CITROEN

FRONT WHEEL DRIVE

"Twelve" & "Fifteen" Models

REPAIR MANUAL

TEXT

1938 1950

CITROEN CARS, LIMITED,
TRADING ESTATE,
SLOUGH, ENGLAND,

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FOREWORD

The contents of this Repair Manual refer to Citroen cars built in France. British made Citroens incorporate a few dissimilarities from the French Models and these are not dealt with in this Manual. It must however be noted that the overwhelming majority of the contents of the Manual apply equally to British and French made Citroens.

USE OF REPAIR MANUAL

ORDER OF OPERATIONS

The sequence of operations for removing, fitting, and re-assembling has been carefully outlined in order to achieve the best results in the shortest time. For example:

Adjustments are indicated in the sequence where they can be executed in the easiest way with the maximum precision.
To save time, operations necessitating the same tools are grouped.

It is in your interest to follow strictly the sequence of operations as indicated.

TOOLS

Opposite each basic operation, tools to be used are shown in a special column.

(i) ORDINARY TOOLS such as hammer, screwdriver, pliers, etc., are not mentioned, but the size of appropriate spanners is given.

(ii) SPECIAL CITROEN TOOLS are indicated by their number followed by the symbol 'T'. These tools can be supplied.

(iii) OTHER SPECIAL CITROEN TOOLS are indicated with their number preceded by the symbol 'MR'. These can be made by Citroen Service Agents themselves and diagrams for this purpose are shown in the Manual.

OBSERVATIONS

Generally the most appropriate spanner is indicated for each operation. Socket spanners, fitting various types of handles are recommended. Flat set spanners and adjustable spanners which damage nuts and set screw heads must be used as little as possible.

INTRODUCTORY NOTE

In view of the difference between British and French designations, the table below shows an outline of the equivalent British and French symbols applicable to various models

FRENCH SYMBOL	CHARACTERISTICS	BRITISH FACTORY SYMBOL RELATING TO YEAR OF MANUFACTURE	BRITISH COMMERCIAL DESIGNATION	R.A.C. RATING
7A	72 x 80; track 1.32 m.	7A (1934)	"Twelve"	12.8
7B	78 x 80; track 1.32 m.	-	-	-
7C	72 x 100; track 1.32 m.	7A (1935) 7A1 (1936) 7C (1937) 7C2 (1938) 7C3 (1939) 7C4 (1940)	"Twelve"	12.8
7 Economique	72 x 100; track 1.32 m. Special gear ratio 10 x 31	-	-	-
11L	78 x 100; track 1.32 m. "Horizontal" carburettor	11L (1936) 11CL (1937) 11CL2 (1938) 11CL3 (1939)	"Light Fifteen"	15.1
11L "Performance"	78 x 100; track 1.32 m. "Downdraught" carburettor	11CL4 (1940) 11CL6 (1946/48)	"Light Fifteen"	15.1
11L "Performance"	78 x 100; track 1.32 m. Raised Pedal Gear	11CL8 (1949)	"Light Fifteen"	15.1
11	78 x 100; track 1.45 m. "Horizontal" carburettor	11A (1935) 11A1 (1936) 11C (1937) 11C2 (1938) 11C3 (1939)	"Big Fifteen"	15.1
11 "Performance"	78 x 100; track 1.45 m "Downdraught" carburettor	11C4 (1940)	"Big Fifteen"	15.1

Drg. No.	Description	Fixture or Tool No.		Remarks
	ENGINE			
2	Extractor for battery terminal	-	2200-T	See electrical
32	Spanner for clutch bell-housing bolts (hexagon head)	-	1675-T	
32	Spanner for clutch bell-housing (two flats on head)	-	1676-T	
1	Chain for lifting engine during removing and refitting	MR.3320-20	-	
2A	Stand for engine when removed	-	2500-T	
4	Timing instrument for distributor	-	1691-T	
5	Torsion spanner	-	2470-T	
21	Spanner for removing carburettor	-	1620-T	
2	Plug spanner	-	1601-T	
8	Spanner for centre bolt of exhaust manifold	-	1625-T	
-	Spanner for crankshaft nut	-	1667-T	
2	Stud extractor	-	2410-T	
9	Mandrel for valve guides	MR.1620	-	
11	Spanner for fan bearing locking nut	-	1976-T	See steering
-	Rubber suction cup for valve grinding.	-	1615-T	
9	Mandrel for fitting valve seats	MR.3098-B	-	
12	Spring testing apparatus	-	2420-T	
12	Standard test spring	-	2421-T	
12	Standard test spring	-	2422-T	
2	Valve spring compressor	-	1611-T	
12A	Tool for fitting sparking plug housings	-	1604-T	
13	Assembly for oil pump adjustment	MR.1811	-	
14	Assembly for reaming water pump bushes	-	1635-T	
14	Reamer for 1635-T	-	1636-T	
14	Tool holder for 1638-T	-	1637-T	
14	End mill for facing water pump bush	-	1638-T	
14	Depth gauge for checking milling of water pump bush face	-	1639-T	
11	Locating stud for positioning fan	MR.3400	-	
-	Clock gauge	-	2440-T	
15	Apparatus for boring and alignment of oil baffles	-	1665-T	
15A	Assembly for fitting oil baffle packings	MR.3505	-	
16	Tool for fitting gudgeon pin circlips	MR.1610	-	
-	Stone used for removing high spots on connecting rods	-	2480-T	
17A	Engine stand	MR.3300-30	-	
18	Assembly for gauging height of cylinder barrels	MR.3377	-	
17A	Engine stand	MR.3300-20	-	

LIST OF SPECIAL TOOLS SHOWN IN MANUAL

Drg.No.	Description	Fixture or Tool No.		Remarks
17B	Ring for fitting pistons to barrels	-	1656-T	
20	Ring spanner for oil return ring on dynamo and water pump drive shaft	-	1640-T	
	CLUTCH			
32	Spanner for clutch bell-housing bolts (hexagon head)	-	1675-T	See engine
32	Spanner for clutch bell-housing bolts (two flats on head)	-	1676-T	See engine
12	Spring testing apparatus	-	2420-T	See engine
24	Apparatus for adjusting clutch toggles	-	1701-T	
24A	Blocks for simplified method of adjusting clutch toggles	MR.3457	-	
	GEARBOX			
25	Gearbox stand	MR.3053	-	
27	Extractor for removing coupling flange	MR.3328	-	
28	Body for differential bearing extractor	-	1750-T	
28	Split collet, ring, and thrust block for differential bearing extractor	-	1753-T	
20	Ring spanner for oil return ring on dynamo and water pump drive shaft	-	1640-T	See engine
30	Distance blocks for mounting front suspension brackets to gearbox cover	MR.1525	-	
31	Tool for assembling synchromesh gear	MR.3025	-	
32	Mandrel for fitting bevel pinion bearing	MR.3047	-	
33	Cutter for refacing differential housing	-	1752-T	
33	Ratchet for 1752-T	MR.3094	-	
32	Mandrel for fitting Timken differential bearing	MR.3327	-	
32	Mandrel for fitting bevel pinion and bearing to gearbox	MR.3044	-	
34	Stop tool for tightening layshaft front bearing locknut	MR.3139	-	
35	Apparatus for adjusting crown wheel and bevel pinion	-	2044-T	
32	Mandrel for fitting mainshaft ball-races	MR.3045	-	
35	Bracket for clock gauge	-	2041-T	
36	Spanner for differential bearing ring nut	-	1751-T	
27	Bar for holding coupling flange	MR.3352	-	
	FRONT AXLE			
37	Extractor for steering ball pin	-	1964-T	
39	Spanner for nuts of front axle mounting studs	-	1880-T	

Drg. No.	Description	Fixture or Tool No.		Remarks
71	Block for removing torsion bars	MR.1578	-	See rear axle
40	Draw-bar for mounting torsion bars	MR.3349	-	
42	Spanner for stub axle nut	-	1810-T	
42	Body for hub and ball-race extractor	-	1750-T	See gearbox
42	Collets and ring for hub extractor	-	1820-T	
42	Collets and ring for ball-race extractor	-	1819-T	
43	Spanner for outer ball-race retaining ring	-	1825-T	
44	Extractor for lower swivel ball	-	1851-T	
44	Spanner for adjusting upper swivel ball bearing	-	1852-T	
44	Extractor for upper swivel ball	-	1850-T	
46	Plunger and socket for dismantling and refitting lower link arm serrated shaft	MR.3363	-	
48A	Extractors for stub axle bearings	-	1821-T and 1823-T and 1828-T	
47	Spanner for stub axle inner ball-race nut	-	1826-T	
48 & 60	Tool for removing stub axle	-	1824-T	
50	Pliers for fitting or removing brake shoe return spring	-	2110-T	
51	Punch and socket for flaring brake adjusting camshaft	MR.3354	-	
-	Reamer for upper link arm boss	-	1860-T	
45	Gauge for positioning upper link bushes	MR.3507	-	
47A	Vice for holding drive shaft couplings during dismantling and refitting	-	1830-T	
52	Assembly for flaring wheel studs	MR.3445	-	
53	Mandrel for rectification of brake drums	MR.3381	-	
56	Extractor body for drive shaft spigot cup or ball-pin	-	1900-T	
56	Collets for ball-pin extractor	-	1901-T	
56	Collets for spigot cup extractor	-	1902-T	
56	Depth gauge	-	1912-T	
56	Pin for use with depth gauge 1912-T	-	1911-T	
-	First cut reamer	-	1905-T	
-	Finishing cut reamer	-	1906-T	
-	Gauging piece	-	1907-T	
57	Three-point contact gauge	-	1908-T	
57	Bearing housing gauge	-	1910-T	
57	Screw-press	-	1903-T	
58	Ferrule for fitting spigot ball pin	-	1904-T	
58	Depth gauge for circlip groove	-	1909-T	
59	Assembly for reboring coupling spline housing	MR.1627	-	

Drg. No.	Description	Fixture or Tool No.		Remarks
39	Gauge for setting lower link arm	MR.3350	-	
61	Apparatus for checking concentricity of brake linings	-	2100-T	
49	Spanner for adjusting brake shoe eccentrics	-	2120-T	
-	Torsion wrench for 1810-T	-	2472-T	
	STEERING			
62	Extractor for steering wheel	-	1950-T	
37	Extractor for steering ball pin	-	1964-T	See front axle
62	Bush for locating steering column fixed tube	MR.3102	-	
65	Clamp for holding rack and pinion steering gear in vice	MR.1561	-	
66	Spanner for steering rack tube cap	-	1975-T	
66	Combination spanner for retaining tube and ring nut	-	1976-T	
66	Spanner for adjusting nut on outer ball pin cup	-	1870-T	
67	Gauge for adjusting track rod length	MR.3340	-	
	REAR AXLE			
67A	Jacking bracket for rear axle beam	MR.3300-110	-	
68	Spanner for dismantling early type axle	-	2050-T	
69	Gauge for positioning axle	MR.3338	-	
71	Block for removing torsion bars	MR.1578	-	
79	Gauge for checking lateral adjustment of axle	-	2051-T	
50	Pliers for fitting or removing brake shoe return spring	-	2110-T	See front axle
74 & 75	Tool for checking camber and toe-in of axle	-	2052-T	
51	Punch and socket for flaring brake adjusting camshaft	MR.3354	-	See front axle
52	Assembly for flaring wheel studs	MR.3445	-	See front axle
76	Mandrel for rectification of brake drums	MR.3381-2	-	
77	Mandrel and guide block for dismantling and assembling silentblocs	MR.3335	-	
72	Fixture for holding link arms during mounting	MR.3336	-	
80	Apparatus for checking concentricity of brake linings	-	2103-T	
49	Spanner for adjusting brake shoe eccentrics	-	2120-T	

Drg. No.	Description	Fixture or Tool No.		Remarks
	SUSPENSION			
81	Funnel for refilling SPICER shock absorbers	MR.3382	-	
81A	Assembly for refilling SPICER shock absorbers	MR.3552	-	
	GEAR SELECTOR			
82	Universal joint spanner	-	2430-T	
	BRAKES			
83	Handle for spanner socket for three-way union bolt on master cylinder	-	2131-T	
83	Spanner for master cylinder inlet union	-	2130-T	
-	Spanner for removing master cylinder	-	Facum	Ideal type 240 x 12
-	Bleed pipe	-	2140-T	
	ELECTRICAL			
1	Extractor for battery terminal	-	2200-T	
88	Screwdriver bit for removing pole-piece screw (For use with ratchet)	MR.1601-4	-	
88	Mandrel for packing dynamo field coils	MR.1601-2	-	
88	Mandrel for packing starter motor field coils	MR.1601-1	-	
	ADJUSTMENTS			
4	Timing instrument for distributor	-	1691-T	
91	Gauge for checking caster angle	MR.1767	-	
92	Gauge for checking length of track rods	MR.1590	-	
93	Steering lock gauge	-	1890-T	
94	Gauge for checking wheel camber	-	2314-T	
-	Gauge for checking heights under hull	-	2300-T	
-	Spanner for adjustment of heights under hull (square socket)	-	2301-T	
-	Spanner for adjustment of heights under hull (hexagon socket)	-	2302-T	
68	Spanner for adjustment of rear body height	-	2304-T	

Drg. No.	Description	Fixture or Tool No.		Remarks
94A	Weighing machine for checking weight distribution	-	2310-T	
96	Apparatus for checking balance of wheels	MR.3396	-	
97	Screen for adjustment of headlamps	MR.1572	-	
	BODY			
100	Jig for realignment of hull	-	2600-T	

We remind you that only tools having a number followed by the symbol 'T' are supplied.

The manual includes detailed drawings showing how to make tools marked 'MR'.

	REMOVING ENGINE AND GEARBOX ASSEMBLY	
1	Drain water from radiator, and meanwhile.	
2	Remove bonnet, radiator shell, radiator block and radiator crossmember.	Flat spanners 12 - 14
2a	Remove supporting brackets (on 'Big 15' model only).	Box spanner 14 - 17
3	Remove battery (using extractor 2200-T, see Drawing 2, fig.1, for removing cable connectors). Disconnect ignition coil, starter motor and dynamo wires.	Extractor 2200-T Box spanners 8 - 10 - 14
4	Uncouple gear control rods (gear tower end only), clutch cable (using spanner 1675-T for hexagon head screws, or spanner 1676-T for twin-flat head screws, see Drawing 32), speedometer cable from gearbox, flexible pipe at petrol pump inlet union, accelerator control rod, starter motor, ignition and carburettor choke controls.	Spanner 1675-T or 1676-T Box spanner 10 Flat spanners 12 - 14
5	Uncouple vertical pipe from exhaust manifold and remove tie rod between vertical pipe and engine.	Universal joint spanner 17 Box spanner 12
6	Uncouple universal drive flanges at gearbox end.	Flat spanner 14
7	Disengage engine and gearbox unit from hull using chain sling MR.3320-20 around water pump body. Raise unit slightly to disengage couplings from gearbox one after the other. Lift out unit completely. (See Drawing 1).	Sling MR.3320-20
8	Drain engine oil.	Adjustable spanner 50
9	Place unit in engine stand (similar to stand 2500-T shown on Drawing 2A).	Stand 2500-T
	REFITTING ENGINE AND GEARBOX ASSEMBLY	
10	Lift the unit with chain sling MR.3320-20 as in removal operation. Place unit on hull, engage rear bearer in its housing, place volute springs on their brackets, ensure that plain washers are in position, lower unit completely, being careful to engage drive shaft couplings with coupling flange bolts.	Sling MR.3320-20
11	ON 'LIGHT 15' TYPE. Mount radiator crossmember and bolt front suspension brackets to it.	Box spanner 17
11a	ON 'BIG 15' TYPE. First fit the crossmember angle pieces to cradle (thus ensuring easy tightening of bolts) then, mount radiator crossmember.	Box spanner 17

12	Fit lock plates and nuts on coupling bolts and tighten well.	Flat spanner 14
13	ADJUST ENGINE SUSPENSION. Rear rubber cushion must be well centered in its housing as well as fitting into it at the correct depth.	
	(a) Centre rear rubber cushion. - From inside the vehicle remove 4 bolts holding housing and take out same. Front end of unit is held in correct position by method of mounting, i.e. - biconical rubber bush on pin. Engine can therefore move up and down slightly round the axis of this pin. This permits correct adjustment of rear rubber cushion in its housing. To centre rubber cushion, loosen lock nuts of volute springs adjusting screws and turn the latter clockwise or anticlockwise. A tolerance of 2 to 3 mm. above horizontal centre line of opening in coque is permitted.	Flat spanner 21 Crank spanner 14
	(b) Adjust longitudinally. - The positioning of the rear cushion in housing is carried out by use of the existing hole in housing. After fitting into place, measure the distance between the back of housing and face of cushion. The distance must be 10 mm. within 2 mm. If existing housing does not permit this, another one must be fitted.	Slide gauge
14	Couple vertical exhaust pipe to exhaust manifold using a copper and asbestos gasket between flanges and well tightening the nuts. Mount exhaust pipe tie-rod using a spring washer under each nut.	Universal spanner 17 Flat spanner 12 - 14
15	MOUNTING AND ADJUSTING CLUTCH CABLE AND BRACKET (See Drawing 3)	
	(a) Adjust height of pedal so that distance from lowest point of pedal to floor felt is 180 mm. or, when carpet is fitted, 175 mm.	
	(b) Connect clutch cable to withdrawal fork lever.	
	NOTE - To prevent undue stress in the cable end make certain that the clevis end of the withdrawal fork lever is parallel to the withdrawal shaft. If necessary set the lever to give this condition.	
	1. ADJUSTMENT OF CABLE FOR '6-SPRING' CLUTCH - Give a lost motion of 30 mm. on the pedal before withdrawal fork contacts toggles.	
	2. ADJUSTMENT OF CABLE FOR '9-SPRING' CLUTCH (LIGHT TYPE) - Loosen adjusting nut (1) by hand until the outer cable rests at both ends at A and B. Work clutch pedal up and down several times to compress cable sleeve. Unscrew adjusting nut (1) one and a half turns and tighten lock nut (2). Adjust the cable by means of adjusting nut (3) brought to bear on trunnion in withdrawal fork lever without pressure.	Flat spanners 14 - 17 Spanner 1675-T or 1676-T

	Check that, when declutching, the collar on the fixed guide (4) remains seated on bearing of the cable guide flange.	
16	Mount speedometer cable.	Box spanner 10
17	Mount accelerator control, starter motor and carburettor choke control, petrol drain pipe, ignition control, ignition coil wires and flexible petrol pipe.	Flat spanners 12 - 14
18	Couple gear control rods. The gear selector forks to be in neutral position and rods at correct length for connecting to gearbox levers without moving the latter.	Flat spanner 17 Box spanner 12
19	Mount radiator and connect hoses. Tighten drain plug.	Box spanner 17
20	Mount radiator shell.	Box spanner 12
21	Fill radiator with water and engine sump with oil to correct level.	
22	Mount battery.	Flat spanner 10
23	Fit bonnet.	
24	SETTING DISTRIBUTOR (See Drawing 4)	
	(a) Crank engine slowly until No.1 cylinder approaches end of compression stroke. Insert 6 mm. locating pin into special hole in bell housing (left side). Then turn crankshaft slowly until pin falls in recess on flywheel. The engine is now set at 8° advance.	6 mm. dia. pin
	(b) Remove distributor cap and push distributor shaft into distributor bush. Rotate spindle slowly in order to engage distributor drive dogs.	
	(c) Fit timing instrument 1691-T with its indicator lamp, the lead of which connects with condenser terminal by means of a crocodile clip. Leave locating pin in position and turn body of distributor in order to bring rotor opposite segment for No.1 plug. Turn body of distributor until contacts break when indicator lamp will light. THIS FIRST ADJUSTMENT CORRESPONDS TO 8° ADVANCE ON FLYWHEEL.	Timing instrument 1691-T Box spanner 10 Flat spanner 10
	(d) With normal quality petrol the advance should be set to 12°. In order to obtain this alternative setting, note position of timing instrument needle, and then without moving rotor, turn distributor body anticlockwise in order to increase advance by 4°. Lock distributor in this position. (The instrument is graduated in flywheel degrees).	
	(e) Withdiaw locating pin and remove timing instrument. Mount distributor rotor and cap. Connect sparking plug leads firing order being 1,3,4,2.	

Start engine and let it idle (500 R.P.M. approx.) for 15 minutes.

26 While engine is hot, tighten cylinder head nuts to 36.17 foot pounds tension (see Drawing 5), using torsion wrench 2470-T.

Torsion wrench 2470-T
Socket end 17

27 Adjust tappets to :

0.15 mm. (0.006") clearance inlet
0.20 mm. (0.008") clearance exhaust

Set of feeler gauges

To do this, proceed as follows :

Run engine until it is hot, remove valve cover and unscrew sparking plugs until there is no compression.

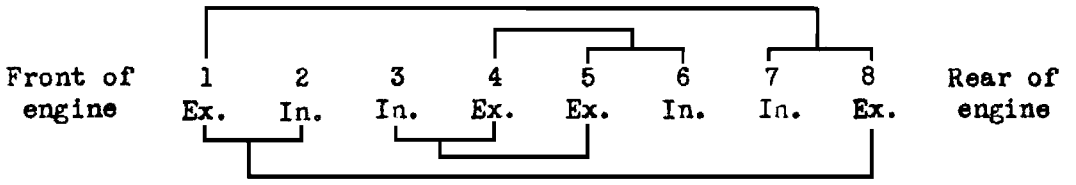
Rotate crankshaft slowly with starting handle until exhaust valve of No.4 cylinder (which is the last valve at rear of engine) opens. Continue turning slowly until valve just closes. Valves 1 and 2 are now in position for adjustment.

Having done this rotate crankshaft slowly half a turn watching No.4 valve until it is just closed. No. 5 and No.6 valves are now ready for adjustment.

Another half turn of the starting handle will now close No.1 valve and allows No.7 and No.8 valves to be adjusted.

A further half turn will close No.5 valve positioning No.3 and No.4 valves for adjustment.

following diagram shows the positions of valves. (Ex. for Exhaust, In. for Inlet).



Do not try method of adjusting tappets while the engine is running.

	REMOVING ENGINE ACCESSORIES (Engine removed)	
1	Place engine and gearbox unit on stand 2500-T (See Drawing 2A).	Stand 2500-T.
2	Remove dynamo and belt, starter motor, distributor, petrol pump, carburettor by use of spanner 1620-T (See Drawing 21), sparking plugs by use of spanner 1601-T (See Drawing 2, fig.2), rear engine bearer, and breather pipe.	Flat spanner 17 or Spanner 1620-T Plug spanner 1601-T Box spanners 10 - 14 - 17
3	Uncouple gearbox and bell housing assembly from engine using spanner 1675-T or 1676-T (See Drawing 32).	Spanner 1675-T or 1676-T Box spanner 17 Flat spanner 17
4	Remove bell housing dust cover.	Flat spanner 14
5	Uncouple clutch from flywheel.	Brace spanner 14
	REFITTING OF ENGINE ACCESSORIES (Engine removed)	
6	REFITTING CLUTCH	
	(a) Ensure that flywheel and clutch pressure plate faces are clean.	
	(b) Couple clutch assembly to flywheel, using a mandrel or mainshaft to centralise clutch plate with mainshaft ballrace. While tightening, make sure that mandrel slides freely ensuring correct alignment. Tighten clutch-holding bolts to a tension of 2 mkg plus 0.250, minus 0 mkg (14.5 foot pounds, plus 1.81, minus 0 foot pounds), with spring washers under heads. Remove mandrel.	Mandrel 17 mm. dia. for ballrace and 21.5 mm. dia. for plate.
7	COUPLING GEARBOX	
	(a) Fit dowel pins with circlips into sockets in cylinder block. Grease splines of clutch centre plate (with grease type Mobilgrease No. 5). Check that the camshaft and relay shaft coupling dog is a slide fit with clearance not exceeding 0.15 mm. If clearance is in excess of this fit a new coupling dog. If unable to fit a new part close up the flanks of the coupling by slight pressure in a vice taking care not to crack the part. Fit the loose coupling to the gearbox relay shaft. Before pushing gearbox fully home, ensure that relay shaft coupling is in alignment with camshaft end. The easiest way to do this is to position both tongue and groove vertically. Position flywheel closing plate between cylinder block and bellhousing flanges and then push gearbox fully home. Fit bolts and tighten to a tension of 2 mkg.	Spanner 1675-T or 1676-T

	(14.5 foot pounds) using spanner 1675-T for hexagon head bolts, or spanner 1676-T for twin-flat head bolts (See Drawing 32).	
	(b) Turn set screw (5) stopping clutch withdrawal fork in order to allow play (a) of 1.25 to 1.75 mm. between faces of thrust washer and toggles. Tighten locknut (6).	Flat spanner 14
	(c) Set gear lock withdrawal fork (8) on guide bracket (7) in order to give clearance (b) of 1 to 2 mm. between head of plunger and face of fork.	Box spanner 10
	(d) Fit dust cover to bellhousing.	Flat spanner 14
8	MOUNTING DISTRIBUTOR Carry out ignition timing after refitting engine (See Operation 101, para. 24).	
9	Fit spark plugs (use spanner 1601-T, see Drawing 2, fig. 2).	Plug spanner 1601-T
10	Fit carburettor (see Operation 109, para. 3). Fit air intake silencer.	Flat and box spanners 10 Spanner 1620-T or flat spanner 17
11	Fit dynamo and belt. Adjust belt tension.	Universal joint spanner. Socket 17
12	Fit starter motor.	Universal joint spanner. Sockets 14 - 17
13	Fit petrol pump using cork gasket between flanges. Fit petrol pipe from pump to carburettor using fibre washer both sides of banjo union.	Flat spanner 14
14	Fit rear engine cushion, tighten two set screws thoroughly, turn back lock tabs again a flat on screw heads.	Universal joint spanner 17

	WHEN MAJOR REPAIRS ARE NECESSARY IT IS RECOMMENDED TO REPLACE THE ENGINE WITH A NEW ASSEMBLY SUPPLIED AS A SERVICE UNIT.	
	DISMANTLING OF ENGINE (See Drawings 7 and 8)	
1	Place engine on a low stand, about 50 cm. (20 ins.) high.	
2	Remove inlet and exhaust manifolds (the two centre nuts with spanner 1625-T), oil breather, right and left volute spring brackets, valve cover, water pump (first uncouple pump body (9) in order to be able to reach two main fixing bolts in cover). Remove set screw holding oil pump, and supply pipe to rocker shaft.	Brace spanner 10 - 12 - 14 16 - 17 Spanner 1625-T
3	Lay engine over, plug side down.	
4	Remove oil sump, timing cover, and cylinder head. Remove push rods, tappet cups, and oil pump.	Flat spanners 16 - 17 - 26 Brace spanner with sockets 12 - 17
5	Straighten out lockplate tabs on connecting rod bolts, on main bearing nuts, and on timing wheel nuts.	
6	Place a wood block between crankcase and web of crankshaft to prevent the latter from turning. Remove timing wheel nuts (using spanner 1667-T). Remove chain and both wheels together in one operation (using screwdriver or small lever.)	Spanner 1667-T Flat spanner 37 or adjustable spanner
7	Mark each connecting rod and its cap. Remove flywheel, connecting rod caps and main bearing caps. Remove crankshaft. When engine is equipped with a heavy flywheel, remove flywheel and crankshaft as one assembly. Then separate flywheel from crankshaft.	Brace spanner 12 - 14 - 17 Brace spanner 14
8	Remove connecting rods and pistons from barrels. Remove barrels from cylinder block with the aid of a screwdriver.	
9	Unbolt camshaft thrust plate (10) in order to remove same.	Brace spanner 12
10	Remove right and left corner brackets.	Brace spanner 17
11	DISMANTLING OF CYLINDER BLOCK	
	(a) Remove distributor bush, chain lubricator, rear hoist plate, upper half of oil baffle (11), two plugs in oil duct, and water drain plug.	Brace spanner 12 - 14 - 16 17 Box spanner 23

	(b) Remove cylinder head studs and dowel (using stud extractor 2410-T, see Drawing 2, fig. 3).	Stud extractor 2410-T
11a	REMOVING PISTONS FROM CONNECTING RODS	
	(a) Remove gudgeon pin circlips. If the pistons are to be used again, gudgeon pin must be extracted after warming assembly to a temperature of approximately 60°C. (140°F.) otherwise damage may result to piston. To warm assembly dip piston in oil bath at the above temperature or warm it in an oven.	
	(b) Keep each gudgeon pin to its particular pistons as they have been weighed and paired. Use a shouldered mandrel to remove connecting rod small end bushes.	Mandrel: small dia. 20 length 20 large dia. 23 length 130.
12	DISMANTLING CYLINDER HEAD	
	(a) Remove valves using spring compressor 1611-T (see Drawing 2, fig.4). Place a wood block 15 mm. thick beneath valve heads in order to stop valve from going down when compressing spring.	Compressor 1611-T
	(b) Remove rocker and rocker shaft assembly.	Brace spanner 12 Box spanner 12
	(c) Remove studs holding rocker shaft assembly, also those holding inlet and exhaust manifolds (using stud extractor, 2410-T, see Drawing 2, fig.3).	Stud extractor 2410-T
	(d) Remove valve guides using mandrel MR.1620 (see Drawing 9).	Mandrel MR.1620
	(e) Remove rocker arms and brackets (12) from rocker shaft. Remove two expanding washers (13) from ends of shaft by piercing each with a sharp punch and levering out. New expanding washers must be fitted after each dismantling. Old ones must not be used again.	Pin punch 6 mm.
13	DISMANTLING OF OIL PUMP (See Drawing 10).	
	(a) Remove oil pump gauzes (14).	Box spanner 12
	(b) Remove base of pump (15) and idler pinion (16).	Box spanner 10
	(c) Drive out both pins (17) holding drive shaft pinion to pump. Remove shaft (18) from pump body, then move fixed pinion (19) on driving shaft along to remove the two halves of lock ring (20). Then remove pinion woodruff key.	Punch 3 mm.

	(d) Remove pump body tubular support (21), drive out spindle (22) of idler pinion. Remove plug (23), spring (24), and steel ball (25) of release valve.	Flat spanner 14 Box spanners 14 - 23
	(e) Remove bush (33) of tubular support using mandrel, support being clamped in vice without undue pressure.	Mandrel 15 x 250
14	DISMANTLING OF WATER PUMP (See Drawing 11)	
	(a) Remove fan and pulley (which comes off easily by tapping end of shaft with mallet), and also remove key. Remove slotted ring nut (26) holding ball race using spanner 1976-T (see Drawing 11). Push shaft out half way using press or mallet, remove two half lock rings (27) of ballrace (28). Remove shaft completely.	Box spanner 10 Spanner 1976-T
	(b) Remove gland nut (29), gland (30), and packing (31). Remove bronze bush (32) with the aid of a shouldered mandrel.	Mandrel 15 x 22 x 150 mm.
	(c) Remove impeller from shaft by drifting out pin. (This operation does not apply to later assemblies as these have the impeller shrunk on the shaft to form one unit. In this case if either part is faulty the assembly must be changed for a new one).	Pin punch 4 dia.
15	Clean all parts.	
	ASSEMBLING OF ENGINE	
16	ASSEMBLING ROCKER SHAFT	
	(a) Clean inside of shaft with circular wire brush and make sure that oil holes are clear, as well as those in rockers.	Wire brush
	(b) Coat seating of expanding washers (13) with Hermetical, fit and flatten them, with hammer and punch, to seal them.	
	(c) After having lubricated rocker shaft, fit brackets, rocker arms, springs, and washers in sequence given overleaf. Fit this assembly with keyway at rear of engine. (Bracket with oilway is also at the rear). The oil holes of the shaft are always downwards. Brackets are fitted with slots on spark plug side of engine.	
	Commence assembling shaft at front end.	

1. One end bracket not bored.
2. One washer, 1 mm. thick.
3. One rocker arm, right hand.
4. One washer, 1 mm. thick.
5. One spring.
6. One washer, 1 mm. thick.
7. One rocker arm, left hand.
8. One washer, 3.5 mm. thick.
9. One bracket.
10. One washer, 3.5 mm. thick.
11. One rocker arm, right hand.
12. One washer, 1 mm. thick.
13. One spring.
14. One washer, 1 mm. thick.
15. One rocker arm, left hand.
16. One distance piece, 18.5 mm.
17. One bracket.
18. One distance piece, 18.5 mm.
19. One rocker arm, right hand.
20. One washer, 1 mm. thick.
21. One spring.
22. One washer, 1 mm. thick.
23. One rocker arm, left hand.
24. One washer, 3.5 mm. thick.
25. One bracket.
26. One washer, 3.5 mm. thick.
27. One rocker arm, right hand.
28. One washer, 1 mm. thick.
29. One spring.
30. One washer, 1 mm. thick.
31. One rocker arm, left hand.
32. One washer, 1 mm. thick.
33. One bracket, bored in centre for oil.

17 ASSEMBLING CYLINDER HEAD (See Drawing 9)

(a) Fit valve guides with tool MR.1620 which limits upper part of guide to 19 mm. height measured from valve spring base. Fit conical end towards combustion chamber. — Mandrel MR.1620-1, Gauge MR.1620-2

(b) Ream guides to 9 mm. plus 0.015, minus 0 mm., for both inlet and exhaust, using an adjustable reamer. If a gauge to these limits is not available, check bore with valve stem. Excessive play may cause heavy oil consumption. — Adjustable reamer 9 mm.

(c) Rectify valve seats with 120° grinding wheel. The width of valve seat must be between 0.9 and 1.5 mm. In the event of the seat being wider, use 150° grinding wheel or cutter to remove upper part of seat, and a 60° grinding wheel or cutter to remove the lower portion. — Vibro Antric Tool and grinding wheels of 40 mm. dia. 120° angle, 40 mm. dia. 150° angle, 40 mm. dia. 60° angle

(d) Reface valves (using rectifying tool such as Black and Decker). — Valve rectifier.

(e) Grind valves (using valve grinder 1615-T which can be operated by hand or driven by a portable electric tool. — Valve grinder and suction cup 1615-T, Electric grinder

(f) **CAREFULLY CLEAN CYLINDER HEAD TO ENSURE THERE ARE NO TRACES OF EMERY POWDER IN VALVE PORTS, ETC.**

(g) Replace valve seat insert (only in the event of the same being broken or burnt).

To do this, heat seat AT ONE POINT ONLY with blow pipe with a 350 jet until metal begins to melt. Allow to cool for approximately three minutes, then remove seat with screwdriver (bent if necessary).

(h) Fit new valve seat insert.

Ensure that seat is clean and remove any rough edges. Dip seat for 15 minutes in liquid nitrogen. Do not touch liquid with fingers. Place seat in position with the aid of mandrel MR.3098-B. Reface valve seat in all cases. — Mandrel MR.3098-B

(i) Fit rocker shaft and inlet and exhaust manifold studs to cylinder head (using stud extractor 2410-T, see Drawing 2, fig.3) — Stud extractor 2410-T

(j) Check valve springs (see Drawing 12)

Use spring testing apparatus 2420-T. The lengths of the springs under given loads must be as follows : — Spring testing apparatus 2420-T with standard springs 2421-T or 2422-T

INNER SPRING		OUTER SPRING	
Load	Length	Load	Length
Nil	43 mm.	Nil	46.5 mm.
9.7 Kg. plus 0.5, minus 0 Kg. or $21\frac{3}{8}$ lbs. plus 1, minus 0 lbs.	32.8 mm.	14.6 Kg. plus or minus 1 Kg. or 32 lbs. plus or minus 1 lb.	37 mm.
16 Kg. plus or minus 0.75 Kg. or $35\frac{1}{4}$ lbs. plus or minus $1\frac{1}{2}$ lbs.	27 mm.	29.5 Kg. plus or minus 2 Kg. or 65 lbs. plus or minus $4\frac{1}{2}$ lbs.	29 mm.

(k) Mount rocker shaft on cylinder head, fitting a paper gasket under each rocker shaft bracket. Tighten nuts to a tension of 1.2 mkg. (8.7 foot pounds). Turn back tabs of lock plates on to nuts. — Box spanner 14

	(l) Place valves in cylinder head, having first oiled valve stems and seats. When fitting cotters make sure they are well in position.	Compressor 1611-T
	(m) Reset spark plug housings (only in the event of oil leaking in the recess). Use tool 1604-T (see Drawing 12A).	Tool 1604-T
18	ASSEMBLING OF OIL PUMP (See Drawing 10)	
	(a) Fit bush (33) into tubular support (21) with the aid of a screw press.	
	(b) With the aid of a screw press fit idler pinion spindle (22). Place idler pinion (16) in position and ensure that it revolves freely. Offer fixed pinion (19) in its housing. Place a straight edge across faces of housing and measure with feeler gauges the distance between pinion face and straight edge. This clearance must not exceed 0.05 mm. Remove fixed pinion (19).	Straight edge Set of feeler gauges
	(c) Fit fixed pinion key on shaft (18). Slide fixed pinion on to shaft past half-ring groove. Fit two half-rings (20) and then slide pinion back over and on to half-rings. Engage shaft in pump body, fit tubular support (21), tighten nut of locking bolt to a tension of 2.5 mkg. (18 foot pounds), and split pin the nut.	Box spanner 14
	(d) Fit driving pinion (34) on shaft and press in pins (17). Make sure shaft rotates freely and that end play does not exceed 0.5 mm. Splay ends of pins with a hammer.	
	(e) Place between pump body face and oblong plate (35) A PAPER GASKET SAME SHAPE AS BODY FACE and between this plate and base of pump (15) A GASKET OF IDENTICAL PATTERN TO PLATE (35). Tighten lower plate screws to a tension of 1.3 mkg. (9-$\frac{5}{8}$ foot pounds). Use spring washers under heads of hexagon bolts. Spread metal of base into screwdriver slot on the countersunk head screw to lock it.	Box spanner 12
	(f) Place at inlet orifice, cork gasket, top piece, two brackets, upper and lower filters, and distance piece. Tighten nut to a tension of 1.3 mkg. (9-$\frac{5}{8}$ foot pounds) and secure with split pin.	Box spanner 12
	(g) Fit steel ball (25), spring (24), and adjusting plug (23).	
	(h) Bench test the pump with oil heated to 60°C. plus 5, minus 0°C. (140°F. plus 9, minus 0°F.) Screw in plug in order to obtain a pressure of **2.5 Kgs./sq. cm.(x)** at 1000 r.p.m. with a 2.80 mm. jet. Tighten lock nut and turn back tab of lock plate on to a flat of the nut. (If no test bench is available test with the simplified assembly MR.1811 described on Drawing 13). **(x) (35$\frac{1}{2}$ lbs./sq.in.)**	Assembly MR.1811

19	ASSEMBLING OF WATER PUMP (See Drawing 11)	
	(a) Fit empeller to shaft, drill hole for pin keeping to the measurement of 131 mm. as shown on Drawing 11. Fit pin and splay both ends. Fit bush (32) in pump body with the aid of a press or shouldered mandrel. (The operation of fitting impeller is only necessary when the assembly is made by pinning, see Operation 14C).	Mandrel 15 x 22 x 150 mm.
	(b) Ream bush (see Drawing 14). To ensure concentricity and alignment of reaming of bush with ballrace housing, IT IS NECESSARY TO USE ASSEMBLY 1635-T which guides reamer 1636-T during the operation.	Assembly 1635-T Reamer 1636-T
	(c) Cut face of bush on 'impeller' side. To prevent impeller shaft seizing in its bush, IT IS NECESSARY TO FACE OFF THIS BUSH so that the impeller does not bear against it. Therefore ENSURE THAT THERE IS A DISTANCE OF 19.7 mm., PLUS OR MINUS 0.3 MM., BETWEEN FACE OF BUSH AND WATER PUMP BODY FLANGE. Check machining with gauge 1639-T. This operation is carried out by using cutter 1638-T fitted to a workshop driller WITH A SPEED BETWEEN 800 AND 1000 R.P.M. NOTE: It is recommended not to use lower speeds in order to avoid an uneven surface.	Gauge 1639-T Cutter 1638-T Cutter holder 1637-T
	(d) Place packing on a mandrel or on pump shaft to push it into bush without deforming or damaging it. Place gland (30) into position and screw on gland nut (29) by hand, taking care not to crush packing. Engage shaft, first greased (with Mobilgrease 6), into bush (32). REMOVE ROUGH EDGES WHICH CAN BE CAUSED BY SHARP CORNER OF SHAFT. Place on shaft both HALVES OF LOCK RING (27) (THE GREASE KEEPS THEM STUCK INTO GROOVE), and retaining washer (36). Push shaft fully into position. Fit ballrace (packed with Mobilgrease 5). Fit and tighten slotted ring nut (26) of ballrace to a tension of 3 mkg. (21½ foot pounds), with the aid of spanner 1976-T. Secure nut with split pin. Place key in shaft keyway, mount pulley, fit and tighten nut to a tension of 4 mkg. (29 foot pounds), and secure nut with split pin.	Spanner 1976-T
	Tighten gland nut (29) to a tension of 2 mkg. (14½ foot pounds) Approx., screw in locking screw so that end rests lightly on bottom of a slot in the gland nut. Tighten nut of locking screw to a tension of 0.5 mkg. (3½ foot pounds).	Flat spanner 10
	(e) MOUNT FAN (early type with two rubber washers, see Drawing 11). Place against water pump pulley, one on each screw hole, the four distance pieces (41), steel washer (37), rubber washer (38), fan (WITH CONCAVE SECTIONS OF BLADES TOWARD REAR OF ENGINE), another rubber washer (38), and lock plate with four tabs (39). Fit and tighten set screws to a tension of 1.5 mkg. (10½ foot pounds) approx. Ensure that steel washer (37) is not pinched between shoulders of set screws and distance pieces (41) which case would cause play in fan mounting and set up abnormal noises. To ensure easy assembling:-	Box spanner 10 Studs MR.3400

Screw in two studs MR.3400 into pulley diametrically opposite one another. Mount parts on studs as previously explained.
Screw in two set screws (56).
Remove two studs MR.3400 and replace with the other two fan set screws (56).
Turn back tabs of lock washer (39) one on each screw head flat.

(f) MOUNT FAN (later type without rubber washers and with 9 mm. thick distance pieces between fan and pulley face. (See Drawing 11, present type from 1945). Place between pulley face and fan blades (CONCAVE SIDE TOWARDS REAR OF ENGINE), four distance pieces (40). Place on fan face lock plate with four tabs (39), fit and tighten set screws to a tension of approximately 1.5 mkg. ($10\frac{1}{2}$ foot pounds). Turn back lock tabs one against each set screw head flat. — Box spanner 10

20 CHANGING STARTER GEAR RING

(a) Remove gear ring from flywheel using a punch or drift with hammer. — Punch or drift

NOTICE: Starter gear rings are tempered in two different ways.
Firstly:- Cyanide tempered. In this case the starter ring has no marking and can be fitted to the flywheel in any position with chamfered teeth facing engine.
Secondly:- Tempered by double duro. In this case the ring bears a punch mark and it MUST BE ASSEMBLED WITH THIS MARK IN ALIGNMENT WITH THE OFF-SET FLYWHEEL BOLT HOLE.

(b) Fit gear ring to flywheel. — Blow pipe
Heat the starter ring with a blow pipe fitted with a 600 to 1000 jet. Heat inner part of ring only, moving pipe constantly round the inside of the ring to obtain an even expansion. Stop heating when ring reaches a temperature of 200° to 250° C. (392° to 482°F.). (Its colour is then straw yellow). Ensure flywheel is clean, offer up starter ring squarely to flywheel and fit quickly (check position of punch mark if there is one).

PREPARATION OF PARTS FOR REALIGNMENT OF CRANKSHAFT AND BEARINGS

Any work on crankshaft, connecting rods, and bearings must be undertaken ONLY WHEN EQUIPMENT AND SPECIAL TOOLS for this class of work (maximum and minimum gauges for connecting rods and bearings, aligning rod, boring bar for bearings) are available.

Failing this, it is preferable to exchange the entire assembly, i.e. crankshaft with connecting rods mounted and bearings adjusted, OR BETTER STILL, EXCHANGE ENTIRE ENGINE.

Play of bearings and connecting rods has been carefully checked during manufacture. IT SHOULD NOT BE INTERFERED WITH UNDER ANY CIRCUMSTANCES. The white metal used (lead containing 8 to 10% of tin), requires play which may seem considerable but which is, nevertheless, indispensable.

Diametral play of crankshaft main bearing - 0.041 to 0.081 mm.
Diametral play of connecting rod big end bearings = 0.044 to 0.061 mm.

Do not fit new or reconditioned connecting rods without making sure that main bearing caps are in perfect condition. If bearing caps have been filed carelessly, standard assembly cannot be fitted. If bearing caps have to be reconditioned, proceed as follows:-

21 Check bearing caps on a surface plate, and if necessary, reface with a file, or better still, with a machine cutter. Fit caps (without bearings) to crankcase and tighten nuts to a tension of 7 mkg. (50½ foot pounds). With gauge (2440-T) measure diameter 'a' (see Drawing 14A). Gauge 2440-T
Make sure that diameter 'a', measured at one end of bearing cap, is the same as diameter 'b', measured at the other end. If the dimensions are not the same, the bearing cap faces are not parallel with the crankshaft axis and they must be rectified with a file, or better still, a cutter. The difference between diameters 'a' and 'b' must not exceed 0.01 mm.
With the rectification carried out, measure again diameter 'a'. The difference between this diameter 'a' and the original diameter of 58.01 mm., plus 0.025, minus 0 mm., represents the thickness of shims 'e' to be placed between bearing caps and crankcase (see Drawing 14A).
Shims must be made with great care. Their faces must be parallel within 0.01 mm. Fit once more the bearing caps (without bearings) to crankcase, this time with shims in position, tighten nuts to a tension of 7 mkg. (50½ foot pounds). Measure again diameter 'a' which must be 58.01 mm. Plus 0.025, minus 0 mm. If necessary touch up shims to give this dimension. Gauge 2440-T
This method, though seemingly slow, is strongly advocated and will ensure fitting of standard assembly. IT IS AGAIN POINTED OUT THAT THE TOLERANCE OF THIS ASSEMBLY HAS BEEN CAREFULLY CHECKED, AND SHOULD, IF AT ALL POSSIBLE, NOT BE INTERFERED WITH.

IMPORTANT NOTE Two types of oil baffle halves have been used successfully.
1. Baffle half with oil return groove.
2. Baffle half with insert.
The insert type replaces the grooved type without alteration. It is advisable to use the insert type in all cases. In the near future only the insert type will be sold at our Spare Parts Department.

21-1 PREPARING AND FITTING OIL BAFFLES (Grooved Type)
IMPORTANT: Oil proofing can only be assured if the oil baffle bore is concentric with the axis of crankshaft and if the clearance between crankshaft and baffle is within the tolerance specified by our Technical Department.
Under no circumstances must part of the crankshaft corresponding in position to the oil baffle be reduced in diameter. The original size must always be maintained. Since the oil baffle has a set bore size, it has been possible to provide a reamer corresponding to the bore diameter of 50 mm., plus 0.01, minus 0 mm.

	THE OIL BAFFLE HALVES MUST BE REPLACED AT EACH OVERHAUL OR REPLACEMENT OF THE CRANKSHAFT. THE OIL BAFFLES SUPPLIED BY OUR SPARE PARTS DEPARTMENT MUST BE REAMED AFTER FITTING. The reaming must be done only after fitting of crankshaft bearings.	
	(a) Mount the oil baffle halves (11 and 42) (see Drawing 7) with the cork gasket. Tighten screws, which must be done alternately and gradually from screw to screw, to a tension of 1.3 mkg. ($9\frac{1}{2}$ foot pounds) and turn back lock tabs against a flat of each set screw head. The centre set screw holding oil baffle to bearing cap, must be coated with 'Hermetical'.	Box spanner 12
	(b) Place guides of apparatus 1665-T (see Drawing 15) in bearings, fit a paper gasket between halves of oil baffle, tighten bearing caps, and ream oil baffle. Remove bearing caps, guides, and bearings.	Box spanner 17 Apparatus 1665-T
21-2	PREPARING AND FITTING OIL BAFFLES (with oil-proof inserts). In this case the oil proofing material must be replaced at each overhaul or crankshaft replacement. To fit inserts to oil baffle halves proceed as follows:-	
	(a) Place oil baffle halves into stand MR.3505 (see Drawing 15A, fig.1).	Stand MR.3505
	(b) Fit inserts into grooves with an equal amount protruding from each side.	
	(c) With the aid of a press and mandrel MR.3505-1 (see Drawing 15A, fig.3) press the inserts into grooves.	Mandrel MR.3505-1
	To ensure oil-sealing between baffle halves when fitting, it is necessary for the insert ends to stand proud of the baffles by 0.5 mm. To do this place on joint surface and against back of insert, a strip of metal 0.5 mm. thick (fig.2) and cut insert parallel to this strip of metal with a sharp blade (such as a razor) to obtain a clean edge.	
	(d) Remove oil baffle halves from stand MR.3505.	
	(e) Fit the oil baffle halves (11 and 42) to the crankcase and bearing cap as described in paragraph 21-1a.	
22	FIT CONNECTING ROD BUSHES Fit bushes using a press. Using an adjustable reamer of 20 mm., ream bushes. If no gauge is available to check maximum and minimum dimensions, use a new gudgeon pin as a check on reaming. We advise, however, against this method of gauging the bush. The bore size is 20 mm., plus 0.015, minus 0.020 mm. and this can only be obtained with a precision tool.	Reamer 20 dia.

22A	FIT GUDGEON PIN TO PISTON The gudgeon pin and the reaming of the piston bosses are slightly tapered, therefore the direction of fitting pin must be observed. The piston boss with the larger bore is marked and the large end of the gudgeon pin likewise. When parts are assembled marks must coincide.	
23	FIT PISTONS TO CONNECTING RODS (a) Heat pistons to an approximate temperature of 60°C. (140°F.) (either by dipping them in an oil bath or placing them in an oven). In order to fit them by hand, oil the gudgeon pins. DO NOT MIX GUDGEON PINS SINCE THEY ARE WEIGHED AND PAIRED WITH PISTONS. Fit circlips using tool MR.1610 and ensure that they are well seated in their grooves (see Drawing 16).	Tool MR.1610
	(b) Check alignment of connecting rods and pistons using surface plate 2480-T with mandrel 2481-T.	Surface plate 2480-T Mandrel 2481-T
24	FIT CONNECTING RODS TO CRANKSHAFT Oil surfaces, USING AN OIL CAN (oil similar to Mobiloil BB). Do not use a brush which may contain foreign matter and have loose bristles. Fit connecting rods so that split skirt of piston is to the left side, THAT IS TO SAY, CAMSHAFT SIDE. FIT THE NUT LOCKING PLATES ON CONNECTING ROD BOLTS IN A MANNER PREVENTING ANTI-CLOCKWOSE ROTATION (see Drawing 17). Tighten nuts to a tension of 3 mkg, plus 1, minus 0 mkg. ($21\frac{3}{4}$ foot pounds, plus $7\frac{1}{4}$, minus 0 foot pounds). Turn back round part of lock tab against a flat of the nut.	Torsion wrench 2470-T with socket 14
24A	FIT CAMSHAFT Fit camshaft to cylinder block having first oiled bearing surfaces. Fit thrust plate (10) and tighten screws to a tension of 1 mkg. ($7\frac{1}{4}$ foot pounds). Turn back lock tabs. Oil and fit tappet cups.	Box spanner 14
25	FIT BARRELS. CHECK HEIGHTS. FIT CYLINDER HEAD. It is advisable to use stand MR.3300-30 (see Drawing 17A, fig.2).	Stand MR.3300-30
	(a) Ensure that seating faces of barrels and crankcase are clean. Adjustment of heights is very important. If the barrel is too high above cylinder joint surface it gets distorted when tightening cylinder head. On the contrary, if it is too low water and gases escape.	
	(b) Place barrels in crankcase without joints, check that they lie squarely on seats, and that there is slight play in the lower crankcase borings.	

	(c) CHECK THAT BARRELS FITTED WITHOUT JOINTS ARE LOWER THAN CRANKCASE UPPER SURFACE BY 0.43 TO 0.50 mm. and that barrel faces are parallel with the crankcase upper face (within 0.05 mm). For checking use a good straight edge and set of feeler gauges. (Place straight edge successively on engine longitudinal axis and then on engine cross axis). Or, better still, USE INSTRUMENT MR.3377 (see Drawing 18).	Straight edge Set of feeler gauges Instrument MR.3377
	(d) USE ONLY HUGO-REINTZ JOINTS stocked by our Spare Parts Department. Choose joints of a thickness WHICH WILL MAKE BARREL FACES STAND ABOVE UPPER CRANKCASE FACE BY 0.05 to 0.10 mm. BEFORE TIGHTENING. Carefully measure the heights of barrel faces above crankcase face by the use of instrument MR.3377. Place the barrels together in pairs, give H-R joints a thin coating of linseed oil and place them on barrels. Place barrels in pairs in cylinder block. The barrels must go into position under their own weight and without hindrance from barrel joint.	Instrument MR.3377
	(e) Fit cylinder head studs and tighten to a tension of 1 mkg. ($7\frac{1}{4}$ foot pounds) by use of extractor 2410-T (the shorter thread on stud is screwed into cylinder block).	Stud extractor 2410-T
	(f) Coat cylinder head gasket with engine oil and fit over studs. Fit dowel then place cylinder head over studs. Fit and tighten cylinder head nuts in the order indicated (see Drawing 5) (first tightening 3 mkg. ($21\frac{1}{2}$ foot pounds), second tightening 5 mkg. (36 foot pounds). These two tightenings are of great importance, therefore a torsion wrench is essential. Adhere strictly to the sequence of tightening. Invert the engine. It is an advantage to use stand MR.3300-20 (see Drawing 17A, fig.1). Check by use of gauge or comparator 2440-T for any distortion in the bores of the barrels. Distortion must not exceed 0.03 mm. except in the lower part of barrel, up to 20 mm. from bottom, where 0.05 mm. is permitted. If distortion exceeds these tolerances, remove cylinder head and replace lower joints on barrels by thinner ones. Refit cylinder head and check barrels again for distortion. When correct reading of barrel bores has been obtained, do not touch cylinder head again. Play between barrel and piston must be between 0.06 and 0.08 mm. inclusive. The measuring entails the use of high precision instruments (fluidometer) such as used by manufacturers. UNDER NO CIRCUMSTANCES MUST THE BARREL AND PISTON ASSEMBLY, sold by our Spare Parts Department, ALREADY PAIRED, BE SEPARATED.	Torsion wrench 2470-T Socket 17 Comparator for cylinder bores 2440-T Stand MR.3300-20
	(g) Fit the push rods by compressing valve springs with tool 1611-T (see Drawing 2, fig.4).	Compressor 1611-T
	(h) Invert engine and place on stand MR.3300-20 (see Drawing 17A, fig.1).	Stand MR.3300-20
26	FIT CRANKSHAFT AND PISTONS TO CYLINDER BLOCK.	
	(a) Mount oil circulation jet. In the event of a new cylinder block being used, make sure there is an oil circulation jet in front main bearing housing, flywheel end.	

	(b) Place main bearing halves on housings ensuring casing and housings are clean. Apply oil by can (a brush can leave loose bristles and other foreign matter) (oil type Mobiloil BB).	
	(c) Oil pistons (with oil can). Set the piston ring gaps (the second and fourth at 180° in relation to the first and third). Place in position the split rings 1656-T (see Drawing 17B). Hold and use the crankshaft to guide pistons into bores to prevent pistons and piston rings fouling sides and breaking. Remove split rings. Mount bearings in caps on shaft. Place the small paper gasket coated with 'Hermetical' between oil baffle halves ensuring that NEITHER PAPER OR 'HERMETICAL' OBSTRUCT THE OIL GROOVE.	Split ring 1656-T
	(d) Fit plugs in oil circulation duct.	Box spanner 23
	(e) Place in position both cork joints of crankcase lower face and ensure that ends are well under front and rear cap ends which must be coated with 'hermetical' (see Drawing 17). Fit lockplates and bearing cap nuts and tighten to a tension of 7 mkg. (50½ foot pounds). Revolve crankshaft to ensure there is an even and easy rotation. Turn back lock plate tabs against nuts.	Torsion wrench 2470-T Socket 17
27	ADJUSTING LATERAL PLAY OF CRANKSHAFT (See Drawing 7) At rear end of crankshaft place on an adjusting washer (43), 0.05 mm. thick, thrust washer (44), crankshaft timing wheel (45) (provisionally without key), tighten nut (46) and push crankshaft towards timing case end by use of a lever or wedge placed between web of crankshaft and crankcase. Measure clearance between thrust washer and bearing (dimension 'c' in fig.2). Clearance should be from 0.10 to 0.15 mm. Adjusting washers (supplied according to our Spare Parts Catalogue) are necessary to carry out this adjustment. Remove timing wheel.	Spanner 1667-T
28	Fit flywheel (located by its offset bolt). Place bearing (47), packed with grease (such as Mobilgrease 5), to flywheel, then locking plate. Tighten nuts to a tension of 2.5 mkg., plus 0.250, minus 0 mkg. (18 foot pounds; plus 1¾, minus 0 foot pounds). Turn back lock tabs against flat of each nut.	Torsion wrench 2470-T Socket 14
29	FIT TIMING GEAR (See Drawings 7 and 19) Mount timing chain lubricator (48), the hole to be towards crankshaft in alignment with axis of crankshaft and camshaft. Tighten lubricator to a tension of 1 mkg. (7¼ foot pounds) and its locknut to a tension of 1.4 mkg. (10 foot pounds). Fit oil duct plug. Place the crankshaft and camshaft timing wheels on bench. Position the latter so that a straight edge passing through the axes of both wheels is also in line with the punch mark or line on camshaft wheel (see Drawing 19). The crankshaft timing wheel is marked either by a line or centre punch as follows:- Case 1. On a tooth Case 2. Between two teeth.	Box spanners 17 - 23 Flat spanners 6 - 12 Spanner 1667-T Box spanner 27 and Tommy bar.

	In case 1, the crankshaft wheel must be set one half tooth to the right of the straight line between wheel centres. In case 2, the crankshaft wheel must be set so that the mark is on the straight line between wheel centres. Without altering the setting of the wheels, fit the timing chain. With No.1 and No.4 cylinders at top dead centre, fit the chain and wheels assembly, ensuring that the keys of crankshaft and camshaft are in exact position. Place lockwasher on camshaft end against timing wheel, screw on nut and tighten to a tension of 15 mkg. (108 foot pounds). Place lockwasher on crankshaft end against timing wheel, screw on nut and tighten to a tension of 20 mkg. (140 foot pounds). Keep the crankshaft from turning by means of a wedge between crankshaft web and crankcase. Turn back tabs of lockwashers against nuts.	
30	FIT OIL PUMP (a) Rotate crankshaft until No.1 piston is at top dead centre at end of compression stroke.	
	(b) Engage pump so that machined slot at top of oil pump is parallel with side of engine and that smaller side of the offset drive is towards the engine after fitting. TIGHTEN POINTED SET SCREW TO A TENSION OF 1.5 mkg. (10¾ foot pounds) MAXIMUM IN ORDER TO AVOID CRUSHING SLEEVE. Tighten set screw lock nut to a tension of 3 mkg. (21½ foot pounds).	Flat spanner 17
	(c) Fit oil pipe from pump body to cylinder block, ensuring that conical union is in place. Tighten unions to a tension of 6 mkg. (43½ foot pounds) and tighten lock nuts to a tension of 4 mkg. (29 foot pounds).	Flat spanners 14 - 26
31	FIT ENGINE SUMP AND TIMING COVER (See Drawing 17) (a) Fit into grooves of front and rear main bearing caps the cork joints (first steeped in water for a few minutes), the ends of which being coated with 'Hermetical'. Mount the sump after removing any sharp corners which may damage the joints. Fit sump bolts with a spring washer under head and tighten to a tension of 1.2 mkg. (8½ foot pounds).	Brace spanner and extension 12
	(b) Fit timing cover with a cork gasket. A small washer must be coated with 'Hermetical' and placed under head of each of the three bolts passing through inside of cover. Tighten bolts to a tension of 1.5 mkg. (10½ foot pounds).	Brace spanner 12
32	Fit the two corner brackets and tighten screws fitted with a spring washer under each head.	Brace spanner 17
33	Provisionally adjust tappets to 0.20 mm. clearance on inlet valves and 0.25 mm. on exhaust valves (The final adjustment of 0.15 mm. clearance on inlet valves and 0.20 mm. clearance on exhaust valves is made when the engine is hot after the final tightening of the cylinder head).	Flat spanner 14
34	Oil valve springs and ball ends of rocker arms. Mount valve cover with joint stuck with 'Hermetical' on cover side only.	Box spanner 12

35	Mount water pump cover, then water pump. Fit spring washers under head of set screws or nuts and tighten to a tension of 3.5 mkg. (25 foot pounds).	Brace spanner with extension 12 - 17
36	Assemble inlet and exhaust manifolds. The faces of the six flanges must be in the same plane. Check on a surface plate with feeler gauges for any variation of the faces of flanges. If variation exceeds 0.1 mm. (0.004") faces must be ground or, in the absence of a surface grinder, trued with a file. Remove all filings or emery dust with compressed air. Fit the assembly to engine and tighten nuts to a tension of 2 mkg. ($14\frac{1}{2}$ foot pounds) (use spanner 1625-T, see Drawing 8, for tightening centre nuts. Fit manifold petrol drain pipe.	Box spanner 14 Brace spanner 14 Spanner 1625-T
37	Fit side mounting brackets and tighten bolts, fitted with spring washers, to a tension of 4.5 mkg. (32 foot pounds). Fit hoist plate and tighten bolts to a tension of 2 mkg. ($14\frac{1}{2}$ foot pounds). Fit breather pipe, the plate in between breather flange and casing having the tongue upwards and outwards, and a gasket on each side of the plate. Tighten set screws, fitted with spring washers, to a tension of 2.5 mkg. ($17\frac{3}{4}$ foot pounds). Fit oil pipe to rear of cylinder head with a vellumoid gasket between pipe flange and head. Tighten set screws, fitted with spring washers, to a tension of 2 mkg. ($14\frac{1}{2}$ foot pounds). Fit union screw through banjo union at lower end of pipe, placing a fibre washer each side of banjo. Tighten screw to a tension of 2 mkg. ($14\frac{1}{2}$ foot pounds).	Box spanner 10 - 12 - 17
38	Paint unit.	

	REMOVING CYLINDER HEAD	
1	Drain water from radiator and cylinder block. Remove bonnet. Disconnect positive battery cable terminal (using extractor 2200-T, see Drawing 2, fig.1). Uncouple radiator hoses from water pump.	Extractor 2200-T Flat spanner 12
2	Remove air intake silencer. Remove carburettor (without disconnecting controls) with spanner 1620-T (see Drawing 21). Remove petrol pipe.	Spanner 1620-T Flat spanners 10 - 16 - 17
3	Disconnect exhaust pipe from exhaust manifold and also exhaust pipe tie-rod. Disconnect fan belt adjusting rod and remove fan belt.	Universal joint spanner 17 Flat spanner 12.
4	Remove valve cover, uncouple oil pipe to rocker arm shaft. Take out spark plugs (using spanner 1601-T, see Drawing 2, fig.2).	Box spanner 12 Flat spanner 10 Plug spanner 1601-T
5	Remove cylinder head nuts and cylinder head (if necessary, prise or lever it off with a screw-driver. Remove push rods also cylinder head gasket.	Brace spanner with extension 17
	REFITTING OF CYLINDER HEAD	
6	After surfaces of cylinder head and cylinder block have been carefully cleaned, coat cylinder head gasket with engine oil. Fit cylinder head gasket on studs and then fit cylinder head. Tighten nuts in correct sequence (see Drawing 5) to a tension of 3 mkg. (21¾ foot pounds) for first tightening, and 5 mkg. (36 foot pounds) for second tightening. The use of a torsion wrench is essential as tension applied to nuts is of great importance. The sequence of tightening nuts is equally important.	Torsion wrench with socket 17
7	Fit push rods in tappet cups and rocker arms using valve spring compressor 1611-T. Provisionally adjust tappets to 0.20 mm. (0.008") clearance on inlet valves, and 0.25 mm. (0.010" clearance on exhaust valves. (Final adjustment of 0.15 mm. (0.006") clearance on inlet valves and 0.20 mm. (0.008") clearance on exhaust valves is made when engine is hot and cylinder head given final tightening.)	Compressor 1611-T Set of feeler gauges
8	Oil valve springs and ball ends of rocker arms.	
9	Fit oil pipe to rear of cylinder head with a vellumoid gasket between head and oil pipe flange.	Flat spanner 10
10	Connect exhaust pipe, TIGHTEN NUTS WELL, also connect exhaust pipe tie-rod. Fit carburettor (see operation 109, paragraph 3), air intake silencer, fan belt and adjust tension. Fit spark	Universal joint spanner Flat spanners 12 - 16 - 17

	plugs (using spanner 1601-T, see Drawing 2, fig.2).	Spanner 1620-T Plug spanner 1601-T
11	Connect radiator hoses to water pump. Tighten radiator drain plug and refill radiator.	
12	Connect battery positive cable to positive battery terminal.	Flat spanner 10
13	Start engine and let it idle for about 15 minutes.	
14	Finally tighten cylinder head nuts to a tension of 5 mkg. (36 foot pounds) in correct sequence (see Drawing 5).	Torsion wrench 2470-T Socket 17
15	Adjust tappets (0.15 mm. (0.006") clearance on inlet valves and 0.20 mm. (0.008") clearance on exhaust valves).	Flat spanner 12 Set of feeler gauges
16	Fit valve cover with joint coated with 'Hermetical' on cover side only.	Box spanner 12
17	Fit bonnet.	

	REMOVING ROCKER SHAFT	
1	Drain water from radiator and meanwhile remove valve cover.	Flat spanner 12
2	Remove rocker shaft.	Brace spanner and Flat spanner 12
	DISMANTLING OF ROCKER SHAFT	
3	Remove brackets, rocker arms and springs from shaft. Remove two expanding washers in ends of rocker shaft (pierce both with a sharp punch and lever out). New expanding washers must be fitted after each dismantling. Old ones must never be used again.	Punch 6 mm.
	RE-ASSEMBLING OF ROCKER SHAFT	
4	See Operation 103, paragraph 16.	
	REFITTING OF ROCKER SHAFT	
5	Place a paper gasket under each bracket. Tighten nuts to a tension of 1 mkg. ($7\frac{1}{4}$ foot pounds) and turn back locktabs against flat of each nut.	Box spanner 12
6	Adjust tappets (0.15 mm. (0.006") clearance on inlet valves and 0.20 mm. (0.008") clearance on exhaust valves).	Flat spanner 12 Set of feeler gauges
7	Fit valve cover with cork joint stuck with 'Hermetical' on cover side only.	Box spanner 12
8	Close radiator drain plug and fill radiator with water.	

	REMOVING MANIFOLDS	
1	Remove air intake silencer. Remove carburettor (using spanner 1620-T, see Drawing 21) without uncoupling controls. Take off manifold petrol drain pipe.	Box spanner 10 Flat spanner 17 or 1620-T Flat spanner 12
2	Uncouple exhaust pipe from manifold also exhaust pipe tie rod.	Universal joint spanner 17 Flat and box spanners 12
3	Remove manifold assembly from cylinder head. Use spanner 1625-T (see Drawing 8) to remove clamp nuts.	Spanner 1625-T Flat spanner 14
4	Uncouple manifolds.	Box spanner 14
	REFITTING MANIFOLDS	
5	Assemble manifolds placing between them a Hugo Reintz joint. Tighten set screws to a tension of 1 mkg. ($7\frac{1}{4}$ foot pounds). Ensure on a surface plate that the six flange faces are in the same plane within 0.10 mm. If not, the faces must be ground or filed with manifolds still coupled together.	Box spanner 14
6	Fit manifolds to cylinder head.	Spanner 1625-T
7	Fit exhaust pipe and tie rod. TIGHTEN FLANGE NUTS WELL.	Universal joint spanner 17 Box and flat spanners 12
8	Fit carburettor (see Operation 109, paragraph 3) and air intake silencer. Fit manifold petrol drain pipe.	Spanner 1620-T Box and flat spanners 12

	REMOVING WATER PUMP	
1	Drain water from radiator. Remove bonnet.	
2	Disconnect radiator hoses at water pump end. Loosen plates holding radiator shell to radiator block.	Flat spanner 12
3	Disconnect fan belt tensioning rod at water pump end only. Loosen dynamo fixing bolt. Take off fan belt.	Box spanner 12 Universal joint spanner 17
4	Remove water pump. For this, push radiator block forward as far as possible. Disconnect water pump body to allow access to two set screws holding pump cover. Remove cover.	Box spanner 17
	REFITTING WATER PUMP	
5	Fit water pump cover with gasket to cylinder head.	Box spanner 17
6	Fit water pump with gasket to cover.	Box and flat spanners 12 - 17
7	Fit fan belt to pulleys, fit tensioning rod, tighten dynamo fixing bolt and adjust tension of fan belt. Fit radiator hoses, tighten plates holding radiator shell.	Box spanner 12 Universal joint spanner 17
8	Close radiator drain plug and fill radiator with water. Fit bonnet.	
	NOTE: For overhauling water pump see Operation 103, paragraph 19.	

	REMOVING OF SHAFT (See Drawing 20)	
1	Drain water from radiator and cylinder block.	Flat spanner 21
2	Remove bonnet.	
3	Remove radiator shell.	Flat spanner 12
4	Remove radiator.	Universal joint spanner 17
5	Remove crossmember supporting radiator.	Universal joint spanner with extension 17
6	Slacken dynamo and disengage fan belt.	Universal joint spanner 17 Bolt spanner 12
7	Remove water pump and dynamo driving pulley.	Universal joint spanner 22
8	Unscrew aluminium oil return ring (49). Remove driving shaft complete with bearings and distance piece.	Spanner 1640-T
9	Remove bearings and distance piece from shaft.	
	REFITTING OF SHAFT (See Drawing 20)	
10	Fit ball races, packed with grease such as Mobilgrease 5, to shaft (the smaller bearing (52) to rear end) and fit distance piece 53).	
11	Engage the assembly into bore of clutch housing, engage drive, screw in and tighten aluminium oil thrower ring (49) and fit split pin.	Spanner 1640-T
12	Place key in position in shaft, fit pulley, tighten nut (54) and turn back lock tab against flat of nut.	Universal joint spanner 22
13	Fit fan belt to pulleys, tighten dynamo and adjust tension of belt.	Universal joint spanner 17
14	Fit crossmember supporting radiator.	Universal joint spanner with extension 17
15	Fit radiator block.	Universal joint spanner 17

16	Fit radiator shell.	Flat spanner 12
17	Fit bonnet.	
18	Fit cylinder block drain plug and close radiator drain plug.	Flat spanner 21
19	Fill radiator with water.	

	REMOVING CARBURETTOR (See Drawing 21)	
1	Remove air intake silencer by slackening only the two nuts in upper part of brackets and the two screwdriver head screws on top connecting silencer to carburettor.	Box spanner 10
2	Disconnect petrol feed pipe, carburettor bi-starter control wire, ignition suction control tube, and throttle control rod. Remove carburettor by unscrewing the two flange nuts.	Spanner 1620-T or flat spanner 17 Flat spanners 7 - 16
	REFITTING CARBURETTOR (See Drawing 21)	
3	Place on the inlet manifold flange in the following sequence: one Hugo-Reintz joint; one thick Ferodo joint; one Hugo-Reintz joint; the shield; one Hugo-Reintz joint; the carburettor. Fit shakeproof washers under the two flange nuts and TIGHTEN FIRMLY (use spanner 1620-T, see Drawing 21).	Spanner 1620-T or flat spanner 17
4	Fit throttle control rod and carburettor bi-starter control wire. Connect ignition suction control tube and petrol feed pipe.	Flat spanners 7 - 16
5	Fit air intake silencer.	Box spanner 10

DISMANTLING CARBURETTOR 35 FPAI (See Drawing 21)

1 Undo four pump screws (20) and remove pump to expose float chamber cover. Take off float chamber cover, disengage float (2), remove needle valve assembly (3 and 4), choke tube (5), correction jet (6), air jet (7) of bi-starter, starter jet (8), main jet (9), pilot jet (10), pilot jet air bleed (11), by-pass or compensating jet (12), and pump jet (17). Split throttle chamber from float chamber. Remove throttle spindle and butterfly. Take off float chamber air vent cover. To remove ball valve (15), take off pump cover (13), and withdraw retaining screw (15). — Flat spanners 8 - 12 - 16 or small adjustable spanner

IMPORTANT - IF THE PUMP DIAPHRAGMS ARE DAMAGED REPLACE PUMP AS A COMPLETE UNIT (FIXED BY FOUR SCREWS (20). NEVER DISMANTLE PUMP.

2 Clean all parts. Clear ducts and jets with the use of compressed air.

RE-ASSEMBLING OF CARBURETTOR (See Drawing 21)

3 Refit valve ball (15) and retaining screw (15). Replace pump cover (13) with gasket. Replace float (2), float chamber cover, needle valve assembly (3 and 4). Mount pump assembly on float chamber cover using gasket at joints. Fit choke tube (5), bi-starter jets (7 and 8), main jet (9) pilot jet (10), pilot jet air bleed (11), by-pass or compensating jet (12), pump jet (17) and correction jet (6).
Mount bi-starter to throttle chamber. Fit butterfly and spindle. Assembly throttle chamber to float chamber. — Flat spanners 8 - 12 - 16 or small adjustable spanner

4 For the standard types of SOLEX downdraught carburettors up to the present the settings are:-

TYPE	CHOKE TUBE	MAIN JET	CORRECTION JET	SLOW RUNNING JET	SLOW RUNNING AIR	STARTER AIR	STARTER PETROL	FLOAT WEIGHT	NEEDLE VALVE	PUMP JET	ECONOMY JET	
35 FATIP	26	135	210	45	180	4	115/125	21 gr.	2	55	-	
35 FPAI	27	130	180	45	180	4	125	21 gr.	2	60	60	Power setting
	25	120	230	45	180	4	125	21 gr.	2	60	60	Economy setting

THE SETTINGS ARE THE RESULT OF EXHAUSTIVE TESTS AND WE STRONGLY ADVISE AGAINST THEIR ALTERATION.

All SOLEX downdraught carburettors have variable petrol control fitted to slow running system.

	DISMANTLING OF AIR SILENCER (See Drawing 22) It is necessary at every 3 750 miles to clean the perforated metal tube and felt constituting the filtering and silencing elements.	
1	Uncouple flange (1) from cylinder body (2), remove both rings (3) which hold felt. Remove perforated metal tube (4). Clean with petrol and dry by the use of compressed air.	Flat spanner 10
2	Brush felt (5) inside of cylindrical body using a round brush and clear by the use of compressed air.	Round brush
	RE-ASSEMBLING OF AIR SILENCER (See Drawing 22)	
	Replace perforated tube (4), refit clips (3) and refit flange (1).	Flat spanner 10

	DISMANTLING OF PUMP (See Drawing 22A)	
1	Remove top cap(1), filter (2) and uncouple the halves of pump body (3 and 4).	Flat spanner 10
2	With the aid of a screwdriver, remove lockplates (5) of the two priming lever guide nuts (6). Unscrew both nuts and remove priming lever (7), control lever (8) and fork (9).	Flat spanner 12
3	Remove diaphragm and rod (10), spring and resin-coated washers (11). Remove diaphragm from rod.	Flat and box spanners 10
4	Remove plate (12) holding valves, inlet (13) and outlet (14). Remove valves and springs.	
	RE-ASSEMBLING OF PUMP (See Drawing 22A)	
5	Mount inlet valve (13) and outlet valve (14). Place gasket in position with plate (12) and tighten with three screws.	
6	Fit diaphragm discs to rod (10), tighten nut and turn back tab of lockwasher against nut. To prevent petrol seeping through nut threads, load solder on and in nut threads (a). Place in position control spring and its cap, then the resin coated washers (11) to ensure petrol proofing. These washers are slit to enable them to be fitted. Offset the slits when fitting.	Flat and box spanners 10
7	Place spring (15) on its support in pump body, place diaphragm assembly in position and engage control lever (8) on to operating rod (10). Position lever fork end (9), fit in priming lever (7) tighten guide nuts (6), fit lockwashers (5), press in rivets.	Flat spanner 12
8	Couple halves of pump body (3 and 4). DIAPHRAGM MUST BE LEFT DRY WITHOUT 'HERMETICAL' OR SIMILAR COMPOUND. Tighten screws.	
9	Place filter (2), cork gasket (WITHOUT 'HERMETICAL'), top cap (1), and tighten clamp screw.	Flat spanner 10
	NOTE. After assembling pump, check for leaks (see Operation 114A).	

	DISMANTLING OF PUMP	
1	Remove pump chamber and filter.	
2	Uncouple halves of pump body.	
3	Remove control lever spring, punch out control lever pin and remove lever. Take out diaphragm assembly and spring.	Pin punch 5 dia.
4	Remove plate holding valves. Remove inlet and outlet valves.	
	RE-ASSEMBLING OF PUMP	
5	Position valve gaskets (without 'Hermetical'), the two valves (which are identical), and the plate holding valves. Tighten plate.	
6	Place in position diaphragm assembly and spring. Fit control lever and engage with operating rod. Fit control lever pin and lock by means of a punch at four points. Fit control lever spring.	
7	Assemble the two halves of pump body (DIAPHRAGM MUST BE FITTED DRY WITHOUT 'HERMETICAL' OR SIMILAR COMPOUND). Fit coupling screws with spring washers under heads.	
8	Fit filter and gasket (WITHOUT 'HERMETICAL'), then pump chamber. Tighten clip.	
	NOTE. After assembling pump, check for leaks (see Operation 114A).	

	DISMANTLING OF PUMP	
1	Remove pump cover and filter. Uncouple two halves of pump body and remove diaphragm assembly.	Flat spanner 10
2	Tap out control lever pin, remove lever, spring and operating rod.	Pin punch 5 dia.
	NOTE. Inlet and outlet valves are set in pump body. In the event of the valves being faulty, replace the pump.	
	RE-ASSEMBLING OF PUMP	
3	Fit all four diaphragm discs to operating rod without tightening the nut.	
4	Place diaphragm control spring in pump body. Mount diaphragm assembly and connect square piece with the priming lever. Fit and engage operating lever with diaphragm operating rod. Fit a fibre washer each side of the lever, fit pin and rivet over ends. Ensure that priming lever is well engaged with diaphragm operating rod. Fit operating lever spring.	
5	Line up holes in diaphragm with those in pump body casting. Tighten nut at end of diaphragm operating rod to clamp discs together. To prevent petrol seeping through nut threads, load solder on and in nut threads.	Flat spanner 10
6	Couple halves of pump body together. FIT DIAPHRAGMS DRY WITHOUT 'HERMETICAL' OR SIMILAR COMPOUND. Tighten screws assembling the two parts. Fit filter, cork gasket (without 'Hermetical'), and filter cover. Fit fibre washer under head of cover screw and tighten.	
	NOTE. After assembling pump, check for leaks (see Operation 114A).	

CHECKING FOR LEAKS (See Drawing 22B)

1 Close outlet orifice by the use of a plug 12 mm. dia., 100 pitch.

2 To the inlet orifice fit a petrol pipe with union nut such as is fitted when on a car.

3 Submerge pump completely into a tank or container of clean petrol.

4 Force air into pipe at a pressure between 100 and 300 ~~gm./sq.cm~~ ($1\frac{1}{2}$ to $4\frac{1}{2}$ lbs. per sq. in.)

5 Air bubbles may appear at first but they may be due to diaphragm movement.

6 Maintain air pressure for a few minutes. If air bubbles appear by way of control lever, the diaphragm is faulty and must be changed. If air bubbles appear by way of pump body joint faces then joint faces are defective or the diaphragm is insufficiently tightened.

REMOVING OF CLUTCH

NOTE. To remove the clutch the engine should first be removed from car. However, it is possible, if necessary, due for instance to the absence of lifting tackle, to remove the clutch on the Light Fifteen as well as on the Big Fifteen, without removing engine. In that case uncouple engine from hull and raise unit with a high lifting jack in order to remove gearbox and clutch housing. This procedure is lengthy, difficult, and accessibility poor. We therefore do not recommend this method.

1	Remove engine (see Operation 101).	
2	Uncouple gearbox from engine (see Operation 102, paragraph 3).	Spanner 1675-T or 1676-T Flat and box spanners 17
3	Uncouple clutch from engine flywheel. For overhauling clutch, see Operation 116.	Brace spanner 14

REFITTING OF CLUTCH

4	Couple clutch to engine flywheel (see Operation 102, paragraph 6).	
5	Couple gearbox to engine (see Operation 102, paragraph 7).	
6	Refit engine (see Operation 101).	

DISMANTLING OF CLUTCH (See Drawing 23)

1	Remove by use of a saw blade, metal forced into clutch bolt slot (1) on each bolt. Unscrew nuts (2) holding bolts in slots, by the use of a screwdriver. Remove pressure plate and springs.	Flat spanner 14
2	Uncouple clutch casing (3) from spacing ring (4). Unhook springs (5) of clutch toggles and remove toggles (6).	Brace spanner 14

RE-ASSEMBLING OF CLUTCH (See Drawing 23)

On the '6 spring' type of clutch, to ensure clutch progression, the pressure plate surface is concave (see Drawing 23, fig.4). This feature must be maintained during any rectification of the pressure plate surface. In the case of the '9' spring type of clutch the corresponding surface is flat or very slightly concave (maximum included cone angle is 0 deg. 14 mins.).

RECTIFY CLUTCH PRESSURE PLATE BY LATHE

Rectification is more efficiently carried out by grinding but can also be done with a facing tool. Each rectification of the pressure plate surface causes loss of pressure on clutch disc. To compensate for this loss of pressure fit steel washers under clutch springs, equal in thickness to the amount removed from the pressure plate.

IMPORTANT NOTE. On the light type of flywheel, dimension 'b' (Drawing 23, fig.3) between clutch pressure surface and clutch casing surface (3) is 0.5 mm.
To avoid risk of 'clutch slip' we advise placing under each clutch spring a washer of 1 mm. thickness.
This note does not apply to the heavy type of flywheel, in which case dimension 'b' is 1.5 mm.

RECTIFY ENGINE FLYWHEEL

Each rectification to the clutch pressure surface must be followed by removing the similar amount of metal from the surface carrying the clutch toggle casing (see Drawing 23, fig.3). The two operations must be done without removing flywheel from lathe in order to obtain perfect alignment of both surfaces.

IMPORTANT NOTE. To prevent the clutch disc damper springs fouling the flywheel nuts it is essential that dimension 'a' between the crankshaft spigot face on the flywheel and flywheel pressure surface (see Drawing 23, fig.1) is greater than 16.8 mm. (on the original assembly this dimension is 17.5 mm.)

5 **TEST SPRINGS**

Use testing apparatus 2420-T (see Drawing 12). Springs are classified in three categories.

Spring testing apparatus 2420-T

PART NUMBER	COLOUR MARK	FREE LENGTH	LENGTH UNDER LOAD	LOAD IN KGS.
Spring No. 490663 for 6 spring type of clutch	Green	42 mm. to 44 mm.	35 mm.	47 to 48
	Yellow			48 to 49
	Orange			49 to 50
Spring No. 493019 for 9 spring type of clutch	Blue	46 mm. plus or minus 1 mm.	34 mm.	35.150 to 36.350
	White			36.350 to 37.600
	Red			37.600 to 38.850

To prevent trouble it is essential that the springs be matched.
On the 6 spring type of clutch the six springs must be of the same colour.
On the 9 spring type of clutch, it is possible:-

To fit nine springs of the same colour (it is not recommended however, to fit nine red springs as the clutch will be too harsh).

To fit six springs of one colour and three of another fitted alternately with springs of the same colour either side of each clutch toggle.

If unable to check or test springs replace springs at each clutch overhaul observing the above rules.

6 Fit clutch casing (3) to spacing ring(4), fit spring washers under nuts and tighten to a tension of 3 mkg. ($21\frac{3}{4}$ foot pounds). Place toggles (6) in position and hook on toggle springs (5) (THE ROUNDED END OF SPRING TO BE FITTED ON TOGGLE).

Box spanner 14

7 Place clutch pressure plate on fitting and checking assembly 1701-T, place on clutch springs and clutch casing and spacing ring assembly. Compress the assembly, place washers (7) on toggle bolts and tighten toggle nuts (2) to bring toggles in contact with underside of central pivoting lug of the fixture (see Drawing 24).

Flat spanner 14
Apparatus 1701-T or fixture MR.3457-1

Should apparatus 1701-T not be available, simplified fixture MR.3457-11 can be used (see Drawing 24A.)
Dimensions should be, 28.3 mm. between surfaces of clutch toggles and pressure plate, and 11.5 mm. between surface of pressure plate and inner surface of spacing ring. IT IS OBVIOUS THAT THESE DIMENSIONS CAN ONLY BE MEASURED BY USING THE APPROPRIATE FIXTURE WHICH PROVIDES FOR THE ASSEMBLY OF THE CLUTCH IN THE OPERATING CONDITION (see Drawing 24 or 24A).
When the clutch is removed from the fixture dimensions cannot be measured accurately.

8	Lock toggle nuts by punching a small portion of the metal of the nut cone in toggle bolt slot.	

	REMOVING GEARBOX.	
1	Drain water from radiator and oil from gearbox. Meanwhile, wedge or block power-unit under clutch bell housing to prevent it from moving when dismantling crossmember under radiator block.	Flat spanner 21
2	Remove bonnet, radiator shell, radiator block, crossmember under radiator block, and uncouple speedometer cable at gearbox end.	Flat spanners 12 - 14 Box spanners 10 - 14 - 17
3	Remove fan belt, clutch dust cover, gear tower assembly and gear lock withdrawal fork bolt.	Box spanner 14
4	Uncouple drive shafts at gearbox flanges.	Flat spanner 14
5	Uncouple gearbox from clutch bell housing.	Box spanners 12 - 14
6	Remove gearbox.	
	REFITTING GEARBOX.	
7	Clean surface of gearbox and clutch bell housing flanges, coat them with 'Hermetical' and fit paper gaskets. Engage gearbox with bell housing and turn mainshaft to allow splines to slide into grooves of clutch disc hub. Fit and tighten nuts with spring washers under heads.	Box spanners 12 - 14
8	Depress clutch pedal to bring toggles JUST INTO CONTACT WITH THRUST RACE. Adjust gear lock withdrawal fork on bracket of thrust race in order to obtain a clearance 'b' of 1 to 2 mm. between head of plunger and face of fork (see Drawing 6).	Box spanner 10
9	Fit clutch dust cover, gear tower assembly and fan belt.	Box spanner 14
10	Fit crossmember under radiator and collars attached to gearbox cover.	Box spanners 14 - 17
11	Couple drive shafts to gearbox flanges. FIT SPRING WASHERS UNDER NUTS AND TIGHTEN WELL.	Flat spanner 14
12	Connect speedometer cable.	Flat spanner 12
13	Fit radiator and hoses.	Box spanner 17
14	Fit radiator shell and bonnet. Remove wedge from underneath bell housing.	Flat spanner 12
15	Fill radiator with water.	

16	Replenish gearbox with oil, to level of filler plug (2 litres of hypoid oil similar to Mobiloil GX).	

	DISMANTLING OF GEARBOX	
1	Drain oil. Place gearbox on a convenient stand (similar to MR.3053, see Drawing 25).	Flat spanner 21 Stand MR.3053
2	Remove dust cover, gear lever tower and socket for speedometer drive pinion.	Box spanner 12 - 14
3	Remove gearbox cover.	Brace spanner 14
4	Uncouple bell housing from gearbox.	Box spanners 12 - 17
5	Remove split pins in centre of differential straps, remove four 21 mm. nuts after removing split pins or turning back lock tabs. Remove differential assembly complete.	Box spanner 21
6	REMOVE MAINSHAFT (see Drawing 26) Remove the two front bearing caps (1 and 2). Engage two gears such as first sliding speed and its counterpart on layshaft, then second gear in synchromesh with second speed idler gear. Turn back lockplates, unscrew mainshaft end cap (3) and nut (4) fixing layshaft front ballrace. Remove the two housings (5 and 6) of front ball-races. Remove locking ring (7), then the two ball-races and spacing washer (which slide off easily), then the other lock ring (7) and first speed sliding gear (8). It is now to remove mainshaft by tipping end downwards, then sideways, and sliding out front end upwards from front of box. Remove direct drive pinion (18) and synchromesh (19).	Brace spanner 14 Box spanner with extension 21 Box spanner 35
7	REMOVE REVERSE GEAR Unscrew set screw (9) holding shaft and knock out shaft (10) towards front of box. Removing the shaft also carries out a plug at the front end. (WHEN REMOVING PINION TAKE CARE NOT TO DISPERSE STEEL BEARING BALLS.	Flat spanners 12 - 14
8	REMOVE LAYSHAFT. Part the second speed pinion (11) from first and reverse speed idler gear (12) so as to provide clearance for the removal of half collars (13) from pinion. Remove these collars and then the layshaft (14) backwards from gearbox. Remove layshaft roller bearing (15) with the aid of a press.	
9	DISMANTLE DIFFERENTIAL Remove nuts holding coupling flanges by means of extractor MR.3328 (see Drawing 27). Remove oil seals and differential ring nuts. Uncouple differential casing. Knock out pins (16) of satellite pins (17) and remove spindles. Remove Timken bearing from differential casing by means of extractor 1750-T using special collets or holder 1753-T (see Drawing 28).	Box spanner 26 Extractor MR.3328 Universal joint spanner 17 Extractor 1750-T Collets 1753-T

10	REMOVE SECOND SPEED IDLER GEAR FROM MAINSHAFT (See Drawing 26, fig.2). With the aid of a small screwdriver depress plunger (20), retaining lockwasher (21), until head of plunger is flush with surface of groove on shaft. This plunger can be seen in one of the lockwasher serrations. Turn lockwasher until serrations coincide with shaft splines. Use two screwdrivers to prise washer from its seating and slide washer off shaft. When removing the washer take care that plunger is not ejected by its spring.	
11	REMOVE SYNCHROMESH FROM MAINSHAFT Wrap gear in a cloth and slide hub (22) out by hand to disengage it from ring (19)	
12	DISMANTLE GEARBOX COVER (See Drawing 29) (a) Remove locking screws (23) of gear selector forks and remove selector fork shafts (24 and 25). Remove locking ring (26) of spring (27) for gear locking shaft (28). Remove locking shaft and plug (29) of locking piece (30).	Flat spanners 9 - 14
	(b) Remove mounting brackets and press out rubber bush with a mandrel.	Box spanner 23 Mandrel 30 dia.
13	DISMANTLE BELL HOUSING (See Drawing 20) Remove water pump and dynamo drive shaft (50). Remove clutch thrust race, thrust race oil feed pipe, clutch withdrawal fork, clutch thrust centre, and withdrawal fork end bearing with the aid a shouldered mandrel.	Box spanner and extension 22 Spanner 1640-T Mandrel small dia. 19.5, length 40, large dia. 21.5 length 110.
14	DISMANTLE GEAR LEVER TOWER Remove levers, shafts and greaser.	Box spanners 11 - 12
15	Clean parts.	
	RE-ASSEMBLING OF GEARBOX	
16	ASSEMBLE GEARBOX COVER (See Drawing 29) Place locking piece (30) in position and screw in plug (29). Fit spring (27) (using only a reinforced spring easily distinguished by being wound right hand) and locking shaft (28). The spring is held in position by a lock-ring set in a cup, the lock-ring being fitted to the groove in locking shaft farthest from the 'T' end. Make sure that the shaft slides and returns freely. Place one locking ball in its housing, pull back locking shaft and fully engage selector fork shaft (24), then allow locking shaft to return. Repeat the operation for the second selector fork shaft (25). Withdraw shafts one at a time sufficiently to fit the selector forks.	

	IMPORTANT. To prevent the upper control lever on the gear tower fouling the fan belt when engaging direct drive, it is ABSOLUTELY ESSENTIAL to make the following adjustment. Slide selector fork controlling direct drive into third gear position, ensuring at the same time that the locking shaft and ball are in lock position. Clearance 'j' (see Drawing 26), between hub of selector fork and face of boss on cover must not then exceed 0.4 mm. to 0.6 mm. If clearance is excessive fit washers (31) upon selector fork shaft to give correct adjustment. Tighten selector fork screws (23) and lock them with wire to prevent any anti-clockwise rotation (see Drawing 29).	Flat spanners 9 - 14
	IMPORTANT NOTE. To prevent second speed 'jumping out' of gear, due to incorrect operation of the clutch pedal, we advise the following modification to the gearbox cover (see Drawing 29). Unscrew plug (29) and fit either a fibre or brass piece 9.3 mm. dia., 7 mm. long into bore exposed. Fit spring Part No. 506348 and replace plug (29).	Flat spanner 14
17	To cover, fit by hand, the rubber suspension bush, engage pin and both supporting collars. Use distance block MR.1525 for positioning collars when locking (see Drawing 30)	Box spanner 23 Distance blocks MR.1525
	IMPORTANT NOTE. SHOULD PINION BUSHES SHOW SIGNS OF WEAR, PINIONS MUST BE REPLACED IT IS ABSOLUTELY ESSENTIAL THAT THE BORE OF PINION BUSHES BE EXACTLY CONCENTRIC WITH THE PINION PITCH DIAMETER. These parts are so made that the BORE OF THE PINION IS NOT CONCENTRIC WITH THE PITCH DIAMETER. The following procedure, strictly adherred to, may be used for replacing bushes. Mount the worn pinion on a mandrel, ADJUSTED TO THE WORN PINION BUSH. (In the case of excessive ovality the pinion cannot be salvaged. Check and, if necessary, rectify the outside diameter of the pinion. Remove mandrel and change pinion bushes. IT IS ABSOLUTELY ESSENTIAL FOR THE BORE OF THE PINION TO BE CYLINDRICAL. IF PINION IS DAMAGED ON SIDE ADJACENT TO SYNCHROMESH RING, IT MUST BE REPLACED. Centre pinion on a lathe using rectified portion as a basis for concentricity. Use tool for boring pinion bush	
18	ASSEMBLE SYNCHROMESH (See Drawing 31) Fit springs (32). Engage false hub MR.3025 mid-way into synchromesh. Place the six steel balls (33) in position. Slide false hub fully home. Follow through with hub to be fitted and which has been previously lubricated. Keep hub constantly in contact with false hub to prevent displacement of balls.	False hub MR.3025
19	PREPARE MAINSHAFT (See Drawing 26) (a) When replacing bushes on second speed idler gear, fit so that direction of oil groove is right hand at the synchromesh dog end and left hand at pinion end. To carry out correct rebore of these bushes see paragraph 17, (IMPORTANT NOTE).	

	(b) Fit keyway washer (34) to mainshaft. This nitrided steel washer can be identified by its four grease grooves and the lack of finish on the surfaces. The grooves face towards the second speed idler gear. Place second speed idler gear (35) in position on shaft, followed by a Celoron adjustment washer (36), insert spring and locking plunger (20) (see fig.2) in recess on shaft, then fit splined washer (21). Depress the locking plunger with the aid of a thin strip of metal similar to a feeler gauge. Push washer fully home and turn it so that plunger locks it in one of the grooves. Check lateral play which should be between 0.05 mm. and 0.10 mm. If this is not so use another Celoron washer from the range listed in the Spare Parts Catalogue to give correct clearance.	
	(c) Mount locking key (37), which spaces washers retaining synchromesh dogs, the synchromesh (with groove for selector fork to the rear of the shaft), the washer with two grooves (38), the direct drive pinion (18), and washer (49) between pinion and front bearing.	
	(d) In order to find the correct adjustment of end play, provisionally mount front bearing. TIGHTEN THREADED END CAP (3), ENSURE THAT END PLAY OF THIRD SPEED PINION IS BETWEEN 0.10 mm. AND 0.20 mm. WITH A FEELER GAUGE MEASURE CLEARANCE BETWEEN WASHER (49) AND PINION (18). IF END PLAY IS NOT WITHIN THE LIMITS SPECIFIED CHOOSE ANOTHER RETAINING WASHER (38) FROM THE RANGE LISTED IN THE SPARE PARTS CATALOGUE TO GIVE THE NECESSARY CLEARANCE. CHECK THAT THE SYNCHROMESH CLEARANCE BETWEEN THE TWO ADJACENT PINION FACES IS NOT MORE THAN 4.2 mm. IF CLEARANCE IS IN EXCESS OF THIS FIGURE, CHANGE THE SYNCHROMESH (see fig.3, Drawing 26). FINALLY REMOVE front bearing.	Box spanner 36
20	ADJUST LAYSHAFT END PLAY	
	(a) With the aid of mandrel MR.3047 (see Drawing 32, fig.3) fit rear roller bearing (15) followed by a Celoron washer (39), floating bush (40), and first and reverse speed idler pinion (12). Then first thrust ball-race (41), split lock ring (13), second speed pinion (11), speedometer drive worm (42), adjusting washer (51), direct drive pinion (43) and the front bearing. Provisionally tighten check nut (4) and ensure that 0.10 mm. to 0.20 mm. end play exists between first and reverse speed idler pinion (12) and washer (39). Failing this obtain necessary clearance by replacing Celoron washer (39) by another of different thickness from the range listed in the Spare Parts Catalogue.	Box spanner 35 Mandrel MR.3047
	(b) Remove all parts from shaft with the exception of the rear bearing.	
21	ASSEMBLE DIFFERENTIAL (See Drawing 26)	
	If necessary, rectify the satellite wheel washer thrust faces in the casing, by using cutter 1752-T in conjunction with tool MR.3094 (see Drawing 33).	Cutter 1752-T Tool MR.3094
	(a) Mount Timken bearings with the aid of mandrel MR.3327 (see Drawing 32, fig.4).	Mandrel MR.3327

	(b) Mount a planet wheel in the casing using a Celoron washer of medium thickness (oil grooves facing planet wheel). Fit satellite wheel (44) and its spindle (17). Determine thickness of satellite washer (45) by checking for high spots when turning casing with the planet wheel tail end held in a vice. The positioning of this satellite will indicate whether the Celoron washer of the planet wheel is too thick or too thin, since the satellite wheel should not ride more than 0.5 mm. above the planet wheel (see fig.4). Use similar procedure, adopted successively, for the other three satellites. End play of planet wheel must not exceed 0.15 mm.	
	(c) Finally fit planet wheel into casing, with bush and Celoron washer all lubricated with grease similar to Mobilcompound. Fit satellite wheels, spider, lubricated carrier spindles and pins (16). Force pins home so that their flats press upon those of spindles.	
	(d) Place planet wheel in crown wheel. Ensure that planet does not bear on the satellite wheels. Fit a Celoron washer of average thickness. Provisionally connect crown wheel to differential casing and ensure that no high spots exist when turning the casing. If high spots are evident choose a Celoron washer of different thickness. Finally fit planet wheel, with shaft portion lubricated with grease similar to Mobilcompound, also washer.	
	(e) Connect crown wheel to differential casing ensuring that markings (letters or figures) line up. Tighten bolts to a tension of 6 to 7 mkg. (43½ to 50½ foot pounds) and turn back tabs of double lockwashers against flat of each crown wheel bolt.	Torsion wrench 2470-T Socket 17
22	ASSEMBLE CLUTCH BELL HOUSING	
	(a) ASSEMBLE WATER PUMP DRIVE SHAFT (See Drawing 20). Fit rear centralising bush (55) by splaying the metal with a pin punch to keep it into place. To shaft (50), fit ball-races (51 and 52) and distance piece (53) and grease with lubricant similar to Mobilgrease 6. Fit this assembly to bell housing. Tighten oil return ring (49), with spanner 1640-T, and fit split pin. Fit pressed steel pulley, tighten nut (54) and turn back lock tab against flat of nut.	Spanner 1640-T Box spanner 22
	(b) Fit clutch fork bearing with the shouldered mandrel used for removing bearing. Engage fork, fit bearings, and ensure, after having tightened bearing nuts to a tension of 2 mkg. (14½ foot pounds), that the fork moves freely. MAKE CERTAIN THAT THE CLEVIS END OF THE WITHDRAWAL FORK LEVER IS PARALLEL TO THE FORK SHAFT. If necessary, set the lever to bring it parallel.	Mandrel, small dia. 25, length 40, large dia. 21.5, length 110 Box spanner 14
	(c) Fit thrust guide, oil pipe fixed by clip, hub for clutch withdrawal thrust race housing and return spring anchor plate. Fit the oil pipe so as to run over the trough of the clutch thrust race housing (clutch in 'engaged' position).	

23	ASSEMBLE GEAR LEVER TOWER Lubricate shafts before assembling, tighten control levers leaving 0.30 mm. end play on both shafts (see Drawing 6, fig.2).	Box spanners 11 - 12
24	ASSEMBLE LAYSHAFT (See Drawing 26) (a) Place Celoron washer (39) in gearbox casing, followed by first and reverse speed idler pinion (12), lubricated thrust bearing (41), second speed pinion (11), speedometer drive worm (42), washer (51), and direct drive pinion (43). Fit shaft (14) with the aid of mandrel MR.3044 (see Drawing 32, fig.1) allowing it to rest on the front bearing housing. Separate second speed pinion from first and reverse speed idler pinion, stick split lock rings (13) in groove by means of grease, and bring both pinions together again.	Mandrel MR.3044
	(b) Ascertain thickness of shims to be fitted between housing (6) and the front bearing cap (2). To do so, offer ball-race up to housing, and measure by means of a straight edge and set of feeler gauges, the amount bearing protrudes from housing. Find the number of paper shims required to give a thickness equal to the amount protruding. NOTE. Front bearing housing (6), Part No. 500,999 is a sheet metal pressing and the thickness of the flange is consequently reduced by 2 mm. This difference is compensated by fitting a distance piece Part No. 500999a, under the housing flange. A paper gasket, Part No. 500993 (cut on request and 'Hermetical' impregnated) must be used between distance piece and housing (6).	Straight edge Set of feeler gauges
	(c) Fit front bearing in housing. Place two paper shims and a single washer between housing (6) and gearbox casing, the paper shims being fitted between the two joints. Tighten nut (4) to a tension of 15 mkg. (108½ foot pounds), using stop tool MR.3139 (see Drawing 34). Provisionally fit front bearing cap with two screws.	Stop tool MR.3139 Box spanner 36
	(d) ADJUST POSITION OF BEVEL PINION (See Drawings 26 and 35). THIS ADJUSTMENT IS VERY IMPORTANT By obtaining correct seating of the teeth one ensures both silence and longevity of the meshing. Read markings on the bevel pinion face (expressed in mms.) denoting the distance from the ground end face of the pinion to the bevel cone apex. This dimension 'd' is also the correct dimension for the distance from crown wheel centre-line to the end face of the bevel pinion. Ascertain distance 'd' with the aid of special clock gauge. Fit packings (46) between the two paper shims so that dimension 'd' is equal to the cone distance engraved on the bevel pinion. This adjustment must be undertaken with maximum precision. THE FIGURE GIVEN IN MMS. MUST BE RIGIDLY ADHERED TO. It necessitates the use of a clock gauge and ATTACHMENT 2044-T. Measurements must not be taken from the point of juncture of the caps since manufacturing tolerance of this point amounts to several lengths of mm. Should apparatus 2044-T not be available, proceed as described on Drawing 35A. After	Apparatus 2044-T

	adjusting, coat the two paper shims with 'Hermetical'	
	(e) Saturate the two paper shims, selected in paragraph 24-b, with 'Hermetical'. Offer up cap (2) and tighten all five screws to a tension of 2 mkgs. (14½ foot pounds) with spring washers under heads.	Universal joint spanner 14
25	FIT REVERSE GEAR SHAFT Fit both inner washers (47) to pinion, affix the balls with grease (13 to each side). BALLS MUST STAND PROUD OF PINION END FACES AT LEAST 0.10 MM. Fit outer thrust washers (48) which also regulate pinion end play which must be between 0.05 mm. and 0.20 mm. For this purpose washers of varying thickness are provided. Insert lubricated shaft and align the conical hole with the tapped hole for locking screw in gearbox casing. Tighten locking screw (9), fit spring washer and lock nut. Ensure that the pinion turns freely. If a shaft has to be replaced, remove sharp edges of oil groove by stoning. Fit front oil plug of reverse gear shaft after coating it with 'Hermetical'.	Flat spanners 12 - 14
26	FIT MAINSHAFT Fit shaft (assembled with second speed idler pinion, synchromesh, washer with two grooves, and direct drive pinion) over the top and into gearbox and sloping downwards to rear. Then fit first and reverse speed sliding pinion (8) and forward circlip (7) of rear bearings. Fit rear bearings with the aid of mandrel MR.3045 (see Drawing 32), and place between the two bearings a washer 1 mm. thick. Fit second bearing circlip (7).	Mandrel MR.3045
	Fit washer (49) between direct drive pinion and front bearing. Fit front bearing with its housing using mandrel MR.3045 (see Drawing 32). Fit lockwasher on shaft, bearing washer (50), the purpose of which is to hold the lockwasher in position, and fit end cap (3). TIGHTEN CAP TO A TENSION OF 14 to 16 MKG. (101 to 115½ foot pounds) with two gears engaged to prevent mainshaft turning. Turn back lockwasher tab against a flat of the end cap. Fit front bearing cap, after treating gasket with 'Hermetical', fit screws with spring washers and tighten to a tension of 2 mkgs. (14½ foot pounds). Ensure that the assembly turns freely.	Box spanner 35 Universal joint spanner 14 Mandrel MR.3045
27	FIT SPEEDOMETER DRIVE PINION Grease pinion end before inserting it in bush. Tighten flange screw with a spring washer fitted under head.	Box spanner 12
28	FIT DIFFERENTIAL (a) Offer up the differential with the crown wheel facing towards filler plug of casing. Fit in threads of gearbox casing the nuts for adjusting bearings so that they bear against the bearing outer rings. Fit bearing caps and lockwashers. Tighten the bearing adjusting nuts but do not lock.	

	(b) Adjust meshing clearance between crown wheel and bevel pinion. To do this instal a clock gauge with the use of clamp 2041-T as indicated on Drawing 35. Tighten the two adjusting nuts with spanner 1751-T (see Drawing 36) to bring the crown wheel into contact with the bevel pinion, then unscrew both nuts a quarter of a turn. Adjust nuts to give THE PLAY OF TEETH MESH AS INDICATED ON THE OUTER EDGE OF CROWN WHEEL (see Drawing 35) (this clearance is measured tangentically at the outside diameter on the flank of a tooth). TAKE MEASUREMENTS AT FOUR POINTS AT APPROXIMATELY 90°. A tolerance of plus 0.05 mm., minus 0.05 mm. is allowed. If above this tolerance, replace the crown wheel. ± .002 Timken bearings must be fitted with a slight play. Tighten the adjusting nuts and then unscrew one slot (approximately 20 mm. on the outer circumference of nut). Fit split pins to adjusting nuts. Tighten bearing cap nuts to a tension of 7 or 8 mkg. (51 or 58 foot pounds), and turn back lockwasher tabs. Fit oil seals to gearbox flanges. NOTE. SPI joints (oil seals) supplied by Spare Parts Department, Paris, have a protective coating and must not be fitted as received, as they would not be leak proof. Joints with tanned leather must be immersed in engine oil at 40°C. (104°F.) for one hour; those with chrome leather must similarly be treated but the immersion period must be for one minute only. Smear the outer surfaces of the SPI joints with 'Hermetical'. Fit coupling flanges. Smear washer sides facing shaft grooves with 'Hermetical'. Tighten coupling flange nuts to a tension of 10 to 12 mkg. (72 to 86½ foot pounds), keeping flanges in position with lever MR.3352 (see Drawing 27), and fit split pins.	Universal joint spanner 21 Spanner 1751-T Bracket for clock gauge 2041-T Box spanner 26 Lever MR.3352
29	FIT GEARBOX COVER, CHECK SECOND AND SPEED GEAR LOCK Fit cover on gearbox and tighten it with two diagonally placed nuts. Engage second speed. LIFT COVER, KEEPING IT ABSOLUTELY VERTICAL AND USING GREAT CARE to avoid shifting of synchromesh. MESH IS CORRECT IF THE REAR FACE OF THE CROWN OF THE SYNCHROMESH PROTRUDES BY 1 mm. FROM THE REAR FACE OF THE SECOND SPEED IDLER PINION DOGS (see Drawing 26; A and A1). Undertake the same operation for mesh of top speed idler pinion. If mesh is incorrect, shift mainshaft assembly by inserting a shim or several paper joints between front bearing housing (5) and gearbox casing. Finally fit gearbox cover using a paper gasket. Fit spring washers and nuts, and tighten to a tension of 2 mkg. (14½ foot pounds).	Universal joint spanner 14
30	CONNECT CLUTCH BELL HOUSING AND GEARBOX Treat the flange faces of both housings with 'Hermetical'. Fit a paper gasket and tighten nuts with spring washers fitted underneath. Fit gear lever tower and dust shield (the latter provisionally as it must be removed for locking shaft adjustment.	Box spanners 12- 17
31	Tighten drain plug fitted with C. and A. washer.	Box spanner 21

32 Paint assembly.

33 Remove gearbox stand MR.3053.

	REMOVING OF FRONT AXLE	
1	Drain water from radiator. Meanwhile, jack up front of vehicle and place stand under body behind steering.	
2	Take off bonnet. Disconnect positive cable from battery terminal using extractor 2200-T (see Drawing 2). Disconnect wiring to head and side lamps, horns, and junction boxes.	Extractor 2200-T Box spanner 14 Flat spanner 10
3	Remove front wheels and front bumper.	Wheelbrace
4	Remove wing and radiator shell assembly (without disconnecting radiator shell from wings). Start by removing bolts fixing wings to wingstays, in order to hold wings in position until removed.	Brace spanner with extension 14
5	Raise engine and gearbox unit and place block under clutch housing.	
6	Remove radiator and radiator crossmember.	Universal joint spanner 17
7	Disconnect Lockheed brake hoses from brackets.	Flat spanner 14
8	Disconnect track rods from right and left hand steering arms by means of ball-pin extractor 1964-T (see Drawing 37).	Box spanner 21 Extractor 1964-T
9	Uncouple drive shafts from gearbox flanges and slide couplings on splines away from gearbox.	Flat spanner 14
10	Remove screws (47) fixing torsion bars (heads of screws are in recess of front silentbloc hubs (see Drawing 38).	Box spanner 14
11	Remove the four nuts (50), holding front axle assembly to hull, with spanner 1880-T (see Drawing 39). Remove wing and bumper brackets.	Spanner 1880-T Universal joint spanner 17
12	Disengage front axle from four hull studs with the aid of a lever.	
13	Should the torsion bars come out together with the front axle, disconnect them after removing front axle by means of split block MR.1578 (see Drawing 71).	Blocks MR.1578
	REFITTING OF FRONT AXLE	
	The right hand torsion bars are identified by one paint mark, the left hand bars by two.	

14	Fit torsion bars to adjusting levers (49) (see Drawing 40) pushing them right through until stopped by the body so as to avoid hindrance when fitting the axle cradle.	
15	Offer up front axle to hull studs, fit wing and bumper brackets, tighten four hull stud nuts (50) to a tension of 20 mkg. (145 foot pounds) using spanner 1880-T (see Drawing 39). Place a spring washer between each nut and axle cradle. Ensure that ball-head screws of adjusting levers are completely unscrewed. Bring each torsion bar into relation to the silentbloc on the cradle and, WITH THE ADJUSTING LEVER RESTING ON THE BALL HEAD OF THE ADJUSTING SCREW, LOWER, BY MEANS OF A LARGE LEVER (to overcome silentbloc resistance), THE LOWER LINK ARM OF THE FRONT AXLE BY ABOUT TWO SERRATIONS. AT THIS POINT FIT THE TORSION BAR. Complete fitting of bar in the silentbloc by using draw-bar MR.3349 (see Drawing 40). Tighten fixing bolt (47) with a spring washer under head (see Drawing 38).	Spanner 1880-T Draw-bar MR.3349 Box spanner 14
16	Connect drive shafts, and TIGHTEN NUTS WELL AFTER FITTING DOUBLE LOCK PLATES. Ensure that the coupling and drive shaft yokes are at 90° to each other (see Operation 120, paragraph 19c).	Flat spanner 14
17	Connect track rods to steering arm ball-pins, tighten nuts and fit split pins.	Box spanner 21
18	Fit radiator crossmember and gearbox support. Turn back lockwasher tabs against flat of nuts after tightening.	Universal joint spanner 21
19	Fit radiator.	Universal joint spanner 17
20	Fit Lockheed brake hoses.	Flat spanner 14
21	Fit wheels.	Wheelbrace
22	Bleed brake system (see Operation 150, paragraph 5).	
23	Lower vehicle to the ground.	
24	Check and adjust heights, track, caster angle and steering lock (see Operation 149-151).	
25	Fit radiator shell and wing assembly. Fit front bumper.	Brace spanner with extension 14
26	Connect battery and wiring to lamps and horns.	Flat spanner 10 Box spanner 14

27 Close radiator drain plug and fill with water.

28 Fit bonnet.

	DISMANTLING OF FRONT AXLE (See Drawing 41)	
1	Place front axle on a strong stand.	
2	Remove shockabsorbers.	Box spanner 21 and tommy bar
3	Unscrew hub nuts using spanner 1810-T (see Drawing 42, fig.3). Remove brake drums (1) by use of extractor 1750-T fitted with collets 1820-T (see Drawing 42, fig.1).	Spanner 1810-T Collets 1820-T Extractor 1750-T
4	Remove steering arms (see Drawing 43). Interpose a distance piece, made from metal similar to cold chisel steel, between brake back plate (2) and steering arm nut (51). Unscrew nut until it touches the distance piece. Continue loosening nut to exert a strong pressure. Assist loosening of arm by hammer blow on boss of arm seating in swivel housing. On later models, the steering arm nut is partly cylindrical. In this case the steering arm cannot be removed until operations described in paragraph 5 are carried out.	Steel wedge 10 mm. thick Flat spanner 26
5	Remove Lockheed hoses (3) and slotted ring nut (4), retaining outer ball-race, by the use of spanner 1825-T (see Drawing 43). Remove also brake back plates assembled.	Flat spanners 17 - 19 - 23 Box spanner 8 Spanner 1825-T Brace, spanner 12
6	REMOVING SWIVEL ASSEMBLY - TRANSMISSION SHAFTS (See Drawing 41). (a) Remove lower swivel balls with the aid of ball extractor 1851-T (see Drawing 44).	Box spanners 10 - 23 Ball extractor 1851-T
	(b) Remove upper link ring nuts (6) by means of spanner 1852-T (see Drawing 44).	Spanner 1852-T
	(c) Remove upper swivel balls (7) by means of ball extractor 1850-T (see Drawing 44).	Box spanner 26 Ball extractor 1850-T
	(d) Remove transmission shafts and swivels as assemblies.	
7	REMOVING UPPER LINK ARMS (See Drawing 45) (a) Remove washers and ring nuts (8), slotted ring nut (9) of bush, and remove bush with the aid of a screwdriver.	Box spanner 23 and extension Adjustable spanner
	(b) Loosen clamp bolts (10) and disengage shafts towards the front, unscrewing them by means of a flat spanner or pair of grips, or for preference, by fitting a lock nut on the threaded forward	Flat and box spanners 17 Cranked spanner

	end of the shafts and unscrewing the assembly.	
	(c) Remove protective leathers (40) (see Drawing 41), followed by ball cup (41) with the aid of a drift. Remove greasers.	Drift Flat spanner 14
	(d) Remove rear bush (35) by means of a press (see Drawing 45).	
8	REMOVING LOWER LINK ARMS (See Drawing 38). This operation requires in some cases a press of 80 tons.	
	(a) Remove bolts (11) fixing silentblocs (12 and 13) to cradle.	Box spanner 14 Flat spanner 17
	(b) Press out splined shaft (14) using drifts and socket MR.3363. Use short drift first to loosen shaft and complete removal with long drift (see Drawing 46). THE SHAFTS BEING TAPERED, IT IS ESSENTIAL TO PRESS THEM OUT TOWARDS THE REAR OF THE CRADLE.	Drifts and socket MR.3363
	NOTE. On later models the splined shafts (14) are a freer fit in the silentblocs (12 and 13) and in the lower link arm (32). They can therefore be removed without a press.	
9	REMOVING TRANSMISSION SHAFT SWIVELS (See Drawing 41)	
	(a) Extract bearing (15) with outer groove, by means of extractor 1750-T with collet 1819-T (see Drawing 42, fig.2). If the outer groove is broken, use extractor 1821-T (for bearing with 10 balls) and collet 1828-T (for bearing with 9 balls) which pull out bearing by inner ring (see Drawing 48A, fig.1). Remove distance piece (16) by hand.	Bearing extractor 1821-T and collets 1828-T or Extractor 1750-T and collets 1819-T
	(b) Unscrew ring nut (17) of inner bearing (18) (right hand thread on left hand swivel and vice versa) using spanner 1826-T, held by the hub locking nut screwed on stub axle (see Drawing 47).	Spanner 1826-T
	(c) Withdraw transmission shaft from swivel using tool 1824-T. Extract inner bearing from swivel using the same tool (see Drawing 48) or extractor 1821-T with extra body 1823-T (see Drawing 48A, fig.2 and 3).	Tool 1824-T or extractor 1821-T and extra body 1823-T
10	DISMANTLING BRAKE BACK PLATES (See Drawing 49) Strip out each plate successively. Remove return spring (19) by means of pliers 2110-T (see Drawing 50). Remove brake shoes (27 and 28), anchor pins (20), and wheel cylinder (21). Cut away riveting to remove adjusting cams (22).	Flat spanners 19 - 22 Box spanner 8 Pliers 2110-T
11	Strip out wheel cylinders (all parts removable by hand). Remove dust covers (23), pistons (24), cup washers (25) and springs (26).	

12 Clean parts.

RE-ASSEMBLING OF FRONT AXLE

13 ASSEMBLING WHEEL CYLINDERS
USE ONLY ALCOHOL OR LOCKHEED FLUID for cleaning parts, any other substance will entail rapid deterioration of the rubber cups. Lubricate cylinder and cups before assembling. The various parts can be assembled by hand (see Drawing 49, fig.2), for positioning of cups.

14 ASSEMBLING OF BRAKE BACK PLATES (See Drawing 49)
Assemble each plate separately. Fit adjusting cams (22), rivet over pins using snap punch and socket MR.3354 (see Drawing 51). Fit brake shoe anchor pins (20), brake shoes (27 and 28), (linings must be quite dry without any trace of oil). The shoe with complete lining (27) is fitted forward. Slightly oil, adjusting washers (29) of the brake shoe positioning studs. Tighten nuts of anchor pins (20) to a tension of 3 mkg. (21¾ foot pounds) and fit split pin. Fit wheel cylinder also spring (19) with the aid of pliers 2110-T (see Drawing 50). Ensure that the brake shoes operate normally and that the washers of the brake shoe positioning studs bear on them sufficiently.

Box spanner 8
Flat spanners 19 - 22
Pliers 2110-T
Snap punch and socket MR.3354

15 ASSEMBLING OF UPPER LINK ARMS (See Drawing 45)
Fit front bush (34) and tighten ring nut (9). Fit rear bush (35) by means of a press using a shouldered mandrel.
To prevent bush wear, dimension 'a' (distance between inner faces of two bushes) must be 139.45 mm., plus or minus 0.1 mm., and the two faces must be parallel within 0.1 mm.
Check these conditions using gauge MR.3507.
Bore grease holes. Ream bushes. To obtain correct alignment of bores, use special reamer 1860-T.

Mandrels:-
small dia. 21.5, length 40
large dia. 34, length 110
Expanding reamer 1860-T
Gauge MR.3507

16 ASSEMBLING OF BRAKE DRUMS
(a) Use assembly MR.3445 (see Drawing 52) to ensure correct seating of the drum, in order to have it bear on the wheel studs and to prevent casting breaking. THE BRAKE DRUM AND HUB MUST NEVER BE COMPLETELY SEPARATED AND STUDS MUST BE REPLACED ONE OR TWO AT A TIME ONLY. Rectification of the drum and the assembly of the two parts is carried out at the factory with the greatest precision. Faulty centering will result in brake vibration. Rivet over studs with a press of 8 to 10 tons (failing a sufficiently powerful press, the operation can be undertaken with a punch and hammer.)

Assembly MR.3445

(b) Drill hole for dowel (set away from its former seating). Drive in dowel. Ensure that it does not stand proud and lock it by means of a pin punch.

(c) Check and rectify, if necessary, the concentricity of drum with hub bore (assemble on

Mandrel MR.3381-1

Mandrel MR.3381-1, see Drawing 53); the ovality tolerance must not exceed 0.06 mm. Check this by means of a clock gauge. Check during this operation the hub and drum assembly, placing a washer 4 mm. thick on each stud and locking with the wheel nuts tightened to a tension of 5 mkg. (36 foot pounds).
Do not increase by more than 2 mm., the original drum dia. which is 255 mm. (10 inch drums) or 305 mm. (12 inch drums).

17 DRIVE SHAFTS (See Drawing 54)
Repair of drive shaft universal joints entails the removal of centre ball joints. When re-assembling, these joints, or new joints WITH SIMILAR DIAMETER OF BALL PIN STEMS, cannot be used as their fit in shaft or stub axle after rebore would be too slack and the joint would be likely to shift when under load.
The exchange of these ball joints for replacement types with over-size pins is therefore essential after each dismantling. It is equally essential to rebore the drive shaft and stub axle.

18 DISMANTLE AND RE-FIT DRIVE SHAFTS (See Drawing 55)
(a) Dismantle stub axle yoke.
(Fig.1) With the assembly held in a vice, remove the four circlips (52) retaining bearing cups (53) on the stub axle side. Remove by means of a scraper, any paint or burrs which might hinder removal of bearing cups.

(Fig.2) By means of a bent screwdriver, push outwards the four sheet metal cork washer retainers (54) which will free the bearing cups (53). Remove the latter together with their needles (see Drawing 54 for details). Do not omit to remove cork washers (55) lining the retainers (54), as well as the retainers themselves, as otherwise the dismantling of the whole assembly cannot be effected (see Drawing 54).

(Fig.3) Tilt the spider (56) so that its trunnion emerges from the double yoke by way of its release aperture. The spider having been freed, withdraw stub axle (31) together with spider (56) and the ball joint assembly (62 and 63) (see Drawing 54 for details).

(b) Remove drive shaft yoke (see Drawing 55).
Remove bearing cups as described above (figs. 1 and 2).

(Fig.4) Remove double yoke (58) by tilting spider (59), the latter remaining on the drive shaft (60).

(c) Remove spider from stub axle end (see Drawing 56).
(Fig.5) Unsolder cup (61) on the stub axle side of the ball joint protecting cover; this cup is soft soldered. Remove grease retaining cups (62) to allow use of ball joint extractor.

If the ball joint protecting cover is unsoldered at the centre the cup (61) must nevertheless be unsoldered.

(Fig.6) Withdraw ball-pin (63) (the joint ball 69 remaining assembled) using extractor 1900-T with collets 1902-T. To prevent distortion, place two bearing cups (53) without needles, into bearing cup housings. Remove spider (56).

Extractor 1900-T
Collets 1902-T

(d) Remove spider from drive shaft end (59).
(Fig.7) Proceed as above, using extractor fitted with collets 1901-T to remove ball joint pin (65).

Extractor 1900-T
Collets 1901-T

(e) Prepare bearings (53) (see Drawing 54).
Lubricate each bearing cup with grease similar to Mobil compound, and then fit twenty-five needles (66) in each cup.

(f) Prepare spiders (56 and 59)
Fill grease holes in spiders with grease similar to Mobil compound.

(g) Rebore stub axle and drive shaft ends (see Drawing 56).
Rebore seating of hollow ball joint stem in stub axle and of ball joint pin in drive shaft. Use successively, first-cut reamer 1905-T and finishing-cut reamer 1906-T. After having carefully cleaned the reamed bores, so that no foreign matter prevents proper working, check diameter of reaming by means of 'GO' and 'NOT-GO' gauge 1907-T.
(Fig.8) Check depth of reaming in stub axle by means of depth gauge 1912-T with pin 1911-T. The depth must be correct within 0.12 mm. It determines the position of the inner ball joint (63). THIS POSITION MUST CONFORM TO THAT INDICATED ON THE DIAGRAM, IN ORDER TO PREVENT NOISE AND RAPID DETERIORATION OF THE JOINT. The depth of the drive shaft bore need not be checked.

First-cut reamer 1905-T
Finishing-cut reamer 1906-T
'Go' and 'NOT-GO' gauge 1907-T
Depth gauge 1912-T
Pin 1911-T

(h) Prepare stub axle (see Drawing 57).
Fit spider (56). THE SIDE 'a' MUST BE POSITIONED IN ACCORDANCE WITH FIG.9.
(Fig.10) Place on stem of ball-pin (63), fitted with its grease retaining soldered cups (62), (assembly sold by our Spare Parts Department), sliding ball (57), cork washer (64), steel washer (67), and spring (68).
Ensure that central bore of stub axle and stem of ball-pin (63) are perfectly clean. Force hollow ball-pin (63) right home (using press 1903-T, see Drawing 57, fig.10). (This may require a pressure up to 12 tons). Use a worn ball-pin (65), modified as indicated on fig.11. TAKE CARE TO FIT ASSEMBLY VERTICALLY TO PREVENT DAMAGE TO THE BALL-PIN STEM.

'Three-point' gauge 1908-T
Gauge for bearing cup housings 1910-T
Press 1903-T

(Fig.12) Check positioning of inner ball joint (69) with 'three-point' gauge 1908-T and the two gauges for bearing cup housings 1910-T.
Fill grease retaining cups (62) with lubricant similar to Mobilcompound.

(i) Prepare drive shaft (see Drawing 57). Fit spider (59). THE SIDE 'a' MUST BE POSITIONED IN ACCORDANCE WITH FIG.13. (Fig.14) (see Drawing 58). Force pin (65) right home (using press 1903-T, see Drawing 57, fig.10). TAKE CARE TO FIT PIN VERTICALLY TO PREVENT DAMAGE TO STEM. PROTECT BALL WITH FERRULE 1904-T.	Ferrule 1904-T Press 1903-T
(j) Fit double joke (58) to stub axle. (Fig.15) If double yoke has two different outside diameters, fit larger diameter stub axle side for preference.	
(k) Fit drive shaft (60) to double yoke (58). (Fig.16). This operation is more easily carried out if the parts are held vertically. Insert a spider trunnion (59) on the drive shaft side in the corresponding bearing cup housing of the double yoke (58). Try, at the same time, to fit ball joint pin (65) into the bore of the inner ball (69) and to fit the second spider (59). This is a delicate operation and no force must be used. Ensure that the inner ball joint (69) is correctly positioned to receive stem of ball pin (65).	
(l) Fit bearings. (Fig.17) With the aid of a tube, fit cork washer retainers (54) and cork washers (55) coated 'Hermetical'. Fit bearing cups AND ENSURE THAT NEEDLES ARE WELL POSITIONED. The cups must bear against cork washers.	Tube 20 x 24 x 100
(Fig.18) Fit bearing cup circlip (52). Check, with gauge 1909-T, that circlip is correctly fitted. Repeat operation for other bearings.	Gauge 1909-T
(m) Check, by moving cardan end, there is neither obstruction or play.	

NOTES

1. Spider trunnions must seat on base of needle bearing cups. There must be no possibility of the spider shifting.
   If the cardan is new, cork washer (55) prevents any such shifting (see Drawing 54).
   If one notices play at 'a' between spider and bearing which has been in use it must be eliminated in order to prevent noisy drive shaft when car is in motion and the wheels on lock. In order to do this, fit a thicker circlip (52) on one side, or, if this is not available, fit a shim of required thickness under the ordinary circlip (see Drawing 54, fig.2) Check again for play, and if it still exists, fit a second thicker circlip, or failing this, another shim on the opposite side.

2. To eliminate noise in the cardan splines (a dull thud reverberating through the body of the

car, particularly on gradients and when accelerating over rough ground) the bore of the yoke must be increased in diameter at each end (see Drawing 59). Centre coupling flange Part No: 408454 on a face-plate in a lathe. Bolt coupling yoke to be modified to flange. Screw threaded cap 'b' to yoke. Fit carrier ring round this cap. Fit guide (c) for centre and bring lathe centre into contact. Adjust carrier ring. Disengage lathe centre and remove guide. By means of a boring tool bore out the diameter of the hub side to 33.5 mm. without touching the splines. Check position of tool giving this diameter. To do so, check vernier reading on tool carrier.
Similarly correct bore on gearbox side. Here it is impossible to check bore measurements. In order to obtain the same diameter of 33.5 mm., the vernier reading on the tool carrier must be the same as it was when rectifying hub side. Here too, the splines must not be machined.

19 REMOVING AND REFITTING OF CARDAN COUPLINGS ON GEARBOX SIDE

(a) Remove circlips, bearing cups and needle bearings, and spiders as instructed for drive shafts (see figs.1, 2 and 3, Drawing 55, and paragraph 18a).

(b) Identical operation as for fitting of drive shaft spider. Check position of circlips (see figs.17 and 18 Drawing 58, and paragraph 18b).

19A MOUNTING GEARBOX SIDE CARDAN COUPLINGS TO DRIVE SHAFTS

Engage drive shafts into cardan couplings, having thoroughly greased the splines with lubricant similar to Mobilcompound. To ensure constant velocity it is essential that one axis of one of the spiders in the double yoke is in the same plane as one axis of the spiders in the single yoke. In practice this condition is obtained when the greasers of the drive shaft and the cardan coupling are in line.
Screw on sheet metal retaining cup complete with its felt lining and split steel washer.

RE-ASSEMBLING OF FRONT AXLE

20 ASSEMBLING OF SWIVELS TO DRIVE SHAFTS

Use tool 1824-T (see Drawings 41 and 60).

(a) Fit oil seal (S.P.I. joint) (30) in swivel. Fit inner bearing (18) lubricated (grease similar to Mobilgrease 5). Position bearing and shaft in swivel (see Drawing 60, fig.2). Tighten nut (17) to a tension of 10 mkg. (72 foot pounds) use spanner 1826-T, see Drawing 47), the drive shaft being held in a vice. Turn back two tabs of the lockwasher into slots of nuts (17). — Tool 1824-T, Spanner 1826-T

(b) Pack swivel with about 0.100 kg. ($\frac{1}{4}$ pound) of grease (similar to Mobilgrease 5).

(c) Fit distance piece (16). Fit outer bearing (15) by means of tool 1824-T (See Drawing 60, — Tool 1824-T

	fig.3).	
	(d) Fit steering arm. Remove all grease from arm cones and swivel by washing with alcohol. Tighten steering arm nut to a tension of 10 mkg. (72 foot pounds) and fit split pin.	Flat spanner 26 and extension
21	ASSEMBLING OF LOWER LINK ARMS (See Drawing 38) NOTE. The lower link shafts are tapered (0.07 to 0.1 mm.). (a) Using a press fit splined shaft (14), waxed, into rear silentbloc (12) (see Drawing 46). Shafts of older models have a large chamfer and central aperture at the end of the greater diameter. Fit shaft from the rear so that smaller diameter is at the front. The shaft must protrude 10 mm. maximum to permit the mounting of the link arm (32). On later types, splines are cleaned off in the shaft centre and at the end with the larger diameter the central hole is countersunk. Assemble shaft from the rear of the cradle so that the smaller diameter (end with short splines) is fitted at the front. Provisionally fit silentbloc on cradle. Fit lower link arm (32) of the protruding part of the shaft, positioning it so as to obtain a measurement of 325 mm. between the upper shockabsorber pin and the lower shockabsorber pin on the link arm (see Drawing 39, fig.3). Use gauge MR.3350 or, in its absence, a rule.	Gauge MR.3350
	(b) Place front silentbloc on guide block MR.3363 (see Drawing 46). Fit shaft by hand or by a press and ensure it fits correctly into splines.	Guide block MR.3363
	(c) Press in shaft so that the disengaged portion of the splines in the rear silentbloc (for accommodating end of torsion bar) be 33 mm., plus or minus 0.5 mm. for the "Twelve" and "Light Fifteen", and 36.5 mm., plus or minus 0.5 mm. for the "Big Fifteen" (see Drawing 38). Eliminate lateral link arm play and adjust position of arm in cradle by inserting split shims (sold by Spare Parts Department) underneath silentbloc flanges. The link arm centre line must be 4 mm. forward of the cradle centre line. Fit spring washers under silentbloc fixing nuts and tighten to a tension of 4.5 to 5 mkg. ($32\frac{1}{2}$ to 36 foot pounds).	Box spanners 14 - 17 Press 80 tons
22	ASSEMBLE UPPER LINK ARMS (See Drawing 45) (a) Lubricate bearing surfaces of shaft (33) and bushes (34 and 35). Fit spindle in front bore of link arm. Fit lockwasher (36) and slotted ring nut (9) to spindle and offer up link arm to cradle. Either, by means of a nut and lock nut fitted to front end threads of spindle, or by use of a 23 mm. flat spanner, screw in the spindle leaving about three threads protruding at the front (this position of the spindle corresponds approximately to its final position after caster angle has been checked on the car). FIRMLY TIGHTEN clamp bolts (10) with spring washers fitted under heads; fit front bush (34), tighten slotted ring nut (9) to a tension of 6 to 8 mkg. (43 to $57\frac{1}{2}$ foot pounds). Turn back tab of lockwasher (36) into slot of ring nut.	Flat spanner 23 Adjustable spanner Box and flat spanner 17
	(b) Adjust lateral play on each bush successively by fitting shims (37) sold by Spare Parts	Universal joint spanner 23

	Department. Tighten nuts (8) to a tension of 9 to 10 mkg. (65 foot pounds). The link arm should not move under its own weight. Turn back tabs of lockwashers.	
23	ASSEMBLE SWIVELS (See Drawing 41) BEARINGS, BALL JOINTS, UPPER AND LOWER CASINGS ARE MATCHED. In the case of slight play, it is permissible to remove shim (38) of 0.05 mm. thickness, BUT ON NO ACCOUNT MUST THE ORIGINAL SHIM (39) BE REMOVED. If play is excessive the whole assembly must be changed.	
	(a) Fit upper ball joint. Fit protecting leather washer (40) on swivel (leather seam to be positioned towards the rear) as well as washers and spring retainer. Fit lower bearing (41) of ball joint in upper link eye. Carefully remove all grease from cone of upper swivel pin and from tapered bore of the ball joint. Fit key in key-way. Fit balljoint, having greased it on the outside. Tighten nut (42) to a tension of 7 mkg. (50½ foot pounds) and lock by punching metal into swivel pin key-way. Fit upper bearing (43). Pack ring cap (6) with grease (similar to Mobilgrease 5) and tighten cap to a tension of 5 mkg. (36 foot pounds). Tighten lock nut to a tension of 8 mkg. (57½ foot pounds) with the aid of spanner 1852-T (see Drawing 44), and turn back tab of lockwasher against flat of nut.	Universal joint spanner 23 Spanner 1852-T
	(b) Fit lower ball joint. Fit leather washer, fit bearings, remove grease from tapers, tighten ball joint as in the case of the upper link arm. FIT SPECIAL SPLIT PIN 426697 TO NUT (44).	Box spanner 29
	(c) Adjust lower bearing. Fit shims (70) between cap (45) and bearing (46) so that after cap has been normally tightened by its screws, there still remains 0.05 mm. to 0.10 mm. play between lower face of link arm and the cap. After the cap screws have been tightened to a tension of 1.5 mkg. (10 foot pounds), they should be flush upon the lower bearing face of the link arm.	Box spanner 10
	(d) Fix leather washers by binding them with brass wire (at least two turns). Leathers must not rotate with the swivels. Swivel rotation must take place under a load of 2.5 mkg. (18 foot pounds), both ball joints being fitted.	
24	FIT BRAKE BACK PLATES. POSITION BRAKE SHOES. (a) Tighten nuts of mounting bolts to a tension of 2 mkg. (14½ foot pounds), and lock with double lockwasher. Tighten outer ball-race slotted ring nut (4), fitted with its grease retaining washer, to a minimum tension of 15 mkg. (108 foot pounds) (see Drawing 43). Lock ring nut by fitting lock tab into one of the slots. Fit lock tab to one of the holes in swivel and plug the other swivel hole with a screw fitted with spring washer under head.	Spanner 1825-T Box spanners 8 - 12
	(b) Position brake shoes. Use gauge 2100-T (see Drawing 61) and spanner 2120-T (see Drawing 49).	Gauge 2100-T Spanner 2120-T

25	FIT HUBS TO STUB AXLES (a) If stub axle is broken, IT IS ABSOLUTELY ESSENTIAL TO FIT A NEW HUB TO THE NEW STUB AXLE, even if the old hub is still in working order. If the stub axle has only been dismantled (but is not broken) it is nevertheless essential, before assembling to:- (b) Ensure that the journal of the stub axle taper is in good condition and shows no signs of cracking, seizing, chipping, etc. (c) Ensure that the hub bore is correctly tapered. (d) Check, by means of engineer's blue, that the hub is well seated at both ends. THE HUB JOURNAL MUST EXTEND PAST THE LARGE DIAMETER OF THE STUB AXLE TAPER. IT MUST NEVER EXTEND BEYOND THE SMALL DIAMETER OF THE TAPER. IF JOURNAL FITTING IS INCORRECT THE HUB MUST BE REPLACED. CLEAN STUB AXLE, TAPER OF HUB BORE, AND FRICTION SURFACE OF THE BRAKE DRUM WITH ALCOHOL. Fit key and engage hub on stub axle, ENSURING THAT KEY HAS NOT SHIFTED (TO DO THIS, INSERT SMALL 2 MM. METAL STRIP INTO KEY-WAY). Before mounting, lubricate face of hub nut. By means of spanner 1810-T and torsion wrench 2472-T (see Drawing 42), tighten nut to a tension of 30 mkg. (216 foot pounds). Fit split pin and open out against flat of nut.	Torsion wrench 2472-T Spanner 1870-T
26	FIT SHOCKABSORBERS Tighten nuts and fit split pins (see Operation 133 to identify shockabsorbers).	Universal joint spanner 21
27	Paint front axle.	
28	Remove axle from stand.	

	REMOVING TRANSMISSION (See Drawing 41)	
1	Jack up front of vehicle, block it under lower link arm, and slacken universal coupling bolts.	
2	Remove wheel.	Wheelbrace
3	Remove brake drum by means of extractor 1750-T and collets 1819-T (see Drawing 42, fig.1).	Spanner 1810-T Collets 1819-T Extractor 1750-T
4	Uncouple track rod from swivel arm using ball-joint extractor 1964-T (see Drawing 37).	Box spanner 21 Extractor 1964-T
5	Remove outer ball-race slotted ring nut (4) from stub axle, using spanner 1825-T (see Drawing 43)	Box spanner 8 Spanner 1825-T
6	Remove outer stub axle ball-race (15) using extractor 1750-T and collets 1819-T (see Drawing 42). Take out distance piece (16) by hand.	Collets 1819-T Extractor 1750-T
7	Prevent drive shaft from turning by means of vice 1830-T (see Drawing 47A). Remove ring nut (17) of inner stub axle bearing (right hand thread for left hand stub axle and left hand thread for right hand stub axle). Use spanner 1826-T (see Drawing 47) held in position by stub axle nut.	Vice 1830-T Spanner 1826-T
8	Remove lower ball joint (5) by means of extractor 1851-T (see Drawing 44).	Box spanners 10 - 19 Extractor 1851-T
9	Unscrew sheet metal grease retaining cap from coupling yoke end. Disengage swivel from lower link arm, lift sufficiently to disengage cardan shaft on the gearbox side, and wedge the assembly at this height to permit withdrawal of shaft when dismantling later.	
10	Remove drive shaft from swivel. Use tool 1824-T (see Drawing 48).	Tool 1824-T
11	Remove inner bearing and oil seal (30) from swivel, using tool 1824-T (see Drawing 48).	Tool 1824-T
12	Uncouple drive shaft coupling from gearbox flange.	Flat spanner 14
	REFITTING TRANSMISSION (See Drawing 41)	
13	Connect drive shaft coupling to gearbox flange. TIGHTEN NUTS VERY FIRMLY AFTER FITTING 'BLOCFORT'	Flat spanner 14

	WASHERS.	
14	Fit S.P.I. joint (30), forming oil seal, into swivel. Fit inner swivel bearing (18) after lubrication (grease such as Mobilgrease 5) and engage transmission into bearing by means of tool 1824-T (see Drawing 60).	
15	Fit driveshaft to cardan, lubricating the splines thoroughly with grease similar to Mobilcompound and engage swivel with lower link arm. To ensure constant velocity IT IS ESSENTIAL THAT ONE AXIS OF ONE OF THE SPIDERS IN THE DOUBLE YOKE BE IN THE SAME PLANE AS ONE AXIS OF THE SPIDER IN THE SINGLE YOKE. In practice this is obtained when the greasers of the drive shaft and cardan coupling are in line.	
16	Fit lower swivel ball joint (5). (For adjustment, see Operation 120, paragraphs 23b and c).	Box spanners 10 - 19
17	Prevent drive shaft from turning by means of vice 1830-T (see Drawing 47A). Tighten inner swivel bearing ring nut (17) to a tension of 10 mkg. (72 foot pounds). Use spanner 1826-T (see Drawing 47). Turn back two tabs of lockwasher into slots of ring nut. Position bearing and shaft in swivel by means of tool 1824-T (see Drawing 60).	Spanner 1826-T Tool 1824-T Vice 1830-T
18	Pack swivel with 0.100 kg. ($\frac{1}{4}$ pound) of grease (similar to Mobilgrease 5) and fit distance piece (16).	
19	Fit stub axle outer bearing (15) by means of tool 1824-T (see Drawing 60).	Tool 1824-T
20	Tighten outer ball-race ring nut (4), to a minimum tension of 15 mkg. (108 foot pounds), using spanner 1825-T (see Drawing 43). Lock ring nut by fitting lock tab into one of the slots. Fit lock tab to one of the holes in swivel and plug the other swivel hole with a screw fitted with spring washer under head.	Spanner 1825-T Box spanner 8
21	Fit hub and brake drum (for fitting precautions, see Operation 120, paragraph 25).	Torsion wrench 2472-T Spanner 1810-T
22	Tighten sheet metal grease retaining cap to coupling yoke end.	
23	Fit wheel.	Wheelbrace
24	Lower vehicle to ground.	

	REMOVING OF FRONT AXLE UPPER LINK ARM (See Drawing 45)	
1	Jack up front of vehicle and place stand under lower link arm.	
2	Remove wheel.	Wheelbrace
3	Remove upper ball joint. Use spanner 1852-T and ball extractor 1850-T (see Drawing 44).	Spanner 1852-T Extractor 1850-T Box spanner 22
4	REMOVE UPPER LINK ARM (a) Unscrew spindle nuts (8) and remove washers. Unscrew slotted ring nut (9) of front bush (34) remove the bush (this is easily done with the use of a screwdriver and with upper link arm forced to the rear).	Flat spanner 23 Adjustable spanner
	(b) Loosen clamp bolts (10). Disengage spindle towards the front by unscrewing it with a flat spanner, pair of grips, or preferably, by mounting lock nuts on the threaded front end of the spindle and unscrewing the assembly. Remove link arm.	Box spanner 17 Flat spanners 17 and 23
	RECONDITIONING OF FRONT AXLE UPPER LINK ARM	
5	STRIPPING OUT LINK ARM (See Drawing 41) (a) Remove protective leather (40) then ball joint bearing (41) by use of a drift. Remove greasers.	Drift Flat spanner 14
	(b) Remove rear bush (35) by means of a press (see Drawing 45).	Mandrels small dia. 21.5, length 40 large dia. 34, length 110
6	RE-ASSEMBLE LINK ARM (See Drawing 45).	
	(a) Fit bush (35) by means of a press and using a mandrel. Fit front bush (34), tighten ring nut (9). To prevent bush wear, the dimension 'a' between the inner faces of the bushes must be 139.45 mm., plus or minus 0.1 mm., and the two faces must also be parallel within 0.1 mm. Check these conditions with gauge MR.3507. Bore grease holes.	Mandrels small dia. 21.5, length 40 large dia. 34, length 110
	(b) Ream the two bushes. Use aligning reamer 1860-T.	Reamer 1860-T
	(c) Fit ball joint bearing (41). Ensure that bearing is correctly seated in upper link housing. Fit greasers.	

	REFITTING OF FRONT AXLE UPPER LINK ARM	
7	Fit upper link arm to front axle (see Operation 120, paragraph 22).	Box spanner 17 Flat spanners 17 - 23 Adjustable spanner Universal joint spanner 28
8	Fit upper ball joint (see Operation 120, paragraph 23a). Swivel movement must take place under a load of 2.5 mkg. (18 foot pounds) with both upper and lower ball joints fitted.	Universal joint spanner 26 Spanner 1852-T
9	Fit wheel.	Wheelbrace
10	Lower vehicle to ground.	
11	Adjust caster angle (see Operation 149, paragraphs 1, 2 and 3).	

	REMOVING OF STEERING (See Drawing 63)	
1	Jack up front of vehicle, blocking it at a height of about 550 mm. to allow withdrawal of steering towards the front.	
2	Remove steering wheel with the aid of steering wheel extractor 1950-T (see Drawing 62). Remove key.	Extractor 1950-T Box spanner 32
3	Disengage track rods (1) from steering arms, using ball joint extractor 1964-T (see Drawing 37).	Box spanner 21 Extractor 1964-T
4	Remove fixing screws of movable steering brackets (2).	Ball joint spanner 12
5	Disengage steering towards the front (the fixed tube remains in the vehicle).	
	REMOVING OF FIXED TUBE	
	See operation 124, paragraphs 2, 3, 4 and 5.	
	REFITTING OF FIXED TUBE	
	See operation 124, paragraph 6, 7, 8 and 11.	
	REFITTING OF STEERING (See Drawing 63)	
6	The car is still blocked up with the lower link arms about 550 mm. above floor level. Engage steering column in fixed tube. Fix the movable brackets (2) under hull. Fit steering provisionally and turn from left to right to ensure that steering is free.	Ball joint spanner 12
7	Adjust height of steering wheel. With steering loosely held in movable brackets (2) and with the fixed tube freed from dashboard and bulkhead:- Bring lowest part of steering wheel to a height of 505 mm. plus or minus 5 mm. from floor carpet. Tighten clamp screws (3) of movable brackets, tighten half brackets on dashboard and the attachment to bulkhead. Adjust height of column, so that it does not scrape on steering wheel, yet engages by several mm. in the wheel recess.	
8	Check concentricity of steering column in the fixed tube. Steering column eccentricity must not	Box spanners 14-17

	exceed 4 mm. Check by means of bush MR.3102 (see Drawing 62, fig.3).	Checking bush MR.3102
9	Lock clamp screws (3) of the brackets and test operation of steering again. If obstruction is noticeable it can only be due to the fixed tube not being concentric. Check again the positioning of the latter.	Box spanner 14 - 17
10	Fit ball-pins (4) of track rods (see Drawing 64, fig.4), dust shield (5), fitted with Belleville washer and rubber cover. Offer up ball pin to tapered bore in track rod. Measure with feeler gauges, clearance between face of track rod eye and Belleville washer. Insert shims (6) to give a clearance of 0 mm. to 0.25 mm. Tighten nuts and fit split pins.	Box spanner 21
11	Line up front and rear wheels. Fit steering wheel, with key in key-way corresponding to one of the steering wheel spokes, and tighten nut. The position of the two upper steering wheel spokes must permit the driver full view of the instrument panel. Fit combined horn and lighting switch.	Box spanner 32
12	Adjust track (see Operation 149, paragraphs 4 and 5).	
13	Adjust steering lock (see Operation 149, paragraphs 6, 7, 8 and 9).	
14	Lower vehicle to the ground.	

	REMOVING OF OUTER TUBE	
1	Remove steering wheel by means of steering wheel extractor 1950-T (see Drawing 62)	Box spanner 32 Extractor 1950-T
2	Remove combined horn and lighting switch.	
3	Remove nuts fixing bracket to instrument panel. Loosen fixing screws of half brackets on bulkhead in order to relieve pressure on rubber bush and to permit removal of outer tube. Remove outer tube.	Box spanner 14
4	Remove bracket fixing outer tube to instrument panel (by hand).	
5	Remove half brackets on bulkhead.	Box spanner 14
	FITTING OF OUTER TUBE	
6	Place half brackets on bulkhead (do not tighten screws).	
7	Fit bracket to outer tube (approximately 180 mm. from top end).	
8	Offer up outer tube. Steering column eccentricity in relation with outer tube must not exceed 4 mm. Check this with the aid of bush MR.3102 (see Drawing 62, fig.1). If eccentricity is over the limit adjust position of outer tube brackets in their slots, and then tighten brackets.	Checking bush MR.3102 Box spanner 14
9	Fit inner rubber bush to outer tube. For easy assembly, coat this bush with either castor oil or Lockheed fluid	
10	Line up front and rear wheels. Fit steering wheel, with key in key-way corresponding to one of the steering wheel spokes so that clear vision of the instrument panel is obtained. Tighten steering wheel nut	Box spanner 32
11	Fit combined horn and lighting switch.	

	DISMANTLING OF STEERING (See Drawings 63 and 64).	
1	Place steering assembly, held in clamp MR.1561 (see Drawing 65), in a vice. Never grip by the steering column or box.	Clamp MR.1561
2	Remove right and left track rods by means of ball extractor 1964-T (see Drawing 37)	Box spanner 21 Extractor 1964-T
3	Remove steering column rubber bush (7). Remove steering column (8).	Box spanner 14
4	Remove rack guide (9) by removing plate (10).	Box spanner 14
5	Remove right and left ends caps (12 and 11). (Use spanner 1975-T, see Drawing 66, fig.3).	Spanner 1975-T Flat spanner 14
6	Remove right hand movable steering bracket (2) and right hand concertina rubber. Disengage ball joint cover (13).	Box spanner 17
7	Slide rack to the right. Remove split pin, unscrew slotted nut forming guide ball (14), and disengage retaining tube (15) from ball pin seating by using spanner 1976-T (see Drawing 66). Remove ball pin sealing plate (16), remove right hand ball pin (17). Bring dowel (18) of protecting sheath to face release aperture 'a' in steering box tube (see Drawing 64, fig.1). Remove dowel, take out remaining ball pin as well as the rack and sliding protecting sheath (19).	Box spanner 10 Spanner 1976-T
8	Remove left hand concertina rubber.	
9	Remove lower bearing cup from steering box. Moderately heat outside of aluminium steering box, using a blow pipe at the level of the bearing cup. The slight expansion of the box will permit free withdrawal of cup without use of tool.	Blow pipe
10	Strip out right and left track rods (see Drawing 64, fig.4). Remove ball pin adjusting nuts (20) using spanner 1870-T (see Drawing 66), disengage cups (21), remove end adjusting sockets (22).	Spanner 1870-T Box spanner 14
11	Clean the parts.	
	ASSEMBLING OF STEERING (See Drawings 63 and 64).	
12	Fit lower bearing cup into steering box by means of a bronze drift. ENSURE THAT THIS CUP IS CORRECTLY SEATED IN THE STEERING BOX BORE.	

13	Place steering box, held in clamp MR.1561, in a vice (see Drawing 65).	Clamp MR.1561
14	ASSEMBLE, AND ADJUST, STEERING COLUMN WITH PINION FITTED (a) Engage steering column (8) into steering box, followed by the upper bearing and its cup (23). Adjust bearings TO MOVE FREELY BUT WITHOUT PLAY, by means of shims (24) chosen from those listed in the Spare Parts Catalogue and placed between steering box and closing plate (25).	
	(b) After adjusting, pack bearings with grease similar to Mobilcompound. Refit cover plate (25) which HAS ONE MACHINED FACE. THIS FACE MUST BE FITTED AGAINST THE BEARING CUP. Fit grease retaining felt and its cap. Fit nuts with spring washers, and tighten.	Box spanner 14
15	ASSEMBLE STEERING RACK (a) If ball-nut or steering box tube has been replaced, ensure that there is 0.05 mm. clearance, slotted ball nut (14) and steering box tube (26). Undertaken the following operation (see Drawing 64, fig.3):- Fit and lock right hand movable bracket (2) to steering box tube (provisional assembly) Engage ball-nut with retaining tube (15). At the same time introduce a shim 0.05 mm. thick and 8 mm. wide. The tube serves to carry nut and shim along a distance of about 140 mm. approximately (distance representing travel of the rack). Nut and shim must slide freely and without play at the point where the steering box tube is gripped by the movable bracket.	
	(b) Fit left hand movable bracket (2). Fit concertina rubber on steering box tube (26), the smaller diameter of rubber against the bracket.	
	(c) Fit rack (having previously lubricated it with grease similar to Mobilcompound), the sliding protecting sheath (19) (ELONGATED HOLE ON RIGHT HAND SIDE). Fit left hand ball-pin (17) with its cup seatings (28), (and distance piece in the case of large model cars).	
	(d) Fit dowel (18) of protecting sheath, tighten nut on copper washer. Fit second ball-pin and its cup seatings.	Box spanner 10
	(e) Fit retaining tube (15) and damper spring (29), tighten with spanner 1976-T. Screw fully home then release one-sixth of a turn. Check tightening of ball-pins which must turn by hand without obstruction. Hold the retaining tube with spanner 1976-T (see Drawing 66) and tighten ball-nut (14). Fit split pin without slackening nut. If split pin hole does not line up with one of the nut slots, drill a new hole at slot farthest removed from original split pin hole. Prevent any drill swarf falling into steering box by plugging tube aperture with a rag.	Spanner 1976-T
16	ADJUST MESH OF RACK AND PINION Position steering wheel. In order to obtain clear vision of the instrument panel between two	

spokes, adjust mesh in the following manner:-

(a) Place steering wheel on steering column with key fitted into keyway corresponding to one of the steering wheel spokes.

(b) Move this spoke into vertical position, pointing downwards.

(c) Mesh rack with pinion by turning steering wheel one and a half turns. If the mesh is correct the rack will then protrude by 37 mm., plus or minus 2 mm. from the face of the aluminium steering box. If it does not, put mesh backwards or forwards by one tooth.

17 ADJUST RACK GUIDE (See Drawing 63)

Engage rack guide (9) in housing in steering box, WITHOUT THE SPRING, fit closing plate (10) the machined face against the box. Fit adjusting shims (30) so as to obtain normal mesh without play or obstruction. A PLAY OF 0.1 mm. to 0.2 mm. BEING NECESSARY to prevent pinion teeth fouling the roof of rack teeth, a shim, 0.1 mm. to 2 mm. thick, must be added to those previously fitted. Remove plate (10) and fit it again with spring (31). Fit spring washers to screws and tighten. If spring pressure is insufficient (steering too light) insert washers (27) between spring and guide. If spring pressure is too great (steering too hard) fit shim (30) between plate and steering box.

Box spanner 14

18 Fit ball-pin sealing plate (16) (longer part on the left hand side). Fit ball-pin upper and lower covers (13). After fitting, pinch and turn down slide ends of upper cover so that the lower slide is carried along by the upper slide when the rack moves. Fit right hand concertina rubber, with smaller diameter against bracket, the right hand movable bracket without tightening as its final position will be determined when assembly is fitted to car. Tighten concertina rubbers WITHOUT USE OF PIN (to prevent scoring), positioning hose clips so that heads of tightening split pins protrude away from concertina rubbers. This is necessary to avoid tearing off the rubber when split pins are being tightened.

19 Fit lock nuts (32) of right hand end cap fitting a lockwasher between locknut and cap. Fill cap with grease (similar to Mobilcompound) and screw on provisionally. HALF FILL ONLY, with the same lubricant, the left hand cap (11), fit paper gasket and tighten nuts fitted with spring washers.
The amounts of grease with which the caps have been lubricated (about 340 grammes - three quarters of a pound) **must** not be exceeded or the steering will leak when working. Fit steering column rubber bush (7). Fit the hose clip with split pin head away from the rubber bush.

Box spanner 14

20 PREPARE TRACK RODS (See Drawing 64, fig.4).
Loosen and articulate the adjustable sockets on the rods (if necessary, touch up socket threads by means of a thread file and taps). After lubricating threads fit sockets (22) to rods, taking

Tap 22 dia. x 100
Thread file 22 dia. x 100

	care to engage both simultaneously. Provisionally adjust sockets to obtain a distance (for all types) of 563 mm., plus or minus 0.2 mm., between ball pins, by using gauge MR.3340 (see drawing 67). Fit track rod ball pins (4) and cups (21) both being previously lubricated. Fit retaining springs for cups and tighten adjusting nuts (20) to a tension of 8 mkg. (57½ foot pounds) (by means of spanner 1870-T, see Drawing 66). Unscrew one eighth of a turn maximum and fit split pins.	Gauge MR.3340 Spanner 1870-T
21	FIT TRACK RODS (See Drawing 64, fig.1) Fit protecting rubbers (33) stems of rack ball pins. Remove all grease from tapers of ball pins and tapered bores of adjustable sockets with alcohol. Righten nuts and fit split pins.	Flat spanner 21
22	Remove steering assembly from clamp MR.1561.	

	REMOVING OF REAR AXLE	
1	Lift vehicle (using bracket or jack attachment MR.3300-110, see Drawing 67A). Block it up at approximately the floor height in order to disengage the rear wings.	Bracket MR.3300-110
2	Remove rear wheels.	Wheelbrace
3	Remove silencer (see Operation 142).	Box spanners 12 - 17
4	Remove shock absorbers.	Universal joint spanner
5	Disconnect Lockheed brake pipe from three-way union, brake cables from handbrake cross-shaft. Uncouple petrol pipe from single clip and move it away from underneath hull to allow for the passage of the tubular crossmember.	Flat spanner 14 Box spanner 12
6	Remove front three fixing bolts of both rear wings, in order partly to disengage wings from hull and to give access to the adjusting screw and locknut (18) (see Drawing 68).	Box spanner 14
7	If necessary, remove carpet from lower part of door opening.	
8	Loosen nuts and sleeves fixing rear crossmember with the aid of spanner 2050-T (see Drawing 68).	Spanner 2050-T
9	Remove front bolts and pins fixing rear tubular crossmember.	Box spanners 17 - 26
10	Remove rear axle.	
	REFITTING OF REAR AXLE	
11	Place gauges MR.3338 on upper rear shock absorber pins on hull (see Drawing 69).	Gauges MR.3338
12	Bring axle beneath vehicle, first of all engage link arms, then lift axle so as to fit lower shock absorber pins into slot of gauges. (The balance and support of the whole axle is better assured thus than by use of a jack). Tighten the pins and bolts fixing the tubular crossmember end plates with shakeproof washers under all heads. Tighten also the nuts, fitted with shakeproof washers, of the sleeves with the aid of spanner 2050-T (see Drawing 68).	Box spanners 17 - 26 Spanner 2050-T
13	Connect Lockheed brake pipe to three-way union. Fit hand brake cables to cross-shaft. Adjust tension of cables so that brakes are engaged on third notch of ratchet and wheels lock on the fourth notch.	Box spanner 12 Flat spanner 14

14	Fit silencer (see Operation 142).	Box spanners 12 - 17
15	Remove gauges MR.3338. Fit both shock absorbers, tighten nuts and fit split pins.	Universal joint spanner 21
16	Bleed Lockheed system (see Operation 150).	
17	Fit both rear wheels.	Wheelbrace
18	Lower vehicle to the ground. Use bracket of jack attachment MR.3300-110 (see Drawing 67A).	Bracket MR.3300-110
19	Adjust heights (see Operation 151, paragraphs 1, 2, and 3).	

	REMOVING OF REAR AXLE	
1	Jack up vehicle (using bracket or jack attachment MR.3300-110, see Drawing 67A). Block it up at approximately the height of the rear floor.	Bracket MR.3300-110
2	Remove both rear wheels.	Wheelbrace
3	Remove rear shock absorbers	Universal joint spanner 21
4	Remove silencer (see Operation 142).	Box spanners 12 - 17
5	Disconnect Lockheed brake pipe from three-way union on crossmember and handbrake cables from cross-shaft.	Flat spanners 12 - 14
6	Remove tie-rod (1) (see Drawing 70). Begin by removing nut (32) on tubular crossmember to prevent the rod turning.	Flat spanners 21 - 29
7	Remove torsion bar retaining plates (2). Fit split block MR.1578 to one torsion bar (see Drawing 71). Knock torsion bar out from centre bracket and repeat same operation for the second bar. Place gauges MR.3338 (see Drawing 69) on shock absorber pins to support the axle assembly while removing silentblocs. Remove screws fixing silentblocs (5) (see Drawing 72).	Flat spanners 12 - 16 Block MR.1578 Gauges MR.3338 Brace spanner with extension 16
8	Remove the assembly from vehicle.	
	REMOVING OF TUBULAR CROSSMEMBER (CRUCIFORM AXLE ASSEMBLY HAVING BEEN REMOVED)	
9	Remove exhaust pipe bracket from crossmember. Disconnect petrol pipe from union and from clip on hull and disengage it outwards to permit free passage of the crossmember.	Flat spanner 14 Box spanner 12
10	Remove set screws fixing crossmember to hull (three screws on each end plate which unscrew from inside the vehicle)	Box spanners 17 - 26 - 35
11	Remove crossmember from hull with the aid of a lever.	
	REFITTING OF TUBULAR CROSSMEMBER	
12	Fit tubular crossmember to hull. Tighten fixing screws.	Box spanners 17 - 26 - 35

	FITTING OF REAR AXLE (See Drawing 72)	
13	Place axle assembly under the vehicle. Fit lower shock absorber pins into intermediate holes of gauges MR.3338 (see Drawing 69). IN THIS POSITION, fit silentblocs to tubular crossmember. Tighten set screws (5) with spring washers fitted under heads.	Gauges MR.3338 Universal joint spanner with extension 16
14	FITTING OF TORSION BARS. (a) Fit lower shock absorber pins in slots of gauges.	
	(b) Torsion bars having been fitted to silentblocs, hold the axle in the bottom gauge slots and at the same time engage torsion bars in the splined centre bracket. (Move axle, if necessary, within the limit allowed by gauge slots). Complete torsion bar engagement by means of split block MR.1578 (see Drawing 71).	Block MR.1578
	(c) Fit torsion bar retaining plates (2) (see Drawing 70). Tighten screws with spring washers fitted under heads.	Box spanner 12
15	Fit tie-rod (1). Secure with split pins (30).	Flat spanners 21 - 29
16	Connect Lockheed brake pipe, petrol pipe, bracket for exhaust pipe on crossmember.	Flat spanners 12 - 14 - 17
17	Fit and adjust hand brake cables (see Operation 150, paragraph 3).	Flat spanner 12
18	Remove gauges MR.3338. Fit shock absorbers. Fit silencer.	Box spanners 12 - 17 Universal joint spanner 21
19	Adjust offset of axle using gauge 2051-T (see Drawing 79).	Gauge 2051-T
20	Bleed Lockheed system (see Operation 150, paragraph 5).	
21	Fit the two rear wheels.	Wheelbrace
22	Lower vehicle to the ground. Use bracket or jack attachment MR.3300-110 (see Drawing 67A).	Bracket MR.3300-110
23	Adjust heights (see Operation 151, paragraphs 1, 2 and 3).	

	REMOVING REAR AXLE ASSEMBLY	
1	Lift the vehicle (using bracket or jack attachment MR.3300-110, see Drawing 67A). Block it up under hull at approximately the forward point of the rear wings.	Bracket MR.3300-110
2	Remove wheels and hubs and brake drums.	Wheelbrace Adjustable spanner
3	Disconnect Lockheed brake pipes and remove them from guides on link arms.	Flat spanners 17 - 19 - 21
4	Remove brake back plates (clean brake cable sheaths with a wire brush and lubricate them to ease their sliding in the guides). Remove back plates from axle without disconnecting the brake cables. Remove tie-rod (1) (see Drawing 70).	Flat spanners 21 - 29 Brace spanner with extension 14 Wire brush
5	Remove shock absorbers from lower pins on axle.	Universal joint spanner 21
6	With the aid of a screwdriver, disengage link arms from axle studs. Place of stretcher between link arms with stretcher ends resting on brackets forming brake sheath guides. Force out link arms and withdraw axle beam. Remove stretcher.	Stretcher 1200 mm.
	FITTING OF AXLE ASSEMBLY (see Drawing 70)	
7	Fit stretcher as indicated for removing axle. Engage axle beam and withdraw stretcher.	Stretcher 1200 mm.
8	Fit tie-rod (1). Secure with split pins.	Flat spanners 21 - 29
9	Fit shock absorbers on axle studs.	Universal joint spanner 21
10	Fit brake back plates and Lockheed pipes.	Brace spanner with extension 14 Flat spanners 17 - 19 - 21
11	Fit hubs and brake drums, tighten nut (31) to a tension of 10 mkg. (72 foot pounds), then slacken one quarter of a turn approximately to obtain an end play of about 0.05 mm. to 0.17 mm., which will allow THE NUT TO BE TURNED BY HAND. FIt split pin. Pack hub caps with 0.080 kg. (3 ozs.) of grease (similar to Mobilgrease 5), and tighten caps to a tension of 5 to 6 mkg. (36 to 43 foot pounds).	Adjustable spanner
12	Adjust offset of axle. Use gauge 2051-T (see Drawing 79).	Gauge 2051-T

13	Bleed Lockheed brake system (see Operation 150, paragraph 5).	
14	Paint axle.	
15	Fit wheels.	Wheelbrace
16	Lower vehicle to the ground. Use bracket or jack attachment MR.3300-110 (see Drawing 67A).	Bracket MR.3300-110

	REMOVING OF AXLE	
1	Jack up vehicle (using bracket or jack attachment MR.3300-110, see Drawing 67A). Block it up under hull at a point level with front tips of rear wings.	Bracket MR.3300-110
2	Remove rear wheels.	Wheelbrace
3	Remove silencer (see Operation 142).	Box spanners 12 - 17
4	Remove rear shock absorbers.	Universal joint spanner 21
5	Disconnect Lockheed brake pipes and handbrake cables from cross-shaft.	Flat spanners 12 - 14
6	Remove tie-rod (1). (First remove nut (32) on tubular crossmember to prevent tie-rod from turning). (See Drawing 70).	Flat spanners 21 - 29
7	Remove torsion bar retaining plates (2). Fit split block MR.1578 (see Drawing 71) to one torsion bar. Knock torsion bar out of centre bracket then repeat operation for second bar. Fit guages MR.3338 (see Drawing 69) to shock absorber pins in order to support axle assembly when removing silentblocs. Remove screws (5) fixing silentblocs to tubular crossmember (see Drawing 72).	Flat spanners 12 - 16 Block MR.1578 Gauges MR.3338 Brace spanner with extension 16
8	Disengage assembly of rear axle beam and link arms from the vehicle.	
	FITTING OF REAR AXLE	
9	Fit gauges MR.3338 on upper shock absorber pins (see Drawing 69).	Gauges MR.3338
10	Place axle assembly under car. Raise axle assembly and fit lower shock absorber pins in intermediate holes of gauges.	
11	Fit silentblocs to tubular crossmember. Tighten screws (5) with spring washers fitted under heads (see Drawing 72).	Universal joint spanner with extension 16
12	Remove gauges from lower shock absorber pins and refit the pins into lower slots of gauges. (For this operation, fairly considerable weight must be exerted upon the link arms).	
13	FIT TORSION BARS NOTE:- RIGHT HAND TORSION BARS ARE IDENTIFIED BY ONE PAINT MARK AND THE LEFT BY TWO.	

	Torsion bars having been fitted to silentblocs, hold the axle in the bottom gauge slots and at the same time engage torsion bars in the splined centre bracket. (Move axle, if necessary, within the limit allowed by gauge slots). Complete torsion bar engagement by means of split block MR.1578 (see Drawing 71). Fit torsion bar retaining plates (2), tighten screws fitted with spring washers under heads (see Drawing 70).	Block MR.1578 Box spanner 12
14	Fit tie-rod (1). Secure with split pin (30).	Flat spanners 21 - 23
15	Connect Lockheed brake pipes and petrol pipes.	Flat spanners 14 - 17
16	Fit and adjust hand brake cables (see Operation 150, paragraph 3).	Flat spanner 12
17	Remove gauges MR.3338. Fit shock absorbers and the silencer.	Universal joint spanner 21 Box spanners 12 - 17
18	Adjust offset of axle using gauge 2051-T (see Drawing 79). Tighten nuts (32).	Gauge 2051-T Flat spanner 29
19	Bleed Lockheed brake system (see Operation 150, paragraph 5).	
20	Fit rear wheels.	Wheelbrace
21	Lower vehicle to the ground. Use bracket or jack attachment MR.3300-110 (see Drawing 67A).	Bracket MR.3300-110
22	Adjust heights of hull from ground (see Operation 151, paragraphs 1, 2 and 3).	

	DISMANTLING OF REAR AXLE (See Drawings 70 and 72).	
1	Place assembly on a suitable stand.	
2	Remove Lockheed brake pipes.	Flat spanners 8 - 12 - 14 - 17 - 19
3	Remove hubs and brake drums (3).	Adjustable spanner
4	Remove brake back plates (4). (Clean brake cable sheaths with a wire brush and lubricate them to ease their sliding in the guides).	Brace spanner with extension 14. Wire brush
5	Remove tie-rod (1). (First remove nut (32) at tubular crossmember end to prevent rod from turning).	Flat spanners 21 - 29
6	Remove torsion bar retaining plates (2). Fit split block MR.1578 (see Drawing 71) on torsion bar (towards centre portion). Disengage bars from centre bracket. Remove screws (5) fixing silentblocs. Remove link arms. Knock torsion bars out of silentblocs (see Drawing 72).	Brace spanner with extension 17 Flat spanner 12 Block MR.1578
7	REMOVE SILENTBLOCS FROM LINK ARMS (See Drawings 70 and 72) (a) Remove circlips (6) from trunnion pins (7) and (17) of the adjusting rods (14). Knock out the pins.	
	(b) Remove circlips (8) from silentbloc ring nuts. Remove ring nuts (9) and take out hubs (10).	Flat spanner 23 Adjustable spanner
8	STRIP OUT BRAKE BACK PLATES (one plate at a time) (see Drawing 73). (a) Remove return spring (19), using pliers 2110-T (see Drawing 50), brake shoes (27) and (28), wheel cylinder (21), and handbrake cables.	Box spanners 10 - 14 - 21 Pliers 2110-T
	(b) Remove adjusting cams (22). Knock out cam pins by means of a punch.	Punch 8 dia.
9	STRIP OUT WHEEL CYLINDERS (all parts can be removed by hand). Remove dust covers (23), pistons (24), cups (25) and spring (26).	
10	STRIP OUT HUBS AND BRAKE DRUMS Knock out inner bearing cups with the aid of a drift.	Drift
11	Clean parts.	

CHECKING CAMBER AND TOE-IN OF CRUCIFORM AXLE

12 CHECK CAMBER (See Drawing 74)

(a) A lathe of capacity at 1800 mm. (72 ins.) between centres, and 225 mm. (9 ins.) between centres and bed is required. Set up axle to be checked in lathe. On stub axles mount tool 2052-T VERTICALLY, and located by the wheel studs (if still in axle) or by a screw (if studs have been removed). The axle must be in its normal position, that is to say, the buffers must be at the top. Fix tool to stub axle with a nut. Tool 2052-T

(b) Rotate the axle one quarter of a turn to bring lower finger of tool 2052-T into contact with a straight edge held in lathe tool-post (see Drawing 74, fig.1).

(c) Rotate the axle one half of a turn to bring the other finger of the tool against the straight edge. The distance between this finger and the straight edge should be between 7.3 mm. and 11.3 mm.

(d) If the dimension obtained is not within the limits specified, remove the axle from the lathe and correct by BEATING OUT (COLD), the upper web if the camber is insufficient, or the lower web if it is too great.
Later types of reinforced cruciform axles can only be corrected in the cold state by means of a press.

(e) Proceed as above for the other side of the axle.

13 CHECK TOE-IN OF AXLE (See Drawing 74).

(a) With the axle set up in lathe as on vehicle (with buffers at the top), position tool 2052-T HORIZONTALLY on stub axle, located by wheels studs (if still in axle) or by a screw (if studs have been removed). Fix tool with nut on axle stub.

(b) Bring forward index finger into contact with straight edge held in lathe tool-post.

(c) Rotate the axle half a turn to bring the other finger of the tool against the straight edge. The distance between this finger and the straight edge should be from 0 mm. to 2 mm. THE LESSER DISTANCE SHOULD BE TOWARDS FRONT OF AXLE. Correct axle, if necessary, by beating out rear web if toe-in is insufficient and front web if it is too great.
Reinforced cruciform axles can only be corrected in the cold state by means of a press.

(d) Proceed as above for the other side of the axle.

	RE-ASSEMBLING OF REAR AXLE (See Drawings 70 and 72).	
14	REPLACE SHOCK ABSORBER PIN (a) Remove arc welding with the use of a chisel.	
	(b) Unscrew pin.	Flat spanner 26
	(c) Fit new pin and tighten well (15 mkg. (108 foot pounds) approximate tension).	Flat spanner 26
	(d) Lock pin by arc welding to avoid heating the axle.	
15	RE-ASSEMBLE WHEEL CYLINDER Use only alcohol or Lockheed fluid to clean parts, any other substance quickly harms the rubber cups. Lubricate cylinder and cups with Lockheed fluid before assembling (see Drawing 73 for order of assembling parts).	
16	RE-ASSEMBLE BRAKE BACK PLATES (re-assemble plates successively) (see Drawing 73). Fit adjusting cams (22), rivetting over pins (with the aid of assembly MR.3354, see Drawing 51). Fit handbrake cable, tighten brackets fixing cable to plate. Fit anchor pins (20). Fit connecting link to brake lever by hand. Fit this lever to brake shoe (28). Hook brake cable on lever and fit brake shoes (27) and (28) (linings must be quite dry and show no traces of oil) (the shoe with the shorter lining is fitted at the rear). Lightly oil adjusting washers (29) of the guide studs. Tighten anchor pin nuts (20) to a tension of 3 mkg. (21½ foot pounds) and fit split pins. Fit wheel cylinder (21). Hook on return spring (19) to brake shoes using pliers 2110-T (see Drawing 50). Check that brake shoes operate normally and that there is sufficient pressure on them from the guide stud washers.	Pliers 2110-T Box spanners 10 - 12 - 14 - 21 Assembly MR.3354
17	REPLACE WHEEL STUDS IN BRAKE DRUM. TRUE UP BRAKE DRUMS. (a) Use assembly MR.3445 (see Drawing 52) in order to ensure drum seats correctly on the studs in order to prevent casting cracking. NEVER COMPLETELY DISENGAGE THE DRUM FROM THE HUB. REPLACE STUDS ONLY ONE OR TWO AT A TIME. The drum is carefully assembled to the hub in our works since faulty centering would result in vibration when braking. Rivet over studs with a press of 8 to 10 tons capacity (in the absence of a press the operation can also be undertaken with a hammer and punch).	Assembly MR.3354
	(b) Drill hole for dowel set away from its former position. Drive in dowel and ensure that it does not stand proud. Punch casting to retain dowel.	
	(c) Fit bearing cups into hubs.	
	(d) Machine the drum in a lathe and mounted on mandrel MR.3381-2 (see Drawing 76). The maximum	Mandrel MR.3381-2

	permitted tolerance of ovality is 0.06 mm. Check this by means of a clock gauge. Do not increase the original diameters of 255 mm. (for 10 inch drums) and 305 mm. (for 12 inch drums) by more than 2 mm.	
18	Fit inner bearing (33) having packed it with grease (similar to Mobilgrease 5). Fit S.P.I. joint (34) forming oil seal, by means of a press (the edge of the leather must be fitted on the bearing side) (see Drawing 70).	
19	PREPARE AND FIT SILENTBLOCS ON LINK ARMS (See Drawings 70 and 72)	
	(a) Remove and refit bearing silentblocs (11) by means of a press and mandrel and guide block MR.3335 (see Drawing 77).	Mandrel and guide block MR.3335
	(b) Engage on the hub (10) (the inner splines of which face towards outside of link arm), link arms (12), levers (13), adjusting rod (14) and its pin (7), friction washers (15) (with chamfer facing hub splines), silentblocs (16), and locking ring nuts (9).	
	(c) Fit in position fixtures MR.3336 (to grip bearings tightly and position them so that their flanges form an angle of 104° with centre-line of link arms) (see Drawing 72, fig.2).	Fixtures MR.3336
	(d) Tighten bearing ring nuts (9) to a minimum tension of 25 mkg. (180 foot pounds). After tightening ensure that threads protrude an equal amount either side.	Adjustable spanner
	(e) Remove fixtures MR.3336. Fit trunnion pin (17) and circlips (6).	
	(f) Drill hub to insert ends of circlip (8).	
20	CONNECT LINK ARMS AND FIT TORSION BARS	
	Right hand torsion bars bear one paint mark and the left hand bars two.	Universal joint spanner 17
	(a) Fit link arms on tubular crossmember after having engaged torsion bars in silentblocs and cruciform axle in link arms. Tighten silentbloc bearing screws (5) with spring washers fitted under heads (see Drawing 72, fig.1).	
	(b) Place a straight edge along upper face of tubular crossmember end flange. Lower the link arm so as to obtain a dimension of 155 mm. to 170 mm. between straight edge and upper part of rear eye of link arm (see Drawing 78). Fit torsion bars. Fit retaining plates (2) and tighten nuts fitted with spring washers.	Box spanner 12
	(c) Provisionally fit tie-rod (1). Secure with split pin (30).	Flat spanners 21 - 29
21	FIT BRAKE BACK PLATES. POSITION BRAKE SHOES	
	(a) Lubricate brake cable sheaths and fit them in brackets on link arms. Fit spring washers	Universal joint spanner 14

	under nuts of sheath brackets and tighten to a tension of 2 mkg. (14½ foot pounds). Tighten nuts fixing brake back plates to a tension of 2 mkg. (14½ foot pounds). Turn back lockwasher tabs.	
	(b) Position the four brake shoes. Use gauge 2103-T (see Drawing 80).	Gauge 2103-T Spanner 2120-T
22	FIT HUBS AND BRAKE DRUMS (See Drawing 70) Before fitting, pack inside of hub with 0.100 kg. (quarter of a pound) of grease (similar to Mobilgrease 5). Fit outer Timken bearing also packed with grease. Tighten stub axle nut (31) to a tension of 10 mkg. (72 foot pounds) and then slacken a quarter of a turn approximately, to give an end play of 0.05 mm. to 0.17 mm. THIS WILL ALLOW NUT TO BE TURNED BY HAND. Fit split pin. Fill hub caps with 0.080 kg. (3 ounces) of grease (similar to Mobilgrease 5). Tighten to a tension of 5 to 6 mkg. (36 to 43 foot pounds).	Adjustable spanner
23	Fit Lockheed brake pipes.	Flat spanners 8 - 12 - 14 - 17 - 19
24	Adjust offset of rear axle using gauge 2051-T (see Drawing 79). Tighten nuts (32).	Gauge 2051-T Flat spanner 29
25	Paint assembly.	

	DISMANTLING OF REAR AXLE (See Drawing 70)	
1	Place assembly on a suitable stand.	
2	Remove Lockheed brake pipes. Remove rubber buffers.	Box spanner 12 Flat spanners 14 - 17 - 19 - 24
3	Remove hubs and brake drums (3).	Adjustable spanner
4	Remove brake back plates (4). (Clean brake cable sheaths with a wire brush and oil them to ease their sliding in the guides). Remove axle link arms.	Brace spanner 14 Wire brush
5	Remove silentblocs from link arms (see Drawings 70 and 72) (see Operation 130, paragraph 7).	Flat spanner 23 Adjustable spanner
6	Strip out brake back plates (see Drawings 73 and 50) (see Operation 130, paragraph 8).	Box spanners 10 - 14 - 21 Pliers 2110-T Punch 8 dia
7	Strip out wheel cylinders (see Operation 130, paragraph 9).	
8	Dismantle hubs and brake drums (see Operation 130, paragraph 10).	Punch 8 dia.
9	Clean parts	
	CHECKING CAMBER AND TOE-IN OF CRUCIFORM AXLE (See Drawings 74 and 75)	
	(See Operation 130, paragraphs 12 and 13).	Tool 2052-T
	ASSEMBLING OF REAR AXLE	
10	Replace shock absorber pin (see Operation 130, paragraph 14).	Flat spanner 26
11	Assemble wheel cylinders (see Drawing 73) (see Operation 130, paragraph 15).	
12	Assemble brake back plates (see Drawings 73 and 50) (see Operation 130, paragraph 16)	Pliers 2110-T Box spanners 10 - 14 - 21 Assembly MR.3354

13	Replace wheel studs. Correct brake drums (see Drawings 52 and 76) (see Operation 130, paragraph 17).	Assembly MR.3445 Mandrel MR.3381-2
14	Fit rear bearing (see Operation 130, paragraph 18).	
15	Prepare and fit silentblocs on link arms (see Drawings 70, 72 and 77) (see Operation 130, paragraph 19).	Mandrel and guide block MR.3335 Fixture MR.3336 Adjustable spanner
16	Fit link arms to axle.	
17	Fit brake back plates. Position brake shoes (see Operation 130, paragraph 21).	Gauge 2103-T Spanner 2120-T Universal joint spanner 14
18	Fit hub and brake drums (see Operation 130, paragraph 22).	Adjustable spanner Box spanner 12
19	Fit Lockheed brake pipes. Fit axle rubber buffers.	Flat spanners 14 - 17 - 19 - 23
20	Paint assembly.	

	REMOVING OF FRONT TORSION BAR (See Drawing 38).	
1	Jack up vehicle at a point approximately under the scuttle in order to take all weight off the torsion bar to be removed. Take off wheel.	Wheelbrace
2	Remove torsion bar fixing screw (47). Screw head is located in silentbloc bore on the front axle cradle.	Box spanner 14 and tommy bar
3	Remove rear half bracket of crossmember under engine (48)	Box spanners 13 - 14 Flat spanner 14
4	Disengage adjusting lever (49). To facilitate this operation, jerk the whole link and swivel assembly by means of a long lever.	
5	Disengage torsion bar. Disengage bar from silentbloc on front axle cradle towards the rear. Tilt bar downwards and then remove it towards the front. Should torsion bar be difficult to extract from front silentbloc, use split block MR.1578 to extract it (see Drawing 71).	Block MR.1578
	REFITTING OF FRONT TORSION BAR (See Drawing 38). Right hand torsion bars bear one paint mark and the left hand two.	
6	With the vehicle remaining jacked up underneath the scuttle, engage torsion bar in half bracket of crossmember (48), then fit adjusting lever (49) with its ball-head screw completely unscrewed. Join both halves of crossmember and tighten up nuts fitted with spring washers. Bring the torsion bar in relation to the silentbloc (13) on the front axle cradle, and with the adjusting lever resting on ball-head of screw, lower the lower link arm about two splines with the aid of a long lever (so as to overcome silentbloc resistance). At this point introduce torsion bar into silentbloc. Complete fitting of bar by using draw-bar MR.3349 (see Drawing 40). Tighten torsion bar fixing screw (47) fitted with a spring washer under head.	Flat spanner 13 Box spanners 13 - 14 Draw-bar MR.3349
7	Fit wheel. Lower vehicle to the ground.	Wheelbrace
8	Adjust heights (see Operation 151, paragraphs 1, 2 and 3).	
9	Check weight distribution (see Operation 151, paragraphs 4, 5 and 6).	Weighing machine 2310-T

	REMOVING OF REAR TORSION BAR (See Drawings 70 and 72)	
1	Jack up vehicle underneath rear of hull.	
2	Take off wheel and shock absorber on the side on which torsion is to be removed. To remove left hand torsion bar, disengage tie-rod (1) from axle only. To remove right hand torsion bar, uncouple silencer from exhaust pipe and disconnect exhaust pipe from bracket on tubular crossmember. Let assembly rest on the ground.	Wheelbrace Box spanners 14 - 17 - 21
3	Remove retaining plate from the torsion bar that is to be taken out.	Box spanner 12
4	Fit split-block MR.1578 to torsion bar. Knock bar out from central bracket (see Drawing 71).	Block MR.1578
5	Fit gauge MR.3338 on upper and lower shock absorber pins to support the axle (see Drawing 69).	Gauge MR.3338
6	Remove screws (5) fixing silentblocs.	Brace spanner and extension 17
7	Disengage torsion bar, remove split-block MR.1578. In the case of a torsion bar breaking off flush with the centre bracket on the tubular crossmember, the second torsion bar has to be removed to allow the remaining end of the first bar to be knocked out.	
	REFITTING OF REAR TORSION BAR (See Drawing 70). NOTE - RIGHT HAND TORSION BARS BEAR ONE COLOUR MARK AND LEFT HAND BARS TWO.	
8	Engage torsion bar in silentbloc with the splined portion protruding. Fit silentbloc to tubular crossmember.	Universal joint spanner with extension 17
9	Fit lower shock absorber pin into slot of gauge MR.3338 by exerting fairly considerable leverage upon the link arm (see Drawing 69).	Gauge MR.3338
10	Fit torsion bar in centre bracket by moving axle within the limits allowed by the slot of the gauge to permit engagement of splines. Fit retaining plate (2) and secure by screw fitted with spring washer. In case of difficulty in engaging splines use split block MR.1578 to complete engagement of torsion bar.	Block MR.1578
11	Connect tie-rod (1) to axle (in the case of left hand bar being fitted).	Box spanner 21

12	Fit Spicer shock absorber.	Universal joint spanner 21
13	Fit silencer and exhaust pipe (in the case of right hand bar being fitted).	Box spanners 12 - 14
14	Fit wheel.	Wheelbrace
15	Lower vehicle to ground.	
16	Adjust heights (see Operation 151, paragraphs 1, 2 and 3).	
17	Check weight distribution (see Operation 151, paragraphs 4, 5 and 6).	Weighing machines 2310-T

	REMOVING SHOCK ABSORBERS	
1	Remove front shock absorbers (lock wheels to right for removing right hand shock absorber and to the left for left hand shock absorber).	Universal joint spanner 21
2	Jack up vehicle at the rear. Remove rear wheels.	Wheelbrace
3	Remove rear shock absorbers.	Universal joint spanner 21
	REFITTING SHOCK ABSORBERS Shockabsorbers are identified by two letters and one figure punched on the lower part of the upper casing. The first letter indicates the location of the shock absorber : O for front shock absorber and P for rear. The second letter indicates the month of manufacture. Example:- A - January E - May The figure indicates the year of manufacture Example:- 4 - 1944 6 - 1946 Shock absorbers can also be identified by their respective lengths when not under load:- 271 mm., plus or minus 2.5 mm. (10.67 ins, plus or minus 0.1 ins.) between eye centres for front shock absorbers. 321 mm., plus or minus 2.5 mm. (12.64 ins. plus or minus 0.1 ins.) between eye centres for rear shock absorbers. Shock absorbers are always fitted with the filler plug pointing downwards. This position as well as the vertical position of the shock absorber as a whole must be observed in the course of maintenance or when storing.	
4	Fit shock absorbers, with rubber bushes between two plain washers, tighten nuts to a tension of of 8 mkg. (57½ foot pounds) and secure with split pins. (a) Fit front shock absorbers. (b) Fit rear shock absorbers.	Universal joint spanner 21
5	Fit rear wheels.	Wheelbrace
6	Lower vehicle to the ground.	

RECONDITIONING (See Drawings 81 and 81A)
Unless there is a substantial leak, used shock absorbers can be completely reconditioned by replacing oil with oil of greater viscosity.

1	Remove guarantee seal. Extend shock absorber to its maximum length and then remove filler plug.	Box spanner 13
2	SLOWLY DRAIN shock absorber by compressing it to its minimum length (using apparatus MR.3552, see Drawings 81 and 81A), then alternately extend and compress it until all oil has been drained and no resistance encountered.	Apparatus MR.3552
3	With shock absorber compressed to its minimum length, screw funnel MR.3382 (see Drawing 81) into filler plug hole. Pour into the funnel the correct quantity of oil according to the type of shock absorber. For front shock absorbers 140 cubic cm., plus or minus 5 cubic cm. (8.54 cubic ins., plus or minus 0.31 cubic ins.) and for rear shock absorbers 160 cubic cm., plus or minus 5 cubic cm. (9.76 cubic ins., plus or minus 0.31 cubic ins.) NEVER EXCEED THESE QUANTITIES. Alternatively extend and compress shock absorber until all the oil is absorbed (this operation must be carried out with the shock absorber fitted and with the filler hole facing upwards). Remove the funnel, fit and tighten plug. The shock absorber being replenished keep it upright (filler plug at the bottom) during period of maintenance or storage.	Funnel MR.3382 Flat spanners 13 - 14 Apparatus MR.3552

REPLACING OF RUBBER BUSHES

4	Insert a screwdriver between rubber bush and shock absorber eye and prise out bush.	
5	Fit replacement bush (previously dipped in water) by hand and force completely home with a mallet or a vice (acting as a press).	

	REMOVING OF SELECTOR	
1	Remove bonnet.	
2	Remove battery. Use extractor 2200-T (see Drawing 2, fig.1) for battery cable terminals.	Extractor 2200-T Flat spanner 10 Box spanner 12
3	Disengage relay shaft control rods from selector levers.	Box spanner 10
4	Remove gear selector by unscrewing the two nuts behind the dashboard and the bolt and nut in the battery housing. Use spanner 2430-T (see Drawing 82, fig.3).	Spanner 2430-T Box spanners 13 - 14
	REFITTING OF SELECTOR	
5	Offer up gear selector by engaging it under the dashboard, first tighten the two nuts behind the dashboard with the aid of spanner 2430-T, then the bolt and nut in the battery housing. Connect relay shaft control rods. With the selector control lever and selector forks control lever in the neutral position, adjust control rods to correct length before fitting to avoid displacement of control levers from the neutral position. Ensure that the operating lever does not foul on its lateral movement. Fit split pins to shouldered bolts of control rods.	Spanner 2430-T Box spanners 13 - 14 Box spanner 10
6	Refit the battery.	Flat spanner 10 Box spanner 12
7	Replace the bonnet.	

	STRIPPING OUT OF SELECTOR (See Drawing 82).	
1	Knock out pin (1) from lever ball joint. Knock out ground shaft (2) from control levers. Remove levers from brackets.	Drift 4 mm.
2	Remove lock spring (3) from one lever. Knock out rivet. Repeat operation on other lever.	Drift 4 mm.
	RE-ASSEMBLING OF GEAR SELECTOR (See Drawing 82).	
3	Fit locking spring (3) on one lever. Peen over rivet. Repeat operation on other lever.	
4	Fit ball joint (4) on to gear change control lever (5). Engage lever in bracket. Fit selector levers. On right hand lever (6), the arm to receive the rod from the relay shaft is located downwards, and on the left hand lever (7) the corresponding arm is located upwards. Fit brass thrust washers (8) between each lever and between levers and bracket. Fit ground shaft (2). Drive in and peen over pin (1).	
5	In case of replacement of ground shaft, drill hole for pin after positioning shaft.	

	REMOVING OF HAND BRAKE CONTROL SHAFT	
1	Disconnect brake cables, hand brake control and return spring.	Box and flat spanners 12
2	To remove control shaft, disengage the two shaft brackets.	Box spanner 12
	REFITTING OF HAND BRAKE CONTROL SHAFT	
3	Fit the two brackets and mount the control shaft. Tighten caps of brackets with spring washers fitted under nuts.	Box and flat spanner 12
4	Connect brake cables and hand brake control. Hook on return spring.	Flat spanner 12
5	Adjust hand brake (see Operation 150, paragraph 3).	Flat spanner 12

	REMOVING OF PEDAL GEAR ASSEMBLY The removal of the pedal gear assembly also entails the removal of the distributor (left hand drive models only), steering wheel, steering column outer tube and master cylinder with its bracket.	
1	Remove distributor and bracket (left hand drive models only).	Box spanners 10 - 12 Flat spanner 17
2	Remove steering wheel with the aid of extractor 1950-T (see Drawing 62).	Extractor 1950-T Box spanner 32
3	Remove steering column outer tube and brackets on hull bulkhead.	Flat spanner 14
4	REMOVE MASTER CYLINDER AND BRACKET ASSEMBLED (a) Fit conical plug into outlet orifice of Lockheed reservoir to seal it off after the feed pipe has been removed	Plug 6 x 10
	(b) Remove feed pipe from master cylinder. Use spanner 2130-T (see Drawing 83). Remove bolt connecting three-way outlet union on master cylinder. Use spanner 2131-T (see Drawing 83)	Box spanner 19 or spanner 2131-T Flat spanner 16 Spanner 2130-T
	(c) Remove screw holding pedal gear fixed shaft (master cylinder bracket side) and screws fixing master cylinder to hull. Remove the entire assembly.	Flat spanners 12 - 26 Box spanner 12
	(d) Remove master cylinder operating lever. Remove key.	Flat and box spanner 12
5	Disconnect clutch cable from pedal.	
6	Unscrew bolts fixing pedal gear bracket. Remove the assembly of pedals and bracket.	Flat and box spanner 12
	REFITTING OF PEDAL GEAR ASSEMBLY	
7	Offer up the pedal gear assembly to the hull, fit key and master cylinder operating lever to pedal shaft, tighten fixing screw with a spring washer fitted under nut.	Flat and box spanner 12
8	Offer up the assembly of the master cylinder and bracket, introduce the operating push rod in the master cylinder and ensure that the protecting rubber is well positioned. Fit, but do not lock, the screw fixing pedal gear fixed shaft. Tighten bolts fixing master cylinder and pedal gear. Tighten screw holding fixed shaft. Turn back tab of lockwasher against flat of nut.	Flat spanners 12 - 26 Box spanner 12

9	Fit bolt fixing master cylinder three-way union. Fit feed pipe to master cylinder, withdraw plug from reservoir and connect up feed pipe. (Use spanners 2130-T and 2131-T, see Drawing 83).	Spanner 2130-T Flat spanner 16 Box spanner 19 or spanner 2131-T
10	Connect clutch cable to pedal.	
11	Fit steering column outer tube (see Operation 124, paragraphs 6, 7, 8 and 9).	Box spanner 14
12	Fit steering wheel and combined horn and lighting switch (see Operation 124, paragraphs 10 and 11)	Box spanner 32
13	Fit distributor and bracket (see Operation 101, paragraph 24) (left hand drive models only).	Box spanners 10 - 12 Flat spanner 17
14	Bleed Lockheed brake system (see Operation 150, paragraph 5).	

	REMOVING OF PEDAL GEAR ASSEMBLY On right hand drive cars only operations 7, 8 and 9 are necessary.	
1	Jack up front of vehicle to approximate height of 50 cm. (20 ins.). Block it up under lower link arms.	
2	If necessary, remove heater tube (by its rear rubber connection).	
3	Remove distributor and bracket.	Flat spanner 17 Box spanners 10 - 12
4	Remove petrol pump and screen.	Flat spanner 14
5	Remove engine rear rubber cushion and housing.	Universal joint spanners 14 - 17
6	With the aid of a lever, shift the engine to the right until it bears against the hull. Keep engine in this position by means of a wood block, about 120 mm. thickness, placed between engine and left hand face of opening in hull.	
7	Remove the steering wheel with the use of extractor 1950-T (see Drawing 62).	Extractor 1950-T Box spanner 32
8	Remove steering column outer tube and brackets on hull bulkhead.	Flat spanner 14
9	Remove master cylinder and bracket assembled (see Operation 138, paragraphs 4, 5 and 6).	
	REFITTING OF PEDAL GEAR ASSEMBLY On right hand drive cars Operations 12, 14, 15 and 16 are NOT necessary.	
10	(See Operation 138, paragraphs 7 and 8).	Box spanner 12 Flat spanners 12 - 26
11	Fit bolt fixing master cylinder three-way union and the feed pipe from reservoir at master cylinder end only. Use spanners 2130-T and 2131-T (see Drawing 83).	Spanners 2130-T - 2131-T
12	Remove wood block, fit engine rear rubber cushion and housing and replace carpet.	Universal joint spanner 14 -
13	Connect feed pipe to Lockheed reservoir and remove plug.	Flat spanner 17

14	Fit petrol pump. Connect petrol pipe.	Flat spanner 14
15	Fit distributor and bracket. Set timing (see Operation 101, paragraph 24).	Flat spanner 17 Box spanners 10 - 12
16	Fit heater tube.	
17	Connect clutch cable to pedal.	
18	Fit steering column outer tube (see Operation 124, paragraphs 6, 7, 8 and 9.)	
19	Fit steering wheel (see Operation 124, paragraphs 10 and 11).	
20	Bleed Lockheed brake system (see Operation 150, paragraph 5).	
21	Lower vehicle to the ground.	

	REMOVING OF MASTER CYLINDER On right hand drive cars only operations 7, 8, 9, 10 and 11 are necessary.	
1	Jack up front of vehicle to approximate height of 50 cm. (20 ins.). Block it up under lower link arms.	
2	If necessary, remove heater tube (by its rear rubber connection).	
3	Remove distributor and bracket.	Flat spanner 17 Box spanners 10 - 12
4	Remove petrol pump and screen.	Flat spanner 14
5	Remove engine rear rubber cushion and housing.	Universal joint spanner 14 - 17
6	With the aid of a lever, shift the engine to the right until it bears against the hull. Keep engine in this position by means of a wood block, about 120 mm. thickness, placed between engine and left hand face of opening in hull.	
7	Fit conical plug into outlet orifice of Lockheed reservoir to seal it off after the feed pipe has been removed.	Plug 6 x 10
8	Remove feed pipe from master cylinder. Use spanner 2130-T (see Drawing 83).	Spanner 2130-T
9	Take out bolt connecting three-way union to master cylinder. Use spanner 2131-T (see Drawing 83).	Spanner 2131-T
10	Disconnect master cylinder from bracket.	Spanner Ideal type 240 x 12
11	Remove master cylinder.	
	REFITTING OF MASTER CYLINDER On right hand drive cars operations 14, 16, 17 and 18 are NOT necessary.	
12	Engage master cylinder in its bracket, engage operating push rod and ensure that the protecting rubber is well positioned. Fit spring washers under fixing nuts and tighten.	Spanner Ideal type 240 x 12
13	Fit bolt fixing three-way union to master cylinder. Fit a copper washer both sides of the union. Fit feed pipe from reservoir to master cylinder only. Use spanners 2130-T and 2131-T (see Drawing 83).	Spanners 2130-T and 2131-T

14	Remove wood block, fit engine rear rubber cushion and housing, and replace carpet.	Universal joint spanner 14 - 17
15	Connect feed pipe to Lockheed reservoir and remove plug.	Flat spanner 17
16	Fit petrol pump. Connect petrol pipe.	Flat spanner 14
17	Fit distributor and bracket. Set timing (see Operation 101, paragraph 24).	Box spanners 10 - 12
18	Fit heater tube.	
19	Bleed Lockheed brake system (see Operation 150, paragraph 5).	
20	Lower vehicle to the ground.	

	REMOVING OF MASTER CYLINDER	
1	Remove distributor and bracket (left hand drive cars only).	Box spanners 10 - 12 Flat spanner 17
2	Fit conical plug into outlet orifice of Lockheed reservoir to seal it off after the feed pipe has been removed.	Plug 6 x 10
3	Remove feed pipe from master cylinder. Use spanner 2130-T (see Drawing 83).	Flat spanner 16 Spanner 2130-T
4	Take out bolt connecting three-way union to master cylinder. Use for preference spanner 2131-T (see Drawing 83).	Spanner 2131-T or flat spanner 19
5	Remove the two screws fixing master cylinder to bracket.	Box and flat spanners 12
6	Take out the master cylinder from bracket (by hand).	
	REFITTING OF MASTER CYLINDER	
7	Engage master cylinder in its bracket, engage operating push rod and ensure that the protecting rubber is well positioned. Fit spring washers under fixing nuts and tighten.	Box and flat spanners 12
8	Fit bolt fixing three-way union to master cylinder. Fit a copper washer both sides of the union. Use spanners 2130-T or 2131-T (see Drawing 83). Remove plug from Lockheed reservoir.	Spanner 2130-T Spanner 2131-T
9	Fit distributor and bracket (see Operation 101, paragraph 24) (left hand drive cars only).	
10	Bleed Lockheed brake system (see Operation 150, paragraph 5).	

	DISMANTLING (SEE Drawing 84)	
1	Remove piston locking ring (1) at the same time keeping piston depressed to avoid scattering the parts under pressure of the spring.	
2	Take out piston (2), cup (3), spring (4) and valve (5). Unscrew the union (6). Remove cup (7) from piston (2).	Flat spanner 23
	CLEANING	
3	Clean all parts in alcohol; do not use any other substance. The master cylinder must not show any traces of rust or scoring. If it does, it must be replaced. All parts being clean and in good condition proceed to re-assemble after having dipped them in very clean Lockheed fluid.	
	RE-ASSEMBLING (See Drawing 84)	
4	Fit valve (5), spring (4), cup (3), and piston (2), fitted with cup (7). Fit thrust washer (8) and locking ring (1). Tighten union.	Flat spanner 23

1	REMOVING SILENCER Slacken bolts of clips on tail pipe suspension to allow tail pipe to slide through clips. Disconnect silencer inlet flange from exhaust pipe under hull. Remove the silencer and tail pipe assembly towards the front.	Flat spanners 12 - 17 Box spanners 12 - 17
2	REMOVING EXHAUST PIPE UNDER HULL Remove clip holding pipe from suspension bracket on tubular crossmember. Disconnect pipe from silencer inlet flange and from flange of vertical pipe. Remove pipe.	Flat and box spanners 17
3	REMOVING VERTICAL EXHAUST PIPE Disconnect pipe from manifold flange and from flange of pipe under hull. Disconnect the tie-rod. Remove pipe.	Flat spanners 12 - 14 - 17 Box spanner 17
4	FITTING SILENCER Slide tail pipe into clips of rear suspension. Connect silencer inlet flange to flange of exhaust pipe under hull using a C. and A. gasket between faces. Tighten flange bolts with spring washers fitted under nuts. Tighten bolts of rear suspension clips.	Flat spanner 12 - 17
5	FITTING EXHAUST PIPE UNDER HULL Fit pipe in clip of suspension bracket on tubular crossmember. Bolt front flange to vertical exhaust pipe flange and rear flange to silencer inlet flange. Fit C. and A. gaskets between flanges and spring washers under flange nuts. Tighten bolts of suspension bracket clips.	Flat and box spanners 17
6	FITTING VERTICAL EXHAUST PIPE Use C. and A. gaskets between flanges. Tighten lower flange bolts with spring washers fitted under nuts. Fit dynamo protecting shield on upper flange, TIGHTEN NUTS WELL. Fit tie-rod.	Box spanner 12 Flat spanners 14 - 17 Universal joint spanner 17

	REMOVING OF DISTRIBUTOR	
1	Disconnect ignition coil and spark plug leads. Loosen suction unit locking screw. Disengage suction unit. Remove control lever. Remove bracket.	Box spanner 8 Flat spanners 10 - 12 - 17
	STRIPPING OUT DISTRIBUTOR	
	Several types of distributors are at present being fitted.	
2	Remove distributor assembly.	Box spanner 7
3	Knock out drive dog retaining pin, remove dog and shaft with centrifugal advance weights.	Pin punch 3 dia.
4	Disconnect leads.	
5	Clean the parts.	
	RE-ASSEMBLING AND ADJUSTING	
6	To shaft fit centrifugal advance weights, cam and springs. Fit shaft in distributor casing. Ensure that there is no play in the bushes.	
7	FIT DRIVE DOG (a) Fit carrier plate and pin assembly in distributor casing. (b) Fit packing washer and then the drive dog. THE DRIVE DOG TONGUE IS OFFSET AND THE PART MUST BE FITTED SO THAT THE NARROWER FACE IS ON THE OPPOSITE SIDE TO THE CAM SLOT. With the drive dog fitted check that the shaft turns freely without end play. If necessary use a different thickness packing washer. Rivet over drive dog pin.	
8	Fit contact carrier plate and contact blades. Adjust contact cap to 0.4 mm., plus or minus 0.05 mm. Fit the condenser.	Box spanner 7
9	Fit spark plug leads to distributor cap and fit cap to distributor.	
10	BENCH TEST (a) Take an ignition coil of identical manufacture to the distributor to be tested and mount coil on test bench. Connect negative ignition coil lead to distributor primary terminal.	

(b) Check insulation of secondary circuit. Adjust gap of test bench tremblers to 15 mm. Connect secondary winding to centre terminal of distributor. Connect spark plug leads to tremblers. Rotate distributor at 1000 R.P.M. for 15 minutes.

(c) Check spark sequence. The angular variation, read against a protractor, must not exceed 1.5° at all speeds (maximum distributor speed is 2000 R.P.M.).

(d) Check adjustment of automatic advance curve. Typical curve is as follows:- 0° at 750 R.P.M. (engine speed), 24° at 3300 R.P.M. (engine speed) (see Drawing 85 for tolerance). The tension of the centrifugal weight springs can be adjusted by bending the spring attachment plates. When operating the test bench it should be remembered that the distributor runs at half engine speed.

(e) Check insulation of primary circuit. Bring distributor (not fitted with condenser) to a temperature of 60° C. With the platinum coated contact screws open, apply an alternating current of 110 volts, 50 cycles across position terminal and earth. Fit a lamp in series with the circuit. Maintain current for one minute. If lamp lights up the insulation is faulty.

REFITTING OF DISTRIBUTOR. IGNITION ADVANCE SETTING.

(See Operation 101, paragraph 24).

	REMOVING OF DYNAMO	
1	Disconnect positive lead on battery and feed wire on dynamo. Use extractor 2200- (see Drawing 2, fig.1).	Extractor 2200-T Flat and box spanners 10
2	Uncouple fan and dynamo belt. Remove dynamo fixing bolt. Take out dynamo.	Flat spanner 12 Universal joint spanner 17
	STRIPPING OUT OF DYNAMO (See Drawings 86 and 87).	
3	Remove combined pulley and fan (1), brush cover (17), end plate (2) with armature and brush carrier plate (3).	Box spanner 8 - 21
4	Remove screws holding pole pieces with the aid of special screwdriver MR.1601-4 mounted in a bench press (see Drawing 88). Take out pole pieces, remove terminals (4 and 5), remove field coils.	Screwdriver MR.1601-4 Bench press
5	Disengage armature from end plate by means of a bench press.	
6	Strip out brush carrier plate (3), use a mandrel to press out bush (6).	Mandrel 15.5 x 19.5, length 150
7	Take out bearing (7) from cover plate after removing retaining plate (8).	
8	Unsolder connections 'a' which join field coils (see Drawing 87, fig.1).	
9	Clean parts.	
	RE-ASSEMBLING OF DYNAMO	
10	Check armature on suitable test set.	
11	True up commutator but do not reduce the diameter by more than 2 mm. from the original size of 45 mm.	
12	With the aid of a scraper, or saw blade ground to the width of the insulators, clean out the spaces between commutator segments.	
13	Check field coils with the aid of a test lamp.	

14 TO REPLACE DEFECTIVE FIELD COILS

(a) A COIL WOUND WITH COPPER WIRE MUST NEVER BE REPLACED BY ONE OF ALUMINIUM AND VICE VERSA.

(b) To fit induction coils see Drawing 87, fig.1.
In the case of coils wound with aluminium wire the following precautions must be taken. The ends of the aluminium wires are copper plated and tinned, therefore they must never be scraped. The removal of the tin and copper would make soldering absolutely impossible. When soldering use resin paste exclusively. NEVER USE ZINC CHLORIDE (spirits of salts) as it corrodes aluminium.

(c) When fitting coils and their connections it is advisable to exercise care to avoid breaking leads by twisting them, since aluminium is more brittle than copper.

15 FIT FIELD COILS AND POLE PIECES
To ensure perfect positioning of field coils and pole pieces, use mandrel MR.1601-2 which will provide a clearance of 0.5 mm. preventing the armature fouling the poles (see Drawing 88, fig.1). — Mandrel MR.1601-2

(a) Fit coils, insert insulating strips (9) and the pole piece fixing screws tightened provisionally (see Drawing 87, fig.1).

(b) Engage mandrel MR.1601-2 completely in pole pieces by means of a press.

(c) Lock pole piece fixing screws by the use of special screwdriver MR.1601-4 fitted in a bench press. — Screwdriver MR.1601-4

(d) Withdraw the mandrel from the opposite end to its insertion.

(e) Twist and solder ends of field coil leads (see Drawing 87, fig.1), and solder them to the terminals (if regulator is fitted on hull).

(f) Fit terminals (4 and 5).

16 RE-ASSEMBLE BRUSH CARRIER PLATE AND END PLATE (see Drawing 86 - 87).
The brush carrier plate bush is of porous bronze. Prior to mounting, soak the bush for approximately 24 hours in an oil bath (engine or similar oil) to saturate the bush.

(a) Fit bush (6) in brush carrier plate (3). Rivet negative brush holder (10) with shim (11), the positive brush holder (12), with insulating plate (13), fitting insulating sleeves on rivets.

(b) To allow the commutator to be fitted between brushes when re-assembling, proceed as indicated in fig.3, Drawing 87.
The greaser for the end cover bearing is no longer fitted. PACK THE BEARING with vaseline before assembly.

(c) To the end plate (2), fit bearing (7) between two washers (16), oil sealing washer (14), paper gasket and retaining plate (8). Fit thrust ring (15) to shaft and then fit assembled end plate by means of a press. Fit the armature into the dynamo casing and tighten end plate fixing screws.

(d) Connect the field coil lead and lead from output terminal to the positive brush as shown at b' (see Drawing 87, fig.3). Fit brush carrier plate (3) and also the dynamo pulley (1). Ensure that the armature rotates freely without friction. Fit brushes in holders to engage with commutator. Fit brush cover (17).

17 Bench test for output. Dynamo output should commence at a speed between 700 and 800 R.P.M. The output at 2,500 R.P.M. should be from 4.5 to 15 amperes, the corresponding voltage being 6.2 to 7.2, the dynamo being discharged into battery.

18 Paint dynamo.

REFITTING OF DYNAMO

19 Fit dynamo. Fit belt on pulley. Fit fixing bolt with the head towards the rear of engine. Tighten bolt with a spring washer fitted under nut. Adjust belt without excessive tension. Tighten belt adjuster. Connect dynamo and battery leads.

Flat and box spanners 10
Flat spanner 12
Universal joint spanner 17

IMPORTANT NOTE - Since aluminium and copper coils have different electrical resistances, an aluminium coil cannot be replaced by a copper coil and vice versa, unless the regulator is also replaced. The following table shows the two types of dynamo that have been fitted and the corresponding regulators.

1. Dynamo with integral regulator; DUCELLIER REGULTOR ONLY CAN BE FITTED.

MATERIAL OF WINDING	SYMBOL ON DYNAMO	SYMBOL ON REGULATOR
Aluminium	1 A L	Ducellier SP 12
Copper	no symbol	Ducellier SP 1

2. Regulator fitted on hull (dynamo with output terminals)

Aluminium	1 A L	Citroen AP Ducellier SP11
Copper	no symbol	Citroen without symbol Ducellier SP 5

The dynamo symbol is found under the series number of the unit on the casing. Symbols of Citroen regulators are punched on one of the large faces of the regulator cover. Symbols of Ducellier regulators are punched either on the fixing lug or on the top of the regulator cover.
TO AVOID SUBSEQUENT ERRORS IT IS URGED TO REMOVE THE SYMBOL 1 A L PUNCHED ON THE DYNAMO CASING, IF, IN THE COURSE OF REPAIRS AN ALUMINIUM COIL IS REPLACED BY A COPPER COIL.

	REMOVING OF STARTER MOTOR	
1	Disconnect positive cable from battery terminal. Use extractor 2200-T (see Drawing 2, fig.1). Disconnect cable from starter motor.	Flat spanners 10 - 12 - 14 Extractor 2200-T
2	Disconnect starter motor switch control wire. Remove petrol drain pipe. Take out pointed screw fixing starter motor.	Universal joint spanner and extensions 14 - 17
3	Take out starter motor (on certain vehicles it may be necessary to remove the rear engine mounting in order to raise the unit and shift it to the left to provide clearance for taking out the starter motor).	Brace spanner 14
	STRIPPING OUT OF STARTER MOTOR (See Drawings 89 and 90).	
4	Remove switch, brush cover (16), bendix housing (1), take out the armature and remove brush carrier plate (2).	Flat spanners 8 - 12
5	Remove pole pieces with the aid of special screwdriver MR.1601-4 fitted in a small bench press (see Drawing 88). Unsolder connecting strips of field coils and terminal (3). Remove field coils.	Screwdriver MR.1601-4 Soldering iron
6	Remove bendix gear from armature.	Flat spanner 16
7	Strip out brush carrier plate (2). Drive out bush (4) from carrier plate (2) and bush (5) from bendix housing with the aid of a mandrel.	Pin punch 3 dia. Mandrel 15 x 17 x 150
8	Dismantle switch.	Flat spanner 14 Box spanner 8
9	Clean parts.	
	RE-ASSEMBLING OF STARTER MOTOR	
10	Check armature between two centres for concentricity. Check armature on suitable test set and the field coils with a test lamp. SHOULD AN ARMATURE WOUND WITH ALUMINIUM WIRE prove defective replace the whole armature unit, since repairs to aluminium windings are difficult and necessary precautions require special equipment.	
11	True up commutator (DO NOT REDUCE THE ORIGINAL DIAMETER OF 45 mm. BY MORE THAN 2 mm.	

12	After trueing up commutator, clean segment separators, using a scraper or saw blade ground to the width of the separators, to ensure insulation of segment.	
13	RE-ASSEMBLE BRUSH CARRIER PLATE AND BENDIX HOUSING. The bushes of the plate and housing are of porous bronze. Before assembling, soak the bushes for approximately 24 hours in an oil bath (engine or similar oil) in order to fully impregnate the material. As a prevention against oil seeping on to the commutator and brushes, no further means of bush lubrication is provided.	
	(a) After impregnating bushes (4 and 5) with oil assemble them into housings with the aid of a small bench press.	
	(b) To the brush carrier plate, rivet negative brush holders (6) with shim (7) and brushes (8). Also rivet positive brush holders (9) with insulating plate (10), fitting insulating sleeves (11) on rivets. Fit positive brushes (15) and tighten up terminals.	Flat spanners 8 - 12
	(c) To fit commutator between brushes when assembling armature, proceed according to Drawing 90, fig.2.	
14	RE-ASSEMBLE FIELD COILS AND POLE PIECES. To ensure correct positioning of field coils and pole pieces in starter motor housing, use mandrel MR.1601-1 (see Drawing 88), which will establish a clearance of 0.7 mm. maximum between armature and pole pieces and also prevent fouling of the items.	Mandrel MR.1601-1
	(a) Fit field coils, insulators (12), and pole pieces. Provisionally tighten fixing screws.	
	(b) Solder field coil terminal strips as shown on Drawing 90. Fit terminal to starter motor casing using insulating sleeves.	Flat spanner 12
	(c) Completely engage mandrel MR.1601-1 between pole pieces with the aid of a press.	Mandrel MR.1601-1
	(d) Lock pole piece fixing screws with the aid of screwdriver MR.1601-4 fitted in a small press. (See Drawing 88).	Screwdriver MR.1601-4
	(e) Take out the mandrel from the opposite end to its insertion.	
15	RE-ASSEMBLE SWITCH Fit terminal (3) with insulators. Fit spring as shown on Drawing 89, fig.2, to ensure return of cam (13). Fit cam, retaining tube and switch lever.	Flat spanners 8 - 14 - 16
16	Fit bendix gear on armature shaft. Lock fixing screws by means of lock plate.	Flat spanner 16

17	Fit brush carrier plate (2) to starter motor casing. Connect field coil leads to positive brushes (15). Tighten screws fitted with spring washers under heads. Engage armature fitted with thrust washers at front and rear and fit bendix housing (1). Ensure that armature turns freely without friction and that the end play is from 0.2 mm. to 1.3 mm. If necessary change thrust washers for those of a different thickness. Bring brushes into contact with commutator. Fit brush cover. Fit switch leaf (14) to terminal lock in position by turning back corners of leaf against flat of nut. Fit the switch AND ENSURE THAT THE CONTACT LEAF IS ABOVE THE SWITCH TERMINAL.	Flat spanner 8
18	Bench test. Current consumption under load is from 180 to 200 amperes. Current consumption with no load is from 50 to 75 amperes.	
19	Paint unit.	
	REFITTING OF STARTER MOTOR	
20	Modified bendix housings are fitted by four screws One of the housing bosses may impede fitting the starter motor. If this is the case, part of the cylinder block casting must be ground away by means of a 150 mm. diameter grinding wheel, for a length equivalent to that of the starter motor. Subsequent fitting of the starter motor will then present no difficulties.	
21	Engage starter motor, tighten pointed screw and lock with nut. Fit starter motor switch control. Tighten battery cable on switch terminal. Connect positive cable to battery terminal. Fit petrol drain pipe.	Universal joint spanner and extensions 14 - 17 Flat spanners 8 - 10 - 14 Adjustable spanner (Crescent type)

REMOVING ASSEMBLY OF FRONT WINGS AND RADIATOR SHELL	
Remove bonnet fixing screws and take off bonnet. Disconnect lamp wiring. Remove screws fixing radiator shell to radiator block, and screws fixing wings to brackets and hull.	Brace spanner with extension 14
REFITTING ASSEMBLY OF FRONT WINGS AND RADIATOR SHELL	
Commence by screwing down all screws by hand. Finally tighten and at the same time adjust wing pipings. Each screw must be fitted with a flat and a spring washer under the head. Connect lamp wiring.	Brace spanner with extension 14
REMOVING OF RADIATOR SHELL	
Remove bonnet fixing screws and take off bonnet. Remove screws holding radiator shell adjusting plates to radiator block. Remove screws holding shell to wing valances.	Box spanners 10 - 14
REFITTING OF RADIATOR SHELL	
Screw down fixing screws by hand. Offer up bonnet and position radiator shell. Tighten all screws after fitting a plain and spring washer under heads.	Box spanners 10 - 14
REMOVING A FRONT WING	
Disconnect lamp wiring. Remove screws fixing wing to wing bracket. Remove screws fixing wing to hull.	Brace spanner and extension 14 Box spanners 10 - 14
REFITTING A FRONT WING	
Tighten all screws after fitting a plain and spring washer under heads. Adjust wing piping. Connect lamp wiring.	Brace spanner with extension 14 Box spanners 10 - 14

1	Jack up rear of vehicle and place blocks under rear link arms.	
2	Remove silencer.	Box spanners 12 - 17
3	Remove inspection cover from rear luggage compartment floor. Disconnect wires from petrol tank gauge unit. Remove petrol pipe and grommet.	Box spanners 7 - 16
4	Disconnect the two petrol tank straps. Remove petrol tank.	Box spanner 14
5	Take out petrol tank gauge unit. Remove petrol outlet pipe.	Flat spanner 14
	REFITTING OF PETROL TANK	
6	Fit gauge unit with a cork washer and tighten the three fixing screws. Fit petrol outlet pipe.	Flat spanner 14
7	Fit petrol tank and tighten up straps.	Box spanner 14
8	Fit silencer.	Box spanners 12 - 17
9	Fit petrol pipe, connect gauge unit wires, fit inspection cover and fit grommet round tank filler neck.	Box spanners 7 - 16
10	Lower vehicle to the ground.	

VALVE TIMING (See Drawing 19)

See Operation 103, paragraph 29.

For record purposes the following table of valve timing is given.

	Inlet valve opens	Inlet valve closes	Exhaust valve opens	Exhaust valve closes
In degrees on flywheel	3° before T.D.C.	45° after B.D.C.	45° before B.D.C.	11° after T.D.C.
In millimetres on piston	0.1	88.7	88.7	1.2

These figures are measured assuming a theoretical clearance of 0.34 mm. on inlet valves and 0.41 mm. on exhaust valves.
No procedure for obtaining the above setting is given here as this very delicate operation requires precision instruments.

VALVE TAPPET ADJUSTMENT

After the engine has idled for about 15 minutes (500 R.P.M.) adjust tappets to 0.15 mm. clearance on inlet and 0.20 mm. clearance on exhaust valves.

Flat spanner 12
Set of feeler gauges

AUTOMATIC ADVANCE ADJUSTMENT

Crank engine slowly to bring No.1 cylinder to end of compression stroke, then turn back slightly. Insert a 6 mm. diameter steel pin in aperture on left hand side of clutch bell housing and slowly turn engine in its normal rotation until the pin drops into slot in flywheel. The engine is now at 8° advance. With **normal** petrol the advance must be increased to 12°.
To do this, remove the distributor cap and fit on timing instrument 1691-T (see Drawing 4), fitted with indicator lamp which is then connected to the distributor condenser terminal. Close the contacts and leave the rod in flywheel slot. Turn the distributor body so as to bring contact piece of No.1 plug lead facing rotor. Turn distributor to obtain "breaking" of contact points. Test lamp will light up the moment contact points are "breaking". This first setting CORRESPONDS TO 8° ADVANCE ON FLYWHEEL.
To obtain the new setting of 12° advance on flywheel it is necessary to ADVANCE A FURTHER 4°.
To do this, check position of pointer on instrument. Without altering rotor turn the distributor body anti-clockwise 4° on instrument scale. Clamp distributor in this position.
The timing instrument is calibrated in flywheel degrees.
WITHDRAW LOCATING PIN FROM FLYWHEEL.
Remove timing instrument.
Fit distributor rotor arm and cap.

CARBURETTOR ADJUSTMENT

Typical settings for SOLEX downdraught carburettors as at present fitted are as follows:

Type	Choke	Main jet	Correction jet	Slow running jet		Starter		Float (weight)	Needle	Pump jet	Economy jet	
				Petrol	Air	Air	Petrol					
35 FATIP	26	135	210	45	180	4	115/125	21 gr.	2	55	-	
35 FPAI	27	130	180	45	180	4	125	21 gr.	2	60	60	Power setting
	25	120	230	45	180	4	125	21 gr.	2	60	60	Economy setting

IT IS STRONGLY RECOMMENDED NOT TO MODIFY THESE SETTINGS AS THEY HAVE BEEN DETERMINED AFTER COMPREHENSIVE TESTS.

SLOW RUNNING ADJUSTMENT (See Drawing 21). Slow running adjustment is effected by:

(a) Adjusting butterfly regulating screw (19) which will vary engine speed.

(b) Adjusting mixture regulating screw (18) which varies the QUANTITY OF PETROL fed through the slow running jet. The action of this screw is extremely sensitive, therefore the adjustment must be made slowly and carefully. If the engine "races", the mixture is too rich and the screw must be tightened (turned clockwise). On the other hand, if the engine is erratic and stalls easily the mixture is too weak and the screw slackened (turned anti-clockwise). The regulating screw (18) must never be screwed right home.

SOME INDICATIONS OF POOR ADJUSTMENT

1. Spark plug colour white; engine back-fires into carburettor; engine knocks, overheats and does not pull; valves deformed : MIXTURE TOO WEAK.

2. Spark plug colour black (sooty); black exhaust smoke; engine races and overheats; loses power : MIXTURE TOO RICH.

3. Difficult to start when hot; firing in exhaust system : SLOW RUNNING JET TOO SMALL.

4. Bad "pick up" : CORRECTION JET TOO SMALL. JETS TOO SMALL.

5. Low speed : CHOKE TOO SMALL, JETS TOO SMALL, CORRECTION JET TOO LARGE, NEEDLE VALVE TOO SMALL.

6. Insufficient climbing power : CHOKE TOO LARGE OR TOO SMALL, NETS TOO SMALL, CORRECTION JET TOO LARGE.

ADJUSTMENT OF CASTER ANGLE (See Drawing 91)

1 Having adjusted heights under hull at front and rear (see Operation 151, paragraphs 1, 2 and 3), and with tyres at correct pressure, place vehicle on a HORIZONTAL surface or on an elevating service platform.

2 Remove greasers from upper and lower link arms (these greasers are for lubricating ball joints). Fit parts of gauge MR.1767 (using greasers to fit brackets) and position as indicated on Drawing 91. The plumb line must fall against the appropriate gauge mark according to the vehicle being checked. — Gauge MR.1767

3 If correct reading is not obtained, correct the caster angle (see Drawing 45). Slacken clamp bolts (10) of the upper link spindle, and with the aid of a nut and lock nut screwed on the threaded portion, or a flat spanner size 23, turn spindle in the direction necessary to carry the upper link arm into the position required to give correct gauge reading. — Flat spanners 14 - 23; Box spanner 17
Having obtained the correct setting tighten clamp bolts (10). Repeat the procedure for other side of axle.
THE CORRECT CASTER ANGLE IS $1^{\circ}30'$, PLUS OR MINUS $0^{\circ}15'$.

'TOE-OUT' OF FRONT WHEELS.

This adjustment must be carried out after adjusting caster angle. Use a gauge of the type commonly sold in the trade. At the height of the wheel centres, measure the distance between the inner edges of the wheel rims at the front. Chalk mark the points measured. Rotate the wheels half a turn and measure the distance between the same two points now at the rear. THE WHEELS MUST 'TOE-OUT' AT THE FRONT. THE DIFFERENCE BETWEEN THE GAUGE READINGS AT FRONT AND REAR MUST BE FROM 0 TO 2 MM.

4 To correct alignment, jack up the vehicle at the front. Slacken the clamp screws of the adjustable sockets of the trackrods. With the aid of a wrench of the "Stillson" type turn both track rods an equal amount. (WHEN ADJUSTED, THE DIFFERENCE IN LENGTH OF TRACK RODS MUST NOT EXCEED 1 mm.). Check lengths of track rods with gauge MR.1590 (see Drawing 92). Ensure that the steering rack ball joints do not move during this operation or the adjustment will be affected. — Box spanner 14; Gauge MR.1590

5 Lower vehicle to the ground. Check adjustment as before. Before locking clamp screws of track rod adjustable sockets ensure that steering rack ball pins are horizontal to prevent jamming of steering on full lock.
The machined part visible of both track rods must be equal in length within 1 mm. in order to ensure correct distribution of threads.

STEERING LOCK ADJUSTMENT

To prevent undue strain upon the transmission, the steering lock angle must not exceed 34°. The right hand steering lock is adjusted by the stop screw (34) on the left hand end cap of the steering rack. The left hand lock is adjusted by the aluminium cover (12) on the right hand end of steering rack (see Drawing 63). (Use spanner 1975-T, see Drawing 66). — Flat spanner 17, Spanner 1975-T

6 To adjust steering lock, jack up the vehicle at the front and turn steering to full lock on one side. Lower vehicle to the ground.

7 Set the length of the steering lock gauge 1890-T. according to the wheel size (NOT THE TYRE) (see Drawing 93). — Gauge 1890-T

8 Offer up the gauge. Engage the locating end into the bore of the lower silentbloc. The pointed end must then touch the inner rim of the wheel at stub axle height. If rim and pointer do not coincide, jack up the vehicle again and adjust either the stop screw or aluminium cover according to the side being checked. Lower vehicle to the ground again and check with a gauge once more.

9 Tighten the stop screw lock nut and the lock nuts of the aluminium cover. (Use spanner 1975-T, see Drawing 66). Turn back tab of lockwasher (fitted between cover and first lock nut) against flat of nut. — Spanner 1975-T, Flat spanner 17

INSPECTION OF WHEEL CAMBER

10 Wheel camber cannot be adjusted. It should be 1°, plus or minus 0°30'. To check this the vehicle must be standing on a horizontal plane with tyres at identical pressure and the heights under hull carefully adjusted. Use gauge 2314-T (see Drawing 94). If camber is defective, check front axle parts and the alignment of the hull. — Gauge 2314-T

1	Jack up vehicle at the front and rear and place it on blocks (use bracket or jack attachment 3300-110, see Drawing 67A).	Bracket 3300-110
2	ADJUST CAMS Turn the hexagon headed pin (71) of the adjusting cam in the direction indicated on fig.3 (see Drawing 49), at the same time revolving wheel by hand, until the brake shoe comes into contact with drum. Turn pin back slightly to free the wheel, and then carefully turn forward again until there is slight friction between brake lining and drum (never make the adjustment on backward movement of brake shoe). The brake shoe must be set as close as possible to the drum so that pedal travel is short. Carry out similar operation on the other shoe and to the other wheels.	Universal joint spanner 17
3	ADJUST HAND BRAKE Successively adjust tension of cables, so that when hand brake control is in the third notch rear wheels brake evenly, and when control is in fourth notch, they lock.	Flat spanner 12
4	ADJUST FOOT BRAKE PEDAL The necessary play between push rod and master cylinder piston is obtained by adjusting stop screw on pedal. The play will permit the piston to return to its rear-most position and so clear the oil feed hole. The adjustment must give an idle pedal movement of 10 mm. before push rod bears against piston.	
5	BLEED LOCKHEED BRAKE SYSTEM To ensure efficiency of the brakes it is absolutely essential that no air bubbles remain in the system. Fill Lockheed reservoir, check level of fluid, and if necessary, top up. On each wheel (the vehicle being still jacked up), remove plug (72) (see Drawing 41) from the wheel cylinder pointed screw (73), and fit a drain pipe (use drain pipe 2140-T). Feed drain pipe into a container, transparent for preference (glass or bottle), already containing a little Lockheed fluid. Slacken pointed screw (73) half a turn. Have brake pedal operated up and down slowly by an assistant. With each pedal stroke a certain quantity of fluid will escape from the drain tube and carrying with it any air bubbles from the system. These bubbles can be observed in the fluid drained into the receptacle. Continue pedal action until no further bubbles emerge from the pipe. At this moment, WITH THE PEDAL STILL DEPRESSED AND THE END OF THE DRAIN PIPE BELOW THE SURFACE OF THE FLUID IN THE RECEPTACLE, tighten the pointed screw (73). Remove drain pipe and replace plug (72). Carry out similar operation on each wheel. DO NOT FORGET TO TOP UP LEVEL OF FLUID IN RESERVOIR. After topping up the sealing of the system must be checked. In the absence of special check instruments, used only by the makers, press down pedal as hard as possible with the foot for 30 seconds to a minute. If the pedal resists to pressure there is no leak. If, on the other hand, the pedal sinks bit by bit (more or less rapidly), a leak exists at a union or in one of	Drain pipe 2140-T Flat spanners 10 - 12

pipes.
Check also the Lockheed reservoir. If the fluid is forced back into the reservoir the master cylinder retaining cup is defective. THE MASTER CYLINDER MUST THEN BE DISMANTLED IMMEDIATELY.
Lower vehicle to the ground.

ADJUSTMENT OF HEIGHTS UNDER HULL (Vehicle complete with all accessories but without passengers).

Ensure that tyre pressures are normal.

"STOP" TYRES			"PILOTE" TYRES			
	Front	Rear			Front	Rear
140 x 40	1.300 Kg. (18½ lbs.)	1.500 Kg. (21½ lbs.)	155 x 400		1.200 Kg. (17 lbs.)	1.400 Kg. (20 lbs.)
150 x 40	1.300 Kg. (18½ lbs.)	1.500 Kg. (21½ lbs.)	165 x 400	Light 15 X	1.200 Kg. (17 lbs.)	1.400 Kg. (20 lbs.)
160 x 40	1.400 Kg. (20 lbs.)	1.600 Kg. (23 lbs.)	165 x 400	Big 15 except 7-seater	1.300 Kg. (18½ lbs.)	1.500 Kg. (21½ lbs.)
			185 x 400		1.300 Kg. (18½ lbs.)	1.500 Kg. (21½ lbs.)

1 Run vehicle on to a level and horizontal floor.
Use gauge 2300-T to check heights. Front height is measured from the torsion bar centre line to the ground. Rear height is measured from underside of hull rear floor to the ground.
The following table shows the heights appropriate to the various models.

Gauge 2300-T

	"STOP" TYRES		"PILOTE" TYRES	
	Front	Rear	Front	Rear
"Twelve" (7A, 7B, 7C)	285	275	267	257
"Light 15" (11AL, 11BL)	295	285	Y 275	X 264
"Big 15" (11A, 11B)	295	295	275	274
"Family 15" (11B, 7-seater, 11C)	300	330	287	317

NOTE. The dimensions are given in millimetres. The tolerance on front dimensions is plus 5 mm., minus 0 mm. The tolerance of rear dimensions is plus 10 mm., minus 0 mm.

2 If the heights have to be adjusted, jack up the vehicle (using bracket or jack attachment MR.3300-110, see Drawing 67A) to take the load off the torsion bars. This will permit easy turning of the ball faced adjusting screws of the front torsion bars, with the aid of spanner 2301-T or 2302-T, as well as the adjusting rod nuts of the rear torsion bars, with the aid of spanner 2304-T (see Drawing 68, fig.3).

Spanner 2301-T or 2302-T
Spanner 2304-T
Flat spanner 23
Bracket MR.3300-110

3 Lower vehicle to the ground. Rock the vehicle to bring torsion bars into action and check heights again.
For each adjustment, the vehicle has to be jacked up, adjusted, lowered and rocked before heights can be checked.

ADJUSTMENT OF LOAD DISTRIBUTION.

4 Check tyre pressure and, if necessary, correct.

5 Run vehicle on to a level and horizontal floor. Make sure that heights under hull are correct.

6 Place weighing machines 2310-T (see Drawing 94A) under each of the four wheels. Centre wheels very carefully on machine platforms. If only one weighing machine is available, a block the same thickness as the machine platform MUST BE PLACED under the other wheel of the same axle. Note weight indicated on the machine scale. The difference in weight between two wheels on the same axle MUST NOT EXCEED 30 Kgs. (66.6 LBS). If weights differ by more than this it is necessary to adjust the torsion bars.

Weighing machines 2310-T
Flat spanner 23
Spanner 2301-T or 2302-T
Spanner 2304-T

Example : vehicle is heavier on front left hand wheel.
(a) Slack front left hand torsion bar adjusting screw one or two turns depending on the amount of weight variation.

(b) Tighten front right hand torsion bar adjusting screw half the amount by which the left hand screw has been slackened.

(c) Slacken rear right hand torsion bar adjuster as for the front left hand.

(d) Tighten rear left hand torsion bar adjuster as for the front right hand.

If the vehicle is heavier on the front right hand wheel the above procedure must be reversed.
The same operation applies to the rear axle.
THE LOAD DISTRIBUTION ON EACH WHEEL IS OF GREAT IMPORTANCE IN THE MATTER OF ROAD HOLDING, BRAKING AND TYRE WEAR. After any adjustment involving torsion bars or hull, load distribution must be checked and if necessary, adjusted. Load distribution is of greater importance than body heights under hull. One must, however, ensure that the minimum heights given in the table above, are observed. If it is impossible to realise these conditions the hull is out of square.

CHECKING WHEELS

7 Checking wheels for distortion and eccentricity (see Drawing 95, fig.4).
With the aid of a suitable fixture check that :

(a) The eccentricity of the rim well;

(b) The distortion of the inner faces of the rim.
The maximum variation permitted in both cases is 4 mm. (see fig.4).
If wheel exceeds the tolerance allowed it must not be fitted on the front axle. Excessive eccentricity or distortion will produce wheel wobble in the same way as a badly balanced wheel.

8 Wheel balance. The method of detecting and correcting badly balanced wheels is indicated herewith. This operation must be carried out using apparatus MR.3396 (see Drawing 96). A wheel must only be balanced when under normal tyre pressure and after being run for several miles to allow correct bedding of outer cover and tube.
Carefully clean wheel and tyre.
Fit the wheel on stand (see Drawing 95, fig. 2).
After several oscillations the wheel will come to rest with the heaviest part at the lowest point 'a' (see Drawing 95, fig.1).
At a point diametrically opposite stick a lump of bituminous putty large enough to balance the wheel.
Mark the position of the putty 'b' (see fig.1).
Weigh the putty.
Apply solder to the point 'b' equivalent in weight to the putty (see Drawing 95, fig.3).
If the wheel is considerably out of balance, make up a steel plate of the necessary weight required to provide correct balance, and either arc weld or rivet it to the rim.
The added weight must always be as near as possible to the centre line of the rim.
With each tyre change it is necessary to balance the wheel.

ADJUSTMENT OF HEADLAMPS.

Use screen MR.1572 following the instructions on Drawing 97.

Screen MR.1572

WIRING.

When rewiring follow circuit diagrams (see Drawings 98 and 99).
IMPORTANT. It is essential to use "shake-proof" washers under terminal screws and nuts. Single-turn spring washers must not be used.

REPLACEMENT OF A BULB IN THE 'AXO' TYPE DIRECTION INDICATOR.

Pinch the rhodoid near the hinge point to release the assembly pins. Press towards hinge and disengage.

HULL REPAIRS

To maintain front wheel drive qualities in road-holding and braking, certain dimensions must be rigidly adhered to when repairing the hull. In practice it is not possible to determine these measurements unless a jig is available. (Use jig 2600-T, see Drawing 100).
For all operations involving the fitting of body sections see Body Repair Manual for Front Wheel Drive Models. The body sections are listed in the Spare Parts Catalogue.

CITROEN

FRONT WHEEL DRIVE

"Twelve" & "Fifteen" Models

REPAIR MANUAL

ILLUSTRATIONS

1938 1950

CITROEN CARS, LIMITED,
TRADING ESTATE,
SLOUGH, ENGLAND,

REPRINTED OCTOBER 1956

INDEX OF ILLUSTRATIONS IN REPAIR MANUAL

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INDEX OF ILLUSTRATIONS IN REPAIR MANUAL

— ENGINE —

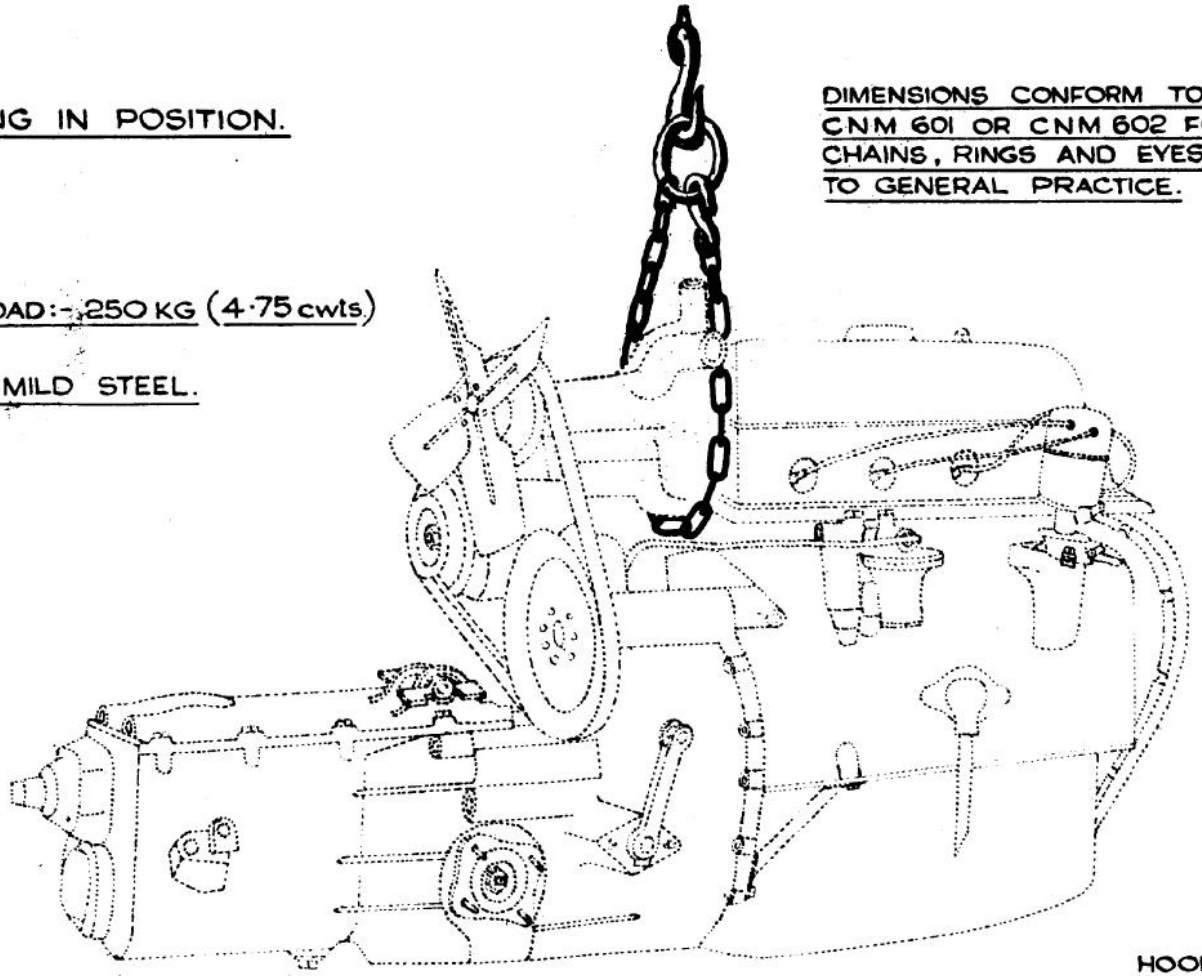
— LIFTING ENGINE —

SLING IN POSITION.

DIMENSIONS CONFORM TO STANDARDS CNM 601 OR CNM 602 FOR LIFTING CHAINS, RINGS AND EYES ACCORDING TO GENERAL PRACTICE.

MAXIMUM LOAD:- 250 KG (4·75 cwts)

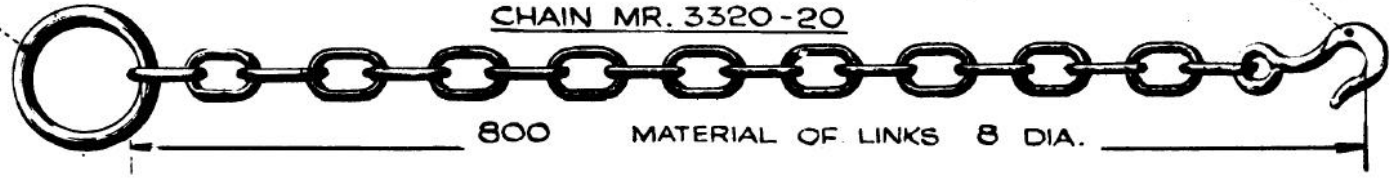
ANNEALED MILD STEEL.



RING, 80 INSIDE DIA. MATERIAL 14 DIA.

HOOK, LOAD : 150 KG (2·85 cwts)

CHAIN MR. 3320-20



VARIOUS TOOLS

Fig.2. – PLUG SPANNER
1601-T

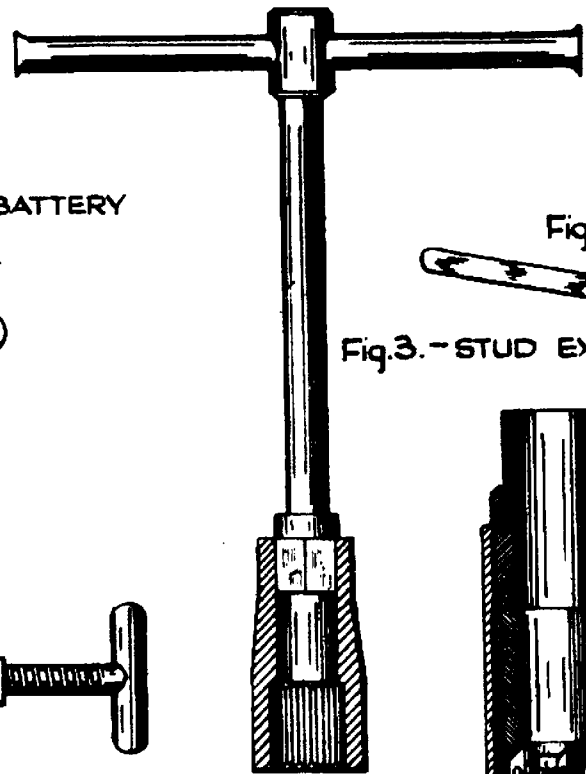


Fig.1. – EXTRACTOR FOR BATTERY TERMINAL
2200-T

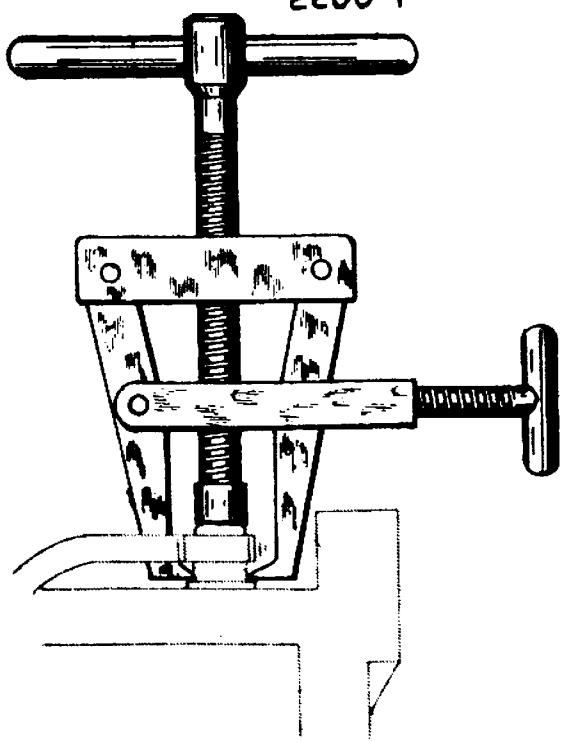


Fig.3. – STUD EXTRACTOR
2410-T

Fig.4. – APPLICATION OF COMPRESSOR

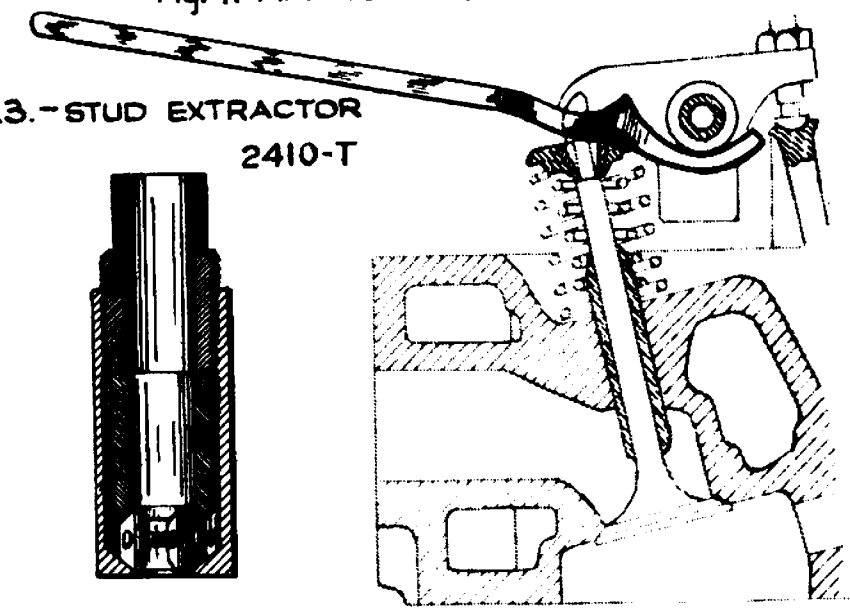
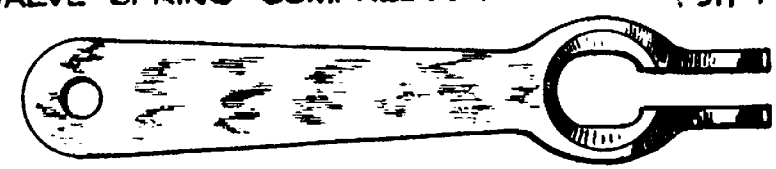


Fig.5. – VALVE SPRING COMPRESSOR 2411-T

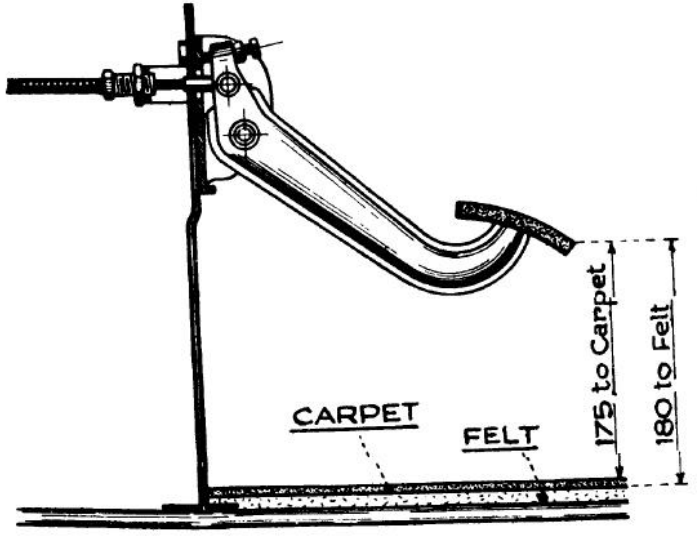


— ENGINE —

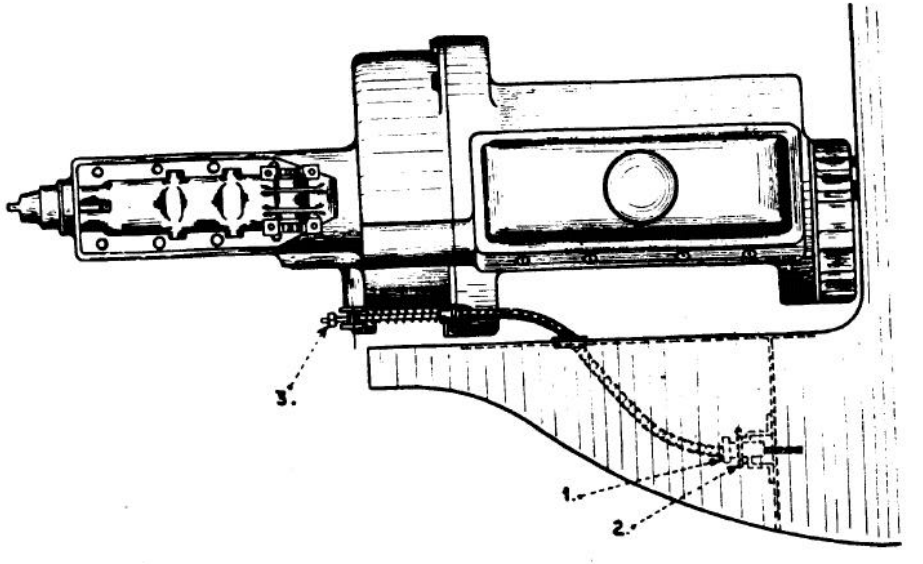
— CLUTCH CONTROL —

SETTING AND ADJUSTING INNER AND OUTER CLUTCH CABLES.

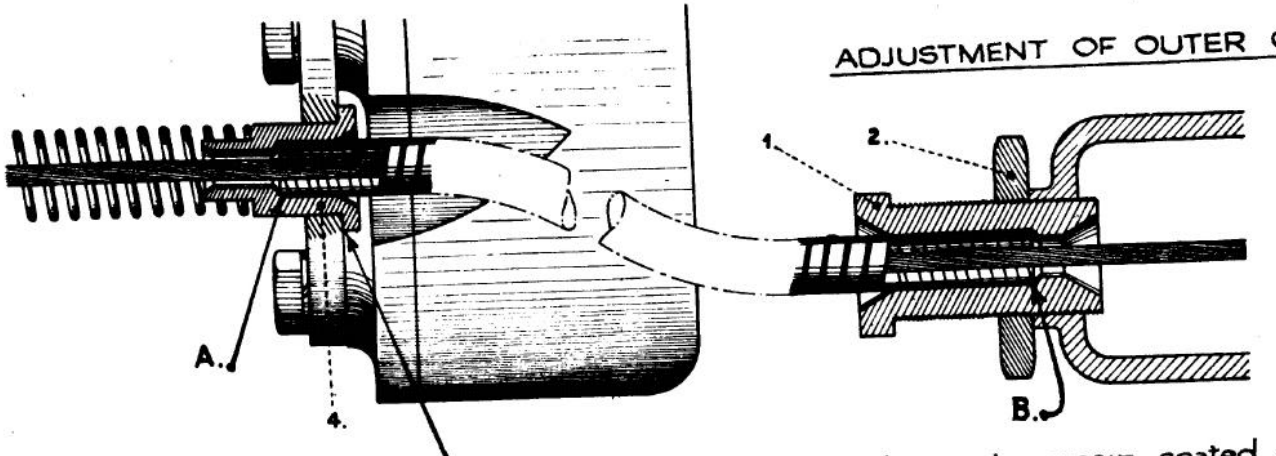
ADJUSTMENT OF CLUTCH PEDAL HEIGHT.



VIEW SHOWING CLUTCH CABLE IN POSITION.



ADJUSTMENT OF OUTER CABLE

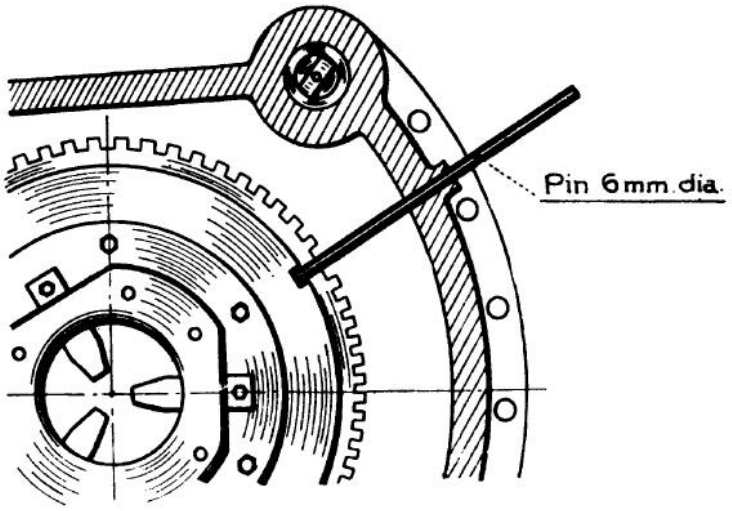


When declutching, outer cable must remain seated on cable guide 4.

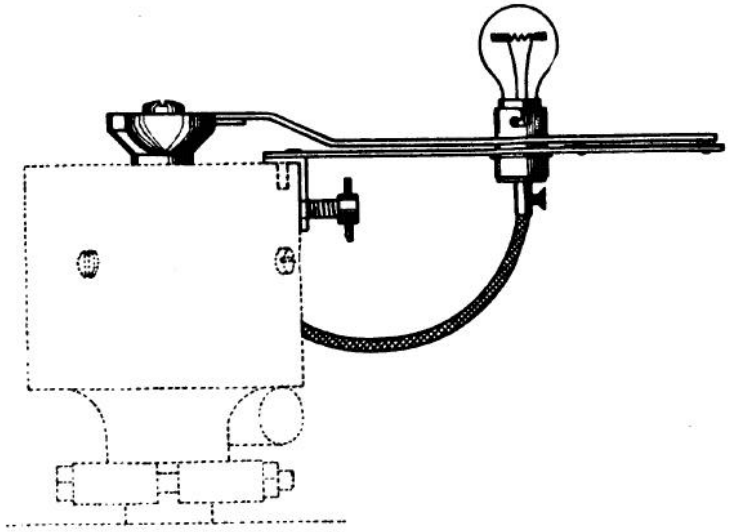
— ENGINE —

— TIMING DISTRIBUTOR —

HOW TO USE LOCATING PIN.

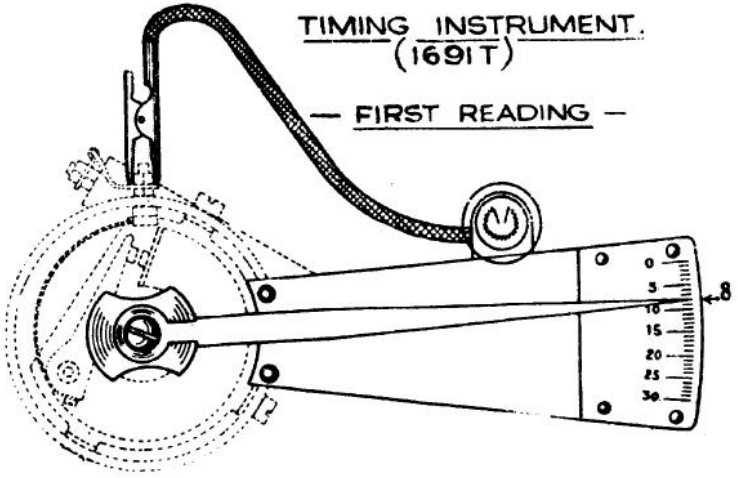


TIMING INSTRUMENT IN POSITION.



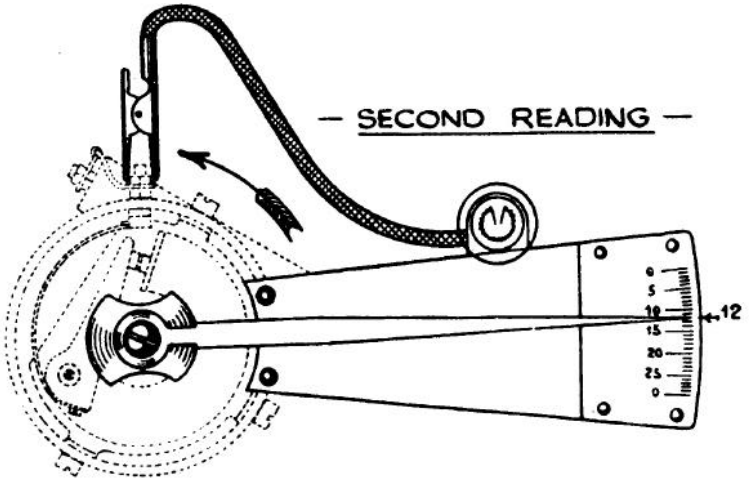
TIMING INSTRUMENT.
(1691T)

— FIRST READING —



FIRST ADJUSTMENT : ENGINE IS SET AT 8° ON FLYWHEEL. 6mm. PIN IS ENGAGED IN FLYWHEEL SLOT AND LAMP IS ALIGHT.
CHECK NEEDLE POSITION.

— SECOND READING —

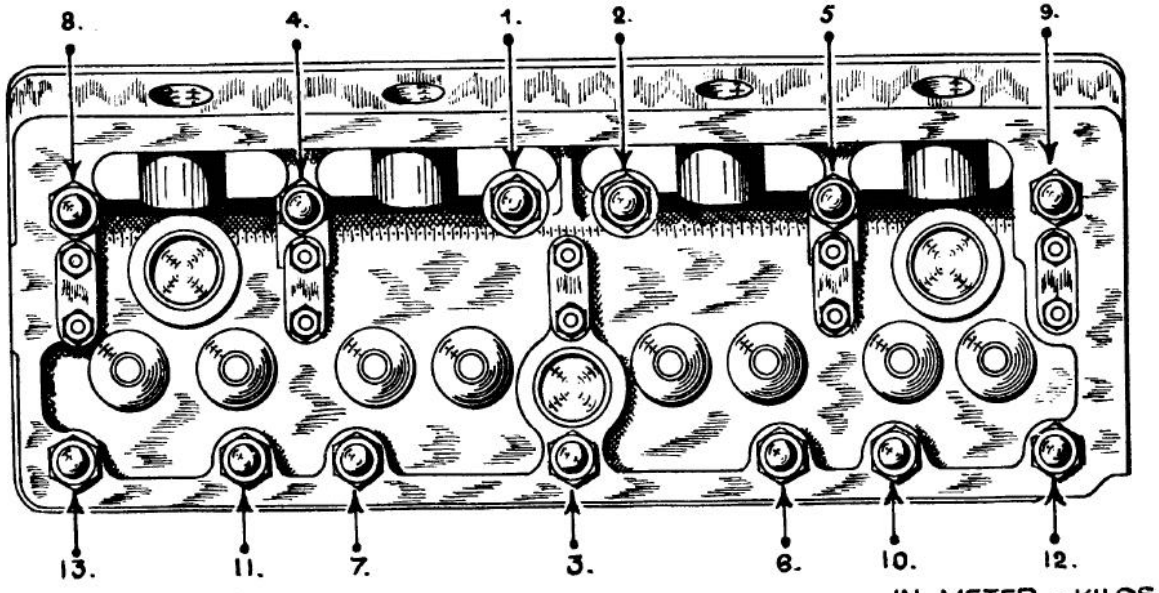


SECOND ADJUSTMENT : TURN DISTRIBUTOR BODY ANTI-CLOCKWISE TO INCREASE ADVANCE BY 4°. NEEDLE SHOWS 4° MORE THAN PREVIOUS READING.

— ENGINE —

— CYLINDER HEAD —

Fig.1.- SEQUENCE FOR TIGHTENING CYLINDER HEAD NUTS.



		IN METER - KILOS	IN FOOT - POUNDS
TIGHTNESS OF CYLINDER HEAD NUTS	1ST. TIGHTENING	3	21 · 7
	2ND. TIGHTENING	5	36 · 17
	TIGHTENING WHEN HOT	5	36 · 17

IT IS RECOMMENDED TO TIGHTEN CYLINDER HEAD NUTS IN THE ORDER STATED : THE DEGREE OF TIGHTNESS INDICATED MUST BE STRICTLY ADHERED TO AND OBTAINED BY USING TORSION SPANNER.

THIS SPANNER IS GRADUATED IN METER-KILOS AND USED WITH 12·7mm. SOCKET (2465 T)

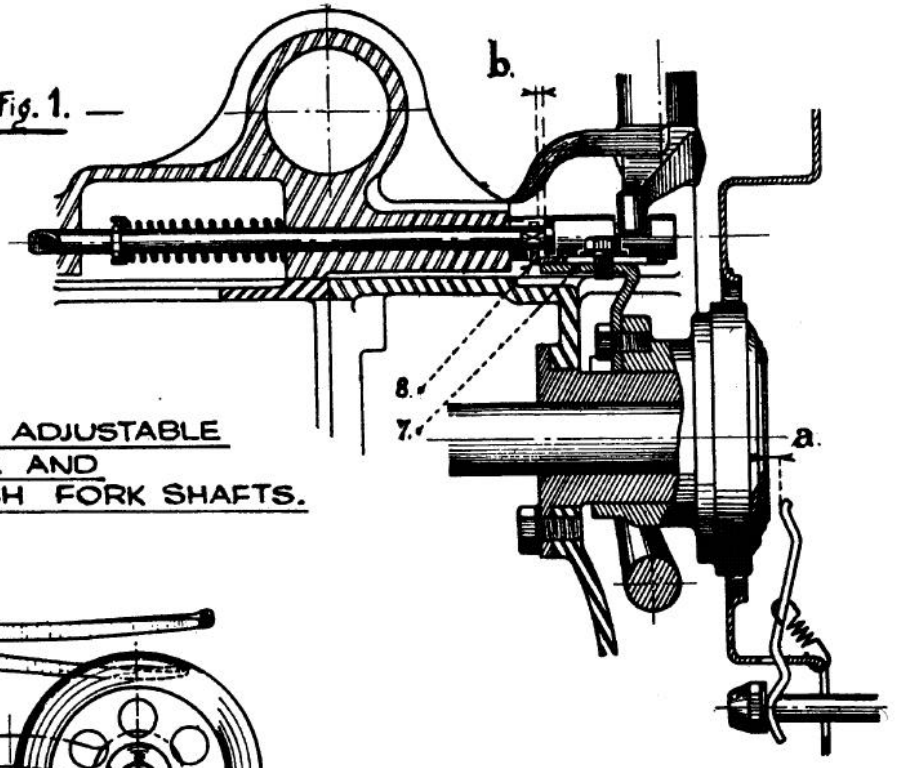
WHEN EFFORT HAS REACHED CORRECT POINT ON GRADUATION AND ARTICULATION "A" FOLDS, STOP TIGHTENING. ARTICULATION "A" MUST NEVER CONTACT BODY OF SPANNER IN "B".

Fig. 2. - TORSION SPANNER. (2470T)

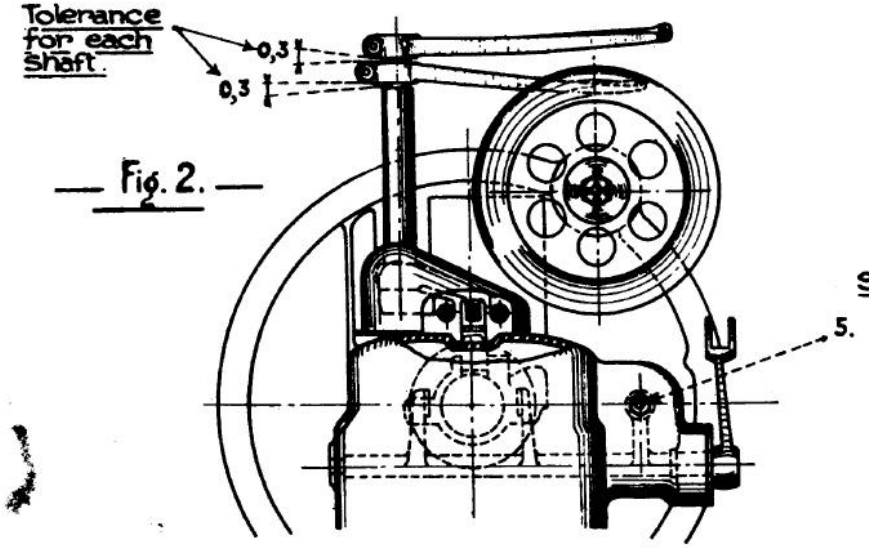
— ADJUSTMENT OF GEAR LOCKING DEVICE, LIGHT —

LONGITUDINAL SECTION ON CENTRE LINE, SHOWING TAPERED END OF GEAR LOCKING ROD.

— Fig. 1. —



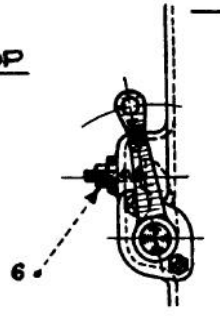
FRONT VIEW SHOWING ADJUSTABLE STOP FOR CLUTCH FORK AND SECTIONAL VIEW THROUGH FORK SHAFTS.



— Fig. 2. —

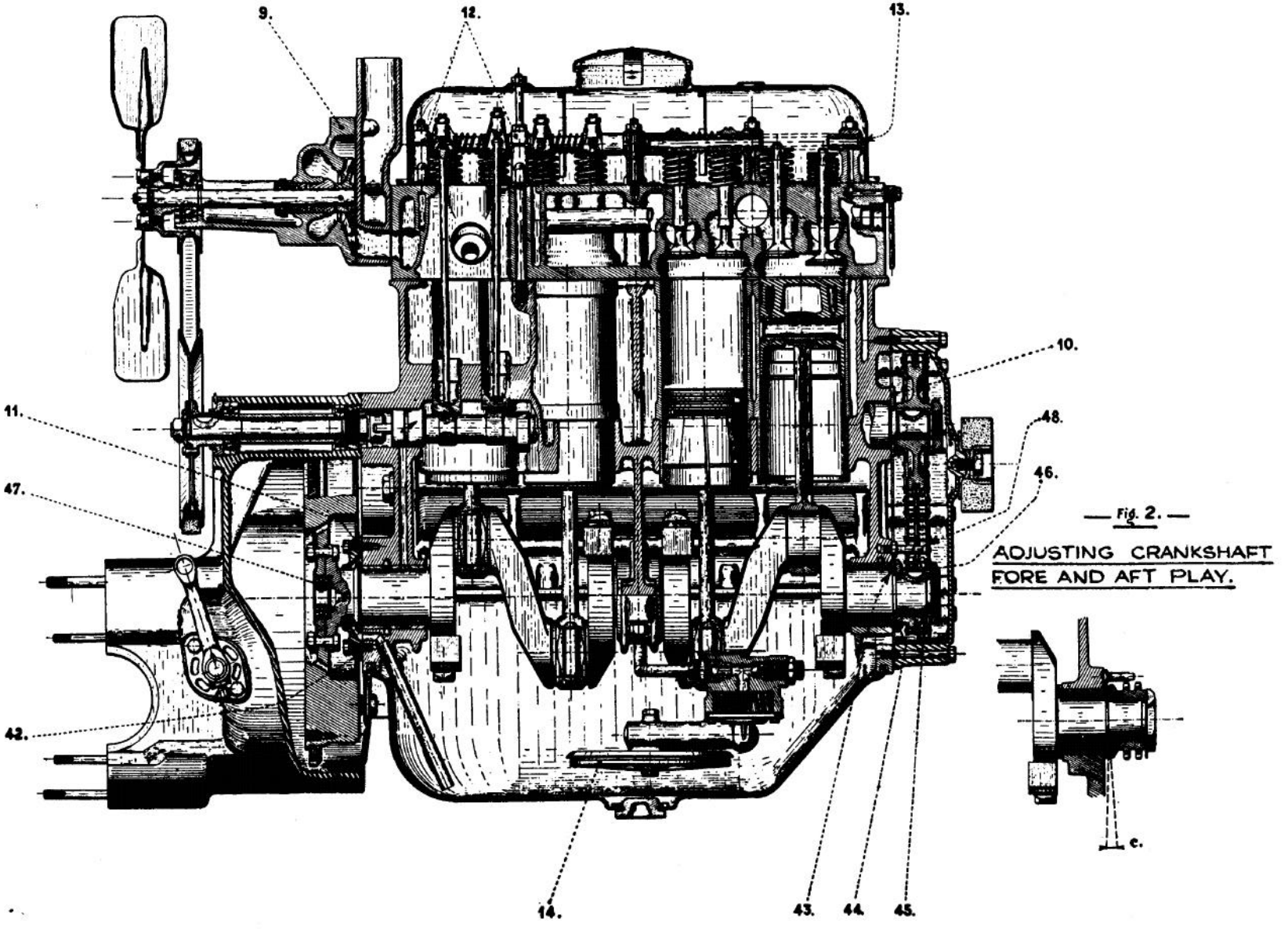
SIDE VIEW SHOWING FORK STOP ADJUSTMENT.

— Fig. 3. —



— ENGINE —

— ASSEMBLY, LONGITUDINAL SECTION —



— Fig. 2. —

ADJUSTING CRANKSHAFT FORE AND AFT PLAY.

— ASSEMBLY, CROSS SECTION —

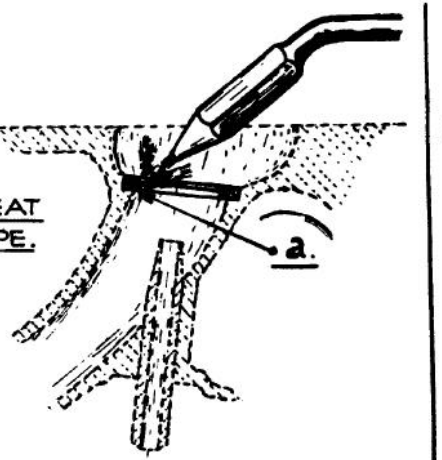
FIG. 2. SPANNER. (16257)

— ENGINE —

— REPLACING VALVE SEAT OR GUIDE —

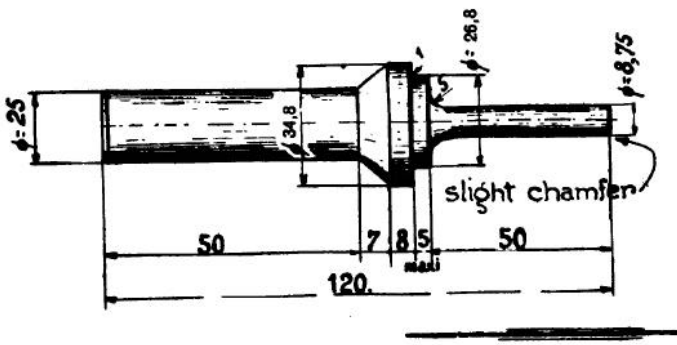
REPLACING SEAT

EXTRACTING SEAT USING BLOW PIPE.

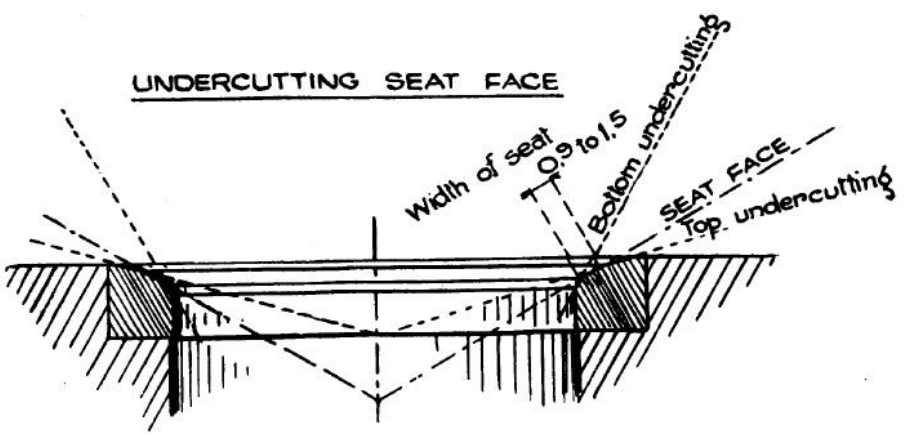


Prise up at 'a' with screwdriver.

MANDREL MR.3098-B FOR FITTING SEAT.

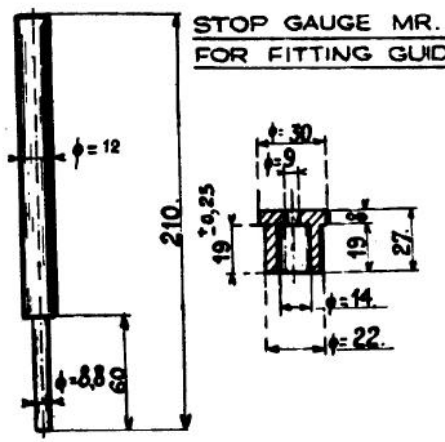


UNDERCUTTING SEAT FACE



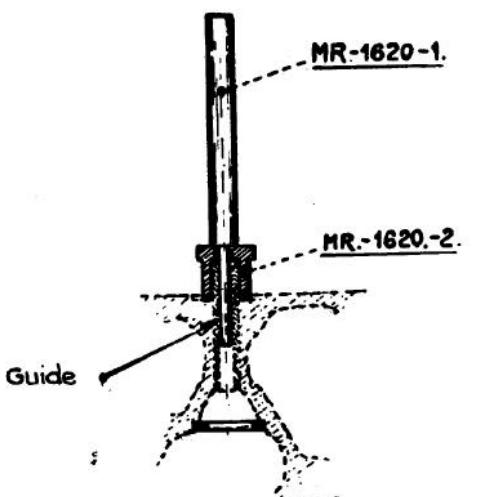
— REPLACING GUIDE —

MANDREL MR.1620-1 TO REMOVE GUIDE.



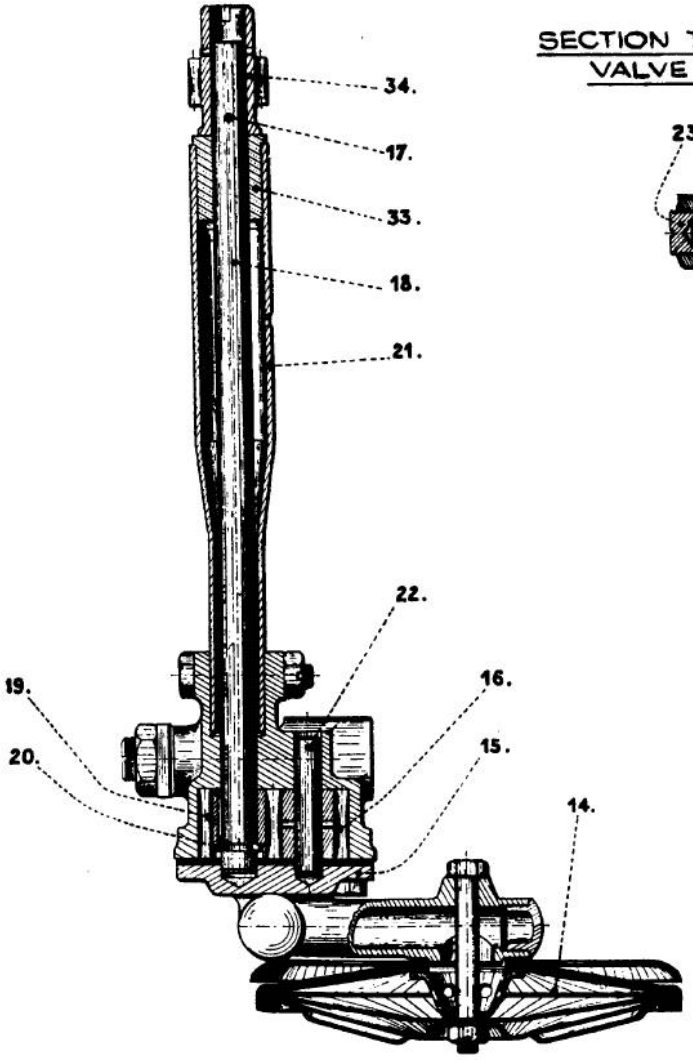
STOP GAUGE MR.1620-2 FOR FITTING GUIDE.

— FITTING GUIDE —

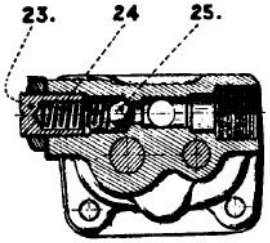


— OIL PUMP ASSEMBLY —

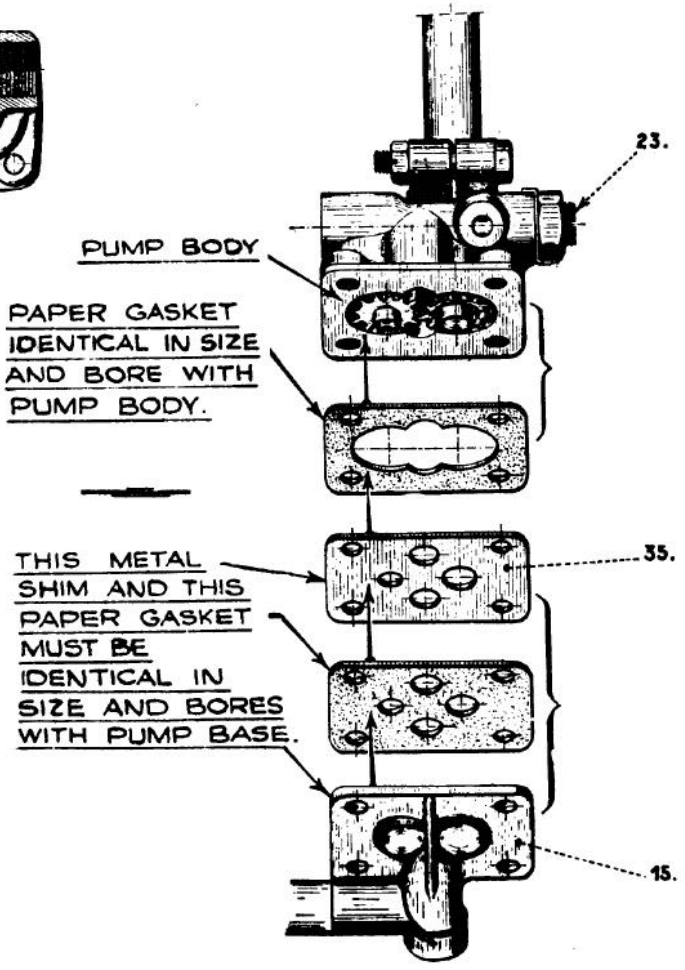
VERTICAL SECTION.



SECTION THROUGH RELEASE VALVE AND SPRING.



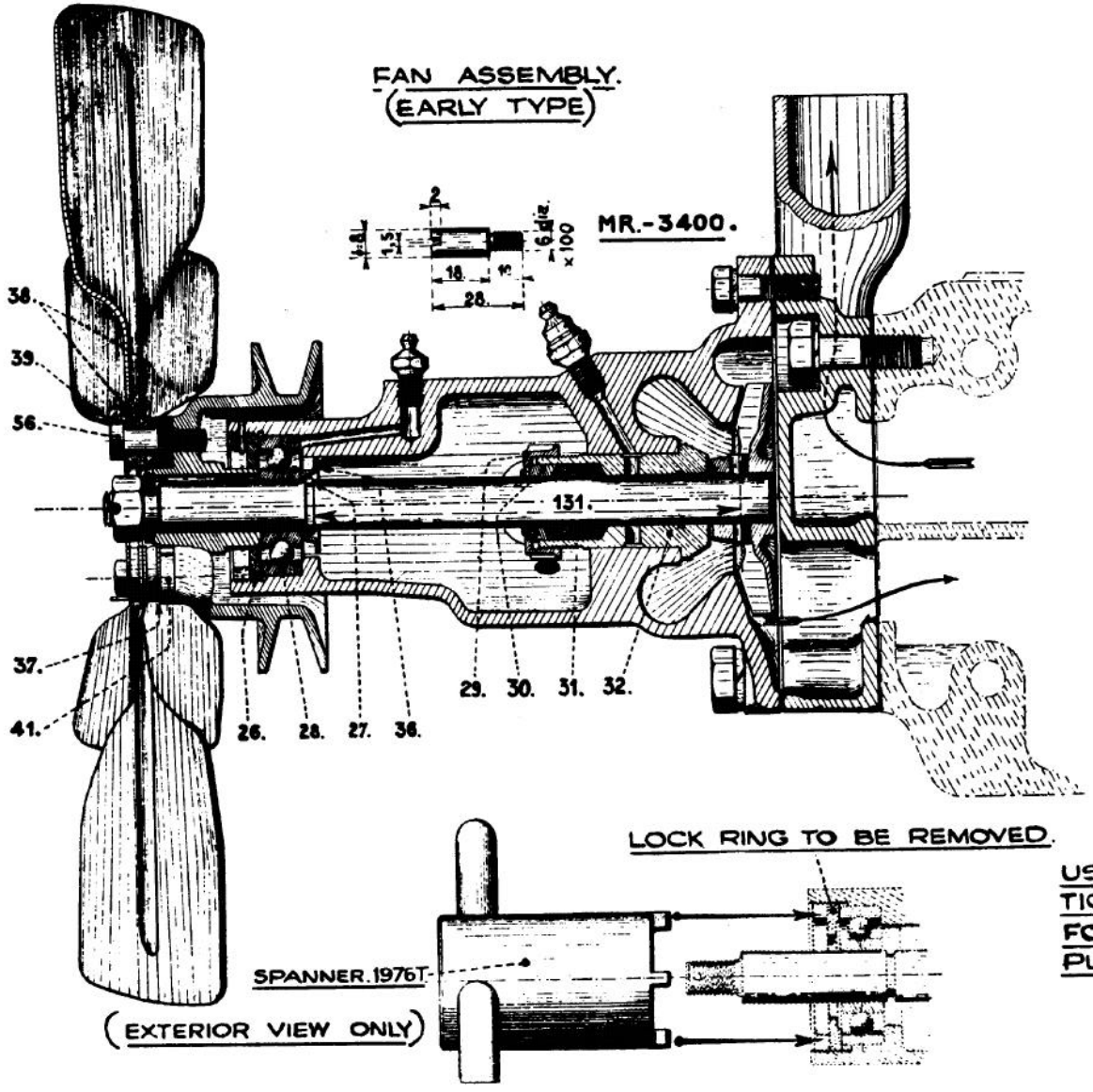
ORDER OF ASSEMBLY OF GASKETS AND MOUNTING OF PUMP BASE.

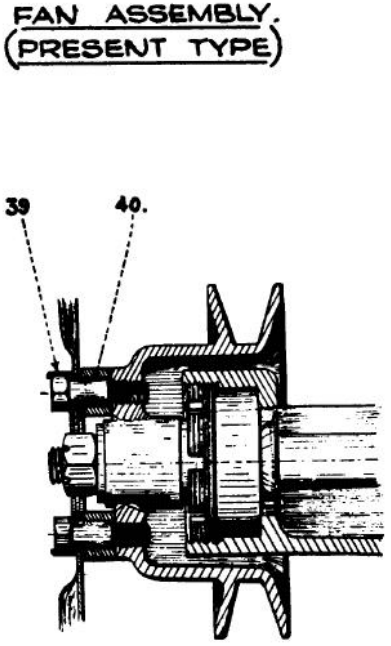


— ENGINE —

— FAN & WATER PUMP ASSEMBLY —

— LONGITUDINAL SECTION ON CENTRE LINE —





USE OF SPANNER 1976T TO TIGHTEN OR LOOSEN LOCK-RING FOR BALL-RACE OF WATER PUMP SPINDLE.

— SPRING TESTING —

1. CHECKING LENGTH OF SPRING:
   PLACE SPRING TO BE CHECKED "1" BETWEEN FACES OF GUIDE "2": DRAW SLIDE "3" INTO CONTACT: ARROW "4" COMES OPPOSITE FIGURE ON SCALE OF LENGTHS "5" INDICATING FREE LENGTH OF SPRING "1".

2. CHECKING LENGTH OF LOAD:
   (a) PLACE STANDARD SPRING "6" (OR "12" ACCORDING TO REQUIREMENTS) IN TWO HOLES "7" AND DRAWSLIDE INTO CONTACT BY MEANS OF HAND-WHEEL "9".
   (b) BRING SPRING TO BE TESTED "1" UNDER LOAD INDICATED IN BOOK BY MEANS OF HAND-WHEEL "9". READ THE LENGTH SHOWN BY ARROW "4" ON LENGTH SCALE "5".
   (c) READ ON SCALE { 10 (in kilogrammes) OPPOSITE ARROW 11 (IF USING STANDARD SPRING 6) / 14 (in kilogrammes) OPPOSITE ARROW 13 (IF USING STANDARD SPRING 12) } CORRESPONDING LOADING.

Fig. 1. - SPRING TESTING APPARATUS. (2420 T)

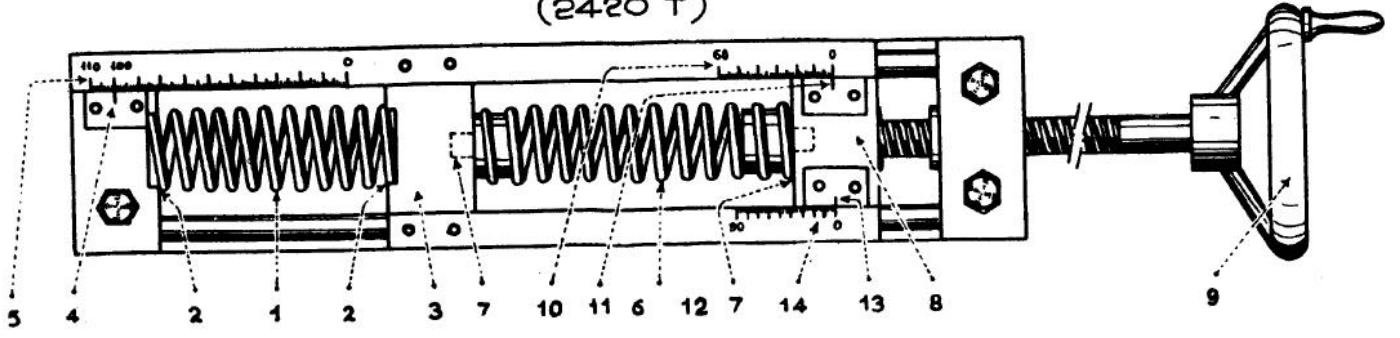


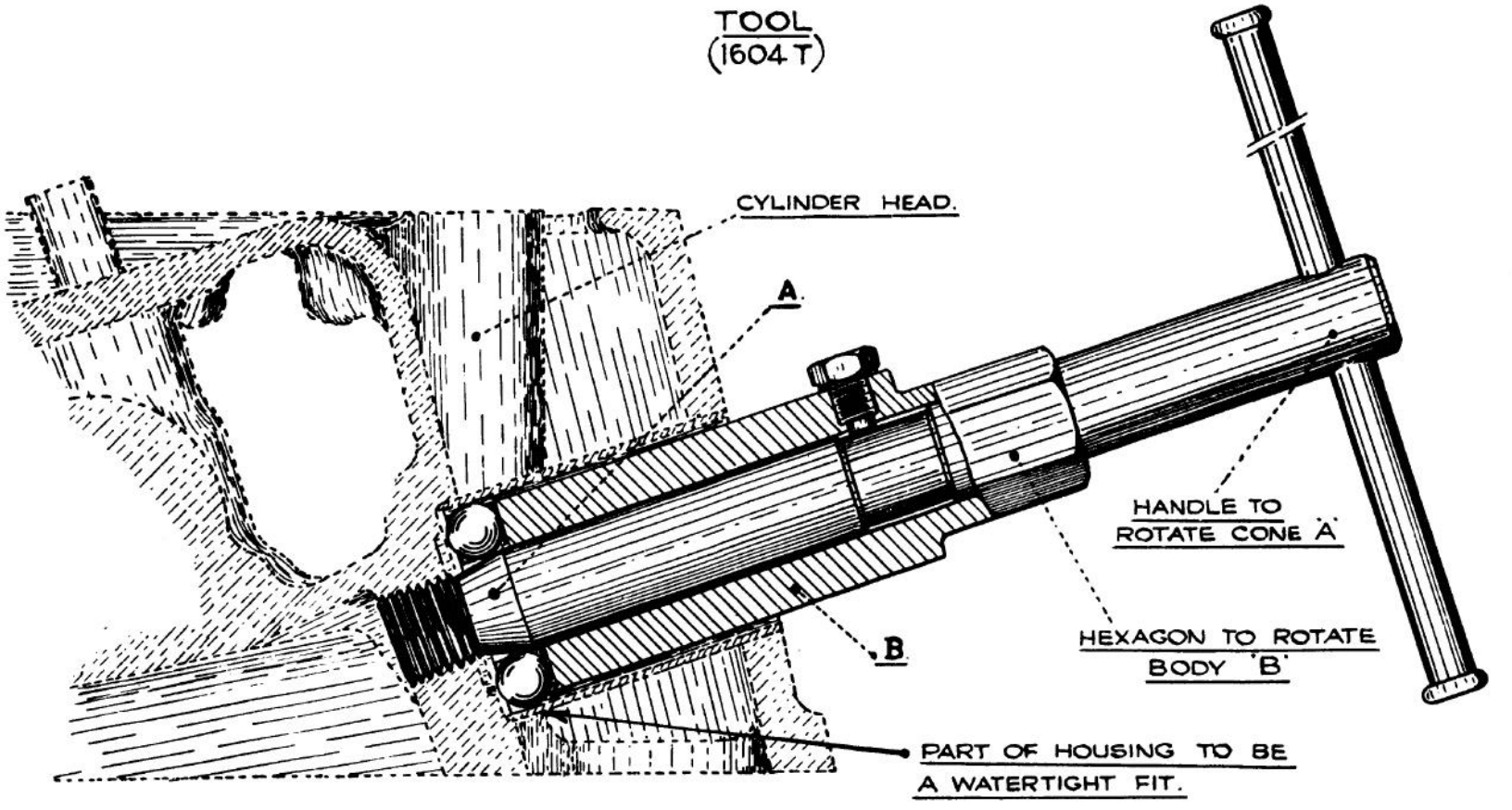
Fig. 2. - STANDARD SPRINGS.

SPRING, COMPRESSION.
1mm. PER 1 KG. LOAD
(2421 T)
This spring is painted yellow.

SPRING, COMPRESSION.
1mm PER 2 KG LOAD.
(2422 T)
This spring is painted red.

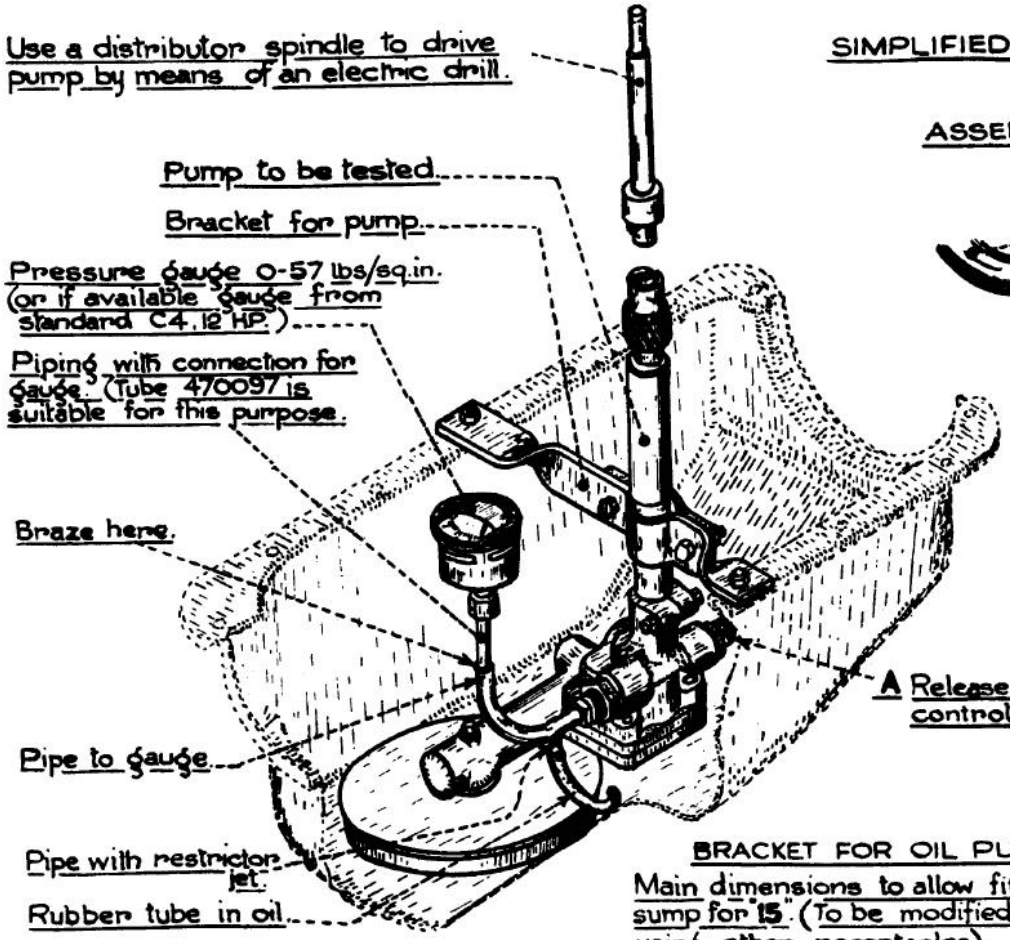
ENGINE

FITTING SPARKING PLUG HOUSINGS



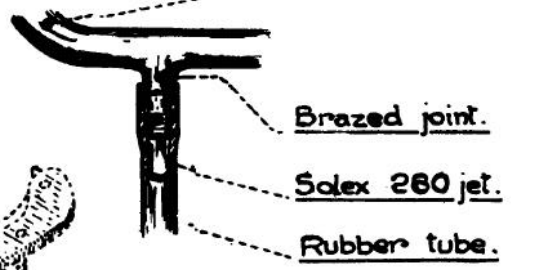
SCREW CONE 'A' INTO SPARKING PLUG THREADING TO EXERCISE PRESSURE ON BALLS.
GIVE ONE TURN TO BODY 'B' BY MEANS OF SPANNER 19 mm. ACROSS FLATS.
SCREW DOWN CONE 'A' AGAIN AND GIVE ONE MORE TURN TO BODY 'B'.
THIS SHOULD BE SUFFICIENT TO ENSURE A WATER-TIGHT FIT.

— ADJUSTMENT OF OIL PUMP —



SIMPLIFIED ASSEMBLY MR. 1811.

ASSEMBLY OF JET.



The pump to be tested fitted on a sump will be driven by an electric drill 1000 - 1500 R.P.M. (Normal speed usually marked on maker's name-plate)

USE WINTER GRADE OIL "MOBILOIL ARCTIC"

NOTE: IF POSSIBLE HEAT OIL TO 150°F. The pressure indicated by gauge should remain between 28 - 31·5 lbs/sq.in.

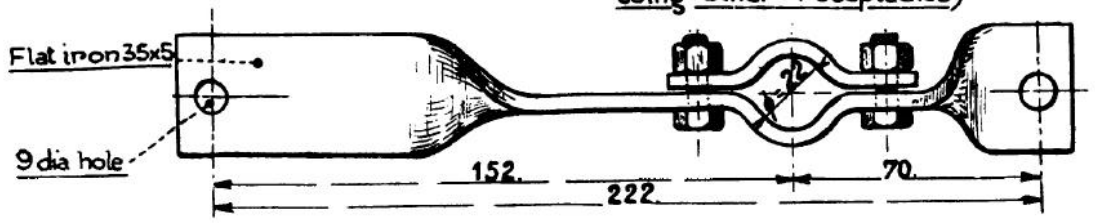
IF THIS IS IMPOSSIBLE BRING OIL TO 68° F

The pressure indicated should remain between 32 - 35 lbs/sq.in.

TO BRING PRESSURE TO CORRECT FIGURE.
Screw up release valve control to increase pressure.
Unscrew release valve control to reduce pressure.

BRACKET FOR OIL PUMP.

Main dimensions to allow fitting on sump for 15". (To be modified when using other receptacles)



— ENGINE —

— WATER PUMP BUSH —

Fig.1. - REAMING BUSH.

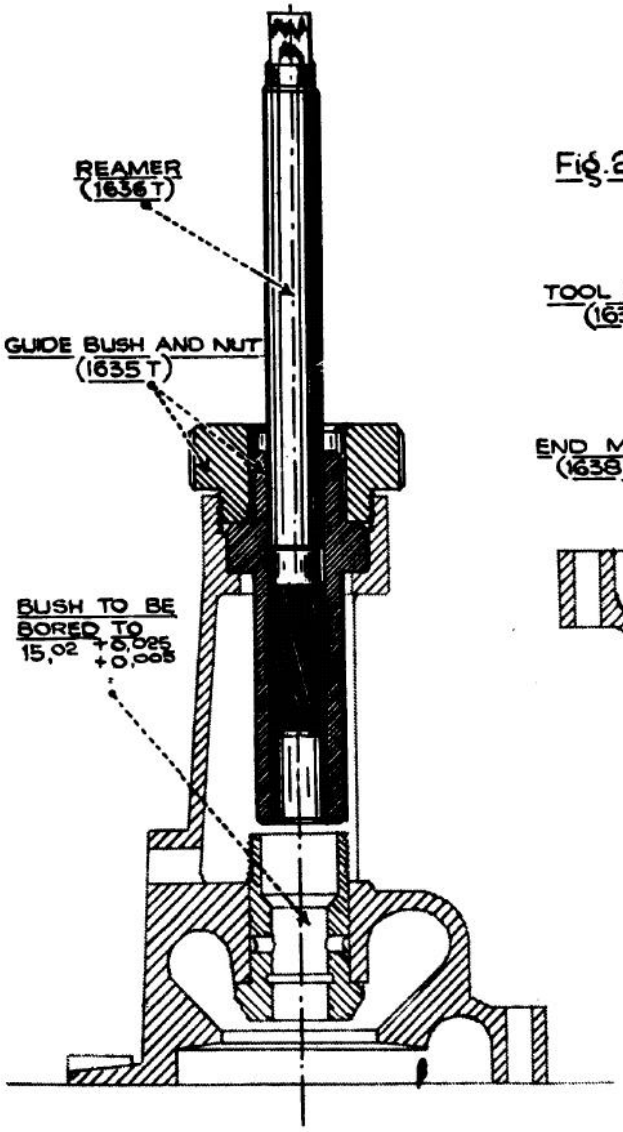


Fig.2. - MILLING IMPELLOR SEATING FACE.

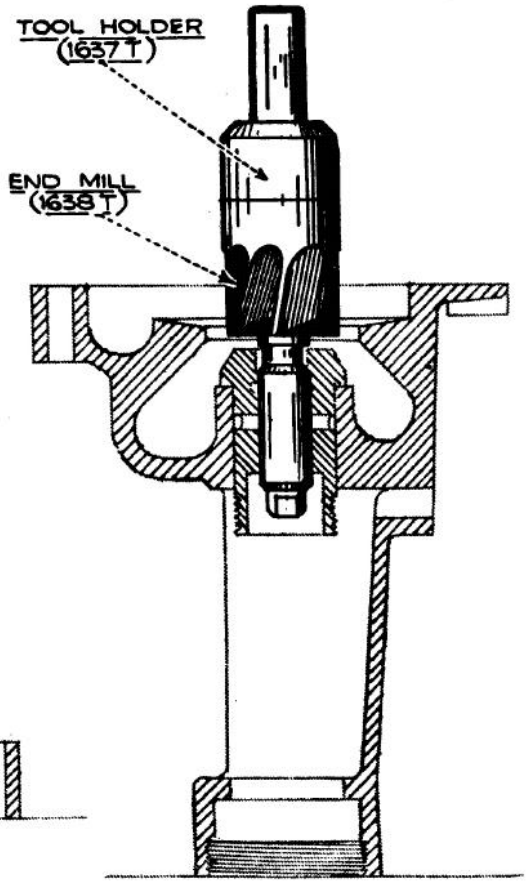
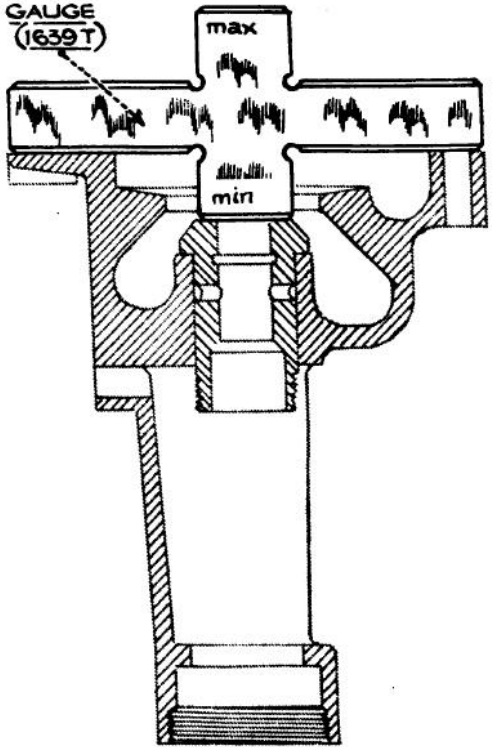
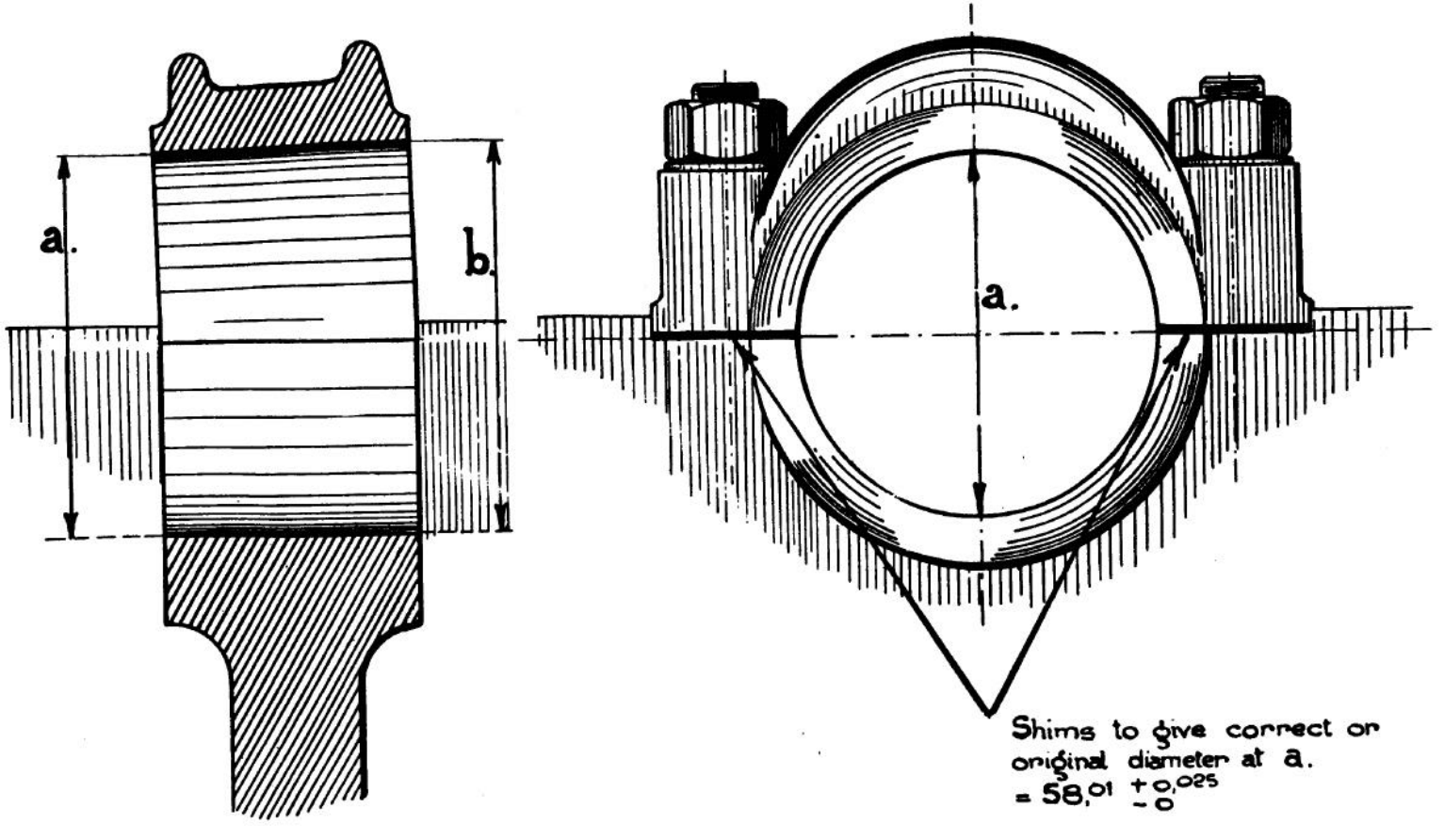


Fig.3. - CHECKING MILLING OF IMPELLOR SEATING FACE.



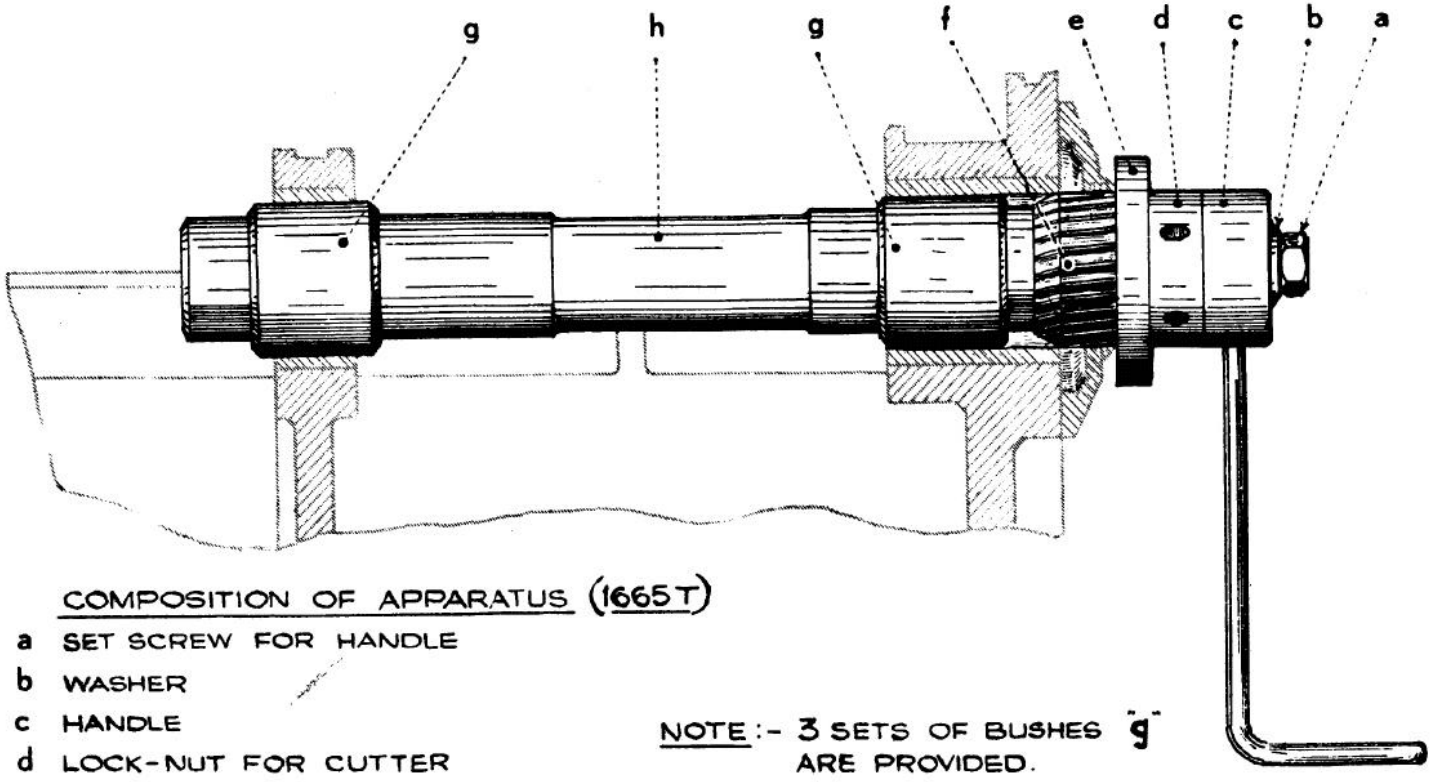
—FITTING BEARINGS BY MEANS OF SHIMS—



Shims to give correct or original diameter at a.
$= 58{,}01\ ^{+0{,}025}_{-0}$

— BORING & ALIGNMENT OF OIL BAFFLES —

USE OF APPARATUS



COMPOSITION OF APPARATUS (1665T)

- a SET SCREW FOR HANDLE
- b WASHER
- c HANDLE
- d LOCK-NUT FOR CUTTER
- e SAFETY RING
- f CUTTER
- g ALIGNMENT BUSH
- h MANDREL CARRYING CUTTER

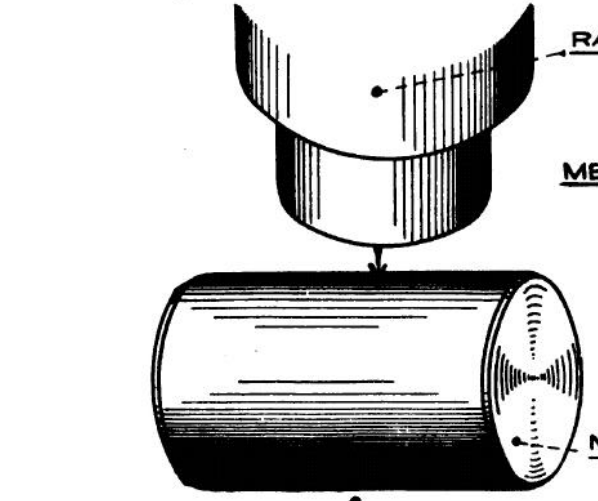
NOTE :- 3 SETS OF BUSHES "g" ARE PROVIDED.

1. OUTER DIA. 50 m.m. (For bearings of original bore)
2. OUTER DIA. 49.5 mm. (For bearings after 1st cut)
3. OUTER DIA. 49 mm. (For bearings after 2nd cut)

The principal items of this apparatus can be used on all models.

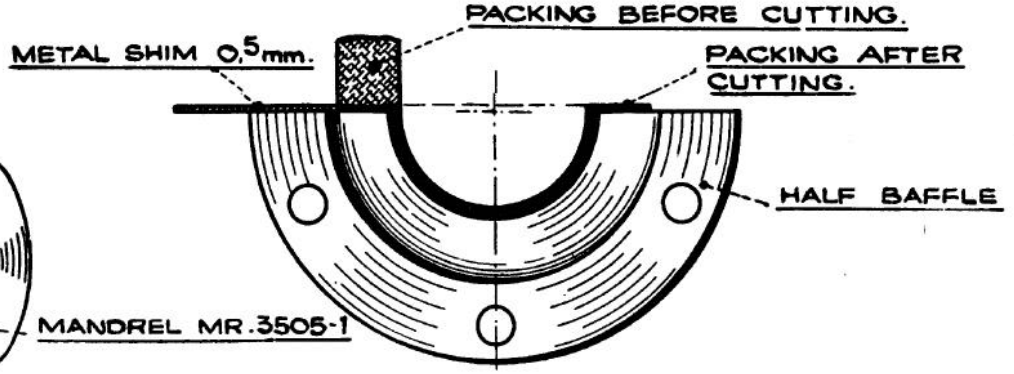
— FITTING OF OIL BAFFLE PACKING —

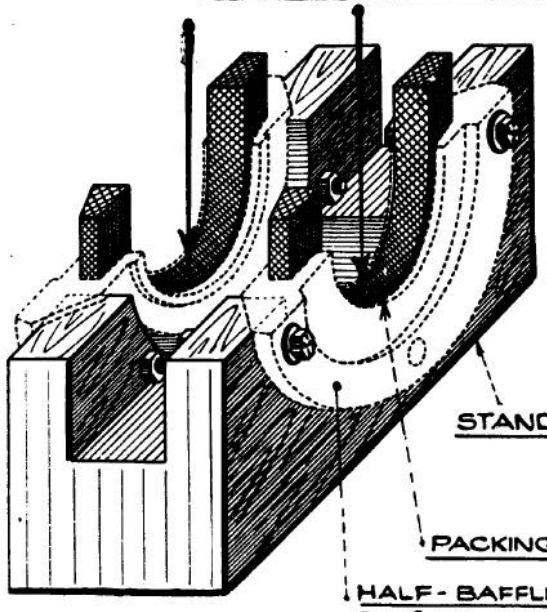
Fig 1. FITTING PACKINGS.



— Fig. 2. —

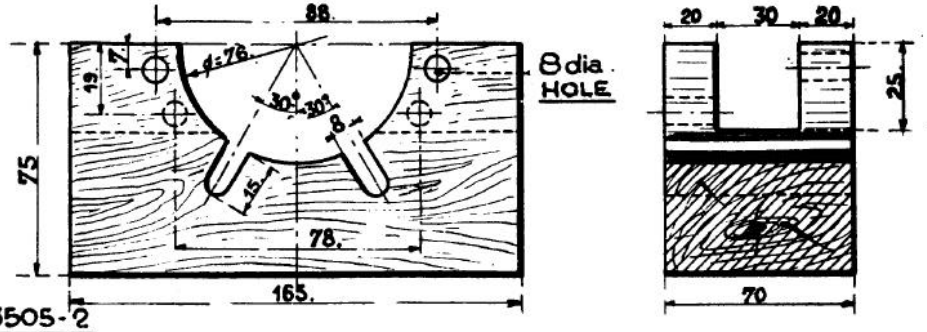
PREPARING PACKING FOR ASSEMBLY.



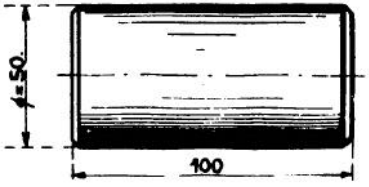


— Fig. 3. —

STAND. MR. 3505-2

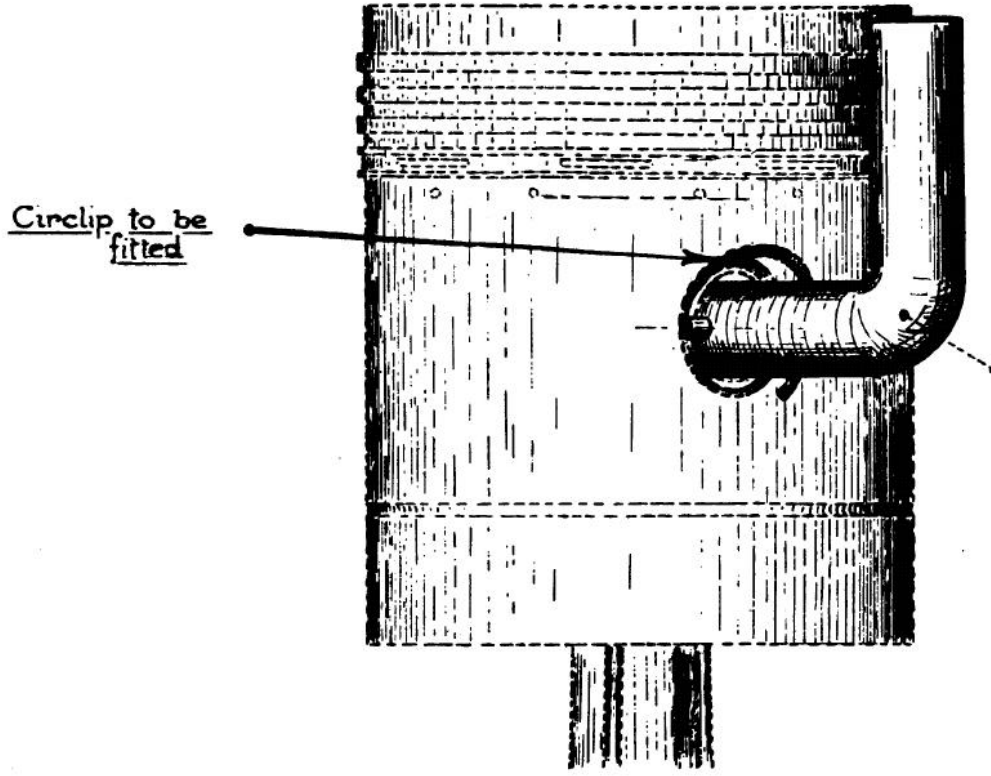


MANDREL. MR. 3505-1



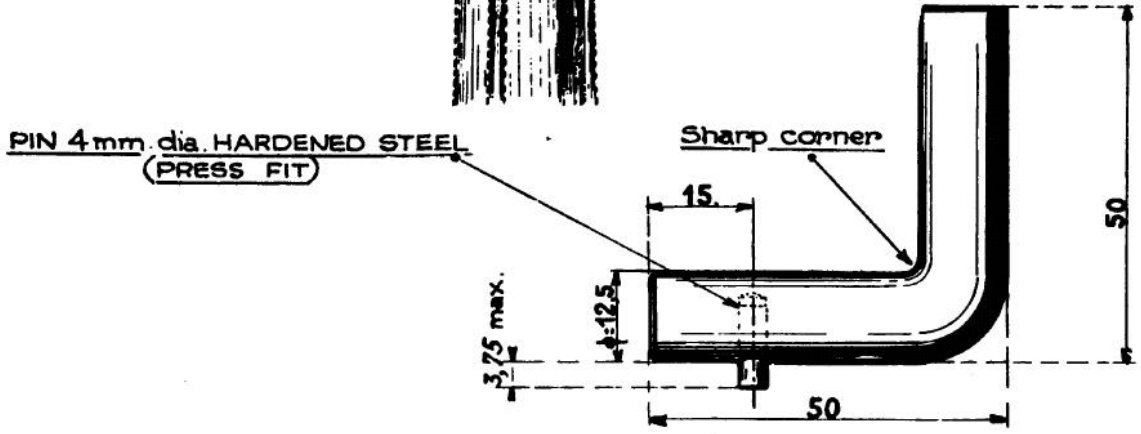
— ENGINE —

— FITTING GUDGEON PIN CIRCLIPS —



— Fig. 1. —

FITTING CIRCLIP.



— Fig. 2. —

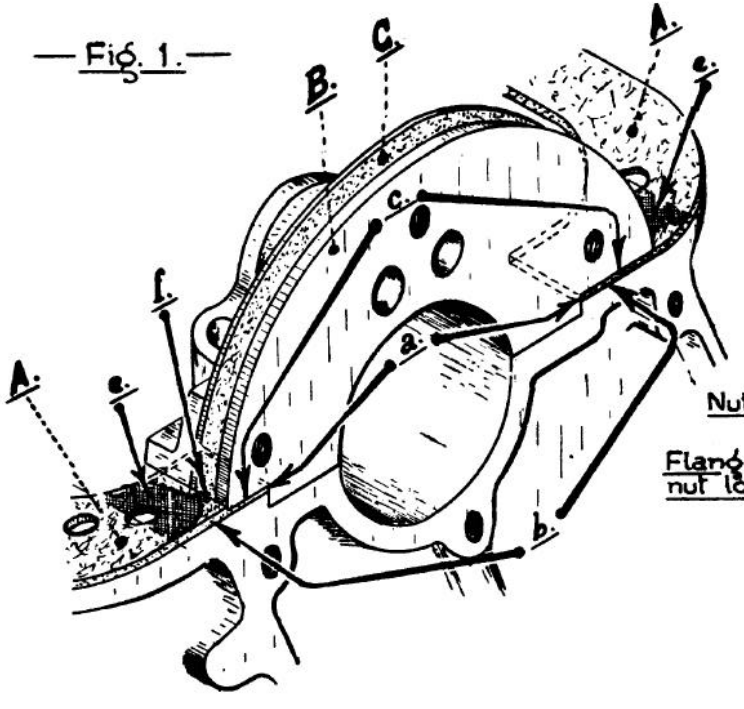
DETAIL OF TOOL MR. 1610.

—ENGINE—

— PRECAUTIONS WHEN ASSEMBLING —

FITTING OF SUMP GASKETS.

—Fig. 1.—



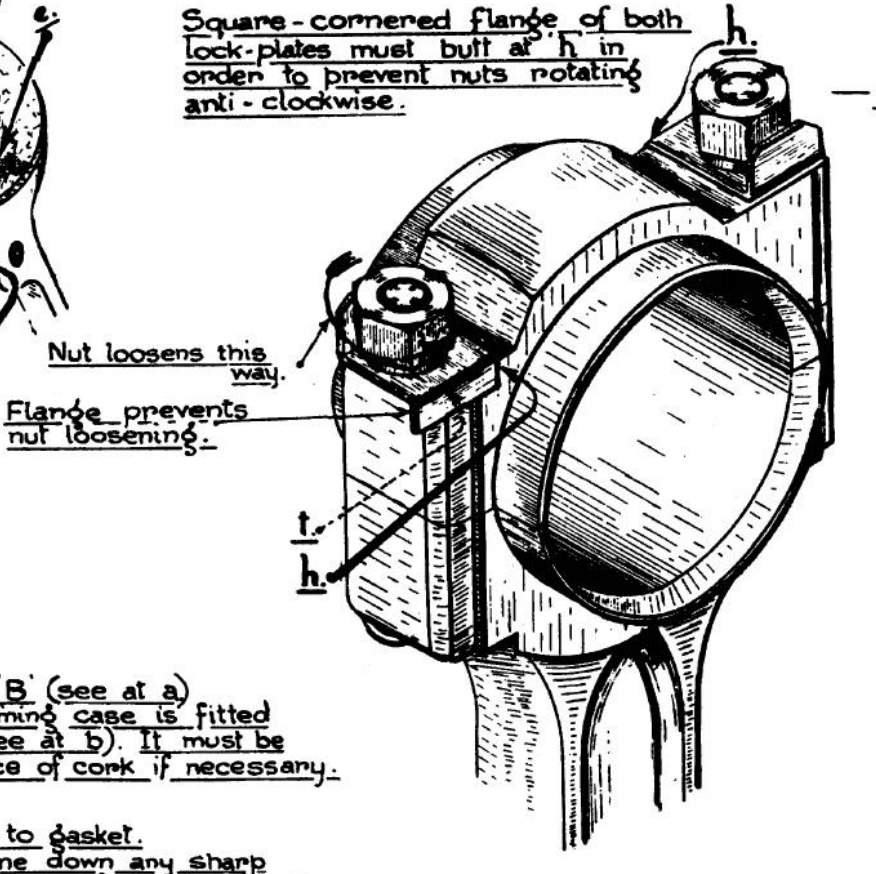
1. Gasket 'A' must butt against bearing cap 'B' (see at a). It must be flush with face against which timing case is fitted and thus preventing any oil escaping (see at b). It must be pinched under cap (see at 'c'); add a piece of cork if necessary.

2. Make certain sump face fits snug at 'e' to gasket. If necessary add metal and reface. Stone down any sharp edges at f without creating rounded or chamfered surfaces in order not to injure circular cap gasket 'C' when fitting sump.
Ends f of circular gasket 'C' in contact with gasket 'A'. and under cap 'B' to be coated with 'HERMETIC'.

POSITION OF LOCK-PLATES FOR BIG END NUT FITTING.

Square-cornered flange of both lock-plates must butt at 'h' in order to prevent nuts rotating anti-clockwise.

—Fig. 2.—

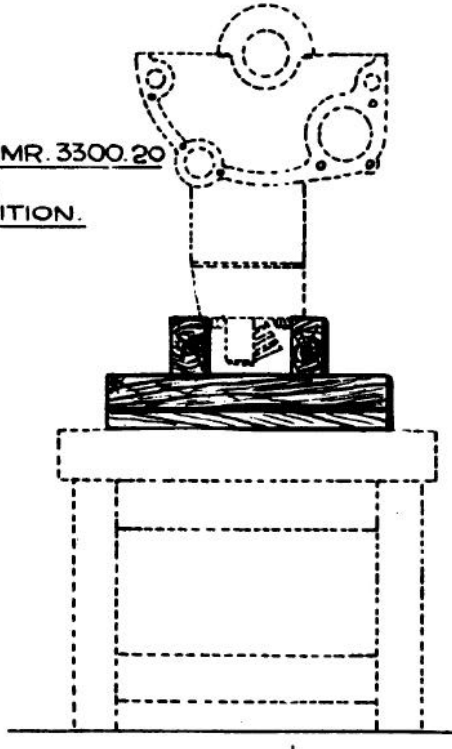


— ENGINE —

— ENGINE STANDS —

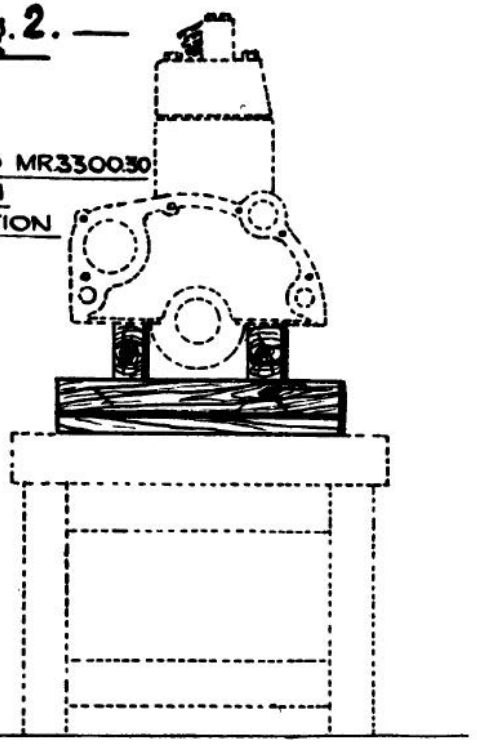
— Fig. 1. —

USE OF STAND MR. 3300.20 FOR ENGINE IN INVERTED POSITION.

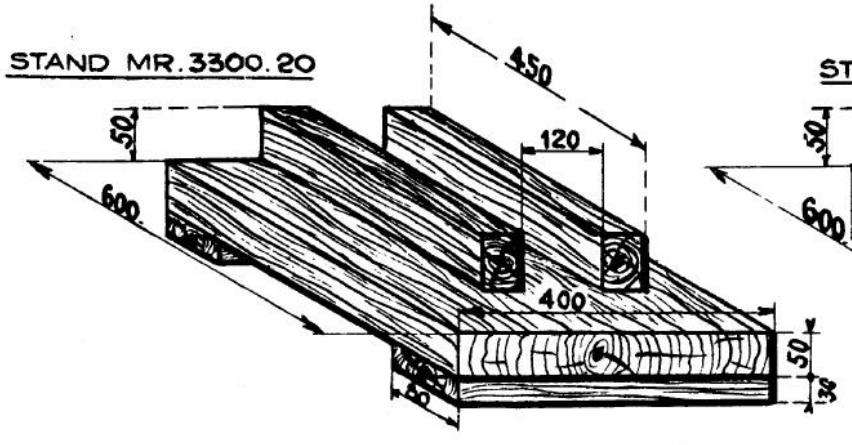


— Fig. 2. —

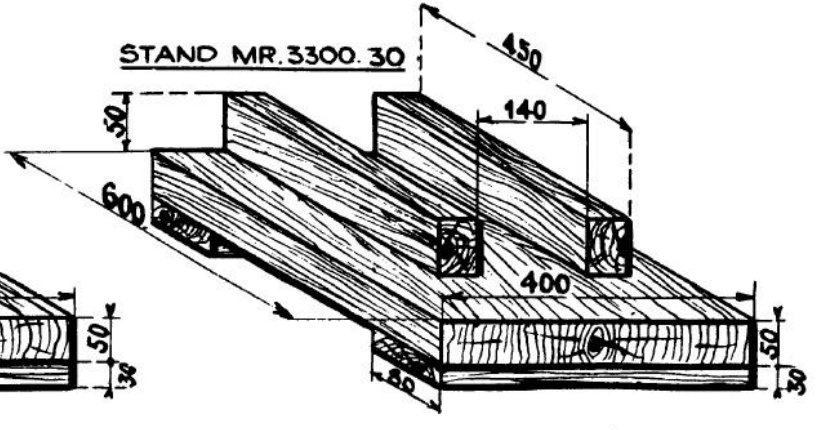
USE OF STAND MR3300.30 FOR ENGINE IN UPRIGHT POSITION



STAND MR. 3300. 20



STAND MR. 3300. 30



— FITTING PISTONS INTO BARRELS —

Fig. 1. - USE OF RING.

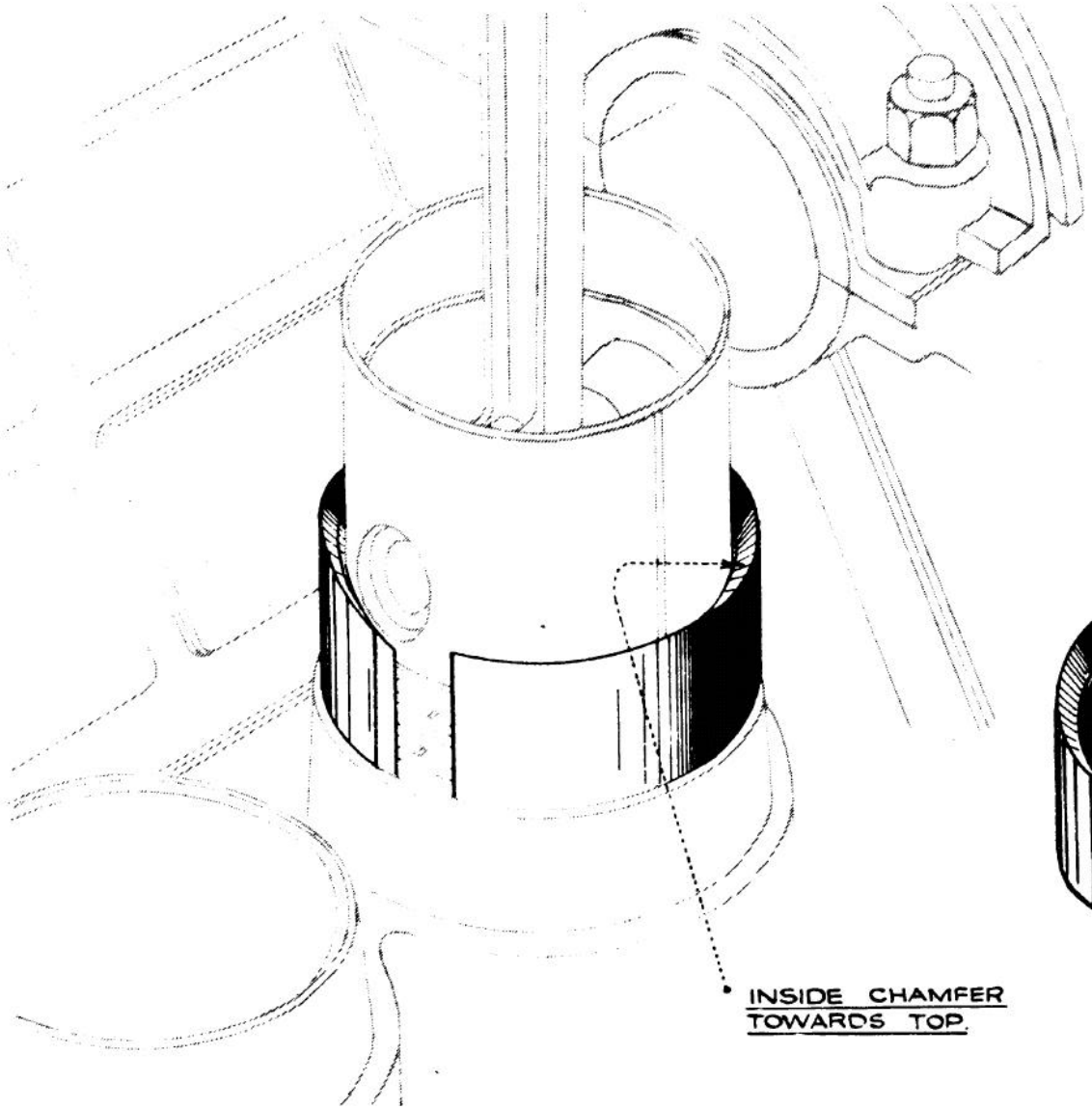
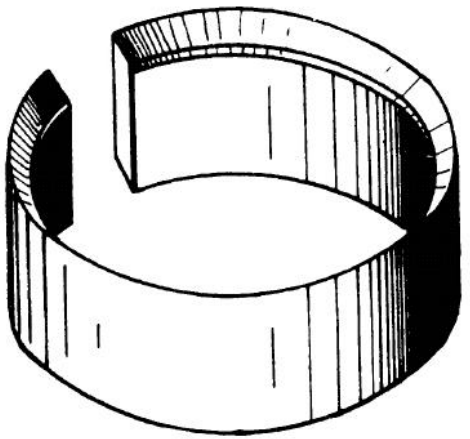
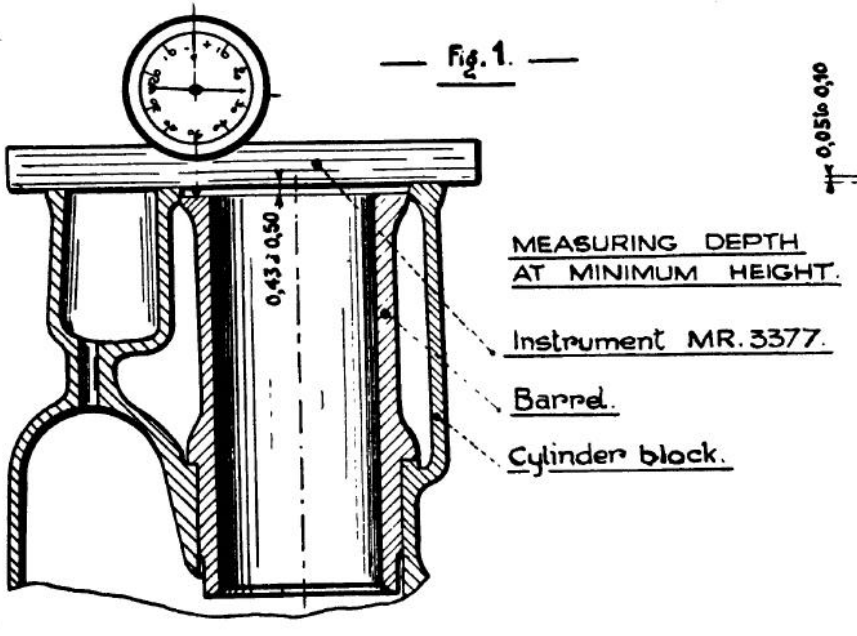


Fig. 2. - RING (1656T)

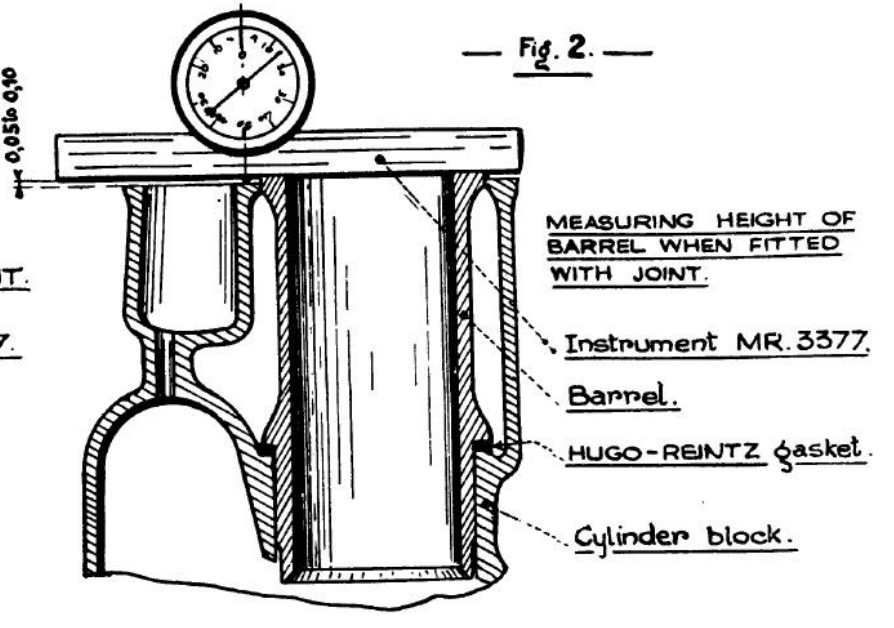


— GAUGING HEIGHT OF BARRELS —

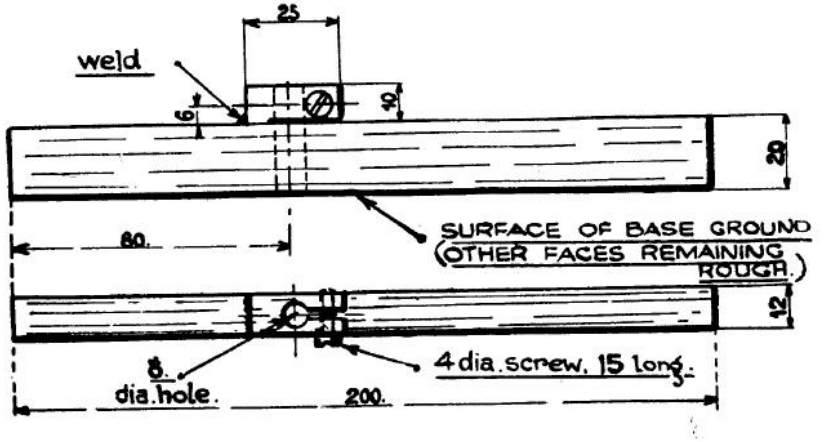
— Fig. 1. —



— Fig. 2. —



INSTRUMENT MR. 3377.



1. PREPARING INSTRUMENT.

PLACE STAND MR. 3377 FITTED WITH CLOCK GAUGE ON SURFACE PLATE OR STRAIGHT EDGE WITH A READING OF APPROX. 2mm. INDICATED. BRING GRADUATED FACE TO ZERO.

2. MEASURING DEPTH AT MINIMUM HEIGHT (WITHOUT LOWER GASKET). Fig. 1.

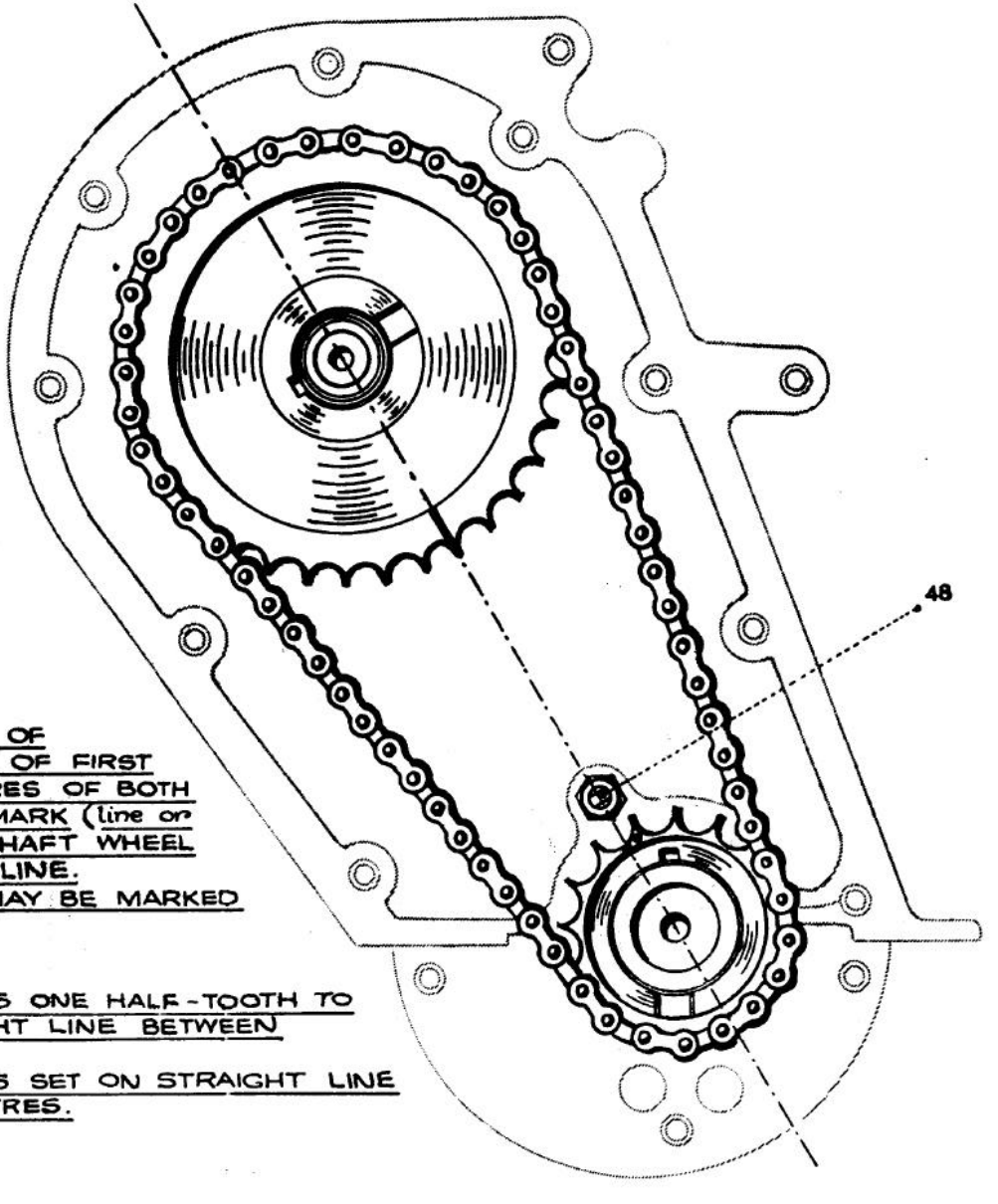
PLACE INSTRUMENT PREPARED AS ABOVE ON BLOCK FACE WITH POINTER CONTACTING BARREL. TAKE READINGS AT 4 CARDINAL POINTS ON BARREL. TAKE AVERAGE.

3. MEASURING HEIGHT OF BARREL (GASKET IN POSITION) Fig. 2.

PLACE INSTRUMENT ON BARREL WITH POINTER CONTACTING CYLINDER BLOCK. THE DIFFERENCE IN READINGS SHOULD BE BETWEEN 0,05 AND 0,10

—ENGINE—

—SETTING TIMING WHEELS—



ENGINE BEING AT TOP DEAD CENTRE AT END OF COMPRESSION STROKE OF FIRST CYLINDER, THE CENTRES OF BOTH WHEELS AND TIMING MARK (line or centre-punch) OF CAMSHAFT WHEEL MUST BE IN STRAIGHT LINE.

CRANKSHAFT WHEEL MAY BE MARKED (line or centre punch):

1. ON TOOTH.
2. BETWEEN TEETH.

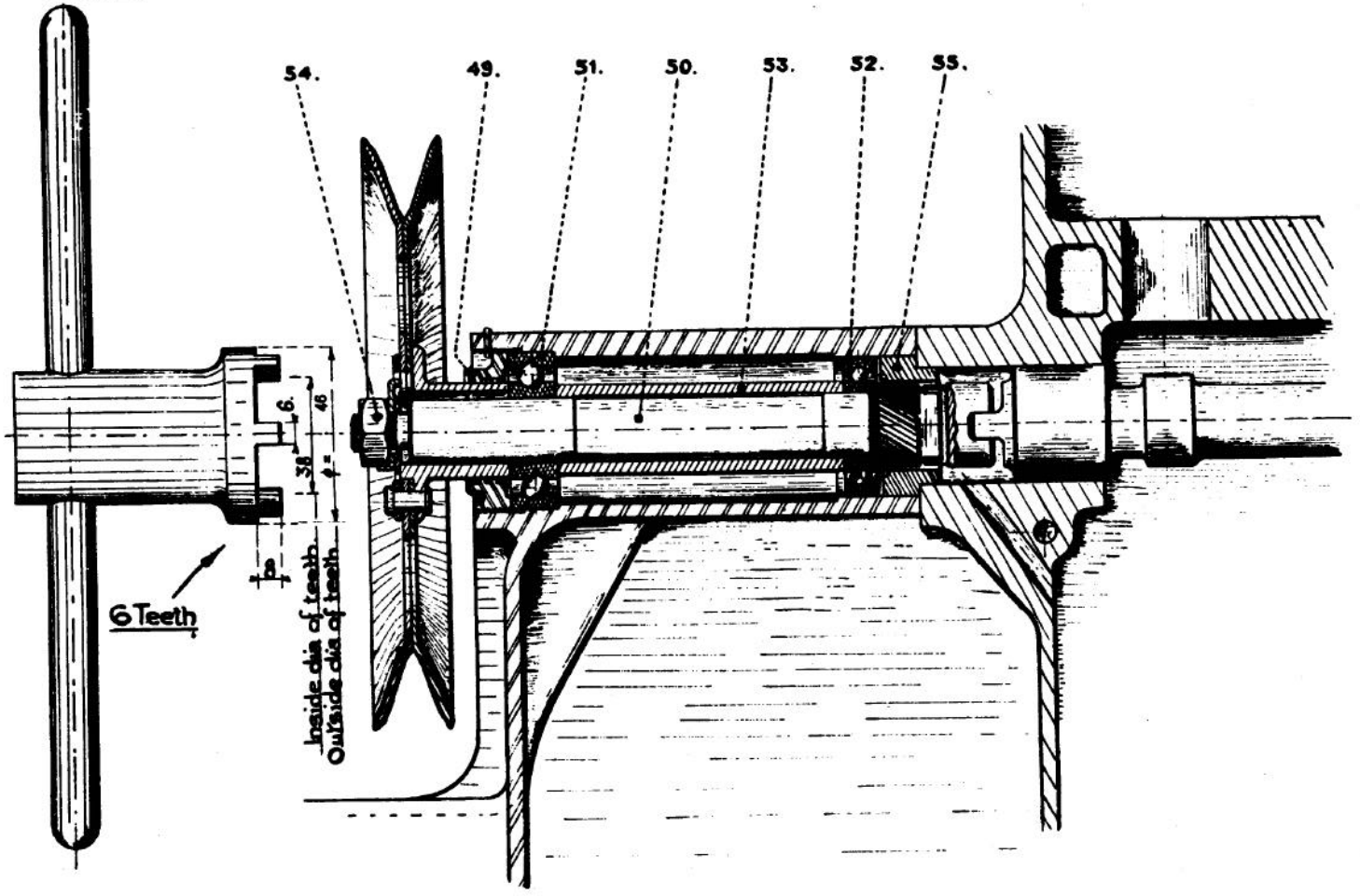
IN CASE 1. THE MARK IS ONE HALF-TOOTH TO THE RIGHT OF STRAIGHT LINE BETWEEN WHEEL CENTRES.

IN CASE 2. THE MARK IS SET ON STRAIGHT LINE BETWEEN WHEEL CENTRES.

— WATER PUMP AND DYNAMO DRIVING SHAFT —

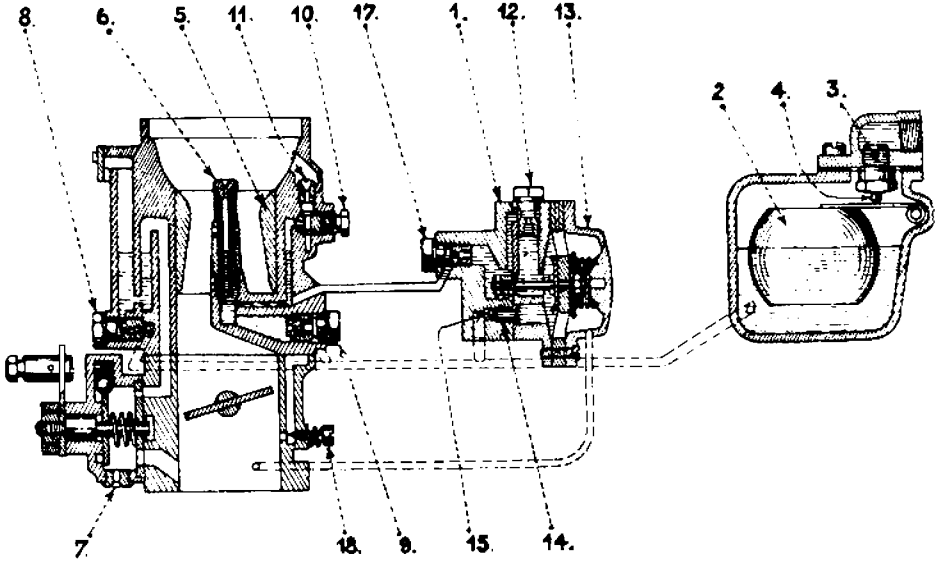
Fig.1. SECTION ON CENTRE LINE OF SHAFT.

Fig.2. SPANNER (1640.T)

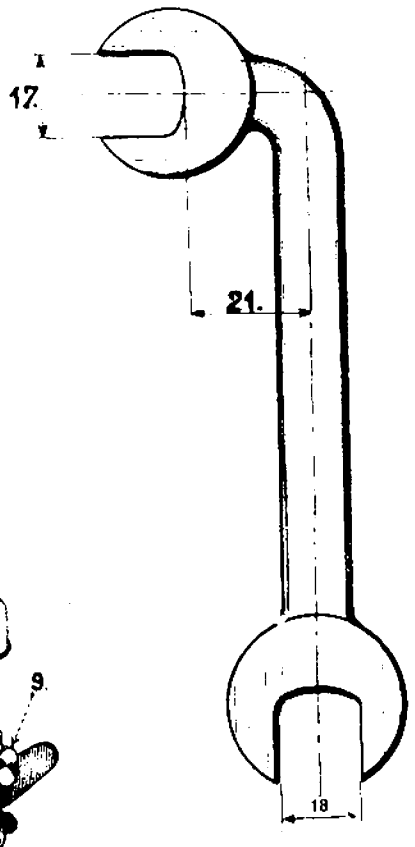


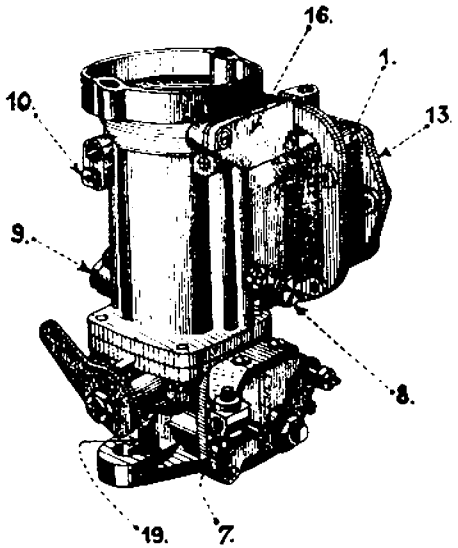
— CARBURETTOR —

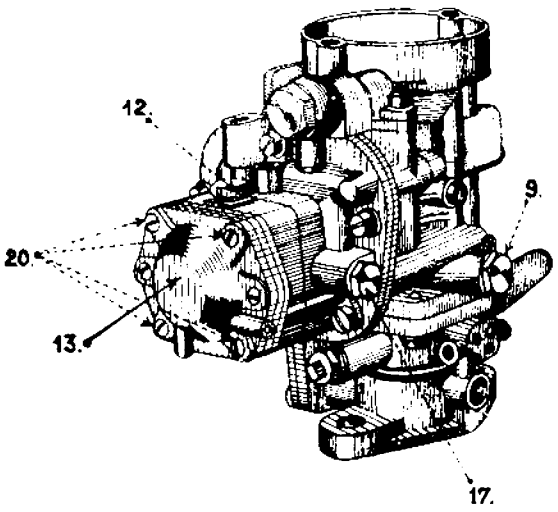
— SECTION AND EXTERNAL VIEWS —



SPANNER
(1620.T.)



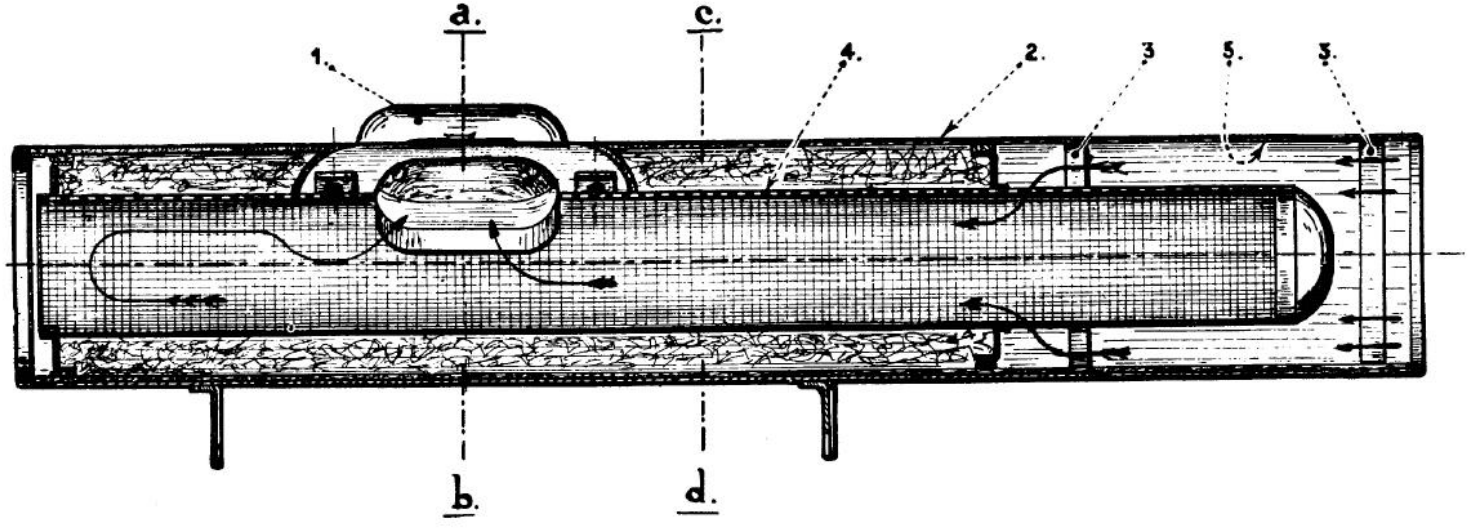




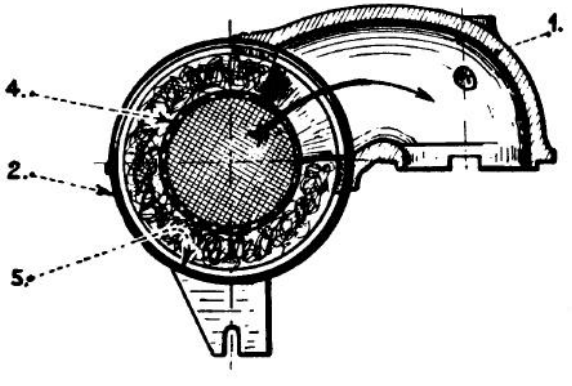
— AIR INTAKE SILENCER —

— SECTIONAL VIEWS —

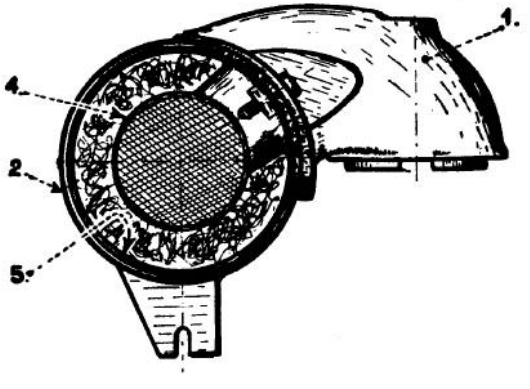
— Fig. 1. — LONGITUDINAL SECTION.



— Fig. 2. — TRANSVERSE SECTION AT ab

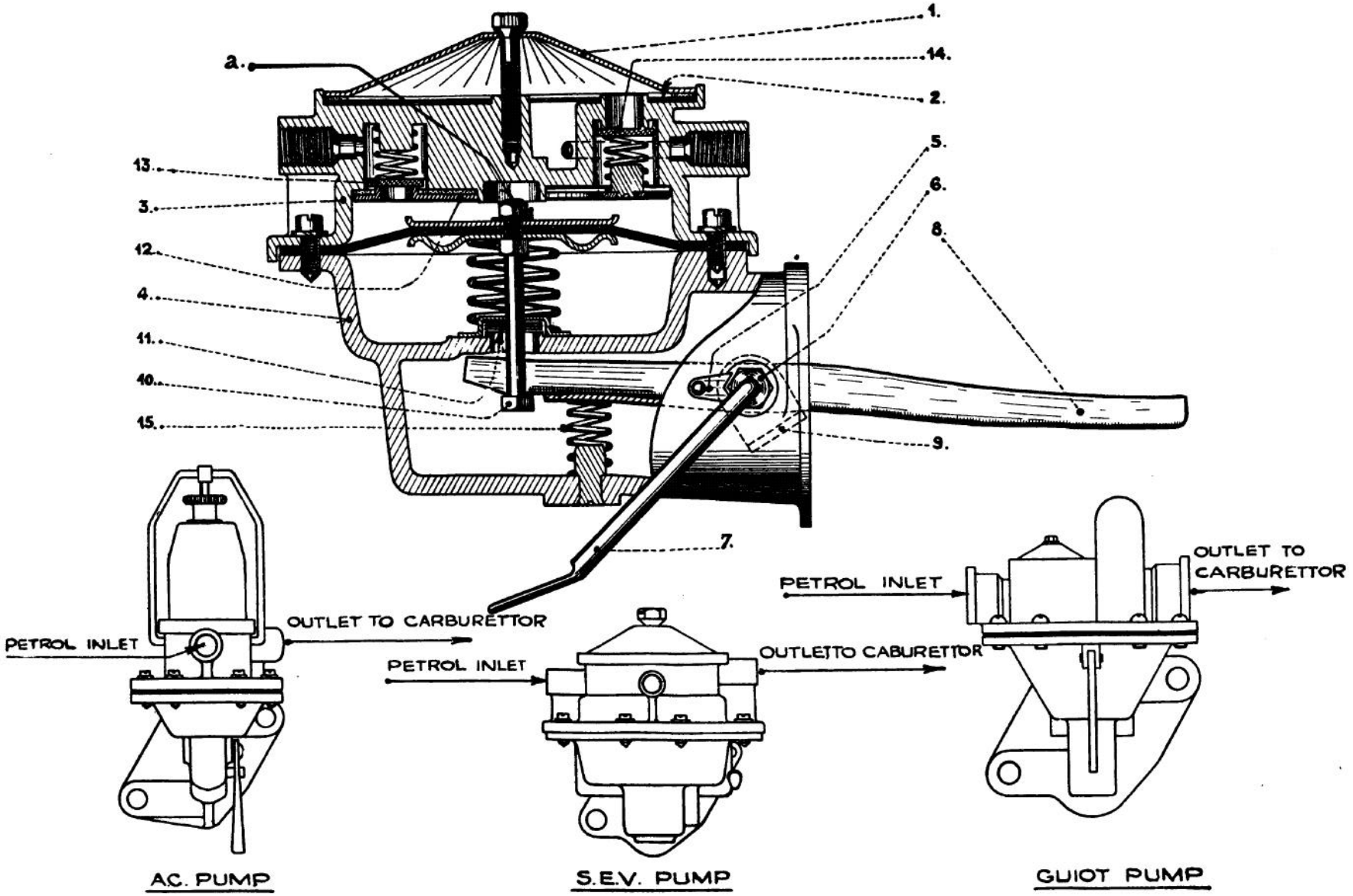


— Fig. 3. — TRANSVERSE SECTION AT cd



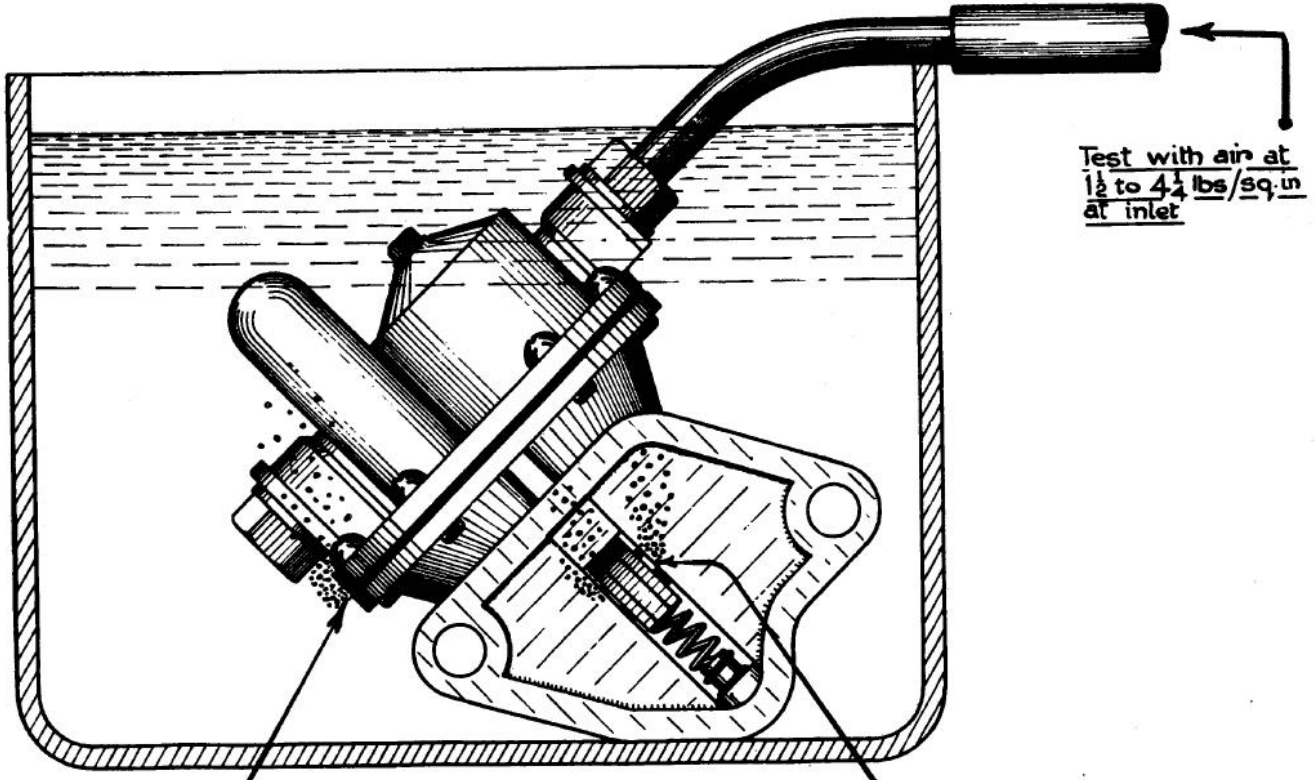
— PETROL PUMP —

— ASSEMBLY : VERTICAL SECTION —



—PETROL PUMP—

— CHECKING FOR AIR LEAKS—

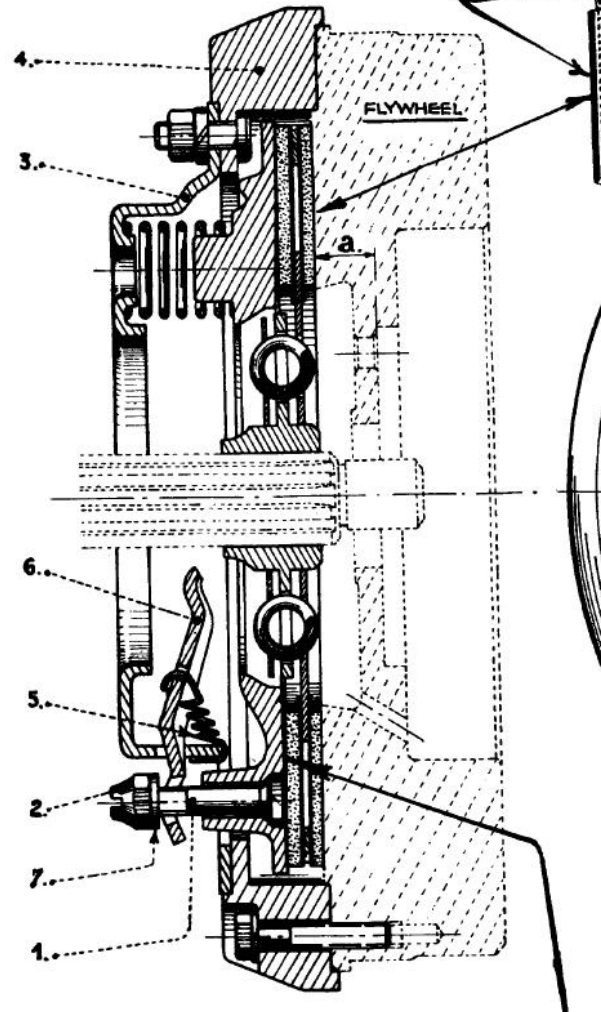


— ASSEMBLY AND SECTION —

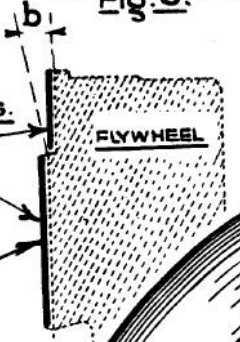
— Fig. 1. —

LONGITUDINAL SECTION ON CENTRE LINE.

Remove same amount from both faces.

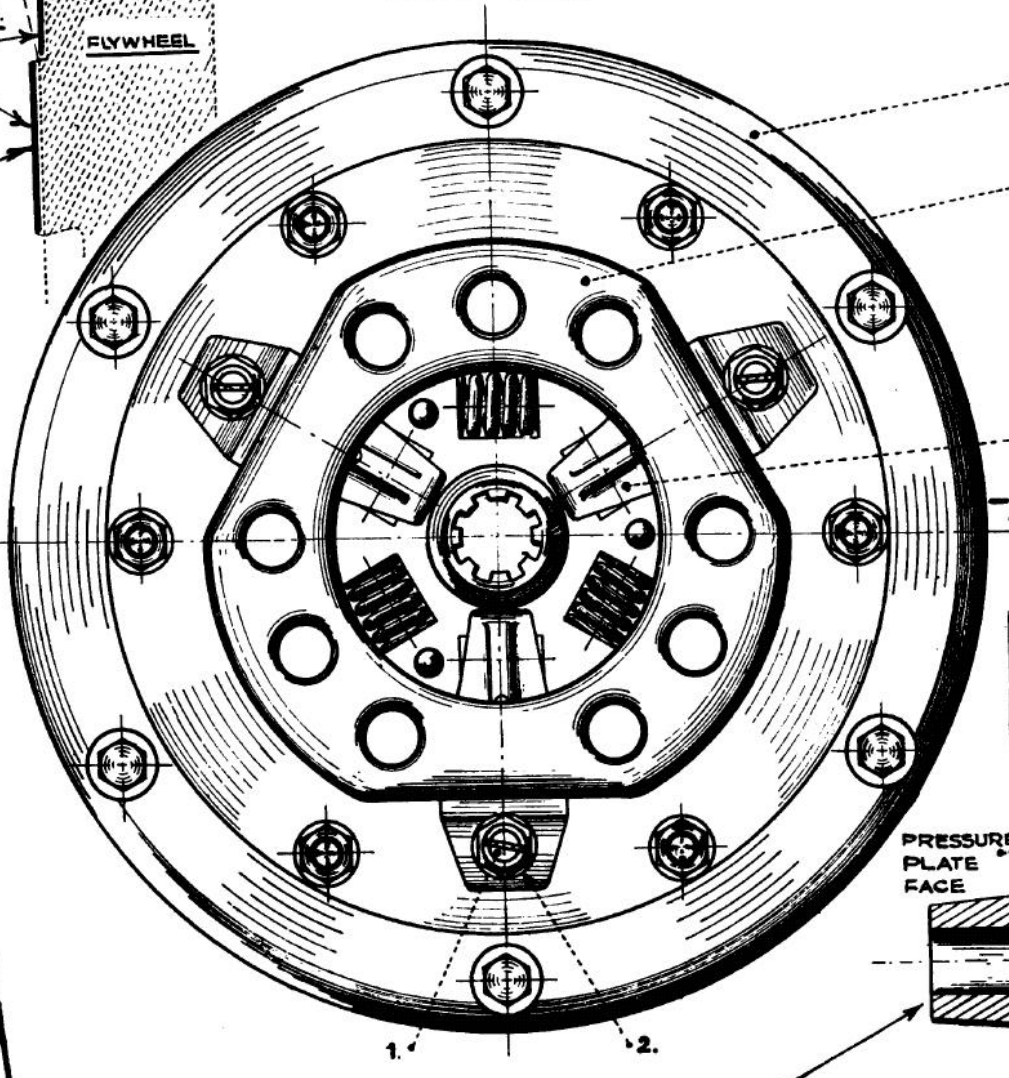


— Fig. 3. —



— Fig. 2. —

FRONT VIEW SHOWING TOGGLES AND CLUTCH HOUSING.



— Fig. 4. —

ON 6 SPRING CLUTCH. ONLY:

THE PRESSURE PLATE FACE IS NOT FLAT BUT SLIGHTLY CONCAVE. (See Fig. 2.)

— CLUTCH —

— TOGGLE ADJUSTMENT —

Fig.1 - APPARATUS FOR ADJUSTING CLUTCH. 1701.T.

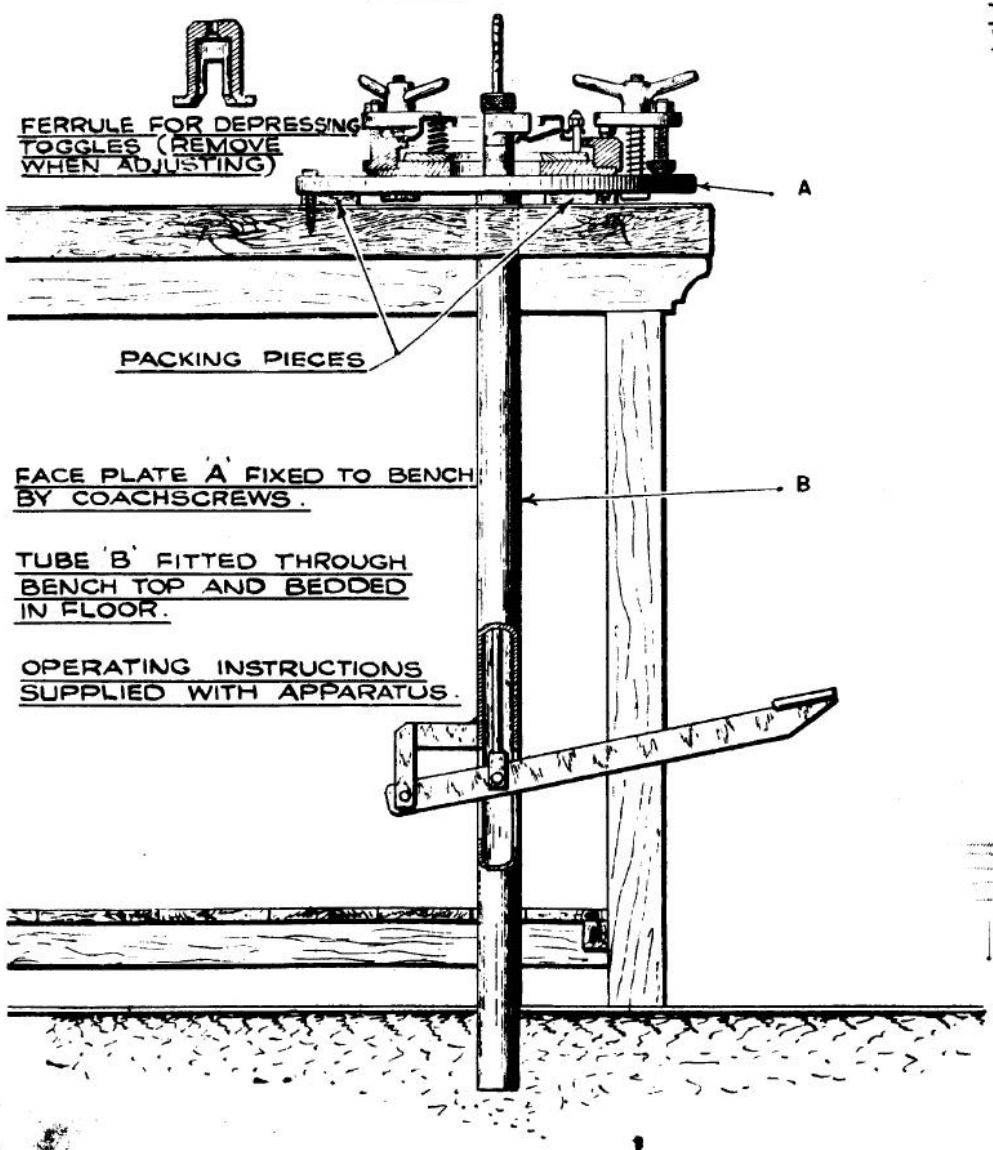


Fig.2 - MECHANISM IN POSITION "CLUTCH IN"

THESE DIMENSIONS CAN ONLY BE MEASURED WHEN MOUNTED ON FACE PLATE.

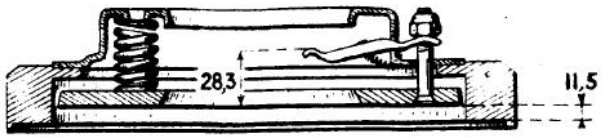
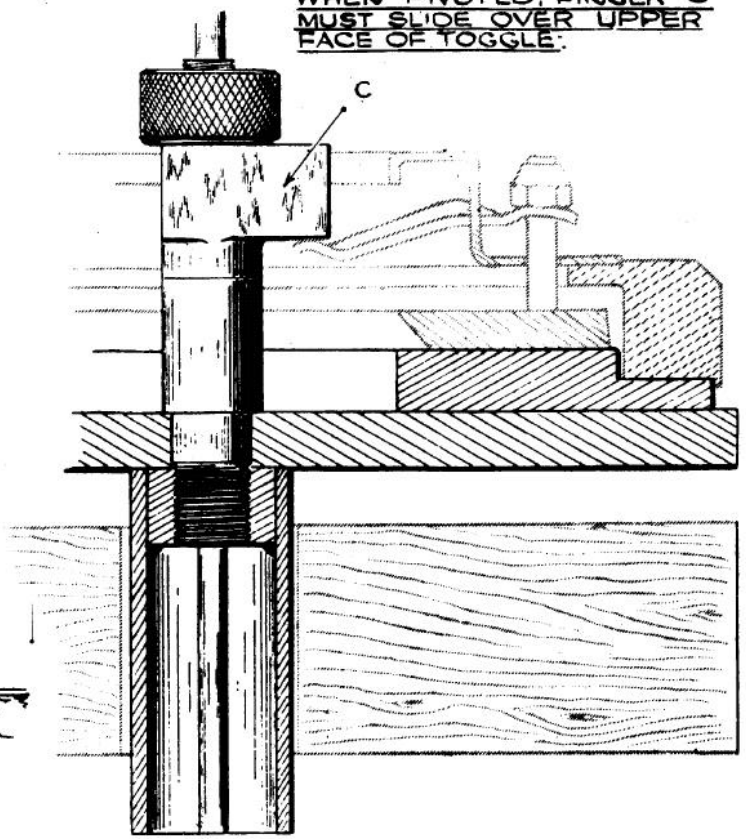


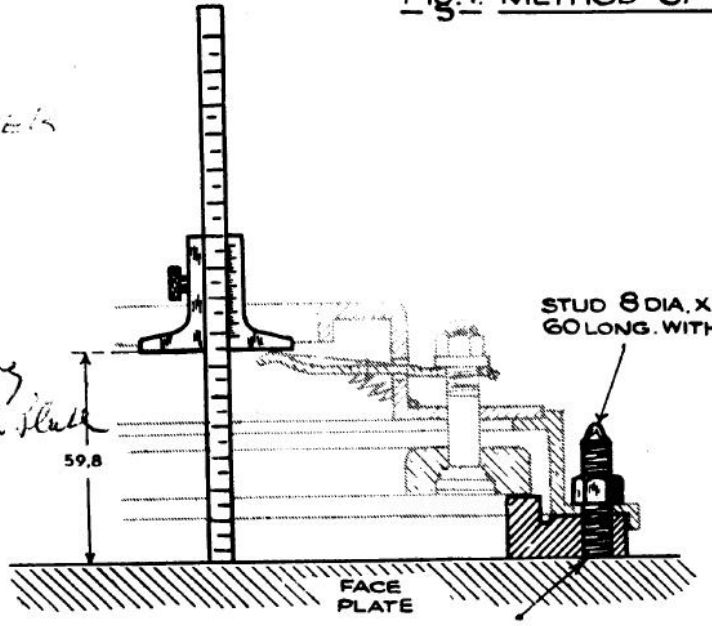
Fig.3 - CHECKING ADJUSTMENT.

WHEN PIVOTED, FINGER C MUST SLIDE OVER UPPER FACE OF TOGGLE.



— TOGGLE ADJUSTMENT (SIMPLIFIED METHOD) —

Fig.1. METHOD OF MOUNTING.



END OF STUDS FLUSH AND LOCKED BY PIN-PUNCH.

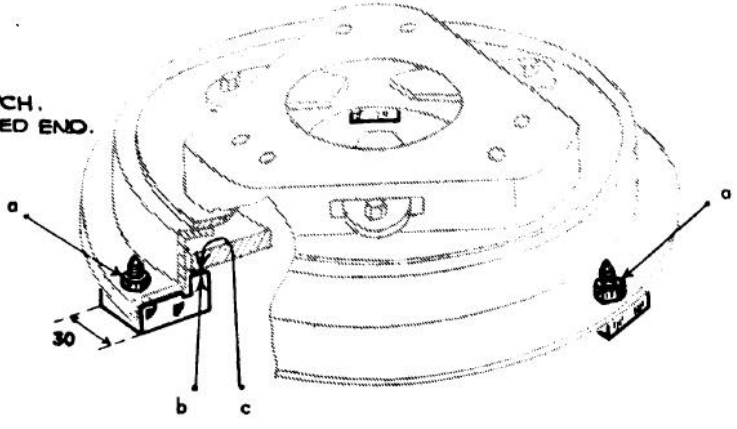
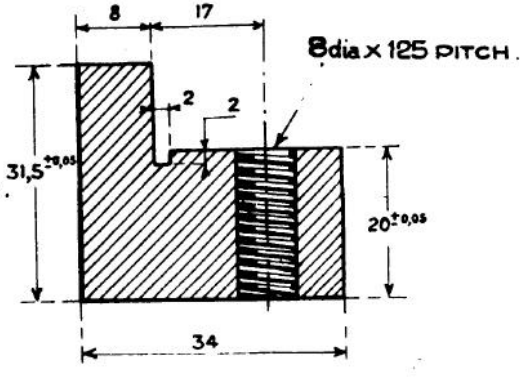


Fig.2. BLOCK MR.3457/11.

REMARKS: THIS ARRANGEMENT IS TO BE ADOPTED WHEN OTHER MEANS ARE NOT AVAILABLE.

DURING ADJUSTMENT IT IS NECESSARY TO APPLY MOTION TO THE TOGGLES EITHER BY A PRESS OR DRILLING MACHINE.



TIGHTEN 3 NUTS 'a' SUCCESSIVELY WITH THE SAME NUMBER OF TURNS.

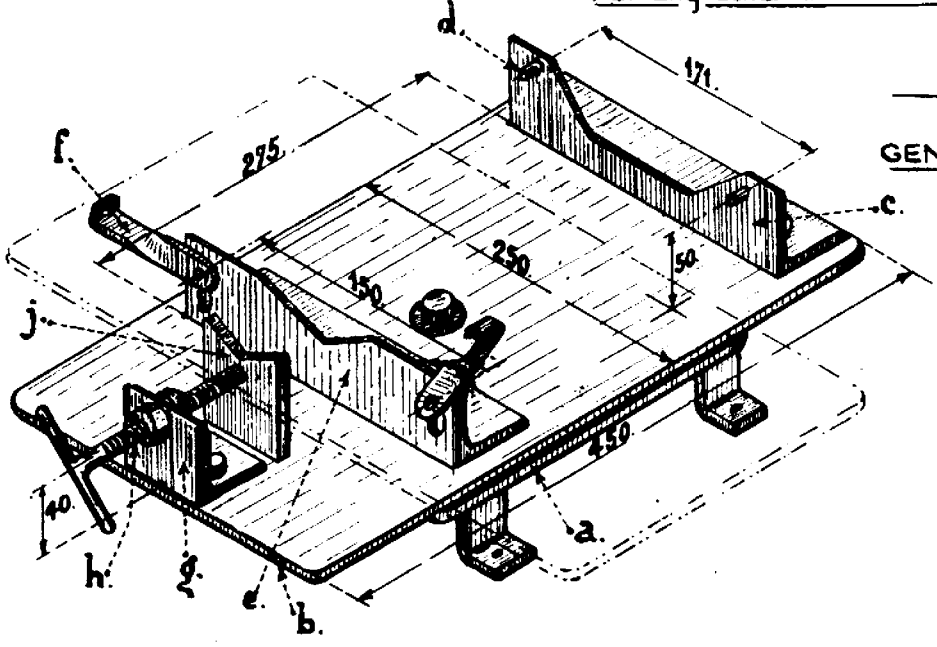
AFTER TIGHTENING WITH 'a' ENSURE THAT BLOCKS AT 'b' ARE IN CONTACT ON RING AT 'c'

3 BLOCKS ARE NECESSARY FOR ADJUSTMENT.

—STAND FOR DISMANTLING & REASSEMBLING GEARBOX—

MR.3053

For any other information regarding this stand, please consult us.

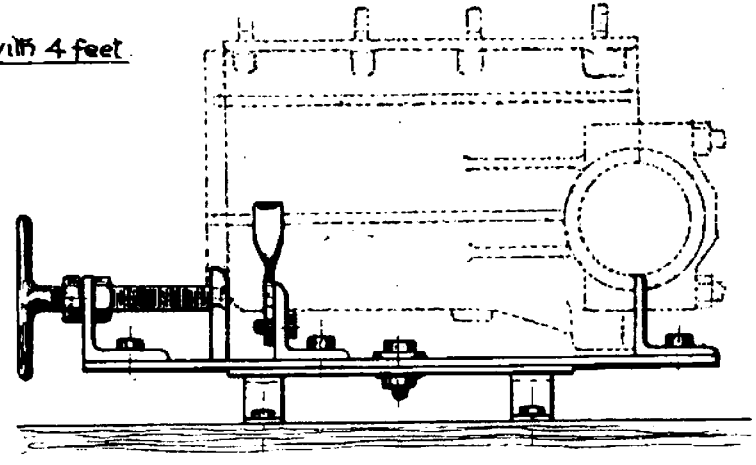


— Fig. 1. —

GENERAL VIEW AND MAIN DIMENSIONS.

— Fig. 2. —

VIEW OF BOX FITTED ON STAND.

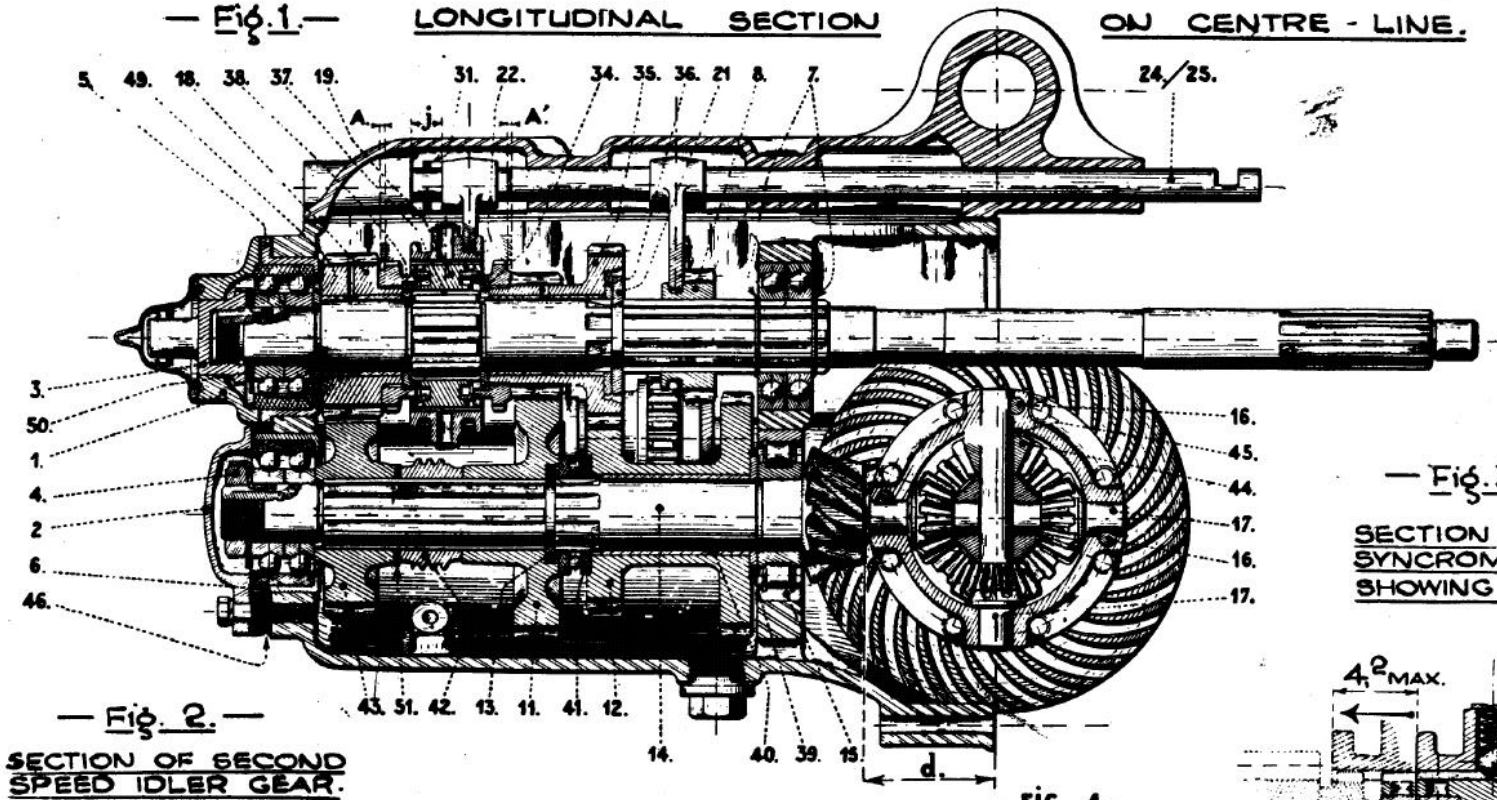


a: Base plate { Square as above 250 x 250, 6 thick, with 4 feet or circular 250 dia. with 3 feet.

b. Top plate swivelling on base plate a.
c. Gearbox stand with 2 locating pins.
d. Locating pins.
e. Stand with 2 clips.
f. Clips.
g. Angle plate with locking screw.
h. Locking screw.
j. Sliding plate, fitting under gearbox.

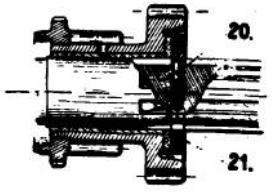
— GEARBOX ASSEMBLY —

— Fig. 1. — LONGITUDINAL SECTION ON CENTRE - LINE.

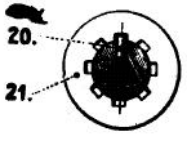


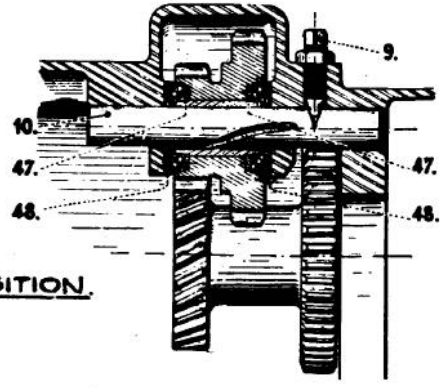
— Fig. 2. —

SECTION OF SECOND SPEED IDLER GEAR.



SPLINED WASHER IN POSITION.

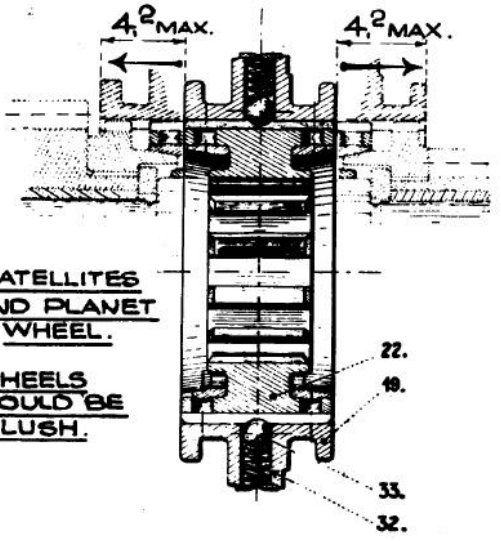




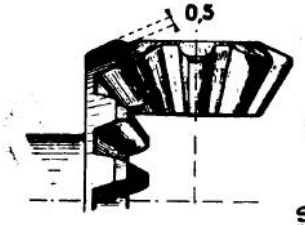
SECTION OF REVERSE SPEED IDLER GEAR.

— Fig. 3. —

SECTION THROUGH SYNCROMESH GEAR SHOWING CLEARANCE.

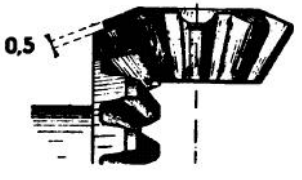


— Fig. 4. —



SATELLITES AND PLANET WHEEL.

WHEELS SHOULD BE FLUSH.



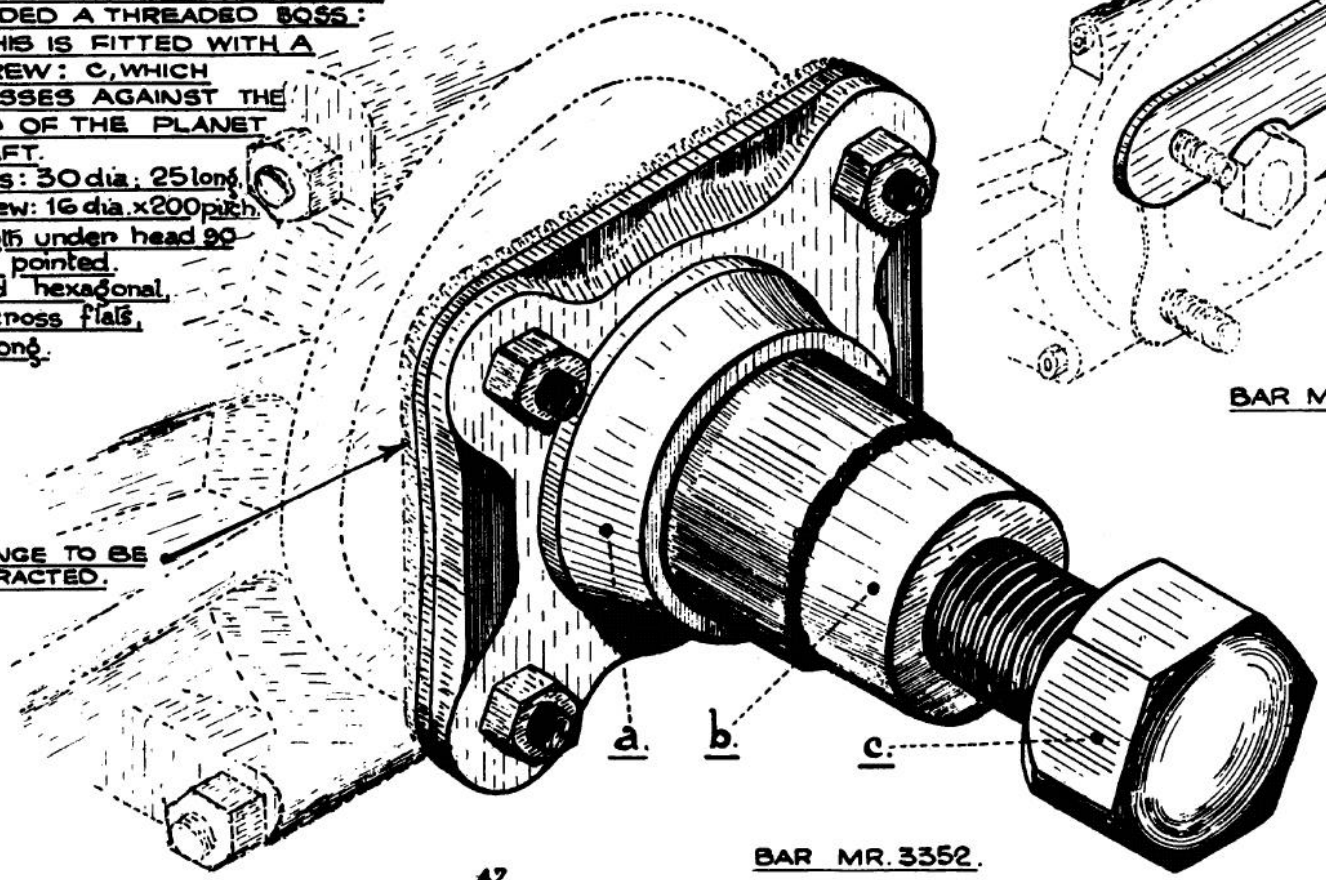
— GEARBOX —

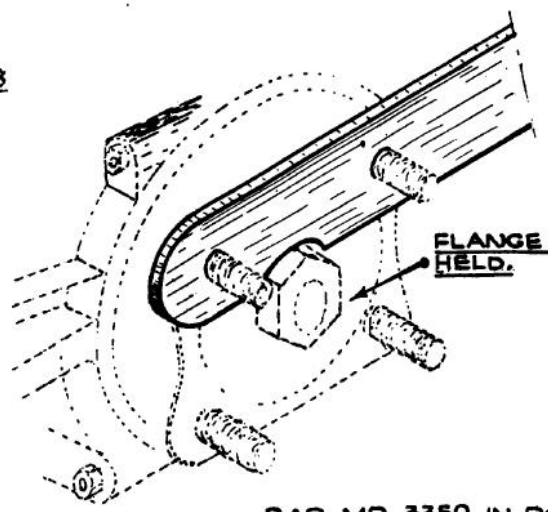
— EXTRACTOR FOR REMOVING COUPLING FLANGE —

— BAR FOR KEEPING OPPOSITE FLANGE IN POSITION —

THIS EXTRACTOR COMPRISES A COUPLING FLANGE OF THE USUAL TYPE : a, TO WHICH IS WELDED A THREADED BOSS : b, THIS IS FITTED WITH A SCREW : c, WHICH PRESSES AGAINST THE END OF THE PLANET SHAFT.
Boss : 30 dia. 25 long.
Screw : 16 dia. x 200 pitch.
Length under head 90
End pointed.
Head hexagonal, 31 across flats, 20 long.

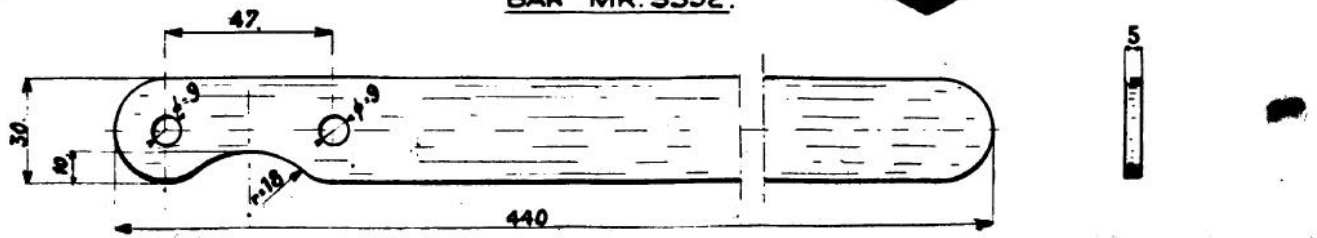
EXTRACTOR MR. 3328





BAR MR 3352 IN POSITION.

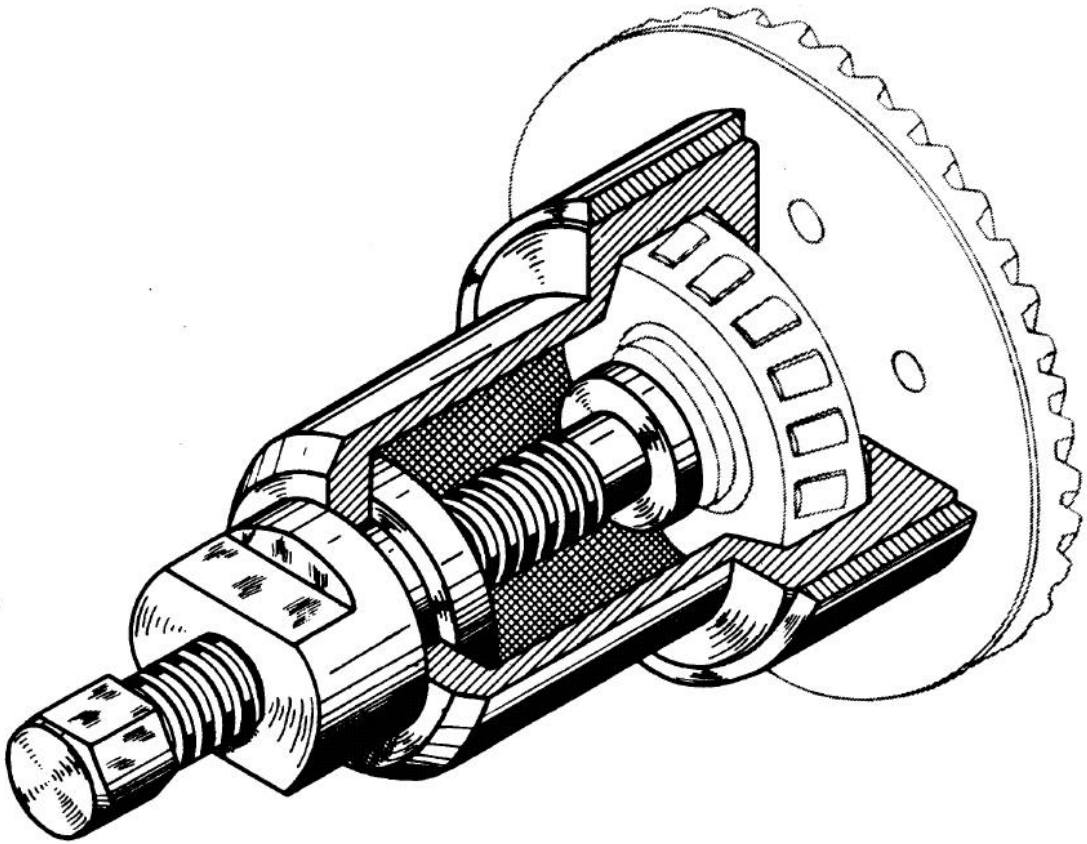
BAR MR. 3352.



—GEARBOX—

— EXTRACTION OF DIFFERENTIAL BEARING —

USE OF EXTRACTOR



EXTRACTOR BODY 1750T.

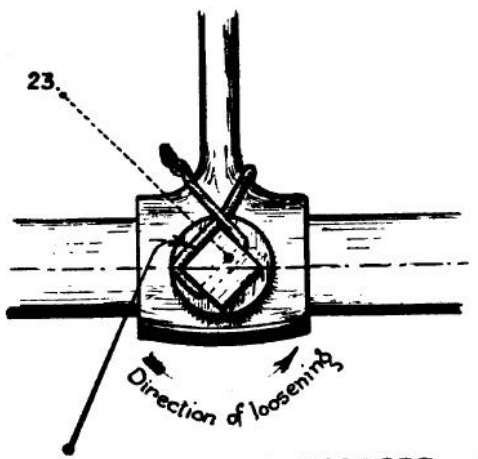
SPLIT COLLET, RING, AND THRUST BLOCK 1753T.

— GEARBOX —

— COVER — FORKS — GEAR LOCK (LIGHT TYPE) —

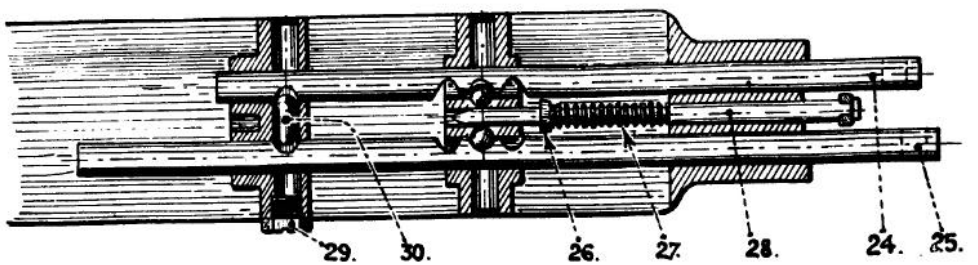
LOCKING SELECTOR FORK SET-SCREW.

Each set screw holding the forks on their shafts must be locked with wire in such a manner that the section under tension is opposed to direction of bolt loosening.

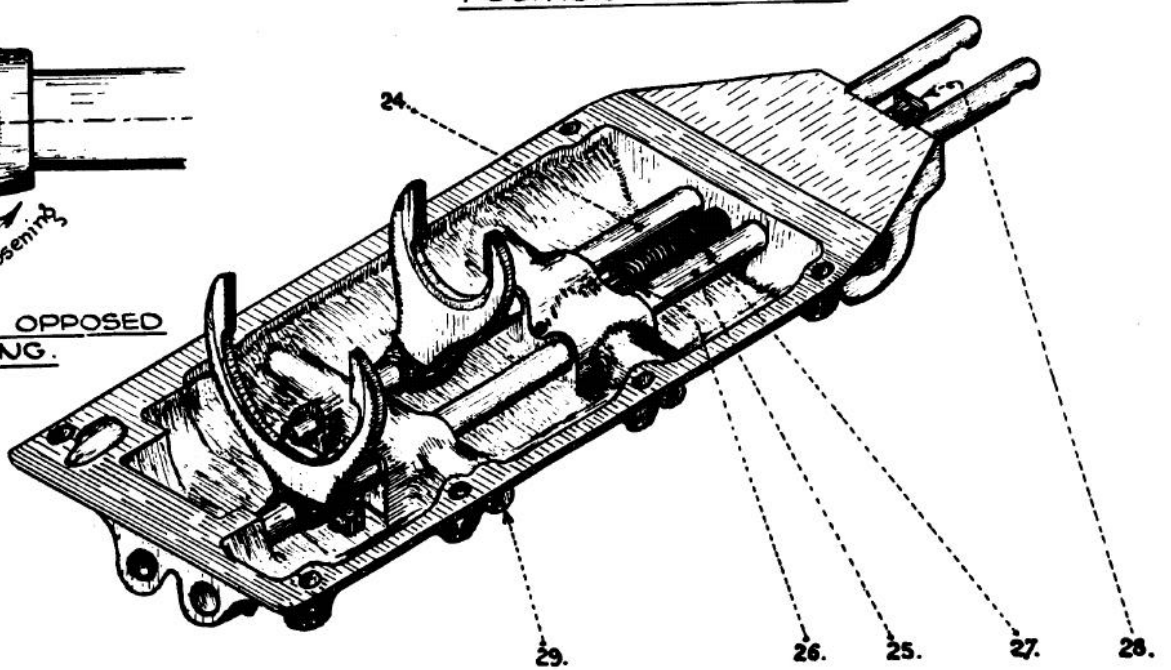


SECTION OF WIRE OPPOSED TO LOOSENING.

DETAIL OF SELECTOR SHAFTS LOCKING DEVICE.



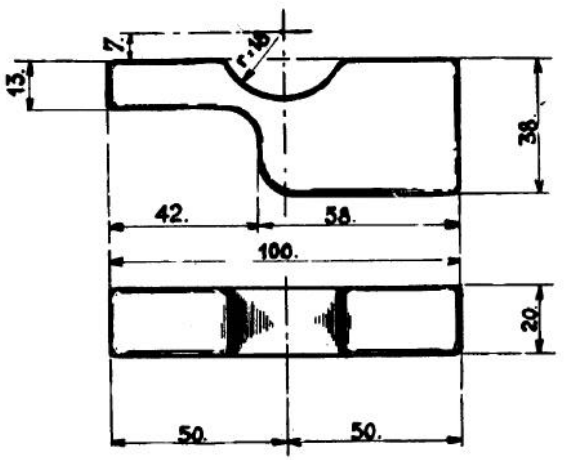
COVER ASSEMBLY INVERTED SHOWING RESPECTIVE POSITION OF FORKS.



— GEARBOX —

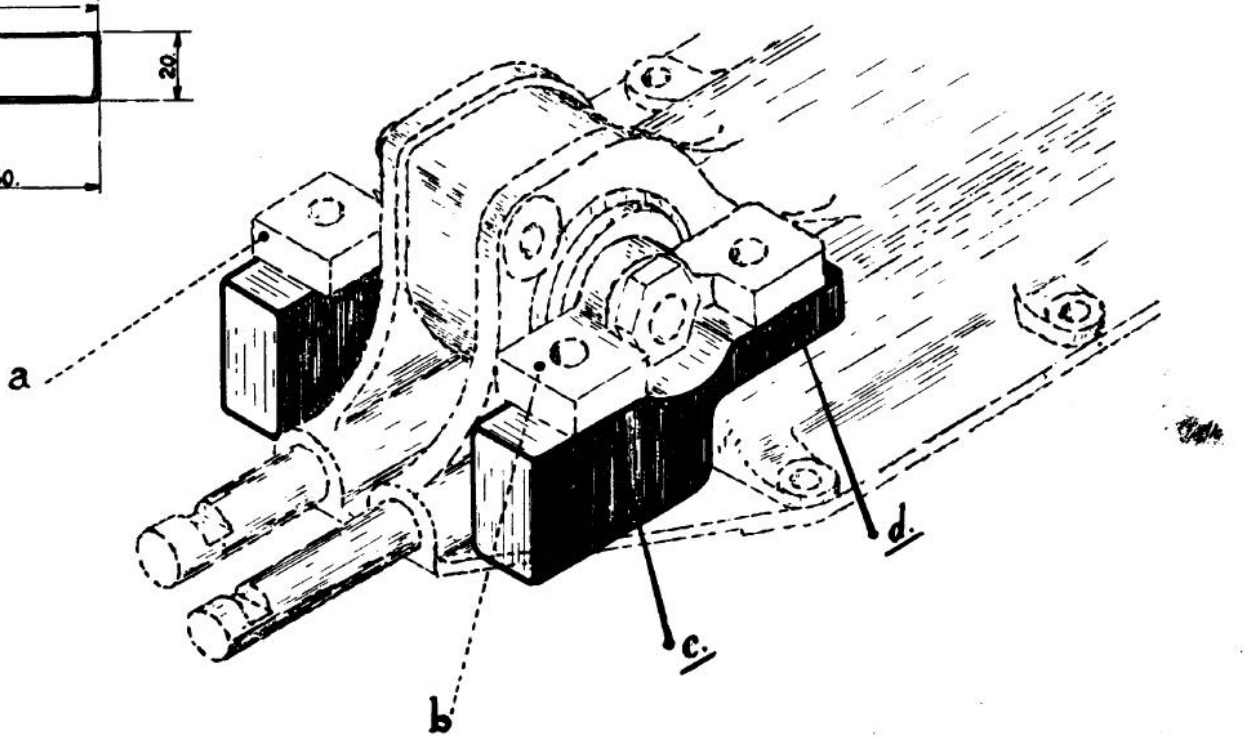
—MOUNTING OF FIXING PLATES—

DISTANCE BLOCK MR. 1525.



POSITIONING OF BRACKETS.

Brackets a and b must rest on each distance block at either end (see c and d)



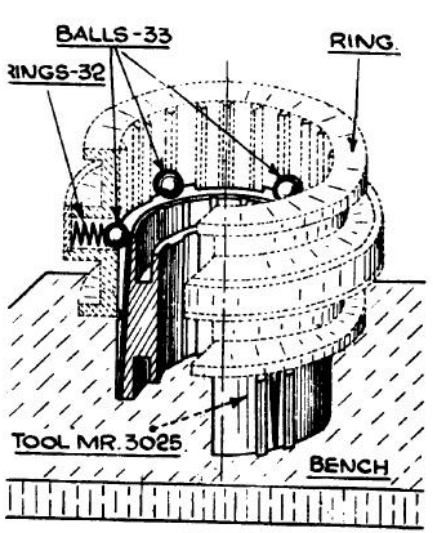
— GEARBOX —

— FITTING SYNCHROMESH GEAR —

TOOL MR.3025 IS MADE OF A CITROEN FRONT WHEEL DRIVE "11" (LIGHT 15 OR BIG 15) SYNCHROMESH CENTRE SLIDE MODIFIED AS FOLLOWS. AFTER MODIFICATION THIS PART CANNOT BE USED IN A GEARBOX.

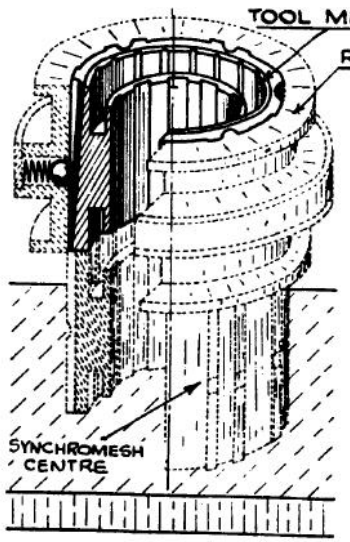
1. Anneal part.
2. Make 6 tapered grooves to receive balls as shown below.
3. Ease off all splines to get free movement of synchromesh ring.

— Fig.1. —



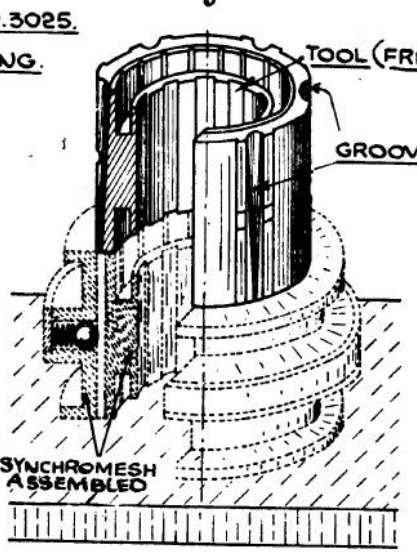
PLACE SYNCHROMESH RING ON TOOL. PLACE 6 SPRINGS IN THEIR HOUSINGS. PLACE 6 BALLS IN GROOVES. PUSH SYNCHROMESH RING DOWN ON TOOL.

— Fig.2. —



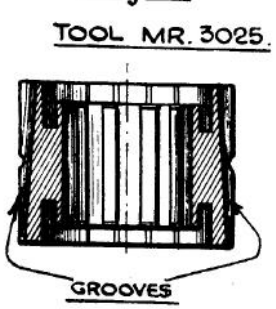
PLACE ASSEMBLY OF SYNCHROMESH RING ON TOOL. PUSH DOWN THE SYNCHROMESH RING TO RETURN THE BALLS.

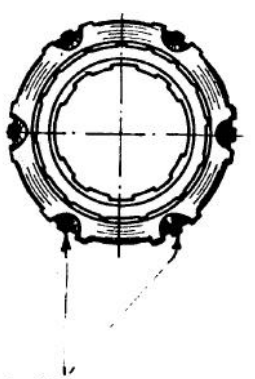
— Fig.3. —



CONTINUE TO PUSH DOWN RING TO FREE TOOL.

— Fig.4. —



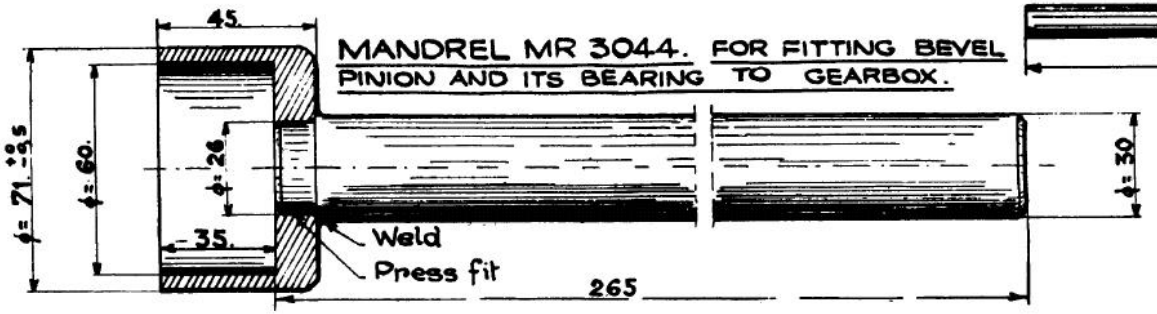


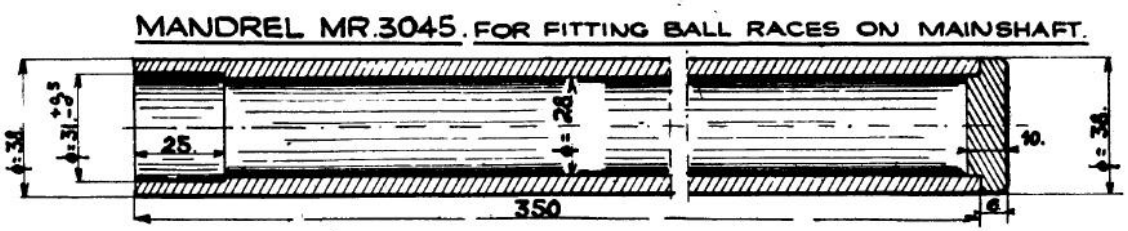
Each groove to be cut out from the middle spline of a group of 3 splines.

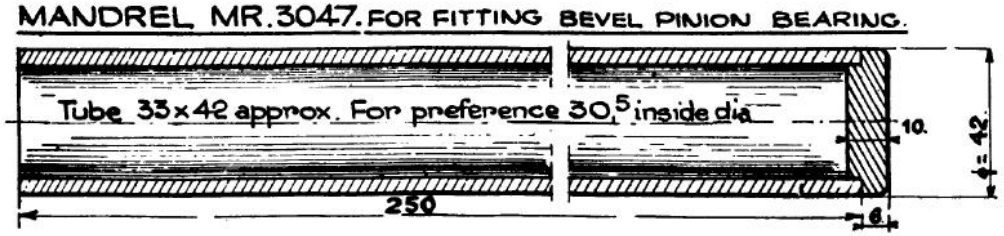
—GEARBOX—

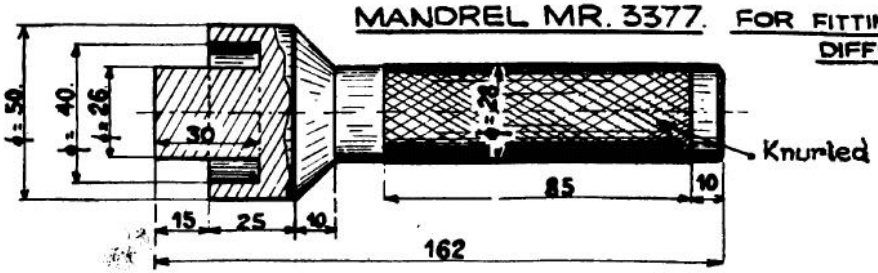
— ASSEMBLING GEARBOX —

1. VARIOUS MANDRELS.



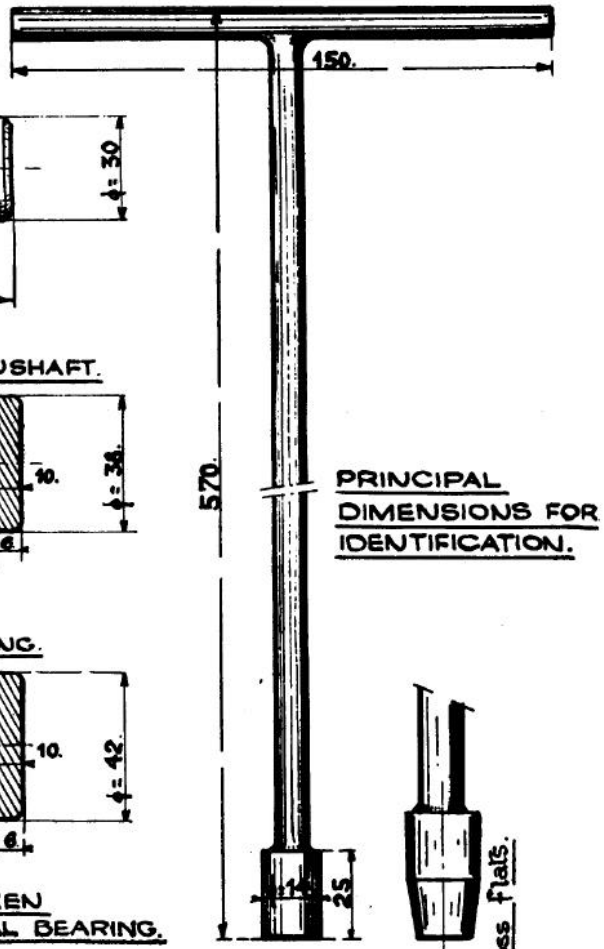


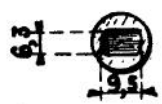




2. SPANNERS.

FOR CLUTCH BELLHOUSING BOLTS.





SPANNER 1676T.

SPANNER 1675T.

— RECTIFICATION OF SATELLITE THRUST FACES —

Fig. 1. USE OF TOOL.

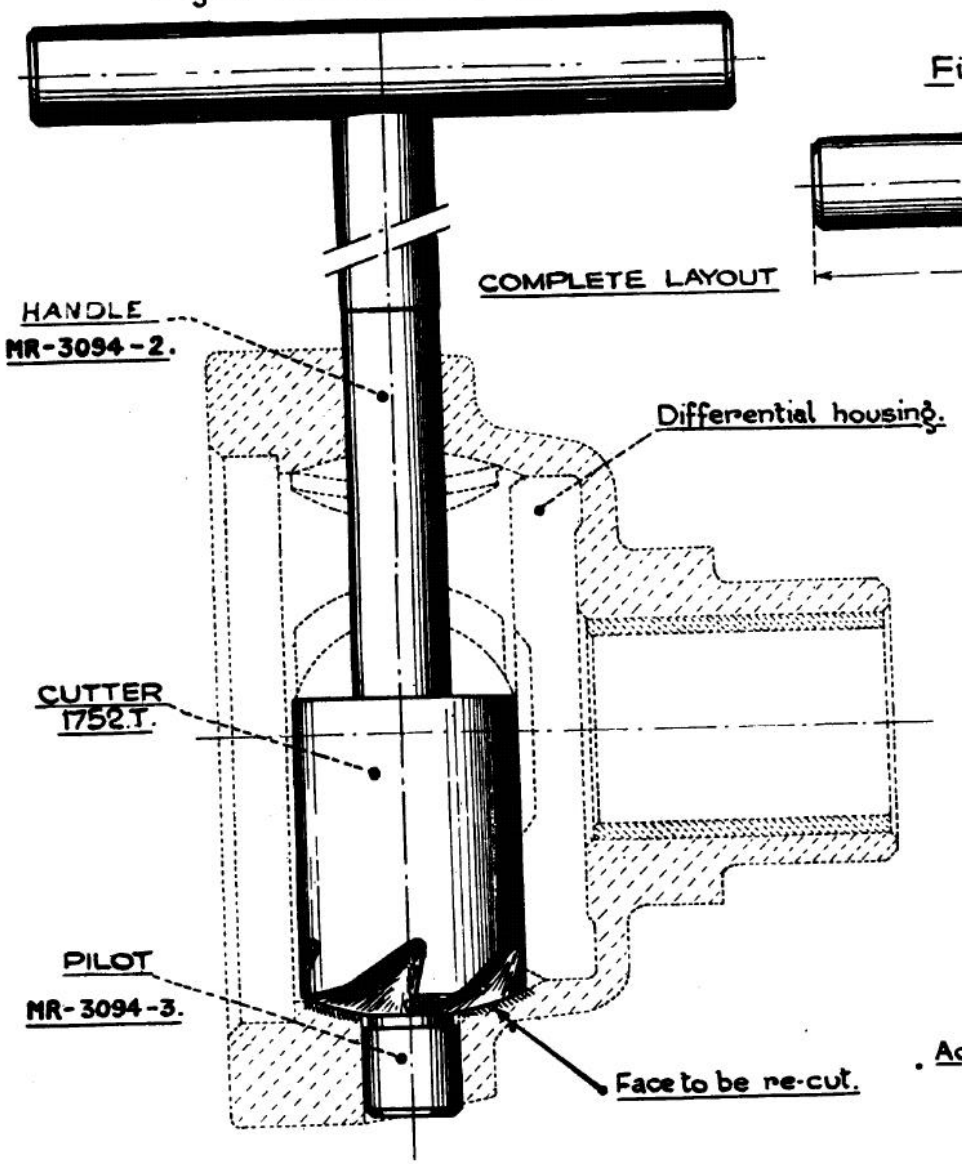


Fig. 2. HANDLE MR.3094-2

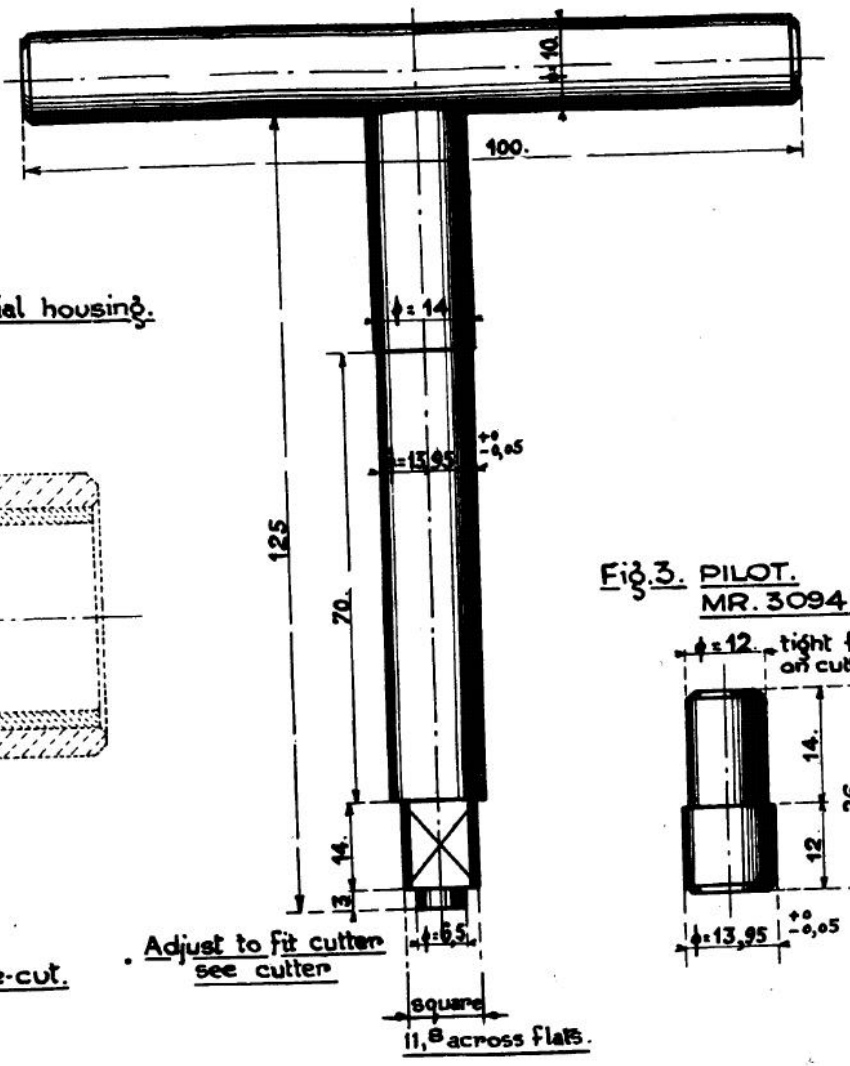
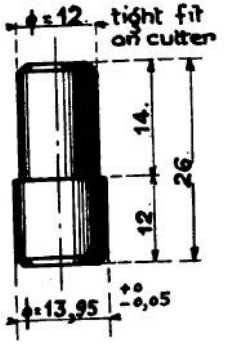
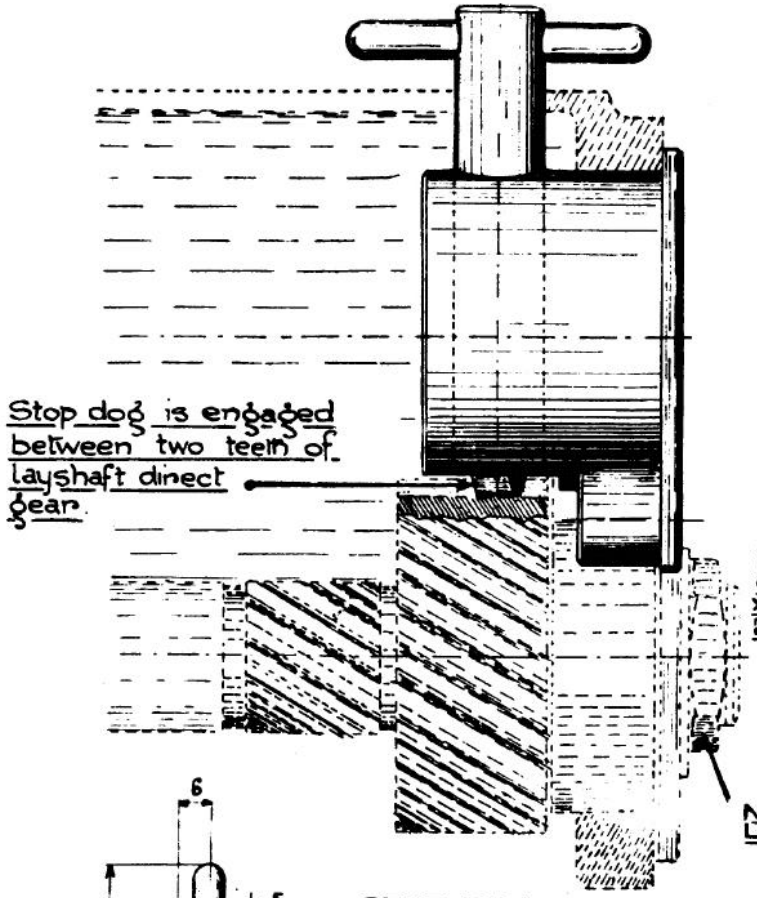


Fig. 3. PILOT. MR. 3094-3



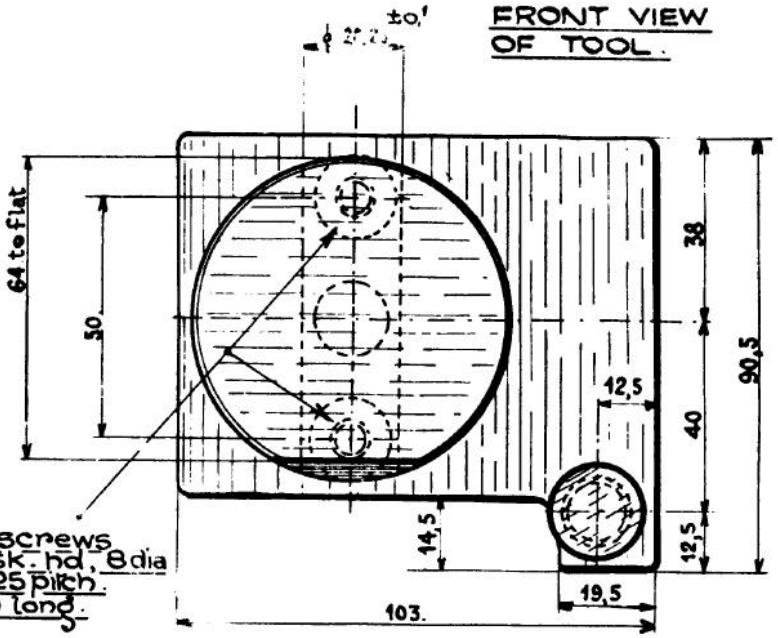
— STOP TOOL FOR TIGHTENING LAYSHAFT FRONT BEARING LOCKNUT —

LAYOUT SHOWING TOOL IN POSITION.

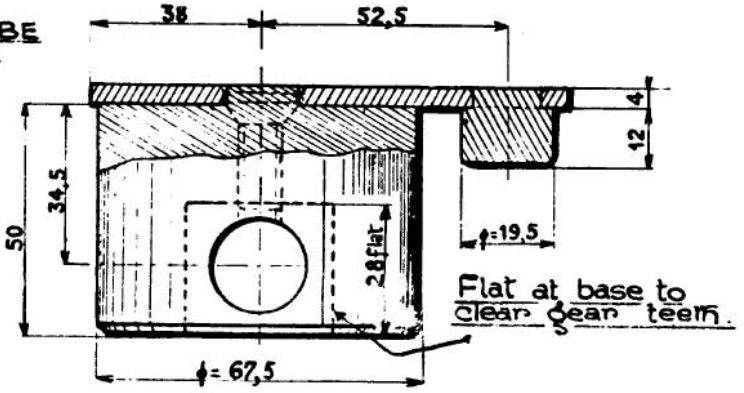


TOOL Nº MR. 3139.

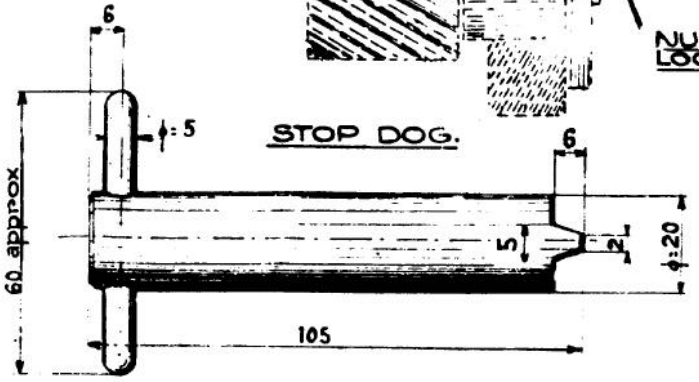
FRONT VIEW OF TOOL.



PLAN VIEW.

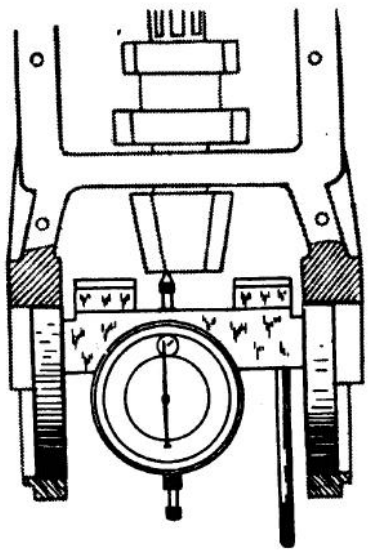


STOP DOG.



— ADJUSTMENT OF CROWN WHEEL AND BEVEL PINION —

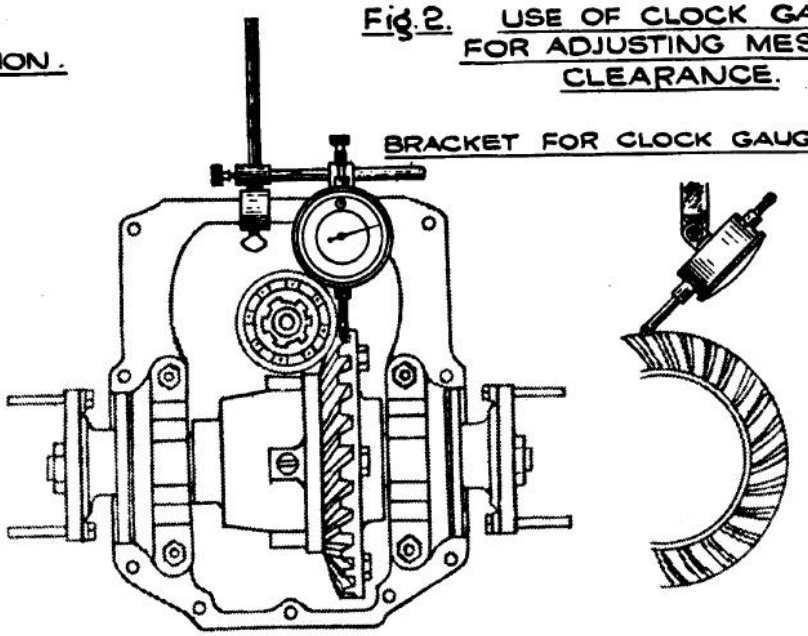
Fig.1. USE OF APPARATUS FOR POSITIONING BEVEL PINION.



APPARATUS 2044.T.

Fig.2. USE OF CLOCK GAUGE FOR ADJUSTING MESHING CLEARANCE.

BRACKET FOR CLOCK GAUGE. 2041T.

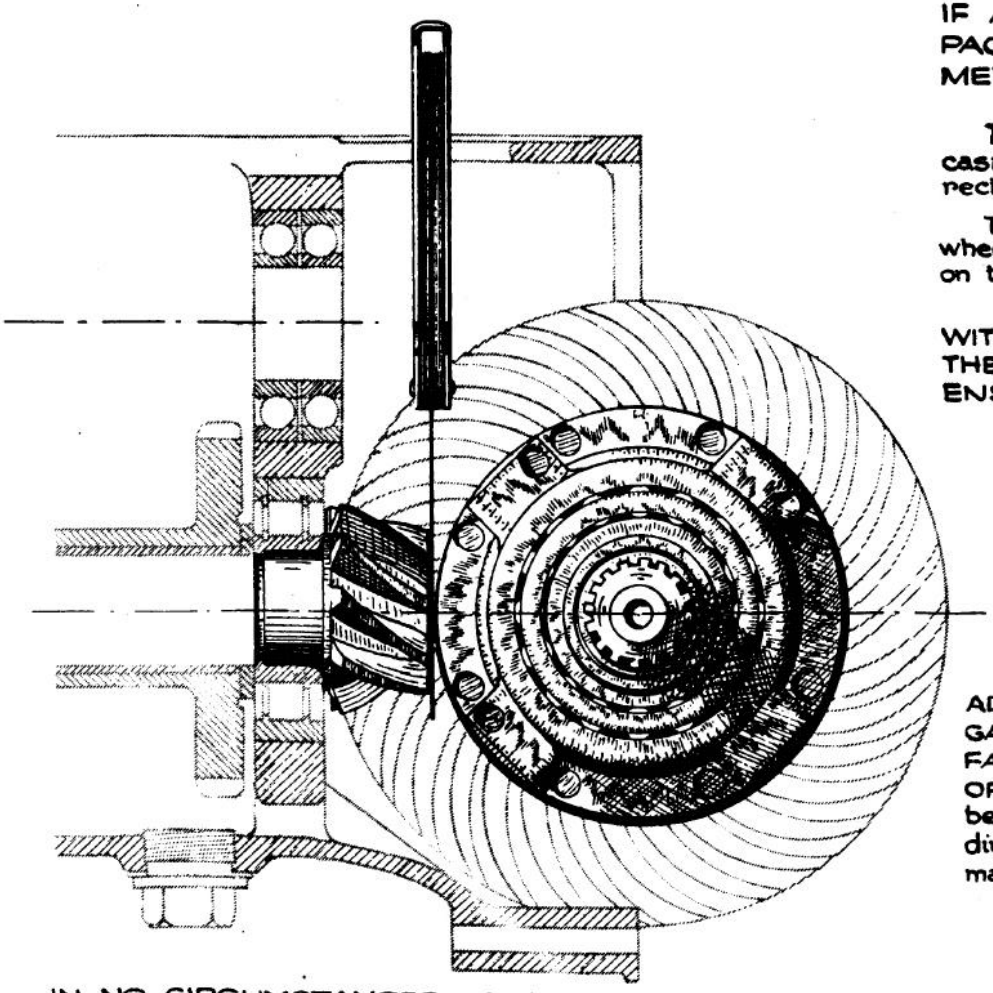


BEVEL PINION

CROWN WHEEL

— ADJUSTMENT OF CROWN WHEEL AND BEVEL PINION —

(SIMPLIFIED METHOD)



IN NO CIRCUMSTANCES IS ANY OTHER MEANS OF ADJUSTING CROWN WHEELS AND BEVEL PINIONS TO BE EMPLOYED.

IF APPARATUS 2040.T. SHOWN ON PAGE 35 IS NOT AVAILABLE USE THE METHOD AS DESCRIBED BELOW:

The outer circumference of the differential casing which locates the crown wheel is rectified to 110 m.m. diameter.

The distance from the centre of the crown wheel to the face of the bevel pinion is etched on the pinion face (see Page 35)

WITH BEVEL PINION FITTED IN PLACE, FIT THE DIFFERENTIAL, TIGHTEN BEARINGS TO ENSURE THAT THERE IS NO SIDE PLAY.

TO ADJUST BEVEL PINION, FIND THE DIFFERENCE BETWEEN PINION FACE AND OUTER CIRCUMFERENCE OF DIFFERENTIAL CASING.

EXAMPLE:

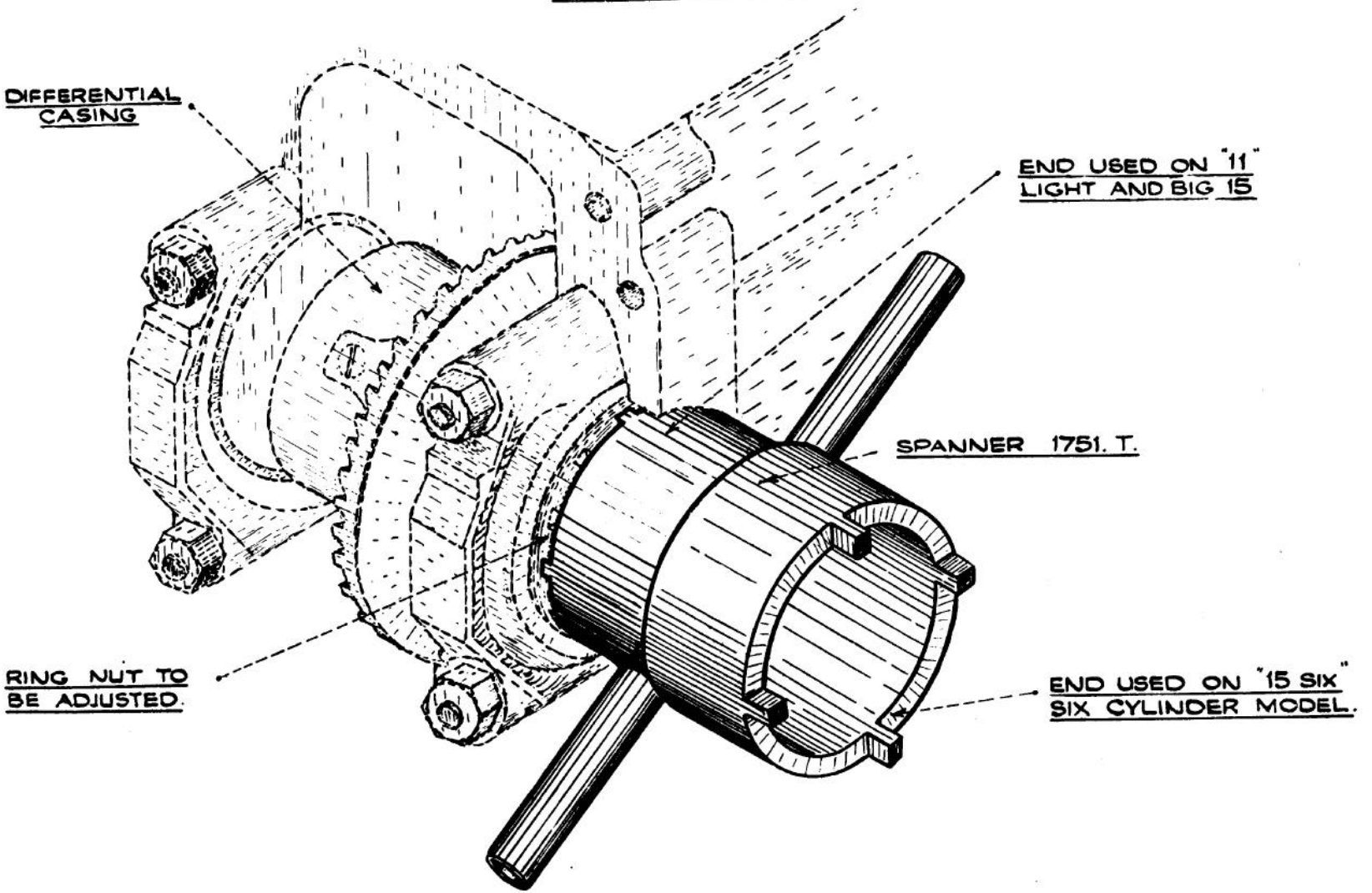
DIMENSION ETCHED ON PINION = 56,20mm
RADIUS OF DIFFERENTIAL CASING = 55 mm
DIFFERENCE = 56,20 − 55 = 1,20mm

ADJUST THE PINION SO AS TO OBTAIN A GAP OF 1.20m.m. BETWEEN FRONT MACHINED FACE OF PINION AND RECTIFIED FACE OF DIFFERENTIAL CASING. (Care must be taken not to measure the pinion dimension from the pinion shaft cap which may stand proud of the pinion face)

MEASURE THIS DISTANCE WITH AN ORDINARY COMMERCIAL FEELER GAUGE (See illustration)

— ADJUSTMENT OF DIFFERENTIAL BEARINGS —

USE OF SPANNER



— FRONT AXLE —

— EXTRACTION OF BALL PINS —

Fig. 1. BALL PIN EXTRACTOR 1964.T.

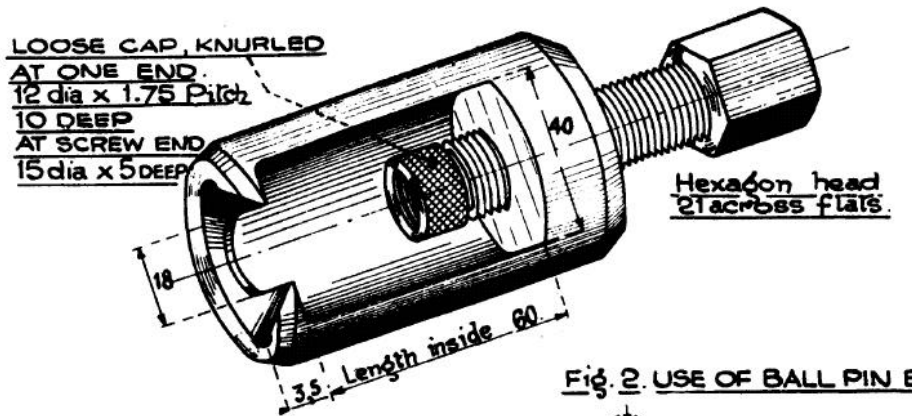
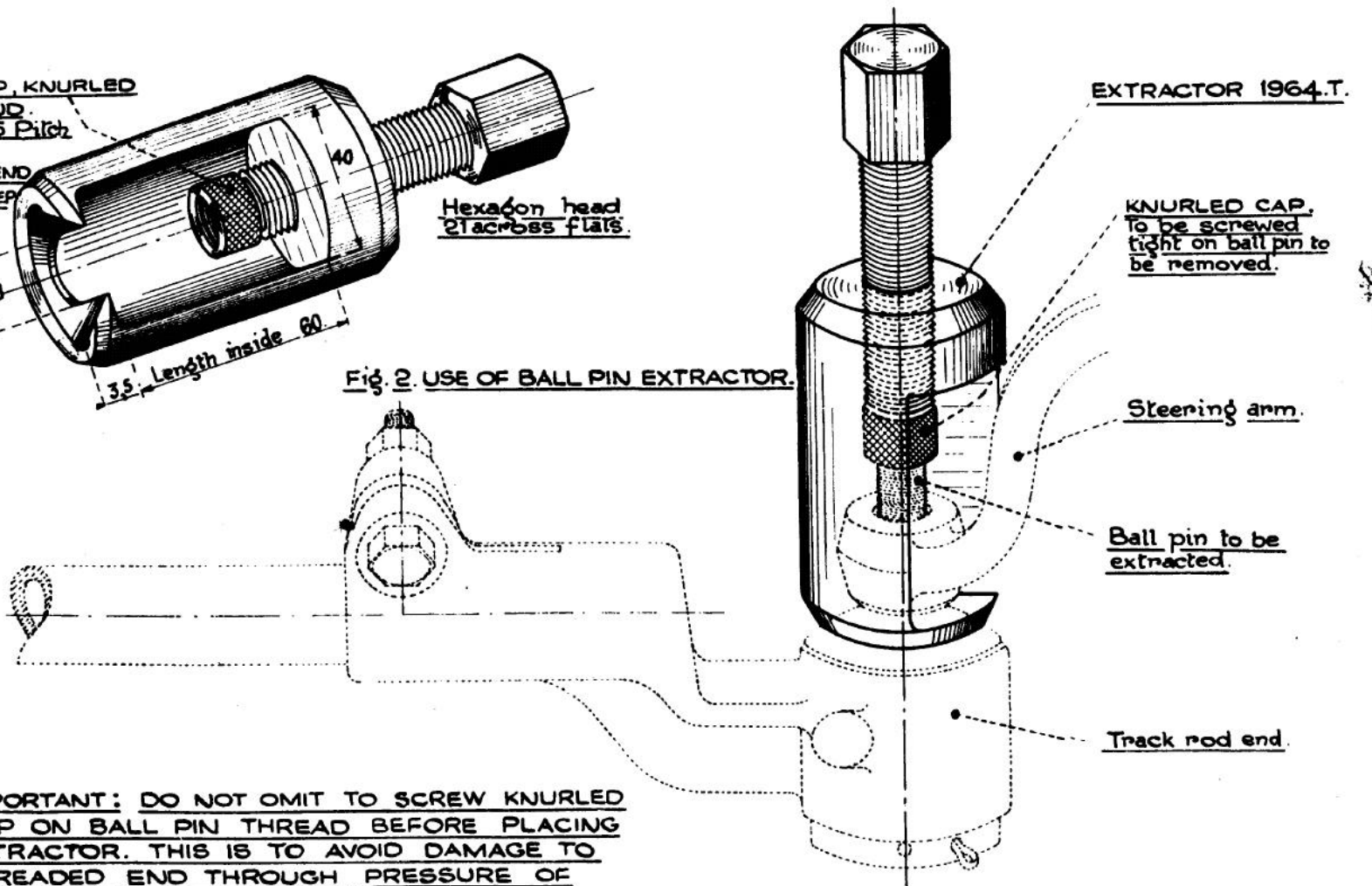


Fig. 2. USE OF BALL PIN EXTRACTOR.

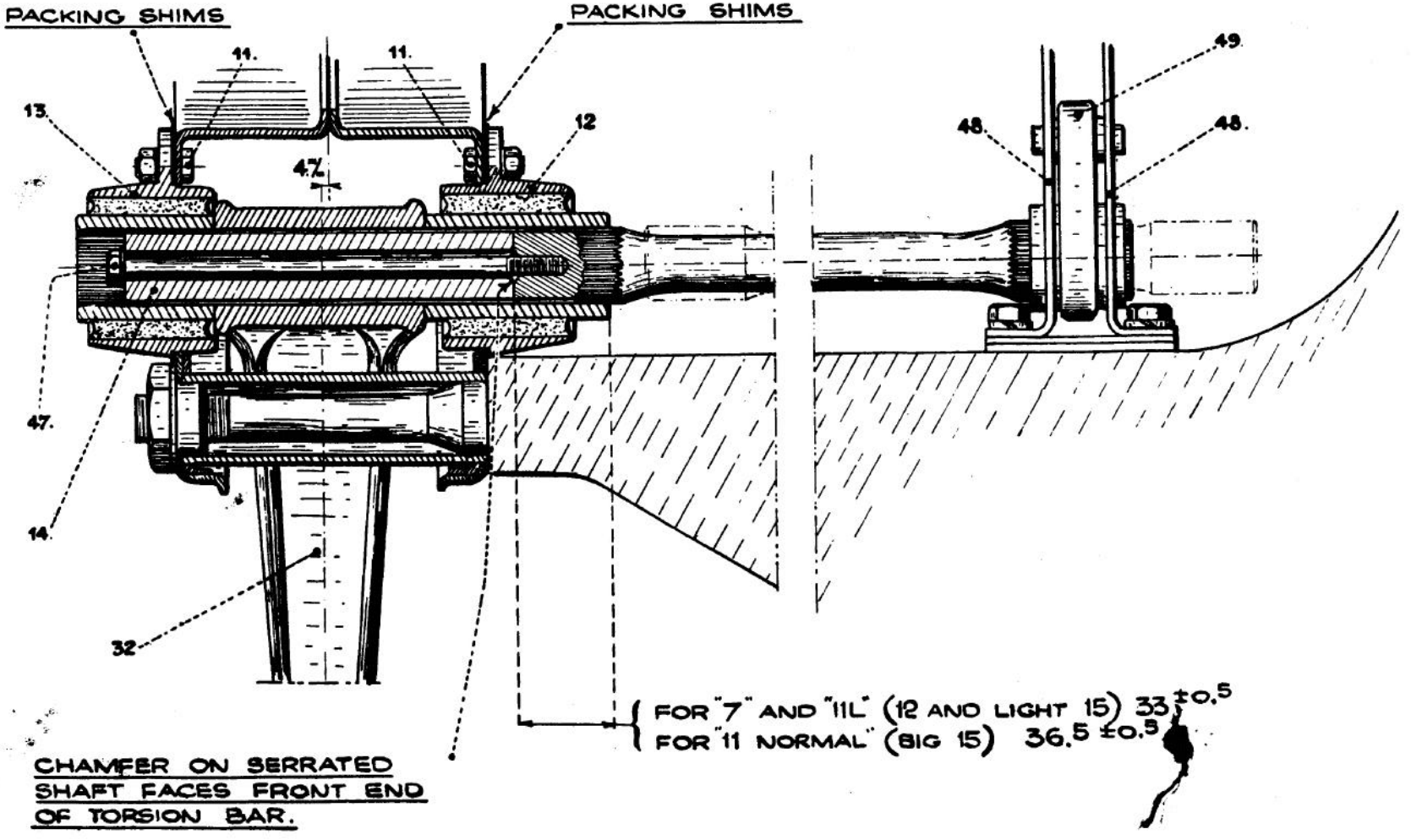


IMPORTANT: DO NOT OMIT TO SCREW KNURLED CAP ON BALL PIN THREAD BEFORE PLACING EXTRACTOR. THIS IS TO AVOID DAMAGE TO THREADED END THROUGH PRESSURE OF EXTRACTOR STUD.

— FRONT AXLE —

— ASSEMBLY OF SILENTBLOC & TORSION BAR —

HORIZONTAL SECTION ON CENTRE - LINE

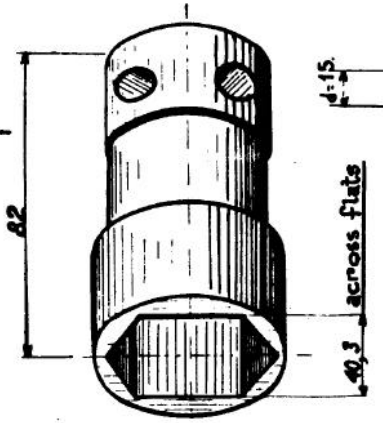


CHAMFER ON SERRATED SHAFT FACES FRONT END OF TORSION BAR.

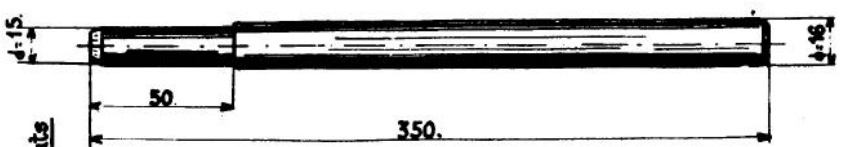
— FRONT AXLE —

— MOUNTING LOWER ARM —

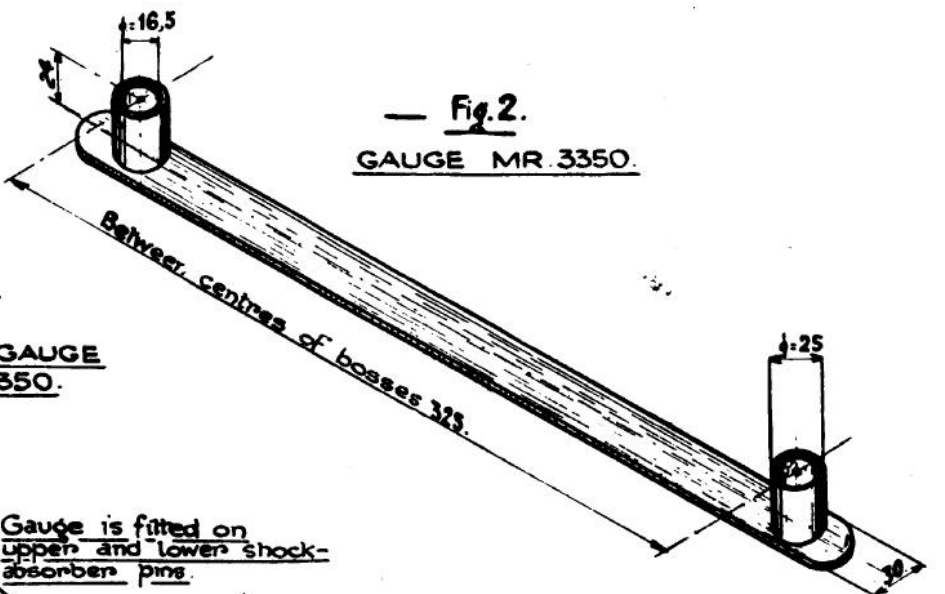
Fig. 1. SPANNER. (1880.T)



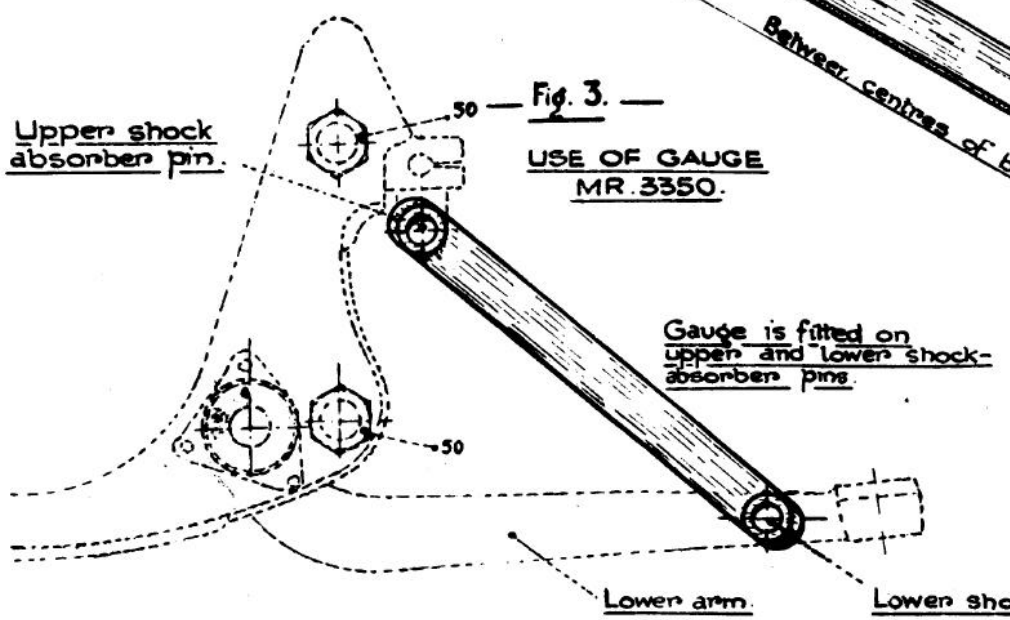
— Fig. 1. —



TOMMY BAR FOR BOX SPANNER MR. 3197-2.



— Fig. 2.
GAUGE MR. 3350.

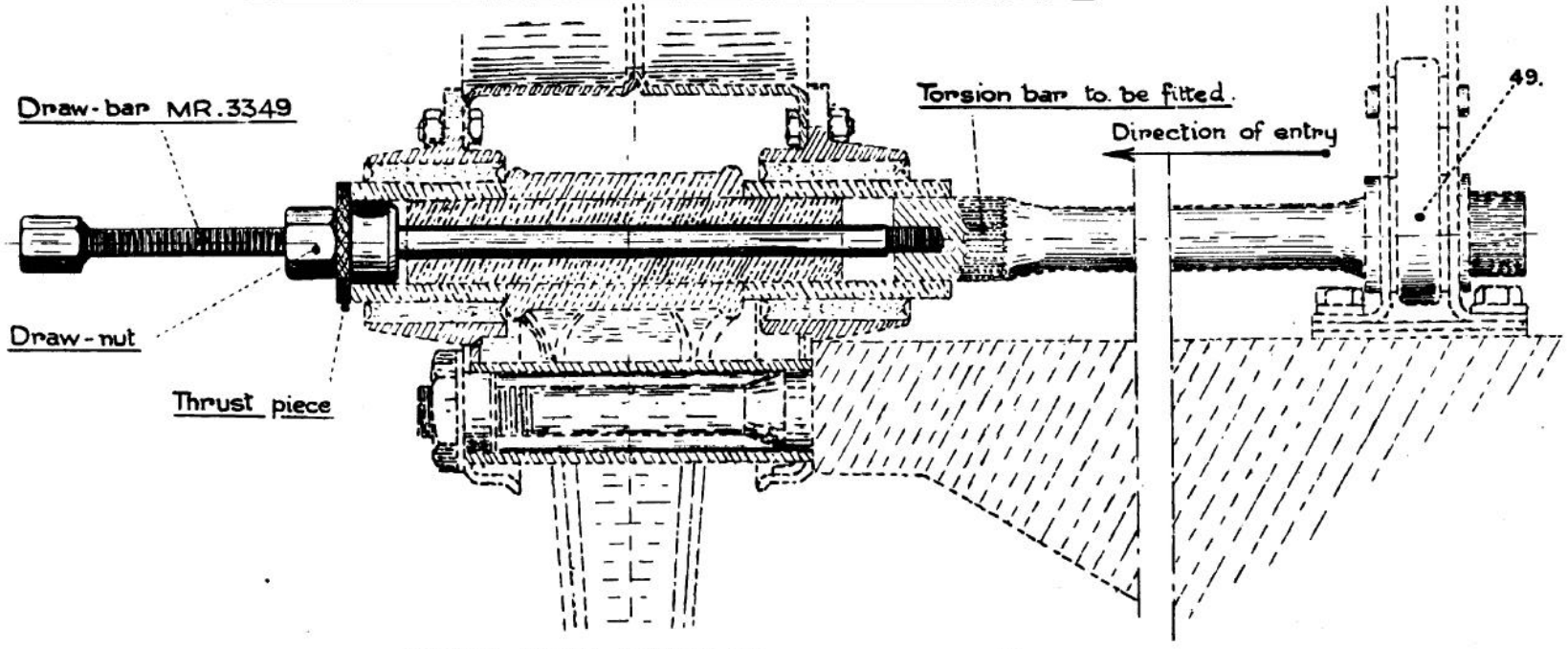


— Fig. 3. —
USE OF GAUGE MR. 3350.

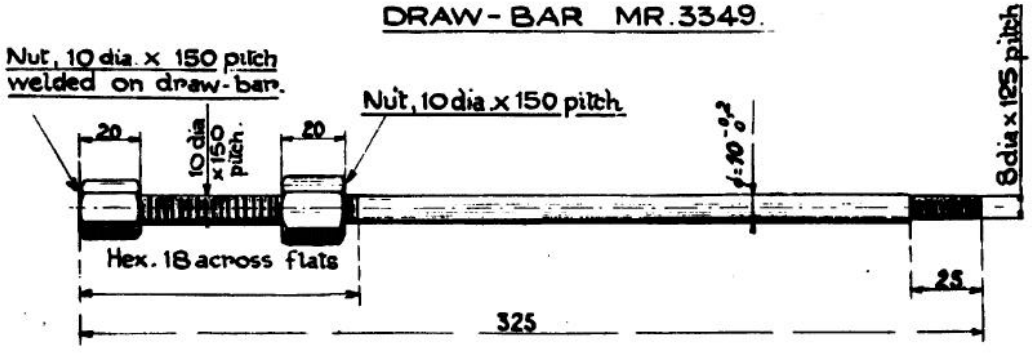
— FRONT AXLE —

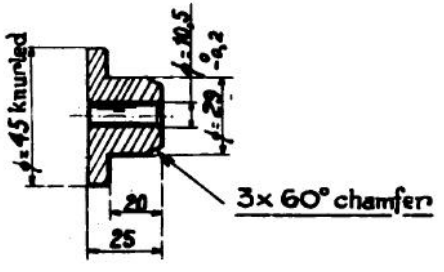
— FITTING OF TORSION BARS —

ASSEMBLY SHOWING TORSION BAR BEING FITTED



DRAW-BAR MR.3349.

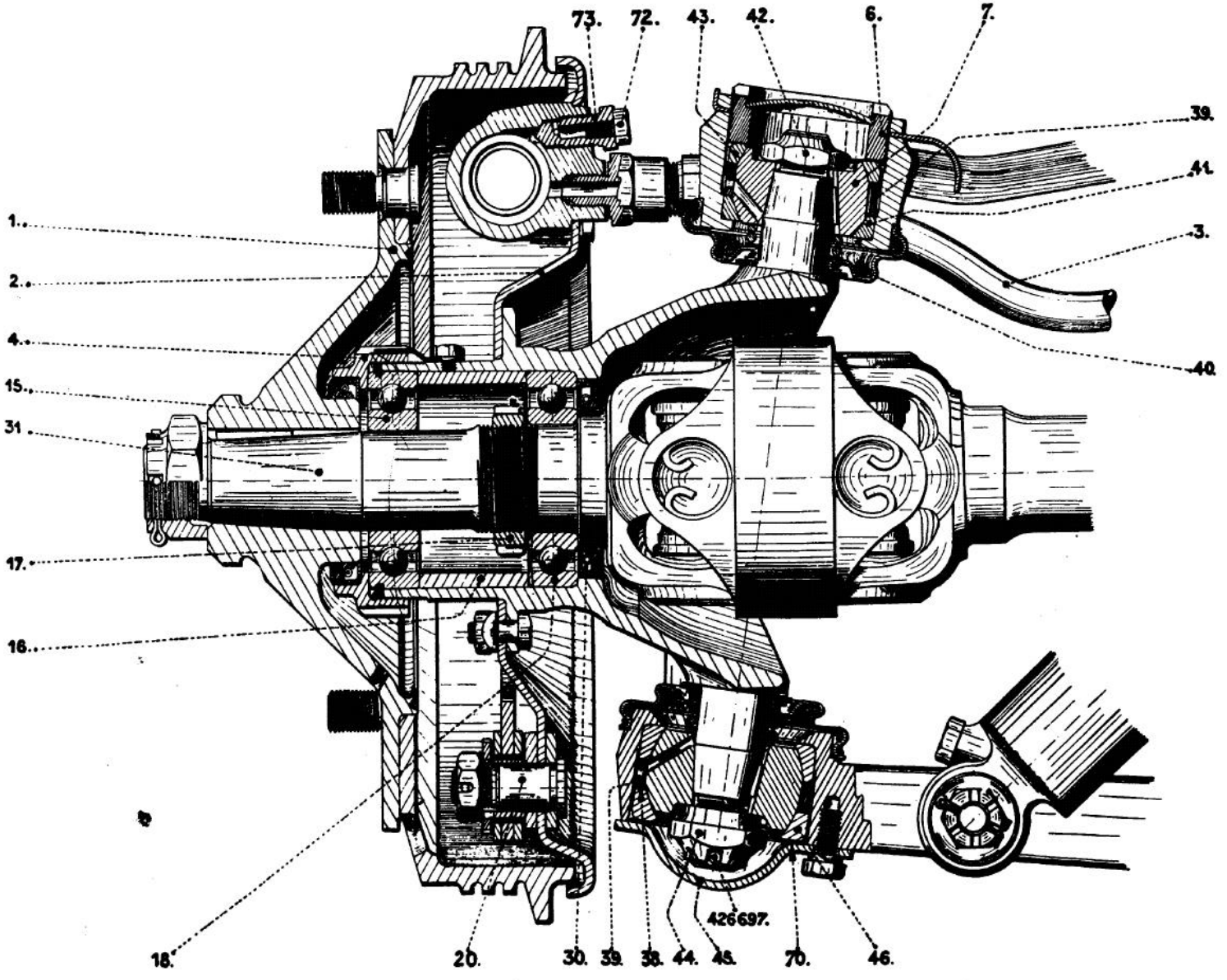




DETAILS OF THRUST PIECE.

— FRONT AXLE —

— VERTICAL SECTION THROUGH HUB & SWIVEL CENTRE - LINE —



— DISMANTLING HUBS AND BALL-RACES —

Fig. 1. EXTRACTING HUB.

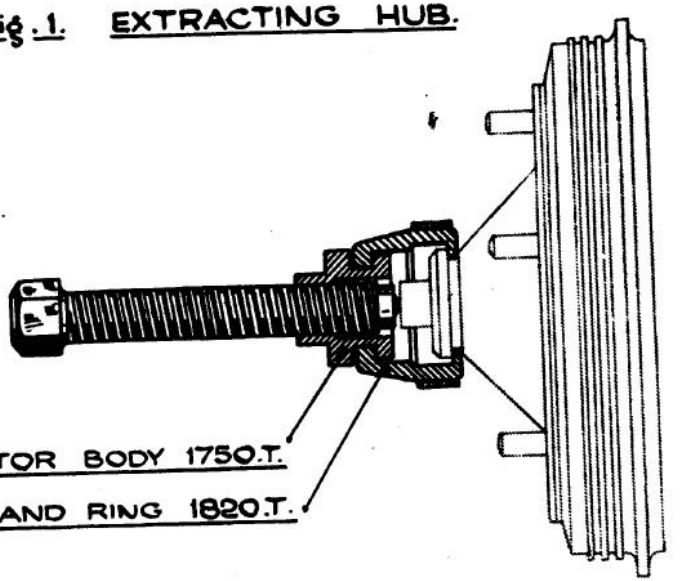


Fig. 2. EXTRACTING BALL-RACE

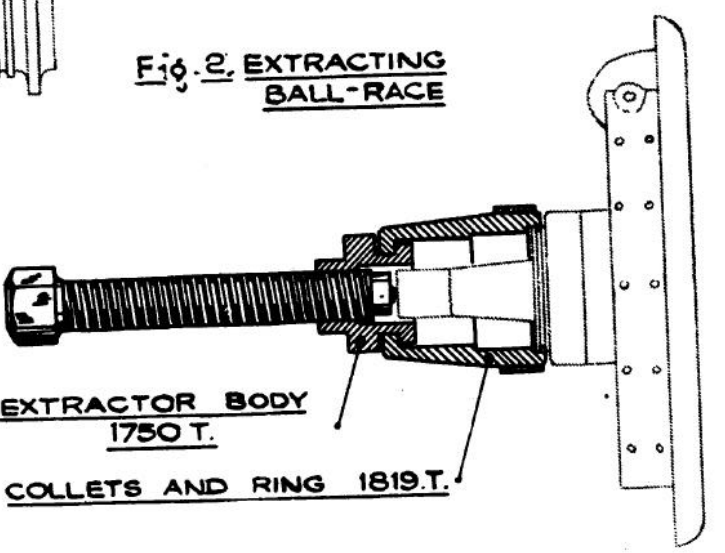
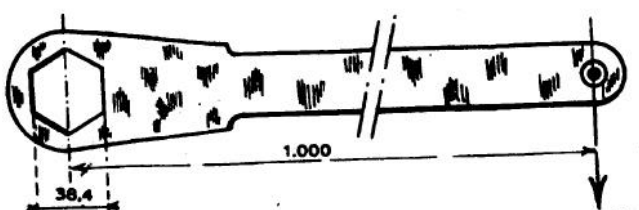


Fig. 3. SPANNER. (1810.T)

THIS SPANNER IS USED WITH TORSION WRENCH 2472.T.



TENSION SHOULD BE APPLIED PERPENDICULARLY TO LENGTH OF SPANNER AS SHOWN.

— DISMANTLING STEERING ARM & OUTER BALL-RACE RETAINING RING —

Fig.1. – REMOVING STEERING ARM

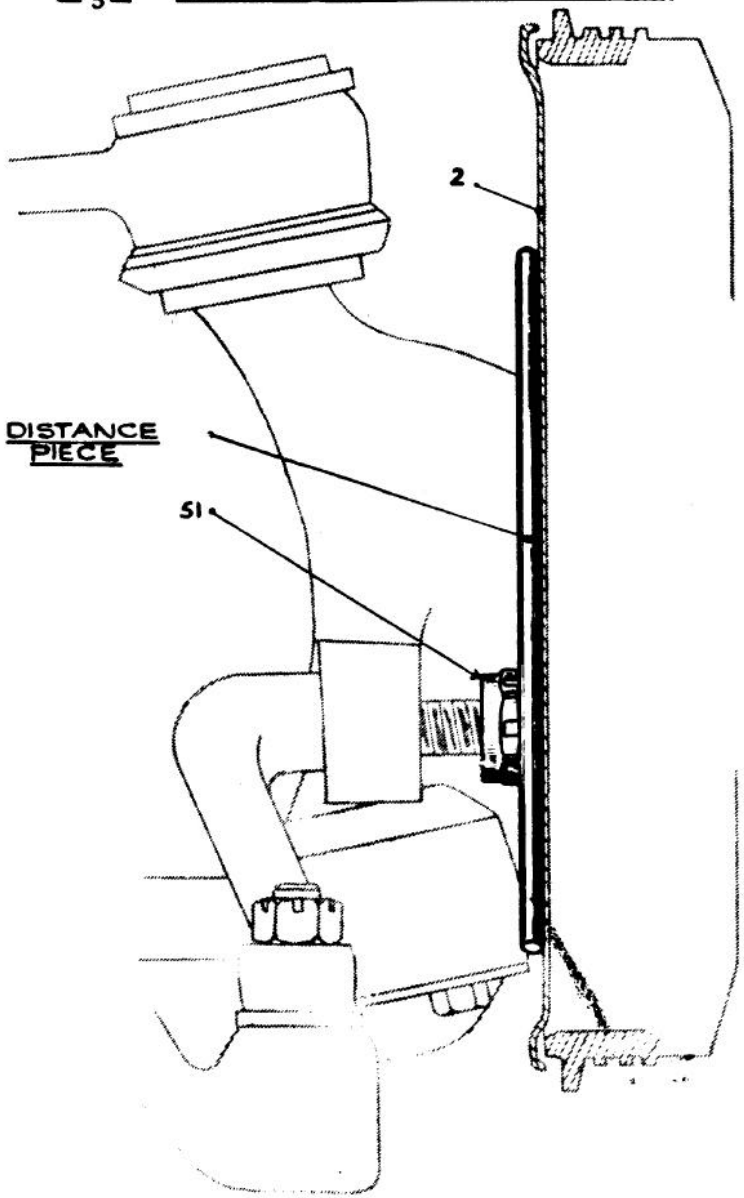


Fig.2 – USE OF SPANNER.

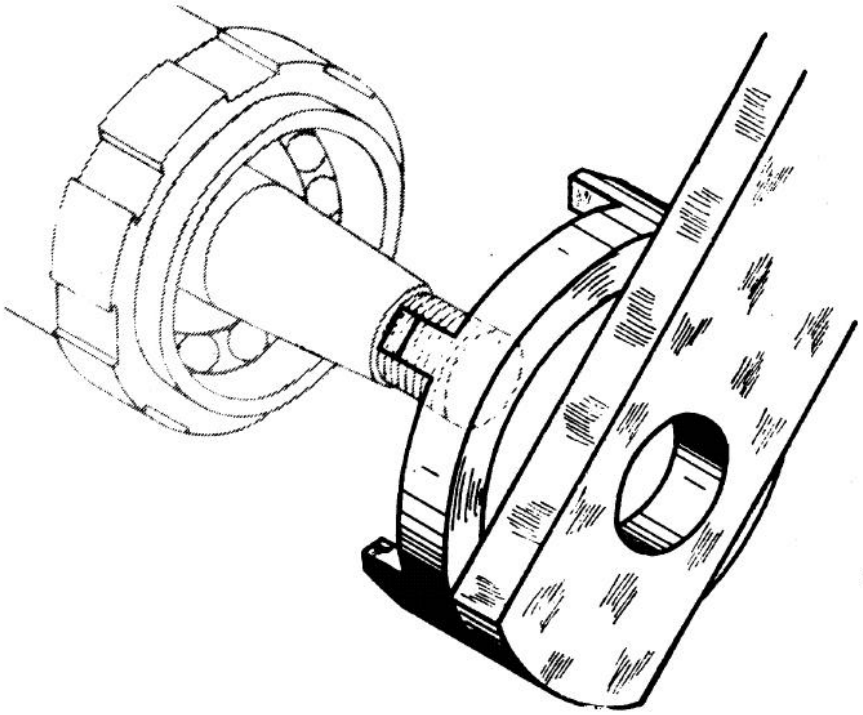
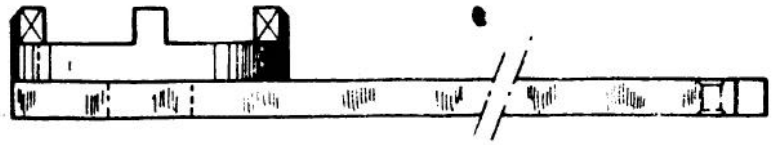


Fig.3. – SPANNER 1825.T.



— DISMANTLING UPPER & LOWER SWIVEL BALLS —

Fig.1. - BALL EXTRACTOR 1850.T.

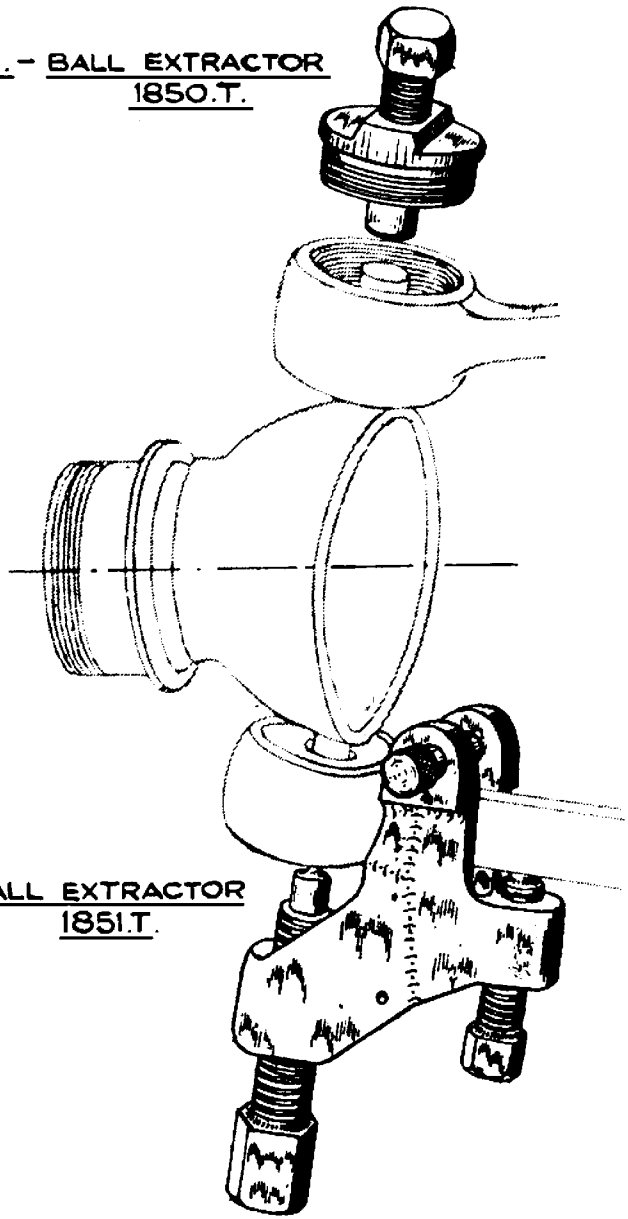
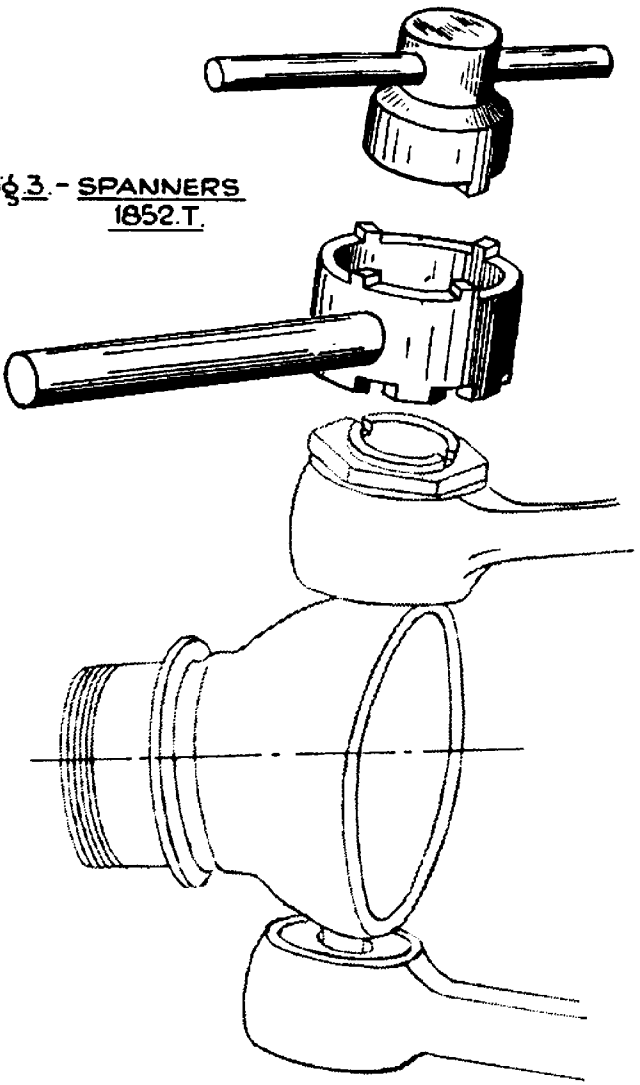


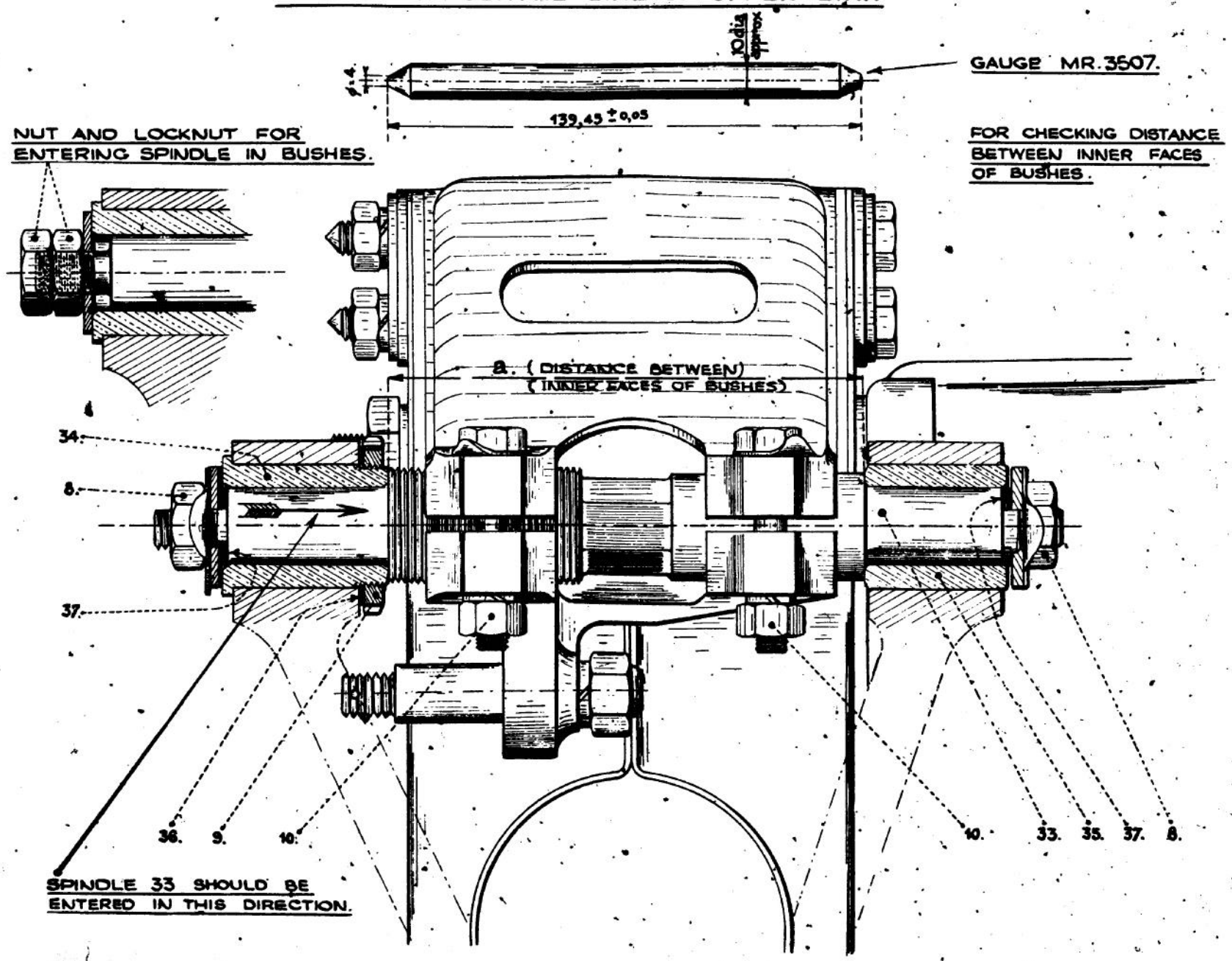
Fig.2. BALL EXTRACTOR 1851.T.

Fig.3. - SPANNERS 1852.T.



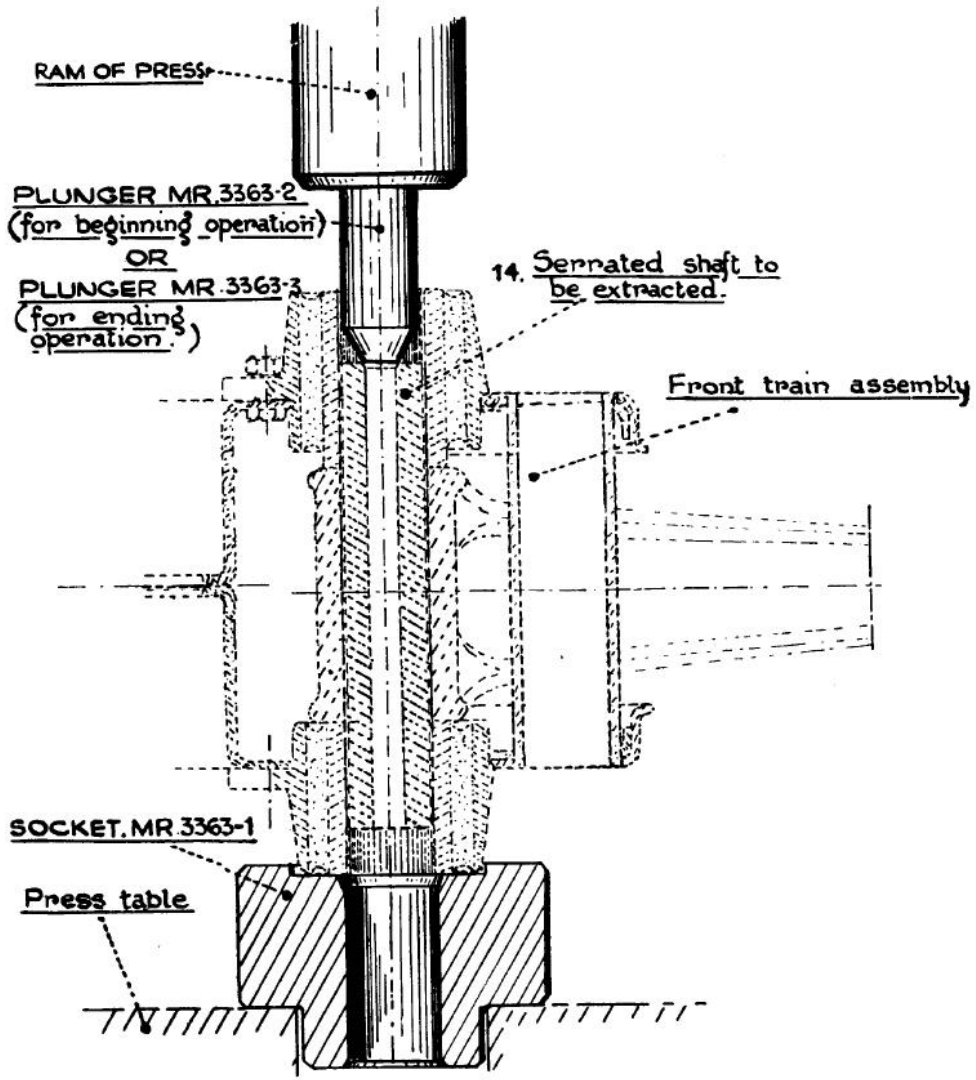
— FRONT AXLE —

— SECTION ON CENTRE-LINE OF UPPER LINK —

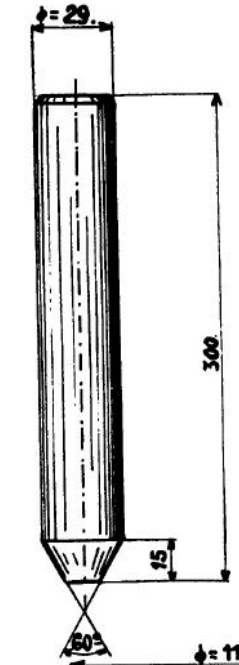


— DISMANTLING & ASSEMBLING SERRATED SHAFT —

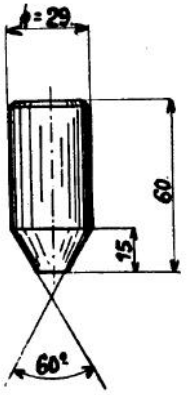
ASSEMBLY SHOWING EXTRACTION OF SERRATED SHAFT.



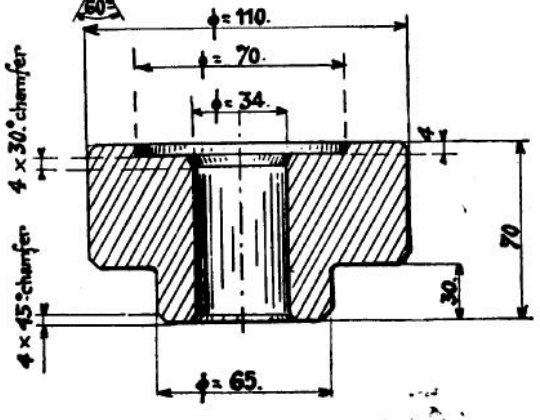
LONG PLUNGER MR. 3363-3



SHORT PLUNGER. MR. 3363-2

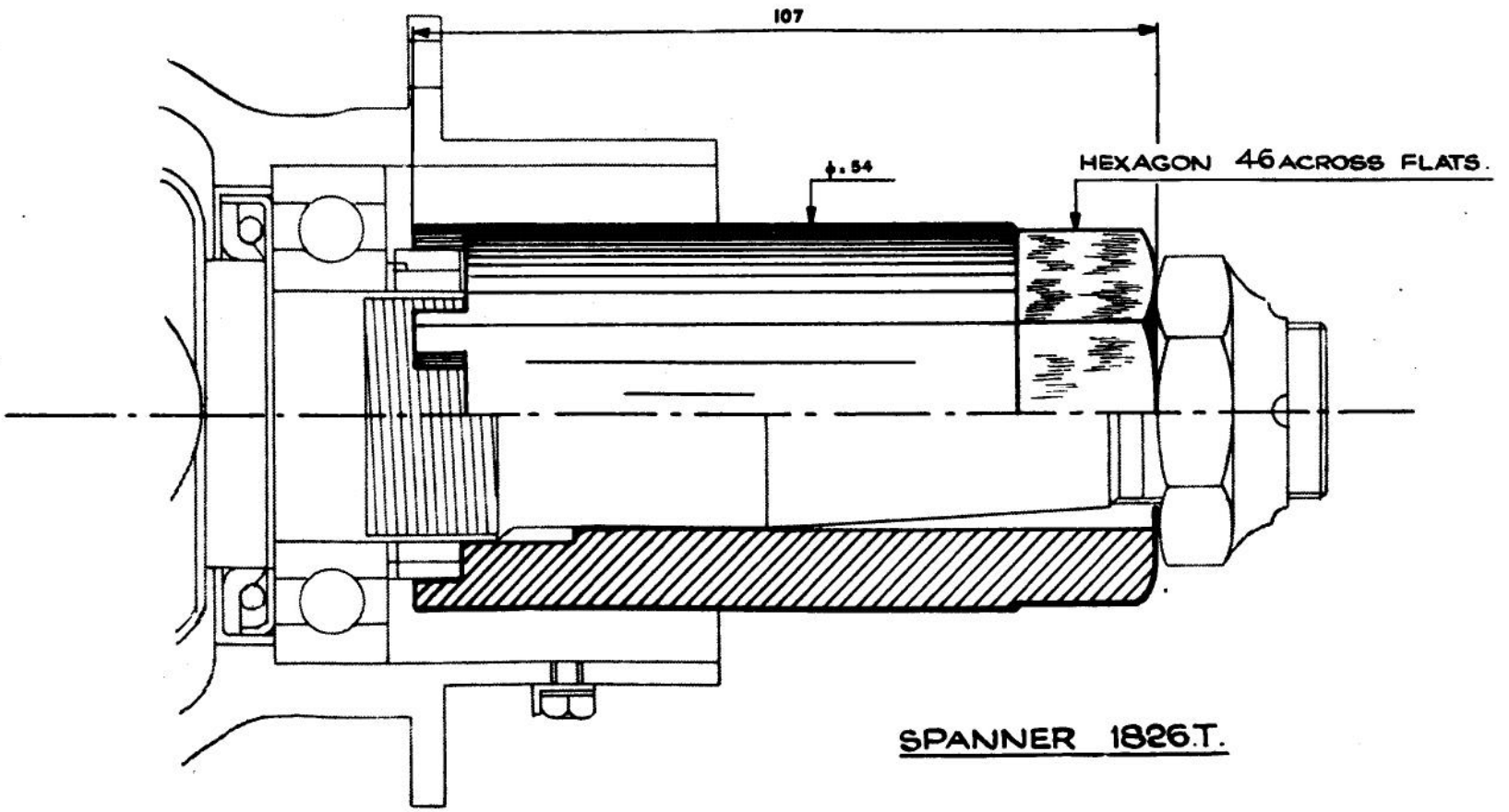


SOCKET. MR.3363-1



— DISMANTLING & ASSEMBLING NUT FOR STUB AXLE INNER BALL-RACE —

USE OF SPANNER



SPANNER 1826.T.

— FRONT AXLE —

— FITTING DRIVE SHAFTS —

Fig. 1.- USE OF APPARATUS.

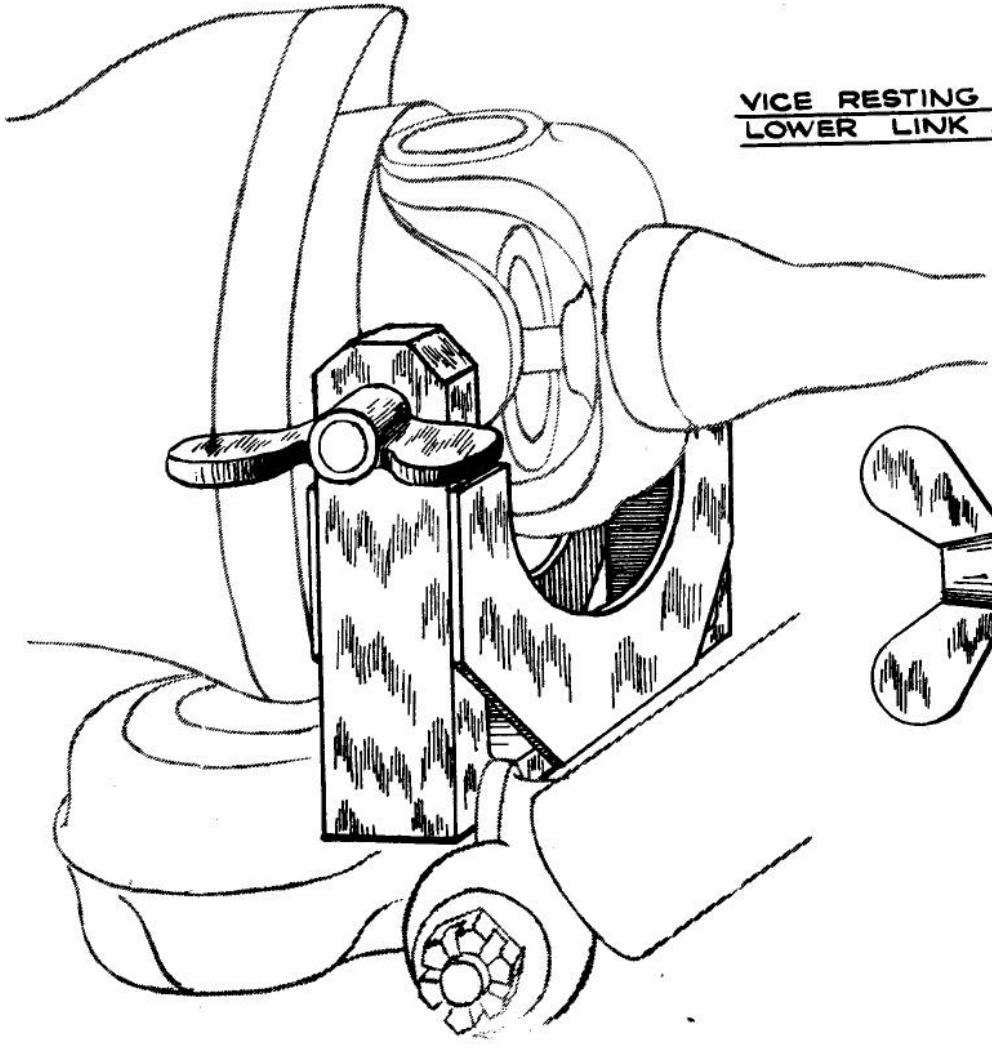
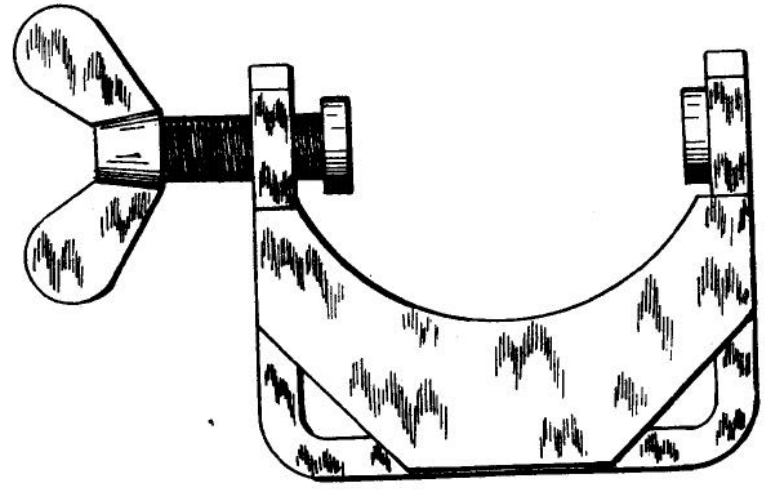


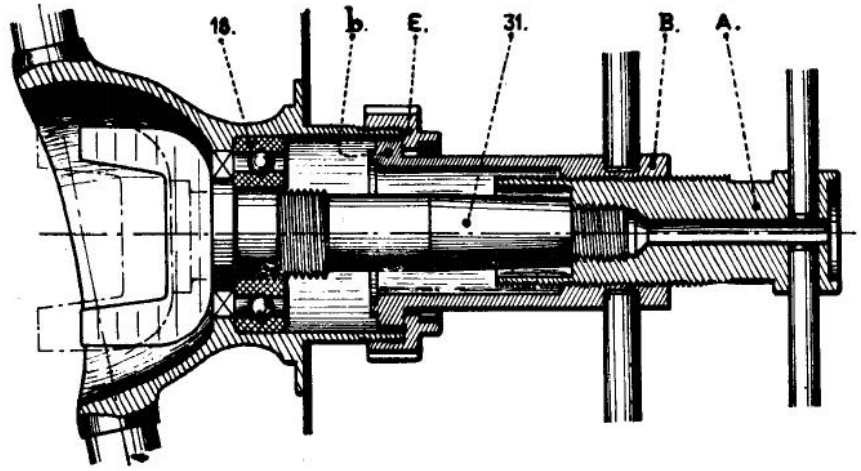
Fig. 2.- VICE 1830.T.



— REMOVING STUB AXLE AND INNER BALL-RACE —

TOOL FOR REMOVING STUB AXLE.
1824.T.

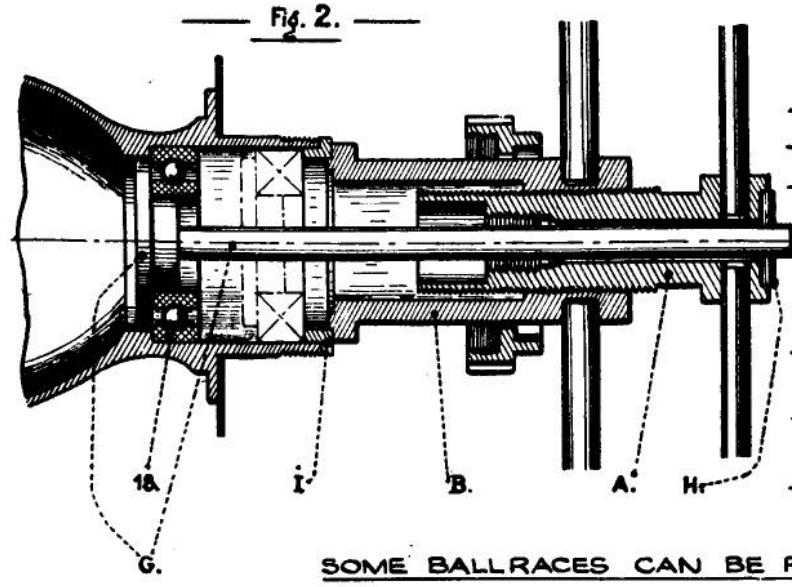
— Fig. 1. —



REMOVING STUB AXLE

- SCREW A DOWN (RIGHT HAND OR LEFT HAND ACCORDING TO SIDE) TIGHTLY ON TO STUB AXLE END : 31.
- TURN B TO RIGHT ROUND A. (b FITS INTO SWIVEL)
- SCREW E ON SWIVEL.
- TURN B TO LEFT (KEEPING HANDLE A STEADY TO PREVENT IT FROM TURNING) A PUSHES STUB AXLE 31 WHICH COMES OUT OF BALLRACE : 18.
- TO FREE TOOL.
  UNSCREW E FROM SWIVEL.
  UNSCREW A FROM STUB AXLE.

— Fig. 2. —



REMOVING INNER BALLRACE

- PLACE BEARING I ON SWIVEL.
- PUSH ASSEMBLY G THROUGH BALLRACE: 18
- FIT ASSEMBLY A AND B OVER SHAFT G UNTIL ASSEMBLY TOUCHES BEARING I.
- SCREW A RIGHT HAND INTO B TO CLEAR HOLE FOR STOP PIN H.
- PUT STOP PIN H IN POSITION.
- TURN B RIGHT HAND (KEEPING A STEADY) UNTIL BALLRACE 18 TOUCHES BEARING I.
- PULL COMPLETE ASSEMBLY WITH BALLRACE 18 AWAY.
- TO FREE TOOL.
  WITHDRAW SHAFT G.

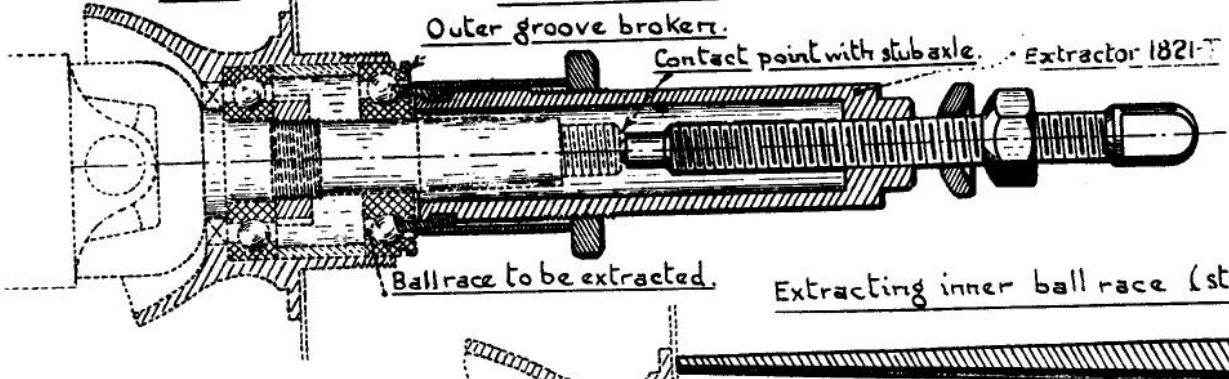
SOME BALLRACES CAN BE REMOVED WITH EXTRUDING TOOL.

— FRONT AXLE —

EXTRACTOR FOR OUTER BALL RACE (OUTER GROOVE BROKEN) —
EXTRACTOR FOR INNER BALL RACE —

— Fig 1. —

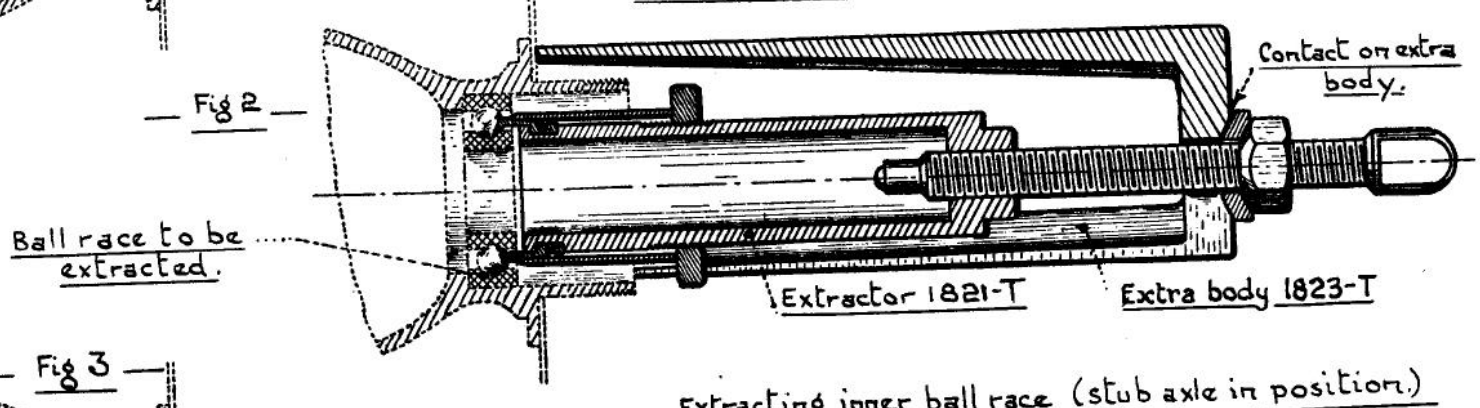
Use of instrument to extract outer ball race.



Extractor with collets for bearing with 10 balls 1821-T.

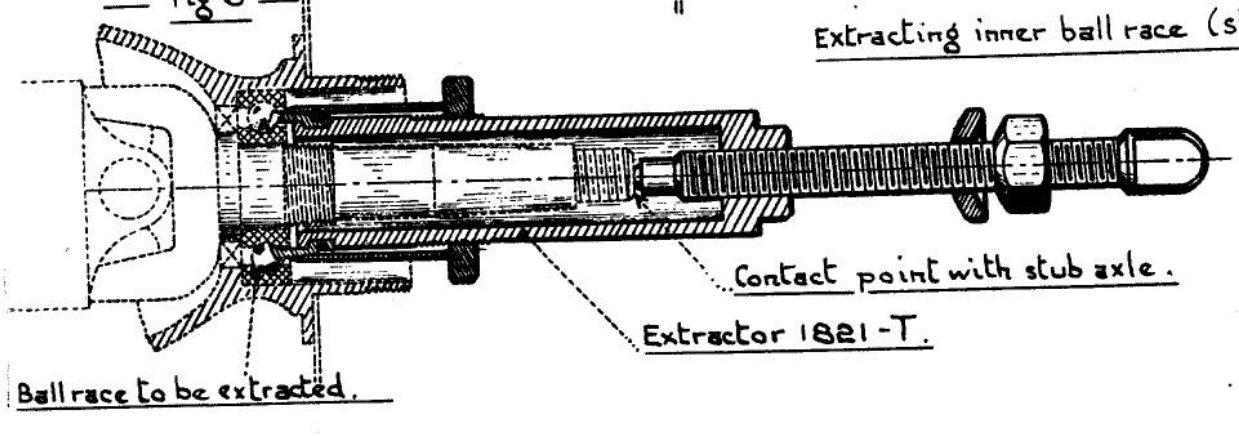
— Fig 2 —

Extracting inner ball race (stub axle withdrawn.)



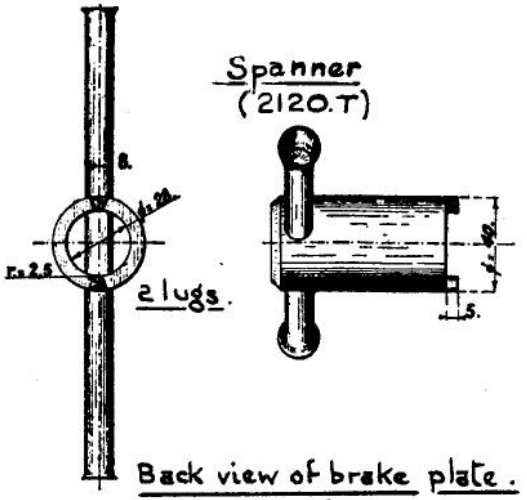
— Fig 3 —

Extracting inner ball race (stub axle in position.)



Collets for bearings with
10 balls - 1822-T
9 balls - 1828-T

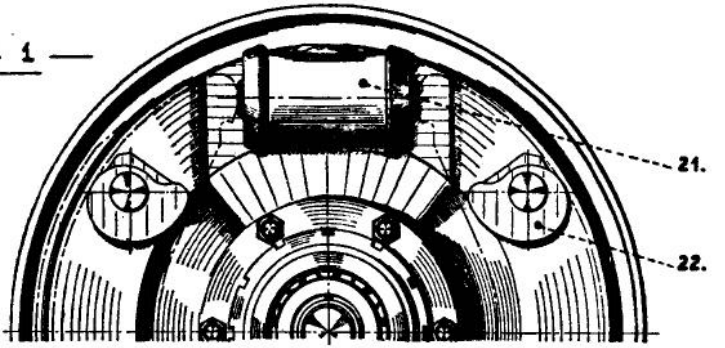
— BRAKE BACK PLATE ASSEMBLY



Back view of brake plate.

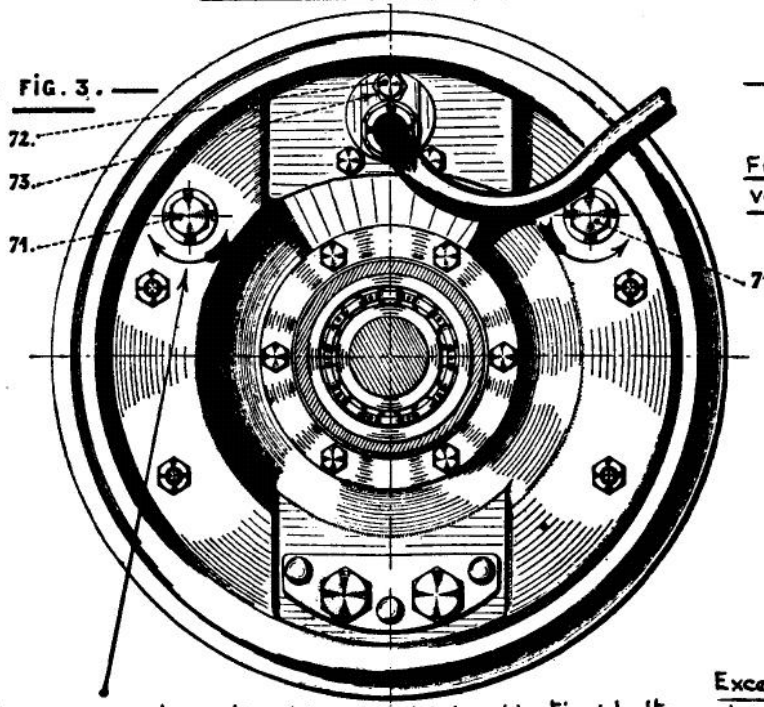
Front view with shoes removed.

— Fig. 1 —



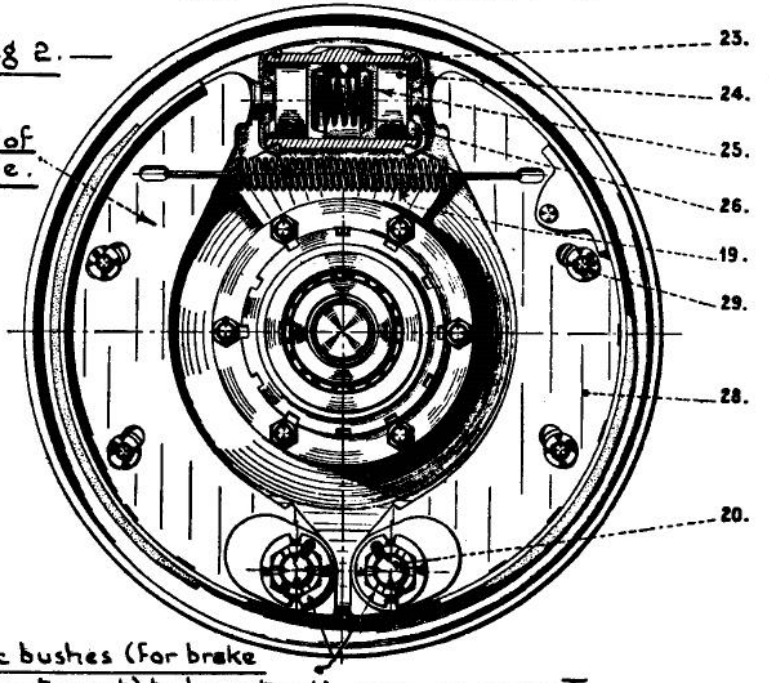
Brake plate assembled (with shoes)

— FIG. 3. —



The arrows show direction in which adjusting bolts rotate in order to set shoes 27 and 28 nearer drum.

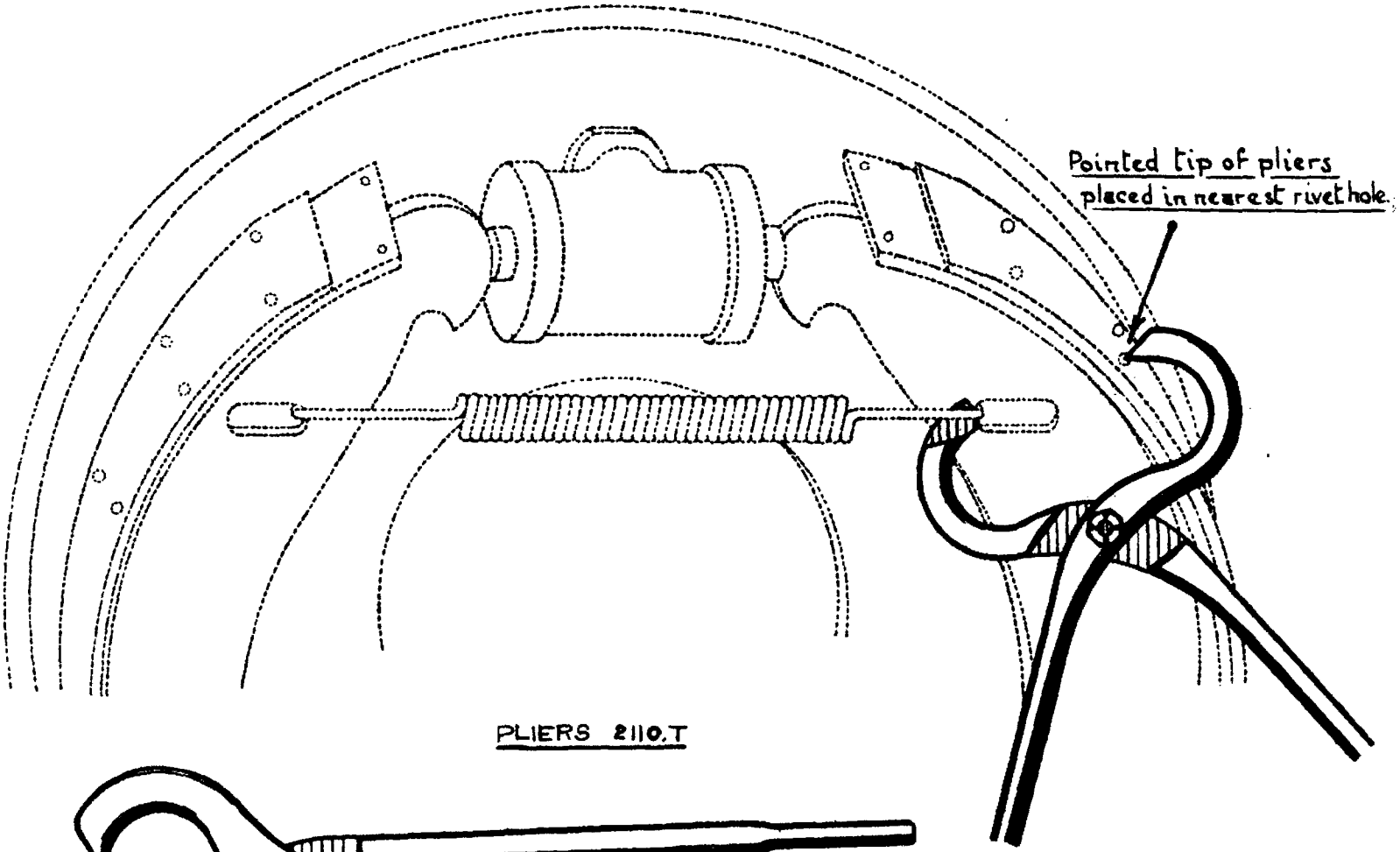
— Fig 2. —



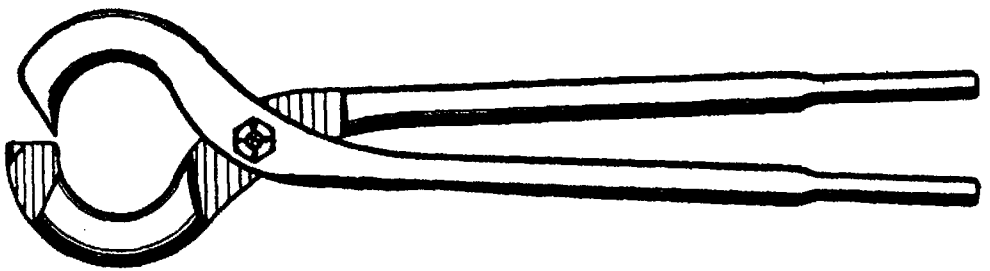
Excentric bushes (for brake shoe adjustment) to be set with spanner 2120-T.

—FRONT AXLE—

—FITTING OR REMOVING BRAKE SHOE RETURN SPRING—

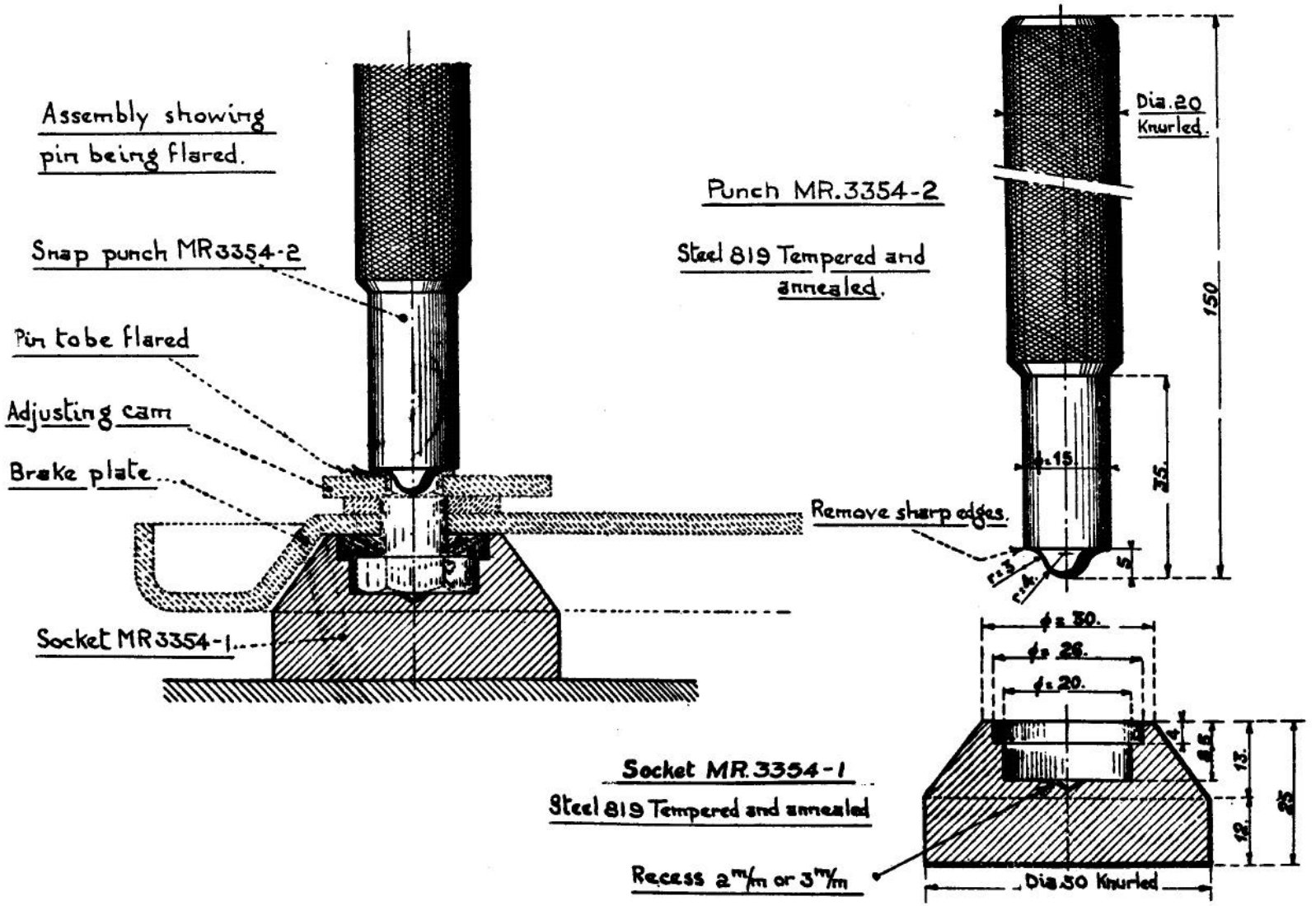


PLIERS 2110.T



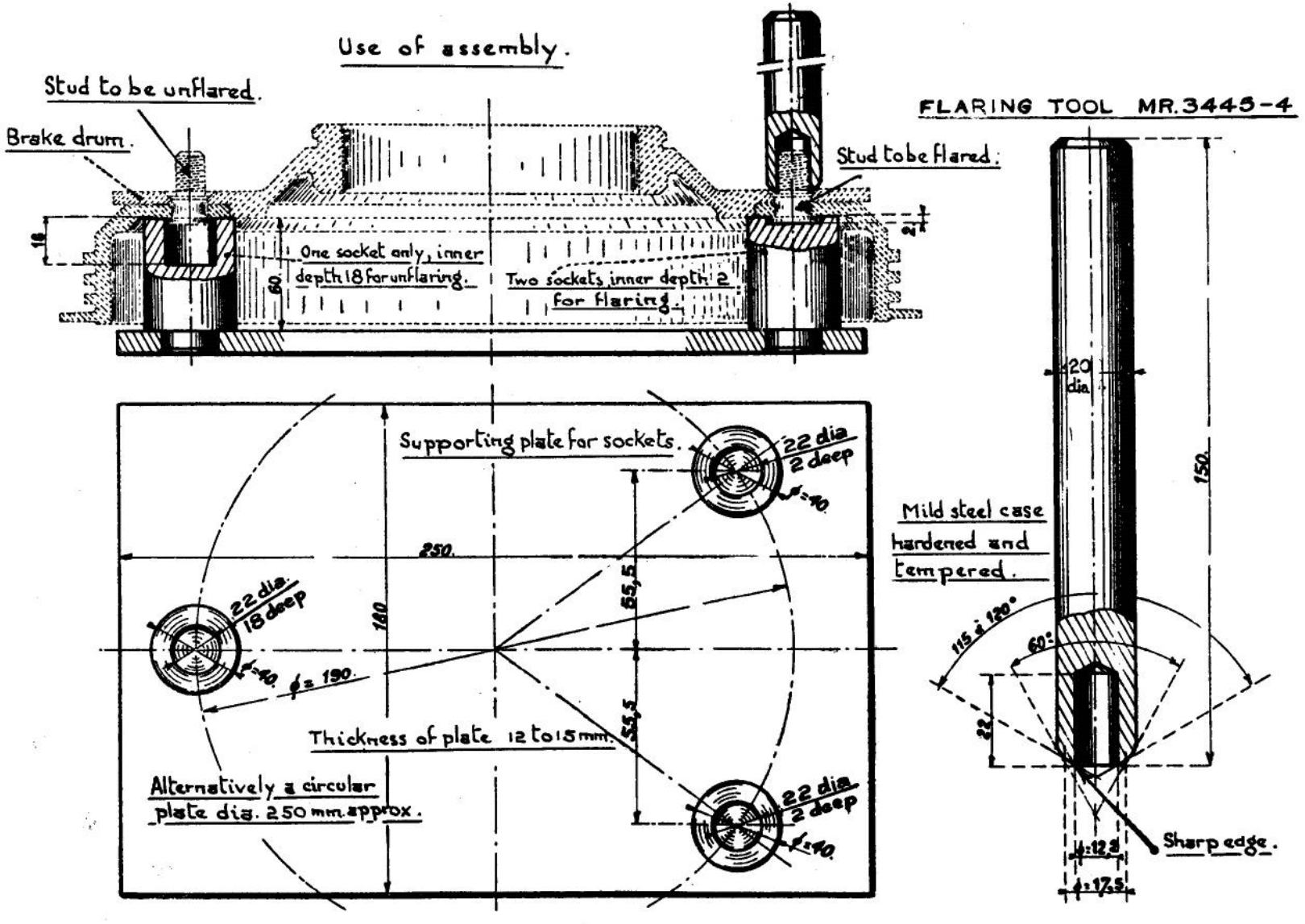
—FRONT AXLE—

—FLARING ADJUSTING CAMS OF BRAKE SHOES—



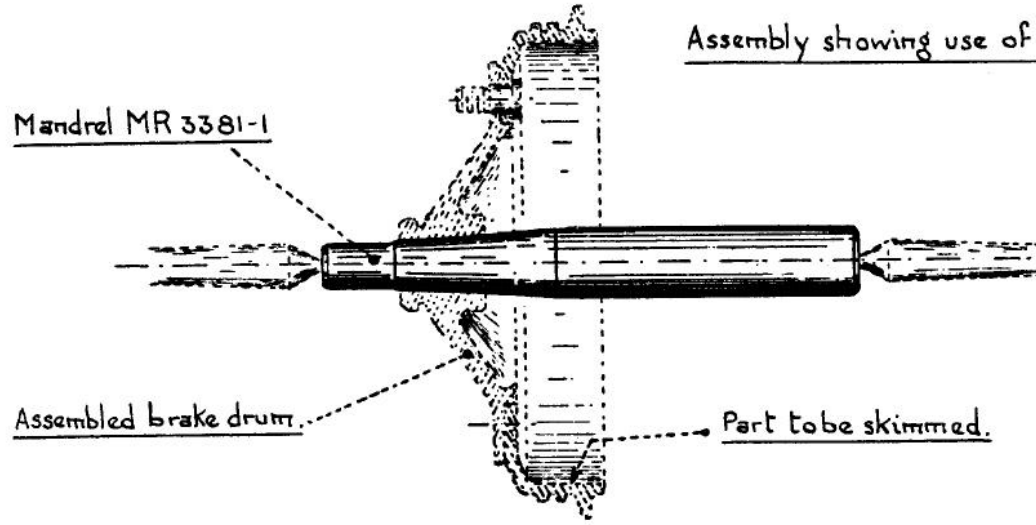
— FRONT AXLE —

— REPLACEMENT OF WHEEL STUDS —

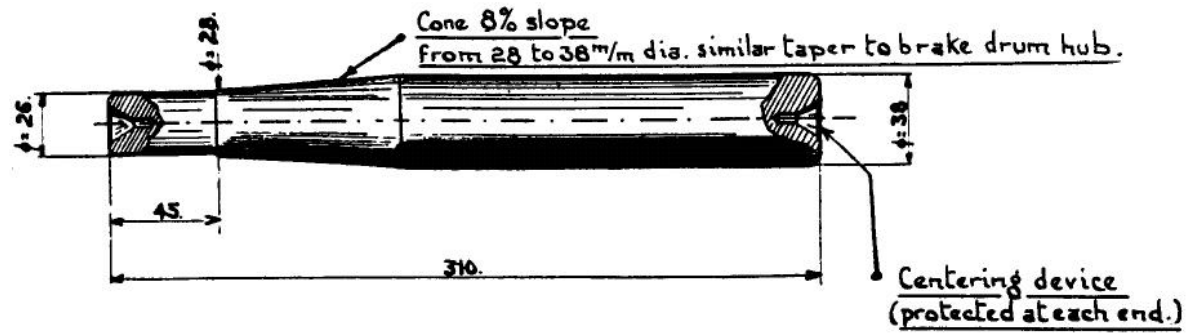


FRONT AXLE

RECTIFICATION OF BRAKE DRUMS



Mandrel MR 3381-1



FRONT AXLE

ASSEMBLY OF SHAFTS

Sectional view.

Fig. 1.

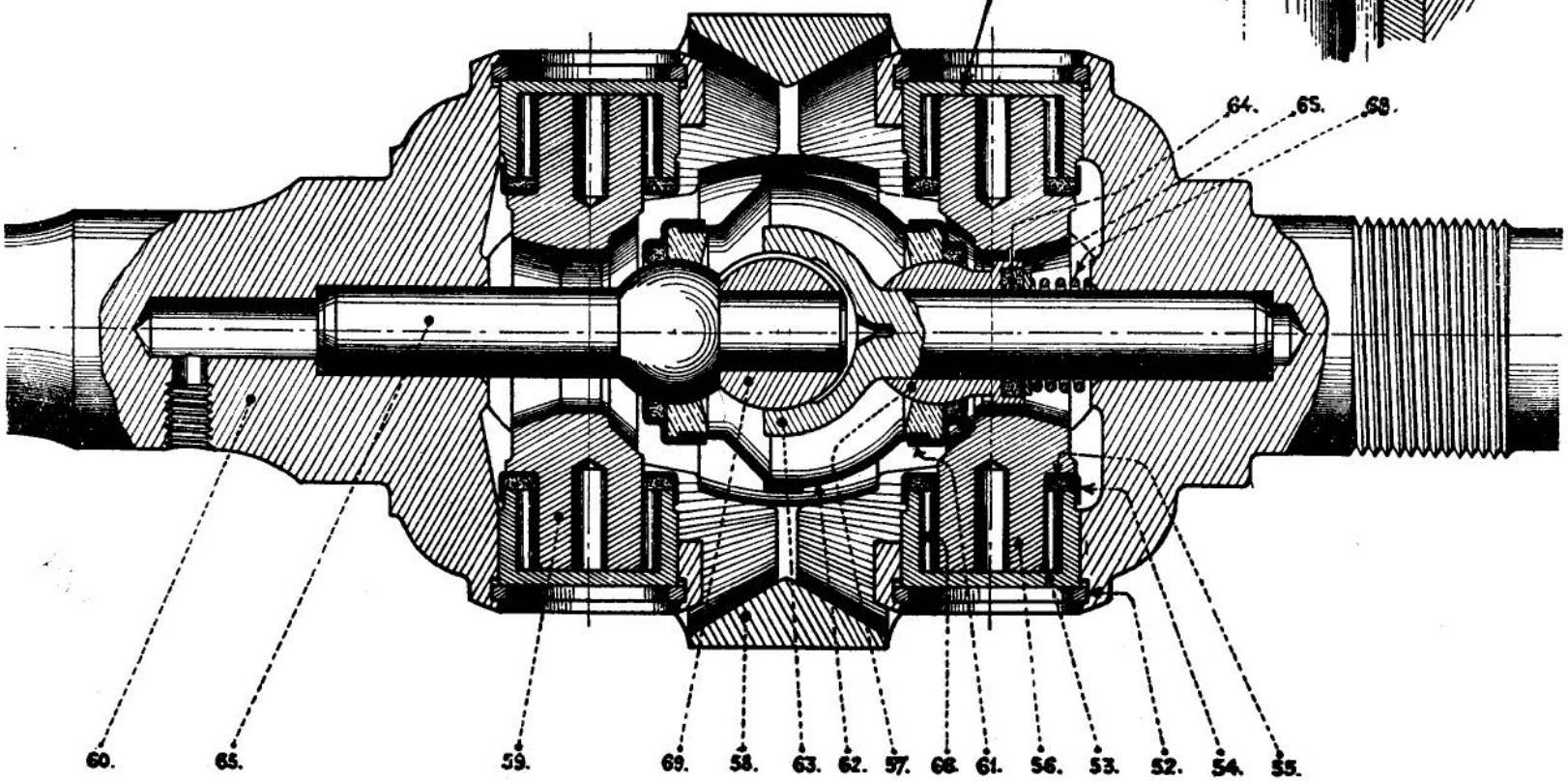
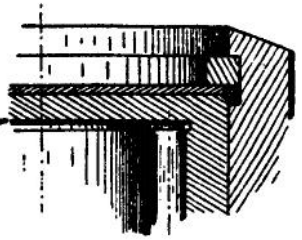


Fig. 2.

Shim to reduce play at 'a'.



FRONT AXLE

DISMANTLING DRIVE SHAFTS

Dismantling yoke end of stub axle.

Fig. 1.

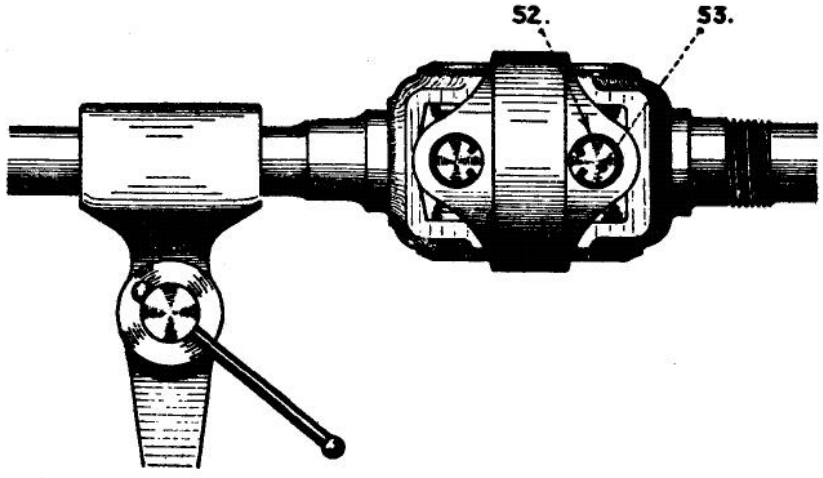


Fig. 2.

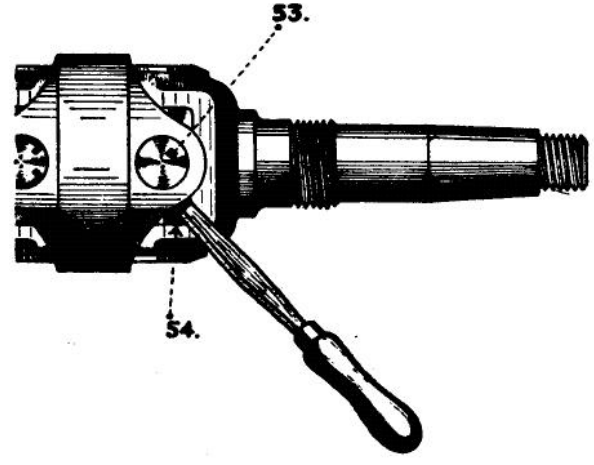
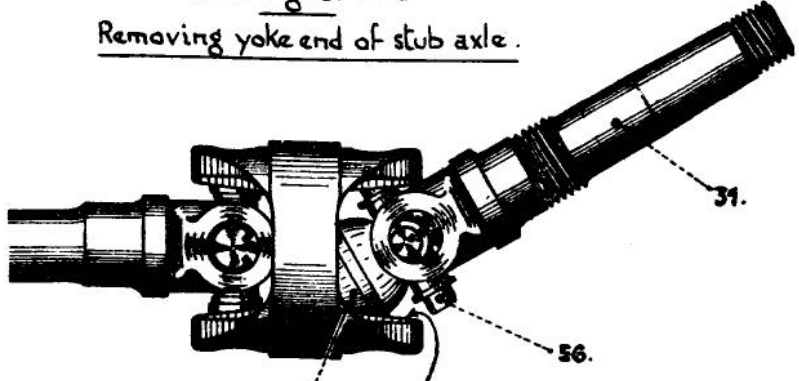


Fig. 3.

Removing yoke end of stub axle.

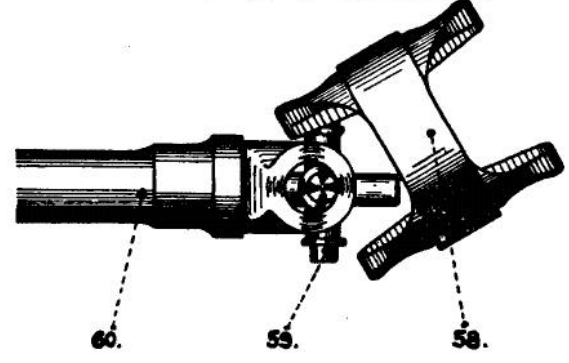


Spigot ball assembly.

Clearance for removing spider.

Fig 4.

Removing double yoke.



FRONT AXLE

DISMANTLING DRIVE SHAFTS

Fig. 5.
REMOVING SPIGOT BALL CASING.

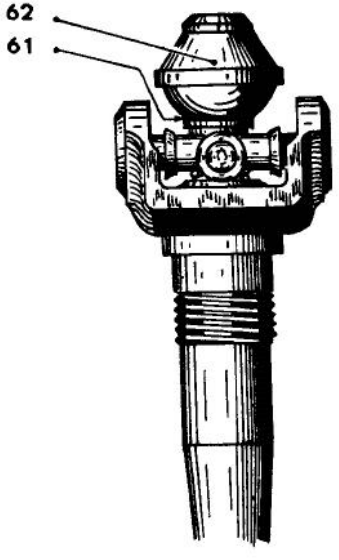


Fig. 6.
EXTRACTING SPIGOT CUP FROM STUB AXLE END.

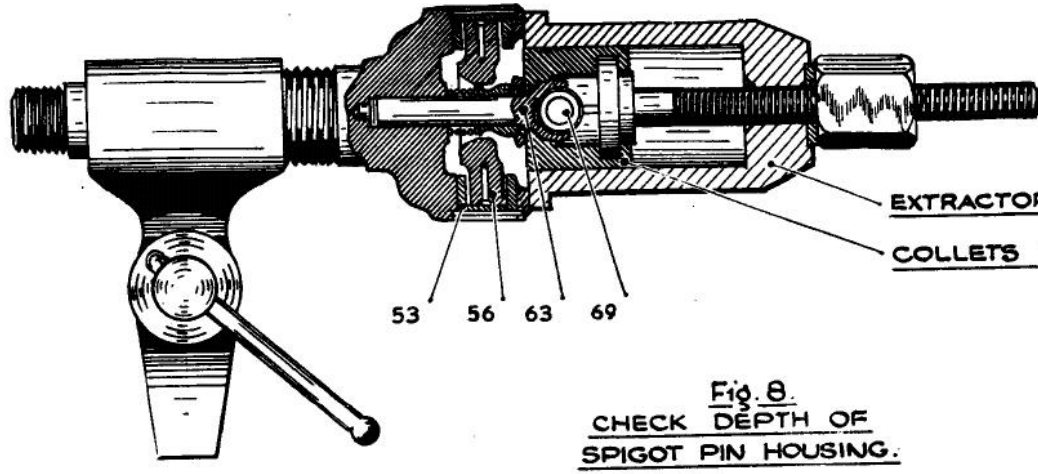


Fig. 7.
EXTRACTING SPIGOT PIN FROM DRIVE SHAFT END.

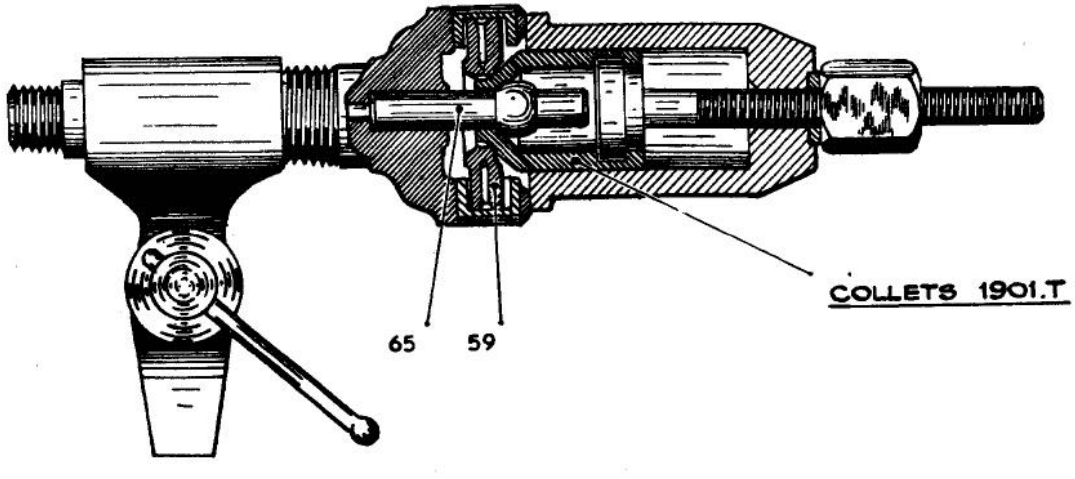
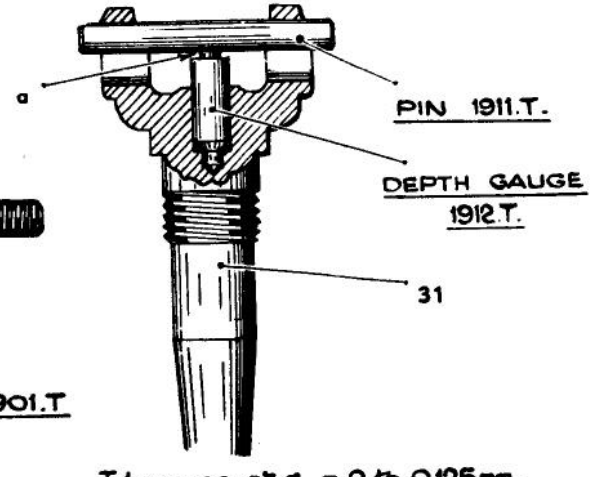


Fig. 8.
CHECK DEPTH OF SPIGOT PIN HOUSING.



Tolerance at a = 0 to 0,125 mm.

— ASSEMBLY OF DRIVE SHAFTS —

Fig. 9.
PLACING SPIDER AT STUB AXLE END.

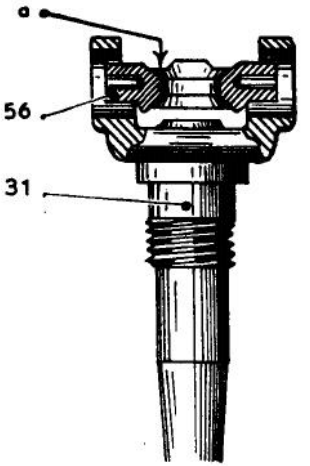


Fig. 10.
FITTING SPIGOT CUP.

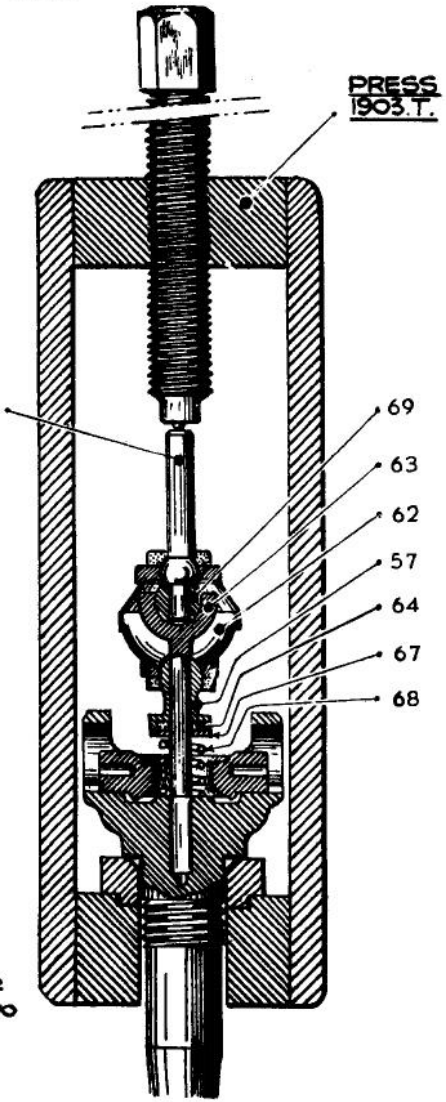
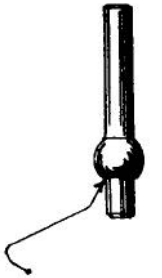


Fig. 11.
MODIFIED SPIGOT PIN.



GRIND ROUNDED PART AT BASE TO OBTAIN A FLAT FOR SEATING ON BALL TOP: 69. THIS PREVENTS PARTS FROM SEIZING WHILE SPIGOT CUP, 63 IS BEING FORCED INTO POSITION.

Fig. 12. CHECKING POSITION OF INNER SPIGOT BALL.

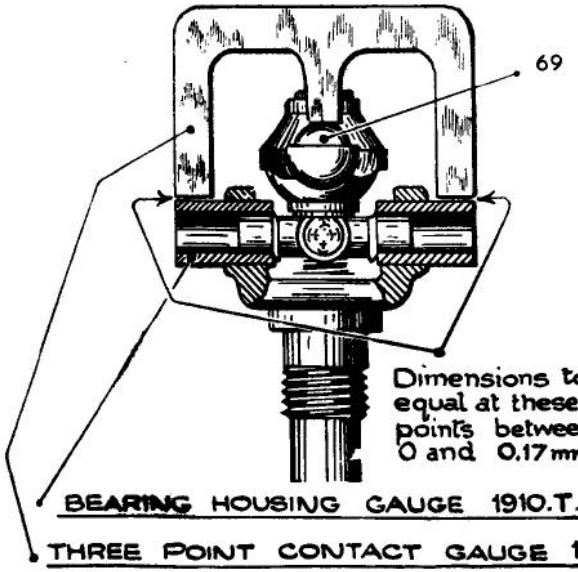
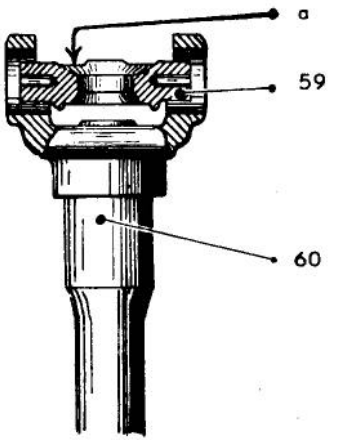


Fig. 13. FITTING SPIDER AT DRIVESHAFT END.



FRONT AXLE

ASSEMBLY OF DRIVE SHAFTS

FITTING OF SPIGOT PIN

Fig. 14.

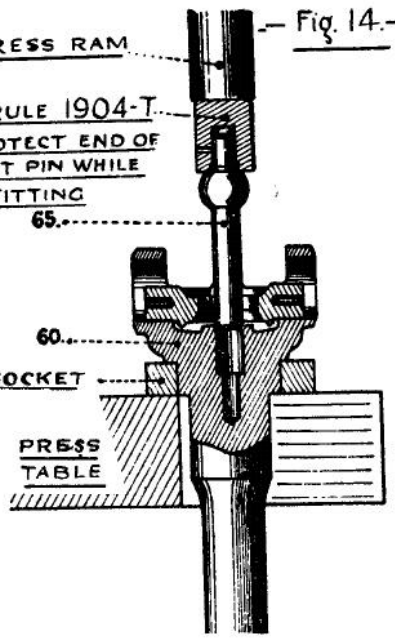


Fig. 15.

FITTING DOUBLE YOKE ON STUB AXLE END

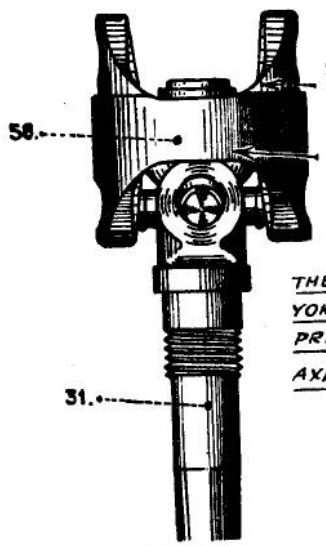


Fig. 16.

FITTING DRIVE SHAFT END TO DOUBLE YOKE

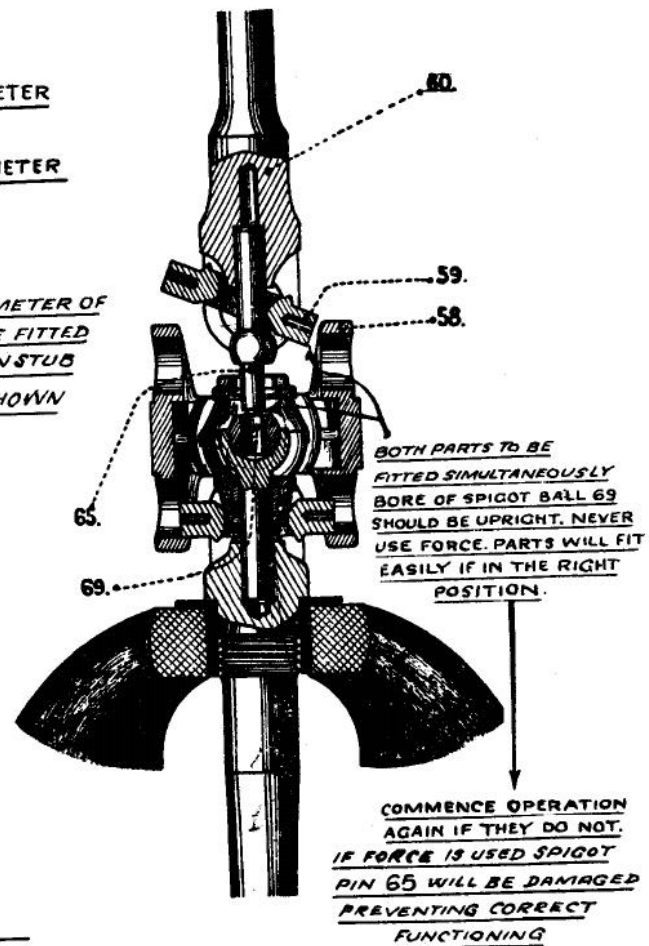


Fig. 17.

FITTING CORK WASHER RETAINER

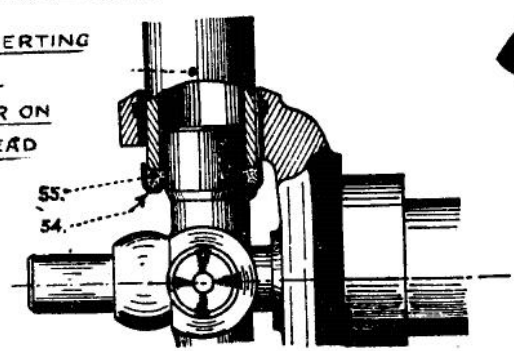
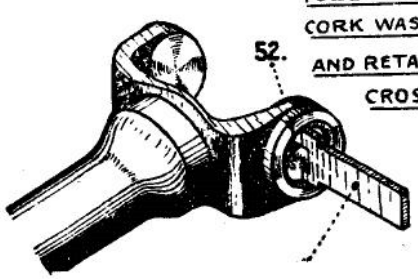


Fig. 18.

CHECKING FIT OF CIRCLIPS



FRONT AXLE

REBORING SPLINE HOUSING OF COUPLING

Fig. 1. DIAGRAM SHOWING ASSEMBLY BEING PREPARED

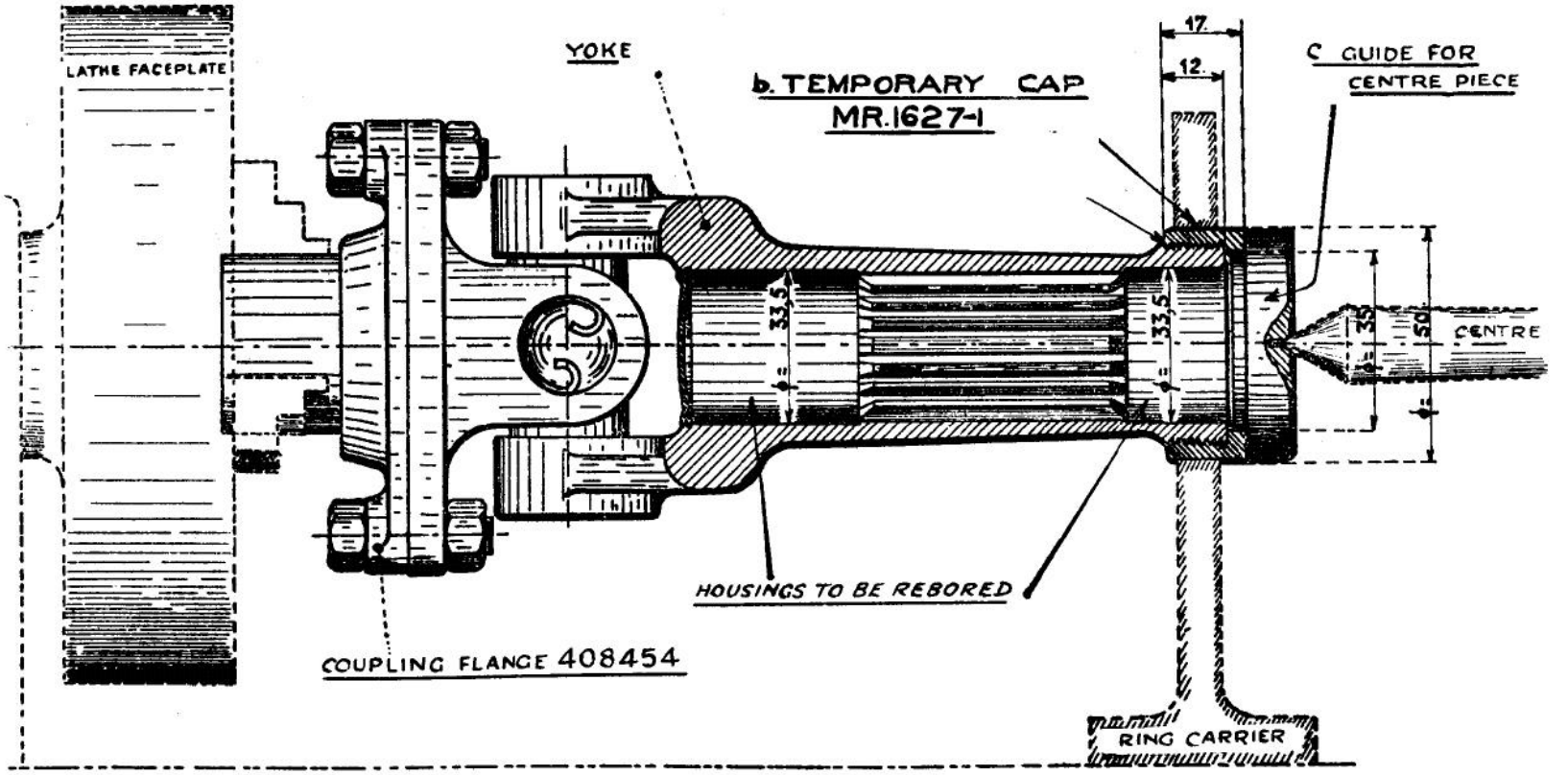
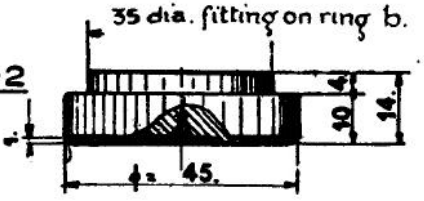


Fig 2
c. GUIDE MR.1627-2



FRONT AXLE

ASSEMBLY OF STUB AXLE END AND BALL-RACE INTO SWIVEL

TOOL FOR DISMANTLING STUB AXLE 1824 T.

TOOL ALREADY MENTIONED ON ILLUSTRATION 48.

Fig. 1.

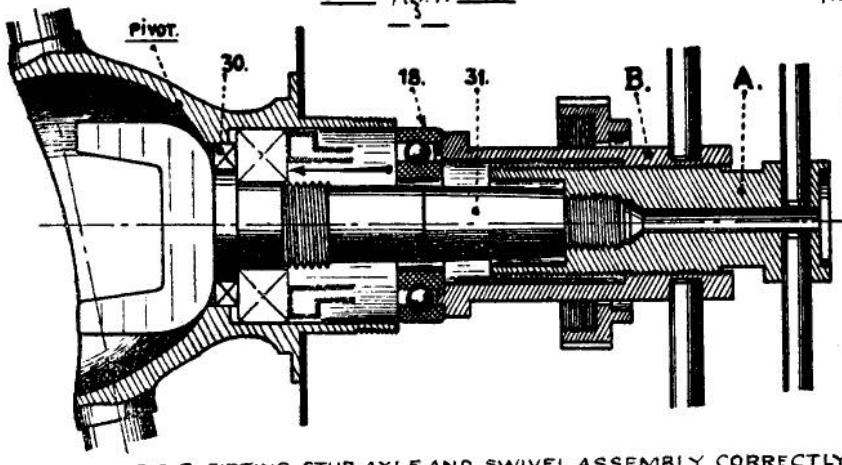


FIG. 2. FITTING STUB AXLE AND SWIVEL ASSEMBLY CORRECTLY

- FIT LOCKWASHER FOR NUT: 17.
- SCREW NUT: 17 WITH SPANNER 1826-T (SEE ILLUSTRATION 47) BEND TAB INTO POSITION
- SCREW A ON AXLE 31 (RIGHT OR LEFT ACCORDING TO SIDE)
- TURN B RIGHT DRIVING b INTO SWIVEL. SCREW E ON SWIVEL.
- TURN B LEFT KEEPING A STEADY UNTIL BALL-RACE IS ON SEATING

RELEASING TOOL

- UNSCREW E, UNSCREW A. (RIGHT OR LEFT ACCORDING TO SIDE)

Fig. 3.

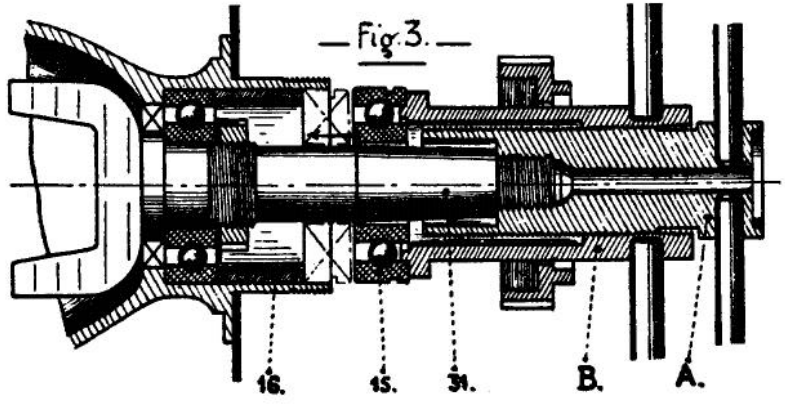


FIG. 1. FITTING INNER BALL-RACE

- PLACE STUB AXLE 31 IN SWIVEL
- PLACE BALL-RACE 18 IN FRONT OF SWIVEL
- LOCK PART A ON STUB AXLE 31. (RIGHT OR LEFT ACCORDING TO SIDE)
- TURN B RIGHT KEEPING A STEADY BY MEANS OF HANDLE

RELEASING TOOL

- UNSCREW A (RIGHT OR LEFT ACCORDING TO SIDE)

Fig. 2.

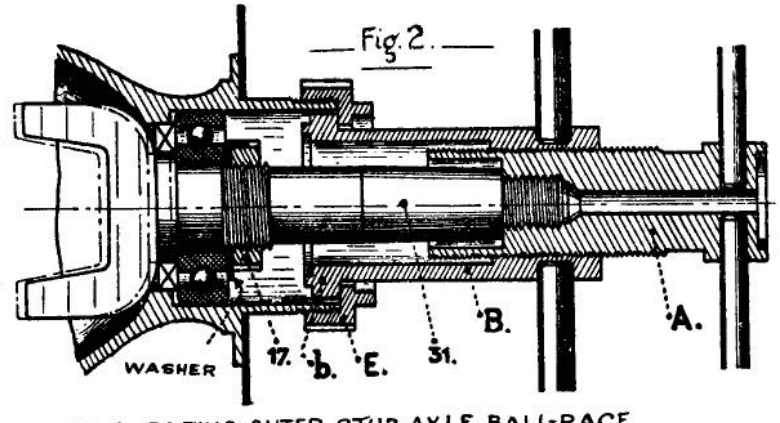


FIG. 3. FITTING OUTER STUB AXLE BALL-RACE

- PLACE DISTANCE PIECE: 16.
- PLACE BALL-RACE: 15, ON STUB AXLE 31.
- SCREW A ON STUB AXLE 31 (RIGHT OR LEFT ACCORDING TO SIDE)
- TURN B RIGHT, KEEPING A STEADY, TILL BALL-RACE 15 IS ON SEATING

RELEASING TOOL

- UNSCREW A (RIGHT OR LEFT ACCORDING TO SIDE)

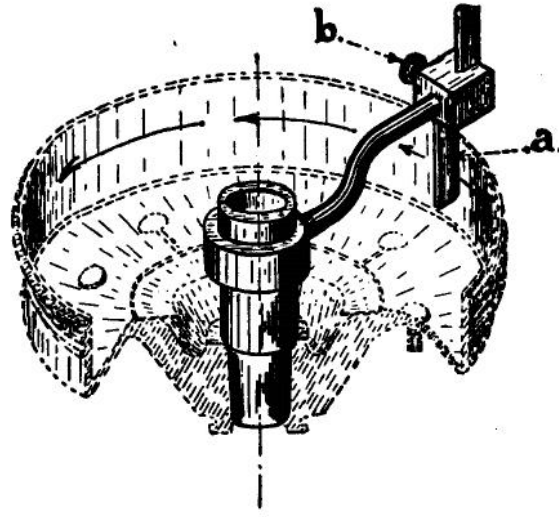
— CHECKING CONCENTRICITY OF BRAKE LININGS —

CONCENTRICITY CHECKING APPARATUS

2100 T

— Fig. 1. —

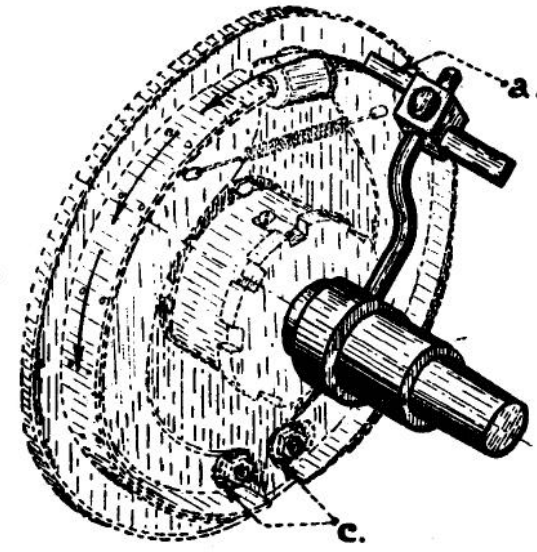
REGISTERING DIAMETER OF DRUM



— INSERT INSTRUMENT INTO DRUM
— BRING INDICATOR a, INTO CONTACT WITH DRUM AND DESCRIBE COMPLETE CIRCLE.
— LOCK INDICATOR AT SET POSITION WITH THUMB-SCREW b.

— Fig. 2. —

CHECKING CONCENTRICITY OF LININGS

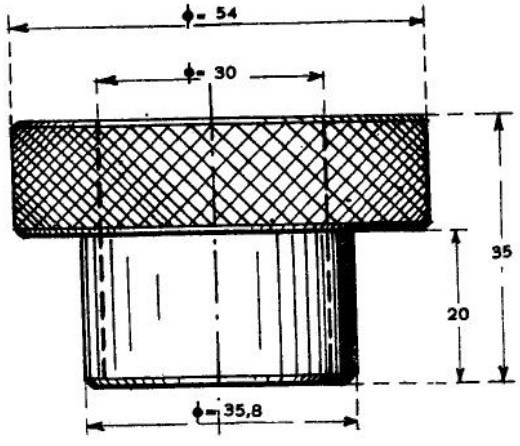


— FIT INSTRUMENT ON STUB (WITH KEY REMOVED)
— PLACE INDICATOR: a, AS PREVIOUSLY SET ON LININGS, INDICATOR MUST REMAIN IN CONTACT THROUGHOUT CIRCUMFERENCE (*IN ORDER TO OBTAIN THIS RESULT, ADJUST LININGS BY ECCENTRIC BUSHES; c, AND ADJUSTING CAMS AT REAR OF BACK-PLATE, NOT SHOWN*)
— REMOVE BURRS ON LININGS WITH RASP.

AFTER CHECK, RELEASE CAMS TO ALLOW FITTING OF DRUM (FOR FINAL ADJUSTMENT OF CAMS, SEE OPERATION 150 PARA. 2.

REMOVING AND REFITTING STEERING WHEEL

Fig.1. - LOCATING FIXED TUBE.



BUSH. MR. 3102

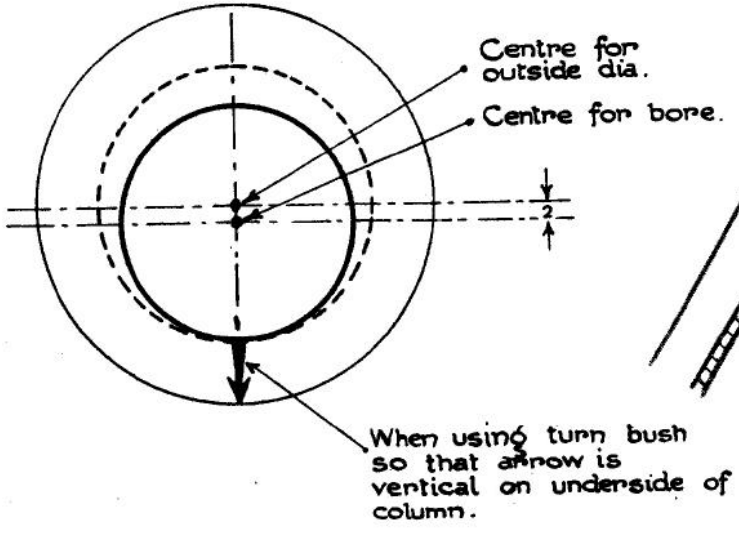
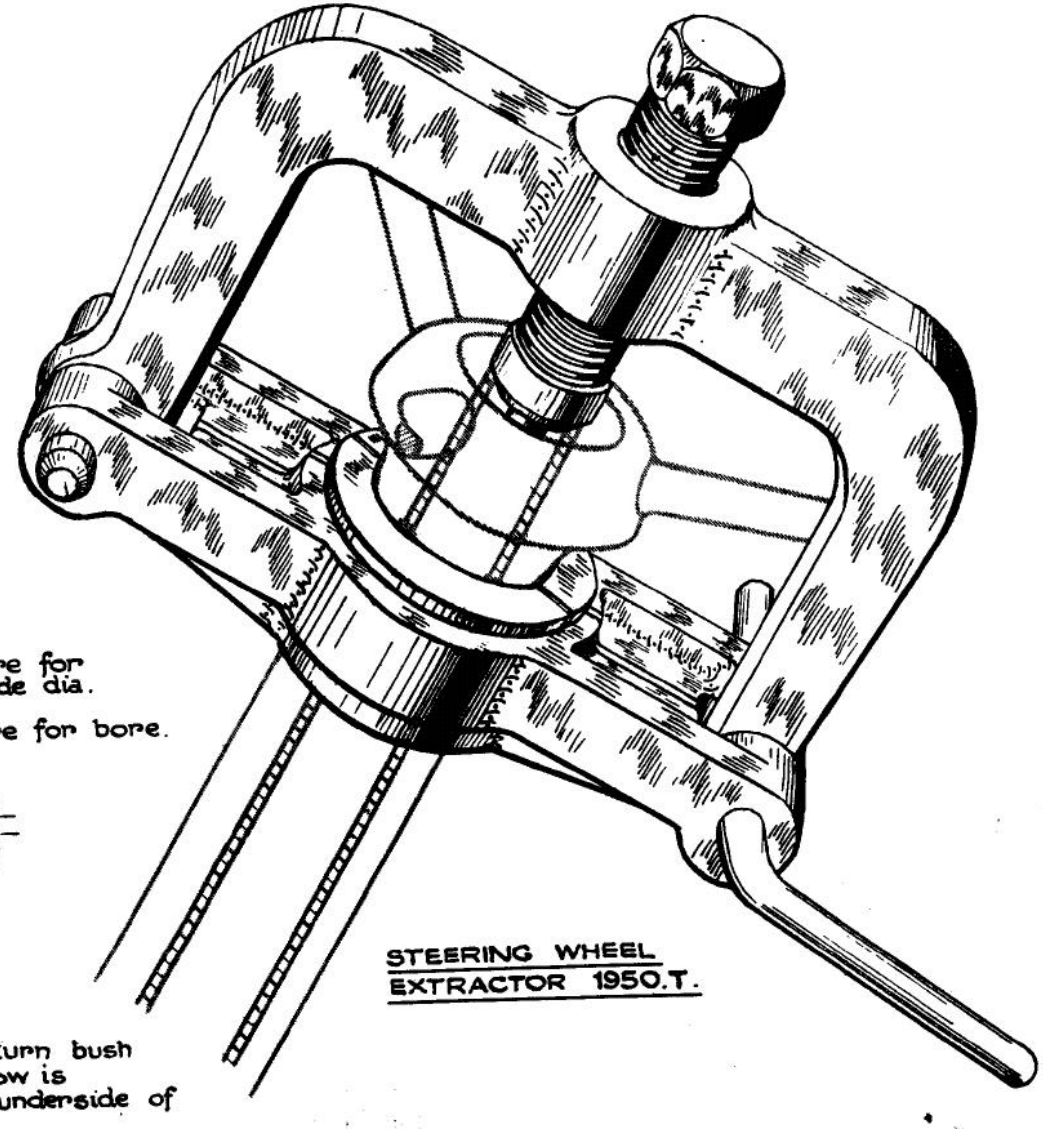


Fig.2. REMOVING STEERING WHEEL.

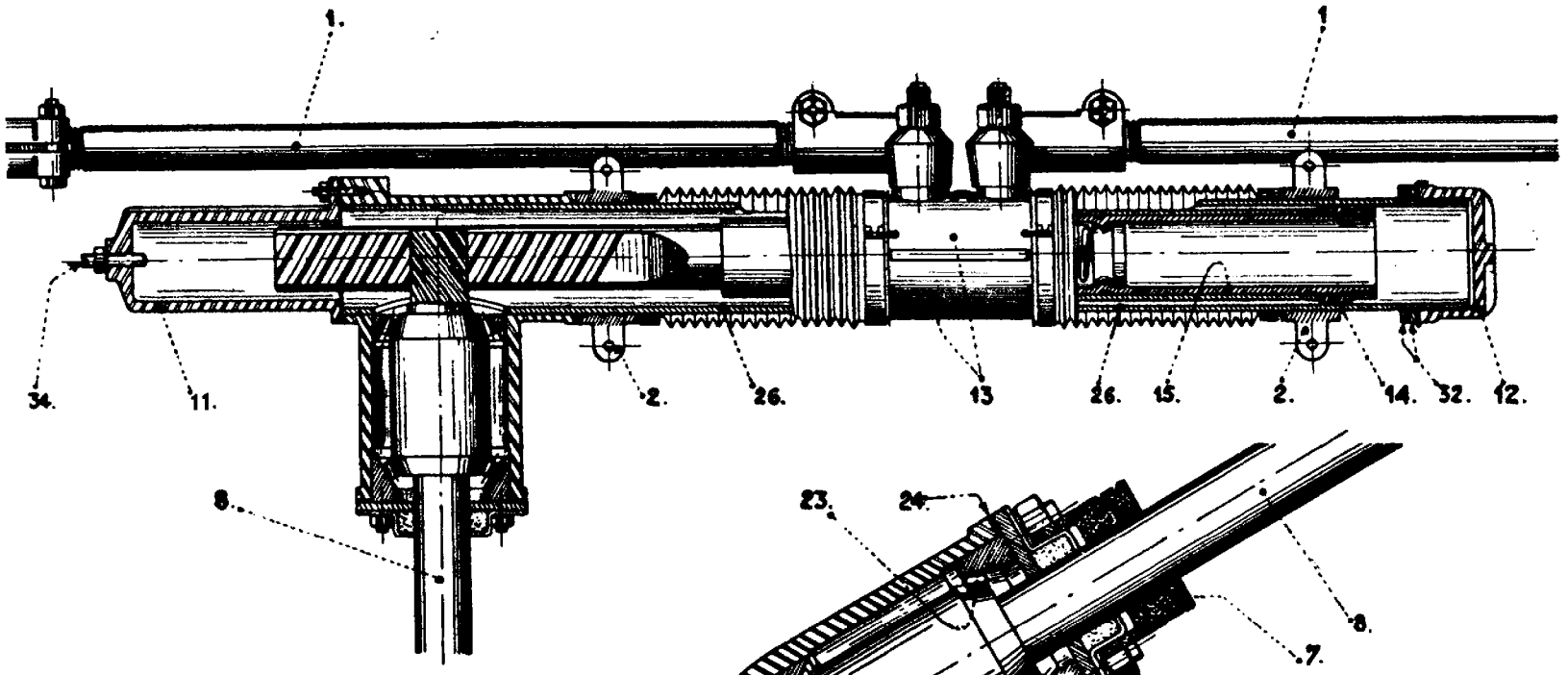


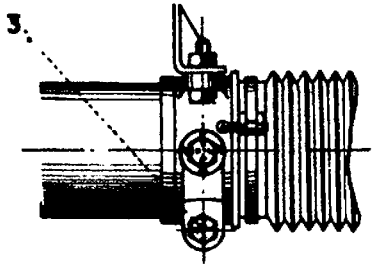
STEERING WHEEL EXTRACTOR 1950.T.

STEERING

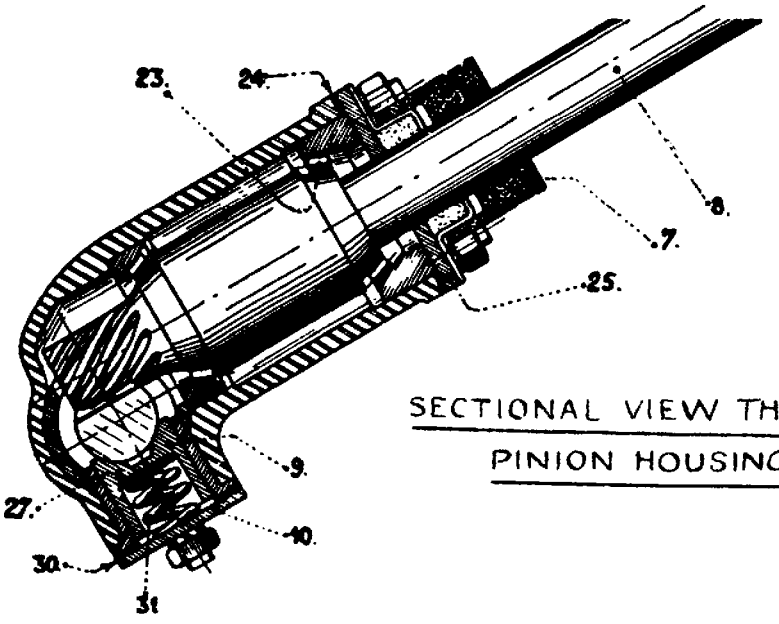
ASSEMBLY

SECTIONAL VIEW THROUGH CASING





DETAILS OF FITTING OF CONCENTRIC RUBBERS

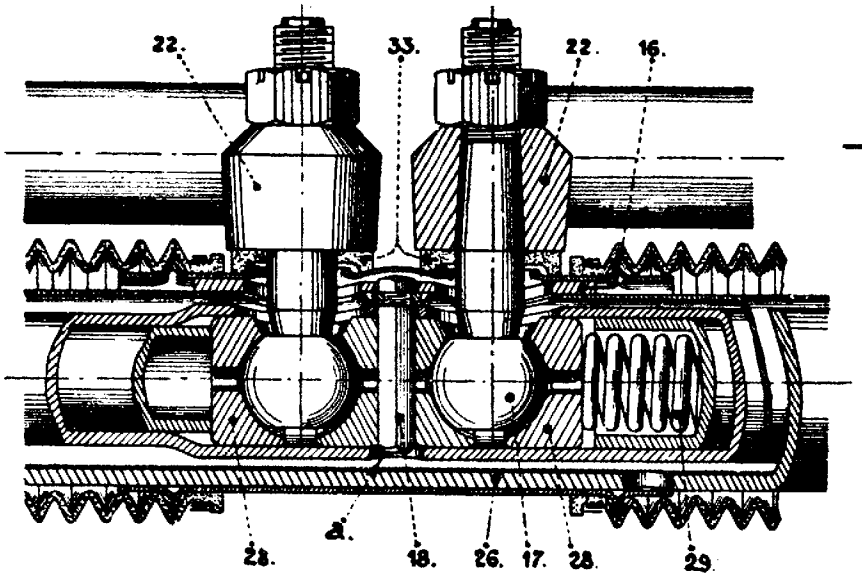


SECTIONAL VIEW THROUGH PINION HOUSING

STEERING

ASSEMBLY OF BALL PINS

FIG.1. SECTIONAL VIEW SHOWING BALL PINS



— Fig. 3. —

FIG.3. CHECKING TOLERANCE OF RING NUT

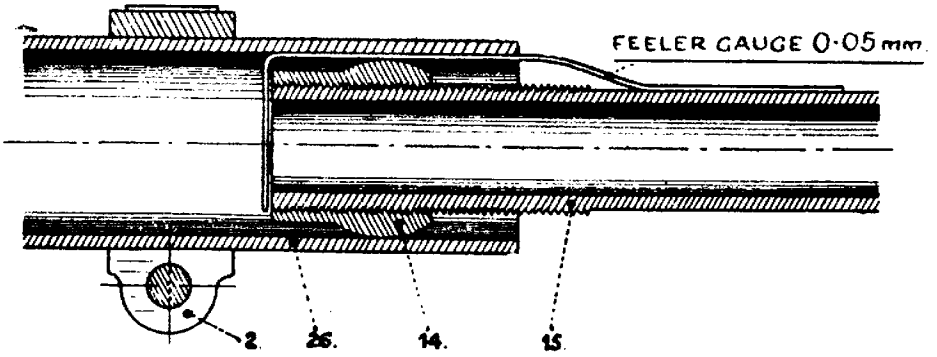
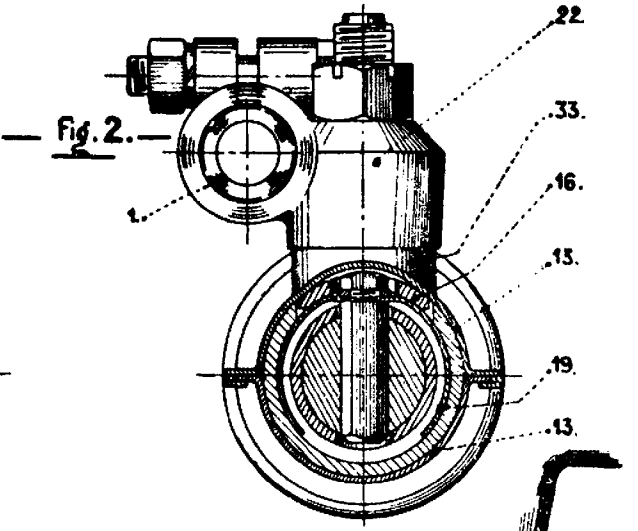


FIG.2. SECTIONAL VIEW THROUGH DOWEL PIN



— Fig.2. —

— Fig.4. —

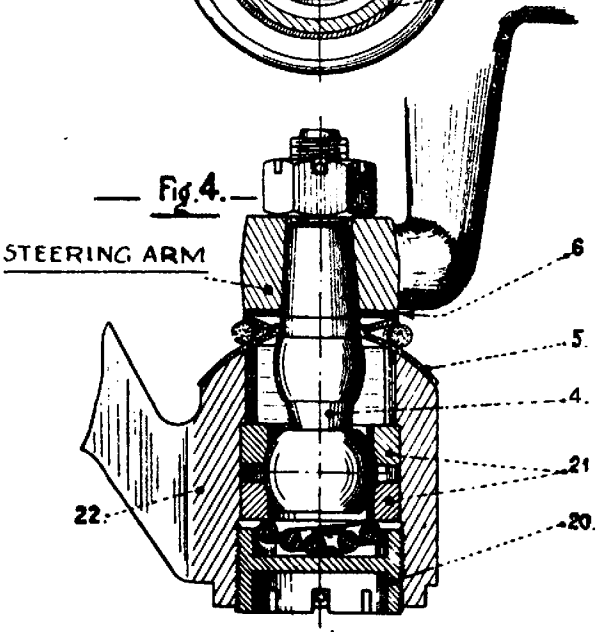
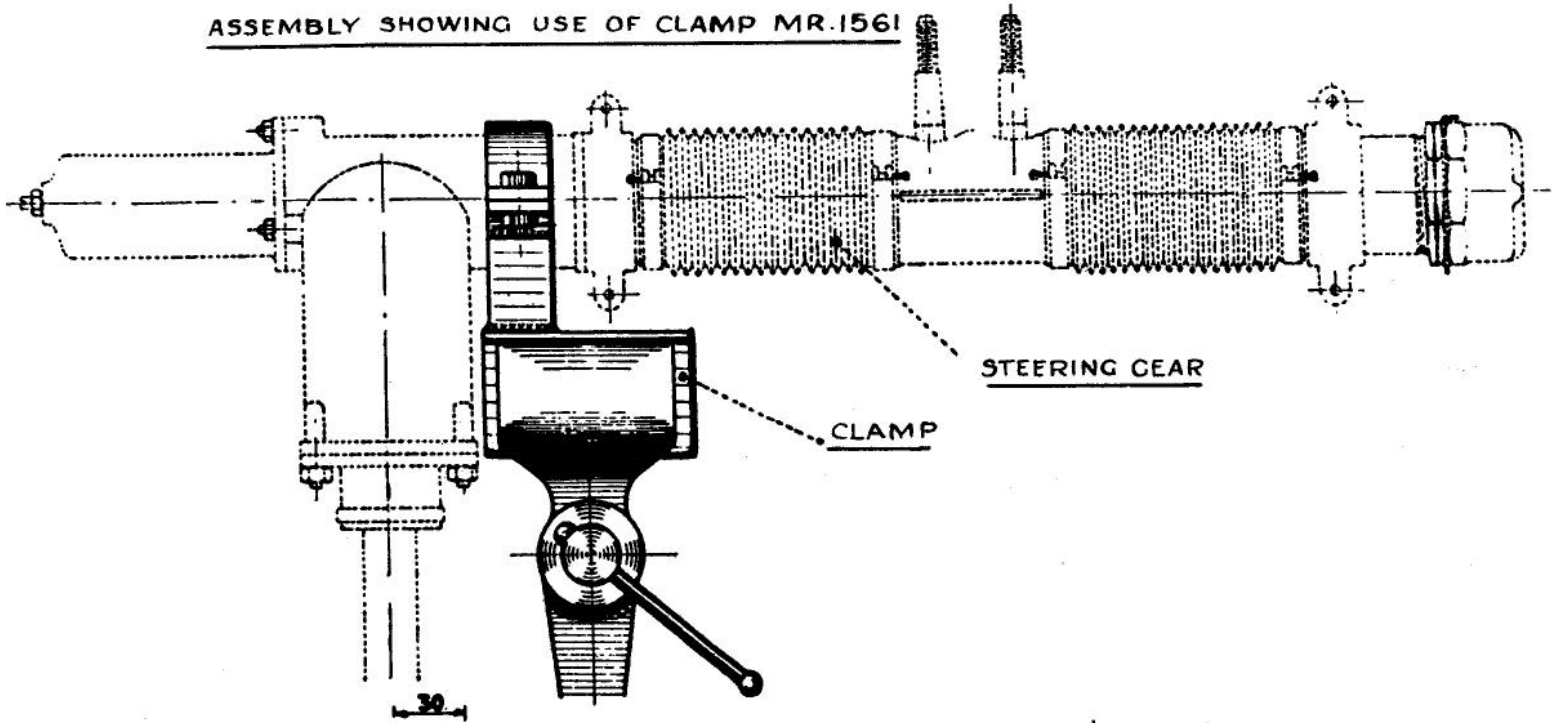


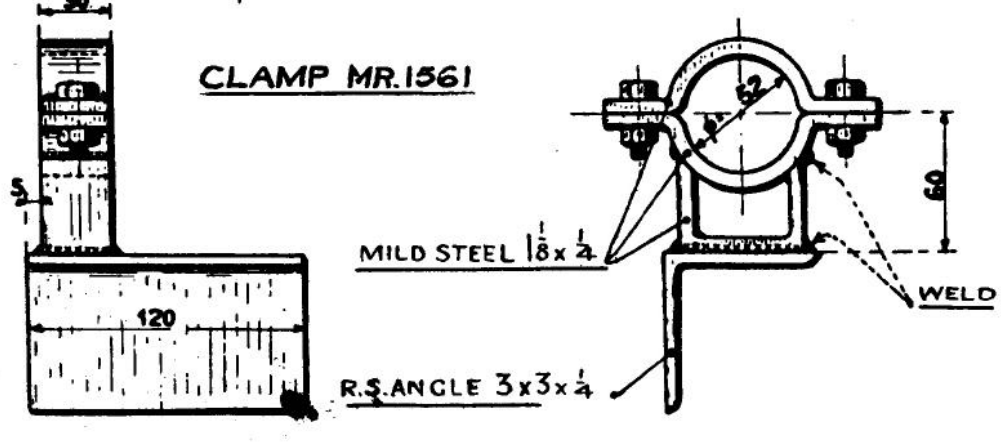
FIG.4 ASSEMBLY OF BALL PINS AT TRACK ROD END

—HOLDING RACK AND PINION GEAR IN VICE—

ASSEMBLY SHOWING USE OF CLAMP MR.1561



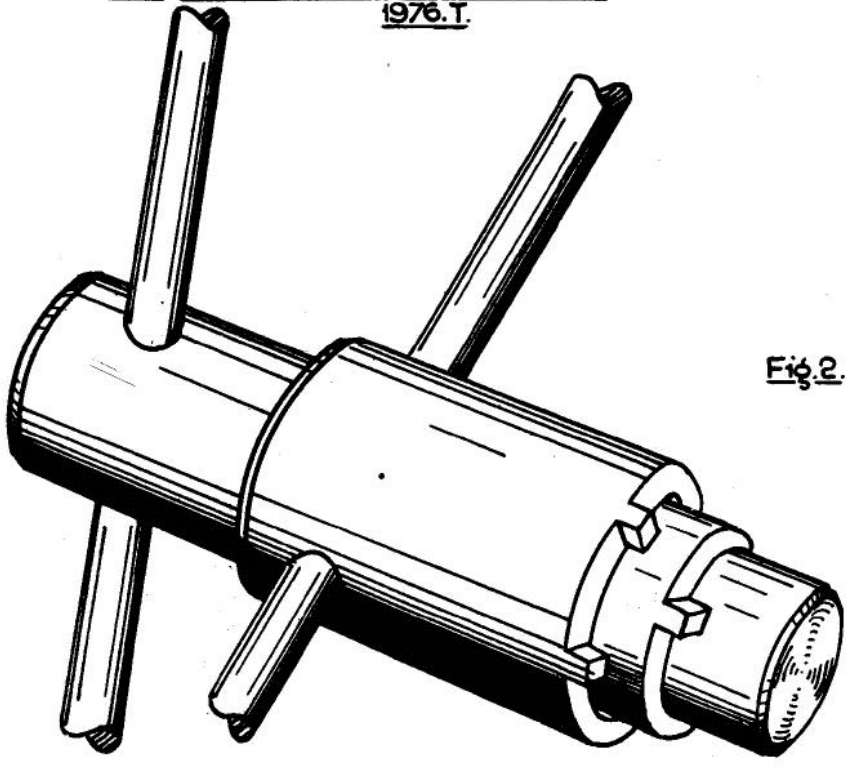
CLAMP MR.1561



— STEERING —

— VARIOUS TOOLS —

Fig.1. COMBINATION SPANNER FOR RETAINING TUBE AND RING NUT 1976.T.



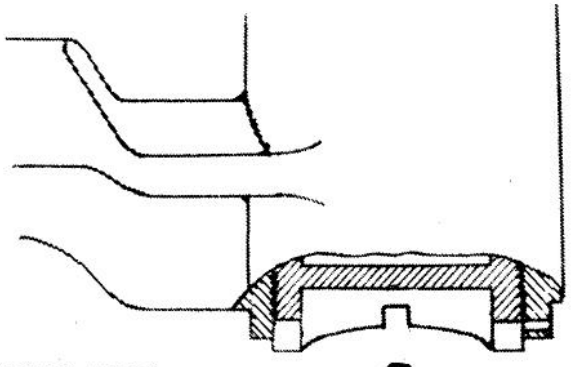


Fig.2. SPANNER FOR ADJUSTING NUT ON OUTER BALL PIN CUP. 1870.T.

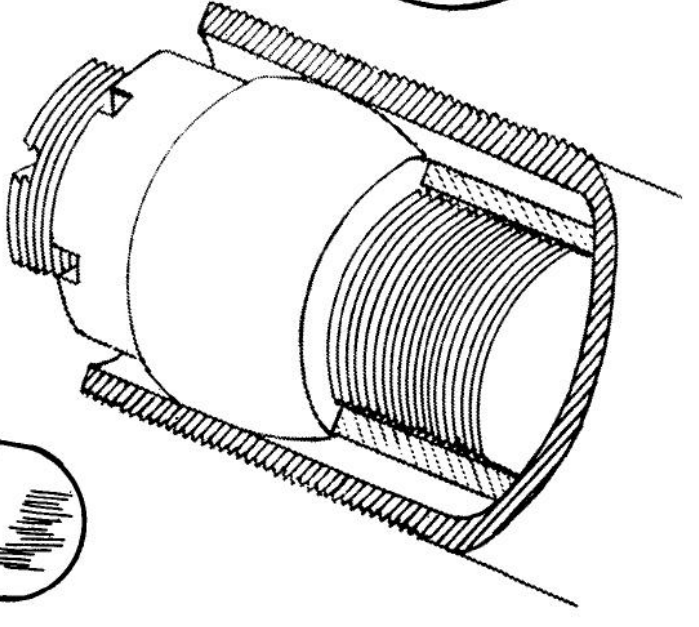
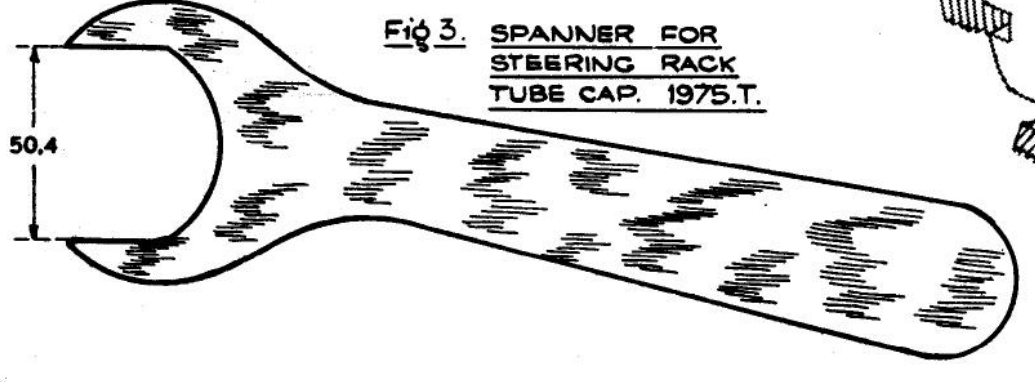
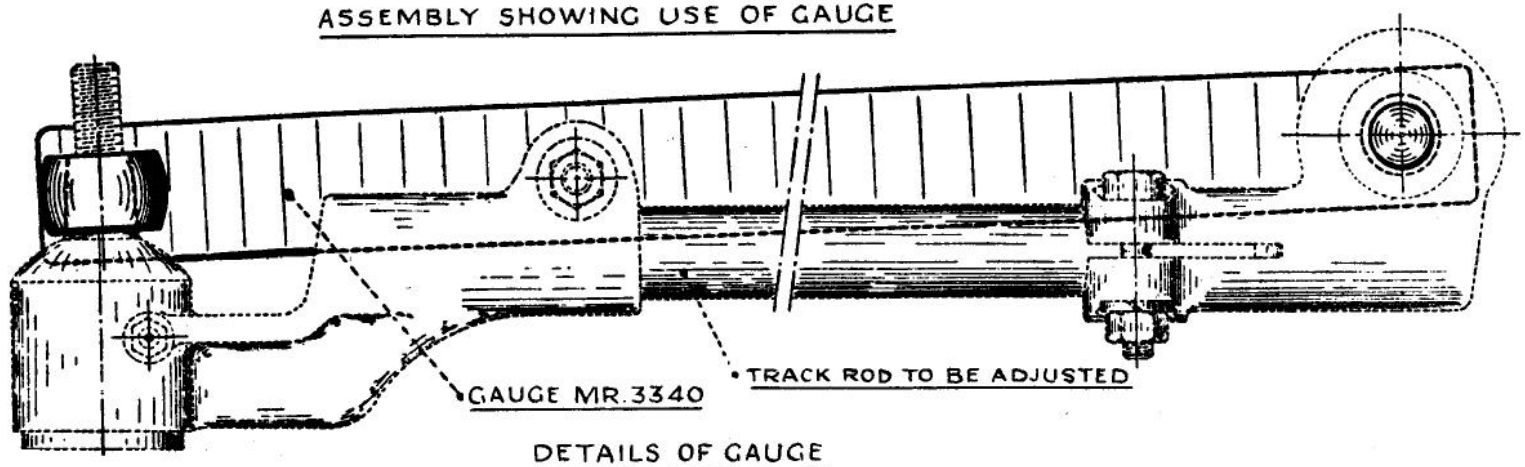


Fig 3. SPANNER FOR STEERING RACK TUBE CAP. 1975.T.

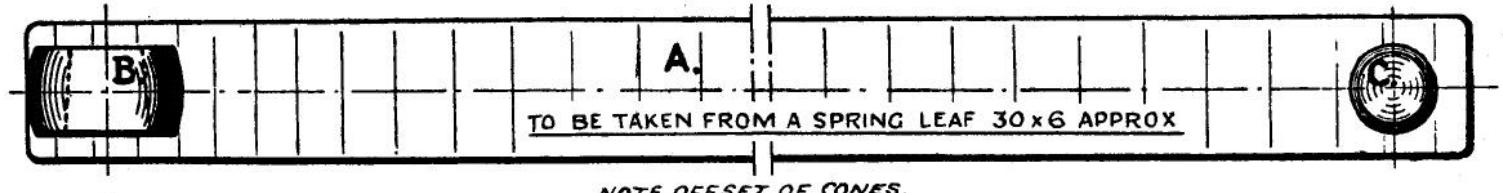


—ADJUSTING LENGTH OF TRACK ROD—

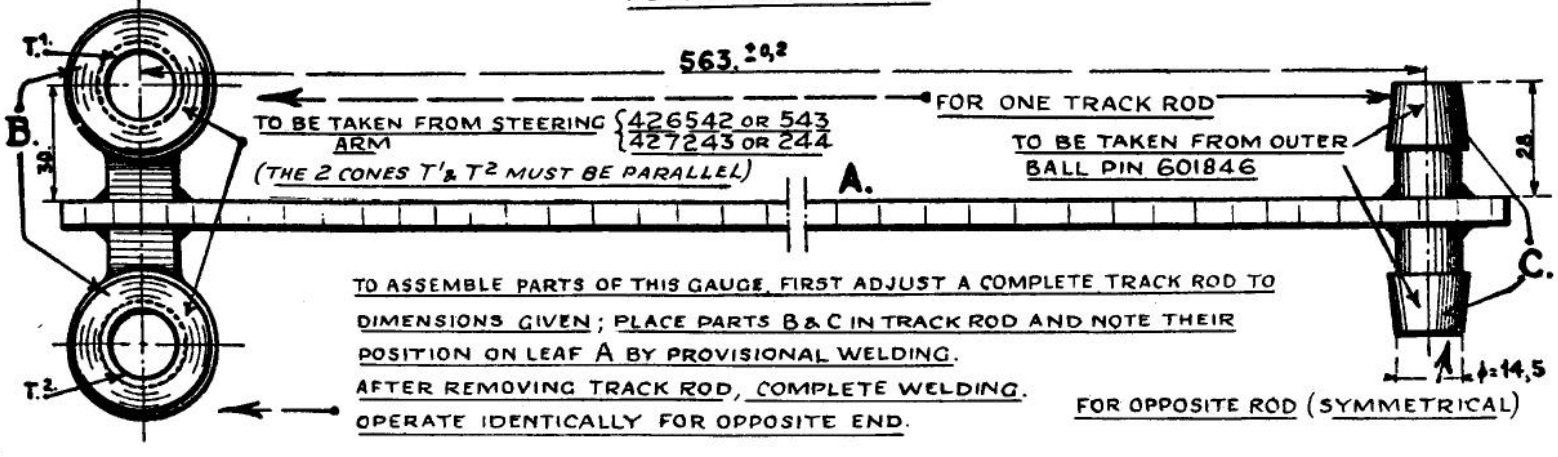
ASSEMBLY SHOWING USE OF GAUGE



DETAILS OF GAUGE



NOTE OFFSET OF CONES.



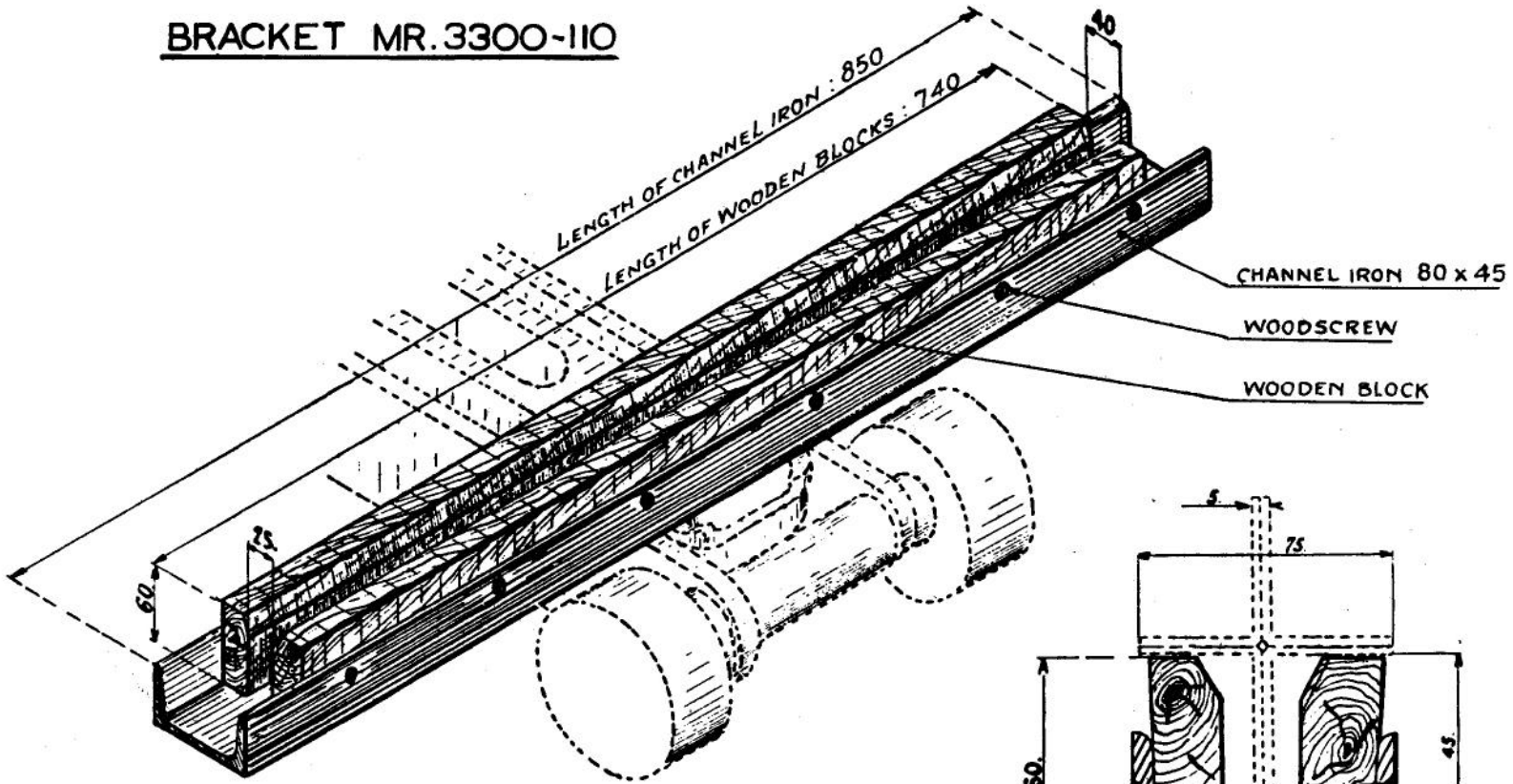
TO ASSEMBLE PARTS OF THIS GAUGE, FIRST ADJUST A COMPLETE TRACK ROD TO DIMENSIONS GIVEN; PLACE PARTS B & C IN TRACK ROD AND NOTE THEIR POSITION ON LEAF A BY PROVISIONAL WELDING.
AFTER REMOVING TRACK ROD, COMPLETE WELDING.
OPERATE IDENTICALLY FOR OPPOSITE END.

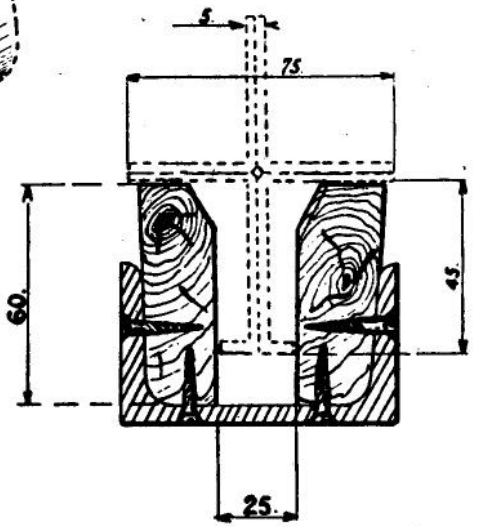
FOR OPPOSITE ROD (SYMMETRICAL)

REAR AXLE

RAISING REAR AXLE

BRACKET MR.3300-110





TO BE FITTED ON JACK HEAD

— DISMANTLING EARLY TYPE AXLE —

Fig.1. USE OF SPANNER.

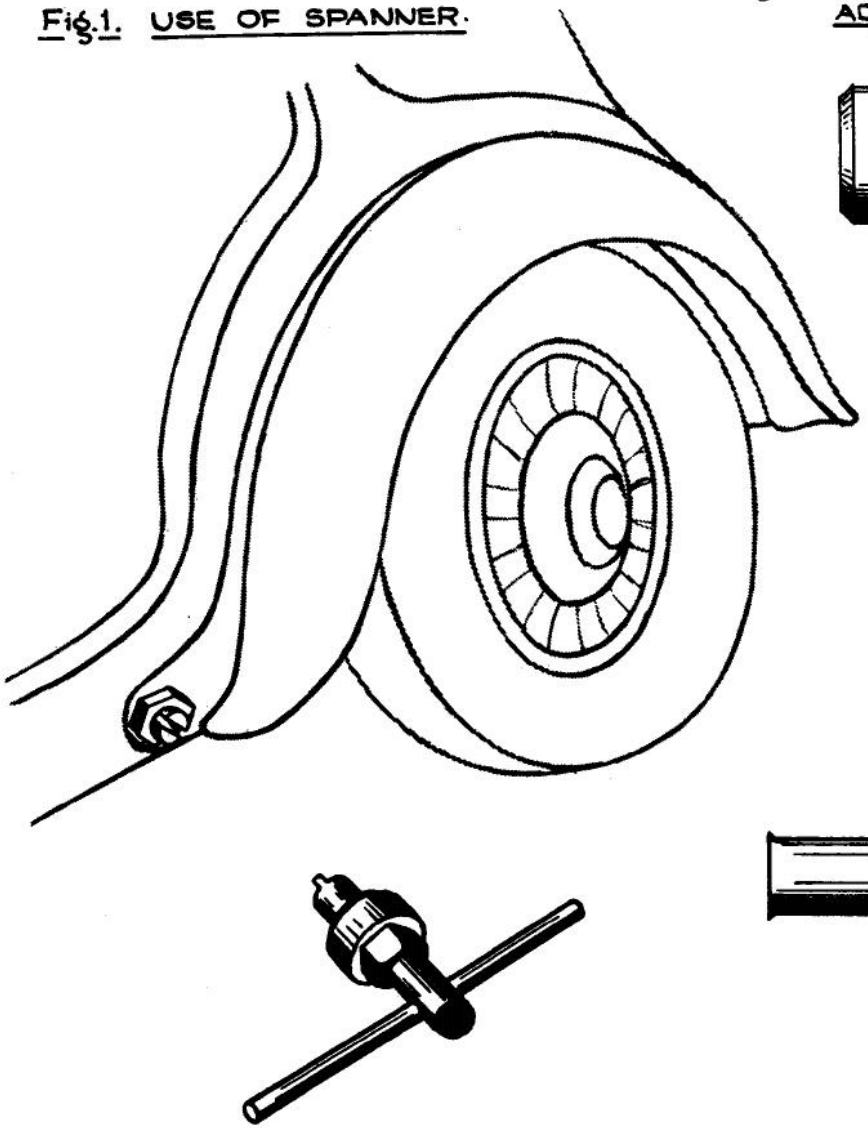


Fig.3. SPANNER FOR REAR HEIGHT ADJUSTMENT. 2304.T.

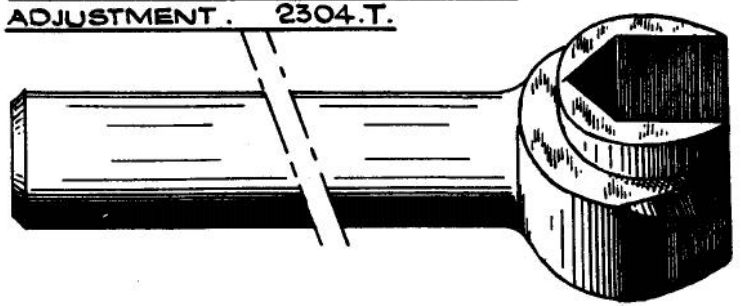
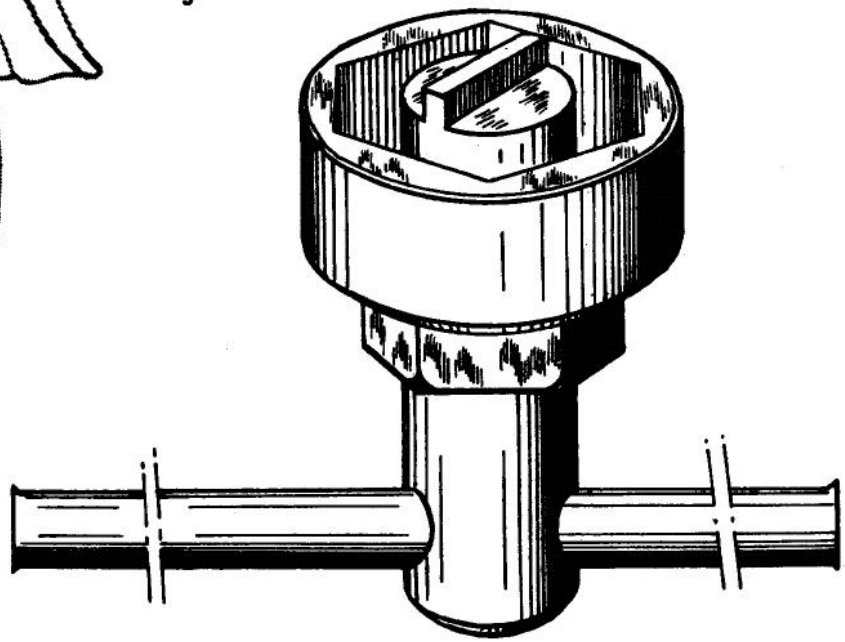


Fig.2. SPANNER 2050.T.



REAR AXLE

POSITIONING REAR AXLE

Fig. 1.

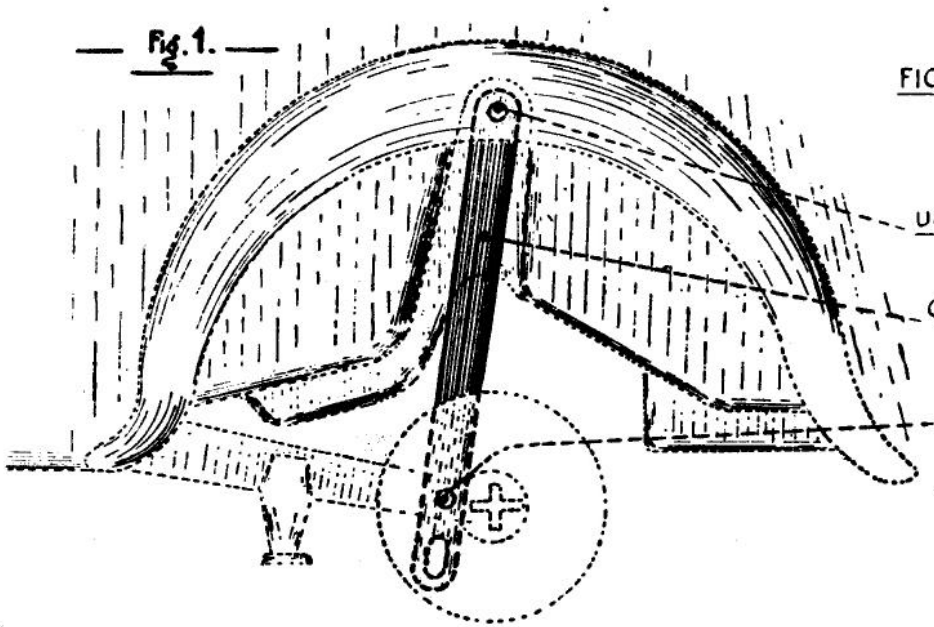
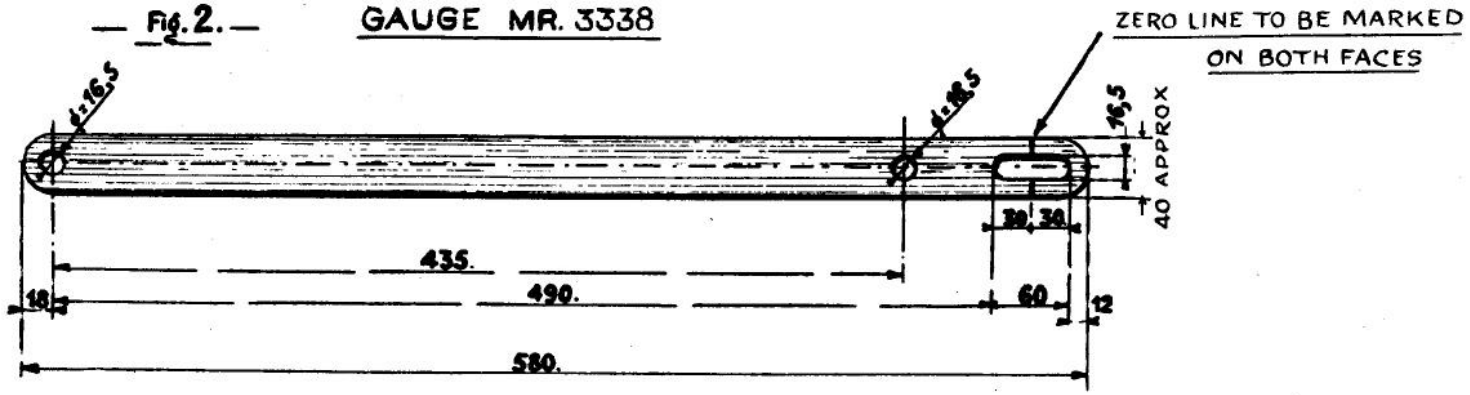


FIG. 1: ASSEMBLY SHOWING USE OF GAUGE

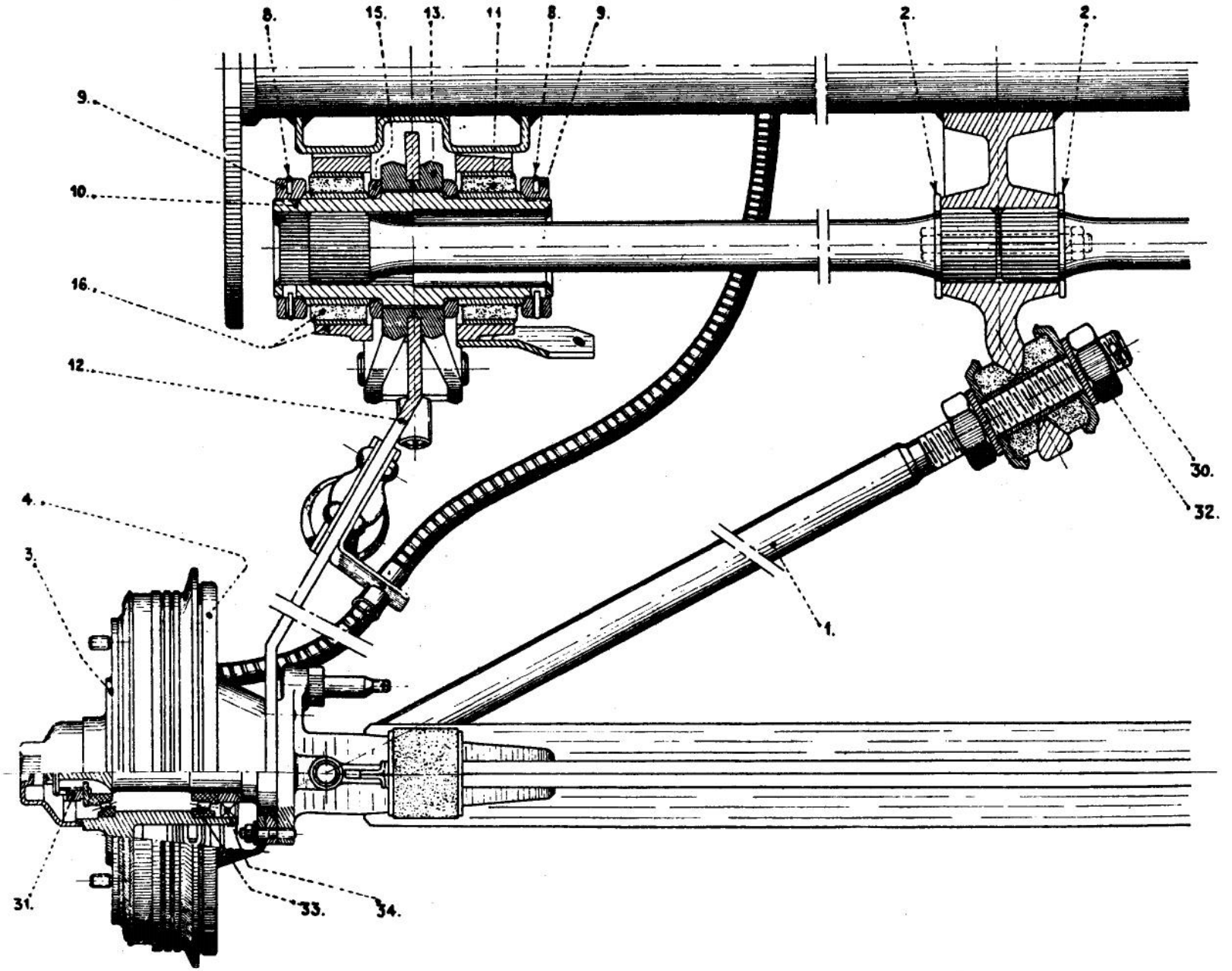
Fig. 2. GAUGE MR. 3338



Thickness 6 to 10 mm.

REAR AXLE

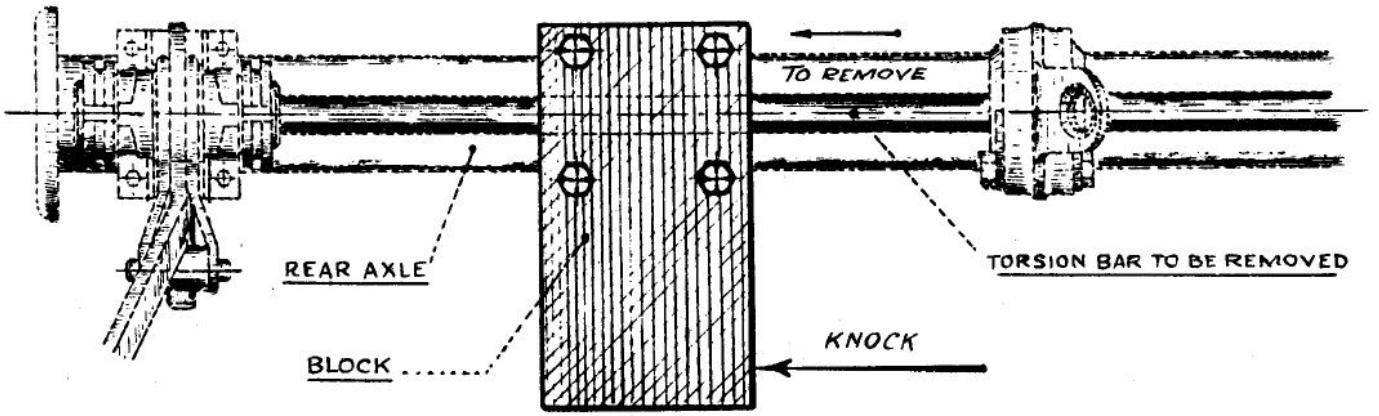
ASSEMBLY: PLAN VIEW



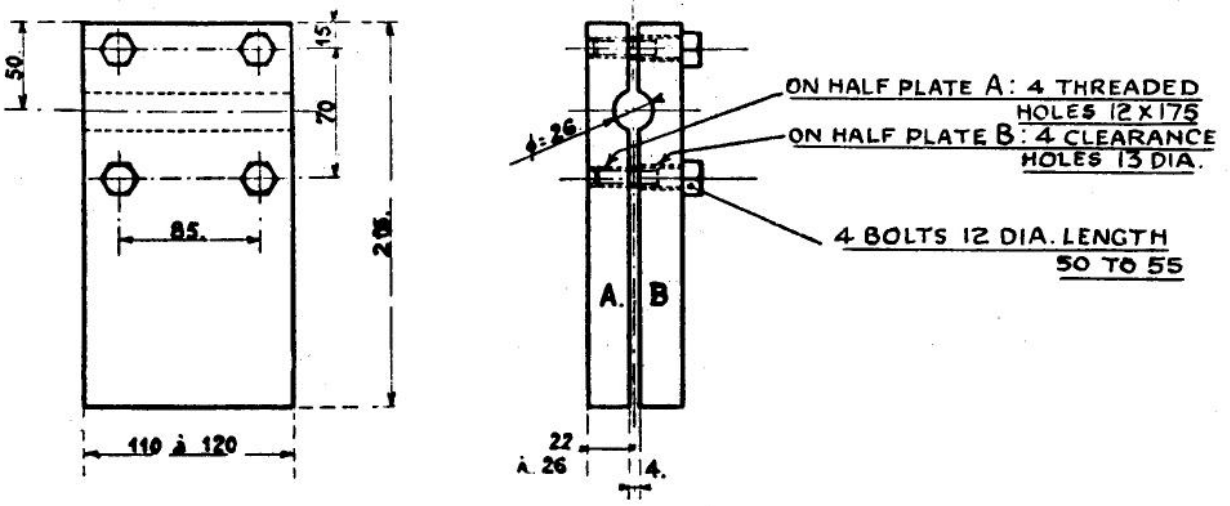
REAR AXLE

REMOVING TORSION BAR

ASSEMBLY SHOWING USE OF BLOCK



BLOCK MR.1578



— REAR AXLE

— REAR LINK ARM —

Fig. 1.

ASSEMBLY OF REAR LINK ARM

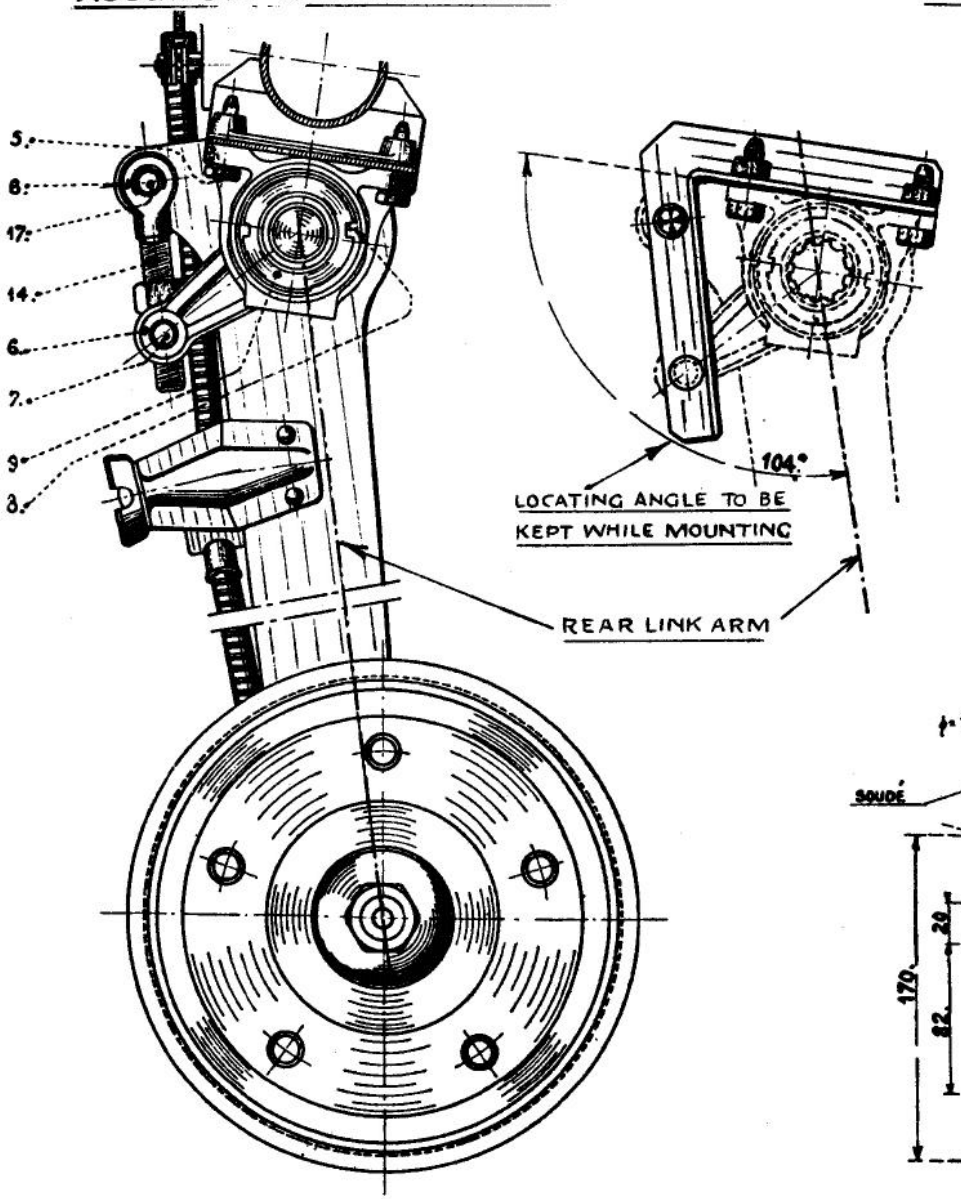
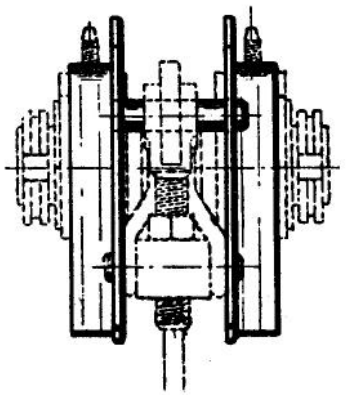


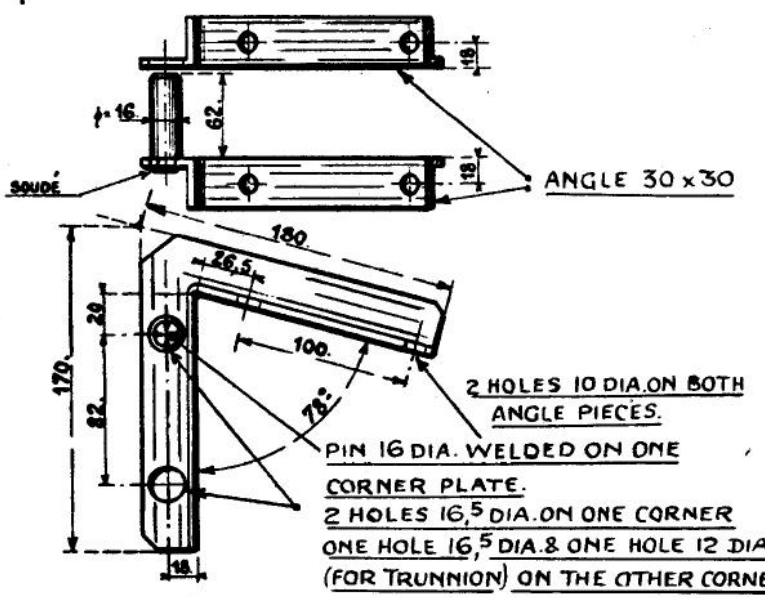
Fig. 2

HOLDING LINK ARM BRACKETS DURING ASSEMBLY



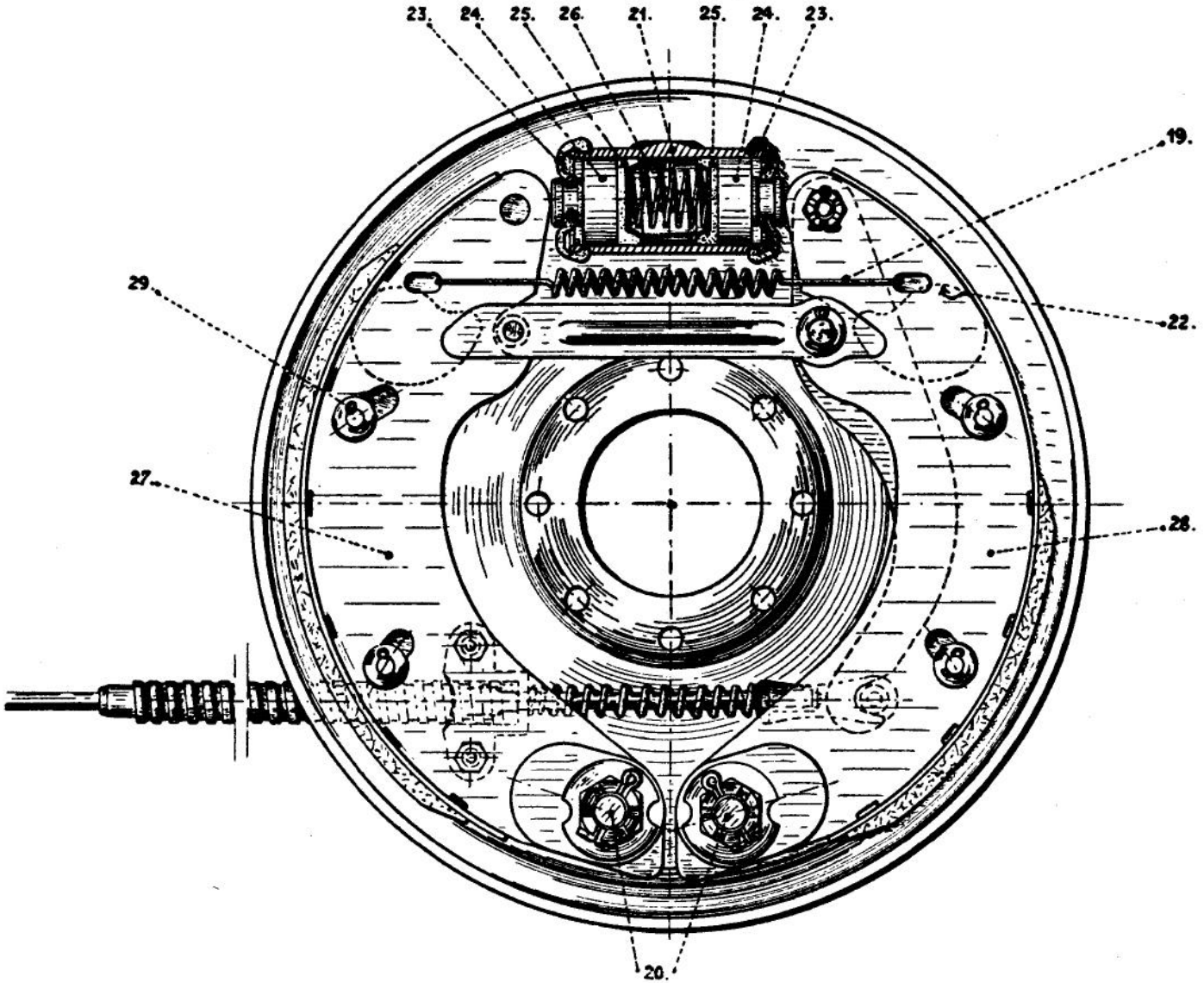
— Fig. 3 —

SET OF ANGLE PIECES MR. 3336



— REAR AXLE —

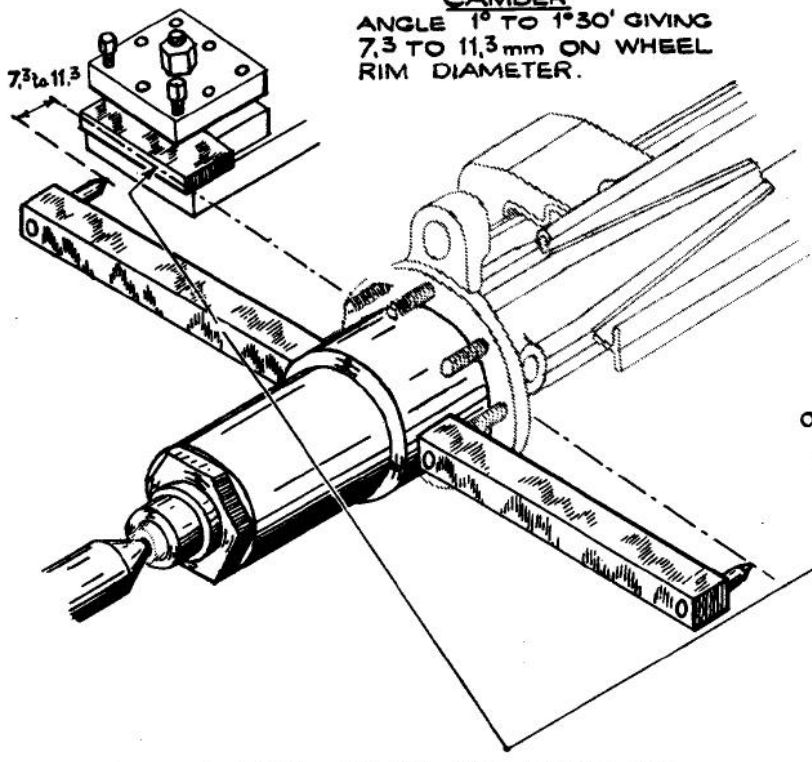
— ASSEMBLY OF BRAKE BACK PLATE —



— CHECKING CAMBER AND TOE-IN OF REAR AXLE —

Fig.1. CHECKING CAMBER.

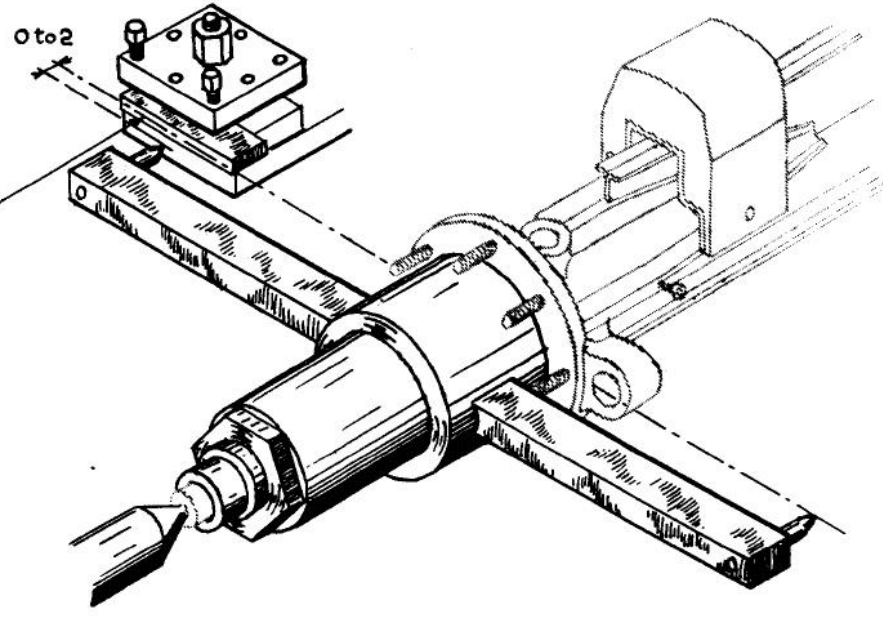
CAMBER
ANGLE 1° TO 1°30' GIVING
7,3 TO 11,3 mm ON WHEEL
RIM DIAMETER.



CHECKING GAUGE 2052.T.

Fig.2. CHECKING TOE-IN.

TOE-IN
0° TO 0°15' GIVING
0 TO 2mm ON WHEEL RIM
DIAMETER.

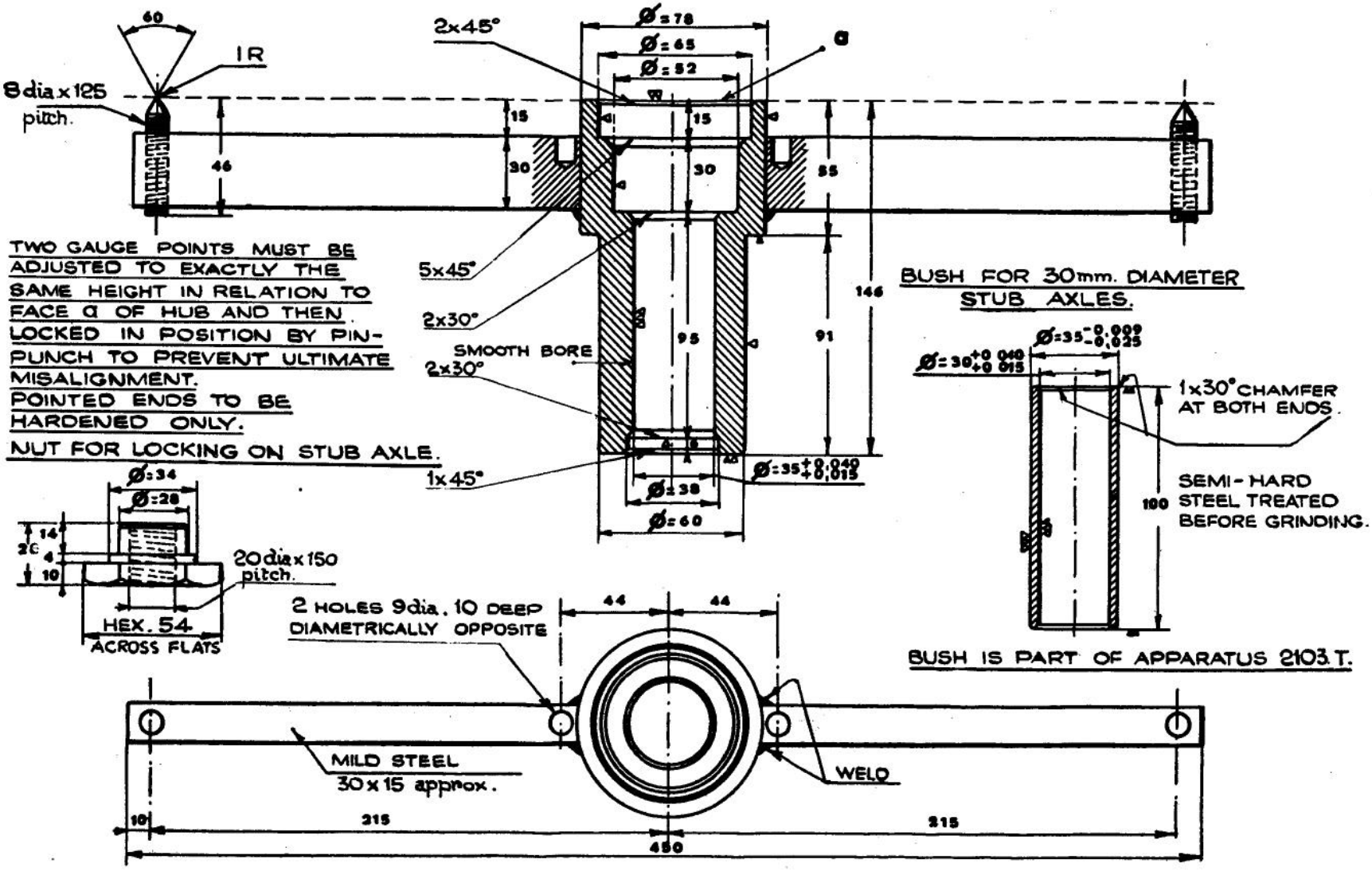


WORKING FACE OF GAUGE MUST BE PERFECTLY SQUARE TO CENTRE LINE OF LATHE.
ON STUB AXLES OF 30mm. DIAMETER A BUSH IS FITTED BETWEEN STUB AXLES AND GAUGE BODY.

— REAR AXLE —

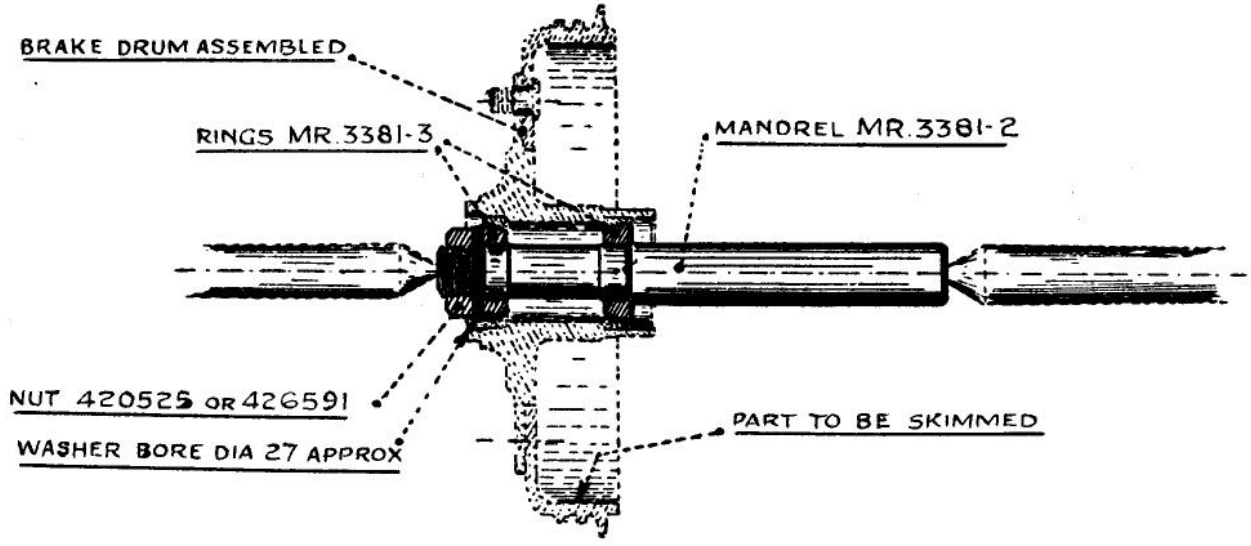
— CHECKING CAMBER AND TOE IN OF REAR AXLE —

TOOL. 2052.T.

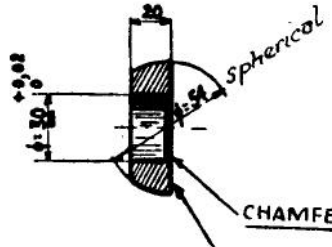


— RECTIFICATION OF BRAKE DRUMS —

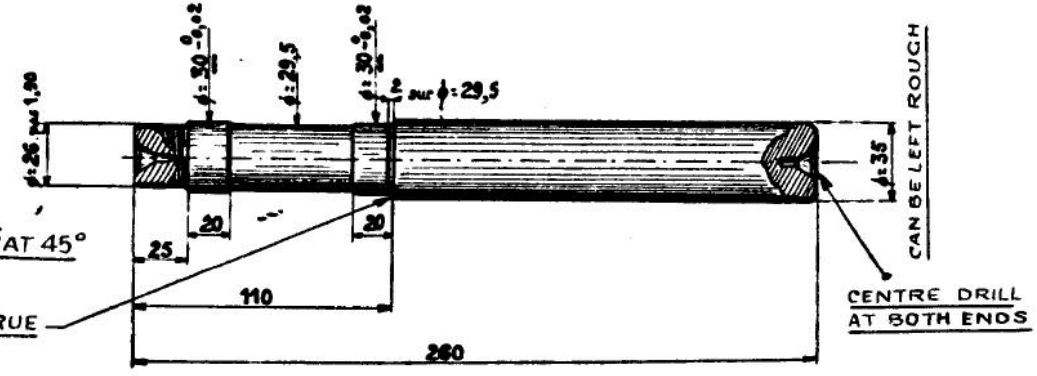
ASSEMBLY SHOWING USE OF MANDREL



RINGS MR.3381-3 (2 pieces)

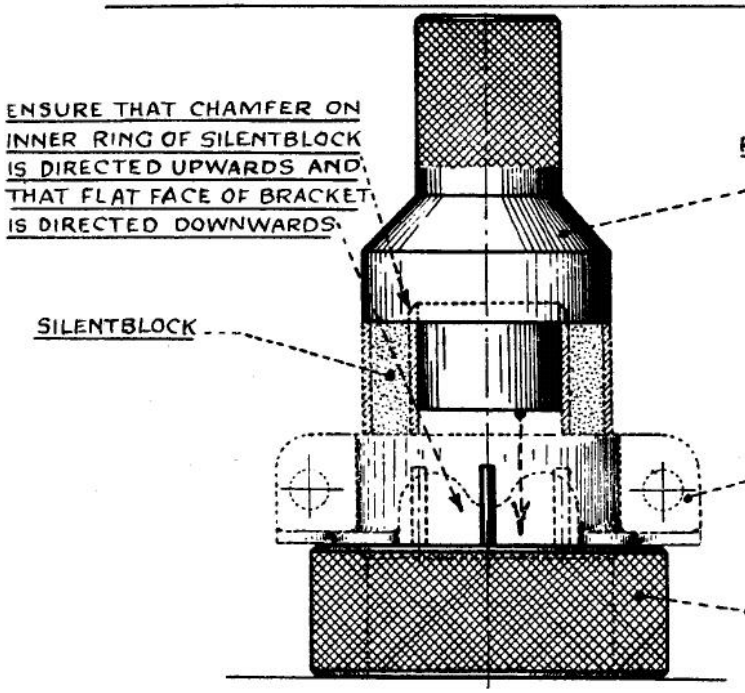


MANDREL MR.3381-2

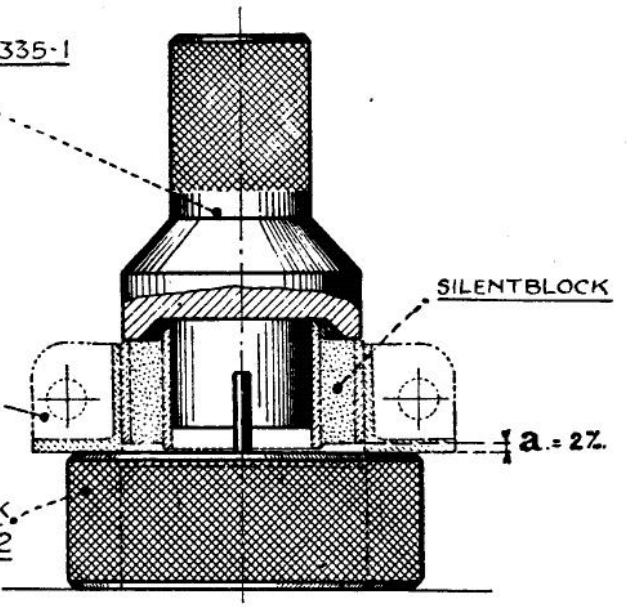


— DISMANTLING AND ASSEMBLING SILENTBLOCS OF SUPPORT BRACKETS —

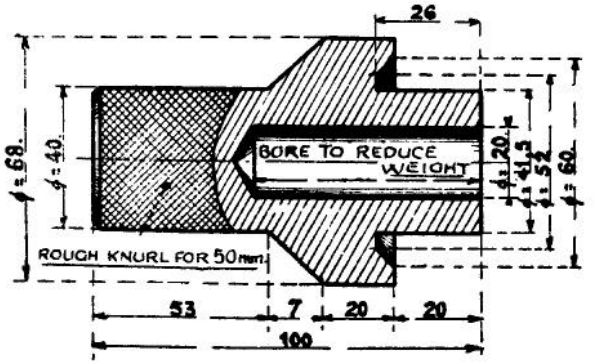
ASSEMBLY SHOWING SILENTBLOCK BEING PUT IN POSITION



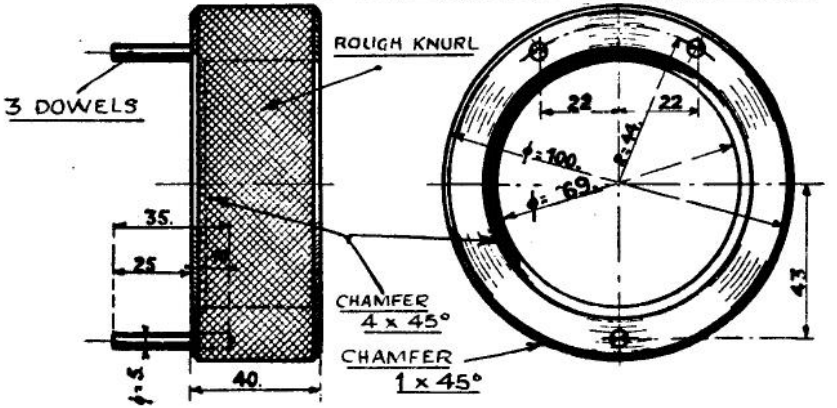
ASSEMBLY SHOWING SILENTBLOCK IN POSITION



DETAILS OF PLUNGER MR.3335-1



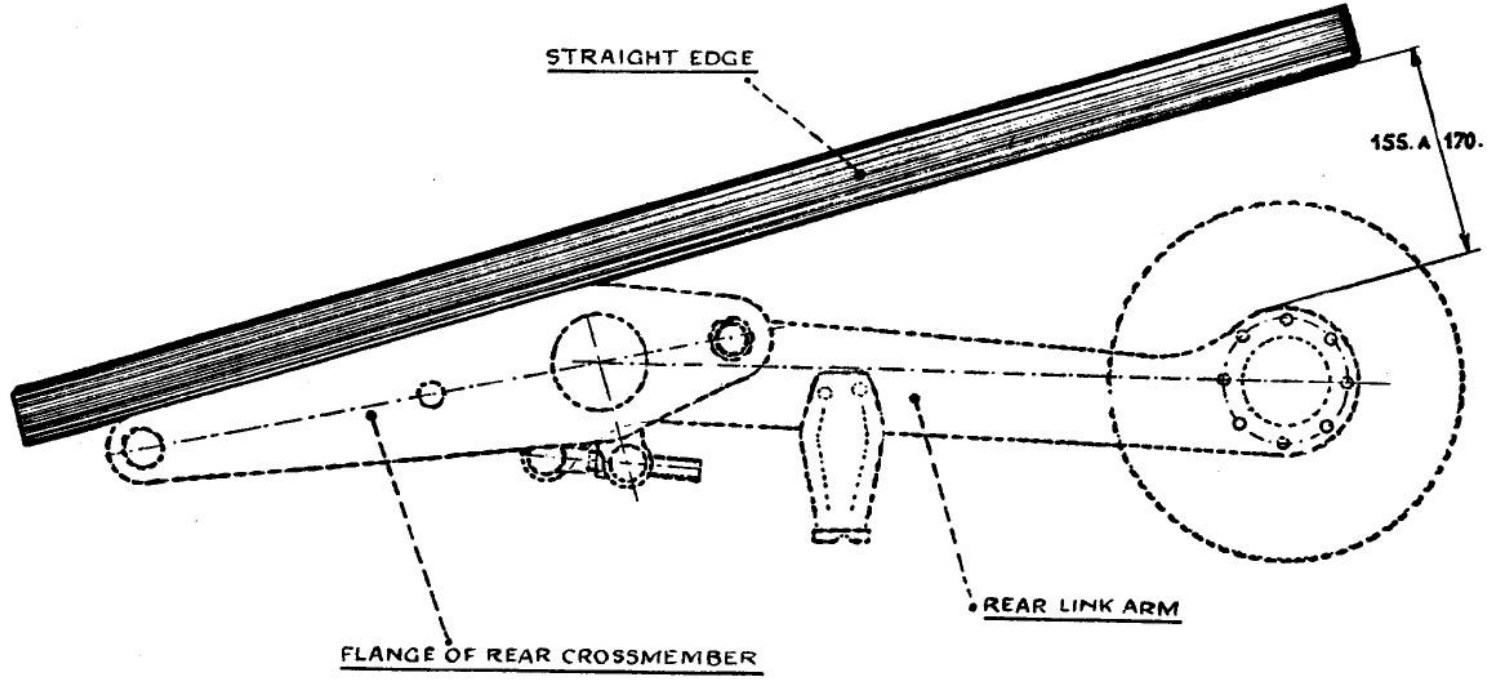
DETAILS OF GUIDE BLOCK MR.3335-2



REAR AXLE

SETTING REAR LINK ARM IN RELATION WITH FLANGE OF REAR CROSSMEMBER WHEN ADJUSTING TORSION BARS

ASSEMBLY SHOWING ANGLE OF ARM AND FLANGE

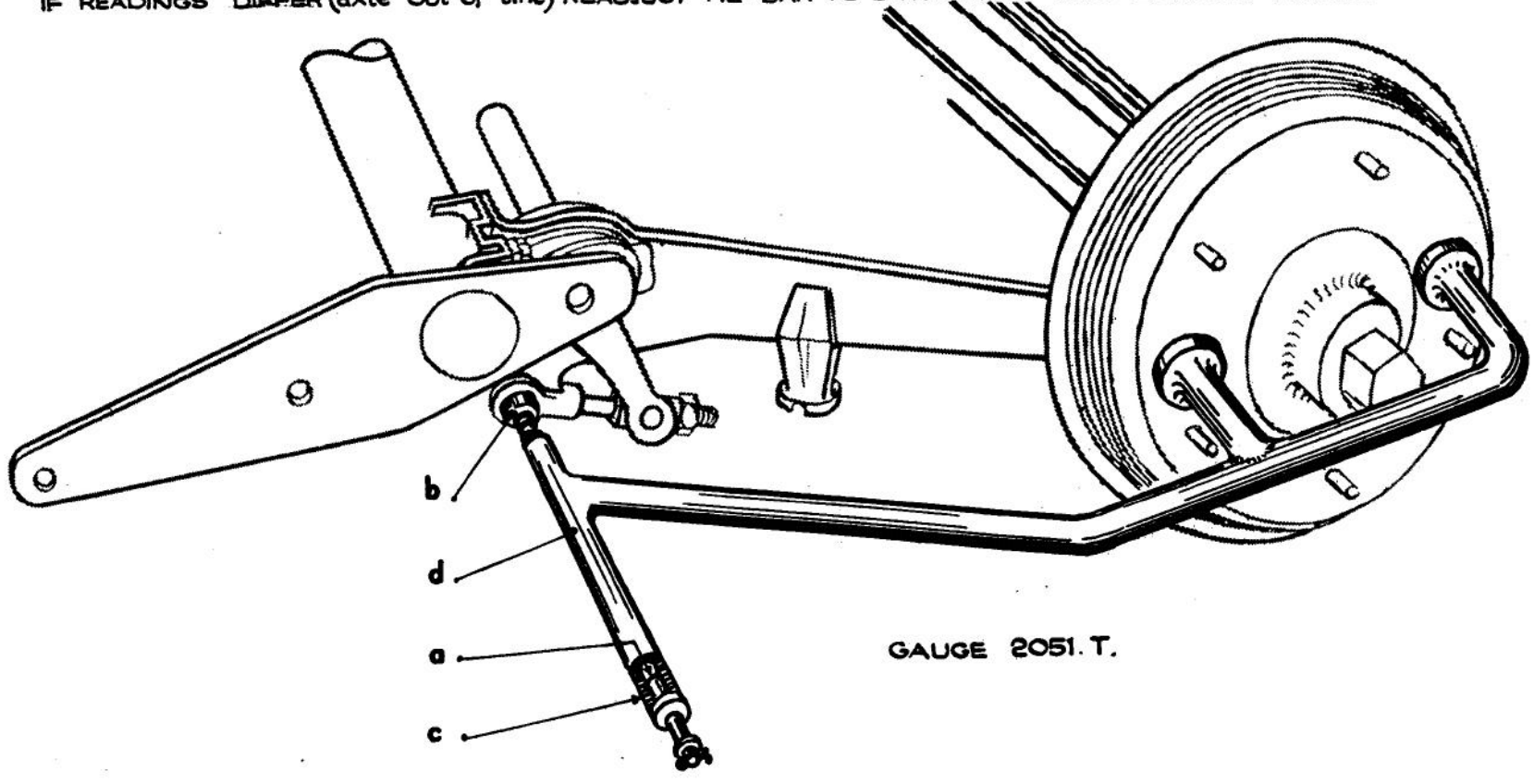


— REAR AXLE —

— CHECKING LATERAL ADJUSTMENT OF AXLE —

USE OF GAUGE

WITH GAUGE APPLIED AGAINST HUB AS SHOWN, CIRCULAR MARKING "a" OF MOVING PIN "b" COMES OPPOSITE ONE OF THE DIVISIONS OF THE SCALE GRADUATED ON GUIDE "d"
Note figure indicated.
APPLY GAUGE TO OPPOSITE HUB.
CIRCULAR MARKING (if axle is in correct adjustment) SHOULD COME OPPOSITE SAME DIVISION AS INDICATED ABOVE.
IF READINGS DIFFER (axle out of line) READJUST TIE-BAR TO BRING AXLE INTO CORRECT ADJUSTMENT.



GAUGE 2051. T.

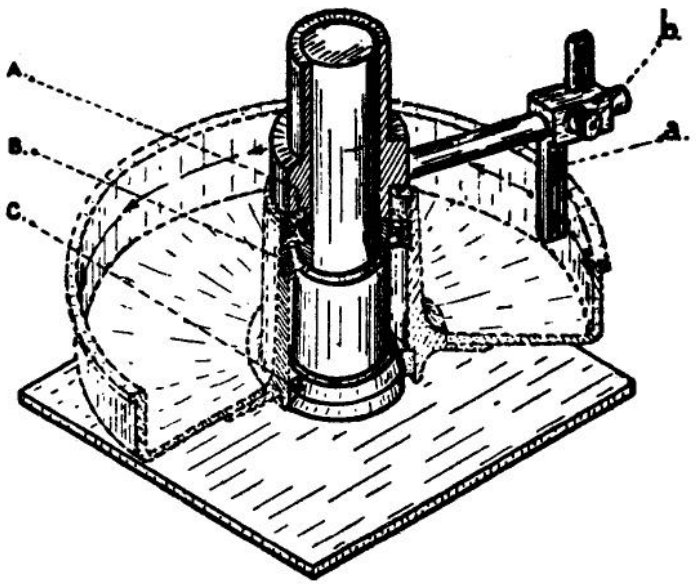
—REAR AXLE—

—CHECKING CONCENTRICITY OF BRAKE LININGS—

—APPARATUS 2103-T—

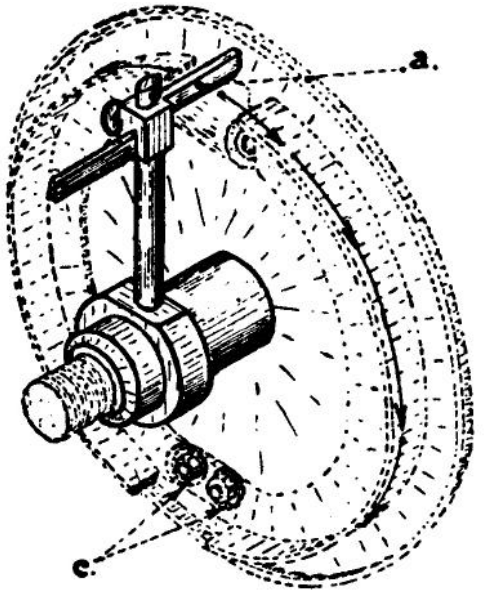
— Fig. 1. —

REGISTERING DIA. OF DRUM



— Fig. 2. —

CHECKING CONCENTRICITY OF LININGS



BRAKE DRUM EQUIPPED WITH S.P.I. OIL RETAINER WITH COMPLETE INNER TIMKEN BALL-RACE B, AND WITH OUTER TIMKEN BALL-RACE C.

- PLACE DRUM ON PIVOT
- PLACE INDICATOR RING ON PIVOT
- BRING INDICATOR a, IN CONTACT WITH DRUM, AND DESCRIBE A COMPLETE CIRCLE.
- LOCK INDICATOR AT SET POSITION WITH THUMBSCREW b.
- FIT INSTRUMENT ON STUB PLACE INDICATOR a, AS SET PREVIOUSLY, ON LININGS; INDICATOR MUST REMAIN IN CONTACT THROUGHOUT CIRCUMFERENCE. *(IN ORDER TO OBTAIN THIS RESULT, ADJUST LININGS BY ECCENTRIC BUSHES, C AND ADJUSTING CAMS AT REAR OF BRAKE PLATE, NOT SHOWN)* REMOVE BURRS ON LININGS WITH RASP.

AFTER CHECK RELEASE CAMS TO ALLOW FITTING OF DRUM (FOR FINAL ADJUSTMENT OF CAMS SEE Nº150, PARA.2)

SUSPENSION

REFILLING SPICER SHOCK ABSORBER

Fig.1. USE OF APPARATUS.

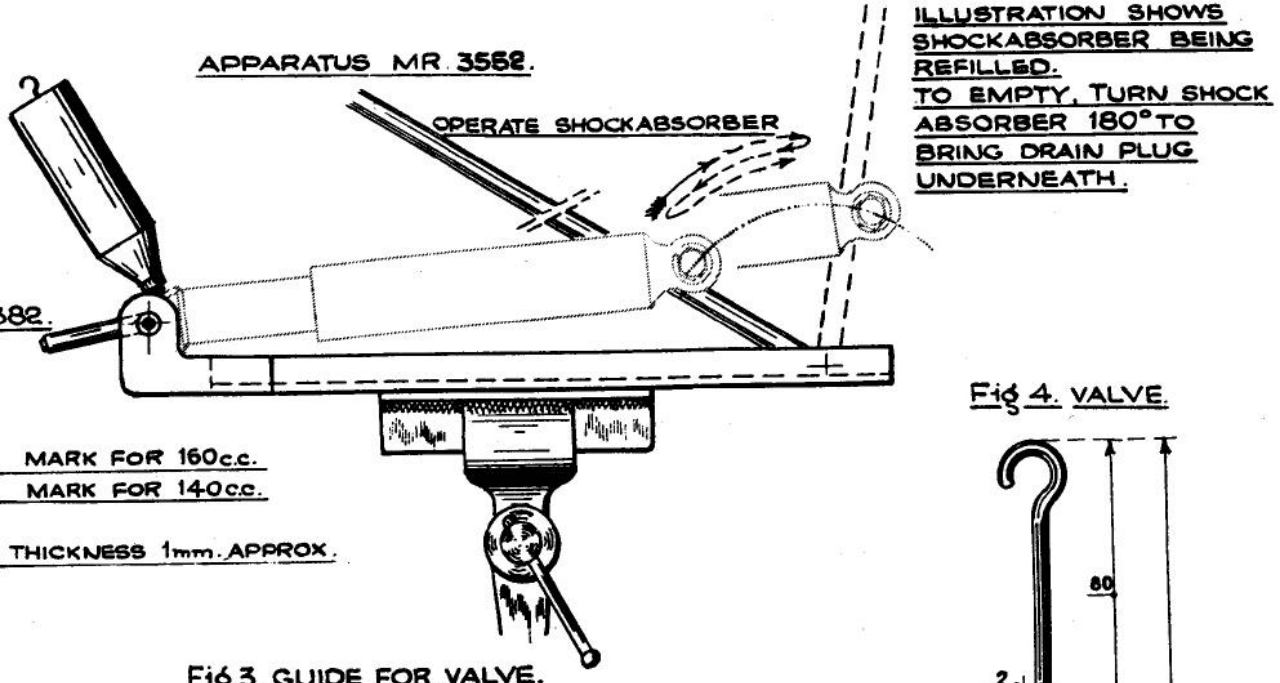


Fig 2. FUNNEL MR.3382.

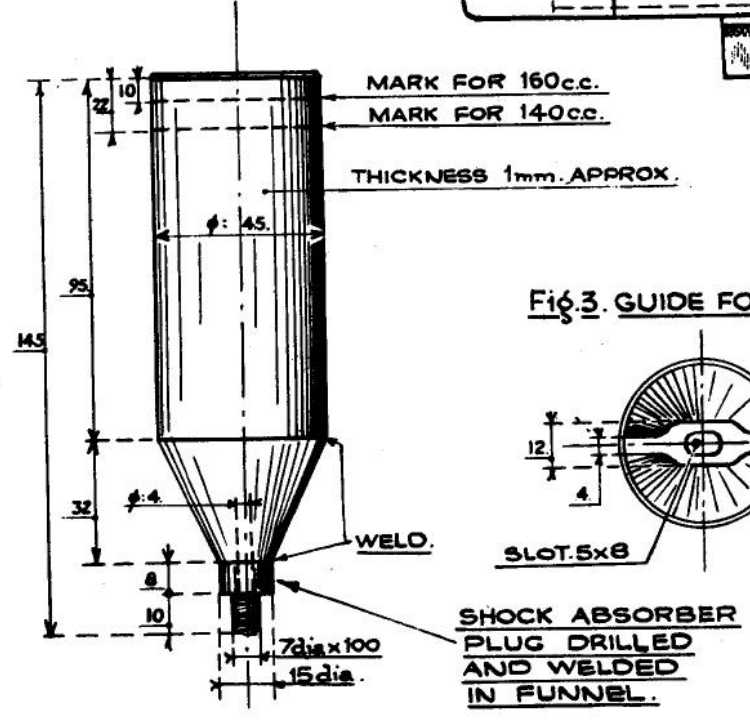


Fig.3. GUIDE FOR VALVE.

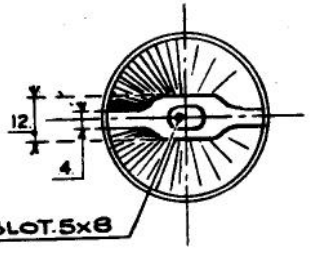
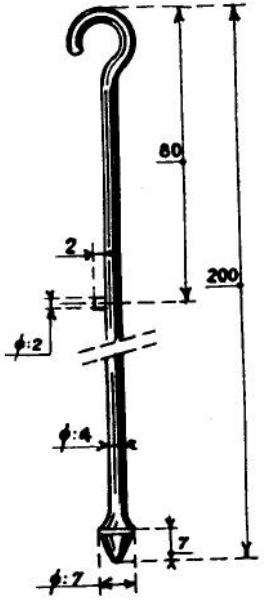


Fig 4. VALVE.



— REFILLING SPICER SHOCK ABSORBERS —

Fig.1. ASSEMBLY MR. 3552.

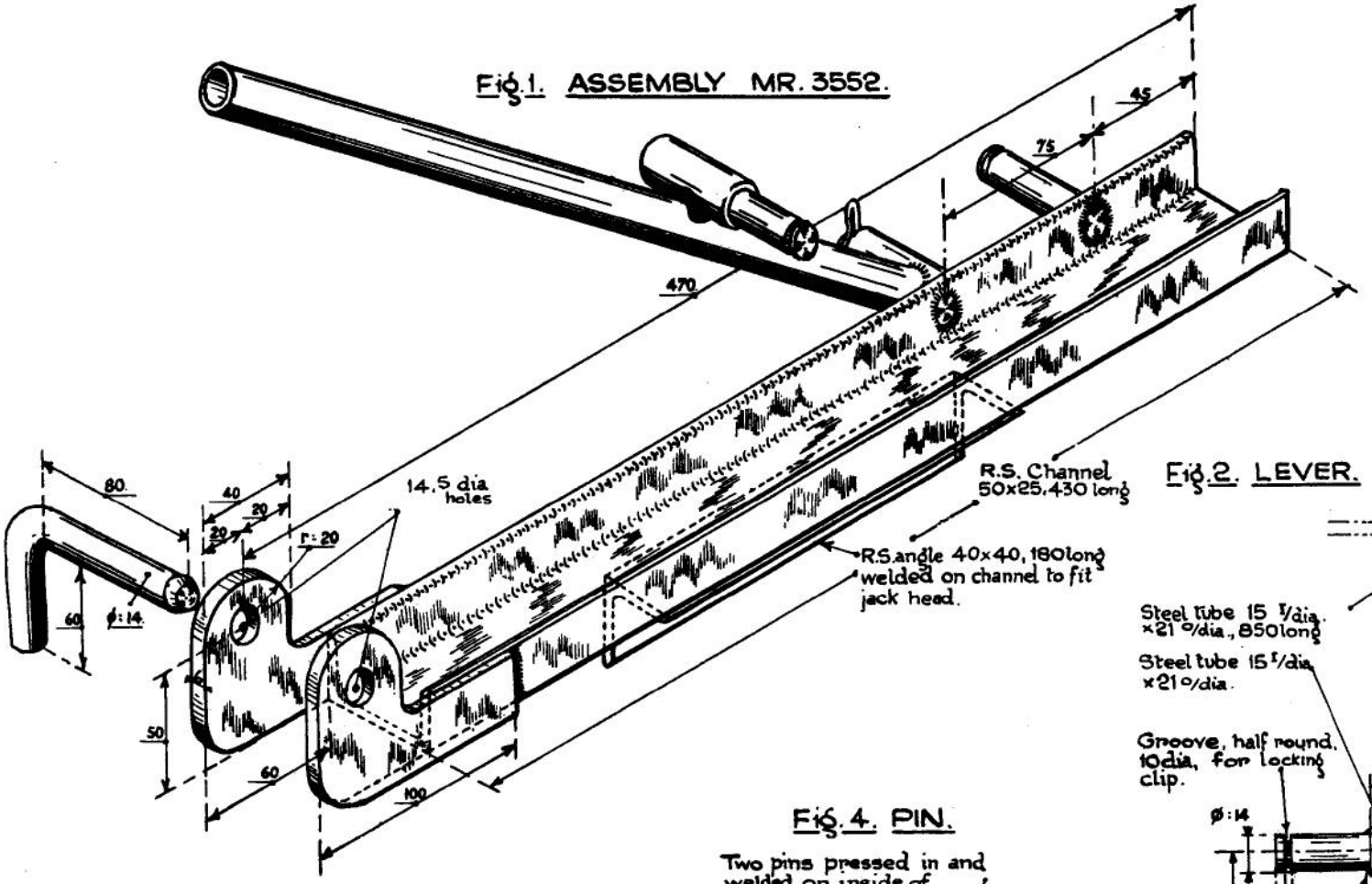


Fig.2. LEVER.

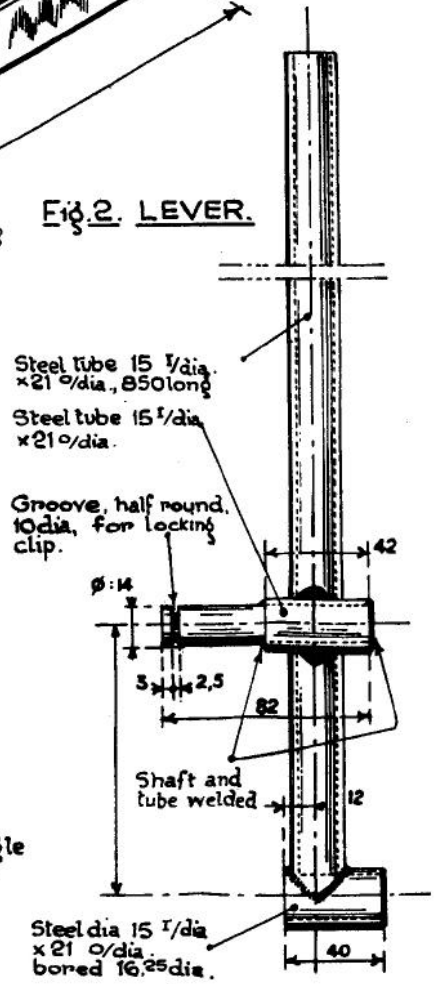


Fig.3. SHOCK ABSORBER LOCKING CLIP.

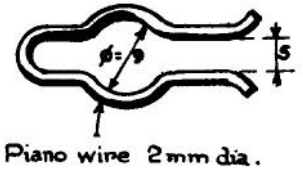
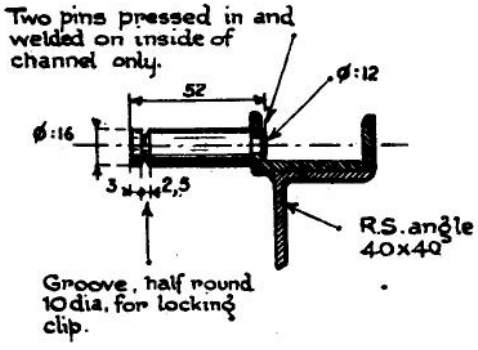


Fig.4. PIN.



GEAR CHANGE ASSEMBLY

SELECTOR ASSEMBLY

FIG.1 PLAN VIEW

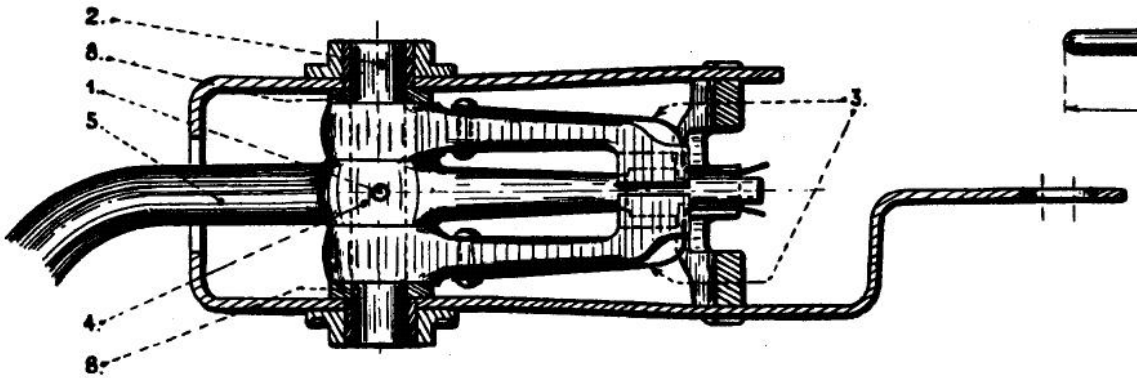


Fig 2 SIDE VIEW

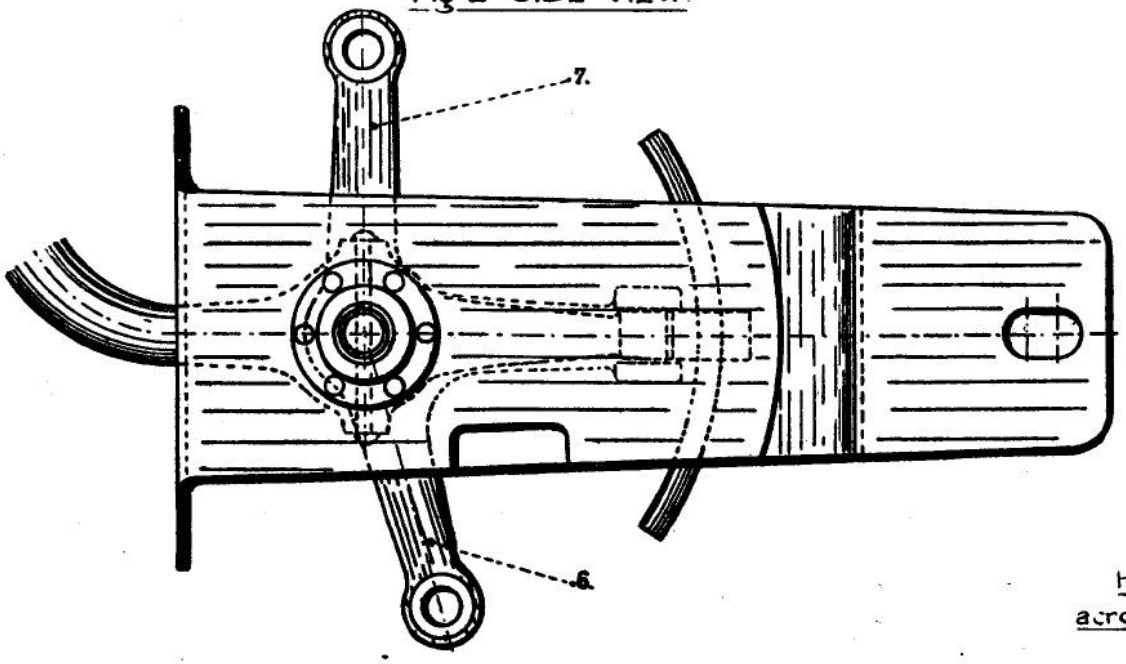
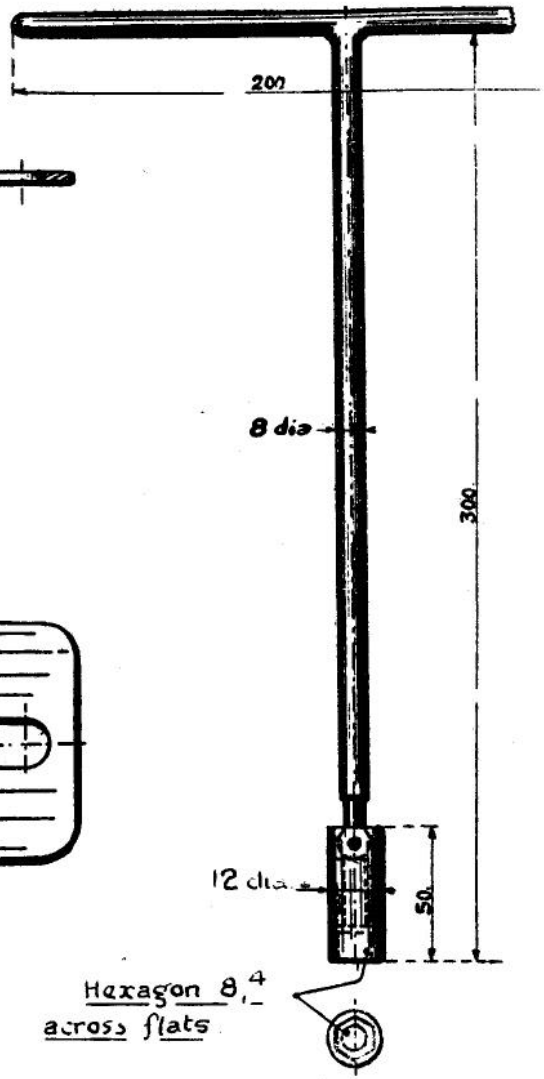
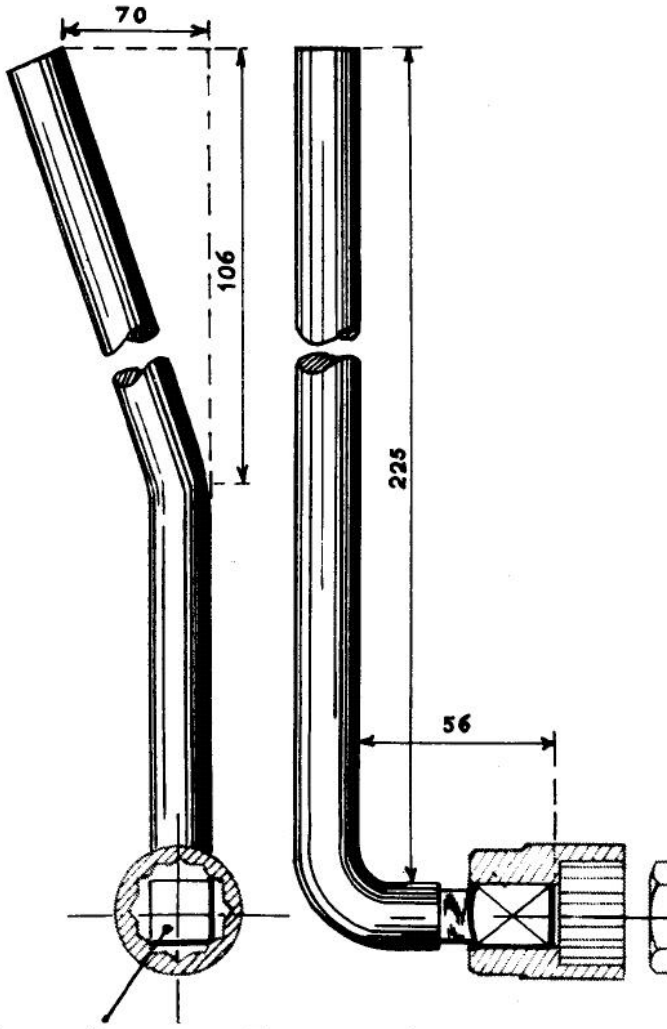


FIG. 3 - SPANNER 2430-T



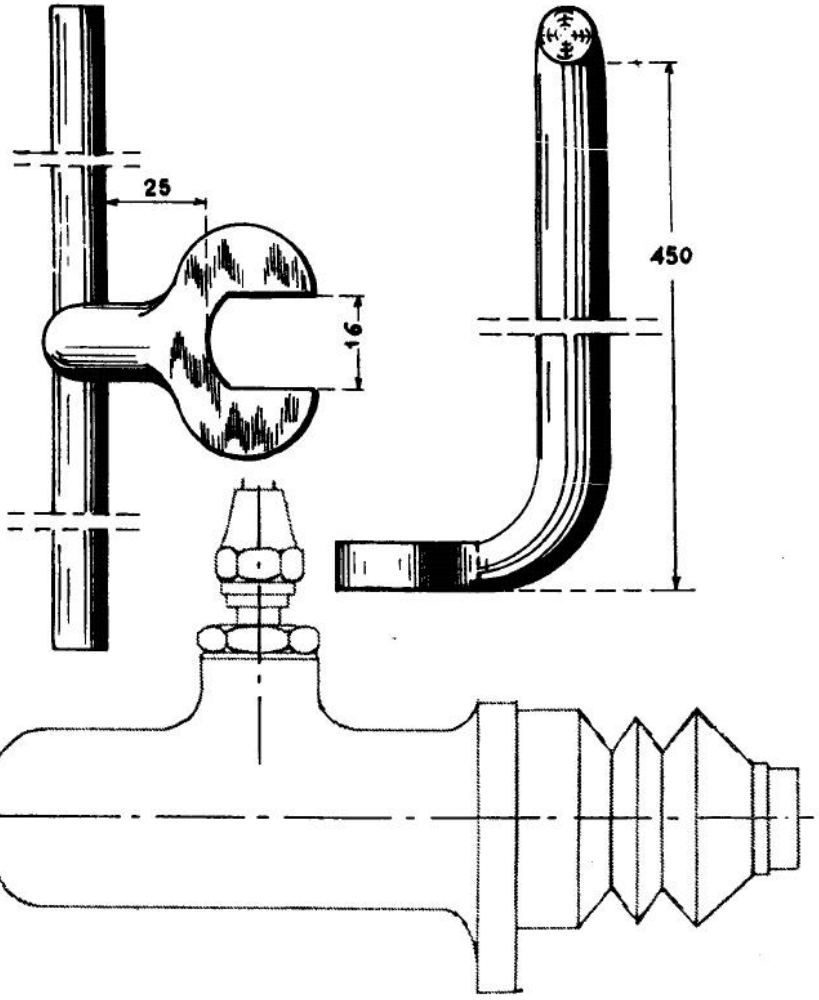
— REMOVING AND FITTING MASTER CYLINDER —

Fig.1. HANDLE 2131.T.



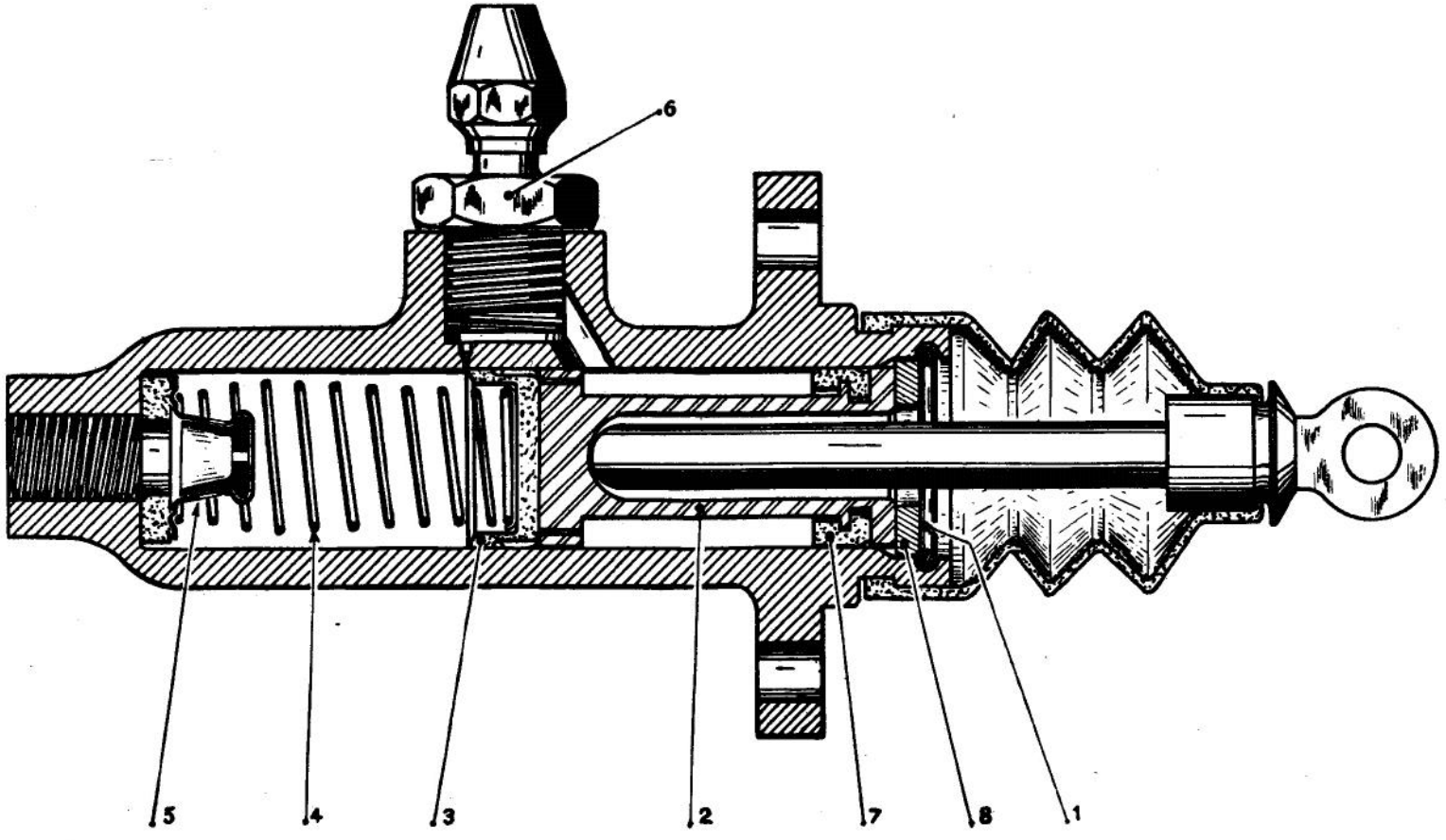
THIS HANDLE IS USED WITH SOCKET WITH 12 FLATS. 19 ACROSS.

Fig.2. SPANNER 2130.T.



— MASTER CYLINDER ASSEMBLY —

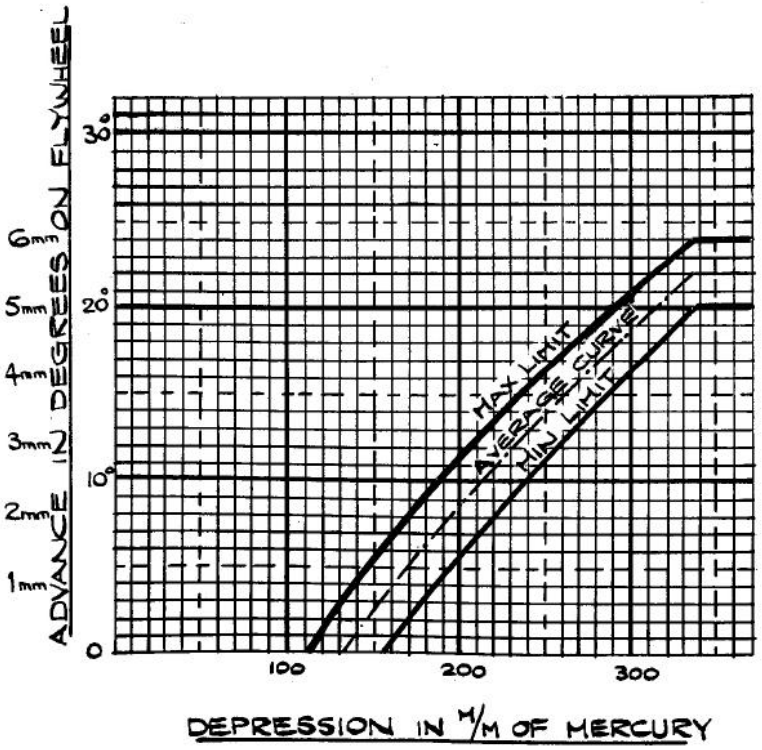
SECTION ON LONGITUDINAL CENTRE LINE.



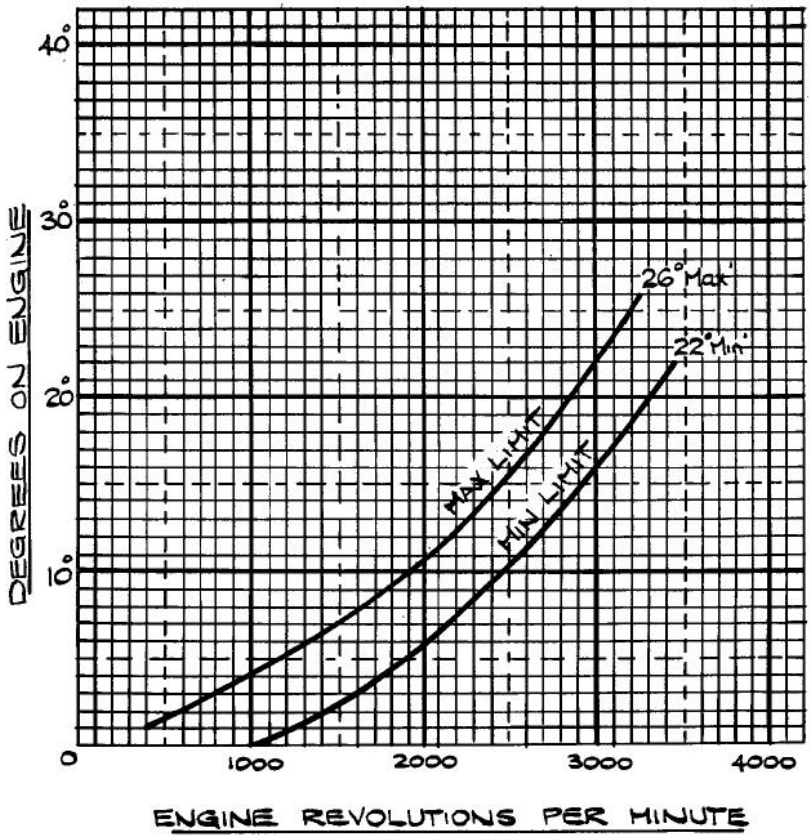
— ELECTRICAL EQUIPMENT —

— AUTOMATIC ADVANCE IGNITION CURVES —

CURVE FOR SUCTION CONTROL



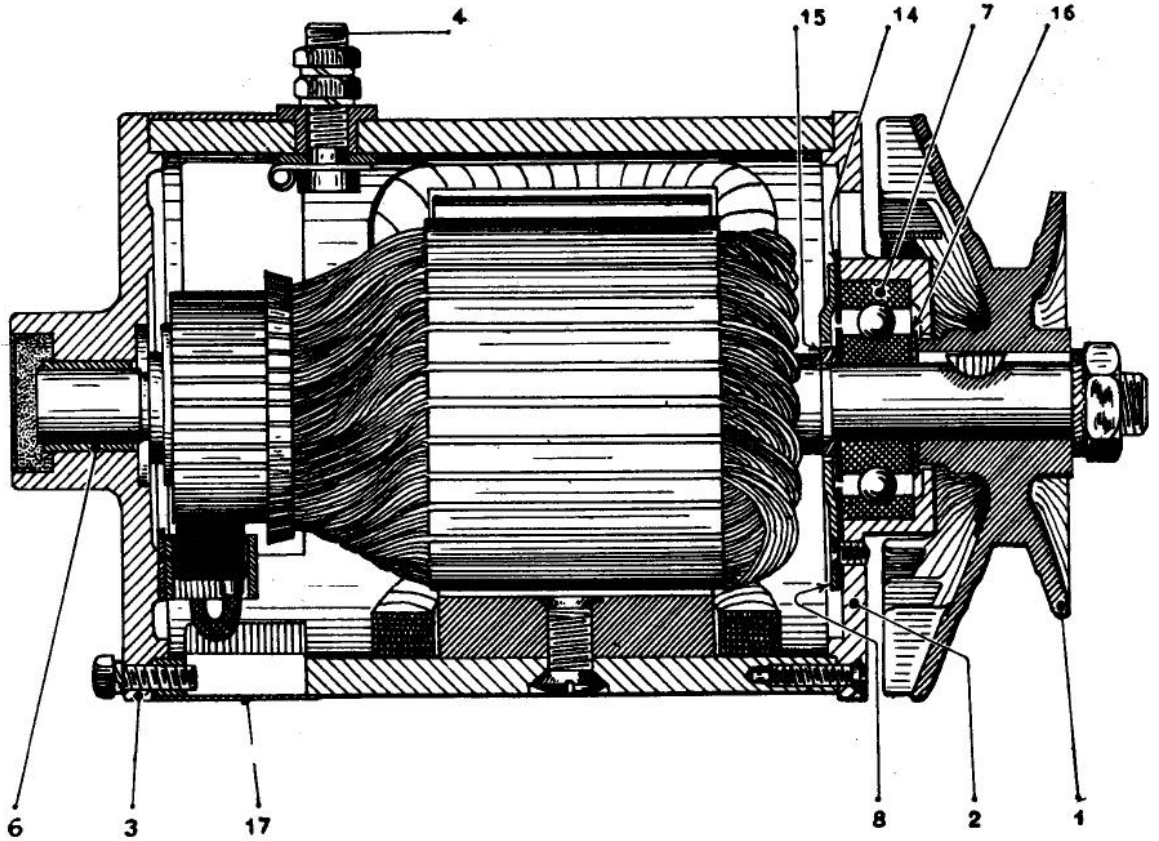
CURVE FOR DISTRIBUTOR



ELECTRICAL EQUIPMENT

DYNAMO ASSEMBLY

LONGITUDINAL SECTION ON CENTRE LINE.



— ELECTRICAL EQUIPMENT —

— DYNAMO ASSEMBLY —

END VIEWS

Fig. 1. INDUCTION COILS
View from opposite side to brushes

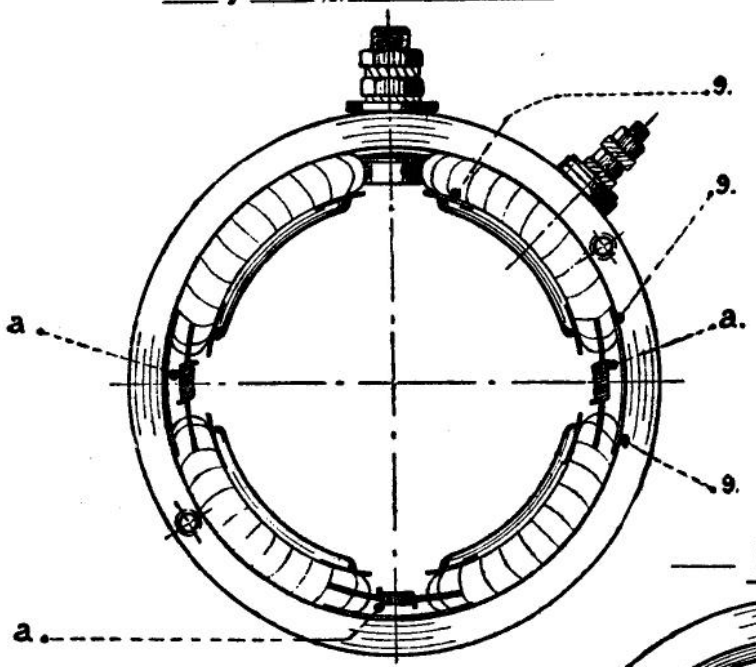
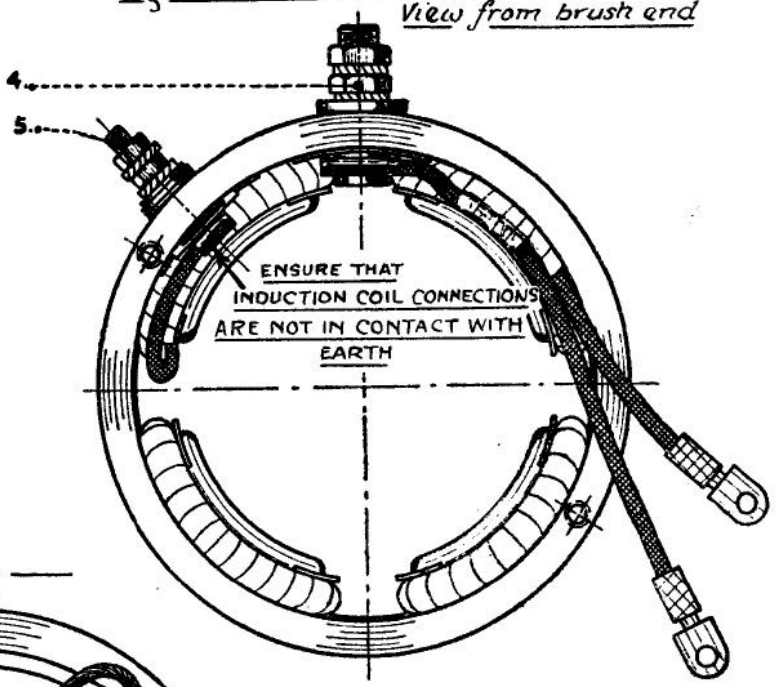


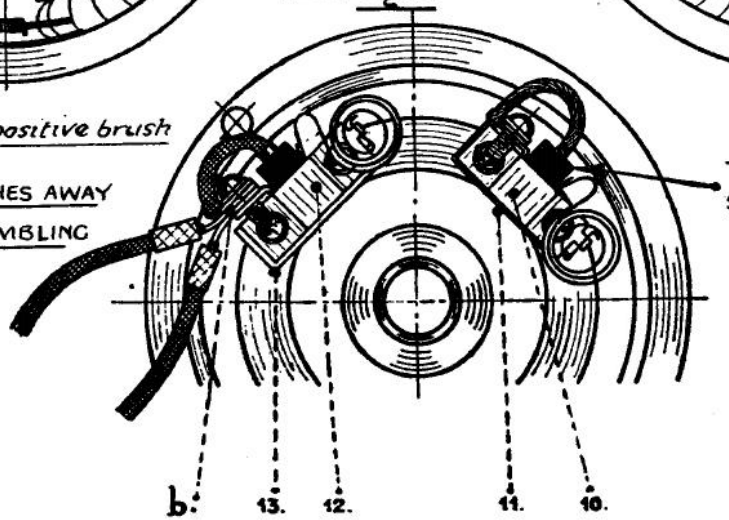
Fig. 2. INDUCTION COILS
View from brush end



INDUCTION COILS *Wiring at positive brush*

SHOWING HOW TO KEEP BRUSHES AWAY
FROM ARMATURE WHILE ASSEMBLING

— Fig. 3. —

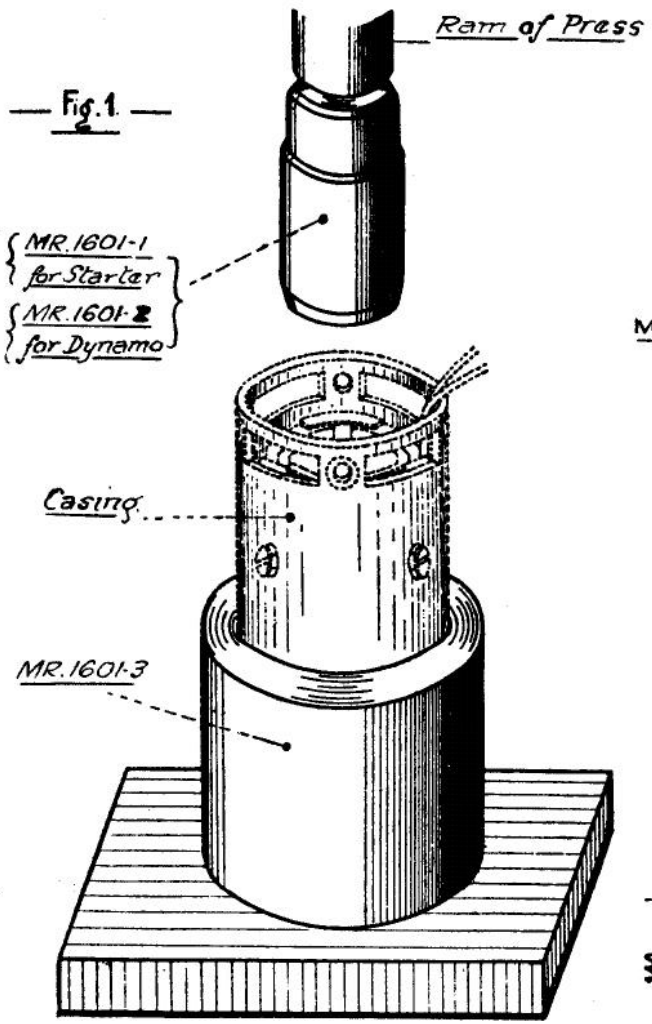


THE BRUSHES ARE HELD AWAY BY THE SPRINGS IN ORDER TO ALLOW THE ARMATURE TO BE FITTED

— ASSEMBLY OF INDUCTION COILS AND POLE-PIECES DYNAMO AND STARTER MOTOR —

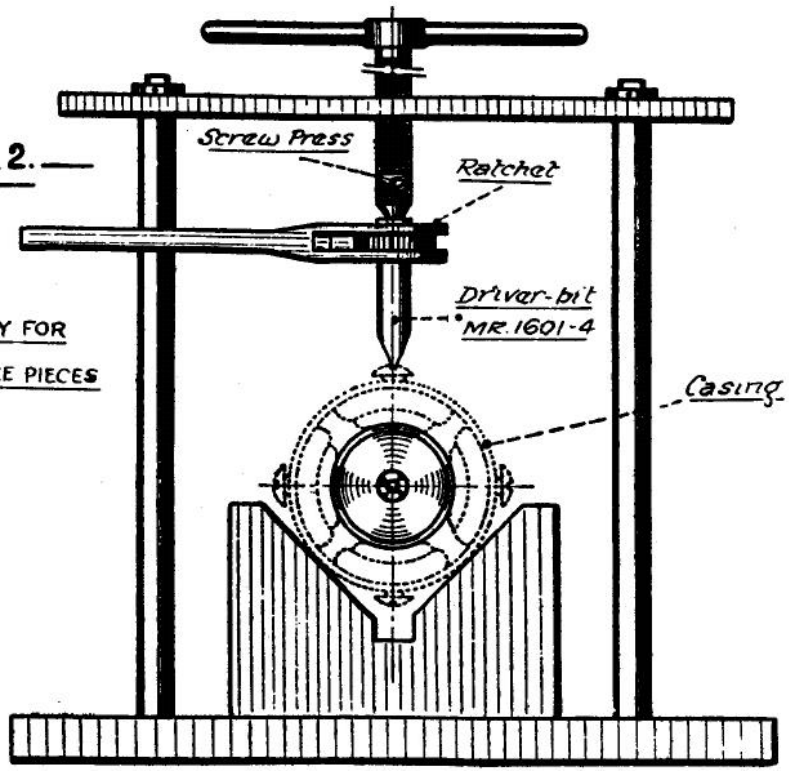
ASSEMBLY FOR PACKING COILS

— Fig. 1. —



ASSEMBLY FOR MOUNTING POLE PIECES

— Fig. 2. —

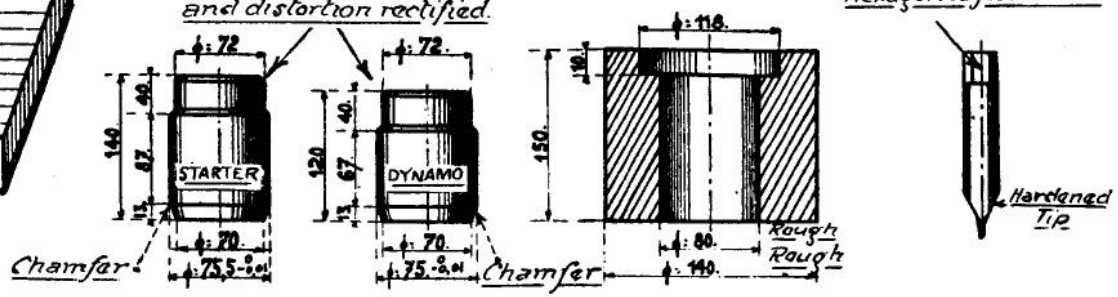


MR. 1601-1 — Semi-hard steel - Tempered and distortion rectified.

MR. 1601-2 — Semi-hard steel - Tempered and distortion rectified.

MR. 1601-3 — Cast-Iron

MR. 1601-4 — Hexagon to fit ratchet



— STARTER MOTOR ASSEMBLY —

LONGITUDINAL SECTION ON CENTRE LINE.

Fig. 1

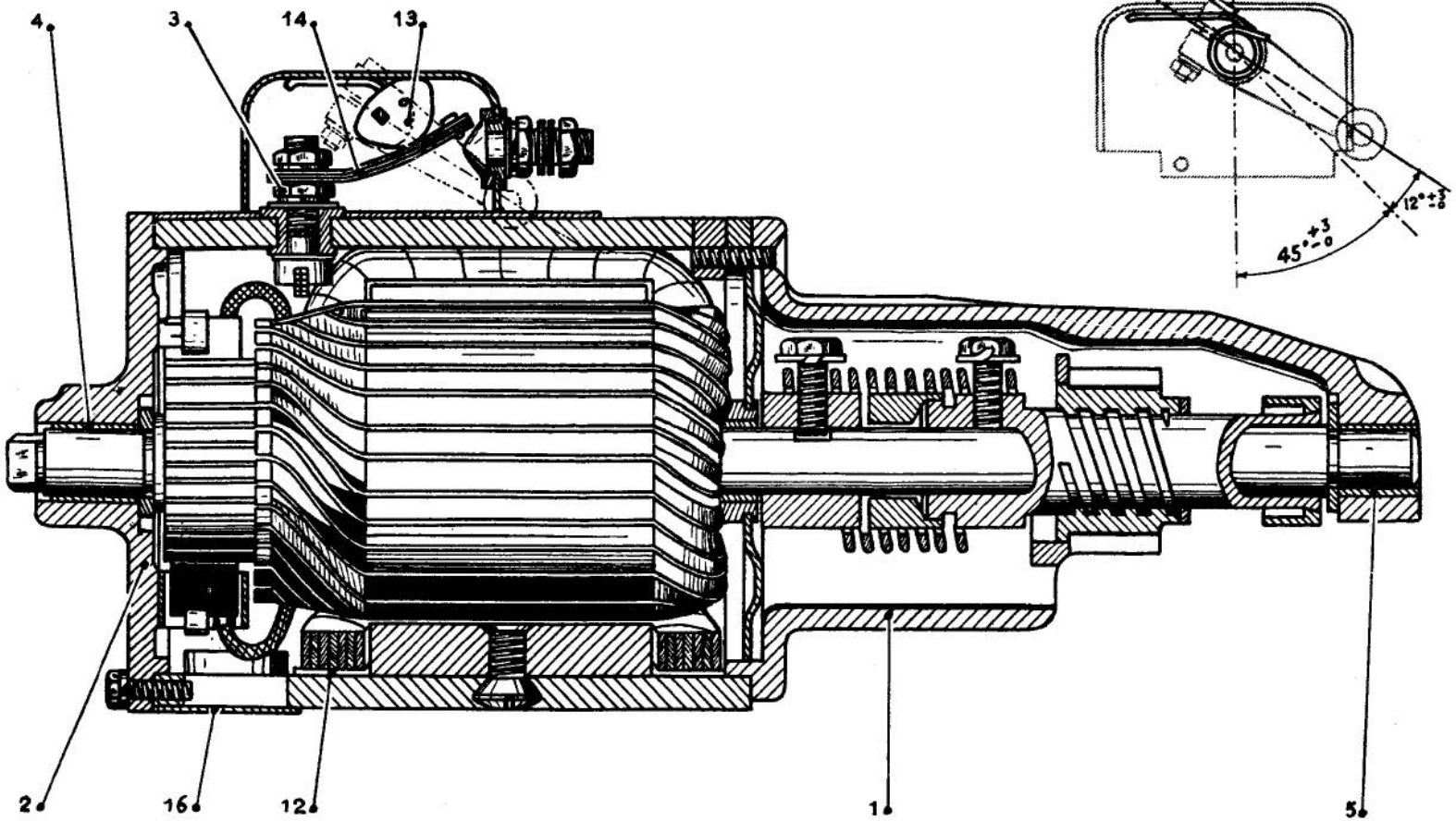
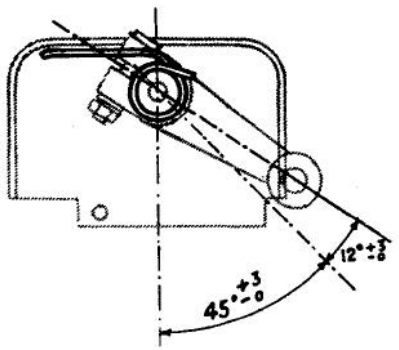


Fig. 2



Return spring for starter pinion not shown.

STARTER MOTOR ASSEMBLY

END VIEWS

Fig. 1.

ASSEMBLY OF INDUCTION COILS

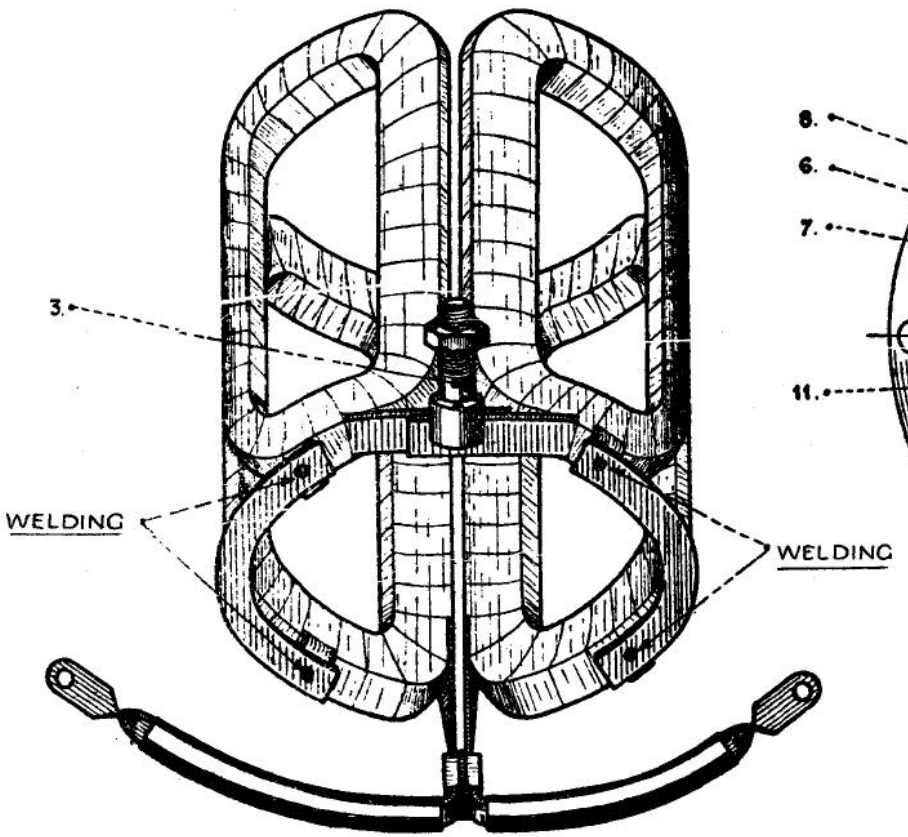
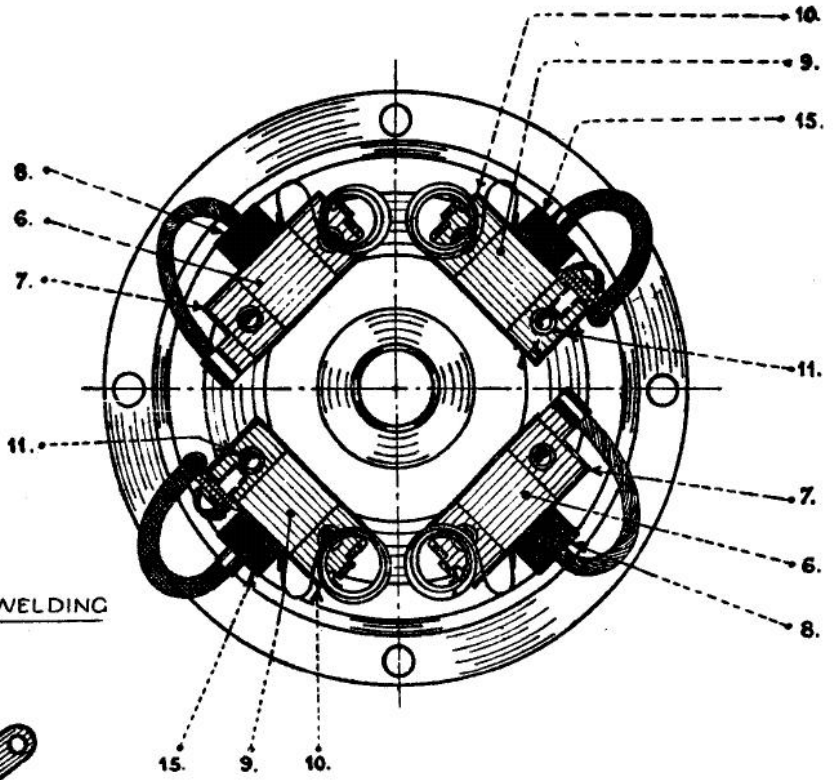


Fig. 2.

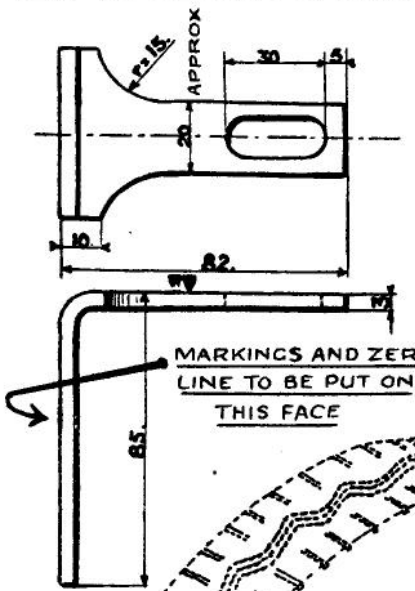
ASSEMBLY OF BRUSHES

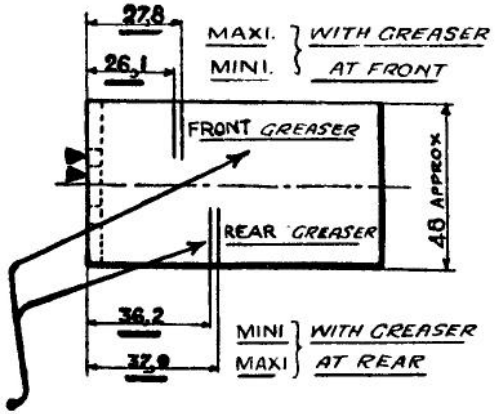


BRUSHES ARE HELD AWAY FROM ARMATURE INSIDE BRUSH CARRIERS BY SPRINGS, THUS ALLOWING PASSAGE OF ARMATURE

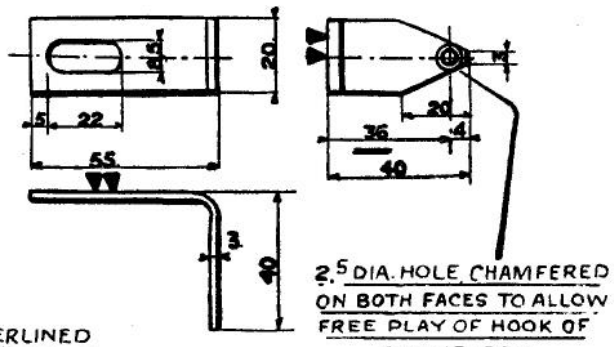
—CHECKING CASTER ANGLE—

DETAILS OF LOWER INDICATOR



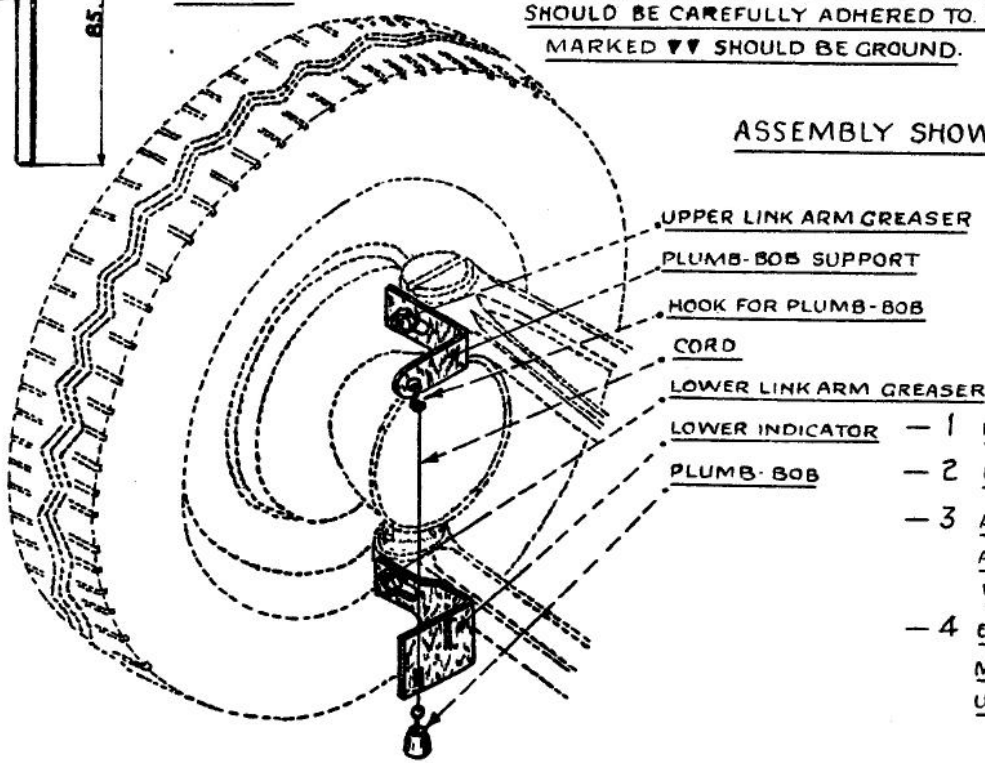


DETAILS OF PLUMB-BOB SUPPORT



NOTE: IMPORTANT DIMENSIONS UNDERLINED SHOULD BE CAREFULLY ADHERED TO. FACES MARKED ▼▼ SHOULD BE GROUND.

ASSEMBLY SHOWING USE OF GAUGE



MR. 1767

MOUNTING GAUGE

— 1 REMOVE GREASERS ON UPPER AND LOWER LINK ARMS

— 2 MOUNT BRACKETS AS SHOWN

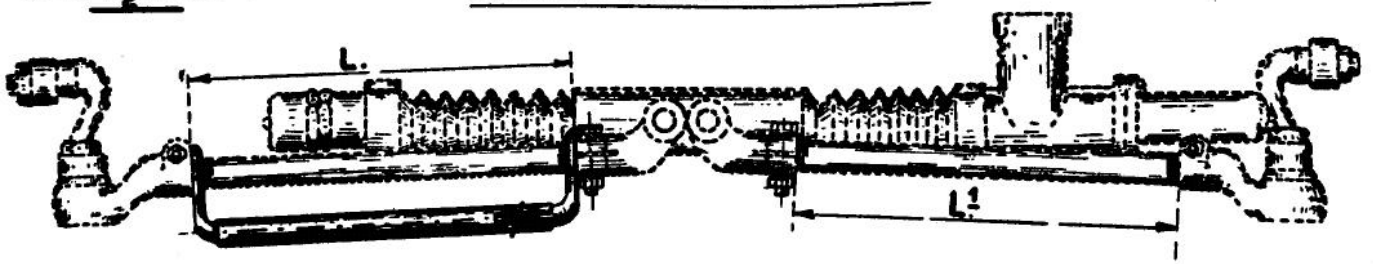
— 3 ADJUST LOWER INDICATOR SO THAT INNER FACE IS AS NEAR CONTACT OF CORD AS POSSIBLE WITHOUT TOUCHING.

— 4 ENSURE THAT PLUMB-BOB CORD FALLS BETWEEN MARKINGS CORRESPONDING TO GREASER TAPPING USED.

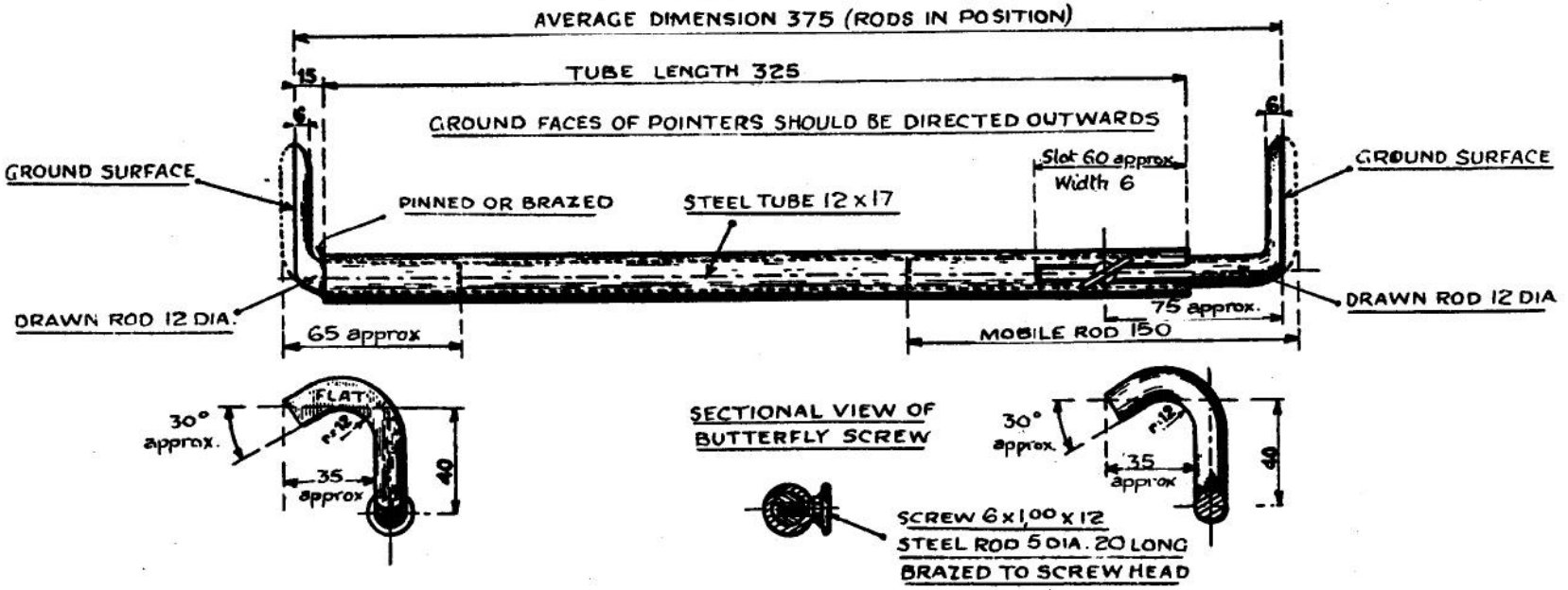
— ADJUSTMENTS —

— CHECKING LENGTHS OF TRACK RODS —

— Fig. 1. — ASSEMBLY SHOWING USE OF GAUGE



DETAILS OF GAUGE **MR1590**



DISTANCE L BETWEEN SOCKET ENDS AT ONE SIDE SHOULD EQUAL DISTANCE L¹ BETWEEN SOCKET ENDS AT OTHER SIDE TOLERANCE 1mm (see fig. 1)

— CHECKING STEERING LOCK —

Fig.1. USE OF GAUGE.

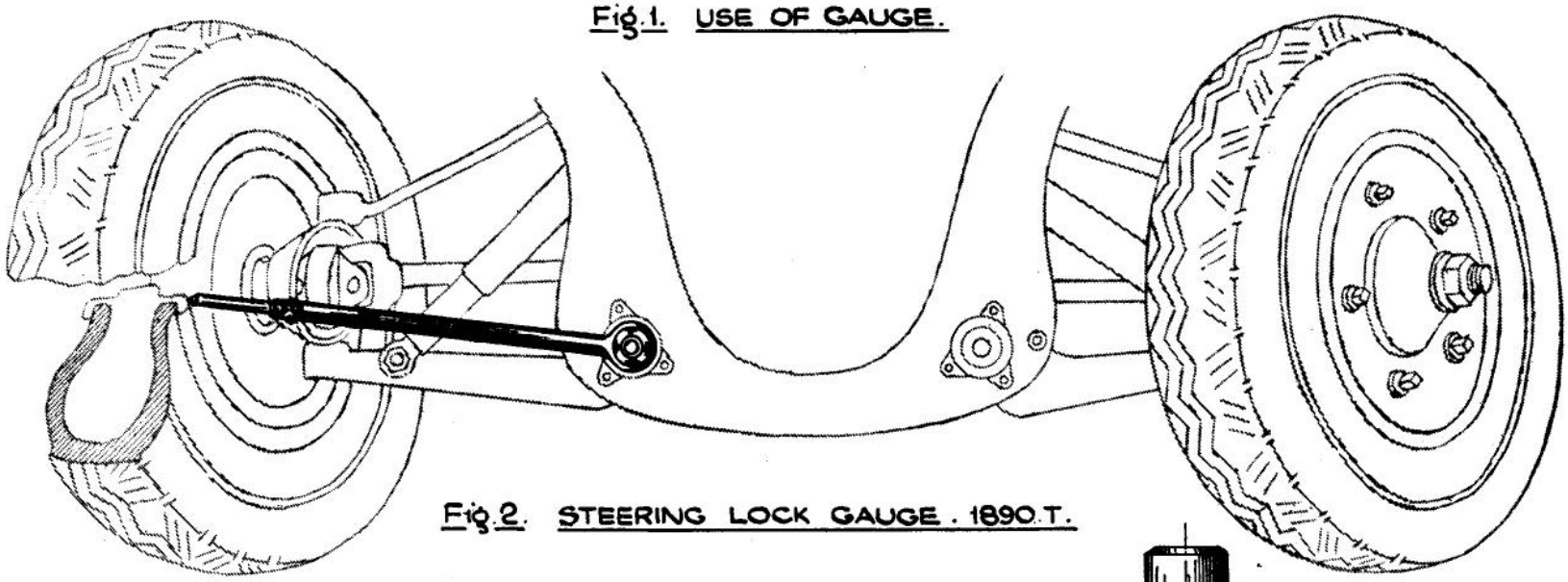
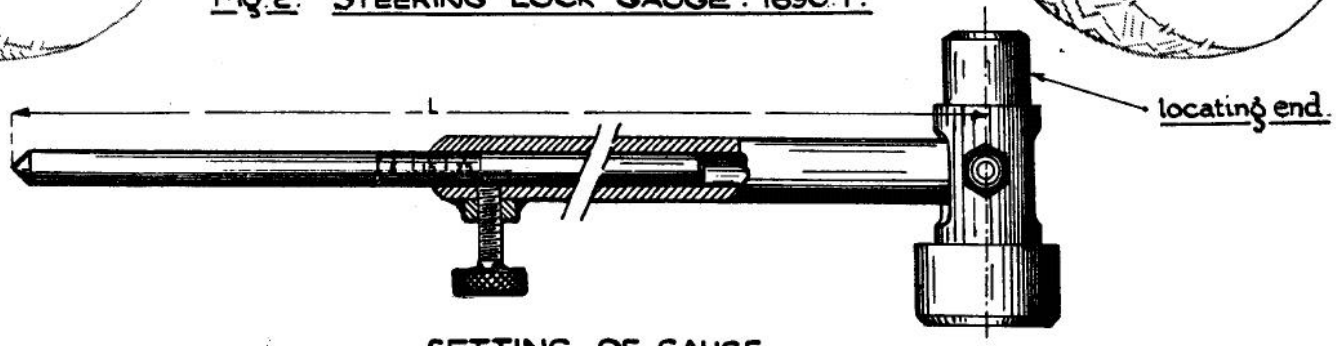


Fig.2. STEERING LOCK GAUGE . 1890.T.



SETTING OF GAUGE.

	TYPE OF WHEEL	READING	LENGTH 'L'
7 & 11 FRONT WHEEL DRIVE	STOP 140x40	18	570
	STOP 150x40	12	564
	STOP 160x40	5	557
	PILOTE 155x400	23	575
	PILOTE 165x400	18	570
	PILOTE 185x400	11	563
	BM 165x400	23	575

— ADJUSTMENTS —

— CHECKING WHEEL CAMBER —

Fig.1. USE OF GAUGE

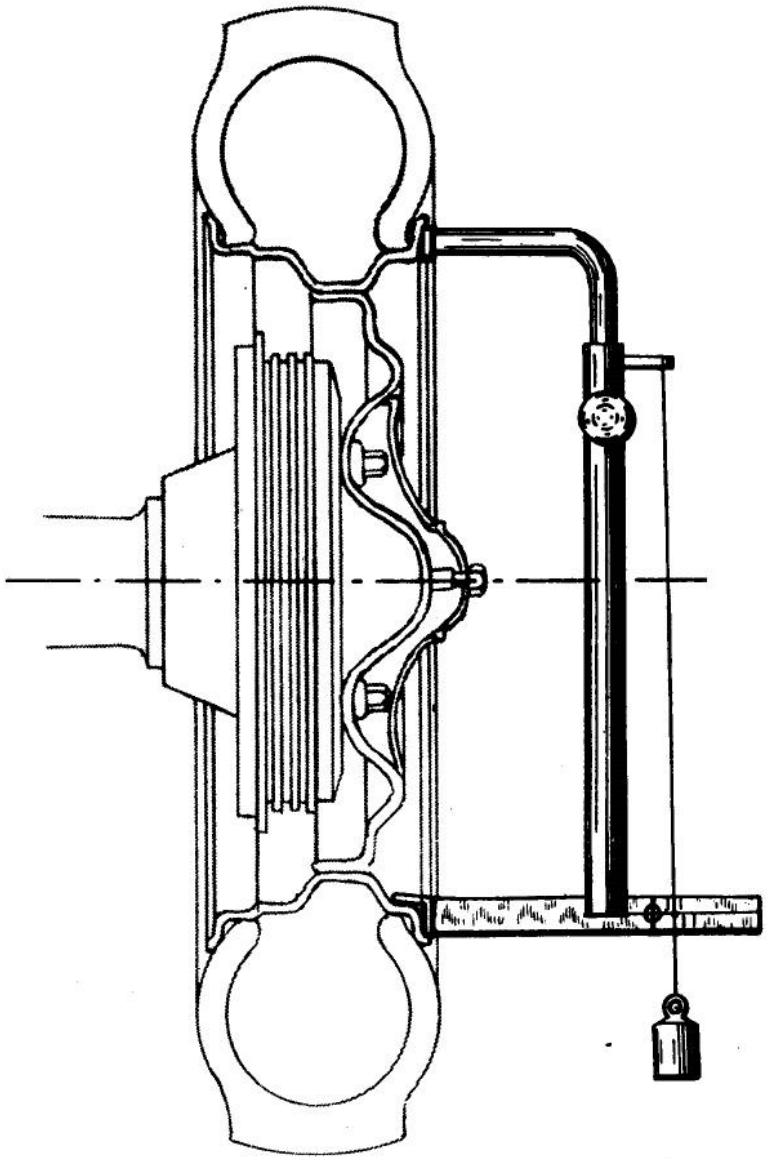
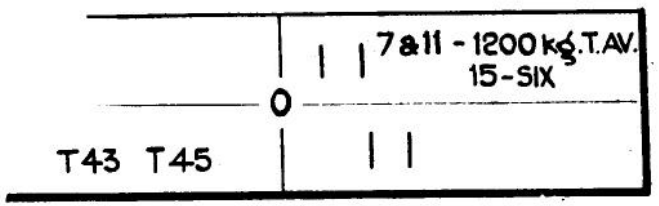


Fig.2. ENLARGED VIEW OF SCALE.

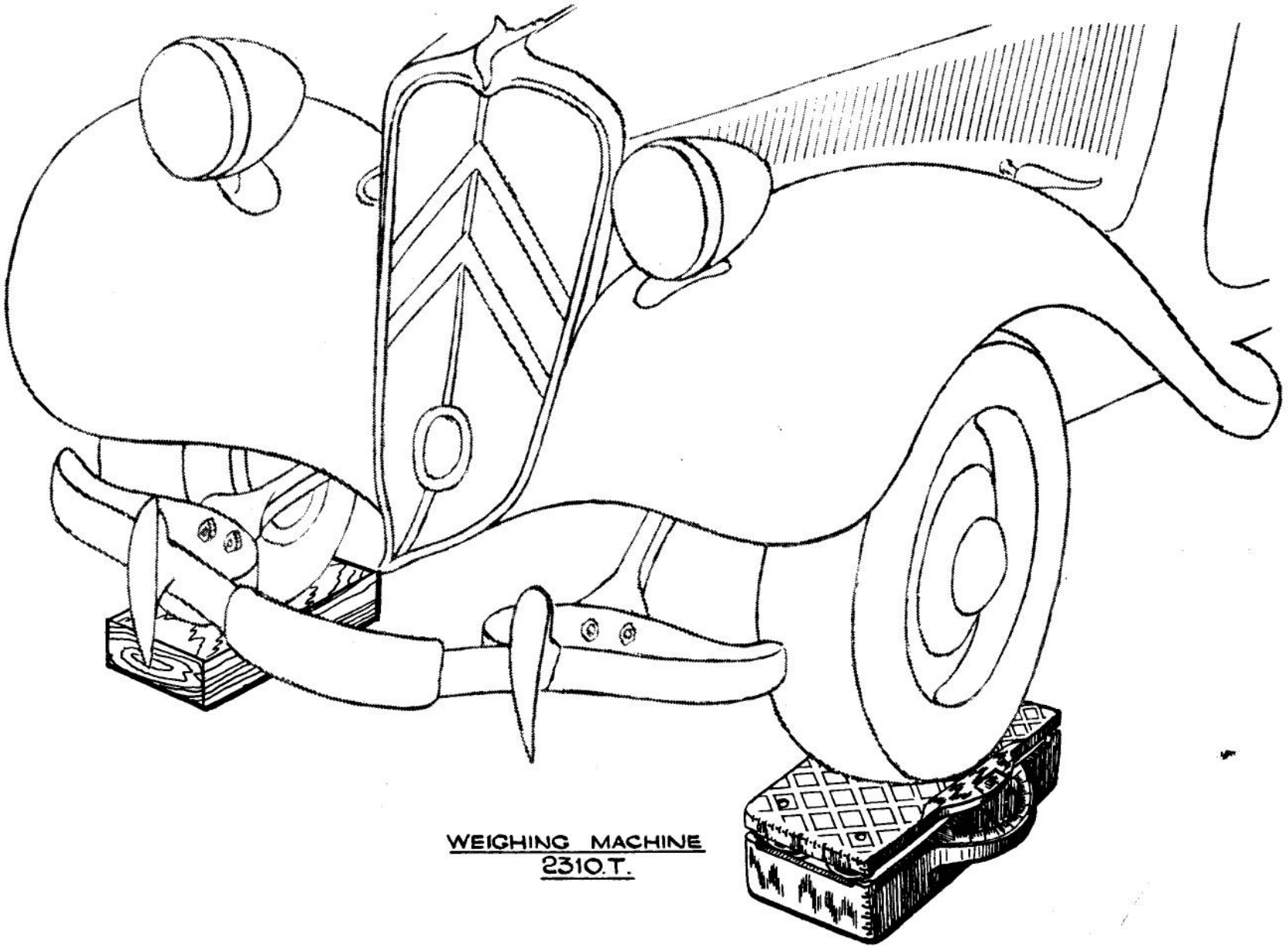
Plumb line must rest between two gauge lines.



GAUGE 2314.T.

ADJUSTMENTS

WEIGHT DISTRIBUTION



WEIGHING MACHINE
2310.T.

ADJUSTMENTS

CHECKING WHEELS

Fig. 1. — LOCATING HEAVY PART

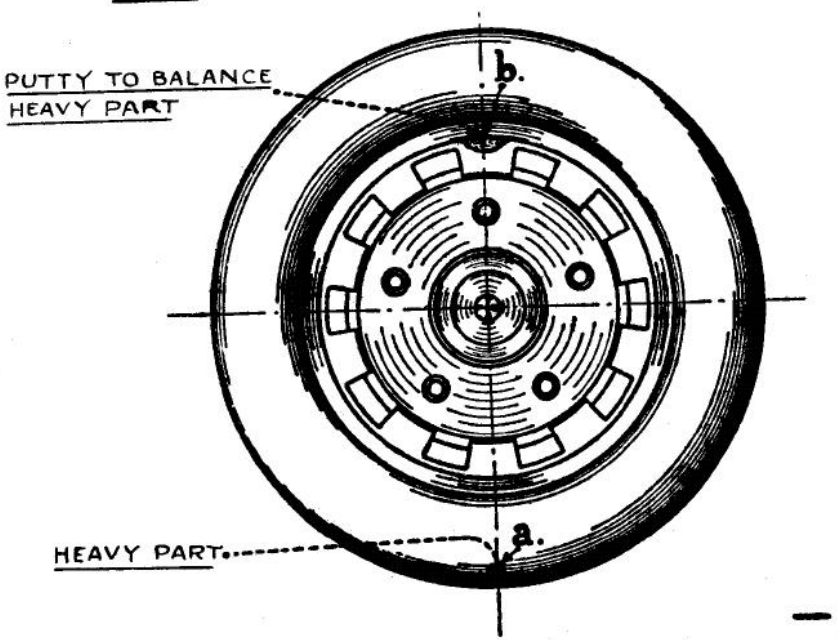


Fig. 2. ASSEMBLY SHOWING WHEEL MOUNTED FOR BALANCING

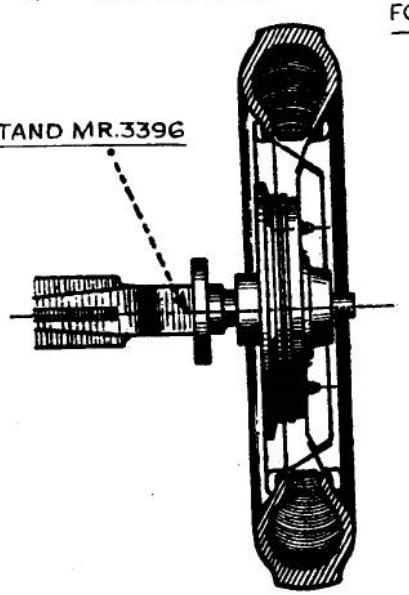


Fig. 3. POSITION OF WELDED BALANCE WEIGHT

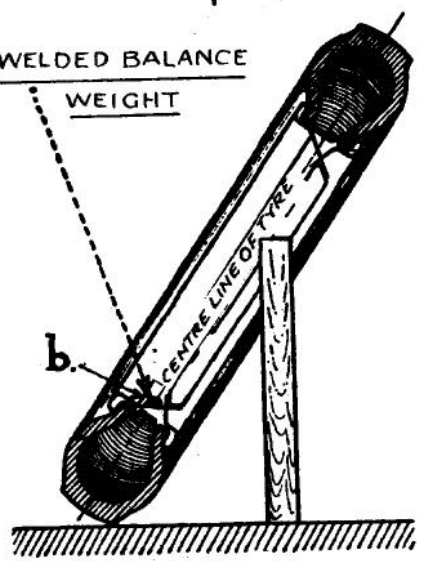
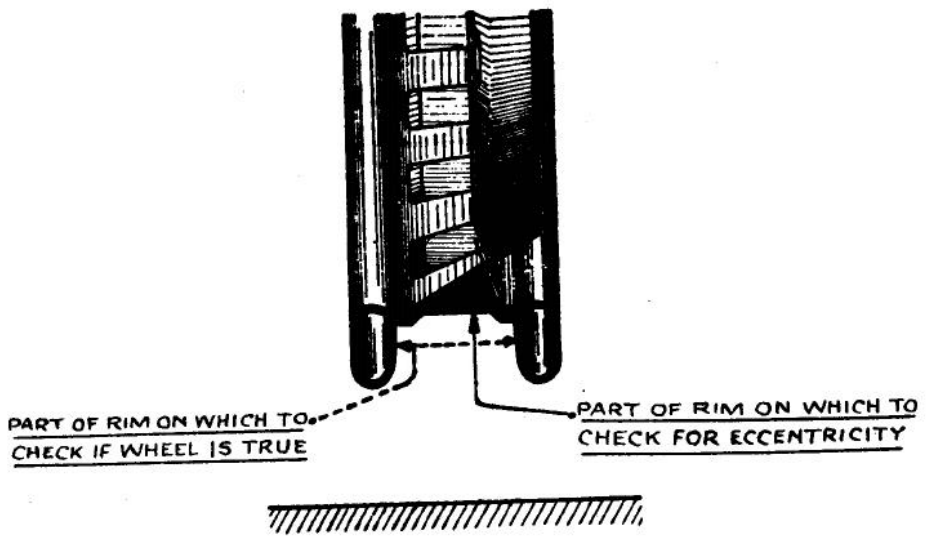


Fig. 4. — CHECKING DISTORTION OF RIM



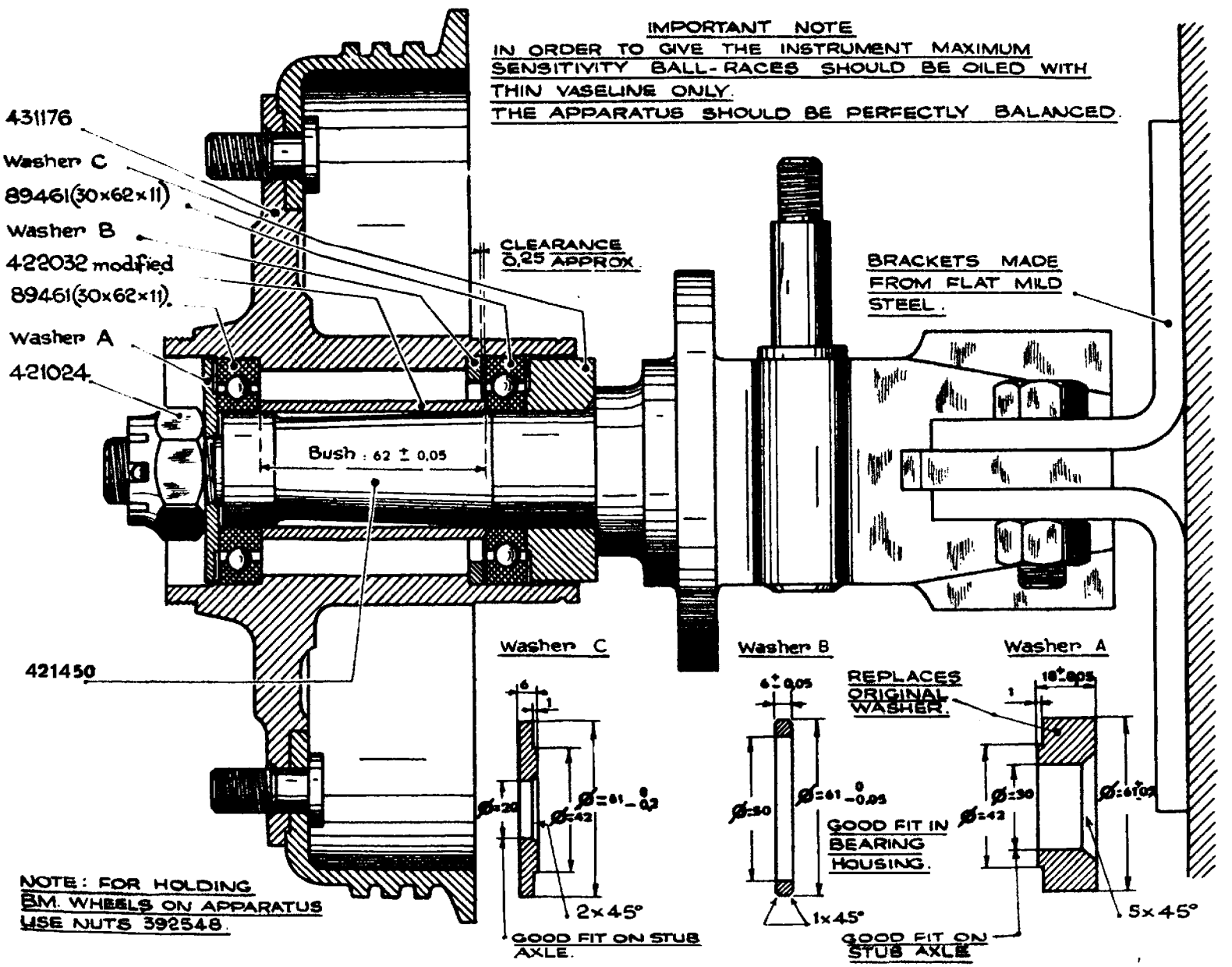
— CHECKING BALANCE OF WHEELS —

APPARATUS MR. 3396.

IMPORTANT NOTE

IN ORDER TO GIVE THE INSTRUMENT MAXIMUM SENSITIVITY BALL-RACES SHOULD BE OILED WITH THIN VASELINE ONLY.

THE APPARATUS SHOULD BE PERFECTLY BALANCED.



NOTE: FOR HOLDING BM. WHEELS ON APPARATUS USE NUTS 392548.

— ADJUSTMENTS —

— ADJUSTING HEADLAMPS —

Fig.1. SCREEN MR. 1572.

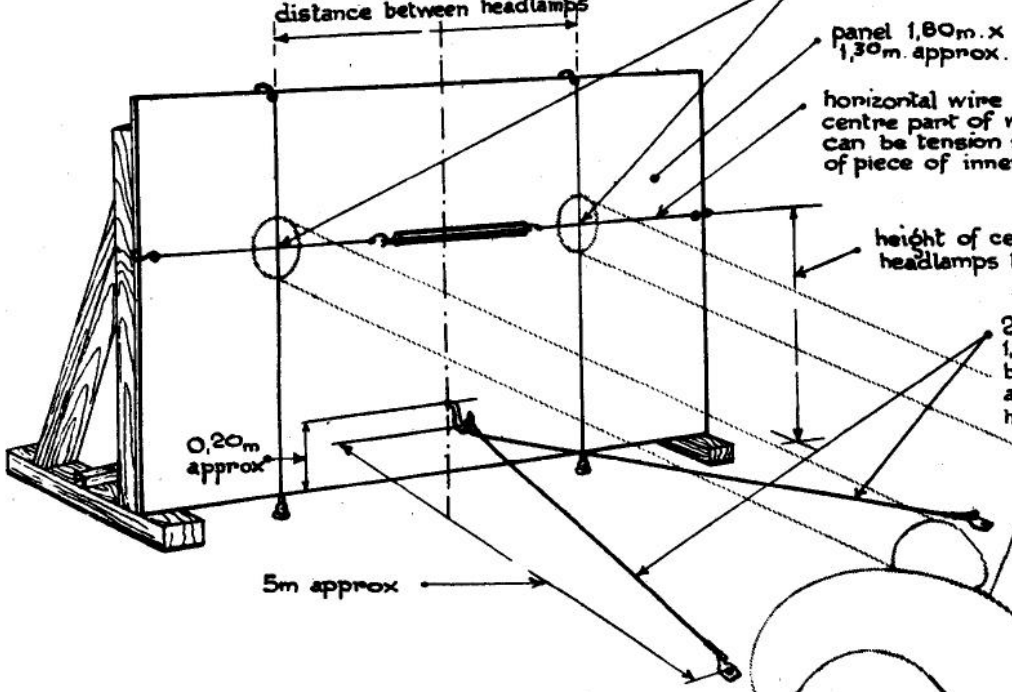


Fig.2. FIXING CABLES ON LOWER LINK ARM BOSS.

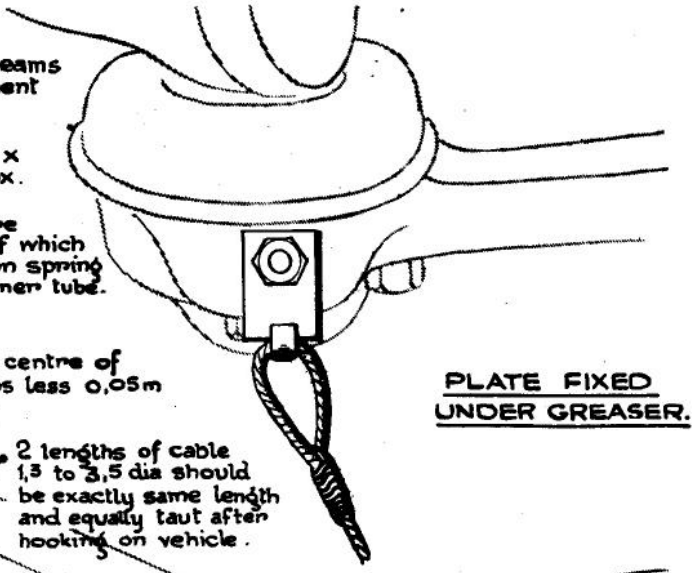


PLATE FIXED UNDER GREASER.

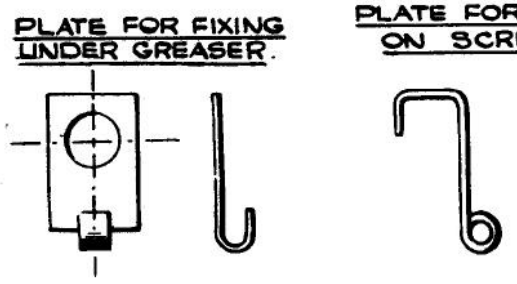
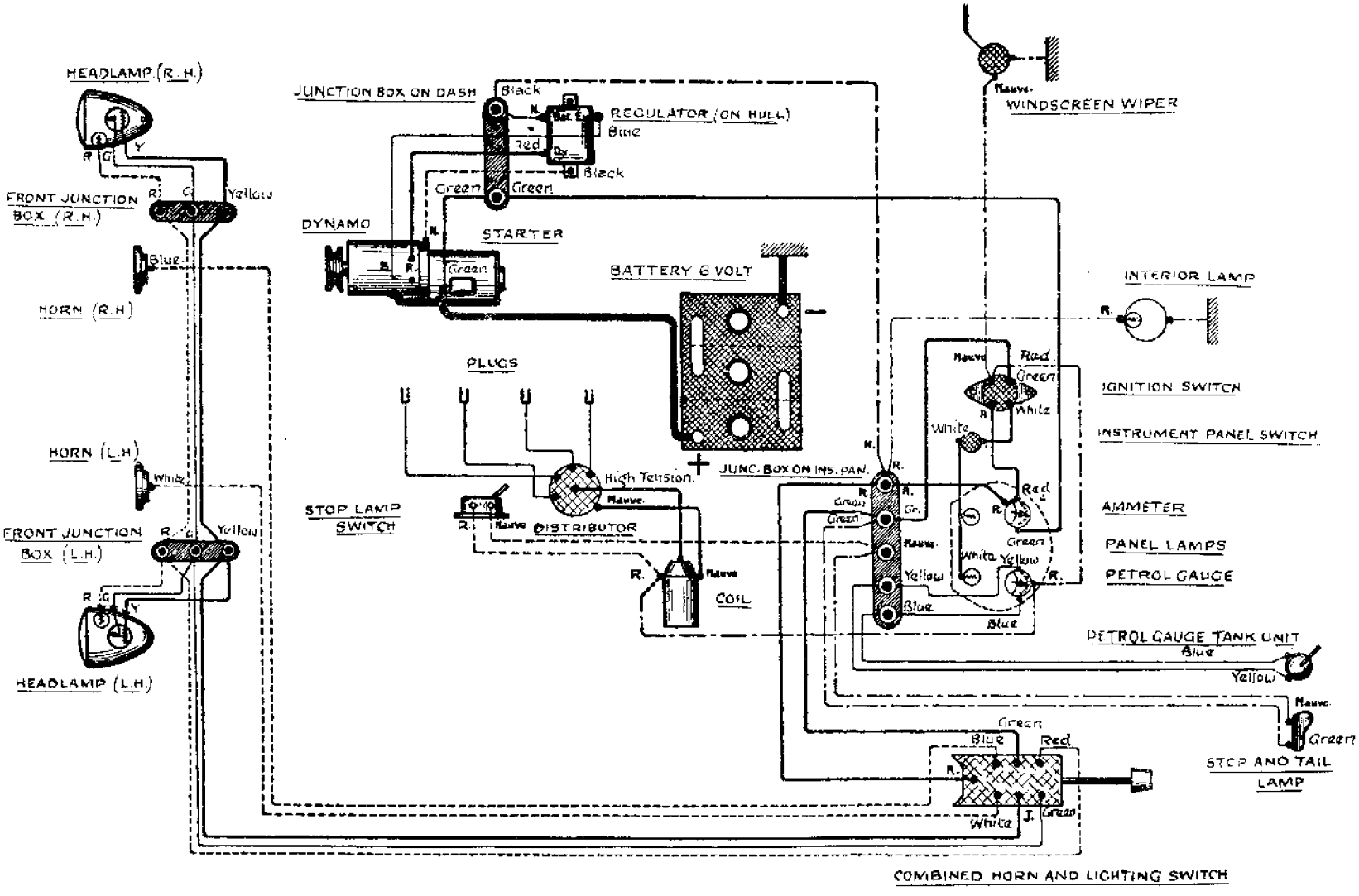


Fig 4 HOOKS ON REAR OF SCREEN TO HOLD CABLES AFTER USE.

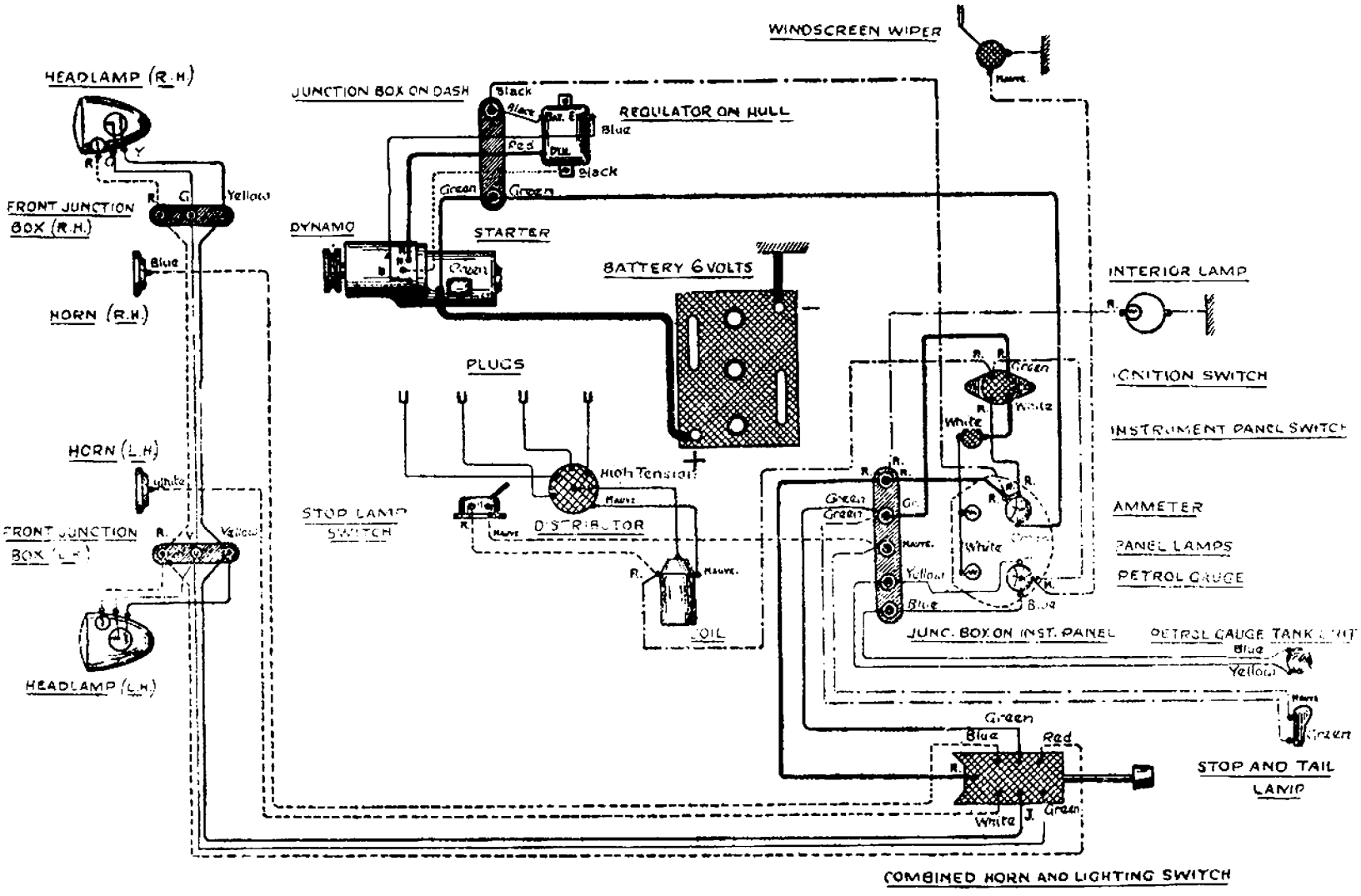
— WIRING DIAGRAM (WITH COMBINED HORN AND LIGHTING SWITCH AND REGULATOR ON HULL) —



—ELECTRICAL—

WIRING DIAGRAM (WITH COMBINED HORN AND LIGHTING SWITCH AND REGULATOR ON HULL)

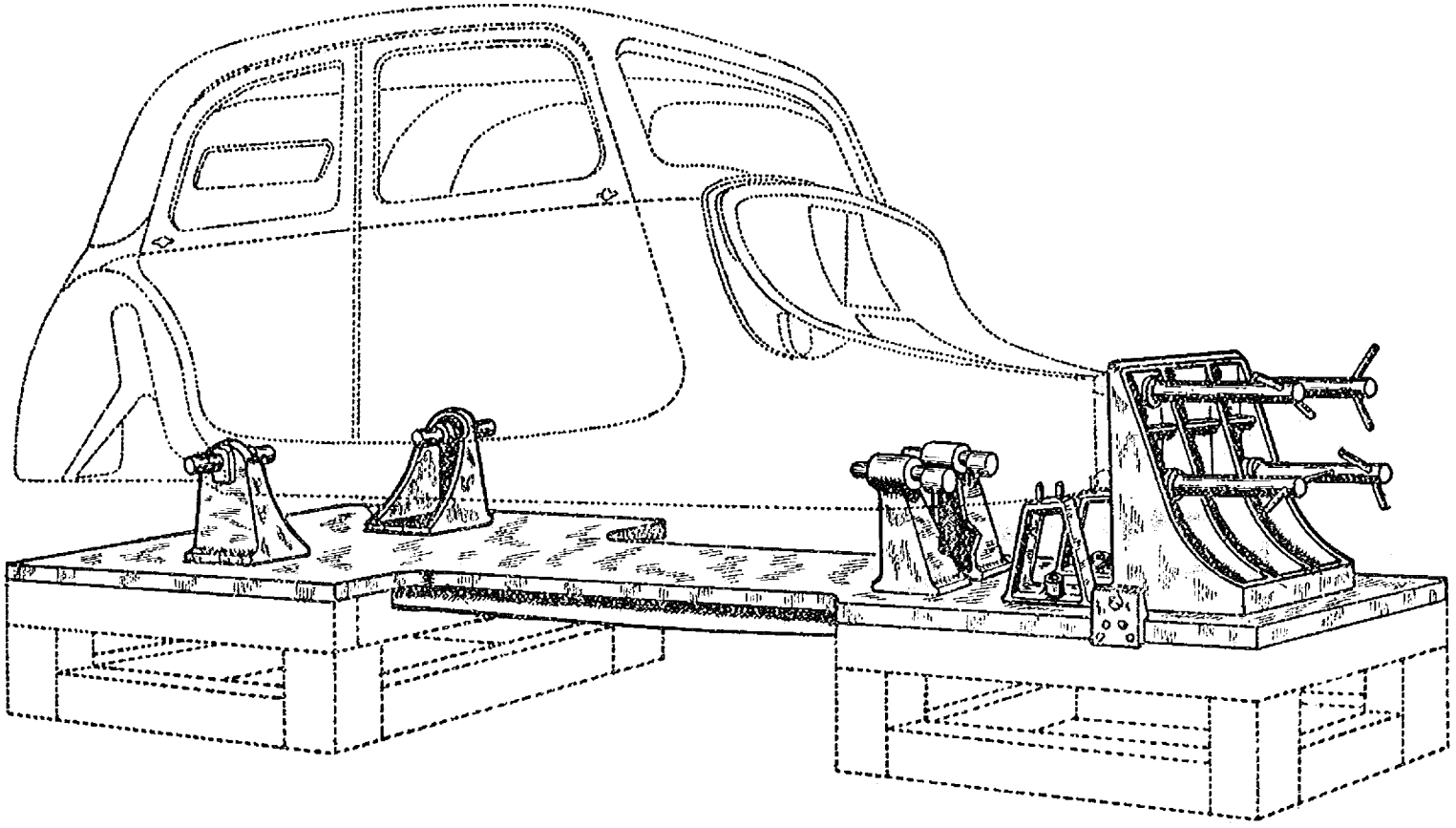
FROM JANUARY 1947



— REALIGNMENT OF HULL —

Use of jig.

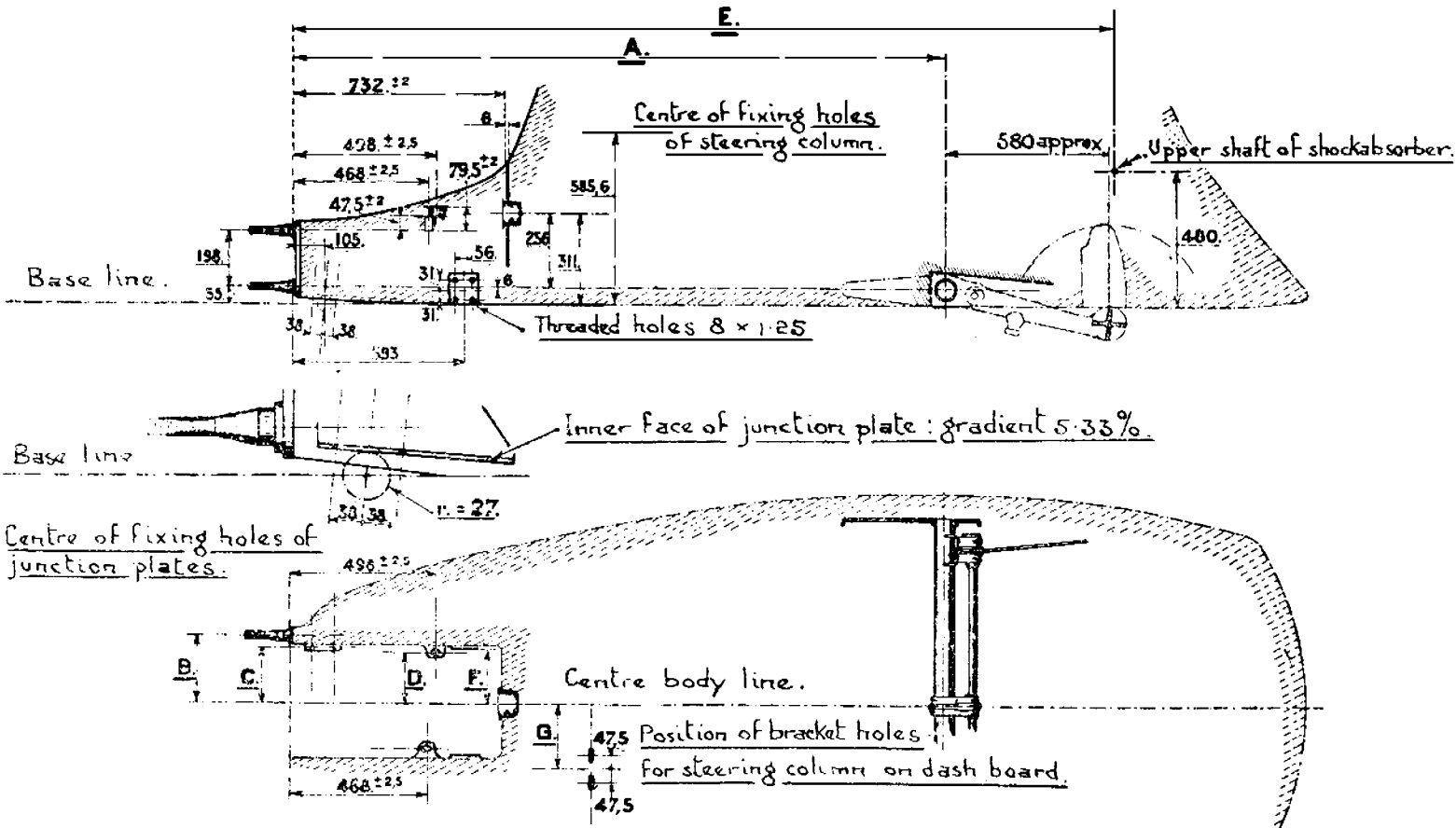
Jig assembly sold under N° 2600-T.



— BODYWORK —

— REALIGNMENT OF HULL —

Readings of points of contact of main mechanical parts.



	Twelve & Light Fifteen.	Big Fifteen.	Family Fifteen.
A.	2259.	2439.	2624.
B.	225.	285.	285.
C.	185,2	245,2	245,2
D.	163 ±1	223 ±1	223 ±1
E.	2850.	3030.	3215.
F.	195,7	255,7	255,7
G.	260.	320.	320