and ignition coil, etc. Discard all gaskets.

Remove the clutch assembly by gradually slackening the clutch housing to flywheel securing bolts in a diagonal sequence.

Remove the valve rocker cover and gradually loosen all cylinder head stud nuts in the sequence indicated on page 78.

NOTE: *The rocker shaft support outer nuts are included in the cylinder head nut tightening sequence; therefore the rocker shaft assembly must not be removed without first loosening all cylinder head nuts.*

Remove the valve rocker shaft assembly and withdraw the valve pushrods, keeping them in the sequence of removal to ensure replacement in their original positions. If necessary the rocker shaft may be dismantled by withdrawing the grub screw which locates the shaft in the rearmost rocker shaft support; then remove the split pins, the plain washers and the spring washers, after which the valve rockers, the spacing springs and shaft supports can be slid off the shaft. Remove the cylinder head by carefully lifting it from the studs; then remove and discard the cylinder head gasket.

If necessary the valve assemblies can be removed, removing the circlip and compressing the valve spring retainer washers with a suitable valve spring compressing tool; when the valve springs are compressed with the valve on its seat, the split cotter-type keys can be removed.

Allow the valve springs to expand and from each valve stem remove the valve spring upper seating washer (the inner valve spring shroud on Riley and MG), the valve spring(s), the O-ring type oil seal, and finally the spring lower seating washer, in that order; then remove the valve. Be sure to keep the valves in order so that they are reinstalled in their original positions. Remove both engine side covers or tappet covers and discard their cork gaskets. Lift the valve tappets from their bores and keep them in the sequence of removal to ensure correct replacement.

With the aid of a suitable spanner, remove the crankshaft pulley attaching bolt after having knocked back its locking plate tab. The bolt has normal (right-hand) thread. In most cases the pulley will come off without having to use an extractor. Remove the pulley and the woodruff key. Remove the engine sump and unscrew the oil pump to crankcase securing nuts. Withdraw the oil pump and pick-up strainer assembly; in most cases the oil pump drive spindle will drop out of its bore; if not, give a rotary pull with suitable needle-nosed pliers to pull it out of mesh with the camshaft skew gear.

If not already done, remove the distributor drive spindle by screwing a tappet cover bolt into the tapped spindle hole; with this bolt the spindle can be easily withdrawn.

From the rear left-hand side of the crankcase, remove the tachometer drive cable adaptor flange and withdraw the drive gear (Riley only).

Remove the timing chain cover with its gasket and remove the concave oil thrower disc from the crankshaft.

Remove the bottom plug from the timing chain tensioner body and insert a 1/8in Allen key; turn the key clockwise until the friction pad is fully retracted; then remove the tensioner body with its backing plate. Unlock the camshaft sprocket nut and lock washer and with the aid of two small levers, ease each sprocket forward, a fraction at a time and remove the assembly.

Remove the woodruff key from the crankshaft and slide off the crankshaft sprocket alignment shim; make a note of its thickness so that the alignment is not unnecessarily disturbed if no related parts are to be replaced. Remove the camshaft thrust/locating flange from the crankcase and carefully withdraw the camshaft, taking care not to damage the bearing shells. Remove the engine front mounting plate with its gasket.

Tap back the tabs of the flywheel securing bolt locking plates, remove the bolts and gently tap the flywheel from its seating. Remove the engine rear mounting plate with its gasket. Withdraw the spigot bearing bush from the crankshaft recess. Ensure that all mounting rods are properly marked in sequence, tap back the connecting rod bearing cap locking plates and remove the bearing cap bolts after having first made markings on the caps and rods to ensure correct replacement. Remove the connecting rod bearing caps and keep the bearing shells with their respective caps. Push the piston and connecting rod assemblies inward and out of the cylinder bores. To remove the rods from the pistons, the pinch bolt in the upper end of the rod should be completely removed.

NOTE: *Do not clamp the rod in a vice as twisting or bending the rod may result. Use the special plugs, which fit in the piston pin bores; with these plugs installed, the assembly can be clamped in a vice without any risk of damage.*

With a dial indicator, check the crankshaft end-float; if correct, be sure to retain the semi-circular thrust-washers, found when removing the centre main bearing cap. Remove the main bearing cap nuts and lift off the bearing caps. When removing the centre main bearing cap, take care of the two semi-circular thrust washers, fitted alongside the cap.

Carefully lift out the crankshaft and remove the upper half main bearing shells and the semi-circular thrust washers from the centre main bearing web.

Thoroughly clean all parts with clean paraffin and dry with compressed air. If to be left stripped down for any length of time, lightly cover with a coating of clean engine oil. Examine all parts for wear, damage or distortion and replace as necessary.

Assembling the engine: Install the valves with lubricated stems into their respective guides, fit the first lower spring seating washer, the valve stem oil seal, the valve spring (double valve springs and inner valve spring shroud on MG and Riley), the valve spring upper seating washer, and compress the spring(s) with a suitable valve spring compressing tool. Insert the split cotters, ensuring that these are properly seated, and secure the keys with the hairpin-type circlip. Repeat the procedure for the remaining valves. Check that the cylinder-head mating face is perfectly clean and ensure that it is not distorted; this can be done with a suitable straight edge.

Assemble the valve rockers, the valve rocker shaft supports and the spacing springs on the rockershaft; lock the shaft in the rearmost support with the grub screw and fit new split pins. Loosen all valve rocker adjustment locknuts and turn

back the adjustment studs. The cylinder head assembly is now ready for installation and should be laid aside.

If removed, install the piston rings into the appropriate ring grooves and arrange their gaps alternately at opposite sides of the piston. Fit the connecting rods to their respective pistons, ensuring that the pinch bolt side of the rod is facing towards the camshaft side of the engine when the stamped marking 'FRONT' on the piston top is facing towards the front of the engine. The pinch bolt should be tightened to 25lb ft with the piston clamped in a vice, using the special holding plugs in the piston pin. (Never clamp the connecting rod in a vice.) With a piston installing tool insert the pistons complete with connecting rods into the cylinder bores from which they were removed. All components and the cylinder bores should be perfectly clean and well lubricated before assembly.

Do not push the assemblies all the way down into the bore; it is sufficient to have the piston tops flush with the cylinder block upper mating face. Thoroughly clean the crankshaft main bearing half bores in the crankcase and install the upper half main bearing shells; used shells must be installed in their original positions. With some grease stick the two upper semi-circular thrust washers (without locating tabs) into the machined groove on each side of the centre main bearing web. If when dismantling the engine the crankshaft end-float was found to be correct, the original thrust-washers should be used. New thrust-washers are available in several thicknesses. Be sure that the lined (soft) side of each washer is facing the crankshaft. Lubricate the main bearing upper half shells liberally with engine oil and place the crankshaft into the block. Install the bearing half shells into their respective main bearing caps and install the caps. At the centre main bearing the thrust-washers should be fitted as outlined for the upper halves. Install the main bearing cap nuts and tighten to a torque of 70 lb ft. Ensure that the assembly can rotate freely.

Push one piston and connecting rod assembly further down into the cylinder bore and install the appropriate connecting rod upper half bearing shell, making sure that the locating tab on the shell is properly seated. Lubricate the bearing shell thoroughly and push down on the piston until the connecting rod seats on the crankpin. Install the bearing lower half shell to the proper connecting rod bearing cap, lubricate thoroughly with engine oil and install the cap, paying attention to the marking made when dismantling. Install a new locking plate and tighten the bearing cap bolt to a torque of 40lb ft. Check that the crankshaft can rotate freely. Install the remaining connecting rod bearings in a similar manner whilst checking frequently for freedom of rotation.

Carefully insert the camshaft, the bearing journals of which should be lubricated liberally with oil.

Install the engine front plate with a new gasket and fit the camshaft locating flange. Insert the oil pump drive spindle and fit the oil pump and pick-up strainer assembly together with a new gasket.

Make sure that the dog on the drive spindle engages with the slot in the oil pump drive shaft.

Tighten the oil pump attaching nuts to a torque of 14ft lb. Install the engine sump with a new gasket after having fitted a new piece of sealing strip, coated with gasket compound, into the recess formed between the engine front mounting plate and the front main bearing cap.

Place the shim(s) found when dismantling over the crankshaft front end. Install the camshaft and the crankshaft sprockets, without the woodruff keys or the

timing chain, on to their respective shafts.

Temporarily fit and tighten the camshaft locating nut and tap the crankshaft sprocket fully home. With a straight edge check the alignment of both sprockets. Any difference can be measured with feeler gauges, after which the thickness of the adjustment shim(s) behind the lower sprocket should be altered accordingly. Remove both sprockets, install both woodruff keys and turn the crankshaft until its key way is exactly at TDC. Turn the camshaft until its key way is approximately in the One o'clock position as seen from the front. Encircle both sprockets with the timing chain; the punch marks in the sprockets should be exactly opposite each other. Keep the sprocket in this position and partially engage the crankshaft sprocket with the key on the crankshaft. Now rotate the camshaft to align its key with the key way in the sprocket and push home fully both sprockets. If removed, install the timing chain tensioner backing plate and secure the tensioner body. Release the pressure pad by inserting an Allen key and turning the plunger clockwise until the pad moves against the chain under spring tension. Install and lock the tensioner bottom plug.

NOTE: *Never turn the tensioner plunger anti-clockwise in an attempt to obtain further tension.*

Install the concave oil thrower disc with the concave side (or side marked 'T') facing outwards to the crankshaft nose and fit the timing cover with a new gasket. Before tightening the cover securing screws, insert the lubricated pulley hub into the oil seal in order to centralize the seal and cover. Install and secure the crankshaft pulley retaining bolt.

Install the engine rear adaptor plate with a new gasket, which should be coated on both sides with gasket compound. Place the flywheel over the locating studs and fit new attaching nut locking plates; tighten the nuts to 40ft lb and bend over the tabs of the locking plates. Install the main drive pinion spigot bearing bush. Insert the valve tappets (coated with engine oil) into the bores from which they were removed; then refit the engine side covers with new cork gaskets. Do not overtighten the cover bolts. Place a new cylinder head gasket over the studs, observing the stamped-in marking 'TOP' (if any), and carefully lower the cylinder head on to the block. Insert the valve push rods into their respective bores and fit the rocker shaft assembly. Gradually tighten the cylinder head stud nuts (including the larger outer rockershaft support nuts) to a torque of 40lb ft*, see page 78.

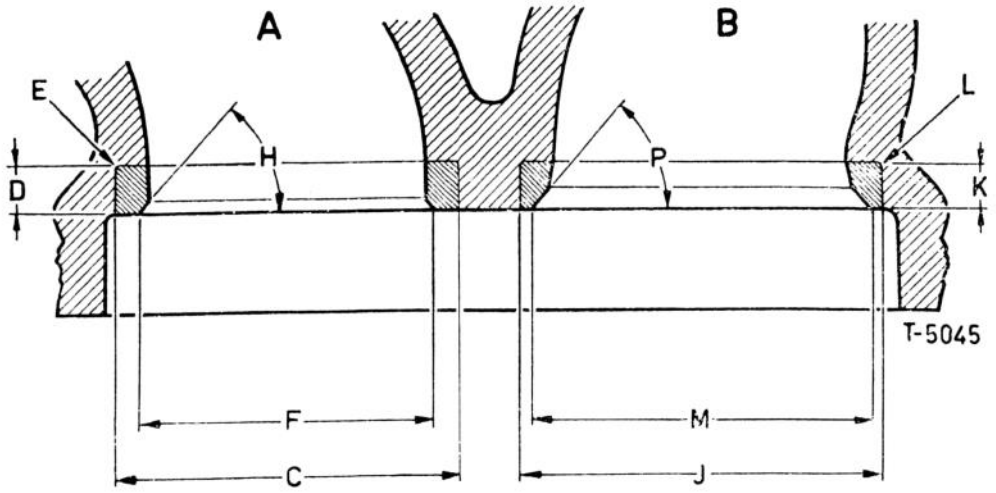
Install the inlet and exhaust manifolds, using a new gasket; tighten the nuts, starting from the centre, to a torque of 15lb ft. Before installing the spark plugs, it is advisable to adjust the valve rocker clearance in accordance with the specifications in *Technical Data*. Finally install the ancillary equipment which will not interfere with easy installation of the engine into the vehicle. When fitting the clutch assembly, centralize the clutch driven plate with a spare main drive pinion shaft, then tighten the securing bolts in a diagonal pattern to a torque of 25lb ft.

* Tighten four inner rocker bracket nuts to 25lb ft.

DETAILED DESCRIPTION OF RECONDITIONING AND SERVICING OF ENGINE COMPONENTS

Cylinder head:

NOTE: *If the valve rocker shaft alone is to be removed, note that all cylinder head nuts must be slackened in the sequence given on page 78. It is therefore essential to drain the cooling system before removal of the valve rocker shaft.*



A Exhaust B Inlet

C	1·312–1·313in	E	Max. radius 0·015in	H	45°	L	Max. radius 0·015in
D	0·186–0·188in	F	1·221–1·241in	J	1·437–1·438in	M	1·396–1·416in
				K	0·186–0·188in	P	45°

Fig. 20. Valve seat inserts, machining dimensions

When dismantling the valve rocker shaft, also remove the screwed plug from the front end of the shaft and clean out the oil passage in the shaft.

The replacement of valve rocker bushes in forged-type valve rockers should be carried out with the aid of Service Tool 18G226. Note that rockers and bushes are very easily ruined by using improvised drifts. When pressing in new bushes, make sure that the split in the new bush coincides with a point just above the oil hole on the adjusting screw side. Once the bush is installed, remove the small plug from the end of the oil hole and drill through the bush with a 0·093in dia drill. With a No. 47 (0·0785in) drill, drill the second oil hole on top of the rocker and drill through the bush. Ream the bush to a diameter of 0·626in. Be sure to replug the oil hole on the adjusting screw side; the new plug should be welded in position.

Valve guides: When new valve guides are to be installed, the old guides must be pressed out towards the combustion chamber side with a suitable drift. New guides must then be pressed in from the top of the cylinder head. The inlet valve guides are shorter than the exhaust valve guides and must be inserted with the end having the largest chamfer at the top, whereas exhaust valve guides should have their counter-bored ends fitted towards the bottom. The valve guides (inlet and exhaust) should be driven into the head until they are 5/8in above the valve spring seating (this is the height of the chamfer). After installation, lap-in the valves as described under *Valve seats.*

Valve seats: If the valve seats show pitting or other irregularities, they can be refaced with the normal workshop cutting tools. These tools however should not be used on hardened steel valve seat inserts; these inserts should be replaced if unserviceable.

Machining dimensions for replacement valve seat inserts are given below. After recutting valve seats, the appropriate valves should be lapped-in by hand, using carborundum grinding paste. After this procedure, the valve seats and ports should be thoroughly cleaned with a petrol-soaked rag and dried with compressed air in order to remove all traces of grinding compound. Fit the valves into their respective bores in liberally lubricated condition.

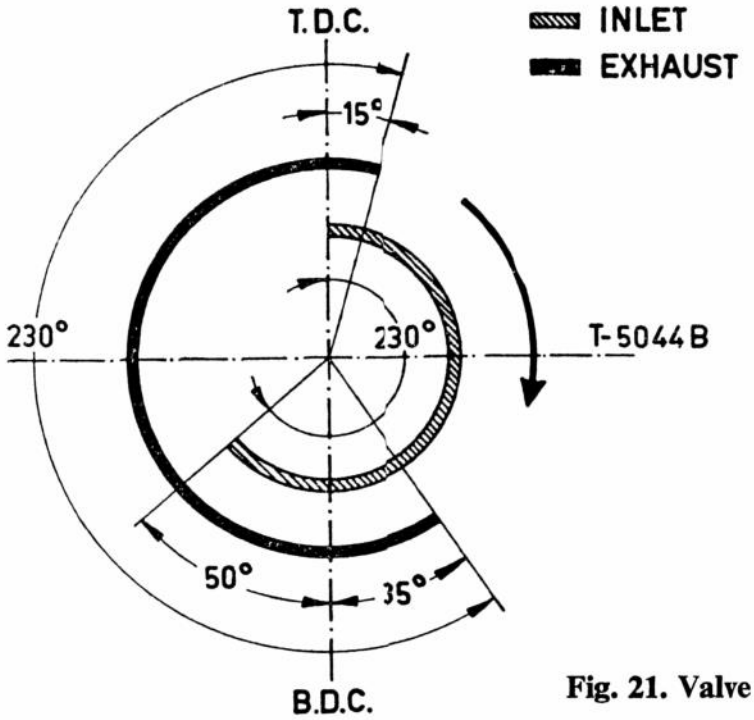


Fig. 21. Valve timing diagram

Cylinder liners: Should the cylinders be worn beyond rebore limits, new dry liners can be installed. If cylinder liners have not been installed previously, the cylinders must be bored out to the dimensions given in Technical Data. If dry liners have already been installed, these should be pressed out with a 5-ton press and a set of suitable pilots. If necessary these pilots can be made from case-hardening steel. After installation of new dry liners, they should be machined and honed to suit the size of the piston to be installed.

Piston and connecting rod assemblies: Pistons for service purposes are available in standard size and in a range of four oversizes. Oversize pistons can be identified by the actual oversize dimension enclosed in an ellipse, stamped on the piston crown. A piston marked 0·020 is suitable only for a bore 0·020in larger than standard; the requisite running clearance is allowed for in the machining.

The piston crowns also bear the marking 'FRONT', which indicates that this side of the piston should face the front of the engine; in this position the connecting rod small end clamp bolt should face towards the camshaft side of the engine. When removing or installing the piston pin, do not clamp the connecting rod in a vice; instead insert the special holding plugs into the ends of the piston pin. With these plugs the assembly can be properly secured without risk of damage.

Piston rings: The piston rings are available in sets of standard and four oversizes, ranging from 0·010 to 0·040in. The second and third compression rings are tapered and marked with a stamped-in letter 'T' (top) for correct assembly. When installing new piston rings. it is recommended to measure their fitted gap; to this end insert a piston approximately 1in into the cylinder bore; then insert the ring on top of the piston. With feeler gauges, measure the ring gap, which should then be between 0·008–0·013in.

Camshaft bearings: If the camshaft bearing bushes become so badly worn that their running clearance becomes excessive, they should be replaced by new, steel-backed, white-metal-lined bearing bushes. Newly pressed-in bearings should be reamed to

give the requisite running clearance as specified in *Technical Data*. It stands to reason that for the above operation the use of special tools is essential.

Valve timing: The valve timing should only be checked when the valve rockers are adjusted to a temporary clearance of 0·021in; after having checked the valve timing, be sure to readjust the valves to their normal working clearances. See *Technical Data*.

Starter ring gear: If the starter ring gear needs replacing, it can be removed by splitting it between two teeth with a cold chisel; to facilitate this, small holes may be drilled through the ring gear in order to perforate it, after which the final break may be done with the chisel.

Make sure that a new ring gear and its seating on the flywheel are perfectly clean and free of burrs, etc.

Heat the ring gear to a temperature of 300° to 400°C (572°–752°F); at this temperature the colour of the ring gear turns to light blue. On no account should the above-mentioned heat limit be exceeded or the temper of the teeth will be adversely affected.

Quickly place the heated ring gear squarely on to its seating with the chamfer of the teeth towards the flywheel boss; when cool, the ring gear will then be a natural 'shrink fit' on its seating, making any additional securing superfluous.

Ignition system: Ignition by battery and coil. The ignition distributor is fitted with a vacuum and centrifugal advance mechanism. After having removed the distributor cap and disconnected the distributor primary lead, the distributor can be withdrawn by removing its two retaining screws from the clamp plate. The distributor timing can be left undisturbed provided the clamp plate pinch bolt is not slackened.

Once the distributor has been removed, the distributor drive spindle with integral gear can be easily withdrawn by screwing a 5/16in dia U.N.F. bolt into the tapped hole of the distributor drive spindle. Before reinstalling the distributor drive spindle, the engine should be set with No. 1 piston at TDC by aligning the notch in the crankshaft pulley with the largest of the fixed pointers on the timing cover, just below the pulley rim. Each smaller fixed pointer represents 5° advance.

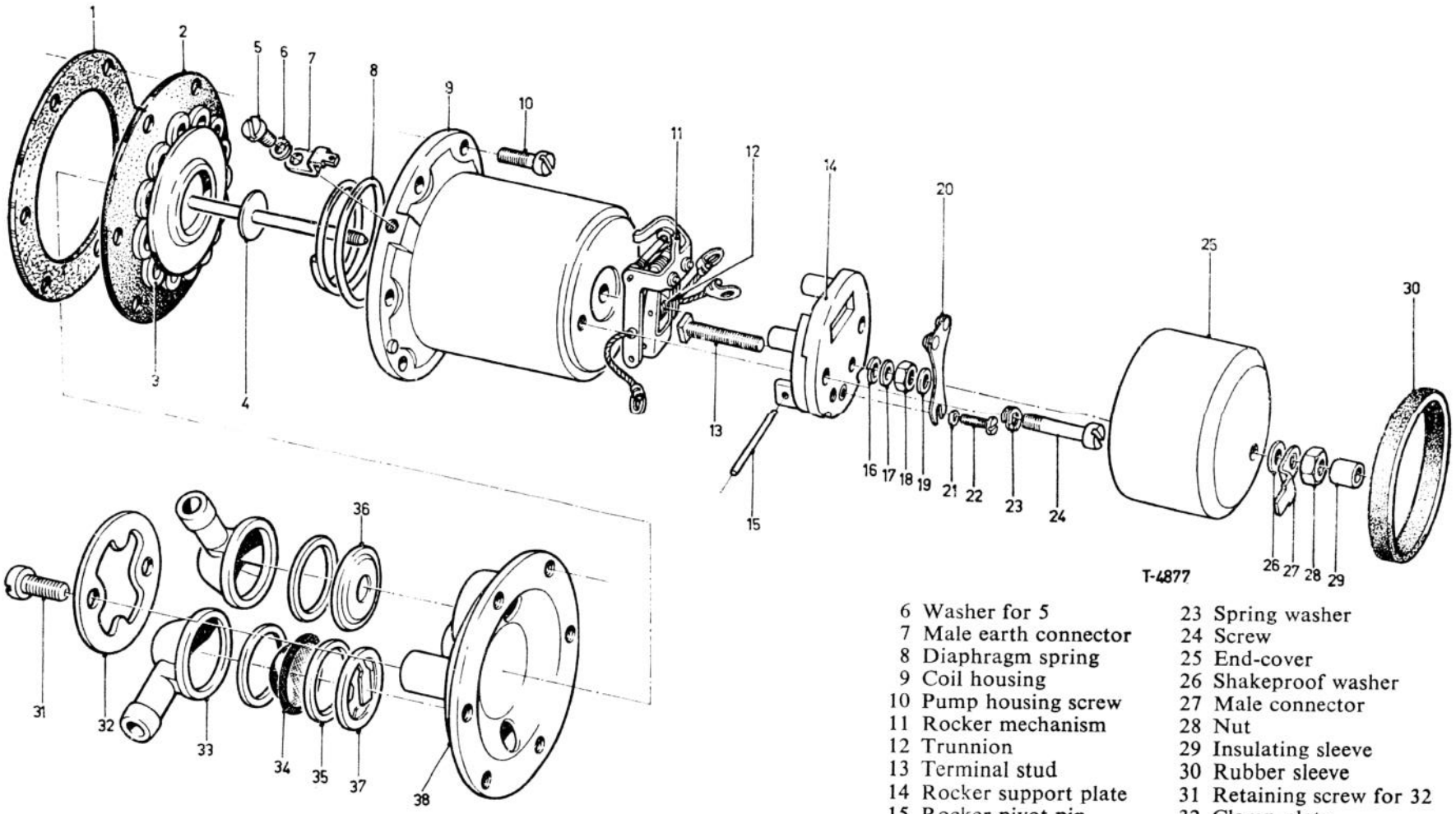
Hold the distributor drive spindle with the slot in its upper portion horizontal, the larger offset uppermost above its bore. As the helical drive gears engage, the slot in the spindle will turn clockwise until the slot is approximately in the one o'clock position.

Align the offset in the distributor shaft drive end with the slot and install; secure it with the attaching bolts and loosen the clamp bolt.

Timing the distributor: If the ignition timing has been disturbed for any reason, the following procedure should be adopted:

Turn the crankshaft through approximately 90° in an anti-clockwise direction, then slowly turn it clockwise until the notch in the crankshaft pulley outer flange lines up with the requisite fixed timing pointer on the timing cover. See *Technical Data*.

The timing pointer consists of three points, the largest of which indicates TDC and each subsequent pointer represents 5 crankshaft degrees of advance. Connect the primary distributor lead and the vacuum line; connect a 12-Volt test lamp between the primary lead on the distributor and a good earth. Turn the knurled vernier adjustment nut on the distributor housing until its scale protrudes half way. Install the rotor, the tip of which should be pointing towards the spark plug segment of No. 1 cylinder inside the distributor cap. Switch on the ignition and



1 Gasket
2 Diaphragm assembly
3 Diaphragm centralizing rollers
4 Collar on diaphragm spindle
5 Earth tag screw
6 Washer for 5
7 Male earth connector
8 Diaphragm spring
9 Coil housing
10 Pump housing screw
11 Rocker mechanism
12 Trunnion
13 Terminal stud
14 Rocker support plate
15 Rocker pivot pin
16 Washer
17 Lead washer
18 Terminal nut
19 Sealing washer
20 Contact blade
21 Washer
22 Contact blade screw
23 Spring washer
24 Screw
25 End-cover
26 Shakeproof washer
27 Male connector
28 Nut
29 Insulating sleeve
30 Rubber sleeve
31 Retaining screw for 32
32 Clamp plate
33 Inlet valve nozzle
34 Filter screen
35 Sealing ring
36 Outlet valve
37 Inlet valve
38 Pump body

Fig. 22. Fuel pump, SU model AUF 200, exploded view

slowly turn the distributor in an anti-clockwise direction until the contact points are fully closed, denoted by the test lamp going out; now slowly turn the distributor in clockwise direction whilst keeping the rotor turned clockwise as far as it will go (in order to take up the slack in the drive) until the contact points just commence to open and the lamp *just* lights up.

Secure the distributor in this position by tightening the clamp plate pinch bolt. Do not forget to switch off the ignition.

The setting can afterwards be altered to some degree by turning the knurled vernier adjustment nut (octane selector nut); the markings on the distributor housing, adjacent to the nut 'A' and 'R', stand for Advance and Retard respectively. It is advisable to check the timing adjustment with the aid of a neon timing light, bearing in mind that in that case the timing will be more advanced if the engine idling speed at which vacuum or centrifugal advance commences should be exceeded.

Fuel pump:

Removal: Disconnect the positive (+) battery lead and the electrical connections at the fuel pump. Disconnect the flexible hoses at the pump.

Remove the two screws securing the pump support bracket to the rear panel.

Installation: Installation is a reversal of the removal procedure; make sure the pump outlet connection is situated vertically above the pump inlet and ensure that the fuel pump is well earthed.

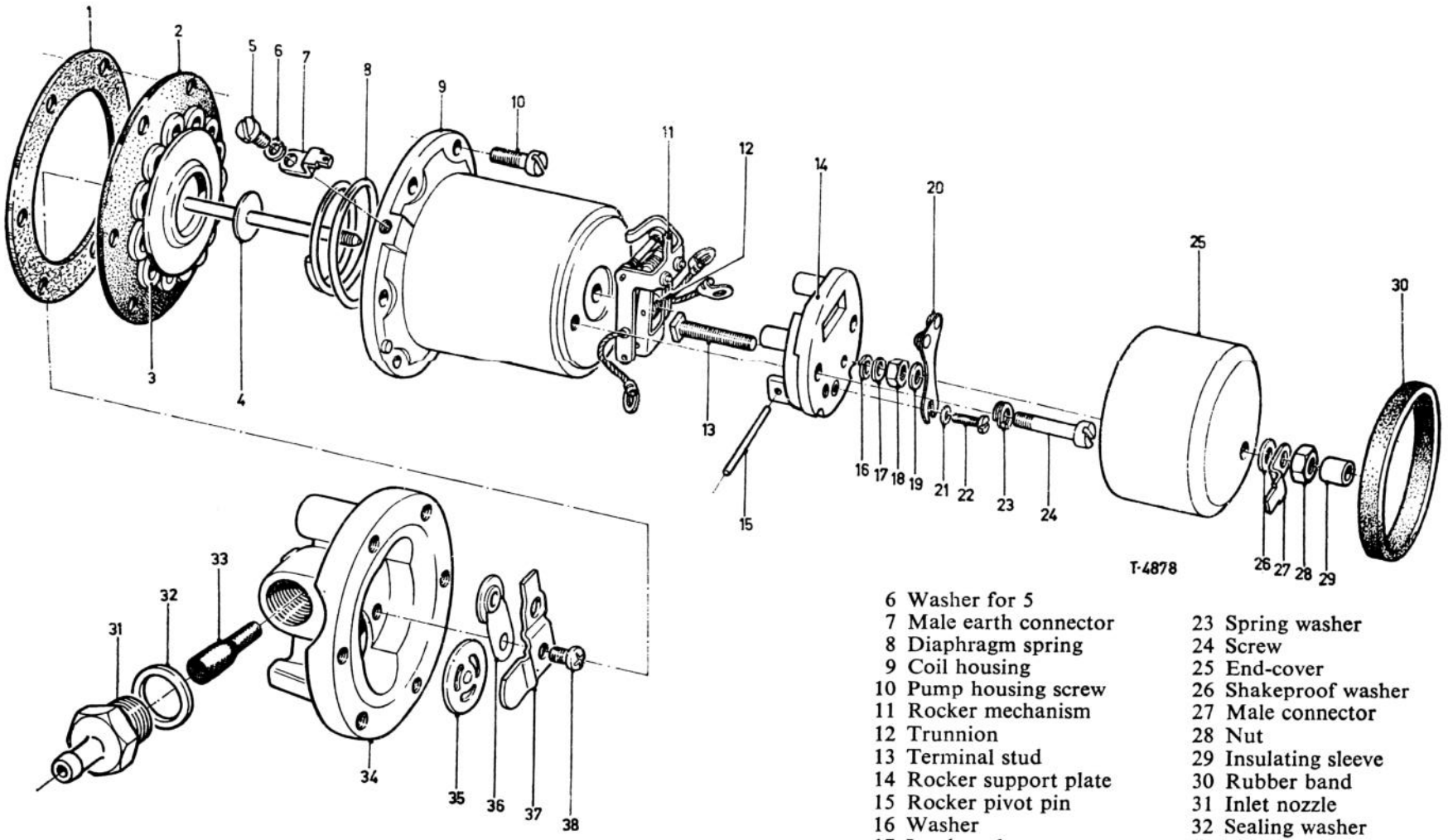
Dismantling: Before dismantling the pump, its exterior should be thoroughly cleaned to avoid contamination of the vital parts. First remove the insulating sleeve, the terminal nut and the connector with its shakeproof washer. Remove the end-cover after having removed the tape seal (if any). Remove the 5 B.A. screw holding the contact blade to the support plate. Withdraw the coil housing screws with a thick-bladed screwdriver to avoid damaging the screw heads. Remove the earthing screw and separate the coil housing from the pump body. Next turn the exposed diaphragm in an anti-clockwise direction until the spring tension pushes the diaphragm away from the coil housing, taking care not to lose the eleven brass rollers. The diaphragm and its spindle form one unit and should not be separated. Remove the terminal nut from the support plate, followed by the lead washer which in most cases must be cut to allow removal. Remove the support plate to coil housing securing screws and remove the earth terminal tag. Tilt the support plate and withdraw the terminal stud from the tag. The support plate together with the rocker mechanism may now be removed. Gently tap the hardened steel pivot pin attaching the rocker mechanism to the support plate. Remove the two screws securing the inlet and outlet connections and remove the connections, the gauze filter and the valves.

Assembly should be preceeded by a thorough examination of all parts, particularly those mentioned below:

Inspect the fuel pump body for cracks, damaged or distorted joint faces or threads. Examine the plastic valve assemblies for distortion, wear or damage; this can best be done by blowing or sucking with the mouth. Check that the valve retaining tab is positioned to retain the valve in the recess but allows a valve lift of approximately 1/16in. If the valve seats are pitted, replace the pump body.

Check that the coil housing vent is unobstructed.

Carefully examine the general condition of the rocker mechanism, replacing those parts that show signs of wear, damage or distortion.



1 Gasket
2 Diaphragm assembly
3 Diaphragm centralizing rollers
4 Collar on diaphragm spindle
5 Earth tag screw
6 Washer for 5
7 Male earth connector
8 Diaphragm spring
9 Coil housing
10 Pump housing screw
11 Rocker mechanism
12 Trunnion
13 Terminal stud
14 Rocker support plate
15 Rocker pivot pin
16 Washer
17 Lead washer
18 Terminal nut
19 Sealing washer
20 Contact blade
21 Washer
22 Contact blade screw
23 Spring washer
24 Screw
25 End-cover
26 Shakeproof washer
27 Male connector
28 Nut
29 Insulating sleeve
30 Rubber band
31 Inlet nozzle
32 Sealing washer
33 Filter
34 Pump housing
35 Outlet valve
36 Inlet valve
37 Valve retainer
38 Screw

Fig. 23. Fuel pump, SU model SP, exploded view

The following parts should always be renewed: Fibre and cork washers, gaskets and O-rings; worn or damaged rollers, damaged bolts and unions.

Assembly:

NOTE: *The hardened steel pivot pin, securing the rocker assembly to the support plate, should only be replaced by a genuine SU part, if necessary.*

Place the support plate upside down and attach the rocker assembly by means of the hardened steel pin. Position the centre toggle in such a manner that when the inner rocker spindle is tensioned against the rear of the contact point, the centre toggle spring is above the spindle accommodating the rollers.

The importance of a completely free-moving rocker mechanism cannot be over-emphasized; any bent parts may be straightened with suitable needle-nosed pliers.

Further assembly of the rocker mechanism is a reversal of the dismantling procedure; the contact blade, however, should not be installed at this stage. The support plate retaining screws should not be over-tightened or damage to the plate will result.

Fit the diaphragm spring, larger diameter first, into the housing. Before fitting the diaphragm, make sure the small neoprene washer is fitted in the armature recess. The diaphragm should not be installed with gasket sealing compound of any kind. Install the diaphragm assembly and screw its spindle far enough into the threaded centre rocker trunnion so that the rocker will not throw-over, but no further.

Install the eleven rollers by turning up the diaphragm edge and dropping them into the coil recess; during this operation the pump should be held with the rocker end downwards; thus preventing the rollers from falling out.

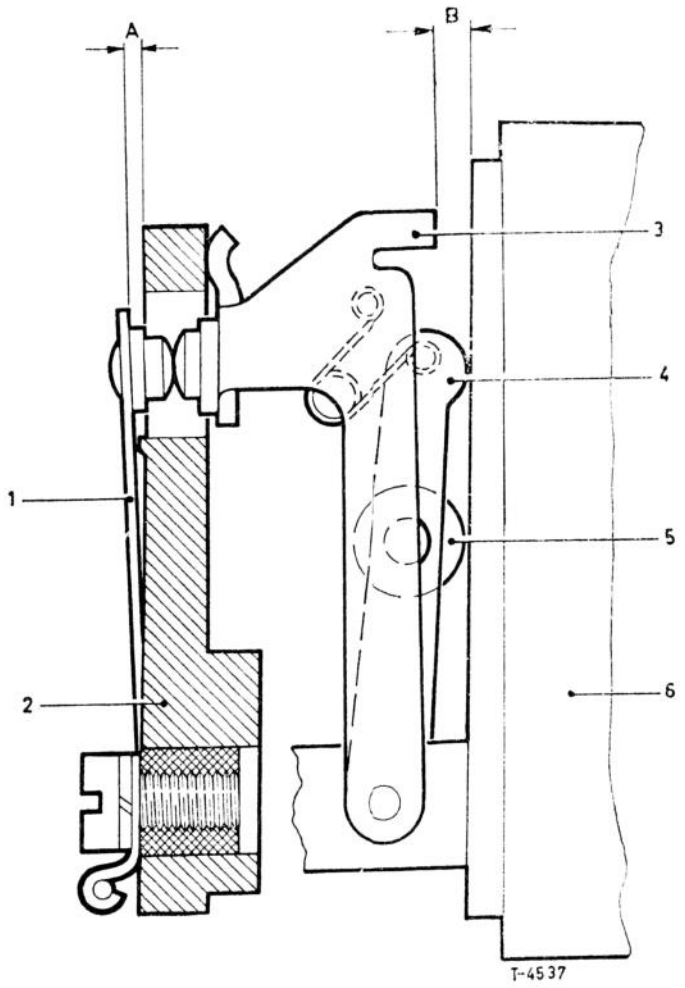
Push the diaphragm spindle firmly whilst unscrewing the diaphragm and push intermittently until the rocker just 'throws-over'; now unscrew the diaphragm until the nearest holes in the diaphragm and the pump housing line up, then unscrew four holes further.

To prevent the rollers falling out, press the centre of the armature and insert the retaining fork (SU tool) at the rear of the rocker mechanism. Fit the outlet valve assembly on the recess marked 'outlet'; place a joint washer on top of the valve and install the outlet connection. Install the inlet valve, tongued side down, in the recess marked 'inlet'; fit a joint washer, the filter (domed-side up) followed by a second joint washer, and then fit the inlet connection. Position both connections as required, install and tighten down the clamping plate.

Place the coil housing on the pump body and align the six holes. Carefully remove the retaining fork, bearing in mind that a displaced roller will cut the diaphragm. Tighten the securing screws evenly in a diagonal sequence. Fit the contact blade and coil lead to the support plate with a washer and 5 B.A. screw.

Adjust the contact blade so that when closed the contact points on it are a fraction above the rocker points, and when the contact points just commence to open or close, one set of points wipes across the centre line of the other in a symmetrical manner. Some degree of adjustment is possible by means of the slotted securing hole in the contact blade.

Ensure that when the outer rocker is pressed toward the coil housing, the contact blade rests on the thin edge or ridge protruding just above the main face of the support plate; if not, swing the blade clear of the support plate and bend it downward to such an extent that when installed it rests lightly against the ridge. Do not over-tension the blade.



1 Contact blade
2 Pedestral
3 Outer rocker
4 Inner rocker
5 Trunnion
6 Coil housing
A 0·035in ±0·005in
B 0·070in ±0·005in

Fig. 24. Fuel pump, rocker adjustment

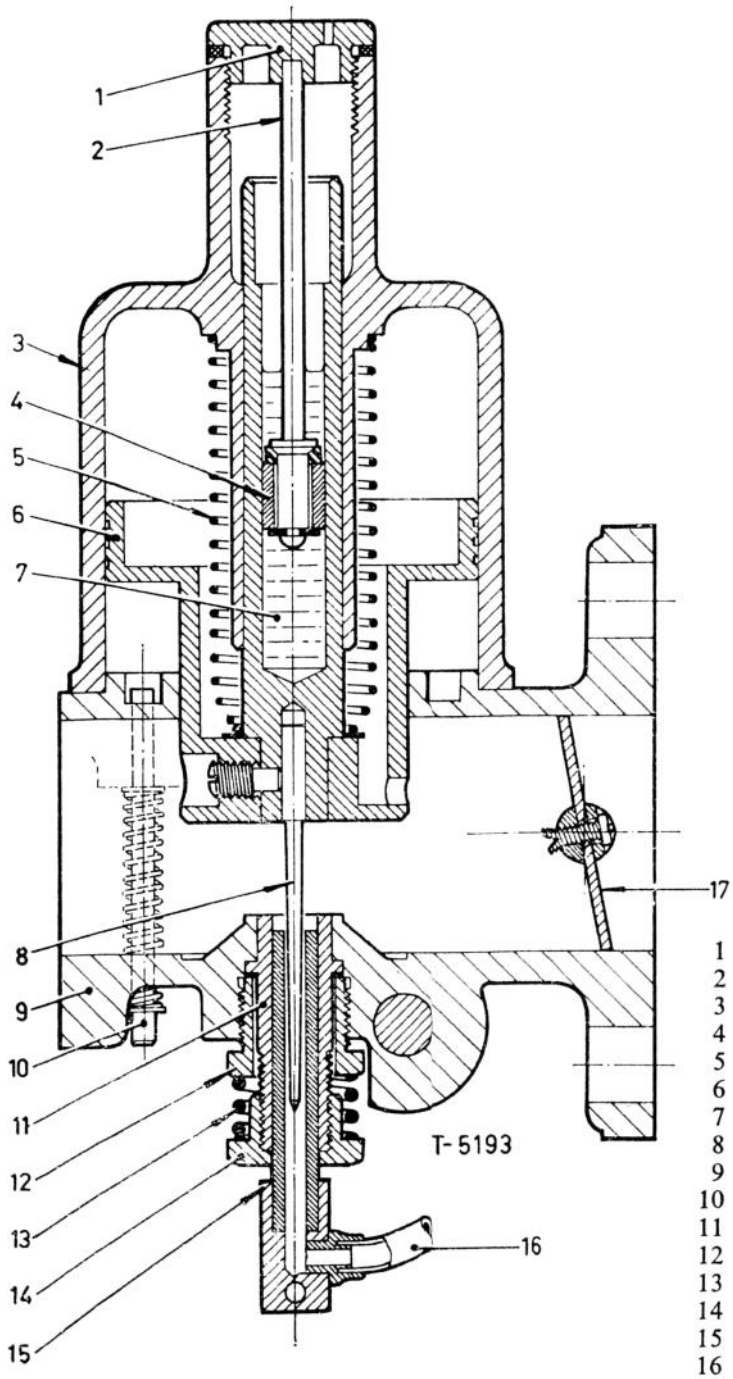
Adjustment: Check the gap produced by the lift of the contact blade above the top of the support plate; if necessary the stop finger beneath the support plate may be bent in order to obtain the requisite gap of 0·035 ±0·005in. Measure the gap between the rocker finger and the coil housing with a feeler gauge; if necessary the stop may be bent to obtain the requisite gap of 0·070 ±0·005in.

Further assembly is a reversal of the dismantling procedure.

Carburettor(s): SU carburettors are of the variable throat type; the fuel is metered by a tapered needle in the jet. The needle is secured to the sleeve which determines the amount of throat opening; the position of the sleeve and needle are controlled by the vacuum piston (the upper part of the sleeve), according to throttle valve opening.

A schematic view of the construction is shown. Normally the piston, the sleeve and the needle are in the bottom position when the throttle is closed, but for the sake of clarity these parts are shown in a raised position. The piston is a free fit in the vacuum chamber with a very small clearance. A guide spindle is centrally located in the piston; this spindle is free to move up and down in the guide bore of the vacuum chamber, thus ensuring correct alignment of the piston and vacuum chamber at all times. When the engine is not running, the piston and needle assembly

fall to the bottom by their own weight and rest on the bridge in the throat. (The HS2 and HD4 carburettors are equipped with a soft assist spring on top of the vacuum piston.) With the engine running, the sleeve forms a restriction to the airstream; thus a partial vacuum is created. This pressure drop also creates a partial vacuum in the vacuum chamber above the piston, causing the piston, the sleeve and the needle to rise a certain amount. The raised needle determines the amount of fuel emerging from the jet; thus the correct air/fuel mixture is automatically



1 Damper piston cap
2 Damper piston stem
3 Vacuum chamber
4 Damper piston assembly
5 Vacuum piston assist spring
6 Vacuum piston assembly
7 Damper oil reservoir
8 Jet needle
9 Carburettor body
10 Piston lifting pin
11 Jet retainer
12 Jet retainer nut
13 Spring
14 Jet adjusting nut
15 Jet assembly
16 Fuel line
17 Throttle valve

Fig. 25A. SU HS2 carburettor, sectioned view (typical)

established. When starting a cold engine, the mixture may be enriched by pulling down the jet; the mouth of the jet will now be in line with a thinner portion of the needle, thereby supplying a richer mixture. The jet is mounted in a jet retainer bush and is fed with fuel by a flexible nylon tube connected to the base of the float chamber.

Fitting jet needles and centring the jets: When fitting the needle, the portion of the needle that is marked with the dotted line must be flush with the vacuum piston sleeve (see Fig. 30). When assembling the carburettor, it is imperative to make sure that the jet and needle are correctly centred. This is done by screwing the adjustment nut all the way up; then lifting the piston and needle assembly and listening for it to fall freely with an audible 'click'. If no click is heard, the needle is fouling the jet, which will then have to be re-centred. This is done by loosening and retightening the jet retainer. Re-check to see that the piston will fall with an audible 'click'; if necessary, repeat loosening and re-tightening the jet retainer until the jet is centred correctly.

Checking the float setting: When the float needle is seated, a 5/16in round bar should be an easy sliding fit between the float hinge arm and the edge of the float chamber cover.

Adjustment: Make sure that the vacuum chamber and piston of the carburettor are clean, the needle properly fitted and the jet correctly centred. Check the damper for correct oil level and top-up if necessary, then proceed as follows:

(1) Ensure that the idle adjustment screw is holding the throttle partly open and that the jet adjustment nut is not screwed all the way up.

(An average setting to start with is obtained by turning the idle adjustment screw down one full turn from the fully closed position and the jet adjustment nut one-and-a-half turns down from the top position.)

(2) Make sure that the jet seats against the adjusting nut; if necessary, readjust or disconnect the choke cable.

(3) Warm-up the engine and set the throttle to an idling speed of about 500rpm.

(4) While the engine is idling at approximately 500rpm, check the mixture by lifting the piston about 1/32in by means of the spring-loaded piston lifting pin.

If, when the piston is lifted, the engine speed increases, the mixture is too rich and the jet adjusting nut must be screwed up one-sixth of a turn; if the speed decreases, the mixture is too weak and the jet adjusting nut must be screwed down one-sixth of a turn.

(5) Continue adjusting the carburettor until, when the piston is lifted, no increase, or only a very slight increase followed by a decrease, in speed is noticed. The mixture is then correct and the engine should run evenly.

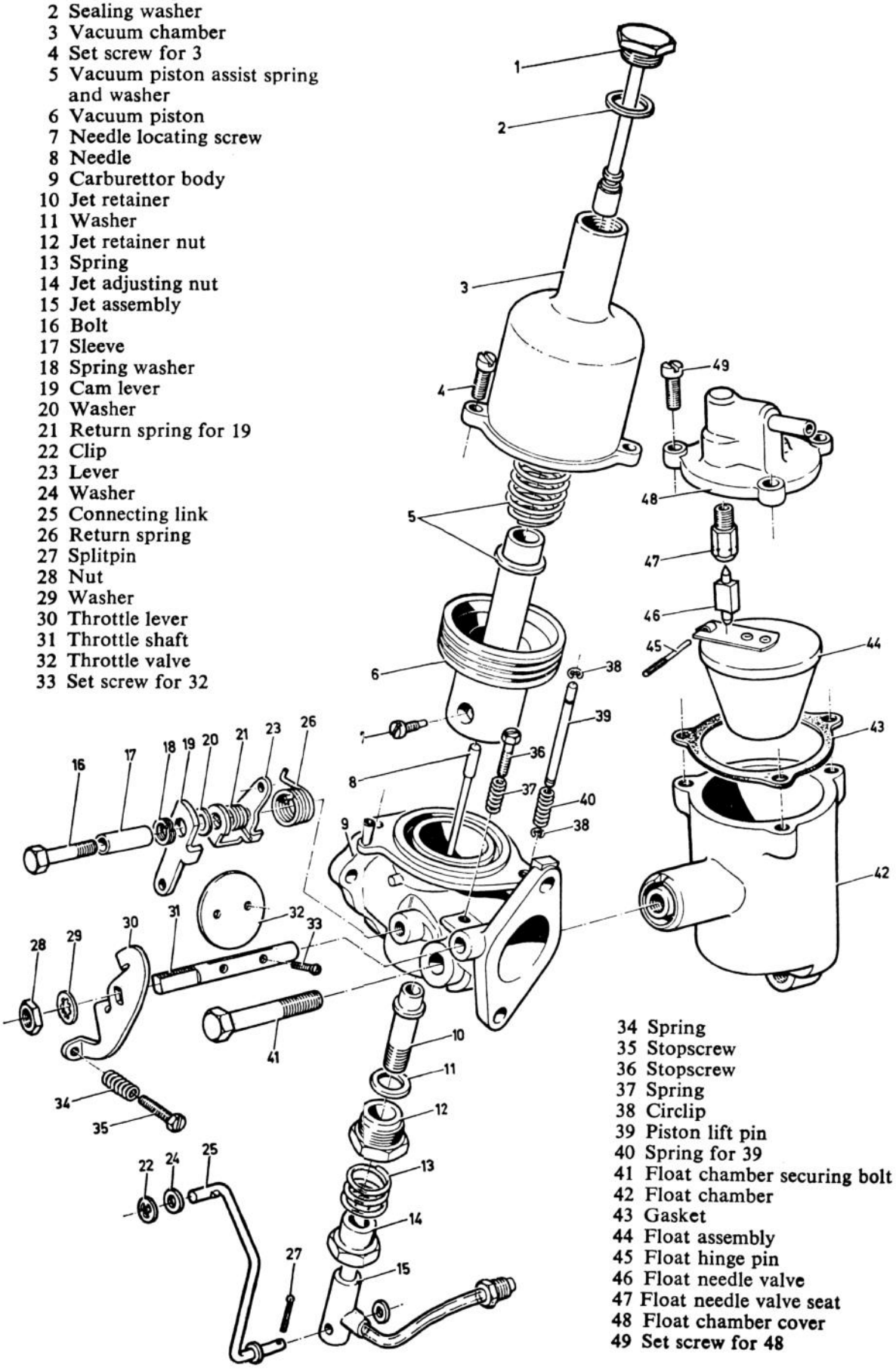
(6) Re-connect and adjust the choke cable. Adjust the fast idle to about 1000rpm when the choke control is pulled out to the limit of its free travel, without moving the jet.

(7) Re-check the idle speed and mixture.

Adjustment and synchronization of twin carburettors: Make sure that the vacuum chambers and pistons on both carburettors are clean, the needles properly fitted and the jets correctly centred. Check the dampers for correct oil level and top-up if necessary, then proceed as follows:

(1) Remove air-cleaner and air-duct, and slacken the clamping bolt on the throttle interconnecting rod to enable each throttle to be set independently. Ensure that

1 Piston damper
2 Sealing washer
3 Vacuum chamber
4 Set screw for 3
5 Vacuum piston assist spring and washer
6 Vacuum piston
7 Needle locating screw
8 Needle
9 Carburettor body
10 Jet retainer
11 Washer
12 Jet retainer nut
13 Spring
14 Jet adjusting nut
15 Jet assembly
16 Bolt
17 Sleeve
18 Spring washer
19 Cam lever
20 Washer
21 Return spring for 19
22 Clip
23 Lever
24 Washer
25 Connecting link
26 Return spring
27 Splitpin
28 Nut
29 Washer
30 Throttle lever
31 Throttle shaft
32 Throttle valve
33 Set screw for 32



34 Spring
35 Stopscrew
36 Stopscrew
37 Spring
38 Circlip
39 Piston lift pin
40 Spring for 39
41 Float chamber securing bolt
42 Float chamber
43 Gasket
44 Float assembly
45 Float hinge pin
46 Float needle valve
47 Float needle valve seat
48 Float chamber cover
49 Set screw for 48

Fig. 25B. SU HS2 carburettor, exploded view (typical)

1 Carburettor body
2 Fast idle cam
3 Jet adjusting nut
4 Jet assembly
5 Connecting link
6 Idle speed adjustment screw
7 Fast idle adjusting screw

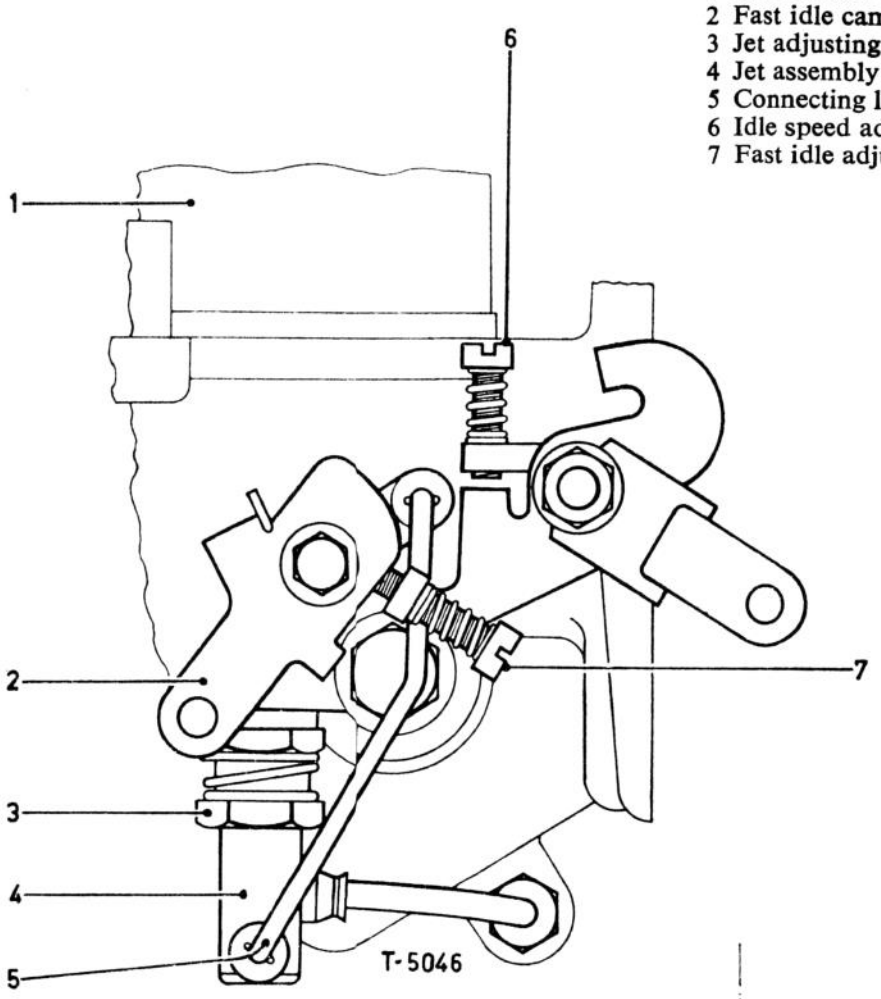
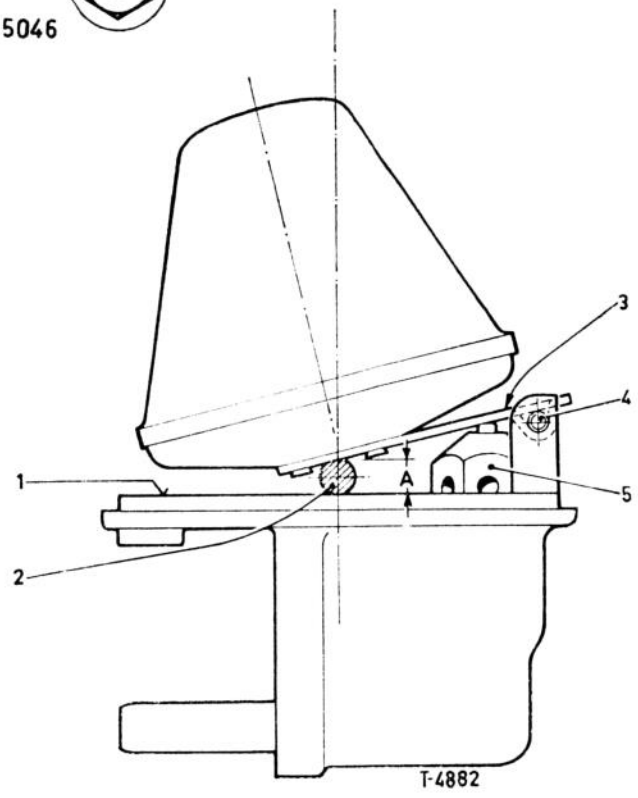
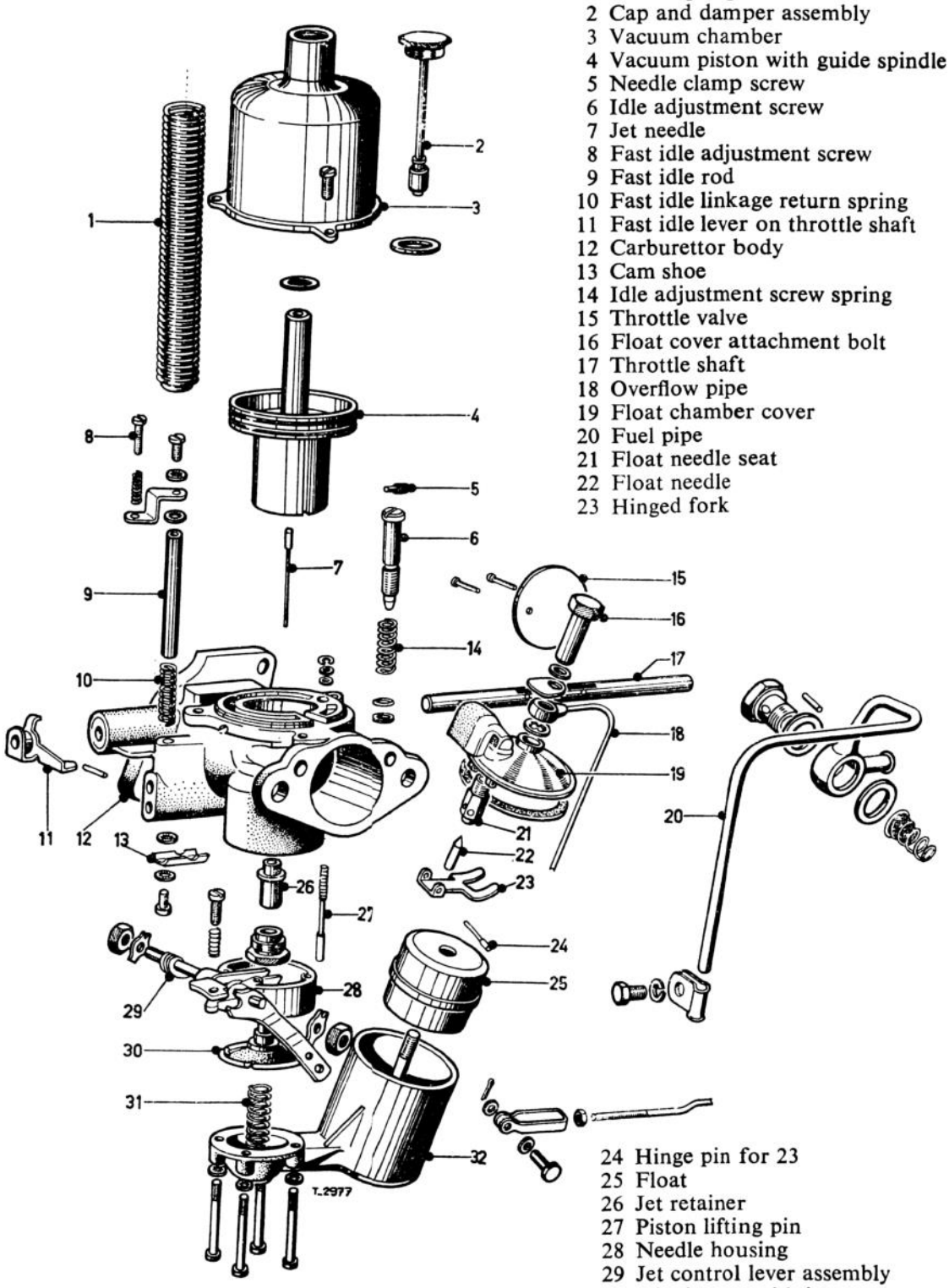


Fig. 26. SU HS2 carburettor, adjustment of controls



1 Edge of float chamber cover
2 5/16in round bar
3 Float hinge arm
4 Pivot pin
5 Float needle
A Sliding fit when float needle is seated

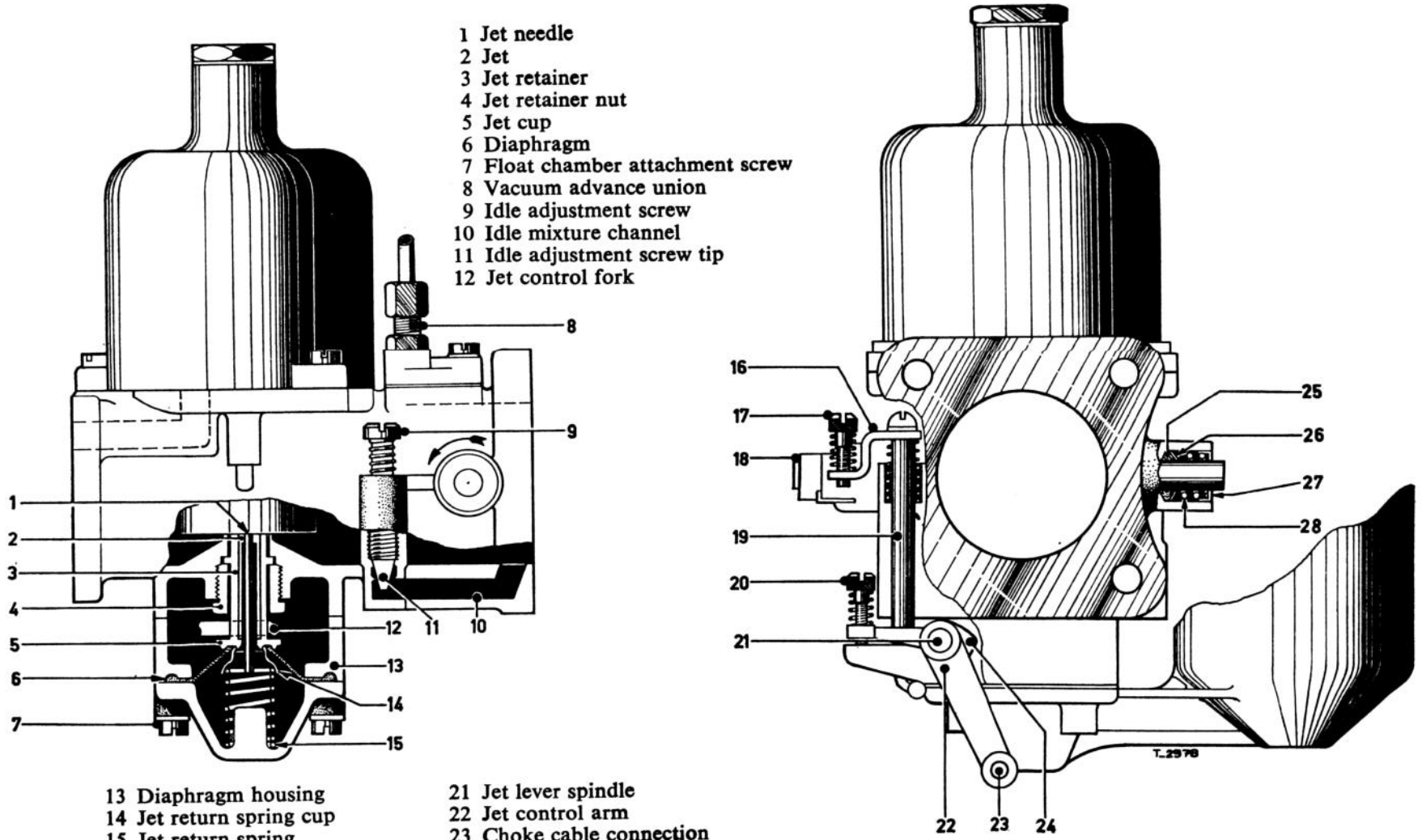
Fig. 27. Carburettor float setting



1 Piston spring
2 Cap and damper assembly
3 Vacuum chamber
4 Vacuum piston with guide spindle
5 Needle clamp screw
6 Idle adjustment screw
7 Jet needle
8 Fast idle adjustment screw
9 Fast idle rod
10 Fast idle linkage return spring
11 Fast idle lever on throttle shaft
12 Carburettor body
13 Cam shoe
14 Idle adjustment screw spring
15 Throttle valve
16 Float cover attachment bolt
17 Throttle shaft
18 Overflow pipe
19 Float chamber cover
20 Fuel pipe
21 Float needle seat
22 Float needle
23 Hinged fork

24 Hinge pin for 23
25 Float
26 Jet retainer
27 Piston lifting pin
28 Needle housing
29 Jet control lever assembly
30 Diaphragm with jet
31 Jet return spring
32 Float chamber

Fig. 28. SU HD4 carburettor, exploded view



1 Jet needle
2 Jet
3 Jet retainer
4 Jet retainer nut
5 Jet cup
6 Diaphragm
7 Float chamber attachment screw
8 Vacuum advance union
9 Idle adjustment screw
10 Idle mixture channel
11 Idle adjustment screw tip
12 Jet control fork
13 Diaphragm housing
14 Jet return spring cup
15 Jet return spring
16 Fast idle link
17 Fast idle adjustment screw
18 Throttle stop lever
19 Fast idle rod
20 Mixture adjustment screw
21 Jet lever spindle
22 Jet control arm
23 Choke cable connection
24 Fast idle cam
25 Cork seal
26 Dished washer
27 Spring retainer
28 Thrust spring

Fig. 29. SU HD4 carburettor, part-sectioned views

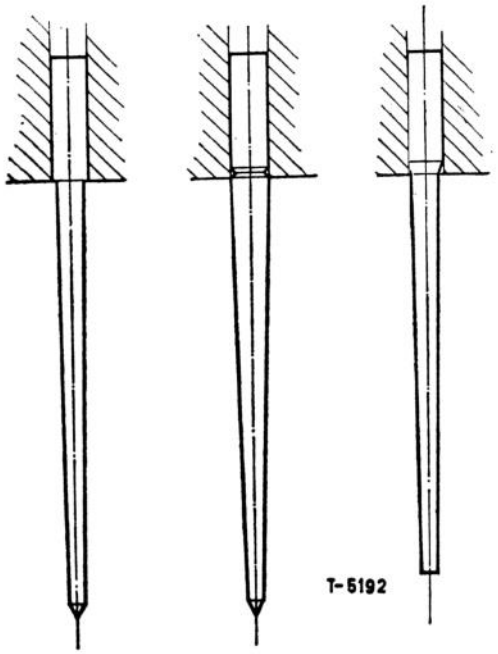


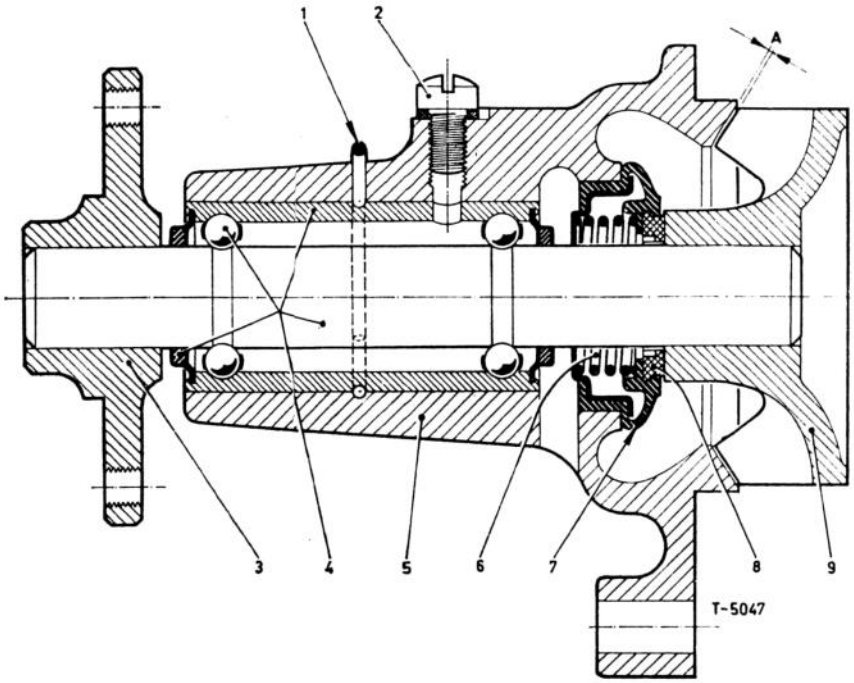
Fig. 30. Carburettor, jet needles

the idle-adjustment screws are holding the throttles partly open and that the jet adjustment nuts are not screwed all the way up. (An average setting to start with is obtained by turning the idle-adjustment screws down one full turn from the fully closed position, and the jet-adjusting nuts one-and-a-half turns down from the top position.)

(2) Make sure the jet seats against the adjusting nut; if necessary, readjust or disconnect the choke cable.
(3) Warm-up the engine, set the throttles to give an idling speed of approximately 500rpm.
(4) Listen to the hiss of air at each carburettor air-intake (the use of a piece of tubing of about 3/8in diameter, one end held to the ear and the other to each air-intake in turn, will make it easier to compare the sound of both carburettors).
(5) Adjust both idle-screws until the hiss is equal on both units and the idle speed is approximately 500rpm.
(6) Now turn off the ignition and with a downward pressure on the rear throttle arm, tighten the throttle connector-rod clamping screws.
(7) Start the engine. While the engine is idling at approximately 500rpm, check the mixture of each carburettor in turn by lifting the piston approximately 1/8in with a penknife blade or a thin screwdriver inserted in the air intake, or by means of the built-in piston lifting pin.

NOTE: Do not lift the piston with a finger, since a finger forms a too large obstruction of the air-intake; it will alter the mixture and lead to false conclusions.

(8) If, when the piston is lifted, the engine speed increases, the mixture is too rich and the jet adjusting nut must be screwed up one-sixth of a turn. If the speed decreases, the mixture is too weak and the nut should be screwed down a sixth of a turn.
(9) Continue adjusting each carburettor until, when either piston is lifted, no increase, or only a very slight increase followed by a decrease, in speed is noticed. The mixture is then correct and the engine should run evenly.
(10) Reconnect and adjust the choke cable. Adjust the 'fast-idle' adjustment screw on the connecting linkage between choke lever and throttle until the tip of the screw is just clear of the cam; the clearance should be about 1/64in.
(11) Refit the air-cleaner. Re-check idle speed and mixture.



A 0·020–0·030in
1 Bearing retaining wire
2 Lubricator screw (if fitted)
3 Pulley hub
4 Bearing and seal assembly
5 Waterpump housing
6 Spring
7 Water seal
8 Collar for 7
9 Impellor

Fig. 31. Waterpump, sectioned view

Water pump: After removal, the water pump can be dismantled as follows: Remove the bearing retaining wire through the hole in the top of the pump body. Gently tap the spindle rearward and withdraw the assembly from the pump body. Withdraw the vane from the spindle with a suitable extractor.

Carefully clean and inspect all parts; renew the seals. Re-assembly is carried out in reverse sequence of the dismantling procedure, noting the following:

Before pressing in the spindle with the bearing in position, make sure that the hole in the bearing is lined up with the lubricating hole in the pump body. The clearance between the vane and the pump body should be 0·020–0·030in.

TRANSMISSION

Clutch: The single dry plate type clutch is hydraulically operated; the clutch assembly is a dynamically balanced unit, together with the crankshaft. The clutch plate is fitted to its hub by means of a flexible mounting with tangential coil springs which serve as torsional impact dampers. The clutch master cylinder is of the Girling C.V.-type, which has an integral fluid reservoir. The throw-out bearing comprises a graphite release bearing, mounted in a steel cup; this assembly is attached to the inner ends of the operating fork by means of retainer springs. The clutch pedal free travel is determined by the mounting of the clutch master cylinder in relation to the pedal; no alteration of this setting is possible.

Removal: After having separated the gearbox from the engine, the clutch assembly can be removed by unscrewing the bolts securing it to the flywheel by one turn at a time to avoid distortion of the housing.

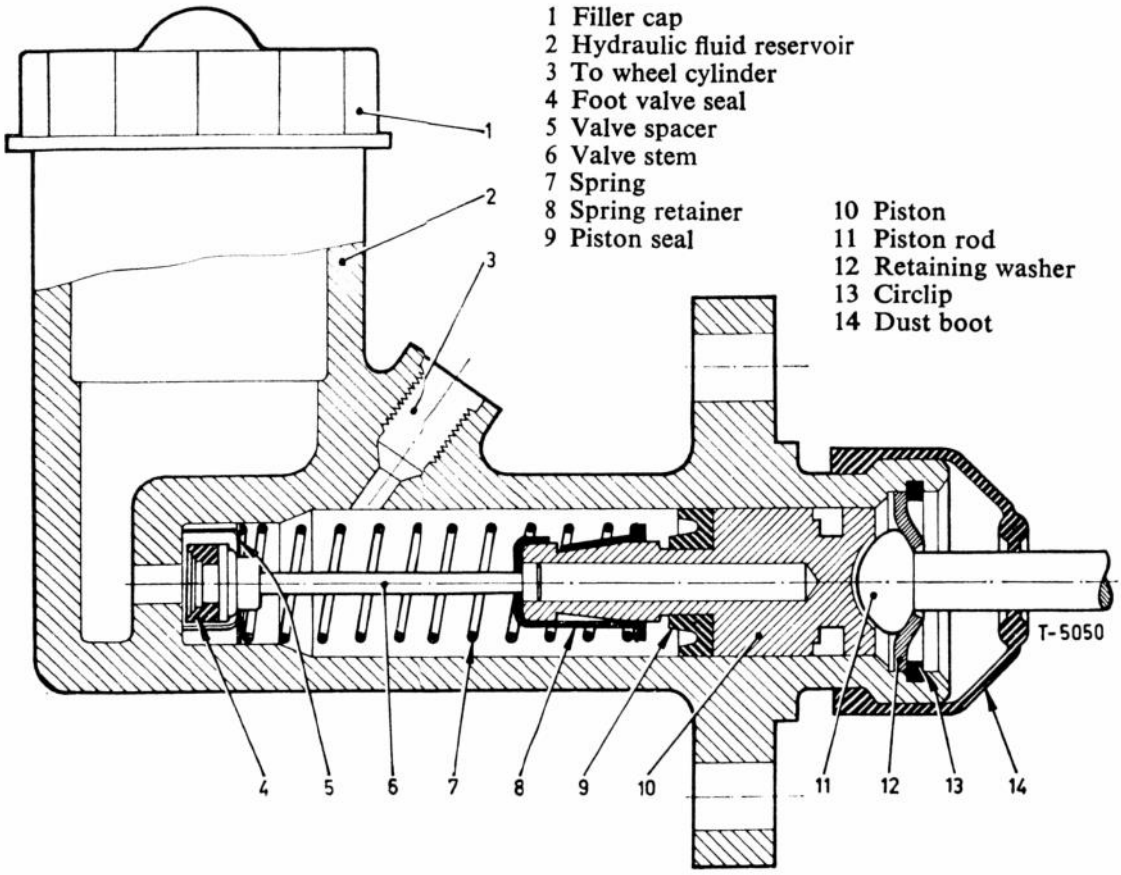


Fig. 32. Clutch master cylinder, sectioned view

Installation: Installation is a straightforward operation, but note the following: The clutch driven plate should be centralized by means of a spare gearbox main drive shaft before the clutch assembly attaching bolts are tightened; this ensures that no difficulty will be encountered when refitting the gearbox.

NOTE: *Make sure that the clutch driven plate is fitted in such a way that the larger splined end of the driven plate hub is away from the flywheel.*

Gearbox: The four-speed gearbox with helical gears for silent operation has synchromesh on 2nd, 3rd and top speeds. First and reverse speed pinions are of the sliding straight spur type.

The rear part of the gearbox, commonly called the gearbox extension housing, is bolted to the rear face of the actual gearbox housing; it accommodates the main shaft with the speedometer drive gear.

The cluster gear runs on three needle roller bearing assemblies, its end-float on the secondary shaft is controlled by the thickness of one large thrust washer at the rear and one small thrust washer at the front end of the cluster gear. Two types of needle roller bearing assemblies are used: earlier models have loose needle rollers, whereas on later models the cluster gear runs on a larger diameter secondary shaft by means of caged needle roller bearings.

Dismantling: Unscrew the speedometer drive but do not remove the drive pinion from its bush unless absolutely necessary or the oil seal will be damaged.

Remove the gear shift lever and the gear shift lever tower assembly.

Remove the gearbox extension housing cover and its gasket.

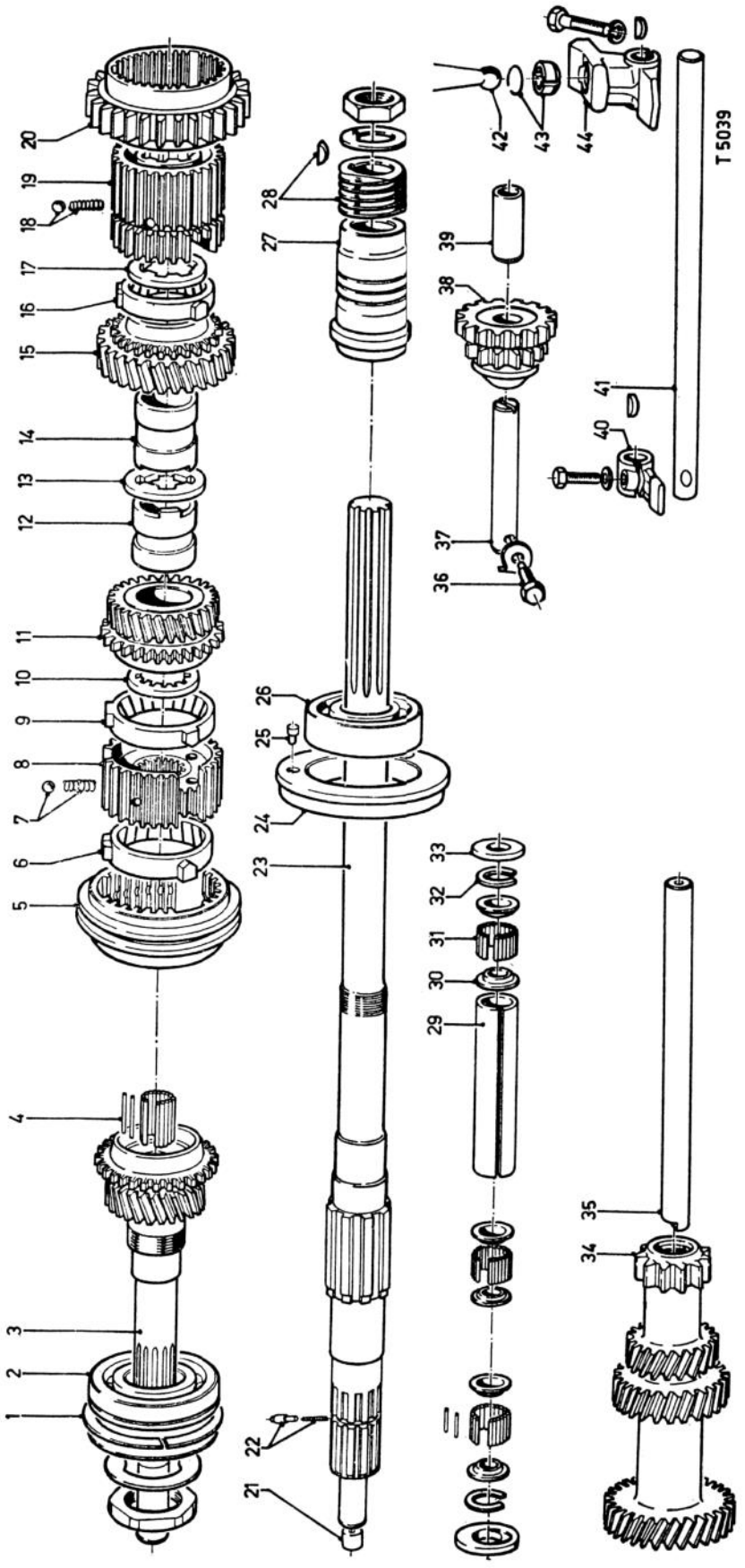


Fig. 33. Gearbox, exploded view

Remove the interlocking arm and bracket from the aperture in the extension housing.

Remove the gearbox cover by unscrewing the three countersunk screws and the seven hexagon-headed screws.

Remove the two nuts and six bolts securing the gearbox extension housing; pull the extension housing rearward and simultaneously manoeuvre the remote control shaft shifter/selector finger from the shifter dogs.

Dismantling and reassembly of the gearbox extension housing is a straightforward operation which requires no particular description.

NOTE: *Should the sliding joint bush need replacing, it should be extracted from the housing and not be driven inwards.*

Cut the locking wire and remove the bolts securing the shifter dogs to the shifter fork shafts; slacken the lock nuts and unscrew the shifter fork locating bolts. Release the shifter fork shaft locating block and remove the block, together with the shifter fork shafts from the gearbox. When withdrawing the shafts, be sure to catch the three detent balls and springs.

Remove the reverse, the top/3rd speed and the 1st/2nd speed shifter forks from the gearbox, in that order.

Remove the clutch operating fork pivot nut, remove the pivot bolt and remove the fork with throw-out bearing assembly. Remove the gearbox front cover complete with oil seal and make a note of the shims fitted between the cover and the ball bearing.

Tap out the secondary shaft and carefully lower the cluster gear assembly to the bottom of the gearbox. Remove the reverse speed pinion shaft locating screw and withdraw the shaft and the pinion.

Key to Fig. 33:

1 Snapring
2 Input shaft bearing
3 Input shaft
4 Needle rollers
5 3rd/Top speed synchro sleeve
6 Top speed synchro ring
7 Detent ball and spring
8 3rd/Top speed synchro hub
9 3rd speed synchro ring
10 Internally splined washer
11 3rd speed pinion
12 Bearing bush for 11
13 Interlocking ring
14 Bearing bush for 15
15 2nd speed pinion
16 2nd speed synchro ring
17 Internally splined washer
18 Detent ball and spring
19 2nd speed synchro hub
20 1st speed pinion
21 Oil restrictor
22 Interlocking plunger and spring
23 Mainshaft
24 Bearing retainer
25 Locating peg for 24
26 Mainshaft bearing
27 Distance piece
28 Speedometer drive gear and key
29 Distance sleeve
30 Thrust washer for 31
31 Needle rollers
32 Snapring
33 Thrust washer
34 Cluster gear
35 Counter shaft
36 Locating screw for 37
37 Reverse idler pinion shaft
38 Reverse idler pinion
39 Bush for 38
40 Selector lever
41 Remote control shaft
42 Gearshift lever
43 Circlip and fulcrum bush for 42
44 Selector lever
45 3rd/Top speed shifter fork
46 1st/2nd speed shifter fork
47 Reverse speed shifter fork
48 1st/2nd speed shifter fork shaft
49 3rd/Top speed shifter fork shaft
50 Reverse speed shifter fork shaft
51 Detent balls
52 Guide block for shifter fork shafts
53 Reverse speed selector
54 3rd/Top speed selector
55 1st/2nd speed selector

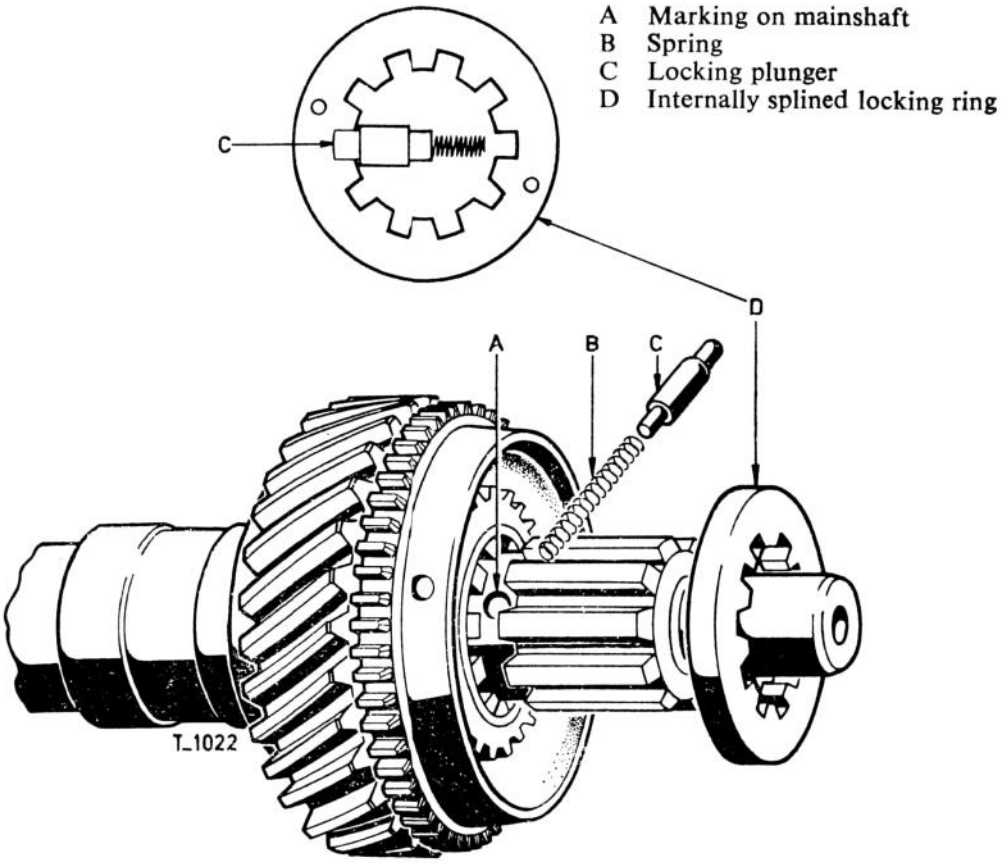


Fig. 34. Gearbox, mainshaft interlocking plunger

Now the mainshaft assembly can be withdrawn towards the rear; tap out the main drive pinion (with the ball bearing towards the front) with a copper or hide mallet, after having first removed the eighteen needle roller bearings from the main drive shaft spigot counter bore.

If necessary the main drive pinion ball bearing can be removed by securing the assembly in a soft-jawed vice and unscrewing the bearing retainer nut *which has a left-hand thread.* The ball bearing can then be pressed off the main drive pinion. Remove the snap-ring from the ball-bearing.

From the gearbox remove the cluster gear assembly and the two thrust washers. The cluster gear needle roller bearings and spacer can be pushed out of the bore after removal of one of the retaining circlips.

Dismantling the mainshaft assembly:

NOTE: *Before dismantling is started check the 3rd speed pinion end-float which will give the correct thickness of the thrust washer to be fitted during re-assembly.*

(1) Remove the top speed synchronizer ring, the synchro hub with sleeve assembly and the 3rd speed synchronizer ring. If necessary the synchronizer sleeve can be slid from the hub, but take care to retain the synchronizer balls and springs which will then be released.

(2) Depress the spring loaded thrust washer locking plunger in the front end of the main shaft and rotate the internally splined locking ring so that one of its

splines covers the plunger; then remove the splined ring, immediately followed by the 3rd speed pinion and its bush. Remove the locking plunger and its spring.

(3) Remove the 2nd speed pinion interlocking ring and remove the pinion, its bearing bush and the thrust washer.

Slide the 2nd speed synchro-hub and sleeve assembly off the shaft; if necessary the sleeve can be removed from the hub, but care should be taken to retain the synchronizer balls and springs thus released.

(4) Tap back the tab of the locking plate, remove the speedometer drive gear securing nut and remove the gear with its woodruff key, followed by the spacer bush.

(5) Press the mainshaft ball bearing assembly from the shaft and press the bearing out of its housing.

Reassembly of the cluster gear: Install a circlip in the innermost groove in the cluster gear bore; clamp the secondary shaft vertically in a vice (cut away portion downward) and assemble the inner roller bearing on the shaft, resting on the vice jaws.

With the largest gear downwards, lower the cluster gear over the shaft and the bearing rollers. Take the assembly out of the vice and push the bearing against the circlip in the cluster gear bore. Now install a circlip, the end roller bearing assembly and another circlip.

Install the spacer tube into the other end of the cluster gear bore; assemble the end bearing and circlip.

Reassembly of the mainshaft: Assemble the synchronizer units with the aid of service tools 18G222 and 18G223.

Press the mainshaft ball bearing into its housing and press the assembly on to the mainshaft.

Slide the spacer tube and the speedometer drive gear with its woodruff key on the mainshaft; fit a new locking plate, install and tighten the nut and bend over the tab of the locking plate.

Install the 1st speed sliding pinion synchronizer unit followed by the synchronizer ring and the rear thrust washer on to the mainshaft.

Install the 2nd speed pinion bush; make sure that the lugs on the bush are facing towards the front and that the oil hole in the bush corresponds with the hole in the mainshaft.

Install the 2nd speed pinion and the interlocking ring, ensuring that the lugs on the bush engage with the interlocking ring.

Fit the 3rd speed pinion bush with the lugs leading; make sure that the lugs on the bush engage the interlocking ring and that the oil hole and cutaway in the bush corresponds with the holes in the mainshaft.

Select a front thrust washer which will fit into the groove in the shaft, but which should be free to rotate. Thrust washers for this purpose are available in three thicknesses:

0·1565–0·1575in
0·1585–0·1595in
0·1605–0·1615in

Fit the locking plunger assembly in the shaft, followed by the 3rd speed pinion and bush; the cone face of the pinion should be facing towards the front.

Locate the pinion in such a manner that the hole in its cone coincides with the locking plunger; with the aid of a thin drift, depress the plunger, install the thrust washer and rotate it until it is locked by the released plunger.

Measure the 2nd and 3rd speed pinion end-float.

For specifications and tolerances refer to *Technical Data.*

Install the 3rd and top speed rear synchronizer ring, the synchro unit and the front synchronizer ring.

NOTE: *When installing new pinion bearing bushes, these should be heated in oil to a temperature of between 180° and 200°C (356°–392°F).*

After a new reverse speed pinion bush is fitted, its inside diameter must be reamed to the finishing dimension of between 0·4996 and 0·5004in.

Re-assembly of the gearbox: Insert the dummy secondary shaft 18G471 into the cluster gear bore; install the larger and the small thrust washer and lower the assembly to the bottom of the gearbox.

Install the main drive pinion assembly, making sure that the bearing is properly located. Stick the eighteen bearing needle rollers into the pilot bearing bore with some grease.

Insert the mainshaft into the gearbox and enter the mainshaft spigot in the needle rollers of the main drive pinion.

Lift the gearbox extension housing gasket to position the dowel and the bearing housing and push the mainshaft all the way home.

Carefully lift the cluster gear assembly into mesh with the mainshaft pinions and the main drive pinion and insert the counter shaft, lining up the cut-away portion at the front end of the shaft with the locating groove in the gearbox front cover.

Install the reverse idler pinion and shaft; secure the shaft with the locating bolt.

Install the gearbox front cover with the shims found during dismantling. Install the clutch lever and fork assembly.

Position the shifter fork in the following order in the gearbox; 1st/2nd speed, 3rd/top speed and reverse.

Bolt the shifter fork shaft guide block to the gearbox rear face; replace the detent springs and balls. Push the shafts through the guide block and pick up the respective shifter forks. Tighten the locating screws.

Fit the shifter dogs to the rear ends of the shifter fork shafts; tighten the locating screws and secure the screws with locking wire. If necessary the extension housing oil seal can be replaced, preferably with tool 18G134 in conjunction with adaptor 18G134N. Secure the extension housing whilst making sure that the shifter/selector finger properly engages the shifter dogs.

Install the interlock arm and plate and fit the top cover. Install the gear shift lever tower and the side cover. Replace the speedometer drive.

After installation in the vehicle, do not forget to fill the gearbox to the correct level with the recommended grade of oil.

Automatic transmission (optional equipment): Borg-Warner type '35' hydraulic torque converter with three-speed planetary type gear box. For description see page 84, for periodical maintenance see page 21. For emergency starting the car may be push- or tow-started, but pushing is recommended since it avoids the danger of the car over-running the towing vehicle. Proceed as follows: select position 'N', switch the ignition on, set the mixture control (choke), and release the parking brake; allow the car to attain a speed of approximately 25mph, then select position 'L'. If the car is to be towed, always check the fluid level in the transmission, and top up if necessary (as described under *Lubrication and Maintenance*). When towing, select position 'N' and ensure that the parking brake is released.

If there is any reason to suspect that the transmission is damaged or faulty, the propeller shaft must be removed or, alternatively, the rear wheels lifted clear of the ground, before towing commences.

In view of the specialized knowledge and tools which are required, no instructions are given here for adjustments, repairs and overhauls. This should be left to the authorized specialist.

Propeller shaft: Open propeller shaft with Hardy Spicer universal joints. The foremost yoke of the front universal joint is a sliding fit over the gearbox mainshaft splines.

NOTE: *Before removing the shaft, the rear universal joint flange must be marked in relation to the final drive pinion flange in order that the shaft can be installed in its original position, thus leaving the balance undisturbed.*

Before removing the propeller shaft, drain the gearbox or, alternatively, install a dummy sliding joint over the mainshaft splines to prevent oil leakage.

For the U-joints no oversize bearing journals or bearings are available.

Rear axle/differential: Three-quarter floating rear axle with hypoid pinion and crown wheel arrangement. For final drive ratios refer to *Technical Data.*

Removal and installation of a rear wheel hub: Jack up the car with parking brake released and remove the road wheel. Remove the brake drum and take care to prevent rear axle oil spilling on to the exposed brake linings when the shaft is withdrawn.

Remove the axle shaft flange set screw and withdraw the shaft.

Bend back the tab washer, unscrew the bearing retaining nut (left-hand thread on left-hand side of car) and remove the tab washer.

With a suitable extractor withdraw the hub. The bearing and oil seal will come away with the hub. If necessary the bearing and oil seal can be pressed out for replacement.

When installing a new oil seal, make sure that the lip of the seal is facing towards the bearing.

Installation is a reversal of the removal procedure, but pay attention to the following points:

The outer face of the bearing must protrude 0·001–0·004in beyond the hub outer face to ensure that the bearing is gripped between the abutment shoulder in the hub and the drive flange on the axle shaft.

Removal and dismantling of the rear axle/differential: Drain the rear axle and disconnect the propeller shaft (mark the coupling flanges for correct re-installation); remove the bolts securing the differential carrier to the rear axle housing and remove the carrier.

Make sure that the differential bearing caps are properly marked, unscrew the bearing cap nuts and remove the differential complete. Drive out the differential pinion shaft lock pin from the crown wheel side and remove the differential shaft, the pinions, the thrust washers and side gears.

With a suitable puller withdraw both differential bearings. Note that the bearings are on one side marked with the word 'thrust'. Take care not to lose the shims fitted behind each bearing and do not interchange the bearings or the shims.

Bend back the tabs of the locking plates and remove the crownwheel attaching bolts; then gently tap the crownwheel from its seating on the differential housing.

Remove the final drive pinion flange and gently tap the pinion assembly rearward.

Remove the pinion shaft oil seal and the pinion front bearing inner race. If

1 Final drive pinion companion flange
2 Deflector plate
3 Oil seal
4 Pinion front bearing
5 Shim
6 Rear axle housing
7 Spacer bush
8 Pinion rear bearing
9 Shim
10 Final drive pinion
11 Crownwheel
12 Locking plate for 13
13 Crownwheel mounting bolt
14 Locking pin for 20
15 Gasket
16 Thrust washer for 17
17 Differential side gear
18 Differential pinion thrust washer
19 Differential pinion
20 Differential pinion shaft
21 Differential housing
22 Shims
23 Differential bearing cap
24 Differential bearing
25 Rear cover
26 Hub assembly
27 Oil seal
28 Wheel bearing
29 Lock washer
30 Bearing retaining nut
31 Bearing spacer
32 'O'-ring
33 Gasket
34 Drive shaft flange
35 Retaining screw for 34

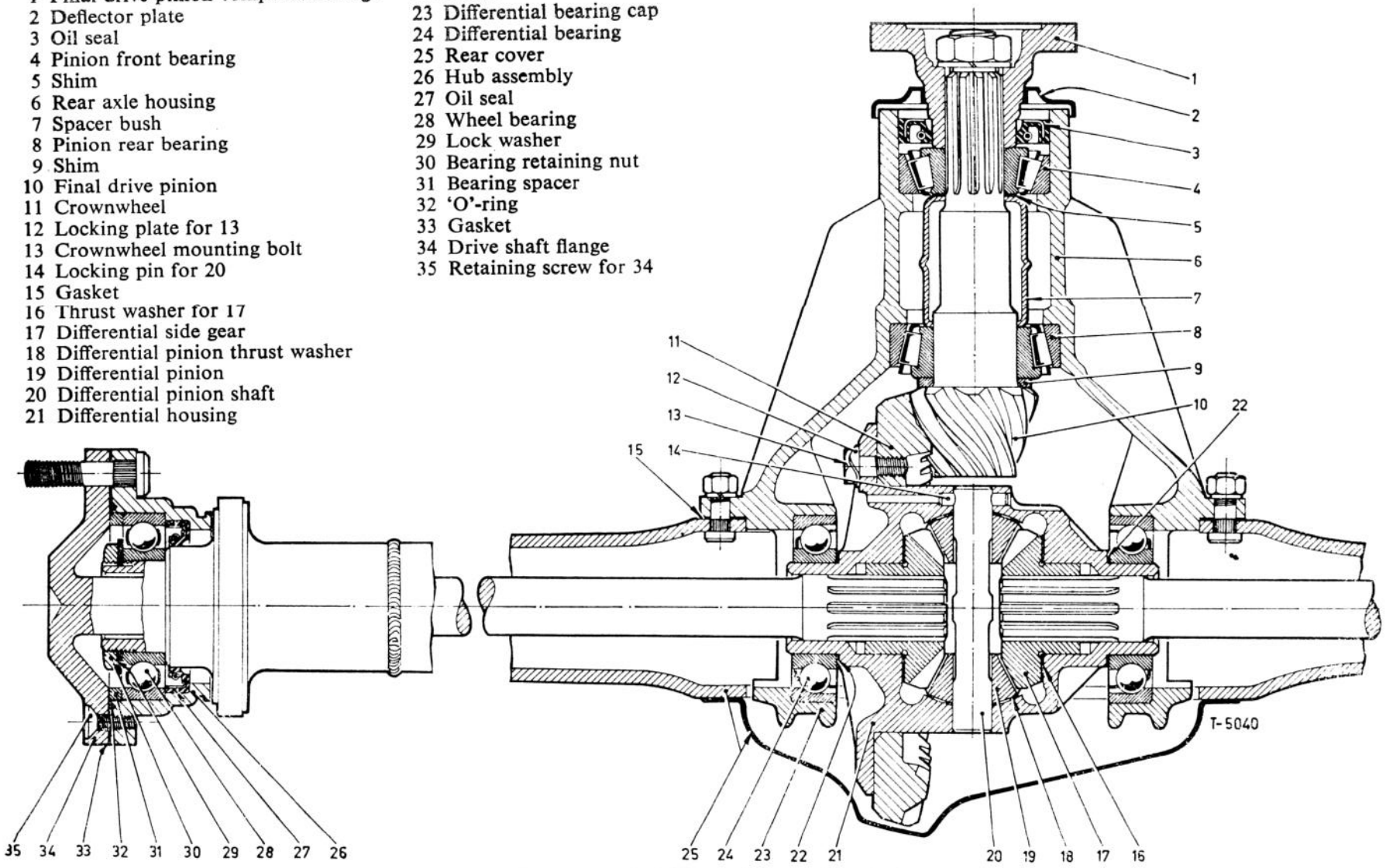


Fig. 35. Rear axle/differential, sectioned view

necessary the bearing outer race can be withdrawn by using a suitable extractor.

Slide the spacer bush and the shims off the pinion shaft, after which the pinion rear bearing can be withdrawn.

Carefully clean and inspect all parts, replacing those that are worn or damaged.

Reassembly and adjustment: Reinstall the pinion bearing outer races, place the shim found during dismantling on the pinion and press on the pinion rear bearing.

Install the pinion in the carrier, fit the pinion front bearing and the pinion flange, tighten the nut until a pre-load of 10–12lb in is obtained. The oil seal, the spacer bush and the pre-load shims are omitted at this stage.

Zero a dial indicator on the machined step 'B' of the large block of tool 18G191B. Remove the keep disc from the magnetic gauge block and position the magnet and the dial indicator.

The stylus of the gauge should rest on the centre of the differential bearing bore. Obtain the maximum depth reading and note the difference from the zero reading. Repeat this check in the opposite bearing bore and note the main reading. The pinion head is in some cases marked with an unbracketed number; this is always minus.

(*a*) If the gauge reading is minus, the gauge reading must be added to the pinion head marking and the thickness of the shim be reduced by this amount.
(*b*) If the gauge reading is plus, but numerically less than the pinion head marking, the shim thickness must be reduced by the difference.
(*c*) If the gauge reading is plus and numerically greater than the pinion head marking, the shim thickness must be increased by the difference.

Example of (*a*)*:*

Gauge reading:	−0·003in
Pinion head marking:	−0·002in
Amount to be subtracted from the shim thickness:	0·005in

Example of (*b*)*:*

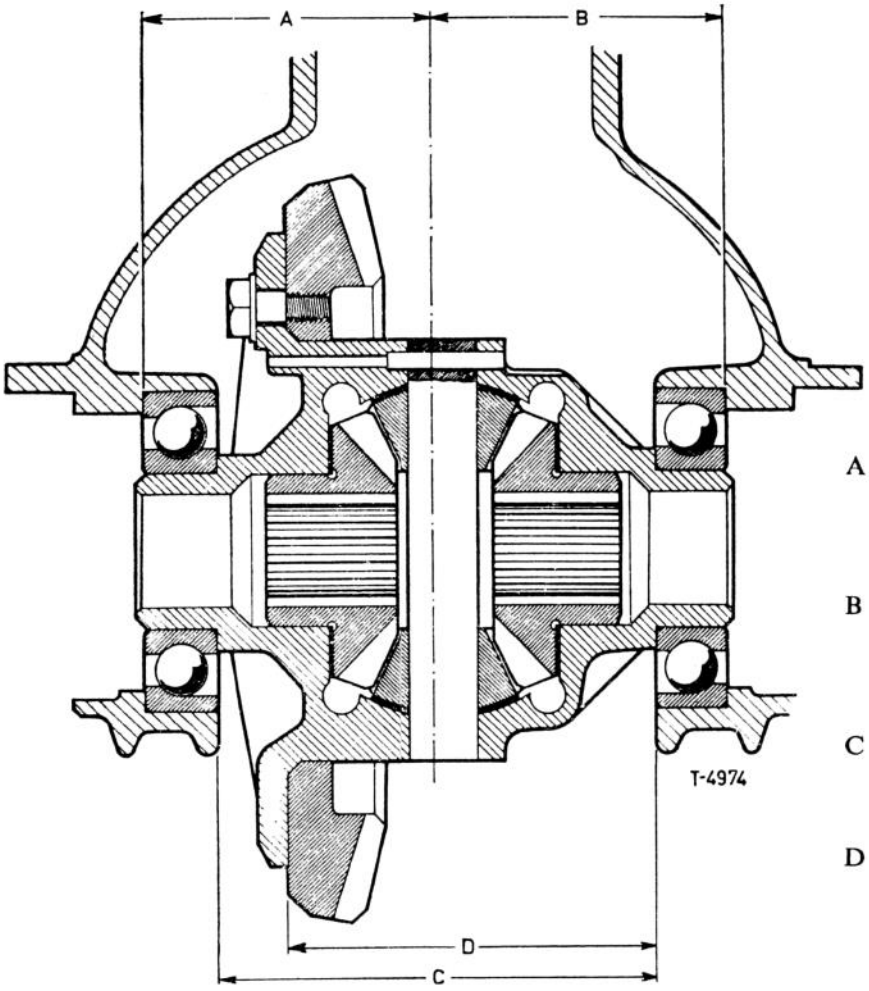
Pinion head marking:	−0·004in
Gauge reading:	+0·003in
Amount to be subtracted from the shim thickness:	0·001in

Example of (*c*)*:*

Gauge reading:	+0·006in
Pinion head marking:	−0·003in
Amount to be added to the shim thickness:	0·003in

When the gauge reading is plus and numerically equal to the pinion head marking, no correction is necessary; the same applies when an unmarked pinion is fitted and the gauge reads zero. The actual mounting distance (pinion depth adjustment) of the pinion is marked on the pinion head in a rectangular bracket. If the marking is a plus figure, the shim thickness must be reduced by an equal amount. If the marking is a minus figure, the shim thickness must be increased by the same amount.

Remove the pinion, install the correct number of shims behind the pinion head and assemble the bearings, the spacer bush, the pre-load shims (approx. 0·012in), the oil seal and the pinion flange. Gradually tighten the pinion nut to 140ft lb. Check the pre-load frequently; this should not exceed 15lb in or the spacer bush will



A Centre line of differential unit to bearing shoulder in carrier on left-hand side
B Centre line of differential unit to bearing shoulder in carrier on right-hand side
C Total width between bearing shoulders of differential housing
D Crown wheel mating face to bearing shoulder on right-hand differential housing

Fig. 36. Differential, adjustment

be permanently distorted. If, however, this pre-load is exceeded, the pinion must be removed and a new spacer bush installed. If necessary, correction to the pre-load is possible by adding or removing shims between the spacer bush and the pinion front bearing.

Install a differential bearing on the small surface of tool 18G191B, the inner race over the recess and the side marked 'Thrust' facing downwards.

Place the magnetic gauge block on to the surface plate and zero the dial indicator with its stylus resting on the step marked 'B' of the small gauge block.

Now transfer the stylus to the plain surface of the bearing inner race and press the race firmly against the balls. Make a note of the gauge reading thus obtained.

A positive reading denotes the thickness of the shim pack to be subtracted from the shims on this side; a negative gauge reading indicates the thickness of the shim pack to be added (variations from standard width of bearings as measured previously).

Repeat this operation with the other bearing.

Refer to the diagram above, Fig. 36.

Variations of the dimensions A and B are stamped on the differential carrier, adjacent to the bearing bores.

Variations of the dimensions C and D are stamped on the differential housing.

The shim pack on the left-hand side is composed as follows: A+D−C+0·007in.

The shim pack on the right-hand side is calculated as follows: B−D+0·006in. The letters in the above formulae are to be substituted by the dimensional variations, stamped on the carrier and the housing.

Compose shim packs as described above and add or subtract the necessary correction for the bearing height as described.

When the back of the crownwheel is marked with a framed number, this must be taken into account before assembling the shims and bearings into the differential housing.

If the framed number on the crownwheel is e.g. −2, a shim of 0·002in must be transferred from the right-hand side to the left-hand side (crownwheel side).

If the number is +2, a shim pack of 0·002in must be transferred from the left-hand side to the right-hand side.

Press the differential bearings (thrust face outwards) preceded by the adjustment shims on to the differential housing.

Install the differential side gears, the differential pinions with their thrust washers and the pinion shaft and its locking pin into the differential housing. Secure the locking pin by peening over some of the surrounding material.

Bolt the crownwheel to the differential housing, tightening the bolts to 60lb ft, but do not bend over the locking plates at this stage.

Place the assembly in 'V' blocks and check with a dial indicator that the crownwheel runs true to within 0·002in; if so the locking plates can be bent over the bolt heads.

Install the differential housing, together with the differential bearings, in the carrier; install the bearing caps in their original positions and tighten the bearing cap nuts to 65lb ft.

Check the gear backlash with a dial indicator. The requisite backlash is etched on the crownwheel.

Backlash should be within 0·005–0·007in. Backlash is adjusted by moving the crownwheel in or out of mesh with the pinion by transferring shims from one side to the other. Do not alter the total number of shims as such would affect the bearing pre-load. Transferring a 0·002in shim from one side to the other results in a variation in backlash of about 0·08in.

Further assembly and installation is a reversal of the dismantling procedure.

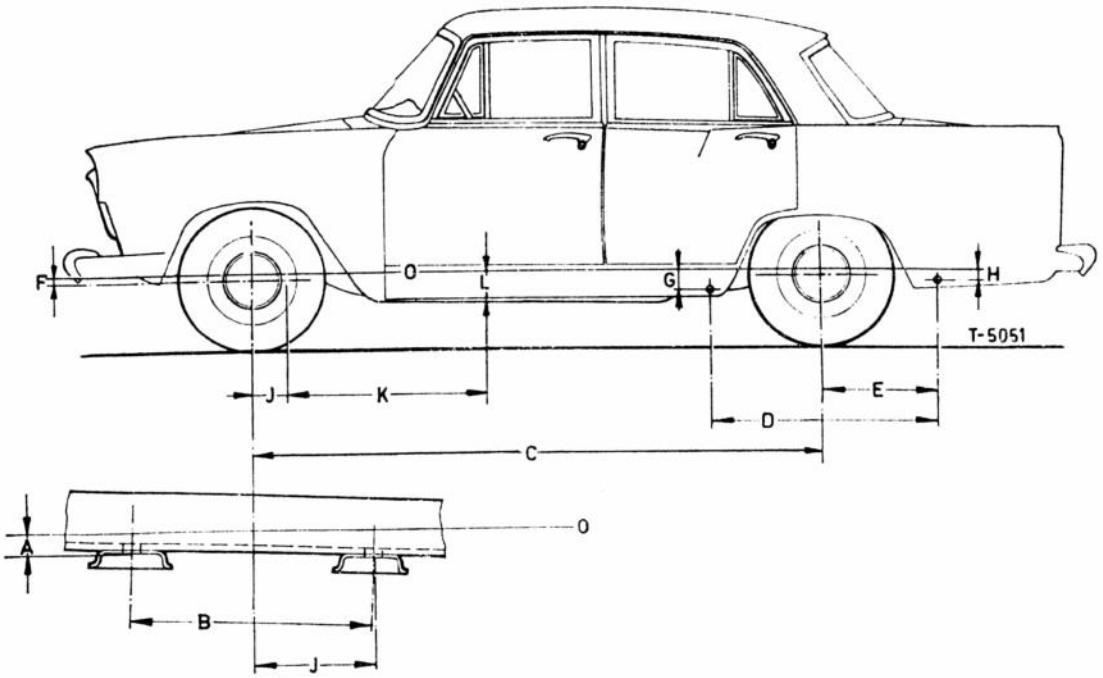
CHASSIS

Chassis: The all-steel body and chassis are welded together to form a single unit or 'mono-construction'.

See diagrams for dimensions.

Front suspension: Independent front suspension by means of suspension arms of unequal length, coil springs, lever type hydraulic shock absorbers and an anti-roll bar.

The suspension unit is mounted to the detachable front sub-frame assembly, which is bolted to the underbody at four points. The double shock absorber arms serve as upper suspension arms and are attached to the wheel swivel upper trunnion link by means of a fulcrum pin and rubber bushes. The lower suspension arms are individual members which are bolted to the coil spring lower seating plate. At their inner ends the arms pivot on rubber bushes fitted to the fulcrum shaft which is rigidly mounted on the front suspension cross member.



O	—	Datum	F	1 11/64in	Datum to front cross-member rear mounting
A	47/64in	Datum to front cross-member front mounting	G	5in	Datum to rear spring front shackle
B	9 7/8in	Front cross-member, front to rear mountings	H	2½in	Datum to rear spring rear shackle
C	100 1/4in	Wheelbase	K	27 15/64in	Front cross-member rear mounting to rear cross-member rear mounting
D	43 5/16in	Rear spring centres, eye to eye	L	5 9/16in	Datum to rear cross-member rear mounting hole
E	20 5/16in	Rear spring centre bolt to rear spring rear shackle			

Fig. 37. Underbody dimensions

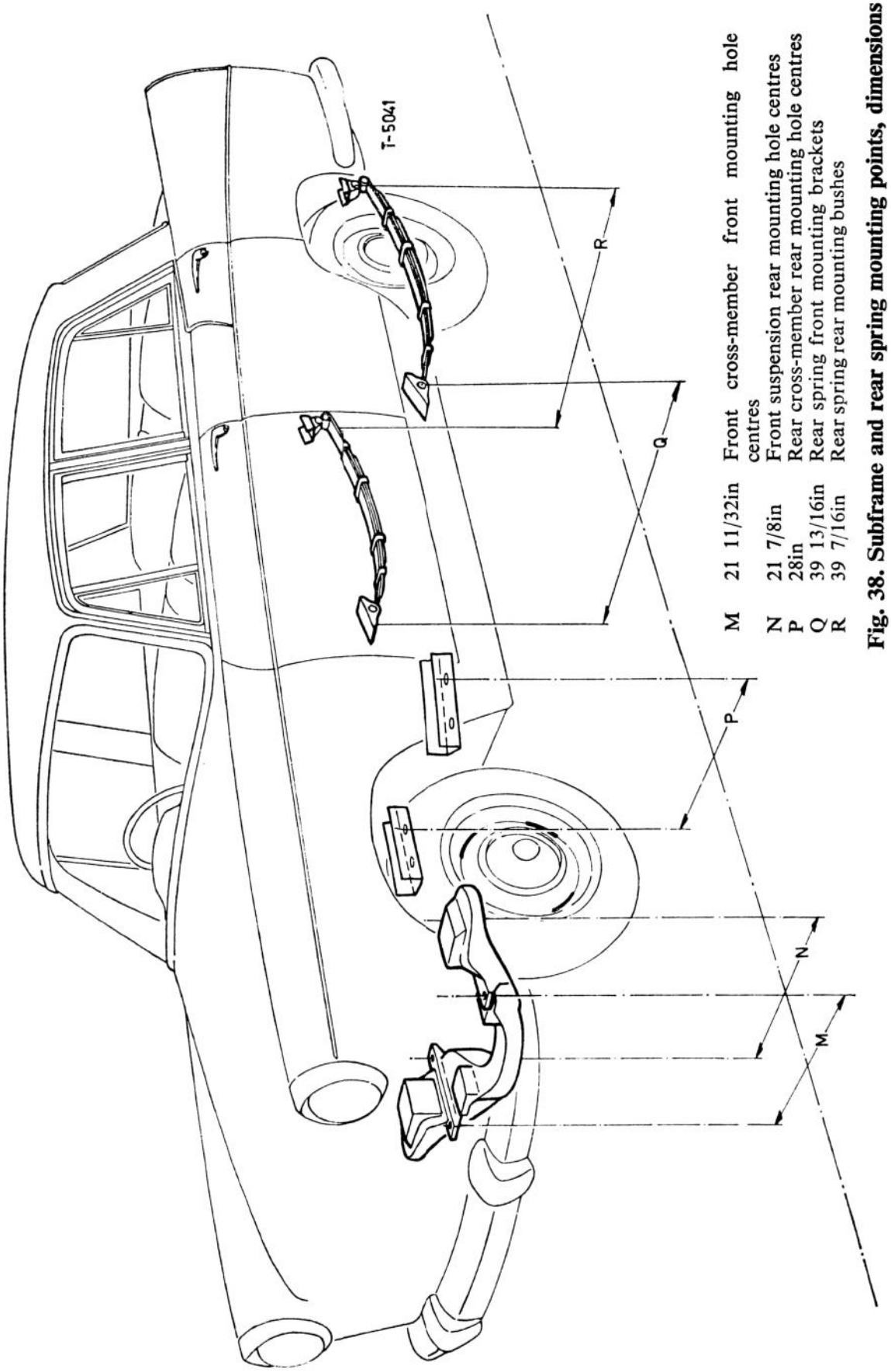
At their outer ends, the lower arms are attached to the front wheel swivel lower end by means of threaded fulcrum bushes which can freely turn on the threaded bolt secured at the lower end of the wheel swivel pin.

Normal maintenance is confined to grease gun lubrication of the fulcrum pins and swivel pins. Grease nipples are provided for this purpose. Use recommended lubricants only.

Removal: The complete front suspension unit can be removed together with the engine and gearbox. See under *Engine*.

For removal of the front suspension unit only, proceed as follows:

Removal and installation: Jack up the front of the vehicle and place chassis stands under the body cross member. Remove both front wheels and take the weight of the engine in a suitable tackle. Disconnect the battery terminals as well as the horn wiring. Drain the hydraulic fluid from the brake system and disconnect the flexible hydraulic hoses at the brake backing plates. Disconnect the centre track rod at the pitman arm and the steering idler arm by releasing the ball joint taper pins. Remove both engine front supports, place a trolley jack under the suspension cross member and remove the four nuts securing the suspension unit to the underbody. Lower the jack and remove the suspension unit from underneath the vehicle.



M	21 11/32in	Front cross-member front mounting hole centres
N	21 7/8in	Front suspension rear mounting hole centres
P	28in	Rear cross-member rear mounting hole centres
Q	39 13/16in	Rear spring front mounting brackets
R	39 7/16in	Rear spring rear mounting bushes

Fig. 38. Subframe and rear spring mounting points, dimensions

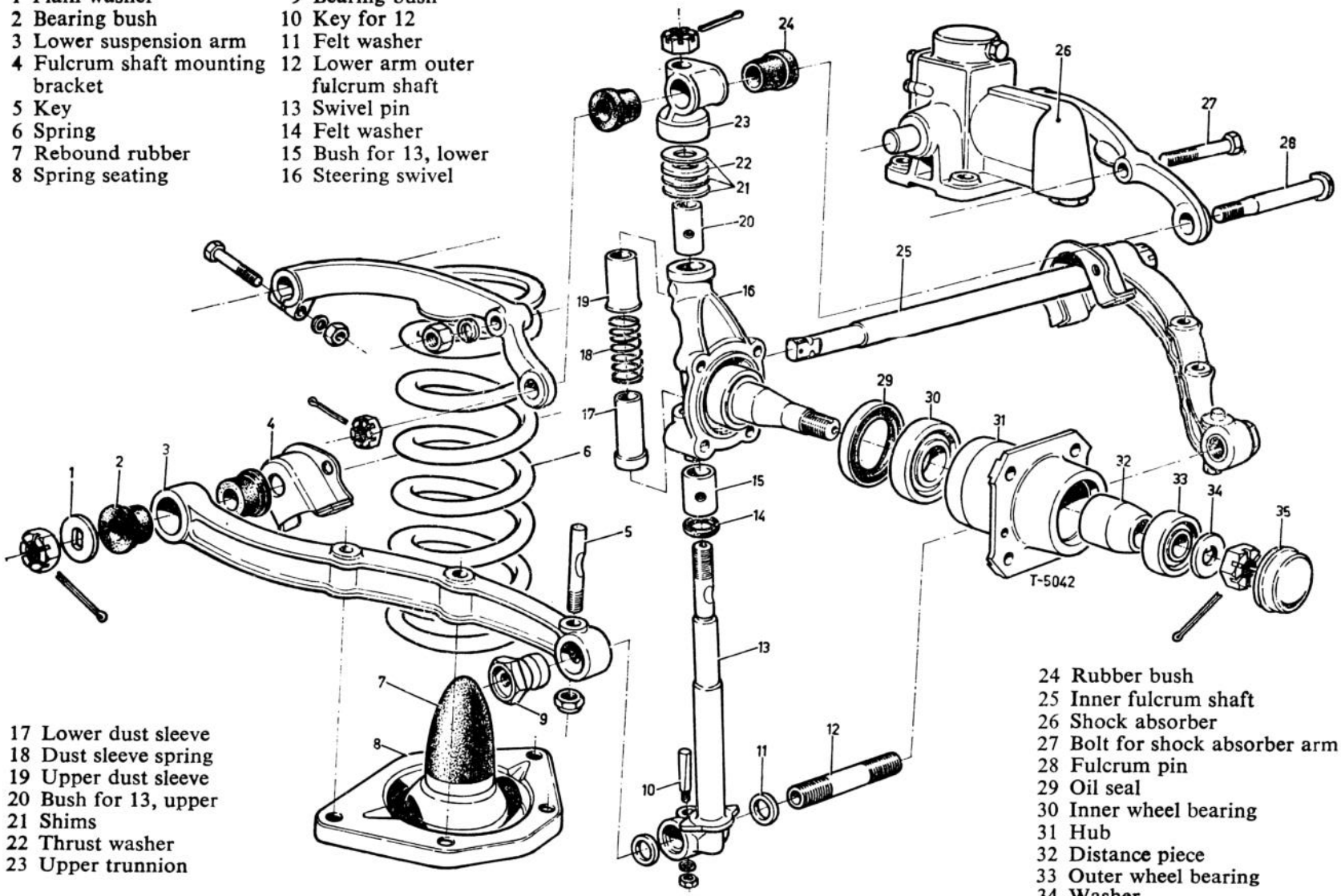


Fig. 39. Front suspension, exploded view

Installation is a reversal of the removal procedure; be sure to refit the rubber packing and to bleed the brakes after having topped up the brake fluid reservoir with the recommended type of brake fluid.

Dismantling: Compress the coil spring with tool 18G37 and unscrew the four spring seat bolts. Instead of tool 18G37 four fully-threaded slave bolts can be used. Replace two diagonally opposed spring seat bolts by the slave bolts and screw the nuts down to the suspension arms. Remove the two retaining spring seat bolts and unscrew the slave bolt nuts a little at a time until the spring is fully retracted.

Unscrew the wishbone arm tie bolt and remove the castellated nut in the upper fulcrum pin.

Partially withdraw the forward half of the upper suspension arm after slackening the clamping bolt and remove the upper trunnion fulcrum shaft.

Remove the shock absorber and the shock absorber arm. Remove both rubber bushes from the upper trunnion; unscrew the castellated nut and lift off the upper trunnion.

Slide the steering swivel assembly upward from the swivel pin. The dust excluder sleeves and spring will come away with the swivel assembly.

Remove the cork washer from the lower end of the steering swivel assembly.

Slacken the nuts of the lock pins in the outer end of the lower wishbones and remove the threaded bushes; then tap out the lock pins. Never tap out the lock pin with the threaded bushes still in place.

Unscrew the lock pin situated in the centre of the lower trunnion and tap out the lock pin. Withdraw the fulcrum shaft.

Assembly is a reversal of the dismantling procedure.

Front wheel alignment: When checking the front wheel alignment it is imperative that the car is standing on an absolutely horizontal and level floor. The tyres should be inflated to the recommended pressures. Bounce the car up and down several times so that it will settle to the normal driving position; then set the wheels in the dead straight ahead position. Toe-in can be adjusted by altering the length of the adjustable centre track rod.

For specifications refer to *Technical Data.*

Rear suspension: Rear suspension by means of conventional semi-elliptic leaf springs, double acting hydraulic shock absorbers of the lever arm-type and a stabilizer bar. The spring eyes are fitted with rubber bushes.

When installing rear springs, do not fully tighten the front spring eye bolt and the shackle nuts until the normal load is applied to the springs; thus the flexible rubber bushes are deflected to an equal amount in both directions during operation. Failure to observe this precaution will inevitably lead to premature deterioration of the spring bushes.

Wheel hubs and bearings: The front wheel hubs run on two non-adjustable ball bearings; the bearing pre-load is determined by a collapsible spacer bush.

The rear wheels run on a single, non-adjustable ball bearing, which is fitted to the outer end of the axle housing, hence the term: 'three-quarter floating rear axle'. See also under *Rear axle* on page 55.

Shock absorbers: Hydraulic shock absorbers of the lever arm type. The units are set in production and no attempt should be made to dismantle them without the use of special tools. Shock absorbers which do not function properly must be replaced. For topping up the fluid reservoirs, only the recommended type of fluid should be used.

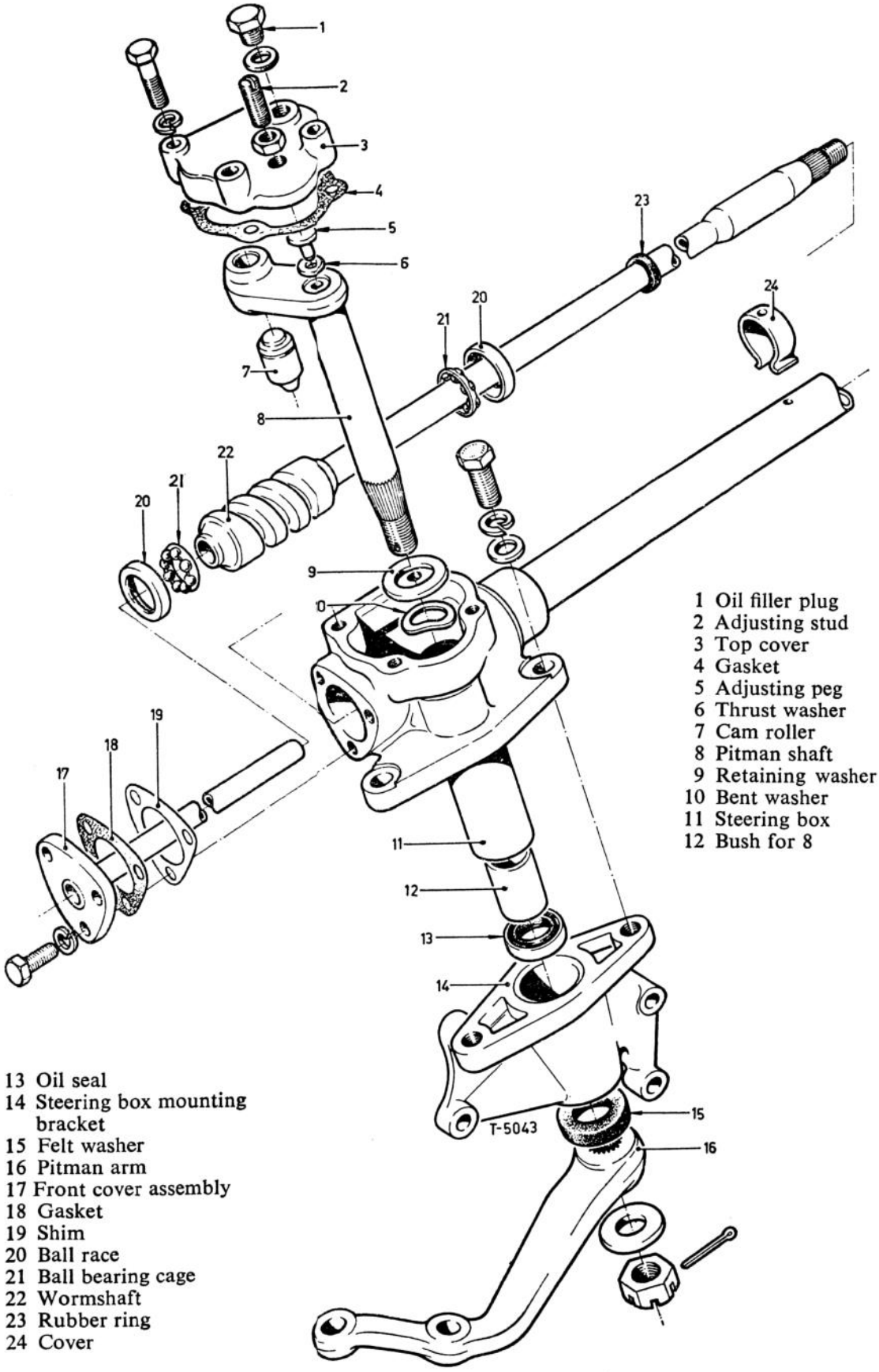


Fig. 40. Steering gear, exploded view

Steering gear: The steering gear is of the worm and needle-mounted peg-type.

Removal and installation: Disconnect and remove the battery (on rhd models only).

Drain and remove the radiator and on rhd cars remove the windshield washer container.

Disconnect the horn at the connector under the steering box. Uncover the steering wheel nut and remove; withdraw the steering wheel with a suitable puller (18G70).

Remove the set screws (four) securing the lower part of the steering column cover and remove the cover. Disconnect all electrical wiring at the direction indicator and ignition/starter switch.

Remove the upper half of the steering column cover.

Remove the direction indicator switch.

Remove the two upper bolts securing the steering box to the sub-frame.

Release the sleeve support bracket from the valance.

Jack up the front of the vehicle and disconnect the ball joints at the pitman arm.

Remove the steering column grommet from the bulk head.

Remove the two lower bolts securing the steering box to the frame, then manoeuvre the assembly downwards and to one side to allow withdrawal from the vehicle.

Installation is a reversal of the dismantling procedure. Do not tighten any securing bolt until the unit has been properly aligned in the vehicle. Fill the steering box with the recommended lubricant. Before fitting the steering wheel, make sure that the front wheels are in the dead straight ahead position. Check the front wheel alignment.

Dismantling the steering box: Remove the pitman arm and drain the oil from the steering box. Remove the steering box cover and withdraw the pitman shaft by gently tapping it out with a soft drift.

Remove the follower peg from the needle-roller bearing in the pitman shaft lever and support the lever over an open jawed vice. Press out the needle roller bearing and its cap.

Remove the end-cover; hold the unit upright so that the steering box end is uppermost and bump the lower end on a wooden block, thus dislodging the worm with its ball bearings. Withdraw the worm shaft complete through the steering box housing bottom aperture. If necessary remove the felt bush from the steering column upper end with a suitable hooked tool.

Assembling and adjusting the steering box: A new felt bush should be smeared with hypoid oil before installation. Assembly is a reversal of the dismantling procedure, noting the following:

Shims should be fitted to the bottom cover until the worm shaft bearings have no end-float but are not pre-loaded; shims for this purpose are available in three thicknesses.

The pitman shaft end-float is adjusted after the steering gear is re-installed in the vehicle. Check that the front wheels are exactly in the straight ahead position and turn down the pitman shaft adjuster screw until there is no free play. Note that there is slight end-float near each lock. With no load on the pitman shaft, the torque required to move the steering wheel through the straight ahead position should be between 6 and 20lb in.

From cars Nos. G/HS2–27144 (rhd), 27232 (lhd) and from R/HS3–20146 (rhd), 20246 (lhd) a spring loaded adjustment screw is fitted; on these models adjustment is as follows:

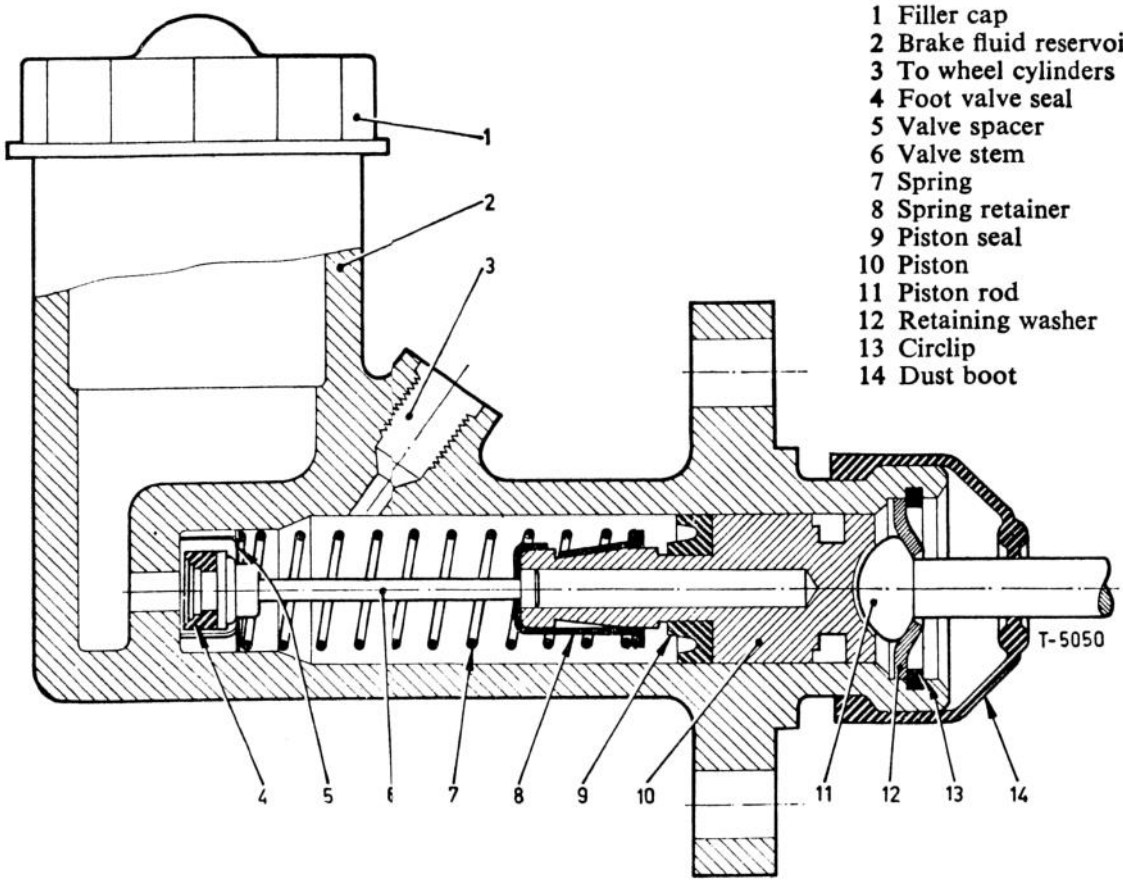


Fig. 41. Brake master cylinder, sectioned view

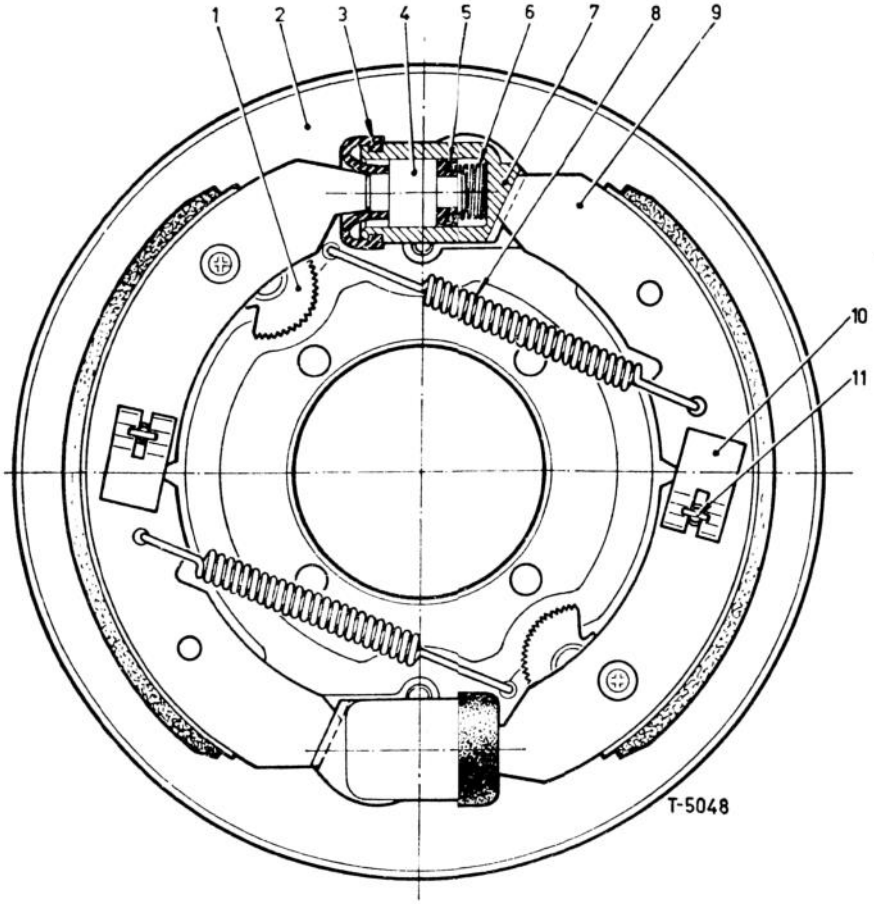
Turn the pitman shaft in the straight ahead position. Release the adjuster screw on the steering box side cover and screw in until solid; then back off by ¼ of a turn and secure the lock nut (tightening torque 14–16lb in). Without load on the pitman shaft, the force required to move the steering wheel across the straight ahead position should be between 12 and 20lb in. Excessive load can be corrected by turning the adjuster screw accordingly in counter-clockwise direction.

NOTE: *The adjuster screw should only be turned in an anti-clockwise direction; if over-adjusted, screw down firmly and readjust.*

Nylon seated track rod ball joints: The ends of the track rods are fitted to the steering arms by means of nylon seated ball joints, which were grease packed in production and do not require periodic maintenance. As the entry of dirt or grit could easily ruin the nylon ball joint, it is of utmost importance that the dust boot is in good condition. If a dust boot is found to be torn or damaged, it is evident that foreign particles have already entered the ball joint; in such a case the entire ball joint must be replaced. If the dust boot should be accidentally damaged while servicing, it is safe to replace the dust boot only.

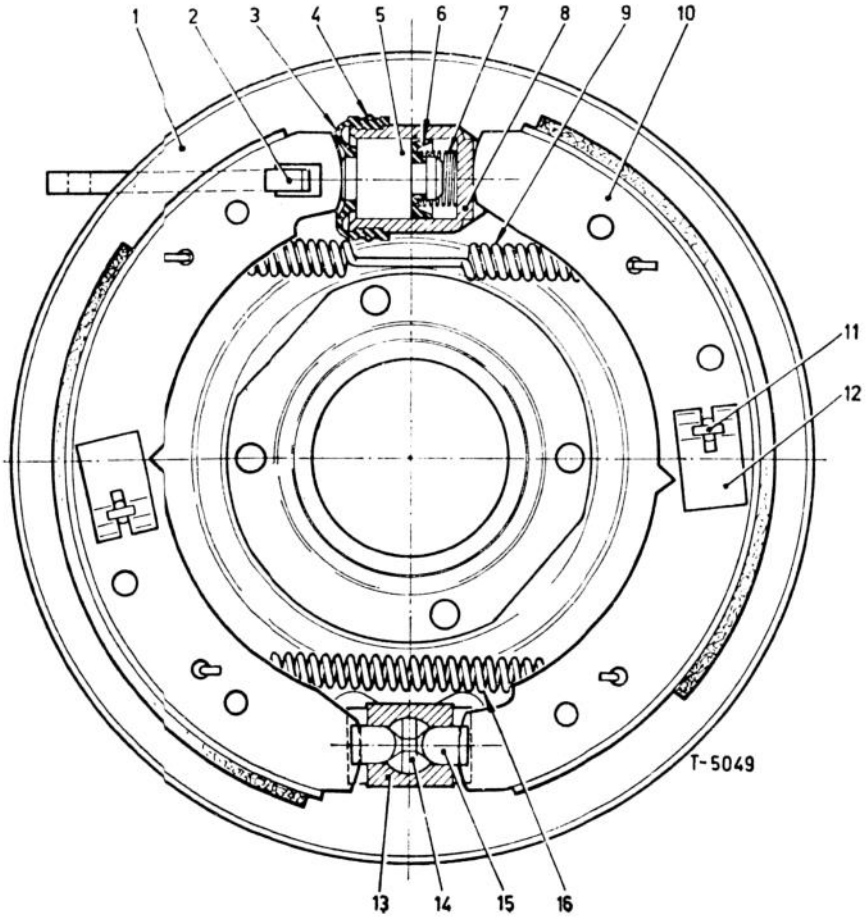
Before fitting a new dust boot, smear the adjacent area with some Dextragrease Super G.P.

Brakes: Girling hydraulically operated foot brake on all four wheels. The front brakes are of the two leading shoe type with a separate slave cylinder for each brake shoe; the rear brakes have a single acting sliding type slave cylinder operating both brake shoes.



1 Adjusting cam
2 Brake backing plate
3 Dust boot
4 Piston
5 Seal
6 Spring
7 Wheel cylinder
8 Brake shoe retracting spring, upper
9 Brake shoe
10 Retaining clip for 11
11 Brake shoe steady pin

Fig. 42. Front brake assembly



1 Brake backing plate
2 Parking brake lever
3 Dust boot
4 Spring clip
5 Piston
6 Seal
7 Spring
8 Wheel cylinder
9 Brake shoe retracting spring, upper
10 Rear brake shoe
11 Brake shoe steady pin
12 Retaining clip for 11
13 Adjuster housing
14 Adjusting stud
15 Adjusting tappet
16 Brake shoe retracting spring, lower

Fig. 43. Rear brake assembly

Each rear wheel brake cylinder incorporates a mechanical expander, operated by the parking brake lever, which is of the conventional ratchet and pawl type. When the brake shoes have been removed, make sure that the shorter hook of each retracting spring is attached to a brake shoe. The brake master cylinder, incorporating an integral brake fluid reservoir, is mounted on the bulkhead; the brake fluid is pressure fed to the slave cylinders via steel tubing and flexible hydraulic hoses.

Front brake adjustment: Jack up the car with the parking brake applied; spin the front wheel and apply the foot brake hard to centralize the brake shoes.

Turn one adjuster on the brake backplate in clockwise direction until the brake shoe is hard in contact with the drum; then turn back the adjuster two 'clicks'. The wheel should then rotate freely without the brake shoe rubbing against the brake drum. Repeat this procedure with the other brake adjuster on that wheel; then adjust the front brake on the opposite side in a similar manner.

Rear brake adjustment: Chock the front wheels, release the parking brake and jack up the rear of the vehicle. Spin the wheel and apply the foot brake hard to centralize the brake shoes.

Turn the square-headed adjuster on the brake backplate in clockwise direction, until the brake shoes are hard in contact with the drum; then back off the adjuster just sufficiently to allow free brake drum rotation. Repeat this procedure with the opposite rear wheel.

Parking brake adjustment: Parking brake adjustment is automatically achieved by adjusting the rear foot brakes. In extreme cases where the parking brake operating cable is stretched, the cable should be shortened by turning the adjusting nut and locking nut at the forward end of the brake cable assembly, but take care not to twist the cable. When correctly adjusted the rear wheels should rotate freely when the parking brake is fully released. Make sure that each rear brake is applied equally when operating the parking brake.

BODY

Removal and installation of a window regulator: Remove the door trim panel and remove the front door pull. Open the ash-tray and remove to gain access to the ash-tray holder securing screws, withdraw the holder.

Push in the inner door handle escutcheon and remove the pin thus exposed; this will allow removal of the handle and the escutcheon. The regulator handle escutcheon consists of two parts, the escutcheon proper and a plastic dome; push in the dome, remove the securing pin and withdraw the handle.

Starting along the bottom edge, carefully prise off the door trim panel which is retained by spring clips. When the panel is free at the bottom and on the sides, carefully bump the top of the door capping whilst pulling up the trim panel.

Removal of a rear door panel is a similar procedure. Remove the four set screws from the spindle plate and the four screws securing the winding mechanism to the door. Remove the bolt from the bottom of the window channel. The regulator mechanism can now be removed through the apertures in the door panel. The rear door window regulator mechanism is removed in a similar manner. Slide the regulator from its channel at the base of the window.

Installation is a reversal of the removal procedure.

Removal and installation of a door lock: Remove the door trim panel as described in the previous paragraph and remove the circlip and thrust washer securing the remote control lever connecting link to the door lock lever. Remove the three

securing screws and remove the remote control mechanism. The lock can be withdrawn after removing its three securing screws.

Installation is a reversal of the removal procedure, noting the following:

All moving parts should be adequately lubricated with grease. The remote control mechanism must be installed in the locked position.

For front doors, replacement locks are supplied with the remote control pegged in the locked position. Align the remote control mechanism by sliding it towards the lock until the lock lever contacts the lock casing; the mounting holes of the remote control mechanism are elongated for this purpose: on front door locks do not forget to remove the locking peg fitted during production.

Instruments and controls, removal and installation (Austin, Morris and Wolseley):

Before removing any instrument or control, make sure that the battery is disconnected.

All instruments and controls can be reached from behind the facia panel.

Heater controls: Depress the spring loaded locking pin in the control knob and withdraw the knob. Detach the inner and outer cables from the clamp bracket and trunnion, remove the locking ring and withdraw the control complete.

Installation is a direct reversal of the above procedure.

Choke control: First disconnect the cable at the carburettor, unscrew the circular retaining nut and withdraw the choke control with the cable.

For installation reverse the removal operation.

Temperature, fuel and oil pressure gauges: Disconnect the electrical leads, the oil pressure gauge pipe at the union, remove the mounting clamps and withdraw the instrument.

For installation reverse the removal operation.

Switches: The switches are each attached to the facia by means of a circular nut. After having removed the nuts and disconnected the wiring, the switches can be removed.

Speedometer unit: First withdraw the warning and lighting bulb holders; detach the speedometer drive cable and unscrew the odometer reset button. Release the mounting clamp(s) and withdraw the unit with its rubber ring from the facia.

Installation is a reversal of the removal procedure.

Instruments and controls, removal and installation (Riley)

Before removing any instrument or control, make sure that the battery is disconnected. All instruments and controls can be reached from behind the facia panel.

For removal of the speedometer head or tachometer, it is necessary first to remove either one of the adjacent instruments.

For removal and installation of switches or the choke control refer to the previous paragraphs.

Instruments and controls removal and installation (MG)

Removal and installation of instruments or controls is a straightforward operation for which it is not necessary to give a detailed description. The attachment of the components is similar to those previously described. All instruments and controls may be reached from behind the facia panel.

Windshield wiper motor

Removal and installation: First disconnect the battery and detach the cable rack from the motor and gearbox, as follows: Unscrew the pipe union nut, remove the

gearbox cover, the split pin and washer from the crankpin and final drive gear; then lift off the connecting link. Disconnect the electrical wire and remove the wiper motor after unscrewing the two mounting bracket securing bolts.

Installation is a reversal of the removal procedure.

ELECTRICAL EQUIPMENT

Electrical system: 12-Volt electrical system with positive (+) earth connection. The battery is located on a platform in the engine compartment.

Wiring diagrams: See pages 71 to 74.

Key to wire colours, Figs. 44 to 47:

1 Blue	18 Green-red	33 Brown	45 Red-green
2 Blue-red	19 Green-yellow	35 Brown-yellow	49 Purple
4 Blue-white	20 Green-blue	36 Brown-blue	53 Purple-white
9 White	21 Green-white	37 Brown-white	56 Purple-black
10 White-red	22 Green-purple	38 Brown-green	57 Black
16 White-black	23 Green-brown	41 Red	62 Black-green
17 Green	24 Green-black	44 Red-white	107 Light green-purple
			108 Light green-brown

Key to wiring diagrams, Figs. 44 to 47:

B	Battery
CL	Clock (if fitted)
CO	Coil
D	Dip switch
DF	Direction indicator, switch
DI.L.F	Direction indicator, left front
DI.R.F	Direction indicator, right front
DI.L.R	Direction indicator, left-rear
DI.R.R	Direction indicator, right-rear
DIS	Distributor
DS	Direction indicator switch
DSW.L	Door switch, left
DSW.R	Door switch, right
DW	Direction indicator warning light
FG	Fuel gauge
FGU	Fuel tank gauge unit
FP	Fuel pump
FU	Fuses (in fuse holder)
GEN	Generator
H	Horn
HB	Horn button
HL.L	Headlamp, left
HL.R	Headlamp, right
HLW	Main beam warning light
HM	Heater motor
HS	Heater motor switch
IL/ILS	Interior light/interior light switch
IN	Instrument light
IN.CIN	Instrument unit light
IN.CL	Clock light (if fitted)
IN.FG.OG	Fuel/oil pressure gauge light (Riley 4/72)
IN.FG.TG	Fuel/temperature gauge light (MG Magnette)
IN.AM.OG	Ammeter/oil pressure gauge light (MG Magnette)
IN.AM.TG	Ammeter/temperature gauge light (Riley 4/72)
IN.SPM	Speedometer light
IN.RC	Revolution counter light (Riley).
IS/STS	Ignition/starter switch
LFU	Line fuse
LL	Number plate light
LU	Luggage compartment light
LUS	Luggage compartment light switch
LS	Light switch
NS	Neutral switch (with automatic transmission only)
R.L	Rear lamp, left
R.R	Rear lamp, right
RBL	Radiator badge lamp (Wolseley 16/60 only)
REL.L	Reversing lamp, left
REL.R	Reversing lamp, right
RELS	Reversing lamp switch
SI	Selector indicator (with automatic transmission only)
SL.L	Side lamp, left
SL.R	Side lamp, right
SM	Starter motor
SSO	Starter solenoid
SSW	Stoplamp switch
STL.L	Stoplamp, left
STL.R	Stoplamp, right
TG	Temperature gauge
TGS	Temperature gauge transmitter unit
VR	Voltage regulator
WI	Windscreen wiper motor
WIS	Windscreen wiper switch

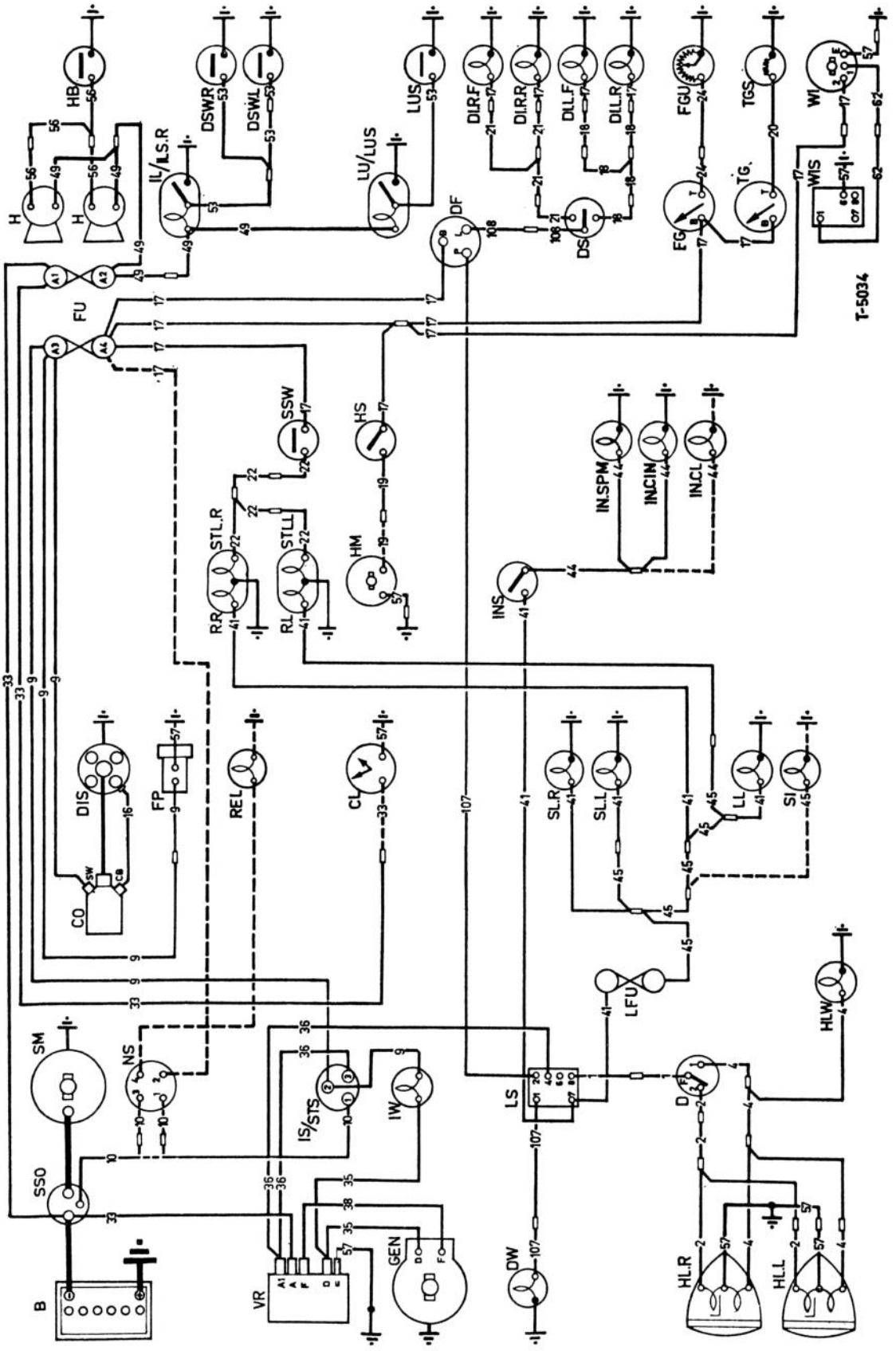


Fig. 44. Wiring diagram, Austin A60 and Morris 'Oxford' Series VI

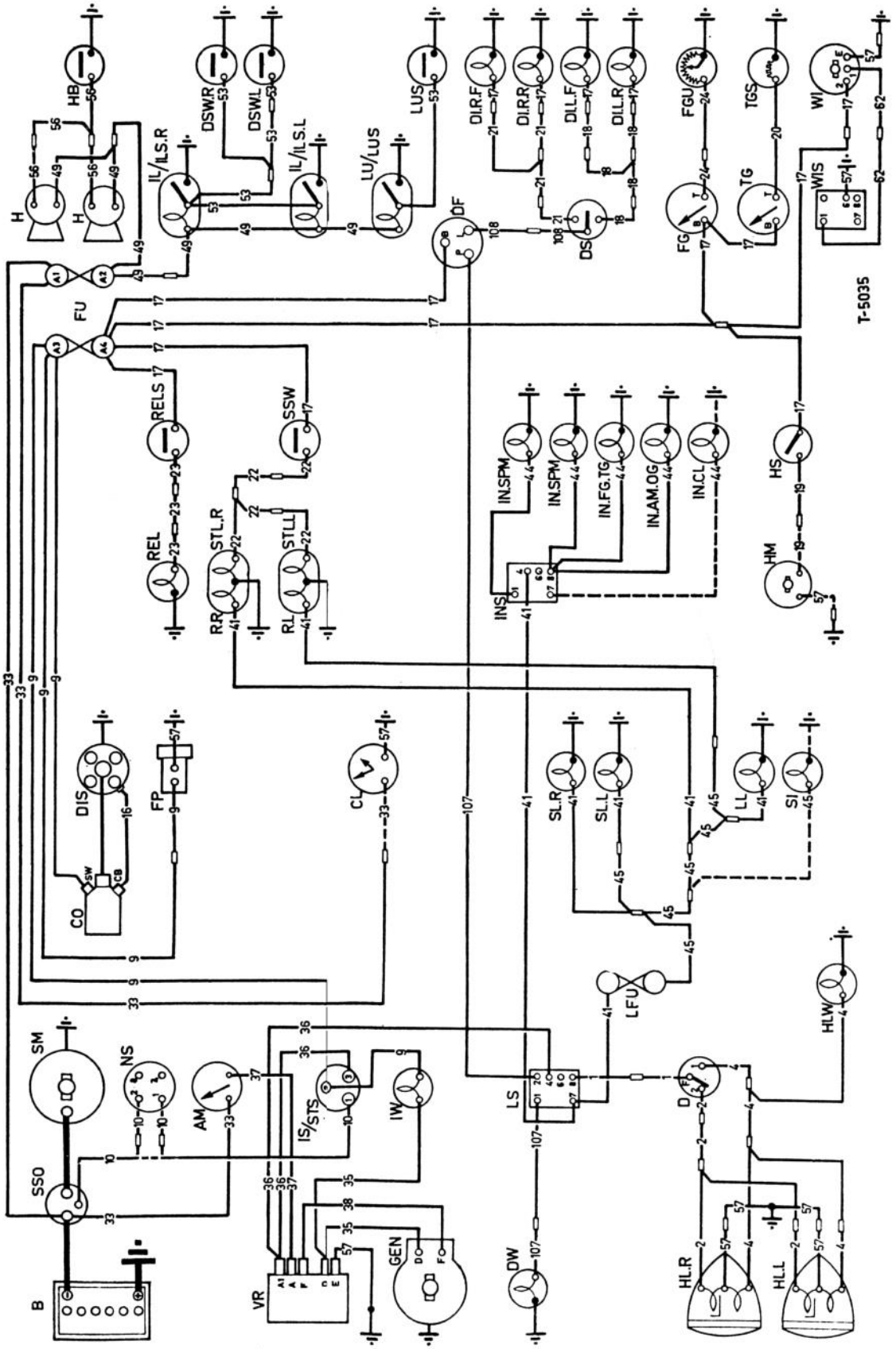


Fig. 45. Wiring diagram, MG 'Magnette' Mk IV

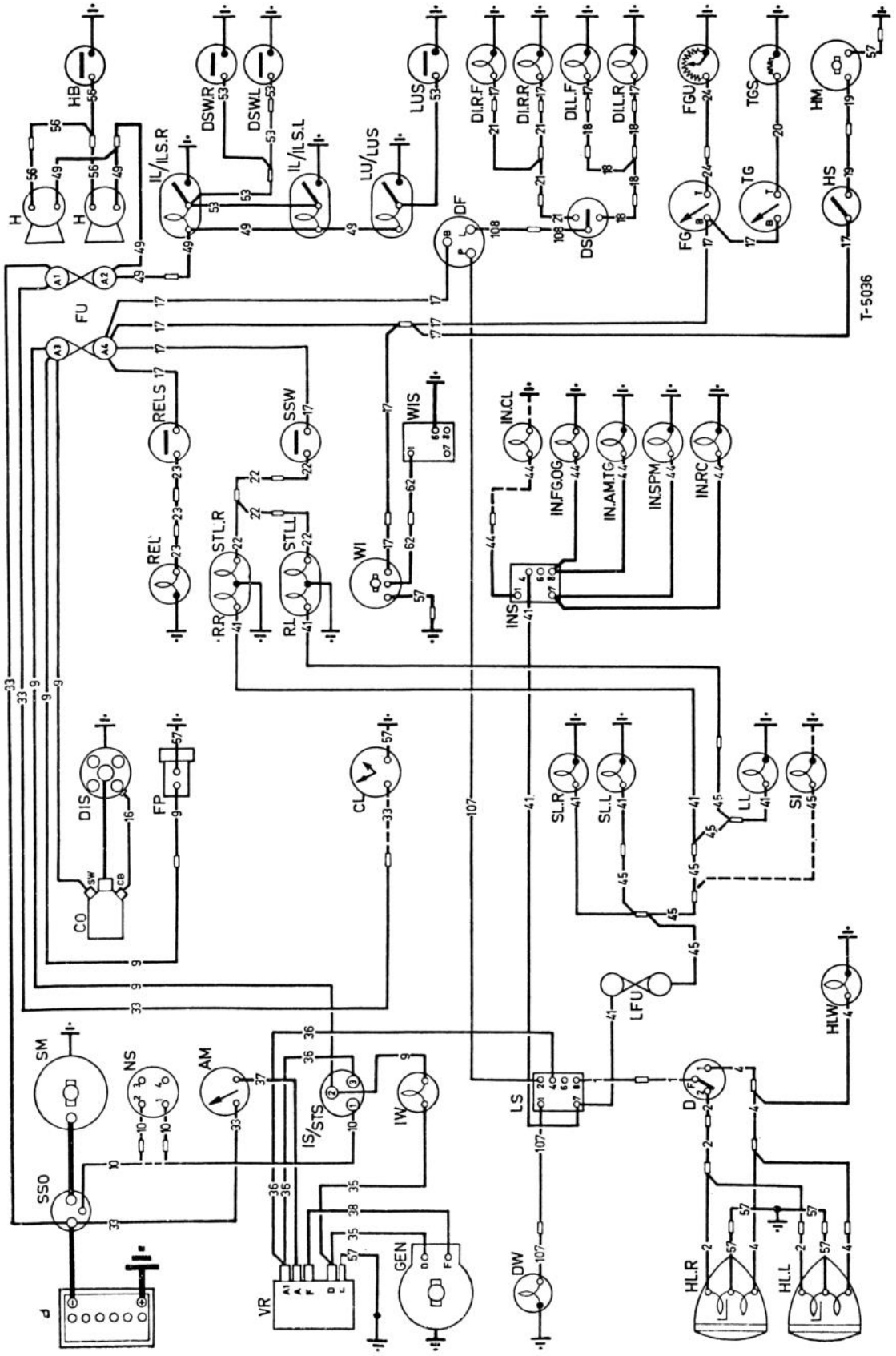


Fig. 46. Wiring diagram, Riley 4/72

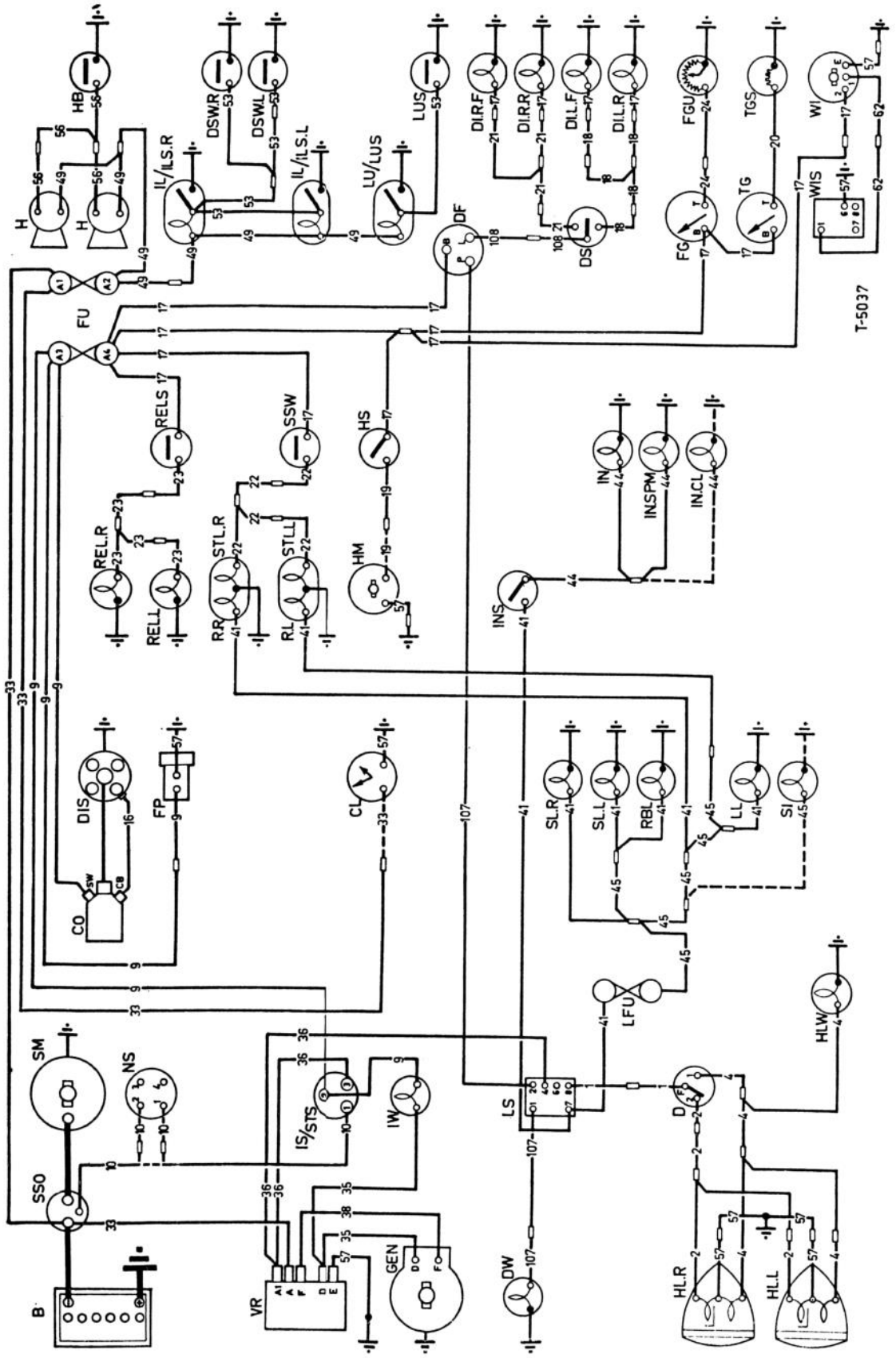


Fig. 47. Wiring diagram, Wolseley 16/60

Generator:

Dismantling: Remove the drive pulley securing nut and withdraw the pulley together with the woodruff key from the armature shaft. Remove the two through-bolts and remove the commutator end cover. Withdraw the pulley end cover together with the armature and its ball bearing from the yoke. Unless the ball bearing is worn or damaged, its removal from the cover is unnecessary; if required the bearing must be pressed out by means of a suitable hand press after the retaining plate nuts have been drilled out.

Inspection and re-conditioning: Thoroughly clean all parts and carry out the following inspections: Check the condition of the carbon brushes and ensure that these can move freely in their holders; if this is not the case, they should be polished with a smooth file.

If the brushes are worn or broken new brushes must be fitted and properly bedded on the commutator. This can be performed by wrapping a strip of very fine sandpaper around the commutator and pressing the brushes in their holders against the commutator, which should then be turned by hand until the brushes are seated properly on the commutator.

The commutator should be smooth and free from pits, burrs or burn spots. Clean the commutator with a soft cloth soaked in petrol and if necessary polish it with a strip of very fine sandpaper. A badly worn commutator should be mounted in a lathe turning at high speed and employing a sharp tool, undercut the insulation to 1/32in, after which the final polishing should be done with very fine sandpaper (see Technical Data). The field coils may be tested *in situ* by means of an ohm meter which should read 6·0–6·3 ohms or by connecting a 12-Volt battery with an ammeter in series between the field coil terminal and the yoke.

The ammeter reading should be approximately 2 amps; no reading indicates an open circuit necessitating renewal of the coils. An ammeter reading of considerably more than 2 amps or an ohmmeter reading of much less than 6 ohms is evidence of a short circuit in one of the field coils. Install new field coils as necessary. The armature should be checked with a growler and voltage drop test equipment: if these are not available check the armature by substitution.

The bearing bush can be removed by means of a suitable extractor or by screwing a 5/8in tap into it after which it can be withdrawn. Before pressing a new porous bronze bearing bush, it should be immersed in light engine oil for twenty-four hours (or for two hours in oil heated to 100°C).

Do not ream the bush after this soaking treatment.

NOTE: When pressing the pulley end cover on to the armature shaft, be sure to support the inner bearing race *and not the end cover*; this is best accomplished with a piece of tube.

Re-assembly: After thorough examination of all parts, renewing those that are worn or damaged, re-assembly is effected in reverse sequence of the dismantling procedure, paying particular attention to the following: If the ball bearing is to be renewed, the new bearing should be packed with high melting point grease before pressing it into the end cover, preceded by the oil retaining washer, the felt washer and the corrugated washer. After the bearing has been pressed home the bearing retaining plate must be secured with new rivets. When installing the commutator end cover complete with the brush gear, the brushes must be held clear of the commutator by partially withdrawing them from their holders until the brush springs push them sideways against the holders, thus keeping them in this lifted position. Once the

end cover is on the shaft and the distance between the cover and the yoke amounts to approximately ½ inch, the brushes should be released on to the commutator with a small hook or screwdriver. Before finally pressing on the end cover ensure that the brush springs are properly seated on the brushes.

Starter motor:

NOTE: Before dismantling note that the commutator and the brush gear can be examined without dismantling the starter motor; in order to check the brush gear it is sufficient to remove the starter cover band. If the brushes are sticky and cannot move freely in their holders they should be pulled out and lightly dressed with a smooth file. If the commutator is blackened or dirty it can be cleaned by holding a soft cloth, soaked in petrol, against it while rotating the armature by hand.
Dismantling: Lift the brush springs and pull the brushes clear of their holders. Remove the terminal nuts and washer from the terminal post on the commutator end cover.

Remove the drive end cover together with the armature and drive assembly.
Examining and re-conditioning: The correct brush spring tension of 30 to 40oz should be checked with a spring balance; if necessary replace the springs. Chipped, cracked, worn or otherwise damaged brushes should be renewed by unsoldering the flexible connections and soldering the new brush connections to the terminals. Replacement brushes are pre-formed, which makes bedding on the commutator unnecessary. The commutator must be smooth and free from pits and burn spots. Clean the commutator with a petrol moistened cloth; if this gives unsatisfactory results carefully polish the commutator with very fine sandpaper. A badly damaged commutator must be skimmed with a high-speed lathe using a sharp tool.
Do not remove more material than is necessary.

NOTE: *Do not undercut the insulation between the segments.*

The field coils can be tested by connecting a 12 Volt lamp with a 12 Volt battery to the tapping point of the coils to which the brushes are soldered and the field terminals post. If the lamp does not light up it becomes evident that there is an open circuit in the field coils, in which case they should be renewed. If the lamp does light up this does not necessarily mean that the field coils are in good order as a short-circuited coil will also cause the lamp to light. This condition may be checked by removing the test lead from the brush connector and connecting it to the yoke instead; if the bulb lights up now it is certain that the coils are short-circuited. The armature core may under no circumstances be machined, nor should attempts be made to true-up a distorted armature shaft.

If the porous armature bearing bushes are worn to such an extent that renewal is imperative, follow the procedure outlined under Generator.

The drive assembly can be withdrawn from the shaft after the spring has been compressed and the circlip has been removed.

Carefully clean and examine all parts and renew them if necessary.
Re-assembly: Re-assembly is a reversal of the above operations.

Lamp bulb replacement:

Head light units: Remove the screw at the bottom and remove the chrome rim and the rubber sealing ring; three spring loaded screws will now be exposed. Press the light unit inward and turn it in an anti-clockwise direction until released from the screw heads. Withdraw the light unit sufficiently to allow withdrawal of the lamp

bulb holder. Replace the bulb and re-install as a reversal of the removal procedure.
Side lamp and direction indicator light bulbs: Access to both bulbs is gained by removal of the plastic lens, retained by two screws. The bulbs are of the bayonet-fixing type.
Tail, stop and direction indicator lamp bulbs: The tail lamp bulbs are of the dual filament type; the second filament serving as stop lamp bulb. The direction indicator lamp bulb is separate. Both bulbs are covered by a one-piece plastic lens. The bulb holder of each unit can be reached from within the luggage boot. Simply pull out the bulb holder, exchange the bulb and replace the holder.
Instrument and warning light bulbs: Each bulb holder can be withdrawn when reaching up behind the facia panel; exchange the bulb and replace the holder.
Number plate lamp bulb: This bulb is located under a domed housing, centrally on top of the rear bumper; its replacement is possible after removal of the domed cover. Later models are fitted with twin bulb number plate illumination; both bulbs are of the bayonet-fixing type.
Interior light bulb(s): The bulb of each light is accessible after removing the plastic cover by gently squeezing its sides inwards. Replace the bulb, which is of the festoon-type, and refit the cover.
Headlamp adjustment: The headlamps should be set in accordance with the local government regulations. Horizontal adjustment is obtained by turning one of the slotted screws at the sides of the unit in either direction as necessary. Vertical adjustment is possible by turning the screw at the top of the unit; this can be reached with a thin-bladed screwdriver without disturbing the embellisher rim.

Technical Data

(See also pages 16 to 18)

ENGINE

Type:	4-cyl. ohv BMC 'B' Series
Model designations:	See page 5.
Bore:	76·2mm (3in)
Stroke:	88·9mm (3·5in)
Cubic capacity:	1622cc (99·5cu in)
Firing order:	1–3–4–2
Compression ratio, standard	8·3:1
optional on Austin and Morris:	7·2:1
Combustion chamber capacity (valves fitted):	2·64cu in (43·0cc)
Engine performance figures:	See page 16.

Valves:

Valve seat angle:	45°
Valve head diameter, inlet:	1·500–1·505in
exhaust:	1·281–1·286in
Valve stem diameter, inlet:	0·3422–0·3427in
exhaust:	0·34175–0·34225in
Valve lift, Austin, Morris, Wolseley:	0·325in
MG, Riley:	0·312in

Valve rocker clearance (cold):	0·015in
Valve stem to guide clearance, inlet:	0·0015–0·0025in
exhaust:	0·002–0·003in
Valve springs (*Austin, Morris, Wolseley*):	
Free length:	2 1/32in (51·6mm)
Number of effective coils:	4½
Spring tension, valve open:	130lb at 1 13/64in (30·6mm)
valve closed:	77·5 ± 2lb at 1 17/32in (38·9mm)

Valve springs (*MG and Riley*):

	inner	*outer*
Free length:	1 31/32in	2 3/64in
Fitted length:	1 7/16in	1 9/16in
Number of effective coils:	6½	4½
Spring tension, valve open:	50lb	105lb
valve closed:	30lb	60½ lb

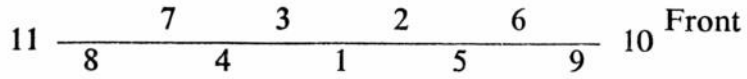
Valve tappets:

Type:	Barrel-type
Length:	2·293–2·303in
Tappet diameter:	0·81125–0·81175in
Clearance in bore:	0·0005–0·00175in

Valve timing (*for diagram see Fig. 21 page 34*):

Chain pitch and number of links:	3/8in; 52 links
Theoretical valve clearance (timing only):	0·021in

Cylinder head nuts, tightening sequence:



Pistons:

Type:	solid skirt
Material:	aluminium alloy
Available oversizes:	0·010; 0·020; 0·030; 0·040in
Piston clearances, bottom of skirt:	0·0015–0·0021in
top of skirt:	0·0022–0·0034in
top of skirt (MG and Riley):	0·0035–0·0042in

Piston rings:

	Austin, Morris, Wolseley	*MG and Riley*
Compression rings, top ring:	plain	plain
second and third:	tapered	tapered
Width:	0·0771–0·0781in	0·0615–0·0625in
Thickness:	0·119–0·126in	0·119–0·126in
Gap, fitted:	0·012–0·017in	0·012–0·017in
Clearance in groove:	0·0015–0·0035in	0·0015–0·0035in
Oil control rings, type:	slotted scraper	slotted scraper
Width:	0·1552–0·1562in	0·1552–0·1562in
Thickness:	0·119–0·126in	0·119–0·126in

Gap, fitted:	0·008–0·013in	0·008–0·013in
Clearance in groove:	0·0016–0·0036in	0·0018–0·0038in

Piston pins:

Type:	clamped
Fit in piston:	0·0001–0·00035in
Fit in connecting rod:	0·0001–0·0006in
Outer diameter (Austin, Morris, Wolseley):	0·75in
Outer diameter (MG and Riley):	0·6869–0·6871in

Cylinder bores and dry liners:

Cylinder bore, ready for liner:	3·1415–3·142in
Dry liner, outer diameter:	3·1435–3·14425in
Interference fit in cylinder bore:	0·0015–0·0027in
Finishing diameter after installation of liner:	2·9995–3·001in

Connecting rods:

Type:	Angled big-end
Length between centres:	6·5in

Big-end bearings:

Material:	Steel-backed, copper-lead
Radial bearing clearance:	0·001–0·0027in
Bearing end-float:	0·008–0·012in

Main bearings:

Number and type:	3, shell type
Material:	steel-backed, copper-lead
Crankshaft end-float:	0·002–0·003in
End thrust:	Taken at centre bearing
Radial bearing clearance:	0·001–0·0027in
Available undersizes:	0·010; 0·020; 0·030; 0·040in

Crankshaft:

Crankpin journal diameter:	1·8759–1·8764in
Minimum regrind diameter:	1·835in
Main bearing journal diameter:	2·0005–2·001in
Minimum regrind diameter:	1·96in

Camshaft:

Bearing journal diameter, front:	1·78875–1·78925in
centre:	1·72875–1·72925in
rear:	1·62275–1·62325in
Camshaft end-float:	0·003–0·007in
Bearing bush outer diameter, not fitted, front:	1·920in
centre:	1·860in
rear:	1·754in
Bearing bush inside diameter, reamed to size, front:	1·790in
centre:	1·1730in
rear:	1·624in
Bearing clearance:	0·001–0·002in

Oil pump:

Type:	eccentric rotor
Relief valve operates at:	50lb/sq in 75 lb/sq in (MG; Riley)
Relief valve spring, free length:	2·859in
fitted length:	2·156in
Capacity:	3¼gal/min @ 1000 pump rpm
Oil pressure (normal running)	50lb/sq in 75lb sq/in (MG; Riley)
Oil pressure at idling speed (engine hot)	15 lb/sq in (min)

Fuel system:

Carburettor (Austin, Morris, Wolseley):	
Make and type:	SU, semi-downdraught, type HS2
Throat diameter:	1¼in
Jet size:	0·090in
Jet needle, standard:	GX
rich:	M
weak:	GG
Piston spring colour:	yellow
Carburettors (MG and Riley):	
Make and type:	Twin SU semi-downdraught, type HD4
Throat diameter:	1½in
Jet size:	0·090in
Jet needles, standard:	HB
rich:	FU
weak:	FK
Piston spring colour:	red
Fuel pump:	
Make and type:	SU electrically operated, SP or AUF 200 (model 204)
Delivery rate (minimum):	56 pints/hr
Delivery pressure:	2–3·8lb/sq in

Ignition system:

Coil:	
Make and type:	Lucas LA 12
Spark plugs:	
Make and type:	Champion N5
Size:	14mm, ⅜in reach
Spark plug electrode gap:	0·024–0·026in
Distributor (*Austin, Morris, Wolseley*):	
Make and type:	Lucas 25 D4
Dwell angle:	60° ± 3°
Automatic advance:	Vacuum and centrifugal
Direction of rotation (viewed on top):	Anti-clockwise
Timing marks:	Pointers on timing cover and notch in crankshaft pulley flange
Breaker points gap:	0·014–0·016in
Breaker point spring tension:	18–24oz

Condenser capacity:	18–24 microfarads
Static ignition setting, high compression:	5° BTDC
low compression:	6° BTDC

	high compression	*high compression*	*low compression*
Serial number:	40822A	40822B**	40821
Automatic advance starts at:*	700rpm	750rpm	600rpm
Vacuum advance, starts at:*	4in Hg	4in Hg	7in Hg
ends at:*	12° at 17in Hg	12° at 17in Hg	24° at 18in Hg
Maximum advance:*	25° at 4000rpm	26° at 4600rpm	30° at 4200rpm
Decelerating check:*	20° at 2400rpm	26° at 3700rpm	30° at 4200rpm
	12° at 1400rpm	18° at 2700rpm	20° at 3000rpm
	8° at 1100rpm	10° at 1400rpm	4° at 1000rpm

Distributor (MG and Riley):

Make and type:	Lucas 25 D4
Dwell angle:	60° ±3°
Automatic advance:	vacuum and centrifugal
Breaker points gap:	0·014–0·016in
Breaker point spring tension:	18–24oz
Condenser capacity:	18–24 microfarads
Static ignition setting:	4° BTDC
Stroboscopic ignition setting:	7° BTDC at 600rpm
Automatic advance, starts at:	700rpm
Vacuum advance, starts at:	6in Hg
ends at:*	24° at 16in Hg
Maximum advance:*	26° at 3700rpm
Decelerating check:*	19° at 2700rpm
	10° at 1400rpm
	6° at 1000rpm

*Crankshaft degrees and rpm. ** Later types: 41150 and 41282.

Cooling system:

Type:	Pressurized radiator, pump and fan assisted
Thermostat setting, Standard:	82°C (180°F)
Hot climates:	74°C (165°F)
Cold climates:	88°C (190°F)

TRANSMISSION

Clutch

Make and type:	Borg & Beck A6-G, single dry plate
Diameter:	8in
Friction lining material:	wound yarn
Number of pressure springs:	6
Colours of springs:	black and yellow
Number of damper springs:	6
Colour of springs:	black and light green

Gearbox:

Type:	four-speed, s/m on 2nd, 3rd and top
Gear ratios:	See page 16–17.
Speedometer gear ratio:	9/28
Synchromesh hub spring length, free:	½in
fitted:	5/16in
Synchromesh hub spring load at fitted length:	4 to 5lb
Selector shaft detent spring length, free:	1 3/16in
fitted:	¾in
Selector shaft detent spring load at fitted length:	18 to 20lb
End-float, 2nd and 3rd speed gear:	0·0035–0·0055in
layshaft:	0·002–0·003in

Propeller shaft:

Type:	Tubular, reverse spline
Length (between centres of U-joints):	42¾in
Diameter:	2½in
Make and type of U-joints:	Hardy Spicer, needle roller

Rear axle/differential:

Type:	Three-quarter floating
Ratios:	See page 16–17
Differential carrier pre-load:	0·002in (nip per bearing)
Pinion bearing pre-load:	13–15lb in (10–12lb in without seal)
Crownwheel to pinion back lash:	Etched figure on crownwheel

CHASSIS

Steering gear:

Type:	cam and lever
Steering wheel turns (lock to lock)	2·9
Steering lock angle of outer wheel with inner wheel at 20°:	19°
Camber angle:	¾ to 1° (car in static unladen condition)
Caster angle:	¼° to 1°* (car in static unladen condition)
King pin inclination:	6½° (car in static unladen condition)
Toe-in:	1/16 to 1/8in (car in static unladen condition)

* 1¼°–3¼° on certain later models.

Front Suspension:

Type:	ifs with coil springs
Spring data:	
Number of effective coils:	7½
Free length:	11·687in
Mean coil diameter:	4·187in
Working load:	678lb
Spring rate:	300lb in

Rear Suspension:

Type:	Semi-elliptic leaf springs	
Spring data:		
	Saloons	*Estate cars*
Number of leaves:	6	7
Width of spring leaves:	1¾in	1¾in
Free camber:	3in	3 9/16in
Working load:	625lb	800lb
Spring rate:	167lb in	185lb in

Shock Absorbers:

Type, front and rear:	Armstrong lever arm

Brakes:

Type:	Hydraulically operated foot brake on all four wheels; parking brake operates mechanically on rear wheels only
Type:	Girling hydraulic drum brakes
Front:	Two leading shoes
Rear:	Single leading shoe
Drum size, front and rear:	9in
Brake lining area, front:	86·25sq in
rear:	60·4sq in
Lining material:	Ferodo AM3

ELECTRICAL EQUIPMENT

Battery:

Make and type:	Lucas, BT9A, BTZ9A, BT11A, BTZ11A
Capacity at 20 hr rate:	(BT9A, BTZ9A) 58 Ah (BT11A, BTZ11A) 72 Ah
Electrolyte fluid capacity:	1 pint per cell

Starter motor:

Make and type:	Lucas M35G/1, four-brush
Brush length, minimum:	5/16in
Brush spring tension, maximum:	30–34oz
minimum:	25oz

Generator:

Make and type:	Lucas C39PC2, C39PV2 or C40/1
C39PV2; C39PC2:	
Brush length:	11/32in (minimum)
Brush spring tension:	22–25oz
Test output:	13 Volts, 19 Amp at 1900–2150rpm
Field coil resistance:	6·0–6·3Ohms
C40/1:	
Brush length:	9/32in (minimum)
Brush spring tension:	30oz (maximum)
Brush spring tension:	13oz (minimum)
Test output:	13·5 Volts, 22 Amp at 2050–2250rpm
Field coil resistance:	6Ohms

Control box:

Make and type:	Lucas RB106/2 (or modified)
Cut-out, cut-in voltage:	12·7–13·3 Volts
drop off voltage:	8·5–11·0 Volts
reverse circuit:	5·0 Amp (maximum)

Voltage regulator data:

Regulator RB106/2 (at 1500 generator rpm): open setting at 20°C (68°F): 15·4–16·4 Volts

Regulator RB106/2 (modified) (at 3000 generator rpm): open setting at 20°C (68°F): 16·0–16·6 Volts

For ambient temperatures other than 20°C (68°F), apply the following corrections to the above:

For every 10°C (18°F) above 20°C, subtract 0·1 Volt

For every 10°C (18°F) below 20°C, add 0·1 Volt

AUTOMATIC TRANSMISSION

Description:

The automatic transmission available at extra cost on all 1·6 litre ADO.38 models is the three-speed Borg-Warner model '35', which was specially designed and developed for vehicles of under 2 litres cubic capacity. It consists of a hydraulic torque converter and gearbox with planetary gear sets, providing three forward ratios and one reverse. Use is made of high pressure die-casting techniques, developed by Doehler-Jarvis, and the main castings for gearbox and torque converter are made from aluminium alloy, which combines thin walls with exceptional soundness of material and ample rigidity, yet the total weight of the gearbox is no more than 90lb, only 13lb more than the standard gearbox, which weighs 77lb. The torque converter (filled) weighs 47lb, whereas the standard clutch and flywheel weigh 60lb, so that overall there is no difference in weight between the two systems.

Principles of operation:

In practice, the driver has the choice between automatic gear-changing, with ratios that have been selected to provide maximum performance under all conditions, and leisurely top-gear motoring at any speed between 15mph and the car's maximum. Lower ratios may also be engaged and held by other means if desired.

The engine can only be started with the selector lever (Fig. 48) in either the 'N' (Neutral) or 'P' (Park) position. Once the engine is running, if the selector lever is moved to the 'D' (Drive) position, and the accelerator pedal depressed, the car will move away smoothly, upward and downward gear-changes taking place entirely automatically, according to the car's speed and the degree of throttle opening.

On a level road, if the accelerator is depressed lightly to the point where the throttle is fully open, upward gear-changes will take place at 20 and 39 mph. If, however, only the minimum throttle is used, the upward changes will occur at speeds as low as 7 and 11mph and at proportionate speeds for intermediate throttle openings.

The driver has a further choice, in that by pressing still harder on the throttle pedal, it may be moved slightly beyond the full throttle position against a supple-

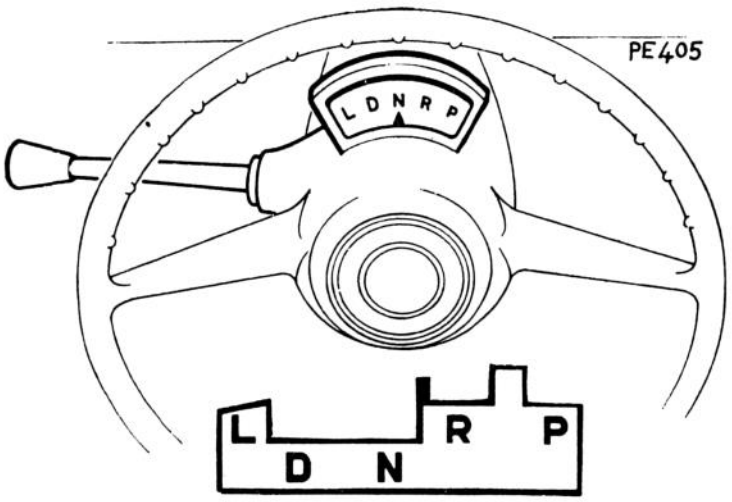


Fig. 48. Selector positions

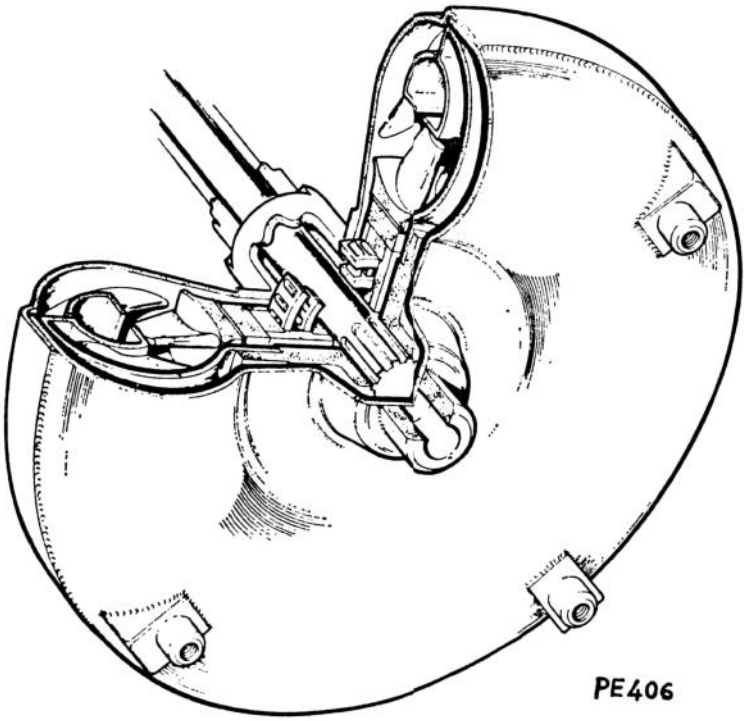


Fig. 49. Torque converter, cut-away view

mentary spring. This is known as the 'kickdown' position and if it is used, upward gear-changes will be delayed until 30 and 50mph, giving maximum acceleration.

Once top gear is engaged, a change down to second will not take place until the speed drops to below 15mph, even if full throttle (but without 'kickdown') is used. At the lower end of this top gear speed range, the fluid torque-converter will 'slip' and multiply the available torque, being particularly effective at around 20mph, enabling smooth motoring to be enjoyed in a leisurely manner without any gear changes over a very wide speed range.

NOTE: See page 54–55 for towing and push-starting instructions.

The steering column selector lever is so connected that the engine can only be started when it is in the 'N' or 'P' position. The driver can override the automatic gear changes by simply moving the lever from 'D' to 'L' which will normally engage second gear. At very low speeds or if the car is started from rest in position 'L', first gear will be held irrespective of throttle position.

The three-element torque converter acts as a fluid coupling and also multiplies engine torque at a 2:1 ratio when the engine is running and the car is at rest, thus providing an 'equivalent' bottom gear of 4·78:1.

The path of torque from the converter to the propeller shaft is shown schematically in this diagram. The 'stars' in the table show which of the multiplate clutches A and B, the band brakes C and D, and the over-running free wheel E, are in use for any particular gear combination. (Lock-up='Low' position).

However, if greater acceleration is required, the accelerator pedal may be depressed to the 'kickdown' position. In this case, at any speed below 42mph the gearbox will immediately change down to second gear, or if the speed is below 23mph directly to first gear, giving a very lively performance for a car of this size. Automatic upward changes will then be made at the speeds mentioned earlier until top gear is engaged again.

Similarly, if a steep gradient is encountered, and the car's speed falls away, top gear will normally be held until the speed drops to below 15mph, even at full throttle, but if 'kickdown' is used, down-changes will be made at 42 and 23mph.

If the car is started from rest with the selector lever in the 'L' (lock-up) position, first gear will be held regardless of throttle opening and no upward change will take place, unless the lever is moved to the 'D' position, when changes will take place normally as before. If, when driving with top gear engaged, the selector is moved from 'D' to 'L' (it is not recommended that this be done at above 60mph), an immediate change down to second gear will be made and from then on, second will be held engaged, regardless of throttle opening, unless the speed drops below 5mph, when a change to first gear will be made. First gear will now be locked in engagement as before and no further up-change will be made. Similarly, if second gear is already engaged when the selector is moved from 'D' to 'L', this gear will be held unless the speed drops below 5mph when a change to first gear will be made. Thus full engine braking in the lower gears is always available for the descent of steep hills, and second gear can always be selected manually if desired for cornering, or held (for example) when climbing a hill with many bends, when continuous automatic changes up and down would be undesirable. On moving the selector back again to 'D' normal automatic control is resumed.

Reverse ('R') and Park ('P') should only be selected when the car is stationary; in the latter position, the transmission is mechanically locked.

First Gear (*Lock-up selected, as shown in Fig. 52, LI*)

The front clutch is applied, connecting the converter to the forward sun gear. The rear band is applied, holding the pinion carrier stationary; the gear set provides a reduction of 2·39:1. The reverse sun gear rotates freely in the opposite direction to the forward sun gear.

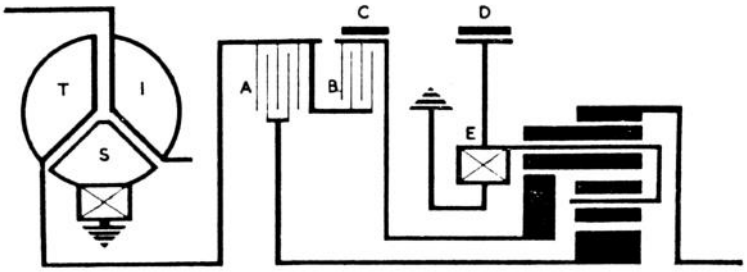
In this combination bottom gear remains engaged both when driving and on the overrun, irrespective of throttle position.

First Gear (*Drive selected, as shown in Fig. 51, DI*)

The front clutch is applied connecting the converter to the forward sun gear. The one-way clutch is in operation preventing the pinion carrier from rotating anti-clockwise; the gear set provides the reduction of 2·39:1. When the car is coasting the one-way clutch overruns, and the gear set freewheels.

With this combination of clutches a bottom gear of 2·39:1 is provided with an over-running free wheel. The upward change to second gear takes place at:

7mph on minimum throttle.
20mph at full throttle.
39mph on 'kickdown'.



	A	B	C	D	E
LOCK UP 1	★			★	
DRIVE 1	★				★
LOCK UP 2 DRIVE 2	★		★		
DRIVE 3	★	★			
NEUTRAL					
REVERSE		★		★	
PARK					

Fig. 50. Power flow diagram (schematic)

Second Gear (Low or Drive selected as shown in Fig. 51, D2/L2)

Again the front clutch is applied, connecting the converter to the forward sun gear. The front band is applied holding the reverse sun gear stationary; the gear set provides a reduction of 1·45:1.

This drawing shows the clutch and gear combination in the second ratio of 1·45:1. With the lever in 'L' this gear will be held at all speeds over 5mph on closed throttle, or over 25mph in the 'kickdown' condition.

In the 'D' position automatic upward changes into top gear will be made at:

11mph on minimum throttle
39mph on full throttle
50mph on 'kickdown'

Downward changes to first gear will automatically be effected at:

23mph on 'kickdown'
2mph on other conditions.

Direct drive (as shown in Fig. 52, D3)

The front clutch is applied, connecting the converter to the forward sun gear. The rear clutch is also applied thereby connecting the converter to the reverse sun gear also. Both sun gears are therefore locked together, the gear set rotating as one unit, thereby providing a ratio of 1:1.

In this condition the drive is taken straight through the gear box from end to end. With the lever at 'D' automatic downward changes will be made to second gear at the following speeds:

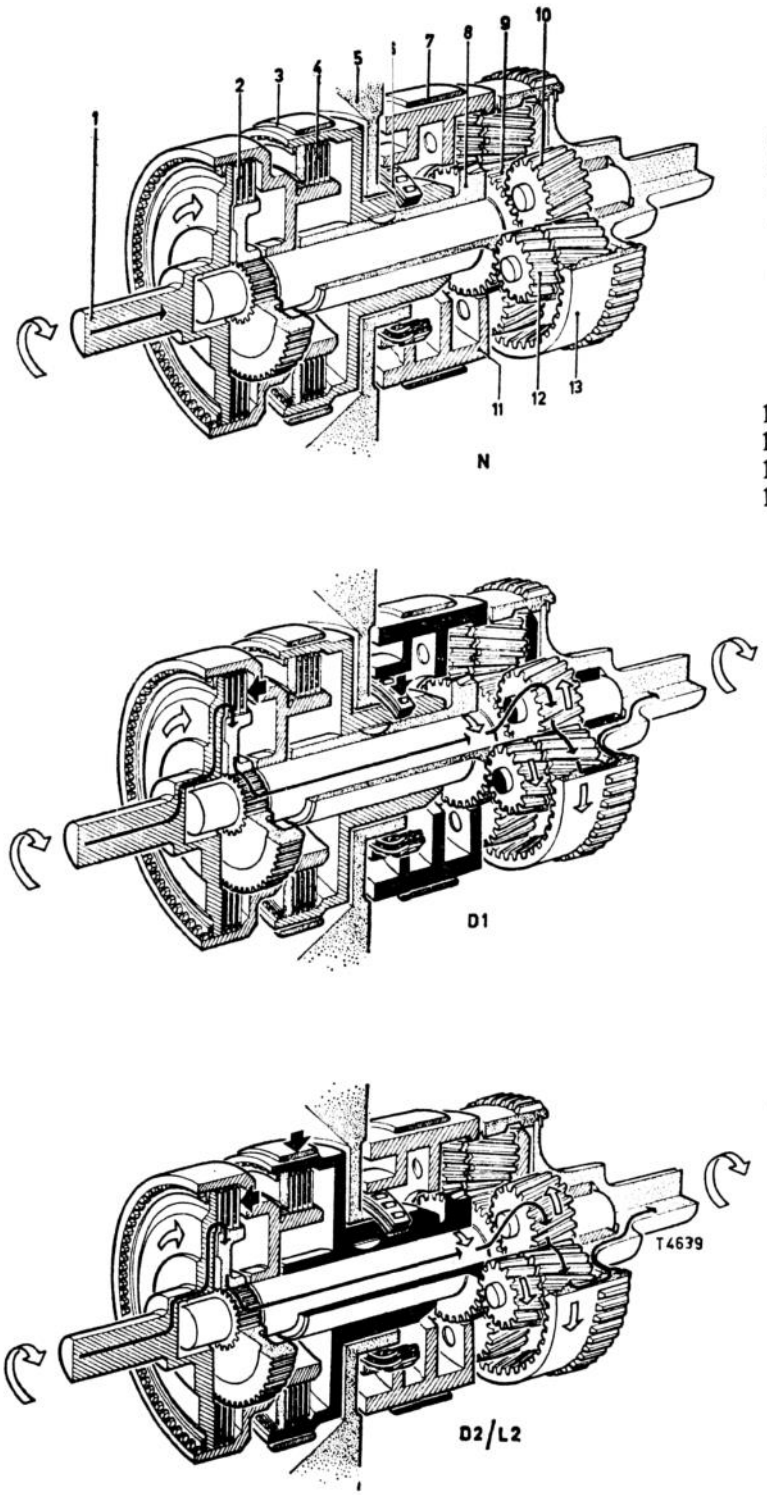
On minimum throttle at 6mph
On full throttle at 11mph
On 'kickdown' at 42mph

Neutral (as shown in Fig. 51, N)

The front and rear clutches are off and no power is transmitted from the converter to the gear set. The front and rear bands are also inoperative.

Park

The situation is mainly the same as in 'Neutral', the only difference being that in 'Park' the parking pawl is engaged, thus preventing the car from moving.



1 Input shaft, rigidly connected to front clutch drum and rear clutch hub
2 Front clutch plates
3 Front band
4 Rear clutch plates
5 Centre support, bolted to transmission housing
6 One-way clutch (freewheel)
7 Rear band
8 Reverse sun gear
9 Forward sun gear
10 Planet pinion, short
11 Planet pinion carrier
12 Planet pinion, long
13 Ring gear (annulus) and output shaft assembly; in position 'P' the parking pawl engages the exterior teeth, thus locking the ring gear and output shaft

Fig. 51. Power flow diagrams, Neutral (N), Normal Low (D1), and Alternative intermediate ratios (D2/L2)

Reverse (as shown in Fig. 52, R)

The rear clutch is applied, connecting the converter to the reverse sun gear. The rear band is applied holding the pinion carrier stationary. The gear set provide a reduction of 2·09 in the reverse direction.

NOTE: Since in this transmission no automatic lock-out system is used to prevent the engagement of 'Reverse' or 'Park' at speed, the selector lever must *on no account*

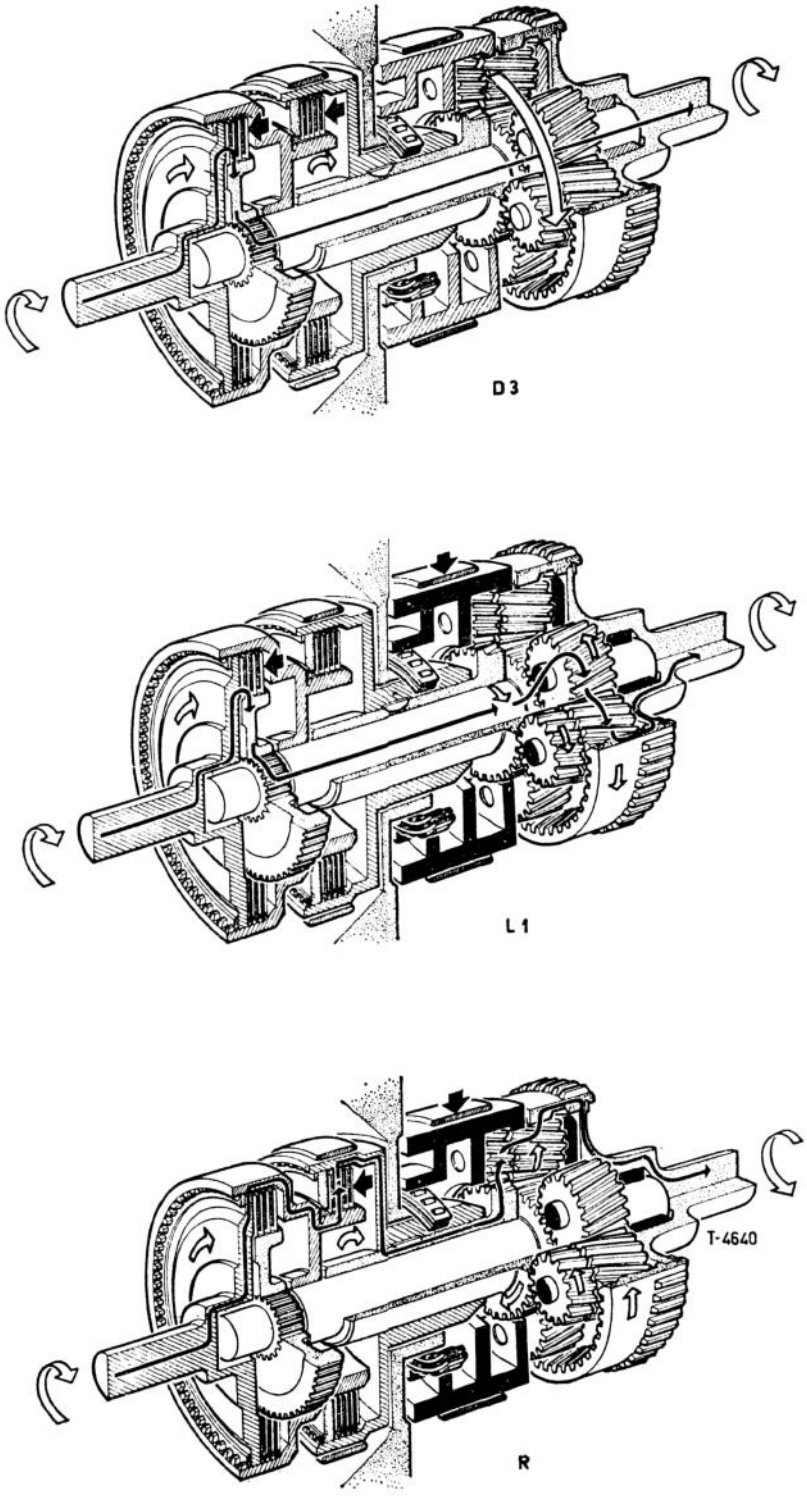


Fig. 52. Power flow diagrams, Top gear (D3), Emergency Low (L1), and Reverse (R)

be placed in 'P' until the car has come to a *complete stop*. Neither should 'R' be selected while travelling at anything over the merest 'crawl', since doing so could cause severe damage to the transmission components and drive line. In order to 'rock' the car out of deep snow, loose sand or mud, however, the selector may be moved alternately between 'D' and 'R' with the engine running at a fast idle.

GENERAL FAULT FINDING CHART FOR PETROL ENGINES

Some items in this chart are not applicable to *every* make of petrol engine.

Engine will not start

A. Starter does not crank engine	
Battery run down	*Recharge; replace if defective*
Battery posts and terminals loose or corroded	*Clean and tighten. If badly corroded, soak with water to facilitate removal and avoid damage to the battery posts*
Faulty starter switch or solenoid, if fitted; broken battery cable or loose connection	*Check wires and cables; check solenoid and switch, replace if defective*
Starter motor defective	*Repair or replace*
Starter drive stuck (starter will run, but does not crank engine)	*Clean and if necessary repair or replace*
Starter drive pinion jammed with starter ring gear	*Free by rotating squared end of starter spindle with a spanner*
B. Starter cranks engine slowly	
Battery partly run down	*Recharge; replace if defective*
Loose or corroded connections	*Clean and tighten*
Faulty starter switch or solenoid; partly broken cable or loose connection	*Check wires and cables; check solenoid and switch, replace if necessary*
Starter motor defective	*Repair or replace*
C. Starter cranks engine, but engine will not start	
Trouble in ignition system:	
No spark at plugs:	
Moisture on spark plugs, ignition distributor, coil and wires (this trouble often occurs after parking overnight in foggy or rainy weather)	*Clean and dry. Avoid recurrence by coating wires, distributor rotor, cap, coil and spark plug insulators with moisture-proof lacquer*
Spark plugs flooded, due to excessive use of choke	*Start engine on full throttle. If this does not help, clean plugs. With plugs removed, turn over the crankshaft a few times to blow the accumulated fuel from the cylinders*

Spark plugs oiled-up	*Clean; if necessary replace*
Spark plug insulator cracked	*Replace*
Spark plug gap too wide or too close	*Reset gap*
No spark at distributor: Loose, broken or shorted low-tension lead between coil and/or inside distributor	*Check and tighten; also check internal leads in distributor. These leads sometimes break inside their insulation, and the break is not always visible. Pull carefully on one end; a broken lead will stretch*
Cracked rotor or distributor cap	*Replace*
Contact breaker points dirty, worn or maladjusted	*Clean and adjust; if necessary replace*
Carbon brush in distributor cap not making contact	*Free; if necessary replace*
Faulty condenser	*Replace*
No spark at coil: High-tension lead loose or broken	*Replace*
Broken or loose low-tension leads or faulty ignition switch	*Check wiring, repair or replace; check switch, replace if defective*
D. Starter cranks engine, but engine will not start	
Trouble in fuel system:	
No petrol in carburettor: Empty fuel tank	*Fill up. If necessary, check and repair or replace fuel gauge*
Obstructed or damaged fuel pipe	*Clean; if necessary repair or replace*
Air leak in petrol line	*Check and repair or replace. Pay special attention to flexible fuel line (if fitted). If flexible fuel line is porous, a temporary 'get-you-home' repair can often be made by securely wrapping the line with friction tape or rubbing with hard soap*
Fuel filter clogged	*Clean and refit with new gasket. Always carry a spare gasket and a glass filter bowl, if so equipped*

Fuel pump defective	*Repair or replace. If electric pump does not function, lightly tap pump housing until ticking resumes*
Petrol in carburettor:	
Jets clogged	*Clean; blow out with air (never use wire to clean jets)*
Float needle stuck	*Clean or replace*
Carburettor flooded	*Clean float needle valve; if necessary replace. If this trouble persists, check fuel pump pressure*
Choke control faulty	*Repair or replace*
Air leak at inlet manifold or carburettor base	*Check nuts and bolts for tightness; if necessary replace gaskets*
Water or dirt in carburettor	*Clean. If this trouble persists, check rubber hose in fuel tank filler neck for damage or looseness, causing water to enter tank*

NOTE *If ignition system and carburettor are in order, yet the engine will not start, check timing.*

Engine starts but does not run properly

E. Engine misfires	
Ignition trouble: Spark plug or coil leads loose or damaged	*Tighten; replace if necessary*
Incorrect spark plug gap	*Regap*
Cracked spark plug insulator	*Replace faulty spark plug*
Spark plug oiled-up	*Clean, if necessary replace with spark plug of correct type. If trouble persists, check for mechanical trouble*
Cracked distributor cap	*Replace*
Loose connection in primary circuit	*Check and repair. Also check, and if necessary replace, ignition switch. In rare cases the ammeter has been found to be the cause of this trouble, due to faulty internal connection*
Distributor otherwise faulty	*See* **C**
Trouble in fuel system:	*See* **D**

Mechanical trouble:	
Incorrect valve clearance	*Adjust*
Valve sticking	*Try to free by pouring a gumsolvent of good quality into carburettor air intake; if not successful, dismantle and repair*
Valve spring broken	*Replace. Usually the valve concerned will have to be ground*
Worn piston, piston rings and cylinder or burnt valve; cylinder-head gasket blown	*Test compression; if too low, dismantle for repairs*
F. Engine starts and stops	
Trouble in ignition or fuel system:	*See* **C** *and* **D**
Obstructed exhaust system	*Check and repair or replace*
G. Engine runs on wide throttle only	
Idle jet clogged or mixture improperly adjusted	*Clean idle jet and/or idle air bleed; adjust*
Valve sticking or burnt; valve spring broken; other mechanical trouble	*Check and repair. Pay special attention to heat riser, if so equipped, since a burnt heat riser will cause exhaust gas to enter intake manifold. This will sometimes cause backfiring in carburettor*
H. Lack of power	
Ignition too far retarded or other ignition trouble	*Check and correct (see* **C**)
Obstructed exhaust system	*Dented exhaust pipe and/or muffler* *Dislocated baffle plate in muffler* *Replace*
Trouble in fuel system	*Check and correct (see* **D**)
Loss of compression	*Test compression; if found to be too low, check valve clearance. If valve clearance is properly adjusted and compression is still low, check for other mechanical trouble, such as burnt valves and/or worn pistons, rings and cylinders*
Dragging brakes	*Check and correct. Essentially this is not an engine trouble*

I. Engine runs roughly	
Ignition timing incorrect	*Check and correct. Pay attention to possibly stuck advance mechanism, because the fixed advance may be correctly adjusted, yet the timing while running will be incorrect if the automatic advance is stuck*
Lean or rich mixture	*Check carburettor and fuel system, (see* **D**)
Improperly adjusted valve clearance	*Check and correct*
J. Engine knocks	
Ignition too far advanced	*Check and correct. Attend to possibly stuck advance mechanism (see* **I**)
Excessive carbon deposit	*Decarbonize*
Loose bearings or pistons or other mechanical cause	*Check and repair*
K. Engine overheats	
Cooling system:	
Lack of water	*Top-up and check for leaks*
Fan belt loose or broken	*Check and adjust or replace*
Radiator clogged by insects	*Clean*
Cooling system clogged internally (in water-cooled engines)	*Clean with a cooling system cleaner of a reputable make and flush out according to maker's instructions. Inspect radiator hoses and replace if in bad condition*
Thermostat stuck or faulty	*Check and replace if necessary*
Ignition improperly timed	*Check and correct. Attend to possibly stuck advance mechanism*
Lean or rich mixture	*Check fuel system (see* **D**)
Excessive carbon deposit	*Decarbonize*
Obstructed exhaust system	*Check and repair or replace*
Cylinder-head gasket of the incorrect type	*Replace*

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80	Bedford CA series
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122	British Leyland Mini Mk II
112	British Leyland Mini Clubman
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