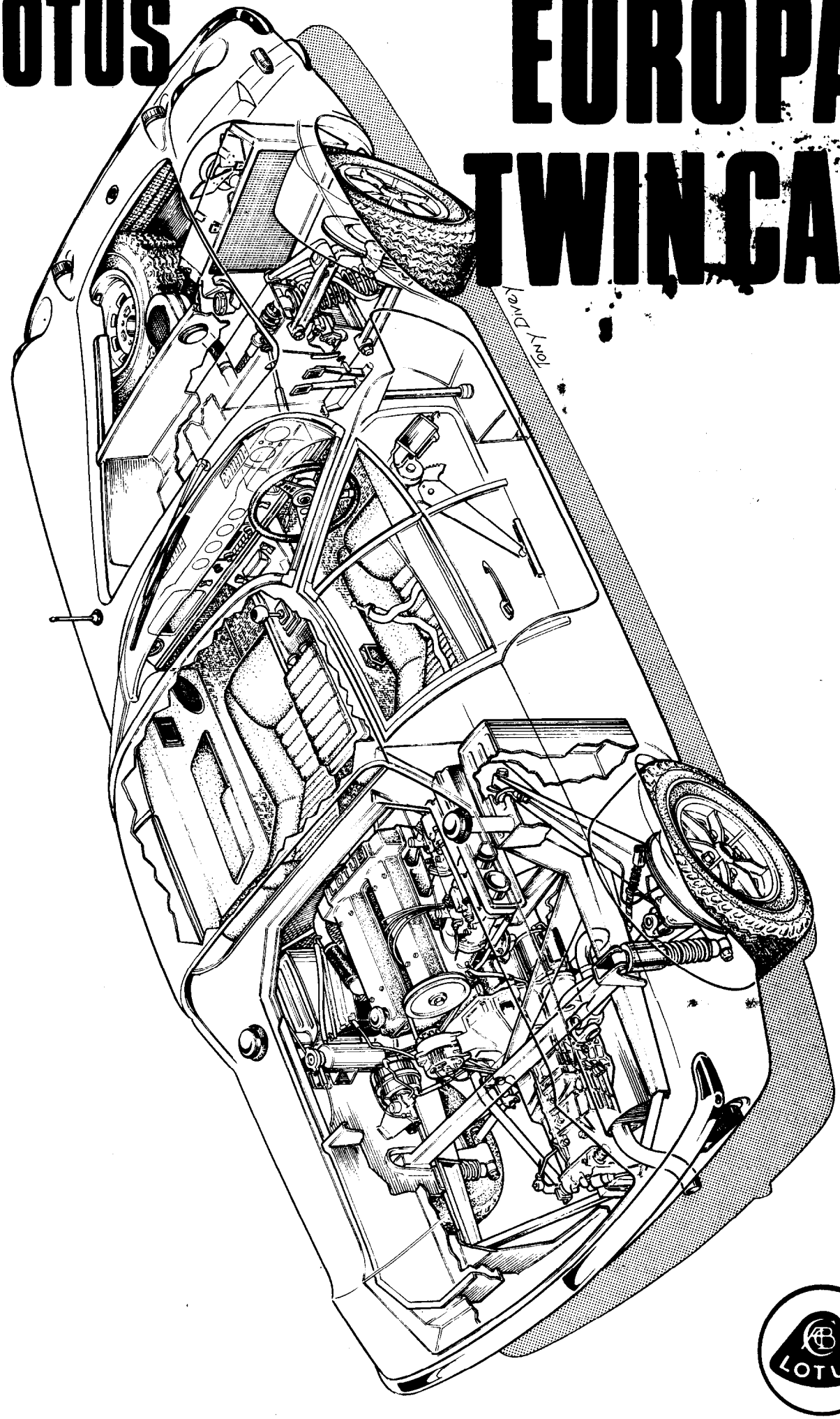
LOTUS EUROPA TWIN CAM



LOTUS

INTRODUCTION

This publication has been designed as a Supplement to the Lotus Europa Workshop Manual and should be read in conjunction with that Manual. Only features which are special to the Twin Cam model and its variants will be covered, all other features being contained in the Europa Manual.

Issued By: LOTUS CARS LIMITED,
Norwich, Norfolk. NOR 92W, England.

Telephone: Wymondham 3411; Cables: Lotus Norwich; Telex: 97401.

Part Number: A074 T 0348B

September, 1972.

CONTENTS.

TECHNICAL DATA.

DIMENSIONS

Wheelbase	233.7 cm. (92 in.)
Track - Front	135.8 cm. (53.5 in.)
- Rear	134.6 cm. (53 in.)
Overall - Length	400 cm. (157½ in.)
- Width	163.8 cm. (64½ in.)
- Height	107.9 cm. (42½ in.)
Ground Clearance (design)	15 cm. (6 in.)
Turning Circle	12.5 m. (41 ft.)
Weight (unladen)	686 kg. (1,513 lbs.)

CAPACITIES.

Engine Sump (including filter)	4 litres (7½ pts.; 9 U.S. pts.)
Transmission	1.75 litres (3 pts.; 3.6 U.S. pts.)
Coolant (with heater)	10.8 litres (19 pts.; 22.8 U.S. pts.)
Fuel	56 litres (12.5 gall.; 15 U.S. gall.)

ENGINE.

General

Number of cylinders	4
Capacity	1558 cc. (95.06 cu. in.)
Stroke	72.746 mm. (2.864 in.)
Bore - Grade 1	82.550/82.558 mm. (3.2500/3.2503 in.)
- Grade 2	82.558/82.565 mm. (3.2503/3.2506 in.)
- Grade 3	82.565/82.573 mm. (3.2506/3.2509 in.)
- Grade 4	82.573/82.580 mm. (3.2509/3.2512 in.)
Compression - Ratio - Europa TC (All Territories)	9.5 : 1
- Europa Special (UK & Export)	10.3 : 1
- Europa Special (N. America)	9.5 : 1
- Pressure at sea level (All models, all Territories)	In excess of 11.248 kg.cm.sq. (160 lbs.sq.in.) Each cylinder within 1.41 kg.cm.sq. (20 lbs.sq.in.) of each other.

Cylinder Head

Material	Aluminium
Gasket	Copper/asbestos
Valve timing - Inlet opens	26° B.T.D.C.
- Inlet closes	66° A.B.D.C.
- Exhaust opens	66° B.B.D.C.
- Exhaust closes	26° A.T.D.C.
Angle of valve seats and faces	45°
Valves:	
Head diameter - Inlet - Europa TC (UK & Export)	38.760/38.862 mm. (1.526/1.530 in.)
- Europa TC (N.America)	39.624/39.776 mm. (1.560/1.566 in.)
- Europa Special (All Territories)	39.624/39.776 mm. (1.560/1.566 in.)
- Exhaust (All models, all Territories)	33.553/33.655 mm. (1.321/1.325 in.)
Stem diameter - Inlet and Exhaust	7.874/7.899 mm. (.310/.311 in.)
Stem clearance in guide - Inlet	.007/.058 mm. (.0003/.0023 in.)
- Exhaust	.063/.076 mm. (.0025/.0030 in.)
Clearance (cold) - Inlet	.127/.177 mm. (.005/.007 in.)
- Exhaust	.228/.279 mm. (.009/.011 in.)
Valve Springs:	
Type	Dual
Free length - Inner	28.70 mm. (1.130 in.)
- Outer	36.83 mm. (1.450 in.)
Rate - Inner @ 23.4 mm. (.92 in.)	5.6 kg. (12.4 lbs.)
- Inner @ 14.7 mm. (.58 in.)	15.2 kg. (33.5 lbs.)
- Outer @ 29.7 mm. (1.17 in.)	20.4 kg. (45.0 lbs.)
- Outer @ 21.1 mm. (.83 in.)	49.4 kg. (109 lbs.)
Valve guides:	
Length - Inlet	36.608 mm. (1.520 in.)
- Exhaust	37.592 mm. (1.480 in.)
External diameter - Std.	12.700/12.713 mm. (.500/.5005 in.)
- O/size	12.852/12.865 mm. (.5060/.5065 in.)
Interference fit (all)	.0127/.0381 mm. (.0005/.0015 in.)
Fitted height above cylinder head	8.128 mm. (.320 in.)
Internal diameter (all) ream after fitting	7.907/7.932 mm. (.3113/3123 in.)

Bore in cylinder head - Std.	12.674/12.687 mm. (.499/.4995 in.)
- O/size	12.872/12.839 mm. (.505/.5055 in.)
Camshafts	
Journal diameter	25.4/25.413 mm. (1.000/1.0005 in.)
End float	.076/.254 mm. (.003/.010 in.)
Bearings - Number	5
- Type	Steel backed white metal
- Running clearance	.013/.050 mm. (.0005/.002 in.)
Cam followers:	
Bore in head	34.925/34.940 mm. (1.375/1.3756 in.)
Outside diameter	34.904/34.912 mm. (1.3742/1.3745 in.)
Follower to head clearance	.013/.036 mm. (.0005/.0014 in.)
Jackshaft	
Bearings - Number	3
- Type	Steel backed white metal
- Length - Front	19.05 mm. (.75 in.)
- Centre	16.26 mm. (.64 in.)
- Rear	19.05 mm. (.75 in.)
- Running clearance	.025/.050 mm. (.001/.002 in.)
Journal diameter	39.624/39.637 mm. (1.560/1.5605 in.)
End float	.063/.190 mm. (.0025/.0075 in.)
Crankshaft	
Balance	Within 14.42 gr. cm. (2 oz. in.)
Diameter - Main journals	53.987/54.000 mm. (2.1255/2.1260 in.)
- Crankpin	49.199/49.211 mm. (1.9370/1.9375 in.)
End float - Dimension	.076/.203 mm. (.003/.008 in.)
- Controlled by	Thrust washers on centre main bearing
Bearings - Number	5
- Type	Steel backed, lead bronze with lead overlay
- Running clearance	.038/.076 mm. (.0015/.0030 in.)
Maximum undersize for re-grind	.762 mm. (.03 in.)
Flywheel	
Maximum run out (lateral)	.101 mm. (.004 in.)
Starter ring gear - Run out - Lateral	.406 mm. (.016 in.)
- Radial	.152 mm. (.006 in.)

Connecting Rod	
Type	'H' Section
Material	Steel forging
Distance between centres	12.19/12.24 cm. (4.799/4.801 in.)
Bearings - Type	Steel backed, lead bronze with lead overlay
- Running clearance	.013/.513 mm. (.0005/.0022 in.)
- End float on crankpin	.101/.254 mm. (.004/.010 in.)
Small end bore (bushed):	
Grade 'A' (silver)	20.635/20.637 mm. (.8124/.8125 in.)
Grade 'B' (green)	20.637/20.642 mm. (.8125/.8127 in.)
Gudgeon (piston) pin	
Type	Floating
Location	Circlips
Diameter - Grade 'A'	20.627/20.628 mm. (.8121/.8122 in.)
- Grade 'B'	20.628/20.632 mm. (.8122/.8123 in.)
Class of fit	Finger push fit
Piston	
Type	Solid skirt
Material	Tin plated aluminium alloy
Length	68.250 mm. (2.687 in.)
Compression Height	39.014/39.065 mm. (1.536/1.538 in.)
Maximum permissible weight variation per set	4 grammes
Rings - Compression	2
- Oil control	1
Diameter - Grade 1	82.466/82.474 mm. (3.2467/3.2470 in.)
- Grade 2	82.474/82.481 mm. (3.2470/3.2473 in.)
- Grade 3	82.481/82.489 mm. (3.2473/3.2476 in.)
- Grade 4	82.489/82.497 mm. (3.2476/3.2379 in.)
Piston clearance in cylinder bore	.076/.091 mm. (.0030/.0036 in.)
Gudgeon pin bore offset	1.016 mm. (.04 in.) towards thrust face
Ring gap (fitted) - Compression	.229/.356 mm. (.009/.014 in.)
- Oil control	.254/.508 mm. (.010/.020 in.)

Piston ring to groove clearance:	
- Compression	.041/.091mm. (.0016/.0036 in.)
- Oil control	.046/.097 mm. (.0018/.0038 in.)

LUBRICATION SYSTEM

Pump: - Type.	
Drive.	Eccentric Lobe
	Gear on Jackshaft
Inner and outer rotor clearance	.15 mm. (.006 in.) Maximum
Inner and outer rotor float	.13 mm. (.005 in.) Maximum
Outer rotor to housing clearance	.25 mm. (.010 in.) Maximum
Normal pressure (hot)	2.4/2.8 kg. cm. sq. (35/40 lbs. in. sq.)
Filter	Full flow (throw away cannister)

FUEL SYSTEM

Pump - Operation	Lever by eccentric on Jackshaft
- Pressure	.087/.176 kg. cm. sq. (1.25/2.5 lbs. in. sq)
Air cleaner type	Paper element, dry
Carburetter - Type and number	Dellorto 40 DHLA, two
- Slow running speed	800 r.p.m.
- Settings:	
Choke	30 mm.
Main jet	115
Main air corrector jet	160
Slow running jet	50
Slow running air corrector jet	7850 - 2
Pump jet	8083.40
Starter jet	70
Main emulsion tube	7772 - 1
Starter emulsion tube	7482 - 1
Needle valve	7180 - 15
Air trumpet length	4.44 cm. (1.75 in.)

OR

Carburetter - Type and number	Zenith-Stromberg 175 CD 2SE
- Slow running speed	800/900 r.p.m.
Settings:	
Needle	B.1G
Spring colour	Light blue
Damper oil	SAE 20W/50

IGNITION SYSTEM

Type	Coil and distributor
Firing Order	1,3,4,2,
No 1 Cylinder	Nearest to front of car
Ignition advance control	Fully automatic
Ignition timing (static):	
Dellorto Carburetters	12° B.T.D.C.
Zenith-Stromberg Carburetters	5° B.T.D.C.
Coil	Lucas LA.12
Sparking plugs - Type	Champion N7Y
- Gap	.584/.635 mm. (.023/.025 in.)

*The above ignition setting may need SLIGHT alteration to meet local fuel requirements.

Distributor

Type	23 D.4
Direction of rotation (from above)	Anti-clockwise
Drive	Gear on jackshaft
Contact breaker gap	.35/.40 mm. (.014/.016 in.)
Contact lever spring tension	.51/.68 kg. (18/24 oz.)
Firing angles	0°, 90°, 180°, 270° ± 1°
Cam dwell angle	60° ± 3°
Despatch no. - Dellorto carbs.	41189
- Zenith-Stromberg carbs.	41225 when suction retard capsule fitted

Centrifugal advance (All distributors)

Crankshaft r.p.m.	Crankshaft degrees B.T.D.C. (Add static setting)
Below 1,000	No advance
1,250	2.4
1,500	4.6
1,750	6.8
2,000	9.2
2,250	11.6
2,500	14.0 Maximum advance

COOLING SYSTEM.

Type	Centrifugal pump and fan
Radiator cap relief valve pressure	.49 kg.cm.sq. (7 lbs.in.sq.)
Thermostat nominal opening temperature	78° C.
Alternator belt tension at top	9.52 mm. (.375 in.)
Impeller vanes to water pump housing clearance	.508/.762 mm. (.020/.030 in.)

CLUTCH

Make and Type	Borg and Beck, diaphragm spring
Operation	Cable
Driven plate diameter	21.59 mm. (8½ in.)
Free movement of withdrawal lever	4.318 mm. (.170 in.)

TRANSMISSION.

Type		4 forward speeds and reverse
Bearings - Mainshaft		Taper rollers
- Secondary gear cluster		Taper rollers
Bearings - Adjustment		See section 'F' (Transmission)
Gear ratios:	4 speed	5 speed
- O/D (5th.)	N/A	0.87 : 1
- 4th.	1.03 : 1	1.21 : 1
- 3rd.	1.48 : 1	1.61 : 1
- 2nd.	2.25 : 1	2.33 : 1
- 1st.	3.61 : 1	3.61 : 1
Reverse	3.08 : 1	3.08 : 1
Final drive - Type		Hypoid gear
- Bearings - Pinion		Taper rollers
- Diff./crown wheel		Taper rollers
Drive shaft end-float		.050/.076 mm. (.002/.004 in.)

Bearings adjustment - Pinion bearing pre-load		See Section 'F' (Transmission)
- Crown wheel/pinion		.127/.254 mm. (.005/.010 in)backlash
Number of teeth - Crown wheel		32 } Type 336/352 gearbox 34 } Type 365 gearbox
- Pinion		9 } gearbox 9 } gearbox
Speedometer gears :	Driving Gear	Driven Gear
Type 336 & 352 gearbox	6 teeth	12 teeth
(4 speed)	(X046 F 6049Z)	(X046 F 6108Z)
Type 365 gearbox	9 teeth	19 teeth
(5 speed)	(A074 F 6111Z)	(A074 F 6136Z)
Final drive ratio - 4 speed		3.56 :1
- 5 speed		3.78 : 1
Overall ratios:	4 speed	5 speed
- O/D (5th.)	N/A	3.289 : 1
- 4th.	3.666 : 1	4.574 : 1
- 3rd.	5.268 : 1	6.086 : 1
- 2nd.	8.010 : 1	8.807 : 1
- 1 st.	12.851 : 1	13.646 : 1
- Reverse	10.964 : 1	11.642 : 1

STEERING

Type	Rack and Pinion
Steering angles - Camber	0° to ± 30'
- Castor	2° 30' ± 30'
- Swivel pin inclination	9° ± 30'
Toe in	4.8 mm. (3/16 in.) to 1.6mm.(1/16 in)
Condition for checking toe in	15 cm. (6 in.) ground clearance at bottom of chassis closing plate.

FRONT SUSPENSION.

Type	Independant
Spring - Number of coils	13.5
- Wire diameter	10.16 mm. (.40 in.)
- Length - Free	31.77 cm. (12.51 in.)
- Fitted	20.01 cm. (7.88 in.)
- Rate	1.33 kg.m. (116 lbs. in.)
Front hub end float	.05/.10 mm. (.002/.004 in.)

REAR SUSPENSION.

Type	Independant
Spring - Number of coils	19.6
- Wire diameter	8.23 mm. (.324 in.)
- Length - Free	42.54 cm. (16.75 in.)
- Fitted	25.04 cm. (9.86 in.)
- Rate	.865 kg.m. (75 lbs. in.)
Wheel camber	1° Negative ± 30'
Toe - in	6.35 mm. ($\frac{1}{4}$ in.) to 3.18 mm.(1/8 in.)

BRAKES.

Make and type	Girling hydraulic (servo assisted)
Front brakes - Disc diameter	24.76 cm. (9.75 in.)
- Pads material	Ferodo FER .2430 F
- Total disc run out	.10 mm. (.004 in.)
Rear Brakes - Drum diameter and width - T/C	20.3cm. (8 in.) x 31.75mm.(1.25 in.)
- Special	20.3cm. (8 in.) x 38.10mm.(1.50 in.)
- Lining material	Don.242
Handbrake type	Mechanical on rear only

WHEELS AND TYRES.

Wheel - Type	Pressed steel - bolt on
- Size	$4\frac{1}{2}$J
Tyres - Type	Dunlop SP Sport with tubes
- Size	155 X HR13
- Pressure (cold):	

At speeds BELOW 160 k.p.h. (100 m.p.h.)	At sustained speeds ABOVE 160k.p.h. (100m.p.h.)
Front 1.27 kg.cm.sq. (18 lbs.in.sq.)	1.69kg.cm.sq. (24lbs.in.sq.)
Rear 1.97 kg.cm.sq. (28 lbs.in.sq.)	2.39 kg.cm.sq. (34 lbs.in.sq.)

NOTE

It is not necessary to increase the tyre pressures for any reason other than those given.

* When inner tubes are fitted, it is essential that these are of the correct type for radial ply tyres.

Optional Wheels and Tyres.

Wheel - Type	Alloy - Bolt on
- Size	$5\frac{1}{2}$J X 13
- Nuts, torque loading	5.53 - 6.22 kg.m.(40-45 lbs.ft.)

Tyres - Type	Firestone Cavalino 'wide oval'
- Size	175/185 x 13
- Pressure (cold):	

At speeds BELOW 160 k.p.h. (100 m.p.h.)	At sustained speeds ABOVE 160 kph (100 mph)
1.125 kg. cm.^{2} (16 lbs. in.^{2})	1.547 kg. cm.^{2} (22 lbs in.^{2})
1.828 kg. cm.^{2} (26 lbs. in.^{2})	2.250 kg. cm.^{2} (32 lbs.in.^{2})

NOTE

It is not necessary to increase the tyre pressures for any reason other reason other than those given.

ELECTRICAL EQUIPMENT

Battery

Type	Exide 6 VTA 29L
Capacity	39 amp. hr. @ 20 hr. rating
Voltage and polarity	12 volt Negative earth

Fuses

Quantity	4; 35 amp

Alternator

Type	AC Delco DN 460
Maximum output	35 amp @ 3,600 r.p.m.
Earth polarity	Negative
Number of poles	14
Stator phases	3

Starter

Type	Lucas M.35 J
Drive	'SB' (inboard)
Brush tension	.80 kg. (28 ozs.)
Light running current	65 amp @ 8,000/10,000 r.p.m.
Lock torque	.97 kg. m. (7 lbs. ft.) @ 350/375 amp

Lamp bulbs (all 12 volts)

Headlamp - RHD	410 (45/40W) with 989 (6W) pilot
- LHD	410 (45/40W) with 989 (6W) pilot
- France	411 (45/40W) yellow with 989 (6W) pilot
- North America	Sealed beam unit

Front and rear indicators	382 (21W)
Indicator repeater	501 (5W capless)
Stop and tail lamps	380 (21/6W)
Rear number plate lamp	254 (6W festoon)
Reverse lamp	273 (21W festoon)
Interior lamp	254 (6W festoon)
Panel (instrument) lamps	987 (2.4W)
Warning lamps	987 (2.4W)

TORQUE LOADING FIGURES

ENGINE	kg. m.	lbs. ft.
Cylinder head (tighten cold)	8.29 - 8.98	60 - 65
Cylinder head to front cover	1.38 - 2.07	10 - 15
Sparking plugs	3.31 - 3.87	24 - 28
Camshafts - Bearing caps	1.24	9
- Sprockets	3.45 - 4.14	25 - 30
Crankshaft - Main bearing caps	7.60 - 8.29	55 - 60
- Connecting rod (big-end) caps	6.08 - 6.36	44 - 46
- Pulley	3.31 - 3.87	24 - 28
Flywheel	6.22 - 6.91	45 - 50
Front timing cover $\frac{1}{4}$" (UNF & UNC)	.69 - .96	5 - 7
5/16" (UNF & UNC)	1.38 - 2.07	10 - 15
- Back plate to cylinder block	.83 - 1.10	6 - 8
Timing chain tensioner - Sprocket pin	5.53 - 6.22	40 - 45
- Retaining bolt	6.22 - 6.91	45 - 50
- Pivot pin	5.53 - 6.22	40 - 45
Jackshaft - Sprocket	.65 - 2.07	12 - 15
- Thrust plate	.69 - .96	5 - 7
Oil filter centre bolt	1.65 - 2.07	12 - 15
Oil pump to cylinder block	1.65 - 2.07	12 - 15
Oil sump to cylinder block	.83 - 1.10	6 - 8
Oil sump drain plug	2.76 - 3.45	20 - 25
Fuel pump to cylinder block	1.65 - 2.07	12 - 15
Exhaust manifolds to cylinder head	1.65 - 2.07	12 - 15
Rear oil seal carrier (crankshaft) to cyl. block	1.65 - 2.07	12 - 15
Generator to mounting bracket	2.07 - 2.48	15 - 18
Carburetter trumpet nuts	1.10	8
Engine mounting bracket to engine	2.48	18

CLUTCH	kg. m.	lbs. ft.
Clutch housing to gearbox	5.53 - 6.22	40 - 45
Clutch assembly to flywheel	1.65 - 2.07	12 - 15
TRANSMISSION.		
Gearbox casing (halves)	See Section 'F'	
Differential case to crown wheel	See Section 'F'	
Differential bearing adjusting nuts	2.07	15
Pinion bearing nut	11.75	85
Speedometer drive worm	See Section 'F'	
Reverse selector pivot	See Section 'F'	
Side cover plates	2.07	15
Gearbox mounting bracket to chassis	4.83	35
FRONT SUSPENSION & STEERING		
Stub axle retaining nut	8.98 - 10.36	65 - 75
Ball joint - To vertical link	5.25 - 5.80	38 - 42
- To upper wishbone	1.65 - 2.07	12 - 15
Lower wishbone - To trunnion *	4.83	35
- To damper *	6.91	50
Inner wishbone retaining nut *	6.91	50
Caliper mounting plate to hub	3.04 - 3.73	22 - 27
Steering arm to vertical link	3.04 - 3.73	22 - 27
Steering tie rod ball joint	3.59 - 3.87	26 - 28
Steering tie rod adaptor	6.91	50
Steering unit mounting clamps to chassis	1.38	10
Steering column impact clamp	3.59 - 4.42	26 - 32

* Tighten with suspension in static ride condition

REAR SUSPENSION.		
Lower link and damper to bearing housing	7.60	55
Lower link to clutch housing	5.53	40
Lower link mounting bracket to transmission	1.65	12

	kg. m.	lbs. ft.
Bearing housing to radius arm	2.48	18
Radius arm front mounting bolt	4.83	35
Rear damper top mounting	5.53	40
HUBS		
Rear hub to outboard drive shaft*	20.70	150
Brake disc to front hub	3.04 - 3.73	22 - 27
Front hub to spindle nut **	.69 - .83	5 - 6

*Assemble with Loctite '35'. A rotational free play NOT EXCEEDING .127 mm (.005 in.) between the hub and shaft measured at the wheel stud MUST be used for LEFT HAND hubs.

**Tighten nut to this torque loading while rotating the hub to ensure bedding of taper rollers. Slacken nut 'one flat', then insert split pin.

BRAKE HYDRAULIC SYSTEM CONNECTIONS		
3/8 in UNF female (bundy and hose connection)	1.10 - 1.38	8 - 10
3/8 in UNF male (bundy to master cylinder, multi-ways etc.)	.69 - .96	5 - 7
7/16 in. UNF male	1.93 - 2.90	14 - 21
3/8 in. bore servo bundy (5/8 in. male)	1.65 - 2.07	12 - 15
Stop lamp switch	1.65 - 2.07	12 - 15
Brake hose to banjo	1.65 - 2.07	12 - 15
7/16 in. UNF female (bundy to reservoir)	1.65 - 1.93	12 - 14

Torque Wrenches

Torque wrenches in daily use should be checked at intervals not exceeding 3 months to ensure that accuracy is maintained.

GENERAL NUTS AND BOLTS

1/4 in. UNF and UNC	.69 - .96	5 - 7
5/16 in. UNF and UNC	1.65 - 2.07	12 - 15
3/8 in. UNC	2.35 - 3.04	17 - 22
3/8 in. UNF	3.04 - 3.73	22 - 27
7/16 in. UNC	4.14 - 4.85	30 - 35
7/16 in. UNF	5.53 - 6.22	40 - 45
1/2 in. UNC	6.22 - 6.91	45 - 50
1/2 in. UNF	6.91 - 8.29	50 - 60
9/16 in. UNC	8.29 - 9.68	60 - 70
9/16 in. UNF	8.98 - 10.36	65 - 75
5/8 in UNC	10.36 - 11.75	75 - 85
5/8 in. UNF	13.82 - 15.20	110 - 110

SECTION A.

CHASSIS.

A.1. - GENERAL DESIGN ASPECTS.

In order to achieve the desired performance from a modest capacity power unit, the basic philosophy behind the design of all Lotus touring cars, is that any part or combination of parts should be of the minimum weight consistent with adequate strength- the strength required being determined from the calculated NORMAL loads applied to any part of the car, plus a safety factor, to arrive at a final figure which is acceptable in the context of the car's envisaged use.

A.2. - ACCIDENT DAMAGE.

Economics, available repair facilities and delivery circumstances provide the criteria for assessment of a chassis repair or replacement.

It follows from this that when parts are subjected to an ABNORMAL load possibility of failure is increased and indeed incipient failure may be initiated. Incipient failure is the more dangerous form, as having no visible effect, the part may be assumed to be in good condition and then fail in ensuing normal service.

Consequently, whenever a car suspension or steering is damaged, consideration should be given to secondary or shock damage.

For example, in the case of the front suspension, both steering mechanism and chassis mountings should be carefully examined for both misalignment and micro-cracks. Even when no damage is apparent to the mounting pins, if the wishbones have been damaged it is strongly advised that a new chassis be fitted. Should the mounting pins be damaged or bent, (however slightly) A NEW CHASSIS MUST BE FITTED. These principals must always apply where driver safety is the prime consideration.

Inspection should be made of engine and gearbox mounting points where a vehicle has been involved in impact. As the unit may have travelled forward, distortion could have occured; check for broken welds etc.

Where broadside impacts or fire have created severe distortion conditions a replacement unit is essential.

Patching as a repair expedient is not recommended, whilst stretching can only be achieved with heat on the buckled surface of larger sections.

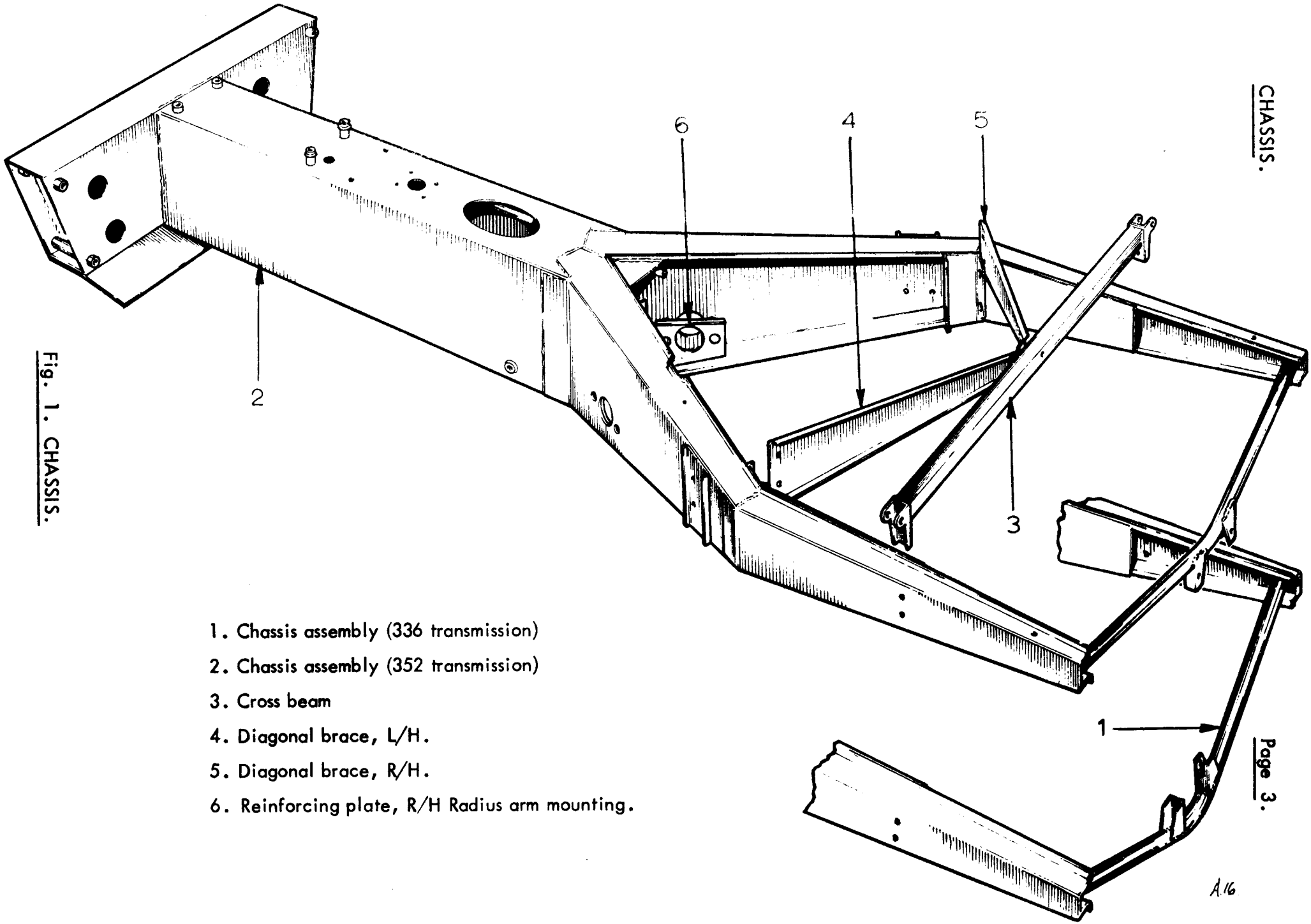


Fig. 1. CHASSIS.

1. Chassis assembly (336 transmission)
2. Chassis assembly (352 transmission)
3. Cross beam
4. Diagonal brace, L/H.
5. Diagonal brace, R/H.
6. Reinforcing plate, R/H Radius arm mounting.

A.16

A.3. - LOWER FRONT SUSPENSION FULCRUM PIN.

New lower fulcrum pins (Part No. C074 C 0115) may be fitted, PROVIDED THAT no excessive damage to the wishbones has occured. Whatever repair is carried out, the responsibility MUST ALWAYS BE with the repairer.

To replace the fulcrum pin, it is only necessary to dismantle the wishbones from the fulcrum pin, then slide out the pin.

Fit new pin by merely sliding into the tubes built into the chassis front box. Ensure correct torque loading of wishbones securing nuts (see 'TECHNICAL DATA') on assembly.

A.4. - CHASSIS ASSEMBLY WITH TYPE 365 TRANSMISSION.

The main difference between this chassis, and those illustrated on Page 3 is that of the gearbox mounting tube.

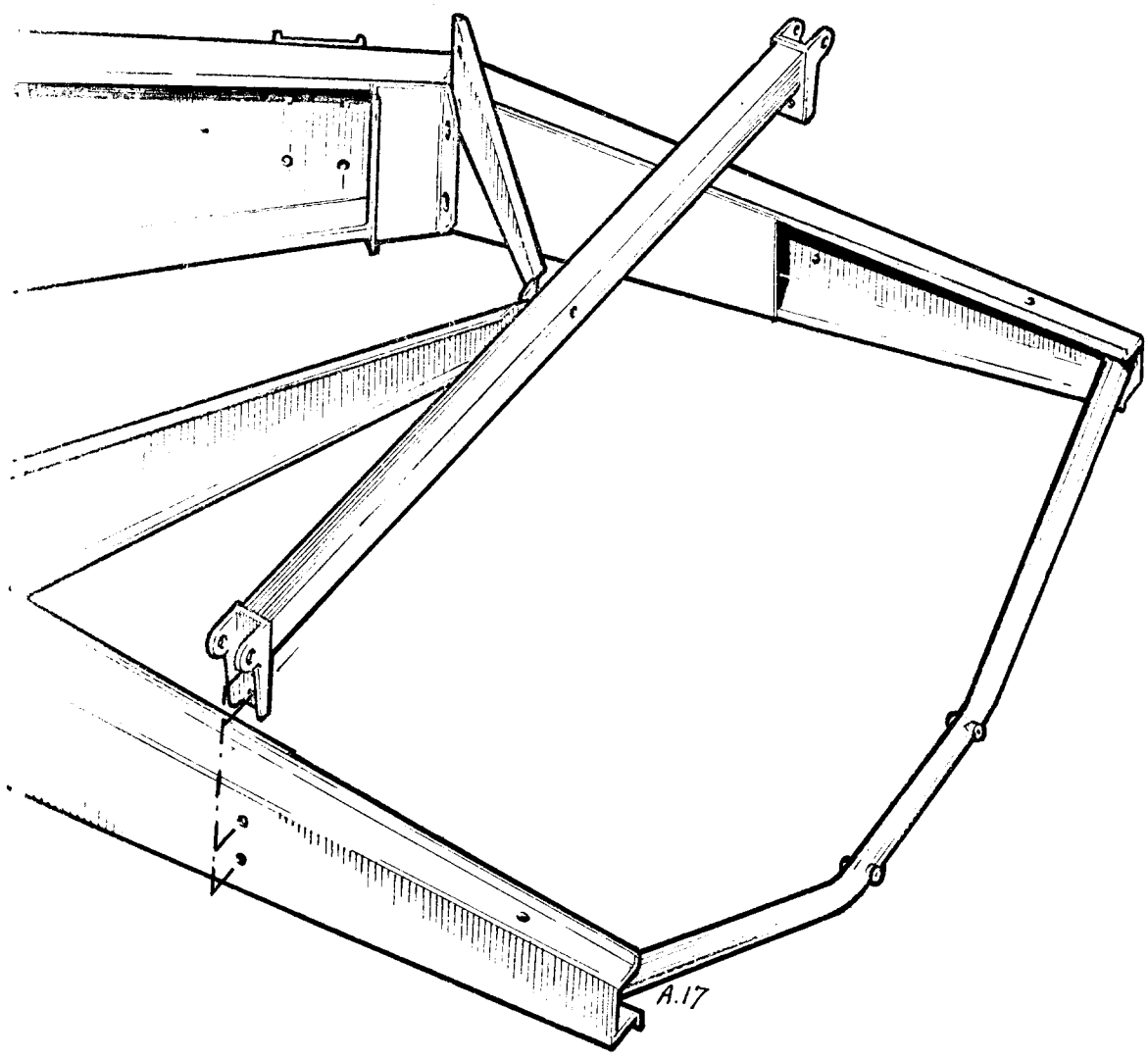


Fig. 2. Chassis Assembly (Type 365)

SECTION B.

BODY.

B.1. - SEATS.

There is no difference in seat removal on Europa Twin Cam cars to the seats fitted in previous Europa cars, except that on cars destined for use in North America, seat 'sensors' are fitted. The sensor, which is beneath the passenger seat, works in conjunction with an audible warning for non-fastening of seat belts .

The seat belt warning system must provide an audible signal (buzzer) and a 'fasten belts' warning lamp (situated on centre console below ashtray), which activate when all the following conditions exist:

a. Ignition switch is 'on' (position 2 & 3).

b. Driver's seat belt NOT fastened.

c. Passenger seat occupied by at least an average 6 year old child and seat belt NOT fastened.

NOTE: The warning signals must not activate when the handbrake is 'on'.

B.2. - SEAT REMOVAL.

1. With the seat in its rearmost position, remove the front runner retaining bolts.
2. Move the seat fully forward and remove the bolts securing the rear ends of the runners.
3. On North American cars, disconnect the seat sensor (two snap connectors) from beneath the passenger seat. Lift out seat and runners as an assembly.

B.3. - SEAT REPLACEMENT.

1. Replacement of the seats is a direct reversal of the removal procedure. On North American cars, do NOT forget to re-connect the seat sensor. On all cars, reseal the runner securing bolts beneath the floor of the car to avoid possible water entry.

B.4. - SEAT BELTS.

Static type seat belts are fitted as original equipment on all cars for all Territories, except in North America, where reel type belts are fitted.

To Remove.

Static type seat belt removal is similar to that given in the Europa Workshop Manual, so will not be detailed here. Reel type belts are removed as follows:-

1. Move the seat forwards as far as possible. Remove the seat belt mounting bolts on either side of the seat.
2. Disconnect the seat belt warning cables from the seat belt receiver (two snap) connectors running from the back of the receiver.
3. Pull off the reel cover and remove the two securing bolts with their nuts now exposed.

To Replace.

1. Reverse the removal procedure, NOT forgetting to re-connect the cables at the seat belt receiver.

B.5. - FACIA PANEL (NORTH AMERICA)

Commencing at Chassis No. 72082684R, all cars destined for use in North America are fitted with a new facia panel (see Fig. 1.) This new facia comprises a re-grouping of the supplementary instruments and different switches (see Section 'M' for their removal).

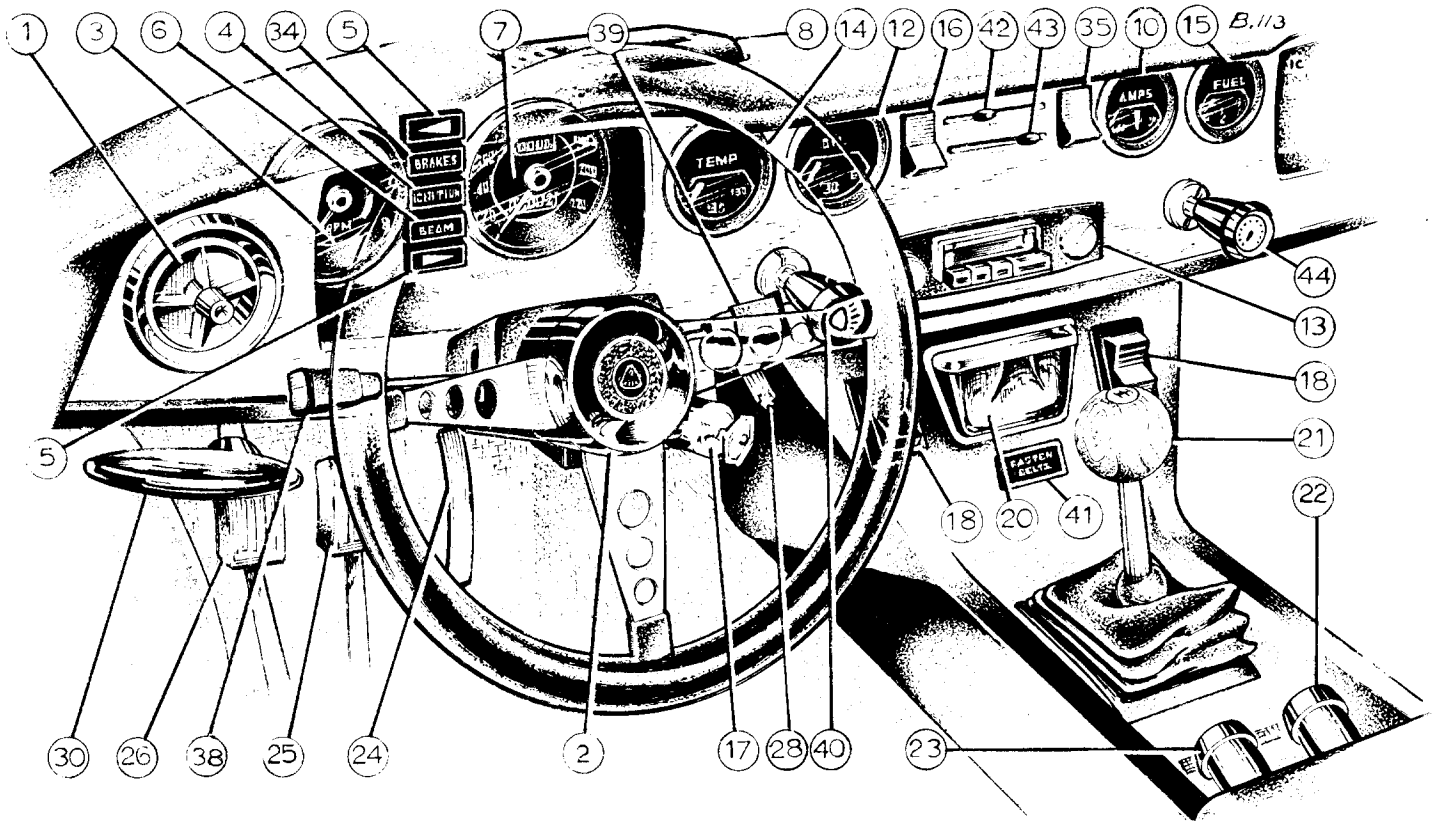


Fig. 1. Facia Panel and Controls (North America only)

Key to Fig. 1.

1. Face level ventilator
2. Steering wheel
3. Tachometer
4. Ignition warning lamp
5. Direction indicator warning lamps
6. Headlamps main beam warning lamp
7. Speedometer
8. Windscreen demister vent
10. Ammeter
12. Oil pressure gauge
13. Radio (when fitted)
14. Water temperature gauge
15. Fuel gauge
16. Heater fan switch
17. Ignition/starter switch and lock
18. Window operating switches
20. Ashtray
21. Gearshift lever
22. Choke control
23. Heater temperature control
24. Accelerator pedal
25. Brake pedal
26. Clutch pedal
28. Speedometer trip control
30. Handbrake
34. Brakes warning lamp
35. Hazard warning switch
38. Horn/indicators/headlamps switch
39. Windscreen wiper/washer control
40. Lighting switch
41. Seat belts 'fasten' warning lamp
42. Heater air direction control, driver
43. Heater air direction control, passenger
44. Panel lamps switch

It is recommended that the Wiring Diagram (LSL.213) be studied in conjunction with Fig. 1.

B.6. - BODY SILLS (SPECIAL)

All Europa Special cars, from Chassis No.

72081783P - U.K.
72081101Q - Export
72082684R - N. America

are fitted with trim sills, attached to the body sills (below the doors). These are retained by trim clips (B of Fig.2.) at their lower edges, and 'pop' rivets at front and rear top edges (into the wheelarch).

To remove the trim sills, drill out 'pop' rivet at both front and rear top edges, ease sills away from body at their upper edges, and remove by pushing down away from the clip (B). Replace by reversing these instructions.

To remove the trim strip (above the trim sill), ease up lower edge from its retaining clips (A of Fig.2.), and remove by lifting up, and out. Take care not to damage the paint during this operation.

Refitting is a reversal of these instructions.

B.115

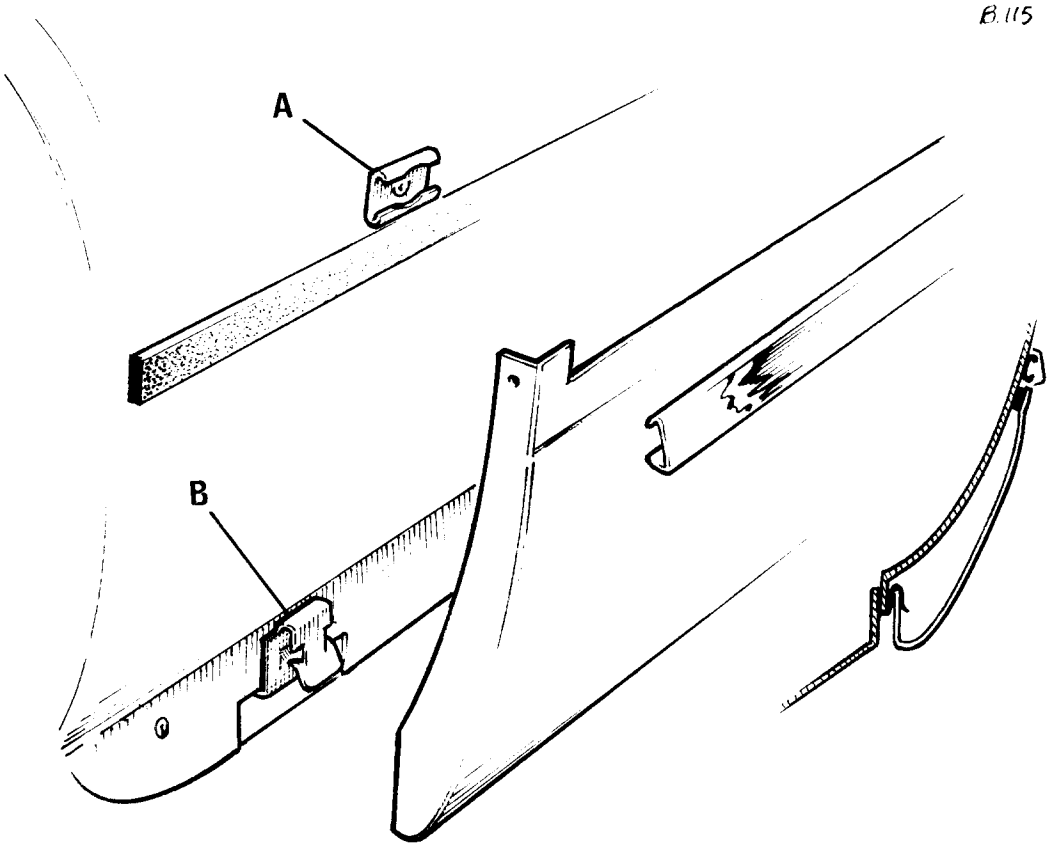


Fig. 2. Body Trim Sill and Trim Strip.

SECTION D.

REAR SUSPENSION.

D.1. - REAR HUBS.

No adjustment is provided, or indeed required on the rear hub bearings. Maintenance is therefore limited to replacement. To gain access to the bearings it is necessary to remove the bearing housing from its mounting in the radius arm. The following procedure is recommended:-

1. Raise the car, support with suitable stands and remove the road wheel and brake drum.
2. Straighten the locking washer securing the rear hub retaining nut, release the nut and remove nut, washer and rear hub.
3. Disconnect the handbrake cable at the brake backplate lever. Release the brake hydraulic pipe at the brake backplate. Insert a suitable plug into the brake pipe to avoid the ingress of foreign matter.
4. Remove the bolts securing the brake backplate to the radius arm assembly. Remove backplate as an assembly. There is no necessity to disturb the brake shoes.
5. Release the bolt which secures both the lower link and the damper assembly to the bearing housing.
6. Release but do not remove the bolt securing the forward end of the radius arm to the chassis. With a suitable drift, remove the tension pin pair (one solid pin inside an open-ended pin) securing the inboard drive shaft to the transmission output drive shaft. While easing out the forward end of the radius arm, pull the inboard drive shaft coupling from the output drive shaft.
7. Temporarily replace the hub securing nut on the end of the outboard drive shaft (to protect the threads) and knock the drive shaft from its bearings in the bearing housing. Note that the bearing lubrication return flinger is not misplaced during this operation.
8. The bolts securing the bearing housing to the radius arm can now be released and the housing withdrawn from its location.
9. To facilitate removal of the bearings, first immerse the bearing housing in hot water for a few minutes. Using a drift against the outer ring of the bearing, knock out the bearing after pushing the bearing spacer to one side. Repeat the operation for the other bearing. Note that an oil seal (which should come out with the bearing) is on the inner bearing.

Replacement of the bearings is a reversal of the removal procedure, but the following points must be observed:-

1. When refitting the inboard drive shaft coupling to the output drive shaft, ensure that the shims are still in place. It is suggested that after removal of the coupling a suitable retainer (such as a bolt with a nut) is inserted through the tension pin hole to secure the shims.
2. BEFORE fitting the rear hubs and to ensure a positive fit between the hubs and the outboard drive shaft, ensure that both the hub and drive shaft are free from grease and dirt. Spray the mating surfaces with Locquic primer grade 'T' and allow to dry. Apply Loctite 'High Strength Retaining Compound Type 35'. Assemble the hub to its drive shaft and secure with lock washer and nut. Torque load the nut to the figure given in TECHNICAL DATA. When assembled, allow a MINIMUM period of 6 hours for the compound to cure.

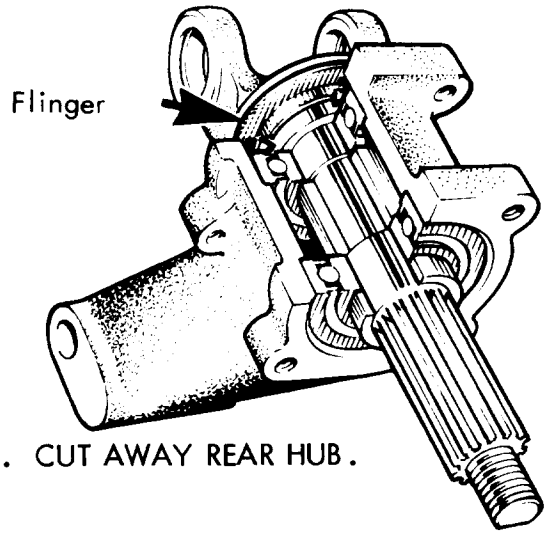


Fig. 1. CUT AWAY REAR HUB.

D.2. - LOWER LINK.

To remove the lower link, the following procedure is recommended:-

1. Raise the car, support with suitable stands and remove the road wheel. The rear of the car should be raised high enough to allow the suspension unit to assume its fully extended position.
2. Release the bolt which secures the lower link and the damper assembly to the bearing housing.

3. Release the bolt which secures the inner end of the lower link to the bracket on the transmission housing. Ease the link from its location. Note there is no necessity to disturb the bracket when removing the link.

When replacing the new lower link, the securing bolts MUST only be finally tightened with the car in its normal ride position. Tighten the bolts to the torque loading given in TECHNICAL DATA.

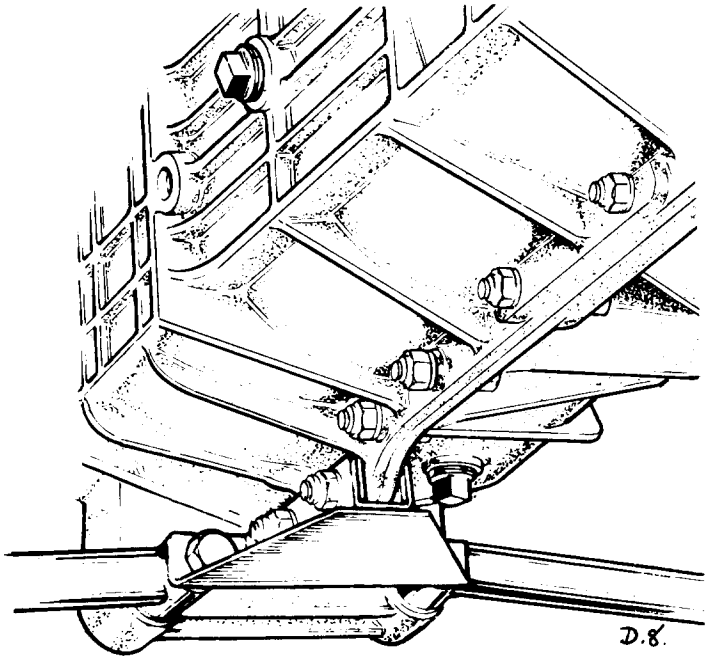


Fig. 2. LOWER LINK BRACKET
(Early cars)

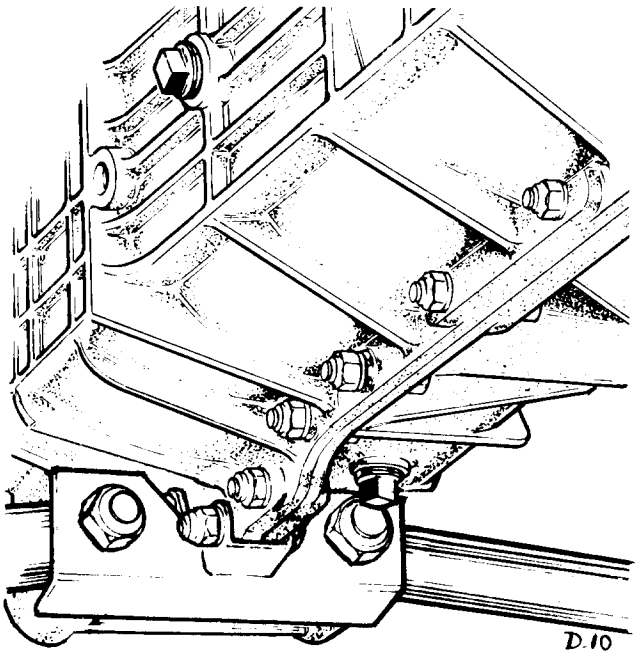


Fig. 3. LOWER LINK BRACKET
(Later cars)

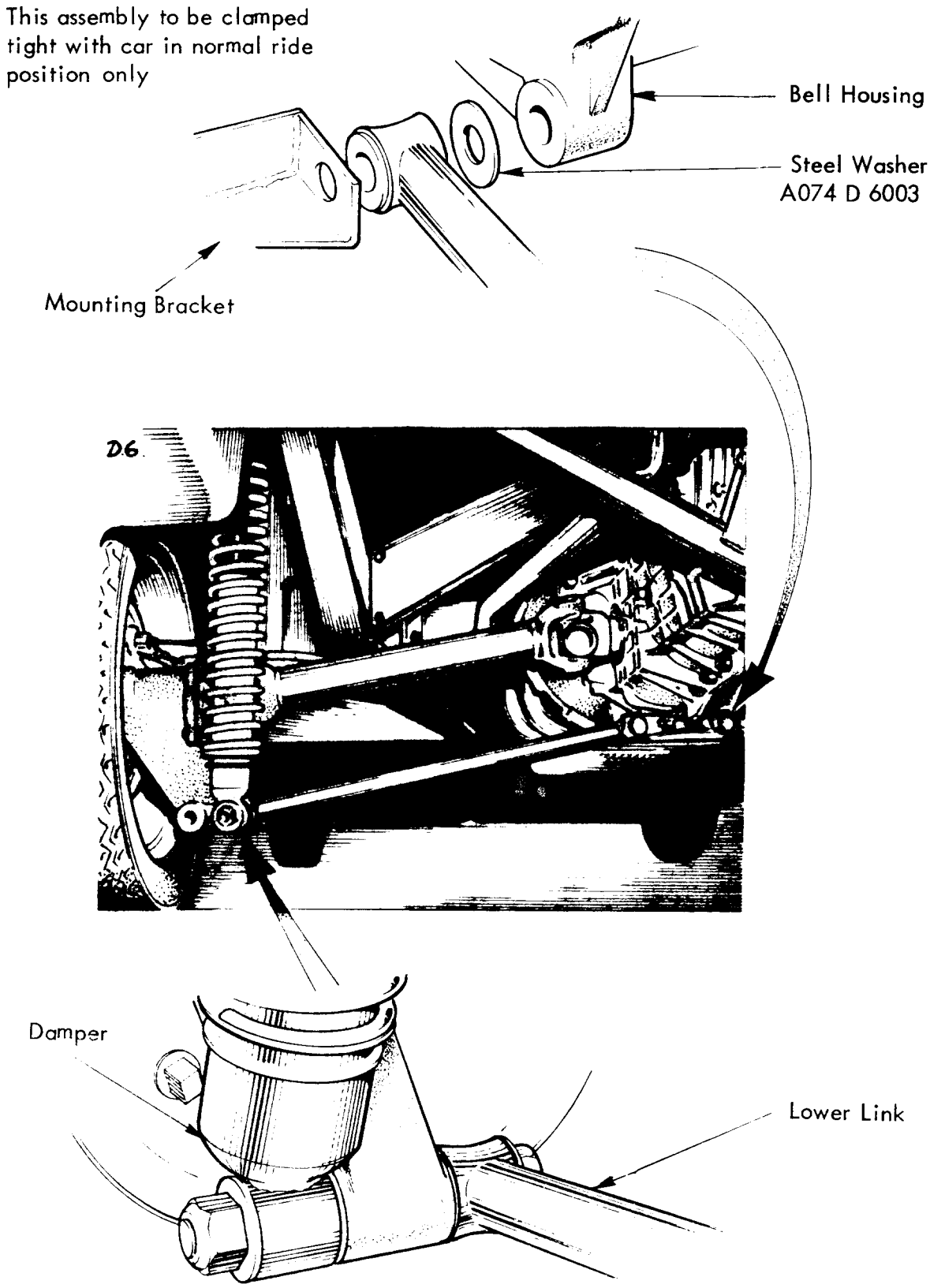


Fig. 4. REAR SUSPENSION.

D.3 - REAR HUB BEARING SPACERS.

When replacing rear hub bearings, it is IMPORTANT to check the length of the spacer (A of Fig. 5.). This measurement is critical and if ignored, could result in a side-load being placed upon the new bearings, thus causing premature failure.

Spacer measurements are as follows :-

X046 D 0148Z = 2.125 ± .010 in. this spacer used an all models up to introduction of Europa Special.

A074 D 0215Z = 2.000 ± .005 in. this spacer being used on Europa Special models only.

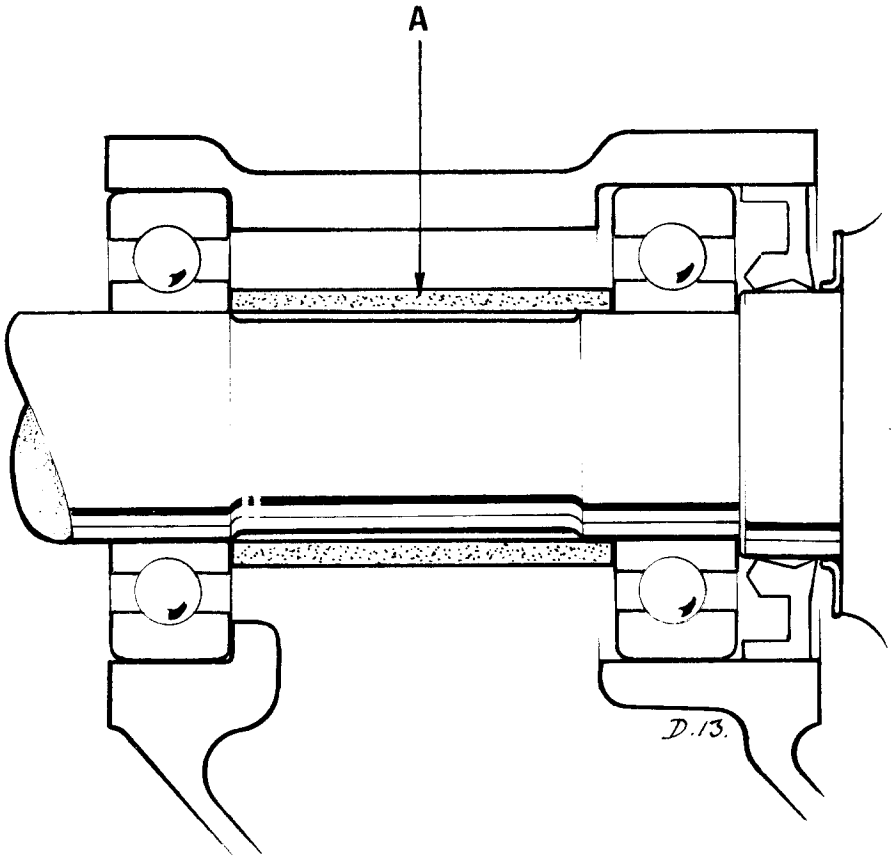


Fig. 5. Location of Hub Bearing Spacer.

SECTION E.

ENGINE.

SECTION E.

ENGINE.
(continuation)

All running clearances, fitting tolerances and dimensions are given in 'Technical Data'.

E.1.-GENERAL DESCRIPTION

The engine is a four cylinder, four stroke, twin overhead camshaft unit having a cast aluminium cylinder head which has fully machined hemispherical combustion chambers and seperate ports for each valve. The valves, of which the inlets are longer than the exhaust have replaceable guides and seat inserts and are at an angle of 27° to the vertical. They are operated by the camshafts acting directly on piston type cam followers (tappets). A spring tensioned single row chain drives the camshafts at half engine speed. The camshaft end float and location depends on a shoulder at the front of each shaft bearing in the head. The timing chain also drives the jackshaft which is situated in the right-hand wall of the cast-iron cylinder block and which drives the oil pump, distributor and fuel pump. The jackshaft is located by a thrust plate bolted to the cylinder block front face and runs in three steel-backed white metal bearings, while the camshafts each run in five bearings of this type. The oil pump, distributor and fuel pump are mounted on the right-hand side of the engine, the oil pump and distributor being driven by a single skew gear on the jackshaft and the fuel pump by a cam also on the same shaft.

The crankshaft, of cast iron construction and dynamically balanced, runs in five steel-backed lead bronze lined bearings, end float being controlled by split thrust washers located in the cylinder block on either side of the centre main bearing.

The connecting rods of 'H' section forgings have steel-backed bronze little end bushes and steel-backed copper lead big end liners, the big end bearing caps being located by two dowels and retained by two bolts. Solid skirt aluminium alloy pistons with two compression and one oil control ring situated above the gudgeon pin are used. The gudgeon pins are retained in position by circlips installed in grooves at each end of the gudgeon pin bore.

A cast-iron flywheel incorporating a steel ring gear drive for the starter, is located on the crankshaft flange and retained by six bolts fitted without lockwashers.

E.2. - LUBRICATION

General

The lubrication system is of the forced feed type, the oil being circulated by a mechanically driven oil pump bolted to the right-hand side of the cylinder block. The pump is driven by a skew gear on the jackshaft, and is of the eccentric bi-rotor type which incorporates a non-adjustable plunger type relief valve.

Oil is drawn from the sump up an inlet pipe attached to the cylinder block and into the pump. When the relief valve opens, oil is passed back into the sump, returning via the base of the sump to prevent aeration. From the pump the pressurised oil flows through the integral full flow filter to a short oil gallery on the right-hand side of the engine. At the forward end of the gallery is a tapped take-off for the oil pressure transmitter. A cross drilling at the rear of the gallery takes the oil to the other side of the engine where the main oil gallery is situated from which all the main bearings are fed. A notch cut in the centre main bearing liner feeds oil to the crankshaft rear thrust washer. Oil is fed to the big end bearings through drillings in the camshaft front, centre and rear journals. Lubrication of the little end bushes, the gudgeon pins and the non thrust sides of the cylinders is by oil mist and an oil jet forced through a small drilling in each connecting rod web at every revolution of the crankshaft.

The jackshaft bearings are fed from the front, centre and rear main bearing via drillings in the block and a metered jet of oil from a front drilling lubricates the chain and sprockets. Oil fed to the overhead camshafts is controlled by flats machined on the jackshaft front journal, and each camshaft bearing is then fed by a central drilling, blocked at the rear end by a tapered Allen screw. Surplus oil from these bearings is then drained back into the sump by way of passages in the head.

Oil Level

The correct level is to the 'FULL' mark on the dipstick, which is located to the left-hand side of the timing cover. When checking the oil level the car must be standing on a level surface and the dipstick withdrawn, wiped, replaced and finally withdrawn and read, the depth of the oil on the end of the dipstick indicating the level of the oil in the sump. If oil needs to be added, remove the oil filler cap on the camshafts cover and pour in clean engine oil of the correct grade, (see Section 'O') until the dipstick indicates that the sump is full. Do NOT overfill. Replace the oil filler cap securely (double notch) otherwise an oil loss could occur, with the resultant failure of the entire engine lubrication system. From new the oil should be changed after 500 miles (800 km.) and then every 5,000 miles (8,000 km). If the oil appears to be excessively dirty before this distance, it should be changed and a new filter element fitted.

The sump capacity is given in TECHNICAL DATA. Where possible it is better to drain the oil when the engine is warm (after having just completed a run) and has a lower viscosity to carry away any sediment.

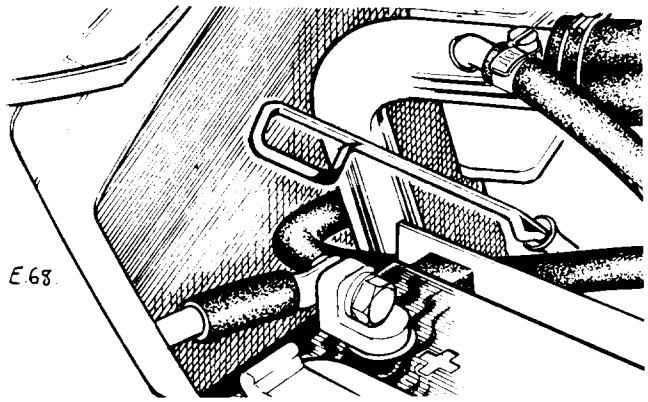


Fig. 1. OIL SUMP DIPSTICK.

Oil Filter

A full-flow 'throw away' cannister type filter is screwed on to an adaptor in the oil pump to make an integral unit, the oil flowing through the filter to the oil gallery. To remove the filter, turn in an anti-clockwise direction. Fully unscrew and discard, together with its sealing ring. The filter should be replaced at intervals of every 5,000 miles (8,000 km.), or more frequently if there are any signs of excessive fouling.

Section 'O' (Lubrication & Maintenance) contains fuller information on renewing the oil filter.

Oil Sump

The sump is pressed steel construction bolted to the block with 18 bolts and spring washes.

E.3. ENGINE TUNE

1. Pull off the sparking plug leads and remove the plugs. Clean the plugs and reset the gaps to the dimensions given in 'TECHNICAL DATA', or if the electrodes are badly burned, fit new plugs, and reconnect the plug leads.
2. Remove the distributor cap and examine the contact breaker points. Replace the points if badly burned or excessive metal transfer is evident. Adjust the points gap to the dimensions given in 'TECHNICAL DATA' and refit the distributor cap.
3. Remove the fuel pump sediment bowl and filter screen. Wash both in clean petrol ensure that the gasket is in good condition and refit screen and sediment bowl to the fuel pump.

4. Remove the air cleaner element and clean by shaking through. If very clogged with dust or dirt, replace. Clean filter body of all accumulated dirt, reassemble and refit air cleaner assembly to car.

5. Disconnect the fuel feed pipes at the carburetters.

6. Dellorto Carburetters - Remove jet covers with its gasket by releasing the securing screws. Unscrew the main jets and the slow running jets. Blow them clear with an air line. Do NOT use wire as this will enlarge the jet orifice. Replace the jets, gasket and cover. Remove the screwed plug to gain access to the pump jets. Repeat cleaning process as for the main and slow running jets.

7. Zenith Stromberg Carburetters - Disconnect air trunk from air box and remove air box. Remove carburetters from engine (see Section 'L') to a clean work bench. Release centre plug from the base of each carburetter. Remove float chambers by releasing the retaining screws, and withdrawing in a vertical motion to avoid damage to the float mechanism. Remove float chamber gasket. Take out floats. Remove needle valve from float chamber cover. Remove 'O' ring from centre plug. Thoroughly clean all removed parts in clean petrol. Refit needle valve into float chamber cover using a new washer. Replace float assembly and check (see Section 'L'). Refit float chambers with new gasket. Fit new 'O' ring to centre plug and replace securely. Refit carburetters to engine using new gaskets. Top up damper reservoirs with oil (see Section 'O').

8. Reconnect the fuel feed pipes at the carburetters.

9. Adjust the valve clearances. (Section 'E7')

10. Connect the leads of a timing light in accordance with the manufacturers instructions. Check that the mark on the crankshaft pulley is visible; if not, mark with paint.

11. Start the engine and point the timing light at the crankshaft pulley, adjacent to the timing scale. Progressively increase the engine speed to 2,500 r.p.m. observing the timing mark, with the aid of the timing light to check that the distributor advances the ignition timing.

12. At 2,500 rev./min. adjust the ignition timing if necessary (see 'TECHNICAL DATA') by slackening the distributor clamp and turning the distributor body as required. After making an adjustment tighten the clamp only sufficiently to hold the distributor in position - DO NOT OVERTIGHTEN. Remove the timing light.

13. Adjust the slow-running speed of the engine (see Section 'L').

E.4. - COMPRESSION CHECK.

1. Warm up the engine to its normal operating temperature then remove all sparking plugs. Set throttles to fully open position.

2. Place the guage in a convenient position and insert the conical-ended rubber tube into No. 1 sparking plug orifice. The normal compression pressure with an engine that has been run in correctly is given in 'TECHNICAL DATA'. At altitudes above sea-level, proportionally lower pressures will be obtained. Compression is checked with starter turning engine at 200 r.p.m. Battery and starter should be in good condition.

3. Test the remaining cylinders in a similar manner, replace sparking plugs and connect the plug leads.

E.5. - CAMSHAFT COVER.

To remove.

1. Remove the eight nuts and washers retaining the camshafts cover.

2. Remove the cover together with its gasket.

To Replace.

When refitting the camshafts cover, it is advisable to use a new gasket to which jointing compound (Part No. A036E6027) has been applied.

E.6. - TIMING CHAIN TENSIONER.

1. The timing chain tensioner is located at the right-hand side of the engine immediately below the cylinder head flange. Release the locknut and screw in (or out) the tensioner until a minimum noise level is achieved, approximately .5in. (12.5 mm.) total movement of the chain between the two camshaft sprockets.

E.7. - VALVE CLEARANCES.

To Remove

1. Remove the camshafts cover (Section 'E .5').
2. Turn the camshaft until the heel of the cam is on the cam follower (tappet) then using feeler guages, determine the distance between the cam follower and the cam heel. This clearance is given in 'TECHNICAL DATA'.
3. Check all valve clearances, noting any which require adjustment.
4. Remove the camshaft.
5. Remove the cam followers with the aid of a valve grinding tool, keeping them in their respective order.
6. Remove each adjustment shim now exposed, where the clearance requires adjustment, and substitute shims (one only to each valve) giving the correct clearance.
   A thinner shim will be required to increase the valve clearance, and a thicker one to reduce the clearance.

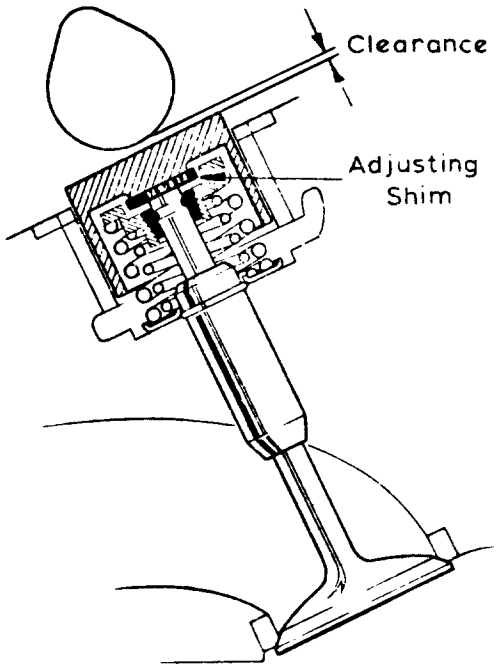


Fig. 2. VALVE ADJUSTMENT.

Select a shim to give the correct size from the following formula:-

Shim thickness required = A.C. + E.S. - CC.

Where A.C. is actual valve clearance

E.S. is existing shim thickness

C.C. is correct valve clearance.

Measure the thickness of the shim accurately with a micrometer, even though the shims thickness is etched around the periphery or on the underside of the shim. Any roughness caused by the etching should be removed with fine emery cloth.

To Replace

1. Refit the cam followers in their respective bores.
2. Fit the camshafts and recheck the valve clearances, re-adjusting if necessary.
3. Refit the camshafts cover.

E.8. CAMSHAFTS SPROCKETS AND TIMING CHAIN.

To Remove

1. Remove the camshafts cover (Section 'E.5.).
2. Set the engine in the timing position by aligning the timing mark on the flywheel with the mark on the clutch bellhousing. At this point the timing marks on the camshafts sprockets should be adjacent to each other and level with the camshafts cover mounting face.
3. Remove the timing chain tensioner (Section 'E.6.').
4. Remove the sprockets by releasing their central retaining bolts, and disconnect the timing chain. To remove the timing chain the front cover (Section 'E.30.') must first be removed.

To Replace

1. Fit the camshafts sprockets and timing chain aligning the timing marks, as set during dismantling. Tighten the retaining bolts to the torque loading given in 'TECHNICAL DATA'. Ensure the correct sprocket replacement. (Ex. sprocket on exhaust camshaft.).

2. Refit and adjust the timing chain tension (Section 'E.6.').
3. Check ignition timing.
4. Refit the camshafts cover (Section 'E.5.').

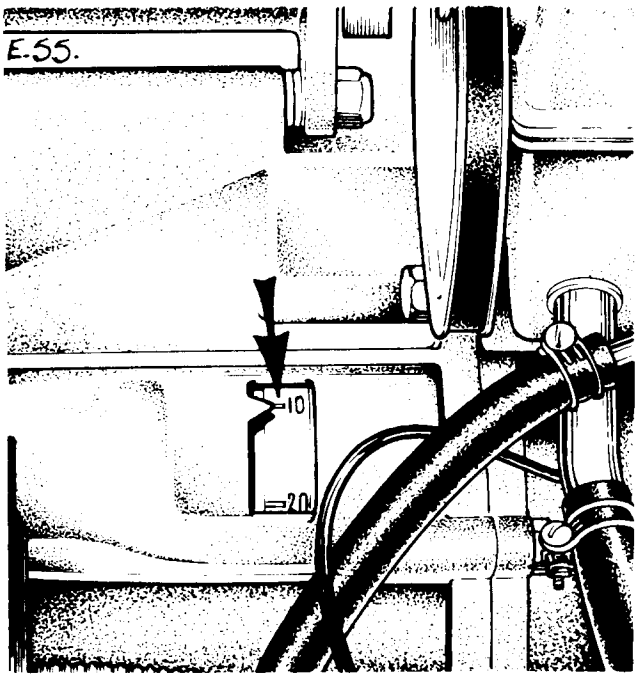


Fig. 3. FLYWHEEL TIMING MARK.

E.9. - CAMSHAFTS AND BEARINGS

To Remove

1. Remove the camshafts covers. (Section 'E.5.').
2. Set the engine in the timing position.
3. Remove the timing chain tensioner.
4. Remove the camshafts sprockets.
5. Remove the alternator driving belt. (See Section 'M').
6. Remove the bolts securing the camshafts bearing caps, and remove the caps marking them (if not already marked) to ensure replacement in their original position.
7. Extract the bearing liners.

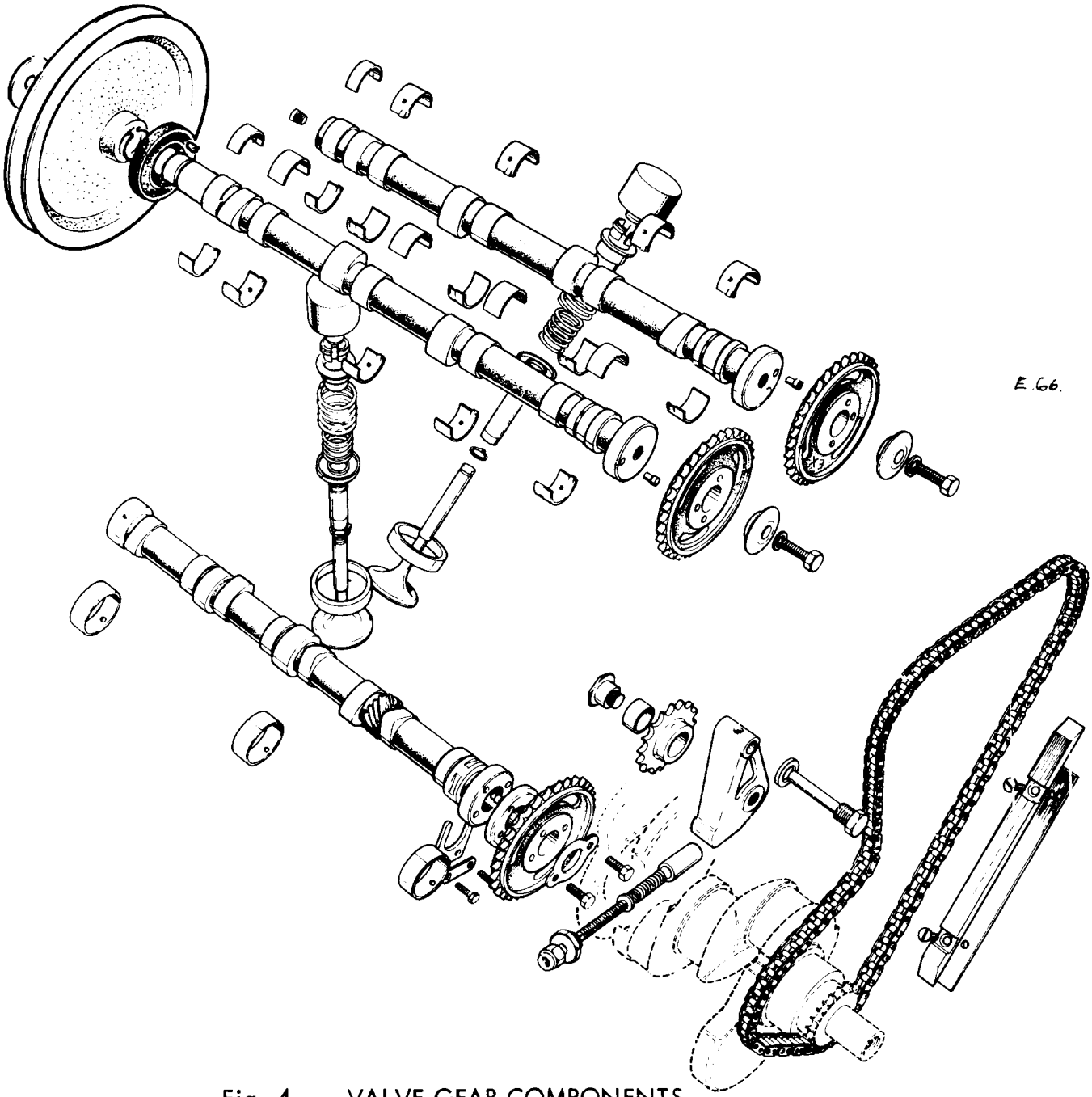


Fig. 4. VALVE GEAR COMPONENTS.

To Replace

1. Fit new bearing liners, noting that the location tags are correctly positioned in their locations in both cylinder head and bearing caps.
2. Fit the camshafts and their bearing caps, tightening the cap bolts progressively from the centre working outwards, to the torque loadings given in 'TECHNICAL DATA'.

   NOTE: The oil seal on the inlet shaft is fitted with the aid of a Lotus Special Tool 'PT. 0020', as shown in illustration.

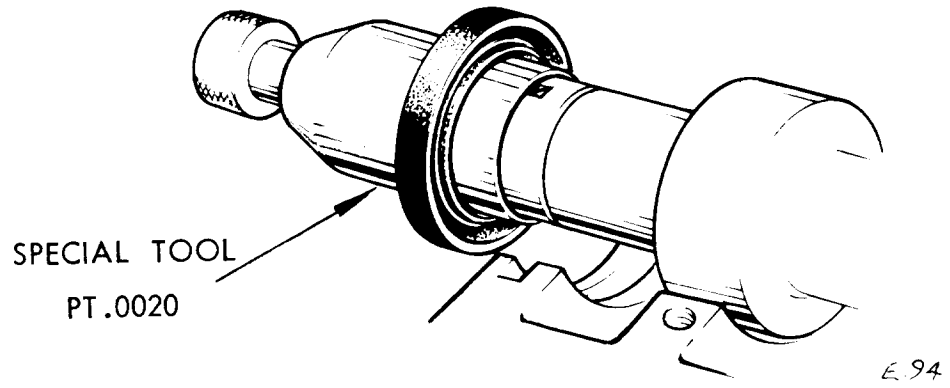


Fig. 5. FITTING CAMSHAFT OIL SEAL.

3. Fit the camshafts sprockets and adjust the timing chain tension. Check and adjust the valve clearances. Finally, fit the camshafts cover, followed by the alternator driving belt.

E.10. - CYLINDER HEAD

To Remove

1. Drain the cooling system.
2. Remove the carburetters air box (see Section 'L').
3. Remove radiator top hose and the heater hose from their connections at the cylinder head.
4. Disconnect the water temperature guage sender unit.
5. Disconnect the throttles and choke cables, fuel pipes from carburetters and exhaust manifold.
6. Remove camshafts covers.
7. Remove the camshafts sprockets.
8. Remove the alternator driving belt.
9. Pull the leads from the sparking plugs.
10. Release the cylinder head bolts evenly and progressively working diagonally from the centre, not forgetting the bolts in the timing cover, and remove the cylinder head together with its gasket. Do NOT lay the cylinder head flat on its face while the camshafts are fitted as this will cause damage to the valves.

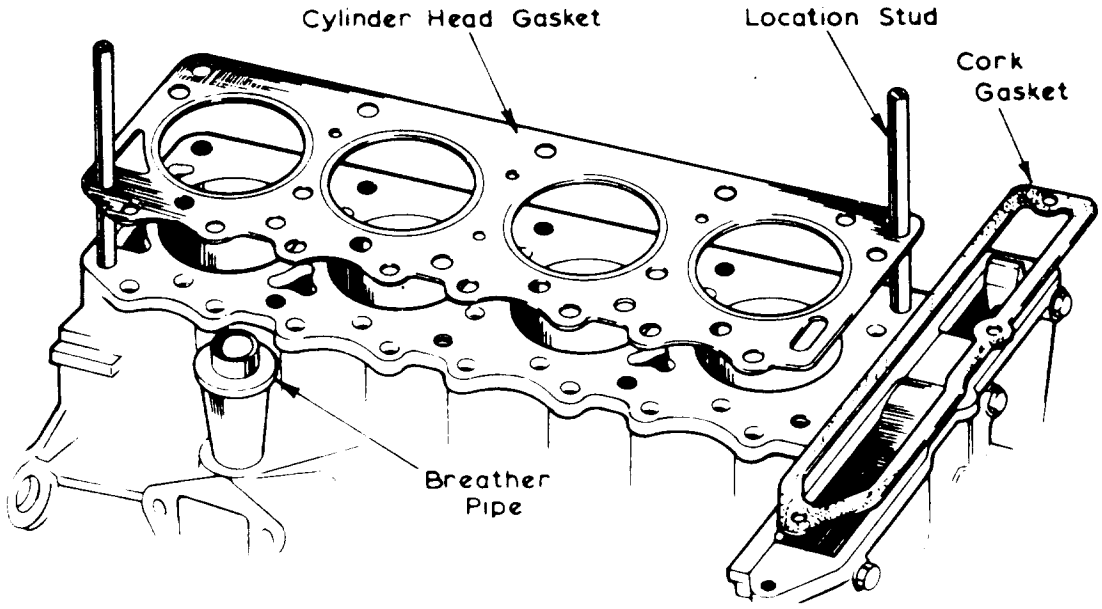


Fig. 6. CYLINDER HEAD LOCATION STUDS & GASKETS.

To Replace

1. Screw into diagonally opposite holes (front left, rear right) in the cylinder block face, two spare cylinder head bolts from which the heads have been removed and screwdriver slots cut. These studs locate the gasket whilst the cylinder head is being fitted. Use a new cylinder head gasket and a new cork gasket on top of the front cover. This cork gasket should have jointing compound (Part No. A036E 6027) applied to its face which will be in contact with the cylinder head.

2. Fit the cylinder head assembly, ensuring that the breather pipe is engaged in its bore. Loosely replace the cylinder head bolts. Extract the two gaskets locating studs and fit the last two bolts. Tighten all bolts to the torque loading given in 'TECHNICAL DATA' working progressively diagonally outwards from the centre. New cylinder head bolts (Part No. 26E 027A) have recently been introduced, these having an improved material specification. There is no change to the tightening torque. Old and new bolts are interchangeable, but it is inadvisable to mix old and new bolts on the same cylinder head, as the thread lengths may differ slightly.

3. Fit the camshafts sprockets, alternator driving belt and camshaft cover.

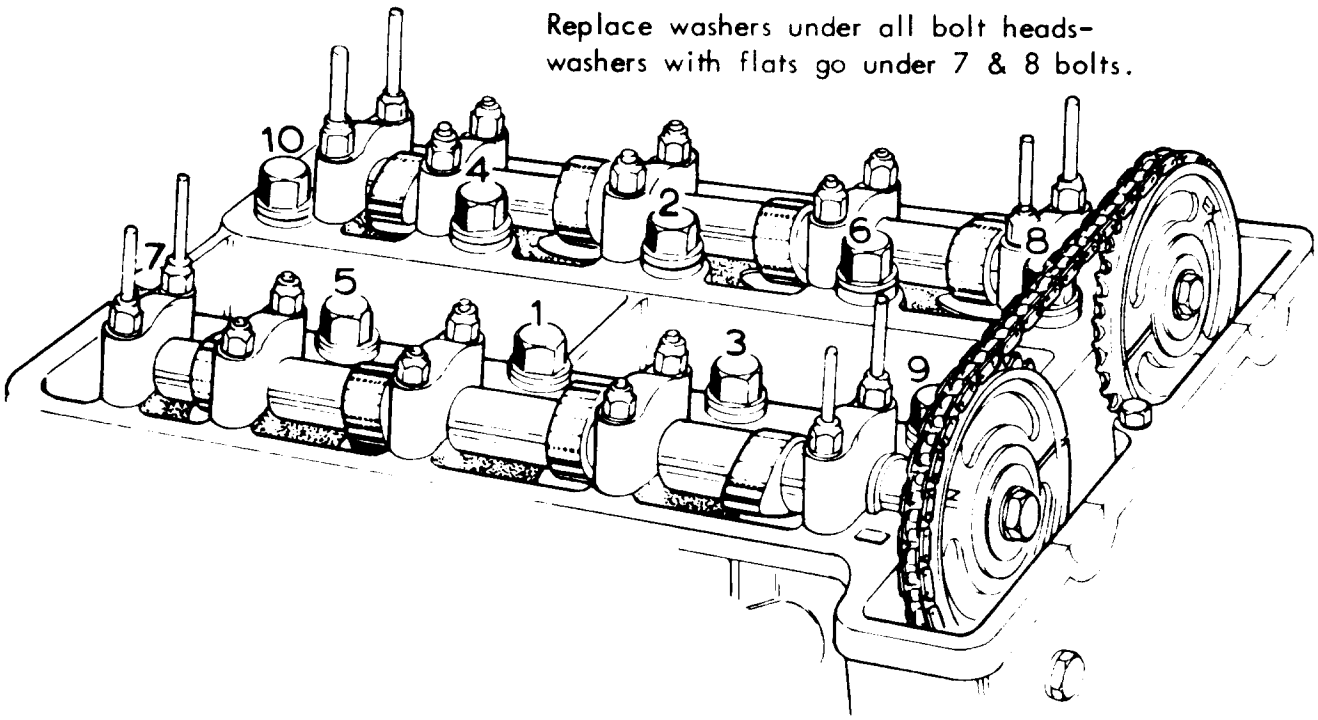


Fig. 7. SEQUENCE OF TIGHTENING CYLINDER HEAD BOLTS.

4. Reconnect the exhaust manifold, throttle and choke cables, and fuel pipes to carburetters. Refit the brake servo vacuum hose, radiator top hose, water temperature guage sender unit and the heater hose. Refit the carburetters air box.

5. Finally, refill the cooling system.

E.11. - VALVES.

To Remove

1. Remove the cylinder head and the camshaft.
2. Remove the cam followers and the adjusting shims.
3. Using a valve spring compressor, compress the valve springs and extract the split collets, valve spring retainer, valve springs and spring seat from each valve.
4. Remove the valve.

To Replace

1. Lightly lubricate the stem of the valve and insert into its guide.
2. Fit spring seat, valve springs, valve spring retainer. Place the valve spring compressor in position and compress the valve springs sufficiently to fit the split collets. Remove the valve spring compressor.

3. Replace the cylinder head followed by the camshafts.

4. Fit the camshafts sprockets, check the valve clearances and finally fit the camshafts cover.

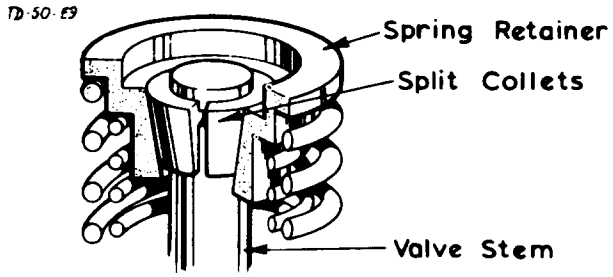


Fig 8. VALVE SPRING RETAINER.

E.12. - DECARBONIZE CYLINDER HEAD AND PISTONS

1. Remove carburetters.

2. Remove cylinder head.

3. Remove the valves.

4. Using a suitable implement such as a blunt scraper, remove all carbon deposits from cylinder head faces, inlet and exhaust ports, piston crowns and valve heads. A ring of carbon should be left around the periphery of each piston crown. The top of the cylinder bores should NOT be touched.

5. Clean each valve thoroughly and carefully examine for pitting. Valves in a pitted condition should be refaced with a suitable grinder or new valves should be fitted. Stamp any new valve with the number of the port to which it is fitted. If the valve seats show any signs of pitting or of unevenness they should be trued by the use of service cutting tools. When using a cutting tool take care to remove only as much metal as is necessary to ensure a true surface. The removal of too much metal could cause the spring retainer to foul the cam follower and/or cause difficulty in achieving the required valve clearances.

6. When grinding a valve onto its seating the valve should be smeared lightly with fine or medium carborundum paste and then lapped in with a suction grinder. Avoid the use of excessive quantities of grinding paste and see that it remains in the region of the valve seating only. A light coil spring placed under the valve head will assist considerably on the process of grinding. The valve should be ground to its seat with a semi-rotary motion and occasionally allowed to rise by the pressure of the light coil spring. This assists in spreading the paste evenly over the valve face and seat.

It is necessary to carry out the grinding operation until a sull, even, matt surface free from blemishes is produced on the valve seat and valve face. On completion, the valve seats and ports should be cleaned with a rag soaked in paraffin, dried, and then thoroughly cleaned by compression air. The valves should be washed in paraffin and all traces of grinding paste removed. Check that no grinding paste has entered the valve guides.

7. Re-assemble the valves to the cylinder head.

8. Refit cylinder head and carburetters.

E.13. - VALVE SEAT INSERTS.

To Remove

1. Remove the cylinder head and dismantle as for decarbonising.

2. Remove the valve seat inserts by milling through, or almost through (dependant on the skill of the operator), the edge of the insert, whereupon the seat should collapse. In the case of a stubborn seat, it is permissable after milling, to start the seat on its way to removal by inserting a suitable drift through the appropriate port and gently tapping the seat from its recess. Ensure that the recess in the cylinder head is ENTIRELY FREE OF FOREIGN MATTER, otherwise the new insert will NOT seat fully in the recess.

To Replace

Valve seat inserts are available in standard and up to .015 in. (.38 mm.) oversize.

1. Heat the whole cylinder head to a temperature NOT EXCEEDING 200°C. (392°F) and freeze the insert with dry ice to a temperature NOT LESS THAN - 80°C.(-112°F)

2. Press the insert into place using a suitable replacer tool ensuring that the seat faces towards the combustion chamber. Allow the cylinder head to cool naturally in the air.

3. Rebuild and refit the cylinder head.

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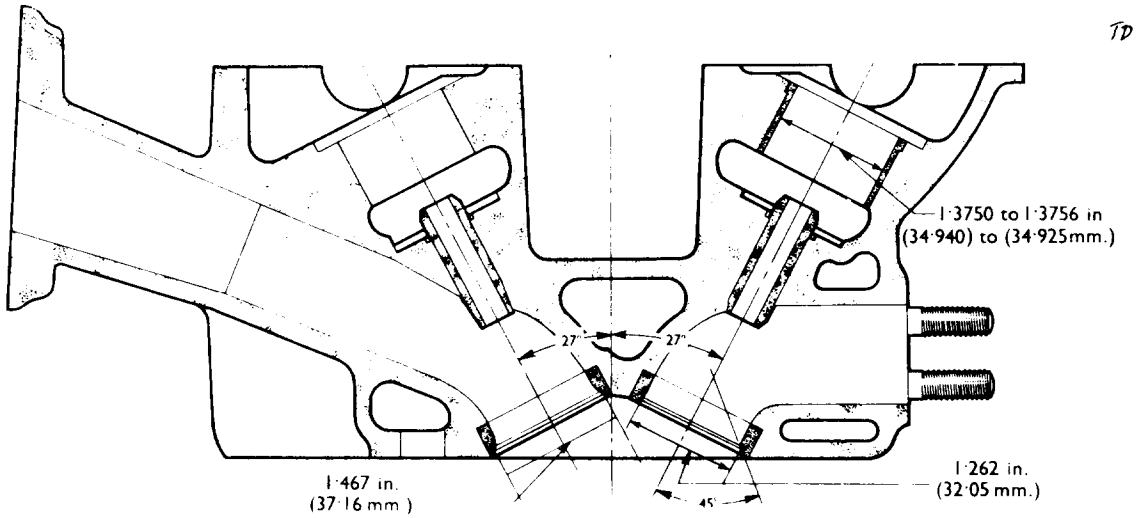

Fig. 9. VALVE SEAT INSERTS, VALVE GUIDES & CAM FOLLOWER SLEEVE.

E.14. - VALVE GUIDES.

To Remove

1. Remove the cylinder head and dismantle.
2. Remove the valve guide with a suitable drift, knocking upwards into the cam follower bore after heating the cylinder head to 100/150°C. (212/303°F.)

To Replace

Valve guides are available in standard and up to .006 in. (.152 mm.) oversize.

1. Heat the cylinder head to 100°/150°C (212/303°F.) locate new circlip on the new guide and press the guide into its bore until the circlip seats completely in its recess. Care must be taken that the guides are NOT driven beyond this point. (See TECHNICAL DATA)
2. Ream the guide AFTER fitting, to the dimensions given in TECHNICAL DATA. Recut the valve seat to ensure that it is concentric with the valve stem bore.
3. Rebuild and refit the cylinder head.

E. 15. - CAM FOLLOWER SLEEVES.

To Remove

1. Remove the cylinder head (Section 'E. 10') and dismantle (Section 'E.12').
2. Remove the cam follower sleeve by cutting a groove adjacent to each scallop, taking care that the cylider head is NOT damaged. Using a suitable sharp chisel remove the sleeve from its location, again taking care NOT to damage the cylinder head.

To Replace

1. Heat the whole cylinder head to 150°C. (302° F).
2. Press the sleeve into place using a suitable tool and machine after fitting to the dimensions given in TECHNICAL DATA. Recut the scallops.
3. Rebuild and refit the cylinder head.

E.16. - OIL SUMP

To Remove

1. Using a suitable receptacle, release the drain plug and allow the oil to drain.
2. Remove the starter motor, bell housing lower cover, oil filter and the exhaust downpipe together with the silencer.
3. Release the setscrews from around the periphery of the sump and remove sump.

To Replace

1. When replacing, which is a reversal of the removal procedure, use jointing compound (Part No. A036 E 6027) on the sump gaskets before bringing into contact with the cylinder block.

E.17. - MAIN BEARINGS

To Remove

1. Remove the oil sump (Section 'E. 16').
2. Mark each cylinder bearing cap (if not already marked) with a similar mark on the cylinder block adjacent to the crankshaft, so that each cap when refitted will be in its original position.
3. Remove No. 1 (from front end) main bearing cap, and release the upper shell bearing from the cylinder block by pushing out, revolving the crankshaft at the same time. Release the lower shell bearing from the cap by lifting out.

To Replace

1. Fit new bearings by reversing the dismantling procedure and refit No.1 bearing cap. Tighten the retaining bolts to the torque loading given in 'TECHNICAL DATA'.
2. Renew remaining main bearing liners in sequence, tightening each bearing cap to its correct torque loading BEFORE releasing the next one in sequence.

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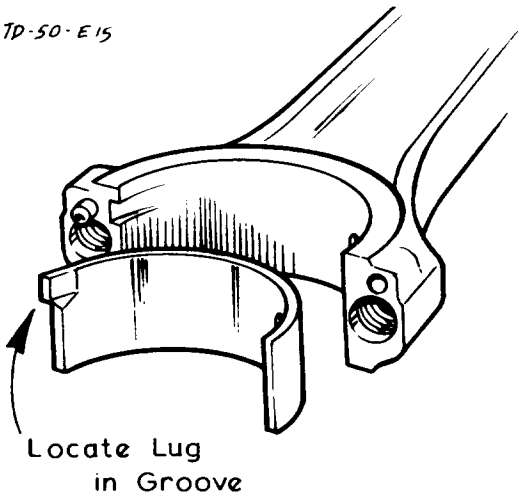

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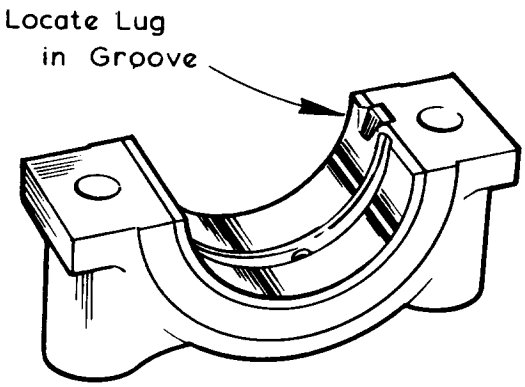


Fig. 10. MAIN BEARING SHELL & CAP. Fig. 11. CONNECTING ROD & SHELL.

E. 18. - CONNECTING ROD BEARINGS

To Remove

1. Remove the oil sump (Section 'E.16').
2. Commencing with No.1 (from front end) connecting rod, turn the crankshaft to facilitate removal of cap and mark cap and rod.
3. Release the big-end bolts by two or three turns, and tap them to release the cap. Fully unscrew the bolts and remove the cap.
4. Remove the upper and lower big-end bearing liner from the connecting rod and the lower bearing liner from the connecting rod cap.

To Replace

1. Replace the lower and upper big-end bearing liners in their appropriate locations.
2. Fit the cap to the connecting rod and tighten the bolts to the torque loading given in 'TECHNICAL DATA'.
3. Renew the big-end bearing liners by repeating the above operation.

E. 19. - PISTONS, PISTON RINGS AND CONNECTING RODS

To Remove

1. Remove the cylinder head (Section 'E.10') and the oil sump (Section 'E.16').

2. Release the big-end bolts by two or three turns, and then tap them to release the cap. Fully unscrew the bolts and remove the cap. Push the piston out of the bore and remove the assembly to a bench.

3. Remove the piston rings. Extract the gudgeon pin circlips and push the pin out of the piston. Separate the piston and the connecting rod.

To Replace

1. Select the new piston of the appropriate grade required (see 'TECHNICAL DATA').

2. Fit the piston rings, oil control first, followed by the lower then the upper compression rings. Ensure that the rings are fitted the correct way up.

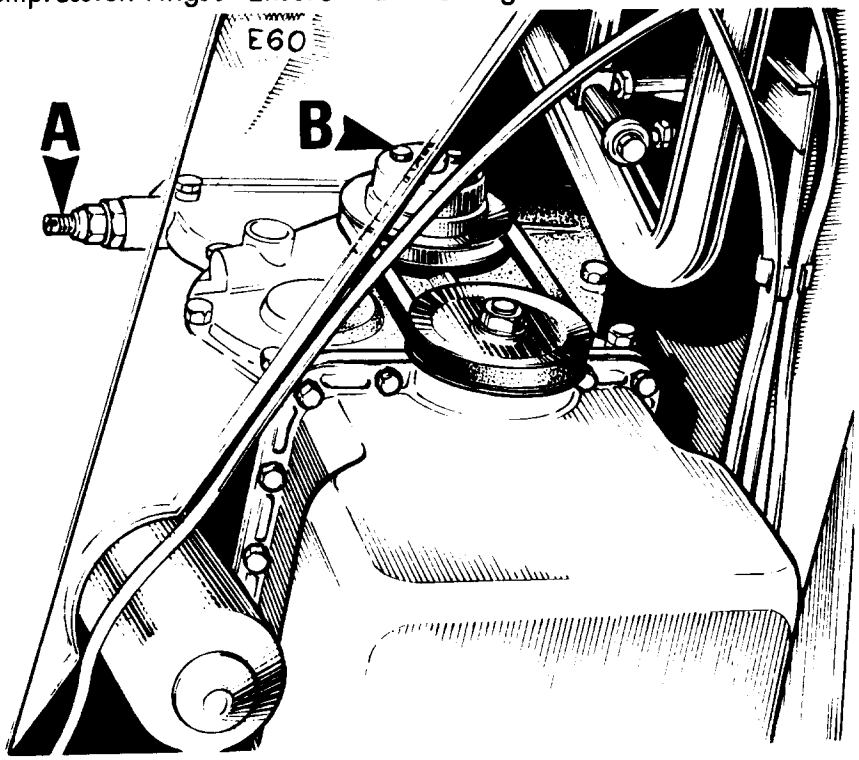


Fig. 12. A - Timing chain tensioner.
B - Water pump pulley.

E.20. - CRANKSHAFT PULLEY

To Remove

1. From beneath the car, release the central retaining bolt and using a suitable puller, remove the pulley together with the water pump driving belt.

To Replace

1. Reversr the removal procedure.

NOTE: There is NO adjustment to the belt.

E. 21. - WATER PUMP PULLEY AND BELT

To Remove

1. From beneath the car, release the bolts ('B' of Fig. 12) securing the water pump pulley to its mounting flange.
2. Pull off the pulley, together with the water pump driving belt.

To Replace

1. Reverse the removal procedure

   NOTE: The above procedure applies when either the belt, the pulley, or both parts require removal. There is NO adjustment to the belt.

E. 22. - OIL PUMP AND OIL FILTER

1. Release the three securing setscrews and remove the pump and filter as an assembly.

To Dismantle

(All clearances are given in 'TECHNICAL DATA')

1. Remove the filter element by unscrewing in an anti-clockwise direction.
2. Remove the end plate and withdraw the 'O' ring from the groove in the pump body.
3. Check the clearance between the lobes of the inner and outer rotors. The rotors are supplied as a matched pair only, so that if clearance is excessive a new rotor pair must be fitted.
4. Check the clearance between the outer rotor and the housing. If clearance between the outer rotor and pump body is excessive a new rotor assembly and/or pump body should be fitted.
5. Place a straight edge across the face of the pump body and check the clearance between the face of the rotors and the straight edge. If this clearance is excessive the face of the pump body can be carefully lapped on a flat surface.
6. If it is necessary to renew the rotor or drive shaft, remove the outer rotor, then drive out the remaining pin securing the skew gear to the drive shaft and pull off the gear. Withdraw the inner rotor and drive shaft.

To Reassemble

1. If the pump has been carefully dismantled, fit the inner rotor and drive shaft assembly to the pump body. Press the skew gear (if undamaged) onto the drive shaft end supporting the shaft, at the rotor end, on a suitable spacer. Replace the

gear retaining pin and peen over the ends securely.

2. Install the outer rotor with its chamfered face inwards, towards the pump body.

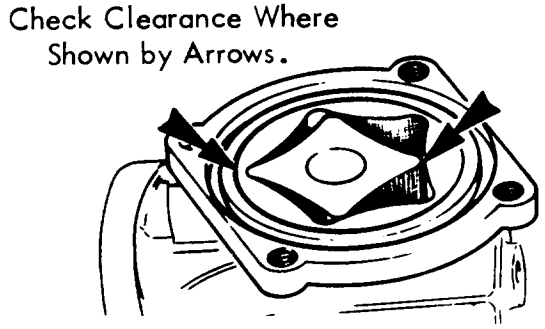


Fig. 13 CHECKING ROTOR SIDE CLEARANCE

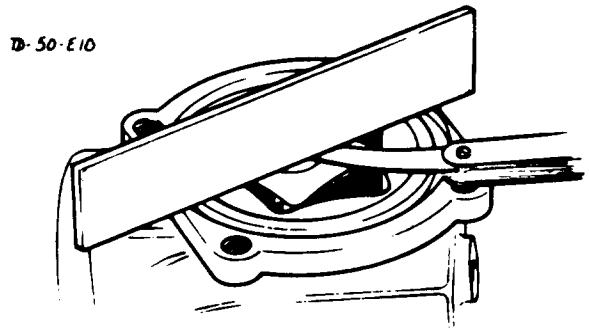


Fig. 14. CHECKING ROTOR FACE CLEARANCE

3. Place the 'O' ring in the groove in the pump body and fit the end plate with the machined face towards the rotors.

4. Fit a new filter element, after ensuring that both the mating face on the oil pump body and the oil filter element are clean, then apply a film of engine oil to the rubber seal which is in contact with the oil pump body. Screw on the filter by HAND just sufficient to make a seal, usually 2/3 to 3/4 turn to ensure an oil-tight joint.

To Replace

1. Place a new gasket on the pump mounting flange and fit pump and filter as an assembly. Tighten the securing bolts to the torque loading given in 'TECHNICAL DATA'.

E. 23. - FRONT (TIMING) COVER OIL SEAL

To Remove

1. Remove the crankshaft pulley (Section 'E.20').

2. With a suitable extractor, remove the oil seal, taking care NOT to damage the casing when removing.

To Replace

1. Using a hollow drift, the outer diameter of which is the same size as the oil seal, insert a new seal.

2. Replace the crankshaft pulley.

E. 24. - TIMING CHAIN TENSIONER SPROCKET

To Remove

1. Remove the camshafts cover (Section 'E.5').
2. Set the engine to T.D.C. (Section 'E.8').
3. Remove the timing chain tensioner by fully unscrewing.
4. Remove the INLET camshaft sprocket (Section 'E.8').
5. Using a suitable piece of wire with a hooked end, insert the hook into the sprocket, then release the pivot pin. Remove bracket and sprocket assembly by passing up between the two camshafts.
6. Unscrew the sprocket pin and remove sprocket.

To Replace

1. Reverse the removal procedure, not forgetting to tighten the bolts, where necessary, to the torque loadings given in 'TECHNICAL DATA'.

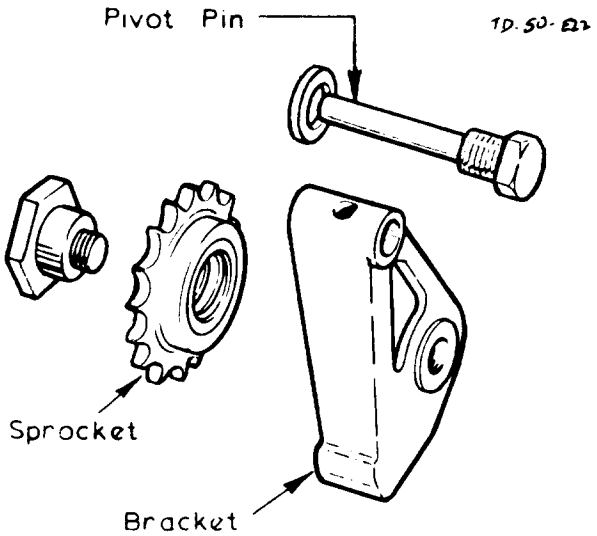


Fig. 15. CHAIN TENSIONER COMPONENTS.

E. 25. - FLYWHEEL AND RING GEAR

To Remove

1. Remove the transmission (see Section 'F' of the main Europa manual).
2. Remove the chassis cross members as follows:-
   a. Release the bolts securing the upper end of the rear dampers to the horizontal member.
   b. Release the bolts securing the diagonal braces to the chassis and the bolt securing the forward end of the braces to the horizontal cross member.

c. Remove the chassis cross members.

2. Unscrew the bolts around the periphery of the clutch assembly and remove clutch from flywheel.

3. Release the six bolts and remove the flywheel.

4. Cut between the two adjacent teeth on the ring gear with a hacksaw and split the gear with a chisel.

NOTE: Under no circumstances must pressure be applied in an attempt to remove the gear for re-positioning on the flywheel.

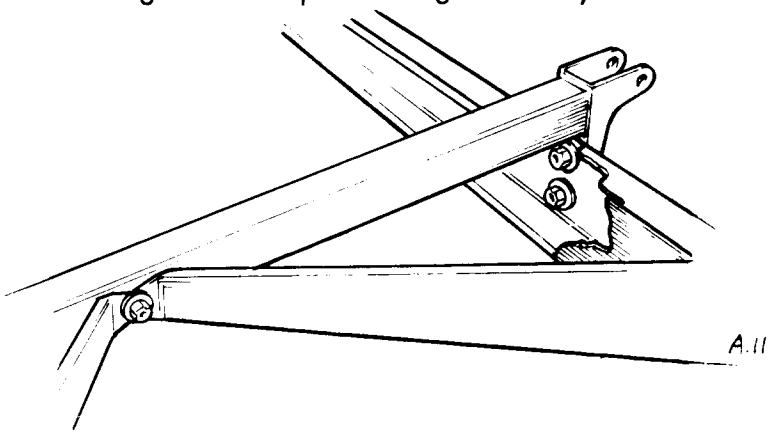


Fig. 16. CHASSIS CROSS MEMBERS

To Replace

1. Heat the new ring gear evenly, to a temperature NOT EXCEEDING 600°F.(316°C.). Do NOT heat beyond this point otherwise the wear resistance properties of the gear will be destroyed. Fit the gear to the flywheel with the chamfers on the leading faces of the teeth relative to the normal direction of rotation. Allow the ring gear to cool naturally in the air. DO NOT QUENCH.

2. Locate the flywheel squarely upon the crankshaft flange, insert the securing bolts and tighten to the torque loading given in 'TECHNICAL DATA'.

3. Check the flywheel run-out using a proprietary dial guage. The total run-out should NOT EXCEED the dimension given in 'TECHNICAL DATA'.

4. Refit the clutch assembly, centralising the driven plate with a dummy gearbox mainshaft. Tighten the bolts to the torque loading given in 'TECHNICAL DATA'.

5. Replace transmission and chassis cross members.

E. 26. - CRANKSHAFT REAR OIL SEAL

To Remove

1. Remove the transmission (Section 'E.25').
2. Remove the flywheel (Section 'E.25') and the oil sump (Section 'E.16').
3. Extract the retaining bolts and remove the rear oil seal carrier from its location on the cylinder block.
4. Using an extractor, remove the oil seal from its carrier.

To Replace

1. Fit a new oil seal to the oil seal carrier.
2. Locate a new gasket on the rear oil seal carrier using a suitable jointing compound, insert the retaining bolts, and locate carrier squarely on the cylinder block before tightening to the torque loading given in 'TECHNICAL DATA'.
3. Refit the flywheel and the oil sump.
4. Refit the transmission.

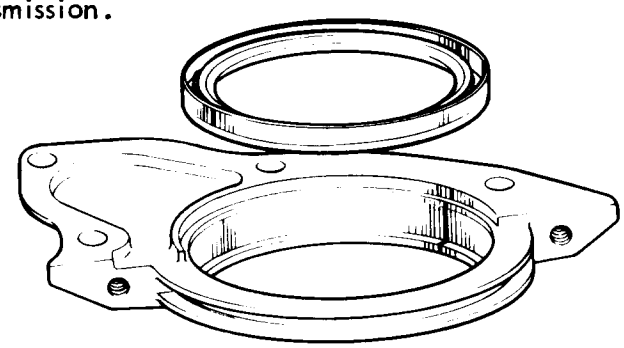


Fig. 17 REAR OIL SEAL AND HOUSING

E.27. - CLUTCH SPIGOT BEARING

To Remove

1. Remove the flywheel (Section 'E.25').
2. With the aid of Special Tool 'CP.7600/7', remove the spigot bearing.

To Replace

1. Replace the bearing squarely into the end of the crankshaft by means of a clutch plate centralising tool 'P.7137'.

   NOTE: The bearing is pre-packed with grease and requires no further lubrication.

E.28. - ENGINE MOUNTING BRACKETS

To Remove

1. Chock the front wheels, jack up the rear of the car and support with chassis stands.
2. Support the engine with a screw-type jack.
3. Remove the right-hand bracket (4 setscrews to cylinder block and 2 bolts with nuts to the mounting on chassis) and replace with a new bracket.
4. It is recommended that the setscrews retaining bracket to the engine, be deleted and studs (Part No. A074 E 0490Z), washers (Part No. A05W 1007) and nyloc nuts (Part No. A074 E 6016Z), used in their place. Use Loctite 'Studlock' on the thread of the studs into the cylinder block. Torque load the nyloc nuts to 2.49 kg.m. (18 lbs.ft.).
5. Repeat operations '3' and '4' for the left-hand bracket.
6. Remove jack from beneath engine, raise rear of car, remove chassis stands and lower car to floor.

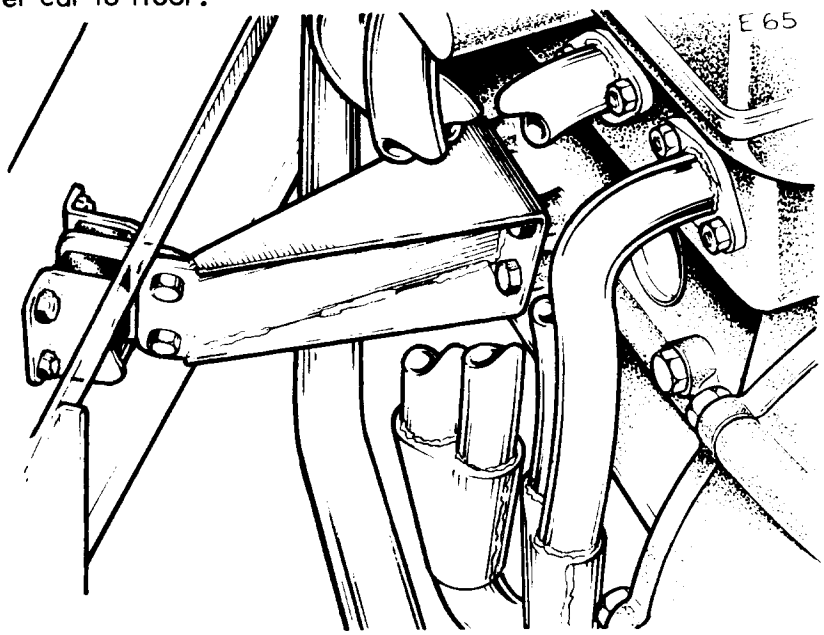


Fig. 18. ENGINE MOUNTING BRACKET

E.29. - ENGINE ASSEMBLY

To Remove

1. Remove the engine compartment lid.
2. Disconnect the battery.
3. Drain the cooling system by releasing the bottom hose from the radiator.

Remove the hose from the water pump on the front timing cover and the hose from the thermostat housing.

4. Drain the transmission casing.

5. Disconnect the air trunking from the air cleaner and remove rear luggage carrier.

6. Disconnent the following connections from their attachments on the engine:-

   a. Water temperature feed

   b. Oil pressure pipe

   c. Alternator feed cables (see Section 'M')

   d. Exhaust manifold (see Section 'S')

   e. Heater hoses

   f. Ignition, distributor and coil cables

   g. Starter motor cable

   h. Choke, throttle and clutch cables

7. Remove the starter motor. Remove fuel feed pipes from fuel pump.

8. Remove the drive shafts (see Section 'D').

9. Disconnect the gearshift linkage (see Section 'F'). Disconnect the reverse lamp switch cable.

10. Release the bolts securing the upper end of the rear dampers to the chassis cross-member. Remove the bolts securing the forward ends of the diagonal cross-brace to the chassis and the centre bolt securing the brace to the cross-member and remove the brace. Release the bolts securing the cross-member to the chassis and remove cross member.

11. Fit a sling and support the engine/transmission unit (power unit) on suitable lifting tackle.

12. Remove the engine mounting brackets and lift power unit up and out of engine compartment.

To Replace

Replacement is a reversal of the removal proceedure, but the following points should be observed:-

a. Ensure earthing strap is fitted beneath engine mounting.

b. Check the gearshift linkage.

c. Re-adjust the clutch cable.

d. Bleed the cooling system after refilling.

e. Fill the engine sump and the transmission with their recommended oils.

f. Reconnect the battery, start engine and check for leaks. Check and re-adjust ignition timing and the carburetters slow running.

g. Refit the engine compartment lid.

E.30. - FRONT (TIMING) COVER AND/OR WATER PUMP

To Remove

1. Remove the engine assembly (Section 'E.29').
2. Remove the cylinder head (Section 'E.10'), water pump pulley and belt (Section 'E.21'), crankshaft pulley (Section -E.20'), sump (Section 'E.16') and the timing chain tensioner (Section 'E.6').
3. Remove the front cover by extracting all the forward facing bolts, of which there are eleven.
4. Remove the crankshaft oil slinger by pulling off from the end of the crankshaft.
5. Disconnect the timing chain taking care NOT to rotate the camshafts, or the crankshaft, thus altering the timing.
6. Remove the jackshaft (auxiliary shaft) sprocket.
7. Remove the front cover backplate with its gasket by extracting the single retaining setscrew immediately below the water pump aperture.
8. Remove the water pump from the front cover by extracting the pump bearing retaining clip from the slot in the housing.

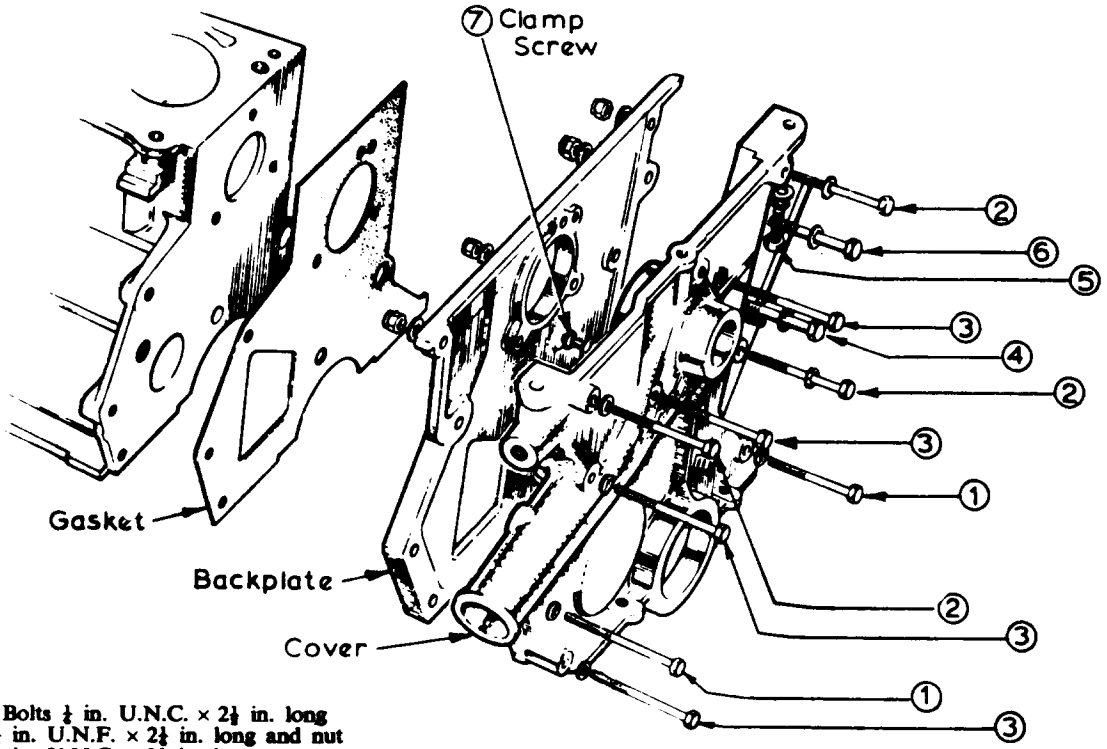
To Dismantle the Water Pump

1. Remove the pump pulley hub from the shaft.
2. Press the impeller, seal, slinger, shaft and bearing assembly out of the housing using a suitable press. Press the impeller off the end of the shaft.

3. Remove the pump seal from the shaft.

4. Carefully split the slinger bush to detach it from the shaft.

5. Remove the insert, with its 'O' rings from the front cover.



1. Dowel Bolts ¼ in. U.N.C. × 2½ in. long
2. Bolt ¼ in. U.N.F. × 2½ in. long and nut
3. Bolt ¼ in. U.N.C. × 2½ in. long
4. Bolt 5/16 in. U.N.C. × 2¾ in. long
5. Bolt 5/16 in. U.N.C. × 1 in. long
6. Bolt ¼ in U.N.C. × 3½ in. long
7. Bolt 5/16 in. U.N.C. × 1¼ in. long
8. Bolt 5/16 in. U.N.F. × 1¾ in. long and nut

Fig. 19. TIMING CHEST BOLTS

To Rebuild the Water Pump

1. Using a new shaft and bearing assembly, press into the housing until the groove in the bearing is in line with the slot in the housing. Fit new clip to retain.

2. Press the pump pulley hub on to the front end of the shaft until the end of the shaft is flush with the outer face of the hub. Fit new slinger bush (flanged end first) on the rear end of the shaft until the flanged end is from 3.17 to 5.08 mm. (.125 to .200 in.) from the end of the bearing. Fit the new pump seal on the slinger bush with the carbon thrust face towards the impeller. Press into housing.

3. Fit new 'O' rings to insert and fit insert to front cover.

4. Press impeller on to the shaft ensuring that the vanes are NOT damaged. With the impeller correctly fitted there should be between .51 to .76mm. (.020 to .030 in.) clearance between the impeller vanes and the housing.

To Replace

1. The backplate is fitted with a DRY paper gasket to the cylinder block and retained by the single clamp screw ('7' of Fig.19). BEFORE tightening, assemble front cover to the backplate, locating both the water pump insert in the cover and the oil seal on the crankshaft. Move timing cover as an assembly including the backplate and its gasket, to ensure a maximum step between oil sump face on timing cover and cylinder block oil sump face and also between top faces of timing cover and backplate. This stap should not exceed .25 mm.(,010 in.).
2. Remove timing cover, taking care NOT to move the backplate and its gasket and tighten clamp screw to the torque loading given in 'TECHNICAL DATA'.
3. Refit timing chain and crankshaft oil slinger.
4. Apply jointing compound (Part No. A036 E 6027) to the cover joint faces and fit the cover. It is important that the cover is correctly aligned and that the bolts are fitted to their correct locations (see Fig. 19). Tighten the bolts to the specified torque loadings given in 'TECHNICAL DATA'.
5. Refit timing chain tensioner, sump, crankshaft pulley and water pump pulley and belt.
6. Apply jointing compound (Part No. A036 E 6027) to a new gasket between timing cover and cylinder head. Replace cylinder head.
7. Replace engine assembly.

E.31. - CRANKSHAFT SPROCKET

To Remove

1. Remove the engine transmission assembly from the car (Section 'E.29') and mount on a suitable stand.
2. Remove the front cover (Section 'E.30').
3. Using a suitable extractor, pull off the crankshaft sprocket.

To Replace

1. Using a new key, press the sprocket on to the crankshaft ensuring that the slot is lined up with the key, and that the long boss os towards the main bearing journal.
2. Refit the front cover.
3. Refit the engine/transmission assembly into the car.

E.32. - CRANKSHAFT

To Remove

1. Remove the engine/transmission assembly from the car (Section 'E.29). Remove transmission from engine and mount engine on a suitable stand.
2. Remove the camshafts cover (Section 'E.5').
3. Set the valve timing marks in the timed position (Section 'E.8') then remove the crankshaft pulley (Section 'E.20').
4. Remove the front cover (Section 'E.30'), crankshaft sprocket, (Section 'E. 31'), flywheel (Section 'E.25'), oil sump (Section 'E.16'), release the timing chain tensioner (Section 'E.6'), disconnect the timing chain (Section 'E.8'), and remove the rear oil seal carrier (Section 'E.26').
5. Unscrew the connecting rod bearing cap bolts (the big-ends) two or three turns, and tap them to release the caps. Completely remove the bolts and release the caps. Push the pistons up into the cylinder bores.
6. Remove the main bearing cap bolts evenly and lift off each cap. Lift out the crankshaft and remove the bearing liners and thrust washers.
7. If the reground crankshaft is being fitted, it is important that the existing fillet radius between journals and webs MUST be maintained. These measurements are:-

   Crankpin journals .070/.084 in. (1.77/2.13 mm.)

   Main bearing journals .080/.094 in. (2.03/2.38 mm.)

   Centre main bearing journal - see Fig. 20 .

To Replace

1. Fit the clutch spigot bearing into the crankshaft (Section 'E.27').
2. Using the new key, fit the crankshaft sprocket,

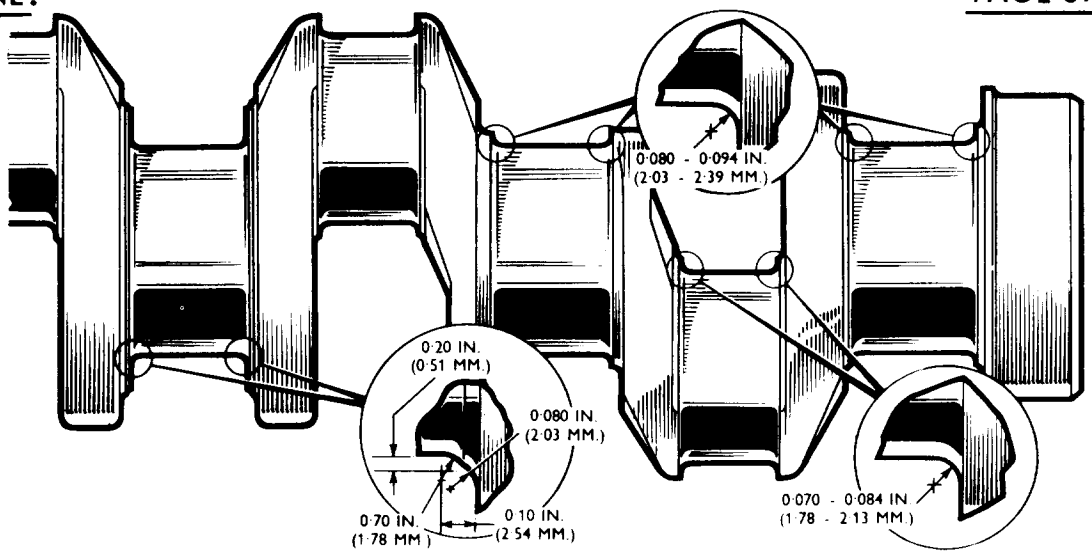


Fig. 20. CRANKSHAFT FILLET RADII - REGRINDING

3. Fit the new main bearing liners and replace crankshaft. Fit new crankshaft thrust washers with the oil grooves towards the crankshaft flange. Refit the main bearing caps (Section 'E.17'). This should be as given in 'TECHNICAL DATA'.

4. Using new bearing liners, refit the connecting rods to the crankshaft (Section 'E').

5. Refit the rear oil seal carrier, reconnect the timing chain and re-adjust the tension, refit the oil slinger, flywheel, front cover, crankshaft pulley, and oil sump.

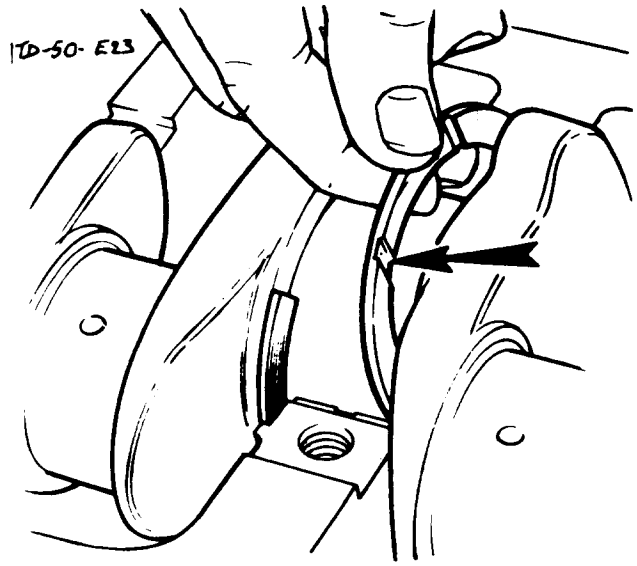


Fig. 21. FITTING THRUST WASHERS

E.33. - JACKSHAFT (AUXILIARY SHAFT)

1. Remove the engine/transmission assembly from the car (Section 'E.29'). Remove transmission from the engine and mount on a suitable stand.
2. Remove the cylinder head (Section 'E10") and front cover (Section 'E.30').
3. Remove the jackshaft sprocket and the jackshaft thrust plate. Withdraw the jackshaft.
4. If it is desired to renew the jackshaft bearing bushes, then the use of a Special Tool (Section 'E.37') for their removal and replacement, is essential.

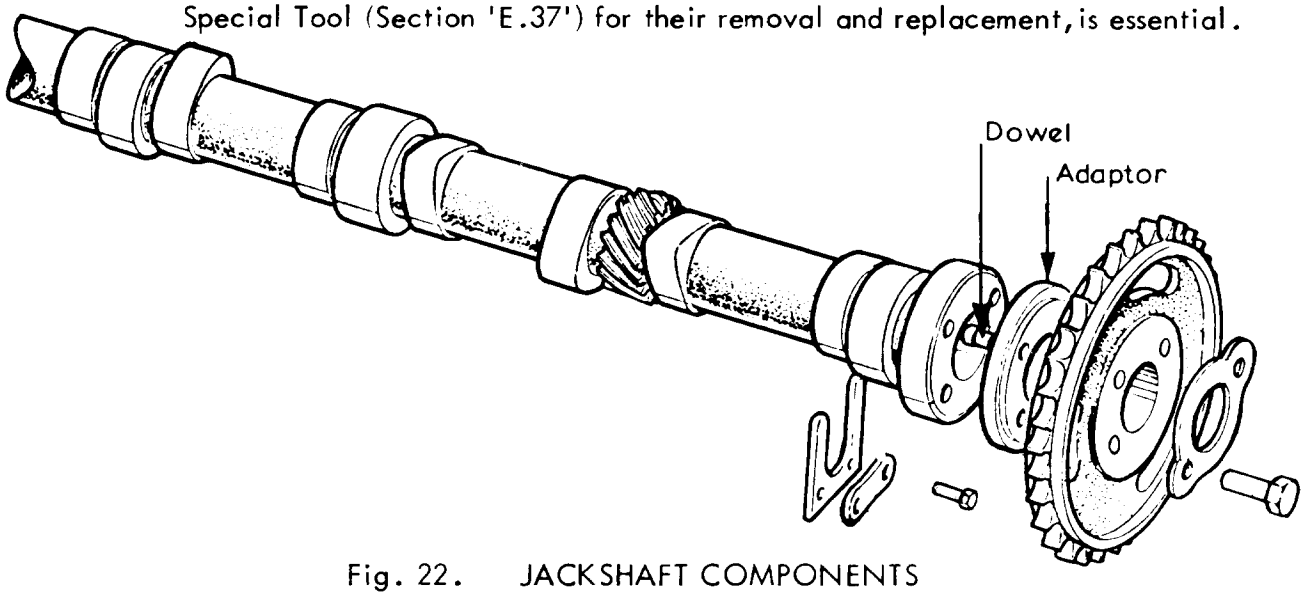


Fig. 22. JACKSHAFT COMPONENTS

To Replace

1. BEFORE fitting new brushes, check that all oilways in the cylinder block are clear. Apply a sealing compound to the oil gallery plugs, proir to refitting.
2. Using the Special Tools (Section 'E.37'), fit new jackshaft bushes, ensuring that the oil holes in bushes and cylinder block are alighned. The splits in the bushes should be upwards and outwards at 45^{o} to the vertical.
3. Fit a new dowel to the new jackshaft and slide the shaft into position. Using a new locking plate under the heads of the setscrews, fit the thrust plate in its groove on the jackshaft. Tighten securing bolts to the torque loading given in 'TECHNICAL DATA'. Check the shaft end-float (see 'TECHNICAL DATA'.
4. Replace the jackshaft sprocket, the front cover and the cylinder head.

5. Refit transmission to engine and replace engine/transmission assembly into car.

E.34. - CYLINDER BLOCK

To Remove

1. Remove the engine/transmission from the car (Section 'E.29'). Remove transmission from engine and mount engine on a suitable stand.
2. Completely strip all components from the engine following the procedures given in the previous chapters.
3. Remove the oil pump filter gauze, oil pump inlet tube and oil return pipe.
4. Remove the cylinder block from the stand.

To Replace

1. Mount the new cylinder block on the stand.
2. Fit the oil pump inlet tube and oil return pipe. Press the pipe fully home to the full depth of the counter-bored hole. Measured along the length of the pipe to the flange of the cylinder block this should read 16.5 cm. (6.5 in.). Fit the filter gauze to the oil inlet tube.
3. Rebuild the remainder of the engine by referring to the previous chapters.
4. Rebuild the remainder of the engine and replace engine/ transmission assembly into car.

E.35. - REBORING

When reboring the cylinder block to suit oversize pistons, each bore is machined to the actual diameter of the piston to be fitted, plus the specified clearance in the bore. Maximum recommended oversize bore is PLUS (+).380 mm. (.015 in.).

To Remove

1. Remove the engine from car (Section 'E.29') mount on a suitable stand and completely strip off all components by following procedures given in previous chapters.

To Rebore

1. Rebore cylinder block using proprietary boring equipment and adhering to the manufacturers instructions.

To Replace

1. Rebuild engine and refit into the car by referring to the previous chapters.

E.36. - RUST INHIBITORS

Engines destined for certain markets are now treated with rust inhibitors as follows:-

Internally

The inhibitor, which is Esso 'Rust Ban' 603 (Part No. A036 K 6024), is inserted through the sparking plug holes, the engine then being rotated by hand to ensure the inhibitor is fully dispersed.

Externally

Esso 'Rust Ban' 394 (Part No. A036 K 6024), is applied to all bare ferrous metal surfaces, including the flywheel. When fitting a clutch assembly, therefore, ensure that the flywheel is clean and dry.

Note: When the engine is first started, the rust inhibitors both internally and externally, will be burnt. This process will cause some amount of smoke to issue from the exhaust system (internal application) and from the engine compartment (external application).

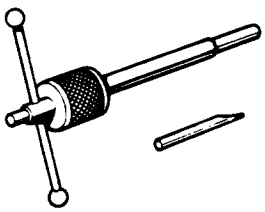
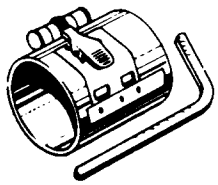
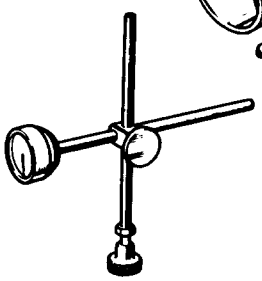
This smoking is quite normal and will disperse as the engine is used more and gets warmer.

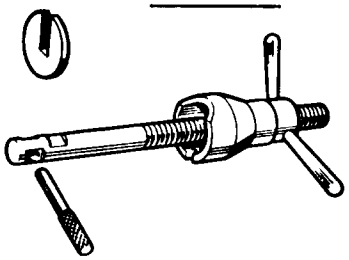
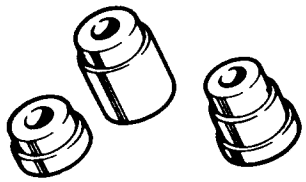
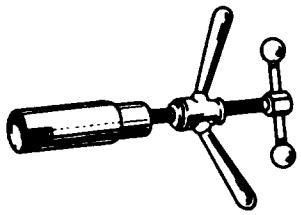
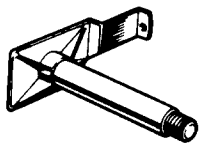
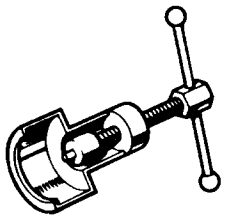
E.37. - SPECIAL TOOLS

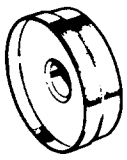
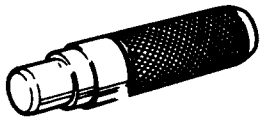
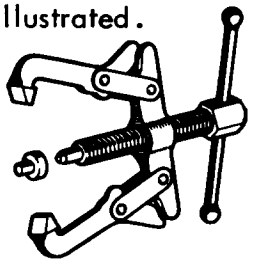
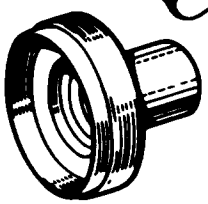
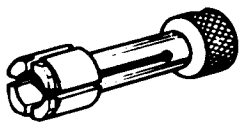
The foregoing sections have all been written without the mention of Special Tools, except in the case of the jackshaft bearing bushes, where the need for Special Tools is essential for their correct removal and replacement.

If much engine repair work is to be undertaken, it will be found more expedient to use some, if not all , the Special Tools from the following list. These tools have been developed in conjunction with Ford Motor Company Limited and V.L. Churchill Limited from whom they are available. Their address is:-

V.L.Churchill & Co. Ltd.,
London Road, Daventry,
Northamptonshire, England.

200A or B	Engine stand	Not illustrated.
316X	Valve seat cutter holder	
316-10	Valve seat cutter pilot	
317-25	Valve seat cutter	
38/U.3	Piston ring compressor	
P.4008	Dial gauge	

P.6031	Camshaft bearing bush remover/replacer	
P.6031-3	Camshaft bearing remover/ replacer adaptors	
P.6032	Crankshaft sprocket replacer	
P.6054	Valve guide remover/replacer	Not illustrated.
P.6107	Adaptor for engine stand	
P.6110	Main bearing liner remover/replacer	
P.6116	Crankshaft sprocket remover	
P.6150	Crankshaft front cover oil seal aligner	
P.6161	Crankshaft front cover oil seal remover/replacer	

P.6165	Crankshaft rear oil seal remover/replacer	
P.7137	Clutch plate centraliser	
P.8000-4B	Water pump overhaul kit	Not illustrated.
P.8000-8A	Slave ring (use with P.8000-4B)	Not illustrated.
PT. 4063A	Cylinder head gasket locating studs	Not illustrated.
CP.6041	Crankshaft pulley remover	
CP.6147	Crankshaft rear oil seal aligner	
CP.7600/7	Needle roller spigot bearing (clutch) remover	
PT.0020	Camshaft (inlet) oil seal replacer	Not Illustrated.

SECTION F.

TRANSMISSION.

TRANSMISSION.

TYPE 336 GEARBOX.

The Type 336 Gearbox was used from the introduction of the Europa Twin Cam until the Type 352 Gearbox was introduced. With the exception of the gear change linkage, described and illustrated here, the information printed in Section 'F' of the Europa Workshop Manual is relevant and should be referred to.

GEARBOX IDENTIFICATION.

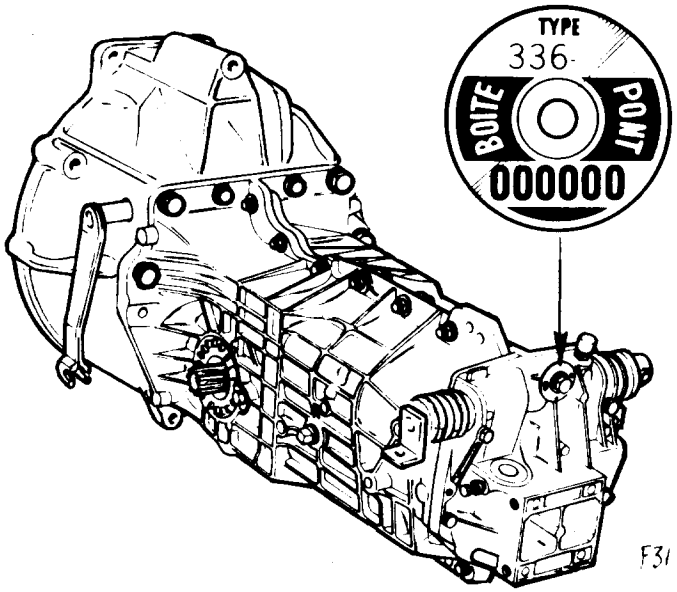


Fig. 1.

The general appearance of the Type 336 Gearbox is as seen in Fig. 1. with an identification tag as shown.

GEAR LINKAGE.

The gears are selected by moving the gear lever to the positions shown in Fig. 2.

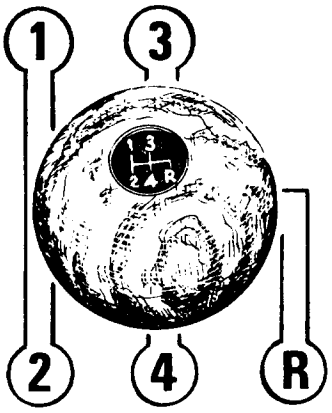


Fig. 2.

The linkage between the gear lever and the gearbox is as shown in Fig. 3. The dimensions shown between centres of the ball joints on the relay lever and the link tube must be strictly adhered to during the initial setting up of the linkage.

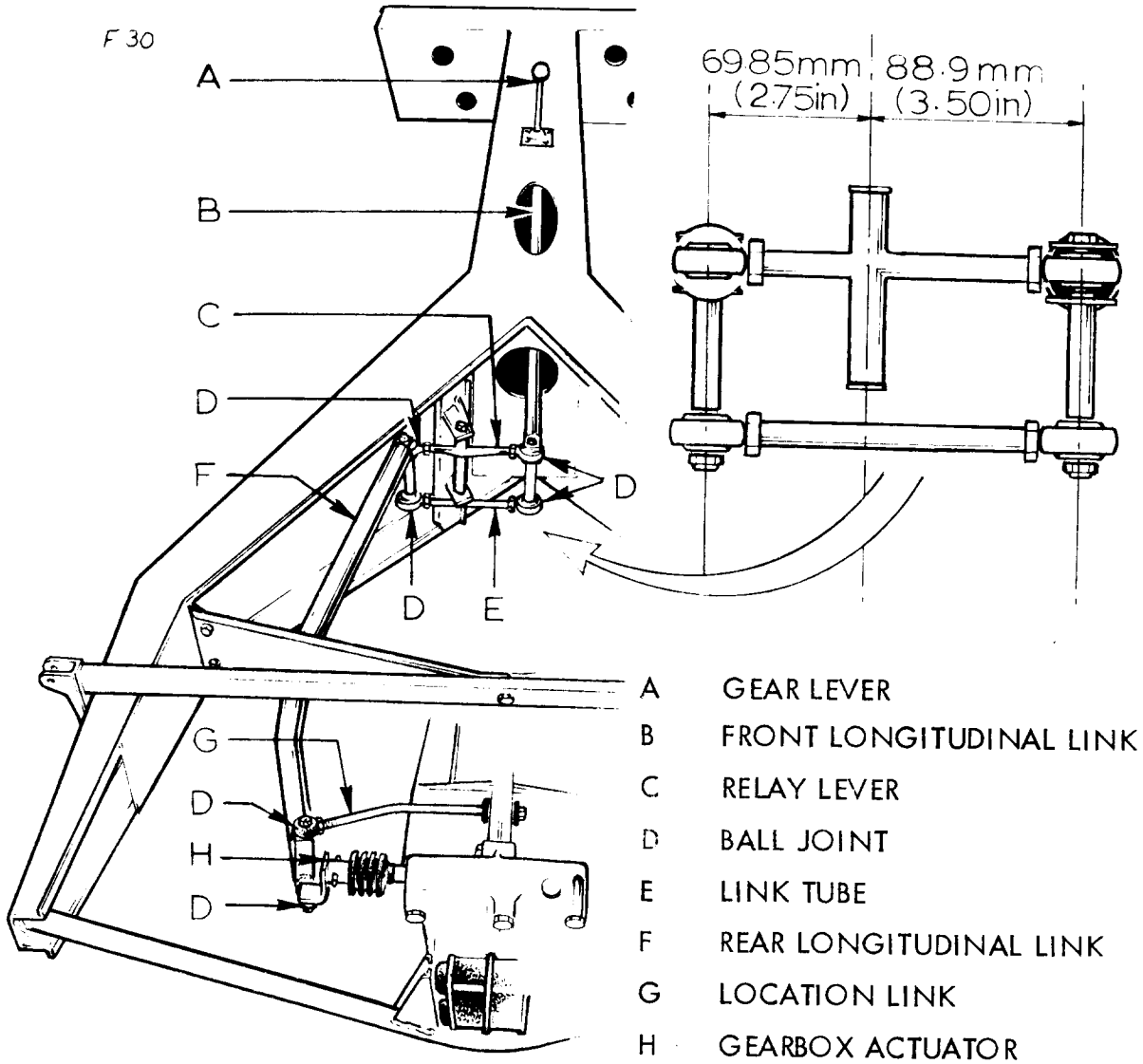


Fig. 30. Gear Change Linkage.

To Detach Linkage From Gearbox.

Remove the bolt, the two washers, and the two rubber bushes, which hold the location link 'G' to the gearbox central web.

Remove the nylon nut, the bolt, and the two spacing washers, which hold the rearmost ball joint to the gearbox actuator 'H'.

Replace in the reverse order. Ensure that a metal washer and rubber bush are either side of the gearbox web before screwing bolt into location link 'G', and that a spacing washer is fitted to either side of the ball joint on refitting the bolt and nyloc nut.

GEAR LEVER ADJUSTMENT.

Following replacement of the linkage to the gearbox it may be necessary to adjust the gear lever to the vertical position.

This may be done as shown in Fig. 4. by screwing the rearmost ball joint in or out of the rear tube at 'B' to adjust the fore and aft position of the gear lever, and adjusting the lateral position of the lever by means of the ball joint in the location link at 'A'.

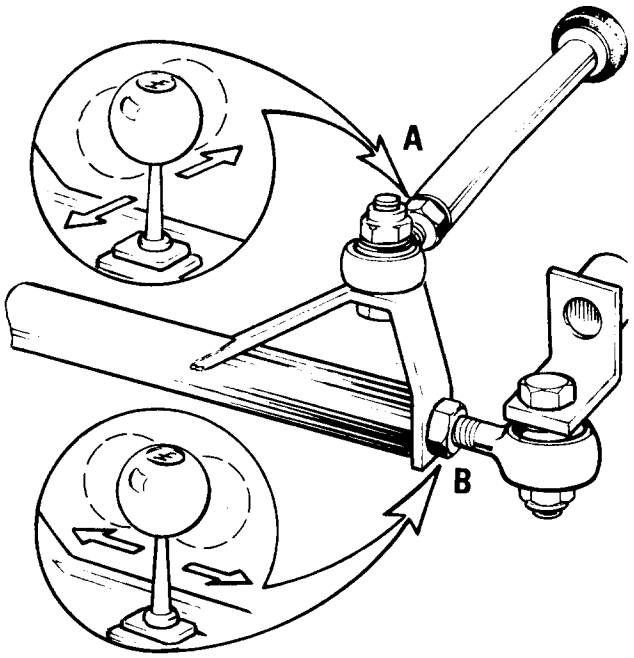


Fig. 4.

REAR TUBE CLEARANCE.

In certain circumstances the rear longitudinal link may clash with the exhaust system when in 1st and 2nd gear position. The clearance at the closest point should be adjusted as shown in Fig. 5. to 4.8 mm (0.19 in.) by screwing out the ball joints on the link tube at 'A' and 'B'.

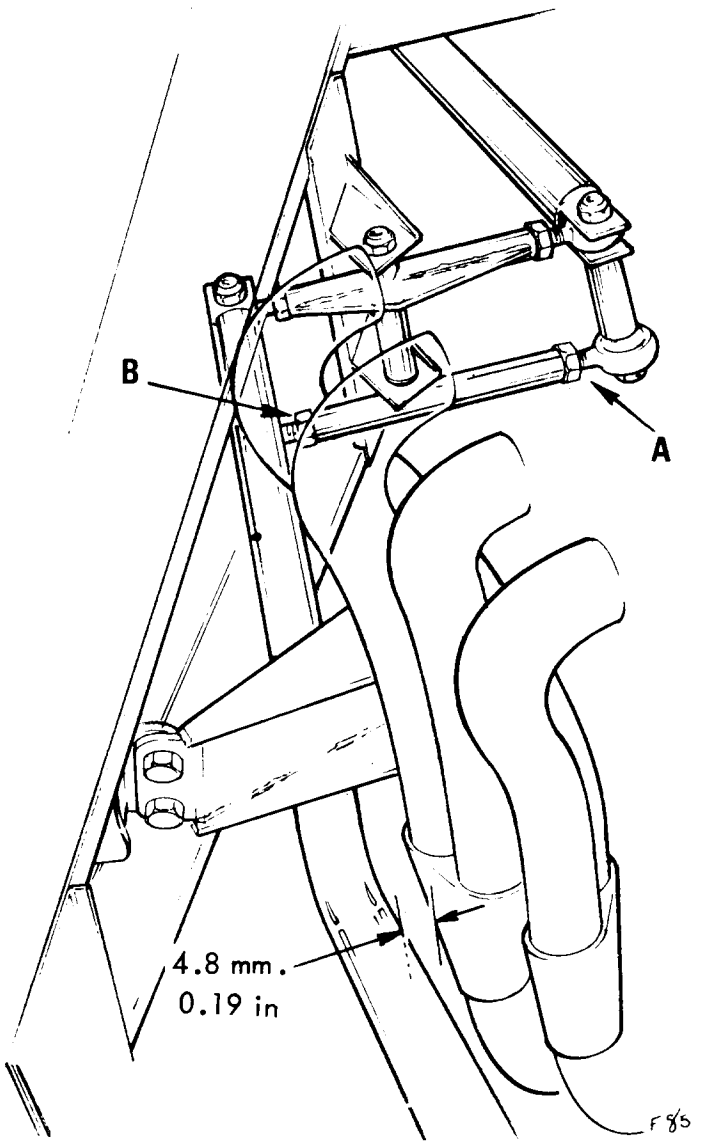


Fig. 5.

TYPE 352 GEARBOX.

The Type 352 Gearbox was introduced at the following Chassis No.:-

72031444P - U.K.

72031020Q - Export

72022150R - North America

All the following information is relevant to this gearbox. Previous information, both in this supplement and the Workshop Manual, relates to the 336 type of gearbox.

GEARBOX IDENTIFICATION.

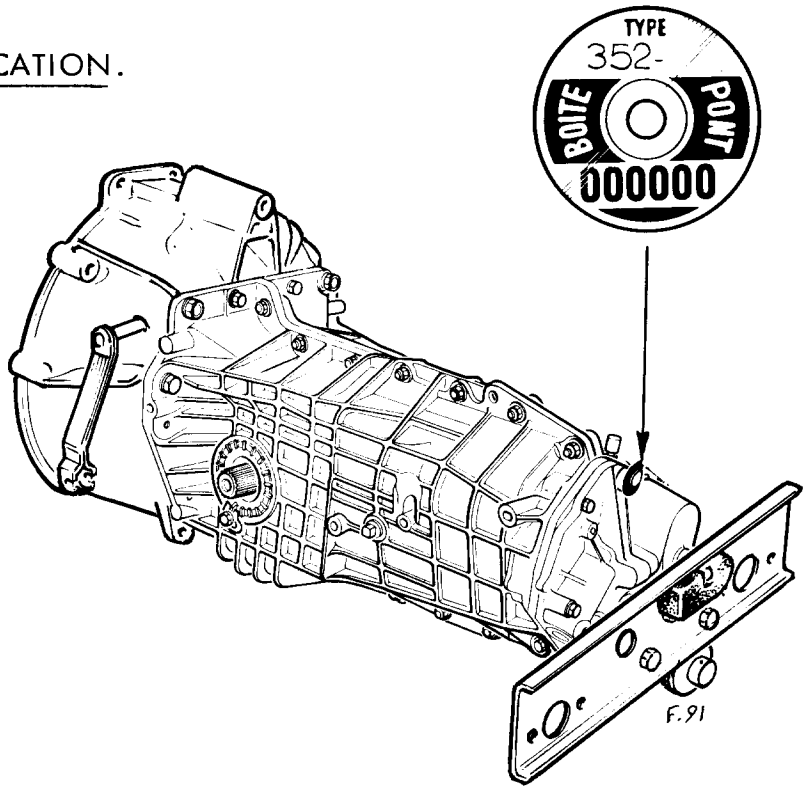
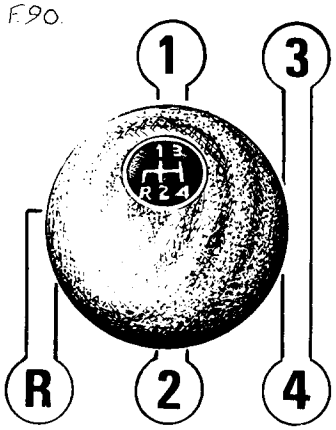


Fig.1.

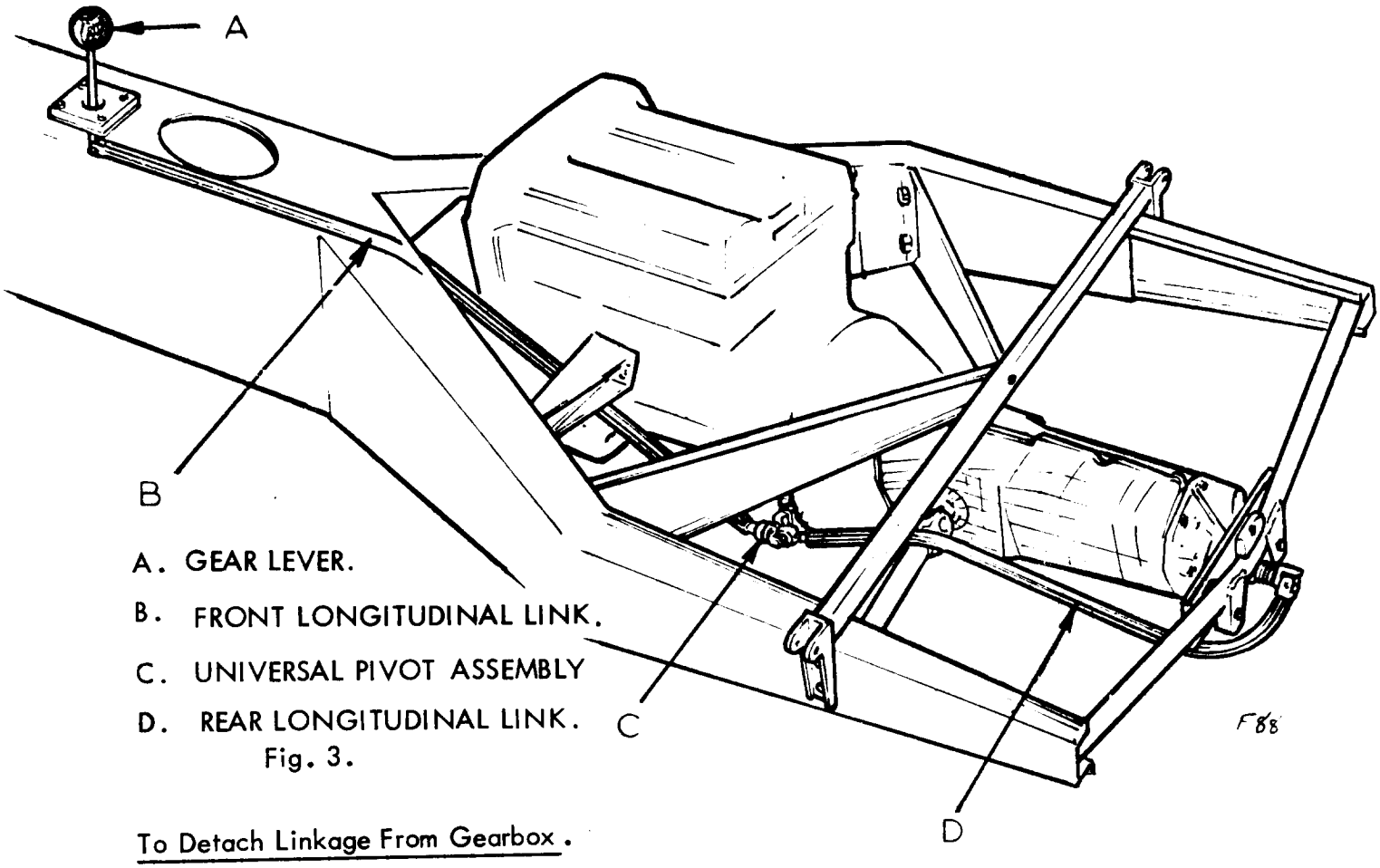
The general appearance of the Type 352 Gearbox is as seen in Fig. 1., with an identification tag as shown.

GEAR LINKAGE.

The gears are selected by moving the gear lever to the positions shown in Fig. 2.



The linkage between the gear lever and the gearbox is basically as shown in Fig.3.



A. GEAR LEVER.
B. FRONT LONGITUDINAL LINK.
C. UNIVERSAL PIVOT ASSEMBLY
D. REAR LONGITUDINAL LINK.

Fig. 3.

To Detach Linkage From Gearbox.

Select 4th gear. Knock out the pin which holds the universal joint on the rear longitudinal link to the gearbox selector shaft. See Fig. 4. Pull the linkage from the selector shaft. Replace in the reverse order.

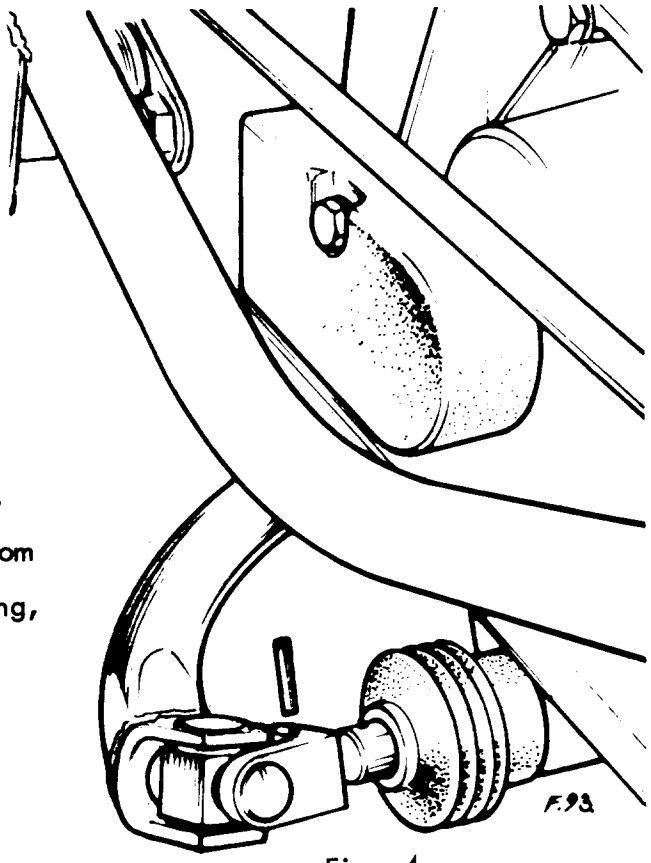


Fig. 4.

To Remove Complete Linkage.

Detach rear longitudinal link, as detailed. Remove the vertical pivot bolt from the bracket on the front of the clutch housing, freeing the universal joint assembly.

Remove the gear knob by unscrewing from gear lever, and remove the tunnel trim.

Remove the four bolts from the gear lever pivot mounting, allowing the gear lever, with the spacer and pivot, to drop into the chassis centre section.

The complete gear linkage can now be withdrawn from the rear of the car.

Replace in reverse order. Ensure that the spacer is replaced above the gear lever pivot, in the chassis centre section.

UNIVERSAL JOINT ASSEMBLY.

The central universal joint assembly is as shown in Fig. 5.

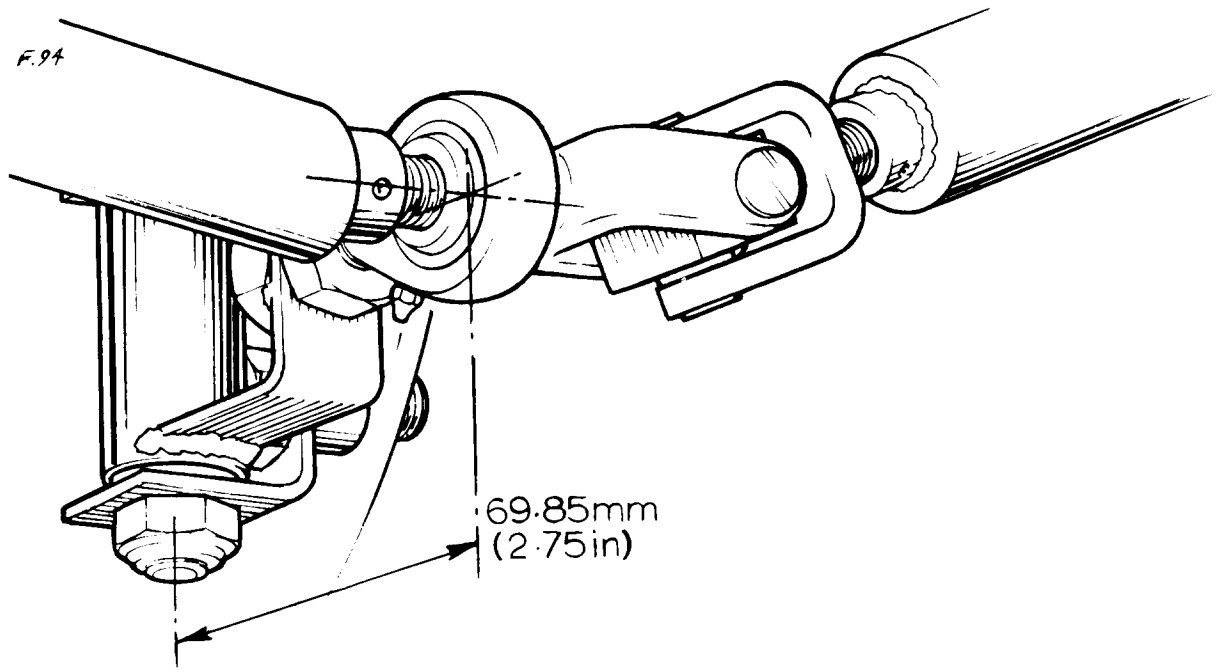


Fig. 5.

To dismantle, knock out pins from front and rear link tubes. (Remove pivot bolt from pivot bracket, on clutch housing when dismantling on car.) Heat the ends of each link tube sufficiently to unlock the 'Loctite', and turn the complete assembly in an anti-clockwise direction, (looking from the rear,) until detached from the link tubes. The front tube is threaded right hand, and the rear is left hand. The spherical joint is 'Loctited' to the universal joint, and has to be heated to be removed. Slacken the locknut and unscrew the spherical joint from the pivot. Remove the spacing bushes from top and bottom of the pivot rubber bush. Remove the bush.

NOTE: During re-assembly of the gear change linkage it is important that, where specified, LOCTITE High Strength Retaining Compound Type 35 must be used as follows:-

1. Thoroughly clean and degrease the mating faces.
2. Spray the mating faces with 'Locquic' primer, Grade 'T' and allow to dry completely.
3. Apply Loctite Type 35 liberally over the mating faces and assemble the components as described.
4. The completed assemblies must be left to cure for a minimum period of 6 hours.

REASSEMBLY.

Replace rubber bush into pivot, screw spherical bearing, with locknut into pivot, to the dimension given in Fig. 5., and tighten the locknut.

Fit the spherical joint with 'Loctite', to the front pin, (longer and R.H. thread) of the universal joint, so that the grease nipple is underneath. Clamp the joint onto the shank of the universal joint, by washers and a $\frac{1}{2}$" U.N.F. nut, until the 'Loctite' has cured. When cured remove the $\frac{1}{2}$" nut and washers.

Refit gear lever assembly, front and rear longitudinal link tubes, and the pivot bracket assembly to the car, in reverse order to removal instructions.

Apply 'Loctite' to both threads of the universal joint, and screw the complete joint assembly into both tubes, turning clockwise. If both tubes and the universal joint are being used again, align the holes and fit new 1/8" X 1" long pins. Allow the 'Loctite to cure.

If new components are being used, the coupling assembly must be screwed into the tubes to the position, (with the pivot pin in place) where the following conditions apply:-

1. The gear lever must be vertical.
2. The centre pivot assembly must be between 88° and 92° to centre line of car.
3. The universal joint on the gearbox must be set in neutral, positioned opposite the 1^{st} and 2^{nd} gears.

With the linkage set as above, drill through links and universal joint shanks to suit one eighth inch diameter pins, and fit new pins. Replace pivot pin and nyloc nut. Allow the 'Loctite' to cure before using linkage.

REVERSE INDENT MECHANISM.

To Remove

Remove the cover. A.

Remove the nyloc nut and knock out the pin from the cam. B.

Hold the ball in place against the spring pressure and remove the cam, ball and spring, and spacing washer if fitted.

Remove the indent housing from the rear cross member. C.

Replace in reverse order, 'Loctiting' and pinning the cam to the shaft, and liberally smearing the spring and ball with molybdinum disulphide grease.

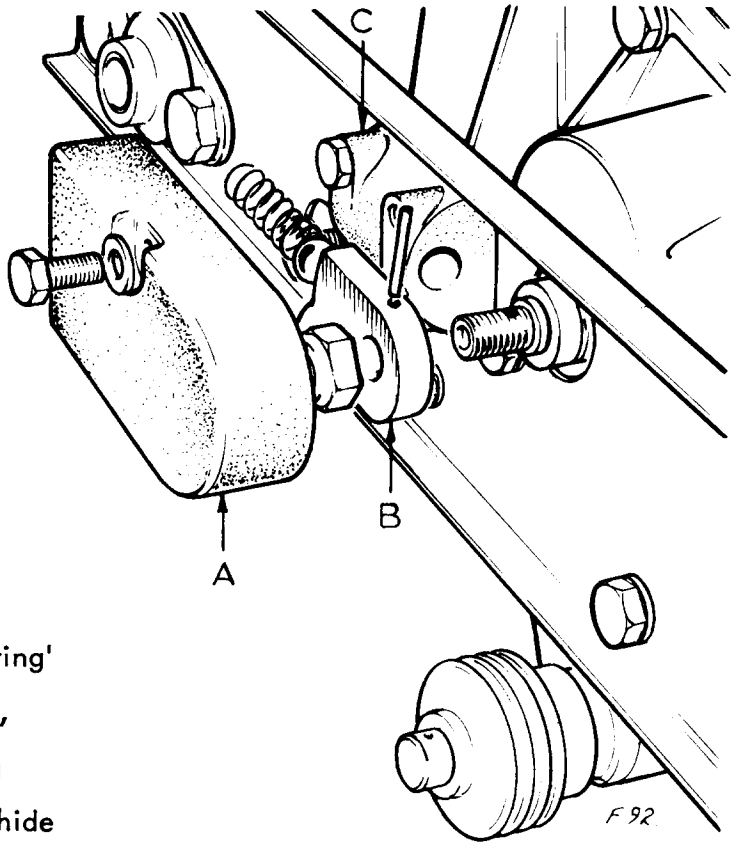


Fig. 6.

SETTING REVERSE INDENT.

If either the cam, or the gearbox shaft, need renewing at any time, the cam must be set as follows:-

Assemble the indent housing into the rear cross member and put the ball and spring into place. Put the cam onto the shaft with 'Loctite', fit the nyloc nut and tighten lightly.

Select first gear. Take up free play in system by lightly holding lever over to right hand side.

Adjust cam so that the ramp has just come into contact with the ball. Fully tighten nut.

Use the pilot hole in cam as location to drill through shaft, and fit one eighth inch pin.

Fit cover.

REMOVING AND REFITTING THE GEARBOX.

Place protective coverings on the body sides around the engine compartment. Removal of the gearbox is facilitated if the engine compartment lid is detached. Remove the two nuts and penny washers under each hinge. Remove the luggage box.

- Disconnect the leads to the alternator, slacken the belt, and remove the alternator.
- Drain the gearbox, using tool (Part No. X046 E 6167Z).
- Disconnect the speedometer drive cable at the gearbox rear housing.
- Disconnect the leads to the reversing lamp switch.

Knock out the pin holding the universal joint of the rear longitudinal link to the gear box selector shaft, and pull from selector shaft. Remove the nave plates from the rear road wheels, and slightly slacken the nuts. Chock the front road wheels. Raise the rear of the car and place a stand beneath each side of the chassis at the rear. Remove the rear road wheels. Disconnect the clutch cable from the lever at the bell housing. Remove the silencer (muffler) assembly.

Remove the bolts securing the silencer (muffler) mounting bracket to the gearbox.

Unscrew the bolts retaining the lower suspension links to the gearbox bracket, allowing the links to drop clear. Drive the roll pins from the inner universal joints on the transmission shafts by means of a drift (Part No. X046 F 6171Z). (Fig. 7.)

Free the drive shafts from the gearbox output shafts by withdrawing them outwards from their splines noting the spacers and shims fitted on the output shafts.

Remove the starter motor.

Place a jack under the rear of the gearbox.

Remove the reverse indent cover.

Remove the two bolts from the rear cross member, lower the gearbox, and remove the jack.

Remove the bolts from the clutch housing, and pull the gearbox rearwards until clear of the clutch shaft.

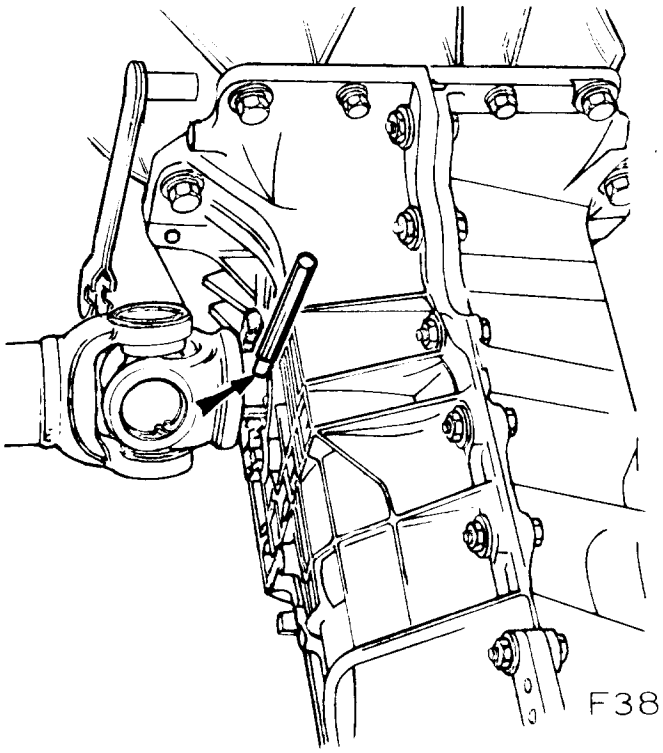


Fig. 7.

REFITTING

Carry out the removing operations in reverse, paying attention to the following points:-

1. Lightly grease the splines on the clutch shaft.
2. Grease the output shaft splines with a graphited grease.
3. Place the pin holes at the bottom of one of the splines in the transmission shaft, in line with the smaller hole on top of the output shaft splines. Note that there are two holes in the output shaft, one slightly larger than the other.
4. To make it easier to fit the transmission shaft roll pins, use the cranked end of drift. (Part No. XO46F 6171Z).

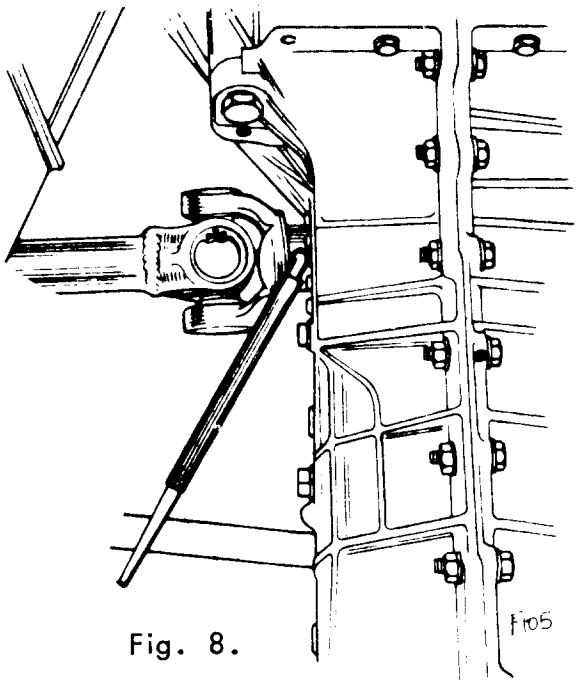


Fig. 8.

OVERHAULING THE GEARBOX

Dismantling

Secure the gearbox to bracket (Tool No. XO46F 6176Z) which is fitted to either the adjustable stand, (Tool No. XO46E 6365Z) or the bench stand.

Remove the securing bolts from inside the clutch housing and pull off the housing, complete with the clutch operating shaft.

Remove the reverse indent mechanism

Remove the cross member.

Remove the rear housing securing bolts and remove the component.

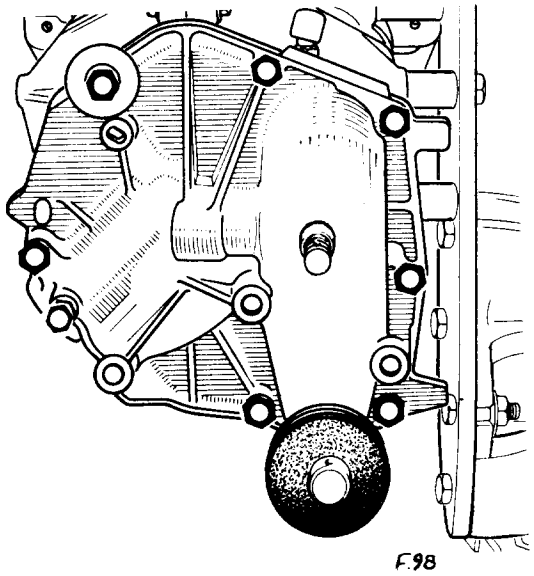


Fig. 9.

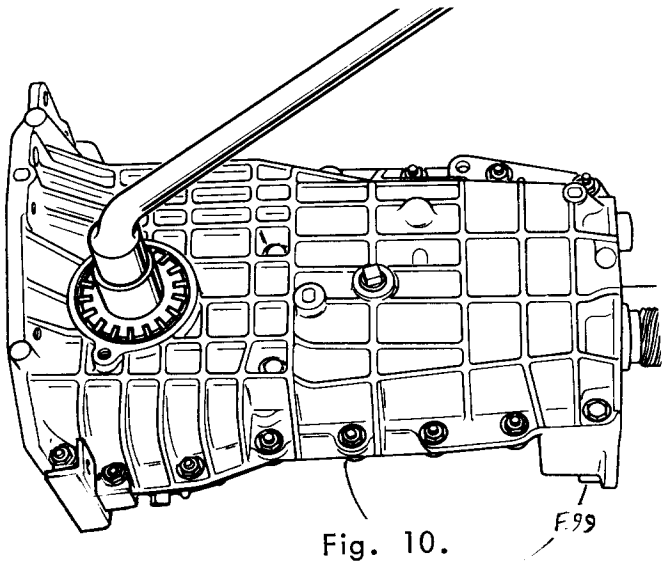


Fig. 10.

Remove the locking plates from the large differential bearing adjusting nuts and unscrew the nuts by means of Special Tool (Part No.X046 F 6179Z)

Remove the bolts which clamp the two halves of the gearbox housing together.

Remove the suspension bracket, and separate the half housing.

Push out the differential bearing outer race from each half housing by means of a suitable tube. Remove the spacer and the adjusting shims from the primary

shaft bearings. Remove the differential. Remove the secondary gear cluster and the stud which locks the outer track ring on the double roller bearing.
Remove the primary shaft.

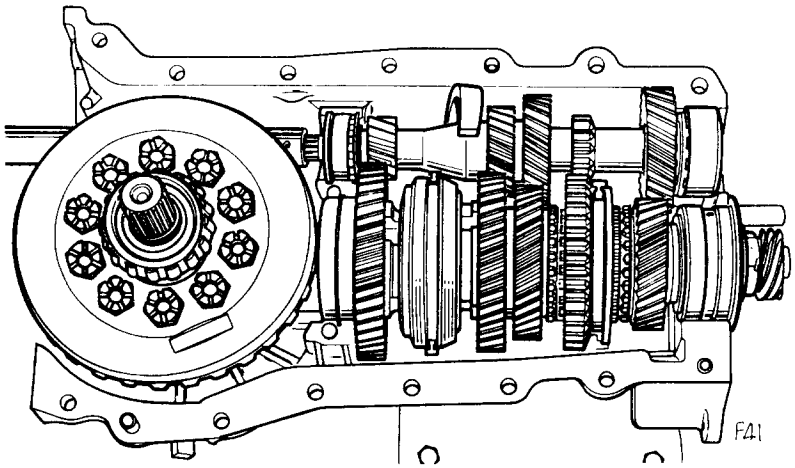


Fig. 11.

Gearshift Control.

Tap out the roll pin from the 3rd-4th shift fork by means of drift.(Part No. AO46F 6180Z)
Remove the shaft, fork, locking ball and spring.
Remove the locking disc shown arrowed, from between the two shafts.

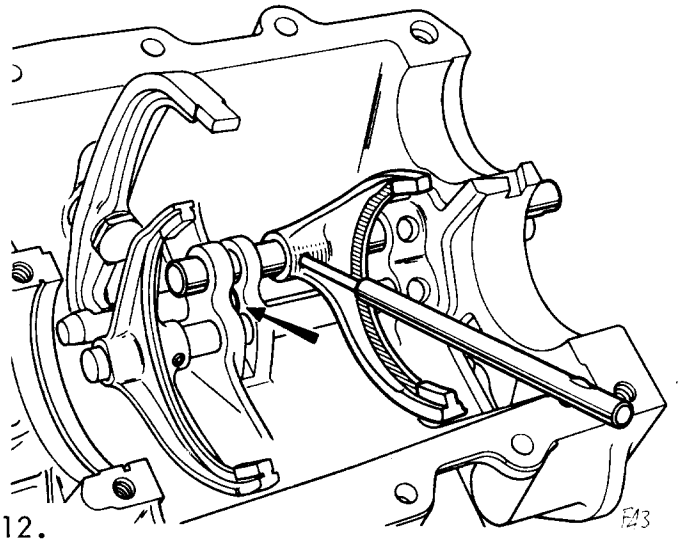


Fig. 12.

Engage first gear.
Pull back the reverse shaft as far as possible towards the rear end.
Tap out the roll pin from the 1st-2nd shaft fork, using drift.

Remove the shaft, fork, locking ball and spring.

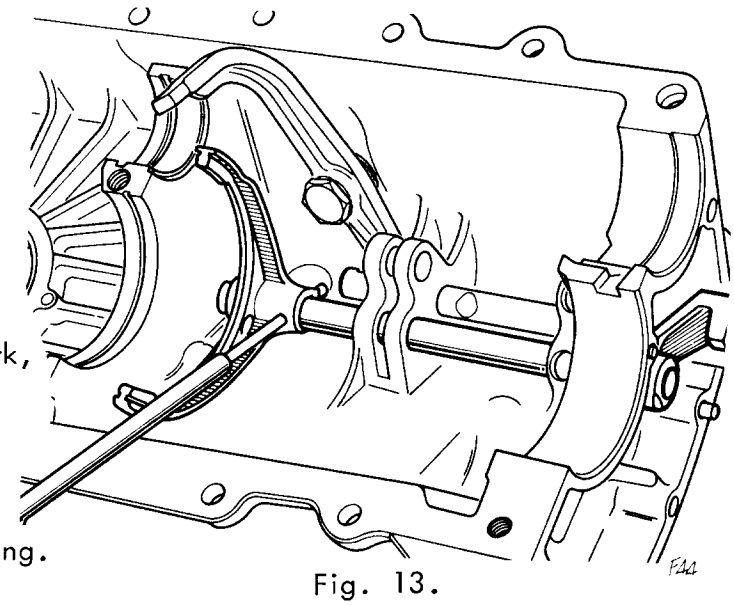


Fig. 13.

Remove the reverse selector by unscrewing the bolt, and remove the shaft.

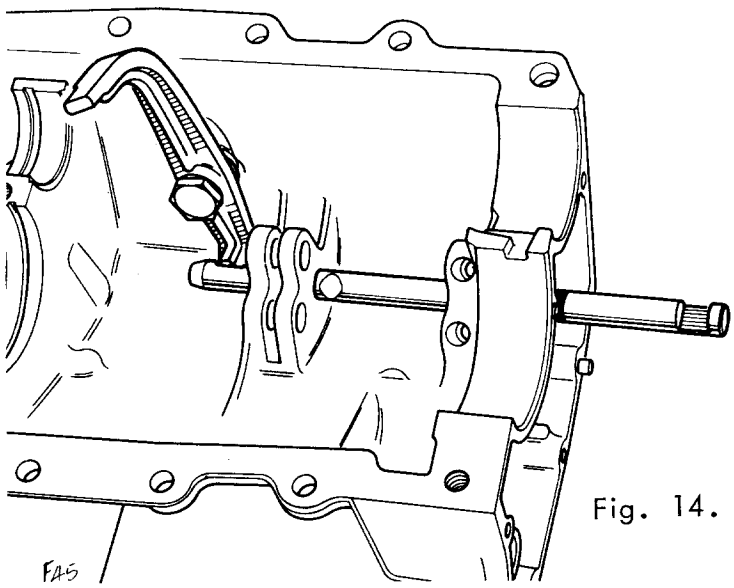


Fig. 14.

Remove retaining circlip and take out the shaft, gear wheel, friction washer, guide, locking ball, and spring.

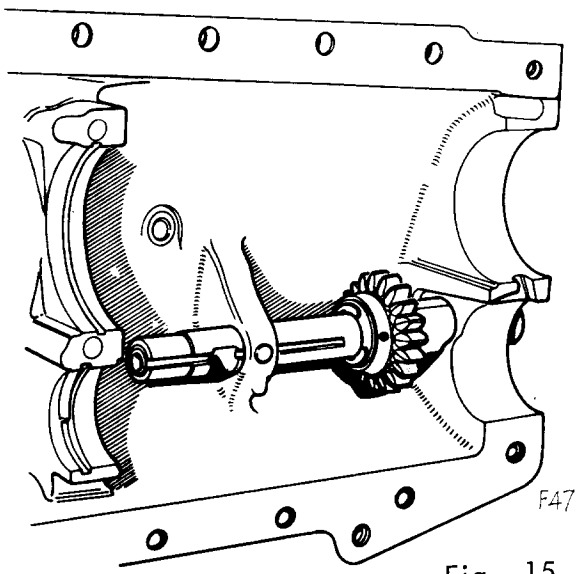


Fig. 15.

Primary Shaft

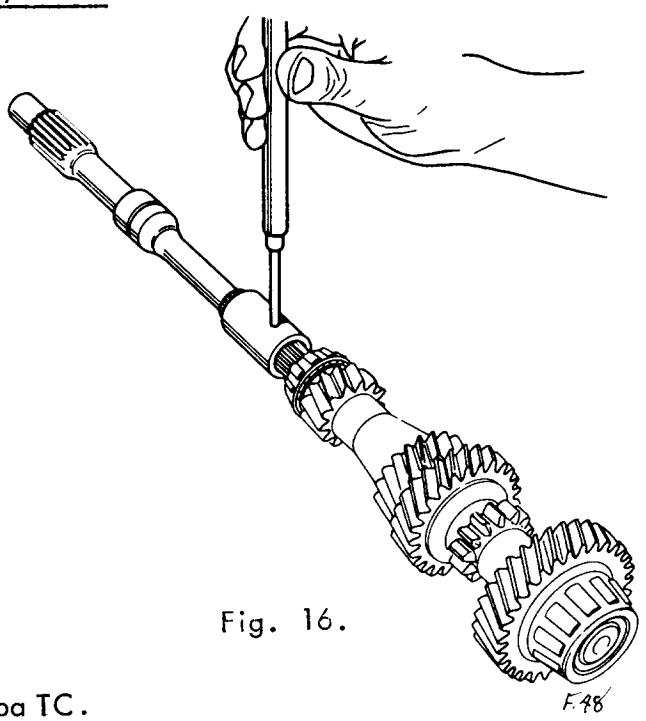


Fig. 16.

Separate the clutch shaft from the primary shaft by pushing out the roll pin by means of drift. (Part No. AO46F 6171Z)

Extract the bearing from the differential end by means of extractor, (Part No.XO46F 6168Z) fitted with shell, (Part No. XO 46F 6172Z).

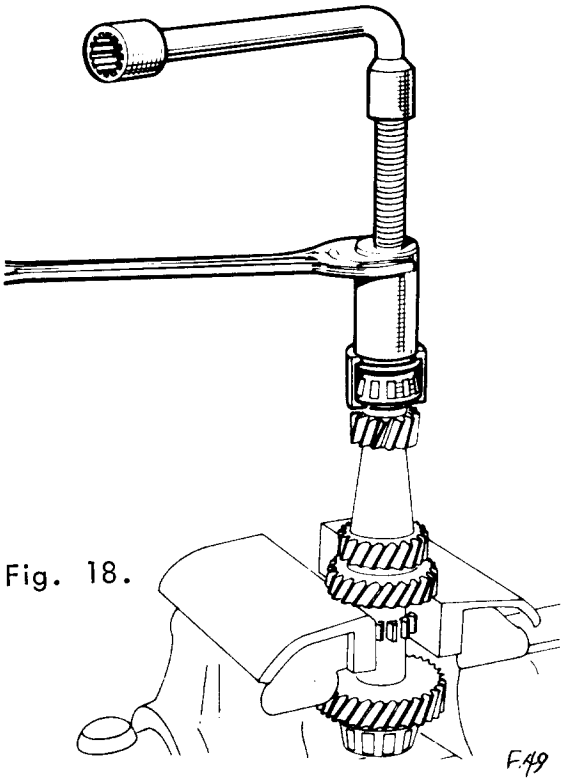


Fig. 18.

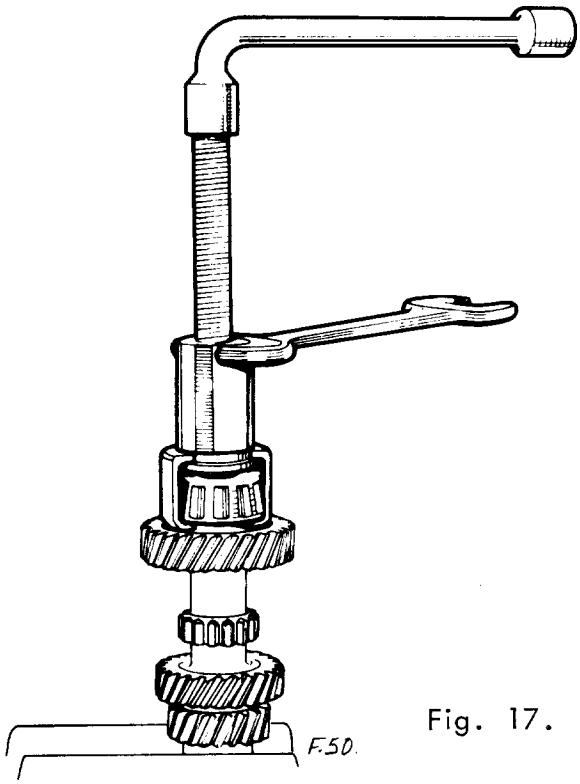


Fig. 17.

Extract the second bearing by means of the same extractor fitted with shell, (Part No. XO46F 6173Z).

Secondary Shaft.

NOTE: Before dismantling the 1st-2nd speed synchroniser hub an electric oven capable of achieving a temperature of 250°C (482°F) is necessary for reassembling.

Grip the shaft in a fibre faced vice on the first speed gear wheel. Engage 1st. gear.

Unlock the speedometer drive worm and unscrew it by means of spanner, (Part No.XO46F 6175Z).

Remove:- the double taper roller bearing.

- the pinion depth adjusting washer.
- the 4th speed gear wheel and its ring.

Mark the position of the 3rd-4th speed synchroniser sliding gear wheel relative to the hub, and remove this gear wheel and the keys.

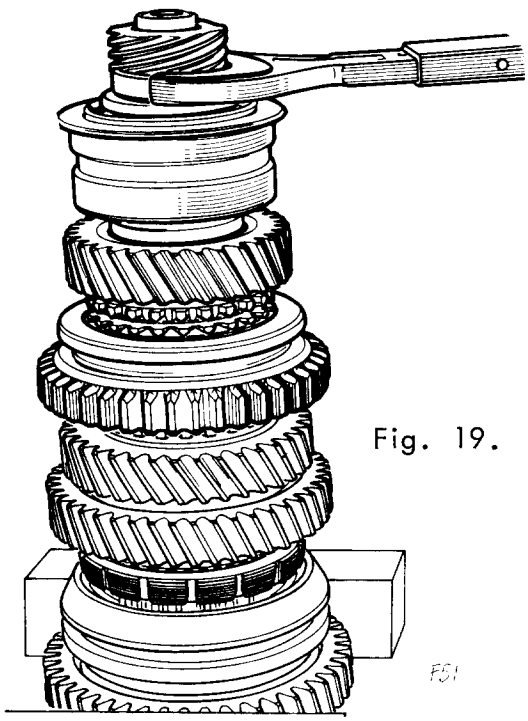


Fig. 19.

Remove the 3rd-4th synchroniser hub by means of special tool, (Part No. XO46F 6181Z) and a press.

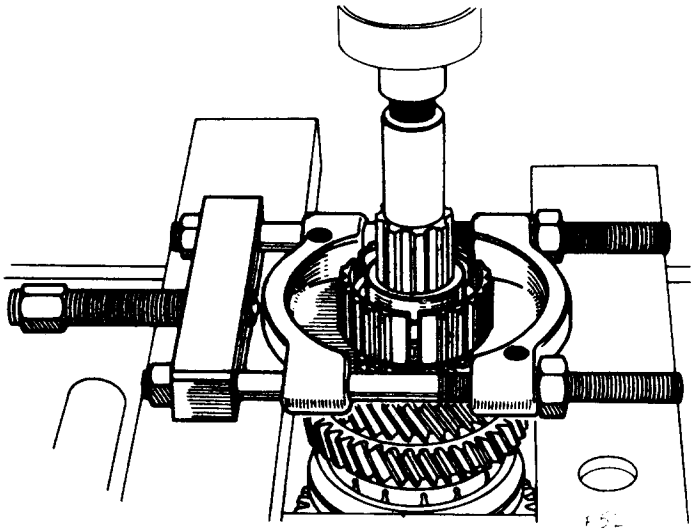


Fig. 20.

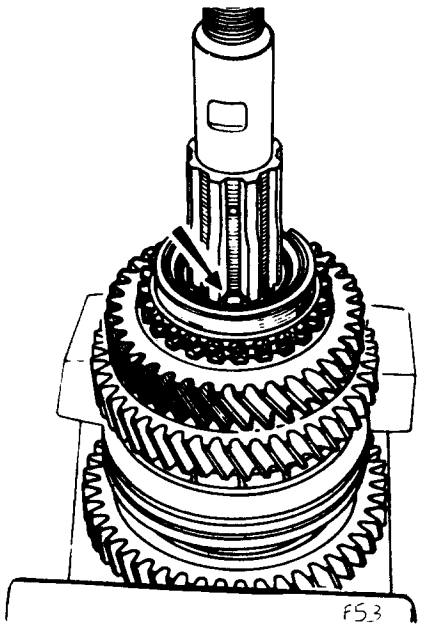


Fig. 21.

Remove the gear wheel stop washer retaining key, shown arrowed, the 3rd speed wheel gear stop washer, the 3rd speed gear wheel and its ring, the 2nd speed gear wheel stop washer and the 2nd speed gear wheel and its ring.

Mark the position of the 1st-2nd speed synchroniser sliding gear wheel relative to its hub, remove the gear and the hub stop washers.

Remove the 1st-2nd speed synchroniser hub by means of the special tool and the press.

Remove the 1st speed synchroniser, the 1st speed gear wheel stop washer, and the 1st speed gear wheel.

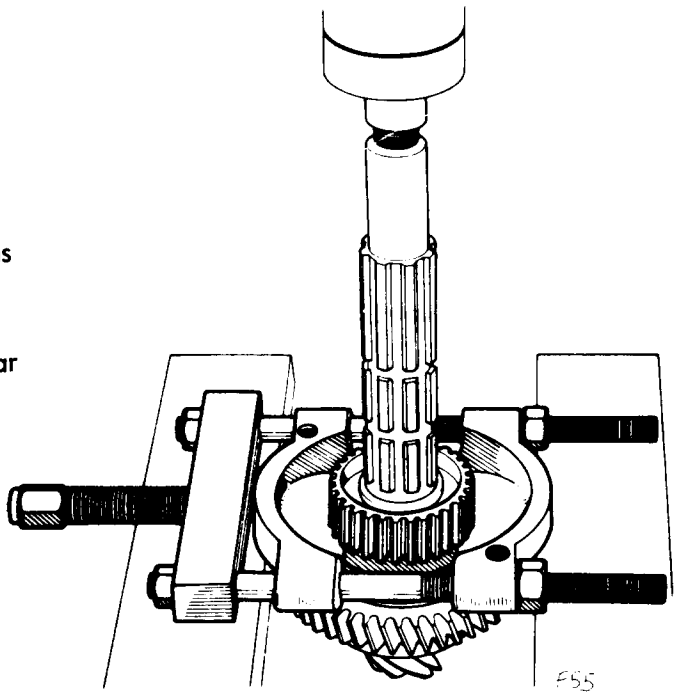


Fig. 22.

Fit the guard over the pinion bearing to retain the outer race, and the rollers in position.
NOTE: that the inner race cannot be replaced.

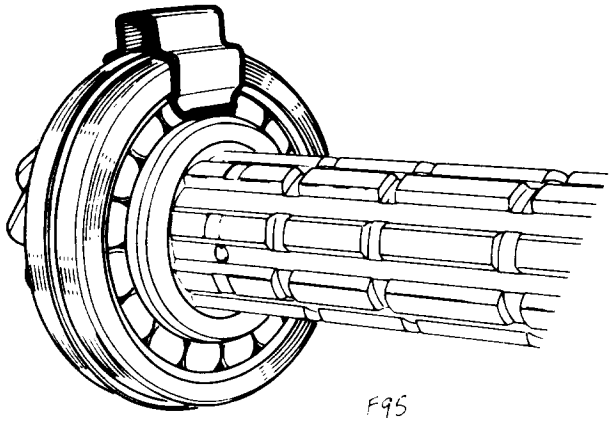


Fig. 23.

DIFFERENTIAL

On the crown wheel side, remove two diametrically opposite securing bolts.
Remove the bearings by means of tool (No.XO46F 6169Z) fitted with claws. (Part No. XO 46F 6174Z
Remove the remaining crown wheel securing bolts.
These are self locking bolts which cannot be used again.
Push out the planet wheel shaft roll pin by means of drift (Part No. XO46F 6171Z).
Separate the various parts.

REAR HOUSING

Unscrew the bolt securing the speedometer drive assembly. Pull out the assembly, together with the 'O' ring.

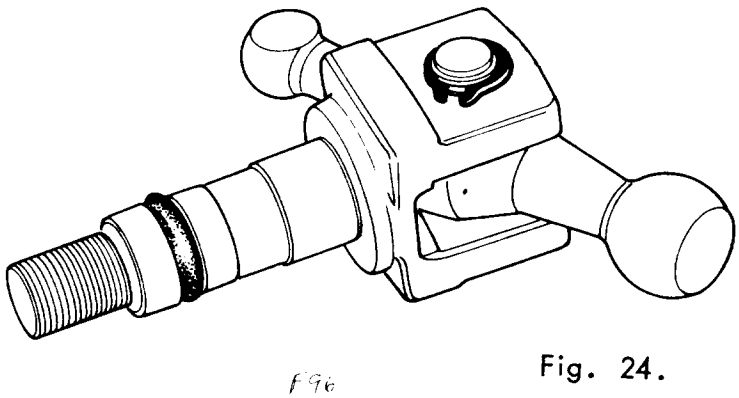


Fig. 24.

Remove the rubber bellows from the selector shaft.
Pull out the selector shaft, and remove the seal.
Pull out the selector swivel assembly, and remove the 'O' ring.

CLEANING AND CHECKING.

Clean and check all the parts.

All seals and gaskets, roll pins and self locking bolts must be replaced by new ones.

REASSEMBLING.

Secondary Shaft.

a. Crown Wheel and Pinion.

The final drive pinion and crown wheel are lapped together during manufacture, and have to be replaced as a unit, complete with the roller bearing, which cannot be supplied separately. A common marking is inscribed on both the crown wheel and the pinion, for example 27:200. OTHER MARKINGS MUST BE IGNORED.

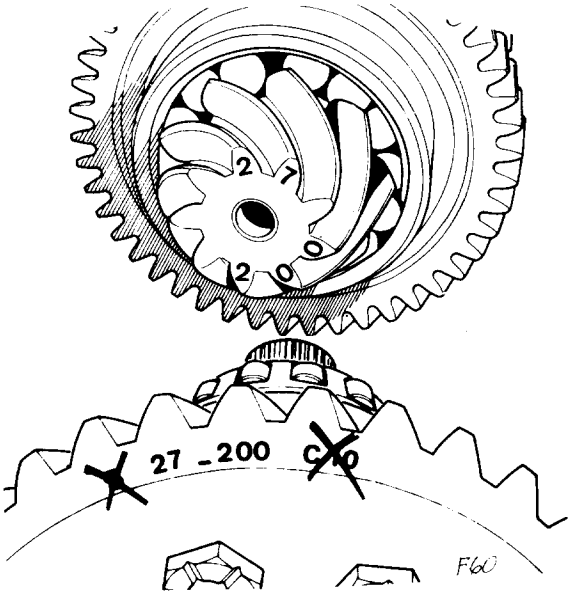


Fig. 25.

b. Matching Final Drive Pinion Shaft To Synchroniser Hub.

If the synchronisers can be used again, the size of the new final drive pinion to be ordered must be determined in order to ensure that the synchroniser hubs match the final drive pinion shaft. To do this, measure the old final drive pinion. If the synchronisers are damaged and the final drive pinion can be used again, the size of the synchroniser hubs to be ordered must be determined in order to ensure that they match the final drive pinion. To do this, measure the final drive pinion, as follows. Measure the dimension across 2 of the splines on the final drive pinion shaft by means of a micrometer. Take a number of measurements at different points around the splines at the point where the synchroniser hub fits and find the average.

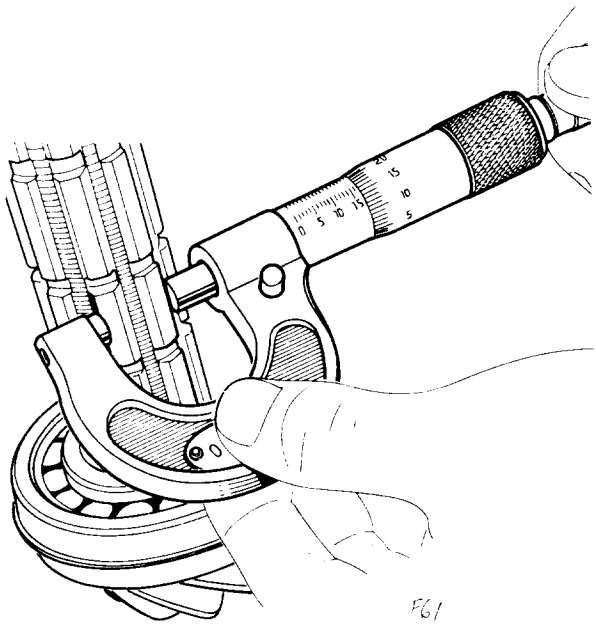


Fig. 26.

There are 2 different size groups for the final drive pinion shaft and the synchroniser hubs. They can be identified by a colour code paint mark.

Final Drive Pinion Shaft Dimension	Colour Code
16.61 to 16.63 mm (.6539 to .6547")	Blue
16.64 to 16.66 mm (.6551 to .6559")	Yellow

The synchroniser hubs are fitted to the final drive pinion shaft on the press :

- 1^{st} - 2^{nd} speed hub: hot at a temperature of 250°C (482°F).
- 3^{rd} - 4^{th} speed hub: cold.

The 1^{st} - 2^{nd} speed synchroniser

As the sliding gear wheel and the hub are matched, mark before separating them. The position mark should be made on the 2^{nd} speed gear wheel side, (the same side as the chamfer,) on the sliding gear wheel so that it can be seen after the hub has been fitted.

Place the hub in an electric oven and heat it to 250°C (482°F).

Wait until it has reached full temperature before starting to re-assemble the secondary shaft assembly.

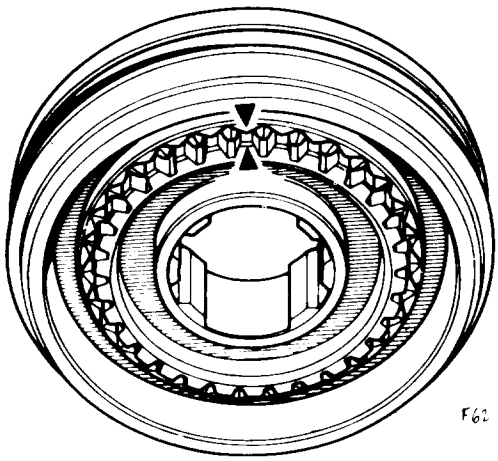


Fig. 27.

The 3^{rd} - 4^{th} speed synchroniser

It is not necessary to dismantle this. If it has been dismantled and can be used again re-assemble it as follows :

Place the three keys and the two springs on the hub. (as shown).

Place the sliding gear wheel in the correct position, with the groove in the sliding gear wheel on the opposite side to the two notches in the hub, and the reference mark on the sliding gear wheel in line with the mark made on the hub during dismantling.

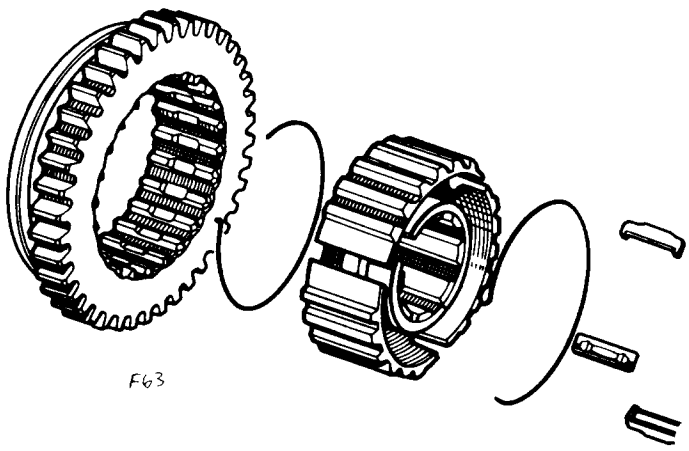


Fig. 28.

Place the synchroniser spring on the 1st speed gear wheel so that it covers the 3 notches.

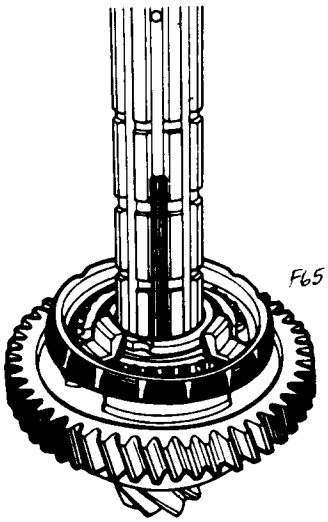


Fig. 30.

Take the 1st - 2nd speed gear wheel hub from the oven and place it on the final drive pinion in the correct position; the part with the position mark on it for positioning the sliding gear wheel is to face towards the 2nd speed gear wheel; the unsplined portion is to be in line with the dummy key.

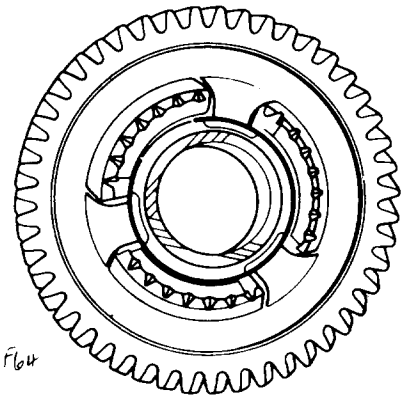


Fig. 29.

Place the following on the final drive pinion (already fitted with its bearing)

- the 1st speed gear wheel and its ring.
- the 1st speed gear wheel stop washer.

Turn it, and locate it by means of a dummy key (this is a washer retaining key one lug of which has been removed).

The dummy key is to be placed in one of the keyways which has an oil hole in it.

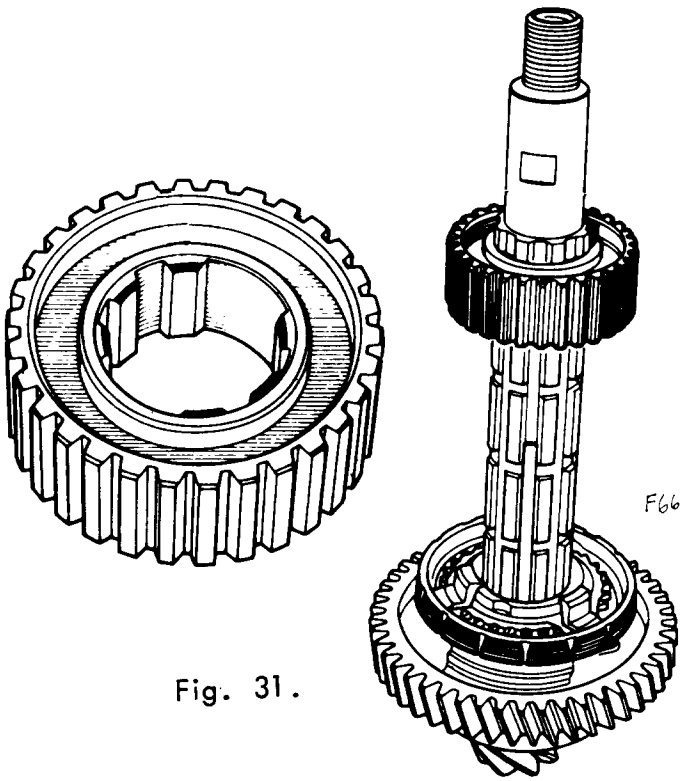


Fig. 31.

Push on the hub on the press until it makes contact with the stop washer.
Hold the synchroniser ring in a central position, with the lugs below the level of the stop washer so as not to damage the spring.
Hold pressure on the press for a time in order to allow the hub to cool down. (Assist by cooling with compressed air)
Release pressure.
Remove the dummy key.

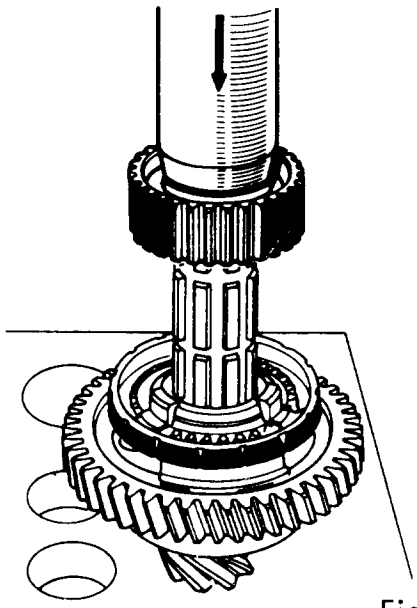


Fig. 32.

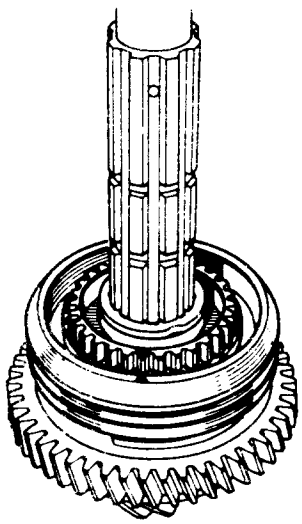


Fig. 33.

Fit the 1st - 2nd speed sliding gear wheel:
- with a chamfer on the 2nd speed gear wheel side.
- with the position reference in line with that on the hub.

Fit the hub stop washer (turn it to align its spline with those on the final drive pinion.)

Place the synchroniser spring on the 2nd speed gear wheel in the position as on the 1st speed gear wheel.
Position the 2nd speed gear wheel and its ring.
Position the gear wheel stop washer (turn it to align its splines with those on the final drive pinion shaft).

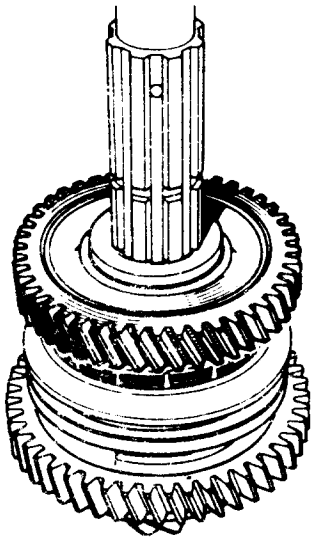


Fig. 34.

Fit the 3rd speed wheel gear and its ring. Position the stop washer so that its splines align with those of the final drive pinion shaft, and fit the gear wheel stop washer retaining key into one of the keyways that has an oil hole in it. Fit the 3rd - 4th speed synchroniser , with the notches on the hub on the 3rd speed wheel side, and in line with the retaining key. Press into place until it makes contact with the 3rd speed gear wheel stop washers.

Warning.

Ensure that the 3 notches on the synchroniser hub are in line with the 3 keys.

Fit - the 4th speed gear wheel and its ring.
- the pinion depth adjusting washer (that was removed during dismantling).
- the double taper roller bearing and the speedometer drive worm gear.

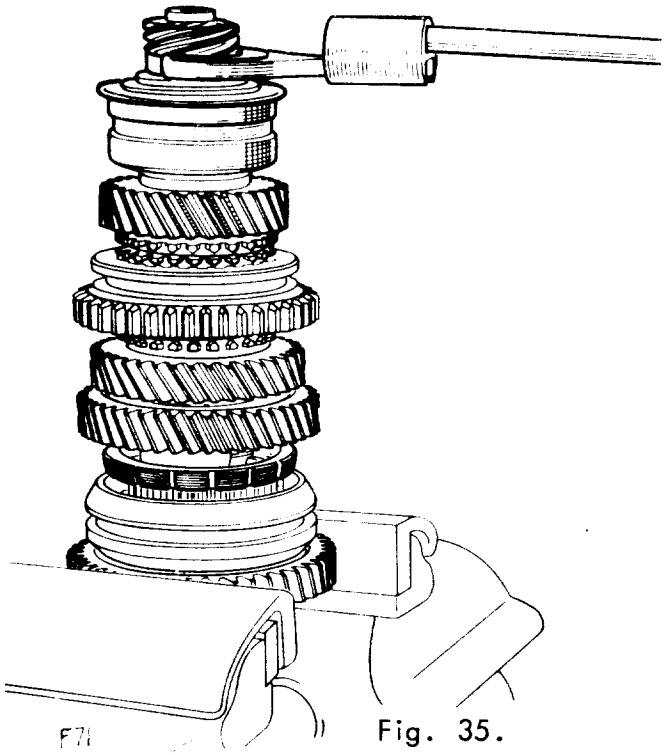


Fig. 35.

Grip the shaft in a vice, across the 1st speed gear wheel.

Engage 1st gear.

Tighten the speedometer drive worm gear by means of torque wrench (Part No.XO46F 6353Z) fitted with spanner (Part No. XO46F 6175Z) : 10 to 12 m. da N. (75 to 85 lb/ft).

Do not lock it, so that the pinion depth can be adjusted later.

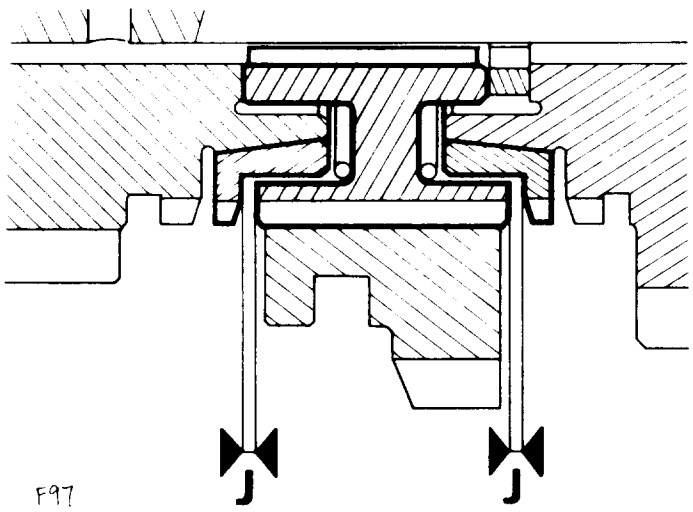


Fig. 36.

Check that the space at J between the synchromesh hub and each synchromesh ring is 0.20 mm. (.008").

DIFFERENTIAL

Fit the following in the housing :

- The bakelite impregnated washer (with the lubrication groove on the sun wheel side)
- The 1.97 to 2 mm. (.077 - .079 in.) shim. (Use the thicker shim 2.03 to 2.07 mm (.080 - .082 in.) only when the play between the planet and sun wheels is excessive.)
- One sun wheel (dipped in oil grade EP 80).
- The planet wheels and their friction washers. (Place the locating lug in the hole in the housing.)

Insert the planet wheel shaft (align the hole in the shaft with that in the housing) and fit the roll pin.

Dip the second sun wheel in oil grade EP 80 and fit it in the crown wheel.

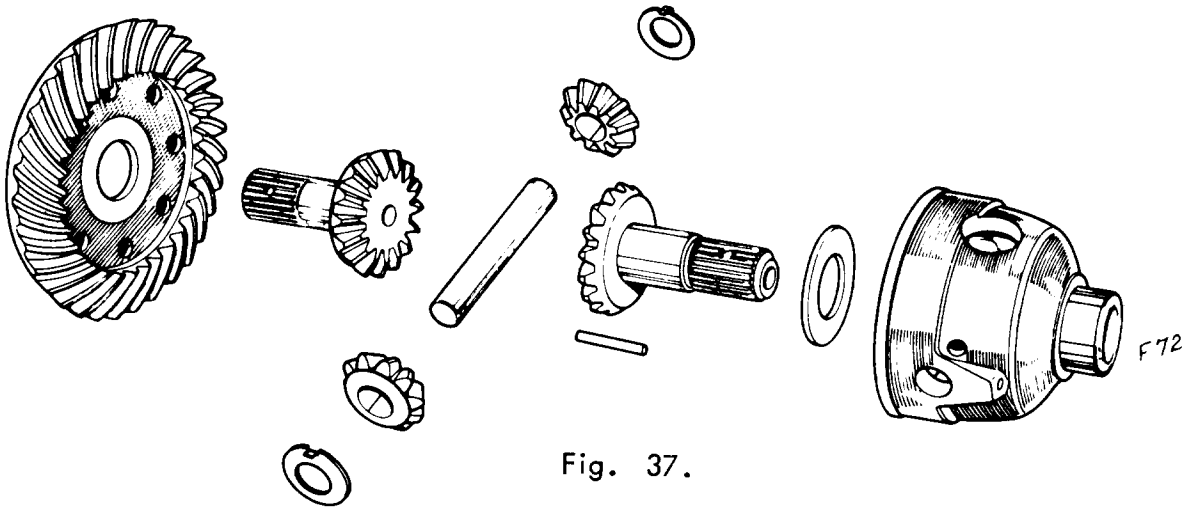


Fig. 37.

Fasten the crown wheel to the housing by means of new, self locking bolts (Part No. XO46F 6139Z) Tighten the bolts to a torque of 6 m. da N. (45 lb/ft.) using torque wrench (Part No. XO46E 6353Z) for the 10 mm. (.394") diameter bolts.

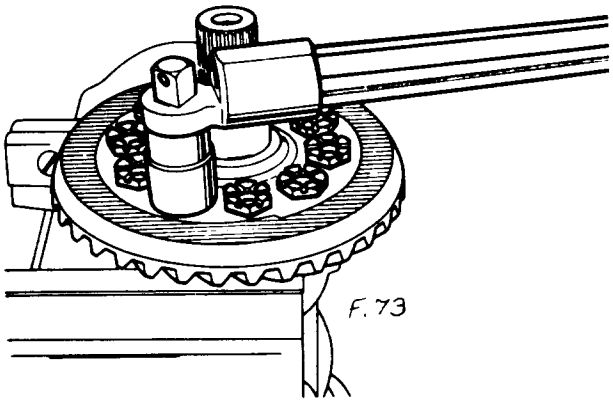


Fig. 38.

Use a press to fit the bearings to the following :-

a. The differential assembly. (as shown in Fig. 39)

b. The primary shaft. (as shown in Fig. 40)

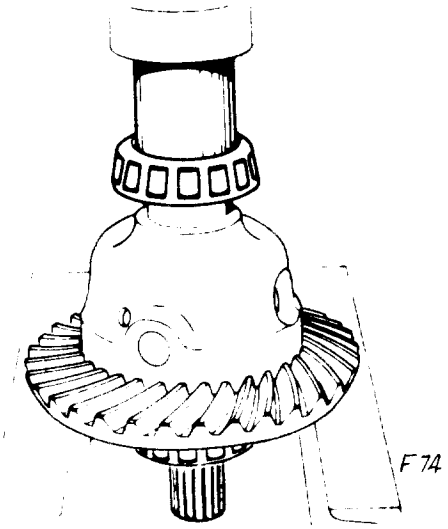


Fig. 39.

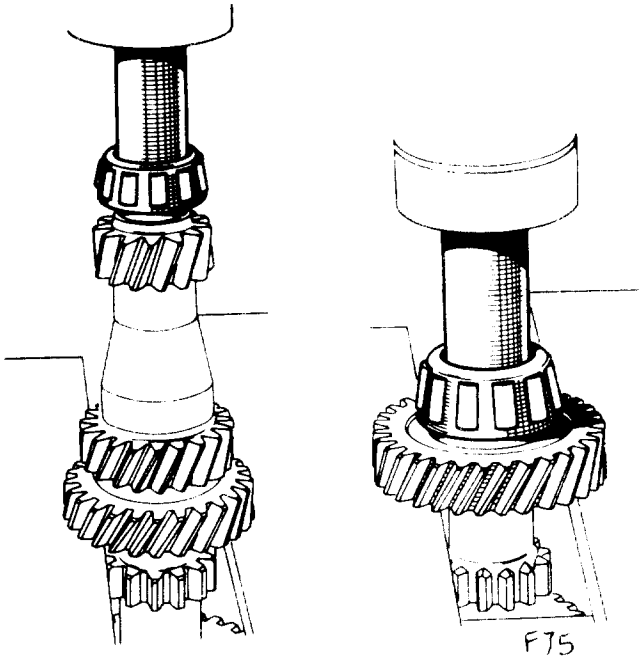


Fig. 40.

TRANSMISSION ASSEMBLY

Adjusting Pinion Depth

The final drive pinion must be positioned by means of the washer shown arrowed, so that the distance from the front face to the crown wheel centre line at 'A' is 59 mm.(2.323 in)

NOTE In some cases the depth 'A' may increase by the amount marked on the pinion at 'X', which is given in hundredths of a millimetre. The example shown in Fig. 41. is +0.20 mm., which has to be added to 59 mm. to give 59.20 mm (2.323 + .008 = 2.331 mm)

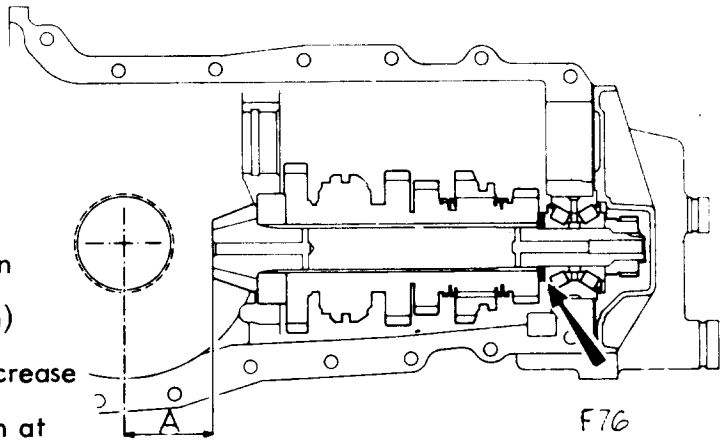


Fig. 41.

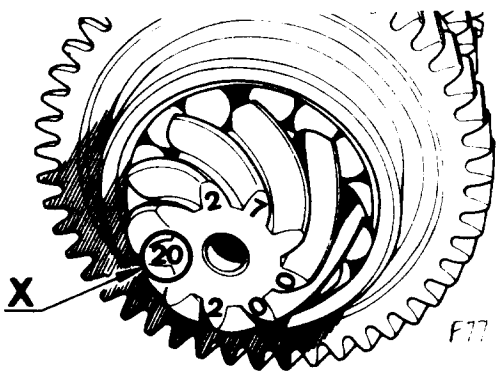


Fig. 42.

Checking the Pinion Depth

This operation is carried out with mandrel (1) (Part No. AO74F 6020Z) which provides the crown wheel centre, and spacer (2) (Part No. AO74F 6021Z) which rests against the front face of the final drive pinion.

Fit the secondary shaft to the left half of the housing.

Fit the right hand half-housing and secure it in place by a number of bolts. (Do not tighten them.)

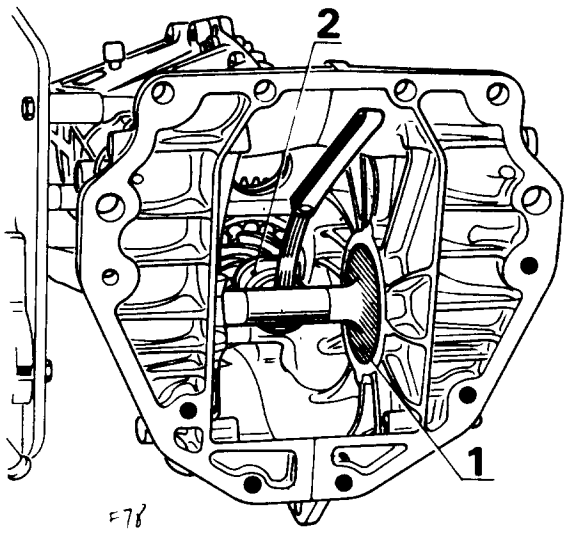


Fig. 43.

Temporarily fit the front housing to hold the double taper roller bearing track ring in position. Tighten the half-housing securing bolts.

Fit mandrel (1). (see Fig.43.) Fit spacer (2) against the front face of the final drive pinion.

Measure by means of a set of feeler gauges, the gap between the spacer and the mandrel. This must be 0.50 mm.(.020 in.) If necessary adjust by means of the washer. Washers are obtainable in thicknesses of 3.50 mm. to 4.10 mm. (.138 to .162") increasing in increments of 5/100 mm. (.002").

When the final adjustment has been obtained, remove gauge. Remove the secondary assembly and lock the speedometer drive worm.

Adjusting the differential bearings:

The adjustment is obtained by screwing nuts (1) and (2) in or out. (see Fig.44.)

Fit the bearing outer race to each half housing so that it is slightly below the inner face of the housing. Fit the differential,together with its bearings, into the right -hand half housing. Fit the half-housing together, replace bolts, and tighten with a torque spanner in the order shown in Fig. 54 ., to 2 m da N (15 lb/ft.) or 7 mm.bolts and 2.8 m da N (20 lb/ft.) for 8 mm. bolts.

Smear the threads on the nuts and in the housing with 'Loctite AV' locking compound.

Screw the adjusting nut into each half-housing until it makes contact with the bearing track ring, using wrench (Part No. X046 F 6179Z) (see Fig. 10.)

If the original bearings are being are being used again, the differential must turn without play.

Continue to screw in the nuts which push in the bearing track rings. Take care to screw in nut 2 (Fig. 44.) on the differential housing side a little more than the one on the other side in order to obtain a crown wheel and pinion back lash which is slightly larger than that required on final assembly.

When the differential can be felt to be turning without play, stop screwing in the nuts. This is the final adjustment.

Mark the position of the nuts with reference to the housing (by means of punch mark).

Remove the left-hand housing and the differential.

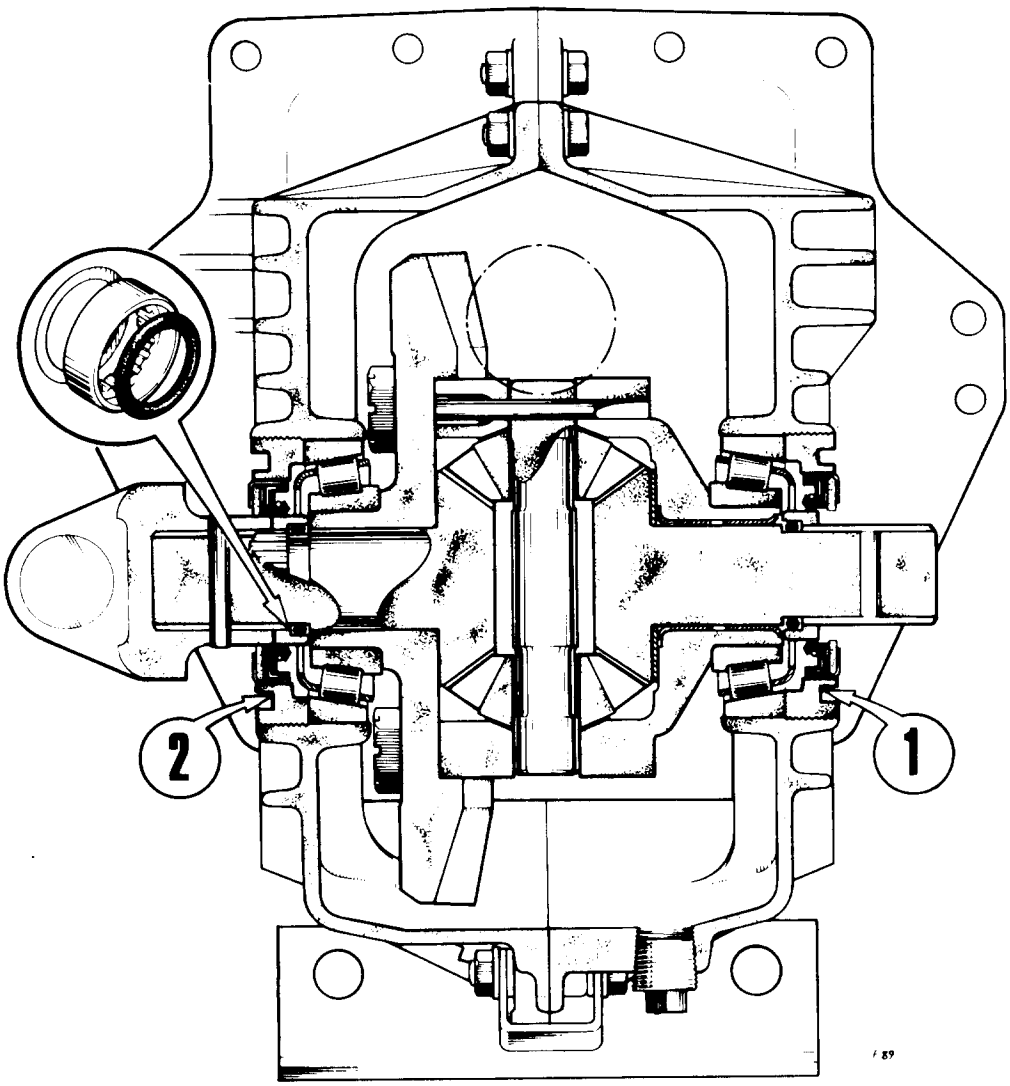


Fig. 44.

If new bearings are fitted the differential should rotate with a resistance torque of between 0.050 and 0.150 m da N.

Screw in nut (2) on the differential housing side more than the nut on the other side to obtain a back lash higher than the required figure on the final assembly.

When the differential becomes slightly stiff to rotate, check the preload as follows:

b. - Adjusting the bearings.

Turn the differential a number of times to centralize the bearings.

Wrap a string around the differential housing.

Pull on the string with a spring balance.

The differentail should rotate under a load of between 1 and 3 da N (2 to7 lb.).

If the adjustment is not correct, screw the nut on the differential housing side slightly in and check the preload again. When the correct adjustment has been obtained, mark the position of the nuts with reference to the housing.

3. Adjusting the primary shaft bearings. Place the bearing track rings (2) and (3) and the adjusting washer (1) onto the primary shaft.

a. - Positioning the primary shaft.

Fit into the right-hand half housing the primary shaft, and the secondary shaft assembly. The face (A) on the primary 3rd speed gear wheel should be offset to face (C) on the secondary shaft 3rd speed gear wheel by the same amount as face (B) on the primary shaft 4th speed gear wheel is offset to face (D) on the secondary shaft assembly 4th speed gear wheel. This position is adjusted by means of washer(1): Washers are available in thicknesses of: 2.50-2.75-3-3.25 -3.50-3.75 and 4 mm. (.079 - .089 - 108 - .118 -.128 -.138 - .148 -.158in). When the correct adjustment has been obtained, remove the secondary shaft assembly.

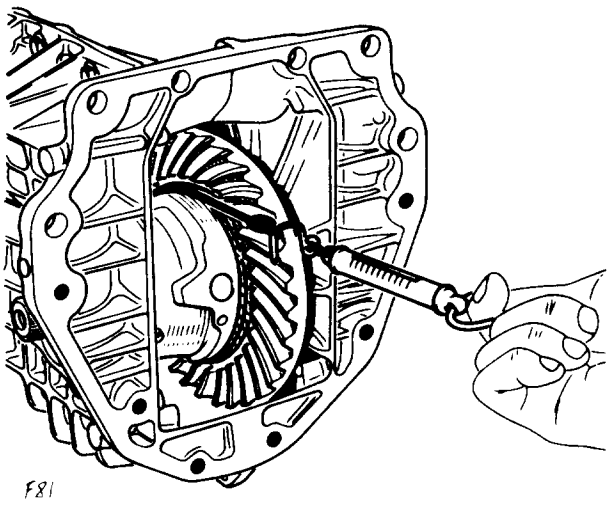


Fig. 45.

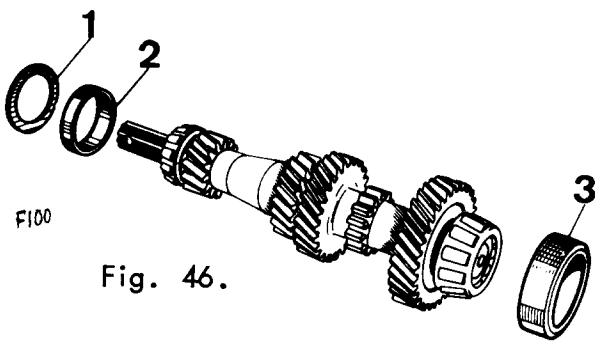


Fig. 46.

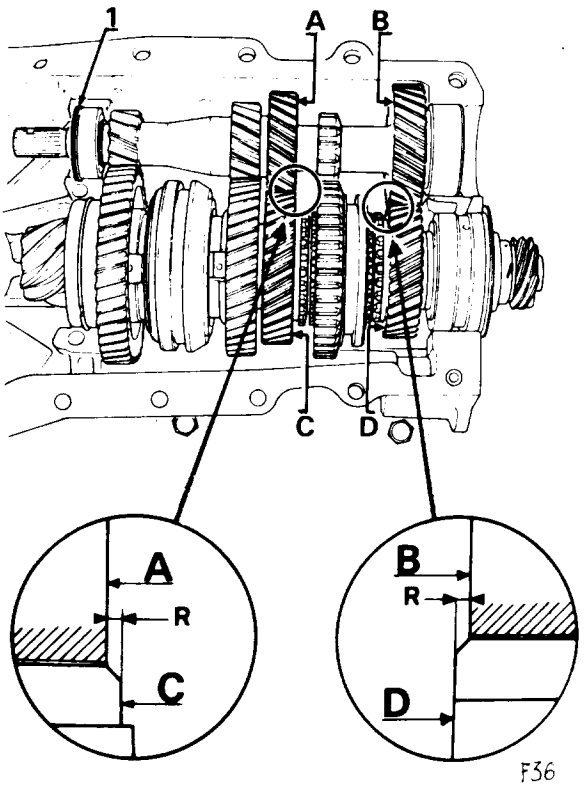


Fig. 47.

b. - Adjusting the bearings.

With the primary shaft in position, place the left half-housing in position without securing it. Fit the adjusting shim (C) and the spacer (4). The shaft should turn freely, without play, and the spacer should project above the housing by .20mm (.008 in.), the thickness of the paper gasket on the front housing.

Place a rule against the spacer and check the dimension (F) between the rule and the housing by means of a set of feeler gauges.

If the adjustment is not correct, increase or reduce the thickness of the shim pack C:

Shims are available in thicknesses of: 0.10 - 0.20 - 0.25 - 0.50 and 1 mm. (.004 -.008 - .010 - .020 - .040 in.)

When the adjustment is complete, remove the right hand half housing and the primary shaft.

Assemble the clutch shaft to the primary shaft by securing the roll pin.

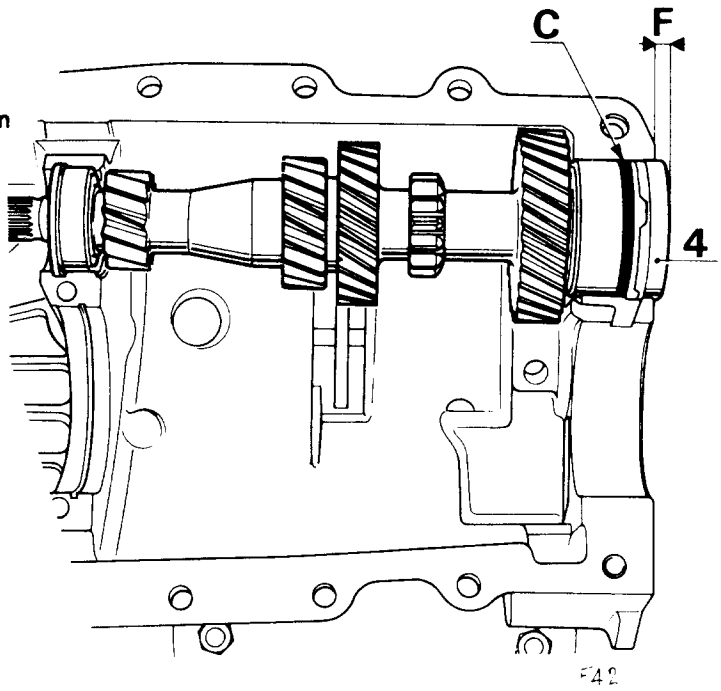


Fig. 48.

IMPORTANT - Roll Pin fitting:
When reassembling, fit the roll pins as shown in Fig.71. Their slots MUST always face towards the speedometer drive housing.

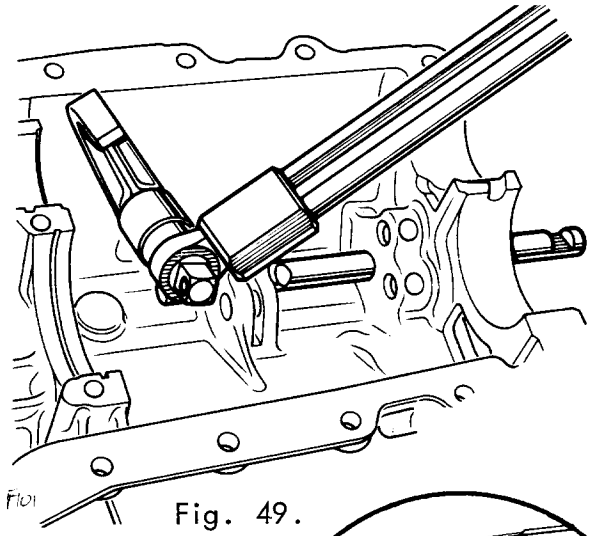


Fig. 49.

REASSEMBLING

1. - Gear Shift Control.

Engage the reverse shaft.
Fit the reverse swivel lever, engaging its end into its slot in the reverse shaft. Tighten its pivot to a torque of 2.8m.da.N (20lb/ft.) by means of torque wrench (Part No.46E 6353)

Fit the 1st - 2nd selector shaft locking ball and spring. Insert the 1st - 2nd selector shaft. Fit the 1st - 2nd selector fork (with the hub towards the control end) and pin it in place.

Fit the locking disc between the shafts. Fit the 3rd - 4th selector shaft locking ball and spring. Insert the shaft and fit the selector fork (with the hub towards the differential end) and pin it in place.

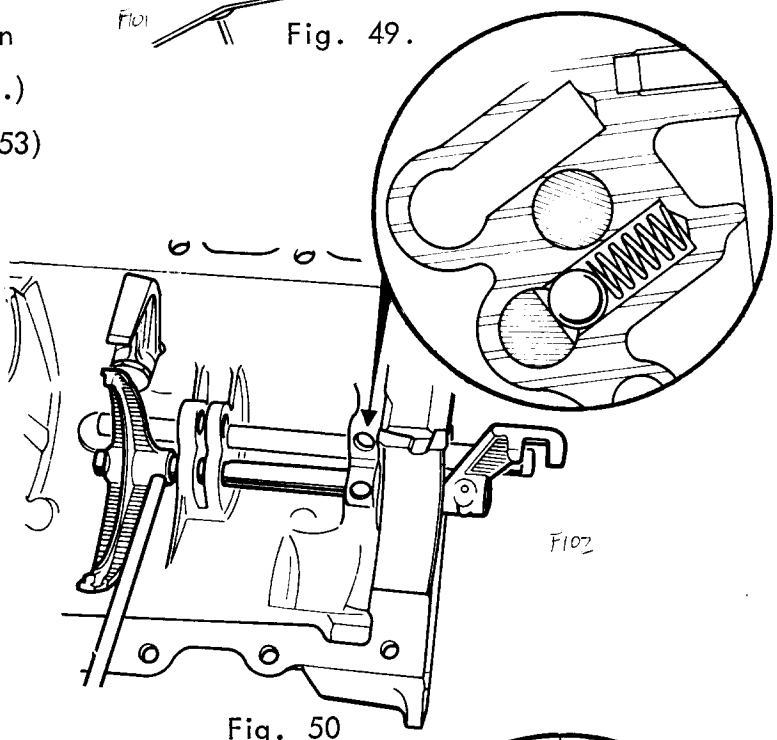


Fig. 50

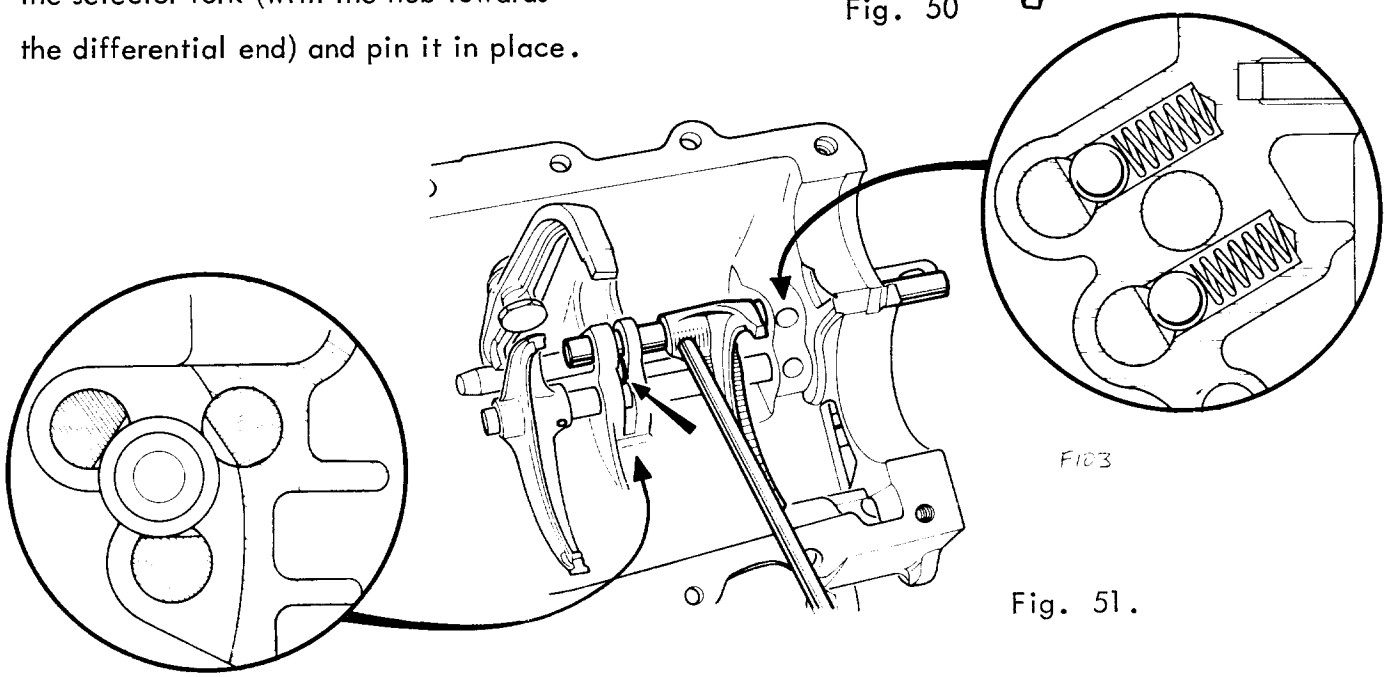


Fig. 51.

2. - Reverse shaft and gear.

Fit the following onto the left hand half housing:

- the locking ball and spring.

Engage the shaft and fit the gear wheel(with the hub towards the differential end) followed by the friction washer (with the bronze face towards the gear wheel).

Insert the guide from inside the bore and push the shaft fully in.

Fit the gear wheel retaining circlips.

Rear Housing.

Fit a new oil seal in the housing, replace the selector shaft, and fit new rubber bellows.

Fit a new 'O' ring to the shaft of the selector swivel assembly, and replace into rear housing.

Replace the speedometer drive assembly, using a new 'O' ring, and fit its securing bolt.

Fit the following to the right-hand half housing:

the primary shaft,

the secondary shaft assembly,

the differential. (See Fig. 11.)

Smear the half housing assembly faces with 'Hylomar' jointing compound.

Fit the left-hand half housing to the right-hand assembly. Make sure that the end of the reverse swivel lever is in the slot of the reverse gear wheel shaft. Insert the half housing securing bolts, but do not tighten them. Fit bracket.

Fit the primary shaft bearing adjusting shims and the spacer.

Use jointing compound on a new paper gasket, offer up the rear housing, and engage the selector swivel with the slots in the selector shafts. Replace the bolts but do not tighten.

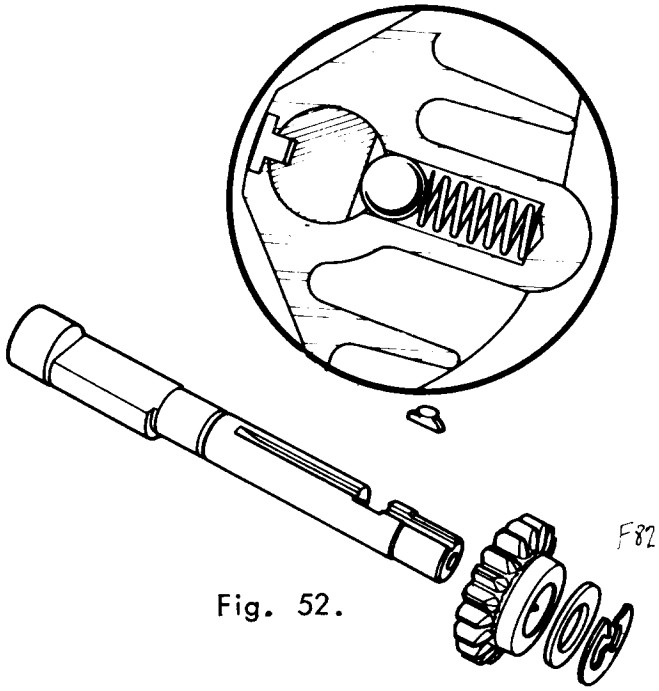


Fig. 52.

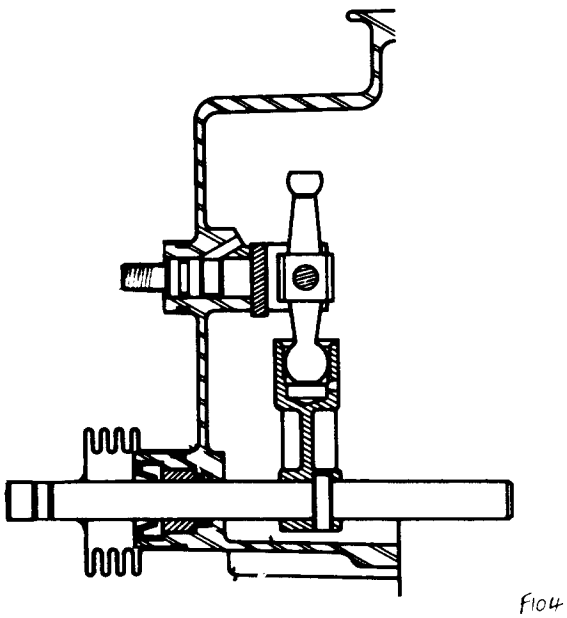


Fig. 53.

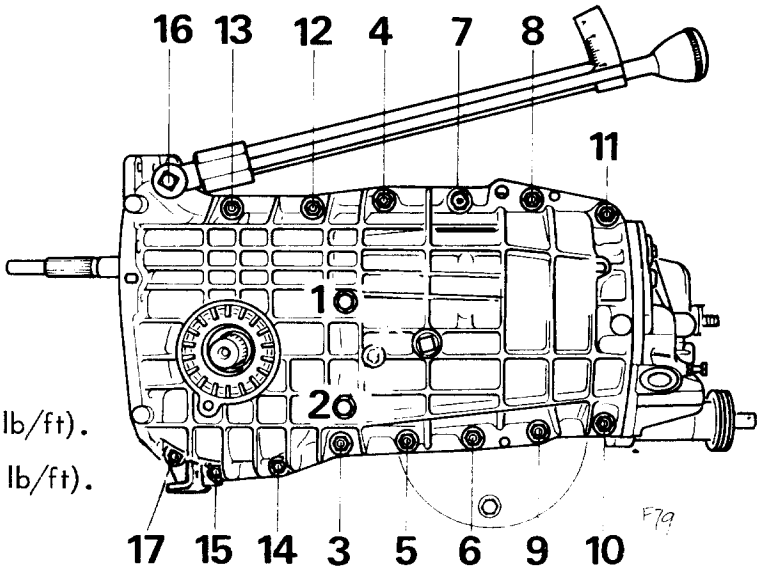


Fig. 54.

Tighten the half housing assembly bolts in the order shown on the illustration:

7 mm bolts: 2 m. da N (15 lb/ft).

8 mm bolts: 28 m. da N(20 lb/ft).

Finally tighten the rear housing securing bolts.

E. - ADJUSTING THE CROWN WHEEL AND PINION.BACKLASH.

The backlash is obtained by screwing nut (2) on the differential housing side in or out and screwing nut (1) on the opposite side in or out by the same amount. (See Fig. 44.)

Feel the back lash by hand.

If it is clearly too large unscrew nut (2) on the differential housing side and screw in nut (1) on the crown wheel side to obtain a smaller back lash.

Mount a dial indicator on the housing with its plunger square with the flank of one of the crown wheel teeth.

The back lash should be between 0.12 and 0.25 mm (,005 to .010 in.)

If it is excessive, unscrew nut (2) on the differential housing side and screw in nut (1) on the crown wheel side by the same amount.

If there is insufficient backlash, unscrew nut (1) on the crown wheel side and screw in nut (2) on the differential housing side by the same amount.

When the correct back lash has been obtained, lock the nuts by means of the locking plates.

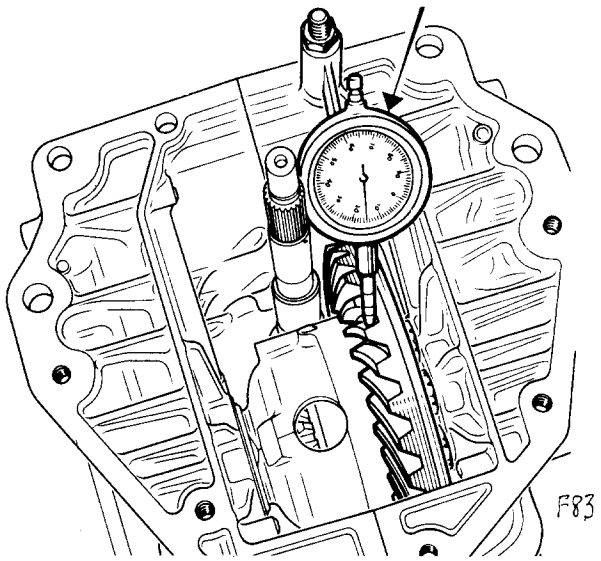


Fig. 55.

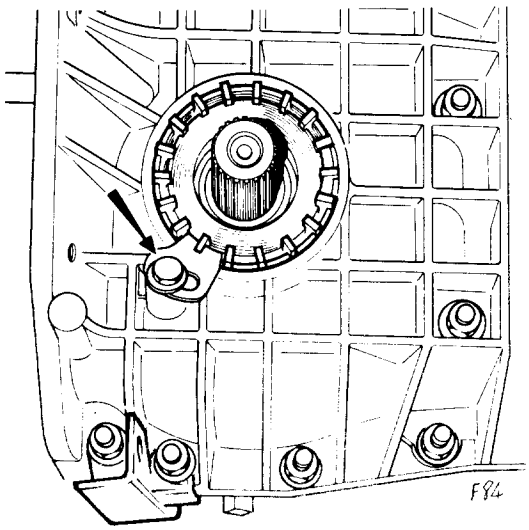


Fig. 56.

TYPE 365 GEARBOX.

The Type 365 Gearbox was introduced into current Production as an optional extra on Europa Special at Chassis No.

72081783P - U.K.
72081101Q - Export
72082684R - North America

GEARBOX IDENTIFICATION.

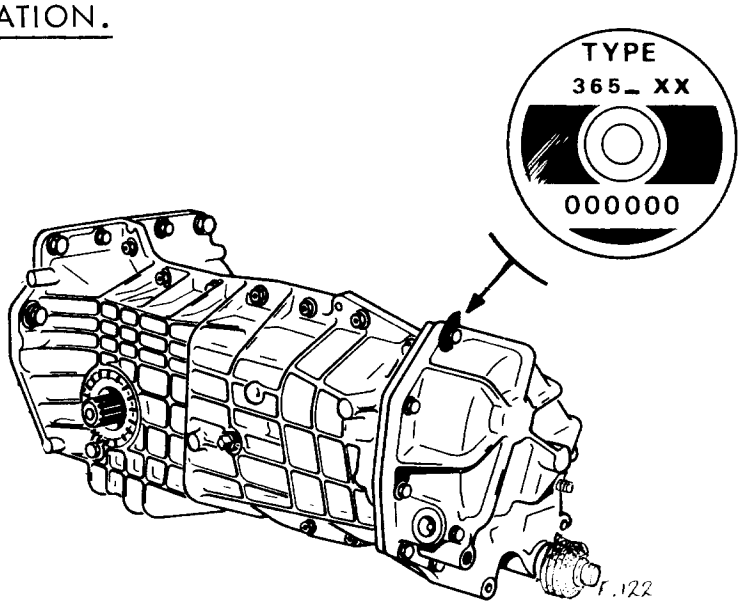


Fig. 57.

The general appearance of the Type 365 gearbox, together with its identification tag, is shown in Fig. 57.

GEARSHIFT.

First and second gears are selected by moving the lever to the left until resistance is felt, and engaged by moving it forwards for first gear and rearwards for second gear. Third and fourth gears are selected by moving the lever to the right, through neutral position until resistance is felt, then forwards for third and rearwards for fourth gears.

Overdrive (fifth) gear is selected by moving the lever fully to the right in neutral, against spring pressure and forwards into gear.

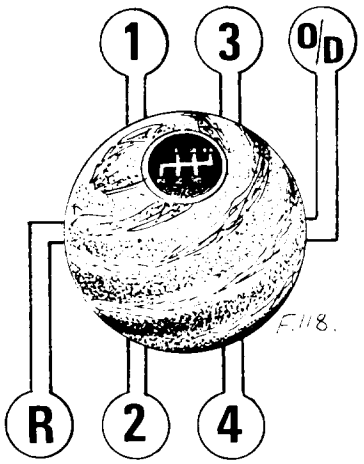


Fig. 58.

Reverse gear is selected by moving the lever fully to the left in neutral, against spring pressure and rear wards into gear.

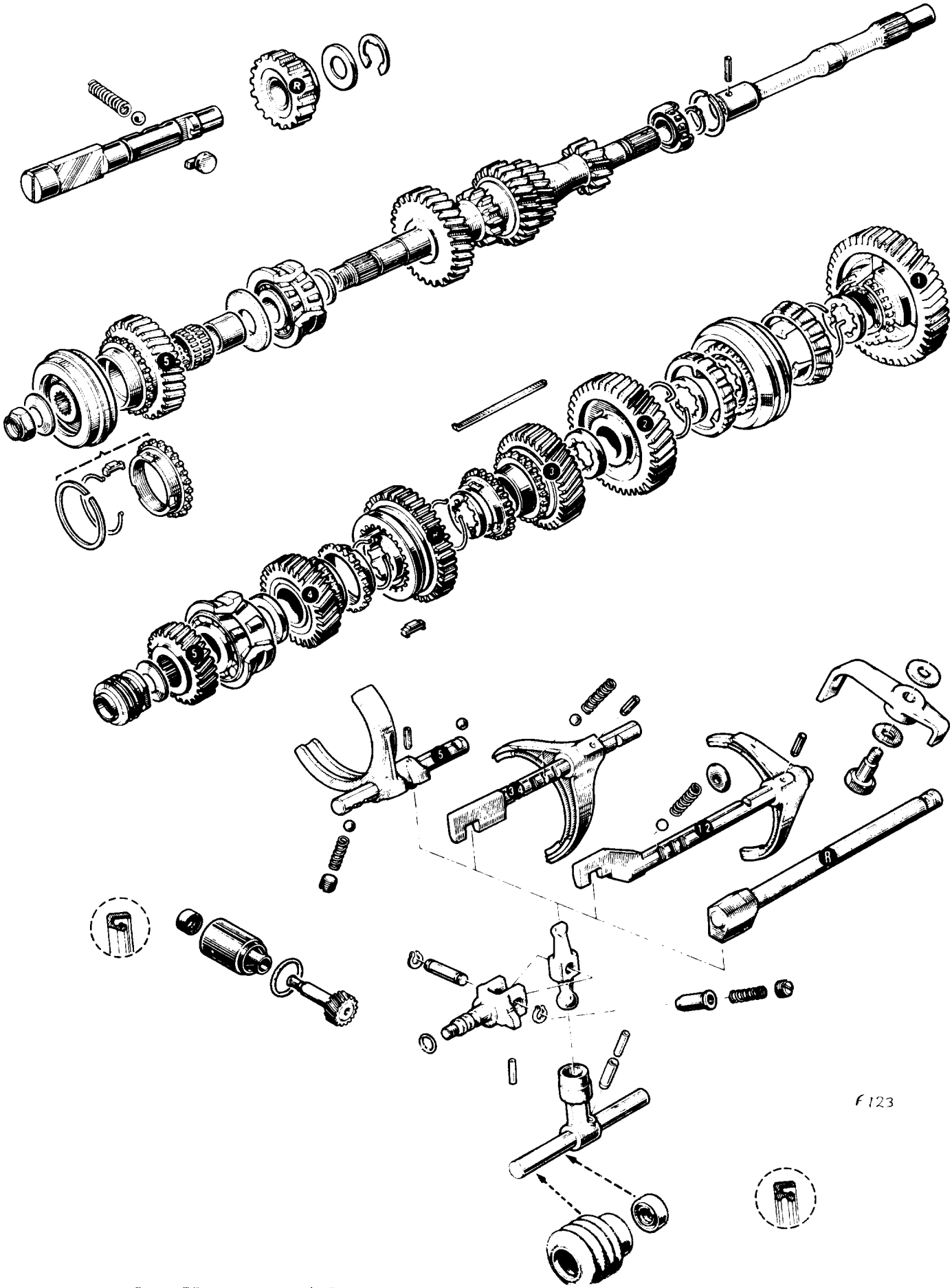


Fig. 59 - Internal Components of Type 365 Gearbox.

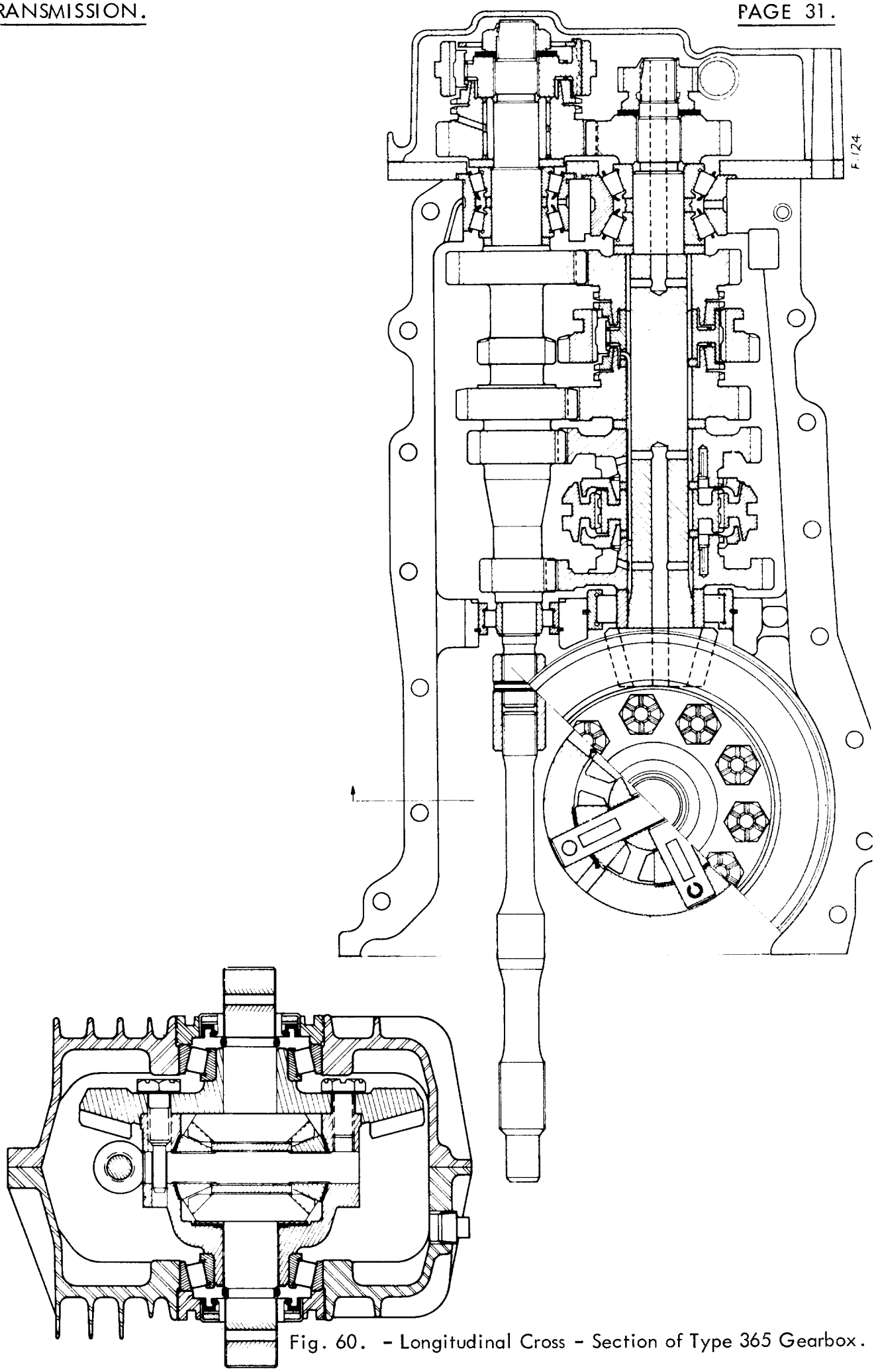


Fig. 60. - Longitudinal Cross - Section of Type 365 Gearbox.

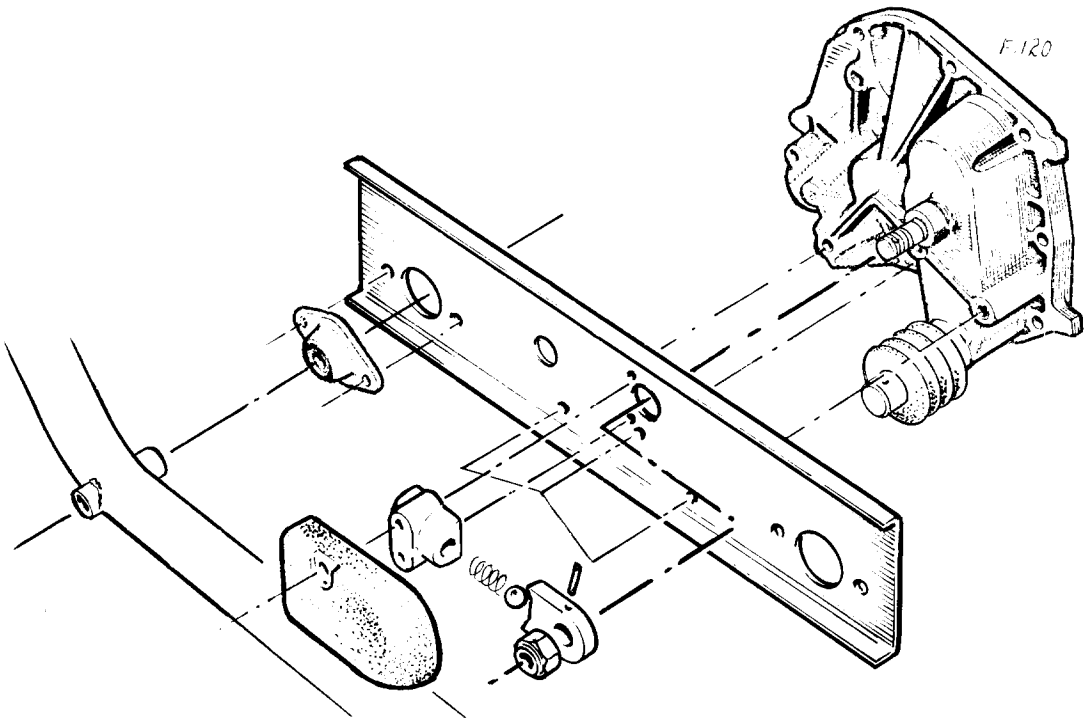


Fig. 61. - Type 352 Gearbox Mounting.

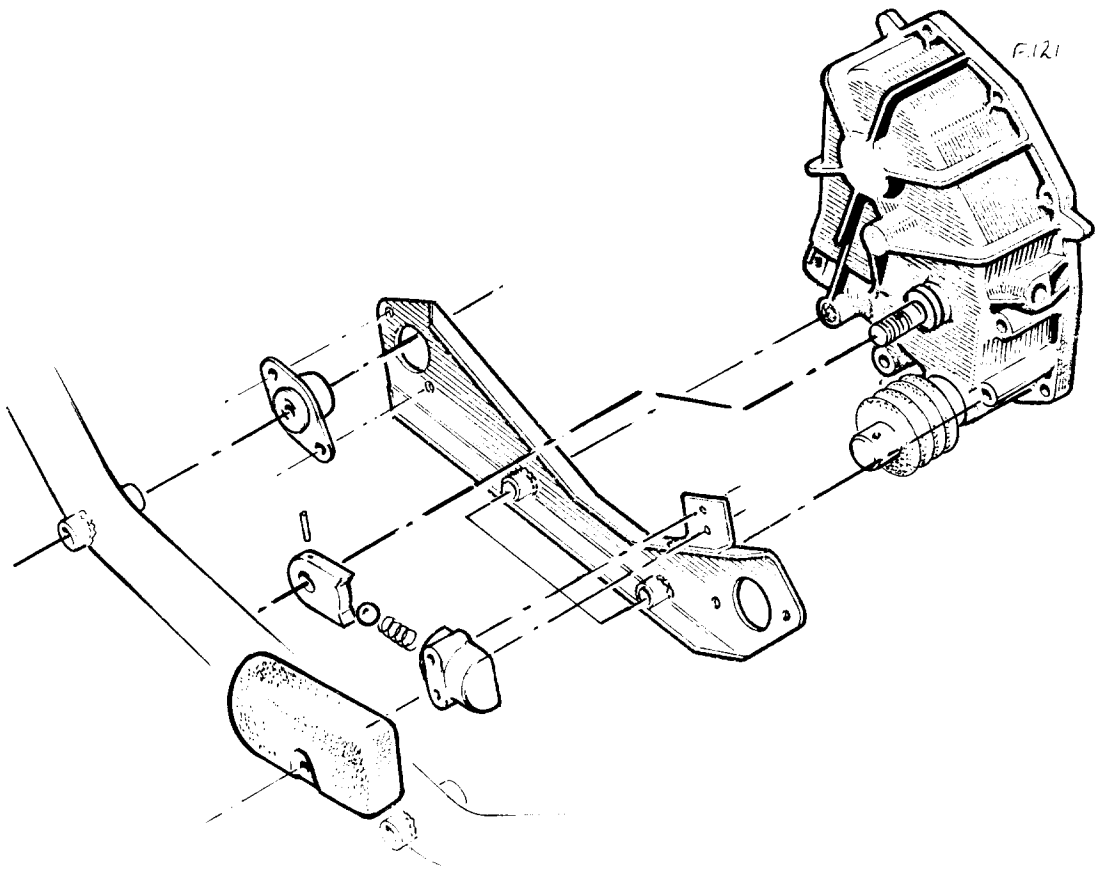


Fig. 62. - Type 365 Gearbox Mounting.

GEAR LINKAGE.

The gear linkage fitted to cars equipped with the Type 365 gearbox, is identical to the linkage described on Pages 3 to 5 inclusive of this Section, with the exception of the lengths of the longitudinal links (see Service Parts List).

REVERSE INDENT MECHANISM.

Removal, replacement and setting of the reverse indent mechanism will be found on Page 6 of this Section. It should be noted, however, that the indent mechanism used on the Type 365 gearbox is NOT interchangeable with the indent mechanism used on the previous Type 352 gearbox (see Service Parts List).

REMOVING AND REFITTING THE GEARBOX.

The Information published on Pages 7 and 8 of this Section is satisfactory for this gearbox.

OVERHAULING THE GEARBOX.

As the Type 365 gearbox is very similar to the Type 352 gearbox, with the exception of the overdrive (fifth) gear, only the differences in procedure will be described here. For all other dismantling, overhauling and rebuilding procedures, see Pages 9 to 28 inclusive of this Section.

Dismantling.

1. Secure the gearbox to bracket (Tool No. X046 F 6176Z) which is fitted to either the adjustable stand, or the bench stand.
2. Release the retaining bolts and remove the clutch housing, complete with clutch shaft.
3. Remove reverse indent mechanism and cross member.
4. Select 4th. speed, then remove plug, spring and 5th. speed detent plunger.
5. Release the retaining bolts and remove rear cover.

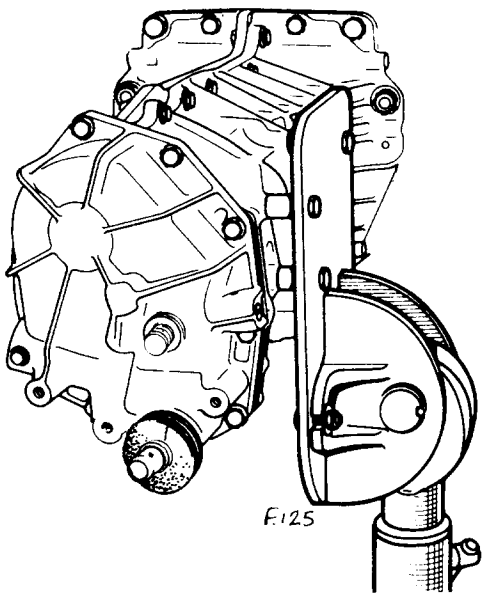


Fig. 63.

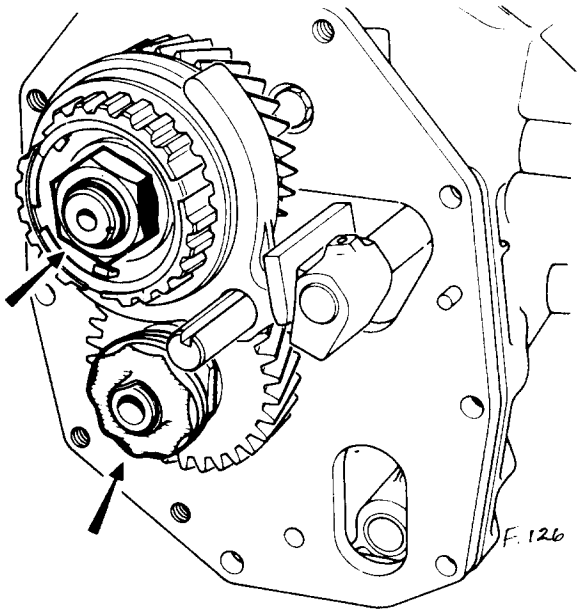


Fig. 64.

6. Return the selector forks to neutral and select both 5th. and reverse speeds together.
7. Loosen the 5th. speed synchro hub nut.
8. Loosen the speedometer drive worm nut using Special Tool (Part No. X046 F 6175Z).
9. Return the selector forks to neutral, then select 4th. speed.

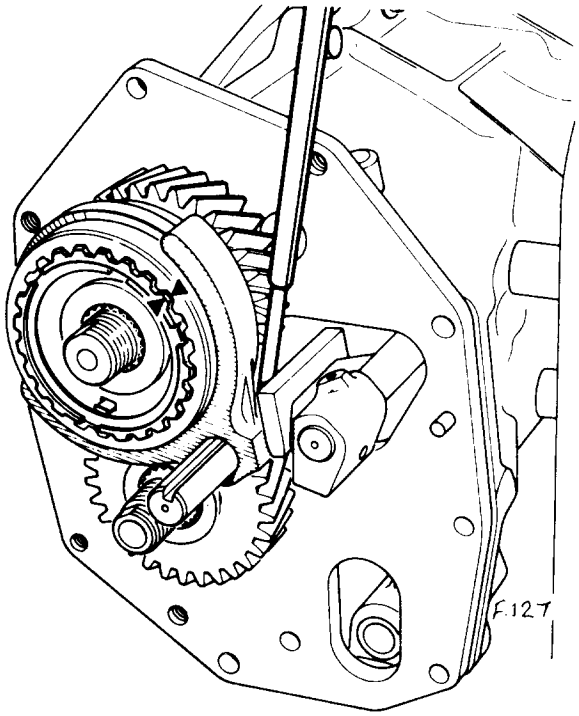


Fig. 65.

10. Push out the 5th. speed fork roll pin (see Fig.65) using the drift (Part No. X046 F 6180Z).
11. Mark the 5th. speed sliding gear and hub in relation to each other.
12. Remove the 5th. speed hub and synchro assembly and fork after removing the retaining nut.
13. Remove the 5th. speed gears after removal of the speedometer drive worm nut.

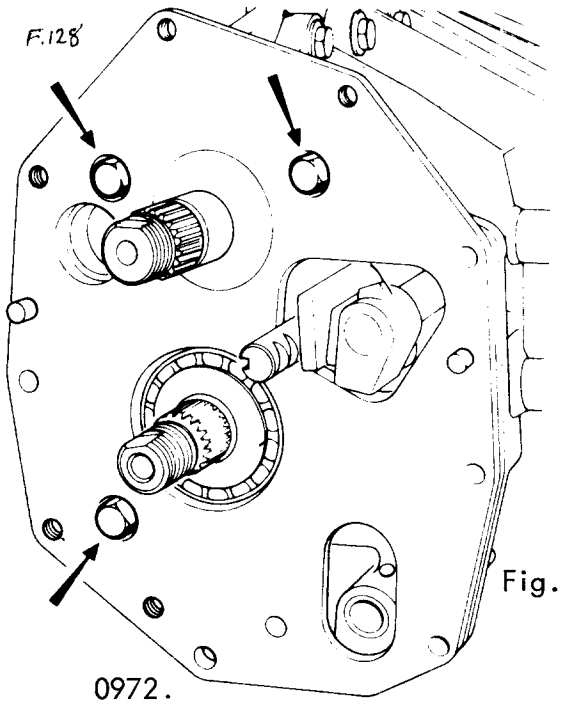


Fig. 66.

14. Remove bolts retaining spacer plate (arrowed in Fig. 66), and pull off plate.
15. Carry on with parting the two halves of the gearbox as detailed on Page 9.

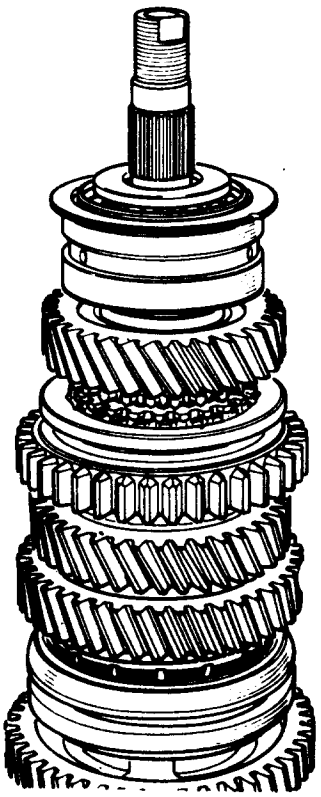
After parting the two halves of the gearbox casing, and the removal of the differential, secondary gear cluster and primary shaft, it is necessary to remove the gearshift control.

1. Return the 3rd./4th. speed selector to neutral.
2. Remove the 5th. speed selector shaft.
3. Remove the locking ball between the 3rd./4th. and 5th. speed selector shafts.
4. Push out the roll pin from the 3rd./4th. speed selector fork using the drift. (Part No. X046 F 6180Z)
5. Remove the shaft, fork, locking ball and spring. Remove the locking disc (see Fig. 12.) from between the shafts.
6. Remove the reverse gear selector and reverse gear shaft.
7. Using drift (Part No. X046 F 6180Z), push the roll pin from the 1st / 2nd. speed selector fork.
8. Remove the selector shaft and fork, together with locking ball and spring.

Remove the primary shaft as detailed on Pages 11 and 12 of this Section.

The secondary shaft is dismantled as follows (see Fig. 67) :-

1. Grip the shaft assembly in a fibre-faced vice, holding it by the 1st. speed gear.
2. Remove the double taper roller bearing, pinion depth adjusting washer, the 4th. speed gear and its ring.
3. Mark the position of the sliding gear in relation to its hub, then remove the 3rd./4th. speed synchro sliding gear with its retaining keys.



F.129

Fig. 67.

The remainder of the dismantling procedure will be found on Pages 13 and 14.

Reassembly of the gearbox is as on Pages 15 to 19 inclusive, with the exception that the 4th. and 5th. speed gears are fitted to the secondary shaft as follows.

1. Fit the 4th. speed gear and its ring.
2. Fit the pinion depth adjusting washer (removed during dismantling.).
3. Fit the double taper roller bearing.
4. Fit the spacer plate; this is necessary to obtain correct adjustment of pinion depth.
5. Fit the 5th. speed gear, wavy washer and speedometer drive worm.
6. Tighten the speedometer drive worm, and check clearance between 3rd. and 4th. speed synchro rings and their relative hubs, as shown on Page 19.

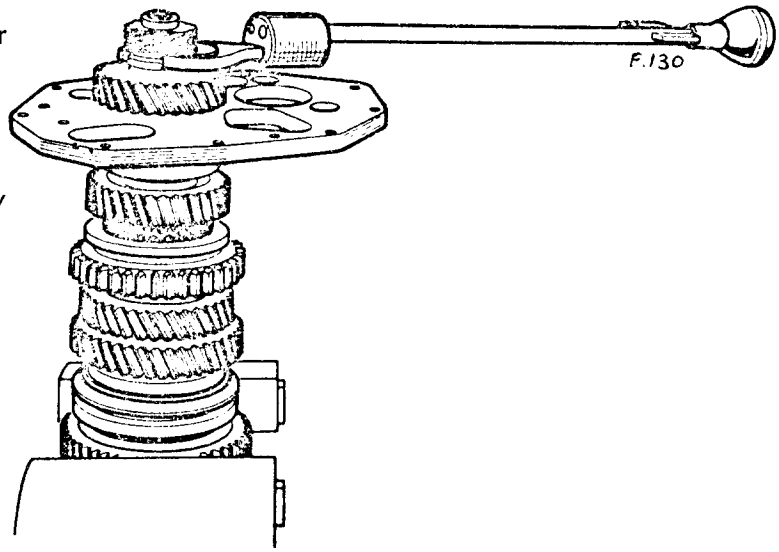


Fig 68.

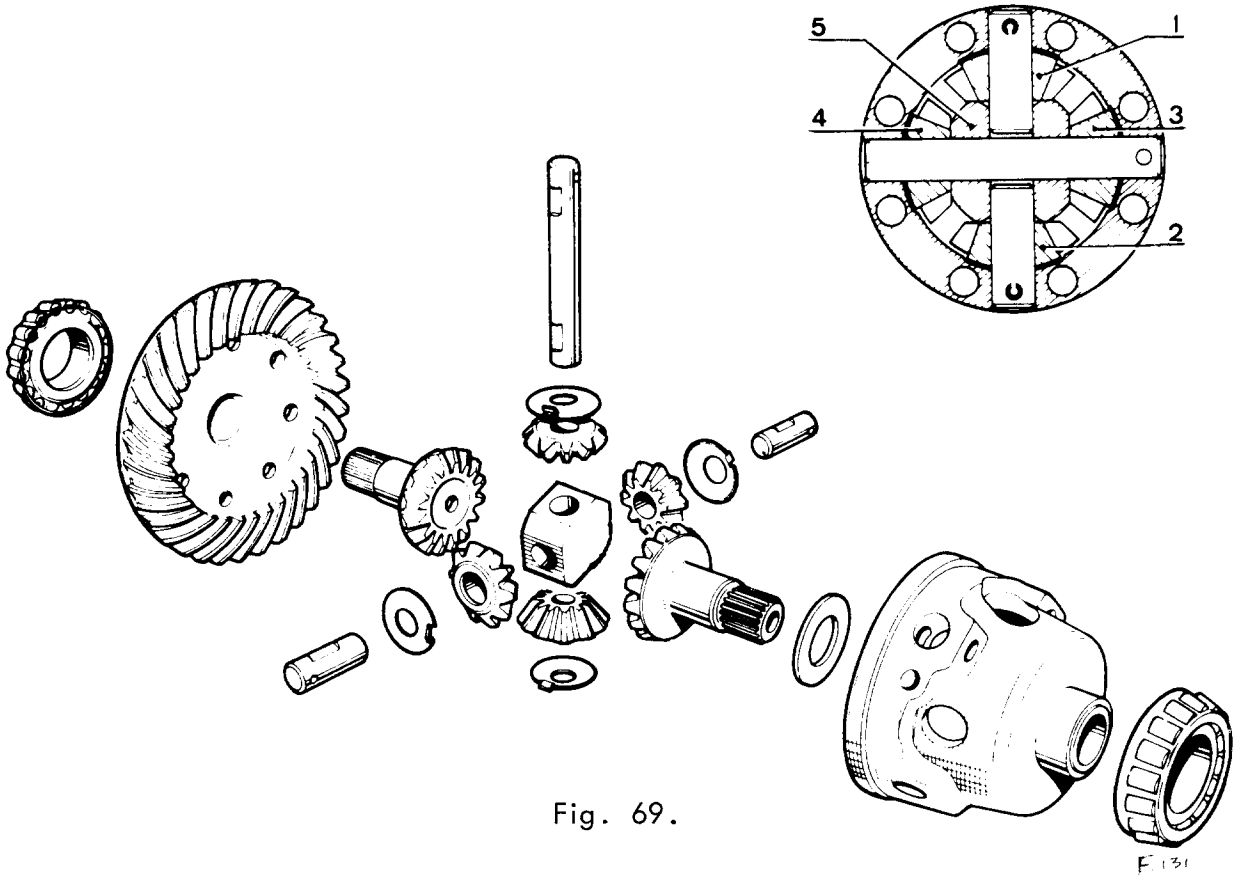


Fig. 69.

DIFFERENTIAL

Fit into the differential housing, the -

a. The bakelite impregnated washer, with the oil groove facing the sun wheel.

b. The 1.97 - 2 mm. (.077 - .079 in.) shim; use the thicker shim 2.03 - 2.07 mm. (.080 - .082 in.) only when the free play between the planet and sun wheels is excessive.

c. One of the sun wheels, having first dipped it in EP.80 oil.

d. The planet wheels (1 and 2) (see Fig. 69) and their thrust washers, ensuring the locking tags are located in the holes in the housing.

e. Insert the planet wheel shafts such that they do NOT protrude beyond the planet wheels.

f. Repeat operations 'd' and 'e' for the planet wheels. (3 and 4).

g. Insert the hub (5), noting that its chamfered ends must face towards the two small shafts. Push all three shafts in as far as possible, lining up the holes with those in the housing. Secure the small shafts with new roll pins.

h. Dip the second sun wheel into an EP.80 oil and insert into crown wheel. Assemble the crown wheel to the differential housing by means of new, self-locking bolts, noting that the bolt with the 'pip' locks the larger planet wheel shaft. Tighten the bolts to a torque loading of 65 - 80 lbs.ft. (9 to 11 m.da N). Fit the 'O' ring seals in position on the sun wheels. Note that after assembly, the differential may be stiff to turn.

j. Fit the bearings to the differential assembly as given on Page 21.

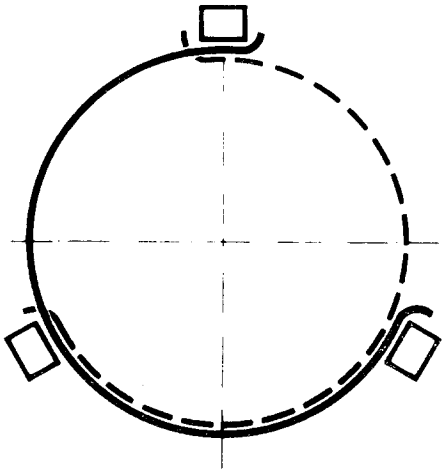
Primary Shaft.

1. Fit the primary shaft positioning washer.
2. Fit the double taper roller bearing.
3. Using a press, fit the roller bearing inner track to the shaft.
4. Using a suitable grease, insert the bearing rollers into the outer track ring, then slide primary shaft through this assembly, retaining the whole with its circlip.
5. Fit the clutch shaft to the primary shaft using a new roll pin for its retention.

5th. Speed Synchro.

Note that the hub and its sliding gear are a matched set.

1. Using Fig. 70. as a reference, fit on to the hub:
   a. The three keys.
   b. The two springs.
   c. The sliding gear, aligning the marks made during dismantling.



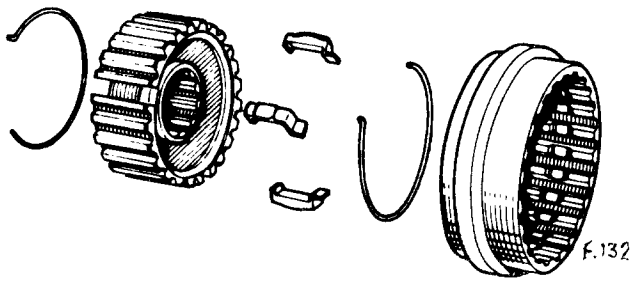


Fig. 70.

TRANSMISSION ASSEMBLY.

Adjusting Pinion Depth.

Adjusting the pinion depth for the Type 365 gearbox is as given for the Type 352 gearbox on Page 21.

Checking the pinion depth is the same as given on Page 22, with the exception that before bringing the two halves of the casing together, it will be necessary to remove the spacer plate, refitting it after bolting the casing together.

When the final adjustment has been obtained, remove the checking gauge, rear cover, left-hand half casing and secondary shaft assembly.

Primary Shaft Position.

This is given on Page 24 with the exception that, before fitting the secondary shaft assembly into the right-hand half casing, it will be necessary to remove the:

a. Speedometer worm nut.
b. Wavy washer.
c. 5th. Speed gear.
d. Spacer plate.

The primary shaft is positioned by means of a washer ('1' of Fig. 47.), the washers being varying thicknesses to accomodate correct positioning (see Page 24). Note that the stop ('R' of Fig. 47.) must be equal for both sets of gears.

When the correct adjustment has been obtained, remove both the secondary and primary shaft assemblies.

REASSEMBLING.

Selector Mechanism

IMPORTANT: Roll Pin fitting:

When reassembling, fit the roll pins as shown in Fig. 71. Their slots MUST always face towards the speedometer drive housing.

Note that this instruction applies to both the Type 365 gearbox and the Type 352 gearbox.

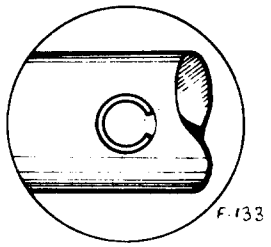


Fig. 71.

1. Gear Shift Control.

Fit the reverse selector, reverse shaft, 1st. / 2nd. selector shaft and 3rd. / 4th. selector shaft as detailed on Page 26.

Fit the 5th. speed selector shaft locking ball in position, and slide in shaft (see Fig. 72.)

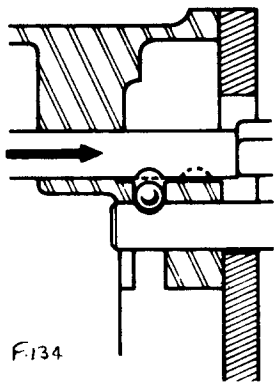


Fig. 72.

Select 4th. gear and retain in this position until gearbox is assembled.

Fit reverse shaft and gear as detailed on Page 27.

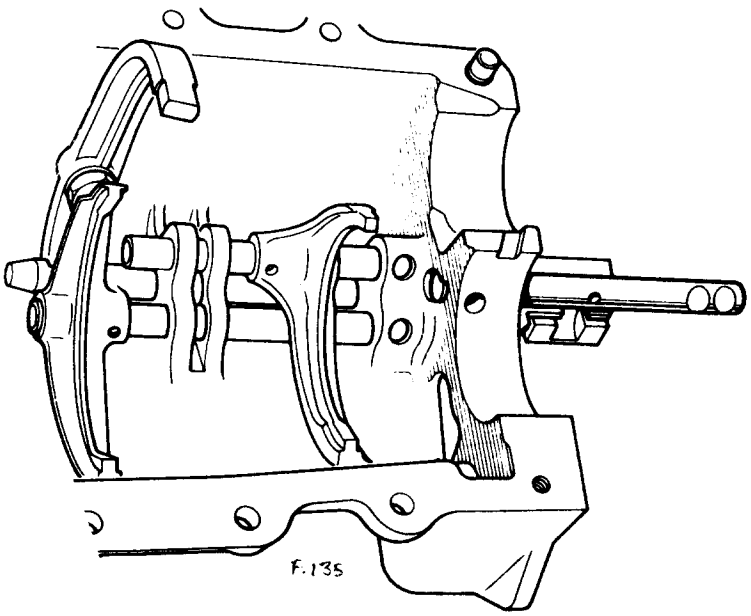


Fig. 73.

Rear Cover.

1. Fit the felt washer (A of Fig. 74) behind the bush.
2. Assemble the rocking lever to its pivot pin, and insert into cover.
3. Fit the selector finger and control shaft.
4. Secure the control shaft with its washer and nut.
5. Fit the speedometer driven gear, together with its guide and new 'O' ring seal.

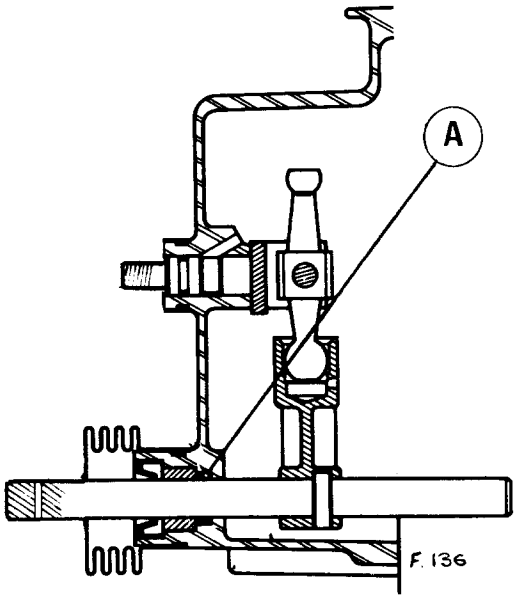


Fig. 74.

Fit the following to the right-hand half housing:

a. The primary shaft.

b. Select 4th. speed, then fit the secondary shaft.

Insert the stop peg for the outer track ring of the double taper roller bearing.

c. The differential (see Fig. 11.)

Smear the half-housings joint faces with 'Hylomar' jointing compound.

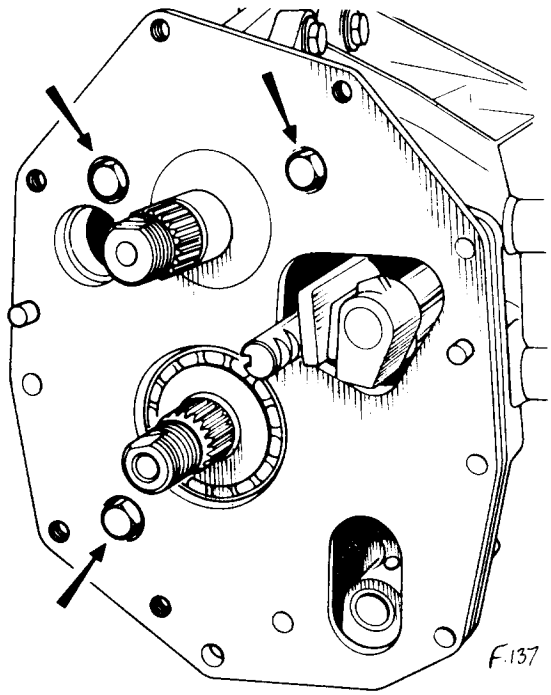


Fig. 75.

Fit the left-hand half housing, ensuring that the end of the reverse gear selector is correctly inserted in the slot in the reverse gear wheel shaft. Fit the half-housing securing bolts, but do not tighten them at this stage.

Fit the spacer plate (Fig. 75) after applying 'Hylomar' to its gasket. Replace the locating dowels. Fit and tighten, the three securing bolts.

Tighten the half-housing securing bolts in the sequence shown in Fig. 76.

7 mm. bolts to 15 lbs. ft. (2 m.da.N).
8 mm. bolts to 20 lbs. ft. (2.8m.da.N).

Primary Shaft.

Assemble the following on to the primary shaft:

a. Spacing washer.
b. Needle roller bearing and sleeve.
c. 5th. speed driven gear with its synchro hub, sliding gear and fork assembly.
d. The wavy washer and synchro nut.

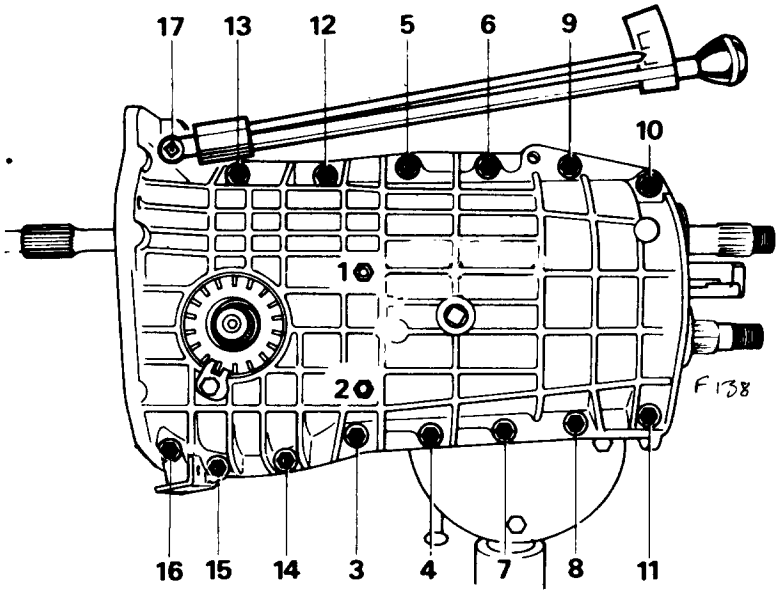


Fig. 76.

Secondary Shaft.

Assemble the following on to the secondary shaft:

a. 5th. speed gear.
b. Wavy washer and speedometer worm nut.

Secure the 5th. speed selector fork with a new roll pin.

Return the selector forks to the neutral position (from 4th.)

Select 5th. speed and Reverse together.

Tighten, and torque load the :

a. Primary shaft nut to 45 lbs. ft. (6 m. da N).
b. The speedometer worm nut to 75/85 lbs. ft. (10/12 m.da N).

Lock the two nuts.

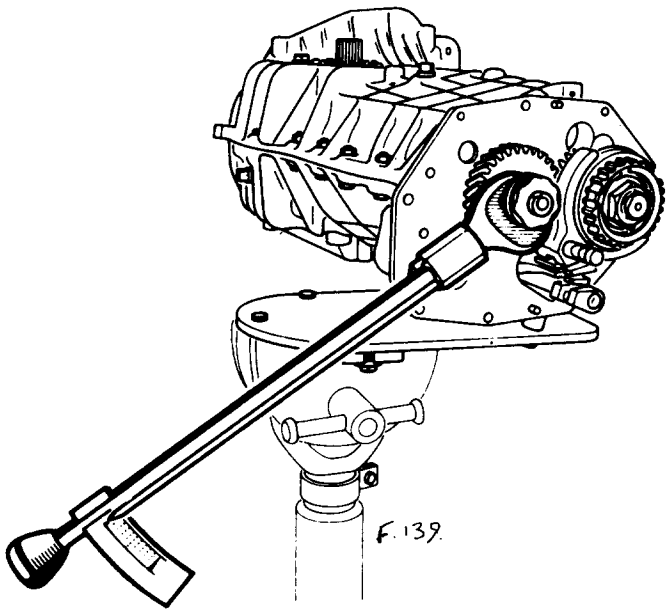


Fig. 77.

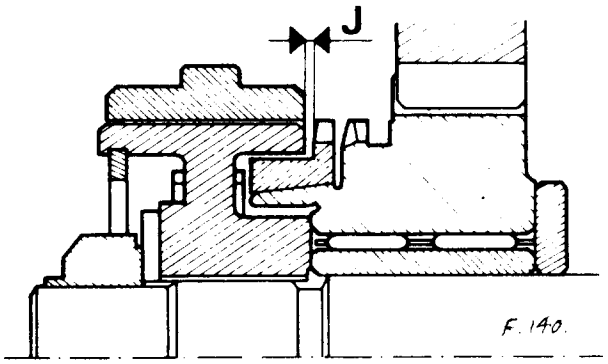


Fig. 78.

Check the clearance 'J' (Fig. 78) between the 5th. speed synchro ring and the hub rim. A minimum clearance of .008 in. (.20mm.) is required, with the gear hard against the hub, and the synchro ring in line with the gear cone.

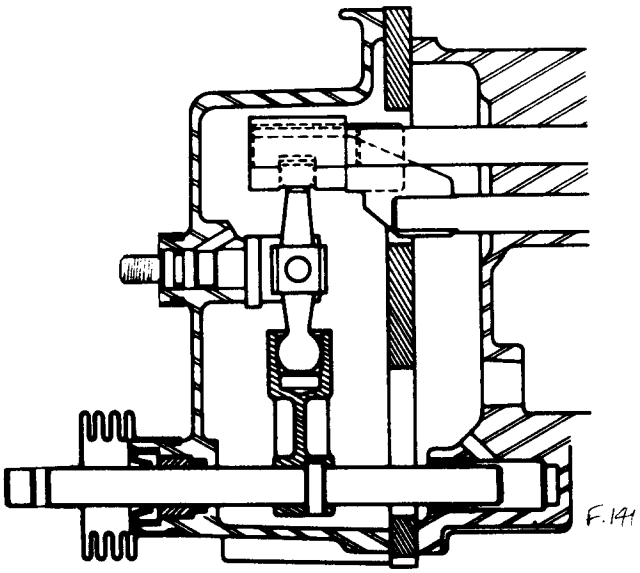


Fig. 79.

Return the selector forks to neutral, then select 4th. speed.

Fit the rear cover after applying 'Hylomar' to its gasket. Ensure the end of the rocking lever enters the slot in the 3rd. / 4th. speed selector shaft. (Fig. 79.)

Push the cover on and fully tighten the securing bolts.

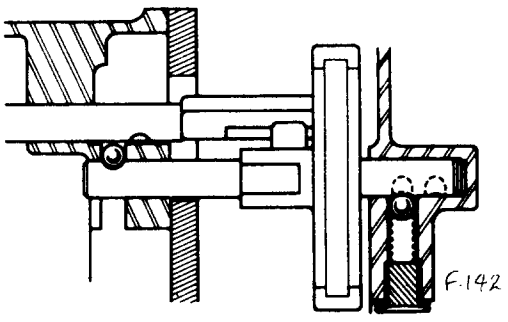


Fig. 80.

Fit the 5th. speed selector locking ball and spring (Fig. 80.)

Smear the plug threads with Loctite "AV", fit washer and screw in plug.

SECTION G.

WHEELS/TYRES.

G.1. - TYRES

It is recommended that the complete assemblies of wheels and tyres are balanced at intervals of every 5,000 miles (8,000 km.)

Maintain the tyres at the correct pressures. Under inflation will cause excessive wear and rapid deterioration of the tyre walls, whilst over inflation will have a detrimental effect on the handling characteristics. Pressures should be checked at least once a week.

Because of their light, precise steering, these cars are highly sensitive to tyre radial run-out and concentricity. If trouble is experienced with replacement tyres, reference should be made to the tyre manufacturer concerned.

When inadvertently running on reduced tyre pressures, the tyre could be suddenly deflated by hard cornering, as the wheel safety ledge is slightly tapered.

The Lotus Europa Twin Cam is equipped with Dunlop 'SP Sport' radial tyres having inner tubes. Note that when tyres are replaced and inner tubes are fitted, it is ESSENTIAL that the tubes are of the CORRECT TYPE for RADIAL PLY TYRES.

It is pointed out, however, that when using the recommended pressures (see TECHNICAL DATA) there is no danger whatever in using tubeless tyres without tubes.

It is recommended that all pressures, including the spare, be checked at intervals of every 1,000 miles (1,600 km.).

G.2. - ALLOY WHEELS.

With this option, larger section tyres are fitted to the rear wheels. The spare is fitted with a small section (front) tyre. NOTE that:

1. Under NO CIRCUMSTANCES must a rear tyre be fitted at the front of the car.
2. A front wheel and tyre assembly MAY BE USED as a 'get you to the nearest garage' EMERGENCY SPARE, PROVIDED that the pressure is adjusted for the rear position and LESS THAN moderate speeds and cornering loads are employed, i.e. NO MORE THAN HALF THE CAR'S POTENTIAL, RELATIVE TO THE PERTAINING ROAD CONDITIONS.
3. It is IMPORTANT that any balance weights are hard up against the corner radius of the wide part of the inside of the wheel (see Fig. 1.)

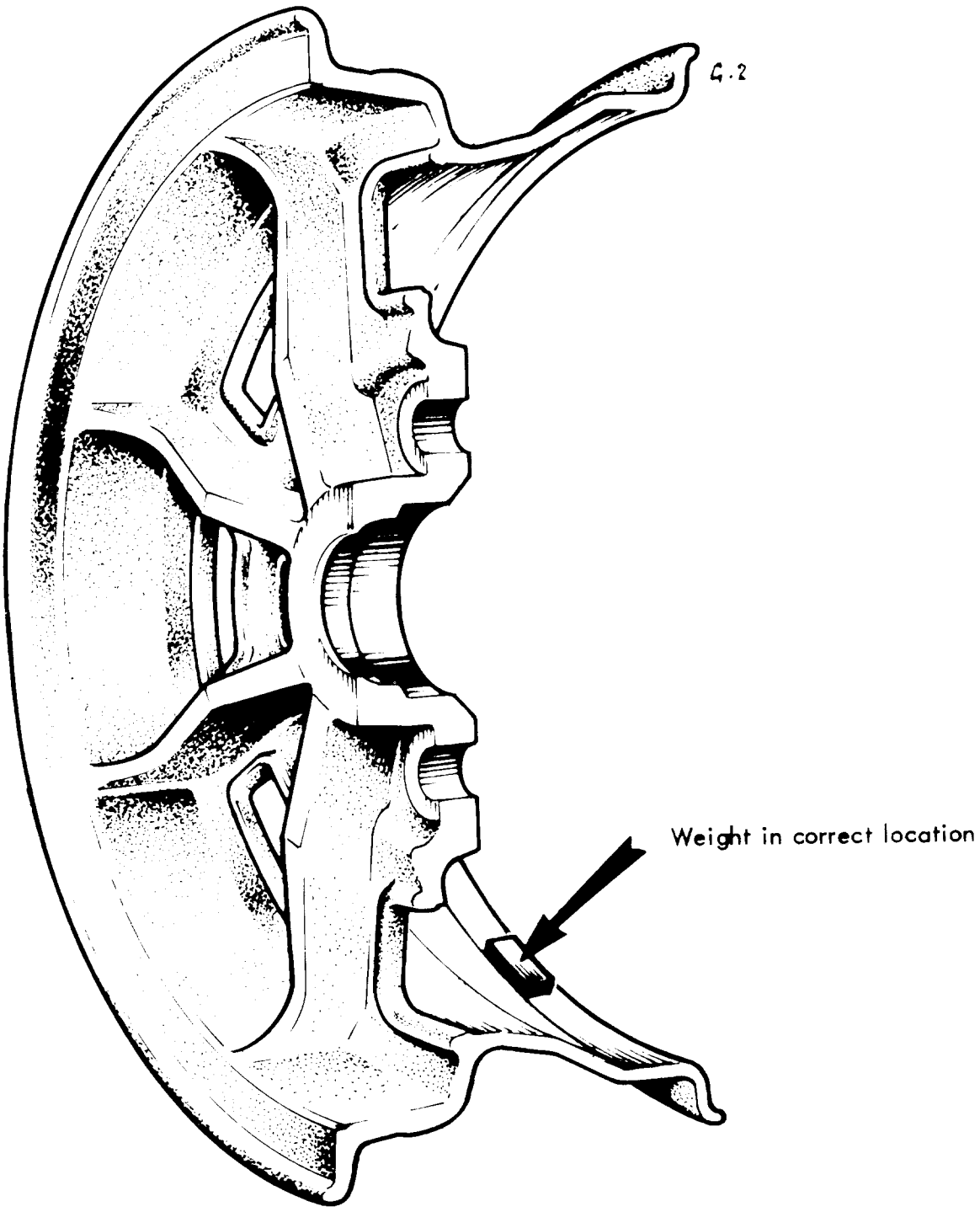


Fig. 1. ALLOY WHEEL SHOWING CORRECT LOCATION OF BALANCE WEIGHTS.

SECTION H.

STEERING.

The only difference (from previous Europa models) to the steering is, a universal joint now incorporated at the lower end of the steering column, attached column to steering unit, in place of the flexible coupling.

Note that no attempt should be made to repair the universal joint: it must be replaced as a complete assembly.

All other information on steering will be found in the Lotus Workshop Manual.

SECTION J.

BRAKING SYSTEM.

J.1. - GENERAL DESCRIPTION.

All Europa Twin Cam cars are fitted with a vacuum operated servo unit as original equipment. On cars destined for markets requiring dual braking systems and to comply with the laws existing in those markets, the braking system is split into two separate hydraulic units with its own master cylinder and servo unit, two brakes (either front or rear).

Also incorporated in the braking system is a 'brake fail' warning lamp with test switch. The lamp will glow RED if a failure occurs anywhere within the braking hydraulic system, or if the test switch is operated.

J.2. - TANDEM MASTER CYLINDER.

To Bleed the System (see also Section 'K' of the Europa Workshop Manual)

Bleed the rear brakes FIRST, commencing with the left-hand wheel, then bleed the front brakes starting with the left-hand wheel - ALWAYS the wheel nearest to the master cylinder first, whether front or rear.

Use only a light pedal action and DO NOT push the pedal through at the end of its stroke. DO NOT 'try' the pedal until the system is fully bled, as either action will cause the plunger to move and actuate the brake fail warning lamp.

If, during the bleeding procedure, the plunger operates the switch and the warning lamp is 'on', the bleed screw must be closed and the bleed screw at the other end of the car opened - if bleeding the front brakes, open the bleed screw on a rear brake and vice versa. A steady pressure must then be applied to the pedal until the lamp goes out, when the pressure must be released immediately and the bleed screw closed, otherwise the piston will move too far in the opposite direction and require resetting again. When the lamp goes 'out' a 'click' will be felt on the pedal as the piston moves back.

J.3. - REAR BRAKES ADJUSTMENT.

To ensure the correct operation of both the rear brakes and the handbrake the undermentioned adjustment procedure should be adopted :-

1. Raise the rear of the car and support on blocks.
2. Disconnect the handbrake cable at the clevis connections on each rear brake backplate.
3. Using the brake adjusting screw, turn clockwise until the wheel locks. The wheel should of course be rotated slowly during this operation. 'Back off' the screw 2 notches ONLY. The wheel should now be free to rotate without undue binding of the shoes in the drum. Ensure that the wheel cylinders are not being held in the 'on' position by the bundy pipes.

4. Re-connect the handbrake cable clevis connections and adjust the handbrake intermediate cable, so that with the handbrake lever in the fully released position, the handbrake is just on the point of coming into operation.

J.4. - PEDALS 'SET-UP' DIMENSIONS.

If the occasion arises where any new pedal has been fitted, then they MUST be 'set-up' to the dimensions shown in Fig.1.

Before final pedal checks are made, endfloat of the throttle pedal assembly in its mounting brackets must be no greater than 1.27 mm.(.05 in.) . Dimensions are taken with the carpets fitted, but with the pedal rubbers removed. Set brake pedal to given dimension from bulkhead (carpet compressed), clutch pedal to be level with brake pedal by adjusting the clutch pedal return stop.

With all pedals at rest, the throttle pedal must be within the dimensions shown for both sideways and fore and aft location.

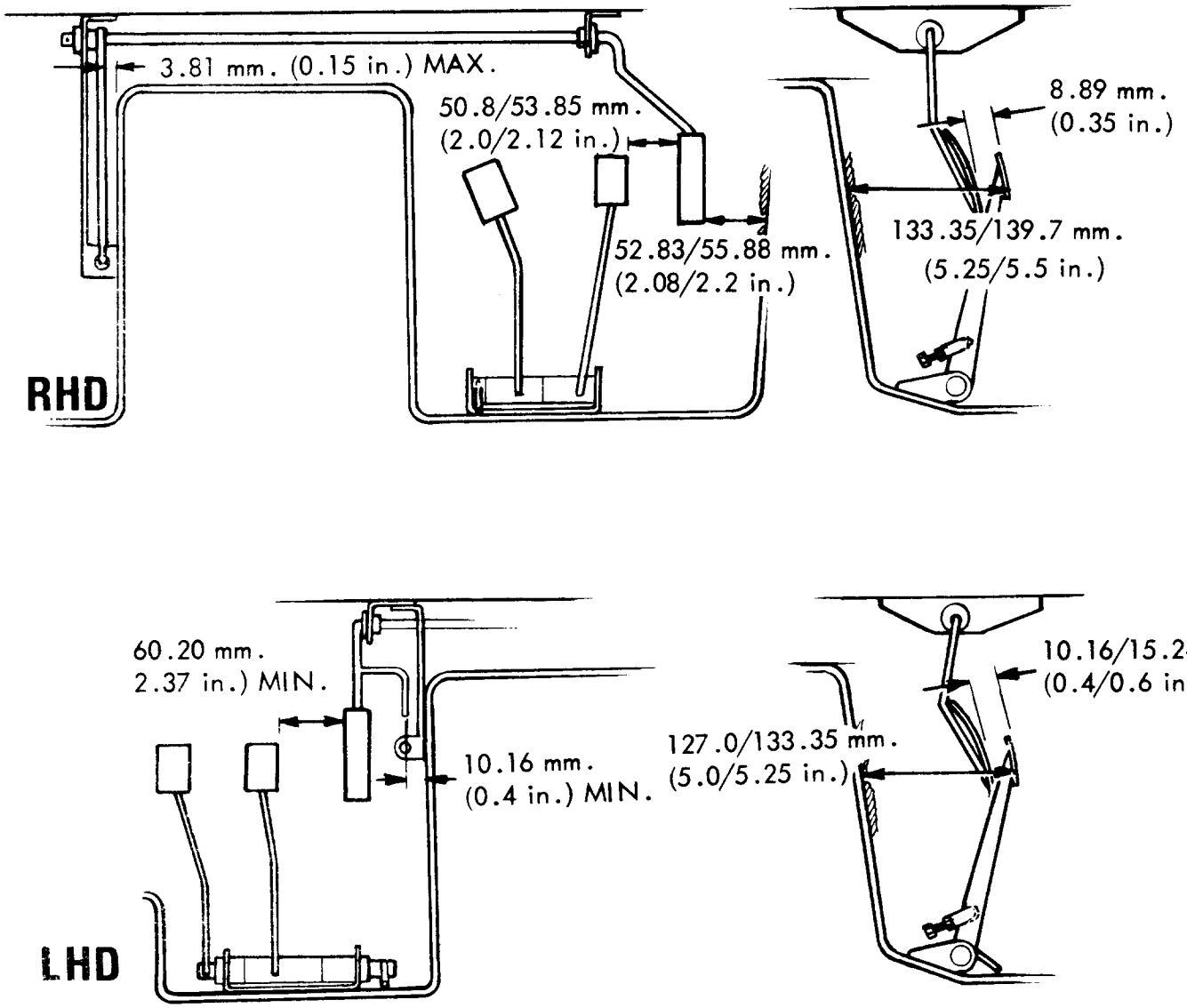


Fig. 1. PEDALS "Set-up" DIMENSIONS.

SECTION K.

COOLING SYSTEM.

K.1. - FILLING THE SYSTEM.

1. Pull heater control (in car) to the 'Hot' position.
2. Open tap (or remove vent plug) on top of radiator.
3. Remove filler cap on header tank and fill with coolant until coolant issues continuously from tap (or vent plug orifice). Close tap (or replace vent plug). Fill header tank to brim.
4. Start engine and 'run' at approximately 1,500 r.p.m. Keep header tank topped up with coolant.
5. Release clip and pull off hose from heater valve (at thermostst housing). Close end of hose with thumb and finger until coolant issues continuously from heater valve. Refit hose to valve.
6. Check that radiator and heater are warming up. If not, repeat operations '3' and '5'.
7. Occasionally slacken tap (or remove vent plug) on radiator to 'bleed' air.
8. "Run" engine until hot (when fan starts). Top up header tank, tighten tap (or replace vent plug) on radiator, switch 'off' engine.
9. Check coolant level after FIRST 160 km. (100 miles) and DAILY for first 10 days of use. Take care when removing the filler cap from header tank, if the system is anything but cold - remove the cap slowly to allow the pressure within the tank to vent slowly. The coolant level when warm should be UP TO THE FILLER CAP and when cold should be no LOWER THAN 10 cm. (4 in.) below the top.

K.2. - FROST PRECAUTIONS

To avoid the possibility of the cooling system freezing whilst the vehicle is stationary, or whilst being driven in very cold weather, it is recommended that an anti-freeze solution is used. Details are given in Section 'O' of quantities required.

We recommend anti-freeze based on inhibited ethylene glycol. Anti-freeze using alcohol as a base is NOT suitable, it being subject to loss by evaporation. Owing to the difficulty in completely draining the heater system with normal draining of the engine cooling system, it is ESSENTIAL that anti-freeze is used when cold conditions are anticipated.

SECTION L.

FUEL SYSTEM.

L.1. - GENERAL DESCRIPTION.

The fuel system comprises of two fuel tanks, one at either rear quarter in the engine compartment, the tanks being inter-connected. Separate fillers are provided for each tank, therefore it is necessary to fill both tanks when re-fuelling. By filling one tank only, an initial false reading will be given on the fuel guage UNTIL the fuel level is balanced in both tanks.

Use fual having a MINIMUM rating of 101 octane. This is equivalent to 'Super' grade, or '5 star'.

A further pipe connects the tanks to the diaphragm type mechanical fuel pump mounted on the right-hand side of the engine and driven by the jackshaft (auxiliary shaft). From the fuel pump, a further pipe delivers fuel to the carbyretters.

Either two side draught Dellorto, or two side draught Zenith-Stromberg carburetters (see respective sections dealing with carburetters and also 'TECHNICAL DATA') are used.

L.2. - FUEL SYSTEM.

To Clean.

1. Remove the air cleaner and clean both the body and element.
2. Disconnect the fuel supply pipe at both the carburetters and the fuel pump.
3. Remove and clean the carburetters (see 'ENGINE TUNE').
4. Using an air line, blow through the previously disconnected fuel feed pipes between carburetters and fuel pump. Replace the pipe.
5. Disconnect the pipe between the fuel tanks and the fuel pump. Blow through using an air line. Replace the pipe.
6. Remove the fuel pump sediment bowl and filter, wash in clean petrol and refit.
7. Replace the air cleaner.

L.3. - FUEL TANK.

To Remove. See Section 'L' of Europa Workshop Manual.

L.4. - FUEL TANK SENDER UNIT.

To Remove. See Section 'L' of Europa Workshop Manual.

L.5. - FUEL GUAGE.

To Remove. See Sectin 'M' of Europa Workshop Manual.

L.6. - FUEL PUMP.

Description

Fuel is drawn from the fuel tank by the pump which is secured to the engine block and is driven by an eccentric on the jackshaft. The pump consists of two main bodies which clamp a diaphragm between their outer flanges.

The lower body assembly comprises a rocker arm and link, both of which pivot on a pin located in the body; attached to the link is the pull rod incorporated in the diaphragm assembly. To protect the diaphragm from the crankshaft oil splash, an oil seal us located at the point in the lower body where the push rod passes through. A return spring is interposed between the undersides of the diaphragm and the lower body, the spring determining the pump output pressure, (see 'Technical Data'). A further spring is fitted between the rocker arm and the body for the purpose of ensuring that the rocker arm is in contact constantly with the eccentric on the jackshaft.

Assembled in the upper body are two valve assemblies, one being opened by suction, the other by pressure. Both valves are held in position by a recess in the upper body which is then staked.

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

Also incorporated in the upper body is a filter gauze which is held in position with a domed glass top cover and gasket, this in turn being held by a centre screw clamping the cover to the upper body.

To Remove Fuel Pump.

1. Disconnect the pipes from the inlet and outlet bosses of the fuel pump. Seal off the ends of the pipes to prevent the ingress of foreign matter.
2. Remove two fuel pump retaining bolts and lockwashers, and withdraw fuel pump and gasket from cylinder block.

To Dismantle.

1. Before commencing to dismantle, clean exterior of pump and scribe a line across the lower and upper body flanges of the pump for location purposes during reassembly.
2. Remove domed glass top cover of pump also gasket and filter gauze.
3. Remove the screws and spring washers securing the lower and upper bodies together and separate the two bodies.

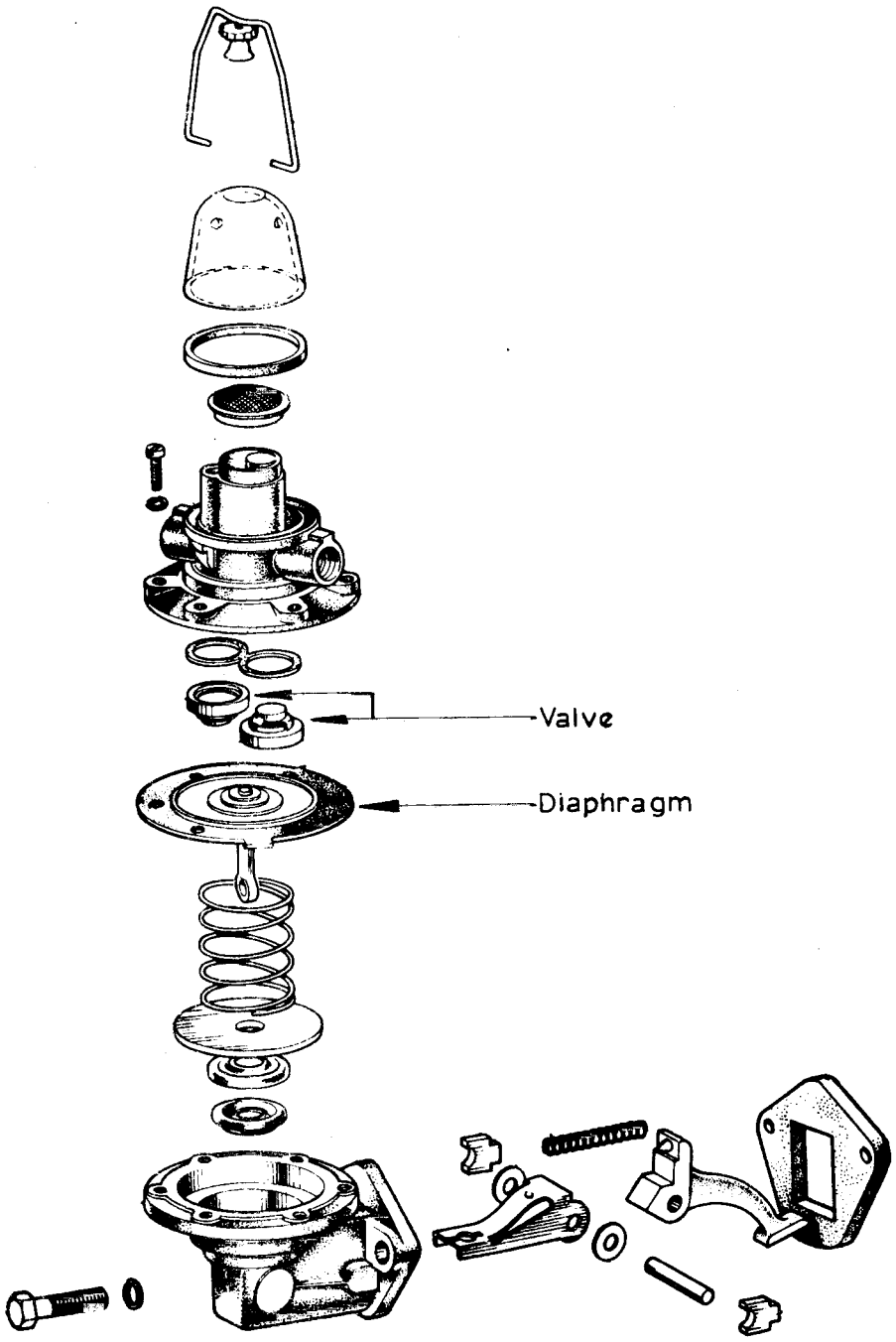


Fig. 1. FUEL PUMP COMPONENTS.

4. The valve assemblies are 'staked' in position and it is necessary to relieve this 'staking' in order to remove valves.

5. From the lower body remove the diaphragm and pull rod assembly, first turning the assembly through an angle of 90° in order to free the rod from the link in the rocker arm assembly.

NOTE: The diaphragm and pull rod are a permanent assembly and no attempt should be made to separate the two parts.

6. Lift out the diaphragm return spring and, when fitted, remove oil seal retaining washer and oil seal.

7. Providing that the rocker arm pin is held firmly in the lower body it should not be necessary to remove the rocker arm pin or associated parts unless undue wear is in evidence. Should it be necessary to remove the rocker arm from body, the following procedure should be adopted:-

The rocker arm and associated parts are located by two retainers, which are fitted into slots at engine face of castings, the retainers in turn being held by punch indentations at each end of retaining pins.

To remove the rocker arm, hold rocker arm firmly in suitable vice and with two flat bars approximately 12 in. long (30.5 cm.) insert one each side in the gap between the casting and vice, lever the body away from the rocker arm and pin.

NOTE: Care should be taken that the type of removing bars used are flat to ensure that the body machined face is not damaged.

Inspection and Overhaul.

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

2. Check the diaphragm for hardening or cracking and examine the lower extremity of the pull rod, where it connects with the rocker arm link, for wear. Renew the diaphram assembly if any of these signs are in evidence.

3. Check diaphragm return spring, if corroded or damaged, it should be replaced.

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

5. Examine the rocker arm face pad for wear. Slight wear is permissable but should not exceed a depth of .010 inches.(.254 mm). Check rocker arm pin and link holes for

wear, also the underside of link where diaphragm pull rod engages for wear. Badly worn or damaged parts should be renewed. Check rocker arm return spring.

6. Discard old oil seal and gaskets.

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

To Re-assemble.

The re-assembly of the rocker arm into the body is as follows:-

Assemble rocker arm, link and spacing washers onto rocker arm pin, place rocker arm return spring into body and insert rocker arm assembly into body of pump. Ensure that the rocker arm return spring is properly engaged between locating 'pips' on casting and rocker arm. Tap two new pin retainers into slots in the body and, while holding the retainers hard against the rocker arm, pin punch over the end of the slots with a 1/8 in. (3.17 mm.) pin punch to prevent retainers working loose.

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

Fit new oil seal washer and steel retaining washer into the lower body. Place the diaphragm return spring in position over oil seal retaining washer. Place the diaphragm assembly over the spring, with the pull rod downwards and with the locating tab on the diaphragm at the twelve o'clock position.

Press down on the diaphragm at the same time turning the assembly to the left in such a manner that the slot on the pull rod will engage the fork in the link, ultimately turning the assembly a complete quarter of a turn to the left, which will place the pull rod in its correct working position in the link. This will also permit the matching up of the holes in the diaphragm with those on the pump body flange and the tab will now be at the nine o'clock position. Place the new valve gasket in the upper body around the valve ports. Place valve assembly in inlet port with spring facing outwards. Fit other valve in the outlet port position with spring inside the port.

When refitting re-stake valve in four positions by using a suitable punch. Refit filter gauze in top of upper body, also glass domed cover with new cover gasket.

Fit central clamping screw.

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

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

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

Replace the securing screws and spring washers and tighten only until the heads of the screws engage the washers.

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

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

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

To Replace.

1. Clean the mounting face on the cylinder block, removing ant reace of gasket which may be adhering to the face. Fit a new gasket to the cylinder block flange, holding it in place with a smear of grease.
2. Insert the rocker arm through the hole in the cylinder block so the arm lies on the camshaft eccentric.
3. Secure the fuel pump to the cylinder block with two spring washers and bolts, tightening the bolts evenly to the torque loading given in 'Technical Data'.
4. Ensure that the pipe joints are clean and refit the fuel pipes.
5. Run the engine and check for leaks at the joints.

L.7. - DELLORTO CARBURETTERS.

Cars designed for use in domestic (United Kingdom) markets are equipped with Dellorto Carburetters . These are very similar in both the operation and physical appearance as Weber carburatters used on Twin - Cam engines on the other Lotus vehicles.

Starting(Figure. 2.)

Fuel from the tanks is delivered to the banjo, (2) then through the filter (1) to the float chamber via the needle valve,(15) and its seat,(14). The fuel level is determined by the float,(17). The float chamber is vented to the atmosphere at (4).

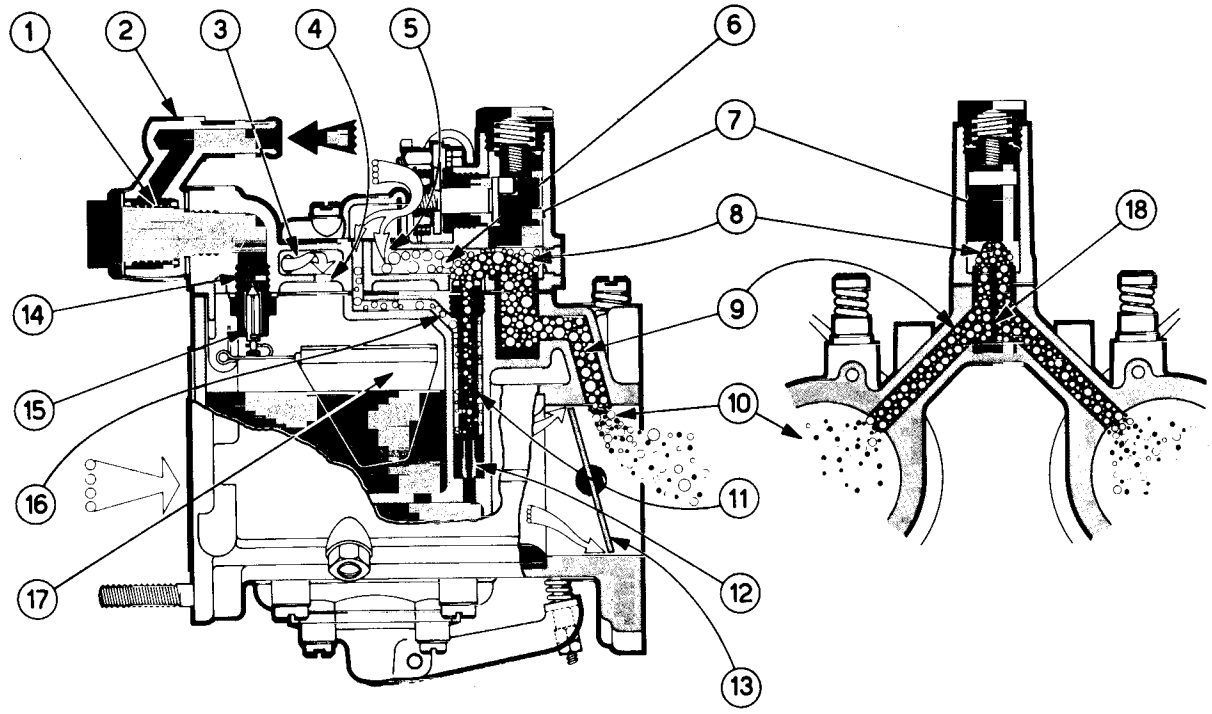


Fig. 2. STARTING CIRCUIT.

When the starter valve (7) is opened, the fuel, set by the jet (12) enters the emulsion tube (11), where it mixes with the air from the channel (16), the mixture passing into channel (6) mixing further with air from hole (5). Arriving at the valve chamber (8), the mixture spreads into the two channels (9) that flow into the main barrels (10), downstream of the throttle butterfly (3). When the starter valve (7) is closed, the communication between the two main barrels and the starter device is disconnected and by means of the partition (18) the one of the two main barrels (10).

Idle (Fig. 3.)

The fuel fron the float chamber is set by the idle jet (20). This fuel mixes with the air from the emulsion tube (3) via the channels (19). The mixture then passes through the channels (21), to the adjustment screws (22), then having been metered, to the main barrels (10) downstream of the throttle valves (13).

Progression (Fig. 3.)

At the opening of the throttle valves (13) during the passage from idle to main, the mixture arrives at the main barrels (10) via the progression holes (23).

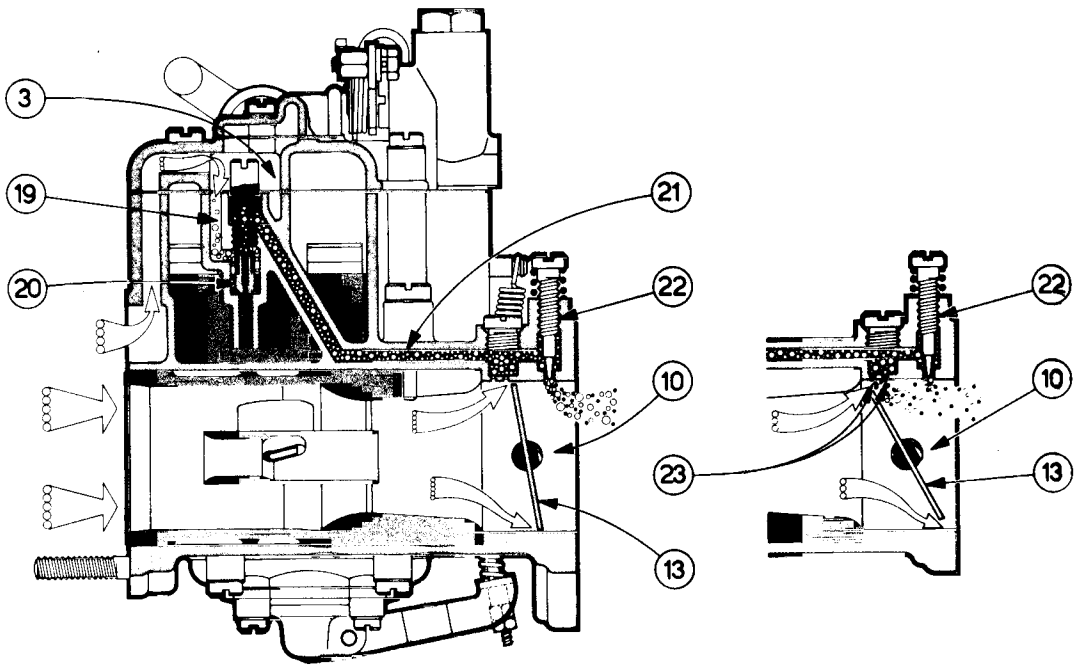


Fig. 3. IDLE & PROGRESSION CIRCUITS.

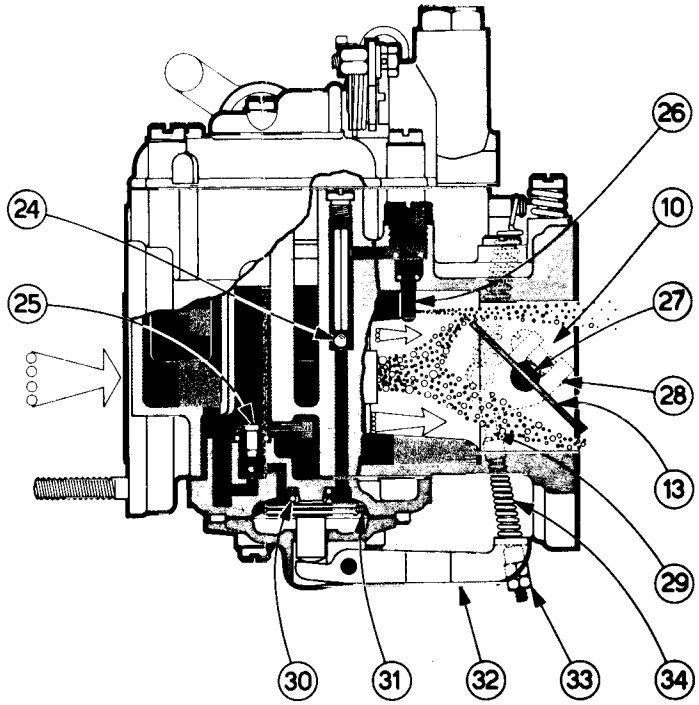


Fig. 4. ACCELERATION CIRCUIT.

Acceleration (Fig, 4.)

When the throttle valves (13) are opened, the lever (28) attached to linkage (27), pushes a rod (29) and spring (34), this is turn actuating a lever (32) thus operating the diaphragm (31). The diaphragm is held in position by a spring (30).

The diaphragm pumps fuel in two separate circuits through the delivery valves (24) and the pump jets (26) , then to the main barrels (10) when the throttle valves are closed, the diaphragm returns to its off position, pushed by the spring (30), sucking fuel from the float chamber via valve (25) during this operation. The nuts (33) are used to adjust the pump capacity.

Main (Fig. 5).

When the throttle valves (13) are opened, the fuel from the float chamber, set by the jets (37), enters the emulsion tubes (36) and mixes with the air set by the calibrating orifice (35). The mixture thus made, enters the channels (39), passes to the auxiliary venturi (38) where further mixing with air from the main intake, the mixture passes to the main barrels (10).

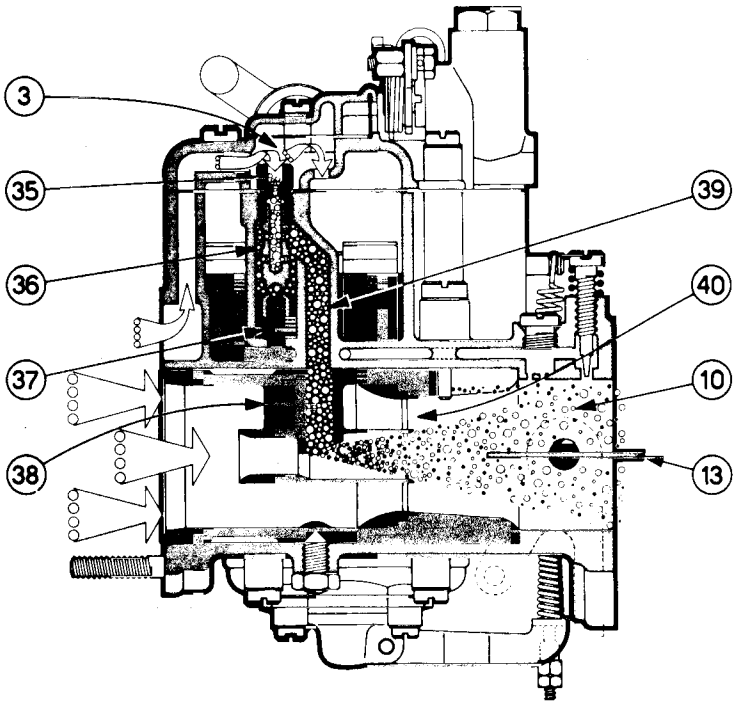


Fig. 5. MAIN CIRCUIT.

Synchronisation (Fig. 6.)

To obtain correct synchronisation of the carburetters, the following procedure is recommended:-

1. Disconnect the accelerator control cable from the lever (1) at the rear carburetter.
2. Release the adjustment screw (2) for the throttle valves making contact with the end of the lever (3).

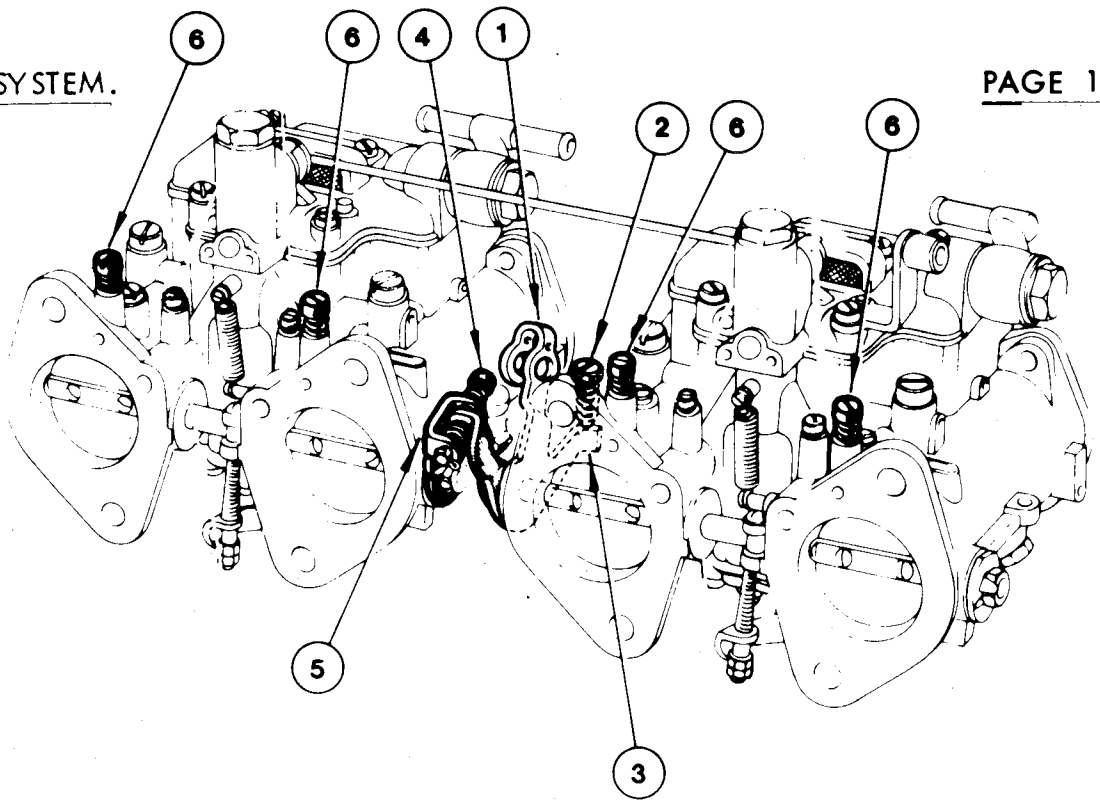


Fig. 6. CARBURETTER ADJUSTING SCREWS.

3. Release the screw (4) in lever (5) to ensure that when pressure is applied to lever (1) on rear carburetter, perfect closure of all throttle valves in both the front and rear carburetters is achieved.
4. Still keeping the same pressure on the lever (1) adjustment screw (4) to hold lever in that position. The throttle valves should all close perfectly.
5. Give ONE FULL TURN to screw (2) so that it is now in contact with the lever (3).
6. Fully close the mixture screws (6), then 'BACK OFF' 2 FULL TURNS.
7. Re-connect the accelerator cable to its lever. (1).
8. Start the engine and allow to reach its normal operating temperature. Using the adjustment screw (2), adjustment screw (2) adjust the engine speed to the r.p.m. given in 'TECHNICAL DATA'. If the engine now runs irregularly, adjust the mixture screws (6) on each barrel, to obtain regular running on all barrels. Turning the screws INWARDS WEAKENS the mixture, whereas turning the screws OUTWARDS RICHENS the mixture.
9. Using the screw (2), readjust the engine speed.

Checking the Float Chamber Level (Fig. 7)

1. Hold the float chamber cover in the vertical position, with the floats hanging down. The tab should be in light contact with the needle.
2. The distance between floats and cover (Dimension 'A'), including gasket should be 14.5 - 15 mm. If necessary bend the needle valve tab to achieve this dimension.

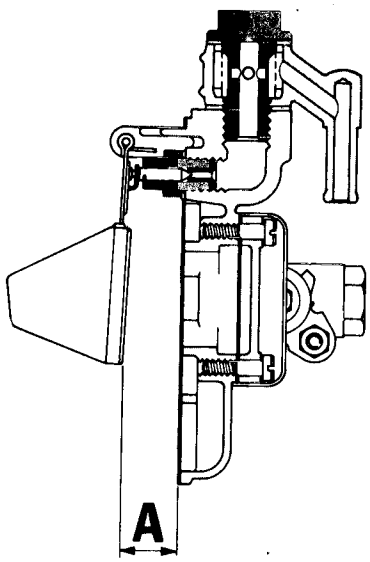


Fig. 7. FLOAT CHAMBER LEVEL.

CARBURETTER FAULT FINDING.

It is assumed that all engine mechanical and/or ignition faults have been corrected, therefore, ONLY possible carburetter faults will be listed below.

Fuel Leakage:

Possible Cause.	Suggested Remedy
1. Float needle valve dirty, or worn, or valve seat loose on its thread.	Thoroughly rinse clean filter and valve. Fully tighten the valve seat.
2. Float not free (tight on its hinge, or rubbing on sides), or heavy.	Fit new float assembly.
3. Fuel feed pipes loose, or broken.	Tighten pipes and unions, or replace.
4. Gaskets hardened, perished or loose.	Fit new gaskets.
5. Torn or punctured pump diaphragm.	Replace diaphragm.

Cold Start Difficulties.

Possible Cause.	Suggested Remedy.
1. Abnormal level of petrol in float chamber	Check float level.
2. Starting device actuating cable not sliding freely, broken unattached.	Replace the cable.
3. Strangler valve seized.	Free strangler valve.
4. Starter jet dirty.	Clean, or replace jet.

Irregular Firing of Engine.

Possible Cause.		Suggested Remedy.
1.	Incorrect adjustment of mixture screws.	See 'Synchronisation'
2.	Idling jet dirty or loose.	Clean and tighten.
3.	Progression holes, or idling circuit ducts blocked.	Thoroughly clean all orifices and ducts.
4.	Air leak from mounting flange.	Replace gaskets and fully tighten screws.
5.	Throttle spindle leaking air through its bearings.	Replace spindle and bearings.
6.	Throttle valves, or their control, not moving freely.	Free throttle valves and throttle spindle.

Vehicle Not Attaining Maximum Speed, or Lacking Hill Climbing Power.

Possible Cause.		Suggested Remedy.
1.	Main jet, power jet, emulsion. calibrating orifice or emulsion tube, blocked or loose.	Check, clean or replace defective parts.
2.	Throttle valve not fully opening.	Check throttle valve and linkage.

Insufficient Acceleration Mainly in Top Gear.

Possible Cause.		Suggested Remedy.
1.	Accelerator pump defective, or faults in its circuit.	Thoroughly overhaul pump and its circuit.
2.	Emulsion tube blocked or defective in other ways.	Replace emulsion tube

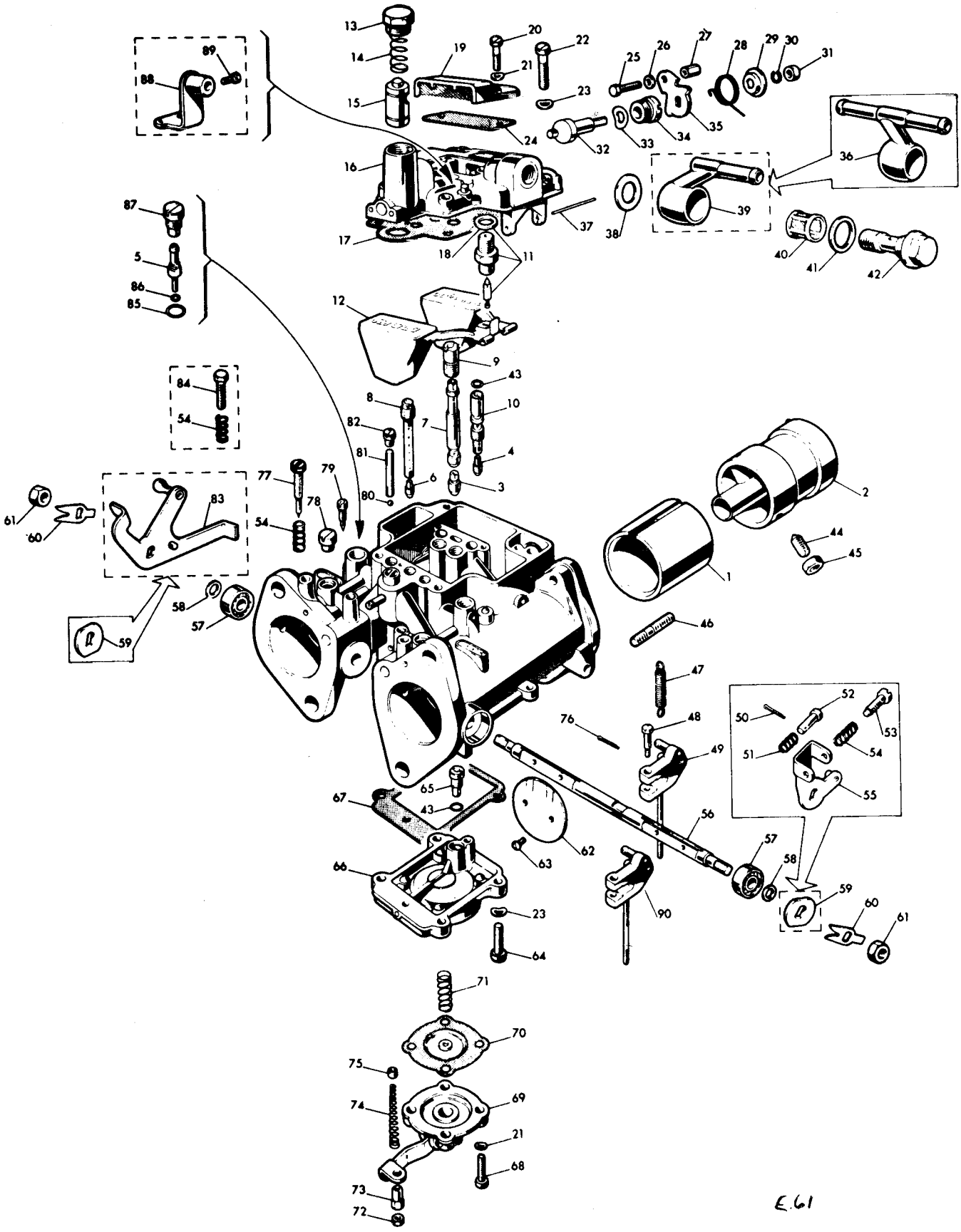


Fig. 8. CARBURETTER COMPONENTS.

Key to Fig. 8. - CARBURETTER COMPOUNDS.

1. Choke
2. Inner venturi
3. Main jet
4. Slow running jet
5. Pump jet
6. Starter jet
7. Main emulsion tube
8. Starter emulsion tube
9. Air corrector jet
10. Slow running air corrector jet
11. Needle valve assembly
12. Float assembly
13. Plug) starter washer
14. Spring)
15. Starter valve
16. Float chamber cover
17. Gasket, float chamber cover
18. Seal, needle valve assembly
19. Jets cover
20. Setscrew, jets cover
21. Spring washer
22. Setscrew
23. Spring washer
24. Gasket, jets cover
25. Setscrew
26. Washer
27. Sleeve nut
28. Spring, lever
29. Distance piece
30. Spring washer
31. Nut
32. Starter spindle
33. Waved washer
34. Sleeve nut
35. Lever
36. Banjo union, front carburetter
37. Pin
38. Seal
39. Banjo union, rear carburetter
40. Filter)
41. Seal) Banjo union
42. Banjo bolt)
43. Seal
44. Grub screw) Retaining venturi
45. Nut)
46. Stud
47. Spring
48. Screw
49. Lever
50. Split pin
51. Spring
52. Pin
53. Screw
54. Spring
55. Throttle lever
56. Throttle spindle
57. Bearing
58. Washer
59. Spacer
60. Tab washer
61. Nut
62. Throttle valve
63. Screw, throttle valve
64. Setscrew, pump body
65. Pump, suction valve
66. Pump body
67. Gasket
68. Setscrew
69. Pump cover
70. Pump diaphragm
71. Spring
72. Nut
73. Sleeve nut
74. Spring
75. Washer
76. Split pin
77. Adjusting screw
78. Plug
79. Sealing plug
80. Delivery valve)
81. Weight) Pump
82. Plug)
83. Throttle speed lever
84. Adjusting screw
85. Seal)
86. Seal) Pump jet
87. Plug)
88. Lever
89. Screw, lever
90. Lever

L.8. - DELLORTO CARBURETTERS.

To Remove

1. Release the clip securing the air cleaner trunking to the air box. Remove the bolts visible in the air box and pull off outer half of box.
2. Release the throttle return spring and throttle cable. Disconnect the fuel supply pipes at the carburetters. Remove the choke cable.
3. Progressively release the nuts securing the carburetters to the engine (four are visible from above, the other four being below). Remove nuts and washers.
4. Carefully remove the two carburetters as an assembly, ensuring that the synchronising linkage between the two is not distorted. Remove the spacers with their 'O' rings from the mounting studs.

To Replace.

1. Ensure that the spacers and 'O' rings are in good condition - the slightest mark will result in an air leak which will seriously affect the efficient running of the carburetters. Fit the spacer assemblies to the mounting studs.
2. Fit the carburetters as an assembly, ensuring that the synchronising linkage has not been disturbed. To each mounting stud fit a double coil spring washer, a plain washer and nut. Tighten the eight nuts progressively until a ..050 in. (1.27 mm.) clearance exists between the coils of the double coil spring washers. Check the clearance with feeler gauges. Do NOT overtighten the nuts otherwise the 'O' rings will be flattened into the recesses of the spacer plates, but more important, with the carburetters rigidly mounted, frothing will occur in the float chambers.
3. Refit the fuel supply pipes to the carburetters. Reconnect the choke control, throttle cable and throttle return spring.
4. Ensure that the gasket is in good condition between the two halves of the air box, then refit outer half. Reconnect the air trunking to the air box.

To Adjust.

The only adjustments required are synchronisation, mixture strength and idling speed. These adjustments are covered in Section 'L.7' under the sub-heading 'Synchronisation' Fig.6).

L.9. - ZENITH STROMBERG CARBURETTERS.

Cars destined for use in North America and other Territories where Exhaust Emission Laws are in force, are equipped with Zenith Stromberg carburetters.

Zenith Stromberg carburetters are developed from the CD (Constant Depression) carburetters, which operate on the principle of varying the effective area of the choke and jet orifice, in accordance with the degree of throttle opening, engine speed and engine load.

Operation.

The petrol inlet is a parallel tube, which accomodates a flexible fuel pipe, situated to one side of the main body. Fuel passes into the float chamber, via a needle valve, where the flow is controlled by the needle in the valve and twin floats mounted on a common arm.

As the fuel level rises, the float lifts and by means of the float arm and tag, closes the needle onto its seating when the correct level has been attained. When the engine is running, fuel is drawn from the float chamber, the float descends and more fuel is then admitted through the needle valve. In this manner, the correct level is automatically maintained, the whole of the time the carburetter is in action.

Fuel in the jet orifice is maintained at the same level as that in the float chamber by means of cross drillings in the jet assembly.

Special features of Emission carburetters ensure that they exactly match one another in respect of flow. Clearance around the piston in its vertical bore permits additional air to 'leak' into the mixing chamber and lower depression. The first special feature therefore is the manufacturing tolerance compensator or leak balancing screw.

A drilling is taken from the atmospherically vented region beneath the diaphragm to meet a further drilling that breaks into the carburetter mixing chamber downstream of the air valve, in order to introduce an 'air leak'. An adjusting screw with conical tip is inserted into the drilling to the mixing chamber. This is capable of either completely blanking off the air bleed of permitting flow adjustment to maximun affective diameter of the air bleed.

When set, the balancing screw, is sealed with a plug which MUST NOT in any circumstances be tampered with in service.

It is essential therefore NOT to change the main body, cover or air valve, after the balance screw has been set and sealed.

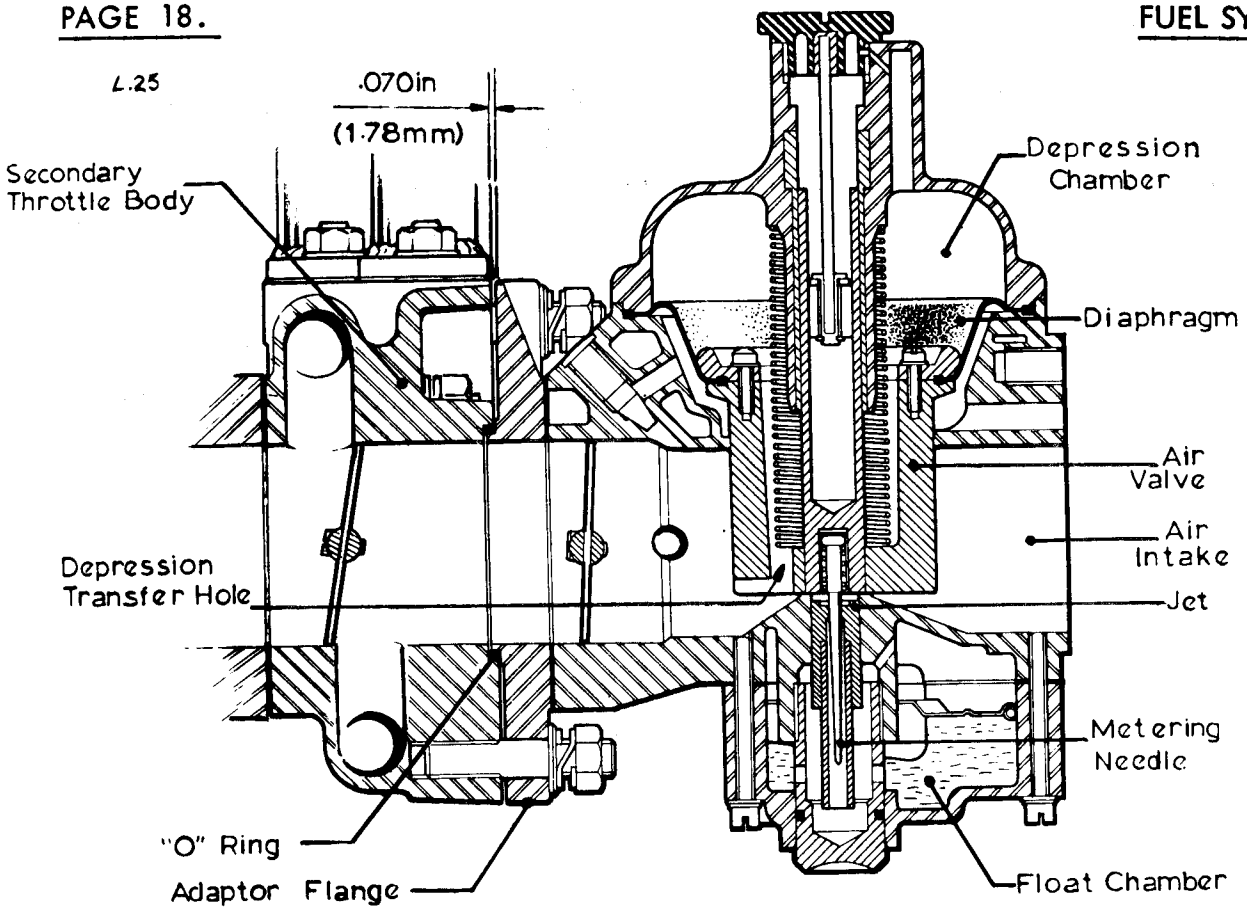


Fig. 9. CROSS SECTION OF CARBURETTER

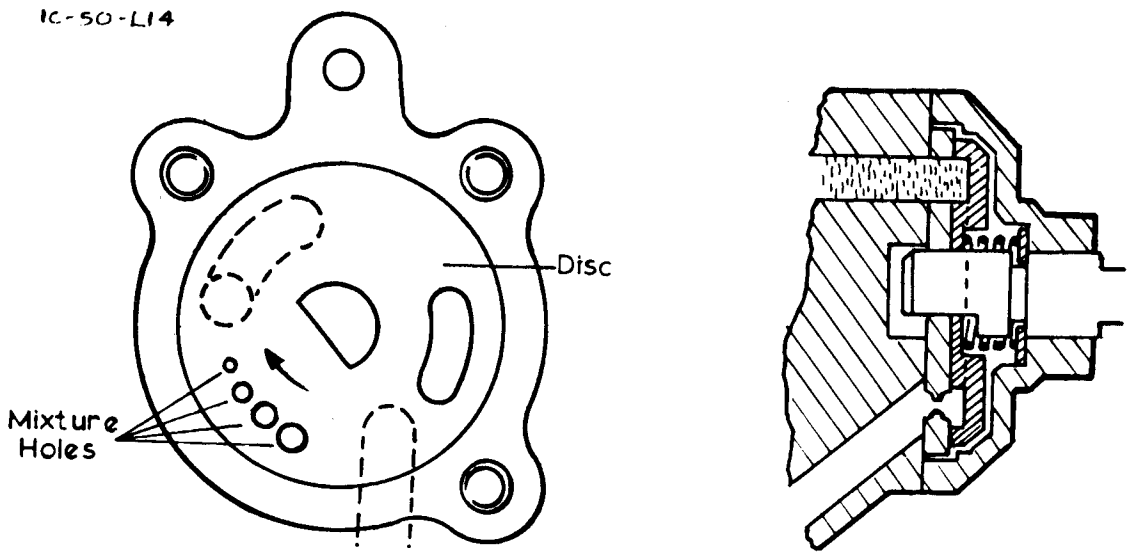


Fig. 10. STARTING DEVICE.

Exhaust Emission carburetters differ slightly from the non-emission type in that the fuel/air mixture is supplied DRY to the cylinders, thus avoiding the deposition of wet fuel in the induction manifold, this being the prime cause of excessive carbon monoxide and hydrocarbon emissions. To achieve dry mixture, the induction manifold requires a heated conditioning chamber. Zenith Duplex employs a main and subsidiary gallery from carburetter to engine. The latter branches from the main gallery, adjacent to the carburetter , conducting the mixture through an exhaust heated conditioning chamber and back into the main gallery. The subsidiary is of smaller cross-sectional area than the main gallery.

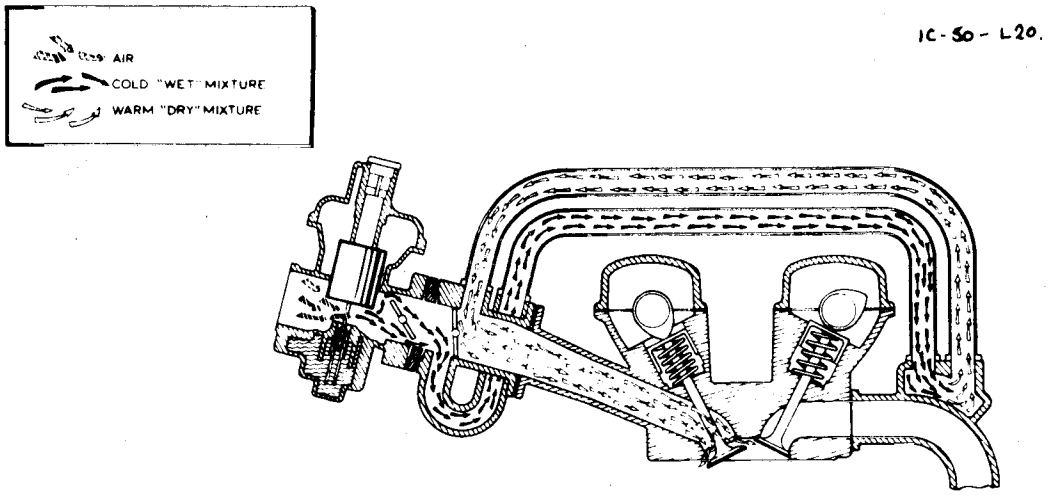


Fig. 11. EXHAUST EMISSION INDUCTION SYSTEM.

Two throttles are, thereforeemployed, primary and secondary, the primary controlling mixture supplied via the subsidiary gallery. The flow capacity of the primary system is sufficient for idling, acceleration up to approximately 50 m.p.h. (80 k.p.h.), over run and cruising conditions. At the operating point where the primary system begins to impose a significant flow restriction to the engine, a mechanical linkage picks up the secondary throttle and mixture is then supplied through the main gallery. In this manner the primary system is by-passed and flow conditions similar to an untreated engine are restored.

As well as the modified induction system a special distributor is necessary. This is equipped with a vacuum retard capsule arranged to operate only when the throttles are closed: that is on idle and over run. This is actuated by a valve attached to the rear carburetter which, when depressed by the throttle lever, connects the distributor to manifold depression.

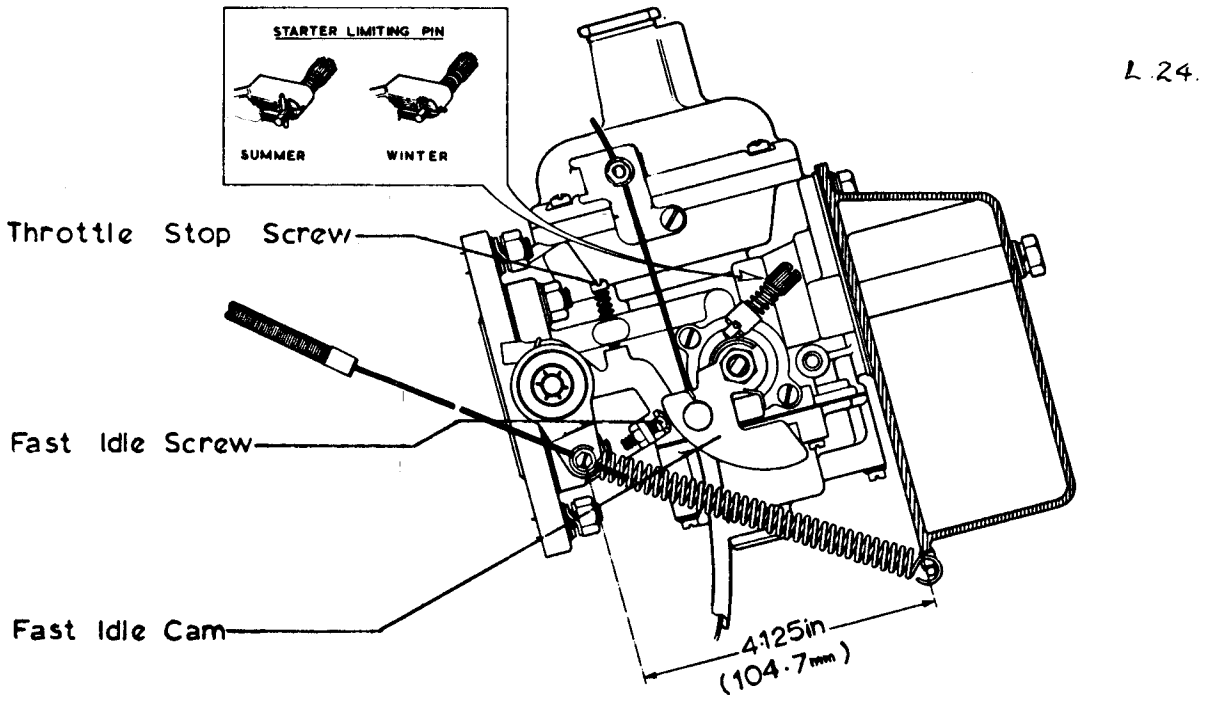
Cold Starting.

When the choke control of the facia panel is pulled out, it operates a lever at the side of both carburetters; this rotates a disc in the starting device in which a series of holes of different diameters are drilled. In the full rich position, all holes will be in communication with the starter circuit and provide the richest mixture.

Petrol is drawn from the float chanber via a vertical drilling adjacent to the central main feed channels, through the starting device and into the throttle body between the air valve and the throttle plate. Simultaneously, the cam on the starter lever will open the throttle beyond the normal idle position, according to the setting of the fast-idle stop screw to provide a faster idle speed to prevent stalling when the engine is cold. As the choke control on the facia panel is gradually released, few and/or smaller holes will provide the petrol feed from the float chamber, thereby progressively weakening the mixture strength to the point where the choke control is pushed fully home. Mixture strength is then governed by the Factory setting of the main orifice and idle speed determined by the setting of the throttle stop screw.

NOTE: Do not pump, or hold open the throttle as this reduces the effectiveness of the cold start device (choke).

It is also important to note that there are two positions (winter and summer) on the starting limit pin. This is the spring - loaded, knurled headed pin located on the side.



L.24.

Fig. 12. ADJUSTING SCREWS & THROTTLE LEVER SETTING.

of each starter housing. Push down and turn through 90° by the screwdriver slot provided. In the 'winter' position the slot will be horizontal when viewed from the side of the car, whereas in the 'summer' position the slot eill be vertical.

Idling.

Fuel for idling is provided by the jet orifice, the amount being controlled by the jet/needle relationship established during manufacture. Idle speed is regulated by adjust--ment of the throttle stop screw, which limits the closure of the throttle when the acceler--ator pedal is released.

An idling trimming screw is provided but THIS IS NOT AN ORDINARY MIXTURE ADJUSTING SCREW. The purpose of this screw is to give a very fine adjustment to compensate for the difference between a new 'stiff' engine and one that is run in. It wi ll be seen that the idle trimming screw regulates a limited amount of air (limited by the size of the drilling) that can be introduced into the mixing chamber. When the engine is new, a slightly weaker mixture can be used and the trimming screw will therefore, be set initially to provide maximum air to the mixing chamber. As the engine loosens during the running-in period, this screw can gradually be turned in a clockwise direction to reduce the air bleed until, when fully turned in, the screw will be seated.

It should be noted that to the ear, there may be no detectable difference between fully 'home' and fully 'open' positions, therefore, it should be adjusted to achieve the best driveability.

Should idling quality deteriorate during the running-in period, the screw should be rotated clockwise slowly until smooth idling is just restored. If it is not possible to obtain satisfactory quality when the screw is fully home, the manifold to carburetter joints should be checked as a leak is probably occuring. ON NO ACCOUNT SHOULD THE SCREW BE OVER - TIGHTENED.

Check also that the choke cable returns the cold start lever to the fully off position when choke control is pushed in. Adjust coupling and cable as necessary.

Normal Running.

Mention has been made of the jet/needle relationship, which together govern correct idle mixture and mixture strength throughout the range. One feature of the assembly is the radially located needle which is biased so that the needle is permanently in contact with one side of the jet, to ensure a consistent fuel flow from a given needle profile. The jet/needle relationship is set during production and MUST NOT be altered.

When the throttle is opened, air flow under the air valve increases and a temporary rise in mixing chamber depression is transferred via drillings in the air valve to the depression chamber which is sealed from the main body by a diaphragm. Pressure difference between the depression chamber and the under diaphragm chamber causes the air valve to lift. Thus any increase in engine speed or load will enlarge the effective choke area until maximum air valve lift, since the air valve lift is proportional to the weight of air passing beneath it. Therefore, air velocity and pressure drop across the jet orifice remain approximately constant at all speeds

As the air valve rises, it withdraws the tapered metering needle held in its base from the jet orifice, so that fuel flow is increased proportionate to the greater air flow.

The metering needle is a variable and machined to very close limits. It provides a mixture ratio for all speeds and loads in line with engine requirements that are determined by exhaustive tests on bench and road during original manufacture. To maintain correct results, it is essential that only the recommended needle is used.

Temperature Compensator.

Testing has shown the need for a temperature compensator, operating over a wide range of air valve lift, to cater for minor mixture strength variations caused through heat transfer to the carburetter castings.

An air flow channel is employed which permits some of the air passing through the carburetters to by-pass the bridge section. With the introduction of this into the mixing chamber, the air valve, in order to maintain depression on its downstream side, rides in a lower position, thus giving a smaller fuel flow annulus. To adjust the quantity of air by-passed, a bimetallic blade is used to regulate the movement of a tapered plug.

Two screws attach the temperature compensator assembly to the carburetter and two seals are provided to ensure that no leakage can occur at the joint with the main body. THIS ASSEMBLY IS PRE-SET AND MUST NOT BE RE-ADJUSTED IN THE FIELD. If it is suspected of malfunction and the tapered plug moves freely when tested carefully by hand with engine both cold and hot, the compensator assembly should be changed for another of the correct specification.

Acceleration.

At any point in the throttle range, a temporary enrichment is needed when the throttle is suddenly opened. To provide this, a hydraulic damper is arranged inside the hollow guide rod of the air valve.

The rod itself is filled with suitable oil (see Section 'O') to within a $\frac{1}{4}$ inch (6.35 mm) of the end of the rod. When the throttle is suddenly opened, the immediate upwardmotion of the air valve is resisted by the damper. For this brief period, a temporary increase in the depression over the jet orifice is achieved and the mixture is enriched.

Downward movement of the air valve is assisted by a coil spring.

Flexible Carburetter Mounting.

When assembling the adaptor flange/carburetter to the adaptor blocks, the 'O' rings should be located carefully and the nuts should be adjusted to give an even gap of .070 in.(1.78 mm) between these parts. Care should be taken not to overtighten the nuts as this could distort the adaptor flange.

Check the clear ance at every 'A' Service (see Section 'O').

Throttle By-pass Valve.

In running experimental Emission Test Cycles, which include two over-run modes, it was shown that rates of hydrocarbon and CO emission are extremely high when manifold depression exceeds 22 in. - 23 in. Hg, the precise critical figure varying with different engines. To prevent rise in excess of the critical figure, therefore, a throttle by-pass valve (97 of Fig. 13) is incorporated in CDSE carburetters. This valve is pre-set and provided that it is free from air leaks, should not require attention. It is possible, however, that small particles of foreign matter may lodge under the valve seating, causing leakage and consequently high idle speed. In these circumstances, the valve cover should be removed, the valve and seating cleaned and the parts re-assembled.

It is important not to vary mixture ratio when the by-pass valve is in operation and the circuit, shown on the diagram, feeds from the mixture chamber to the downsteam side of the primary throttle.

Manifold depression acting on the valve diaphragm will cause the valve to open when a value is reached that will overcome the coil spring tension.

Ignition Retard Capsule.

As an aid to emission control on idle and over-run and also as an engine brake to partially compensate for the throttle by-pass, an ignition retard capsule is fitted to the distributor. This is operated by the manifold depression through a valve mounted on the rear of the rear carburetter. This valve connects manifold depression to the distributor only when the throttles close. When the throttles open the valve seals the manifold tapping and vents the distributor to atmosphere. Consequently, the depression pipes must be fitted to

the correct spigots on this valve. The bottom spigot connects to the distributor retard capsule.

The adjusting screw on the rear carburetter is factory set, but should it be disturbed, reset to give approximately 3/32 in.(2.4 mm) movement on the valve plunger when the throttles are closing and approximately 1/64 in.(.4 mm) free play on the plunger when the throttles are closed.

All pipe connectors must be air tight.

Float Height.

When correctly set and with the carburetter inverted, measure to the highest point of the floats above the face of the main body with the fuel inlet needle on its seating. The correct measurement is 16 to 17 mm. Great care must be taken NOT to twist or distort the float arms, this to ensure a correct fuel level.

Should it be necessary to reset the float height, this can be carried out by bending the tag which contacts the end of the needle. Care should be taken to maintain the tag at right angles to the needle in the closed position.

L.10. - ZENITH STROMBERG CARBURETTERS.

To Remove.

1. Release the clip and disconnect the air cleaner trunking from the air box. Remove the bolts securing the air box to the carburetters and remove box together with the two gaskets.
2. Disconnect the throttle and choke cables. Remove the fuel supply pipe at the 'T' piece junction (located between carburetters.).
3. Progressively release the carburetters securing nuts (four are visible from above, the other four being below). Remove nuts and washers.
4. Carefully remove the two carburetters as an assembly, ensuring that the synchronising linkage between the two is not distorted. Pull off the gaskets.
5. If it is suspected that an air leak is evident between the adaptor flange and the adaptor blocks, the 'O' ring may be damaged, then the flanges should be removed by releasing their securing nuts. When replacing, always use new 'O' rings and adjust securing nuts as given under 'Flexible Carburetter Mounting' ,(Section 'L.9'.).

To Replace.

1. Using new gaskets (after ensuring no traces of old gaskets remain on mating faces) fit the carburetters as an assembly, tightening their securing nuts progressively to avoid possible distortion of the mounting faces.

2. Reconnect the throttle and choke cables to their respective locations. Replace the fuel supply pipe at the 'T' - piece junction.

3. Using new gaskets, refit the air box. Replace the air trunking between air box and air cleaner.

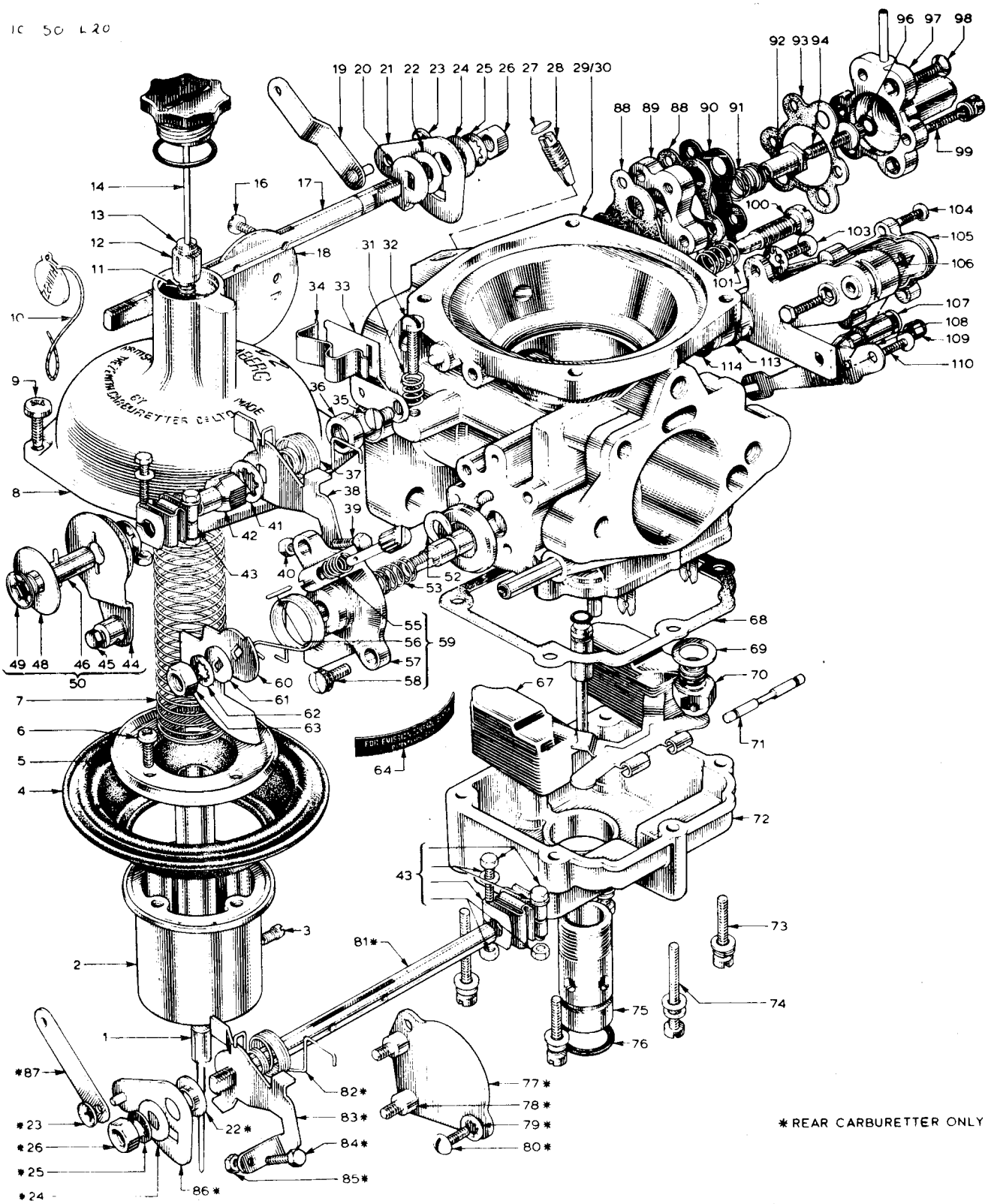


Fig. 13. ZENITH STROMBERG EXHAUST EMISSION CARBURETTER.

FUEL SYSTEM.

1. Needle
2. Air valve
3. Locking screw
4. Diaphragm
5. Retaining ring
6. Screw
7. Air valve spring
8. Top Cover
9. Top cover screw
10. Seal
11. Retaining ring
12. Bushing
13. Washer
14. Damper
16. Throttle screw
17. Spindle, front throttle
18. Throttle
19. Lever, throttle
20. Tabwasher
21. Plate
22. Spacer
23. Lockwasher
24. Washer
25. Lockwasher
26. Nut
27. Plug
28. Screw
29. Body, front carburetter
30. Body, rear carburetter
31. Spring
32. Throttle stop screw
33. Plate
34. Clip
35. Screw
36. Bush
37. Spring
38. Throttle stop lever
39. Fast idle screw
40. Locknut
41. Lockwasher
42. Sleeve nut
43. Coupling
44. Plate
45. Screw
46. Sleeve
48. Spacer washer
49. Lockwasher
50. Sleeve and plate
52. Clip
53. Spring
55. Spring
56. Pin
57. Housing, starter
58. Housing screw
59. Housing assembly
60. Starter cam
61. Spacer
62. Lockwasher
63. Nut
64. Label
67. Float and arm
68. Gasket
69. Gasket
70. Needle seating
71. Fulcrum pin
72. Float chamber
73. Screw
74. Screw
75. Screw
76. 'O' ring
77. Mounting plate
78. Stud
79. Lockwasher
80. Screw
81. Spindle, rear throttle
82. Spring
83. Throttle stop lever
84. Fast idle screw
85. Locknut
86. Lever mounting plate
87. Throttle lever
88. Gasket
89. Valve body
90. Diaphragm
91. Spring
92. Sleeve nut
93. Gasket
94. Retaining screw
96. 'O' ring
97. Throttle by-pass valve
98. Retaining screw
99. Retaining screw
100. Adjusting screw
101. Spring, adjusting screw
103. Screw, body
104. Screw, cover
105. Cover
106. Body
107. Valve
108. Bi-metal strip
109. Nut
110. Screw
113. Gasket
114. Gasket

L.11. - ZENITH STROMBERG CARBURETTERS.

To Adjust.

The only adjustments that can be made to these carburetters in service are:-

a. Idle speed. Adjusted by rotation of the throttle stop screw.

b. Idle mixture. Adjusted over very fine limits by trimming screw for best quality idle and driveability. THIS IS NOT A NORMAL ADJUSTMENT. Variations are very slight indeed.

c. Synchronisation.

1. Fast Idle.

The fast idle screw incorporated in the cold start devices is factory set and should not need attention. Should it be disturbed at any time reset as follows:-
The throttle plate should be held open a fixed amount by laying a drill (size .6mm) in the bottom of the port directly below the spindle. With the starter in the full enrichment position the fast idle screw should be adjusted until it touches the fast idle cam. Lock securely with lock nut and remove drill. The carburetters must, of course, be removed from the engine for this operation.

2. Synchronisation.

When the carburetters, adaptor flanges and adaptor blocks have been assembled to the cylinder head, leave the clamping screws on the 'W' clips loose until the carburetters have been synchronised and the throttle lever set. Unscrew the throttle stop screws to permit the throttle in each carburetter to close completely, then screw in the throttle stop screws to the point where the ends of the screws are just touching the levers. From this point rotate the stop screws $1\frac{1}{2}$ complete turns each, to open the throttles an equal amount and provide a basis from which the final speed of idle can be set.

Ensure fast idle screw is clear of cam, otherwise incorrect synchronisation can result. Check also that the cold start lever is fully off against the stop with the choke control pushed in. Adjust coupling and cable as necessary. Start engine and warm up to normal temperature.

With the airbox off check synchronisation by either:-

Tube to ear method: Insert one end of a tube in the choke of the carburetter and note the hiss heard at the other end. Repeat this for the other carburetter and adjust the throttle stop screws until both hisses are of equal volume and the idle speed is as given in 'TECHNICAL DATA'.

NOTE: There is no mixture or volume screw only an idle trimming screw, the function of which has already been described.

Crypton Synchro (or similar) Test: These are proprietary instruments which give a measure of air flow when pressured against the inlet of the carburetter. When doing this take care not to lock the screws until equal airflows are obtained and the idle speed is correct.

NOTE: As this system incorporates a balance pipe, carburetters CANNOT be synchronised by shorting out spark plugs and noting the drop in engine speed. Fit the air box, etc. and recheck idle speed.

3. Throttle Lever Setting.

There is a lost motion built into the throttle lever and coupling spindle assembly to allow the throttle spindle to turn when the cold start and hence the fast idle is operated without pulling the throttle cable return spring.

NOTE: Idle quality and low speed running depend to a large extent upon the general condition and it is, therefore, essential to check cam followers adjustment, spark plugs and ignition timing if idling is unstable. It is also important to eliminate any leaks at manifold joints.

L.12. - ZENITH STROMBERG CARBURETTERS.

To Clean .

1. Remove the carburetters from the engine (Section 'L.10') to a clean bench.
2. Yellow Service Every 20,000 kilometres (12,000 miles). For this service, one Yellow Pack 'A' is required for each carburetter. This pack contains 1 float chamber gasket, 1 'O' ring for float chamber plug, 1 needle valve washer and 1 manifold/ carburetter gasket.
3. Remove carburetters, place on a clean bench to keep the parts free from contamination and disconnect one carburetter from the other.
4. Have a receptacle available into which fuel from each float chamber may be drained, then unscrew brass centre plug to carry out this operation.
5. Unscrew the float chamber fixing screws, taking care not to lose the washers and withdraw float chamber vertically away from body to clear the float mechanism. Take off float chamber gasket. Unclip float pivot pin and , noting carefully the top in order to ensure correct re-assembly, take out floats. Unscrew hexagon bodied needle valve from carburetter body.

6. Take off 'O' ring from centre plug then thoroughly cleanse all parts that have so far been removed.
7. Refit needle valve into float chamber cover with new washer (htickness 1.6 mm) and make sure it is screwed tightly into position.
8. Replace float assembly, after inspecting for damage or distortion, slide in pivot pin and clip assembly into position. (see Float Height in Section 'L.9.')
9. With the new gasket in position, refit float chamber and tighten the retaining screws securely from centre, outwards. Fit new 'O' ring to centre plug and replace tightly in position. Refit carburetters to adaptor flange with new gaskets supplied.
10. Top up damper resevoirs with the recommended oil (see Section 'O') to within $\frac{1}{4}$ in. (6.35 mm.) of top of centre rod.
11. Refit carburetters and reset controls as described in Section 'L.9.'

L. 13. - ZENITH STROMBERG CARBURETTERS.

Overhaul.

1. Remove the carburetters from the engine (Section 'L.10.') to a clean bench.
2. Red Service Every 40,000 kilometres (24,000 miles). This is a more comprehensive service for which one Red Pack 'B' is required for each carburetter. This pack contains 1 float chamber gasket, 1 'O' ring, 1 needle valve, 1 diaphragm, 2 throttle seals, 2 temperature compensator seals, 1 flange gasket.
3. Remove carburetters from induction manifold, check carburetter induction flanges for flatness and face-up if necessary. Carry out similar procedure to that outlined for the 10,000 miles service in respect of float chamber cleanliness and float setting. In this instance, however, fit the new needle valve assembly with a new washer.
4. Unscrew damper assembly from centre of cover. Unscrew the four cover fixing screws and carefully lift off cover. Remove air valve return spring then take out air valve and diaphragm assembly. Avoid possibility of corrosion to shaft from perspiration of hands by lifting upwards with the diaphragm.
5. Drain oil from damper resevoir (centre of guide rod). Slacken metering needle clamping screw and withdraw metering needle from air valve. Place this carefully to one side to avoid damage.
6. To fit the new diaphragm, undo the four screws holding the diaphragm retaining ring onto valve, making sure that the locating tag is recessed into the aperture provided. Drop in retaining ring and replace the four fixing screws tightly .

7. Take metering needle and check spring action in the housing at the top of the shank. Fit metering needle into base of air valve, lining up the flat portion with the locking screw. Using a straight edged strip placed lightly against the small shoulder on the needle, press the assembly into the air valve until the strip aligns the shoulder with the flat surface of the air valve. The locking screw should then be lightly tightened taking care not to collapse the needle housing. Shoulder alignment is extremely critical and this operation should be accurately carried out. Correctly fitted, the needle will be biased toward the throttle and the shoulder of the needle will be exactly flush with the air valve face. To check that the caooect needle is fitted, hold the housing and CAREFULLY pull out the needle. The needle part number can then be seen on its shank.
8. Carefully enter air valve and diaphragm assembly into the main body, guiding the metering needle into the jet with a finger in the air intake. Locate the outer tag of diaphragm in aperture of top of body.
9. To check assembly, look down centre of air valves to see that the two depression transfer holes are parallel to the throttle spindle and that the metering needle is also biased towards the throttle.
10. Replace the air valve return spring.
11. When refitting the cover, hold the air valve with finger or thumb in air intake and slide on cover, locating the screw holes. This method will avoid air intake. Tighten the four cover screws evenly than check movement of air valve. Freedom of movement over the full travel is essential and, when released from uppermost position, the air valve should fall with a sharp metallic click onto the carburetter bridge.
12. Top up damper resevoirs with the recommended oil (see Section 'O') to within $\frac{1}{4}$ inch, (6.35 mm.) of top of centre rod.
13. Undo the two screws which retain the temperature compensator unit to the main body of the carburetter and withdraw the assembly. Take out the inner seal from carburetter body and remove outer seal from the valve. Change both seals and refit the assembly to the carburetter tightening the two retaining screws evenly.
14. Take off the compensator cover by removing the securing screws and check for free movement of the valve by lifting off its seat. On releasing, the valve should return freely. Do not stain the bi-metal blade or attempt to alter the adjustment. Provided the valve is free, replace cover and fit screws.

15. Release the screws securing the throttle by-pass body and remove body and gasket Discard the gasket. While the by-pass body is removed, replace the primary throttle spindle seals. Replace throttle by-pass body and gasket after fitting new seals.

16. To replace the throttle spindle seals, first take off any levers fitted to the spindle ends then carefully prise out the old seals noting how they are fitted. Slide new seals along spindle and press into body recess using Lotus Tool T.339.

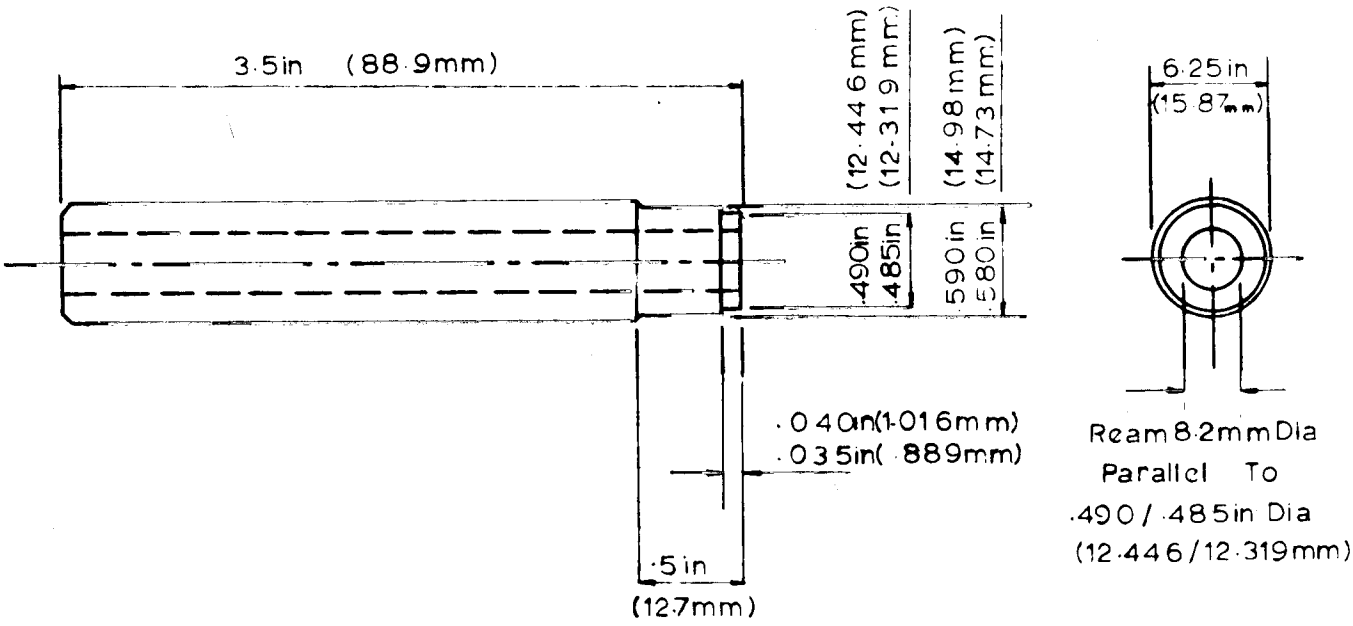


Fig. 14. LOTUS TOOL T.339.

17. Refit carburetters and reset controls as described in Section 'L.9.'

Special Parts. Although already covered, it is thought worthwhile to repeat the items which must not be changed or adjusted in Service.

Items that must not be changed.

a. The jet assembly.

b. The air valve.

c. The depression chamber cover.

Items that must not be adjusted.

d. The position of the metering needle.

e. The temperature compensator.

f. The air valve return spring loading.

If any of the above items require changing or adjusting with the exception of 'f', the sub-assemblies or the complete carburetter must be returned for re-setting. In the case of 'd', it is permissible to replace the metering needle provided that the procedure given is followed absolutely, and the correct type ONLY used.

Air Valve/Diaphragm Assembly.

A bead and locating tab is moulded to both the inner and outer radii of the diaphragm to ensure correct positioning of this item. The diaphragm is secured to the air valve by a ring and screws with lockwashers and it is necessary to ensure the bead is correctly located and the screws fully tightened.

Location for the bead and tab on the outer radii of the diaphragm is provided by a location channel at the top of the main body. It is important that location beads and tabs are accurately positioned.

When refitting the suction chamber cover, place it accurately so that the screw holes line up with those in the main body, as this will prevent any disturbance of the located diaphragm.

Air Valve Rod and Guide.

The air valve rod and guide must be kept clean and should not be handled unduly if corrosion is to be avoided. A few drops of oil (see 'Data') should be applied to the rod before fitting.

Float Chamber Removal.

To prevent the leakage of petrol from the float chamber, a rubber 'O' ring is situated between the jet cover and the float chamber spigot boss.

Care should be taken when removing the float chamber to avoid damage to the faces and floats.

CARBURETTER FAULT FINDING.

It is assumed that all mechanical and/or ignition faults have been corrected, therefore, ONLY possible carburetter faults will be listed.

Erratic or Poor Idling.

1. Incorrect fuel level caused by maladjusted floats and/or worn or dirty needle valve. Check float height and wash needle valve in clean methylated spirits or alcohol. Replace needle valve if worn. Check also that floats are not punctured.
2. Throttles not synchronised. Re-set correctly.
3. Air valve sticking. Check free movement of spring-loaded metering needle, clean air valve rod and guides. Lubricate air valve rod and guide with a few drops of light oil.
4. Metering needle incorrectly fitted. See that shoulder of needle is flush with face of air valve and that the needle is biased towards the throttle. Also, check identification to ensure correct needle fitting. Check that needle housing has not been distorted by overtightening retaining screw.

3. Partially or fully obstructed diaphragm and float chamber ventilation holes. Check that air box is correctly fitted and that gaskets are not causing obstruction.
4. Diaphragm incorrectly located or damaged. Check location with depression chamber cover removed. The two depression holes at the base of the air valve should be in line with and towards the throttle spindle. Renew diaphragm if damage is evident. When replacing depression chamber cover, the damper ventilation boss must be towards the air intake.
5. Temperature compensator not operating correctly. With the engine and carburetters cold, remove cover from temperature compensator assembly. Tapered valve should be seated in this condition. Check operation by carefully lifting the valve off its seat; when released, the valve should return freely. If any damage should have occured that prevents themechanical operation functioning correctly, the compensator unit should be changed.
6. After reasonable service, inspect throttle spindle seals and throttle spindle for fracture and wear respectively. Replace if necessary.
7. Leakage at induction manifold joints. Remake joints facing-up flanges as required. Check that 'O' ring, adaptor flange block and balance pipe 'O' rings are correctly located.

Hesit ation or Flat Spot.

Possible causes are given for 'Erratic or Poor Slow-Running' but with the addition of the following:

1. Damper inoperative. Check oil level and top up with oil (see Section 'O').
2. Air valve return spring missing or incorrect part fitted.

Heavy Consumption.

Here again, any points that have been covered under the two previous headings can contribute to heavy fuel consumption.

Ensure choke cable returns the cold start lever to the fully off position when choke control is pushed in. Adjust coupling and cable as necessary.

Additionally, check that there is not a fuel leak from the float chamber joints.

L.14. - AIR CLEANER.

The intervals at which the air cleaner will require attention vary in accordance with the operating conditions.

In towns and areas where the roads are relatively dust free, the intervals given in Section 'O' should be adhered to but, in areas where the atmosphere is smoke or fog-laden,

or where the roads are unmetalled, attention will be needed at more frequent intervals.

To Renew Element.

1. Release the clips securing the air trunking to the air cleaner from the airbox. Pull off air trunking.
2. Remove the wing-nut situated on the wall of the luggage compartment. This nut secures the front flange to the body.
3. Discard the old element with its sealing rings. Clean the inside of the body and front flange of any accumulated dust and dirt.
4. Place a rubber sealing ring (supplied with the new element) at either side of the element, fit element assembly into cleaner body, fit front flange and secure whole with the wing-nut.
5. Replace air trinking between air cleaner and airbox, securing with its clips.

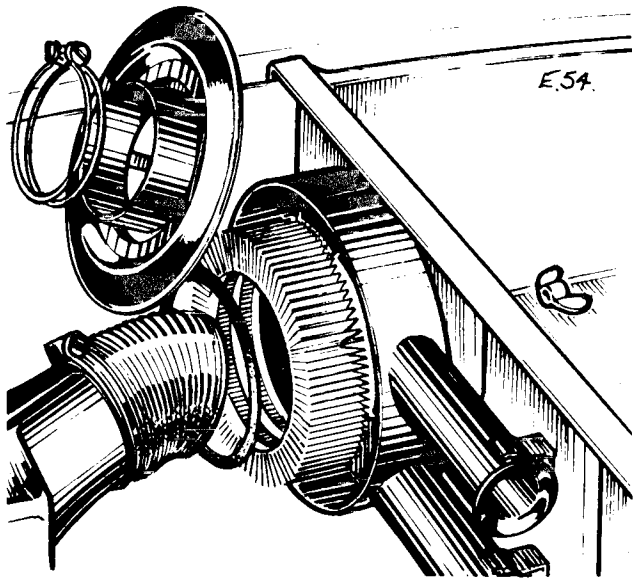


Fig. 15. AIR CLEANER ASSEMBLY.

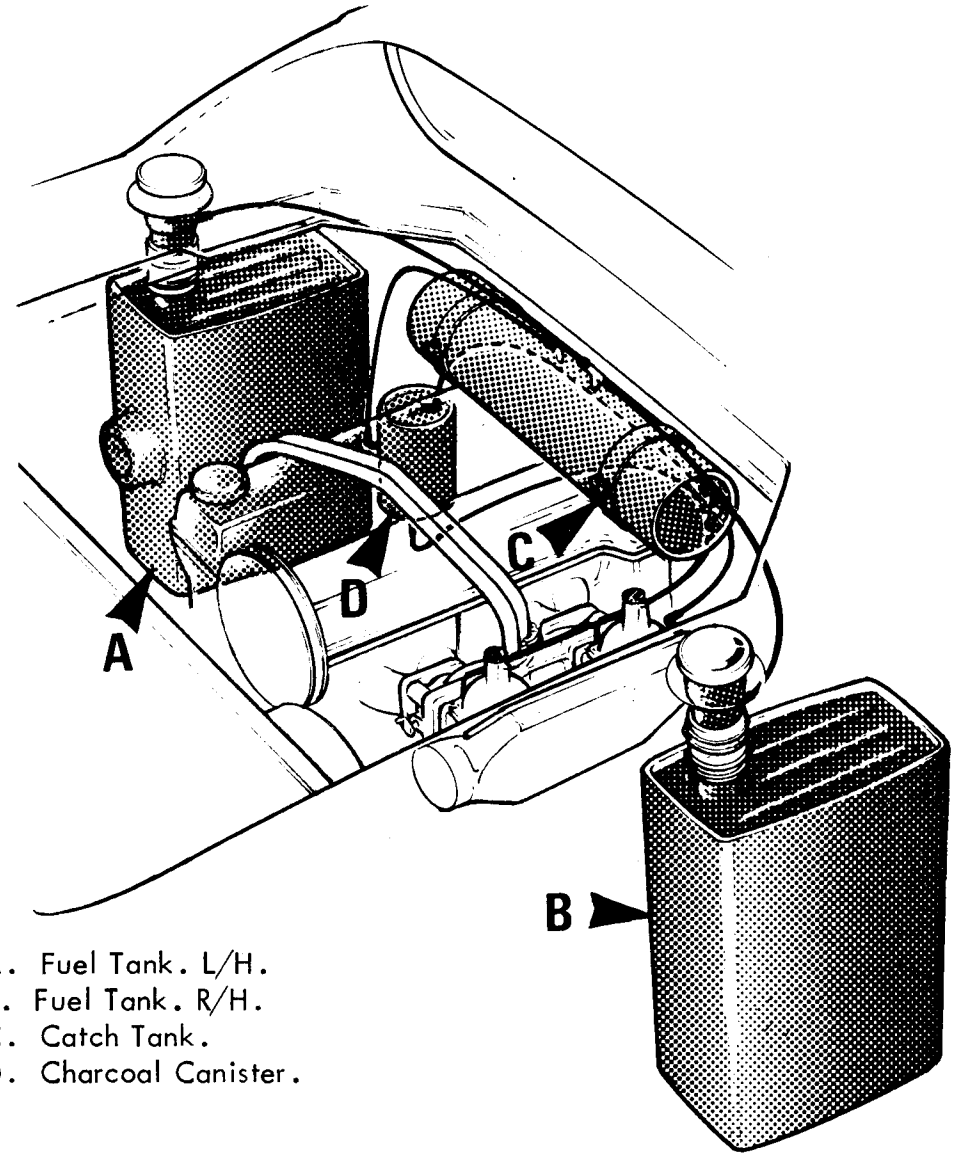
L.15. - 1972 EVAPORATIVE LOSS CONTROL (EXHAUST EMISSION).

To eliminate fuel vapourization into the atmosphere and thus comply with the 1972 U.S. Federal Motor Vehicle Safety Standards, and 'evaporative circuit' has been incorpor--ated into the fuel system.

The evaporative loss control system consists basically of an activated charcoal canister which collects the fuel vapour given off from the fuel tank vent. Additional to the fuel tank is a catch tank, which cannot be filled through the main tank fuel filler neck. This catch

prevents neat fuel from reaching the charcoal canister in conditions of extreme heat, of violent vehicle movements. The absorbed vapour in the charcoal is 'purged' by clean air while the engine is running, via throttle edge drillings (in the carburetter).

The system is effectively maintained by renewing the charcoal canister at intervals of every 48,000 miles.(60,000 km.).



A. Fuel Tank. L/H.
B. Fuel Tank. R/H.
C. Catch Tank.
D. Charcoal Canister.

Fig. 16. EVAPORATIVE LOSS CONTROL SYSTEM.

L. 16. - CHOKE CONTROL.

To Remove.

1. Disconnect inner cable at the carburetters then pull out from front of facia.
2. The outer casing can be removed by first releasing it at the carburetter clamp, then releasing the locking ring from the front of the facia.

To Replace.

1. Replacing both the inner cable and the outer casing is a reversal of the removal procedure, but noting that the outer casing is not fouling, or being fouled by other facia equipment behind the facia. Also check that the grommet is fitted correctly where the outer cable passes therough the bulkhead.

L. 17. - THROTTLE CABLE.

To Remove.

1. Disconnect inner cable at the carburetters.
2. From the footwell inside the car, release the split pin, pull out cother pin and pull cable from its location. Continue pulling to fully free the cable.

To Replace.

1. Replacing the inner cable can only be done by threading through the body apertures from inside the footwell.

SECTION M.

ELECTRICAL.

M.1. - GENERAL.

The main difference between the Europa Twin Cam model and the previous model, is that of the alternator. Wiring diagrams will be found at the end of this section.

On cars destined for use in North America, the following are also incorporated into the electrical equipment specification:-

a. Hazard warning system.

b. Brake fail warning system.

c. Fasten seat belts warning system.

M.2. - ALTERNATOR.

General Description.

The alternator features a solid state regulator which is mounted inside the slip ring end frame. All regulator components are enclosed into a solid mould and this unit, along with the brush holder assembly is attached to the slip ring frames. The regulator voltage setting does NOT require adjusting and no provision is made for this.

The rotor bearings contain sufficient lubricant for the life of the machine. Two brushes carry current through the two slip rings to the field coil mounted on the rotor and under normal conditions will provide long periods without attention.

The stator windings are assembled on the inside of a laminated core that forms part of the alternator frame. A rectifier bridge connected to the stator windings contains six diodes and electrically changes the stator 'a.c.' voltages to a 'd.c.' voltage which appears at the alternator output terminals. Field current is supplied through a diode trio which also is connected to the stator windings.

No periodic adjustments, or maintenance of any kind are required on the entire alternator assembly.

Fault Finding Procedure. (Fig. 1.)

Close adherence to the following procedure in the order given, will lead to the location and correction of charging system defects in the shortest possible time. It will NEVER be necessary to perform all the procedures, in order to locate the trouble.

To avoid damage to the electrical equipment, ALWAYS observe the following precautions:-

a. Do NOT polarize the alternator.

b. Do NOT short across, or ground any of the terminals in the charging circuit, EXCEPT as given here.

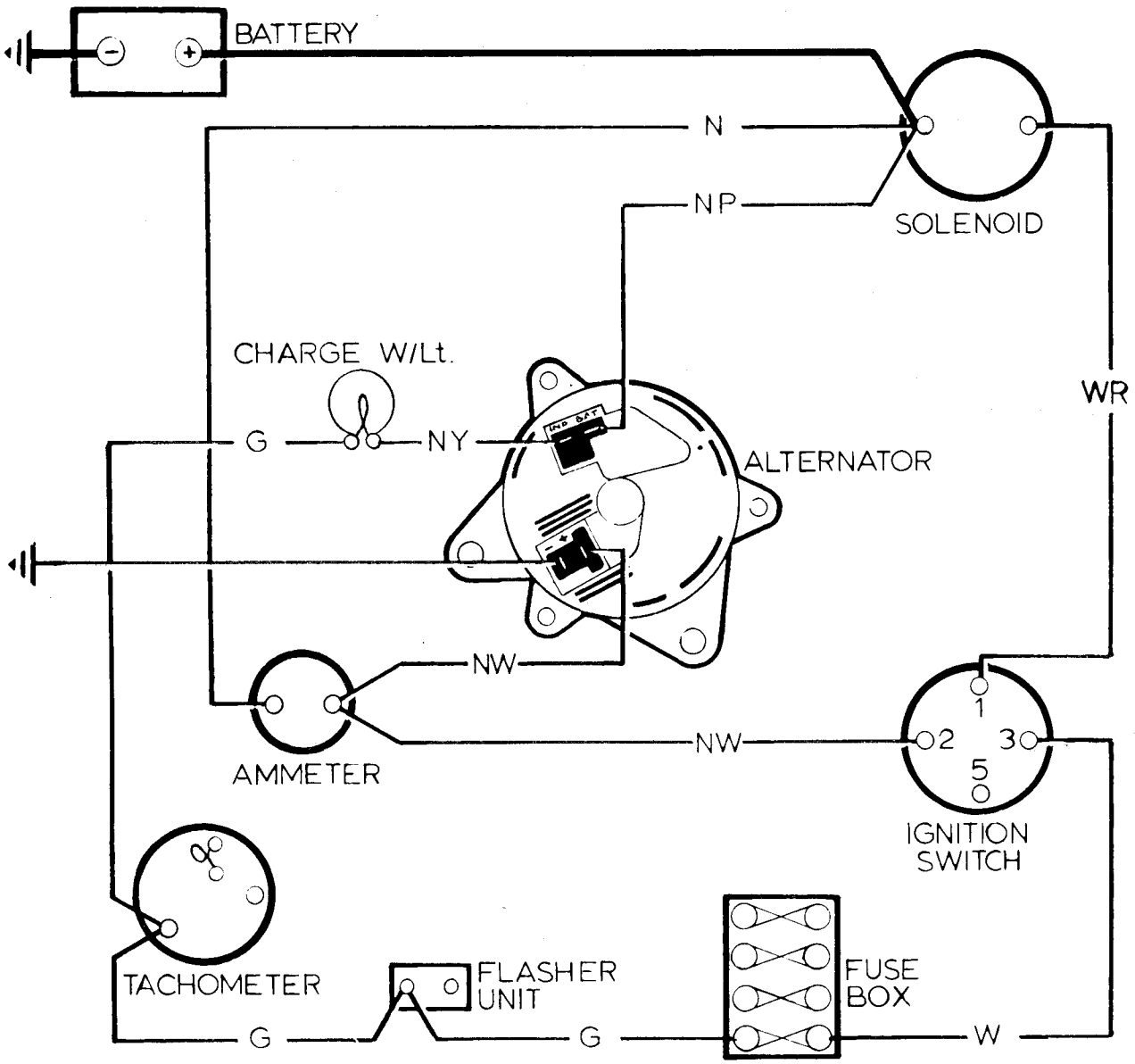


Fig. 1. - ALTERNATOR CHARGING CIRCUIT.

c. Ensure that both the alternator and battery have the SAME ground polarity.

d. When connecting a charger to the battery, connect NEGATIVE to NEGATIVE and POSITIVE to POSITIVE.

Trouble in the charging system will show up as one of the following :-

a. Undercharged battery, evidenced by a slow engine cranking and low specific gravity readings.

b. Overcharged battery, evidenced by excessive water usage.

Undercharged Battery.

This condition will be dealt eith in the following manner:

1. Ensure that the undercharged condition has NOT been caused by accessories having been left on for excessive periods.

2. Check the drive belt for correct tension.

3. Inspect the wiring for defects. Check all connections for tightness and cleanliness including the slip connectors at the alternator and cable clamps and battery posts.

4. With the ignition switch 'on' and all wiring harness leads connected, connect a voltometer from:-

a. Alternator '+' to ground.

b. Alternator IND (NY) terminal to ground.

c. Alternator BAT (NP) terminal to ground.

A zero reading indicates a break between voltometer connection and battery.

NOTE: The alternator is provided with a built-in safety feature which avoids avercharge and accessory damage by preventing the alternator from turning 'on' if there should be a break in the wiring harness connected to the BAT (NP) terminal.
Breaks in the wiring harness connected between the BAT (NP) terminal and the battery may be between the terminals, at the crimping of harness wire and terminal, or in the wire.

5. If paragraphs 1 through to 4 are satisfactory, now check the alternator as follows:-

a. Disconnect the battery ground (Negative) cable.

b. Connect an ammeter in the circuit at the '+' terminal of alternator.

c. Reconnect the battery (Negative) ground cable.

d. Switch on windscreen wipers, lamps main beam, heater fan motor and radio if fitted. Connect a carbon pile across the battery.

e. Operate engine at modest speed and adjust carbon pile to obtain maximum current output.

f. If ampere output is within 10% of rated output (See TECHNICAL DATA), alternator is not defective; recheck paragraphs 1 to 4 inclusive.

g. If ampere output is not within 10% of rated output, ground the field winding by inserting a screwdriver into the test hole (See fig. 2.)

CAUTION: Do NOT force screwdriver deeper than 25 mm.(1 in.) into end frame.

h. Operate engine at moderate speed and adjust carbon pile to obtain maximum current output. Remove ammeter and switch off accessories.

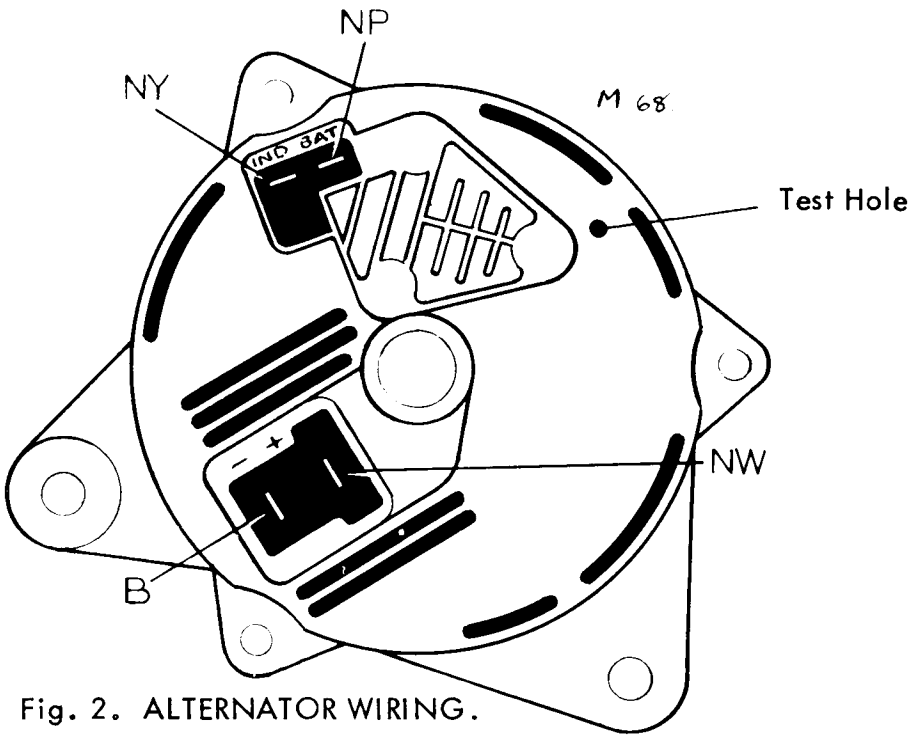


Fig. 2. ALTERNATOR WIRING.

Overcharged Battery.

1. Check battery condition as normal workshop practise.

2. Connect a voltometer from alternator BAT (NP) terminal to ground. If reading is zero, BAT (NP) cable circuit is 'open'.

3. If battery and BAT (NP) cable circuit checks are satisfactory, but an obvious over--charge exists as evidenced by excessive water usage, then an internal fault exists in the alternator (i.e. field winding shorting, brush lead clip grounded or regulator defective), in which case, replace the alternator.

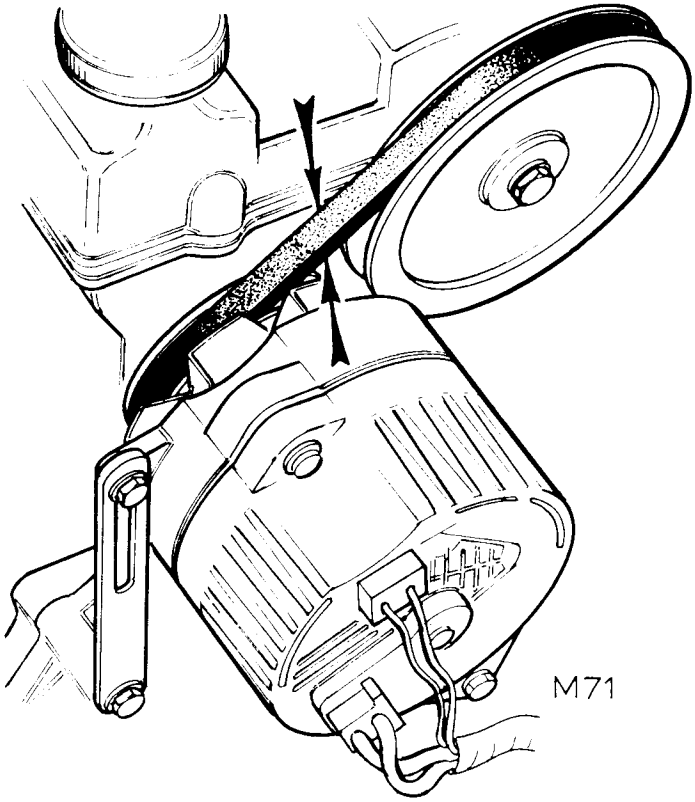


Fig. 3. BELT TENSION.

ALTERNATOR DRIVING BELT ADJUSTMENT (Fig. 3.)

The belt is correctly tensioned when a total of 9.5 mm.(.375 in.) movement can be obtained on the belt mid-way between the pulleys at the top.

To adjust the Belt Tension.

Slacken the mounting bolts situated at the forward end of the alternator and also the securing bolt of the adjusting strap. Move the alternator about its mountings until the correct tension is achieved, then fully tighten the bolts.

Run the engine briefly, switch 'off' and re-check belt tension.

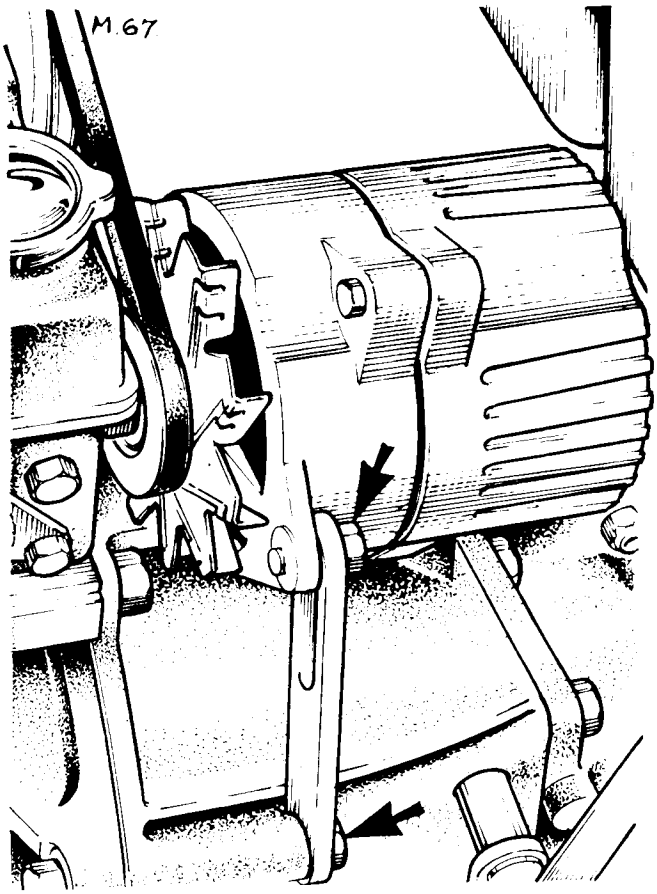


Fig. 4. ALTERNATOR ADJUSTING SCREWS.

M.3. - BATTERY.

To ensure a positive battery clamping action, it is necessary to RETAIN the packing pieces fitted below the battery. These are located at :-

a. Between chassis and body - 8 inches long
b. Between battery support bracket and body - 3 inches long
c. Between body and battery base - 8 inches long

It is important to ensure also, that the nuts on the battery clamp rods are tightened sufficiently to ensure that the battery does not move on its base.

M.4. - HAZARD WARNING SYSTEM (where fitted)

The hazard warning system is operated by the horizontally mounted switch adjacent to the glove compartment. When switched 'on', all four direction indicator lamps flash in unison, together with the warning lamp located in the centre of the facia panel.
Bulb failure in any of the direction indicator lamps will be shown bythe warning lamp failing to flash, or flashing rapidly.

NOTE: Do NOT operate the direction indicator switch when the hazard warning system is in operation.

M.5.- BRAKE FAIL WARNING SYSTEM (where fitted).

See Section 'J' Braking System.

M.6. - SEAT BELT WARNING SYSTEM.(where fitted)

See Section 'B' Body.

M.7. - COOLING FAN MOTOR.

Where moisture is found to be entering the cooling fan motor, it is recommended that Valvoline 'Tectyl 506' be brushed on to casing bolts, seams, etc. Ensure that the sealant does NOT contaminate the motor terminals.

Drying time of the sealant is approximately 1 hour.

M.8. - PHILLIPS RN.314 'TURNLOCK' RADIO.

Full details for fitting a radio are given in Section 'M' of the Europa Worshop Manual.

The Phillips radio receiver is earthed to a conveneint body-to-chassis mounting bolt.

Feed to the receiver is from the 'AUX' side of the ignition/starter switch, through an in-line 2 amp. fuse.

The aerial is fitted to the passenger side of the car (see Fig. 5.) with the co-axial lead running behind the top of the carpet in the foot well.

The single speaker is fitted behind the door trim panel in the passenger door.

Suppression required with this radio to give a reduction of interference to an acceptable standard, proceed as follows:-

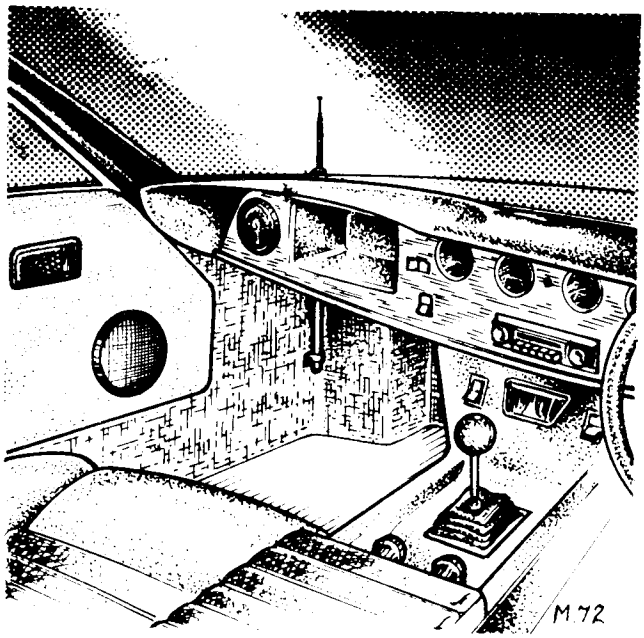


Fig. 5. RADIO INSTALLATION.

1. Filtering. A 1 mf. capacitor is fitted to each item -
   a. Alternator casing to 'IND' cable (1 off).
   b. Voltage stabiliser 'BAT' terminal to earth (1 off).
   c. Wiper motor casing to 'fast speed' terminal and to 'slow speed' terminal (2off).
   d. Stop lamp switch terminal to terminal (1 off).
2. Filtering. A 2 mf. capacitor is fitted from the POSITIVE (+ve) side of the coil to an engine mounting block. Keep clear of radius arm.
3. Bonding. Bonding braids are fitted as follows:-
   a. 38 cm.(15 in.) braid from bonnet hinge bolt to camshaft cover (see Fig. 6.)
   b. 15 cm.(6 in.) braid from each forward inner seat mounting bolt to chassis (see Fig. 7.)
   c. 30.5 cm.(12 in.) braid from coil mounting bolt to chassis.
   d. In addition to the above, check that the following connections have been made, these being incorporated in the main wiring harness (loom).
      Both fan motors to earth.
      Wiper motor casing to earth.
      R/H fuel tank to earth - this is most IMPORTANT.
4. Screening. Using Dunlop 'S.758' adhesive, attach a piece of perforated foil 53 cm.(22 in.) X 51 cm.(20 in.) to the underside of the engine compartment lid. Note that the foil is beneath the bonnet mounting nuts with the braid in contact with the foil (see Fig. 6.)

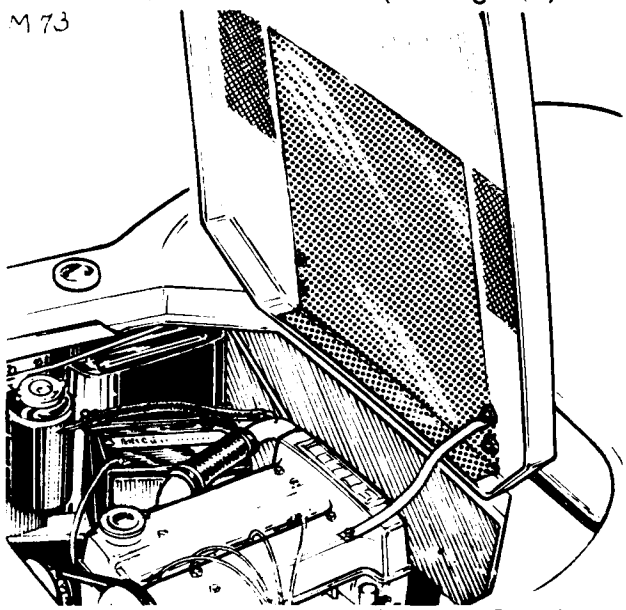


Fig. 6. ENGINE COMPARTMENT SCREEN AND EARTH.

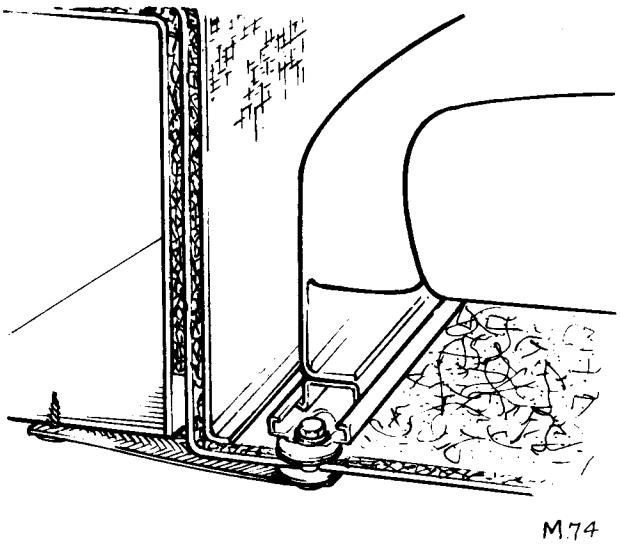


Fig. 7. SEAT EARTHING

M.9. - SWITCHES

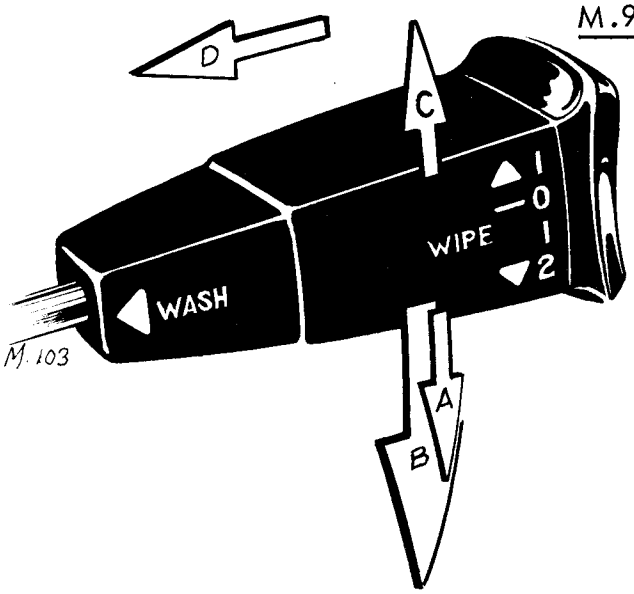


Fig. 8 . Windscreen Wiper/Washer Control.

North American cars are fitted with new switches from Chassis No. 72082684R onwards. These are:

Windscreen Wiper/Washer Control

Move the lever downwards to the FIRST position (A). The wiper speed is increased by moving the lever further downwards to the SECOND position (B).

To 'flick wipe' the screen, move the lever UP (C) and hold for duration of wipe. On release, the lever will automatically cancel and return to the 'off' position, the blades returning to their normal position.

To use the screen washer, push in the lever towards the steering column (D), and release.

To remove the switch, first remove the steering wheel, then release the switch clamp on the steering column. Pull out cable multi-plugs at lower end of column, and remove switch. Note that the switch is an assembly together with the headlamp/horn switch.

Horn, Direction Indicators and Headlamp Switch.

Horn: Push the lever in towards the steering column and release (A).

Direction Indicators: Move lever FULLY up for right-hand turn (B) and FULLY down for left-hand turn (C). Switch will cancel when steering wheel is moved to execute turn.

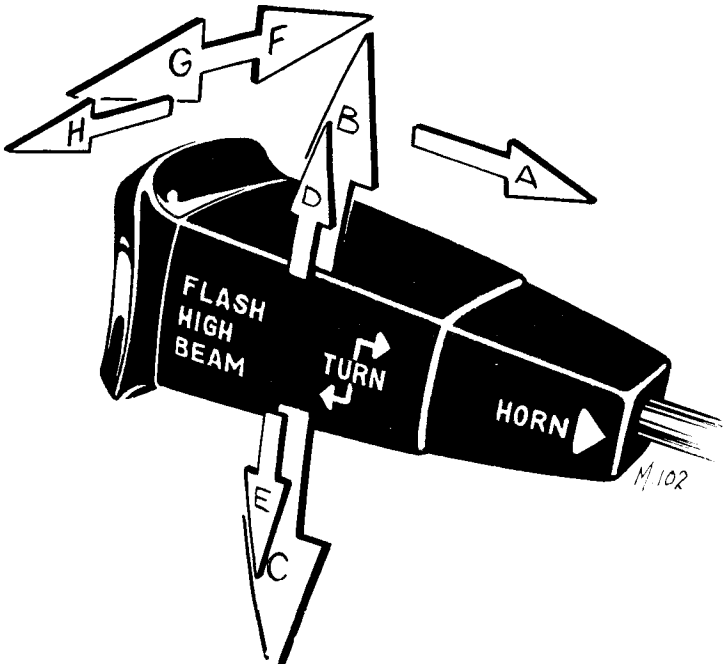


Fig. 9.Horn, Direction Indicators and Headlamp Switch.

For 'lane changing', move lever up (D) to FIRST position and hold for right-hand change, and down (E) to FIRST position, holding for left-hand change.

Headlamps: Main beam is obtained with the lever in the downwards position (F); to select dipped beams move the lever upwards (G). These positions are only operative when the lighting switch (Fig.10) is in operation.

Lifting the lever towards the steering wheel (H) flashes the headlamps main beams irrespective of the position of the lighting switch.

To remove the Horn, Direction Indicators and Headlamp Switch, see under the heading 'Windscreen Wiper/Washer Control'.
The two switches are mounted on a common base plate, thus forming an assembly.

Lighting Switch.

Fig. 10. Lighting Switch.

Turn knob fully to the right, in direction of arrows (Fig.10), to switch 'on' the side, rear and tail lamps; pull the knob fully out while in the turned position, to energise the headlamps.

To remove the switch, depress the knob locking peg and pull off knob. Turn the slotted nut in an anti-clockwise (counter-clockwise) direction, remove nut and, from front of facia, push switch out. Mark position of cables, then release.

Panel Lamps Switch.

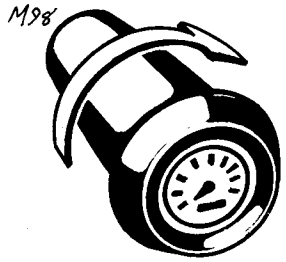


Fig. 11. Panel Lamps Switch.

Turn the knob to the right in the direction of arrow (Fig. 11), to illuminate the panel lamps.

The switch incorporates a rheostat which, when the knob is turned further to the right, reduces the glow from the lamps. The switch is only operative when the lighting switch is in operation.

To remove the switch, depress the knob locking peg and pull off knob. Turn the slotted nut in an anti-clockwise (counter-clockwise) direction, remove nut and, from front of facia, push switch out. Mark position of cables, then release.

M.10. - CONTROL ILLUMINATION.

Commencing at Chassis No. 72082684R, all cars destined for use in North America are fitted with control illumination (see Figs. 12 and 13).

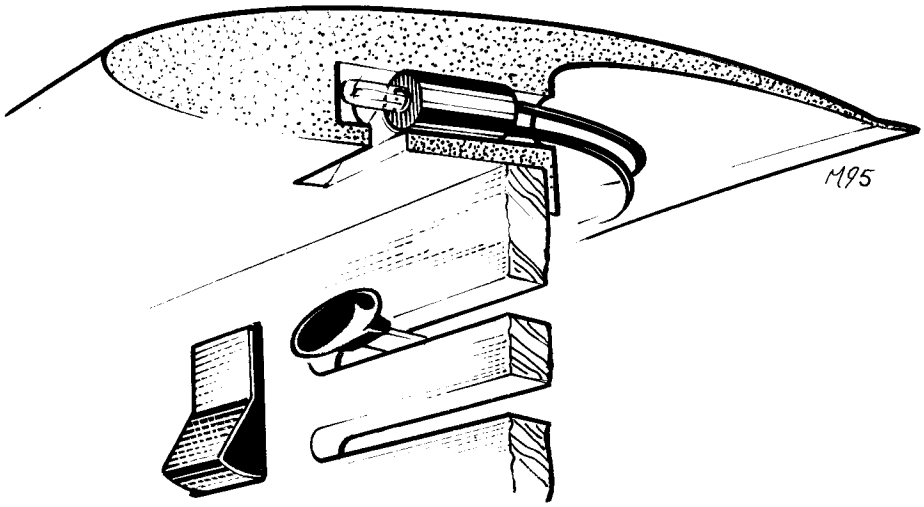


Fig. 12. Facia Panel Illumination

To replace any of the illumination bulbs, simply pull from their location, fit new bulbs, and replace holders.

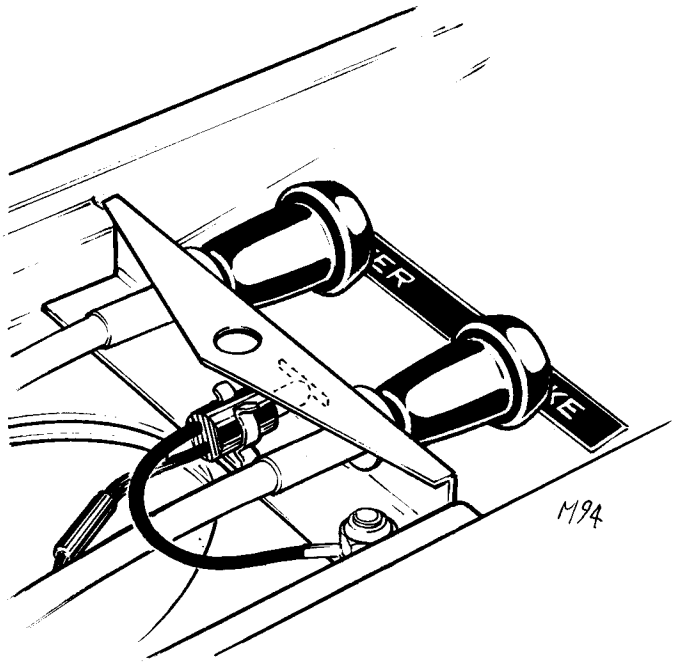
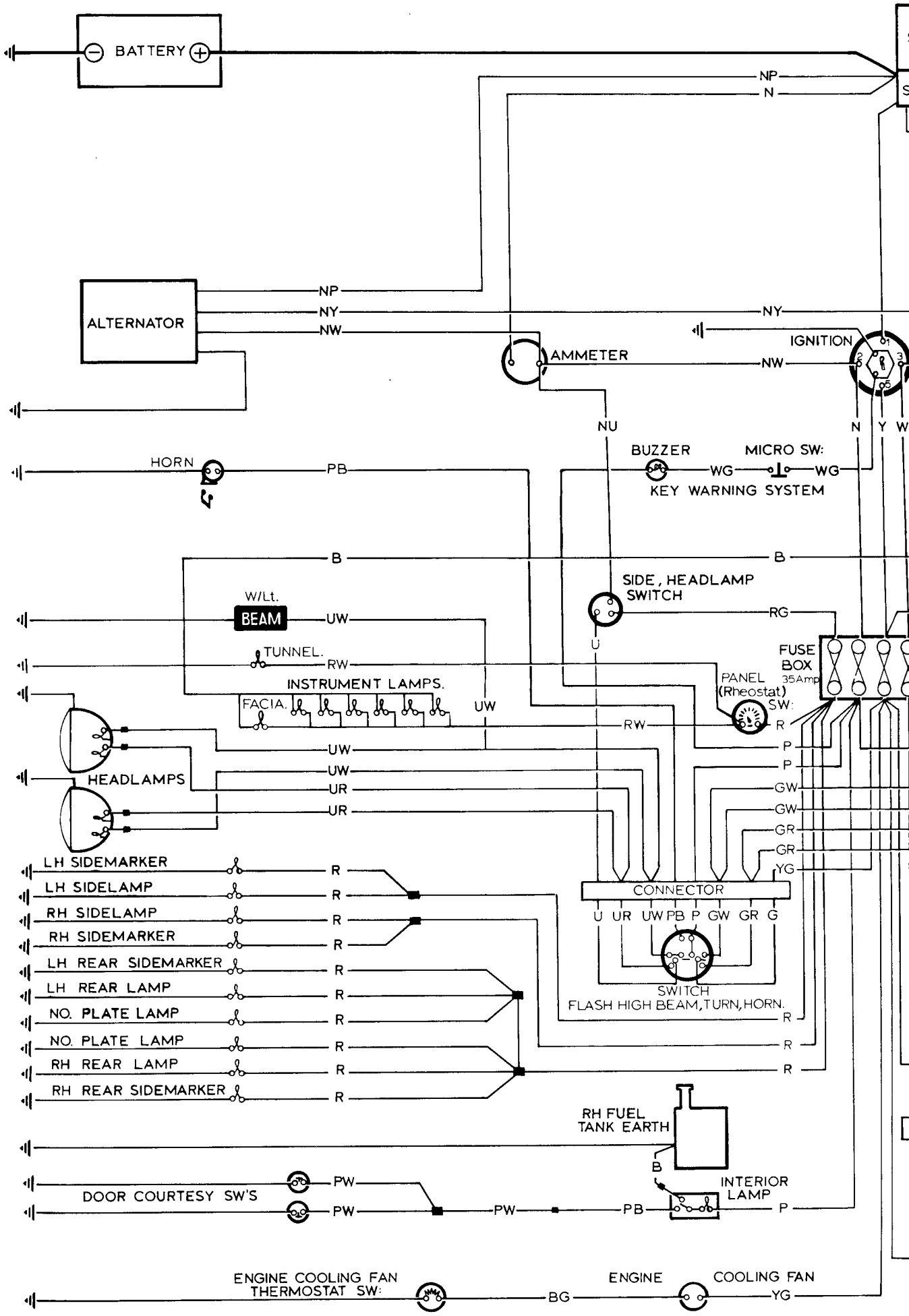


Fig. 13. Choke/Heater Temperature Illumination


BATTERY
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ALTERNATOR
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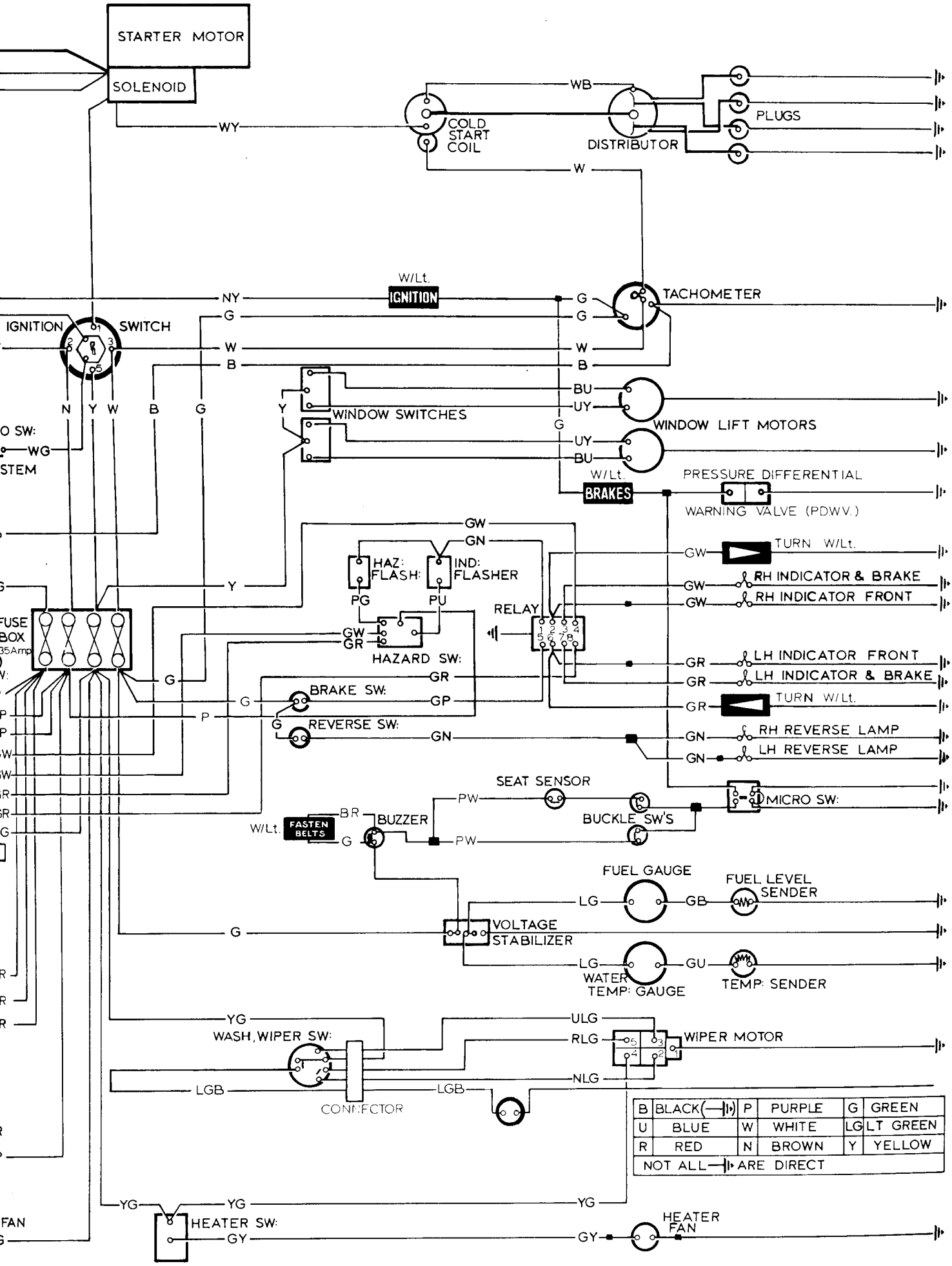
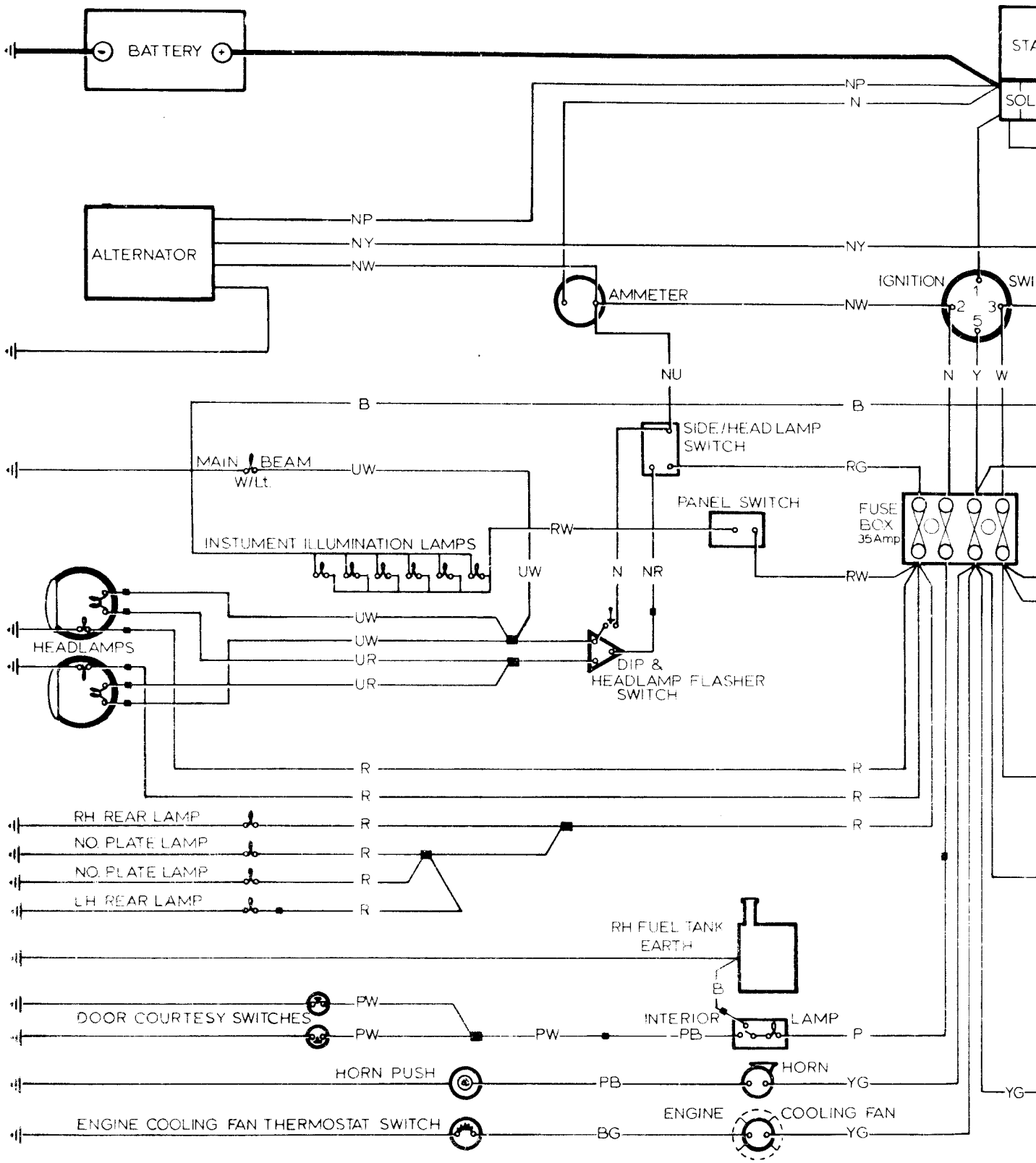
NY
NW
AMMETER
NY
IGNITION
NW
NU
N Y W
HORN
PB
BUZZER
WG
MICRO SW:
WG
KEY WARNING SYSTEM
B
B
SIDE, HEADLAMP SWITCH
W/Lt.
BEAM
UW
RG
U
TUNNEL.
RW
FUSE BOX 35Amp
PANEL (Rheostat) SW:
INSTRUMENT LAMPS.
FACIA.
UW
RW
R
P
HEADLAMPS
UW
UW
UR
UR
P
GW
GW
GR
GR
YG
LH SIDEMARKER
LH SIDELAMP
RH SIDELAMP
RH SIDEMARKER
LH REAR SIDEMARKER
LH REAR LAMP
NO. PLATE LAMP
NO. PLATE LAMP
RH REAR LAMP
RH REAR SIDEMARKER
R
CONNECTOR
U UR UW PB P GW GR G
SWITCH
FLASH HIGH BEAM, TURN, HORN.
RH FUEL TANK EARTH
B
INTERIOR LAMP
P
DOOR COURTESY SW'S
PW
PW
PW
PB
ENGINE COOLING FAN THERMOSTAT SW:
BG
ENGINE
COOLING FAN
YG



EUROPA SPECIAL WIRING DIAGRAM (FEDERAL)

M.104


BATTERY
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AMMETER
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IGNITION
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B
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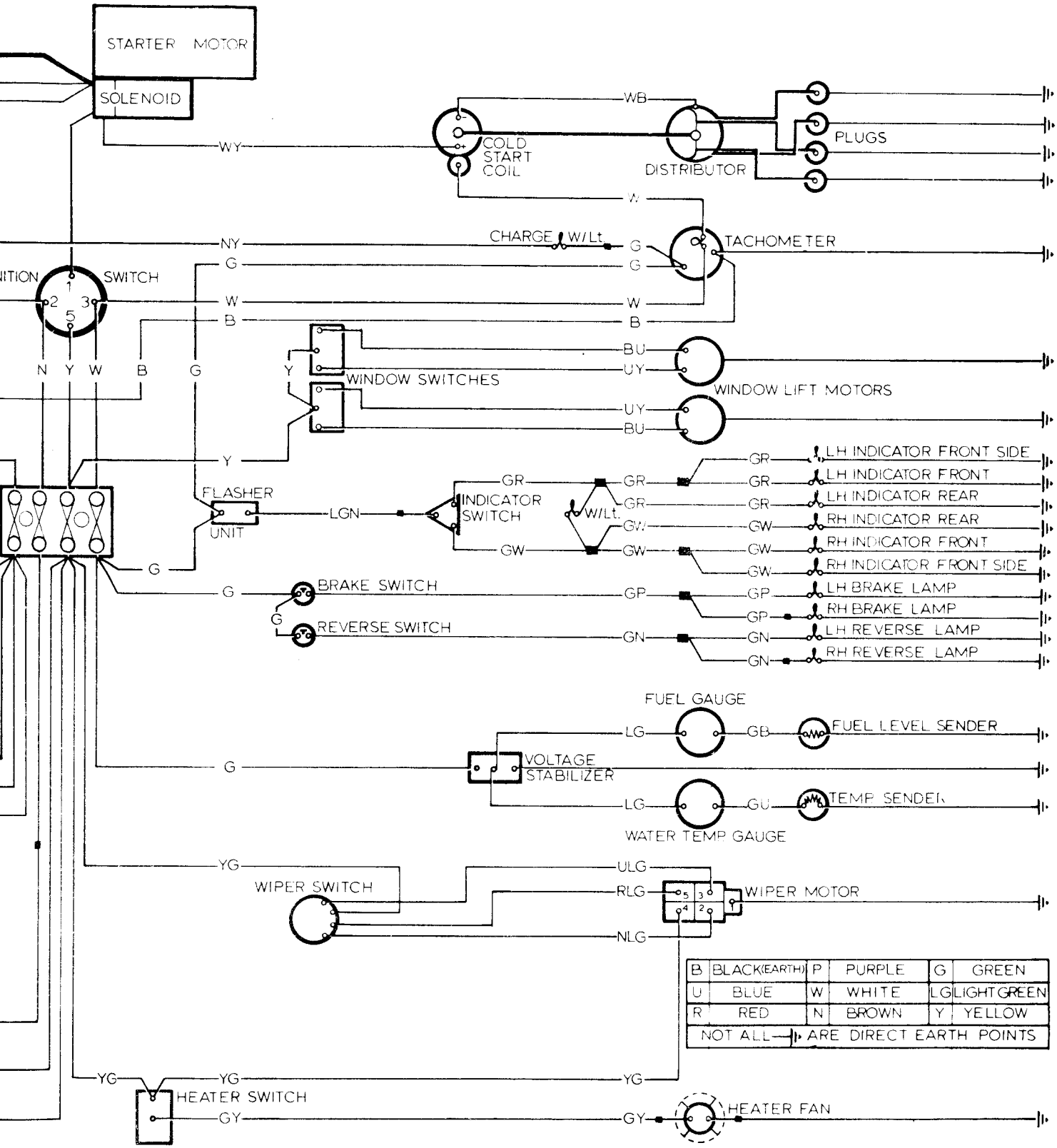
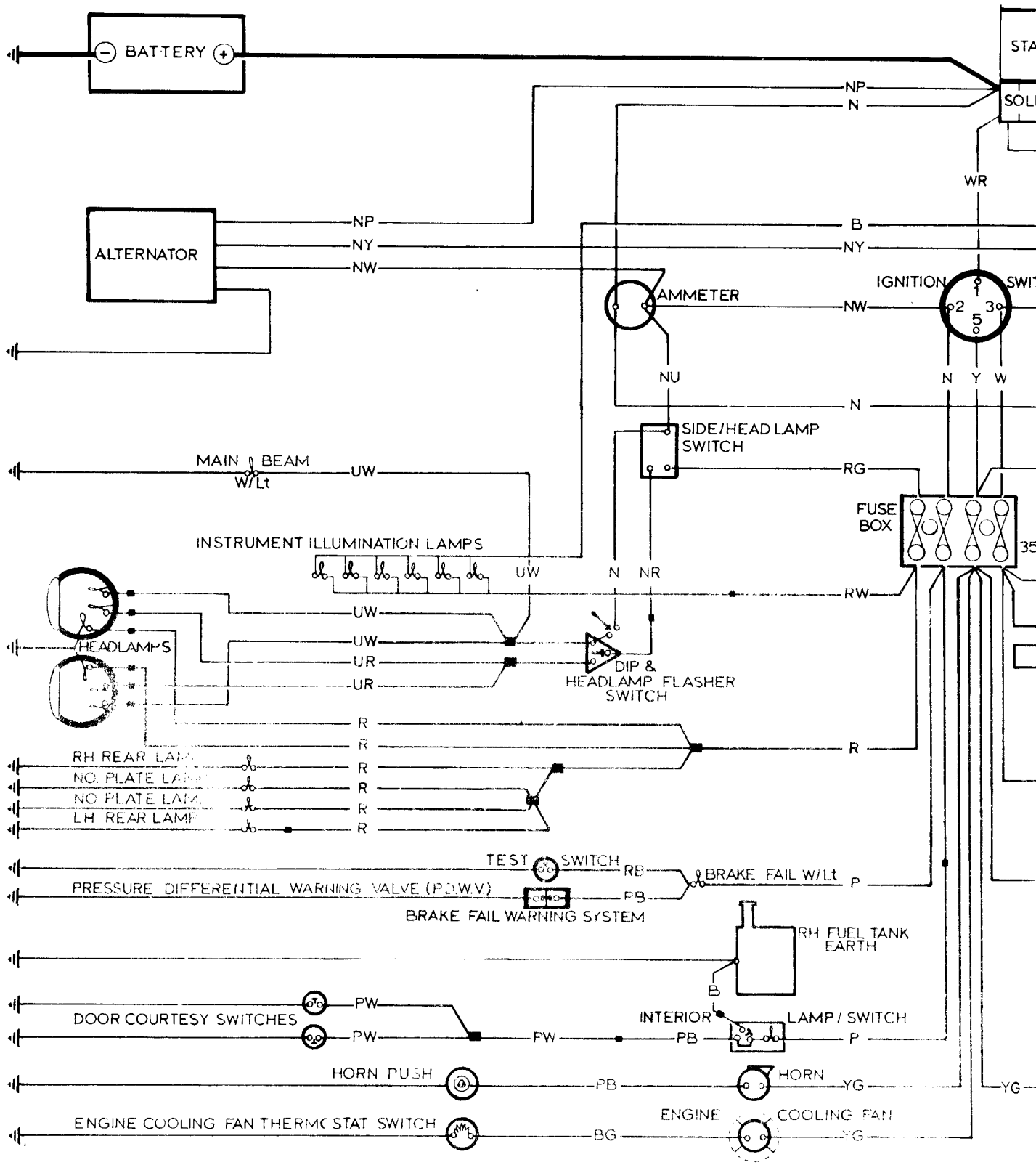
SIDE/HEAD LAMP SWITCH
MAIN BEAM
W/Lt.
UW
RG
PANEL SWITCH
FUSE BOX
35Amp
INSTUMENT ILLUMINATION LAMPS
RW
UW
N
NR
RW
HEADLAMPS
UW
UW
UR
UR
DIP & HEADLAMP FLASHER SWITCH
R
R
R
R
RH REAR LAMP
R
R
NO PLATE LAMP
R
NO PLATE LAMP
R
LH REAR LAMP
R
RH FUEL TANK EARTH
B
DOOR COURTESY SWITCHES
PW
PW
PW
INTERIOR LAMP
PB
P
HORN PUSH
PB
HORN
YG
YG
ENGINE COOLING FAN THERMOSTAT SWITCH
BG
ENGINE COOLING FAN
YG

LSL 185



B	BLACK(EARTH)	P	PURPLE	G	GREEN
U	BLUE	W	WHITE	LG	LIGHT GREEN
R	RED	N	BROWN	Y	YELLOW
NOT ALL — ARE DIRECT EARTH POINTS					

EUROPA TWIN-CAM WIRING DIAGRAM (U.K.) M66


BATTERY
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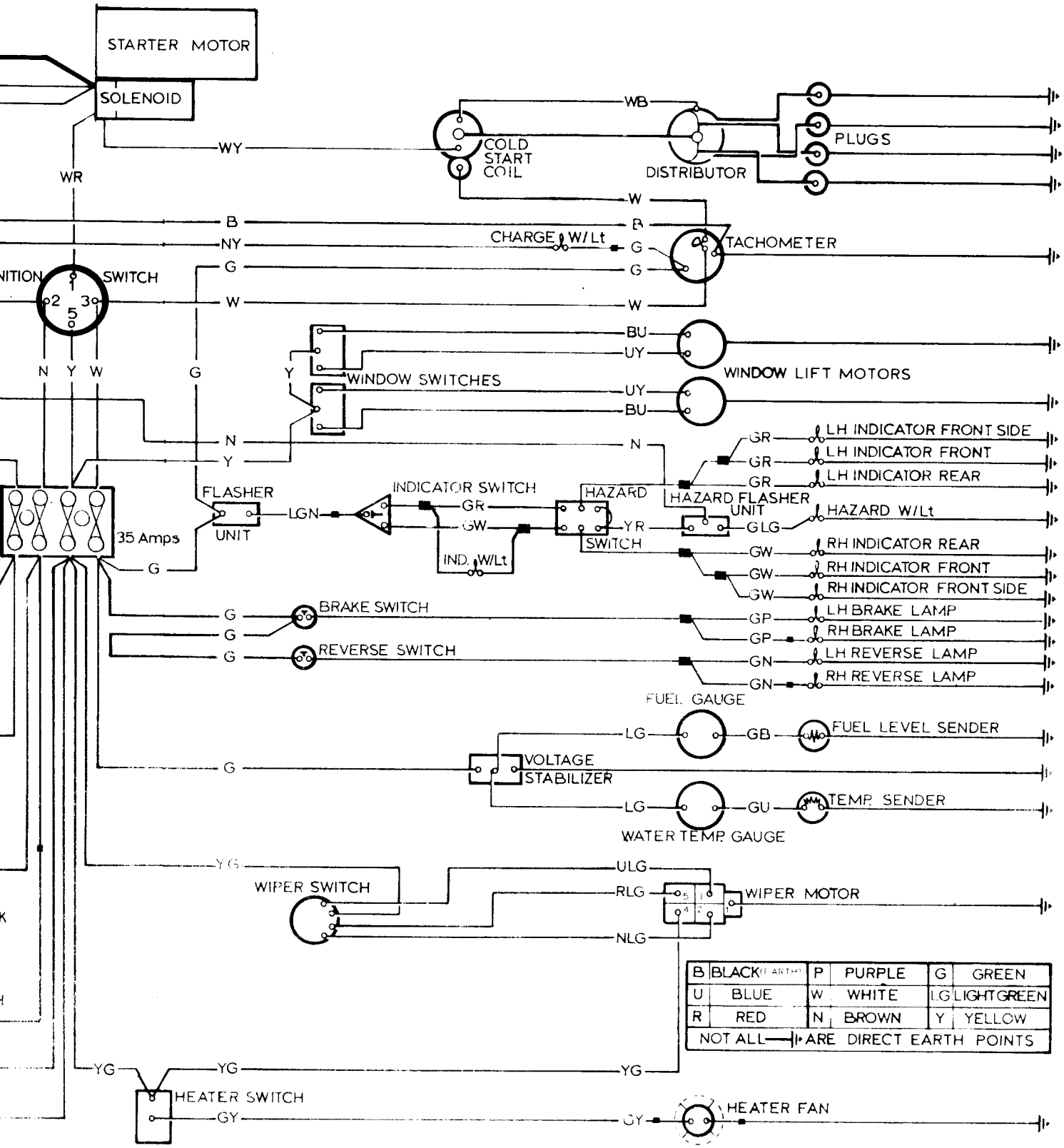
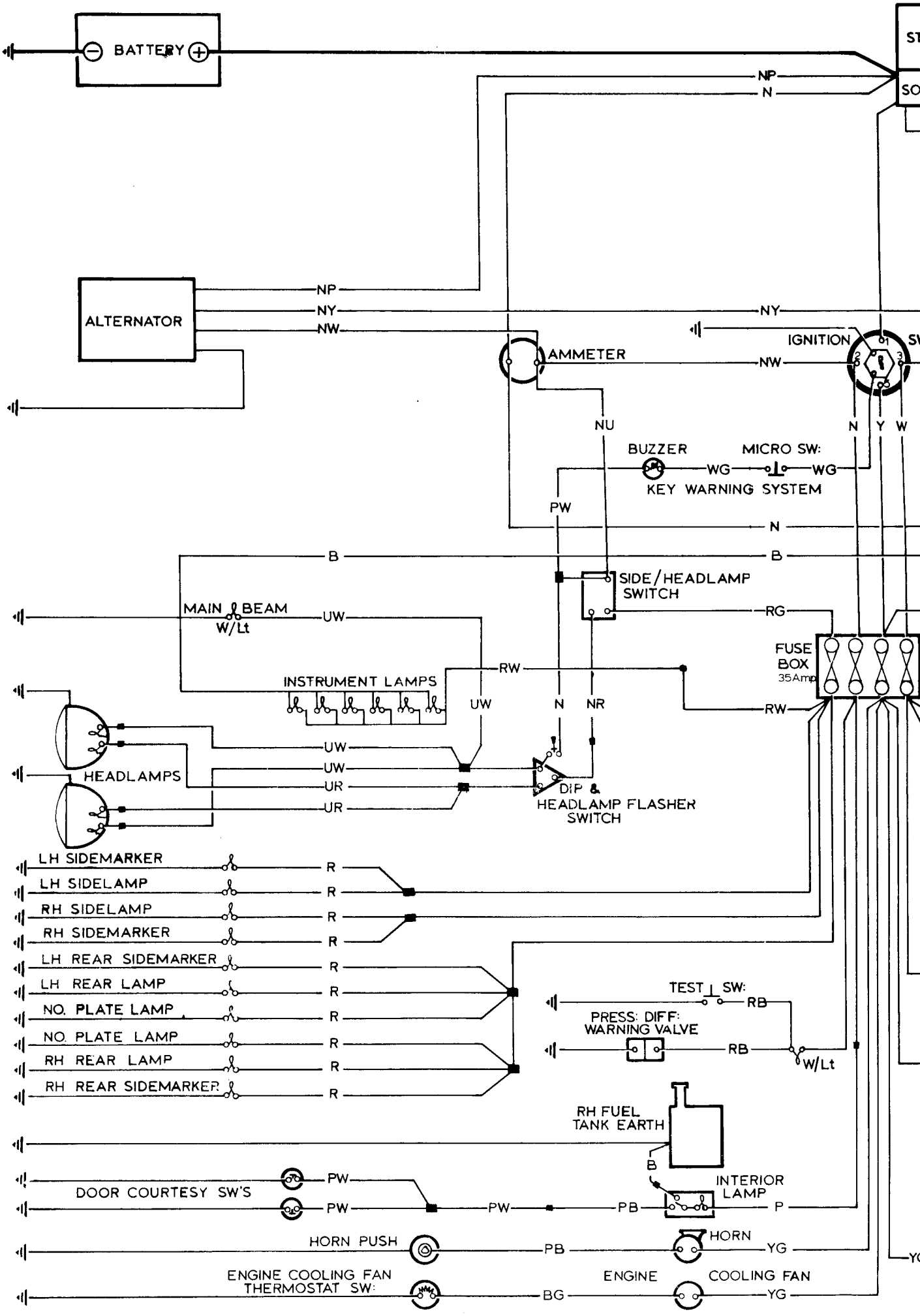
SIDE/HEAD LAMP
SWITCH
MAIN BEAM
W/Lt
UW
RG
FUSE
BOX
35
INSTRUMENT ILLUMINATION LAMPS
UW
N
NR
RW
UW
HEADLAMPS
UW
UR
UR
DIP &
HEADLAMP FLASHER
SWITCH
R
R
R
RH REAR LAMP
NO. PLATE LAMP
NO. PLATE LAMP
LH REAR LAMP
R
R
R
R
TEST
SWITCH
RB
BRAKE FAIL W/Lt
P
PRESSURE DIFFERENTIAL WARNING VALVE (P.D.W.V.)
RB
BRAKE FAIL WARNING SYSTEM
RH FUEL TANK
EARTH
B
DOOR COURTESY SWITCHES
PW
PW
PW
INTERIOR
LAMP / SWITCH
PB
P
HORN PUSH
PB
HORN
YG
YG
ENGINE COOLING FAN THERMOSTAT SWITCH
BG
ENGINE
COOLING FAN
YG



B	BLACK (EARTH)	P	PURPLE	G	GREEN
U	BLUE	W	WHITE	LG	LIGHT GREEN
R	RED	N	BROWN	Y	YELLOW
NOT ALL ARE DIRECT EARTH POINTS					

EUROPA TWIN-CAM WIRING DIAGRAM (NON-FEDERAL)

M.77


BATTERY
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ALTERNATOR
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AMMETER
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IGNITION
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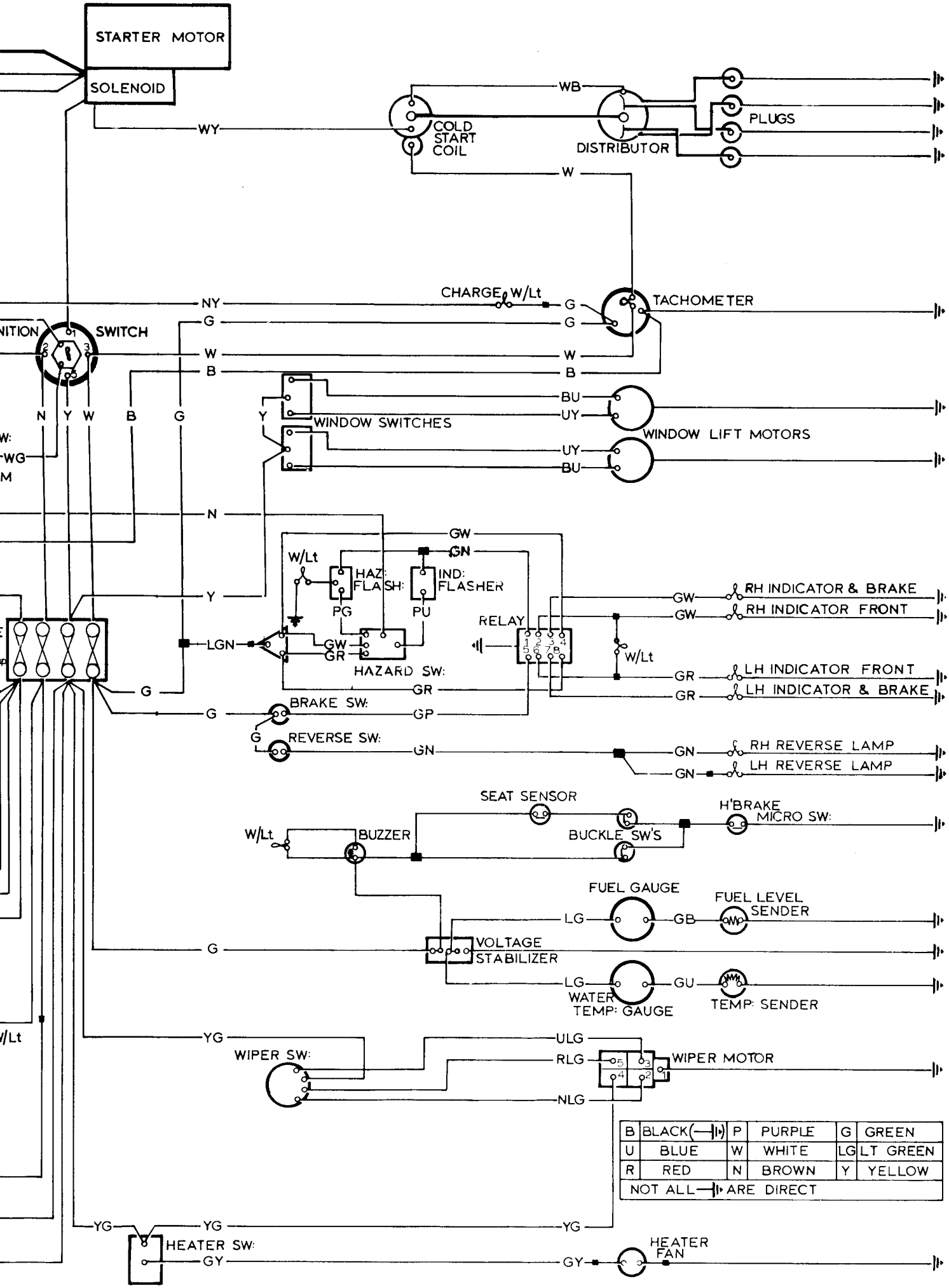
BUZZER
MICRO SW:
WG
WG
KEY WARNING SYSTEM
PW
N
B
B
SIDE/HEADLAMP SWITCH
RG
MAIN BEAM
W/Lt
UW
FUSE BOX
35Amp
RW
INSTRUMENT LAMPS
UW
N
NR
RW
UW
UW
UR
UR
HEADLAMPS
DIP & HEADLAMP FLASHER SWITCH
LH SIDEMARKER
LH SIDELAMP
RH SIDELAMP
RH SIDEMARKER
LH REAR SIDEMARKER
LH REAR LAMP
NO. PLATE LAMP
NO. PLATE LAMP
RH REAR LAMP
RH REAR SIDEMARKER
R
TEST SW:
RB
PRESS: DIFF: WARNING VALVE
RB
W/Lt
RH FUEL TANK EARTH
B
DOOR COURTESY SW'S
PW
PW
PW
PB
INTERIOR LAMP
P
HORN PUSH
PB
HORN
YG
ENGINE COOLING FAN THERMOSTAT SW:
BG
ENGINE
COOLING FAN
YG



EUROPA TWIN-CAM WIRING DIAGRAM (FEDERAL)

M76

SECTION O.

LUBRICATION/MAINTENANCE.

O.1. - GENERAL.

The Voucher Service commences with a FREE 'After Sales Service' which is carried out at 800 km. (500 miles). Further Vouchers are inclined in the Service Voucher Book to cover Lubrication and Maintenance at intervals of every 8,000 km.(5,000 miles).

NOTE: A fold out illustration will be found at the end of this Section which shows the main lubrication items in the Services.

O.2. - PERIODIC SERVICES.

FREE AFTER SALES SERVICE - 800 Kilometres (500 miles)

1. LUBRICATION

Drain engine without flushing and refill with new oil. Drain transmission and refill with new oil. Lubricate lower steering swivels. Lubricate drive shafts. Lubricate throttle linkage and controls. Top up carburetter damper reservoirs (Stromberg).

2. ENGINE.

Check valve clearances and adjust if necessary. Check carburetter slow running adjustment. Check vertical movement of carburetters on manifold. Check torque loading of cylinder head bolts .Top up coolant level in coolong system header tank if necessary. Make visual inspection of all water pipe conections including heater pipes. Check alternator belt tension and adjust if necessary. Check water pump drive belt. Check timing chain tensioner adjustment. Check security of carburetter ram pipes (Dellorto) securing nuts. Check security of complete exhaust system, engine mountings, distributor and alternator mounting bolts.

3. IGNITION.

Check and adjust if necessary, distributor contact breaker points, sparking plug points and static ignition timing.

4. BRAKES

Check brakes, system and operation including handbrake. Check foot pedal and adjust if necessary. Check brake fluid reservoir level and top up if necessary. Check security and conditions of all brake hydraulic pipes, vacuum hoses and unions. Check and tighten if necessary front wheel discs and caliper mountings. Check security of rear wheel brake backplates.

5. CLUTCH

Check operation of clutch and adjust clearances if necessary.

6. STEERING AND SUSPENSION.

Check that all steering connections including column clamps are secure. Check wishbone and damper connections on front and rear suspension units to specified torque loadings. Check front suspension upper and lower fulcrum pins and lower trunnion bolts to specified torque loadings. Check steering unit mountings for tightness. Check front wheel alignment.

7. ELECTRICAL.

Check operation and function of all electrical equipment, including voltage regulator output. Check security of battery terminals. Check electrolyte level of battery and top up if required.

8. WHEELS AND TYRES.

Check all wheel nuts for tightness. Check all tyre pressures, including spare.

9. BODY.

Check body condition generally including door adjustment, front and rear baggage compartment locks and all body attachment points. Check seat sliding mechanisms. Check operation of windscreen wiper and washers.

10. GENERAL.

Check condition of engine mountings and bolt to specified torque loadings. Check drive shafts, universal joints for security. Check fuel pipes, chassis, grommets, fuel tank drain plugs for security. Check chassis cross-beam and diagonal brace locating bolts to specified torque loading. Ensure steering wheel and upholstery are free from grease. Check security of alternator mounting bolts.

'A'Service - every 8,000 kilometres (5,000 miles) or 3 months (whichever is the sooner)

1. LUBRICATION

Drain engine and refill with new oil. Fit new engine oil filter. Check transmission oil level and top up if necessary. Lubricate drive shaft universal joints. Lubricate lower steering swivels. Lubricate steering unit pinion. Lubricate all doors, front and rear baggage compartment locks, catches and hinges. Top up carburetter damper reservoirs (Stromberg).

2. ENGINE.

Check carburetter slow running adjustment. Check vertical movement of carburetters on manifold. Check timing chain tensioner adjustment. Clean petrol pump filter. Check alternator drive belt for condition and adjust if necessary.

Make visual inspection of all water pipes including heater pipes. Top up coolant level in cooling system header tank if necessary. Clean air cleaner body and element.

3. IGNITION.

Check distributor settings and adjust if necessary. Lubricate cam and weights. Clean and adjust sparking plug points.

4. BRAKES.

Check brakes system and operation, including handbrake. Check foot pedal travel. Check front wheel disc pads and if down to a thickness of 1.6 mm. (1/16 in.) replace pads. Check brake fluid reservoir and top up if necessary. Check security and condition of all brake hydraulic pipes, vacuum pipes hoses and unions. Renew brake servo unit air filter.

5. CLUTCH.

Check operation of clutch and adjust if necessary.

6. STEERING AND SUSPENSION.

Check steering assembly for general condition. Check both front and rear wheels alignment and adjust if necessary. Check front suspension upper and lower fulcrum pins and lower trunnion bolts to specified torque loadings. Check wishbone and damper connections on front and rear suspension units to specified torque loadings. Check rear hub retention.

7. ELECTRICAL.

Check electrolyte level of battery. Clean battery parts and terminals and smear with silicone grease, ensuring tightness of terminals on replacement. Check operation of all circuits, including cooling fan motor operation. Check headlamp focus, resetting if necessary. Check windscreen wiper operation and arc.

8. WHEELS AND TYRES.

Check all wheel nuts for tightness. Check all tyre pressures including spare. Dynamically balance wheel and tyre assemblies.

9. BODY.

Check body condition generally including door adjustment front and rear baggage compartment locks and all body attachments points. Check seat slide mechanisms for ease of functioning. Check door windows for ease of operation. Check heater system and operation. Check there is water in windscreen washer container.

10. GENERAL.

Check conditions of engine mountings and bolts to specified torque loadings. Check security of alternator mounting bolts. Check chassis cross-beam and diagonal brace locating bolts to specified torque loadings. Check torque loadings of fixings securing brake disc and calipers, rear brake backplates, steering unit mountings, drive shaft universal joints, all exhaust system mountings and ignition distributor mounting.

'B' Service - every 16,000 kilometres (10,000 miles) or 6 months (whichever is sooner)

1. LUBRICATION.

Drain engine and refill with new oil. Fit new engine oil filter. Check transmission oil level and top up if necessary. Lubricate drive shaft universal joints. Lubricate lower steering swivels. Lubricate steering unit pinion. Lubricate all doors, front and rear baggage compartment locks, catches and hinges. Lubricate throttle linkage and controls. Top up carburetter damper reservoirs (Stromberg.)

2. ENGINE.

Check carburetter slow running adjustment. Check vertical movement of carburetters on manifold. Check timing chain tensioner adjustment. Clean petrol pump filter Check alternator drive belt for condition and adjust if necessary. Make visual inspection of all water pipes including heater pipes. Top up coolant level in cooling system header tank if necessary. Clean air cleaner body and fit new element. Check valve clearances and adjust if necessary. Check torque loading of cylinder head bolts. Check security of carburetter ram pipes (Dellorto) securing nuts. Check water pump drive belt. Check condition of all engine ancillaries.

3. IGNITION.

Check distributor settings and adjust if necessary. Lubricate cam and weights. Clean and adjust sparking plug points, renewing plugs if their condition demands this.

4. BRAKES.

Check brakes system and operation, including handbrake. Check foot pedal travel. Check front brake disc pads and if down to 1.6 mm. (1/16 in.) replace pads. Check condition of rear brake linings. Check brake fluid reservoir and top up if necessary.

Check security and condition of all brake hydraulic pipes, vacuum pipes, hoses and unions. Renew brake servo unit air filter. Check for wear on master cylinder linkage and pedal bearings.

5. Check operation of clutch and adjust if necessary. Check for wear on clutch linkage and pedal bearings.

6. STEERING AND SUSPENSION.

Check steering assembly for general condition. Check both front and rear wheels alignment and adjust if necessary. Check front suspension upper and lower fulcrum pins and lower trunnion bolts to specified torque loadings. Check wishbone and damper connections on front and rear suspension units to specified torque loadings. Check rear hub bearings. Check front hubs lubrication and repack with grease. Check condition of front and rear wheel bearings, hubs and seals. Check security of steering unit mountings. Check all steering and suspension moving parts for wear.

7. ELECTRICAL.

Check electrolyte level of battery. Check battery posts and terminals and smear with silicone grease, ensuring tightness of terminals on replacement. Check operation of all circuits, including cooling fan motor operation. Check headlamp focus, resetting if necessary. Check windscreen wiper operation and arc.

8. WHEELS AND TYRES.

Check all wheel nuts for tightness. Check all tyre pressures, including spare. Dynamically balance wheels and tyre assemblies.

9. BODY.

Check body condition generally including door adjustment front and rear baggage compartment locks and all body attachment points. Check seat slide mechanisms for ease of functioning. Check heater system and operation. Check there is water in windscreen washer container.

10. GENERAL.

Check condition of engine mountings and bolts to specified torque loadings. Check security of alternator mounting bolts. Check chassis cross-beam and diagonal brace locating bolts to specified torque loadings. Check torque loadings of fixings securing front brake disc and calipers, rear brake backplates, steering unit mountings drive shafts universal joints, all exhaust system mountings and ignition distributor mounting. Check condition of gearshift linkage joints.

O.3. - AIR HORNS LUBRICATION.

Where air horns are fitted the compressor should be lubricated, through the oil hole provided, initially on installation and subsequently at monthly intervals.

O.4. - RECOMMENDED LUBRICANTS.

(The products shown are not listed in order of preferance)

	Esso	B.P.	Castrol	Mobil	Shell
Engine(above 0^0C)	Uniflo	Super Viscostatic 20W/50	Castrol GTX	Mobiloil Super 10W/50	Shell Super 100
Engine (below 0^0C)	Uniflo	Super Viscoststic	Castolite	Mobiloil Super 10W/50	Shell Super 10W/30
Transmission	Esso Gear Oil GX 80	B.P. Gear Oil GX 80	Castol Hypoy Light	Mobilube GX 80	Shell Spirax 80 EP
Front Hubs	Esso Multi - Purpose Grease	B.P. Energrease L.2.	Castrol Grease LM.	Mobil Grease MP.	Shell Retinax 'A'
Steering Swivels	Esso Gear Oil GP90/140	B.P. Gear Oil SAE 90EP	Castrol Hypoy	Mobilube GX 90	Shell Spirax 90 EP
SteeringUnit	Esso Multi - Purpose Grease	B.P. Energrease L.2.	Castrol Grease LM.	Mobil- Grease MP.	Shell Retinax 'A'

Pivots and Linkages Engine Oil

Hinges Locks Catches Engine oil or silicone grease.

Brake master cylinder reservoir Castrol Girling Brake Green to specification SAE 70 J.1703B

O.5. - EXHAUST EMISSION ENGINES.

The following additional servicing must be carried out on all cars equipped with the above engine.

1. AT FIRST 1,600 KILOMETRES (1,000 miles)

a. ENGINE:

Check and adjust if necessary, engine idling speed.

b. IGNITION:

Check ignition timing and adjust if necessary.

2. EVERY 20,000 KILOMETRES (12,000 miles)

a. ENGINE:

Carry out carburetter 'YELLOW' service (see Section 'L'). Renew adaptor flange 'O' rings. Check for induction leaks and renew all gaskets that are disturbed. Clean crankcase breather.

b. IGNITION:

Check ignition timing and adjust if necessary. Fit new sparking plugs.

3. EVERY 40,000 KILOMETRES (24,000 miles)

a. ENGINE:

Carry out carburetter 'RED' service (see Section 'L'). Renew adaptor flange 'O' rings. Renew all induction system gaskets. Visually inspect secondary throttle spindle seals. Check for induction leaks. Clean crankcase breather.

b. IGNITION:

Check timing and adjust if necessary. Fit new sparking plugs. Fit new distributor contact breaking points.

O.6. - APPROVED ANTI-FREEZE SOLUTIONS

Lotus Cars Limited approve anti-freeze solutions, for use in the engine cooling system, based on inhibited ethylene glycol provided it conforms to British Standard Specifications 'BSS.3151'.

Solution Strength	Against Frost Damage	Safe Pump Circulation
25%	-26° C. (-15° F)	-12°C.(10°F.)
30%	-33° C. (-28°F)	-16°C.(3° F.)
35%	-39° C. (-38°F)	-20°C.(-4°F)
40%	-41° C. (-42°F)	-23°C.(-10°F)
50%	-47° C. (-53°F)	-36°C.(-32°F)

HEATER

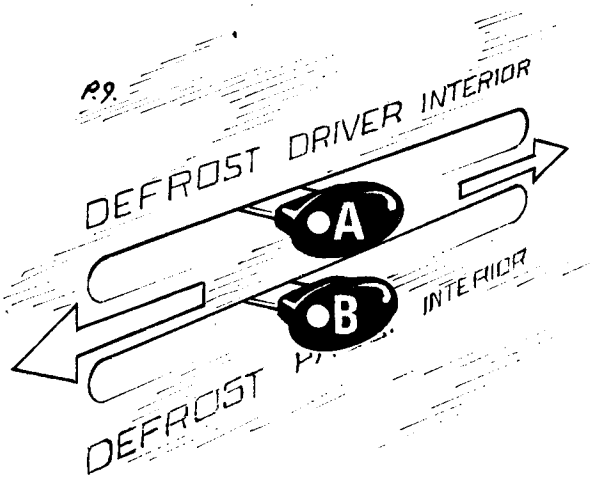


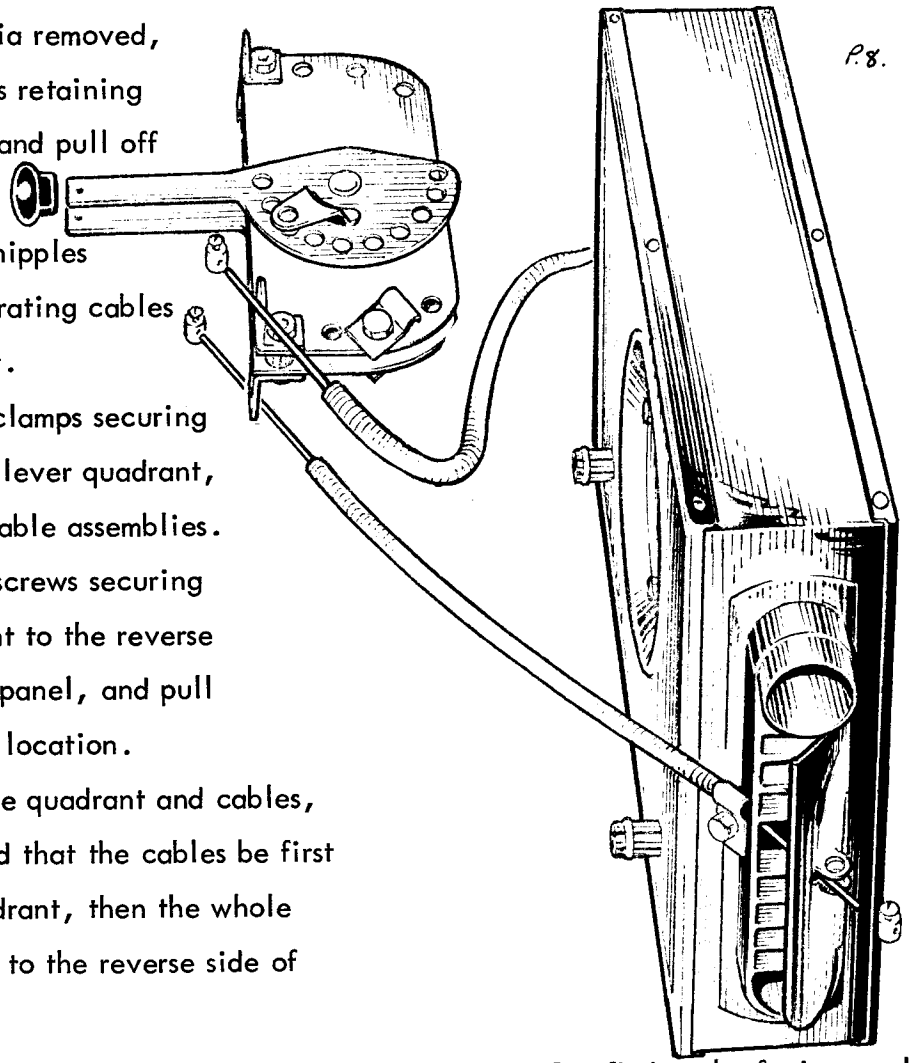
Fig. 1. HEATER CONTROLS.

Commencing at Chassis No. 72082684R, all cars destined for use in North America are fitted with a lever operated heater unit.

Interior heating and ventilation can be controlled individually by both driver (A) and passenger (B) alike, using the control levers as shown in Fig.1.

To remove the heater unit, see Section 'P' of the main Europa Manaul (X046 T 0327Z).

To remove control lever assembly, it will be necessary to remove the facia panel, in which case, see Section 'B' of the main Europa Manual.



1. With the facia removed, remove the screws retaining the lever knobs, and pull off knobs.
2. Release the nipples retaining the operating cables at the heater unit.
3. Release the clamps securing the cables to the lever quadrant, and remove the cable assemblies.
4. Remove the screws securing the lever quadrant to the reverse side of the facia panel, and pull quadrant from its location.

When refitting the quadrant and cables, it is recommended that the cables be first fitted to the quadrant, then the whole assembly secured to the reverse side of the facia panel.

Adjust lengths of cables at the heater end of them, AFTER refitting the facia panel.

SECTION Q

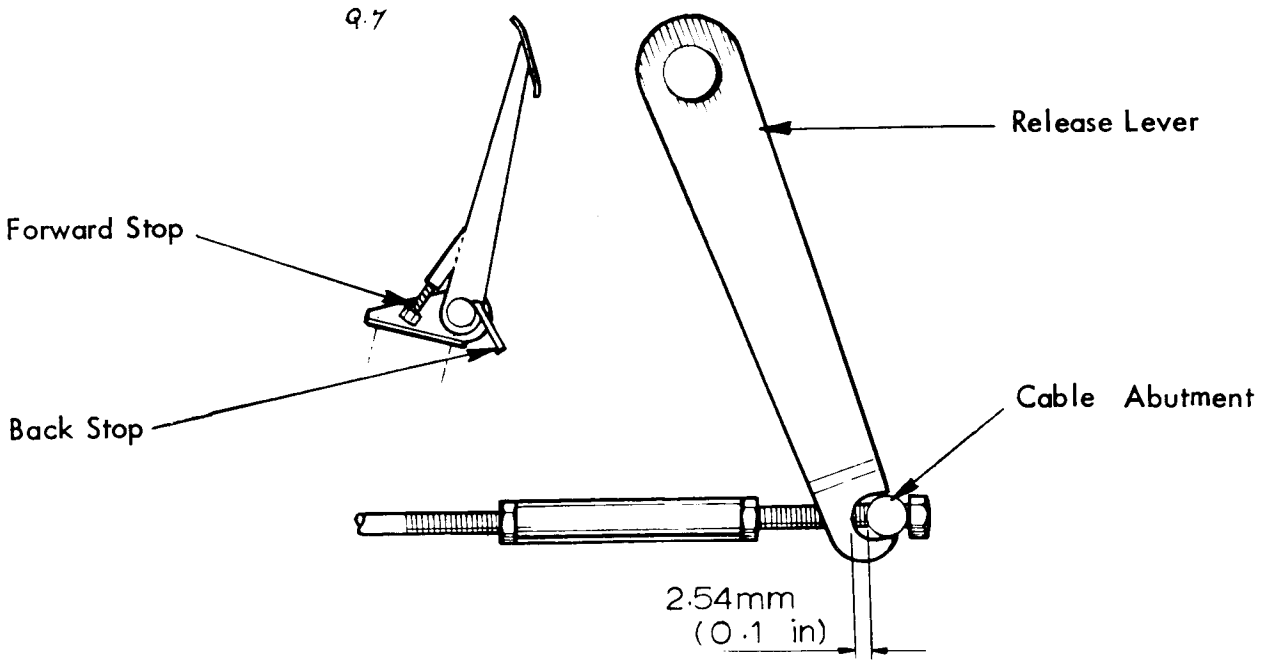
CLUTCH

Q.1 - CLUTCH ADJUSTMENT

(see also Section 'J' for pedal "set up")

For correct operation and functioning of the clutch, it is most important that the adjustment is carried out correctly. Recommended procedure is as given here.

1. Slacken the locknut on the end of the operating cable sufficient to enable the release lever to be moved by hand.
2. Push the release lever forwards by hand until the release bearing contacts the diaphragm spring of the clutch assembly. This will be felt as a marked resistance.
3. Adjust the cable to give the clearance at the cable abutment (see Fig. 1).
4. With the aid of the turnbuckle in the cable, take up any additional slack or free play in the cable.
5. With a second operator inside the car, adjust the pedal forward stop to give an additional .63 in. (16 mm.) at the release lever adjacent to the cable abutment.



Fig, 1. CLUTCH ADJUSTMENT.

SECTION S.

EXHAUST SYSTEM.

S.1 - GENERAL.

The exhaust system is comprised of either:

a. Fabricated manifolds into a common intermediate pipe

b. Cast manifold into a common intermediate pipe.

With the fabricated manifold type of exhaust, ports '1' and '4' exhaust into one manifold, while ports '2' and '3' exhaust into a further manifold.

With the cast type of manifold, all ports exhaust into the one common manifold.

S.2 - FABRICATED TYPE SYSTEM.

To Remove

1. Release the clip connecting the intermediate pipe to the silencer.
2. Remove fixings securing silencer and remove silencer from car.
3. Release the clips connecting the intermediate pipe to manifolds and remove intermediate pipe.
4. Remove the nuts securing the manifolds to cylinder head and pull manifolds from their mounting studs. If difficulty is experienced in removing the manifolds, it is suggested that the L/H engine mounting bracket be first removed. (see Section 'E')

To Replace

1. Reverse the removal instructions.

S.3 - CAST TYPE SYSTEM.

To Remove

1. Release the clip connecting the intermediate pipe to the silencer.
2. Remove fixings securing silencer and remove silencer from car.
3. Remove the nuts securing the flange of the intermediate pipe to the manifold and remove intermediate pipe.
4. Remove the nuts securing the manifold to the cylinder head and remove manifold.

To Replace

1. Reverse the removal instructions.

S.4 - SILENCER.

To Remove

1. See Section 'S.2' and 'S.3'.

S.5 - INTERMEDIATE PIPE.

To Remove

1. See Section 'S.2' and 'S.3'.