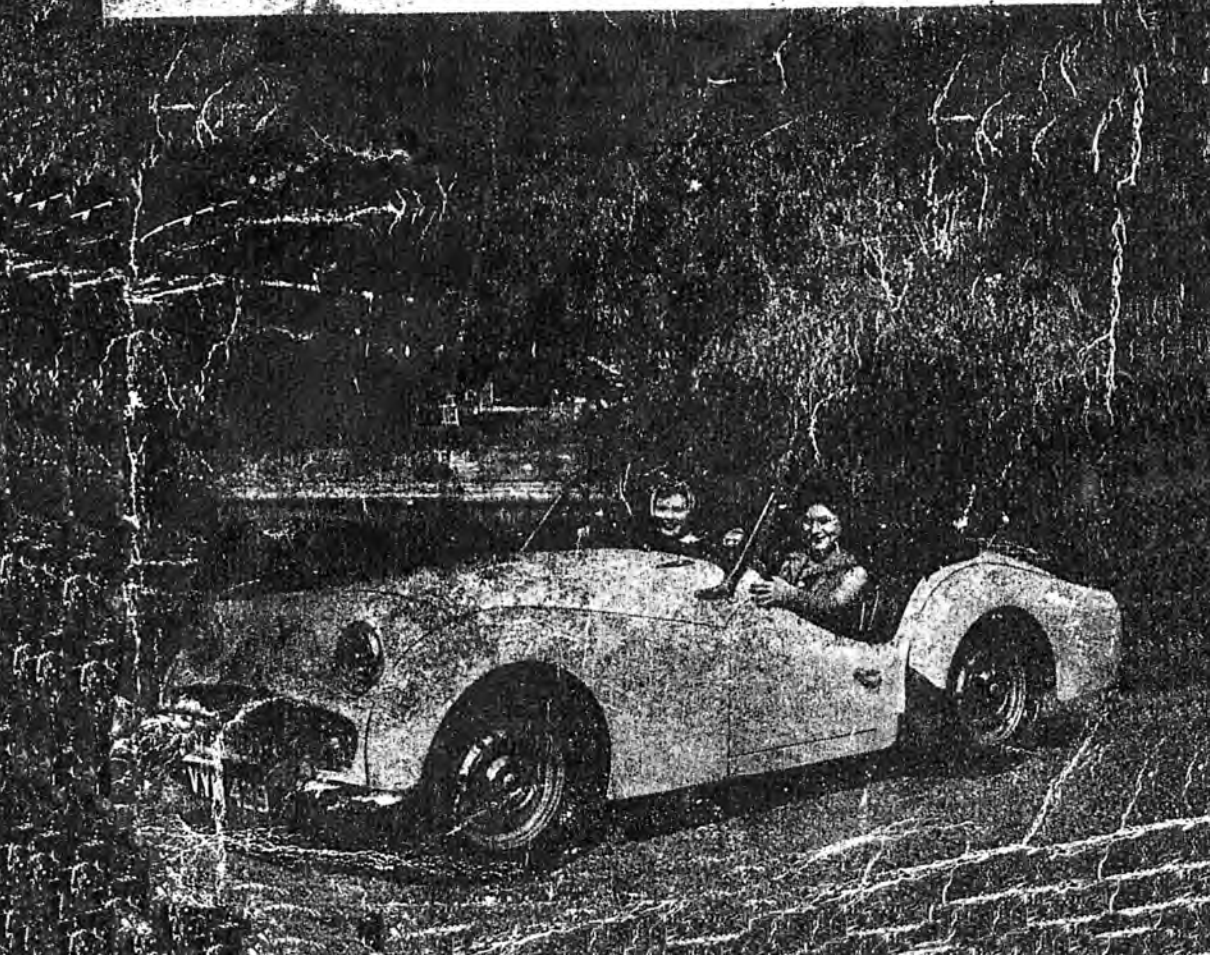
P. OLYSLAGER

TRIUMPH

SPORTS ROADSTERS
HARDTOP COUPES
from 1953

TR 2
TR 3
TR 3A



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Handbook for the

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PIET OLYSLAGER MSIA MSAE

THE SUNDAY TIMES
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Contents

Preface

THE PIET OLYSLAGER MOTOR MANUALS have been known to Continental motorists and garages for ten years and have proved their worth many times over. They are unique in their compact completeness and contain all the information needed to service, maintain and repair all makes of cars.

The manuals are presented in two forms in the English language, in these handy small books covering individual models and in cumulative loose-leaf form keeping abreast of all alterations and developments.

These two services cover all that a motorist or garageman needs to know to get the best out of motoring, and the series will eventually cover all popular makes of cars in the world.

The manuals were described, after considerable research by the International Commission on Automobile Documentation as 'The best automobile documentation so far in the world', and can therefore be confidently recommended for accuracy, precision, and thoroughness.

We are grateful to the manufacturers for their kind and enthusiastic co-operation in the production of this manual.

Fig. 1. TR 2 Sports Roadster, 1953-1955

Fig. 2. TR 3 Sports Roadster, 1955-1957

TRIUMPH TR2
TR3
TR3A

SPORTS ROADSTER
HARDTOP COUPE
from 1953

General

INTRODUCTION

The Triumph Sports car was first shown as the 'Triumph 2 Litre Sports' at the Earls Court motor show in October 1952 (model 20 SR).

The engine and gearbox were derived from the Standard Vanguard, the front suspension and rear axle being based on Triumph 'Mayflower' components. In August 1953 a restyled body with spare wheel under the luggage compartment floor was introduced (model 20TR2), known as the TR2.

In 1955 the TR3 (model 20 TR 3) was introduced, the TR2 being discontinued in November of that year. The TR 3 can be distinguished from the TR 2 by the addition of a cellular grille in the front air intake. The TR 3 was built without important modifications until in August 1957 the TR 3 A was introduced with a wider grille and exterior door handles. In January 1958 the TR3 became available for the UK market.

IDENTIFICATION

ENGINE NUMBER

The engine number is stamped on a boss on the cylinder block, just below No. 3 sparking plug.

The engine number is prefixed TS and suffixed E. When the engine is factory rebuilt, a new number is stamped in. This number is prefixed TS and suffixed FR.

CHASSIS SERIAL NUMBER

This number is stamped on a plate on the engine bulkhead at the right-hand side. It is prefixed 'TS'.

Typical Chassis numbers (for guidance only)

August 1953	TS 1 onwards
January 1954	TS 310
January 1955	TS 5200
September 1955	TS 8637 (TR 3 Series)
January 1956	TS 9670
January 1957	TS 15020
August 1957	TS 22014 (TR 3 A Series)
January 1958	TS 25640
January 1959	TS 41640
January 1960	TS 65130
January 1961	TS 82040

Fig. 3. TR 3A Sports Roadster, 1958-1961

Gearbox Number: This number is stamped on the left-hand side of the gearbox.

Rear Axle Number: This number is stamped above the rear axle cover plate.

MODIFICATIONS

1954. Power output raised to 90 bhp.

Redesigned tail with spare wheel under luggage compartment floor. Fuel tank of 12·5 Imp. gallons above the rear axle, filler opening centrally between the locker lid and the hood (top). The chassis was stiffened and the front and rear suspension was modified in detail.

1955. New 3·7: 1 rear axle

Stiffer front springs and larger rear dampers; an undershield is fitted to protect the chassis.

Modified hood with rear quarter lights, and shallower doors with a narrow body panel beneath them; modified air intake, 10 in brakes all around.

Laycock-de-Normanville overdrive on top gear, glass-fibre hardtop with perspex sliding panels, leather upholstery and many other optional extras available.

The TR 2 was discontinued in November 1955

1956. TR 3 introduced in September 1955, similar to the TR 2, except for the following points.

Bigger SU carburettors and higher compression ratio, resulting in an output of 100 bhp. Overdrive on second, third and top gears available as optional extra. The rear of the body was modified to permit the installation of an occasional rear seat; the capacity of the fuel tank was reduced to 12 Imp. gallons.

Fig. 4. TR 3A Hardtop Coupé, 1958-1961

Scuttle ventilator and sliding plastic panels in the side screens.
Cellular grille in the air intake.

1957. Girling brake system: disc brakes on front wheels, conventional drum-type brakes on rear wheels. New rear axle with taper roller hub bearings; separate brake and clutch master cylinders.

4·1: 1 rear axle ratio available on cars fitted with overdrive. Power output raised to 100 bhp.

1958. (TR 3 A)

Redesigned air intake with wider grille; improved bucket seats, reinforced overriders and external lockable door handles.

1959-60-61

During this period no important technical or body modifications were made.

PRICES (UK)

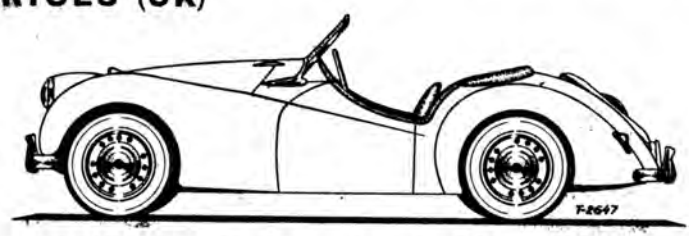


Fig. 5. Two-door, two-passenger Roadster 1952, model 20 SR

	Basic	Including PT
1952. 2-Litre Sports	£555	£864 16 8

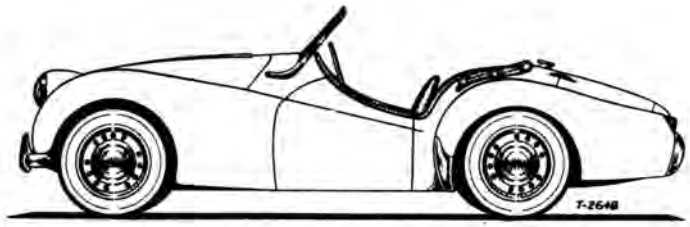


Fig. 6. Two-door, two-passenger Roadster, model TR2

		Basic	Including PT
April 1953.	TR 2	£555	£787 7 6
January 1954.	TR 2	£595	£844 0 10
May 1954.	TR 2	£625	£886 10 10
November 1954.	TR 2 Hardtop	£670	£950 5 10
Heater			£10 0 0
Overdrive			£40 0 0
Leather upholstery			£12 0 0

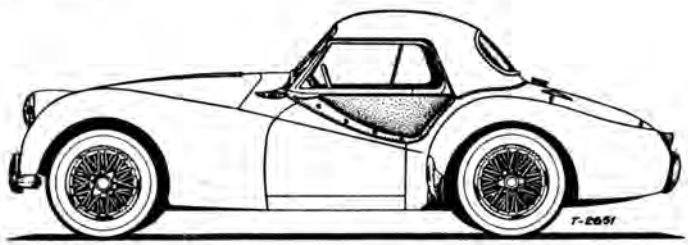


Fig. 7. Two-door, two-passenger Hardtop coupé, model TR 3

		Basic	Including PT
October 1955.	TR 2	£625	£938 17 0
	TR 2 Hardtop	£670.	£1006 7 0
	TR 3	£650	£976 7 0
	TR 3 Hardtop	£695	£1043 17 0
May 1956.	TR 3	£680	£1021 7 0
	TR 3 Hardtop	£725	£1084 7 0

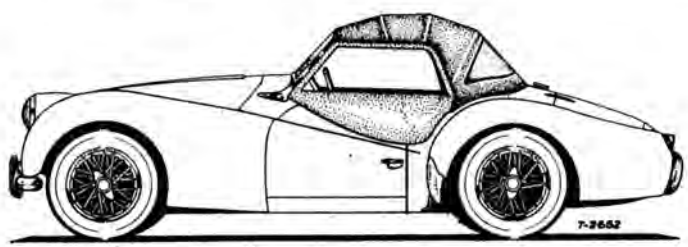


Fig. 8. Two-door, two-passenger Roadster, model TR 3A

		Basic	Including PT
October 1956.	TR 3	£680	£1021 7 0
	TR 3 Hardtop	£715	£1073 17 0
January 1958.	TR 3 A	£699	£991 7 6
	TR 3 A Hardtop	£734	£1040 19 2
June 1961.	TR 3 A	£699	£991 7 6
	TR 3 A Hardtop	£734	£1040 19 2
August 1961.	TR 3 A	£699	£1020 7 9
	TR 3 A Hardtop	£734	£1071 8 7

INSTRUMENTS AND CONTROLS

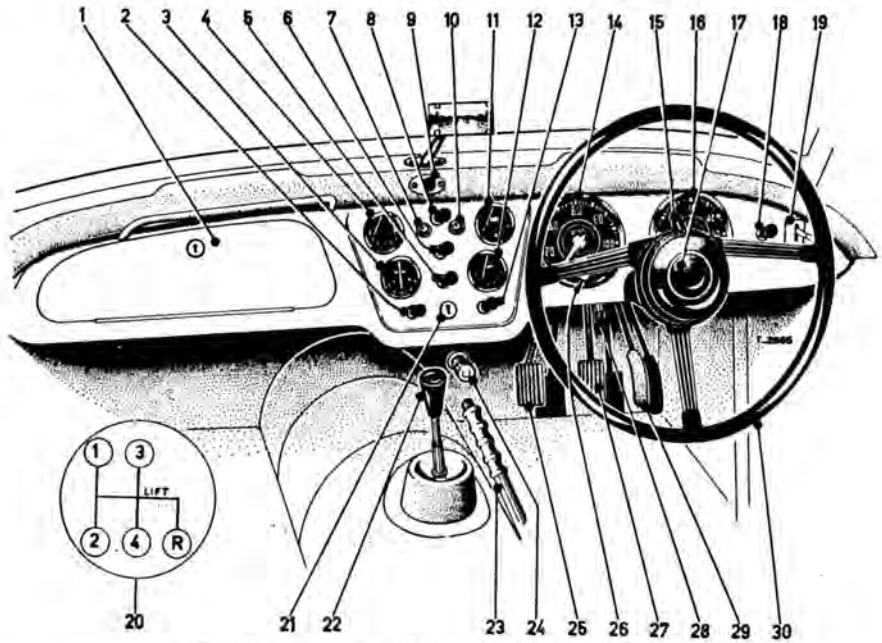


Fig. 9. Instruments and controls, right-hand drive

Key to Figs. 9 and 10

1 *Glove box.* The glove box can be locked with the ignition key
2 *Starter switch*
3 *Ammeter*
4 *Fuel gauge*
5 *Light switch.* Pull to switch on side lights.
Turn clockwise and pull again to switch on head lights.
6 *Windscreen wipers*
7 *Ignition/generator warning light* (red).
8 *Instrument panel light switch.* Turning the knob clockwise will dim the illumination progressively
9 *Vent control knob*
10 *Direction indicator warning light*
11 *Oil pressure gauge.* Mean oil pressure: 70 lb/sq in
12 *Water temperature gauge.* Normal temperature 185° F (85°C)
13 *Choke control*
14 *Speedometer with trip and distance recorder*

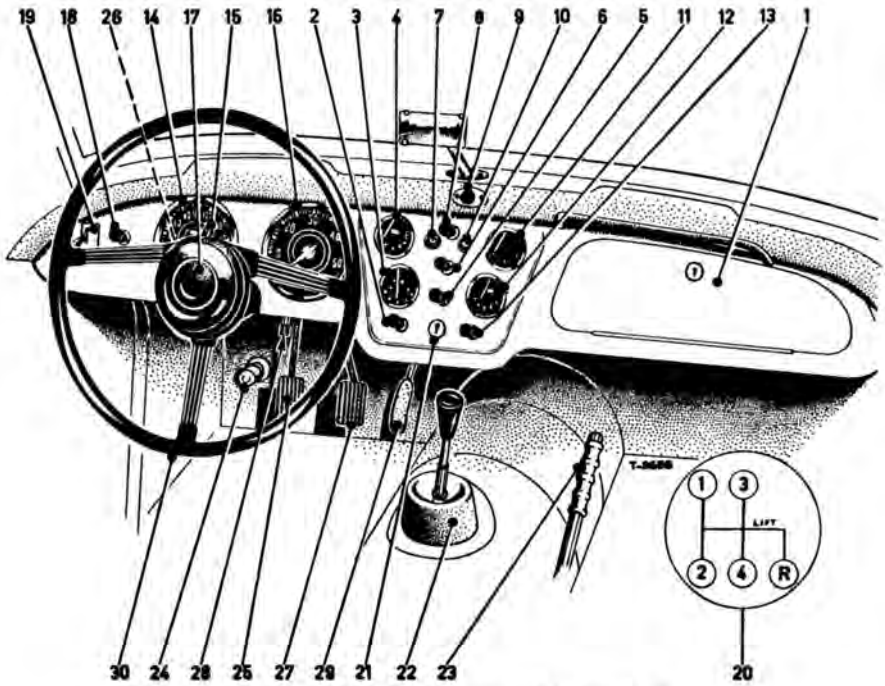


Fig. 10. Instruments and controls, left-hand drive

15 *Direction indicator switch*
16 *Revolution counter*
17 *Horn button*
18 *Heater fan switch* (optional extra)
19 *Overdrive switch* (optional extra)
20 *Gear pattern*
21 *Ignition key*
22 *Gear lever*
23 *Parking brake*
24 *Dimmer switch*
25 *Clutch pedal*
26 *Main beam warning light*
27 *Brake pedal*
28 *Trip reset*
29 *Accelerator*
30 *Steering wheel*

ELECTRICAL EQUIPMENT

12 V battery, located on the engine bulkhead, under the bonnet. Positive (+) terminal connected to earth.

Headlights and separate sidelights, incorporating the front flashers, twin stop/tail lights, rear flashers, rear number plate light and panel light.

Twin electric windscreen wipers which park automatically when switched off.

Twin windtone horns.

The flasher type direction-indicators and warning light are operated by self-cancelling switch. Instrument panel light switch with rheostat. Warning lights for mainbeam (red) ignition/generator (red) and direction-indicator. Radio and/or heater with fan can be installed as optional extras.

The overdrive, which is also an optional extra, is electrically operated on second, third and top gears by a switch on the facia panel. Early models had overdrive on top gear only.

BODY

Two-door, two-passenger roadster with bucket-type seats and removable soft top. A hard-top is available at extra cost. Single-tone vynide upholstery; leather available as optional extra. The front seat back rest on the passenger's side tips forward to give access to the occasional rear seat which may be installed as an optional extra.

Interior ventilation via a vent flap in the cowl.

Dimensions and Weights

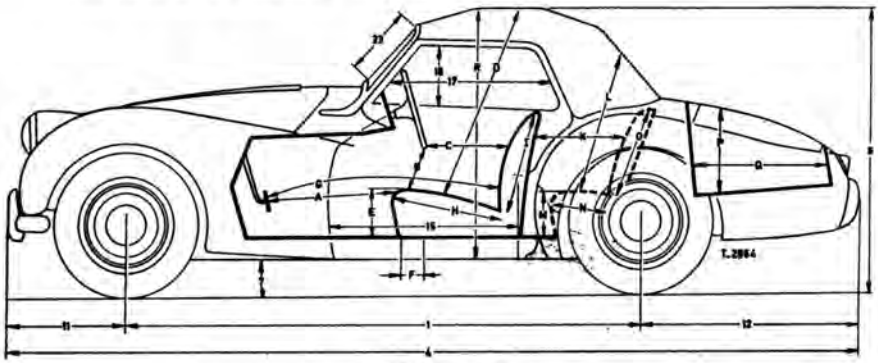


Fig. 11. Dimensions

EXTERIOR DIMENSIONS

		inches
1	Wheelbase	88
2	Track, front	45
3	Track, rear	45·5
4	Total length	151
5	Total width	55·5
6	Total height (hood raised)	50
	Total height of scuttle	40
7	Ground clearance	6
8	Turning circle	32 ft
15	Width of door	28
17	Width of door window	27
18	Height of door window	10·5
23	Height of windscreen	11
	Width of windscreen	42·5

INTERIOR DIMENSIONS

		inches
A	Pedal to front of seat (max.)	20
B	Steering wheel to seat	6
C	Steering wheel to front seat back rest (max.)	17
D	Height over front seat	35
E	Height of front seat	8
F	Maximum adjustment of front seat	5
G	Pedal to front seat back-rest	40

H	Depth of front seat	21·5
I	Height of front seat back-rest	17
K	Front seat back rest to front of occasional rear seat (max.)	5·5
L	Height over rear seat	26
M	Height of rear seat	12
N	Depth of rear seat	10·5
P	Height of luggage compartment (max.)	14·5
Q	Depth of luggage compartment	24
R	Maximum interior height	39
S	Height of door gap	25
W	Width of front seats	18
X	Width of occasional rear seat	34·5
Z	Width of luggage compartment	43·5

WEIGHTS

	TR 2	TR 3
1 Complete car, dry weight	2110	2460
2 Complete car, ready for use	2310	2660
3 Complete car, ready for use, two passengers	2580	2930
4 Ratio of load on front and rear wheels, ready for use	53/47%	54/46%

Technical Specifications

Figures in the following tables are based on measurements and weights according to the Imperial system, as used in Great Britain, i.e. the Imperial Gallon and Long Ton. Figures in parentheses represent measurements and weights according to the American system, i.e. the U.S. gallon and Short Ton.

ENGINE

(1) Type: water-cooled, four-stroke, petrol engine, in line with overhead valves.	
(2) Number of cylinders	4
(3) Bore and stroke	3·268 × 3·622 in 83 × 92 mm
(4) Piston displacement	121·5 cu in 1991 cc
(5) Compression ratio	8·5 : 1
(6) Stroke/bore ratio	1·108 : 1
(7) Total piston area	33·528 sq in 216·3 sq cm

PERFORMANCE

(1) Max. bhp	100 at 5000 rpm
Early models	90 at 4500 rpm
(2) Brake mean effective pressure (bmep)	145 lb/sq in
(3) Max. torque	117·5 ft lb at 3000 rpm
(4) Bhp per sq in piston area	2·98
(5) Bhp per litre	50·23
(6) Max. mean piston speed at 5000 r.p.m.	3010 ft min.

GEAR RATIOS

	Gearbox	*Overall*	
		3·7 : 1	*4·1 : 1*
1st gear	3·38 : 1	12·50 : 1	13·86 : 1
2nd gear	2·00 : 1	7·4 : 1	8·2 : 1
2nd gear overdrive	1·64 : 1	6·068 : 1	6·72 : 1
3rd gear	1·325 : 1	4·90 : 1	5·43 : 1
3rd gear overdrive	1·09 : 1	4·02 : 1	4·45 : 1
Top gear	1 : 1	3·7 : 1	4·1 : 1
Top gear overdrive	0·82 : 1	3·03 : 1	3·36 : 1
Reverse	4·35 : 1	16·09 : 1	17·83 : 1

A 3·7 : 1 rear axle is fitted on cars without overdrive and on early cars with overdrive.

A 4·1 : 1 rear axle is fitted on later cars with overdrive.

Early models were fitted with a 3·89 : 1 rear axle.

Tyre size: 5·50—15 (1961 : 5·90—15 or Michelin X 155—15)

SPECIFIC PERFORMANCE DATA

(*dry weight*)

These figures are based on a dry weight of 2460 lb and an engine output of 100 bhp.

(1) Piston area per ton	30·4 sq in (27·2 sq in)
(2) Litres per ton	1·81 (1·62)
(3) Bhp per ton	91·08 (81·3)
(4) Brake lining area per ton*	149 (143)
(5) lb per bhp	24·6
(6) lb per cu in piston displacement	73·3
(7) Road speed in top gear (rear axle ratio 3·7 : 1)	
at 1000 rpm	20·2 mph
at 5000 rpm	101 mph
(8) Road speed at 2500 ft/min. piston speed in top gear	83·50 mph

* Early models fitted with drum brakes.

THEORETICAL ROAD SPEEDS

with 3·7 : 1 rear axle

Road speeds in mph, piston speeds in ft min.

	a	*b*	*c*
1st gear	5·9	17·7	29·5
2nd gear	10·1	30·3	50·5
2nd gear overdrive	12·3	36·9	61·5
3rd gear	15·2	45·6	76·0
3rd gear overdrive	18·5	55·5	92·5
Top gear	20·2	60·6	101·0
Top gear overdrive	24·6	73·8	123·0*
Piston speed	603	1809	3015

a—1000 rpm

b—3000 rpm (max. torque)

c—5000 rpm (max. bhp)

* Theoretical value only.

with 4·1 rear axle

Road speeds in mph; piston speeds in ft min.

	a	*b*	*c*
1st gear	5·3	15·9	26·5
2nd gear	9·1	27·3	45·5
2nd gear overdrive	11·1	33·3	55·5
3rd gear	13·7	41·1	68·5
3rd gear overdrive	16·7	50·1	83·5
Top gear	18·2	54·6	91·0
Top gear overdrive	22·2	66·6	111·0*
Piston speed	603	1809	3015

a—1000 rpm
b—3000 rpm (max. torque)
c—5000 rpm (max. bhp)

* Theoretical value only.

ROAD TEST

	TR 2	TR 3
(1) **Maximum speed:**	107 mph	104 mph
(2) **Cruising speed in top gear:**	80 mph	80 mph
Cruising speed in overdrive	90 mph	90 mph
(3) **Cruising range:** when touring, approx	410 miles	approx 360 miles
(4) **Speed in gears:** (mph)		
1st gear	22–29	20–26
2nd gear	40–50	35–45
2nd gear overdrive	50–61	45–55
3rd gear	60–76	55–68
3rd gear overdrive	75–92	65–83
Top gear	80–100	80–100
Top gear overdrive	90–100	90–100
(5) **Acceleration times:** (sec) through gears		
0–30 mph	3·6	3·8
0–40 mph	5·8	6·0
0–50 mph	8·1	8·5
0–60 mph	11·9	12·4
0–70 mph	15·8	16·7
0–80 mph	22·1	23·5
0–90 mph	30·5	32·0

	Top gear	*Overdrive*	*Top gear*	*Overdrive*
10–30 mph	9·4	—	9·4	—
20–40 mph	9·3	12·1	9·2	11·8
30–50 mph	9·3	12·3	9·3	12·0
40–60 mph	9·5	12·8	9·5	12·7
50–70 mph	10·4	14·5	10·6	14·9
60–80 mph	11·4	16·7	11·9	17·4
70–90 mph	14·5	22·1	15·2	23·2
Standing quarter mile		18·1		18·6

(6) **Brake efficiency:**		
Mean retardation	0·97 g	1·00 g
Stopping distance 30–0 mph	31·5 ft	30 ft
(7) **Climbing power:**		
2nd gear	1 in 3·4 = 33%	1 in 3·8 = 26%
2nd gear overdrive	1 in 4·4 = 22·5%	1 in 4·7 = 21%
3rd gear	1 in 5·9 = 17%	1 in 6·3 = 16%
3rd gear overdrive	1 in 7·6 = 13%	1 in 7·9 = 12·5%
Top gear	1 in 8·0 = 12·5%	1 in 8·4 = 12%
Top gear overdrive	1 in 11·4 = 9%	1 in 11·1 = 9%
(8) **Fuel consumption:**		
Touring fuel consumption	34·5 mpg (28·7 mpg)	29 mpg (24·1 mpg)
Fuel consumption at constant speed of 50 mph in top gear	45 mpg (37·4 mpg)	39 mpg (32·4 mpg)
Fuel consumption at constant speed of 50 mph in top gear overdrive	49·5 mpg (41·2 mpg)	43 mpg (35·8 mpg)
(9) **Speedometer correction:**	2% fast	2% fast
Distance recorder	accurate	1% fast

Lubrication and Maintenance

RUNNING-IN SPEEDS

For the first 500 miles do not exceed 3500 rpm. During the following period of 1000 miles progressively increase this maximum to 5000 rpm for short periods.

Never overload the engine but change down to a lower gear in good time and avoid fierce acceleration.

GENERAL DATA

Engine: Sump capacity: 11 Imp pt (13·2 US pt)

Refill with 10 Imp pt (12 US pt)

Oil viscosity: Above 70°F (21°C) : SAE 40
40° to 70°F (4·5° to 21°C) : SAE 30
10° to 40°F (—12° to 4·5°C) : SAE 20W } or Multi-grade 10W/30
Below 10°F (—12° C) : SAE 10W }

For racing purposes use oils of high viscosity in view of the increased oil temperatures.

Oil dipstick: on left hand side of engine. The lower mark indicates that 4 Imp pt (4·8 US pt) are required for topping up.

Oil filler: On valve rocker cover.

Oil drain plug: At bottom of sump.

Change the oil when the engine is warm.

Air cleaners: The gauze element must be flushed out in petrol every 6000 miles. Soak in oil and allow to drip before refitting.

Carburettor dashpots: The dampers should be removed and the dashpots topped up with SAE 20W in winter and SAE 30 in summer.

Cooling system: Capacity 14 Imp pt (16·8 US pt): with heater 14·5 Imp pt (17·4 US pt)

The cooling system is provided with two drain cocks, one in the radiator bottom tank and one at the rear of the cylinder block, on the right hand side. As the cooling system is pressurized, it is necessary to remove the filler cap when draining.

Oil filter: Early models were fitted with a by-pass oil filter; later models are equipped with a full-flow filter.

Replace the element every 6000 miles. Always install a new gasket between the mounting flange and the filter housing. Filter elements (full-flow type) AC AC33A, Fram C870PL, Purolator MF52A, Tecalemit FP3305/105 or FP3312.

Water pump: Lubricate the water pump every 6000 miles with lithium-base grease.

Gearbox/Overdrive: Capacity: 1·5 Imp pt (1·8 US pt)
When an overdrive is fitted: 3·5 Imp pt (4·2 US pt)
refill with : 2·75 Imp pt (3·3 US pt)
Oil grade: EP gear oil.
Oil viscosity: Above 32°F (0°C): SAE 90
Below 32°F (0°C): SAE 80
Oil filler/level plug: On left hand side of gearbox.
Drain plugs: At bottom of gearbox and at bottom of overdrive.
Change oil when gearbox and overdrive are warm.

Fuel tank: Capacity: 12 Imp gallons (14.4 US gallons).
The fuel tank is situated over the rear axle; the filler opening is centrally located between the luggage locker and the hood. On early models (1952–1953) the filler opening was incorporated in the spare wheel hub.

Rear axle: Capacity: 1·5 Imp pt (1·8 US pt)
Oil grade: EP gear oil.
Oil viscosity: Above 32°F (0°C) SAE 90.
Below 32°F (0°C) SAE 80.
Oil fillier/level plug: at the rear right hand side of the differential carrier.
Oil drain plug: At bottom of rear axle housing.

Steering gear: For topping up the steering gear, the rubber plug in the steering column must be removed.
Top up with EP gear oil to the level of the orifice.

Front wheel hubs: The hubs should be repacked with lithium-base grease every 12000 miles (when the car is used for racing, every 6000 miles).
Never intermix grease of different brands.

Rear wheel bearings: Lubricate with lithium-base grease every 6000 miles through the nipples behind the brake backing plate.
Never intermix grease of different brands.

Universal joints: Lubricate every 1000 miles with lithium-base grease.

Brake and clutch fluid reservoir: On early models this reservoir is incorporated in the twin-bore master cylinder. On later cars a separate fluid reservoir is fitted over the steering column.

During production the brake and clutch system on cars with disc brakes is filled with Wakefield Girling brake and clutch fluid. Lockheed brake fluid is used when

drum brakes are fitted. It may be dangerous to intermix this fluid with fluid of other brands.
SAE specification: SAE 70 R 3 for disc brakes.

Shock absorbers: The rear shock absorbers should be topped up with Armstrong Crimson shock absorber fluid every 12000 miles.

JACKING POINTS

Apply the parking brake and chock the wheel diagonally opposite the wheel to be removed. Remove the floor carpet on the side to be lifted and remove the rubber plug just in front of the seat. Engage the lower lip of the jack boss with the bottom edge of the rectangular hole, swing the jack into a vertical position and lift.

TYRE PRESSURES

Dunlop	front: 22 lb/sq in rear: 24 lb/sq in	increase by 6 lb/sq in for high speed motoring
Michelin X	front: 24 lb/sq in rear: 28 lb/sq in	increase by 5 lb/sq in for high speed motoring

ROUTINE MAINTENANCE

Daily: Check oil level, radiator, petrol, tyres and lights.

Weekly: Check battery electrolyte and tyre pressures.

Running-in period

After the first 1000 miles: check cylinder head nuts for tightness.
See page 25 for tightening sequence.

A Every 1,000 miles:

*A*1 to *A*5 incl. Lubricate with grease gun.
*A*1 Upper and lower steering swivels (4 nipples).
*A*2 Lower suspension arm outer bushes (4 nipples).
*A*3 Outer track rod ball joints (4 nipples).
*A*4 Steering idler arm (1 nipple).
*A*5 Propeller shaft (3 nipples).
*A*6 Brake and clutch fluid reservoir: Top up if necessary.

The suspension arm inner nylon bushes should be lubricated sparingly with engine oil.

B Every 3,000 miles:

*B*1 Engine sump: drain and refill.
*B*2 Carburettor dashpots: top up with engine oil. Lubricate the throttle linkage with oil.
Clean and adjust spark plugs.
Interchange wheels.

C Every 6,000 miles:

*C*1 Clutch shaft bearings: lubricate with grease gun (2 nipples).
*C*2 Waterpump: lubricate with grease gun (1 nipple).
*C*3 Parking brake cable: lubricate with grease gun (1 nipple).
*C*4 Parking brake balance lever pivots: lubricate with grease gun (2 nipples).

C5 Rear wheel bearings: lubricate with grease gun (2 nipples).
C6 Generator: lubricate with engine oil.
C7 Distributor: remove rotor and apply a few drops of machine oil on screw thus exposed, one drop on breaker arm pivot and a few drops on automatic advance mechanism. Lightly smear cam profile with engine oil.
C8 Parking brake lever: lubricate with engine oil.
C9 Oil filler cap: flush out in petrol and allow to dry.
C10 Gearbox: check oil level, top up if necessary.
C11 Rear axle: works recommendation up to 1960: Drain and refill.
works recommendation 1960 onwards: Check oil level, top up if necessary.
C12 Steering gear: check oil level, top up if necessary.
C13 Rear springs: clean and paint or spray with oil.
C14 Air cleaners: clean elements in petrol, re-oil with engine oil.
C15 Oil filter: clean container and renew element.
Front wheel hubs (when the car is used for competition work): clean and repack.
Lubricate door locks, hinges, bonnet safety catch, boot and spare wheel compartment locks with engine oil.
Check all bolts and nuts for tightness.
Check cluch free play.

D Every 12,000 miles:
D1 Front wheel hubs (normal use) clean and repack.
D2 Gearbox: drain and refill.
D3 Rear axle: works recommendation 1960 onwards: drain and refill.
D4 Rear shock absorbers: top up if necessary.
Fit new spark plugs.

E Every 25,000 miles:
Repack generator front bearing with grease. Clean commutator.

Repair Data

Repairs are best performed by authorized dealers, who possess special tools and experience.

These data have been compiled from the official repair manuals, and other publications supplied through the kind co-operation of Standard-Triumph Organisation.

ENGINE

Engine: Water-cooled, four-cylinder, four-stroke, overhead valve engine. Unit construction with clutch and gearbox, suspended in three rubber mountings.
Removal of engine and gearbox:
(1) Disconnect the battery and close the petrol shut-off cock. Drain oil and water and remove the bonnet.
(2) Disconnect the headlamp and sidelamp wiring.
Remove the central grille pressings and the starting handle bracket.
Remove the radiator.
(3) Remove the carburettors, the horns and the generator. Remove the chassis front cross tube.

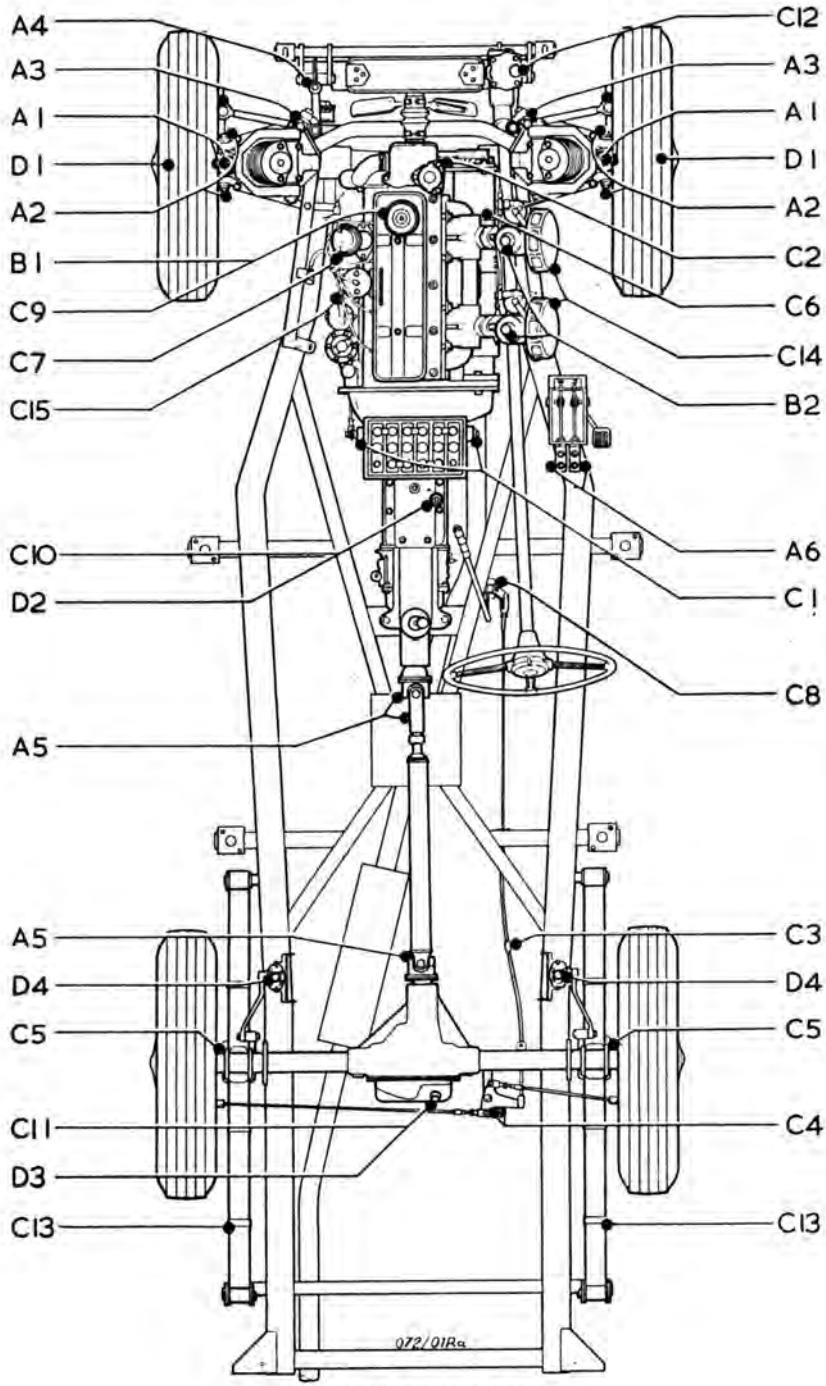


Fig. 12. Lubrication Chart

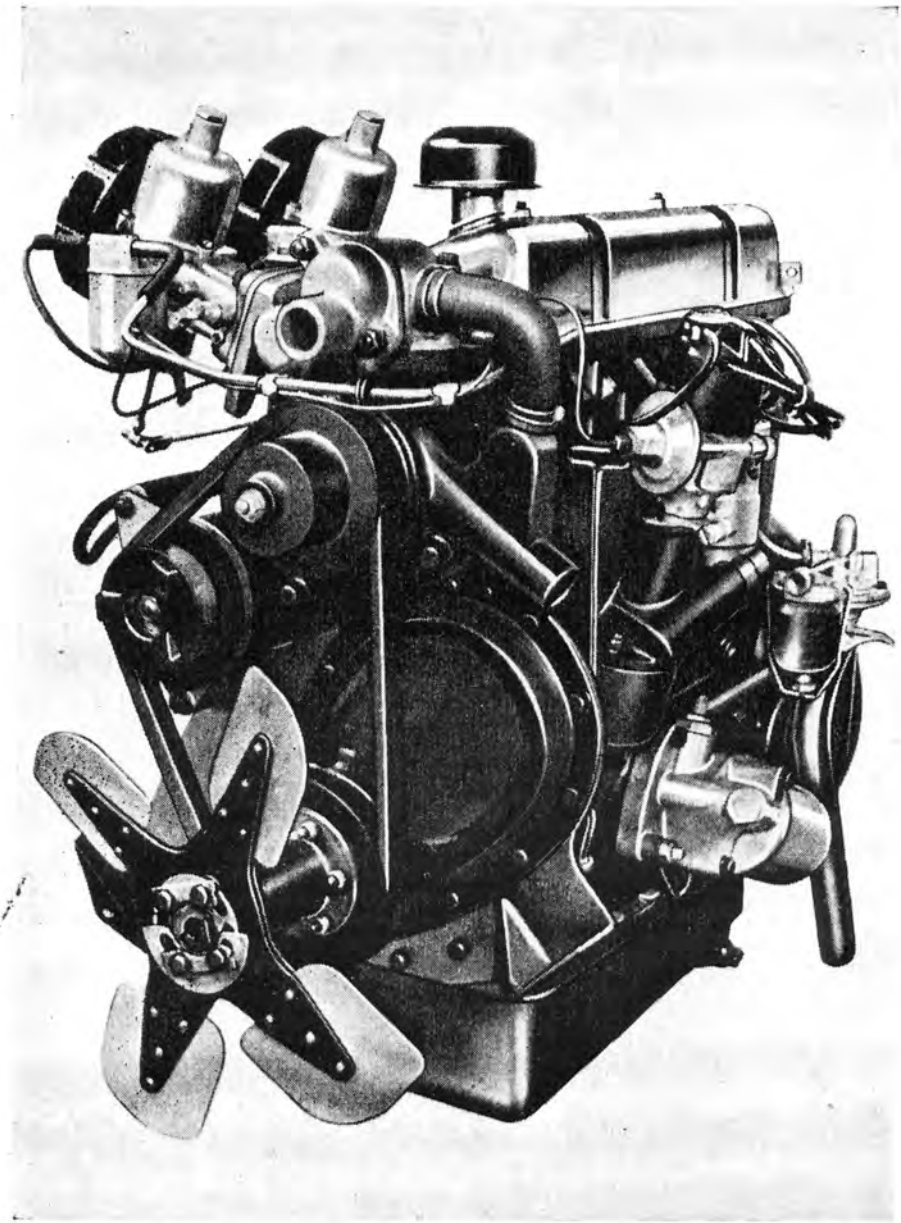


Fig. 13. Engine, general view

(4) Disconnect the exhaust pipe from the manifold; disconnect the flexible fuel pipe at the shut-off cock, the oil pressure gauge pipe, starter motor cable, low tension lead from the coil and the tachometer drive cable. Withdraw the water temperature transmitter unit.
(5) Remove the seats and the gear lever with its rubber dust cover.
(6) Remove the speedometer drive cable and the overdrive wiring on the solenoid switch (when an overdrive is fitted). Remove the starter motor.
(7) Drain the clutch hydraulic system and disconnect the flexible clutch hose at the chassis side-member.
(8) Uncouple the propeller shaft and remove the two nuts securing the gearbox to the chassis.
(9) Remove the bolts securing the engine mountings to the chassis and lift the engine from the car.

Re-installation is done in the reverse order of removal.

Engine compression: The compression pressure at cranking speed, with warm engine and wide open throttle should be 120 lb/sq in. A special low compression kit is available.

Cylinder head: The cylinder head incorporates the overhead valve mechanism. Valve seats are machined directly in the cylinder head.

After the first 1000 miles the cylinderhead nuts should be tightened following the sequence below (engine hot).

9	3	1	6	8
7	5	2	4	10

Gradually tighten the bolts to 100–105 ft lb.

Cylinder block: The cast iron cylinder block incorporates the upper half of the crankcase. Separate cylinder sleeves are fitted.

Cylinder sleeves: The cylinder sleeves are of the 'wet' type, centrifugally cast in nickel-chrome iron.

The locating flanges are provided with two pairs of machined flats at 90° to each other, providing alternative fitting positions to deal with wear on the thrust side of the sleeve.

The cylinder sleeve gasket is of plastic-covered steel and has the shape of a figure eight. When new gaskets are installed, examine them for chipping or peeling of the plastic coat. When refitting the sleeves, coat the underside of the gasket with gasket cement. The cylinder sleeves are spigot mounted; when installed in the cylinder block with a new gasket, the sleeve protrudes 0·003–0·0055 in over the cylinder block. A grading number is engraved on the upper face of each sleeve; for specifications see under 'Pistons'.

When the cylinder head has been removed, sleeve retainers (Churchill tool S 138 or an other suitable tool) should be installed to keep the sleeves in place.

Inlet and exhaust manifolds: Separate inlet and exhaust manifolds; the inlet manifold is of aluminium alloy.

On TR 3 engines a redesigned inlet manifold is fitted to accommodate the larger carburettors on this model. Starting from engine number TS 93 50E the inlet ports in the cylinder head were enlarged, necessitating a larger inlet manifold diameter. The manifold gaskets are not interchangeable.

The bolts that secure the inlet to the exhaust manifold should be tightened to 12–14 ft lb. Tighten the manifold attachment bolts to 22–24 ft lb.

Engine sump: The removable engine sump is a steel pressing. A cast aluminium sump is available as an optional extra. Both sumps are provided with an oil baffle plate.

Crankcase ventilation: The air for crankcase ventilation enters the engine through a steel-wool filter in the oil filler cap. The outlet is fitted on the left-hand side of the engine.

Pistons: Aeroflex compensating pistons of aluminium alloy, with two compression rings and one oil control ring fitted above the piston pin (gudgeon pin). When installing the piston, the T-slot in the piston skirt should be facing the camshaft side of the engine.

When installing new pistons, take care to elect pistons of the proper grade; the grading number, F, G, or H is stamped on the flat piston crown.

The pistons and connecting rods can be removed upwards from the cylinder block.

Specifications:

	Grade F	*Grade G*	*Grade H*
Cylinder bore diameter	3·2673–3·2676 in	3·2677–3·2680 in	3·2681–3·2684 in
Top diameter of piston skirt	3·2622–3·2626 in	3·2626–3·2630 in	3·2630–3·2634 in
Bottom diameter of piston skirt	3·2637–3·2641 in	3·2641–3·2654 in	3·2645–3·2649 in
Clearance at top of skirt, all grades	0·0047–0·0054 in	(0·007 in max.)	
Clearance at bottom of skirt, all grades	0·0032–0·0039 in	(0·005 in max.)	

Pistons are available in 0·020, 0·030 and 0·040 in oversize. In cases of light wear it is possible to withdraw the piston and rotate the cylinder sleeve 90°.

Piston rings: Two compression rings and one oil control ring are fitted above the piston pin. Starting from engine No. TS 9731 E, the pistons are fitted with one plain (top) ring, one taper ring and one oil control ring.

Width of compression ring:	0·061–0·062 in
Groove width:	0·0635–0·0645 in
Clearance, when new:	0·0015–0·0035 in
Width of oil control ring:	0·155–0·156 in
Groove width:	0·157–0·158 in
Clearance, when new:	0·001–0·003 in
Ring gap, when fitted (all rings):	0·003–0·010 in
Piston rings are available in:	0·010, 0·020, 0·030 and 0·040 in oversize.

Piston pins (Gudgeon pins): Hollow steel, full floating piston pins, retained in the pistons by means of circlips.

Pistons pin diameter:	0·87485–0·87510 in
Clearance in bush:	0·0002 in at 68° F

Heat the pistons in oil or water before fitting the piston pins; they should be a light push fit in the piston.

Connecting rods and connecting rod bearings: The connecting rods are molybdenum-manganese steel forgings of I-beam section; the big-end bearing bore is cut-off at an angle; the bearing caps face the camshaft side. The piston pin bushes are of phos-

phor-bronze. The connecting rods are drilled for piston pin lubrication. When assembling the pistons to the connecting rods, make sure that the split in the skirt faces the cap side of the connecting rod; when installing the connecting rods in the cylinder, the cap of the big-end bearing should be on the camshaft side of the engine.

Specifications:

Length, centre to centre:	6·248–6·252 in
Width of connecting rod big-end:	1·1775–1·1795 in
Connecting rod end float:	0·007–0·014 in
Big-end bearing, internal diameter:	2·0882–2·0885 in
Clearance when new:	0·0016–0·0035 in
Internal diameter of bore in connecting rod:	2·2327–2·2335 in
Bearing width:	0·9650–0·9670 in
Bearings are available in undersizes of:	0·010, 0·020, 0·030 and 0·040 in
Bore for piston pin bush:	0·9950–1·000 in
Piston pin bush, external diameter:	0·995–1·0005 in
Piston pin bush, internal diameter:	0·8748–0·8752 in
Piston pin clearance:	0·0002 in at 68° F

The connecting rods, bearing caps and bearing inserts should on no account be filed or scraped and no hand fitting is permissible.

Connecting rod bearing bolts should be tightened to 55–60 ft lb.

Crankshaft: The crankshaft is a molybdenum-manganese forging and runs in three Vandervell bi-metal, steel-backed bearings. No hand fitting of these bearings is required or permissible. Crankshaft end float is taken by two pairs of semi-circular white-metal lined washers fitted on either side of the centre main bearing.

When the engine has been dismantled for an overhaul and the rear oil seal has been removed, check when installing a new oil seal, that its two halves bear the same number.

These parts are machined as a matched pair and changing them for others will result in oil leakage.

Tighten the attachment bolts to 8·10 ft lb.

Specifications:

Journal diameter:	2·4790–2·4795 in
Bearing, internal diameter:	2·4805–2·4815 in
Clearance when new:	0·0010–0·0025 in (0·006 max.)
Bearing housing, internal diameter:	2·6250–2·6255 in
Bearings are available in 0·010, 0·020, 0·030 and 0·040 in undersize.	
Length of centre main bearing:	1·7498–1·7507
Width of centre main bearing cap, including two thrust washers:	1·7390–1·7450 in
Clearance, when new:	0·0048–0·0117 in

A clearance of 0·004–0·006 in is specified and obtained by selective assembly of thrust washers.

Crankpin diameter:	2·0860–2·0866 in
Crankpin width:	1·1865–1·1915 in
Out-of-round and taper of the crankpins and journals should not exceed 0·002 in.	
Internal diameter of clutch pilot bearing:	0·4998–0·5005 in
Tighten big-end bearing caps to:	55–60 ft lb
Tighten main-bearing caps to:	85–90 ft lb

Flywheel: The cast-iron flywheel is secured to the crankshaft by means of four bolts and a dowel pin.

The flywheel is marked with an arrow which should be aligned with the scribed line on the cylinder block to set Nos. 1 and 4 pistons at TDC.

Maximum allowable run-out of the clutch surface: 0·003 in. The clutch pilot bearing is pressed in the crankshaft.

Tighten the flywheel bolts to 42–46 ft lb.

Starter ring gear: The starter ring gear, of special heat-treated steel, is shrunk on to the flywheel.

Camshaft: The camshaft is of special iron alloy and runs in four bearings in the left-hand side of the crankcase upper half. The cams are symmetrical; camshaft end-float is taken by the flanged front bearing; to reduce the end-float a new bearing of correct length must be fitted. On early production engines the front camshaft bearing was a cast iron sleeve; the second, third and rear bearings were machined directly into the crankcase. Starting from engine number TS 9095 E, engines are equipped with replaceable Vandervell bearings. These engines can be recognized by the three set screws in the left-hand side of the crankcase, retaining the second, third and rear bearing.

To remove the rear bearing, the sealing disc should be removed, which in turn requires the removal of clutch and flywheel. For removal of these bearings the use of Churchill tool No. S 32 with adaptors S 32–1 is recommended.

The camshaft can be removed with the engine in place. Do not forget to fit sleeve retainers, directly after removal of the cylinder head.

See also under 'Cylinder sleeves'.

Specifications:

Front journal diameter:	1·8710–1·8720 in (min. 1·869 in).
Front journal bearing bore:	1·8748–1·8757 in
Clearance when new:	0·0028–0·0047 in
External diameter of front bearing:	2·2493–2·2498 in
Bore in block:	2·2498–2·2507 in
Diameter of second, third and rear journal:	1·7152–1·7157 (min. 1·7127 in).
Radial clearance:	0·0026–0·0046 in
End float:	0·003–0·0075 in

Camshaft drive: The camshaft is driven by a double roller chain with non-adjustable spring-blade tensioner. The crankshaft sprocket is fitted to the crankshaft by means of two Woodruff keys; shims for aligning the crankshaft sprocket with the camshaft sprocket are fitted at the back of the former. The camshaft sprocket is secured to the camshaft with two bolts; four bolt holes are provided for alternative setting of the valve timing.

When the camshaft sprocket is fitted at 90° to its original position, half a tooth of adjustment is obtained; if the sprocket is turned back to front from its original position, a quarter of a tooth of adjustment is obtained, while a 90° movement from this position will give three-quarters of a tooth of adjustment.

When the timing has been correctly set, lines should be scribed as shown in fig. 14.

In addition two centre punch marks can be made as shown in the same figure.

Number of teeth on crankshaft sprocket	21
Number of teeth on camshaft sprocket	42
Tighten camshaft sprocket bolts to	24–26 ft lb

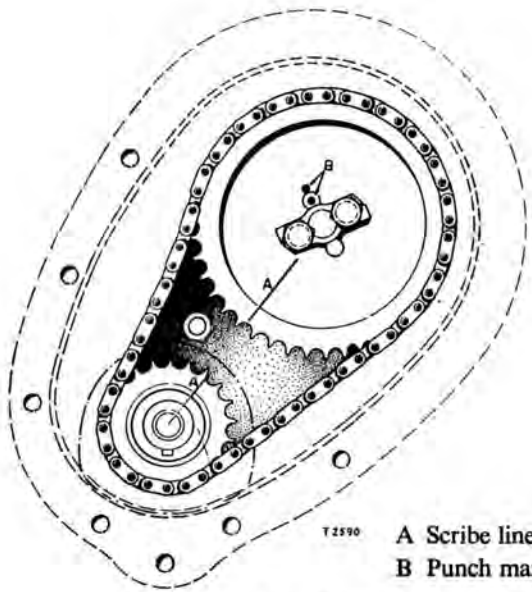


Fig. 14. Timing gears

Valve timing: The valve timing should be checked with a valve clearance of 0·015 in (engine cold).

Inlet valve opens	15° BTDC
Inlet valve closes	55° ABDC
Exhaust valve opens	55° BBDC
Exhaust valve closes	15° ATDC

15° BTDC or ATDC is equivalent to 0·081 in of piston travel or 1·5 in measured on the flywheel circumference, next to the starter ring gear.

Valve clearance: (engine cold)

Normal use:

Inlet valve clearance 0·010 in } when cast-iron rocker-shaft supports are
Exhaust valve clearance 0·012 in } fitted.

High speed:

Inlet valve clearance 0·013 in } when cast-iron rocker-shaft supports are
Exhaust valve clearance 0·013 in } fitted.

Normal use and high speed:

Inlet valve clearance 0·010 in } when aluminium rocker-shaft supports are
Exhaust valve clearance 0·010 in } fitted.

Valves: Overhead valves, operated by tubular push-rods. In early production engines the inlet and exhaust valves were made from a chrome-nickle-silicon alloy; starting from engine number TS 481 E, nickle-chromium-tungsten exhaust valves were installed.

Specifications:

Inlet valve head diameter:	1·5580–1·5620 in
Inlet valve stem diameter:	0·3100–0·3110 in
Exhaust valve head diameter:	1·2290–1·3030 in
Exhaust valve stem diameter:	0·3705–0·3715 in
Valve stem to guide clearance, inlet:	0·001–0·003 in
Valve stem to guide clearance, exhaust:	0·003–0·005 in
Valve face angle, inlet and exhaust:	45°

Valve seats: The valve seats are machined directly into the cylinder head.
Valve seat angle 44° 30 min
Width of inlet valve seat: approximately 0·0469 in
Width exhaust valve seat: approximately 0·0469 in
If necessary valve seat inserts can be shrunk in.

Valve insert dimensions: (inches)

	Insert dimensions			*Bore in cylinder head*	
	Inner diameter	*Outer diameter*	*Depth*	*Diameter*	*Depth*
Inlet	1·466–1·471	1·722–1·723	0·250–0·253	1·716–1·717	0·250–0·253
Exhaust	1·188–1·193	1·444–1·445	0·250–0·253	1·438–1·439	0·250–0·253

Valve springs: Inlet valves are each fitted with two valve springs; exhaust valves have three springs each. Valve keepers are of the split collet type. When installing valve springs, make sure that the close coils of each spring are nearer the cylinder head.

Specifications:

Outer valve spring, inlet and exhaust:

Free length, approximately	1·980 in
Fitted length	1·560 in
Fitted load	38 lb

Inner valve spring, inlet:

Free length, approximately	2·080 in
Fitted length	1·500 in
Fitted load	33 lb

Inner valve spring, exhaust:

Free length, approximately	2·080 in
Fitted length	1·450 in
Fitted load	36·5 lb

Auxiliary exhaust valve spring:

Free length, approximately	1·540 in
Fitted length	1·140 in
Fitted load	10 lb

Valve guides: The valve guides are pressed into the cylinder head.
Inlet guide diameter: 0·3120–0·3130 in (max. 0·3160 in).
Exhaust guide diameter: 0·3745–0·3755 in (max. 0·3785 in).
For valve guide clearances see under 'Valves'.

Valve tappets: Valve tappets of the barrel type. The valve tappets can be removed after removal of the cylinder head and pushrods. When removing the tappets, be sure to note the location of each tappet in order that it may be re-installed in the original bore.

Valve rockers and valve rocker shaft: The valve rockers are assembled on a hollow steel rockershaft, which rests in four supports on the cylinder head. In early production engines cast iron supports were used; later production engines were equipped with aluminium rockershaft supports.

When assembling the rockershaft, make sure that the oil holes in the shaft coincide with the oil feed hole in the No. 4 rockershaft support.

Tighten the rockershaft support nuts to 24–26 ft lb.

Lubrication: Full pressure lubrication by means of a double rotor type oil pump, driven in tandem with the distributor from the camshaft. The oil enters the pump through a wire-mesh screen and is fed to an annular space around the pump drive shaft, from where part of the oil is forced through the by-pass oil filter; the remainder of the oil is fed directly to the main oil gallery, which runs the full length of the cylinder block on the camshaft side. Later production engines are fitted with a full-flow oil filter. In this type of filter all the oil passes through the filter element. When a pressure of 70–80 lb/sq in is exceeded, a spring-loaded ball-type relief valve is opened and the oil returns directly to the sump. From the main oil gallery the oil is fed to the main bearings through separate drillings. The connecting rod big-end bearings are lubricated in the usual way by oil which is fed from the main bearings through drilled oilways in the crankshaft. The second and third connecting rod bearings are lubricated from the centre main bearing; the first and fourth connecting rod bearings from the front and rear main bearings respectively.

The connecting rod small ends are drilled for lubrication of the piston pins, and the connecting rod webs are drilled transversely for additional lubrication of the cylinder walls. The front, second and rear camshaft bearings are lubricated by oil fed via drillings from the oilways leading to the main bearings; the third camshaft bearing is lubricated by oil supplied through a metering hole in the main oil gallery. From the rear camshaft bearing oil is fed through an oilway in the rear of the cylinder block and cylinder head to the drilled rear rocker shaft support and hollow rocker shaft.

The oil flowing down from the cylinder head lubricates the push rods and valve tappets.

The timing sprockets are lubricated by oil from the front camshaft bearing.

Oil pressure: The normal oil pressure at 2000 rpm is 70 lb/sq in.

Oil pressure relief valve: An oil pressure relief valve is incorporated in the oil filter head.

The valve opens at a pressure of 70–80 lb/sq in.

The pressure relief valve is set during initial assembly and no attempt should be made to reset it.

Oil pump: Hobourn Eaton, double eccentric rotor pump, driven in tandem with the distributor from the camshaft.

Specifications:

Rotor outer diameter:	1·5965–1·5975 in
Inner diameter of housing:	1·6030–1·6040 in
Clearance, when new:	0·0055–0·0075 in
Depth of rotor:	1·4985–1·4995 in
Depth of housing:	1·5000–1·5010 in
Clearance, when new:	0·0005–0·0025 in
Major diameter of inner rotor:	1·1710–1·1720 in

Minor diameter of inner rotor: 0·7290–0·7310 in
Clearance on rotors, min: 0·0005–0·0025 in
max: 0·001–0·004 in

Tighten the oil pump attachment bolts to 12–14 ft lb.

Oil filter: Up to engine number TS 12650 E a by-pass oil filter was fitted; subsequent units were fitted with a full flow filter.

If desired, this later filter unit can also be fitted to engines prior to TS 12650 E. For oil filter elements see under 'Lubrication and Maintenance' on p. 20.

Tighten the central bolt to 14–16 ft lb.

Ignition system: Ignition by means of coil and battery. Firing order 1–3–4–2. The foremost cylinder is No. 1. The ignition system is suppressed for radio and television.

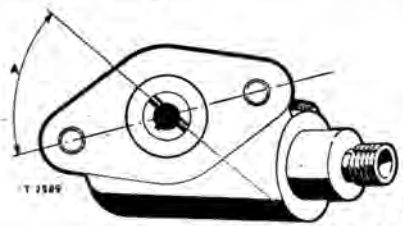
Ignition timing:

The contact breaker points should start to open at 4° BTDC.

To time the distributor, proceed as follows:

(1) Check that the distributor and tachometer gear assembly is fitted with an end float of 0·003–0·007 in. Correct if necessary.

(2) Turn the number one piston to its TDC on the compression stroke. When the oil pump drive shaft is correctly located, the offset slot in the gear assembly is positioned as shown in fig. 15.



A Approximately 53°

Fig. 15. Ignition timing

(3) Fit the distributor with the rotor arm pointing to number 1 push rod tube.

(4) Adjust the contact breaker points to 0·015 in and set the vernier adjustment on the third marking of the scale. Lock the distributor to the adaptor when the contact breaker points just start to separate.

(5) Now advance the vernier adjustment screw one division, which is equivalent to 4° BTDC on the flywheel.

Distributor: Lucas DM 2 P 4.

Contact breaker point gap: 0·014–0·016 in
Breaker arm spring tension: 20–24 oz
Condenser: 0·2 microfarad
Distributor drive shaft: 0·4980–0·4990 in
Radial clearance, when new 0·0015–0·0030 in
End–float: 0·003–0·007 in

Centrifugal advance: Check centrifugal advance when distributor is decelerating on the synchrograph.

Distributor rpm	*advance, distributor degrees*
2700	13–15
2000	12½–14½
750	8½–10½

Distributor rpm	*advance, distributor degrees*
600	6½–9
200	0–2

No advance below 200 rpm.

Vacuum advance:

Vacuum (in Hg)	*advance, distributor degrees*
18	6–8
9½	5–7
4¾	½–2½

No advance below 2 in HG.

Spark plugs: Two types of spark plugs may be fitted as standard equipment, viz. Lodge or Champion. Spark plug gap: Lodge, 0·025 in; Champion, 0·032 in.

	Champion	*Lodge*
Normal use	L 7/L 10 S	CNY
High speed use	L 5/L 11 S	HN
Competition use		2 HN

Ignition coil: Lucas B 12 or HA 12.

Resistance of primary winding: 4·0–4·4 ohm.

Fuel system: The fuel tank is situated between the rear seat back rest and the luggage compartment. The fuel pipe runs along the left-hand side of the chassis to the Ewarts petrol shut-off cock. To close the cock, turn it in a clockwise direction. From this shut-off cock the fuel is fed to the twin SU carburettors by means of a mechanically operated fuel pump of the diaphragm type. The high compression ratio requires the use of fuel with a minimum octane rating of 80.

Carburettors: Twin SU side-draught carburettors, type H4 on TR 2 models and type H6 on TR 3 models.

H4 carburettors:

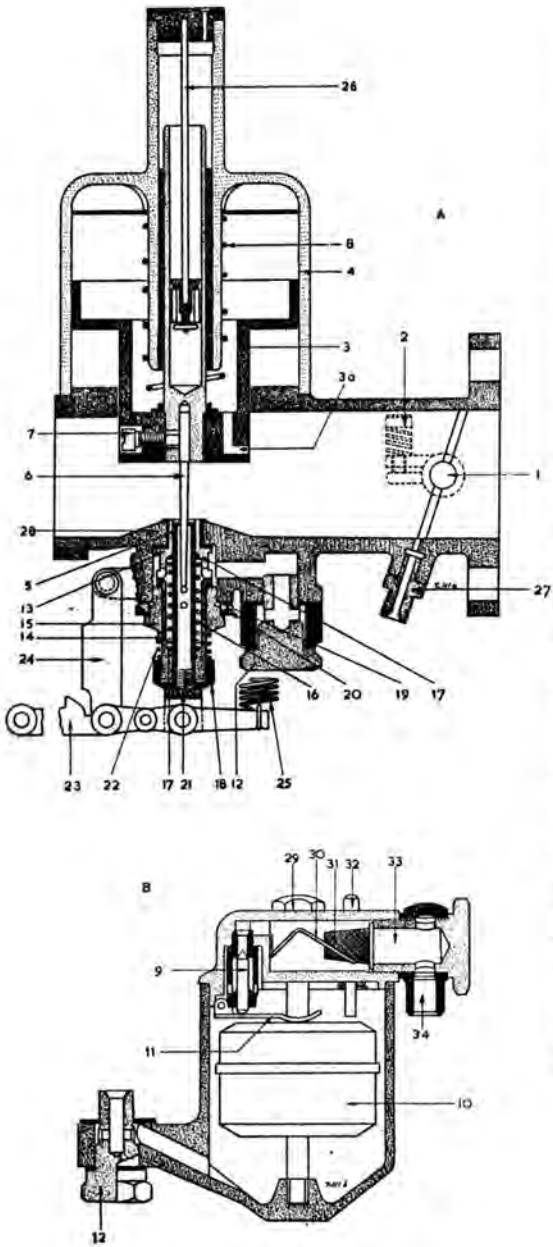
Standard needle FV.

High speed motoring needle GC.

H6 carburettors:

Needle SM. On early models TD or TE needles were fitted; these should be replaced by SM needles when a replacement is necessary.

SU carburettors are of the variable throat type; the fuel is metered by a tapered needle in the jet. The jet needle is secured to a sleeve which determines the amount of throat opening, the position of the sleeve and needle being controlled by a vacuum piston (the upper part of the sleeve), in accordance to throttle valve opening. In fig. 16 a schematic view 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 spigot is centrally located in the piston; this spigot 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 will fall to the bottom position by its own weight and rest on the bridge in the throat. (Some SU 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 air stream; thus a partial vacuum is created. This pressure drop also creates a partial vacuum in the vacuum chamber



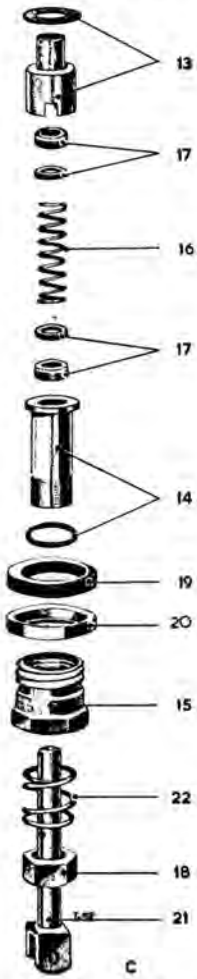
1 Throttle valve
2 Idle speed adjustment
3 Vacuum piston and sleeve
3a Vacuum passage
4 Vacuum chamber
5 Jet
6 Jet needle
7 Needle clamping screw.
8 Vacuum piston assist spring (not on all S.U. carburettors)
9 Float needle valve
10 Float
11 Float arm
12 Hollow float chamber attachment bolt
13 Upper jet guide with joint washer
14 Lower jet guide with joint washer
15 Jet retainer
16 Spring
17 Gland packing joint washers and thrust washers
18 Adjusting nut
19 Jet retainer joint
20 Joint retainer with bevelled bore
21 Jet (5 in schematic drawing)
22 Lockspring for 18
23 Jet lever lever
24 Jet lever link
25 Jet lever retracting spring
26 Damper valve stem
27 Connection for vacuum pipe to ignition distributor
28 Bridge
29 Float chamber cover bolt
30 Fuel strainer retaining spring
31 Fuel strainer
32 Float actuating pin
33 Fuel line connector
34 Fuel line

Fig. 16. SU carburettor, schematic view

above the piston, causing the piston, the sleeve and the needle to rise a certain amount, increasing the effective diameter of the throat. The raised needle increases the amount of fuel emerging from the jet; thus the correct air/fuel mixture is automatically established. When starting a cold engine, the mixture may be enrichened by pulling down the jet; the mouth of the jet will now be in line with a thinner portion of the needle, thus supplying a richer mixture. The jet is mounted in the jet retainer by means of two spring-loaded gland joints, thus ensuring a fuel-tight seal. In fig. 17 an exploded view of the jet assembly is shown.

Fitting jet needles and centring the jets:

Two types of jet needles are in use; one with straight-cut shoulder, the other with rounded shoulder, as shown in figure 18. When fitting the needle, the portion of the



13 Upper jet guide with joint washer
14 Lower „ „ „ „ „
15 Jet retainer
16 Spring
17 Gland packing joint washers and thrust washers
18 Adjusting nut
19 Jet retainer joint
20 Joint retainer with bevelled bore
21 Jet (5 in schematic drawing)
22 Lockspring for 18

Fig. 17. Carburettor jet assembly, exploded view

needle that is marked with the dotted line must be flush with the bottom of the piston. When assembling the carburettor, it is imperative that the jet and needle are correctly centred. This is checked by screwing the adjusting nut all the way up; then lift the piston and needle assembly and let it fall when there should be an audible click. If no click is heard, the needle is fouling the jet, which will have to be recentred. This is done by loosening and retightening the jet retainer. Recheck

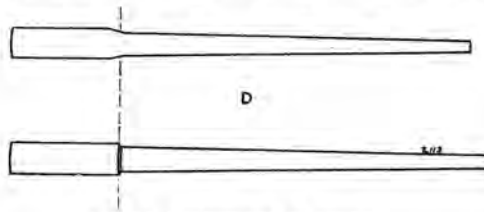


Fig. 18. Carburettor jet needles

whether the piston will now fall with an audible click; if necessary repeat the loosening and retightening operation until the jet is centred correctly.

Float setting: When the float needle is seated, a $\frac{1}{16}$ in round bar should be an easy sliding fit between the arched fork of the float hinge arm and the edge of the float chamber cover. If adjustment is necessary, carefully bend the hinge lever fork; *do not* bend the straight portion of the hinge lever.

Adjustment:

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 screw on the throttle connector rod to enable the throttles to be set independently. Ensure that 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.

On cars with connecting linkage between choke lever and throttle, unscrew the 'fast idle' adjustment screw until it is well clear of the cam.

(3) Warm up the engine and set the throttles to give an idling speed of approximately 500 rpm.

(4) Listen to the hiss of air at each carburettor air intake (the use of a piece of tubing of about $\frac{3}{8}$ in diameter, one end held to the ear and the other end 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 500 rpm.

(6) Now turn off the ignition and, with a downward pressure on the rear throttle arm, tighten the throttle connector rod clamping screw.

(7) Start the engine. While the engine is idling at approximately 500 rpm, check the mixture of each carburettor in turn by lifting the piston approximately $\frac{1}{8}$ in with a pen-knife blade or a thin screw driver, inserted in the air intake.

NOTE: Do not lift the piston with a finger, since a finger forms a too large an 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 lean 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 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 $\frac{1}{64}$ in.

(11) Refit the air duct and air cleaner. *Recheck idle speed and mixture.*

Air cleaner: One AC Sphinx air cleaner is fitted to each carburettor. The element consists of oil-wetted steel shavings; it should be cleaned in petrol every 6000 miles, or more often in very dusty conditions.

When refitting the air cleaners, it is important that the holes above the mounting stud holes in the carburettors are in line with the corresponding holes in the cleaner.

Cooling system: Pressurised water cooling by means of an impeller type pump and fan. The cooling system is provided with two drain cocks, one on the right-hand side of the cylinder block towards the rear and one at the radiator base.

To drain the system these two cocks, together with the radiator filler cap and the heater cock, should be opened.

Capacity: 13 Imp pints (15·8 US pints) without heater and 14 Imp pints (17 US pints) when a heater is fitted. The relief valve in the radiator filler cap opens when the pressure in the cooling system exceeds 4 lb/sq in; to relieve the vacuum when the system cools, a spring loaded relief valve is incorporated in the centre of the pressure valve.

Water pump: The impeller type water pump is mounted on the front face of the cylinder block; the water pump shaft runs in two removable ball bearings.

Fan: A four-bladed fan of $12\frac{1}{2}$ in diameter is fitted on the crankshaft pulley. When the fan has been removed, special attention should be paid to the location of the balance weight. When reassembling, make sure that the drilled holes in the component parts are in line with the dimple in the hub extension.

Fan belt: Single V-belt, driving water pump and generator. The fan belt should be adjusted so that it has $\frac{1}{2}$–$\frac{3}{4}$ in flex, measured in its longest run.

Thermostat: A thermostatic valve is incorporated in the water outlet at the front face of the cylinder head. When the thermostat is closed the water circulates through the by-pass passage in the water pump to recirculate through the cylinder block and head.

The thermostat is set to open at 158° F (70° C) and must be fully open at 197° F (92° C).

Frost protection: Use a reputable brand of anti-freeze only, diluted according to the instructions given by the manufacturer.

TRANSMISSION

Clutch: Single dry plate clutch, hydraulically operated. The clutch pedal operates

the clutch master cylinder, which is mounted on the engine bulkhead on the driver's side.

The clutch fork is operated by an actuating cylinder, which is mounted on the left-hand side of the clutch housing. Up to chassis number TS 13101, the clutch master cylinder was incorporated in a twin-bore cylinder on the engine bulkhead; starting from the chassis number mentioned above, when disc brakes were first fitted to the front wheels, separate clutch and brake master cylinders were installed, although still fed from a common fluid reservoir.

For an exploded view of the piston assembly in the twin-bore master cylinder see Fig. 29, where the brake master cylinder piston is shown. The clutch master cylinder is identical except for the items 11, 12 and 13 (foot valve assembly).

The clutch master cylinder which is fitted from chassis number TS 13101 onwards is shown in Fig. 33.

The clutch and brake master cylinders of the newer type are identical. Starting from engine number TS 7830E an improved clutch plate was installed. This plate can be distinguished from the former model by four tabs protruding through the spring retainer plates, adjacent to the longer side of the hub. The six damper springs in the new clutch plate are white and light green instead of red and grey as in the former model.

Specifications:

Model: A6G
Diameter: 9 in
Number of springs: 9 (cream)
Rate: 120–130 lb
Clutch pedal free play: 0·820 in
Clearance between piston rod and master cylinder piston: 0·030 in
Clearance between actuating cylinders and push rod: 0·075 in

Key to Figure 19:

1 Welch plug
2 Top cover
3 Gasket
4 Welch plug
5 Seal
6 Cover plate
7 First/second gear shifter fork shaft
8 Gear lever socket retaining bolt
9 Gear lever socket
10 First/second gear shifter fork
11 Third/top gear shifter fork
12 Lock screw
13 Third/top gear shifter fork shaft
14 First/second gear selector dog
15 Gear lever knob
16 Detent ball and spring
17 Reverse shifter fork shaft
18 Interlock pin and ball
19 Reverse gear selector dog
20 Reverse detent plunger, spring and plug
21 Gear lever
22 Ball seat cap
23 Cross shaft bush
24 Gasket
25 Gasket
26 Gearbox extension
27 Oil seal
28 Shifter/selector finger
29 Clutch release bearing sleeve/front bearing retainer
30 Countershaft cluster
31 Oil seal
32 Cross shaft bush
33 Oil drain plug
34 Speedometer driven gear
35 Gearbox support
36 Speedometer pilot assembly
37 Support bracket

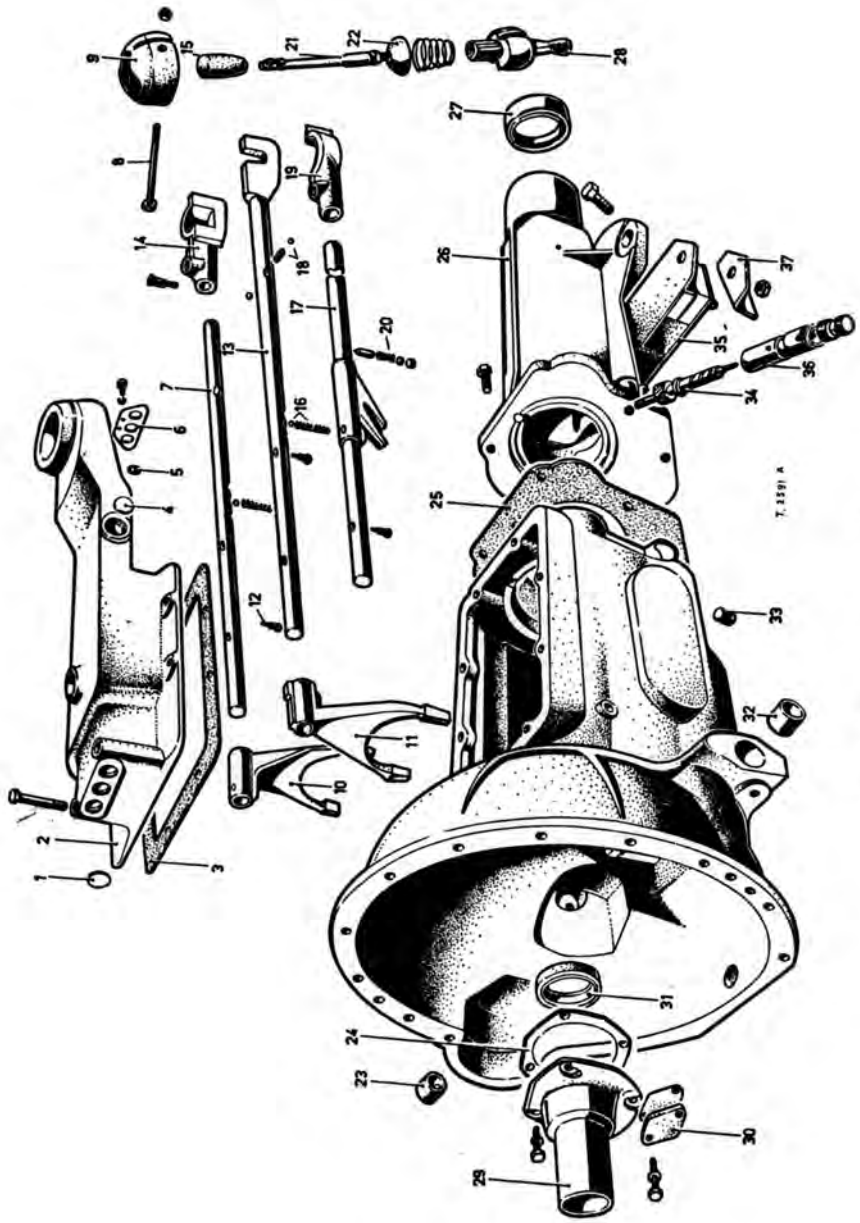


Fig. 19. Gearbox, exploded view

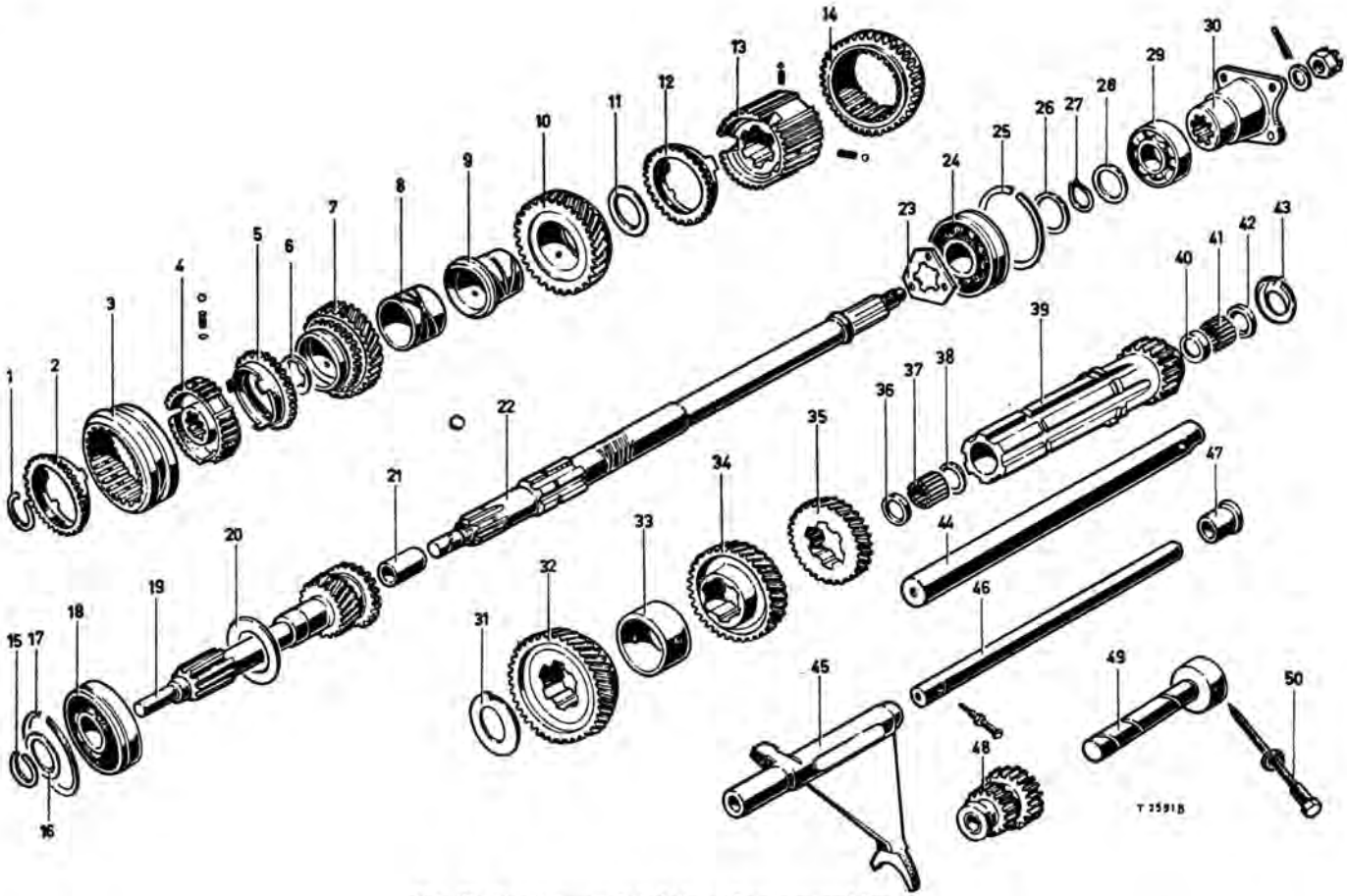


Fig. 20. Gearbox, exploded view of gear assemblies

Height of clutch fingers from flywheel face: 1·895 in

Minimum travel, measured at end of fingers: 0·38 in (maximum available travel: 0·47 in)

Clutch release bearing: The clutch release bearing is a single row ball-bearing. The bearing is packed during assembly and does not require any special maintenance. Clearance between release bearing and release levers: 0·0625 in.

NOTE: Do not rely on clutch pedal free play alone when checking clutch release bearing clearance. Always measure actuating cylinder to push-rod clearance.

Gearbox: Four-speed gearbox with synchromesh engagement on second, third and top gear.

The constant-mesh gears are of the helical type. The overdrive unit, which is available as an optional extra, is described under a separate heading.

Ratios

First	3·38 : 1
Second	2·00 : 1
Third	1·325 : 1
Top	1·00 : 1
Reverse	4·28 : 1

In Figs. 19 and 20 an exploded view of the gearbox is shown.

Key to Figure 20:

1 Mainshaft circlip
2 Top gear synchronizer ring
3 Third/top gear synchronizer sleeve
4 Third/top gear synchronizer hub and detent spring, ball and shim
5 Third gear synchronizer ring
6 Thrust washer
7 Third gear idler pinion
8 Third gear idler pinion bearing bush
9 Second gear idler pinion bearing bush
10 Second gear idler pinion
11 Thurst washer
12 Second speed synchronizer ring
13 First gear synchronizer hub with interlock ball and pin (upper) and detent ball and spring (lower)
14 First gear sliding sleeve
15 Circlip
16 Washer
17 Bearing circlip
18 Ball bearing
19 Main drive gear
20 Oil slinger
21 Pilot bearing
22 Main shaft
23 Triangular washer
24 Ball bearing
25 Bearing circlip
26 Washer
27 Circlip
28 Washer
29 Ball bearing
30 Companion flange
31 Countershaft front thrust washer
32 Constant mesh gear
33 Countershaft spacer bush
34 Third speed pinion
35 Second speed pinion
36 Bearing needle abutment ring
37 Needle bearing
38 Bearing needle abutment ring
39 First speed pinion and gear cluster sleeve
40 Bearing needle abutment ring
41 Needle bearing
42 Bearing needle abutment ring
43 Countershaft rear thrust washer
44 Countershaft
45 Reverse gear shifter fork
46 Shifter fork guide rail
47 Bush
48 Reverse idler gear
49 Reverse idler shaft
50 Countershaft and reverse idler shaft lock screw

Removal of gearbox with engine in place:

(1) Disconnect the battery; remove the front seats, the gear lever and the centre floor section.

(2) Disconnect the propeller shaft, the speedometer drive cable and remove the clutch actuating cylinder.

(3) Disconnect the wiring from the solenoid switch (when an overdrive is fitted).

(4) Support the engine with a wooden block and a jack placed under the rear of the sump and remove the gearbox mounting. Remove the starter motor; unscrew all bolts and nuts securing the clutch housing to the engine and withdraw the gearbox.

Re-installation is done in the reverse order of removal.

Dismantling:

(1) Remove the top cover together with the shifter/selector mechanism. Dismantling of the top cover is described under the heading 'Top cover'.

(2) Remove the clutch fork shaft together with clutch fork, coil spring and throw-out bearing.

(3) Unscrew the speedometer-drive locating bolt and remove the speedometer drive assembly.

(4) Remove the propeller shaft flange and the gearbox extension. If necessary the oil seal and ball race can be tapped out.

(5) Remove the countershaft front cover and drive out the countershaft, using a suitable tube to retain the 48 needle rollers in place.

(6) Remove the gearbox front cover and extract the main drive gear assembly with a suitable puller (e.g. Churchill tool No. 20 SM 66A).

Remove the circlip locating the maindrive gear ball bearing and pull off the bearing.

(7) Tap the mainshaft towards the rear to dislodge the mainshaft bearing from the housing. Tilt the mainshaft upwards and remove the third/top gear synchronizer unit from the shaft.

(8) Remove the mainshaft circlip (e.g. with Churchill tool No. 20 SM 69). Always fit a new circlip when reassembling. Withdraw the thrust washer, third gear idler pinion with bearing bush, second gear idler pinion with bearing bush, thrust-washer (with three lugs) and second speed synchronizer unit with first speed shifter gear. The mainshaft can now be withdrawn from the gearbox.

After removal of the circlip the mainshaft bearing can be pressed from the shaft.

(9) Remove the reverse shifter fork shaft locating screw and drive out the shifter fork shaft, remove the shifter fork.

(10) Tap out the reverse idler shaft through the rear of the gearbox and lift out the reverse idler pinion.

(11) The countershaft assembly can now be lifted out of the gearbox. Take care not to lose the 48 roller needles. If necessary the countershaft gears can be slid from the countershaft. Carefully clean and inspect all parts and replace those that are damaged or worn.

Reassembly:

(1) Assemble the countershaft and install it, together with the bronze thrust-washer, in the gearbox. Check that the end-float does not exceed 0·006–0·010 in.

If there is insufficient end-float, the length of the spacer bush should be reduced; too much end-float necessitates installing new thrust washers.

Lower the countershaft to the bottom of the gearbox.

(2) Install the reverse idler pinion with the smaller gear towards the front of the gearbox. Check that the holes for the locating bolt are in line, but do not install this bolt yet.

Fit the reverse gear shifter fork, the shifter fork guide shaft and the steel bush; fit the locating bolt. Install the welch plug.

(3) Slide the triangular washer on the mainshaft and press the mainshaft bearing in place. Install new circlips.

(4) Check end-float of the following parts:

Second gear idler pinion on its bearing bush:	0·004–0·006 in
Third gear idler pinion on its bearing bush:	0·004–0·006 in
Overall bush float on the mainshaft:	0·007–0·012 in

Check the load required to pull the second and third gear synchronizer sleeve from its rest position.

Second gear synchro unit 25–27 lb

Third gear synchro unit 19–21 lb

If necessary add or remove shims under the synchronizer springs.

(5) Now assemble the mainshaft as follows:

(*a*) Second speed synchronizer unit with first speed shifter gear.

(*b*) Second speed synchronizer ring.

(*c*) Thrust washer with three lugs.

(*d*) Second gear idler pinion with bearing bush.

(*e*) Third gear idler pinion with bearing bush.

(*f*) Thrust washer with the scrolled side towards the gear.

(*g*) A new mainshaft circlip.

(6) Install the third and top gear synchronizer unit on the mainshaft with the short boss of the synchronizer hub towards the mainshaft circlip.

(7) Push the mainshaft ball bearing home in its bore; take care that the gap in the larger circlip corresponds with the breather hole in the gearbox wall.

(8) Install a new oil baffle plate on the maindrive pinion and press the maindrive gear bearing on the shaft. Install a thrust washer of the correct thickness and install the circlips (one on the shaft and one in the outer race of the bearing).

(9) Fit the Oilite spigot bush in the maindrive gear with the internally bevelled portion towards the mainshaft.

(10) Drive the maindrive gear bearing home in the gearbox housing; make sure that the gap in the larger circlip is in line with the breather hole in the gearbox wall.

(11) Carefully move the synchronizer sleeve of one of the synchronizer units towards its idler gear until the synchronizer ring is seated on the cone of the idler gear pinion. Now measure the distance between the teeth on the synchronizer ring and the row of narrow teeth on the idler pinion. This distance should be 0·035–0·040 in for new parts and 0·005–0·010 for parts which have been run-in.

NOTE: *Do not* slide the synchronizer sleeve out of its rest position or the synchronizer balls and springs may be released and drop to the bottom of the gearbox.

Repeat this operation with the other synchronizer unit.

(12) Use a suitable bar to centralize the countershaft thrust washers and drive out the pilot tool with the countershaft.

(13) Fit the locating bolt through the reverse idler pinion and countershaft and tighten the bolt.

Fit the countershaft front cover and lock the bolts with lock wire.

(14) Assemble and install the gearbox extension, securing the bolts with lock wire. Install the thrust-washer, ball bearing and oil seal in the extension housing. Fit a plain washer and tighten the castellated nut to 85–100 ft lb. Fit a split-pin.
(15) Install the speedometer drive assembly and secure it with the locating bolt.
(16) Fit the front cover (with a new oil seal) and secure the bolts with lock wire.
(17) Assemble the clutch throw-out bearing; install the clutch fork and the clutch fork shaft and wire the locating bolts. Fit a grease nipple at the right-hand end of the clutch fork shaft.
Install the top cover.

Top cover:

Dismantling:

(1) Check that the shifter/selector mechanism is in neutral and remove the gear-lever assembly.
(2) Remove the first and second speed shifter fork shaft rearwards from the top cover after removal of the shifter fork locating bolt and detent mechanism.
(3) Remove the reverse and third/top gear shifter fork shafts in the same way, taking care not to move more than one shifter fork shaft at a time, otherwise damage will be caused to the shaft bores by the interlock mechanism. Take care not to lose the interlock balls and roller.
(4) The selector dogs on the first/second and reverse shifter fork shafts can be removed if necessary.
(5) Remove the shifter fork shaft rear locating plate and the oil seal rings and tap out the welch plugs if necessary.

Reassembly is done in the reverse order of removal with the exception of the following point.

First install the third/top gear shifter fork shaft, then the interlock mechanism and the reverse and first/second gear shifter fork shafts. Always make sure that the shifter fork shaft that has been fitted is in the neutral position.

Specifications:

Internal diameter of mainshaft pilot bearing 0·6880–0·6887 in
Clearance of mainshaft in pilot bearing bush, when new: 0·0005–0·0017 in
Diameter of mainshaft: 1·2481–1·2488 in
Inner diameter of second gear idler pinion bearing bush: 1·2495–1·2507 in
Clearance, when new: 0·0007–0·0026 in
Inner diameter of third gear idler pinion bearing bush: 1·2488–1·2495 in
Clearance, when new :0·000–0·0014 in
Length of second gear idler pinion bearing bush: 1·160–1·162 in
Length of second gear idler pinion: 1·154–1·156 in
End-float: 0·004–0·006 in
Length of third gear idler pinion bearing bush: 1·223–1·225 in
Length of third gear idler pinion: 1·217–1·219 in
End-float 0·004–0·006 in
Overall endfloat: 0·007–0·012 in

Key to Figure 21*:*

1 Input shaft
2 Cone clutch spring
3 Front housing
4 Clutch bearing
5 Brake ring
6 Cone clutch
7 Planet shaft
8 Rear housing
9 Annulus
10 Freewheel
11 Output shaft
12 Oil pump
13 Sun gear
14 Planet
15 Speedometer pinion

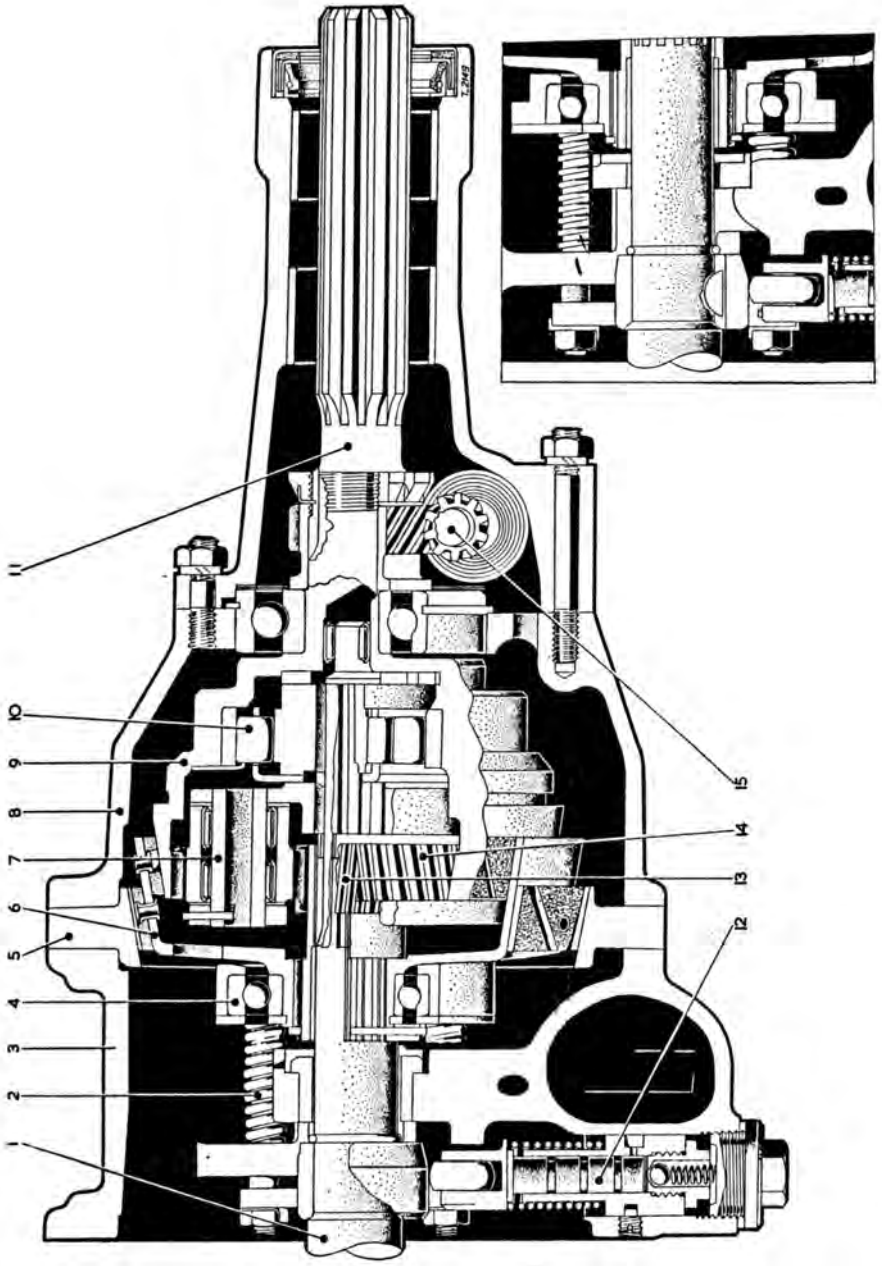


Fig. 21. Overdrive, sectioned view

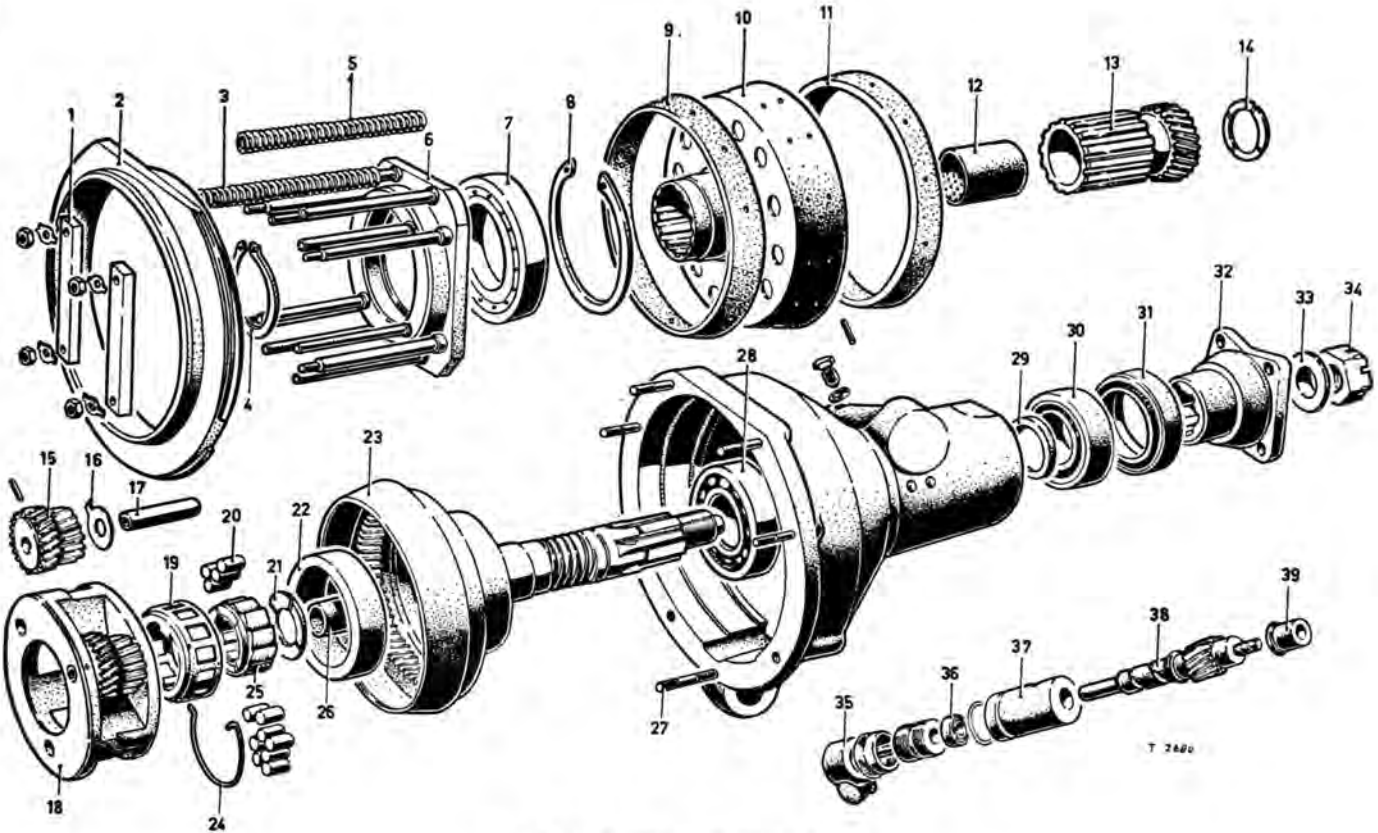


Fig. 22. Overdrive, exploded view

External diameter of countershaft: 0·7908–0·7913 in
Inner diameter of countershaft gears: 0·8978–0·8983 in
Roller diameter: 0·119 in
Overall length of countershaft gears and two thrust-washers: 6·7565–6·7675 in
Thickness of front thrust-washer: 0·066–0·068 in
Thickness of rear thrust-washer: 0·105–0·107 in
Internal width of gearbox: 6·769–6·771 in
Overall end-float of countershaft gears: 0·0015–0·0145 in
Diameter of reverse idler shaft: 0·5613–0·5618 in
Internal diameter of bushes: 0·5625 in
Clearance, when new: 0·0007–0·0012 in
Load required to move second speed synchonizer hub from its rest position: 25–27 lb
Load required to move third speed synchronizer hub from its rest position: 19–21 lb
Gap between synchronizer ring teeth and teeth on mainshaft synchro gears:
Engaged: 0·035–0·040 in
Free: 0·060–0·075 in

Overdrive: The Triumph TR 2 and TR 3 can be equipped (as optional extra) with a Laycock de Normanville overdrive. On early models the overdrive could only be engaged with top gear; on later production models, overdrive on second, third and top gear is available. Refer to Figs. 21 and 22 for the working principles of the Laycock de Normanville overdrive.

Construction: The overdrive unit is bolted to the gearbox, the mainshaft of which differs from the mainshaft of a standard gearbox. The overdrive annulus forms part of the output shaft; gear teeth are cut in its inner circumference; the outer circumference is conically-shaped in order to fit the inner facing of the cone clutch.

The teeth in the annulus are constantly in mesh with the planet pinions of the carrier, these pinions being mounted on short shafts which are fitted in the carrier.

Key to Figure 22:

1 Bridge piece
2 Brake ring
3 Clutch spring, long
4 Circlip
5 Clutch spring, short
6 Clutch thrust ring
7 Bearing
8 Circlip
9 Clutch lining, outer
10 Cone clutch
11 Clutch lining, inner
12 Bearing bush
13 Sungear
14 Thrust washer
15 Planet pinion
16 Lock washer
17 Planet pinion shaft
18 Planet carrier
19 Free-wheel roller cage
20 Free-wheel rollers
21 Thrust washer
22 Free-wheel outer race
23 Annulus
24 Free-wheel expander spring
25 Free-wheel cam
26 Bearing bush
27 Stud
28 Ball bearing
29 Spacer ring
30 Ball bearing
31 Oil seal
32 Companion flange
33 Washer
34 Castellated nut
35 Speedometer driven gear adaptor
36 Oil seal
37 Spindle sleeve
38 Speedometer driven gear
39 Cable pilot

Also in constant mesh with the planet pinions is the sun gear, which is fitted to the gearbox mainshaft by means of a bearing bush, so that it may revolve around the mainshaft.

Splined to an extension of the sun gear hub is the double cone clutch, the inner lining of which is in contact with the annulus, when the clutch is pushed back by spring pressure. When the clutch is pushed forward by oil pressure, its outer face contacts the stationary brake ring. A freewheel, the inner race of which is splined to the gearbox mainshaft, allows the output shaft to revolve faster than the mainshaft during operation in overdrive.

Oil pressure for operating the clutch is supplied by a plunger pump, incorporated in the overdrive unit. The plunger is pushed down once during each revolution of the mainshaft by a cam and pushed upwards by pressure of the plunger return spring. The oil flows from the pump check valve into a relief valve, which keeps the oil pressure at a constant value. Oil supply to the clutch actuating pistons is controlled by the operating valve. When the overdrive is engaged, the operating valve is lifted, thereby lifting a spring-loaded ball check valve off its seat, thus allowing oil pressure to reach the pistons which move the cone clutch foreward to the position 'overdrive engaged'.

When the operating valve is returned to the 'overdrive disengaged' position, the spring-loaded ball check valve is returned to its seat, thereby shutting off the pressure to the pistons, whereupon the cone clutch is returned to the rearward position by spring pressure. The oil from the pistons returns to the overdrive sump through the centre of the hollow operating valve, thereby passing through a small orifice in the valve; this allows smooth re-engagement of the clutch with the annulus.

Electrical control system: A schematic lay-out of the electrical control system is shown in Fig. 23. Movement of the overdrive operating valve is controlled by a solenoid, which incorporates two coils and a pair of contacts. On early production types, the overdrive could only be engaged with top gear; later models have a lay-out which makes it possible to engage overdrive with second, third or top gears.
Assuming that the selector switch is closed, closing of the control switch will allow current to flow through the relay coil, thus closing the relay contacts, which in turn energizes the solenoid coils. The majority of the current flows through the 'pull-in' coil, a small amount of current going through the 'holding coil'. As soon as the solenoid plunger moves (thus lifting the operating valve) the series contacts are opened, which brakes the current through the 'pull-in' coil; thereafter the solenoid is held in the 'overdrive engaged' position by a small current through the 'holding' coil, thus saving undue current consumption. When either the central switch or the selector switch is opened, the relay (and consequently the solenoid) are de-energized and the operating valve returns to the 'overdrive disengaged' position.

Principles of operation: The cone clutch (6), which is fitted to an extension of the sun-gear (13) is retained by spring pressure in its rearward position, so that its inner clutch lining is in contact with the outside of the annulus (9). As the sungear and the annulus revolve at the same speed, the gear train is locked.

The gear train consists of the planet carrier (7) and the planet pinions (14). The drive is now transmitted directly through the locked freewheel (10) to the output shaft.

When overdrive is engaged, the cone clutch is held foreward by hydraulic pressure so that the outer clutch face is in contact with the brake ring (5) and the cone

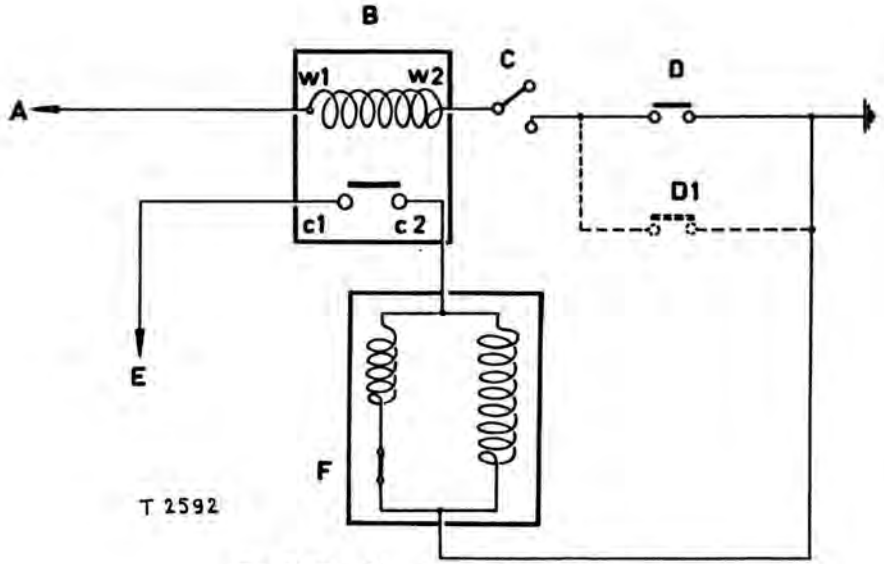


Fig. 23. Overdrive, electrical control system

A To starter solenoid switch B (Hot lead)
B Relay
C Operating switch
D Isolator switch
D1 Isolator switch
E To ammeter (if fitted)
F Solenoid assembly

clutch, together with the sun gear, are held stationary. The planet carrier, which is splined to and driven by the mainshaft, drives the planet pinions around the stationary sun gear, so driving the annulus and the output shaft at a speed higher than the mainshaft speed.

Removal and dismantling:

(1) Remove the gearbox as previously described but do not forget to disconnect the wires from the solenoid and the selector switch, or switches.

(2) Remove the overdrive unit from the gearbox by unscrewing the bolts securing the overdrive adaptor to the overdrive. Remove the nuts on the shorter studs first.

(3) Remove the cone clutch springs; remove the two bridge pieces retaining the operating pistons and withdraw the pistons.

(4) Remove the operating valve plug, take out the plunger and spring and remove the ball with a magnet.

(5) Gradually slacken the nuts, securing the two halves of the housing. The brake ring can be removed by gently tapping around its flange with a soft hammer.

(6) Lift out the clutch cone, together with the thrust bearing and the sun gear.

Lift out the planet carrier assembly. If it is necessary to remove the planet gears from the carrier, the lock pins securing the planet bearings shafts must be extracted before the latter can be tapped out.

Remove the freewheel. Use a suitable ring or sleeve to prevent the freewheel rollers from dropping out of the roller cage.

(8) Remove the propeller shaft coupling flange; remove the speedometer drive unit and tap out the annulus.

The annulus front bearing will come away on the shaft, but the rear bearing remains in the housing.

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

Reassembly:

(1) Install the annulus in the rear housing and fit the speedometer drive assembly and the propeller shaft flange. Check that there is no end-float. End-float is corrected by selective assembly of shims, which are available in several sizes.

(2) Install the thrust-washer and the freewheel. Make sure that the spring is correctly located, so that the cage urges the rollers up the ramps of the ratchet.

(3) Assemble and install the planet carrier assembly together with the sun gear. Turn the planet carrier until the locating peg on the inner member of the freewheel enters the corresponding hole in the planet carrier. Check the end-float of the sun gear and adjust by selective assembly of shims.

(4) Install the cone clutch, together with the thrust bearing. Fit the brake ring to the front housing and bolt the front housing to the rear extension.

(5) Install the operating valve, insert the operating pistons, fit the two bridge pieces and install the clutch cone springs over their pins. The longer springs should be fitted on the outside.

(6) Engage top gear and offer up the overdrive unit to the gearbox adaptor; make sure that the gearbox mainshaft engages the splines in the planet carrier properly.

Before tightening the nuts, make sure that the cone clutch springs are located on the locating pegs on the face of the adaptor.

Adjustments:

The controls are correctly adjusted when a $\frac{3}{16}$ in rod can be passed through the hole in the solenoid lever into the hole in the overdrive housing.

When performing this check, the ignition should be switched on, top gear engaged and the switch on the facia panel in the overdrive position.

If it is not possible to insert this rod the valve must be adjusted as follows:

(1) Remove the cover plate and slacken the solenoid lever clamping bolt.

(2) Rotate the valve setting lever until the $\frac{3}{16}$ in rod can be inserted.

(3) Actuate the solenoid and check that the plunger is drawn into the solenoid as far as possible.

(4) Ensure that the solenoid lever is against the head of the actuating bolt and tighten the solenoid lever clamping bolt. Repeat the check previously described and refit the cover plate.

When correctly adjusted the closing current should not exceed fifteen amperes and the holding current should be less than one ampere.

Adjustment of the selector switch:

(1) Engage second gear. Wire a test lamp in series with the battery and the switch contact.

(2) Screw the switch into the top cover until the contact closes and the lamp lights.

(3) Measure the gap between the switch and the top cover boss. Subtract 0·040 in from this dimension and make up a shimpack of the remaining thickness.

(4) Remove the switch and refit it with the shims. Repeat this operation with the third and top selector switch.

Propeller shaft: Hardy-Spicer Series 1300. When reassembling the propeller shaft, make sure that the sliding and fixed yoke are in the same plane and that the arrow markings coincide.

Tube diameter: 2 in
Overall length: 28 $\frac{3}{16}$ in

Rear axle/Differential: Semi-floating rear axle, with hypoid pinion and crown wheel. Starting from chassis number TS 13431 a new rear axle was introduced. The major differences from the former model are new drive shafts and hub assemblies, adjustable taper wheel bearings and a thrust block on the differential pinion shaft.
In Fig. 24 an exploded view of the rear axle is shown. The insert shows the arrangement after chassis number TS 13431. On later production cars a 4·1 : 1 rear axle is fitted when an overdrive is installed.

Removal of a drive shaft (on cars equipped with wheel bearings of the ball bearing type):

(1) Jack up the rear of the car; remove the wheel and the brake drum. If the car is equipped with wire wheels, the split tapered collar should be prised off the hub with a screw driver.
(2) Disconnect the brake hose and the parking-brake cable and remove the bolts securing the brake backing plate and the bearing housing to the axle flange.
(3) Withdraw the drive shaft, together with the brake backing plate assembly.
(4) Hold the drive shaft in a vice with soft jaws, remove the castellated nut, washer and splined collar and extract the hub with a suitable puller.
(5) Remove the hub bearing with a suitable puller. If necessary drive out the oil seal from the bearing housing.

Re-installation is done in the reverse order of removal. On later models the hub is an interference fit with the drive shaft and has to be re-installed with a suitable press. Tighten the hub securing nut to 110–125 ft lb on rear axles prior to axle number TS 8039 and to 125–145 ft lb from this number onwards.

Removal of a drive shaft (on cars equipped with taper roller bearings):

(1) Jack up the rear of the car; remove the wheel and the brake drum.
(2) Remove the castellated nut, the thrust washer and extract the hub with a suitable puller.
(3) Remove the bolts securing the brake backing plate and bearing housing to the axle housing and remove the bearing housing together with the outer race.
Removal of the brake backing plate is normally not required.
(4) Withdraw the drive shaft together with the roller bearing. After removal of the key, the bearing can be pulled off the shaft. If necessary, tap the oil seal out of the bearing housing and remove the outer race.

Re-installation is done in the reverse order of removal. When the re-installation has been completed, the end-float should be checked. End-float should be within 0·004–0·006 in. Tighten the castellated nut securing the hub to 110–125 ft lb on rear axles prior to axle No. TS 8039, and to 125–145 ft lb from this number onwards.

Differential:

Removal and dismantling:

(1) Remove the rear wheels, the brake drums and drive shafts. Disconnect the propeller shaft from the pinion drive flange.

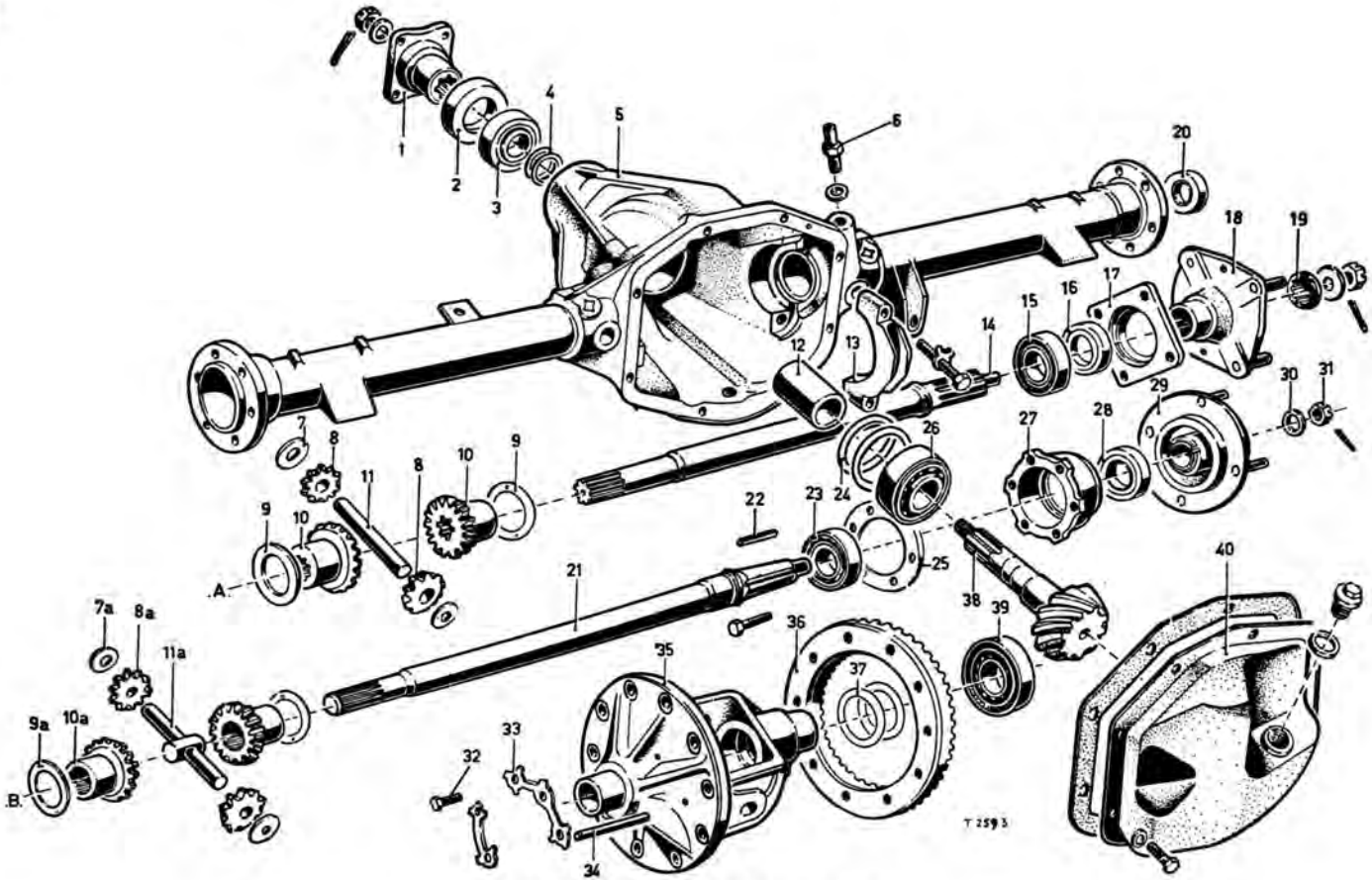


Fig. 24. Rear axle/differential, exploded view

(2) Remove the rear axle cover and joint.

(3) Remove the differential bearing caps and check if they are marked.

(4) Install Churchill spreading tool No. S 101 on the housing flange and spread the housing by screwing the tensioner screw hand tight and then turning it a further half turn. *Do not exceed this amount or the housing will be seriously damaged.*

(5) Lift the differential assembly out of the casing and place it on a bench. Remove the crown wheel. Further dismantling is described in a later stage.

(6) Remove the pinion flange nut and flange, and tap out the pinion with a soft hammer. Take care not to lose the pinion preload shims.

(7) If necessary remove the outer races with a suitable drift. Take care not to lose the shims for pinion depth adjustment. The pinion rear bearing can be removed with a suitable puller.

(8) Re-install the different assembly in the carrier and release the tension of the spreading tool.

Install a dial gauge on the carrier flange and let its plunger rest at right angles to the crownwheel mounting flange. Check the run-out of the crown wheel flange; this should not be more than 0·003 in. Check the run-out of the crown wheel on a surface-plate.

(9) Drive out the differential pinion shaft locating pin and withdraw the shaft.

Remove the differential pinions, the differential side gears and their respective shims. On later models the differential pinion shaft is provided with a thrust block, which can be taken out after removal of the differential pinion shaft.

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

Key to Figure 24*:*

A Differential pinions, axle shaft and rear wheel bearing, old model
B Ditto, starting from chassis number 13046
1 Pinion drive flange
2 Oil seal
3 Pinion front bearing
4 Preload shims
5 Rear axles housing
6 Breather
7 Thrust washer
8 Differential pinion
9 Thrust washer
10 Differential side gear
11 Differential pinion shaft
12 Spacer bush
13 Bearing cap
14 Axle shaft
15 Hub bearing
16 Oil seal
17 Bearing cover
18 Hub
19 Splined collar
20 Oil seal
21 Axle shaft
22 Key
23 Hub bearing
24 Depth adjustment shims
25 Shim for 23
26 Pinion rear bearing
27 Bearing housing
28 Oil seal
29 Hub
30 Washer
31 Castellated nut
32 Crownwheel bolt
33 Lock plate
34 Differential pinion shaft lockpin
35 Differential housing
36 Crownwheel
37 Shims
38 Pinion
39 Differential bearing
40 Rear cover

Re-assembly:

(1) When the pinion bearing outer races have been removed, they must be pressed back in place with Churchill tool No. M 70.

(2) Install the dummy pinion M 84 and the pinion bearings in the pinion carrier; tighten the flange nut until a bearing pre-load of 15–18 in lb is obtained.

(3) Install the pinion setting gauge block in the carrier after having zeroed the dial gauge with a ground setting plate, which is held firmly against the gauge block. Make a note of the dial reading.

A thickness of 0·002–0·003 in should be subtracted from the dial reading to compensate for bearing distortion, as the bearings are a sliding fit on the dummy pinion and a press fit on the actual pinion.

(4) Remove the gauge block, the dummy pinion with bearings and the rear pinion bearing outer race.

(5) Install a shimpack of the correct thickness and reinstall the bearing outer race with tool M 70.

Press the rear pinion bearing fully home on the pinion shaft. Install the pinion spacer bush (chamfer outwards) and the shims for bearing pre-load on the pinion shaft.

(6) Fit the pinion front bearing and the drive flange. Do not install the oil seal at this stage.

Tighten the pinion flange nut to 85–100 ft lb.

(7) Fit a torque gauge to the pinion drive flange. The correct bearing pre-load is between 15 and 18 in lb. If the preload is inadequate, shims must be removed, whereas addition of shims is necessary to correct a high gauge reading.

(8) When the correct pre-load has been obtained, the drive flange must be removed and an oil-seal fitted. Do not forget to fit a new split-pin in the pinion flange nut after re-installation of the drive flange.

(9) Drive the differential bearings into the differential housing. The differential bearing shims are omitted at this stage. Install the differential housing in the differential carrier. Screw down the bearing cap nuts and then slacken off a $\frac{1}{4}$-turn. This will allow the housing to move sideways.

(10) Install a dial gauge on the carrier flange with the plunger at right angles to the crownwheel flange. Move the housing away from the dial gauge as far as possible and zero the dial. Now move the housing fully in the opposite direction. Make a note of the dial reading; this indicates the total side float of the differential housing. Let this (for example) be 63.

(11) Remove the housing from the carrier and assemble the differential pinions, the side gears and the respective thrust washers.

Do not forget the thrust block on later models.

(12) Fit the crown wheel to its flange and tighten the crownwheel bolts to 22–24 ft lb when $\frac{7}{16} \times 24$ UNF bolts are fitted and to 35–40 ft lb when $\frac{1}{2} \times 24$ UNF bolts are fitted. Bend over the lock plates.

(13) Install the differential assembly in the carrier and install a dial gauge on the mounting flange. Let the plunger rest against a crownwheel bolt.

(14) Move the differential assembly away from the dial gauge until the teeth on the crownwheel are fully engaged in the teeth on the pinion. Zero the dial and then move the differential assembly towards the dial gauge. Note the reading. Let this be 41.

(15) The side-float, measured in the last operation, less the crown wheel and pinion

backlash (0·004–0·006 in) will indicate the thickness of the shimpack to be installed on the crownwheel side.

(16) The shimpack for the opposite bearing is found by subtracting the thickness of the shimpack on the crownwheel side from the total thickness, established under (10) and adding to this 0·005 in for pre-load.

(17) *Example:*

Side float, measured under (14):	41
Gear backlash (0·004–0·006)	5
	36

A shimpack of 0·036 in should be installed on the crownwheel side.

Total side-float, measured under (10):	63
Addition for pre-load	5
	68
Shimpack on crownwheel side	36
	32

A shimpack of 0·032 in should be installed on the opposite side of the crownwheel.

(18) Extract the differential bearings and install the two packs of shims in their respective positions; then refit the differential bearings.

(19) Install the spreading tool as previously described and spread the carrier just enough to enable the differential assembly to enter the casing.

Fit the bearing caps in their respective positions (the numbers stamped on the caps should coincide with those on the housing) and tighten the bearing cap bolts to 34–36 ft lb.

(20) Install a dial gauge at right angles to the heel of a crown wheel tooth and check the gear backlash. This should be within 0·004–0·006 in. An average of several teeth should be taken. If the backlash is excessive, the transfer of shims from the side opposite the crown wheel to the crown wheel side is necessary. Should the backlash be insufficient, the reverse procedure should be followed. Always maintain the same overall total.

(21) Paint the teeth with a suitable marking compound and check the tooth contact.

(22) Fit the rear axle cover with a new gasket. Install the drive shafts, brake drums and wheels in the reverse order of removal. Tighten the castellated nut securing the hub to 110–125 ft lb on rear axles prior to axle No. TS 8039 and to 125–145 ft lb from this number onwards.

Specifications:

Crownwheel run-out max. 0·003 in
Gear backlash 0·004–0·006 in
Actual pinion depth 3·4375 in
Pinion bearing pre-load, without oil seal 15–18 lb in
Diameter of differential bearings, early production 2·8440–2·8446 in
later production 2·8450–2·8460 in
Bearing cap bolts 34–36 ft lb.
Pinion nut tightening torque 85–100 ft lb.
Crownwheel bolts tightening torque $\frac{1}{16}$ × 24 UNF: 22–24 ft lb
$\frac{1}{8}$ × 24 UNF: 35–40 ft lb
Hub securing nut prior to axle No. TS 8039: 110–125 ft lb
starting from axle No. TS 8039: 125–145 ft lb

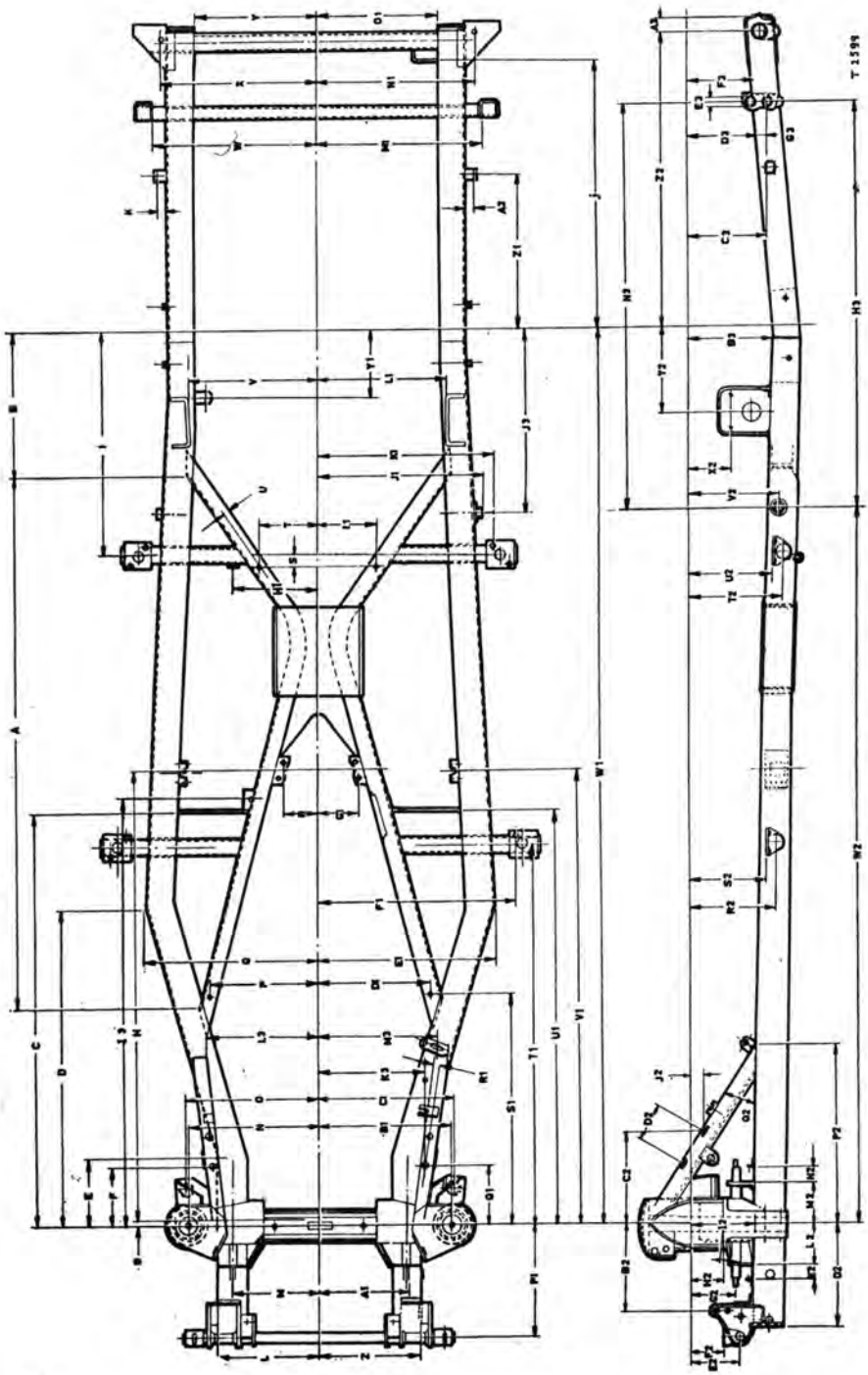


Fig. 25. Chassis frame, dimensions

Key to Figure 25:

A 52·63 in
B 14·25 in
C 40·06 in
D 31·00 in
E 6·50 in
F 5·50 in
G 0·485–0·515 in
H 43·72–43·78 in
I 22·00 in
J 26·50 in
K 0·81 in
L 10·19 in
M 8·77 in
N 13·188 in
O 13·50 in
P 11·13 in
Q 17·50 in
R 3·53 in
S 1·19 in
T 6·00 in
U 0·75 in
V 12·94 in
W 16·75–16·81 in
X 15·88 in
Y 15·00 in
Z 10·19 in
A1 8·77 in
B1 13·188 in
C1 13·50 in
D1 11·13 in
E1 17·50 in
F1 19·57 in
G1 3·97 in
H1 8·50 in
I1 6·00 in
J1 16·35–16·41 in
K1 17·50 in
L1 12·94 in
M1 16·75–16·81 in
N1 15·88 in
O1 15·00 in
P1 11·00 in
Q1 5·50 in
R1 0·63 in
S1 22·50 in
T1 37·00 in
U1 40·06 in
V1 44·00 in
W1 Wheel base: 88·00 in
Y1 6·50 in
Z1 15·50 in
A2 0·81 in
B2 8·44 in
C2 8·49 in
D2 3·58 in
E2 4·56 in
F2 3·12 in
G2 4·19 in
H2 2·19–2·97 in
I2 6·13 in
J2 0·50 in
K2 1·65 in
L2 4·00 in
M2 4·00 in
N2 1·65 in
O2 10·00 in
P2 17·50 in
Q2 32° 19 min
R2 8·19 in
S2 7·13 in
T2 8·19 in
U2 7·13 in
V2 7·72–7·78 in
W2 69·94–70·06 in
X2 2·88 in
Y2 8·63 in
Z2 28·75 in
A3 1·50 in
B3 6·88 in
C3 5·72 in
D3 4·22–4·28 in
E3 0·875–0·880 in
F3 4·50 in
G3 1·63 in
H3 39·60–39·90 in
I3 41·25 in
J3 18·00 in
K3 11·12 in
L3 11·81 in
M3 11·81 in
N3 39·60–39·90 in

CHASSIS

Chassis: Steel chassis frame consisting of box-sectioned side and cross members; the centre of the frame is stiffened by channel sectioned steel pressings and gusset plates. For chassis frame dimensions see Fig. 25.

Front suspension: Independent front suspension by means of suspension arms ('wishbones') of unequal length, coil springs and hydraulic telescopic shock absorbers.

See Fig. 26 for a general arrangement and Fig. 27 for an exploded view of the front wheel suspension. The upper and lower suspension arms are fitted with rubber bushes. Starting from chassis number TS 9121 these bushes were replaced by nylon bearings. See Figs. 28A and 28B for the dimensions of the upper and lower suspension arms.

Removal and dismantling:

(1) Place the car on stands and remove the appropriate front wheel, the hub cap and, if fitted, the grease nipple. (The grease nipples were omitted from chassis number TS 5348 onwards).

(2) Unscrew the castellated nut and remove the hub with a suitable puller. Remove the grease retainer, the inner wheel bearing and the grease seal.

If necessary the stub axle can be removed from the steering swivel after removal of the castellated nut on the inner side of the stub axle.

(3) Partially compress the coil spring and detach the shock absorber upper mounting. Remove the rebound rubber.

(4) Remove the four nuts from the bottom and centre of the lower spring seat. Remove the rebound rubber abutment plate and withdraw the shock absorber through the spring seat. If necessary the lower attachment brackets can be removed.

(5) Support the lower spring seat with a jack and remove the nuts and bolts securing the spring seat to the lower suspension arms. Insert guide pins through the holes thus exposed and remove the spring seat by carefully lowering the jack; withdraw the coil spring from its upper attachment together with the rubber washers and spacer sleeve.

(6) Disconnect the brake hose and plug the opening. Remove the brake backing plate. When unscrewing the bolts that secure the brake backing plate to the steering swivel and steering arm, care should be taken not to lose the spacer bushes.

(7) Remove the lower supension arm inner fulcrum brackets and disconnect the lower suspension arms from the lower trunnion.

(8) Disconnect the upper suspension arms from the chassis and remove the suspension unit from the car.

Reassembly and reinstallation is done in the reverse order of removal. When fitting the lower suspension arms, ensure that the outer boss of each arm has 0·004–0·012 in end-float.

To obtain this end-float, proceed as follows:

(1) Tighten equally the castellated nuts until the assembly is solid.

(2) Slacken the nuts 1½–2 flats to line up with the split-pin hole and insert a split-pin.

(3) *Gently* tap the suspension arms outwards to seat the washers against the nuts and provide the necessary clearance between the trunnion and the arms. This should be carried out on both sides alternatively to avoid altering the location of the shackle pin in the lower trunnion.

(4) Check the assembly for freedom of movement over its full range of operation.

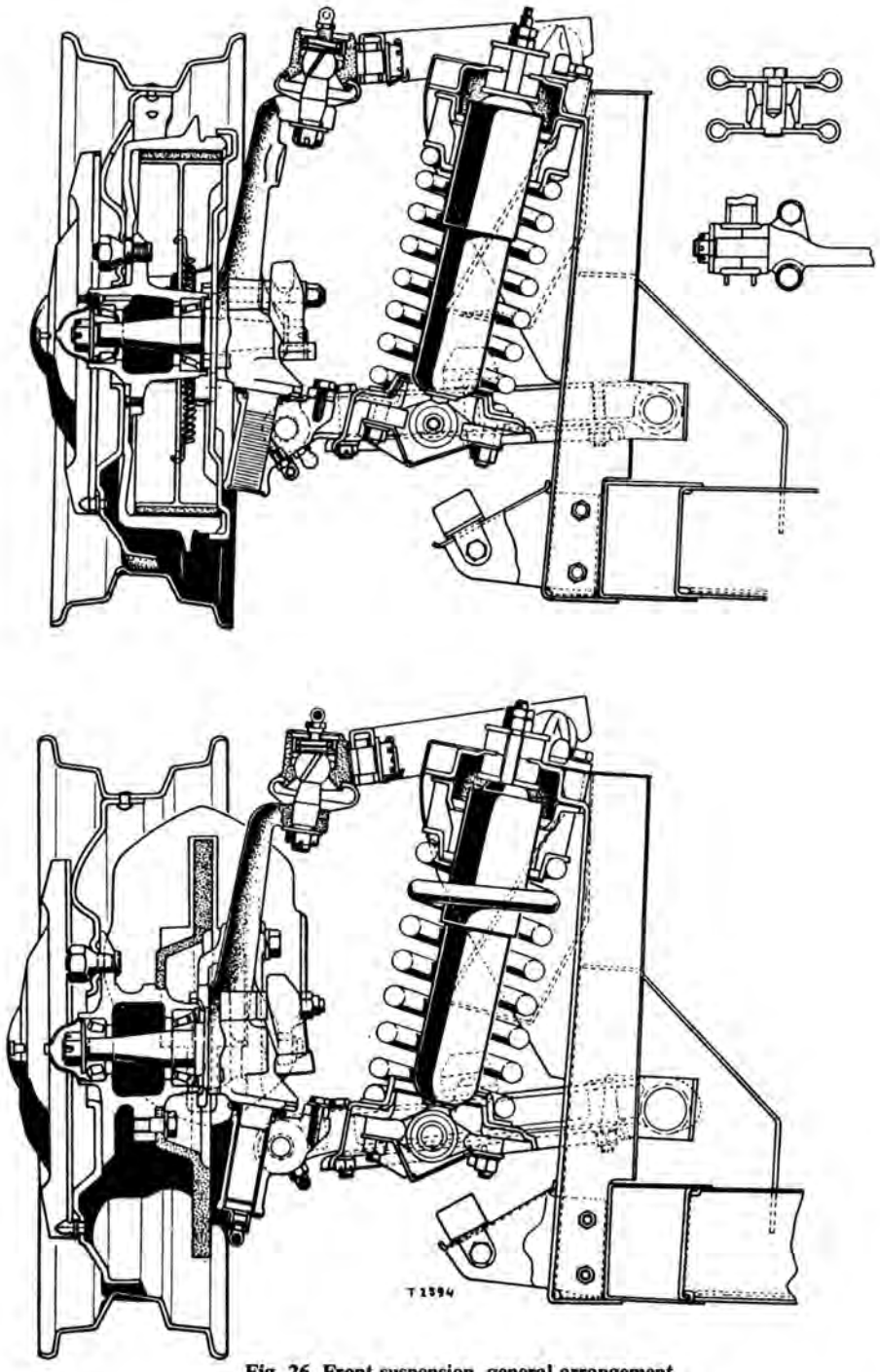


Fig. 26. Front suspension, general arrangement
(Top: drum brake Bottom: disc brake)

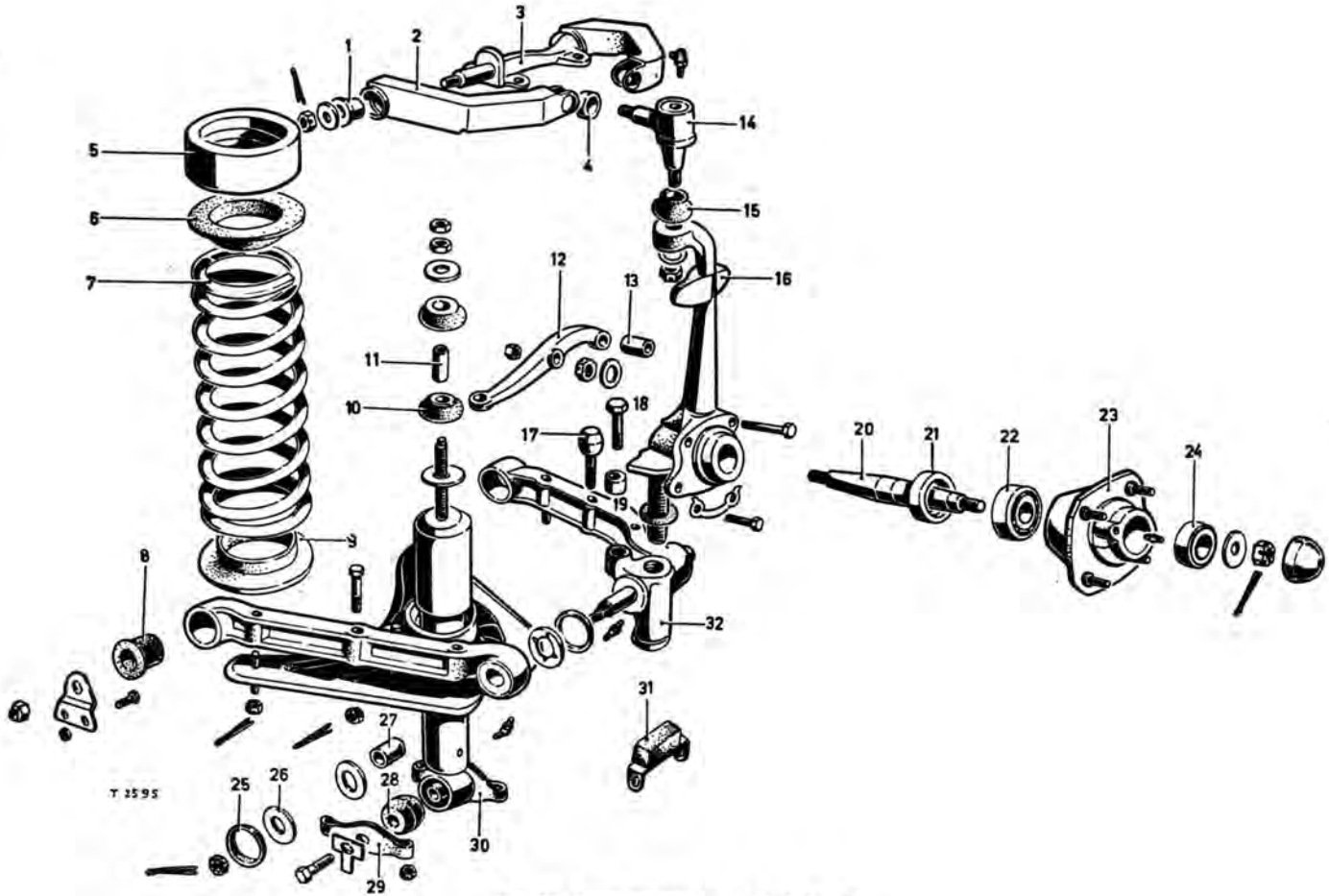


Fig. 27. Front suspension, exploded view

Specifications:

Static laden to bump: 3 in

Static laden to rebound: 2·25 in

Coil spring data:

	Standard	Competition
Free length (approx.)	9·75 in	9·19 in
Fitted length	6·75 ± $\frac{3}{32}$ in	6·75 ± $\frac{3}{32}$ in
Solid length	4·13 in	2·44 in
Number of active coils	$6\frac{3}{4}$	$6\frac{1}{2}$
Mean diameter of coils (approx.)	3·5 in	3·5 in
Rate	310 in lb	380 in lb
Fitted load	925 lb	925 lb

Front wheel alignment: When checking front wheel alignment the car should be standing on an absolutely level floor, tyre pressures should be correct, the amount of wear on both front tyres should be the same and the car should be in a static laden condition. Move the car up and down a few times so it will settle to the normal position; then turn the front wheels to the straight-ahead position.

Toe-in: $\frac{1}{8}$ in. When Michelin X tyres are fitted, toe-in must be 0–$\frac{1}{16}$ in. The outer track rods are adjustable to correct toe-in. The length of the outer track rods must be approximately 7·68 in; when toe-in is adjusted and it is found that the length of the track rods differ greatly from 7·68 in, the front wheel suspension should be checked for accidental damage.

Toe-out on turns:

Inner wheel (back lock): 31°

Outer wheel (Front lock): 28° 30 min

When the inner wheel is adjusted to 31° back lock and the outer wheel does not reach 28° 30 min front lock, the steering swivels and steering arms must be checked for alignment according to the dimensions given in Figs. 30 and 31.

Caster

Zero.

Key to Figure 27:

1 Rubber bush
2 Upper suspension arm
3 Fulcrum shaft
4 Spacer bush
5 Spacer sleeve
6 Spring seat rubber washer
7 Coil spring
8 Rubber bush
9 Spring seat rubber washer
10 Shock absorber rubber
11 Protecting sleeve
12 Steering arm
13 Spacer bush
14 Ball joint assembly
15 Dust cover
16 Steering swivel
17 Bump rubber
18 Bolt for 19
19 Steering lock stop (eccentric)
20 Stub axle
21 Oil seal
22 Inner front wheel bearing
23 Hub
24 Outer front wheel bearing
25 Grease seal
26 Serrated washer
27 Suspension arm bush
28 Shock absorber rubber
29 Shock absorber bracket
30 Shock absorber bracket with fulcrum sleeve
31 Rebound rubber
32 Trunnion

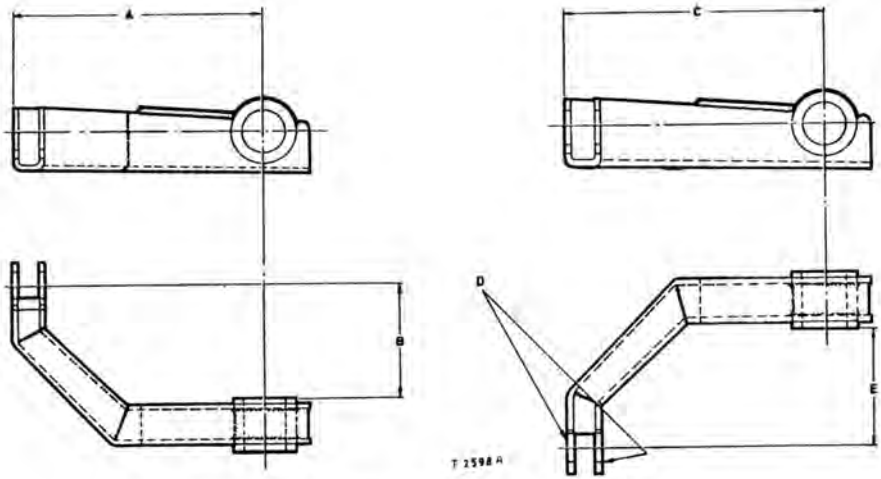


Fig. 28A. Upper suspension arms, dimensions

A 5·5 in
B 2·38 in
C 5·4 in
D Boss must be parallel with these faces
E 2·38 in

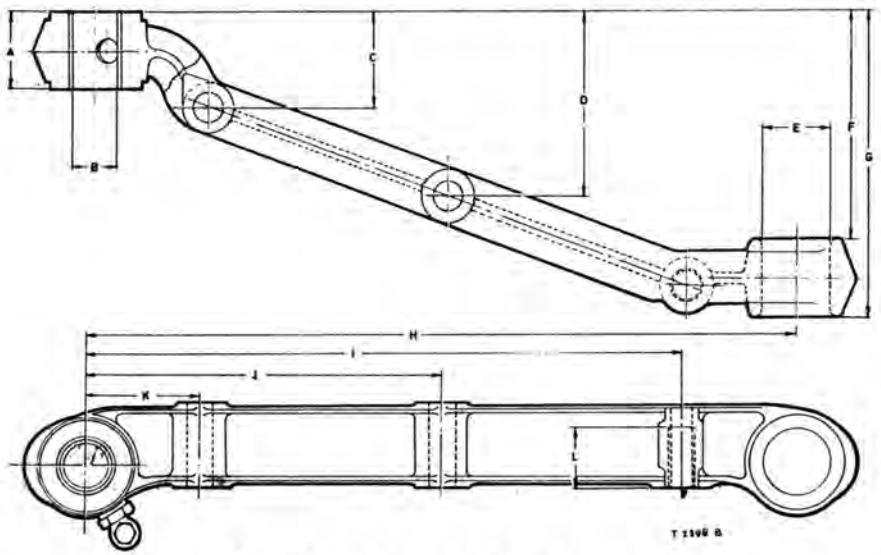


Fig. 28B. Lower suspension arms, dimensions

A 1·13 in
B 0·6245–0·6250 in
C 1·38 in
D 2·66 in
E 1·031–1·037 in
F 3·31 in
G 4·43 in
H 10·25 in
I 8·63 in
J 5·13 in
K 1·63 in
L 0·88 in

Camber:
Static laden: 2°
Full bump: 0° 30 min
Full rebound: 1°
King pin inclination: 7°

Rear suspension: Semi-floating rear axle with semi-elliptic leaf springs; the front of each spring is secured in a silentbloc to a bracket welded to the chassis side member, whilst the rear end of each spring is supported on rubber-bushed shackles.

Specifications:
Length of leaf spring, static laden: 41·0, plus or minus 0·13 in
Front spring eye diameter: approximately 1·313 in
Rear spring eye diameter: 0·875–0·880 in
Number of leaves: 6
Static load: 515 lb
Rate: 128, plus or minus 6 in lb
Camber laden, blue: $\frac{5}{8}$–$\frac{7}{8}$ negative
red: $\frac{7}{8}$–1$\frac{1}{8}$ negative
Tightening torques:
Spring front end to frame: 28–30 ft lb
Spring shackle 26–28 ft lb
Spring to rear axle 28–30 ft lb

NOTE: When installing springs, tighten the front eye bolt and shackle while the spring is under normal load. Failure to do so will result in abnormal distortion and damage of the rubber bushes.

Shock absorbers: The front shock absorbers are of the hydraulic telescopic type and are fitted in the centre of the coil spring. The shock absorbers are sealed units and need no topping up; if not functioning properly, they should be replaced.

Maximum load of compression: 200 lb
Maximum load of extension: 500 lb

The rear shock absorbers are of the double-acting piston type; check and if necessary top up the fluid level every 15000 miles.

Use Armstrong shock absorber oil No. 624 only (Manufacturers recommendation).

Wheel bearings and hubs: The front wheels run on two adjustable taper-roller bearings each. These bearings are adjusted as follows:

Tighten the castellated nut to 10 ft lb and then slacken off 1$\frac{1}{2}$ to 2 flats to line up with a split-pin hole. The front wheel bearings should not be preloaded.

The rear wheel bearings on early production models (up to chassis number TS 13046) were of the non-adjustable ball-bearing type. Later production cars were equipped with adjustable taper roller bearings. These bearings should be adjusted to give the drive shafts an end-float of 0·004–0·006 in.

Steering gear: The steering gear is of the worm and ball peg type with a ratio of 12 : 1.

See Fig. 29 for an exploded view of the steering gear.

Removal:
(1) Disconnect the battery and place the front of the car on stands. Remove the front bumper, the central grille pressing and the road wheel on the drivers side.
(2) Disconnect the centre track-rod from the pitman arm. Remove the horn push

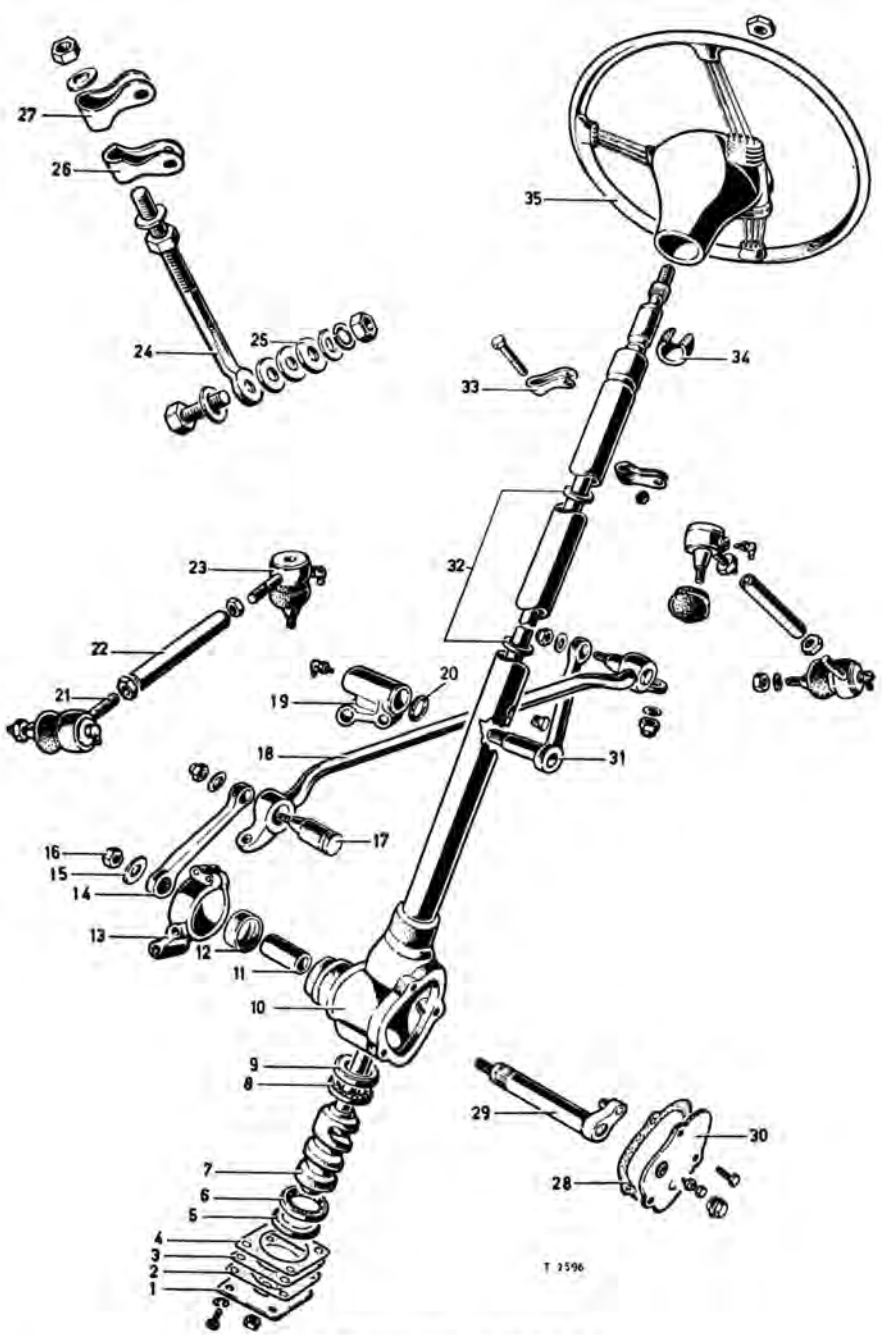


Fig. 29. Steering gear, exploded view

button and the direction indicater switch from the steering wheel and remove the steering wheel with a suitable puller.

(3) Loosen the clamp securing the outer steering column to the facia panel and remove the clip from the draught excluder.

(4) Remove the two bolts securing the steering gear housing to the chassis and withdraw the steering column through the draught excluder.

(5) Unscrew the pitman shaft nut and remove the pitman arm with a suitable puller.

Remove the trunnion bracket from the steering gear housing.

(6) Remove the top cover, protect the pitman shaft oil seal with a thin metal cylinder and withdraw the pitman shaft.

(7) Remove the end cover, taking care not to damage the shims and gaskets. Remove the lower worm bearing and its outer race and withdraw the worm and wormshaft. The upper worm bearing will come away with the worm shaft.

(8) Remove the split felt bush in the top of the outer steering column.

If necessary the upper worm bearing outer race and the pitman shaft bearing bush and seal can be driven out.

Re-assembly:

(1) If necessary press a new bearing bush in the housing and fit the oil seal.

(2) Fit the upper worm bearing outer race into the steering gear housing and feed the wormshaft with the rubber rings and ball bearing into the steering gear housing.

(3) Install the lower ball bearing and its outer race in the housing. Install a new gasket and the old shimpack on the end cover and fit it to the housing.

(4) Check that all end-float is eliminated; a very small amount of pre-load is permissible.

If necessary adjust by the removal or addition of shims between the end cover and the steering box.

Key to Figure 29:

1 Bottom cover
2 Gasket
3, 4 Shims
5 Lower worm bearing outer race
6 Lower worm bearing
7 Steering worm
8 Upper worm bearing
9 Upper worm bearing outer race
10 Steering gear housing
11 Pitman shaft bush
12 Oil seal
13 Mounting bracket
14 Pitman arm
15 Washer
16 Pitman shaft nut
17 Fulcrum pin with silent block
18 Steering rod
19 Steering idler bracket
20 Grease seal
21 Ball joint assembly
22 Track rod
23 Ball joint assembly
24, 25, 26, 27 Steering column assembly, starting from chassis No. TS 1390
28 Gasket
29 Pitman shaft
30 Top cover
31 Steering idler
32 Rubber ring
33 Steering column clamp (up to chassis number TS 1390)
34 Felt bush
35 Steering wheel

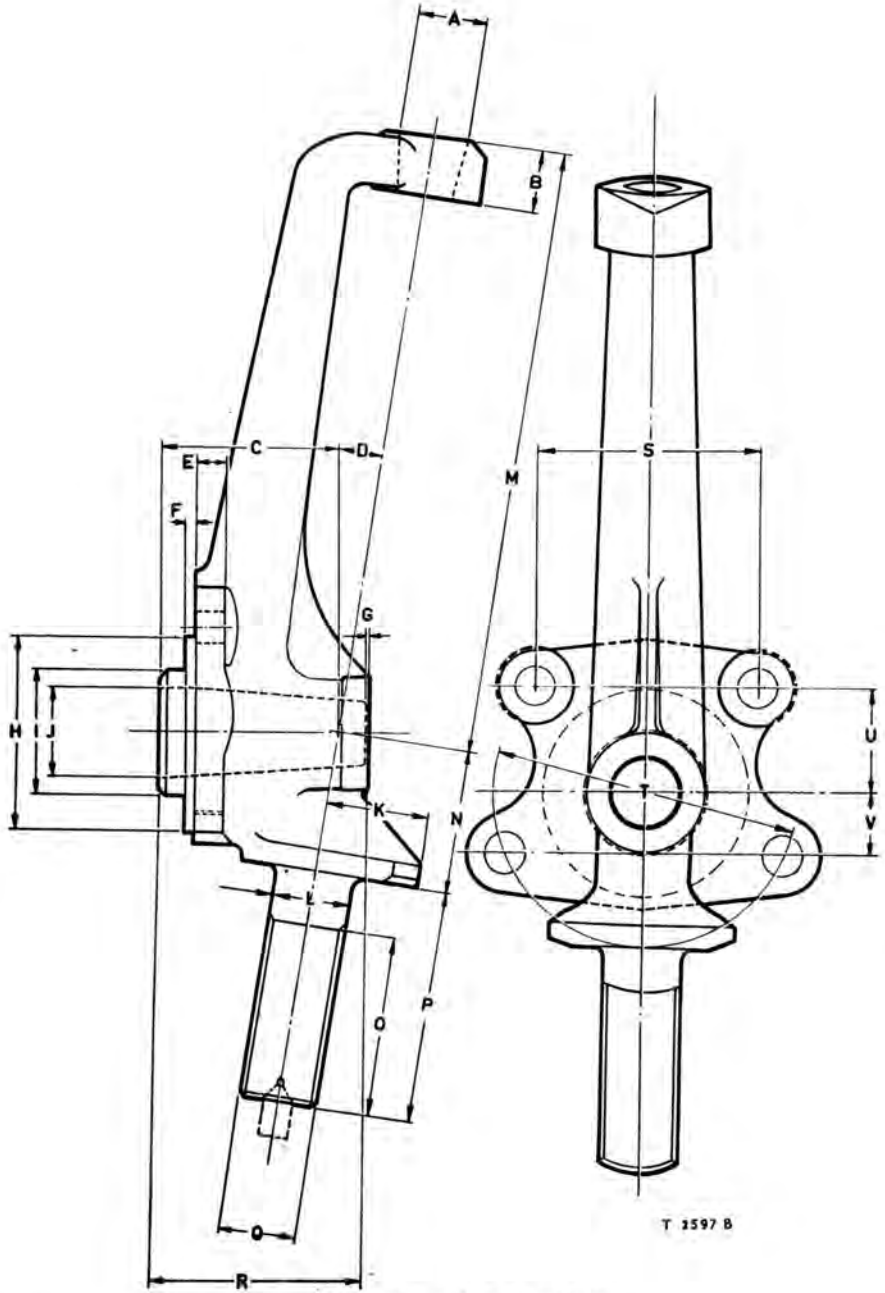


Fig. 30. Steering swivel, dimensions

(5) Protect the oil seal with a sheet of metal and install the pitman shaft in the housing; ensure that the conical peg engages the groove of the worm.
(6) Unscrew the adjusting screw in the top cover and fit the top cover with a new gasket.
(7) Fit the trunnion bracket to the housing with the chassis mounting points pointing forward and downward. Leave the bolts hand-tight. Fit the pitman arm to the pitman shaft so that the scribed lines are in line. Tighten the nut and bend over the lock plate.
(8) Adjust the pitman shaft by screwing the adjustment screw in the top cover either in or out. The adjustment is correct when slight resistance is felt when the pitman shaft is in the straight ahead position.
(9) Install the split felt bush in the outer steering column and pass the column through the draught excluder in the body floor and the clamp on the facia panel. Fit the two bolts, the longer one lowermost, through the trunnion bracket and leave them handtight.
(10) Secure the column to the facia panel and tighten the bolts securing the trunnion bracket to the chassis and finally the two bolts of the trunnion bracket to the steering gear housing.
(11) Fit the centre track rod, tighten the draught excluder clip and fit the steering wheel, with horn push and direction indicator switch.
(12) Fill the steering gear housing with hypoid SAE 90 oil, fit the central grille pressing, the front bumper and reconnect the battery.

Adjustable steering column: An adjustable steering unit is available as an optional extra. The unit is similar to the normal equipment, apart from the following points:
(1) The steering column splines are longer.
(2) The outer column is shorter.
(3) The steering wheel is adjustable over a range of 2·5 in.

Track-rods: The track rods are equipped with non-adjustable ball joints; the outer track rods are adjustable to correct toe-in.

Brakes: Up to chassis number TS 13101, Lockheed drum brakes were fitted to all four wheels. Starting from the above-mentioned chassis number Girling disc brakes were fitted to the front wheels and Girling drum brakes to the rear.

The two types of brake systems will be described separately.

Key to Figure 30:

A Diameter 0·749–0·751 in. Taper 1 in 8
B 0·63 in
C 1·955–1·965 in
D 9°
E 0·31 in
F 0·245–0·255
G 0·010–0·015 in
H 2·1225–2·1240 in
I 1·380–1·382 in
J Diameter 0·9995–1·0005. Taper 1 in 8
K 1·01 in
L Diameter 0·8115–0·8135 in
M 6·50 in
N 1·53 in
O 2·00 in full thread
P 2·59 in
Q Clearance on effective diameter when screwed into bush: 0·002–0·008 in
R 2·25 in
S 2·343–2·347 in
T 3·245–3·255 in
U 1·120–1·130 in
V 0·682–0·692

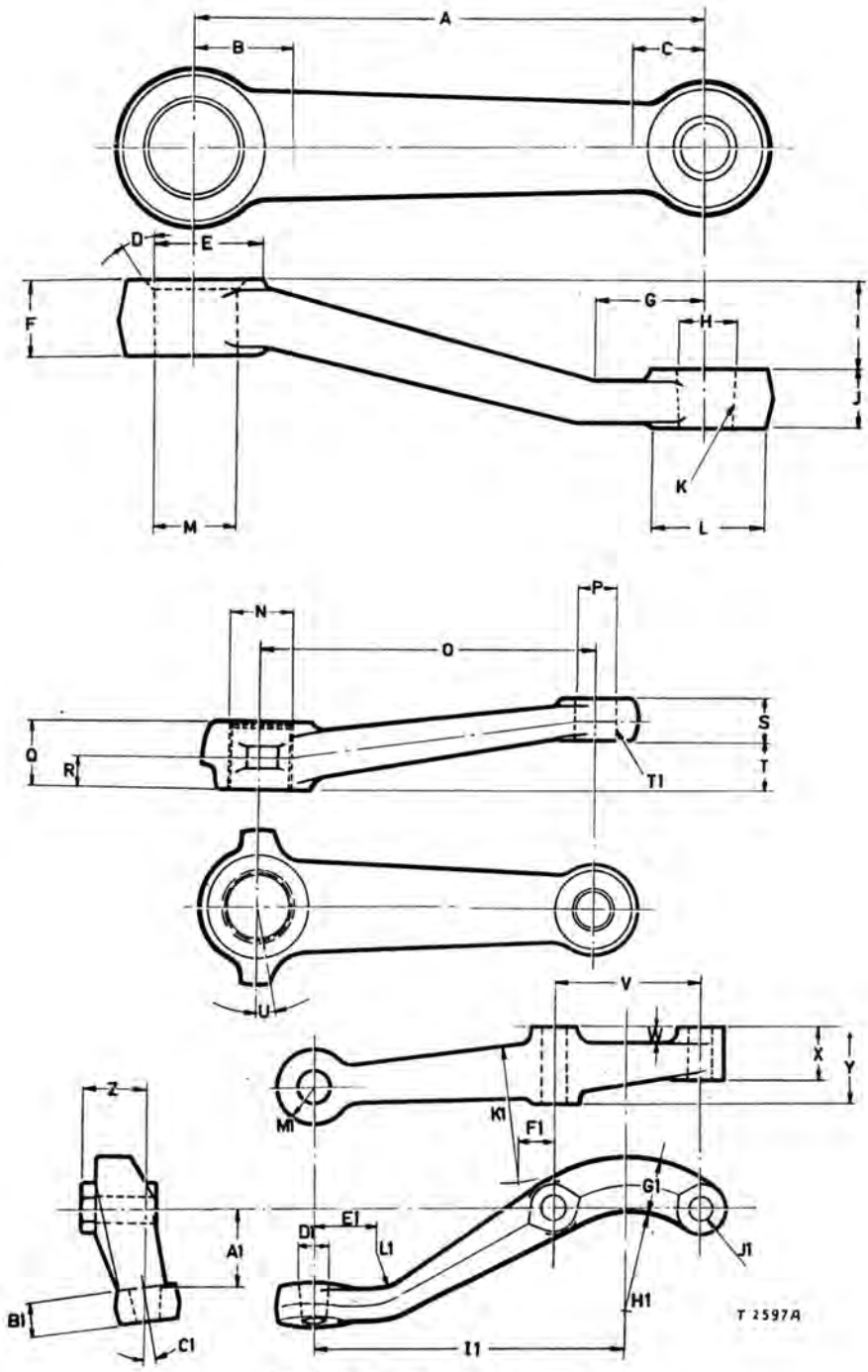


Fig. 31. Steering arms, dimensions

A. Lockheed drum brakes: Two leading shoes on the front wheels; one leading and one trailing shoe on each rear wheel. The parking brake operates the rear brakes mechanically. The front and rear brake assemblies are shown in Fig. 33.

The fluid level in the supply tank, which is integral with the master cylinder, should be kept $\frac{1}{2}$ in below the cover plate.

Specifications:

Front brakes: 10 × 2¼ in
Rear brakes up to chassis No. TS 5481: 9 × 1¾ in
Rear brakes after chassis No. TS 5481: 10 × 2¼ in

Brake linings:

Chassis number	*Lining*	*Identification*
Front: TS 1–TS 3247 Rear: TS 1–TS 3219	DM 7	3 blue markings on lining edges
Front: TS 3247–TS 5216 Rear: TS 3220–TS 5480	DM 8	2 narrow and 1 wide blue marking
Front: TS 5217–TS 5480	M 20	5 green markings
Front: TS 5480 Rear: TS 5480	M 20	5 green markings

Brake adjustment:

Front brakes:

(1) Apply the foot brake hard to centralize the brake shoes.
(2) Jack up the front of the car and remove the wheels.
(3) Rotate the hub until the hole in the brake drum is in line with a snail-cam adjuster.

Turn the adjuster until the brake shoe contacts the drum, then turn back one notch. Check for freedom of operation.

(4) Repeat these operations on the second snail-cam adjuster.

Adjust the other front brake in the same way.

Key to Figure 31*:*

A	4·50 in	U	3°
B	0·88 in	V	2·343–2·347 in
C	0·63 in	W	0·25 in
D	30°	X	0·81 in
E	1·19 in	Y	1·19 in
F	0·63 in	Z	1·03 in
G	1·03 in	A1	1·28 in
H	0·497–0·500 in	B1	0·50 in
I	0·88 in	C1	5°
J	0·50 in	D1	0·499–0·501
K	Taper 1 in 8		Taper 1 in 8
L	1·00 in	E1	0·81 in
M	0·7495–0·7501 in	F1	0·47 in
N	0·88 in	G1	0·78 in
O	4·50 in	H1	radius 1·38 in
P	0·497–0·500 in	I1	5·00 in
Q	0·88 in	J1	0·375–0·377 in
R	0·44 in	K1	Radius 2·88 in
S	0·50 in	L1	Radius 0·88 in
T	0·66 in	M1	Radius 0·50 in

Fig. 32. Brake master cylinder, piston and related parts

1 Push rod
2 Circlip
3 Dust boot
4 Circlip
5 Secondary cup
6 Piston
7 Protecting shim
8 Primary cup
9 Spring retainer
10 Spring
11 Valve body
12 Valve cup
13 Valve seat
} Valve assembly, brakes only

Rear brakes:

(1) Apply the foot brake hard to centralize the brake shoes.

(2) Chock the front wheels, jack up the rear of the car and remove the wheels.

(3) Rotate the hub until the hole in the brake drum is in line with the snail-cam adjuster. Turn the adjuster until the brake shoes contact the brake drum then turn back one notch.

Check for freedom of movement.

Repeat these operations on the other rear brake.

Parking brake adjustment:

Adjustment of the footbrake normally readjusts the parking brake. When the brake system has been overhauled, the parking brake cables should be set to the following dimensions:

Length of right-hand parking brake cable (9 in brakes), centre to centre 12·97 ± 0·06 in

Key to Figure 33*:*

A Rear wheel brake
1 Snail cam adjuster
2 Adjuster mask
3 Guide block
4 Piston
5 Cup
6 Cup filler
7 Parking brake lever pivot pin
8 Spring
9 Bleeder screw
10 Wheel brake cylinder
11 Copper gasket
12 Banjo connection
13 Copper gasket
14 Banjo bolt
15 Dust boot
16 Parking brake lever
17 Retracting spring
18 Brake drum
19 Brake backing plate
20 Brake shoe
21 Brake shoe anchor block
22 Retracting spring
B Front wheel brake
23 Snail cam adjuster
24 Adjuster mask
25 Piston
26 Cup
27 Cup filler
28 Spring
29 Rubber seal
30 Wheel brake cylinder
31 Brake shoe
32 Brake backing plate
33 Grease baffle
34 Brake shoe
35 Brake drum
36 Retracting spring
37 Balance pipe

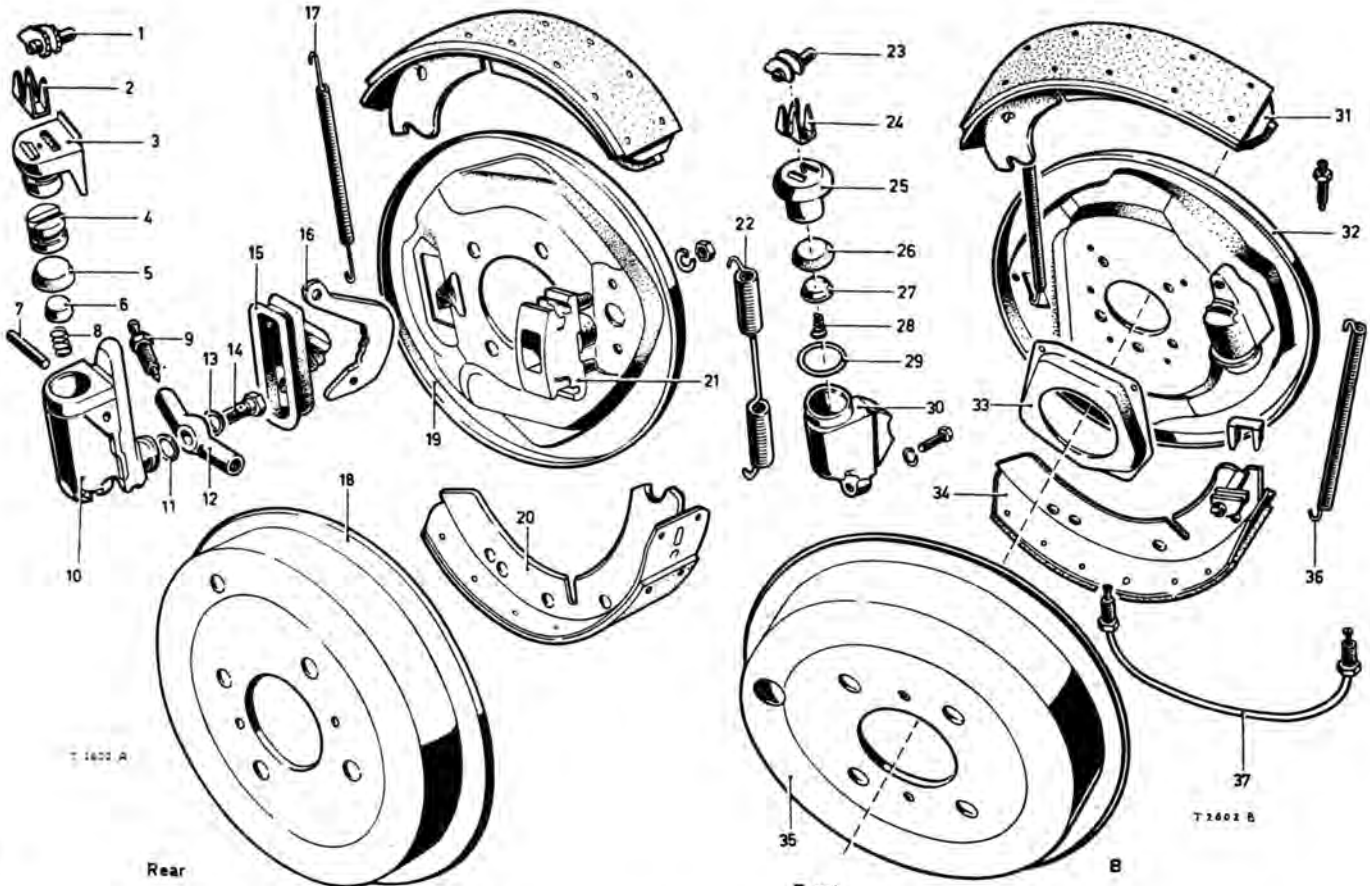


Fig. 33. Brake assemblies, front and rear (drum type)

Length of right-hand parking brake cable (10 in brakes)
centre to centre 12·47 ± 0·06 in
Length of left-hand parking brake cable (9 in brakes).
centre to centre 26·85 ± 0·06 in
Length of left-hand parking brake cable (10 in brakes)
centre to centre 26·35 ± 0·06 in
Angle of compensating lever: 17°

Brake master cylinder: The clutch and brake master cylinders are housed in one twin-bore master cylinder, which is mounted on the scuttle on the driver's side.

In Fig. 32 the brake master cylinder piston and related parts are shown. The clutch master cylinder piston is identical except that there is no foot-valve assembly (items 11 to 13).

Use Lockheed brake fluid only (manufacturers recommendation).

B. Girling disc/drum brakes: Starting from chassis number TS 13101 Girling disc brakes are fitted to the front wheels, with Girling HL 3 drum brakes at the rear.

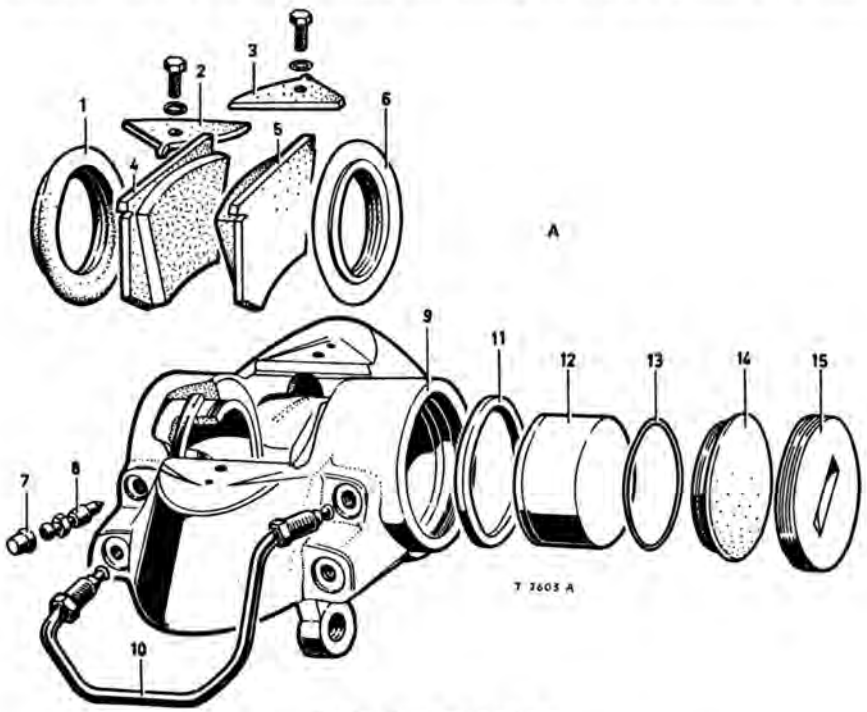


Fig. 34. Disc brake caliper

1	Dust cover	6	Dust cover	11	Seal
2, 3	Retaining plates	7	Dust cap	12	Piston
		8	Bleeder screw	13	Seal ring
4, 5	Brake segments	9	Brake caliper	14	End plug
		10	Balance pipe	15	Plug retainer

The parking brake lever actuates the rear brake shoes. The fluid reservoir, which contains the fluid for the clutch and brake system, is mounted on the engine bulkhead, over the steering column, on the driver's side. There is a partition in the reservoir which separates the fluid supply for the two systems to ensure that a defect in one system does not affect the other. The fluid reservoir should be kept ¾ full by topping up with Girling Crimson brake and clutch fluid.

Specifications:

Diameter of brake discs: 11 in
Maximum permissible run-out: 0·004 in
Lining material: Ferodo DS 1
When reconditioning the discs, do not remove more than 0·060 in

Replacement of lining segment (pads):

The lining segments should be replaced when the lining thickness is reduced to ⅛ in. It is extremely important that this figure is respected, for, if the lining segments are worn thinner, the heat insulation between brake disc and brake fluid will be

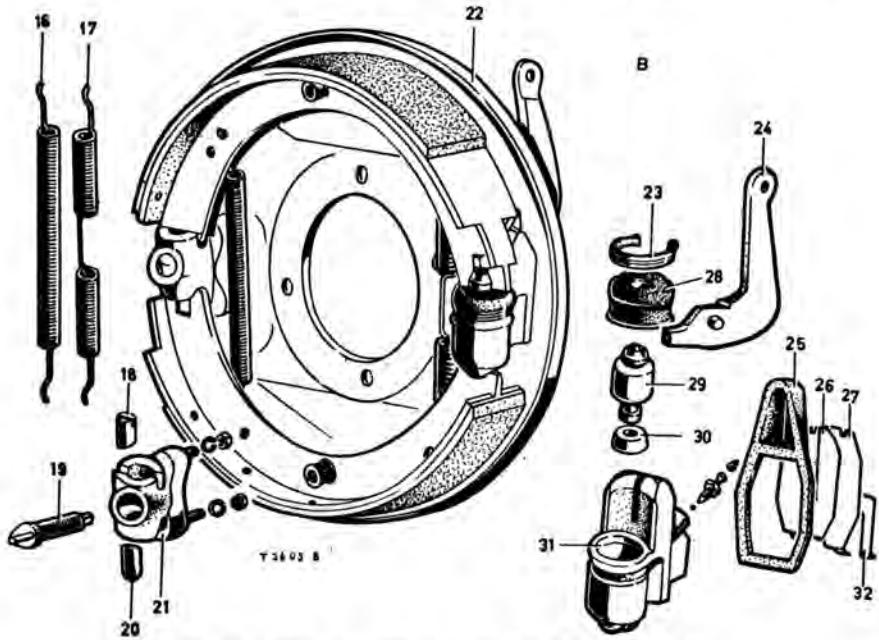


Fig. 35. Rear brake assembly (cars with front disc brakes)

16, 17	Retracting spring	22	Brake backing plate	28	Dust cover
18	Adjuster link	23	Dust cover clip	29	Piston
19	Adjuster wedge	24	Parking brake lever	30	Seal
20	Adjuster link	25	Dust boot	31	Wheel cylinder
21	Adjuster housing	26	Spring plate	32	Retaining clip
		27	Retaining plate		

reduced and the brake fluid may start to boil under prolonged hard brake application. Proceed as follows:

(1) Jack up the front of the car and remove the wheels.
(2) Unscrew the two set bolts on top of the caliper body and swing the segment retaining plates away.
(3) Lift the lining segments out of the caliper.
The lining segments should never be relined, but always be replaced by new ones.
(4) Push back the pistons in the caliper and place the new segments in position.
(5) Replace the retaining plates in their original position and tighten the set bolts.
(6) Pump the pedal several times until a solid resistance is felt. Bleeding is unnecessary.

In Fig. 34 an exploded view of a brake caliper is shown.

Adjustment of rear brakes: The rear brakes are adjusted by turning the square-headed wedge on the rear side of the brake backing plate clockwise until the drum is fully locked. Then back off just enough to let the drum rotate freely. When the brake shoe retracting springs have been removed they should be refitted in the positions shown in Fig. 35.

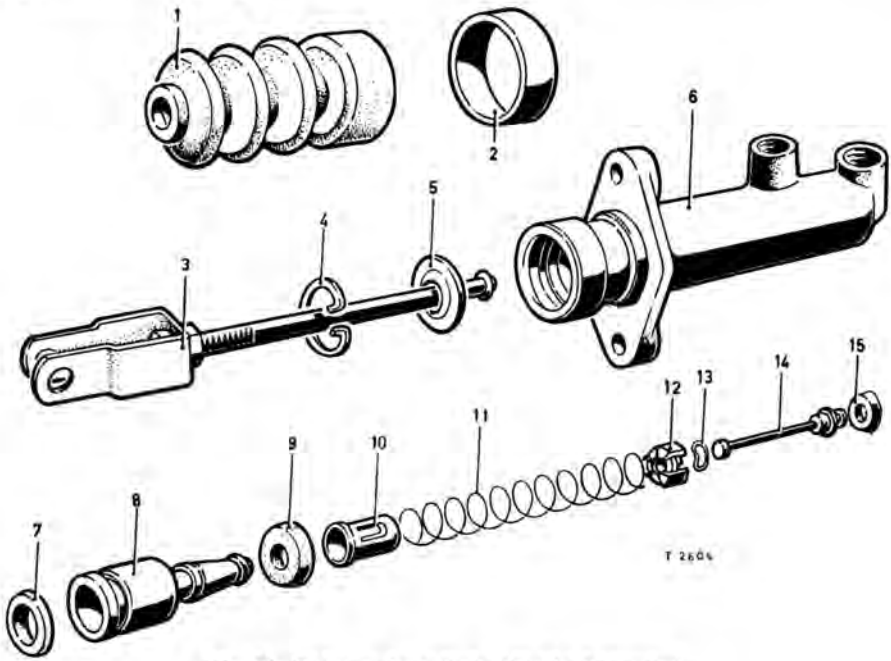


Fig. 36. Brake master cylinder (disc brake version)

1 Dust boot
2 Dust boot retaining band
3 Push rod
4 Circlip
5 Locating washer
6 Master cylinder
7 Secondary cup
8 Piston
9 Primary cup
10 Spring retainer
11 Spring
12 Valve spacer
13 Spring washer
14 Valve stem
15 Valve seal

Adjustment of the parking brake: Turn the square headed wedges on each brake backing plate clockwise until the drum is fully locked. Apply the parking brake one notch. The parking brake cables should just be taut.

Brake master cylinder (disc brake version):
An exploded view of the Girling brake and clutch master cylinder is shown in Fig. 36.

Wheels and tyres: Pressed steel disc wheels are fitted as standard; centre-lock wire wheels are optional extra. The wire wheels are mounted on splined hub extensions. When these extensions are fitted the wheel studs must be sawn-off flush with the outside of the wheel nuts.

NOTE: Right hand side centre-lock wheel nuts are turned anti-clockwise to tighten (left-hand thread). Left hand side nuts are turned clockwise to tighten (right-hand thread).

Tyre sizes and pressures:
Tyre size: 5·50 × 15 in.
1961: 5·90 × 15 in or Michelin X 155–15 in
Tyre pressures: Dunlop, Front 22 lb/sq in
Rear 24 lb/sq in
Michelin X, Front 24 lb/sq in
Rear 28 lb/sq in
For high-speed motoring the pressure of Dunlop tyres should be increased by 6 lb/sq in; that of Michelin X tyres by 5 lb/sq in

ELECTRICAL EQUIPMENT

Electrical system: 12 Volt, positive (+) terminal earthed.

Wiring diagram: See Fig. 37.

Battery: Lucas, type GTW 7A/2; GTW 9A/2; GT 9A/Z or GTZ 9A/2.

Battery	*No. of plates per cell*	*Ampere hour capacity at 10 hour rate*	*Ampere hour capacity at 20 hour rate*	*Normal re-charge current*
GTW 7A/2	7	38	43	4
GTW 9A/2, GT 9A/2, GTZ 9A/2	9	51	58	5

Specific gravity of electrolyte: 1·270–1·285, at normal temperature 70°F (21°C), fully charged.

Specific gravity of electrolyte: 1·110, at normal temperature 70° F (21°C), discharged.

Add four points specific gravity for every 10°F (5½°C) above 70°F (21°C).
Subtract four points specific gravity for every 10°F (5½°C) above 70°F (21°C).

Generator: Shunt-wound, two-pole, two-brush generator. Lucas type C.39 PV/2.
Cut-in speed: 1050–1200 rpm at 13 generator volts.
Maximum output: 19 Amp at 1900–2150 rpm at 13·5 generator volts.
Field resistance: 6·1 Ohm.
Brush spring tension: 22–25 oz.
Minimum length of brushes: 11/32 in.
Undercutting depth of commutator insulation: $\frac{1}{32}$ in.

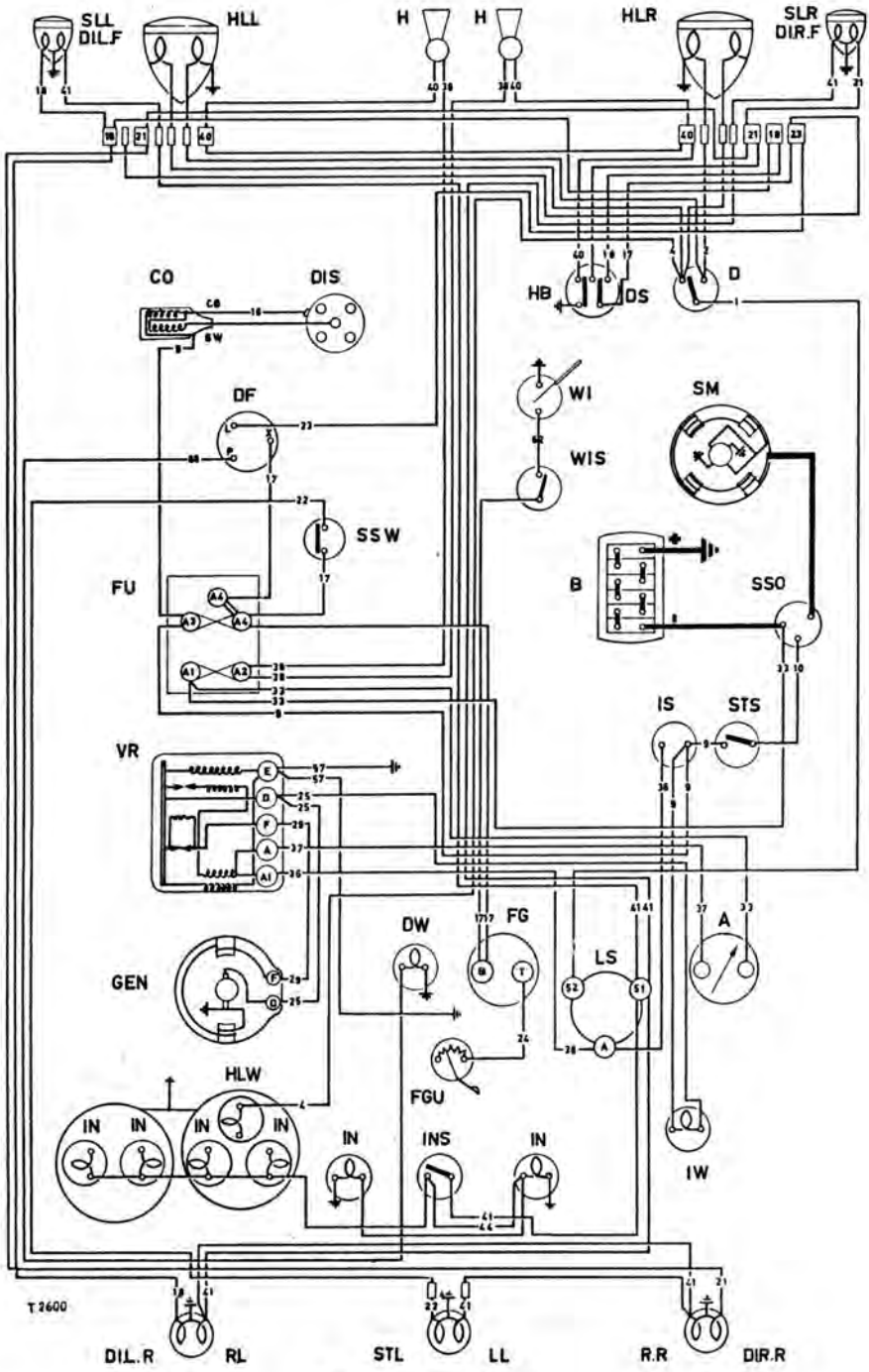


Fig. 37. Wiring diagram

Voltage regulator: Lucas: RB 106–1 or RB 106–2.
Open circuit setting at 20°C and 1500 generator rpm: 15·6–16·2 V.
Subtract 0·3 V for every 10° C (18°F) above 20°C.
Add 0·3 V for every 10° C (18°F) above 20°C.
Cut-out:
Cut-in voltage: 12·7–13·3.
Drop-off voltage: 8·5–10·0.
Reverse current: 3·5–5·0 Amp.

Starter motor: Series-parallel connected four-pole, four-brush starter motor.
Lucas type: M 41 8G.
Lock torque: 17 ft lb with 440–460 amp at 7·4–7·0 V.
Torque at 1000 rpm: 8 ft lb with 250–270 amp at 9·4–9·0 V.
Free running current: 4·5 amp. at 7400–8500 rpm.
Brush spring tension: 30–40 oz.
Minimum length of brushes: $\frac{1}{8}$ in.
Do *not* undercut the commutator insulation.

Fuses: The fuse box is located in front of the voltage regulator and contains two

Key to Figure 37:

A	Ammeter	HLW	Main beam warning light
B	Battery	IN	Instrument light
CO	Coil	INS	Instrument light switch
D	Dimmer switch	IS	Ignition switch
DF	Direction indicator flasher unit	IW	Ignition/generator warning light
DI.L.F.	Direction indicator, left front	LL	Number plate illumination
DI.L.R.	Direction indicator, left rear	LS	Light switch
DI.R.F.	Direction indicator, right front	R.L	Rear lamp, left
DI.R.R	Direction indicator, right rear	R.R	Rear lamp, right
DIS	Distributor	SL.L	Side lamp, left
DS	Direction indicator switch	SL.R	Side lamp, right
DW	Direction indicator warning light	SM	Starter motor
FG	Fuel gauge	SSO	Starter solenoid
FGU	Fuel gauge tank unit	SSW	Stoplamp switch
FU	Fuses	STL	Stoplamp
GEN	Generator	STS	Starter push
H	Horn	VR	Voltage regulator
HB	Horn button	WI	Windscreen wiper
HL.L	Headlamp, left	WIS	Windscreen wiper switch
HL.R	Headlamp, right		

Key to wire colours :

1 Blue	21 Green with white	37 Brown with white
2 Blue with red	22 Green with purple	38 Brown with green
4 Blue with white	23 Green with brown	40 Brown with black
9 White	24 Green with black	41 Red
10 White with red	25 Yellow	44 Red with white
14 Green with brown	29 Yellow with green	57 Black
16 White with black	33 Brown	62 Black with green
17 Green	36 Brown with blue	66 Light green
18 Green with red		

operating and two spare fuses of 35A. The left hand fuse protects the horn; the right hand fuse the direction indicators, windscreen wipers, stop light, petrol gauge and heater (if fitted).

On cars for export to the USA a separate 25A fuse is mounted behind the facia panel to protect the side, tail and panel lamps.

Windscreen wiper: Type CRT 15.

Horns: Type WT 614 and WT 618.

Lamp bulbs: 12 Volt.

	Watt
Headlamps, LH dip	60/36
Headlamps LH dip (export markets)	42/36
Headlamps RH dip	36/36
Headlamps, Vertical dip	45/40
Side lamps/front direction indicator flashers	6/21
Number plate illumination	4
Rear direction indicator lamps	21
Tail/Stop lamps	6/21
Warning lights	2·2

Bulb replacement:

Headlamps:
Remove the headlamp rim; press in the lamp unit and turn it anticlockwise until the key-hole slots line up with the adjustment screws.

Remove the lamp unit.

Rotate the back cap anti-clockwise and remove. Remove the bulb.

Bulbs should never be touched with bare hands.

Parking lamps and direction-indicator lamps:
Prise back the rubber ring and remove the rim. Withdraw the bulb. When replacing the rim, first slip the edge over the two small lugs, then prise back the rubber.

To gain access to the stop and tail lamp bulbs, the two screws securing the cover should be removed. To gain access to the numberplate lamp, the securing screw should be removed. The instrument and warning lights are accessible from the rear of the facia panel.

Head lamp adjustment: When the headlamp rim has been removed, three adjustment screws are visible. The upper one serves to raise or lower the beam; with the two side screws the beam is swung in the horizontal plane.

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AUSTIN SEVEN 850 Saloon, Countryman, Van and Pick-Up from 1959

CITROEN 2CV A, AZ, AZL, AZC, AZLM, AU, AZU, AZUL, AP, AZP, BJ Bijou, Sahara 4 x 4, from 1949

FORD ANGLIA/PREFECT/POPULAR/ESCORT/SQUIRE 100E models from 1953, Thames Van 300E, models from 1954

FORD ANGLIA 105E/PREFECT 107E from 1959

FORD CONSUL/ZEPHYR SIX/ZEPHYR ZODIAC Mark I 1951-1956

FORD CONSUL 1700/ZEPHYR and ZODIAC 2500 Mark II from 1956

HILLMAN MINX Series I, II, III, IIIA, IIIB from 1956; HILLMAN HUSKY Series I, II from 1958 and EASIDRIVE

MERCEDES BENZ 180/190

MORRIS MINI-MINOR 850 Saloon, Mini-Traveller, Mini-Van and Mini-Pick-Up from 1959

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FIAT 1100
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MERCEDES BENZ 220
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WOLSELEY 1500
AUSTIN A55 Mark II
MORRIS OXFORD Mark V
WOLSELEY 15/60
M.G. MAGNETTE Mark III
RILEY 4/68

P. OLYSLAGER

TRIUMPH

SPORTS ROADSTERS
HARDTOP COUPES
from 1953

TR 2
TR 3
TR 3A