REPAIR MANUAL

CITROEN

FRONT WHEEL DRIVE
SIX CYLINDER MODEL

FRENCH DESIGNATION ..... 15-SIX (15 CV)
BRITISH DESIGNATION ..... "SIX" (22.6 H.P.)

CITROEN CARS LIMITED,
TRADING ESTATE,
SLOUGH,
ENG.

SEPTEMBER 1957

ILLUSTRATIONS

Drawing No.	Modification
	Add to Index of Illustrations : "124A - Spanner for holding intermediate shaft."
5	Read dimension : "368 ± 0.25" instead of : "353 free."
57	Read : "Steel type 819 quenched and tempered" instead of : "Mild steel, case hardened and ground."
69	Steering rod is solid, not tubular as shown.
71	Add : "washer 602345" : between distance piece 34 and spring 35.
123	Alter threads on nuts (241) and (251) to indicate R.H. threads.
126	Alter distance pieces (304), (305), (306), and (307) to show slots bearing against forks.
139	Show adjusting washers (161) between lockwasher (146) and link arm. Delete washer shown under spring (125).

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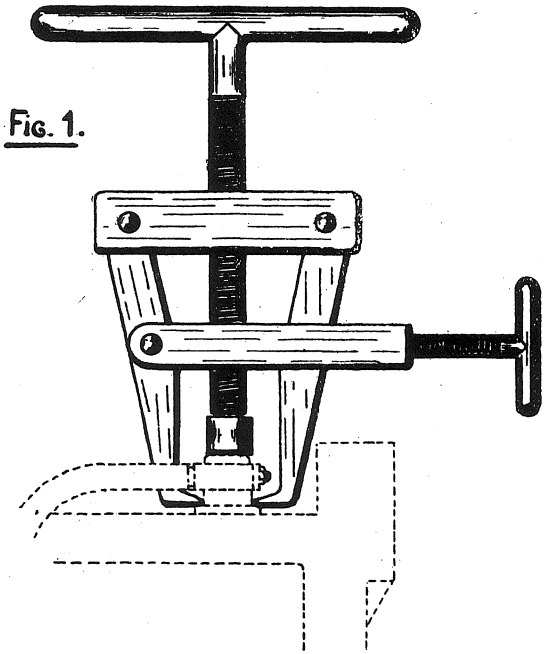
ENGINE

VARIOUS TOOLS

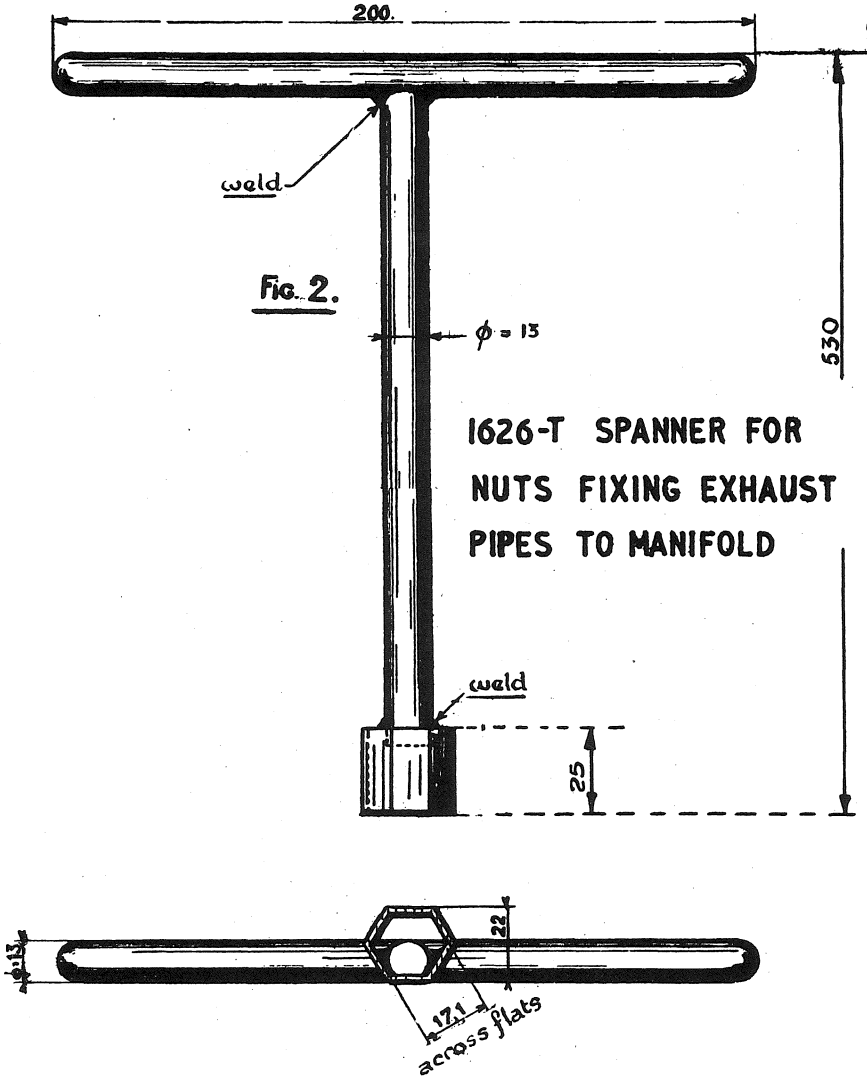
2200-T EXTRACTOR FOR BATTERY CABLE TERMINAL

Fig. 1.



1626-T SPANNER FOR NUTS FIXING EXHAUST PIPES TO MANIFOLD

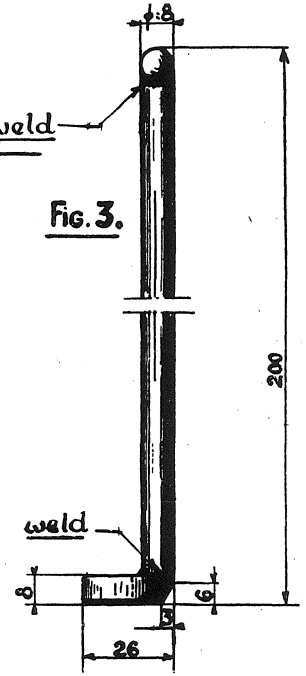
Fig. 2.

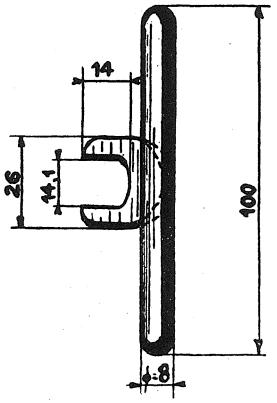


1626-T SPANNER FOR NUTS FIXING EXHAUST PIPES TO MANIFOLD

1621-T SPANNER FOR NUTS FIXING CARBURETTOR

Fig. 3.





ENGINE

LIFTING ENGINE

USE OF CHAIN SLING

Maximum load : 350 kg. (7 cwts)

Annealed mild steel

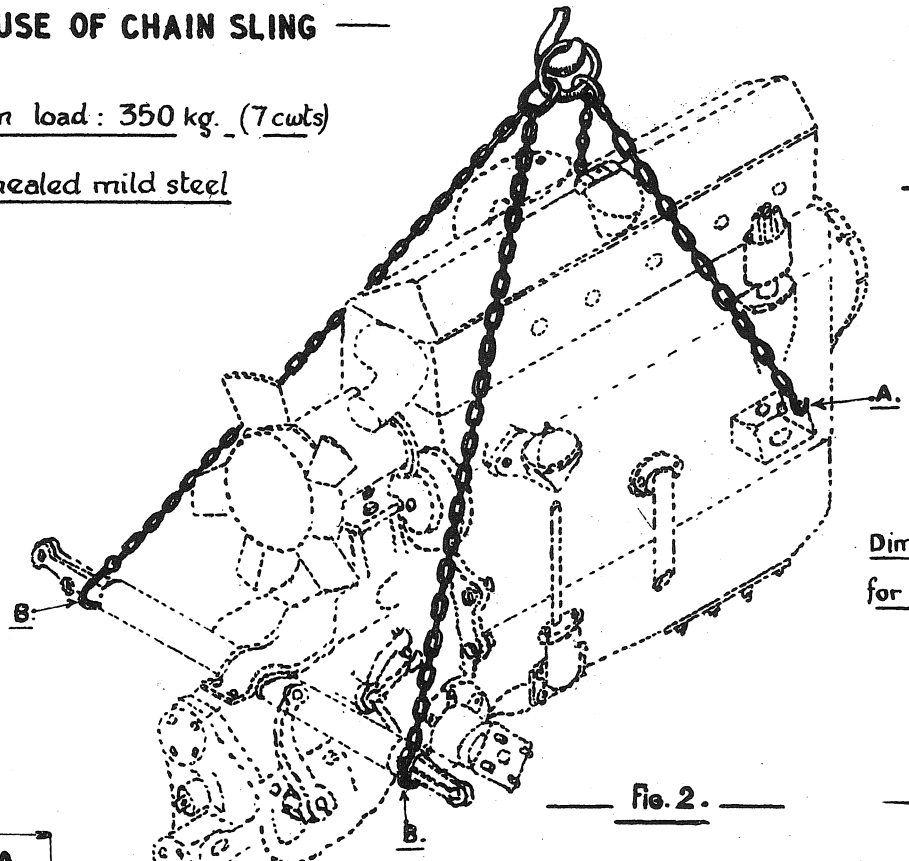
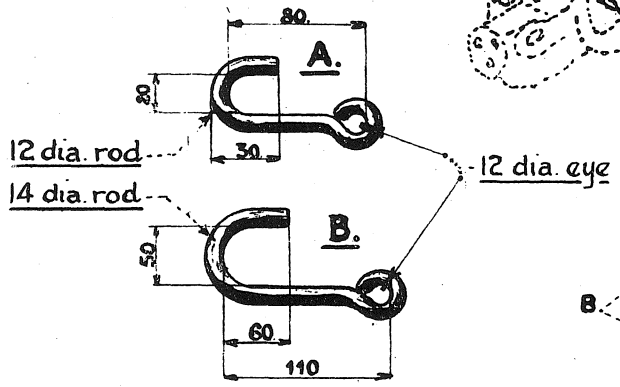


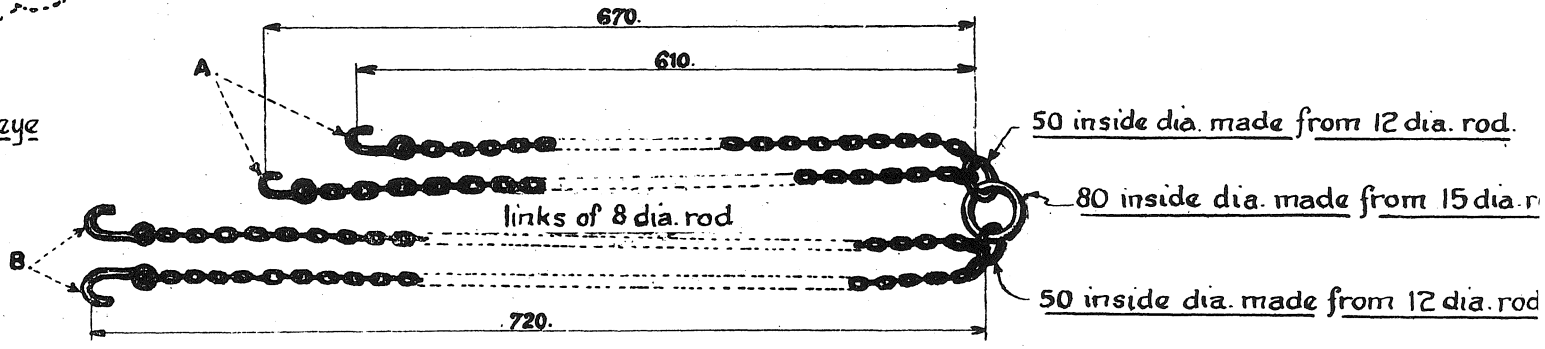
Fig. 1.

Dimensions conform to Standards CNM 601 or CNM 602 for lifting chains. Rings and links to general practice.

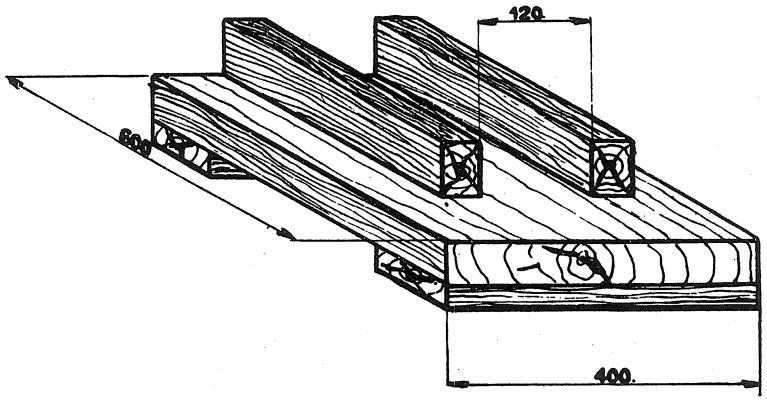
Fig. 2.

CHAIN SLING MR.3320-30



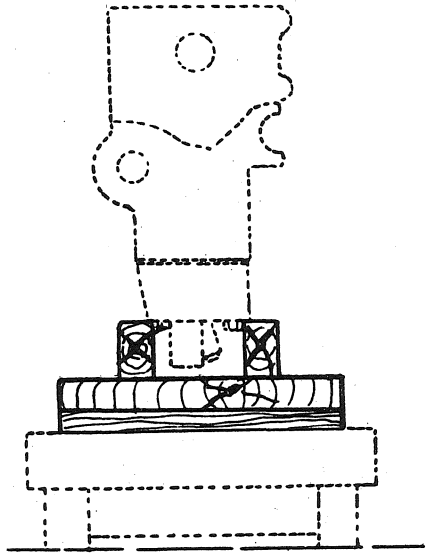


— ENGINE STAND —



— STAND MR.3300-20 —

Main dimensions

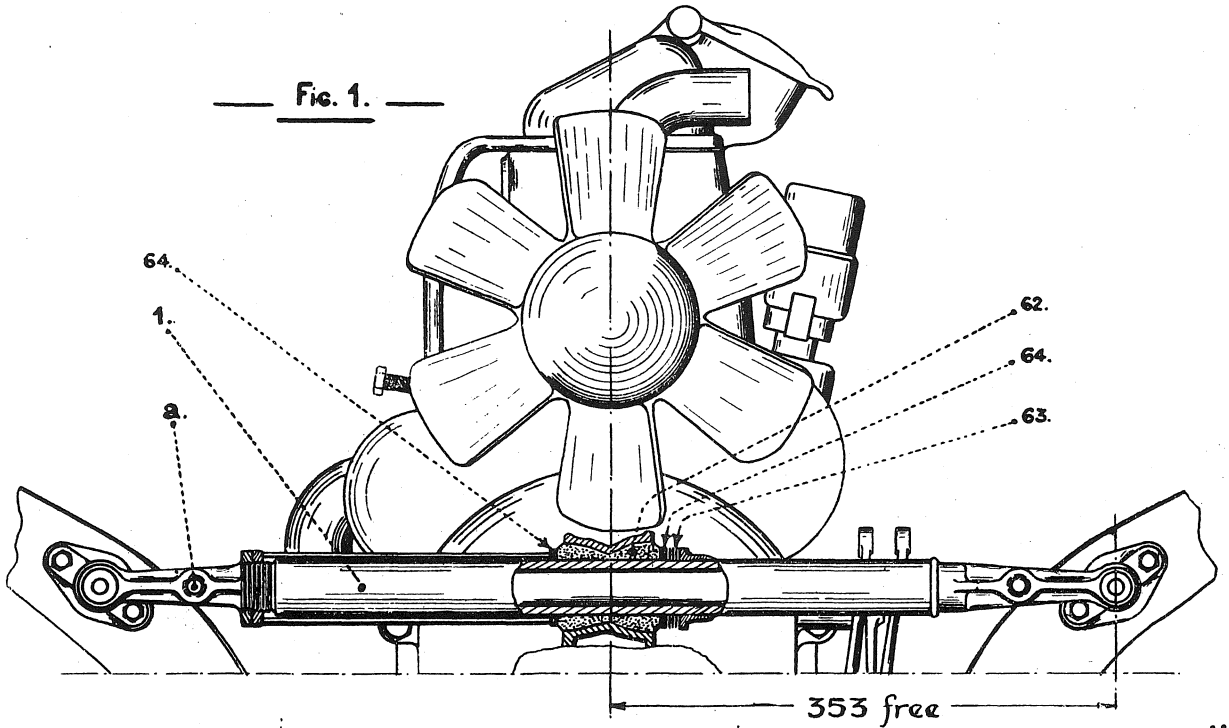


— USE OF STAND MR.3300-20 —

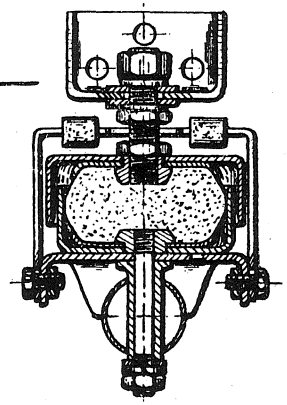
— ENGINE —

— FRONT AND REAR SUSPENSION —

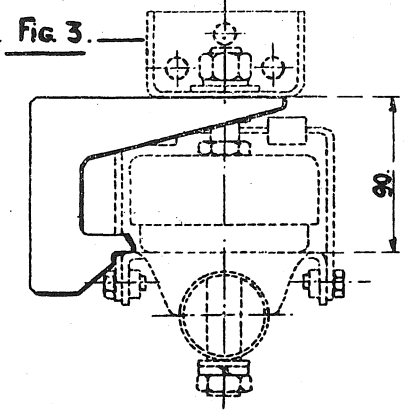
— Fig. 1. —



— Fig. 2. —

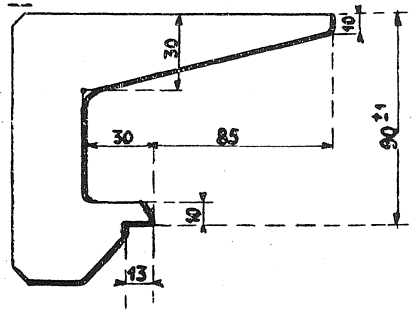


— Fig. 3. —

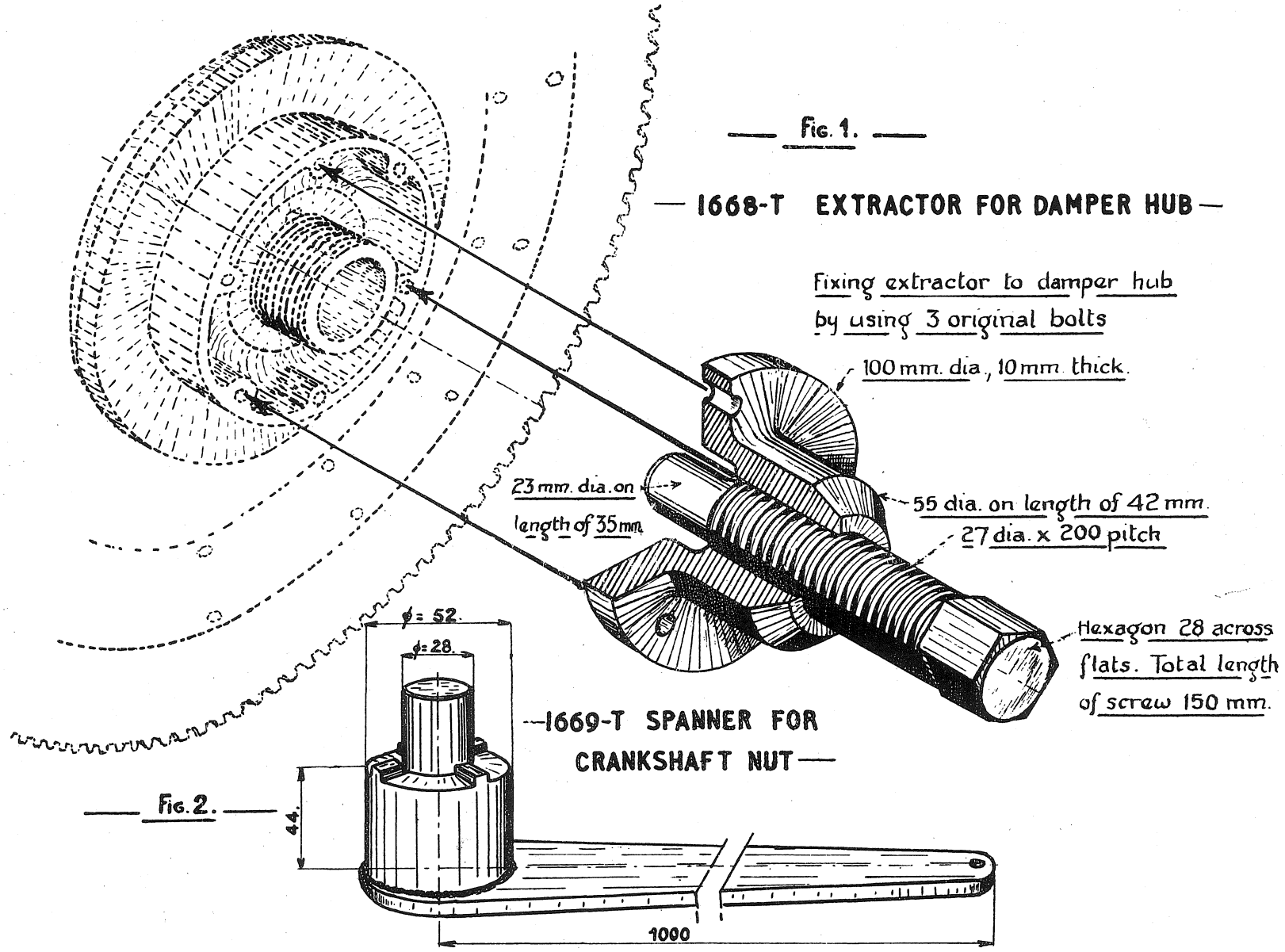


— HEIGHT GAUGE MR. 3450 —

— Fig. 4. —



— DISMANTLING DAMPER HUB —

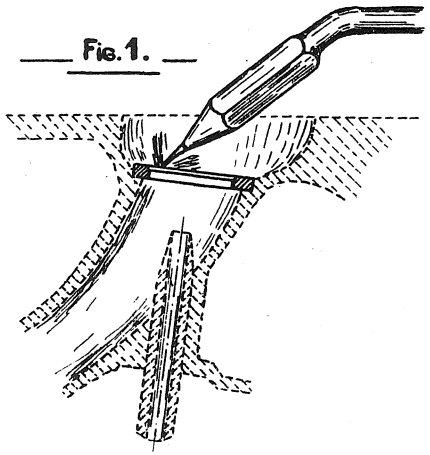


— ENGINE —

— REPLACEMENT OF VALVE SEATS AND GUIDES —

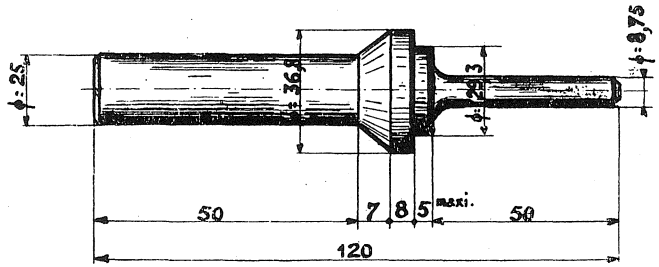
— REPLACEMENT OF A VALVE SEAT —

— Fig. 1. —



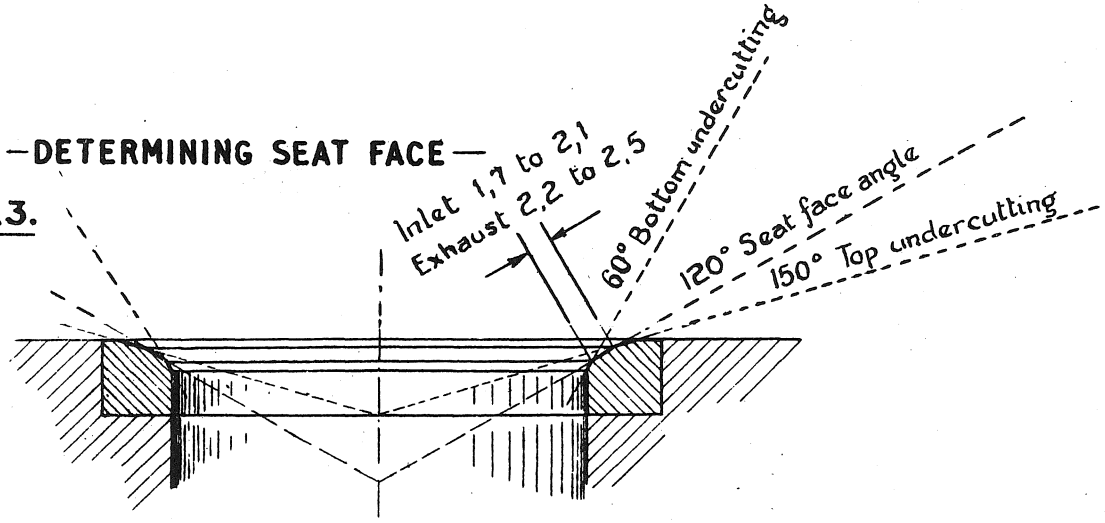
MR. 3098-B MANDREL

— Fig. 2. —



— DETERMINING SEAT FACE —

— Fig. 3.

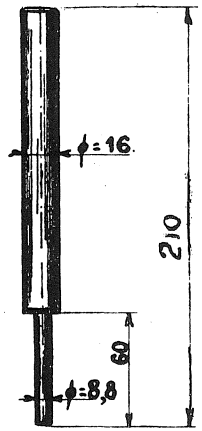


— REPLACEMENT OF A VALVE GUIDE —

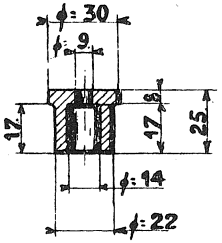
MANDREL & FERRULE FOR FITTING GUIDES

— Fig. 4. —

MANDREL MR. 1620-1

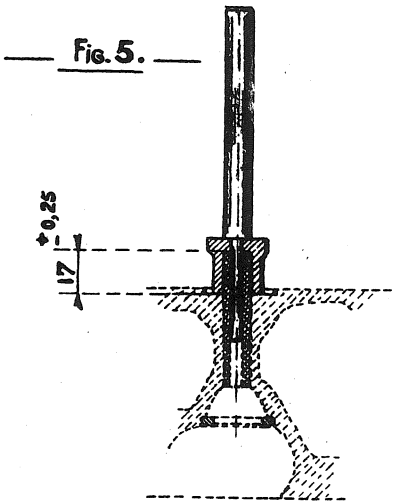


FERRULE MR. 1620-4

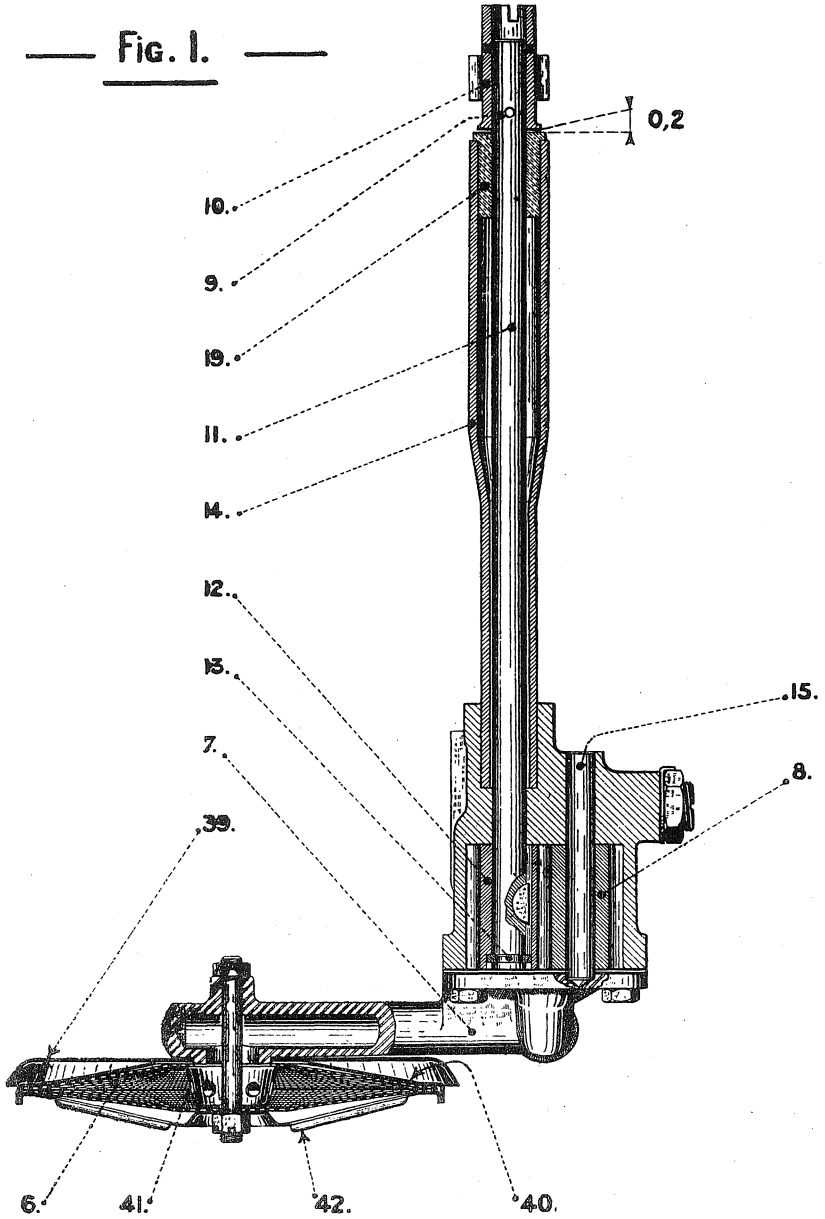


— USE OF MANDREL MR. 1620 —

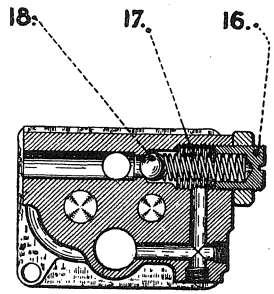
— Fig. 5. —



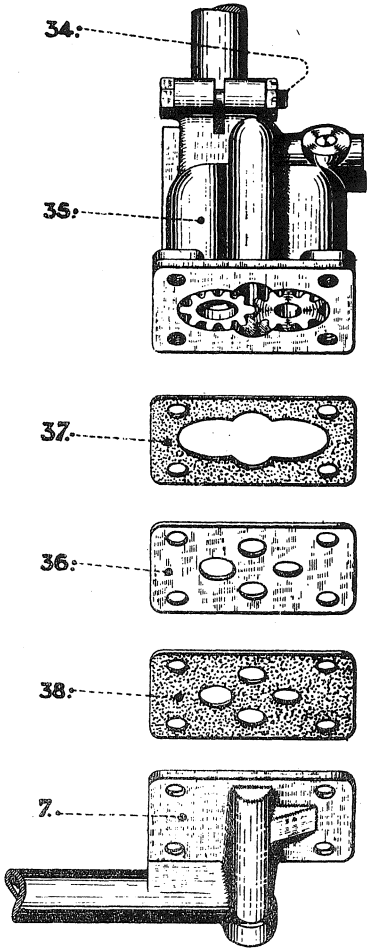
— Fig. 1. —



— Fig. 2. —



— Fig. 3. —



—ENGINE—

— SPRING TESTING —

— SPRING TESTING APPARATUS 2420-T AND METHOD OF USE —

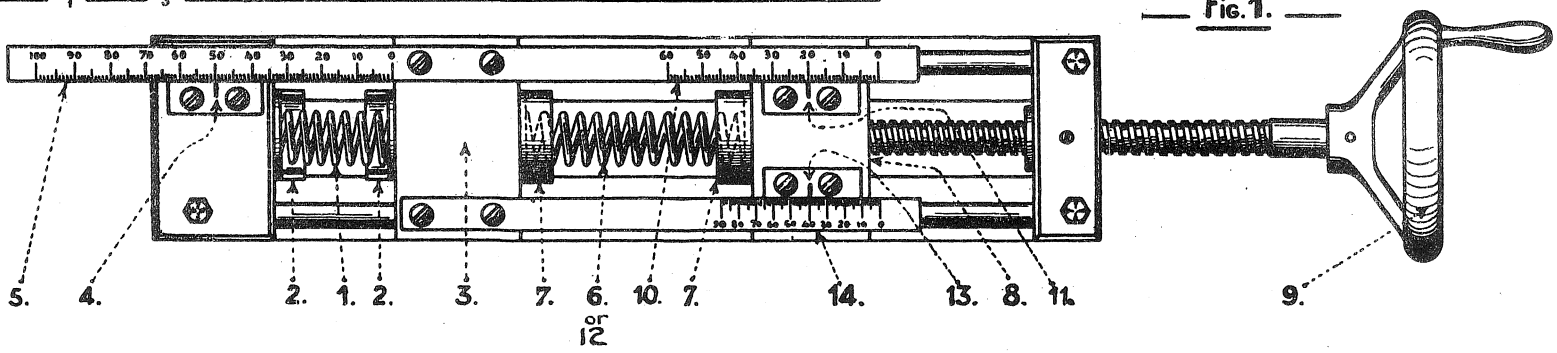
1. CHECKING FREE LENGTH OF SPRING. Place spring to be checked "1" between the guides "2". Draw slide "3" into contact. The line "4" comes opposite scale of lengths "5" indicating free length of spring "1".

2. CHECKING LENGTH UNDER LOAD. (a) Place standard spring "6" (or "12" according to requirements) in two guides "7" and draw slide "8" into contact by means of hand wheel "9". (b) By means of hand wheel "9" bring the spring to be checked "1" to the length under load indicated in the book. Read the length shown by line "4" against length scale "5".

(c) Read on scale { "10" (in kilogrammes) opposite line "11" (If using standard spring "6").
"14" (in kilogrammes) opposite line "13" (If using standard spring "12")

the corresponding load which must be within the limits stated in the book.

— Fig. 1. —



— Fig. 2. —

SPRING 2421-T

Spring deflection 1mm. per kilogram.

THIS SPRING IS PAINTED YELLOW

STANDARD SPRINGS

SPRING 2422-T

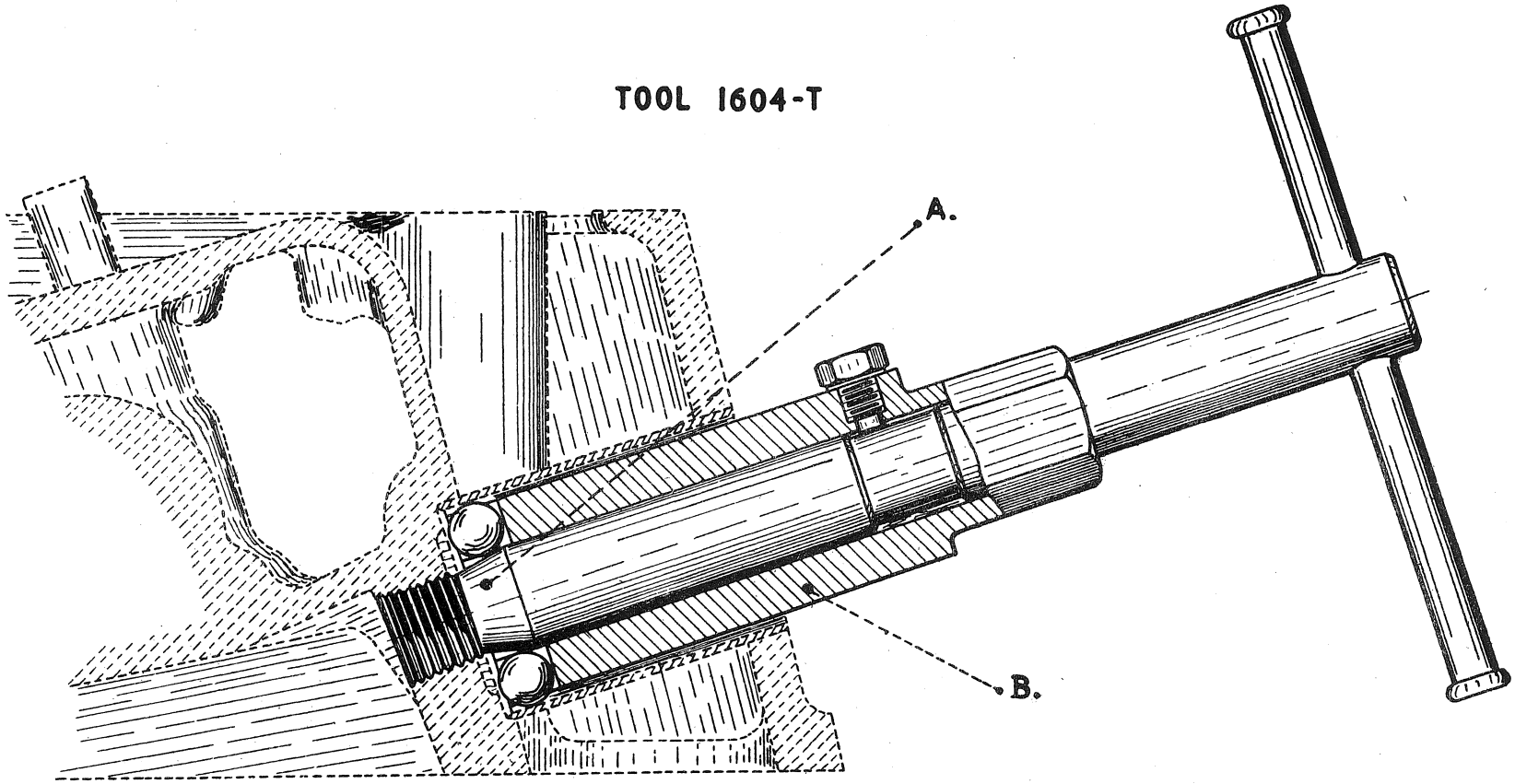
— Fig. 3. —

Spring deflection 1mm. per 2 kilogrammes.

THIS SPRING IS PAINTED RED

— FITTING SPARK PLUG HOUSINGS —

TOOL 1604-T



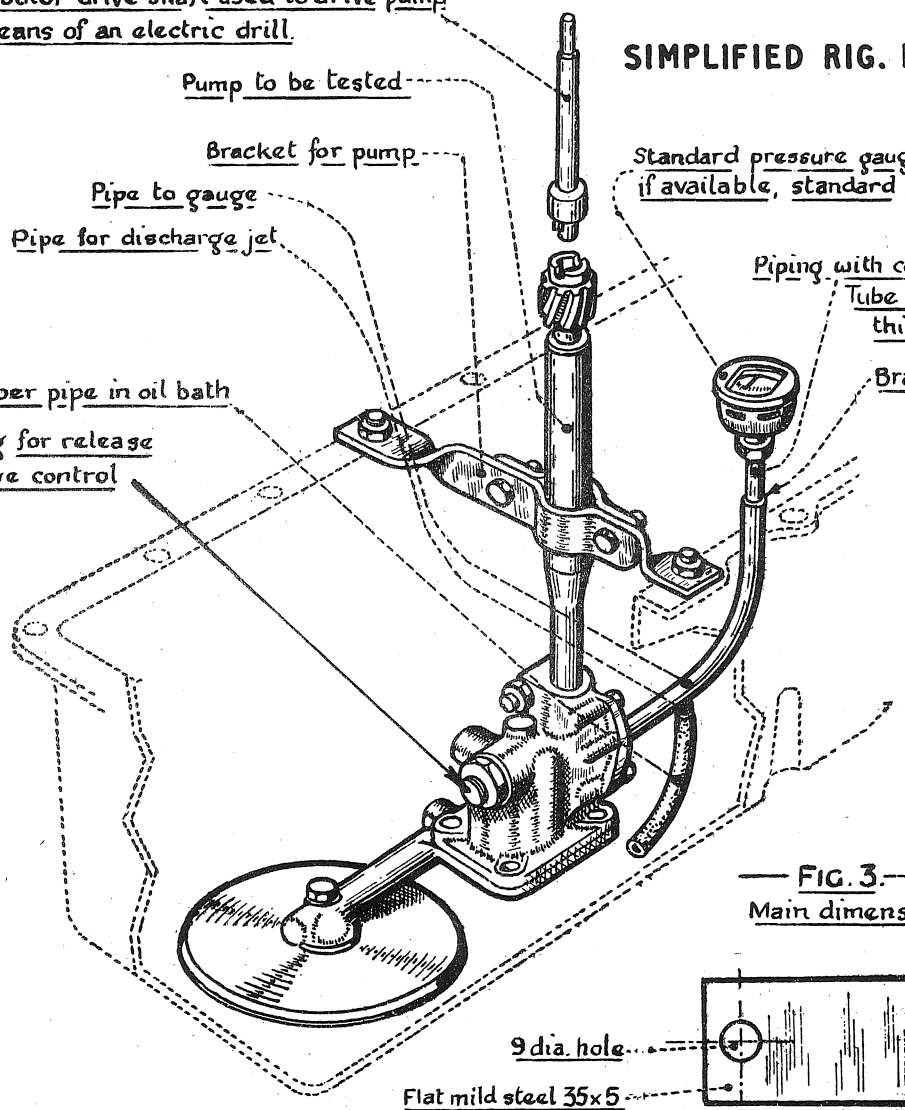
Push body "B" into spark plug housing.
Screw cone "A" into threaded hole for spark plug in order to exert pressure on the balls.
By means of a spanner, 19 mm. across flats, rotate body "B" one revolution.
Screw in cone "A" again and then rotate body "B" another turn.
In general, two turns are sufficient to ensure a water-tight fit.

— ENGINE —

— TESTING OIL PUMP —

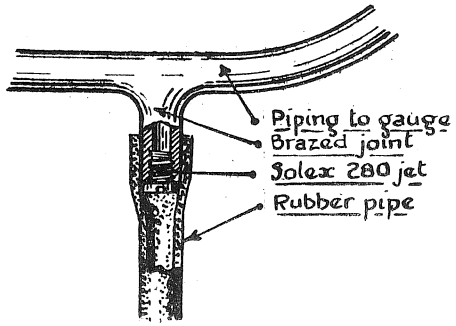
— FIG. 1. —

SIMPLIFIED RIG. MR. 1811



ASSEMBLY OF JET LIMITING DISCHARGE

— FIG. 2. —

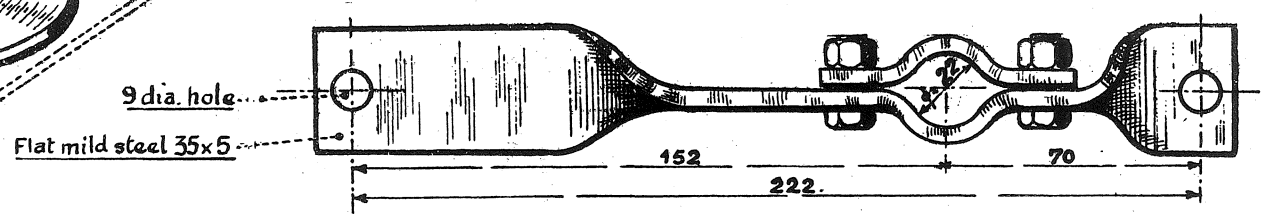


The pump to be tested is fitted on an engine sump and driven by an electric drill at a speed between 1000 and 1500 r.p.m. (Normal speed of machine and usually marked on maker's name plate).
Use winter grade oil similar to "MOBILOIL ARCTIC"
NOTE: If possible heat oil to 140° F. ± 9° F.
The gauge pressure must be 35 lbs./sq.in.
If this is not possible bring oil to 20° F.
The pressure then must be 40 lbs./sq.in.
To bring pressure to correct figure { Screw up plug "16" of release valve to increase pressure. / Unscrew plug "16" of release valve to reduce pressure.

— FIG. 3. —

OIL PUMP BRACKET

Main dimensions to allow fitting on Six Cylinder or Fifteen sump.



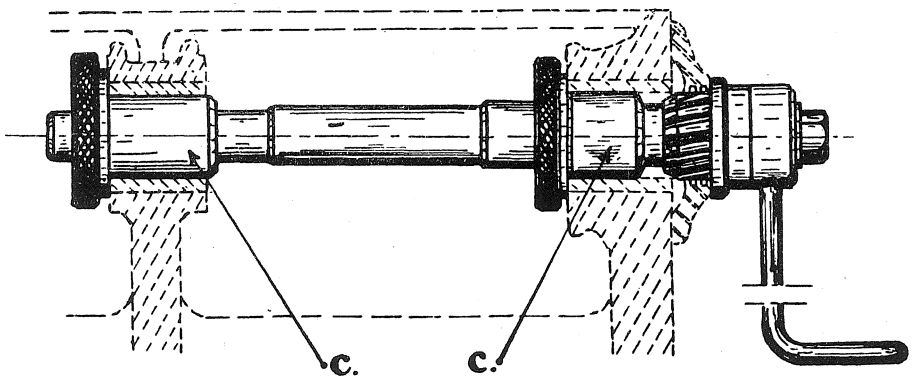
— ENGINE —

— CRANKSHAFT —

— BORING OIL BAFFLES —

BORING TOOL 1665-T

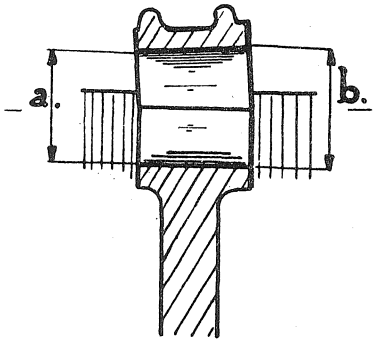
— Fig. 1. —



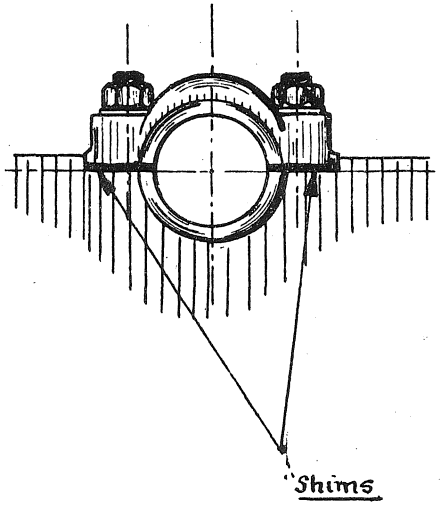
There are three sets of bushes "C"
1: Outside diameter 50 (for bearings to the original size of crankshaft.
2: Outside diameter 49,5 (for bearings of first regrind of crankshaft.
3: Outside diameter 49 (for bearings of second regrind of crankshaft

— FITTING MAIN BEARING CAPS —

— Fig. 2. —



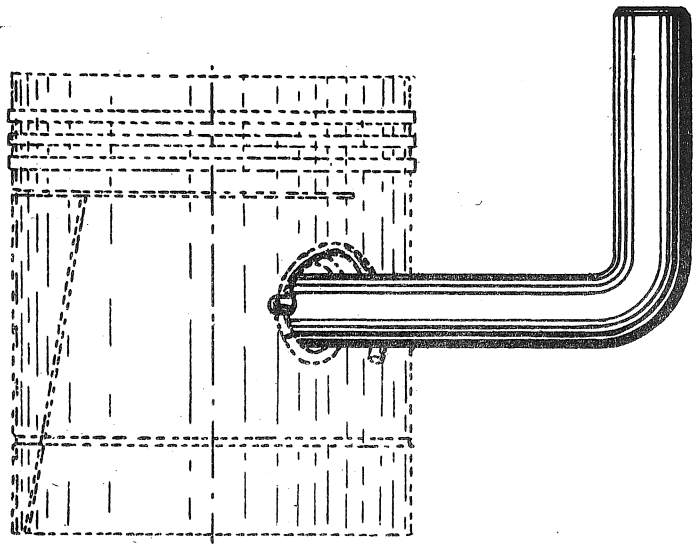
— Fig. 3. —



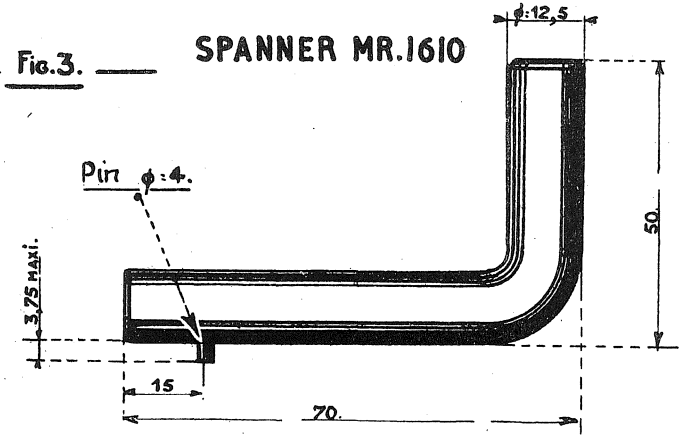
— FITTING GUDGEON PIN CIRCLIPS —

USE OF SPANNER MR.1610

— Fig.1. —

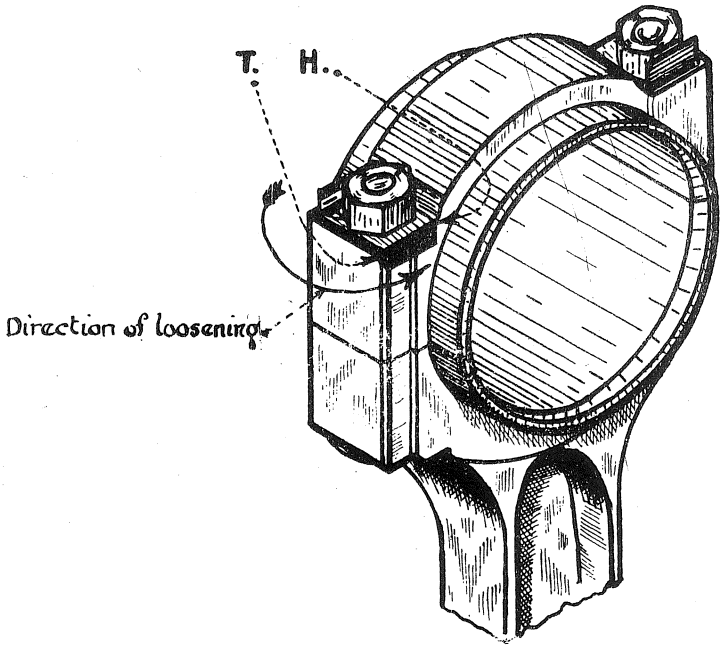


— Fig.3. — SPANNER MR.1610



— LOCKING CONNECTING ROD NUTS —

— Fig.2. —

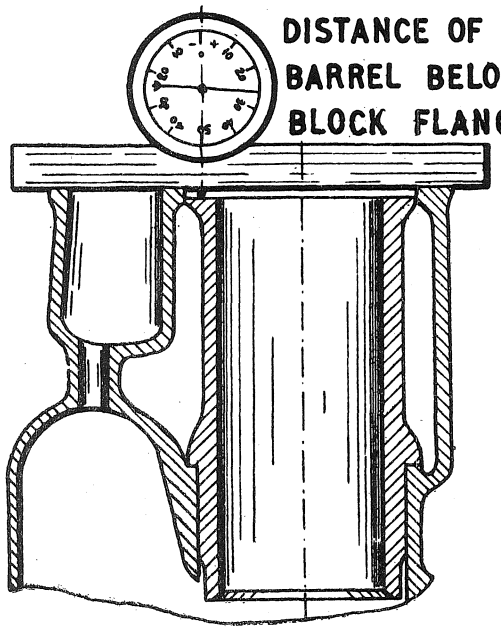


Tab "T" of each lockwasher must butt at "H" in order to prevent nuts turning in the direction of loosening.

— GAUGING HEIGHT OF CYLINDER BARRELS —

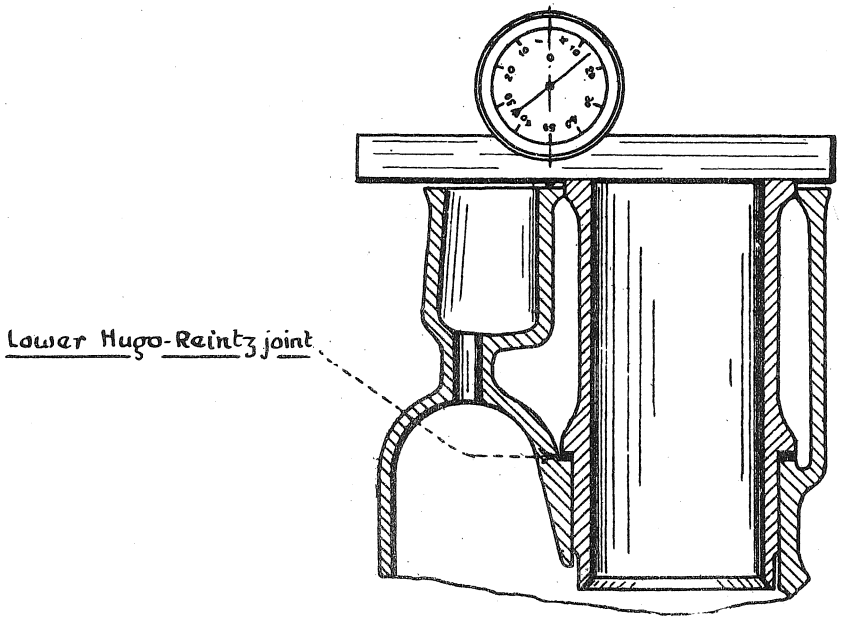
— Fig. 1. —

MEASURING THE DISTANCE OF THE BARREL BELOW BLOCK FLANGE



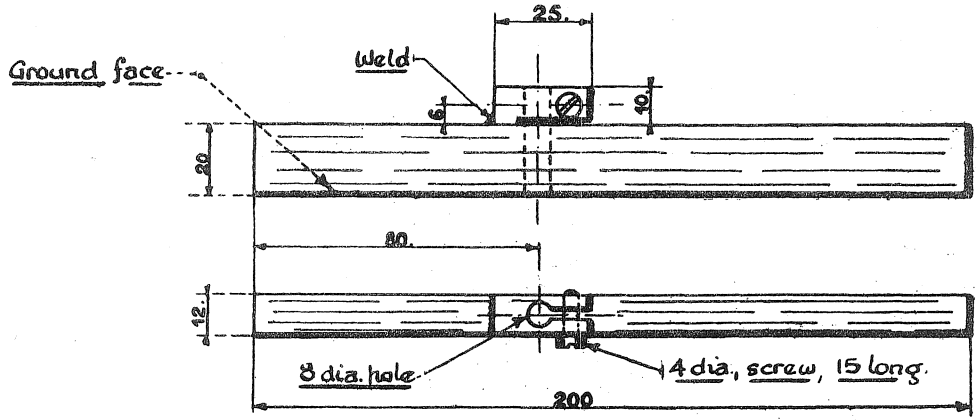
MEASURING THE AMOUNT THE BARREL STANDS PROUD OF BLOCK FLANGE AFTER FITTING LOWER JOINT

— Fig. 2. —



— Fig. 3. —

APPARATUS MR.3377



1. PREPARING APPARATUS.

Place bracket MR.3377, fitted with a clock gauge, on a surface plate or straight edge. With the clock gauge needle indicating about 2 mm., bring the dial to zero.

2. MEASURING DISTANCE OF BARREL BELOW CYLINDER BLOCK FLANGE (without lower joint) FIG. 1.

Place the apparatus, as prepared above, on the cylinder block with the clock gauge pointer bearing on the top face of the barrel. Take readings at four cardinal points on barrel and find the average of the four.

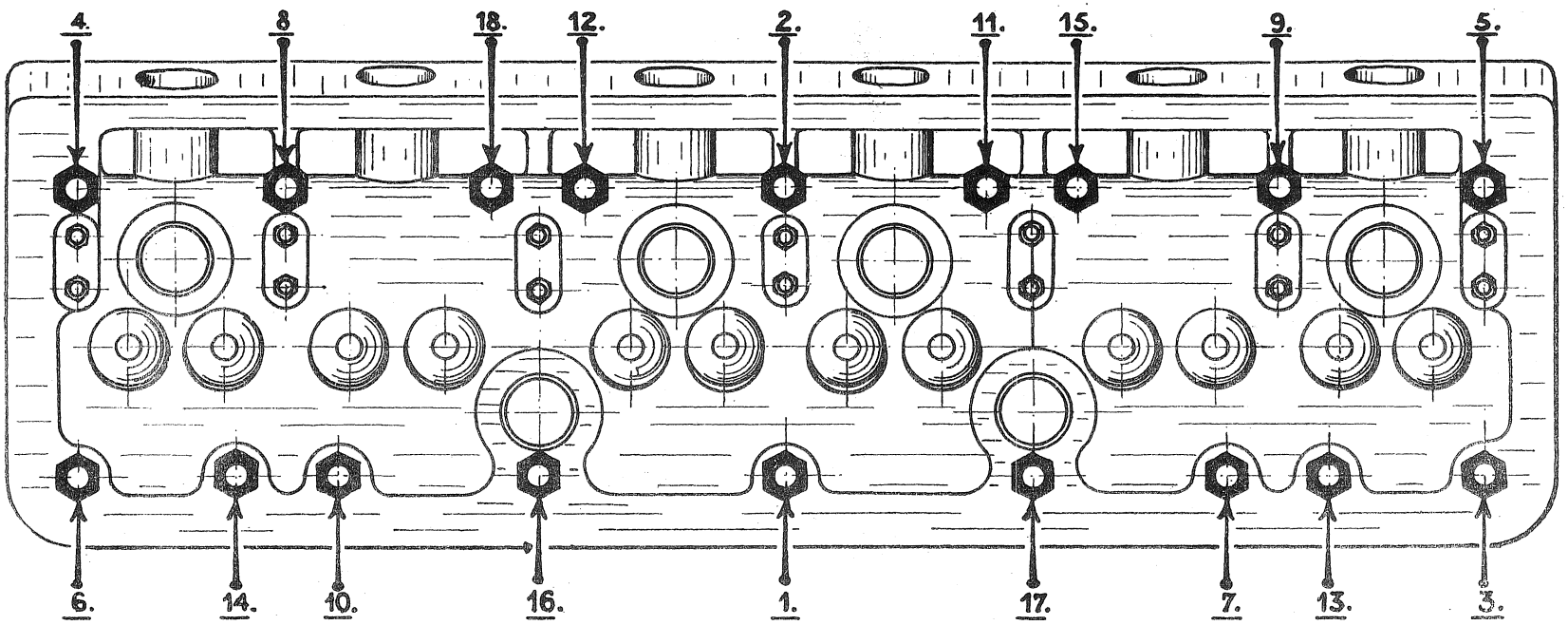
3. MEASURING HEIGHT OF BARREL (lower joint fitted) FIG. 2.

Place apparatus on barrel with pointer contacting cylinder block. The indicated height must be between 0,08 mm. and 0,12 mm.

— ENGINE —

— TIGHTENING CYLINDER HEAD —

— Fig. 1. —



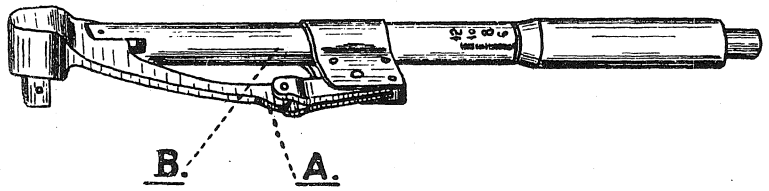
TIGHTNESS OF CYLINDER HEAD NUTS

1st. tightening : 2 m.kg. (14,5 foot-pounds)
2nd. tightening : 5 m.kg. (36,17 foot-pounds)
Tightening when hot : 5 m.kg. (36,17 foot-pounds)

It is recommended to tighten the cylinder head nuts in the order indicated above. The degree of tightness must be strictly adhered to. It is essential to use a torsion wrench. This wrench is graduated in meter-kilograms for direct reading and has a square shaft of 12,7 mm. which accommodates either F.A.C.O.M. or SNAP-ON types of socket.
When effort has reached correct point on graduation, and articulation "A" folds, stop tightening. Articulation "A" must never contact body of spanner at "B".

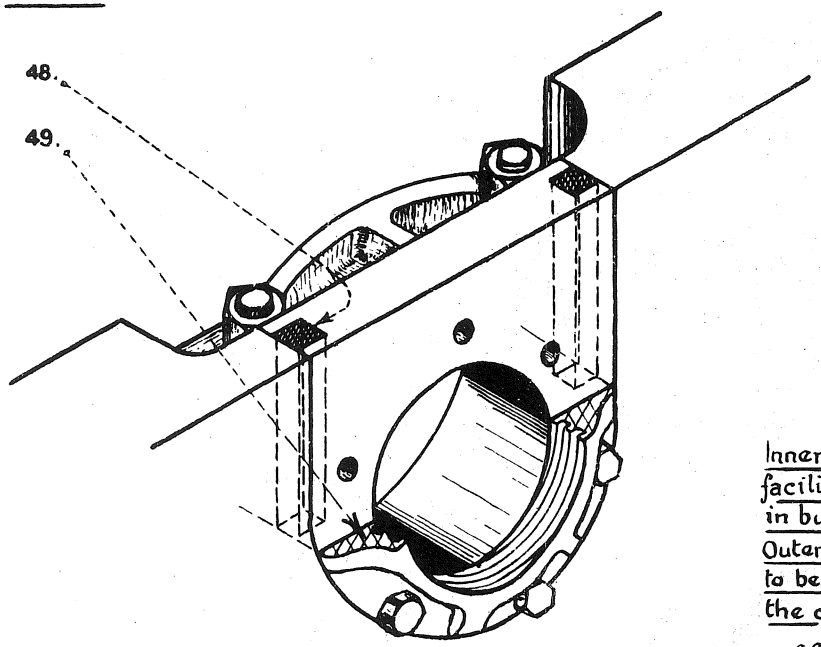
— Fig. 2. —

TORSION WRENCH
2470-T



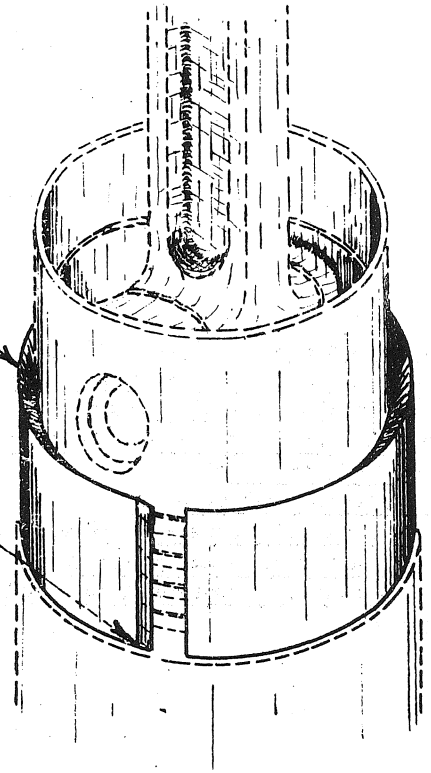
FITTING MAIN BEARING CAP GASKETS

Fig. 1.



FITTING PISTONS

Fig. 2.



GUIDE BUSH FOR PISTON RINGS 1656 T

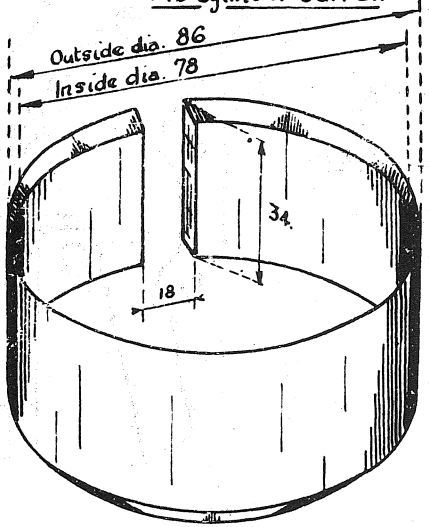


Fig. 3.

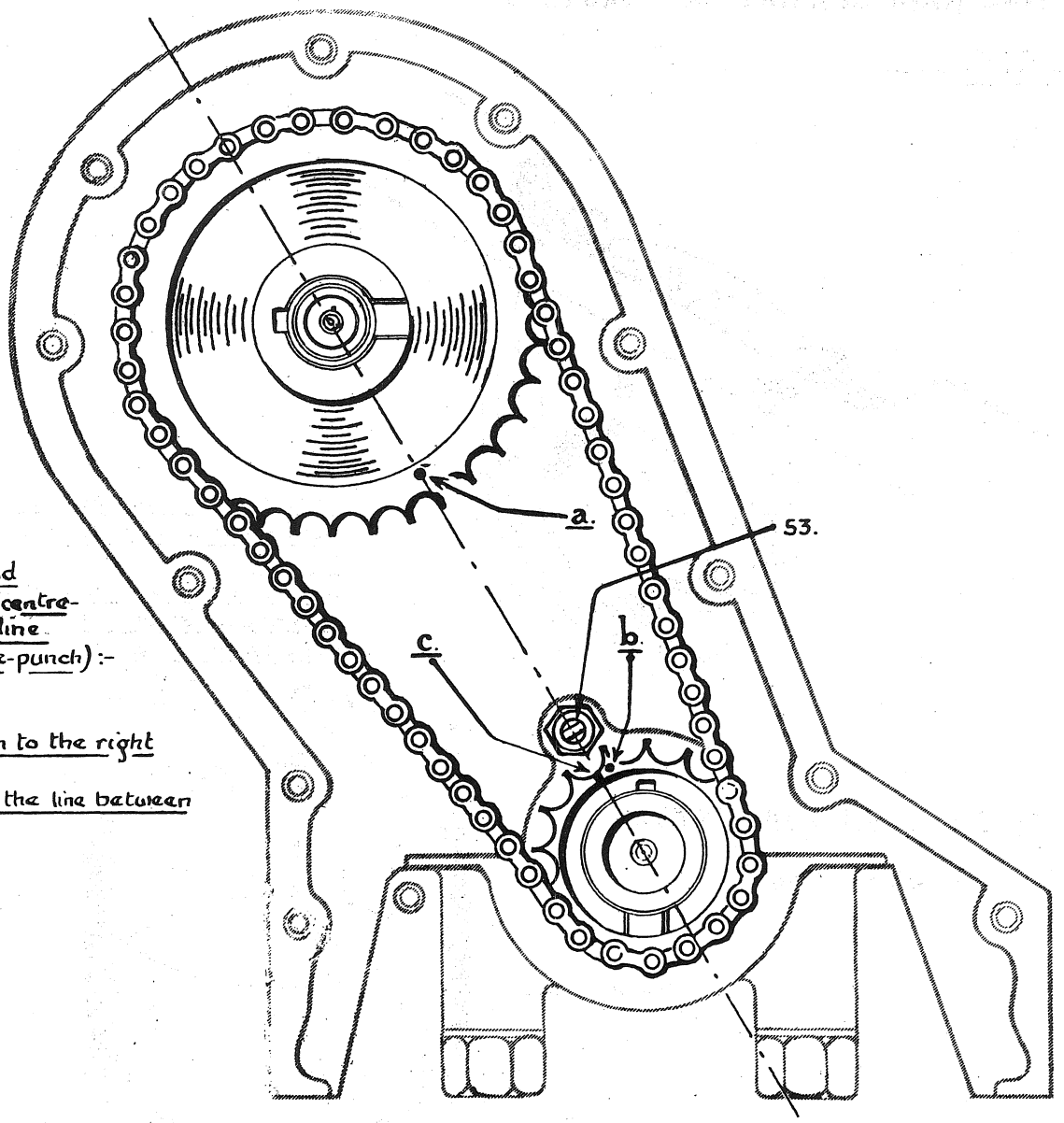
ENGINE

SETTING TIMING WHEELS

The end cylinders being at approximately top dead centre, the centres of both wheels and mark "a" (centre-punch) on camshaft wheel must be in a straight line
The crankshaft wheel is marked (by line or centre-punch) :-

1. On a tooth as at "b"
2. or between teeth as at "c"

In the first case "b" the mark is offset half a tooth to the right of the line between wheel centres.
In the second case "c" the mark coincides with the line between wheel centres.

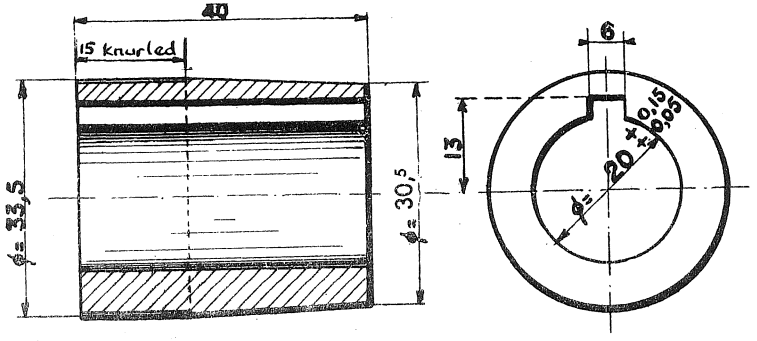


— ENGINE —

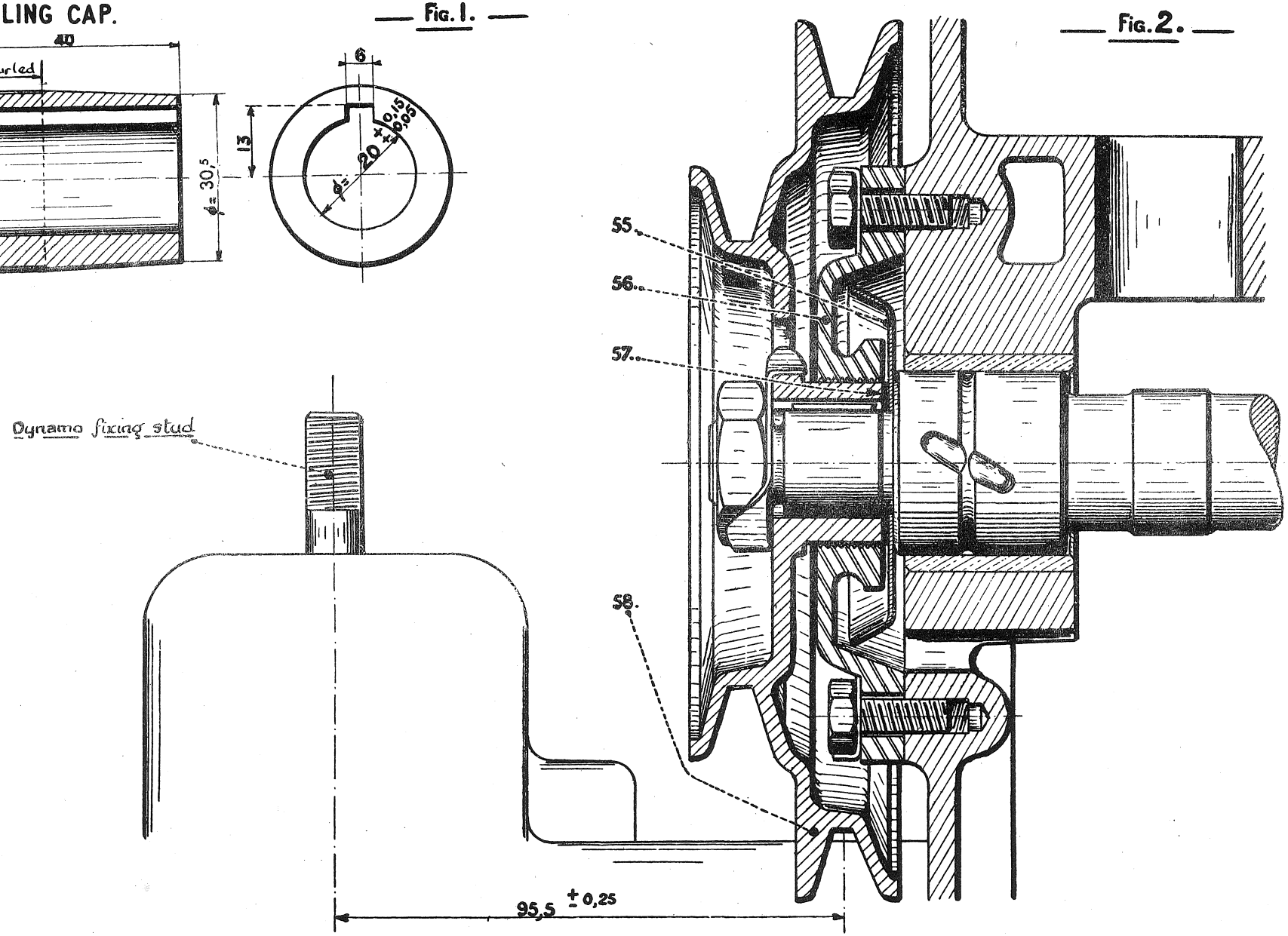
— ASSEMBLY OF DOUBLE PULLEY —

MR. 3421 CENTRALIZING BUSH
FOR OIL SEALING CAP.

— Fig. 1. —

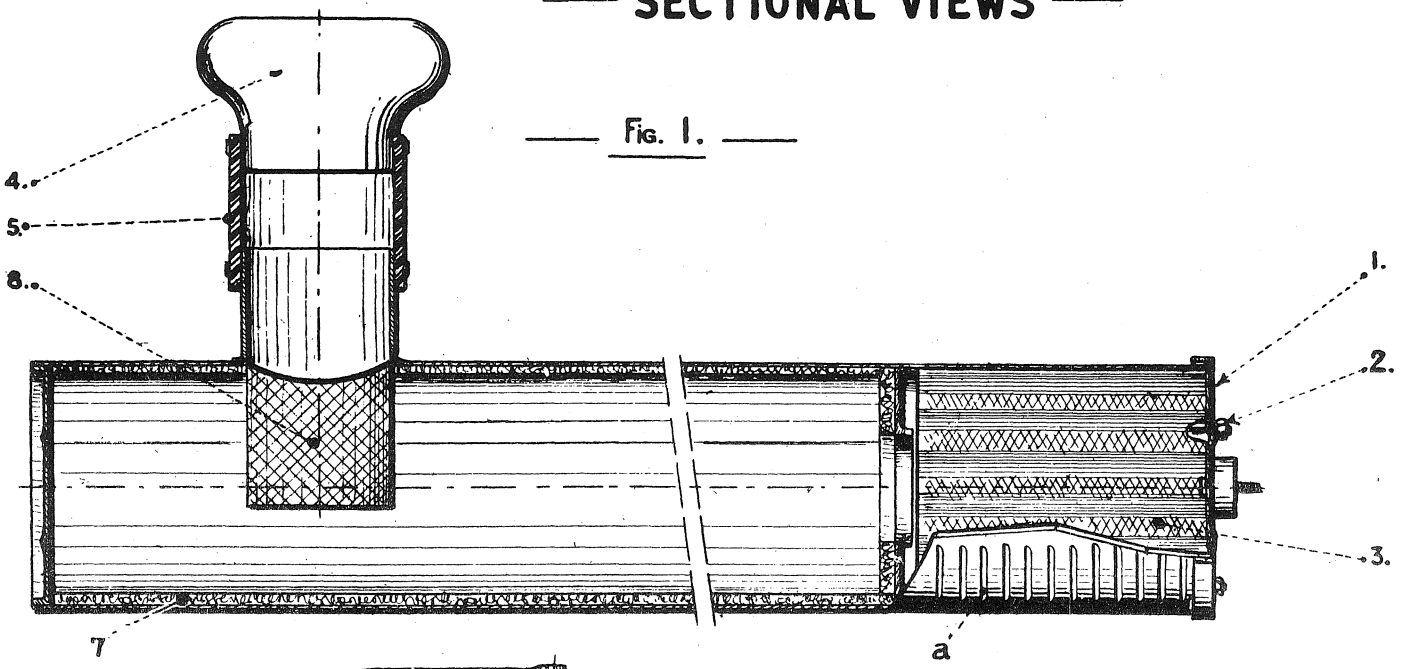


— Fig. 2. —

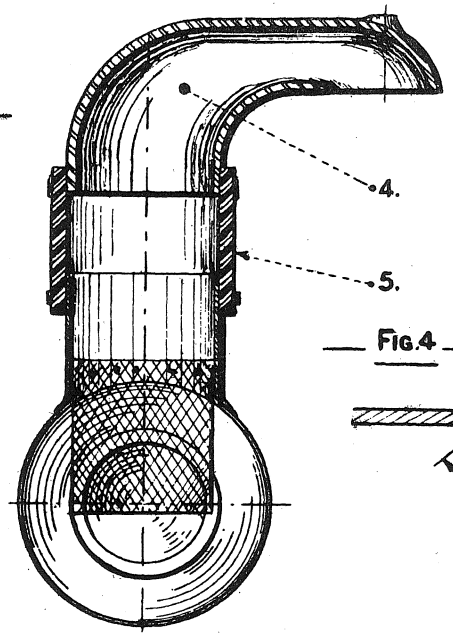


— AIR INTAKE SILENCER —
— SECTIONAL VIEWS —

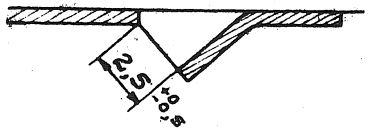
— Fig. 1. —



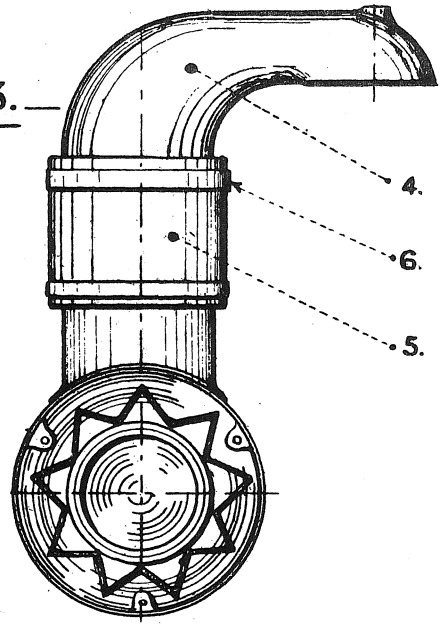
— Fig. 2. —



— Fig. 4 — DETAILS OF LOUVRE a

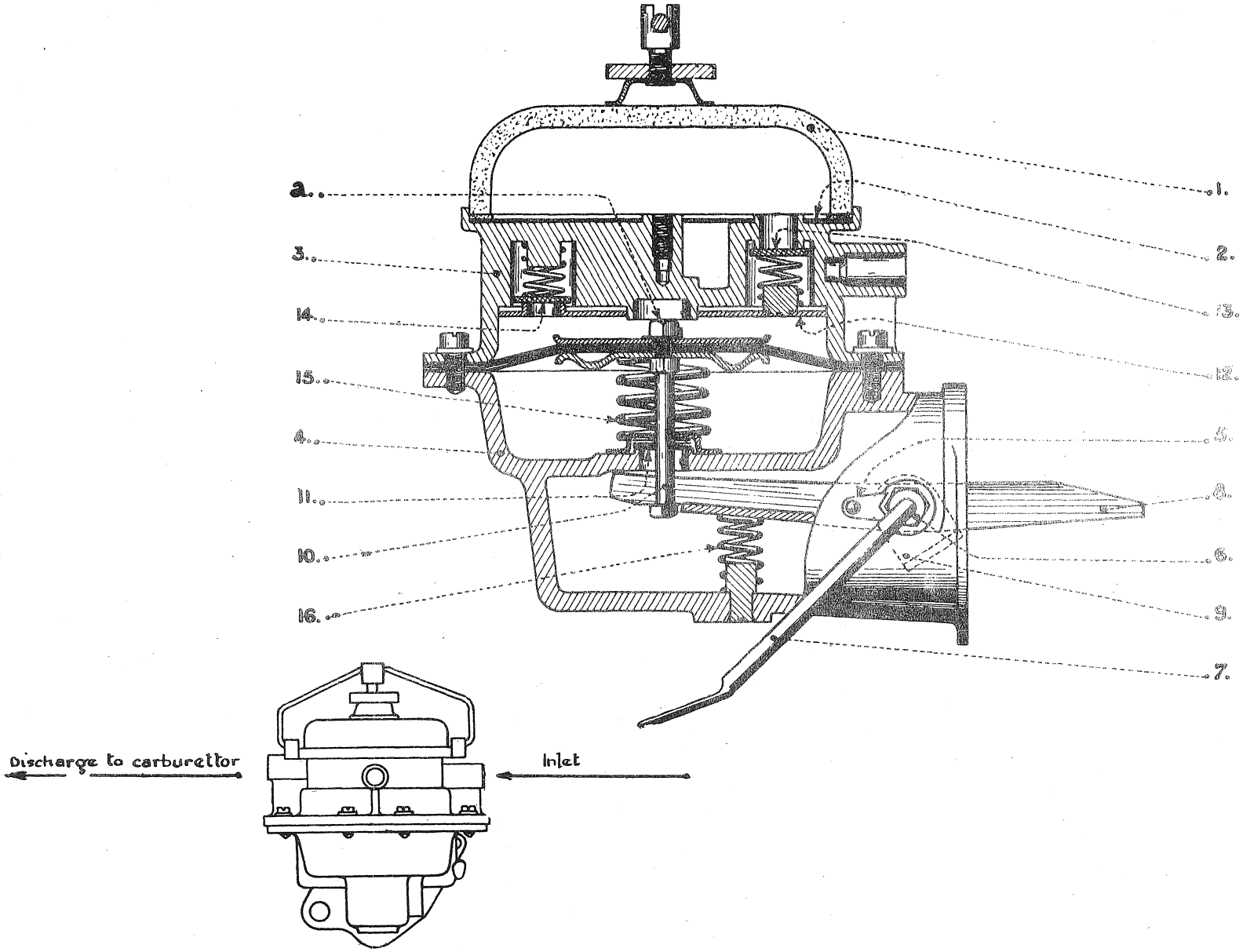


— Fig. 3. —



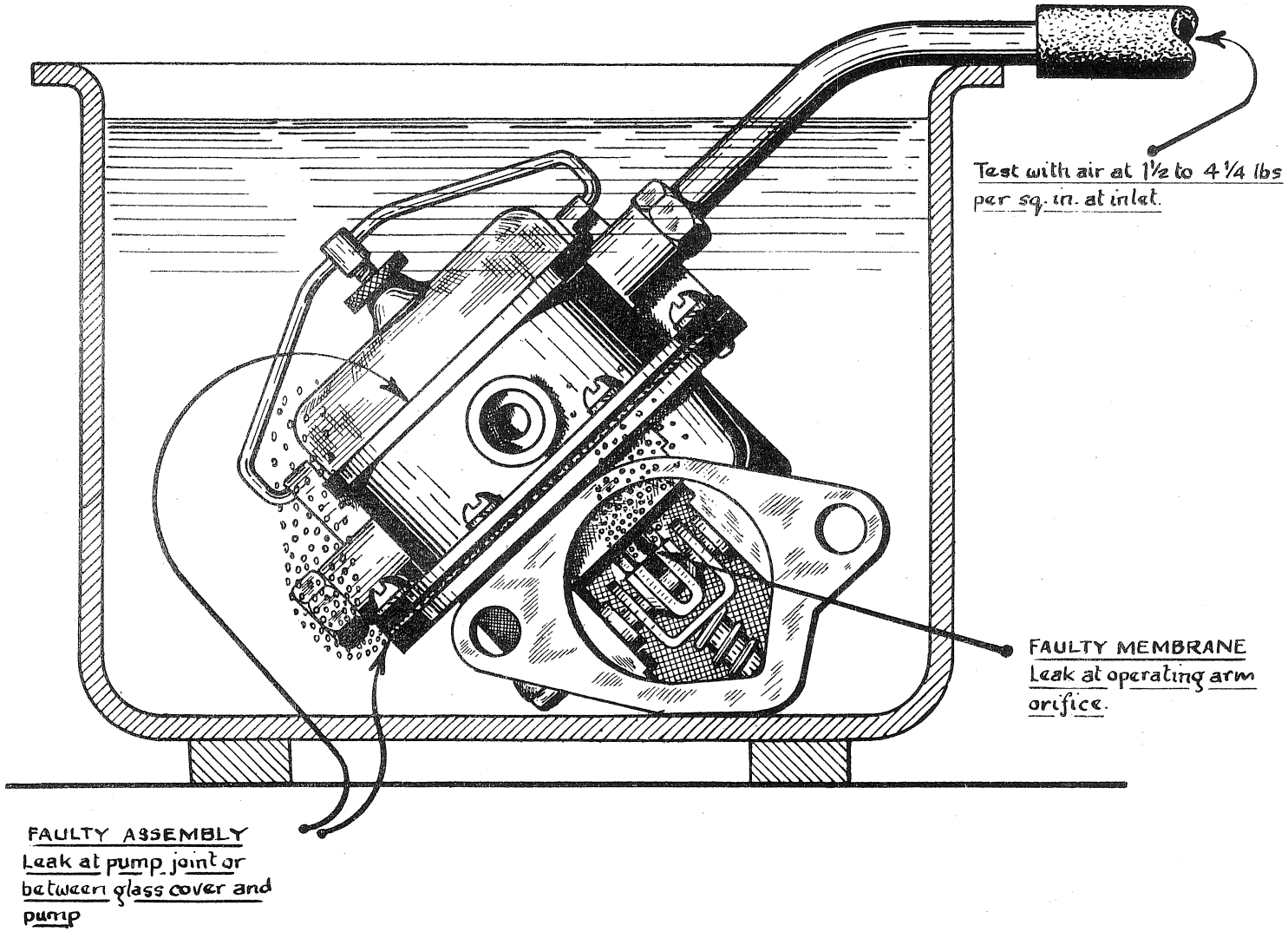
— PETROL PUMP —

— SECTION THROUGH S.E.V. TYPE PUMP —



PETROL PUMP

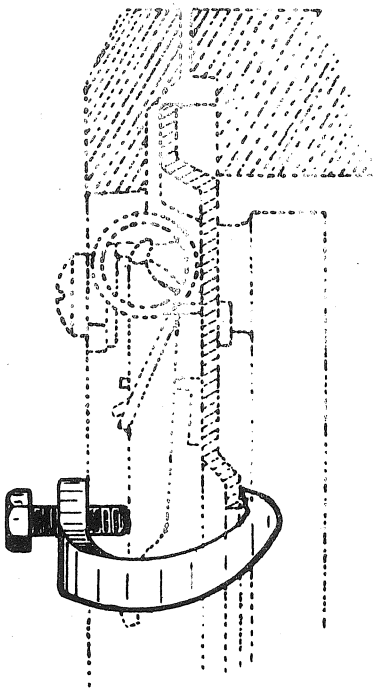
CHECKING FOR LEAKS



— CLUTCH —

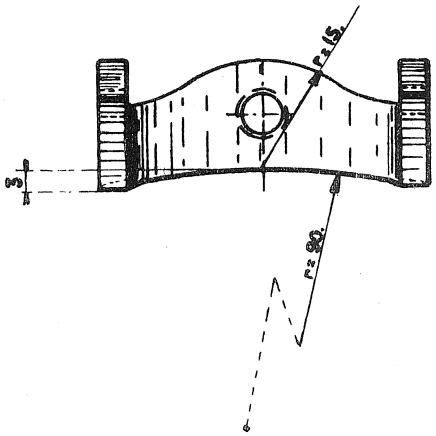
— REMOVING AND FITTING —

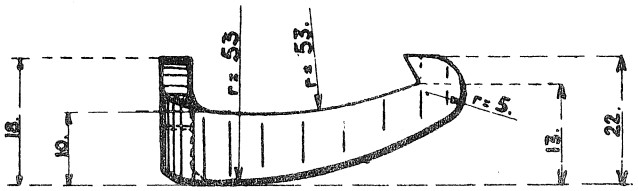
USE OF CLAMP MR. 3451



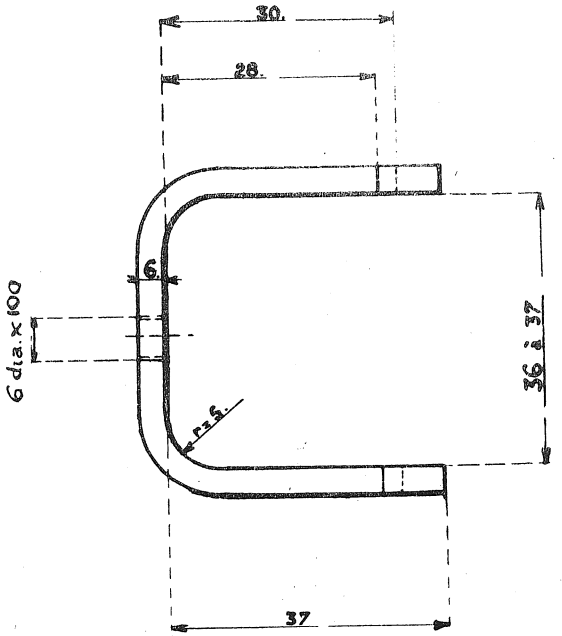
CLAMP MR. 3451

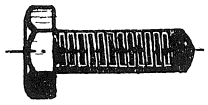
Mild Steel 3,5 mm. to 4 mm. thick





Three clamps and three screws are required for one set





Screw, 6 dia. x 100 pitch, 20 long

CLUTCH ASSEMBLY

Fig. 1.

LONGITUDINAL SECTION

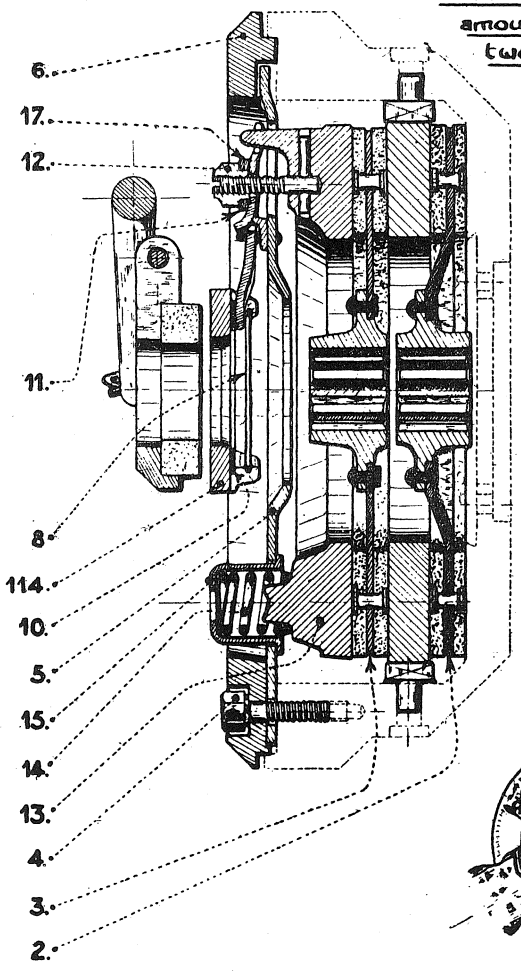


Fig. 3.

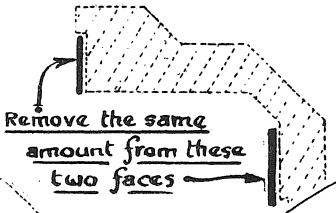


Fig. 2.

VIEW OF TOGGLES

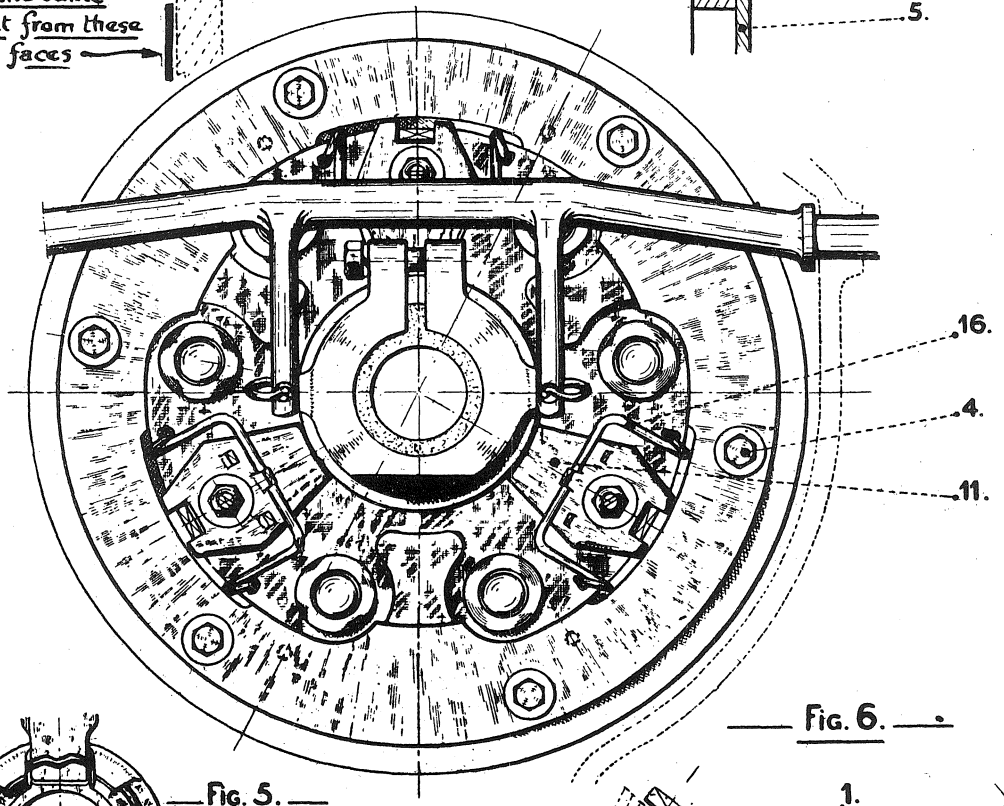


Fig. 4.

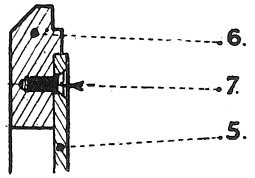


Fig. 5.

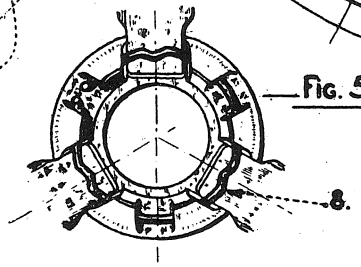
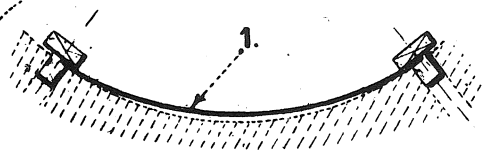


Fig. 6.



— CLUTCH —
— CLUTCH ADJUSTMENT —

FIG. 1. ADJUSTING FIXTURE 1701-T

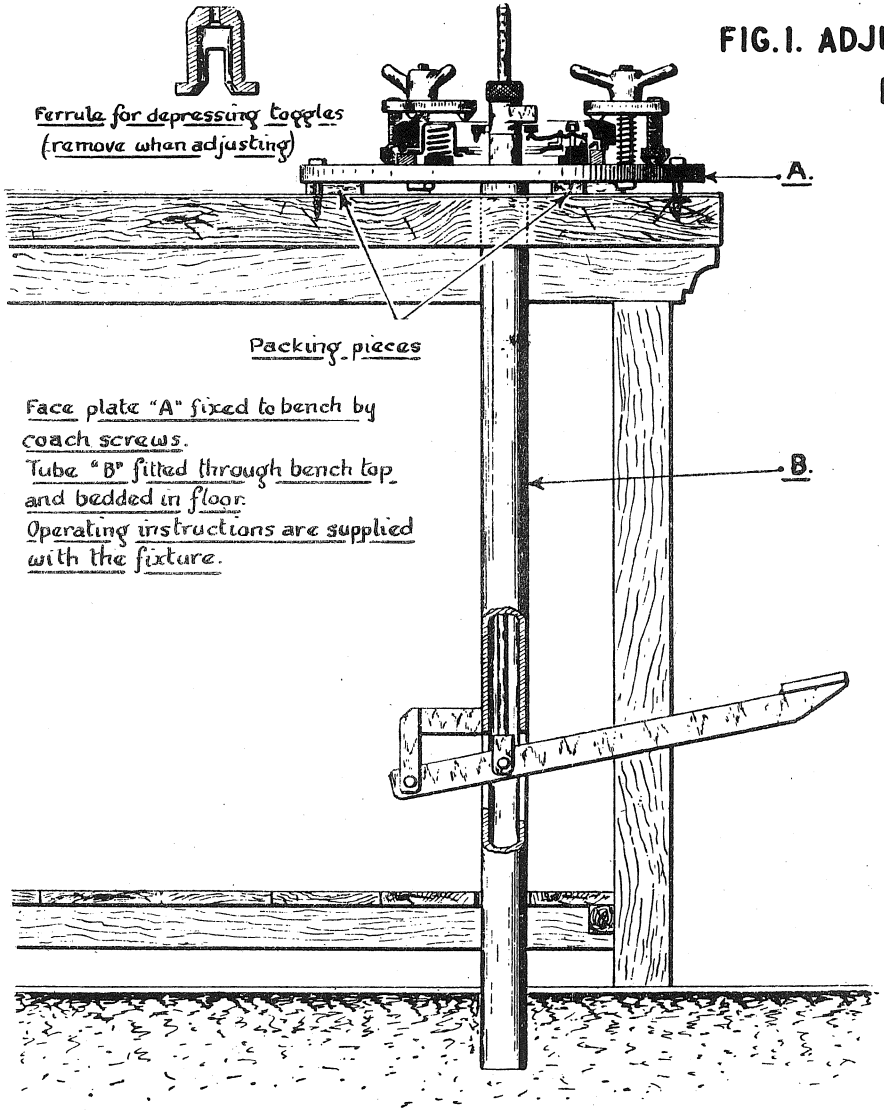
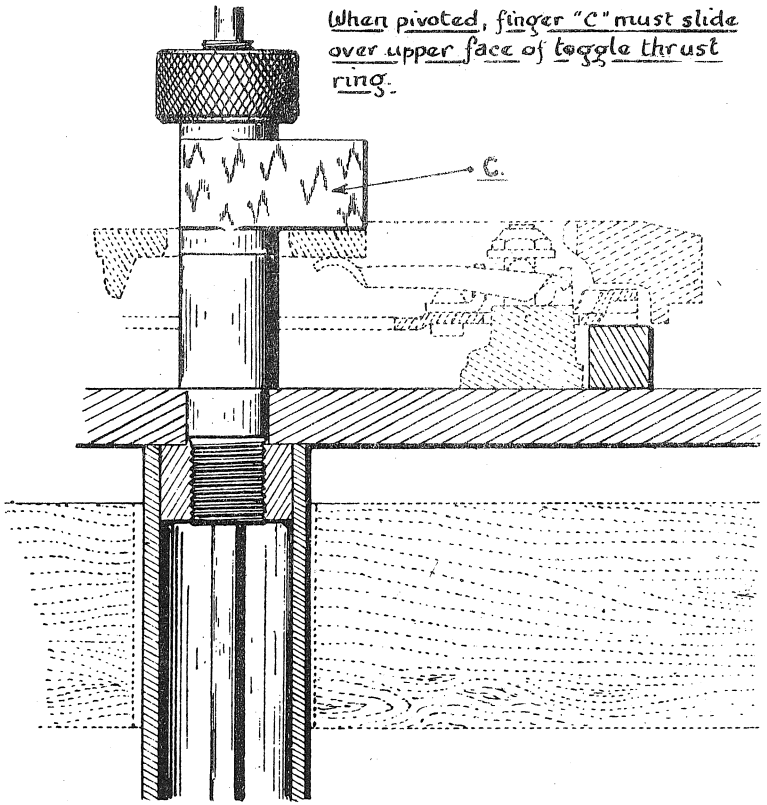


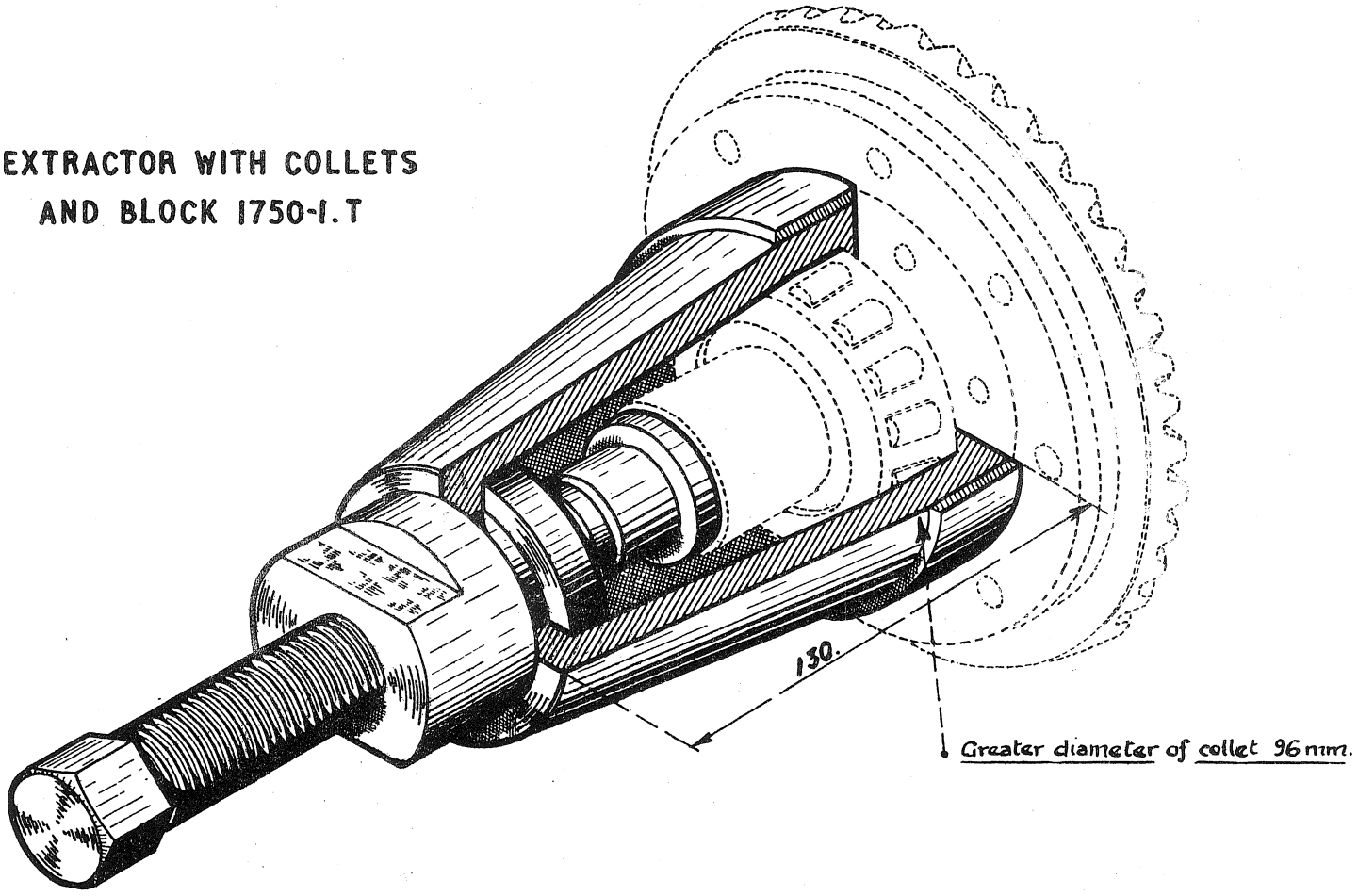
FIG. 3. CHECKING ADJUSTMENT



GEARBOX
DIFFERENTIAL

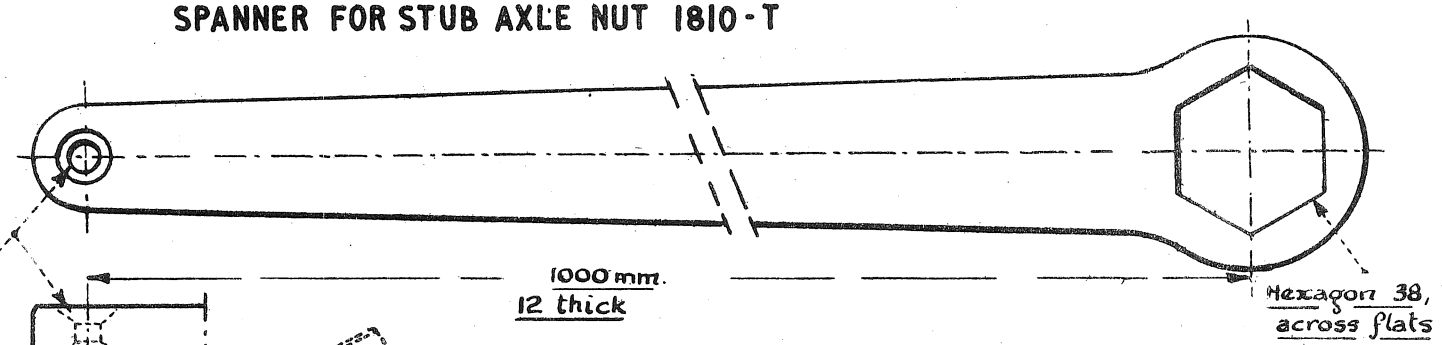
DISMANTLING DIFFERENTIAL BEARINGS

EXTRACTOR WITH COLLETS
AND BLOCK 1750-I.T



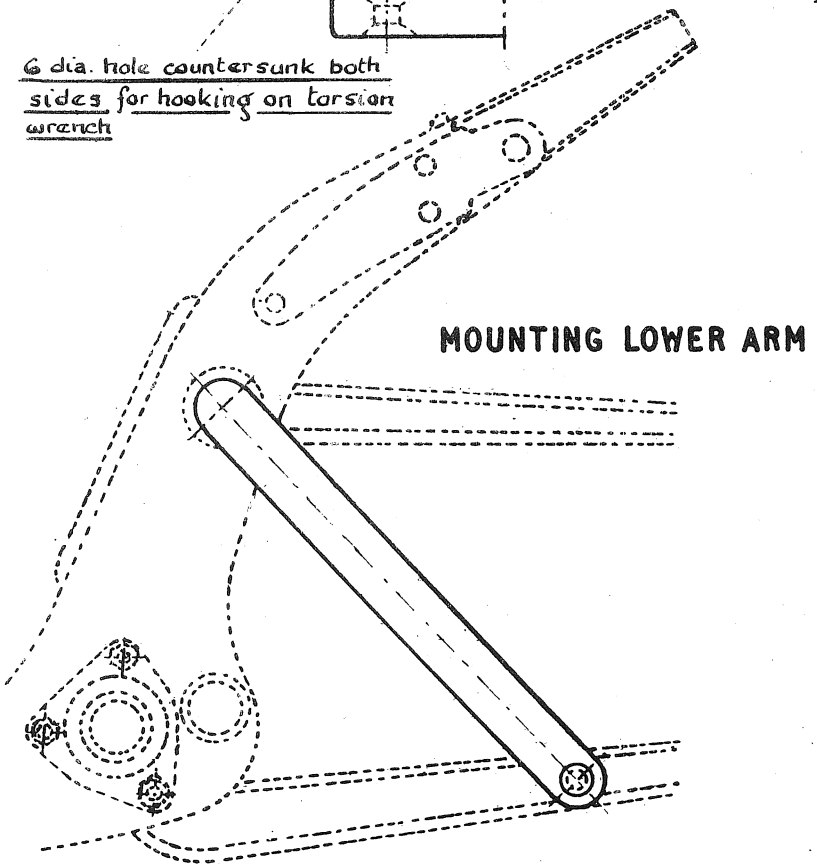
— FRONT AXLE —
— MOUNTING LOWER LINK —

SPANNER FOR STUB AXLE NUT 1810-T

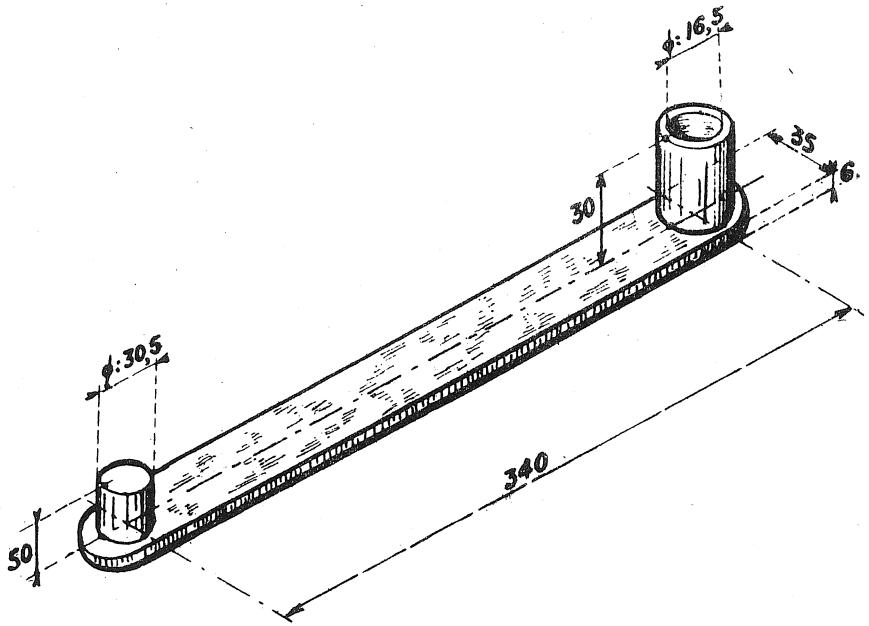


6 dia. hole countersunk both sides for hooking on torsion wrench

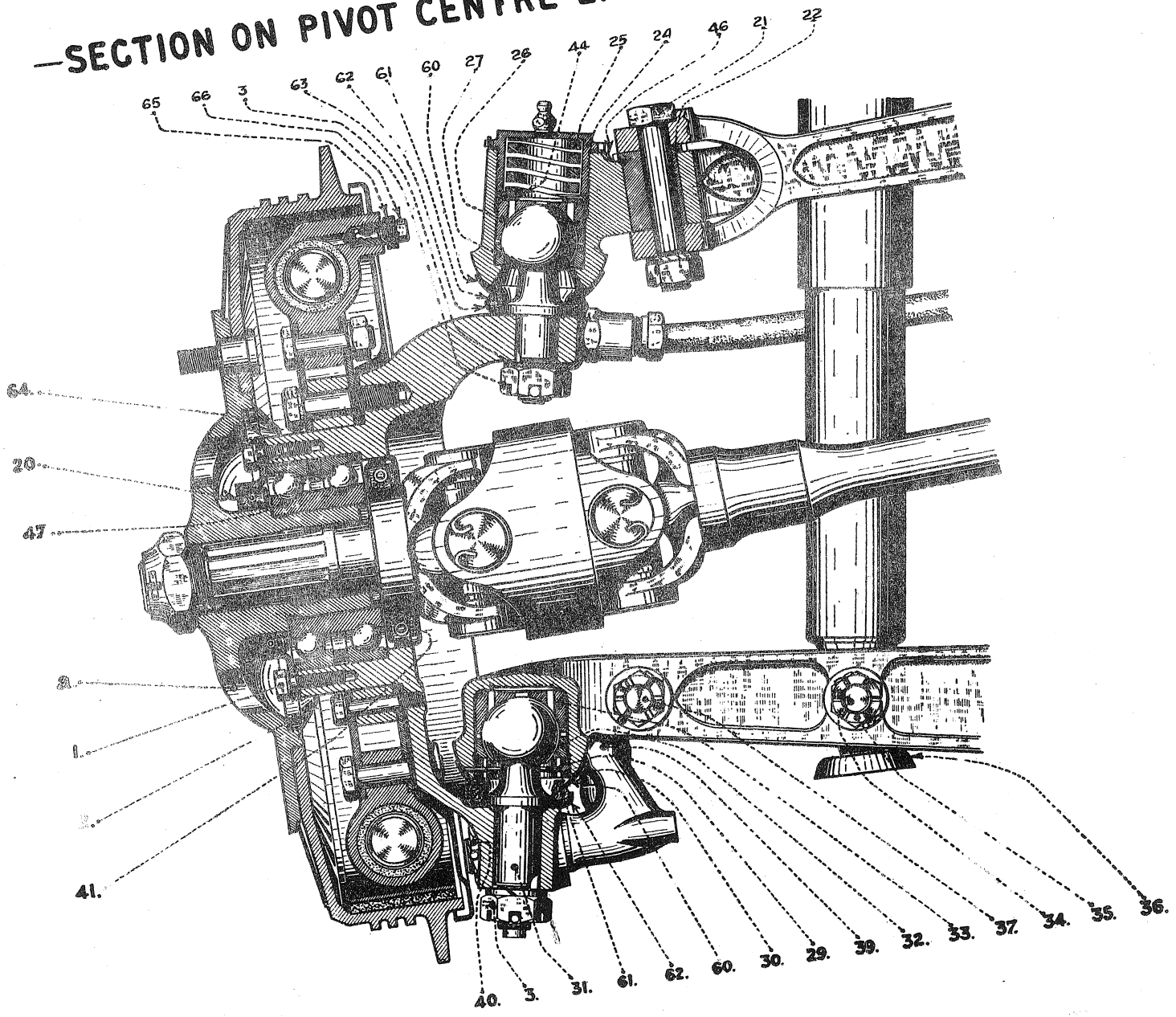
MOUNTING LOWER ARM



GAUGE MR.3447 FOR MOUNTING LOWER ARM



— FRONT AXLE —
—SECTION ON PIVOT CENTRE LINE—



— FRONT AXLE —
— MANDRELS —

MANDREL MR.3432 FOR REMOVING LOWER LINK SPLINED SHAFT.

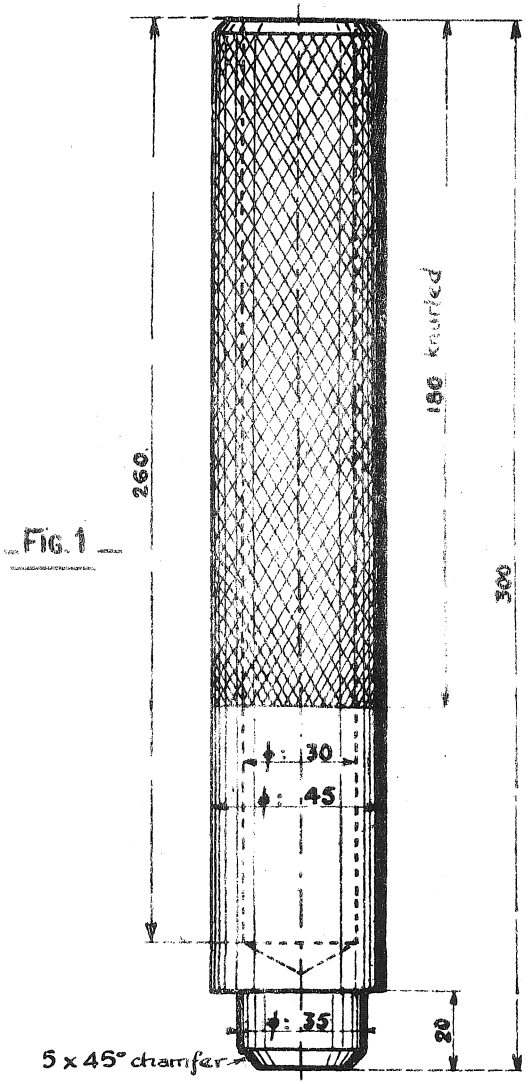


Fig. 1

MANDREL MR. 3436 FOR REMOVING FRONT HUB

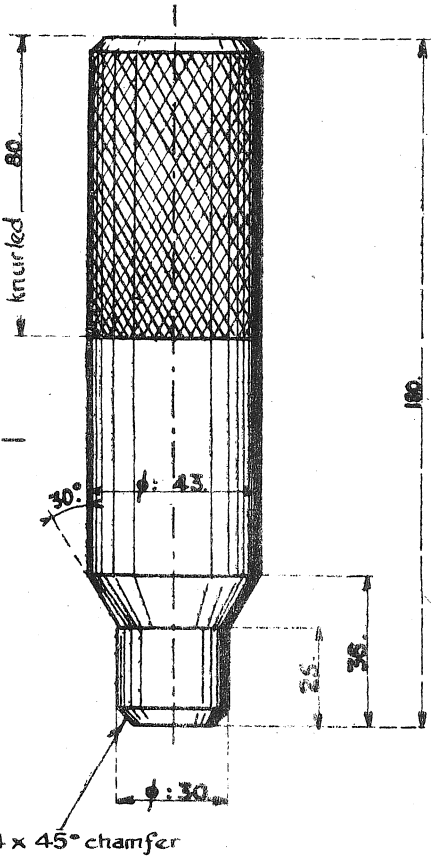


Fig. 2

MANDREL MR. 3431 FOR REMOVING BALL PIN LOWER BEARING.

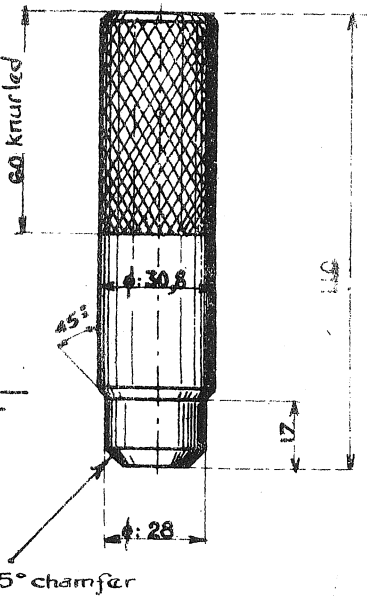
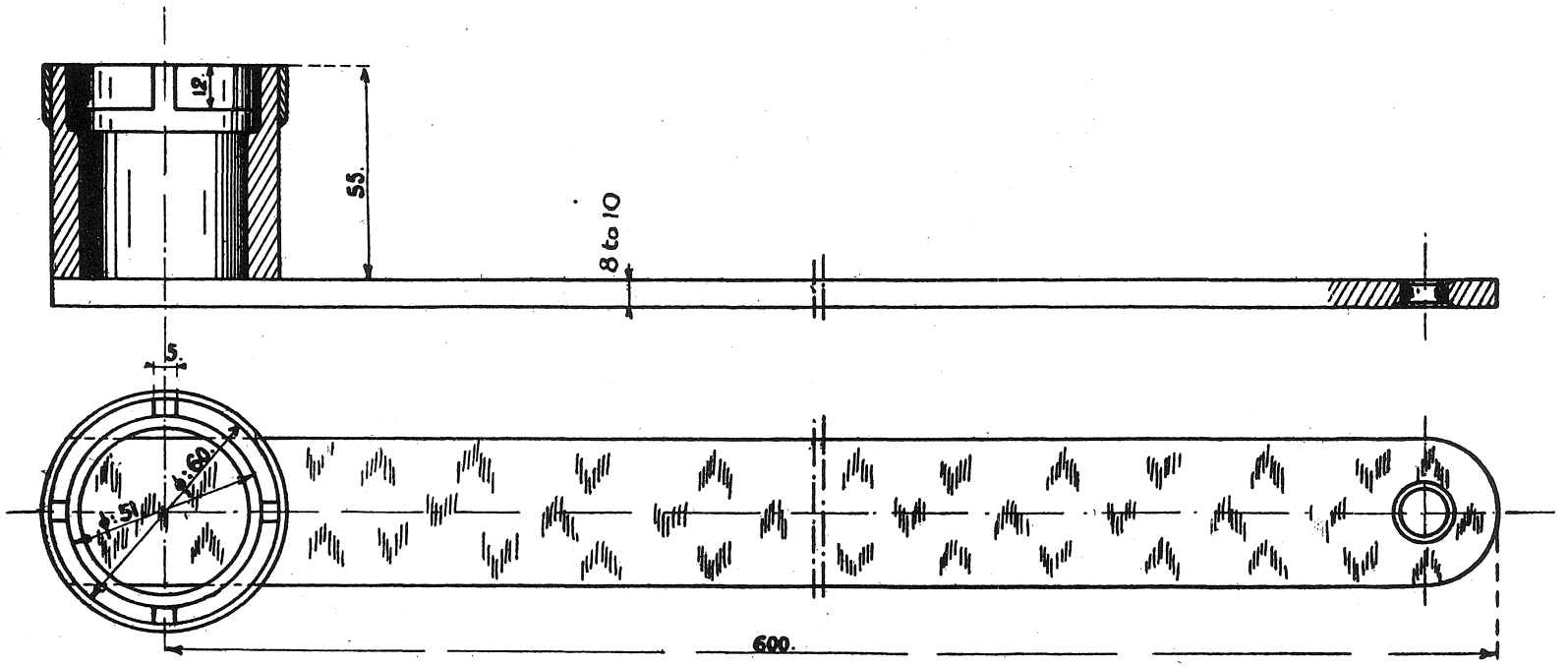


Fig. 3

— FRONT AXLE —

— SPANNERS FOR UPPER LINK —

Fig.1. SPANNER FOR UPPER LINK SPINDLE SLOTTED RING NUT, 1861-T.



— FRONT AXLE —

— EXTRACTING UPPER LINK SPINDLE —

FIG.1.
USE OF EXTRACTOR

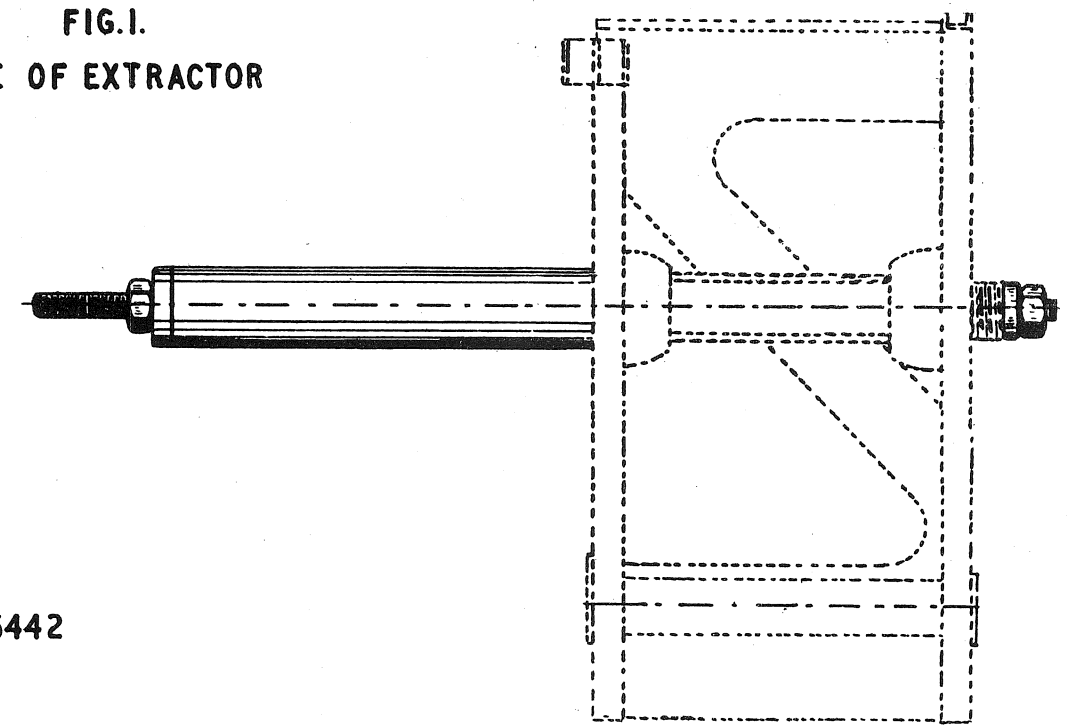
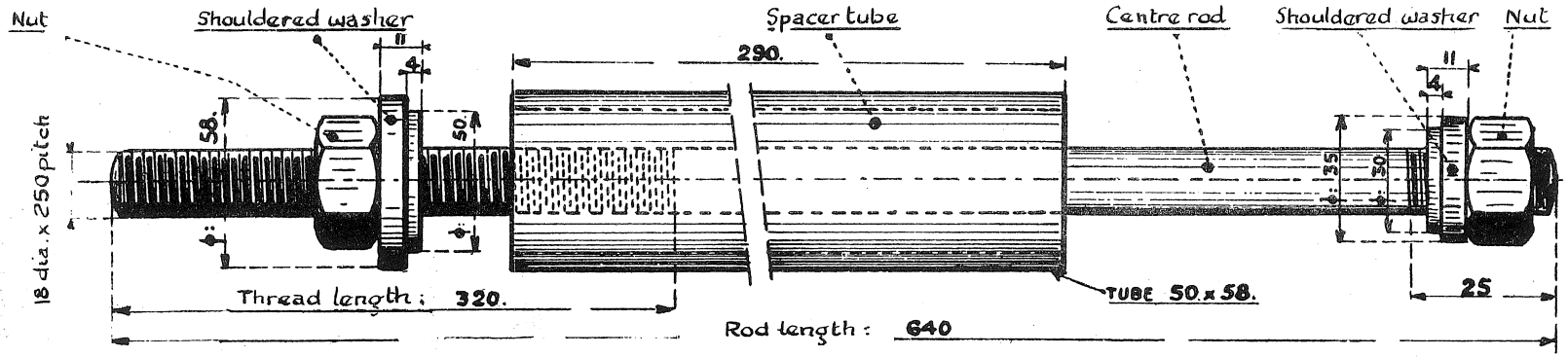


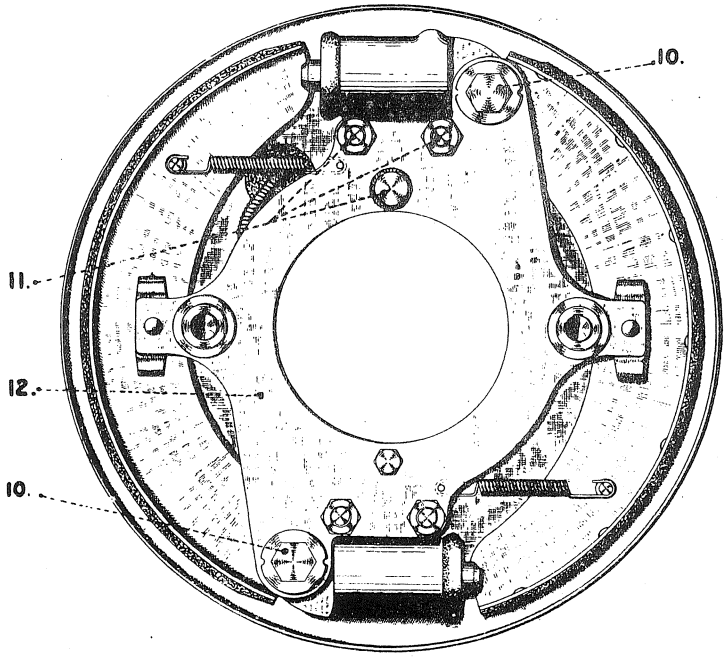
FIG.2.
EXTRACTOR MR.3442



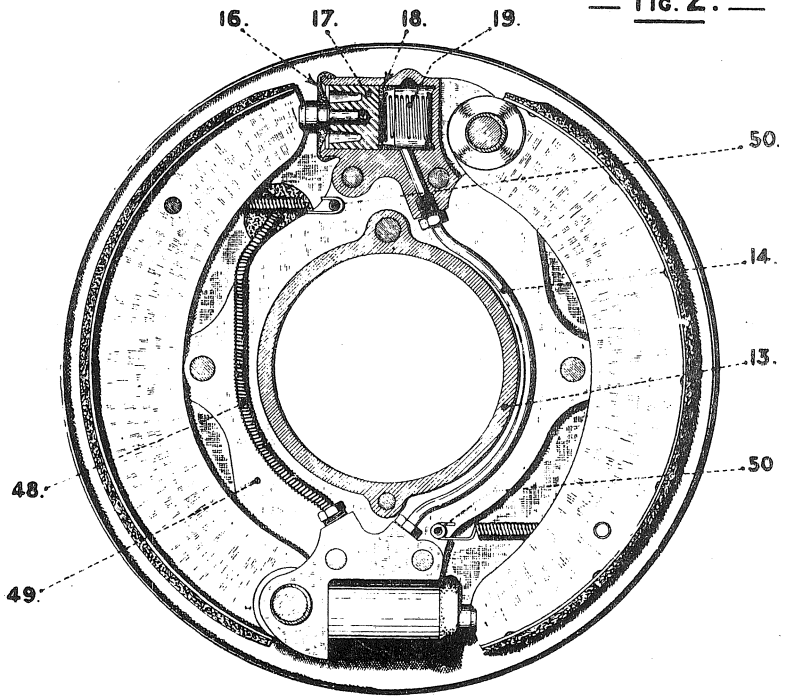
— FRONT AXLE —

— BRAKE BACK PLATE —

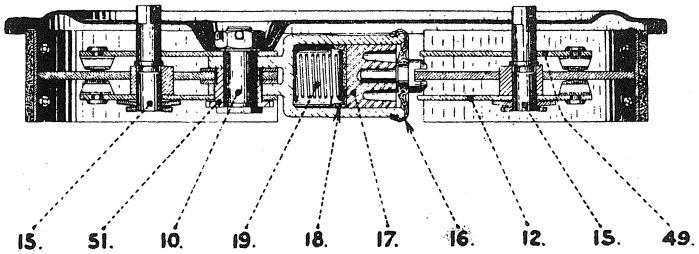
— Fig 1. —



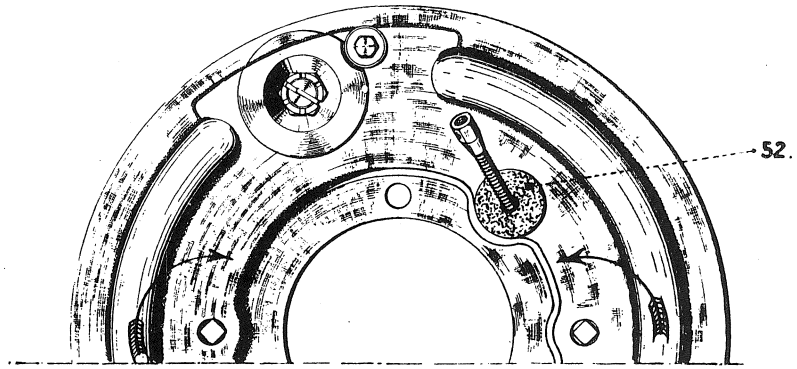
— Fig. 2. —



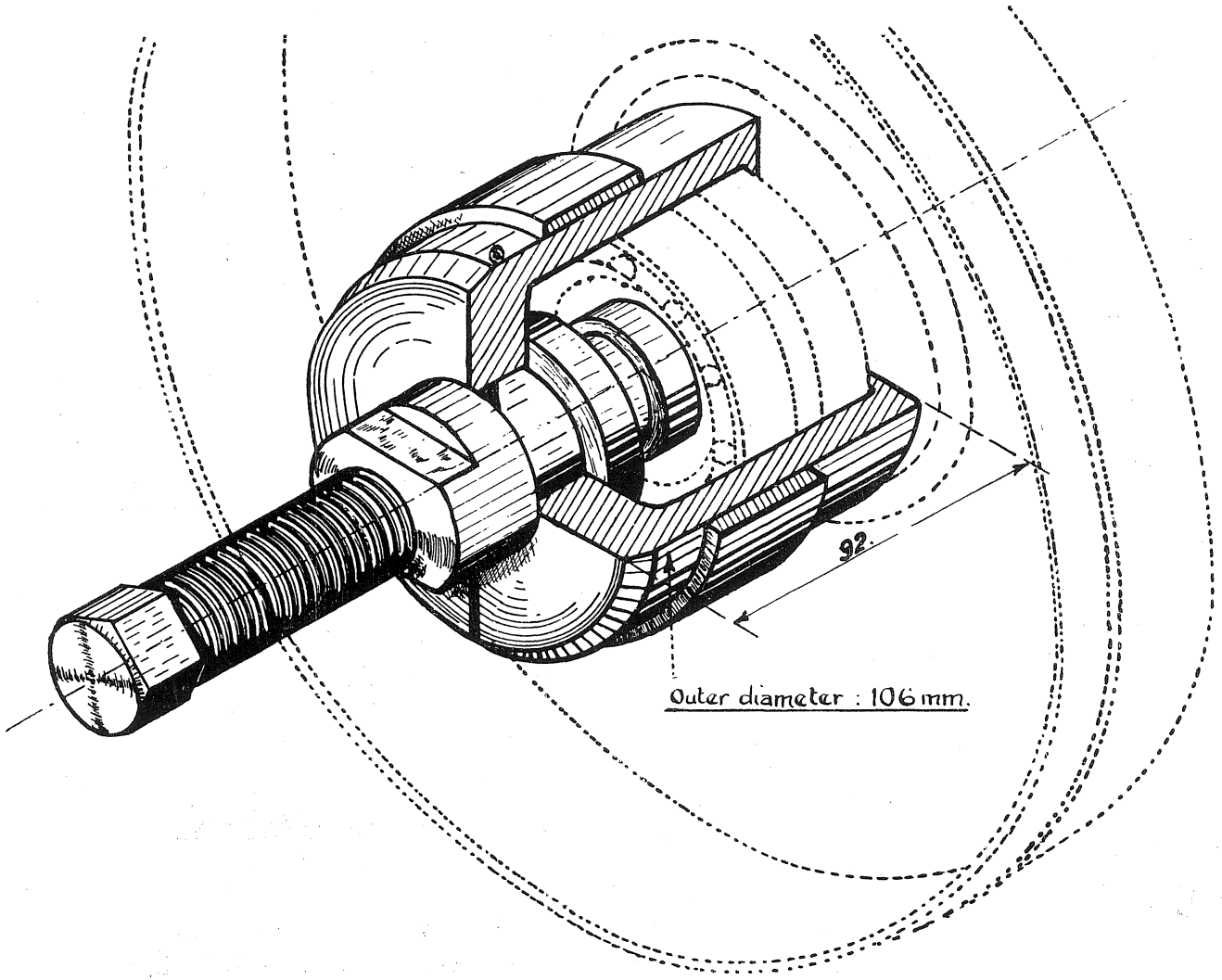
— Fig. 3. —



— Fig. 4. —

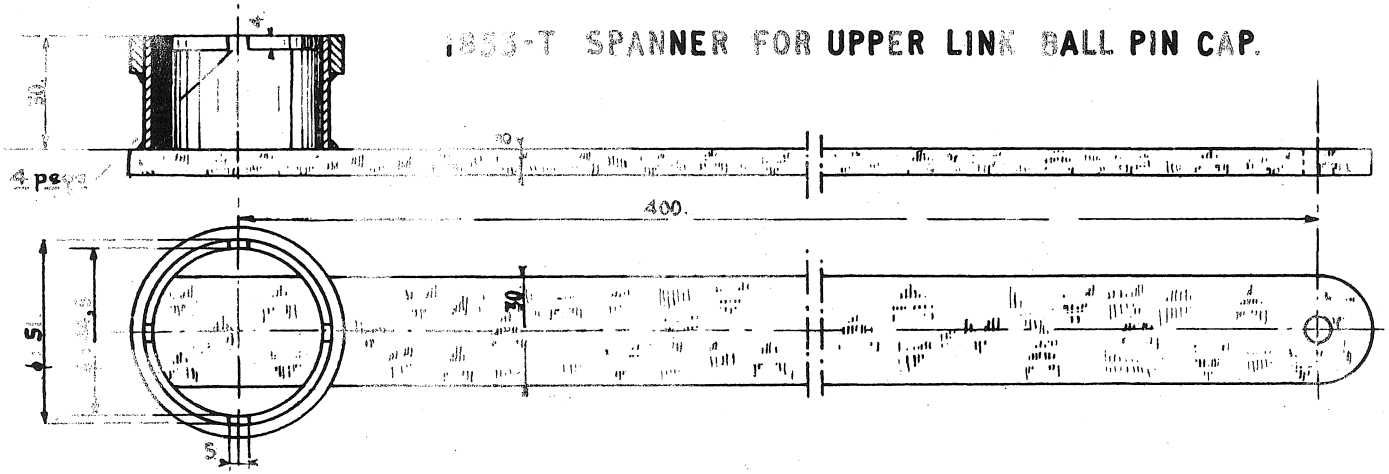


BEARING EXTRACTOR 1750-T WITH
COLLETS, RING, AND BLOCK.

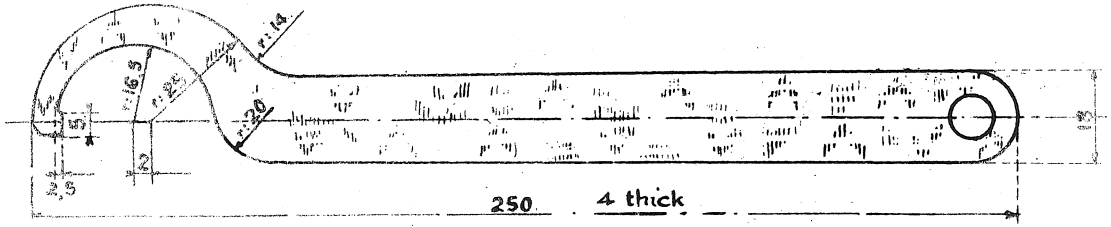


FRONT AXLE
SPANNERS

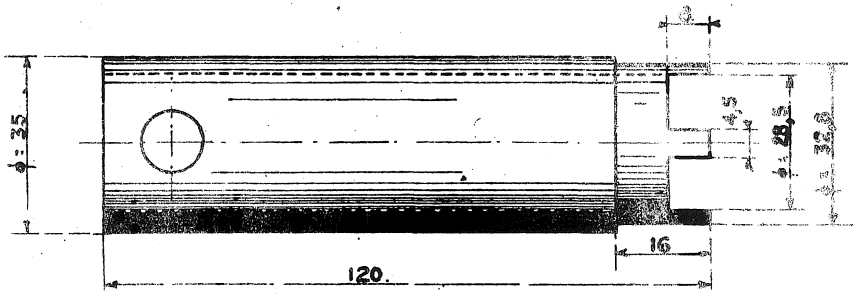
1855-T SPANNER FOR UPPER LINK BALL PIN CAP.

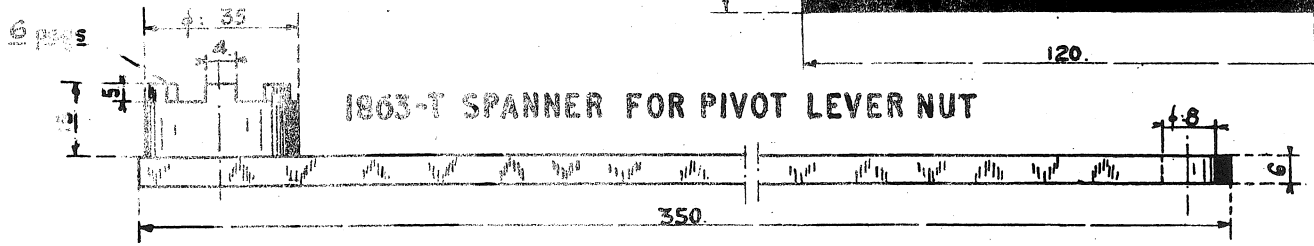


1854-T SPANNER FOR CASTER ANGLE ADJUSTMENT.



1855-T SPANNER FOR LOWER LINK BALL PIN NUT.





1863-T SPANNER FOR PIVOT LEVER NUT

— FRONT AXLE —

— ASSEMBLY OF UPPER LINK SILENTBLOC —

Fig.1

DISMANTLING

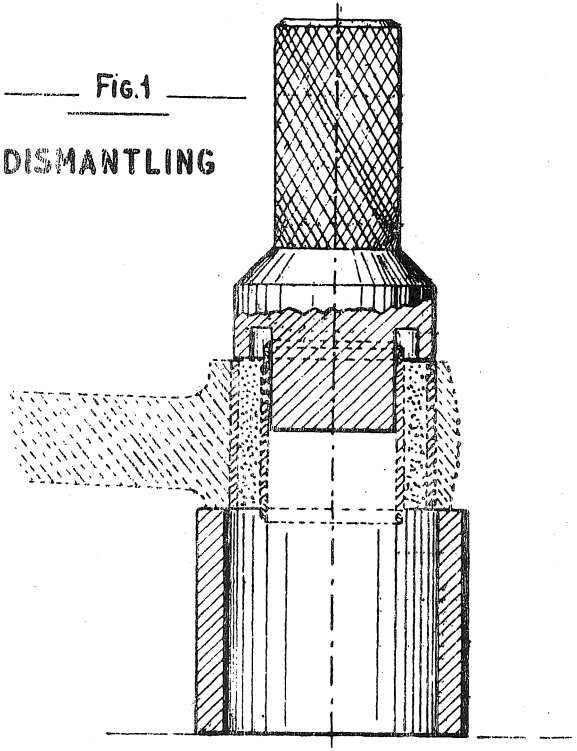


Fig.2

ASSEMBLING

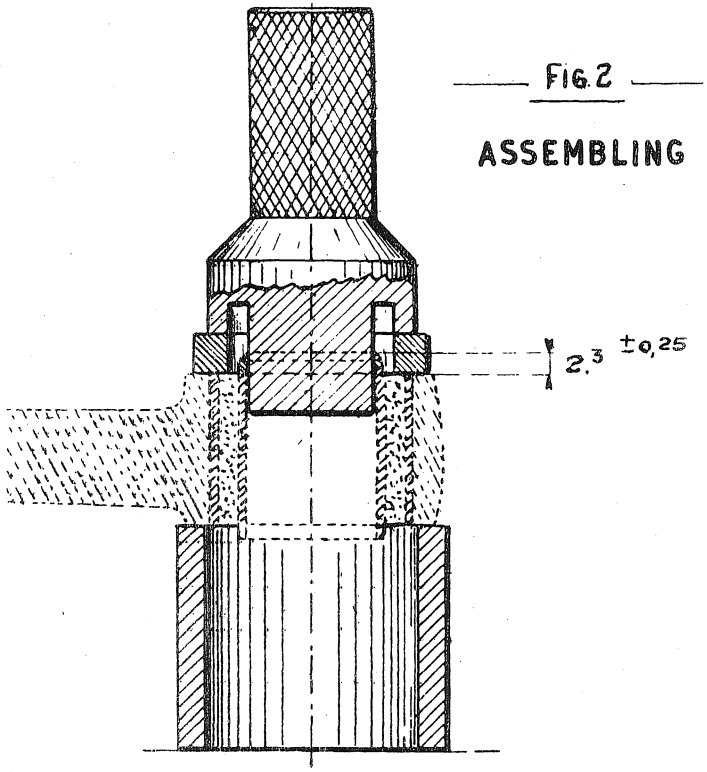
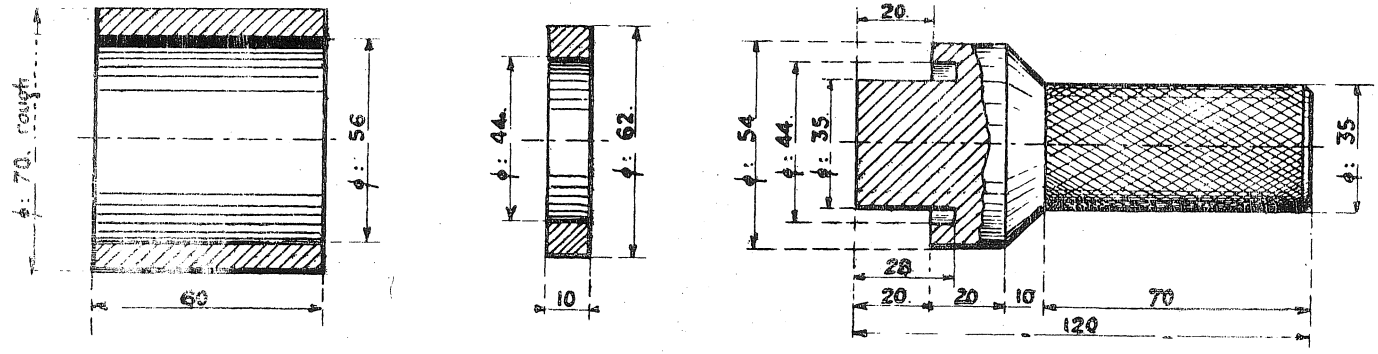


Fig.3

MR.3440 SLEEVE AND RAM

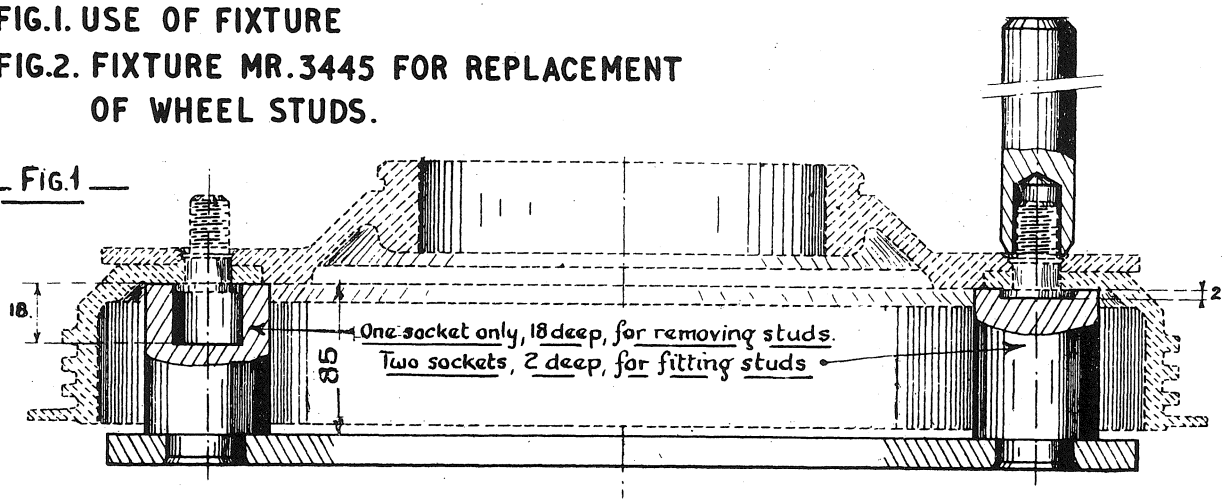


— FRONT AXLE —
— REPLACEMENT OF WHEEL STUDS —

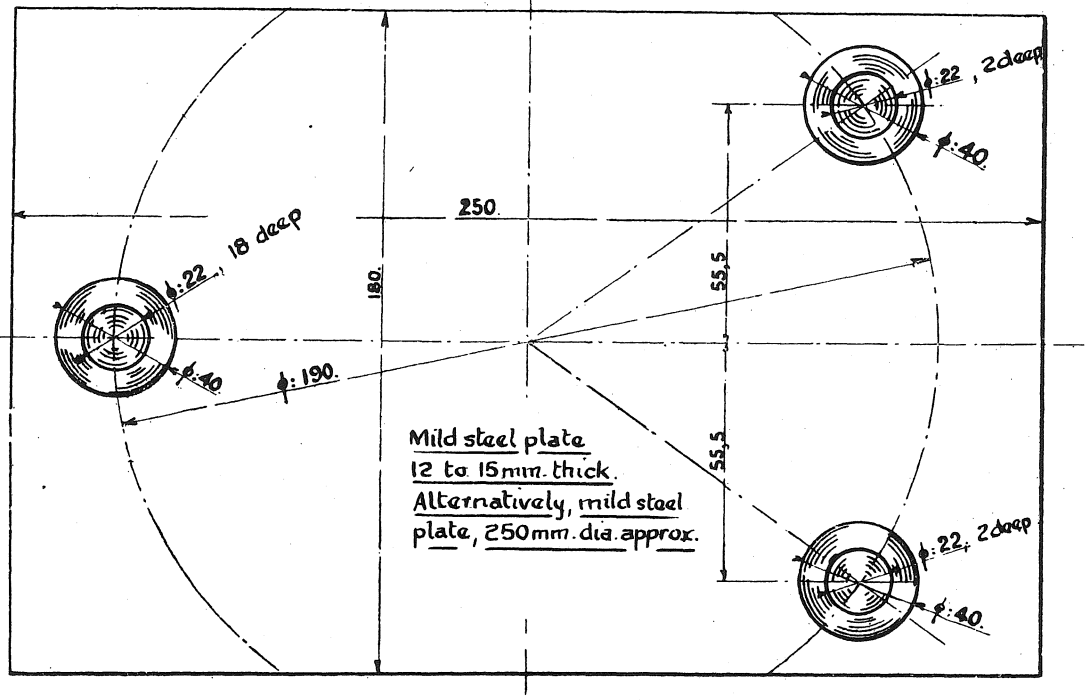
FIG.1. USE OF FIXTURE

FIG.2. FIXTURE MR.3445 FOR REPLACEMENT OF WHEEL STUDS.

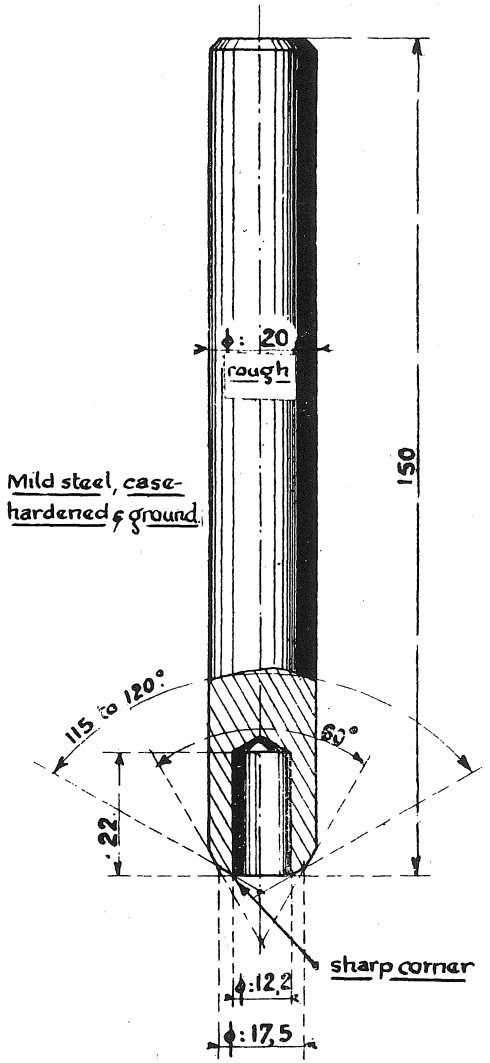
— FIG.1 —



— FIG.2 —



HOLLOW PUNCH MR. 3445-4 FOR LOCKING STUDS



—FRONT AXLE—
—RECTIFICATION OF FRONT BRAKE DRUMS—

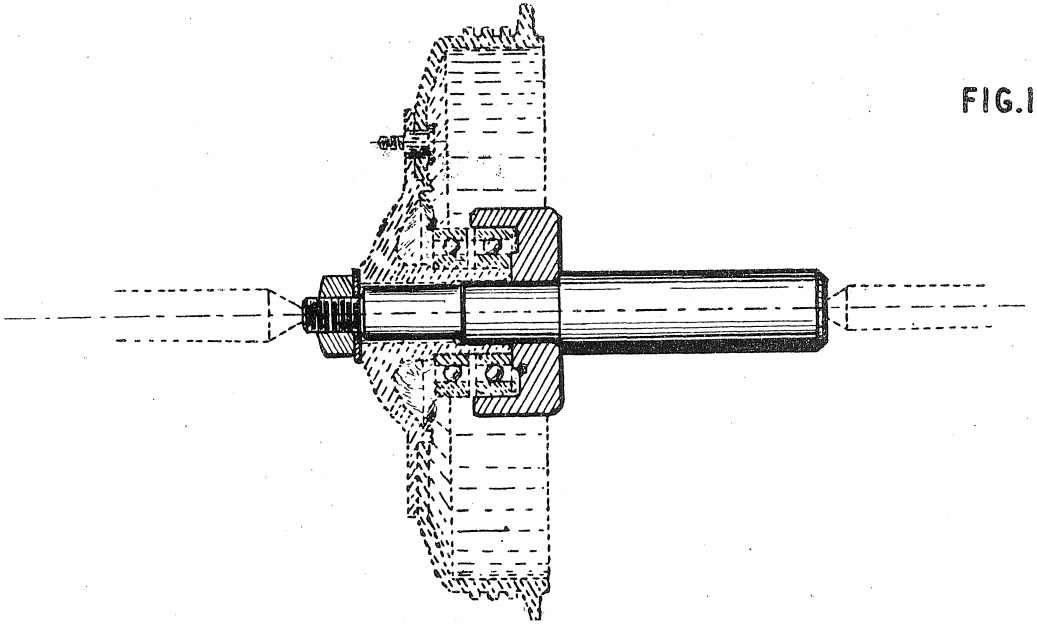
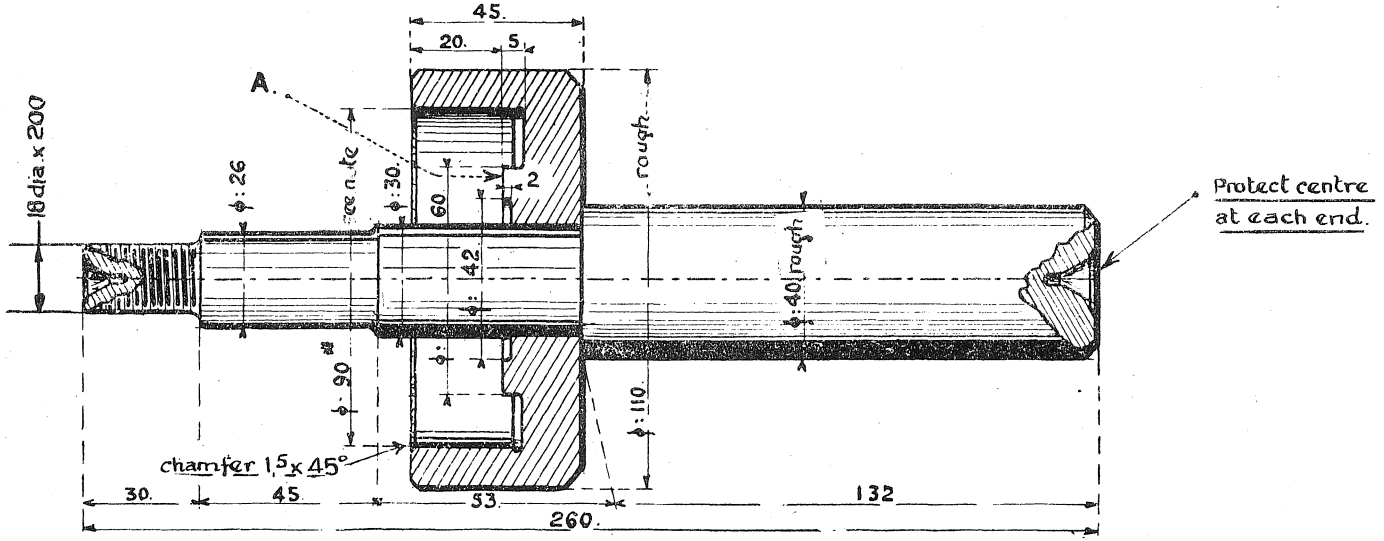


FIG.1. USE OF MANDREL

FIG.2 — MANDREL MR.3441

NOTE: Diameter 90* to be finished after ring is pressed on shaft. Face A to be trued up likewise. Diameter 90* must permit good fitting of ring on a greasy bearing.



— FRONT AXLE —

— PEENING OVER BRAKE SHOE CAM PINS —

FIG.1. USE OF FIXTURE MR.3444.

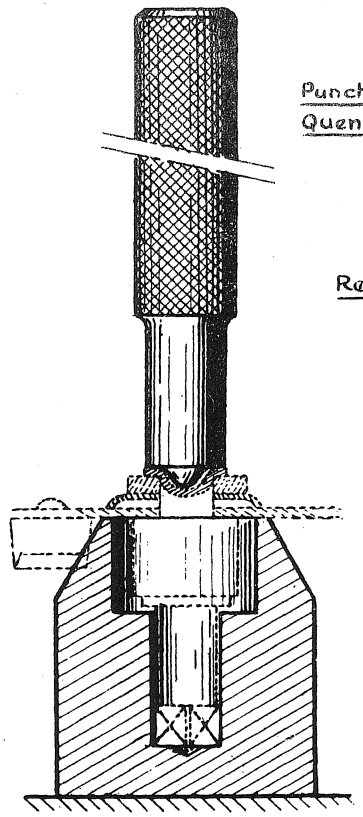
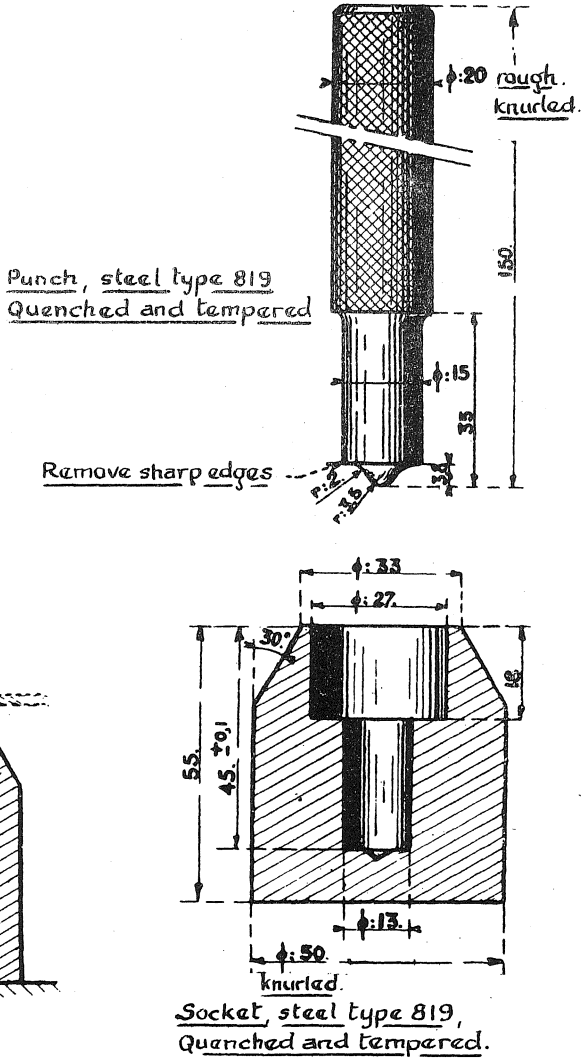


FIG.2. FIXTURE MR.3444.



Socket, steel type 819, Quenched and tempered.

FIG.3. USE OF FIXTURE MR.3354.

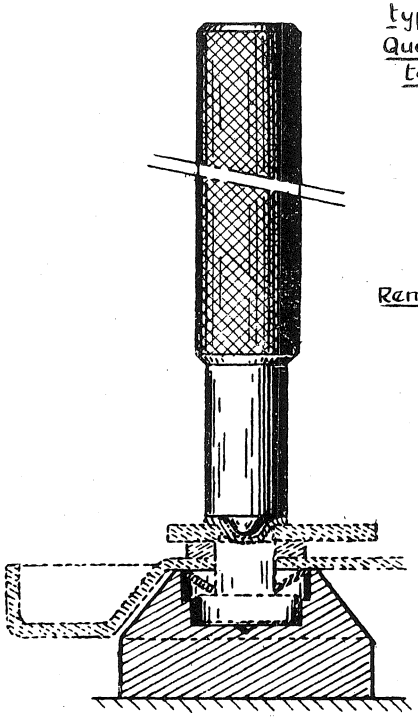
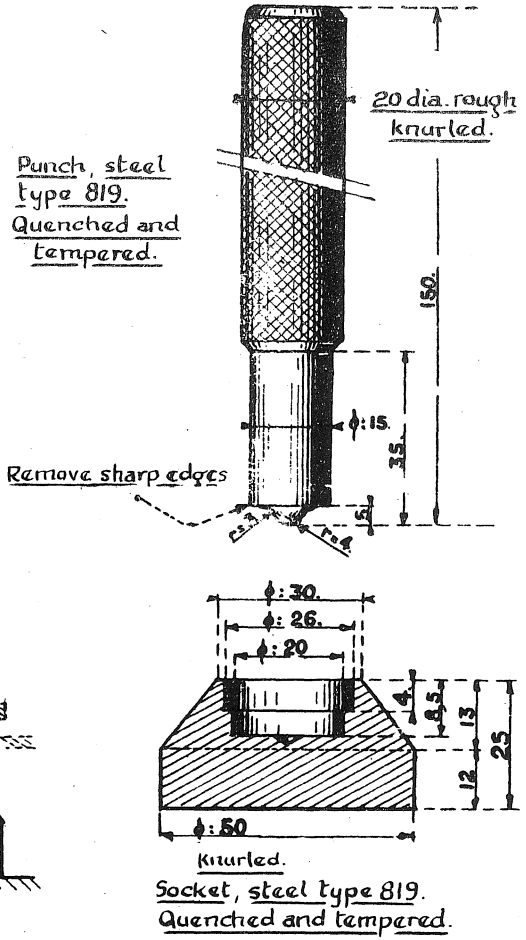


FIG.4. FIXTURE MR.3354.

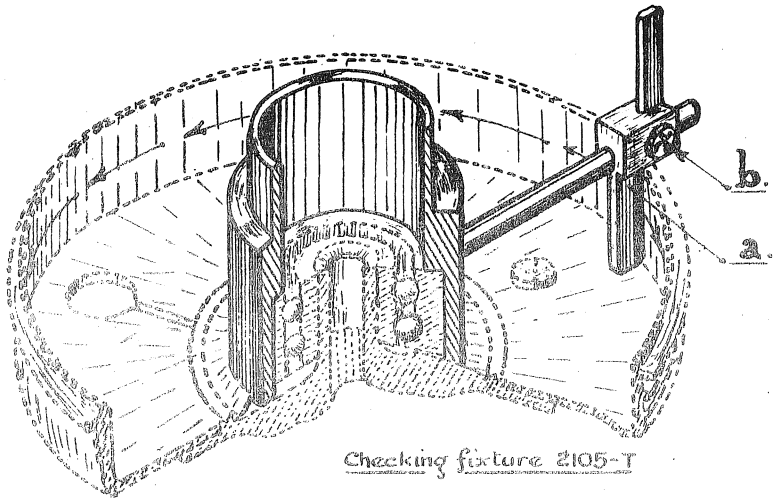


Socket, steel type 819. Quenched and tempered.

— CHECKING CONCENTRICITY OF BRAKES —

FIG.1. CHECKING BRAKE DRUM DIAMETER.

Place fixture on bearing.
Bring indicator "a" into contact with drum and describe a complete circle.
Lock indicator in the set position by means of screw b.



Checking fixture 2105-T

FIG.2. CHECKING CONCENTRICITY OF LININGS.

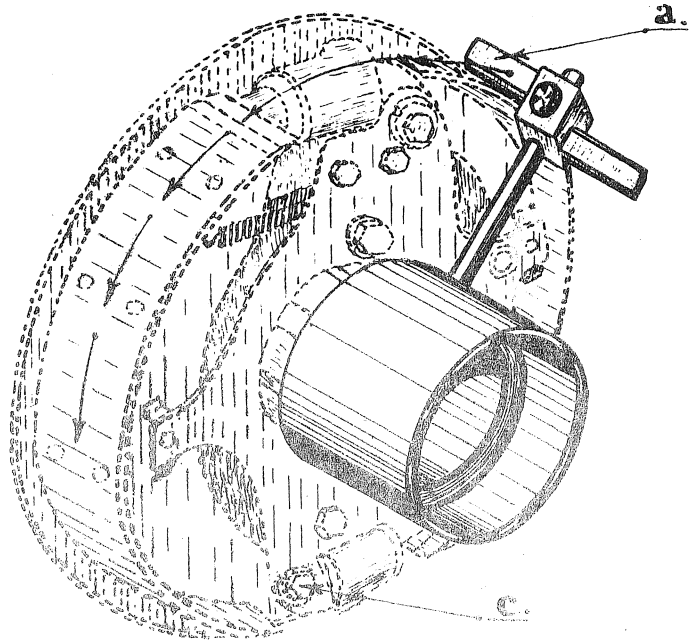
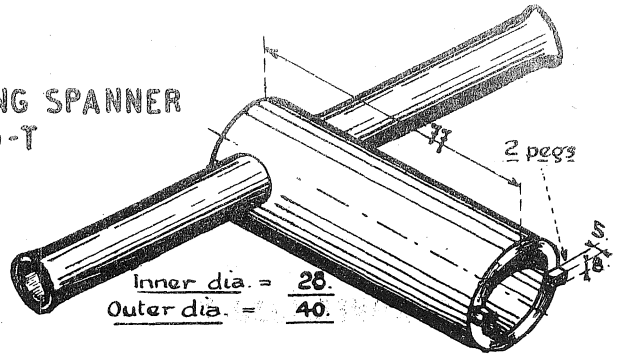


FIG.3. ADJUSTING SPANNER 2120-T



Place fixture in bore of bearing.
Offer up indicator "a", as set in the preceding operation, to the brake linings. Indicator must remain in contact throughout circumference.
(In order to obtain this condition, adjust linings by eccentric bushes "c" and adjusting cams at rear of backplate, not shown)
Remove burrs and high spots from linings with a rasp.

After checking, release cams to allow fitting of brake drum. (For final adjustment of cams, see Operation 749, paragraph 2.

— TRANSMISSION —

— UNCOUPLING AND COUPLING DRIVE SHAFT SLIDING INNER FLANGE —

FIG.1. LEFT SIDE

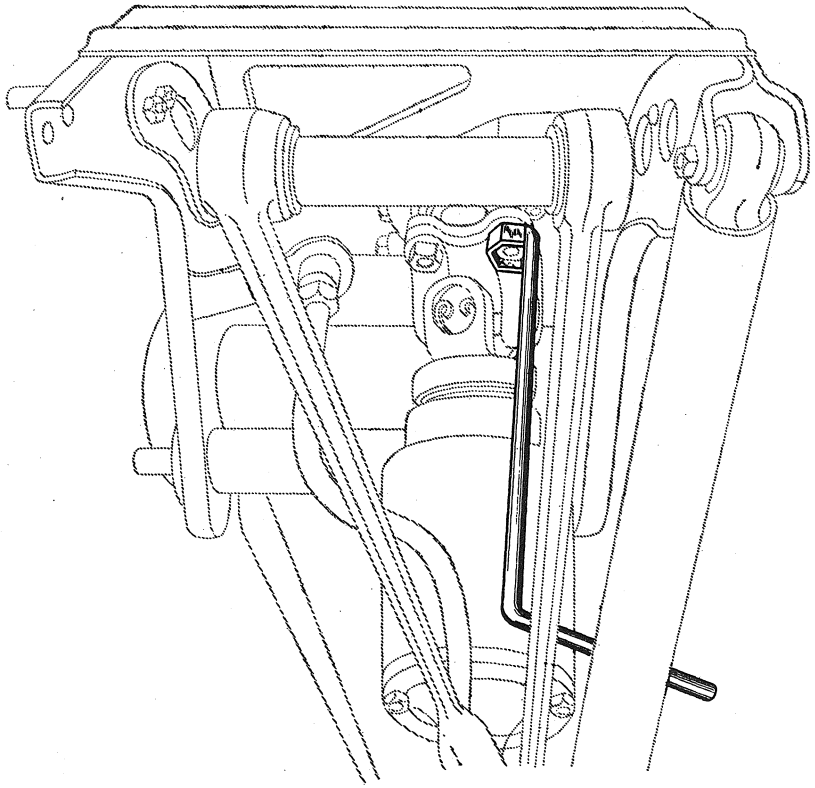
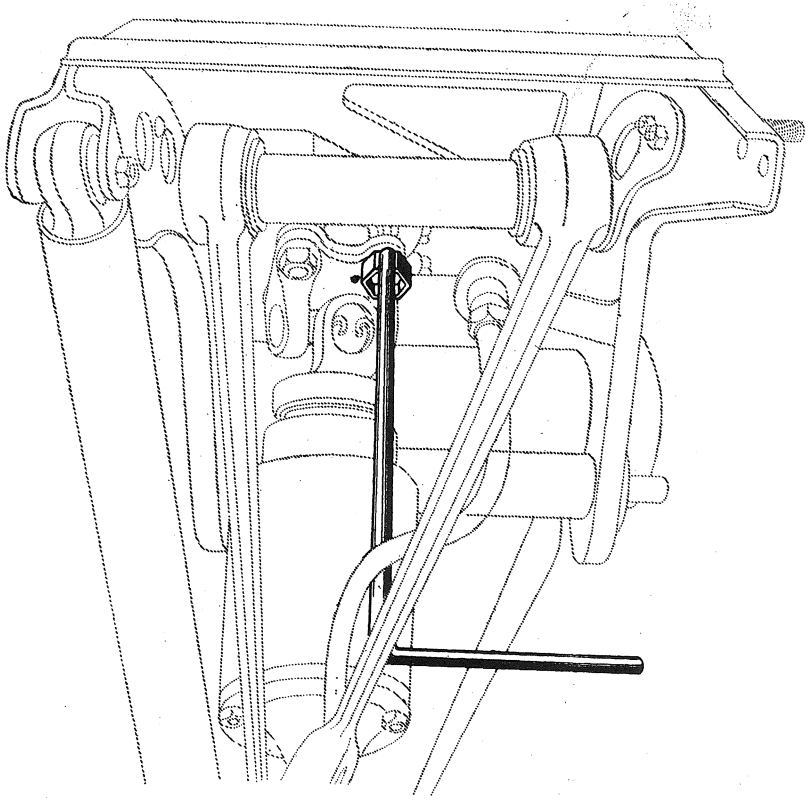
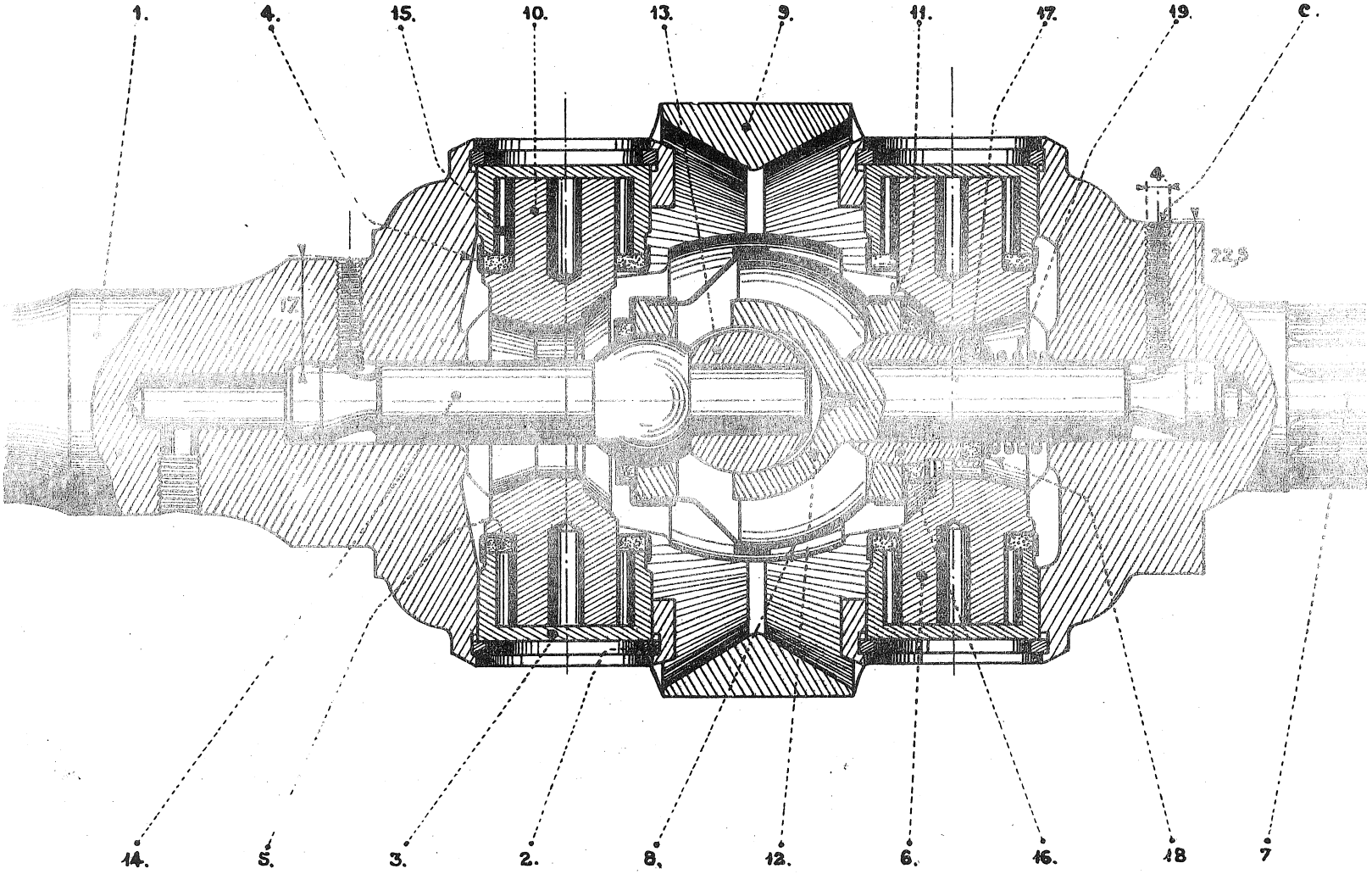


FIG.2. RIGHT SIDE



SPANNER 1832-T

— LONGITUDINAL SECTION THROUGH DOUBLE COUPLING —



— TRANSMISSION —

— LONGITUDINAL SECTION THROUGH FLEXIBLE COUPLING —

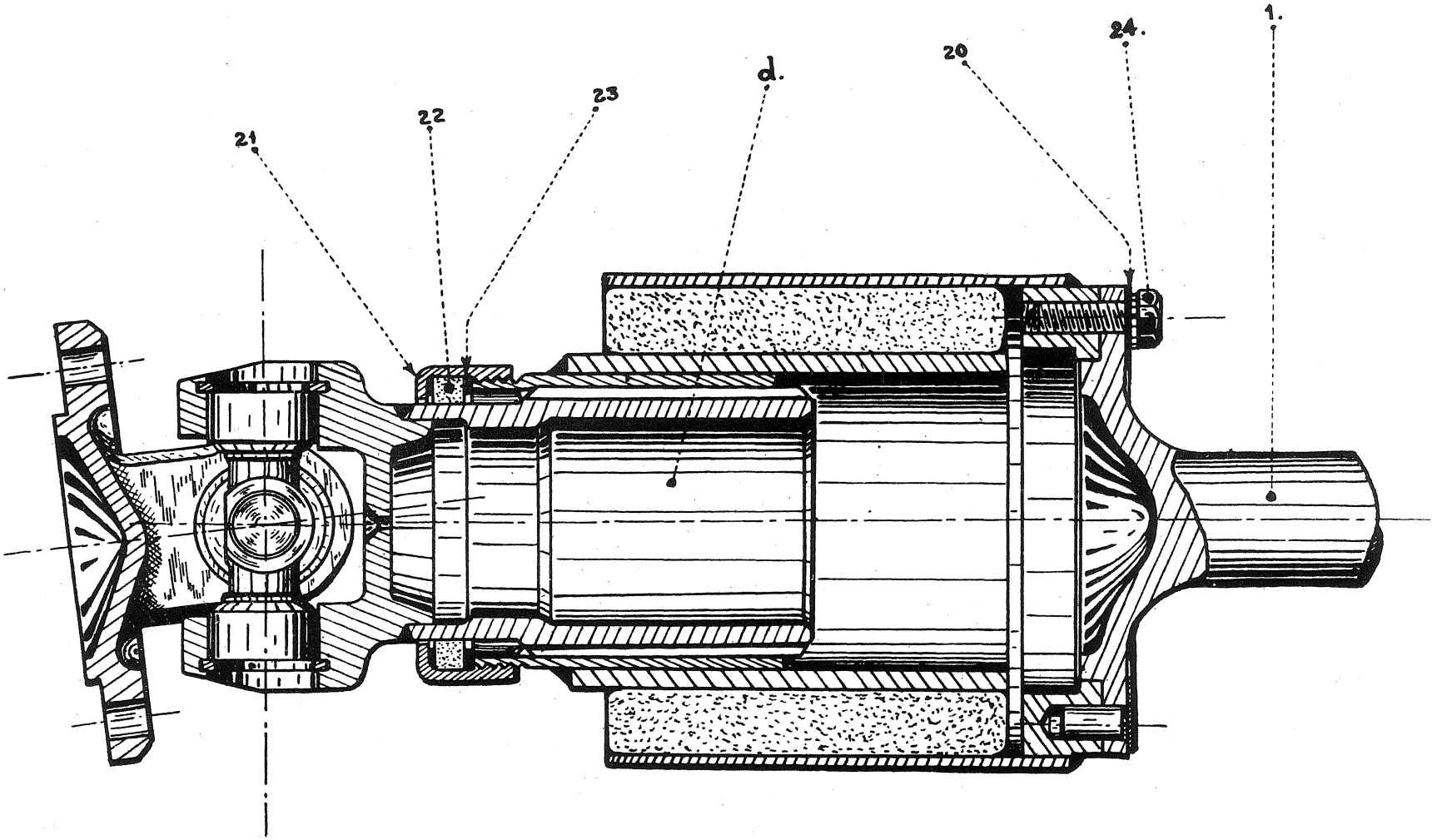


FIG.1. REMOVING CIRCLIPS

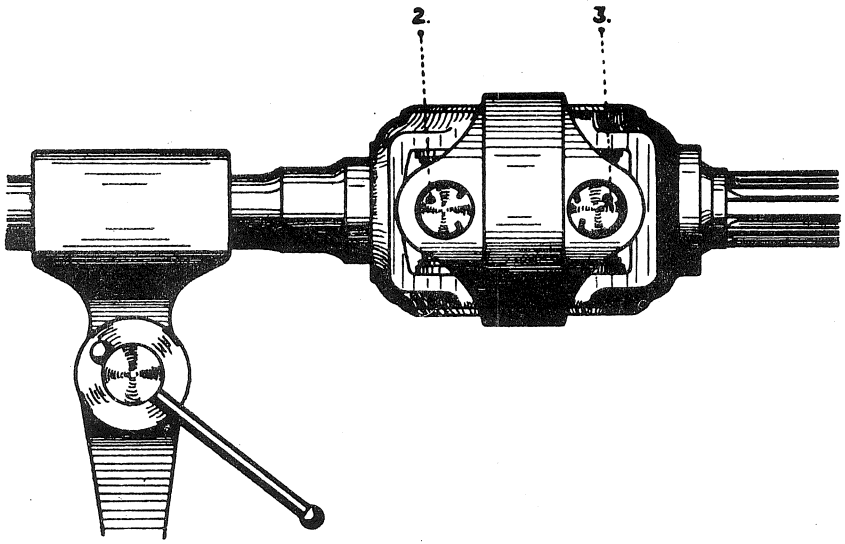


FIG.2. REMOVING NEEDLE BEARING CUPS.

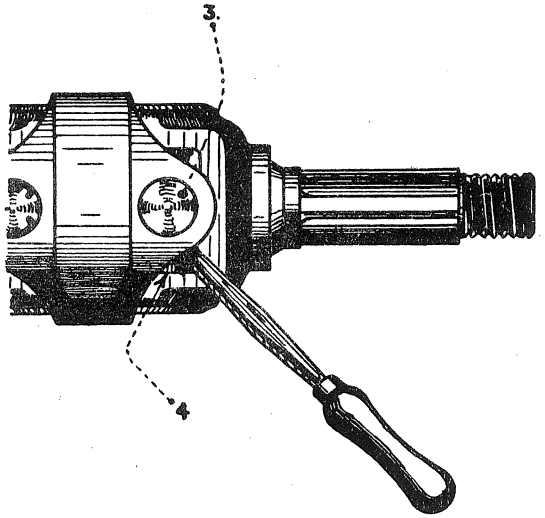


FIG.3. REMOVING STUB AXLE

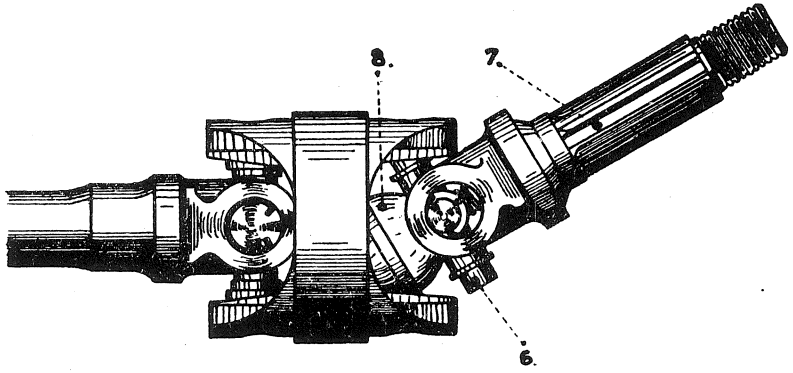


FIG.4. REMOVING DOUBLE YOKE

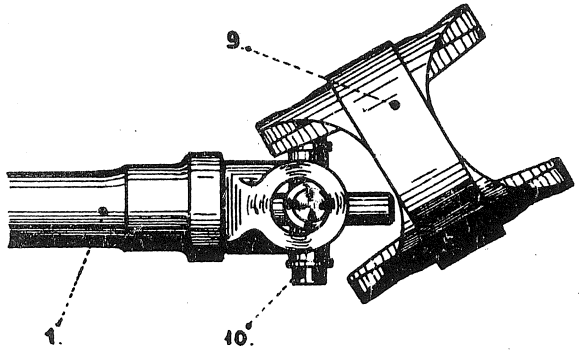


FIG. 5. REMOVING PROTECTING CUPS.

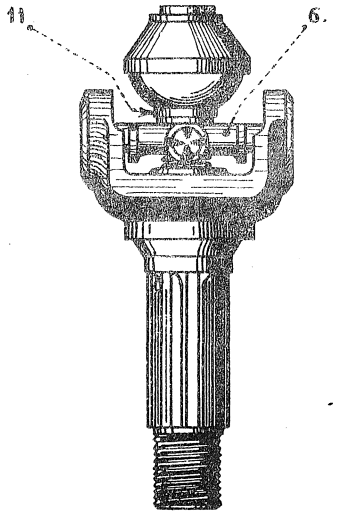


FIG. 6. EXTRACTING SPIGOT BALL AT STUB AXLE SIDE.

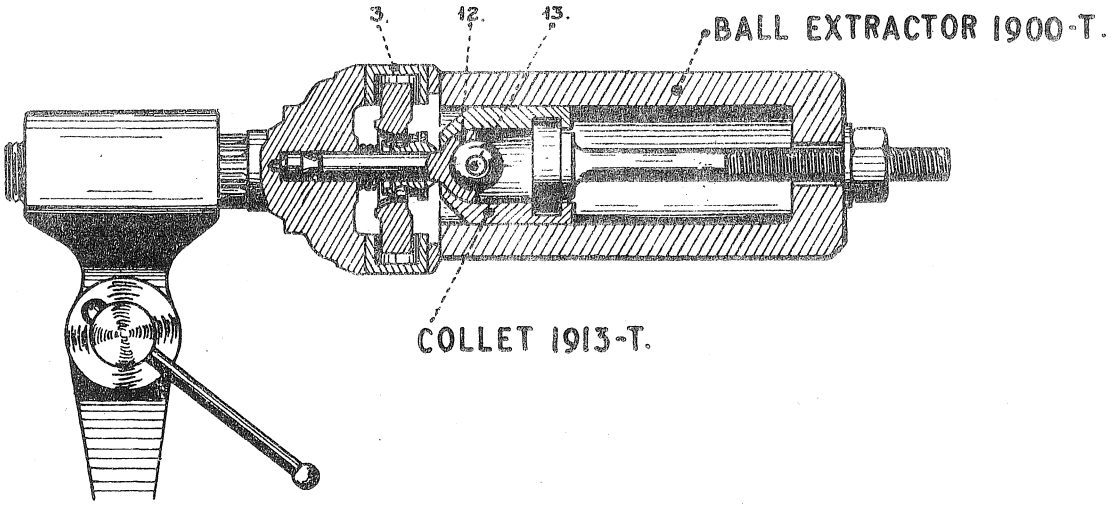


Fig. 7. — EXTRACTING BALL SPINDLE.

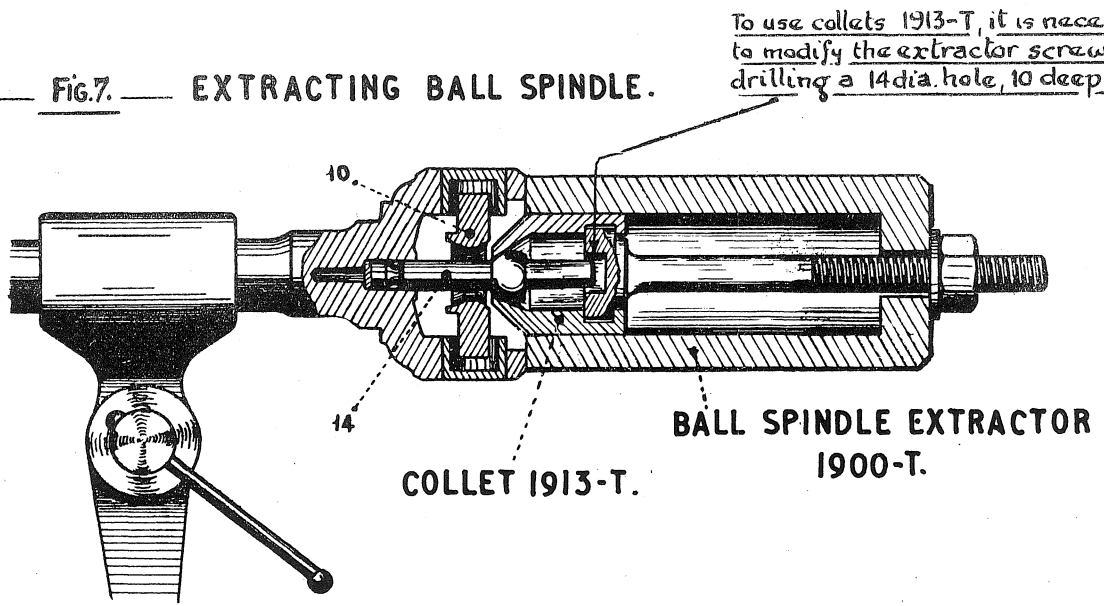


FIG. 9. FITTING CROSSHEAD.

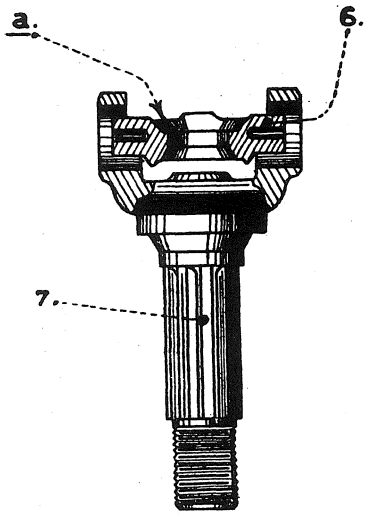


FIG. 10. FITTING BALL-PIN.

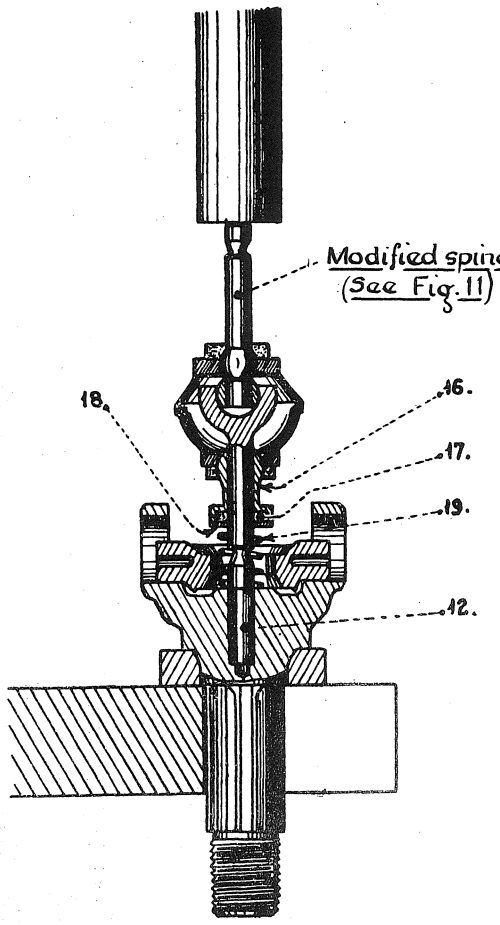


FIG. 11. MODIFIED BALL SPINDLE.

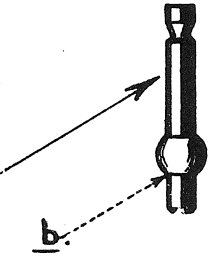


FIG. 12. CHECKING POSITION OF INNER BALL.

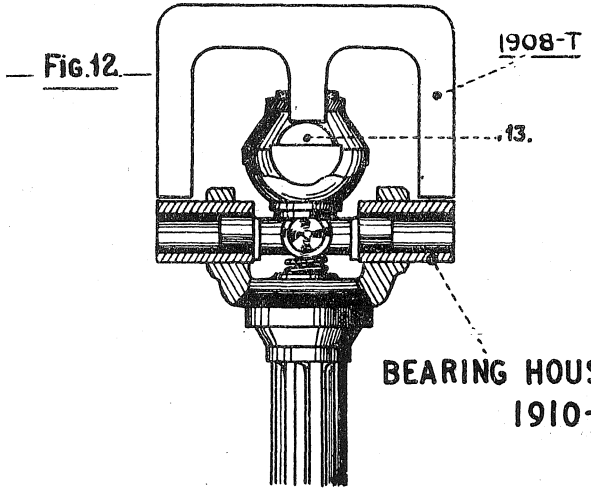
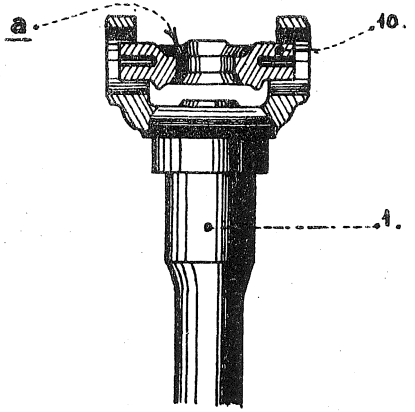
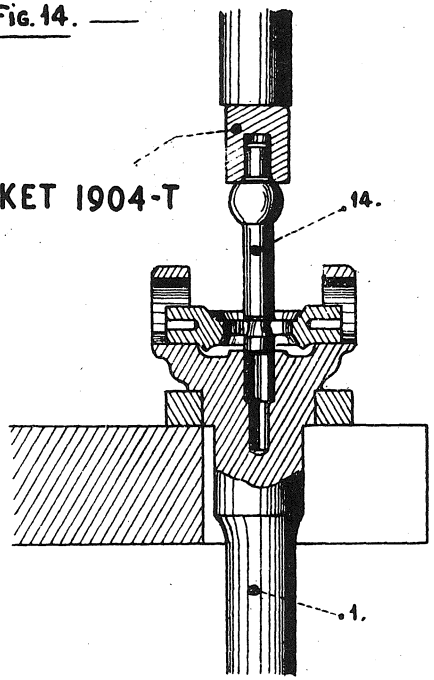


FIG. 13. FITTING CROSSHEAD.



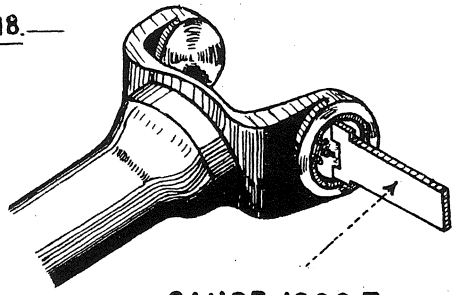
FITTING BALL PIN SPINDLE

Fig. 14.



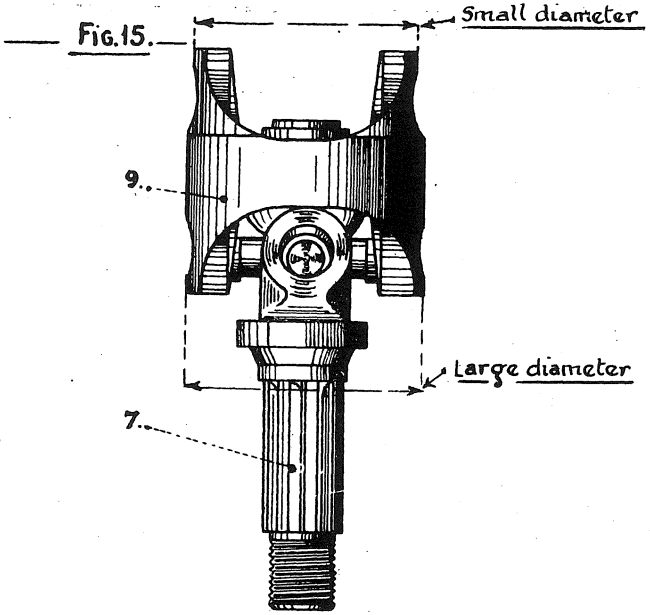
CHECKING FITTING OF CIRCLIPS

Fig. 18.



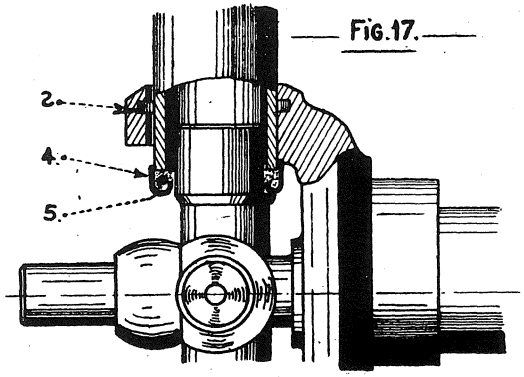
FITTING DOUBLE YOKE

Fig. 15.



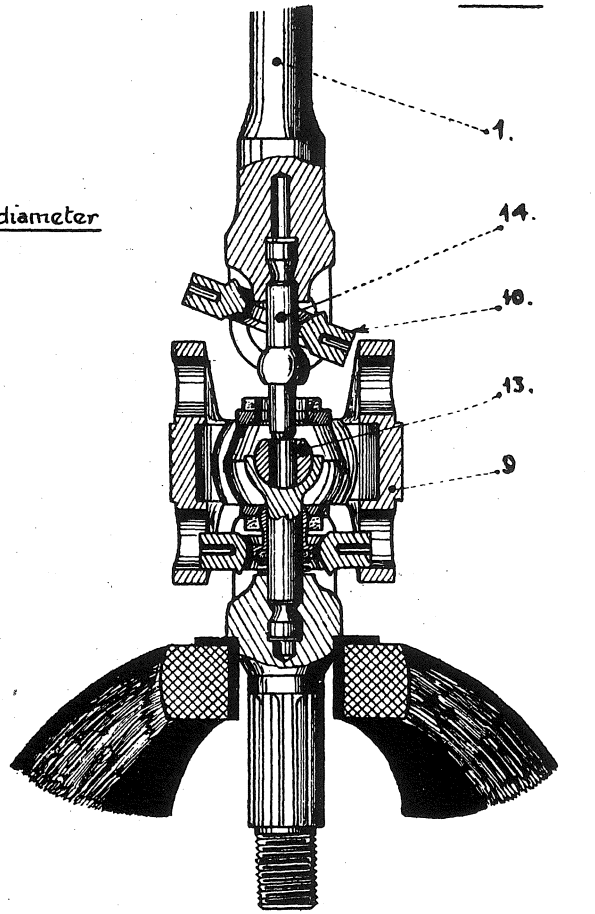
FITTING CUPS AND CORK WASHERS

Fig. 17.

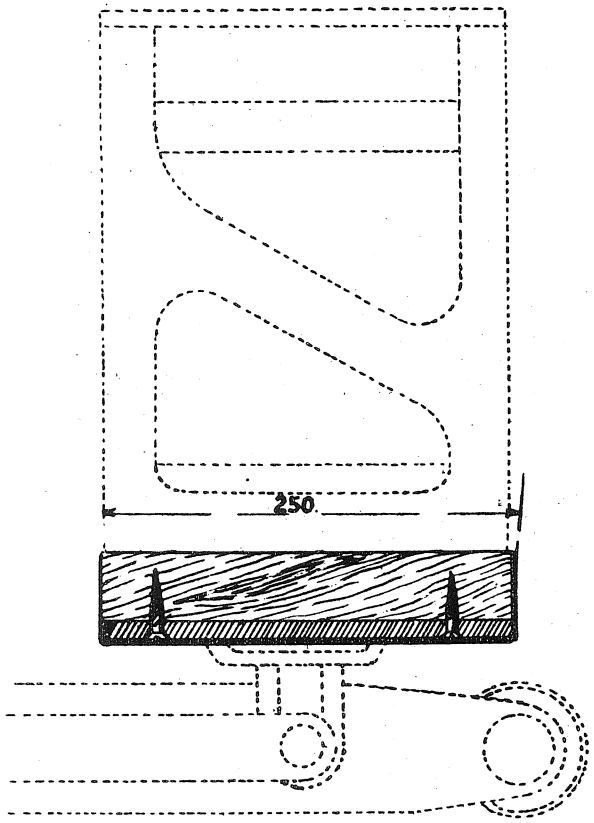


FITTING DRIVE SHAFT

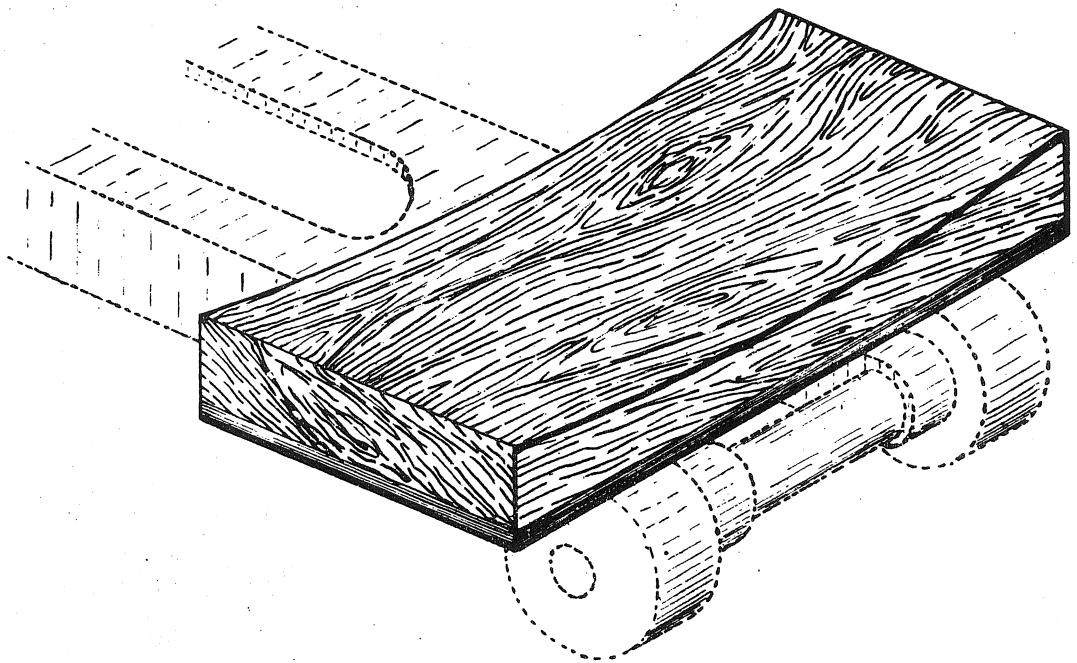
Fig. 16.



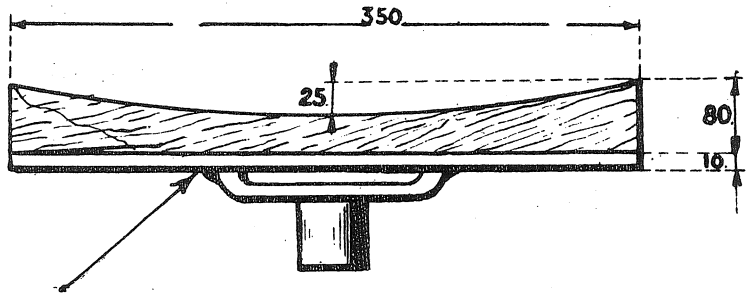
— LIFTING FRONT AXLE —



APPLICATION



SPECIAL JACK HEAD MR.3300-90

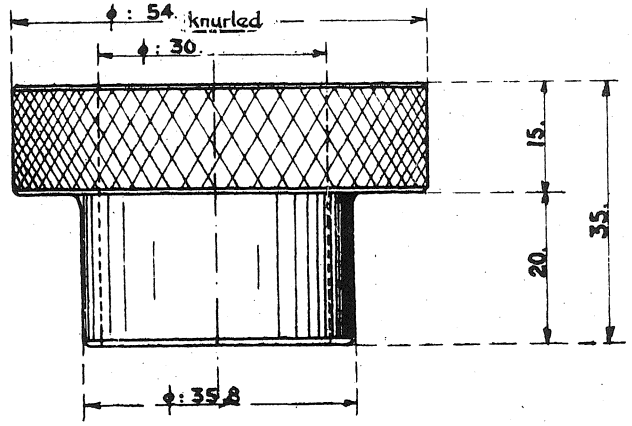


Steel plate welded to standard jack head

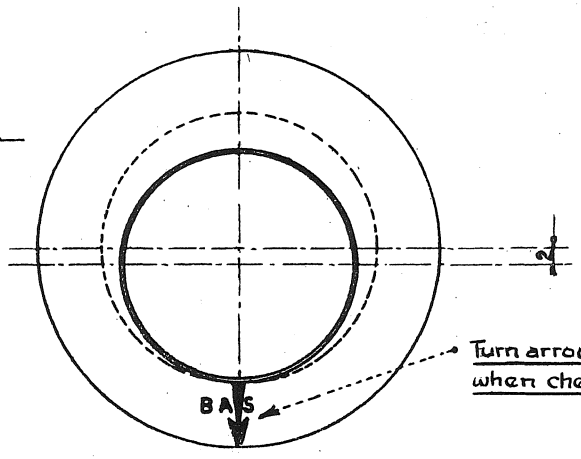
— REMOVING STEERING WHEELS. CHECKING CENTERING OF STEERING WHEEL—

LOCATING BUSH MR.3102.

— Fig.1. —



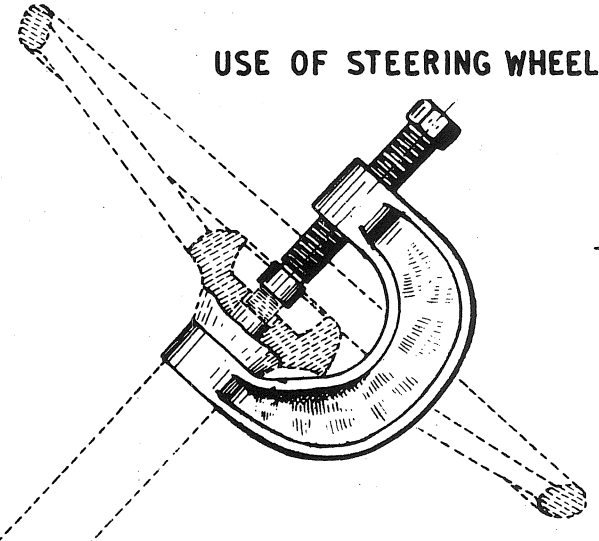
— Fig. 2. —



Turn arrow towards bottom when checking.

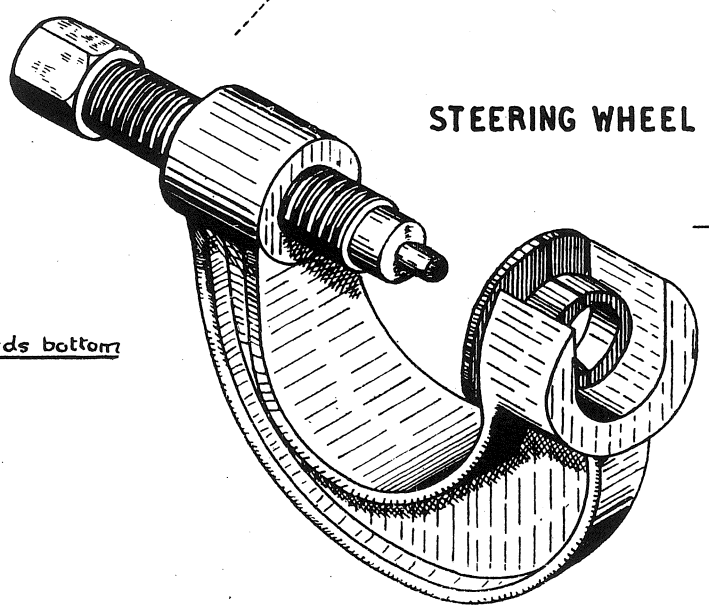
Steering column must turn in bore of bush without touching.

USE OF STEERING WHEEL EXTRACTOR.



— Fig.3. —

STEERING WHEEL EXTRACTOR 1950-T

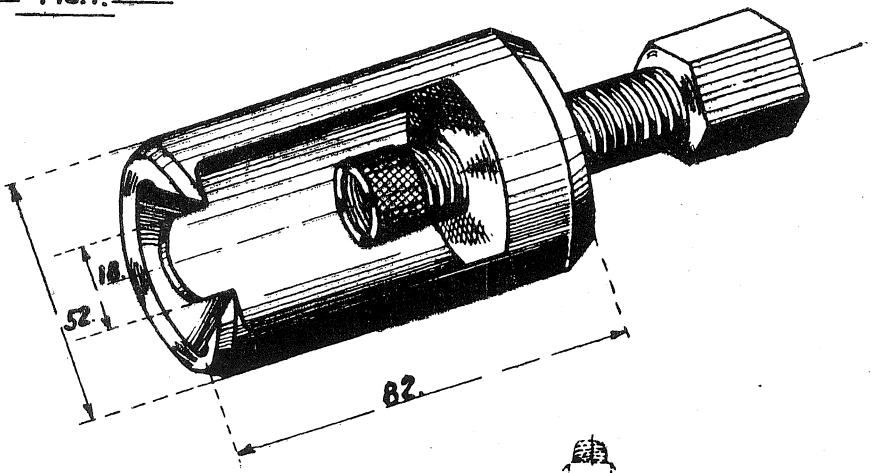


— Fig. 4. —

— DISMANTLING TRACK RODS —

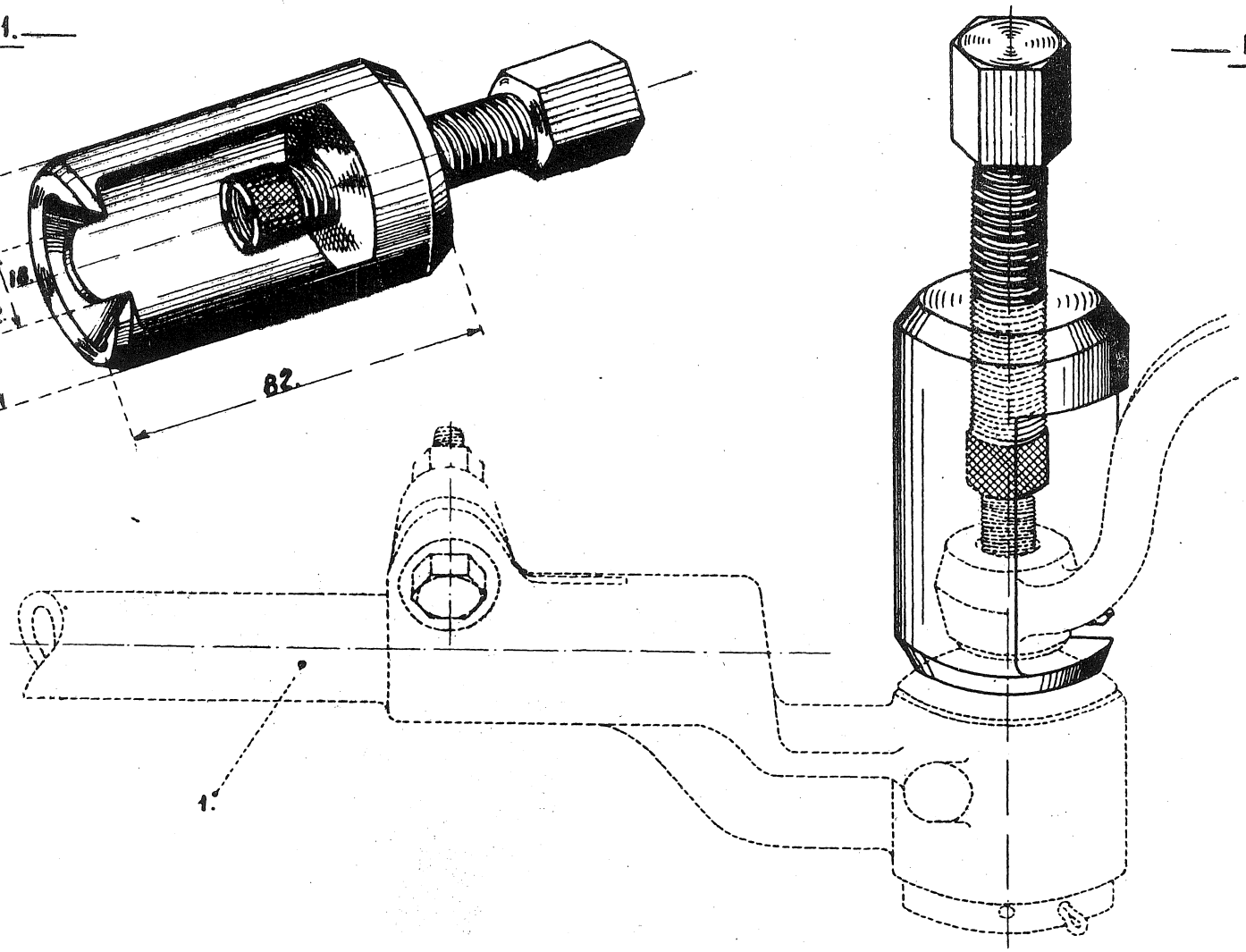
BALL PIN EXTRACTOR 1964-T

— Fig.1. —



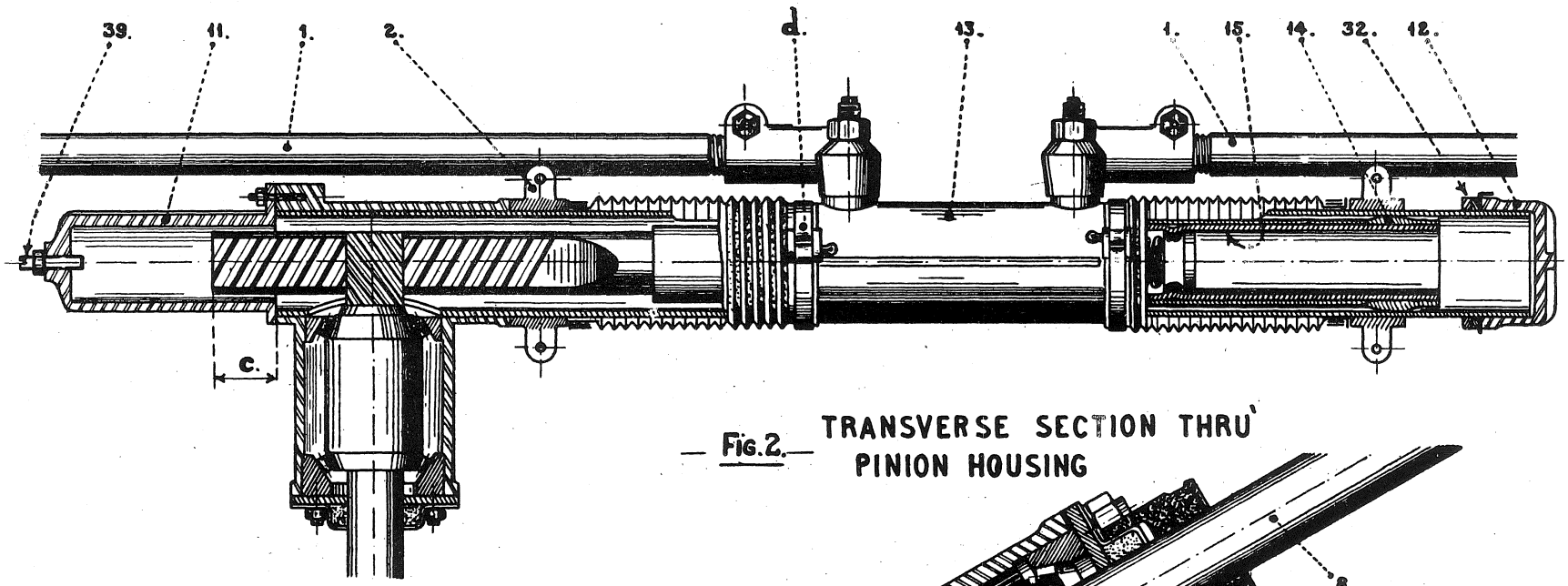
USE OF EXTRACTOR

— Fig.2. —

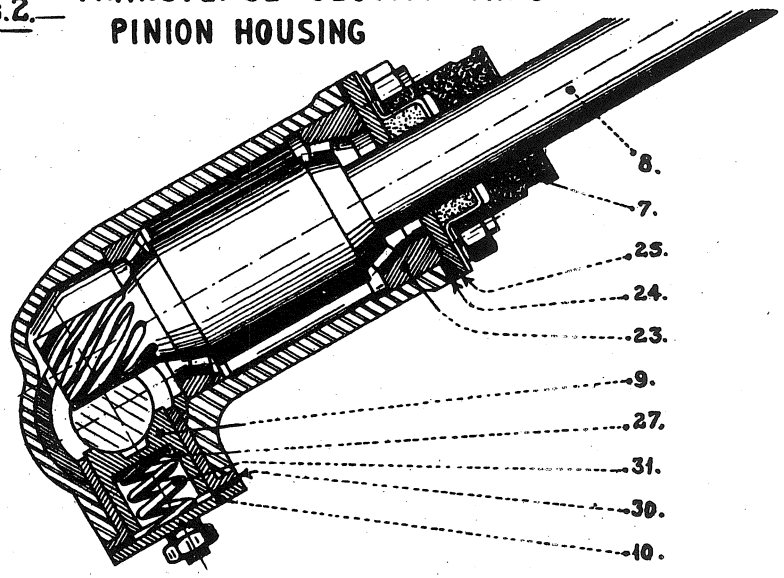


STEERING SECTIONS

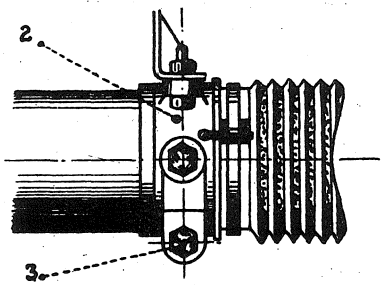
— Fig.1. — LONGITUDINAL SECTION



— Fig.2. — TRANSVERSE SECTION THRU PINION HOUSING



— Fig.3. — FITTING OF BRACKET



STEERING
SECTIONS

Fig.1. SECTION THROUGH BALL PINS

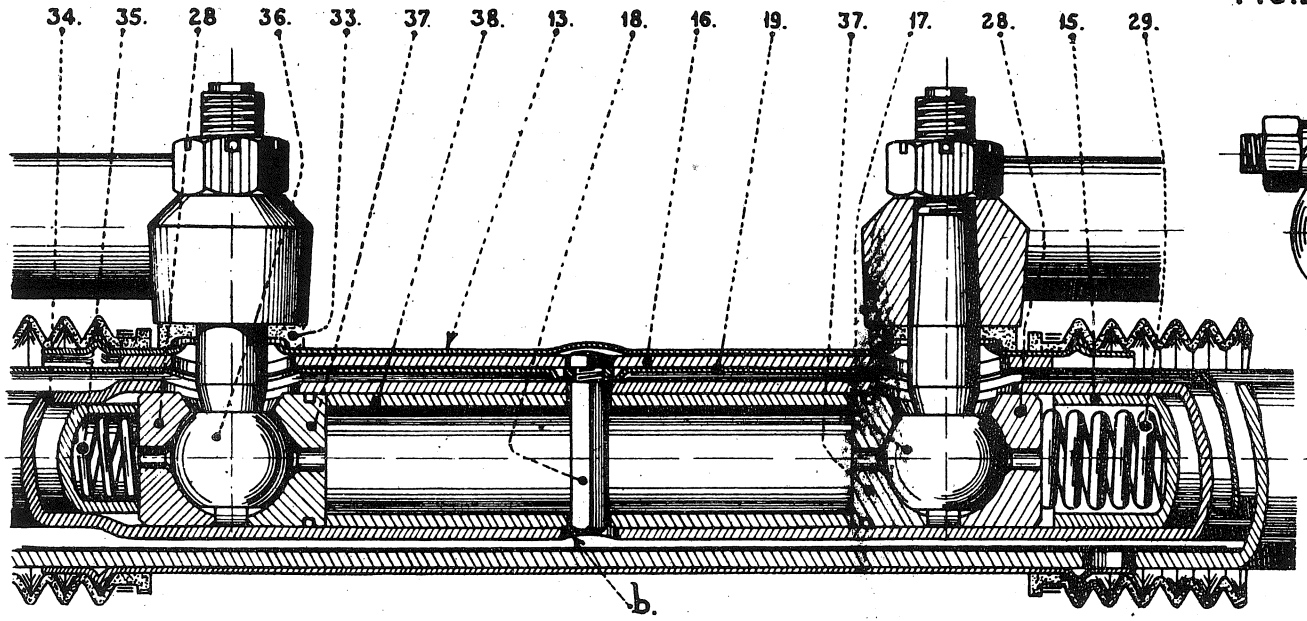


FIG.2. TRANSVERSE SECTION

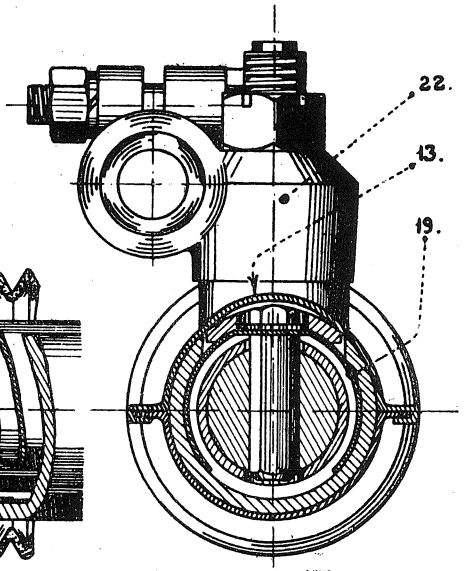


Fig.3.

CHECKING TOLERANCE OF BALL NUT

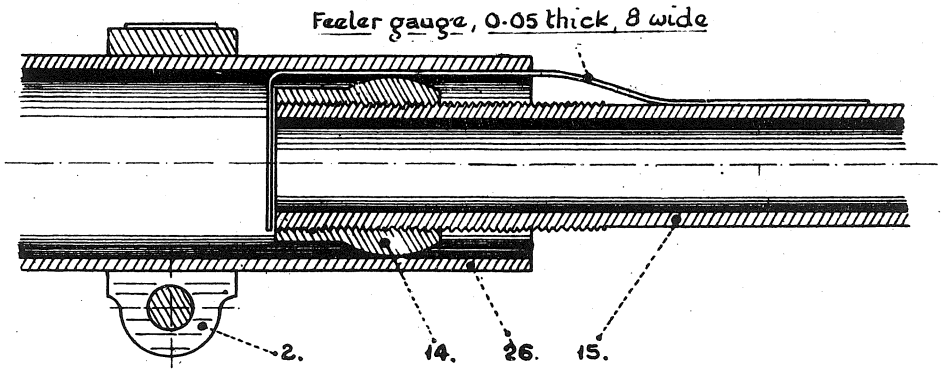
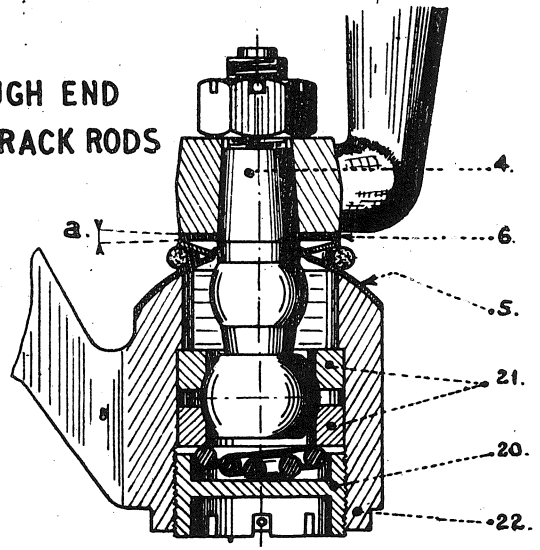


Fig.4.

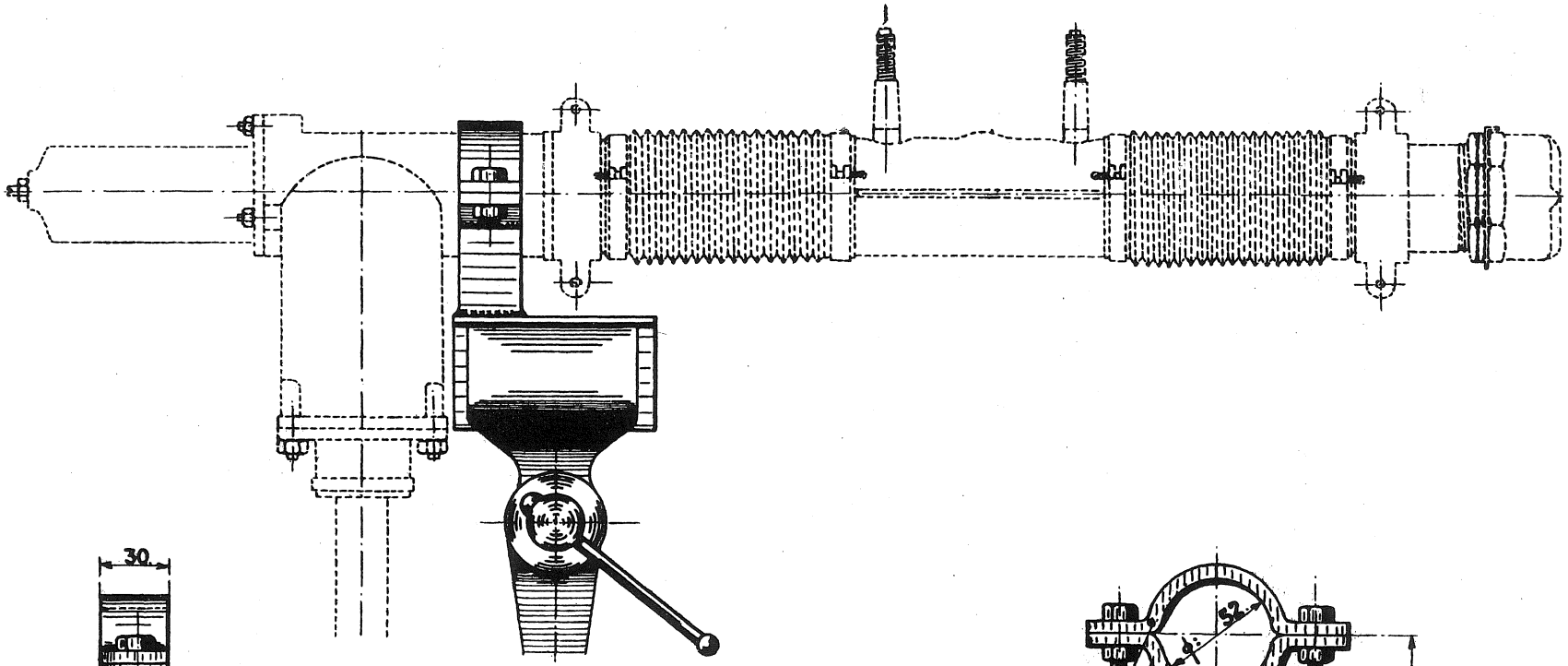
SECTION THROUGH END BALL PINS OF TRACK RODS

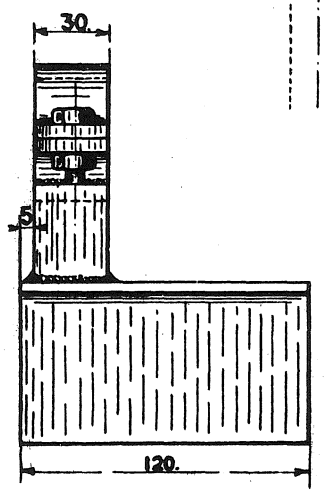


— STEERING —

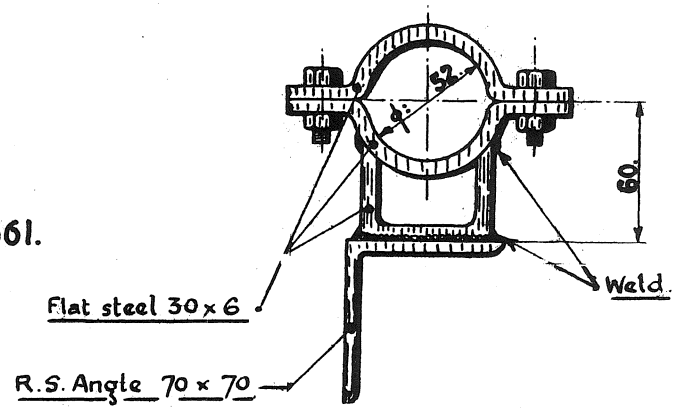
— HOLDING IN A VICE —

USE OF FIXTURE





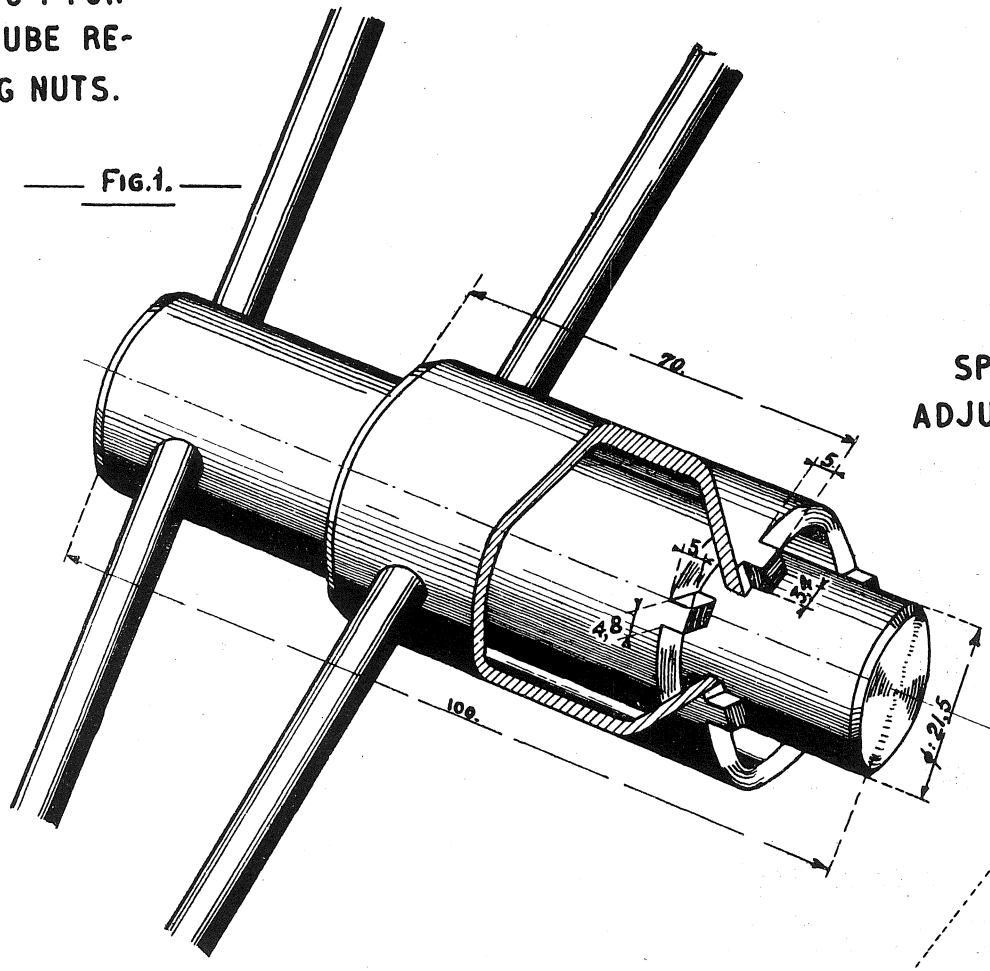
FIXTURE MR.1561.

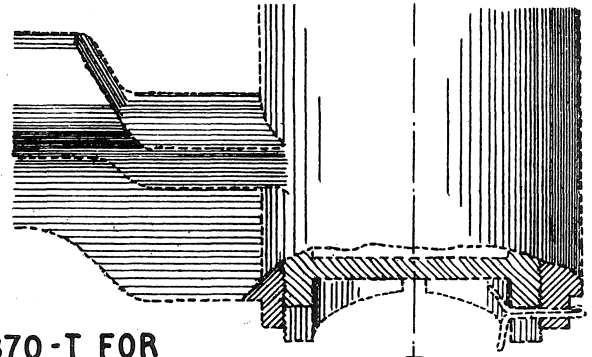


— STEERING —
— ADJUSTING TUBE RETAINING RING NUTS —
— ADJUSTING BALL PINS —

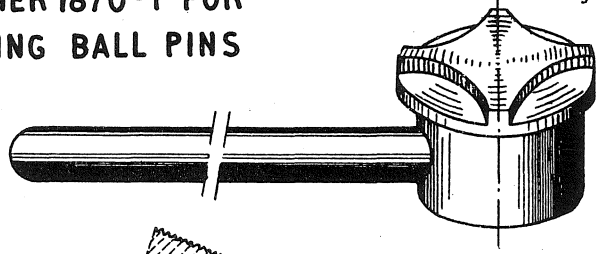
SPANNER 1976-T FOR ADJUSTING TUBE RETAINING RING NUTS.

— Fig.1. —

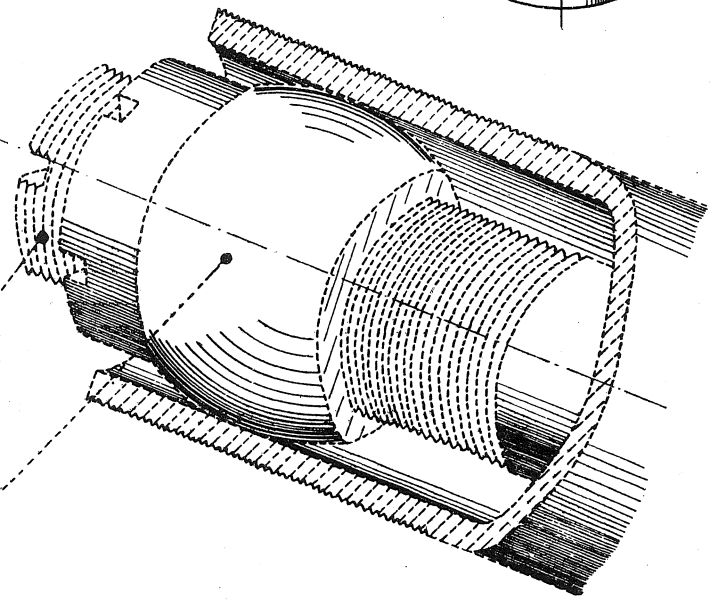




SPANNER 1870-T FOR ADJUSTING BALL PINS



— Fig.2 —



— STEERING —
— TRACK ROD ADJUSTMENT —

Fig.1. USE OF GAUGE

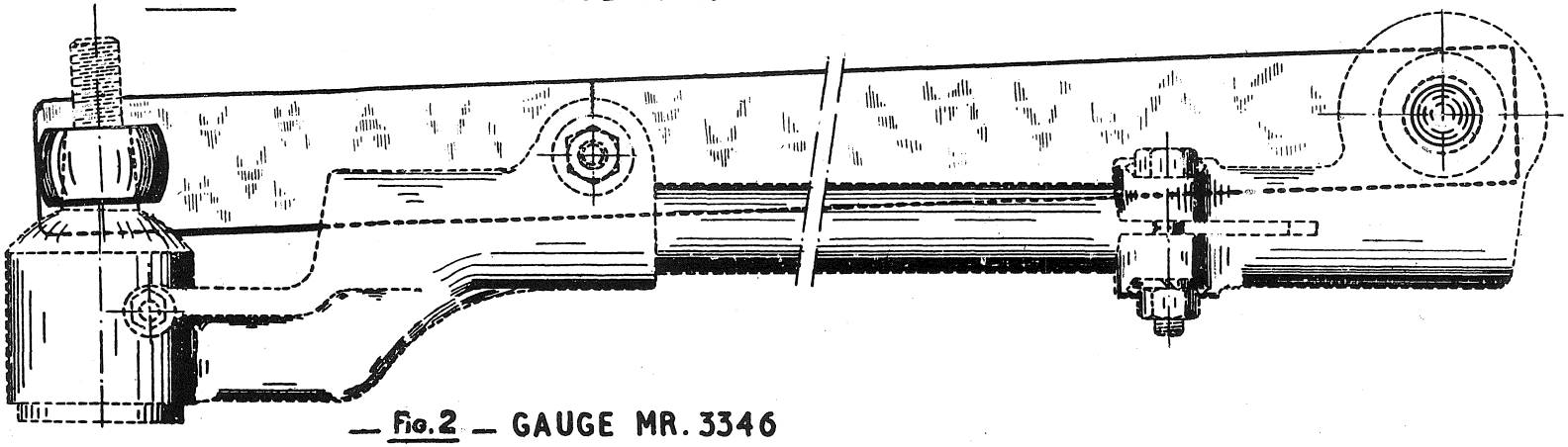
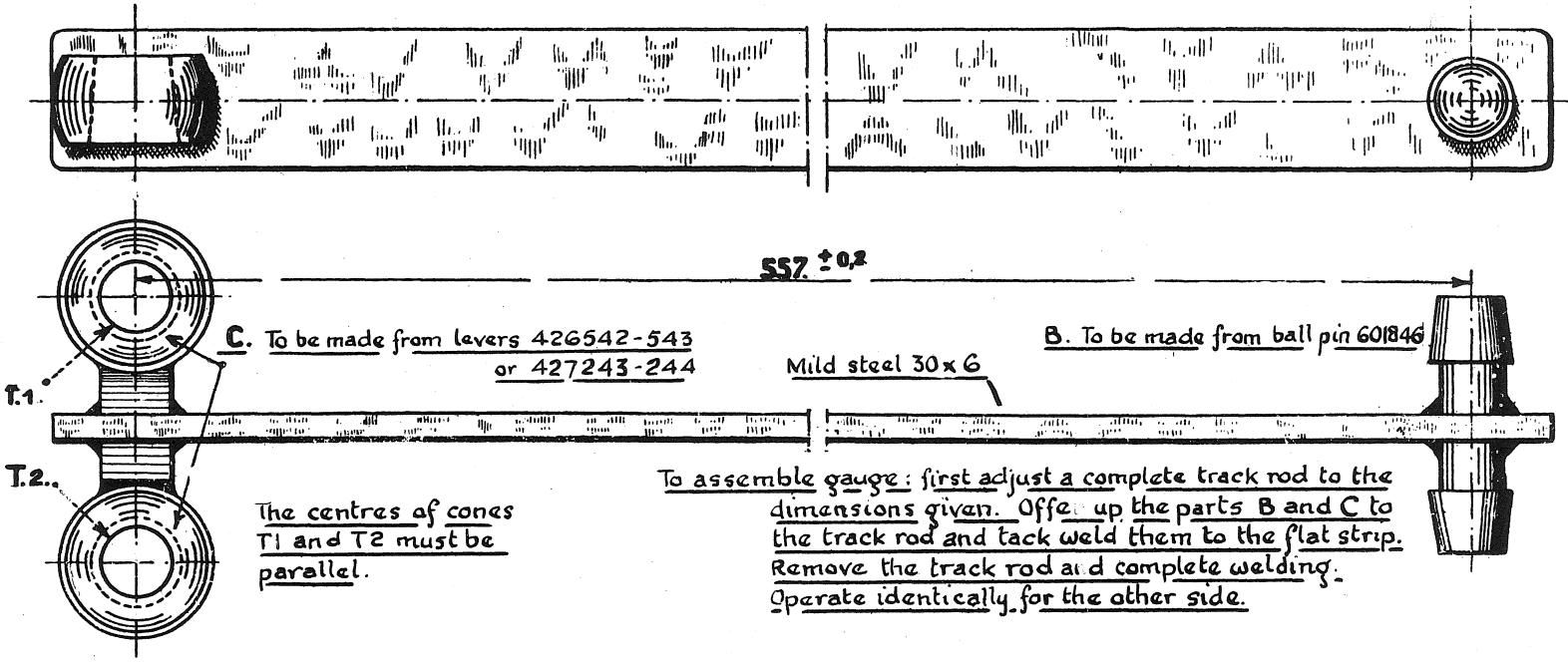
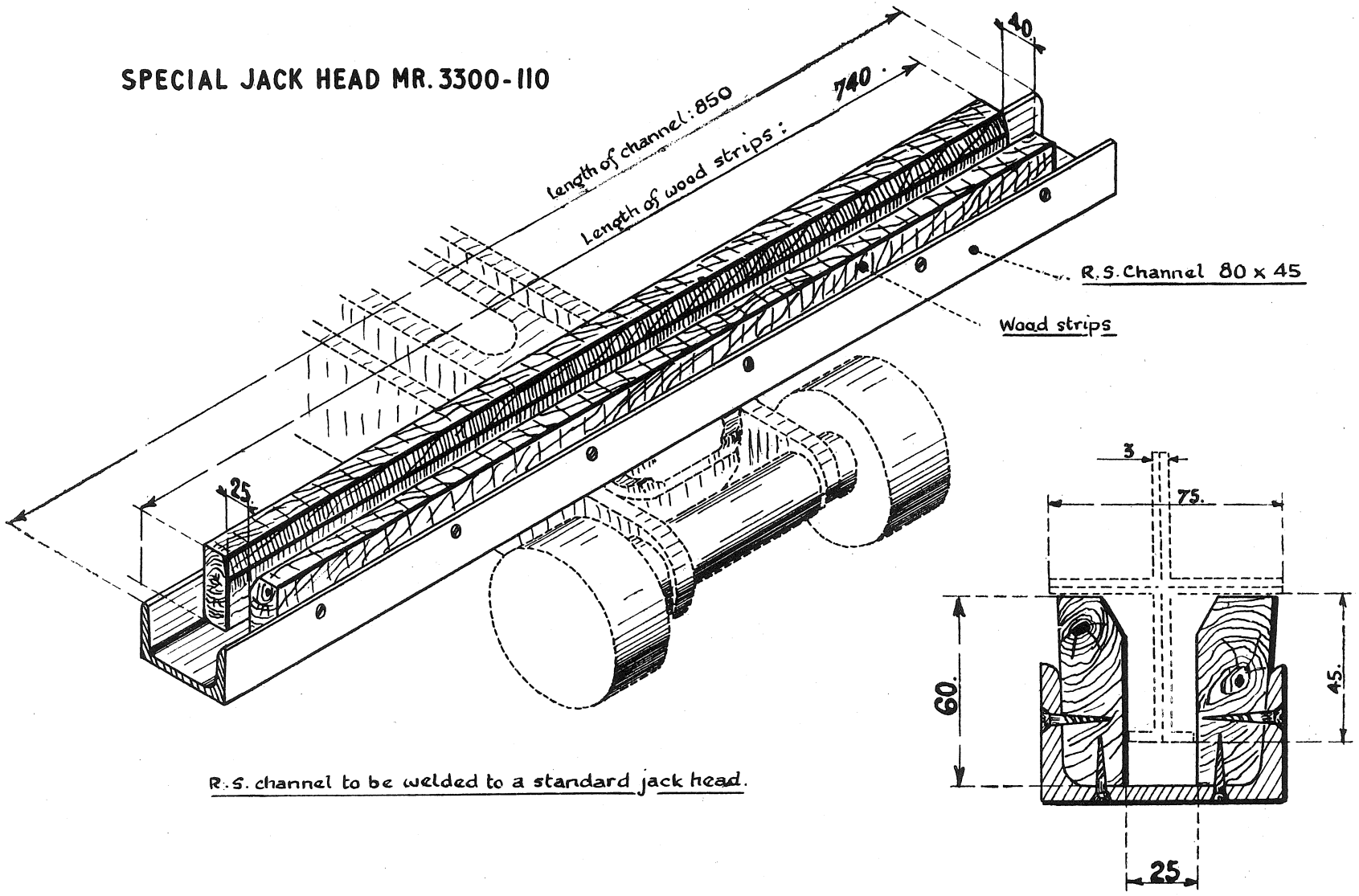


Fig.2 — GAUGE MR. 3346



— LIFTING REAR AXLE —

SPECIAL JACK HEAD MR. 3300-110



R.S. channel to be welded to a standard jack head.

— REAR AXLE —

— POSITIONING REAR AXLE —

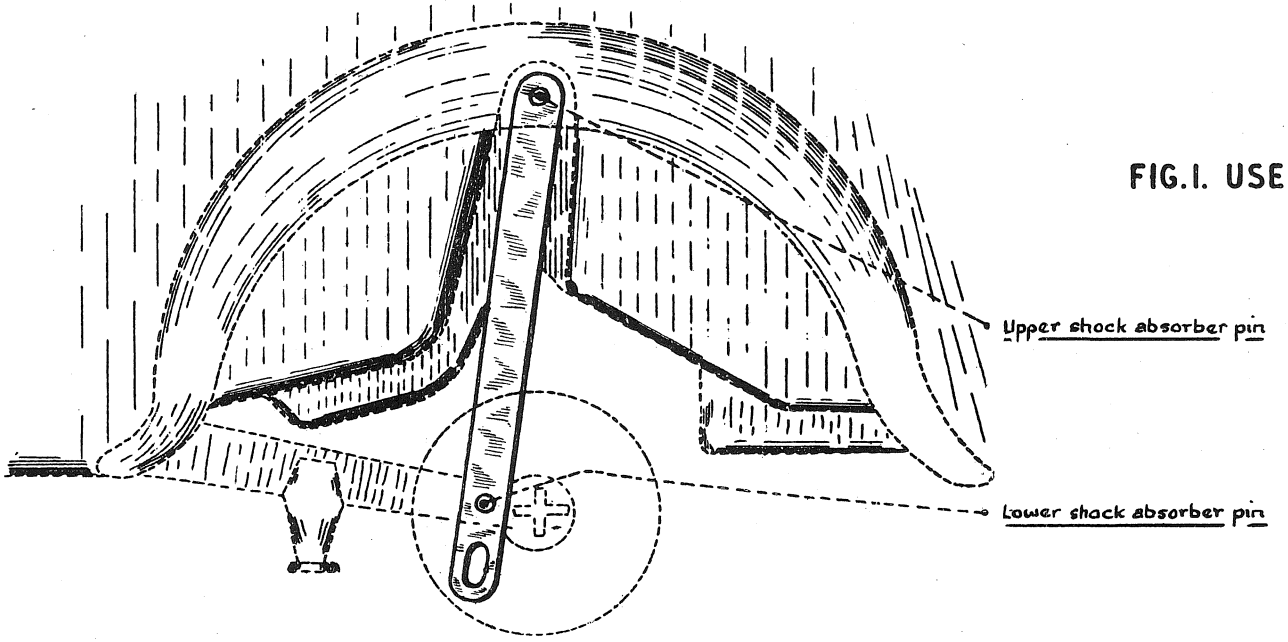
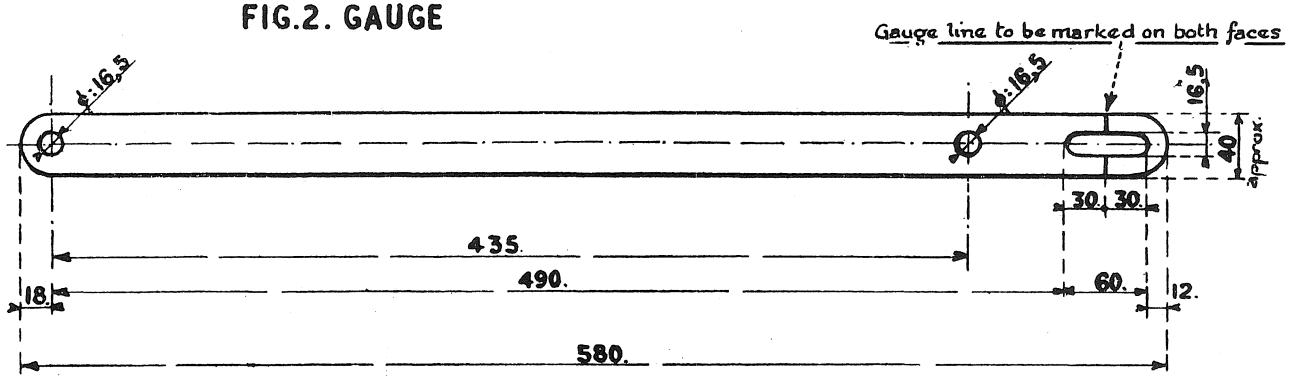


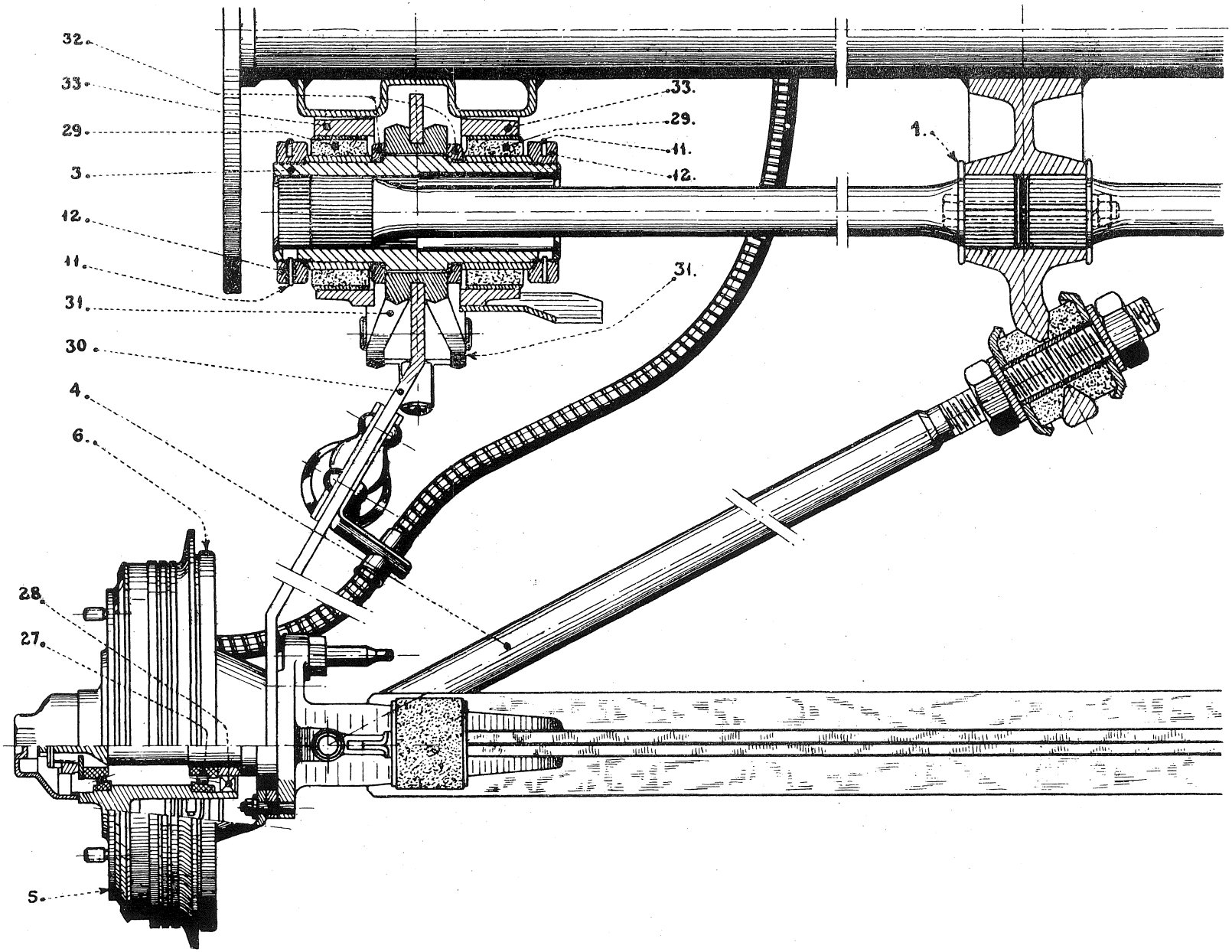
FIG.1. USE OF GAUGE

FIG.2. GAUGE



6mm. to 10mm. thick

— REAR AXLE —
— PLAN VIEW —



REAR AXLE

LINK ARM

USE OF FIXTURES

Fig.1

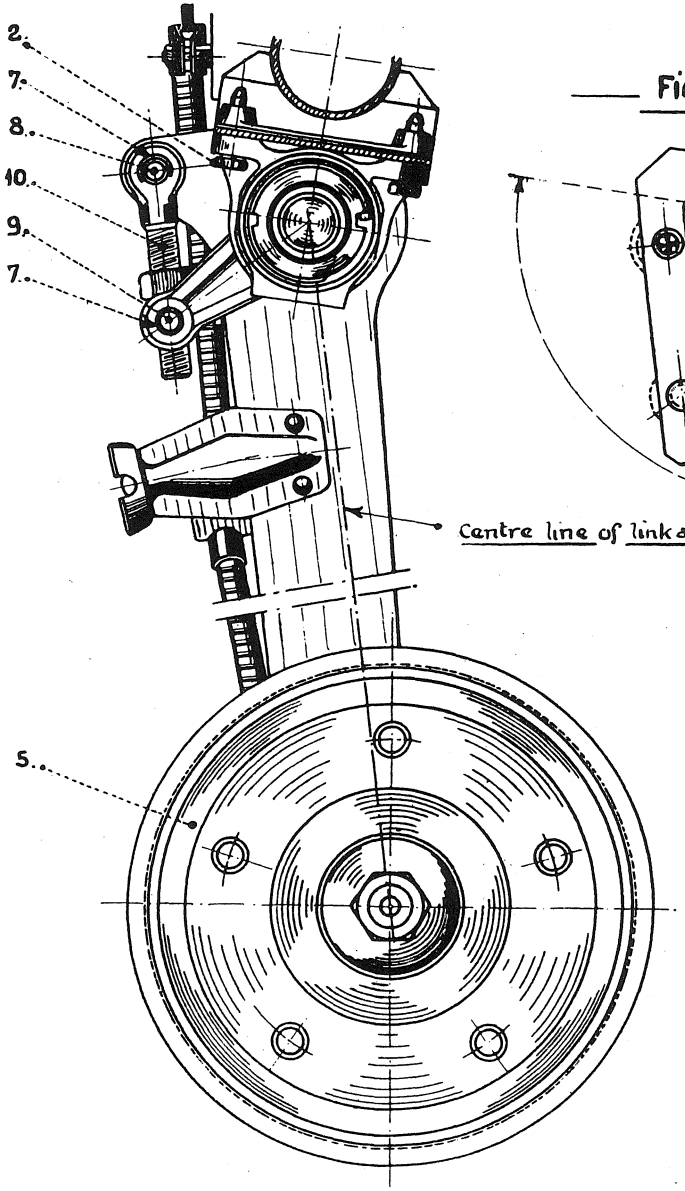


Fig.2.

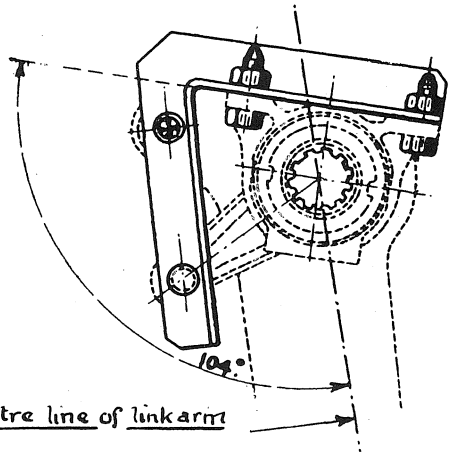
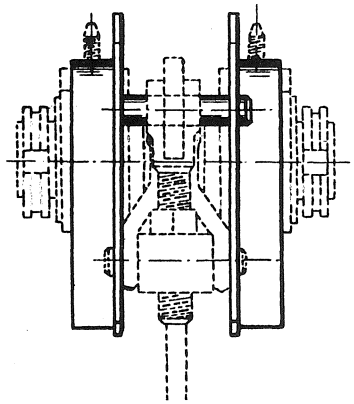
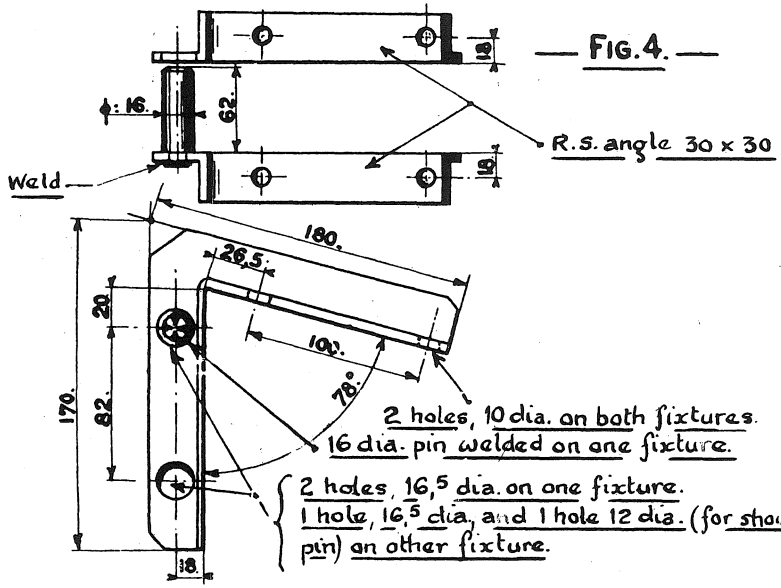


Fig.3



FIXTURES MR.3336

Fig.4.



— REAR AXLE —
— REMOVING TORSION BARS —

Fig.1. USE OF DRIVING BLOCK ASSEMBLY

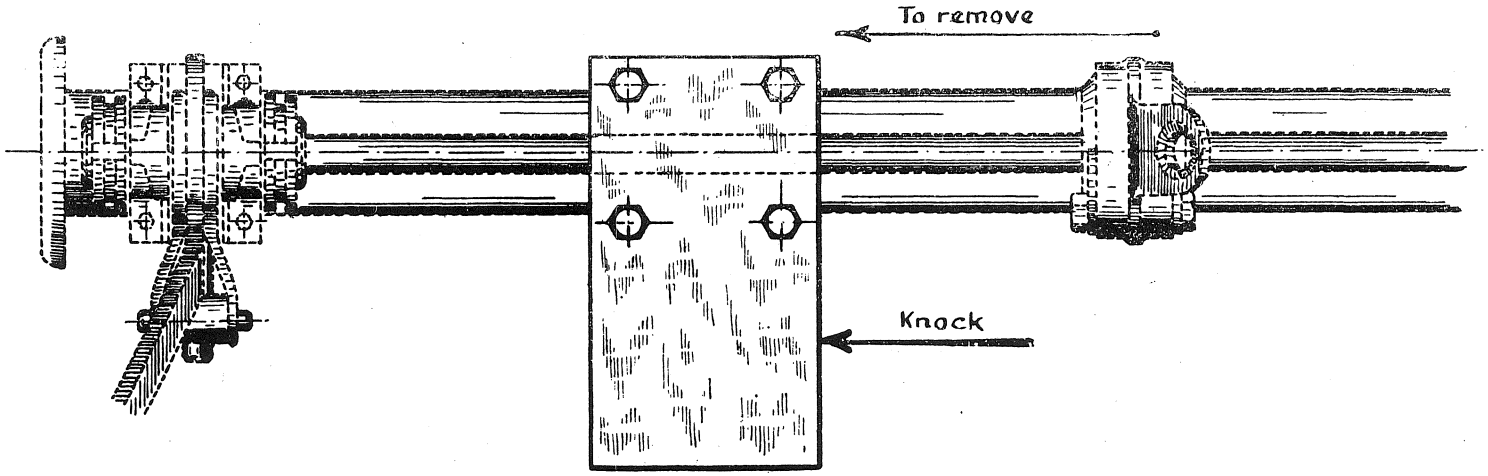
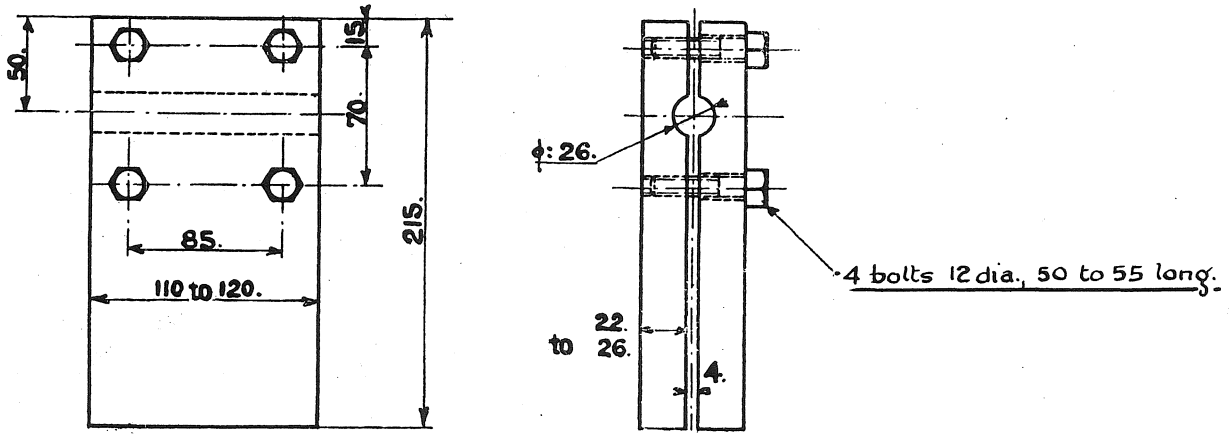


Fig.2 DRIVING BLOCKS MR.1578.

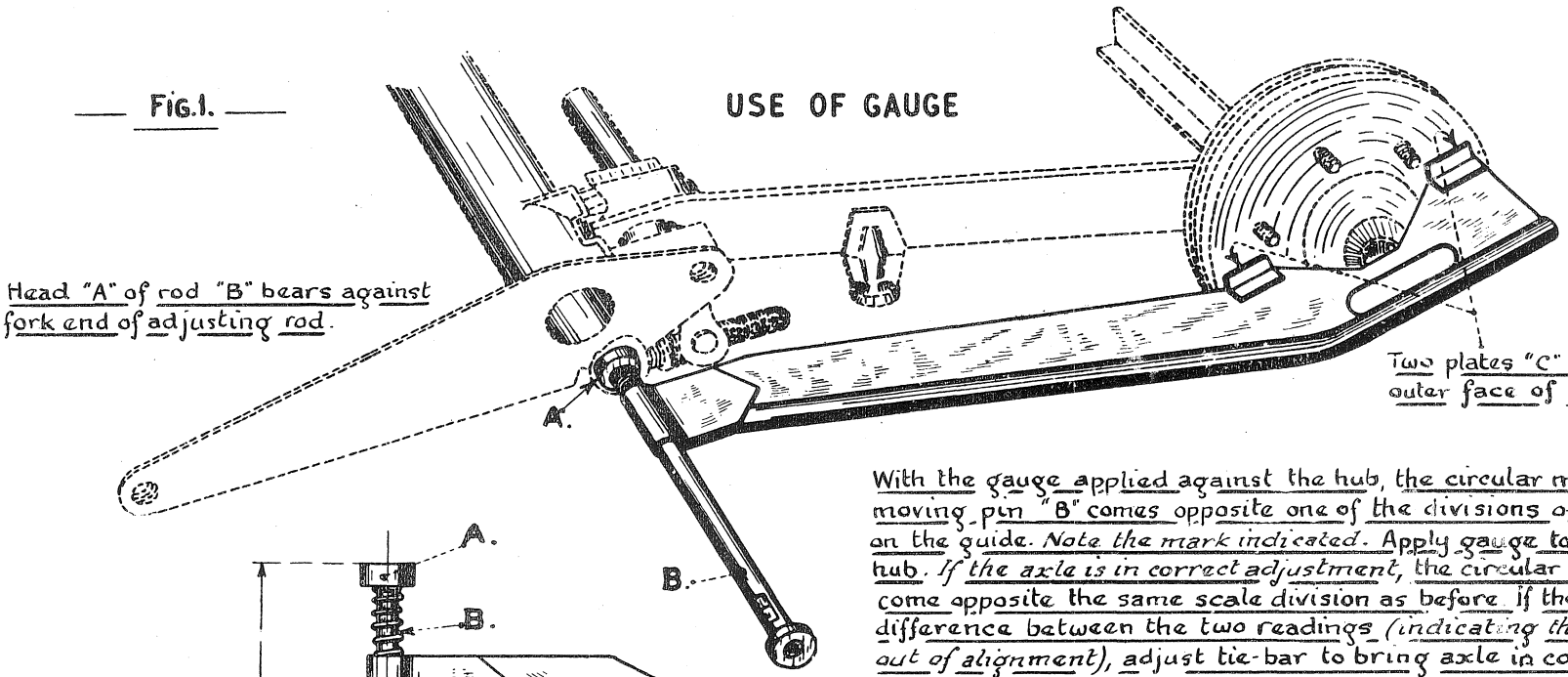


— REAR AXLE —

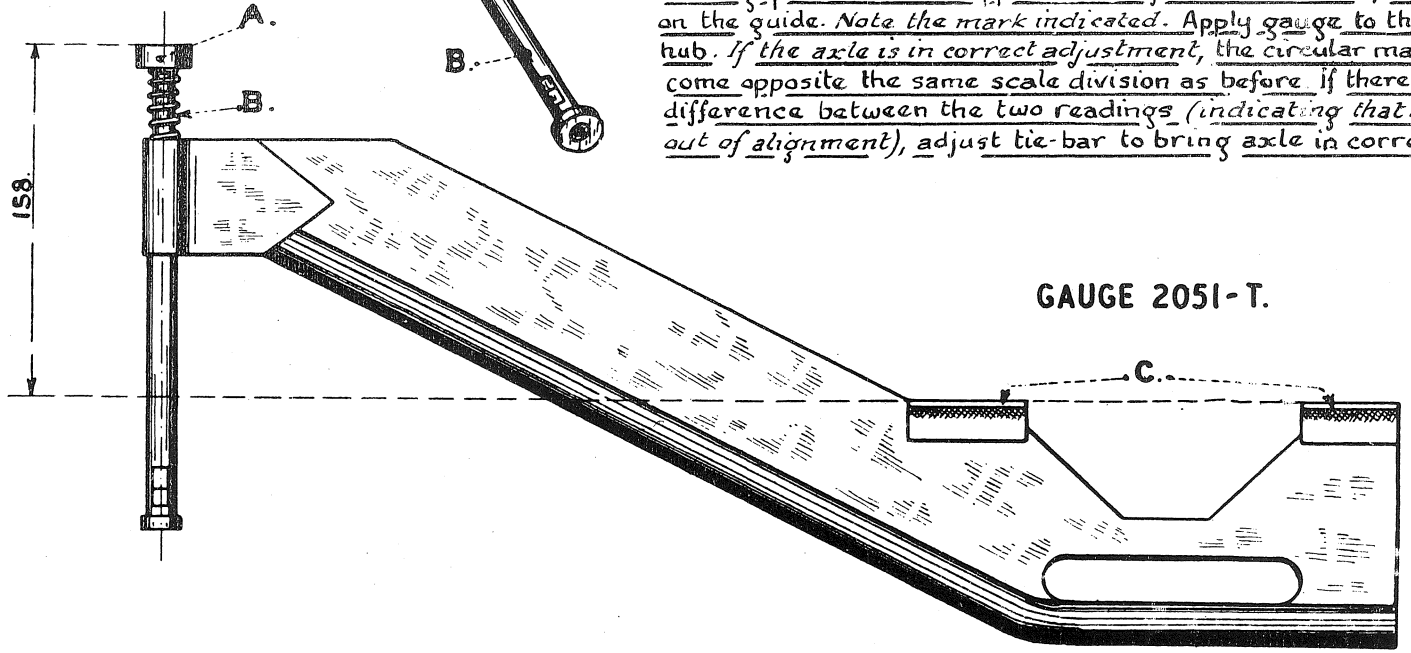
— LATERAL POSITIONING OF AXLE —

— Fig.1. —

USE OF GAUGE

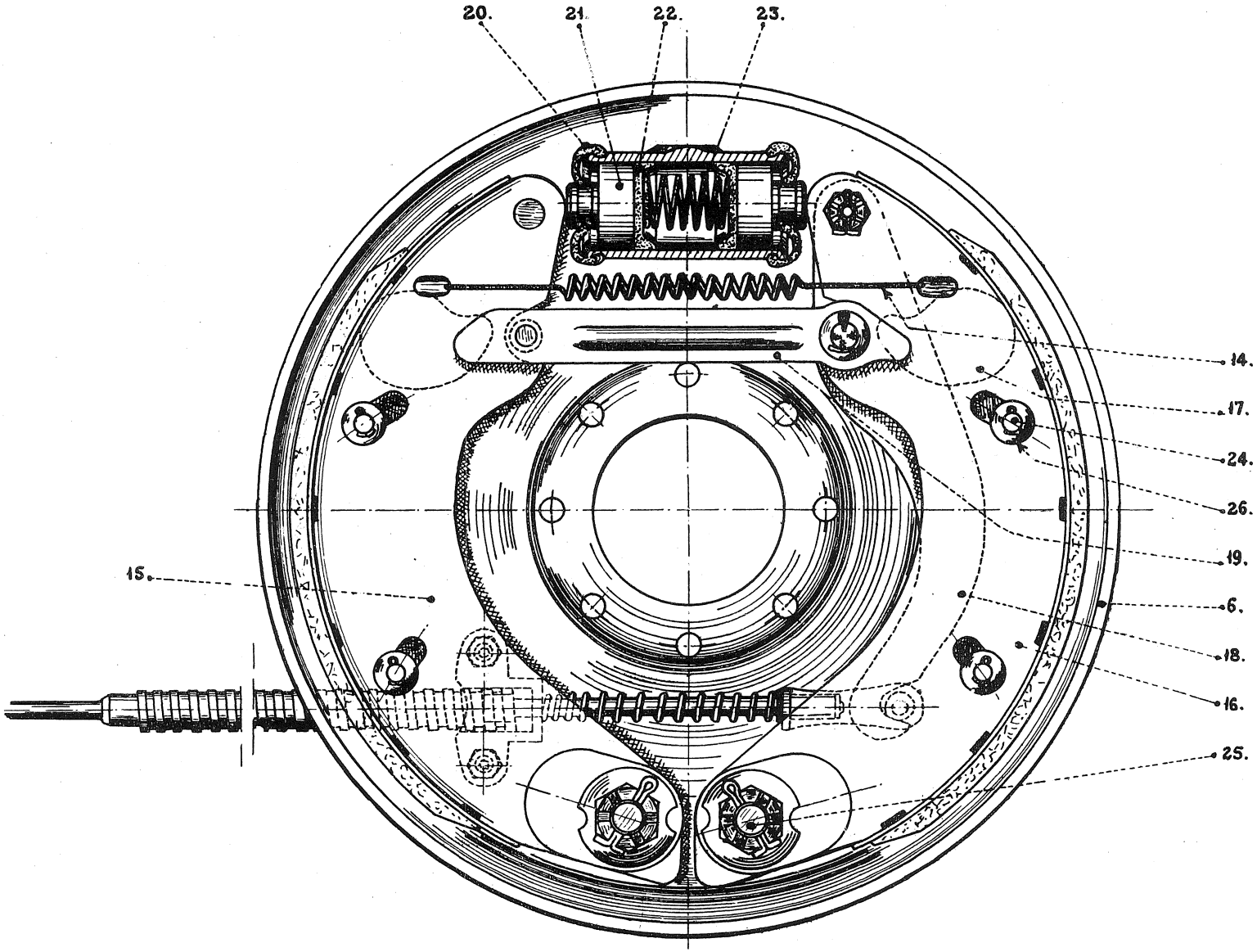


With the gauge applied against the hub, the circular mark of the moving pin "B" comes opposite one of the divisions of the scale on the guide. *Note the mark indicated.* Apply gauge to the opposite hub. *If the axle is in correct adjustment,* the circular mark will come opposite the same scale division as before. If there is a difference between the two readings *(indicating that axle is out of alignment)*, adjust tie-bar to bring axle in correct position.



GAUGE 2051-T.

— REAR AXLE —
— BRAKE BACK PLATE —



— REAR AXLE —

— FITTING OR REMOVING BRAKE SHOE RETURN SPRINGS —

FIG.1. REMOVING A SPRING.

Pointed tip of pliers placed in nearest rivet hole.

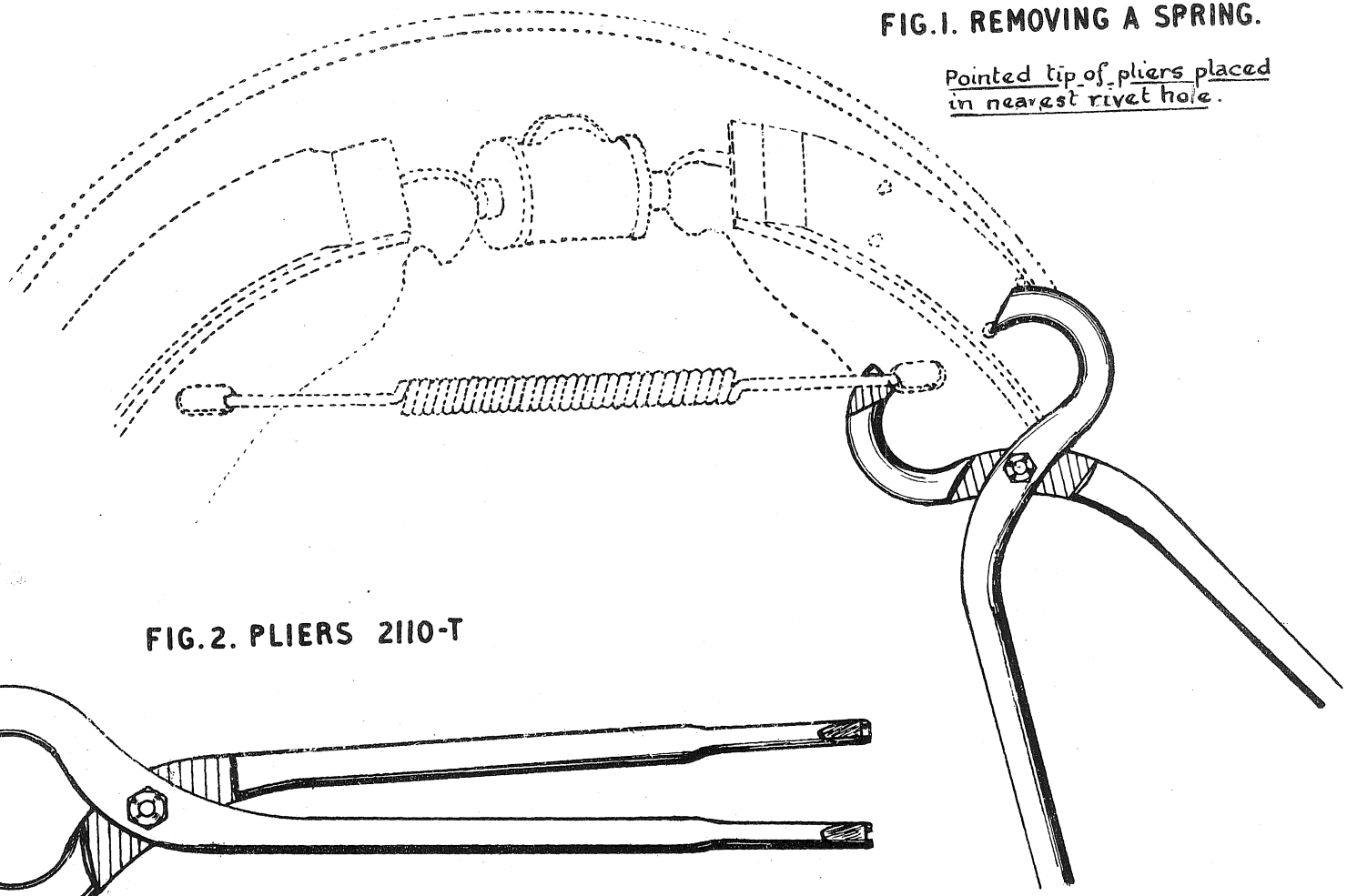
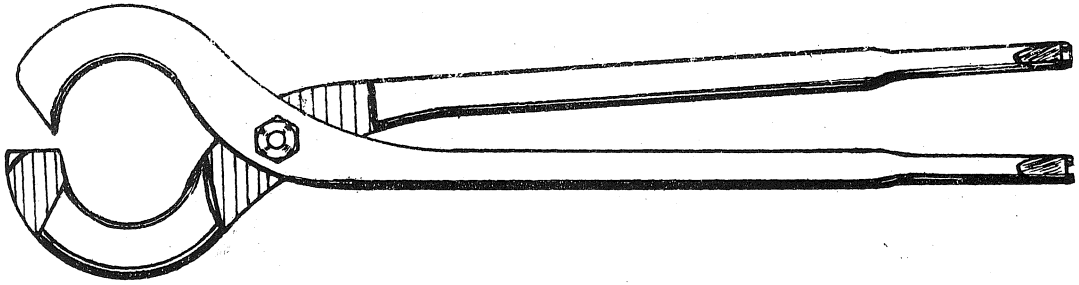


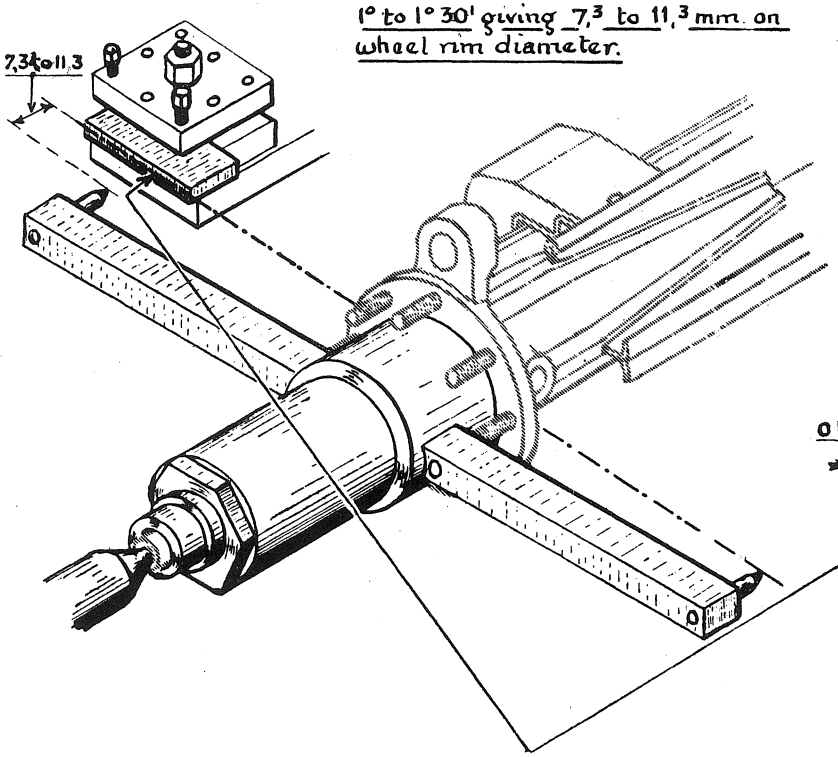
FIG.2. PLIERS 2110-T



— CHECKING CAMBER AND TOE-IN OF REAR AXLE —

— FIG. 1. — CHECKING CAMBER

CAMBER
1° to 1° 30' giving 7,3 to 11,3 mm. on wheel rim diameter.

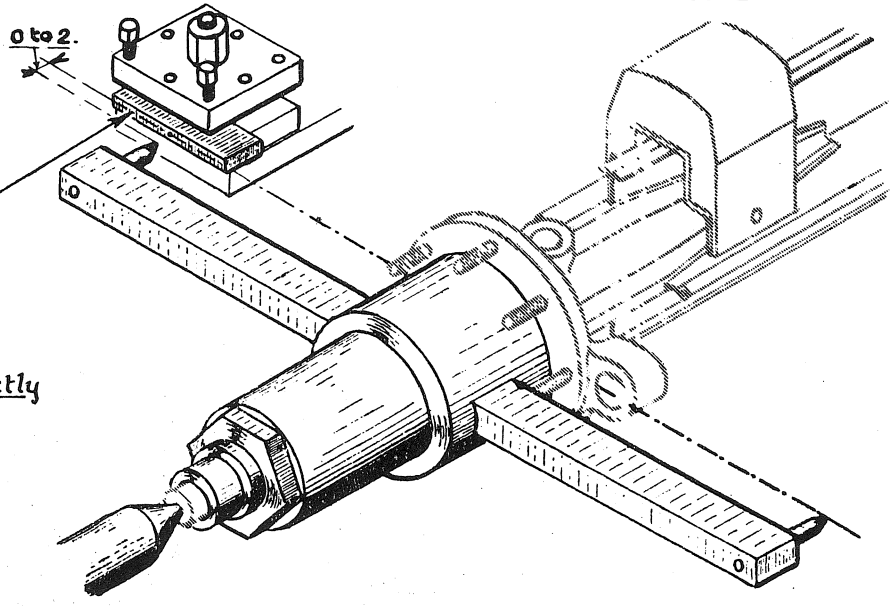


Working face of gauge must be perfectly square with centre line of lathe.

On stub axles of 30 mm. dia. it is necessary to fit a bush between stub axle and gauge body.

— FIG. 2. — CHECKING TOE-IN

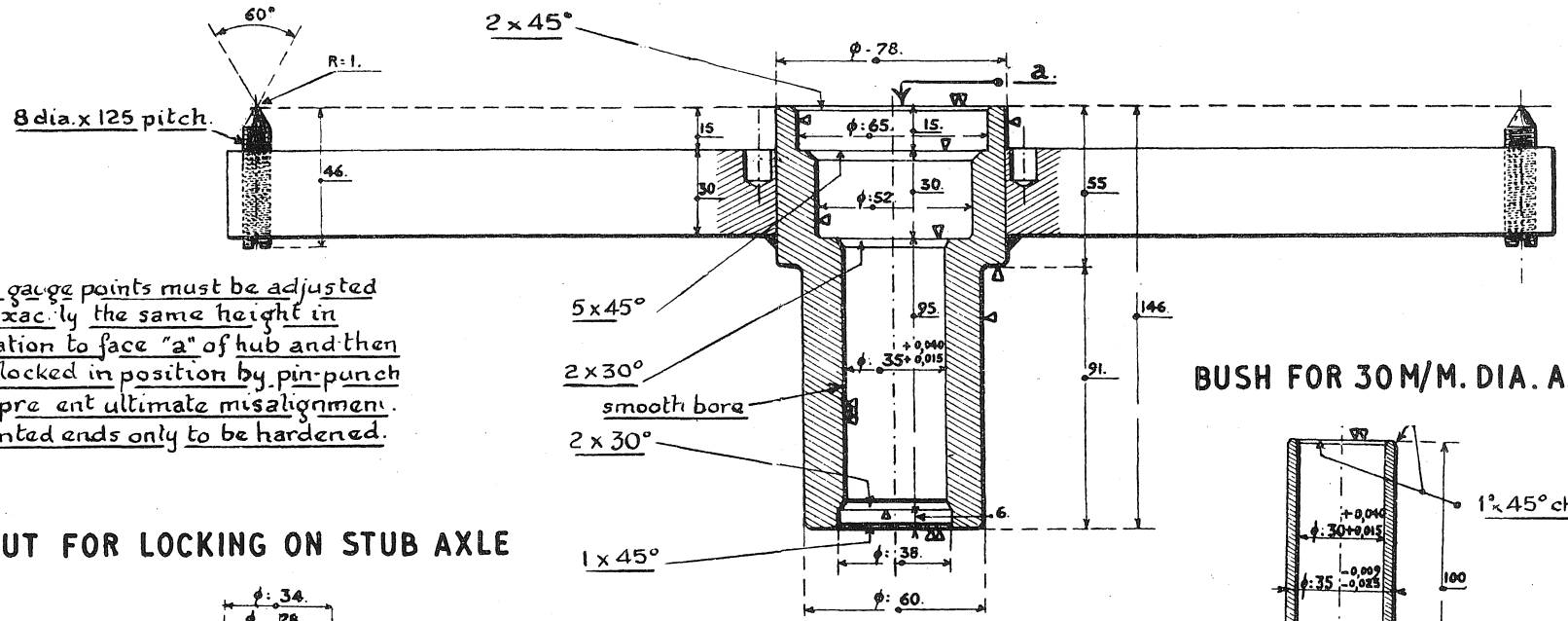
TOE-IN
0° to 0° 15' giving 0 to 2 mm. on wheel rim diameter.



— REAR AXLE —

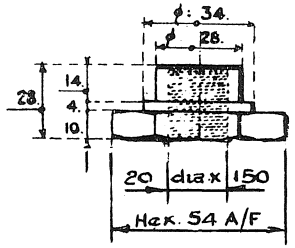
— CHECKING CAMBER AND TOE-IN OF REAR AXLE —

APPARATUS 2052-T

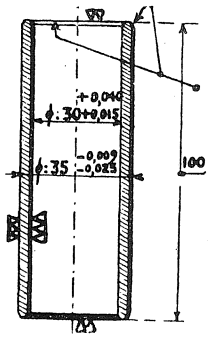


Two gauge points must be adjusted to exactly the same height in relation to face "a" of hub and then be locked in position by pin-punch to prevent ultimate misalignment. Pointed ends only to be hardened.

NUT FOR LOCKING ON STUB AXLE

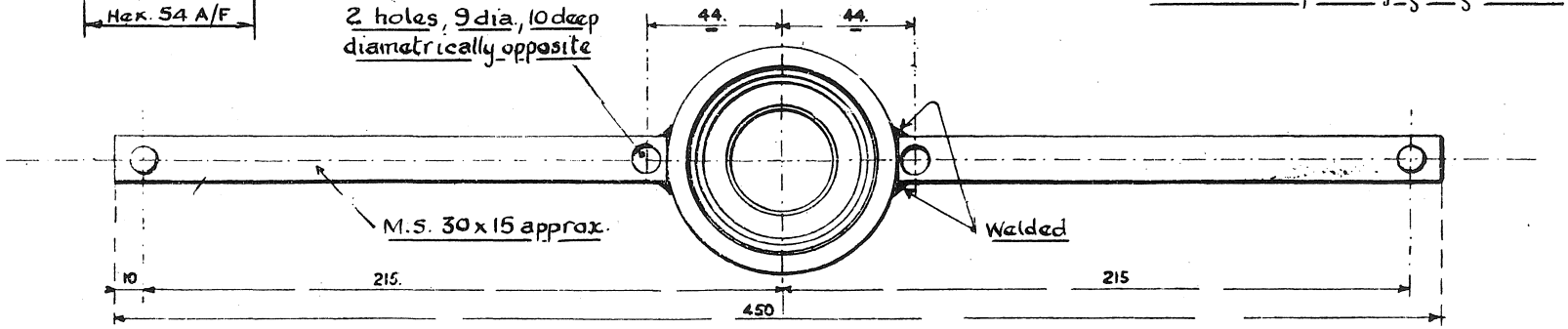


BUSH FOR 30 M/M. DIA. AXLES



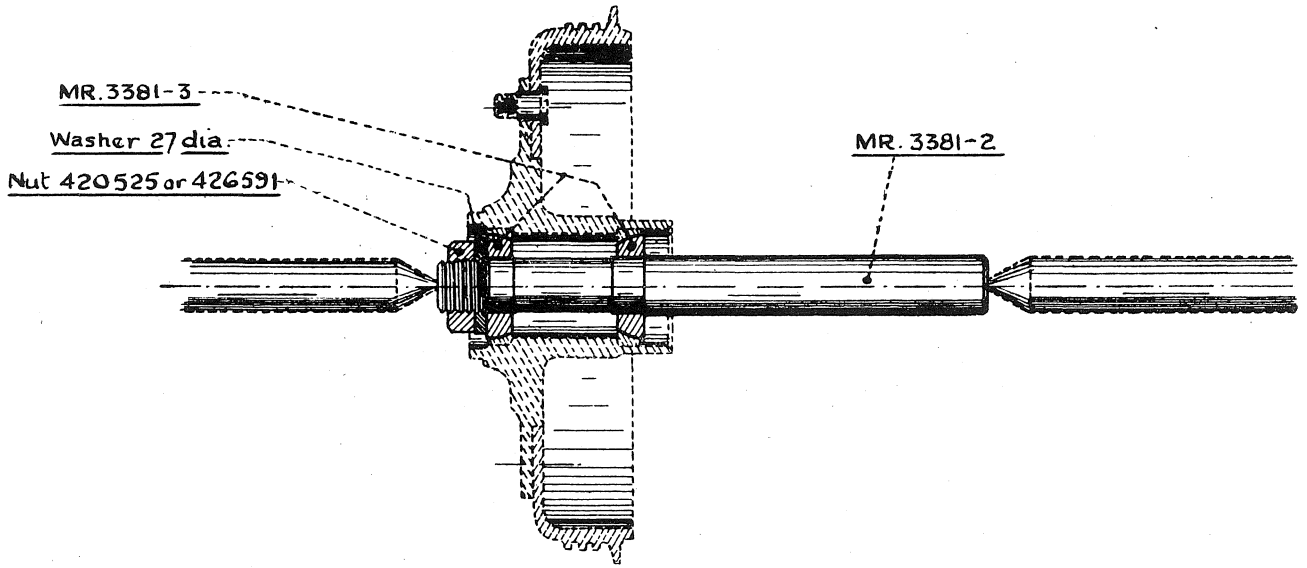
Semi-hard steel treated before grinding

This bush is part of gauge 2103-1

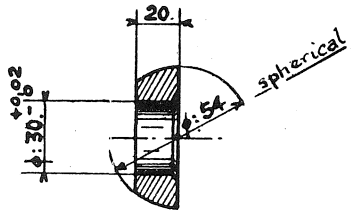


— REAR AXLE —
— RECTIFICATION OF BRAKE DRUMS —

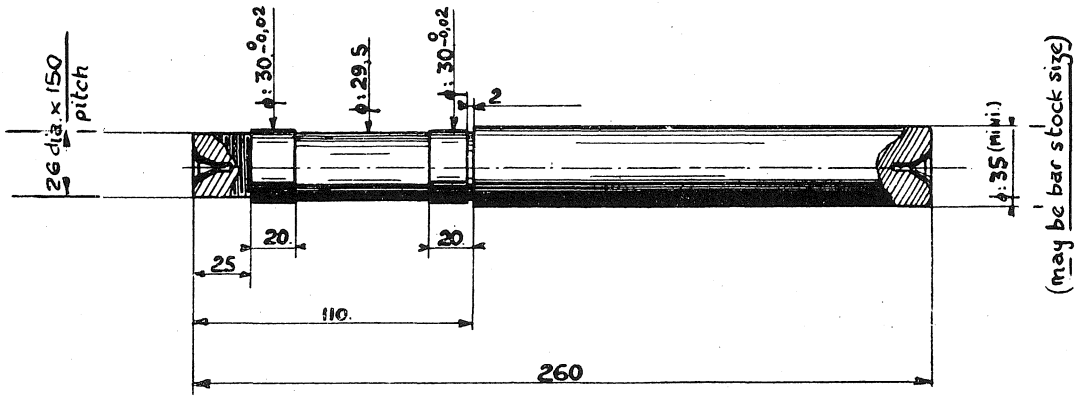
USE OF MANDREL



BUSH MR.3381-3



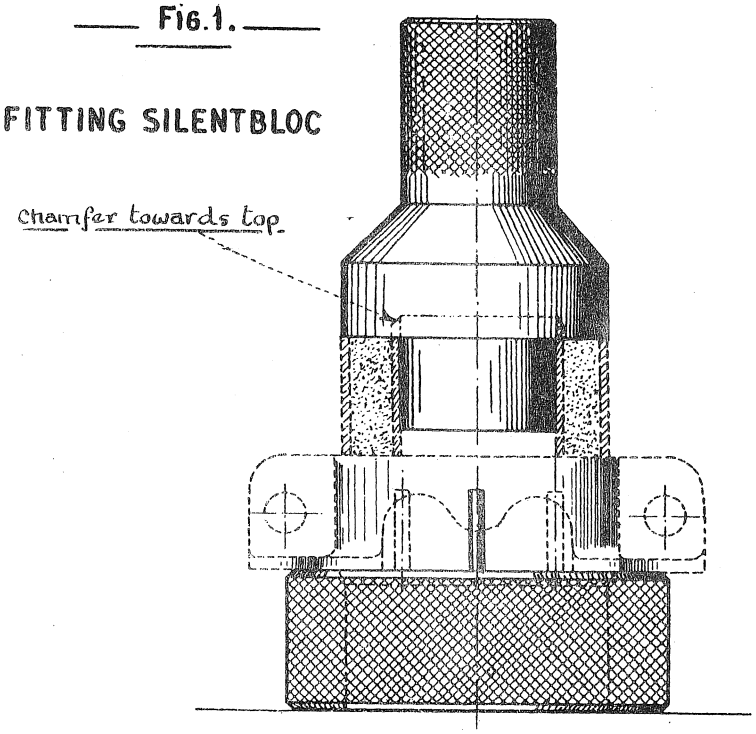
MANDREL MR.3381-2



— REAR AXLE —
— REPLACEMENT OF SILENTBLOCS —

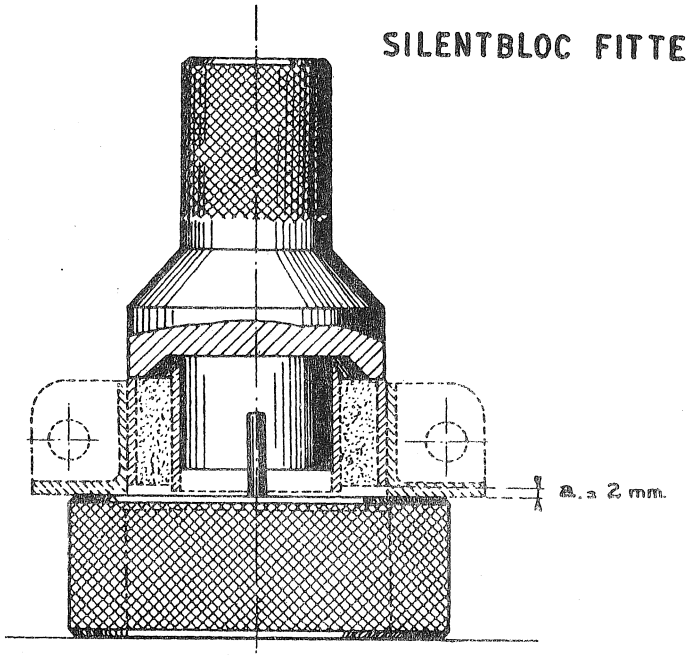
— Fig.1. —

FITTING SILENTBLOC

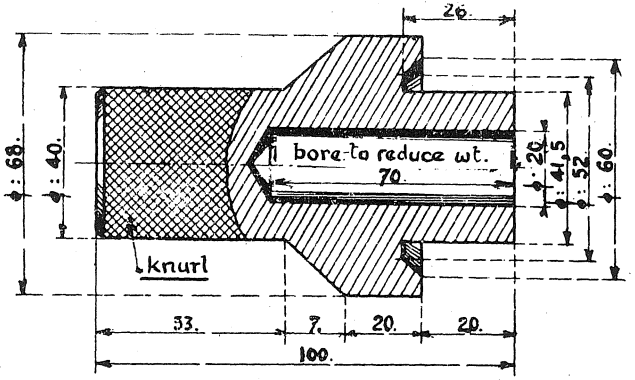


— Fig.2. —

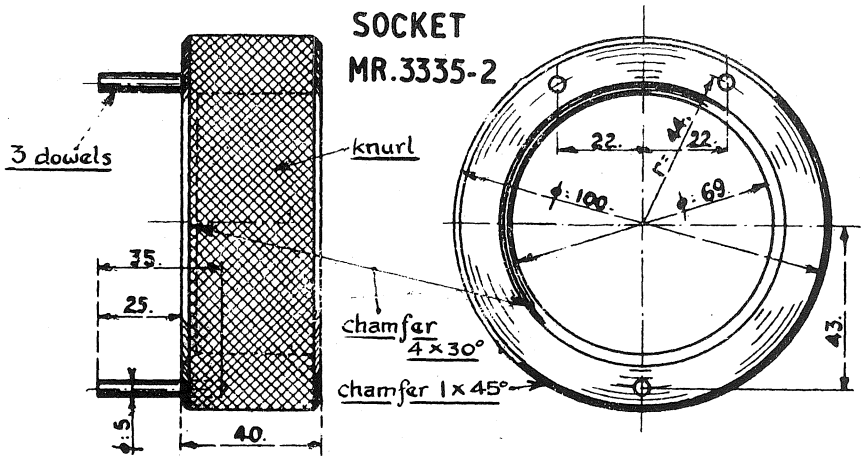
SILENTBLOC FITTED



— Fig.3. — PLUNGER MR.3335-1



SOCKET
MR.3335-2

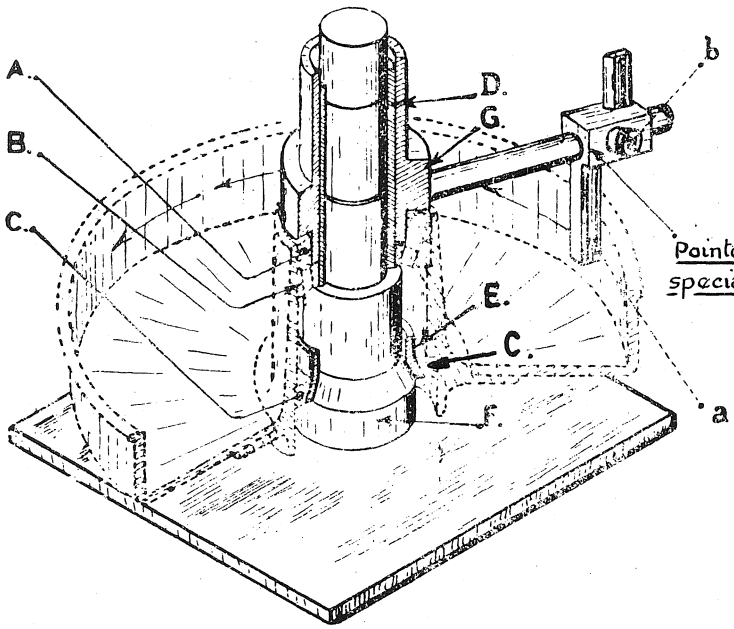


— REAR AXLE —

— CHECKING BRAKE SHOE CONCENTRICITY —

GAUGE 2103-T & 2104-T

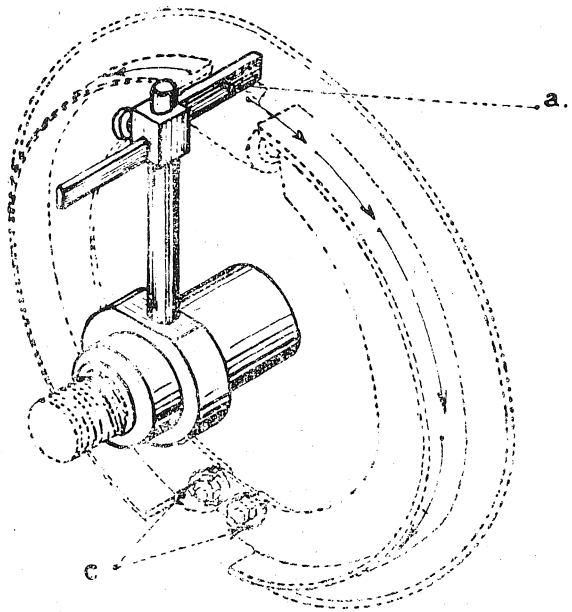
— Fig.1. — CHECKING BRAKE DRUM DIA.



Brake drum equipped with S.P.1. oil seal, complete inner Timken bearing "B", and outer race only of outer Timken bearing "C".

Fit sleeve "D" and conical bush "E".
Fit brake drum on pivot "F".
Place on pivo , bush "G", carrying pointer.
Bring pointer "A" into contact with friction surface of drum, and describe a complete circle.
Lock the pointer in this position by means of screw "b".

— Fig.2. — CHECKING CONCENTRICITY OF LININGS



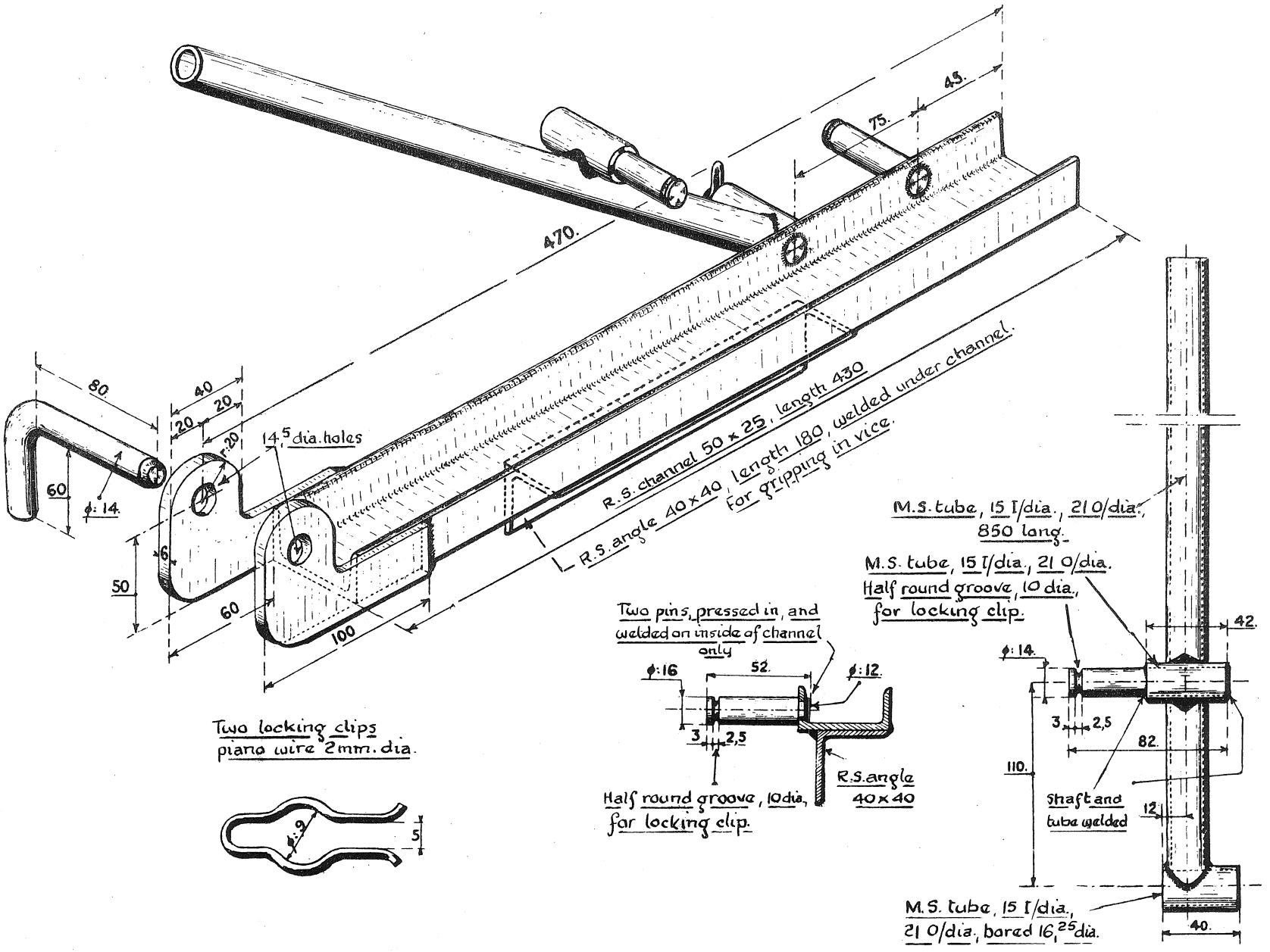
Do not use sleeve "D".

Place gauge on stub axle. Offer up pointer "a", as set in the previous operation, to brake linings. The pointer must contact linings throughout circumference. *(In order to obtain this result, adjust linings by eccentric bushes "c" and adjusting cams at rear of backplate, which are not shown on drawing).*

Remove burrs and high spots on linings with a rasp.

After checking, release cams to allow fitting of brake drum. (For final adjustment of cams see operation 749, paragraph 2).

— FIXTURE MR.3552 FOR DRAINING AND REFILLING SPICER SHOCK ABSORBERS —



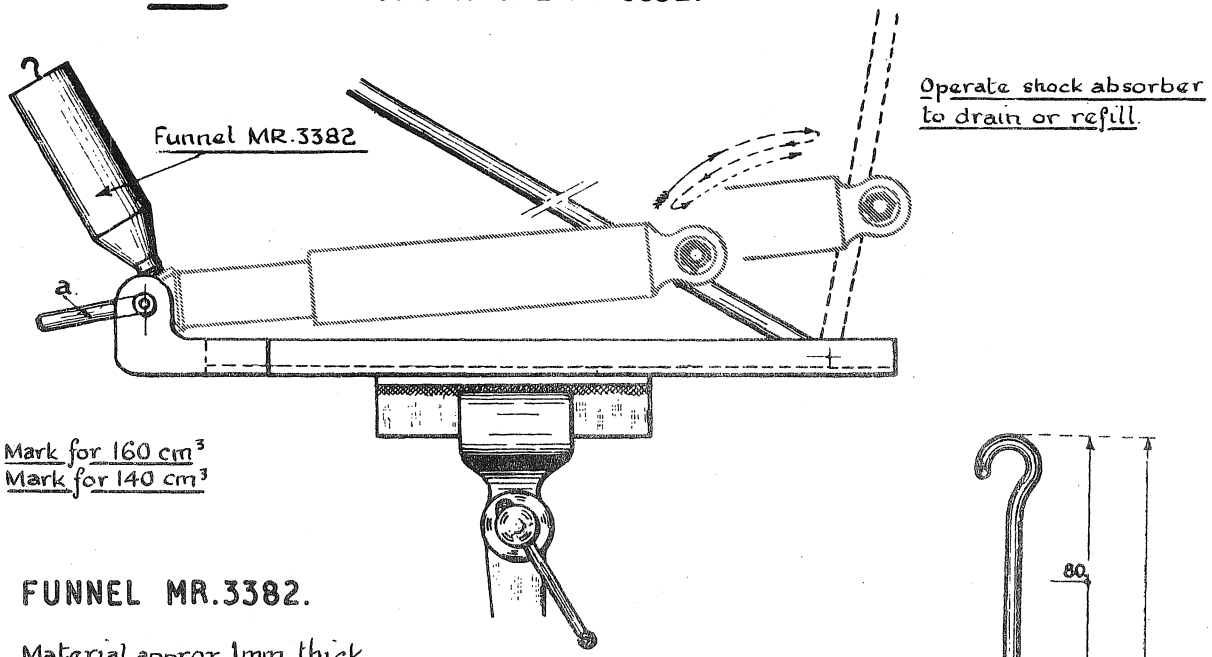
SUSPENSION

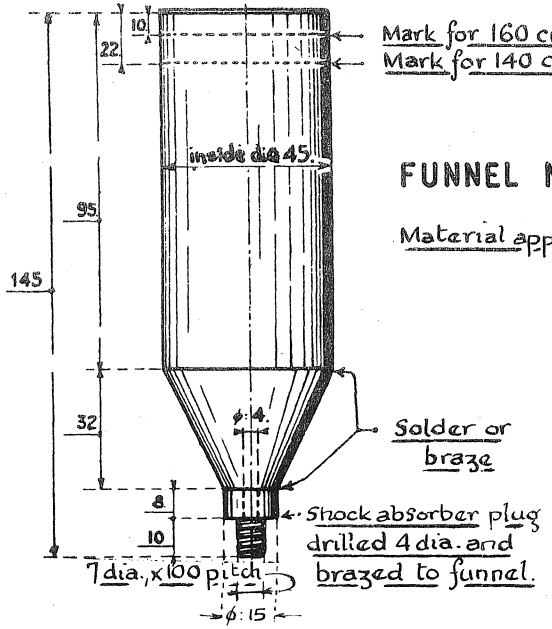
DRAINING AND REFILLING SPICER SHOCK ABSORBERS

Shock absorber in place for filling with funnel MR.3382

To drain, take out pin "a", and turn shock absorber 180° to bring orifice underneath, thereby allowing oil to drain into a receiver.

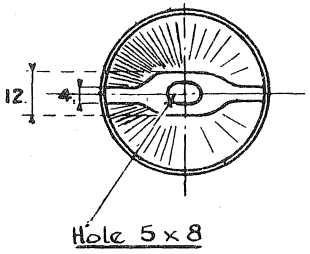
Fig. 1. — USE OF FIXTURE MR.3552.

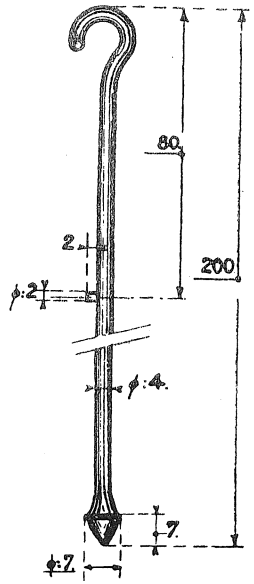




FUNNEL MR.3382.

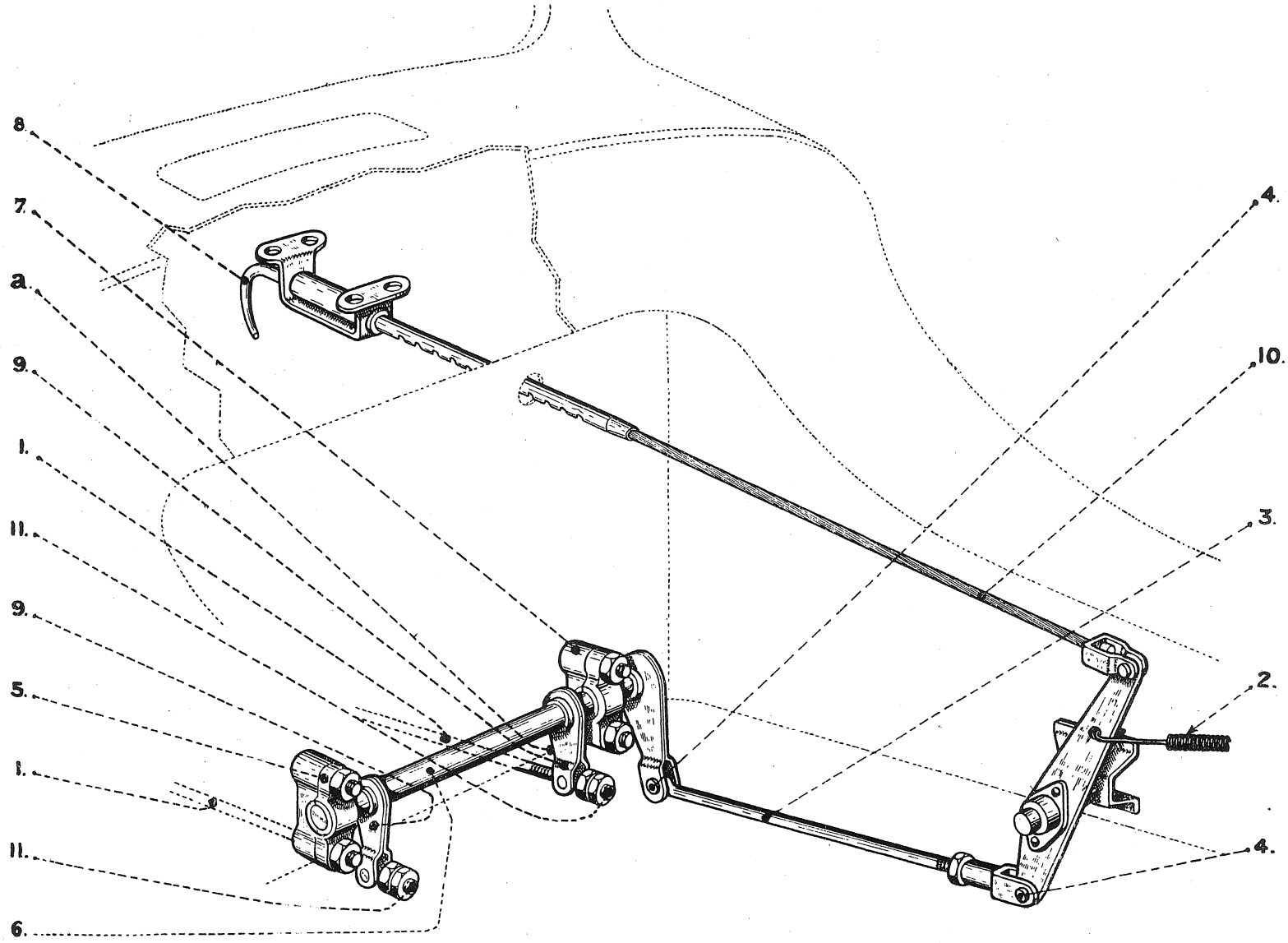
Material approx 1mm. thick





PLUG FOR FUNNEL.

— BRAKES —
— HAND BRAKE CONTROL —



— REMOVING AND FITTING MASTER CYLINDER —

FIG.1. SPANNER 2131-T.

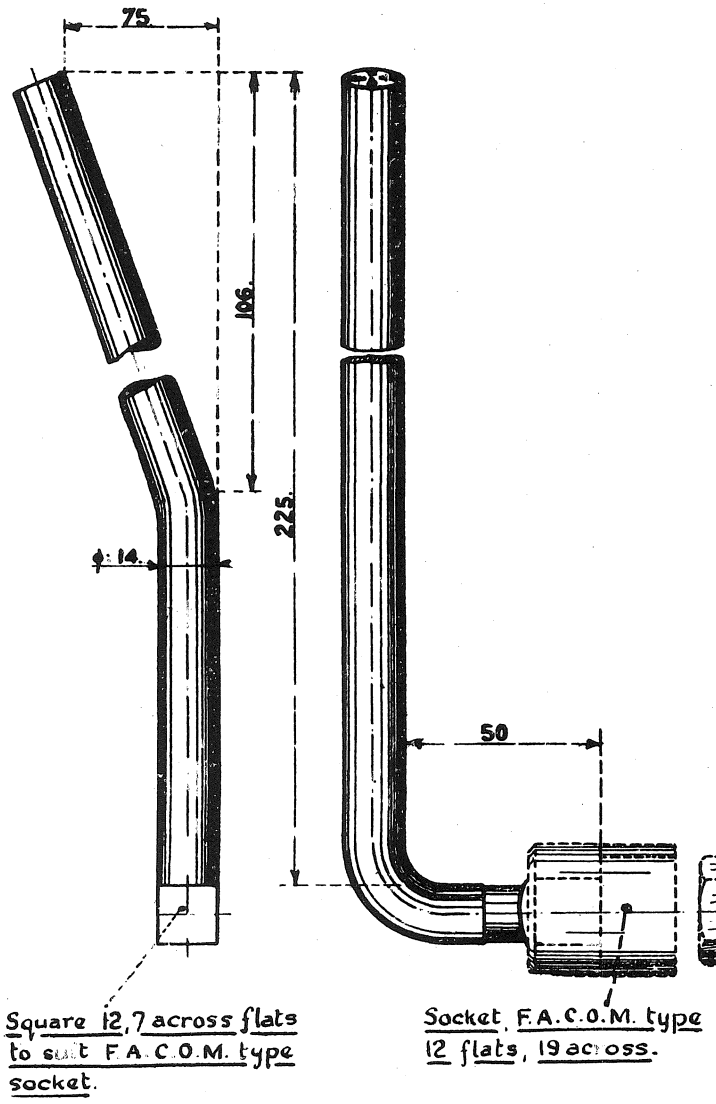
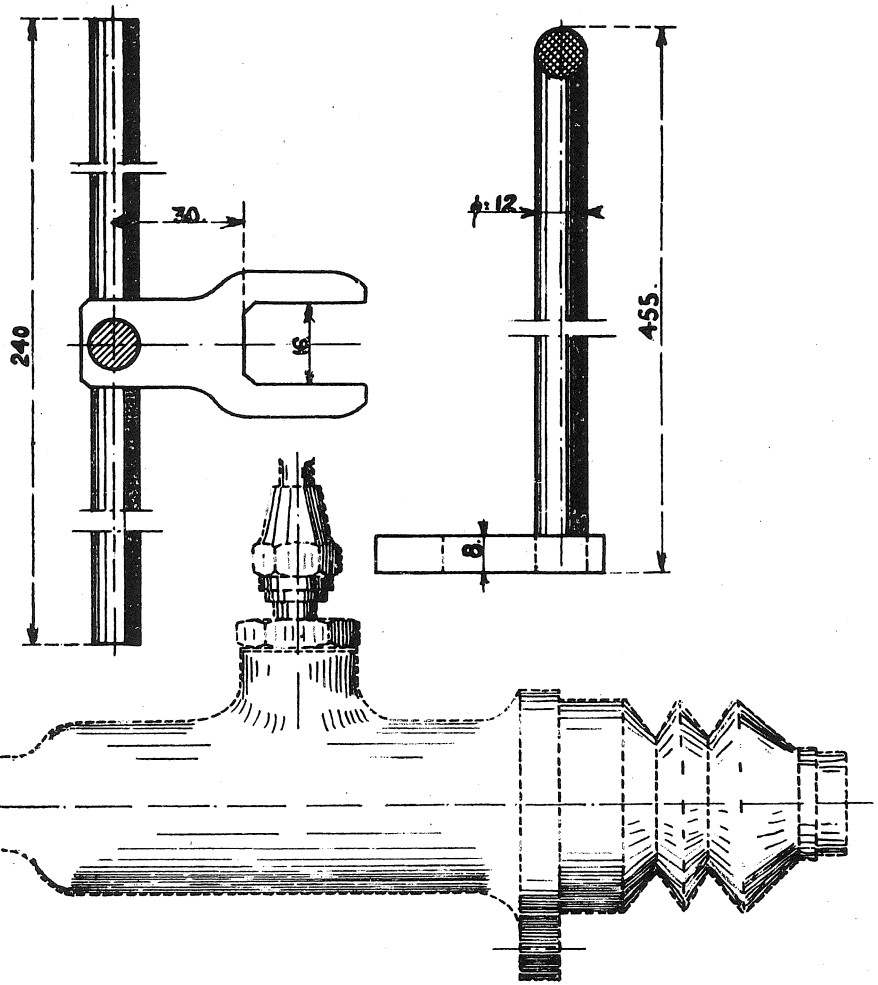
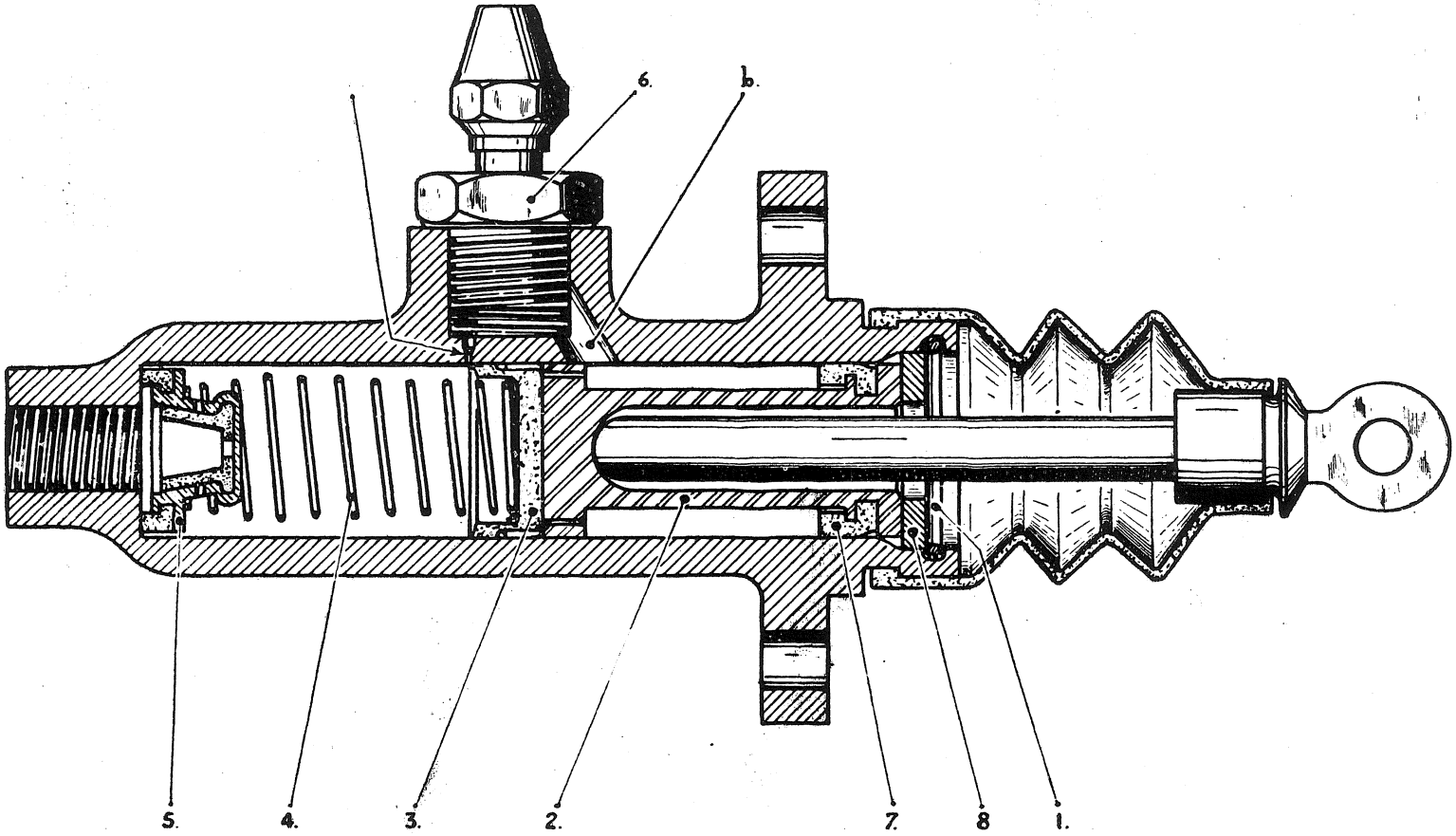


FIG. 2 SPANNER 2130-T.

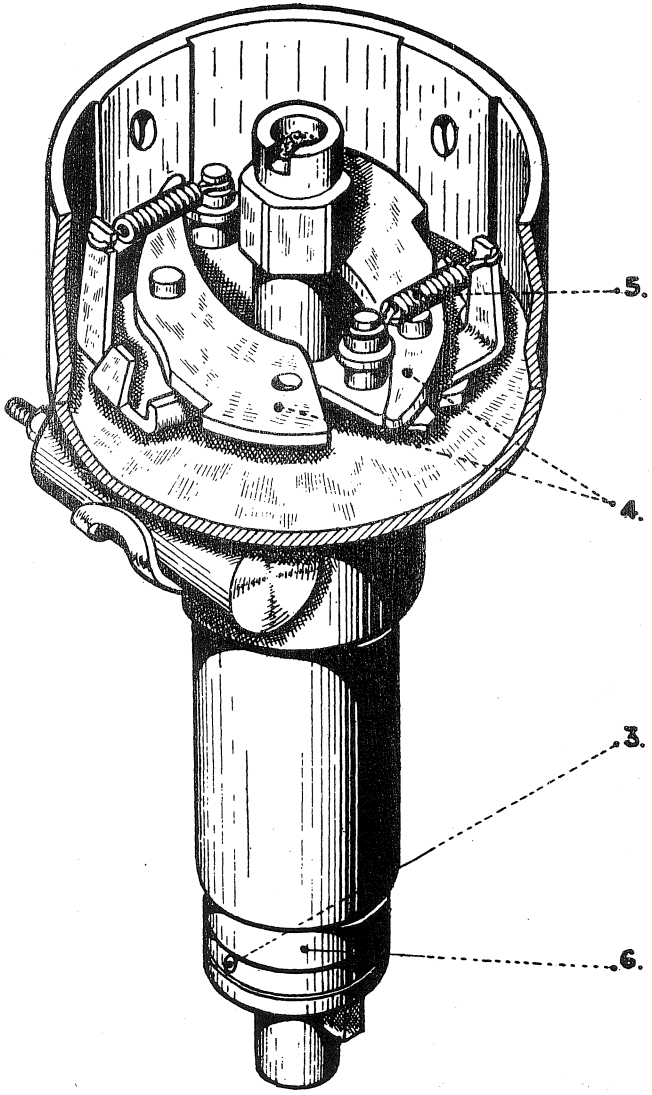


— BRAKES —

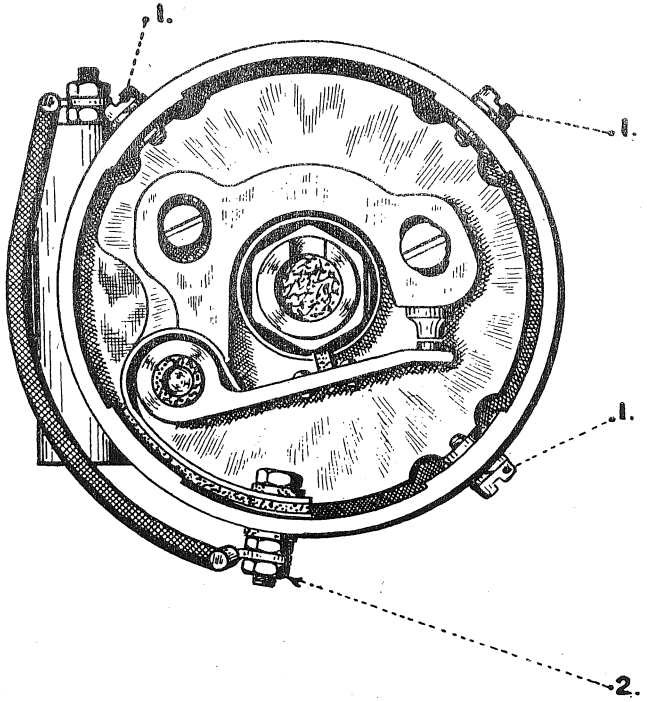
— SECTION THROUGH MASTER CYLINDER —



— Fig. 1. — SECTIONAL VIEW

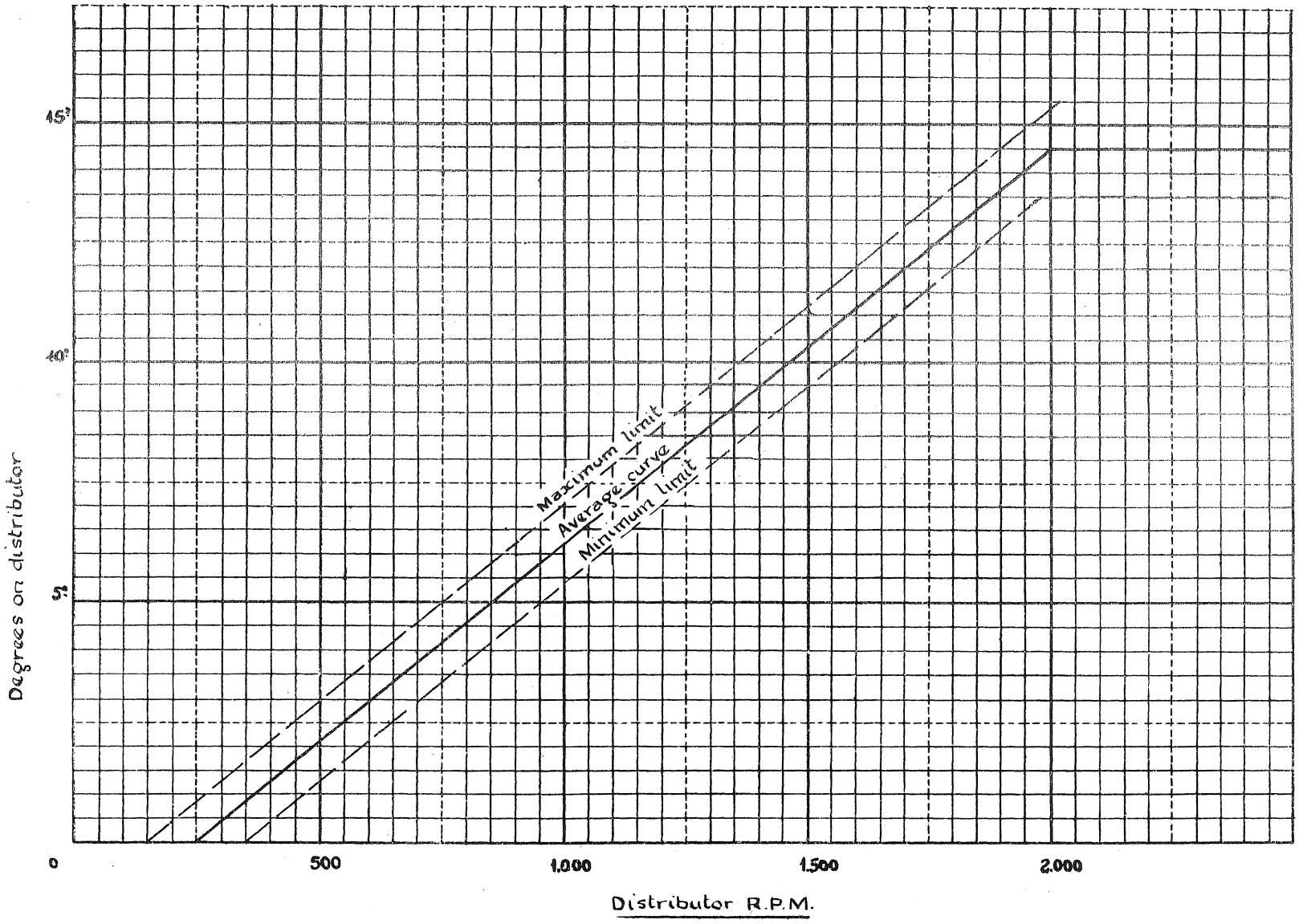


— Fig. 2. — PLAN VIEW

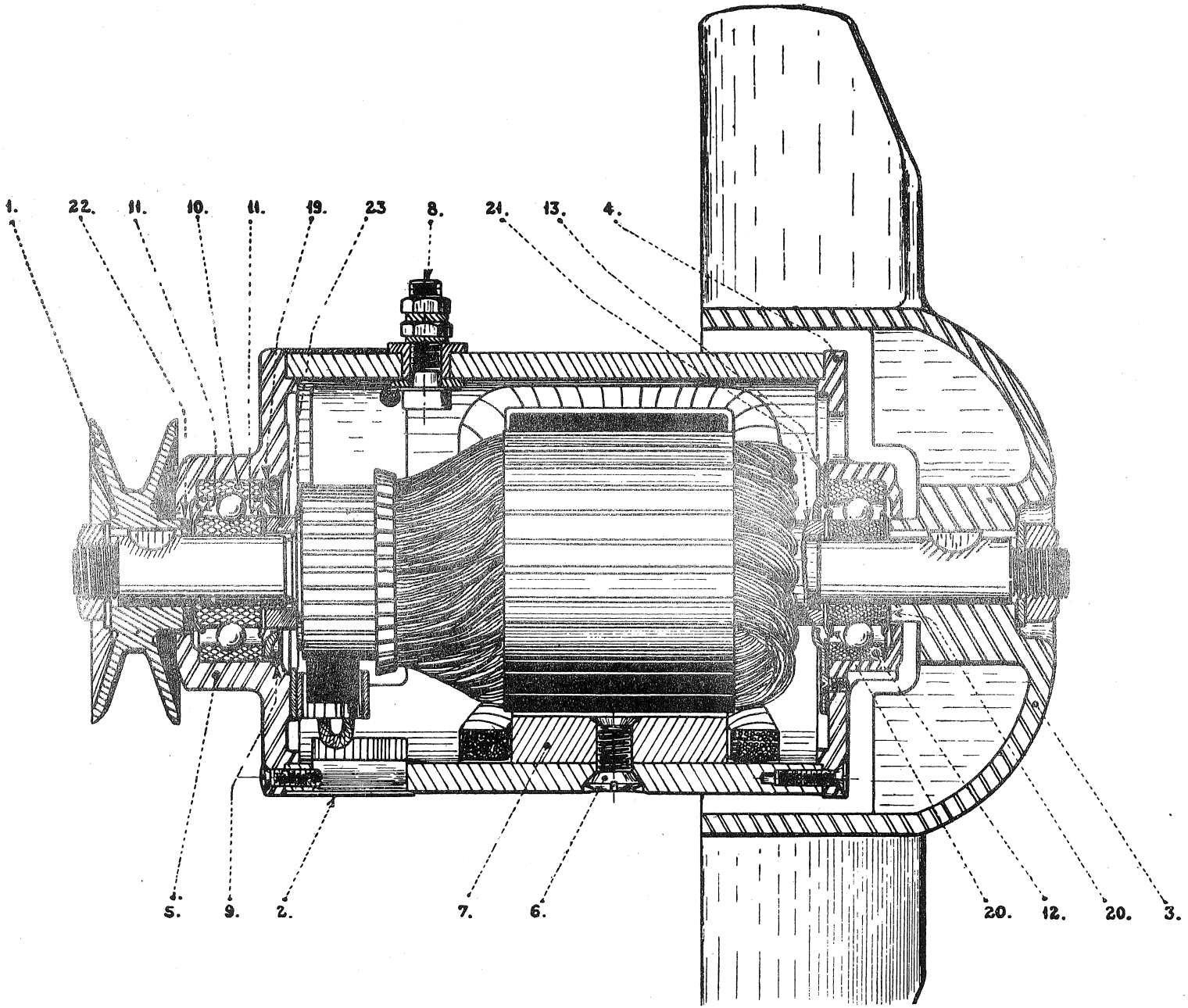


— ELECTRICAL EQUIPMENT —

— DISTRIBUTOR AUTOMATIC ADVANCE CURVE —



— ELECTRICAL EQUIPMENT —
— SECTION THROUGH DYNAMO —



ELECTRICAL EQUIPMENT

CROSS-SECTIONAL VIEWS OF DYNAMO

Fig.1.

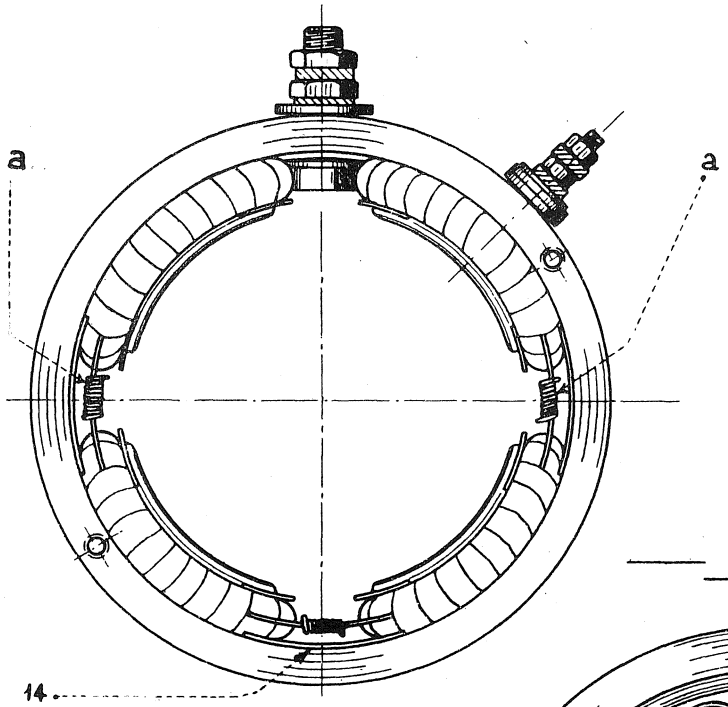


Fig.2.

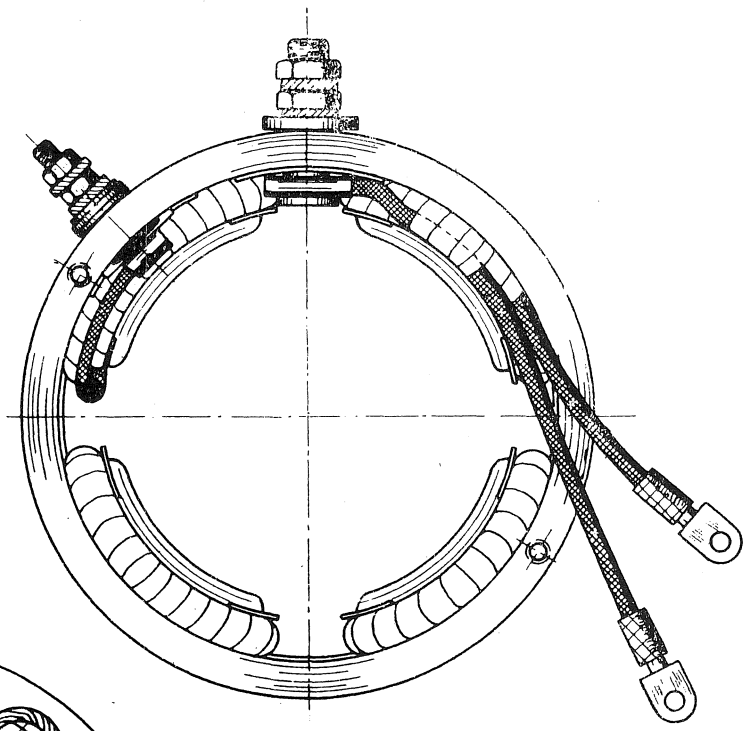
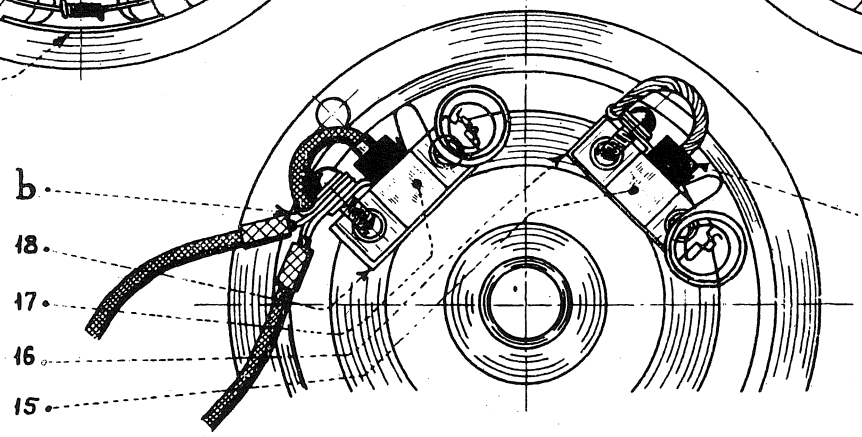


Fig.3.



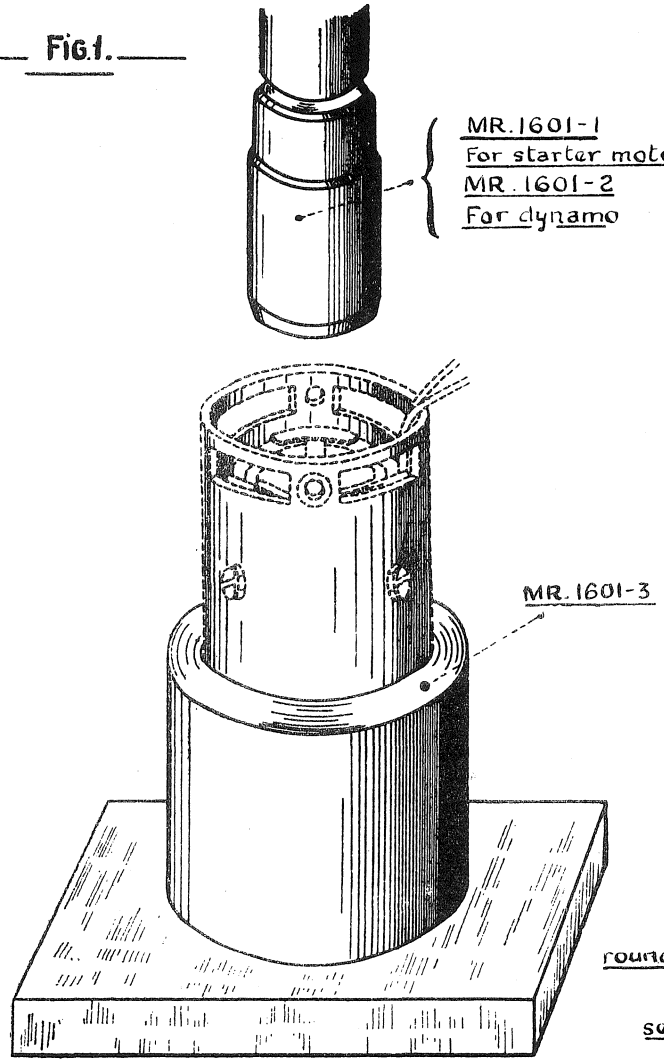
Brushes held in raised position by springs to allow fitting of armature.

— ELECTRICAL EQUIPMENT —

— DISMANTLING AND REFITTING DYNAMO AND STARTER MOTOR POLE PIECES —

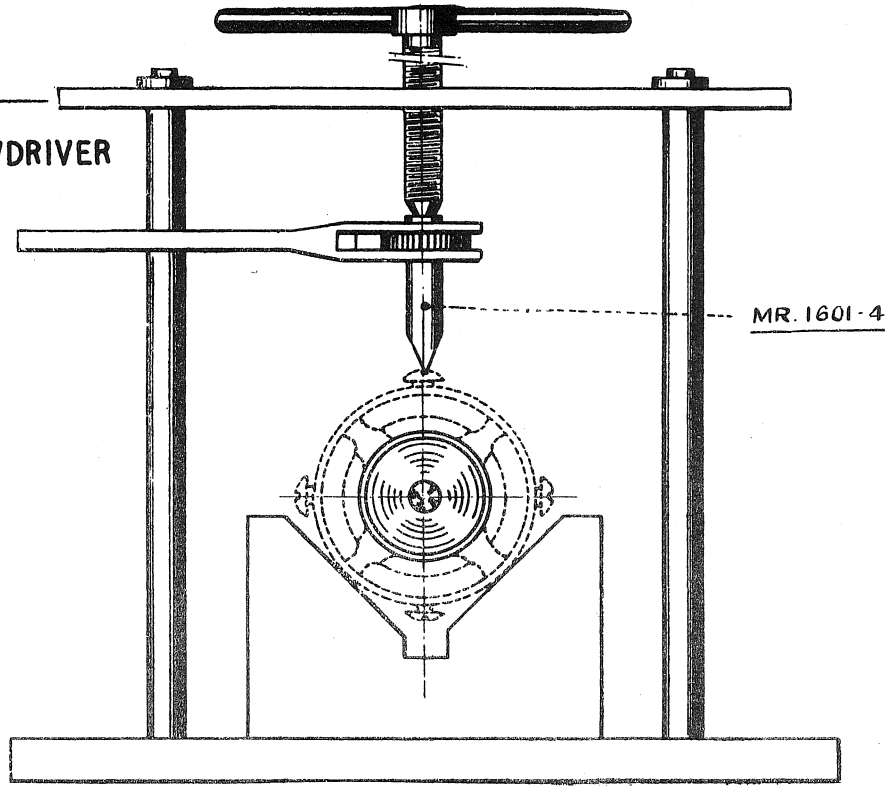
USE OF MANDREL

— Fig.1. —

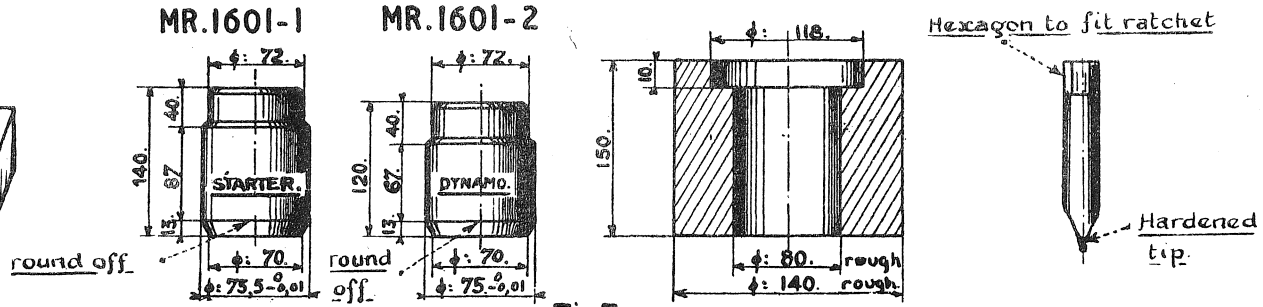


USE OF SCREWDRIVER

— Fig.2. —



MANDRELS SOCKET MR.1601-3 SCREWDRIVER MR.1601-4



semi-hard steel, quenched and ground.

— Fig.3 — Cast iron.

ELECTRICAL EQUIPMENT

SECTION THROUGH STARTER MOTOR

FIG.1.

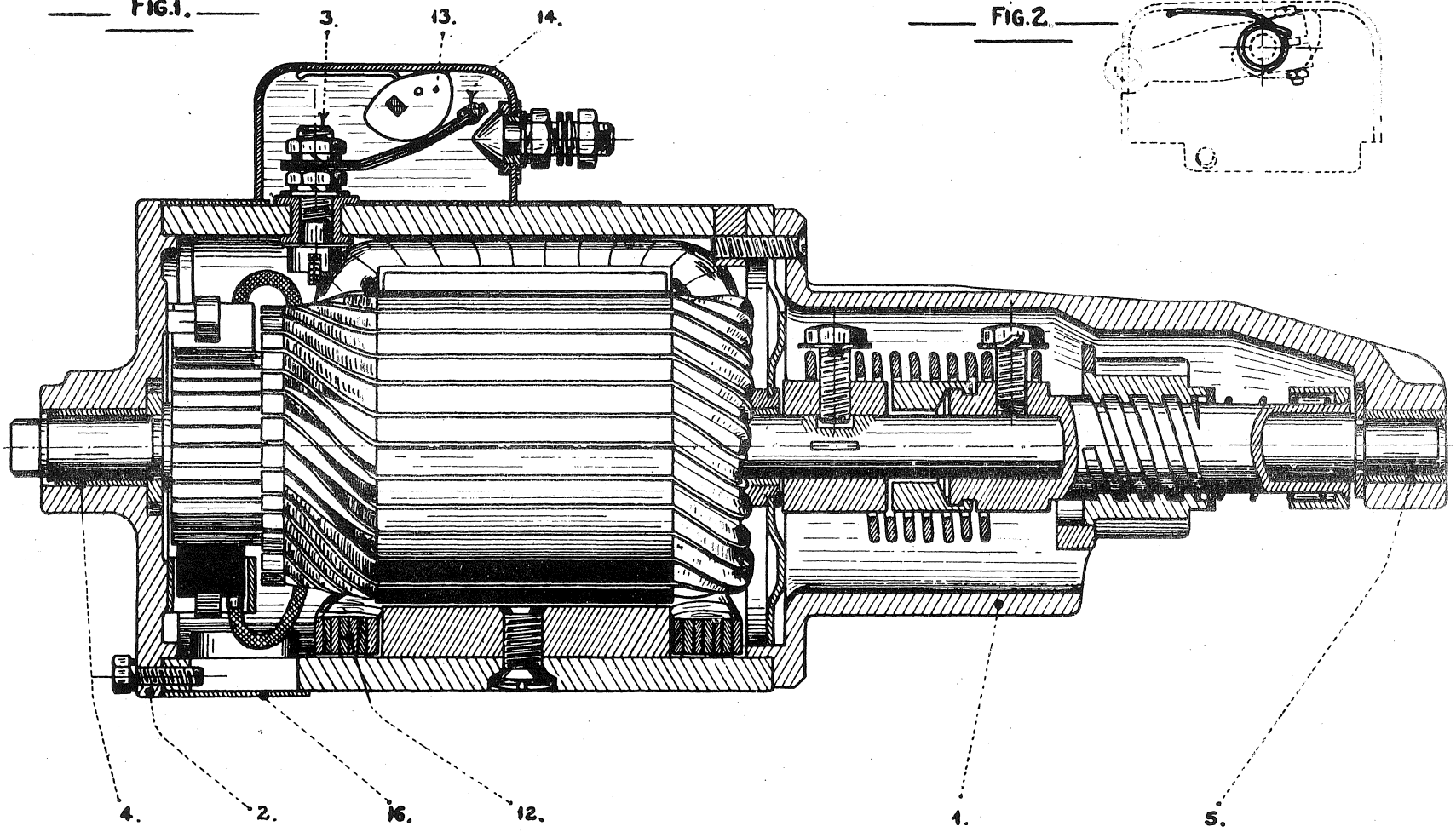
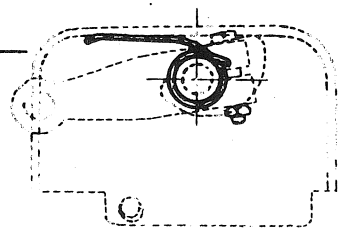


FIG.2.



— END VIEWS OF STARTER MOTOR —

Fig.1. FIELD COILS

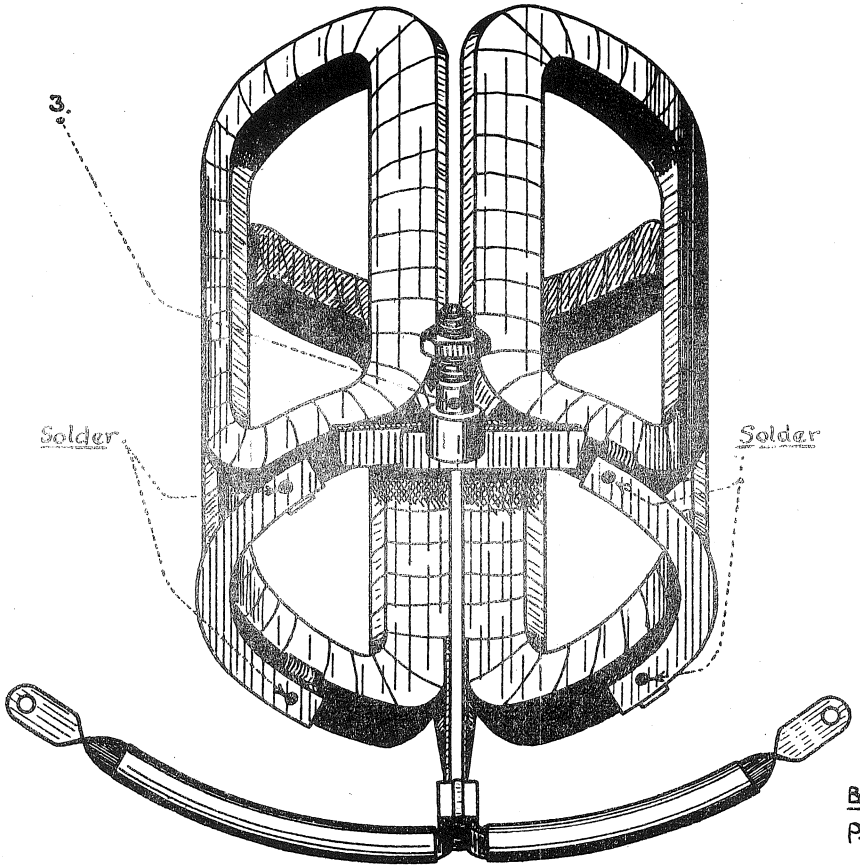
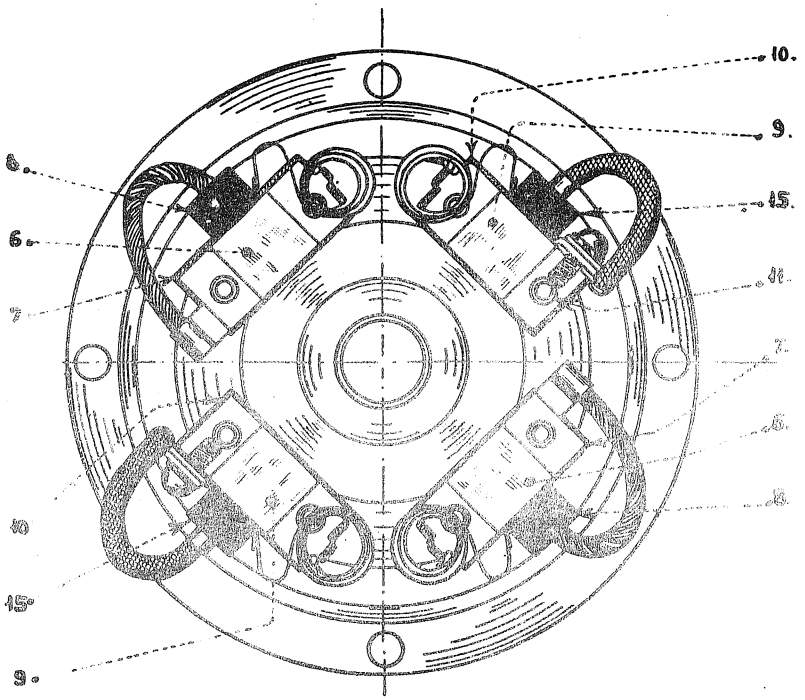


Fig.2. FITTING OF BRUSH GEAR

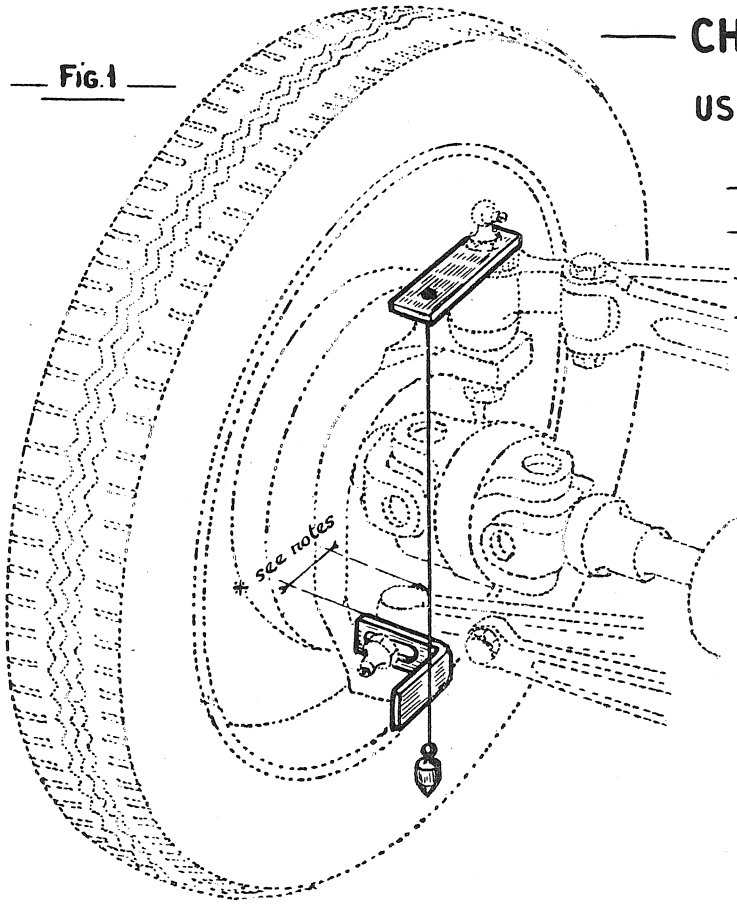


Brushes are held in raised position by springs to allow passage of commutator when fitting armature.

ADJUSTMENTS

CHECKING CASTER ANGLE

Fig.1

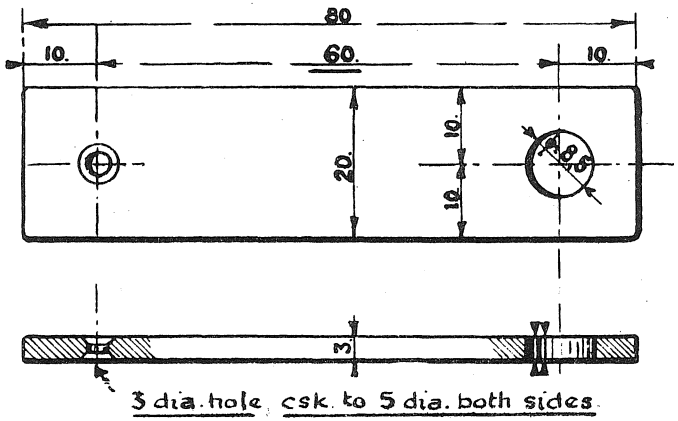


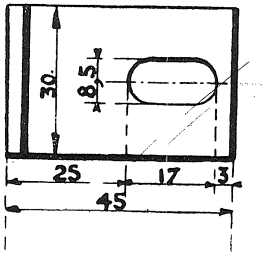
USE OF APPARATUS

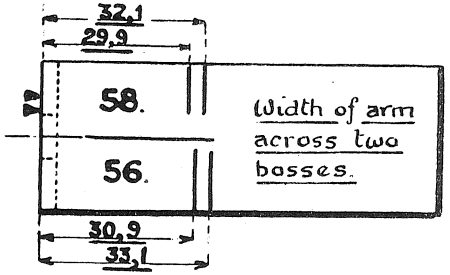
FITTING APPARATUS

1. Unscrew upper and lower link arm greasers.
2. Find width across bosses. } As shown on
3. Mount the apparatus. } drawing.
4. Adjust the lower bracket so that the plumb line lies against bracket face towards centre of vehicle.
5. Check that the plumb line falls between the pair of gauging lines corresponding to the width across the bosses (*paragraph 2*).

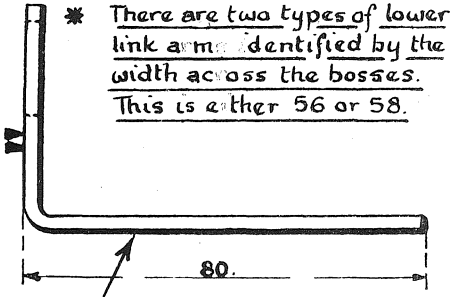
Fig.2. APPARATUS MR. 3449







Dimensions underlined are important and must be adhered to.
Faces marked thus ▼▼ should be ground and checked from time to time



* There are two types of lower link arm identified by the width across the bosses. This is either 56 or 58.

ADJUSTMENTS

CHECKING LENGTH OF TRACK RODS

FIG.1. USE OF GAUGE

Lengths L and L¹ must be equal within 1 mm.

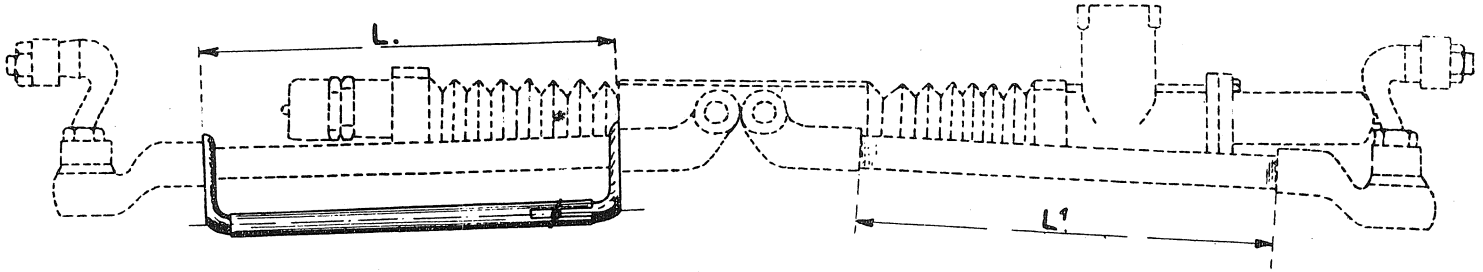
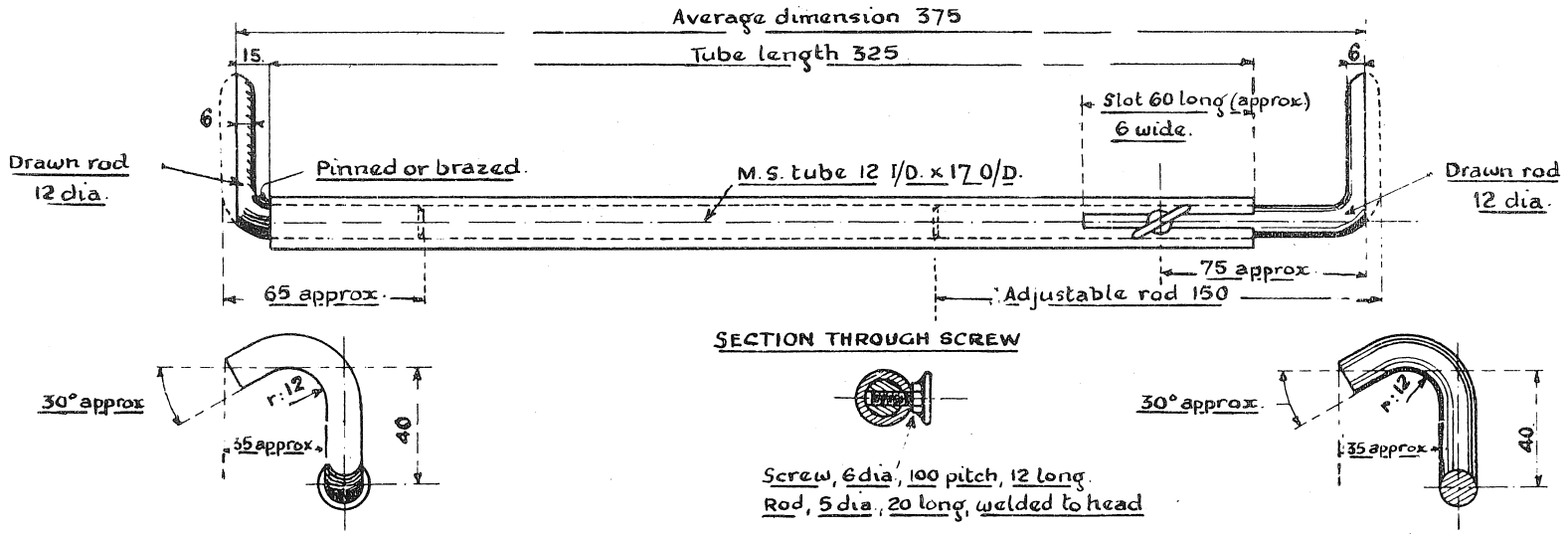


FIG.2. GAUGE MR.1590



ADJUSTMENTS

CHECKING STEERING LOCK

Fig.1 USE OF GAUGE

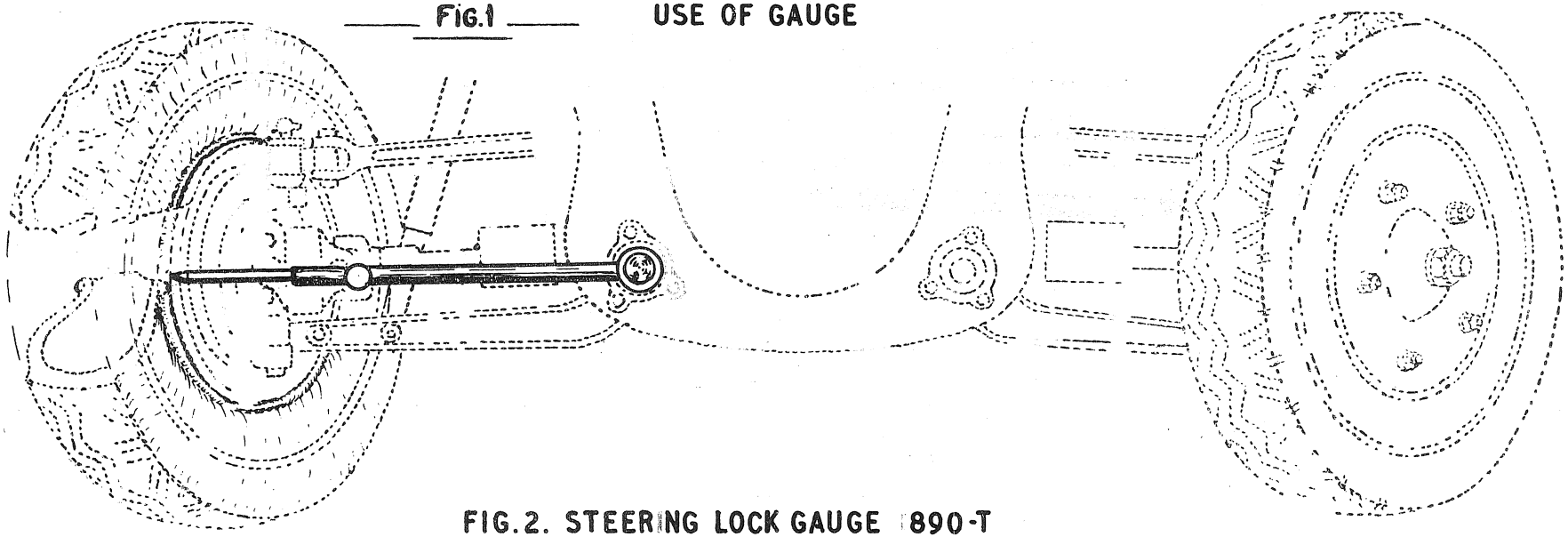
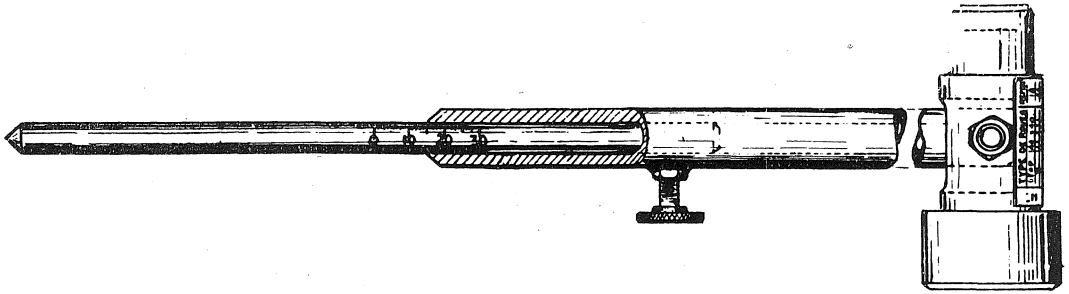


FIG.2. STEERING LOCK GAUGE 890-T



SETTING OF GAUGE ACCORDING TO WHEEL TYPE

Pilote wheels	185 x 400	Reading 18
B.M. wheels	185 x 400	Reading 23

— CHECKING WHEEL CAMBER —

— FIG. 1. — USE OF GAUGE

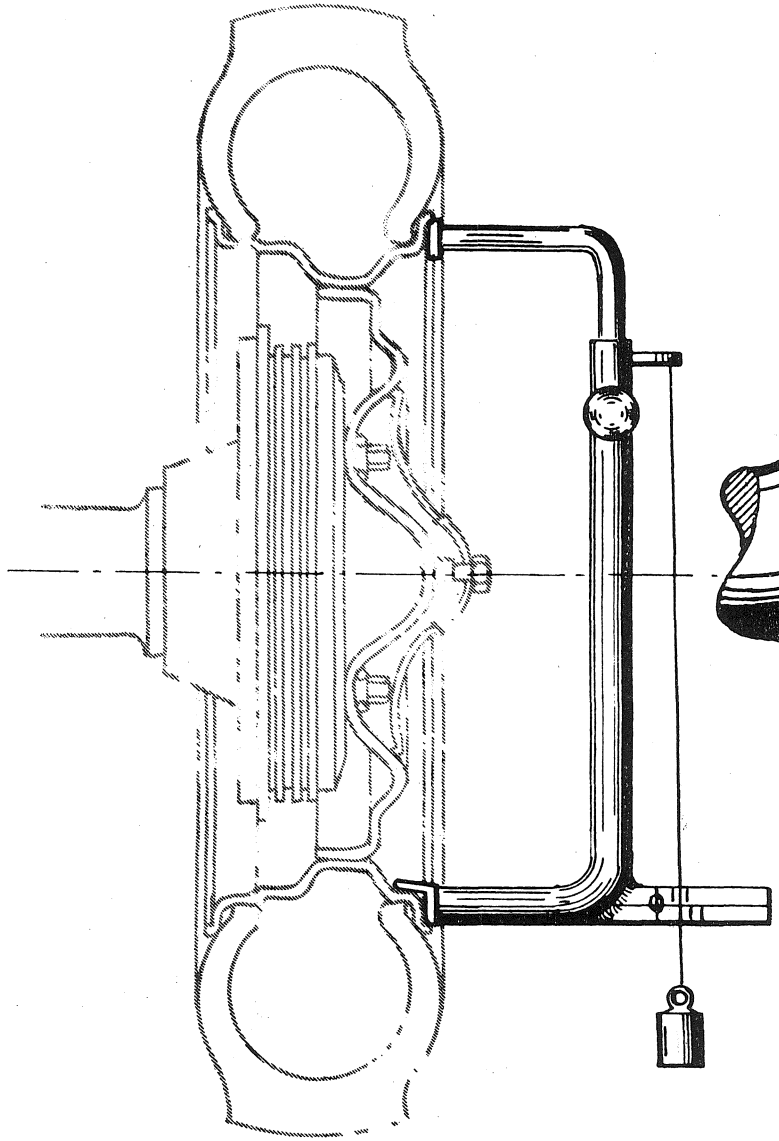
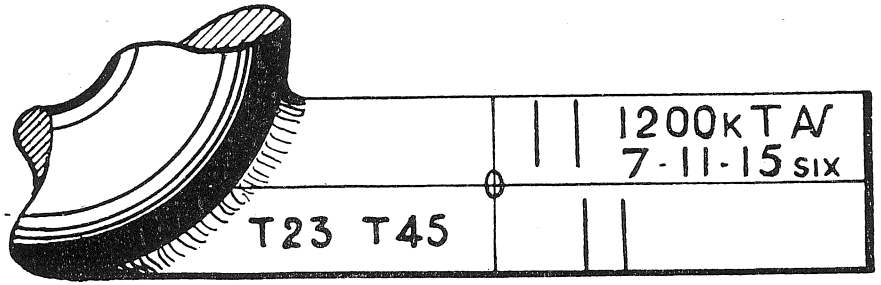


FIG. 2. ENLARGED VIEW OF SCALE

Plumb line must fall between two gauge lines.



GAUGE 2314-T

FIG. 1. LOCATING HEAVY PART

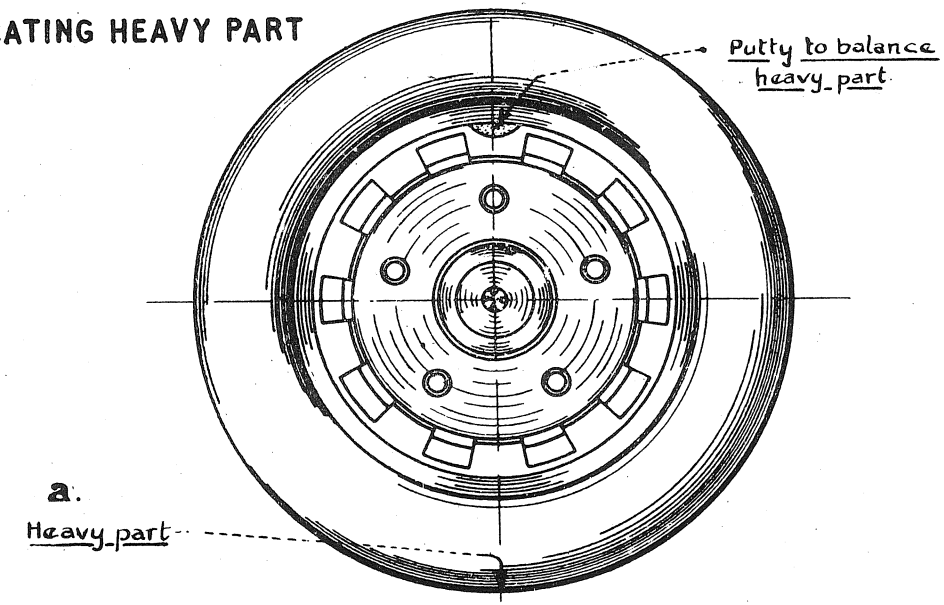


FIG. 2. USE OF FIXTURE

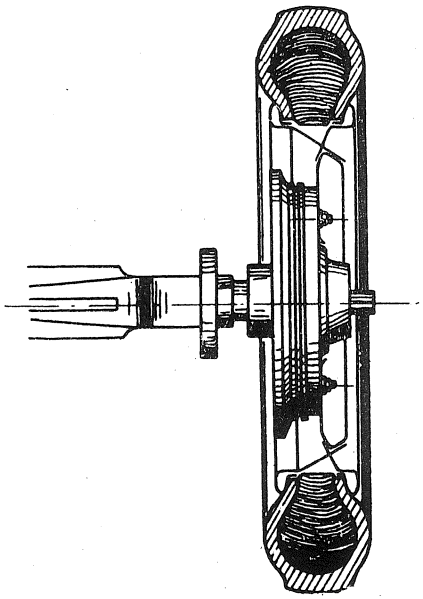


FIG. 3. POSITION OF WELDED BALANCE WEIGHT

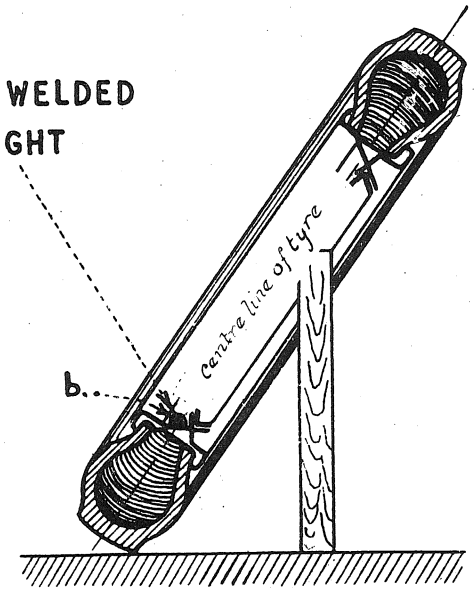
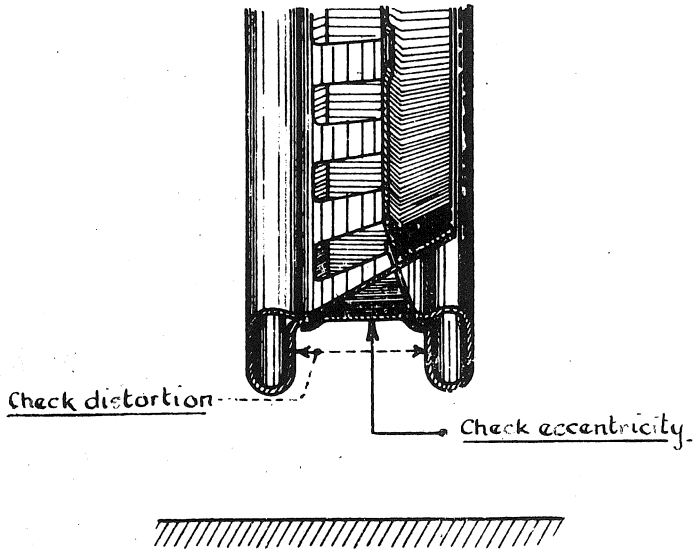


FIG. 4. CHECKING DISTORTION OF RIM

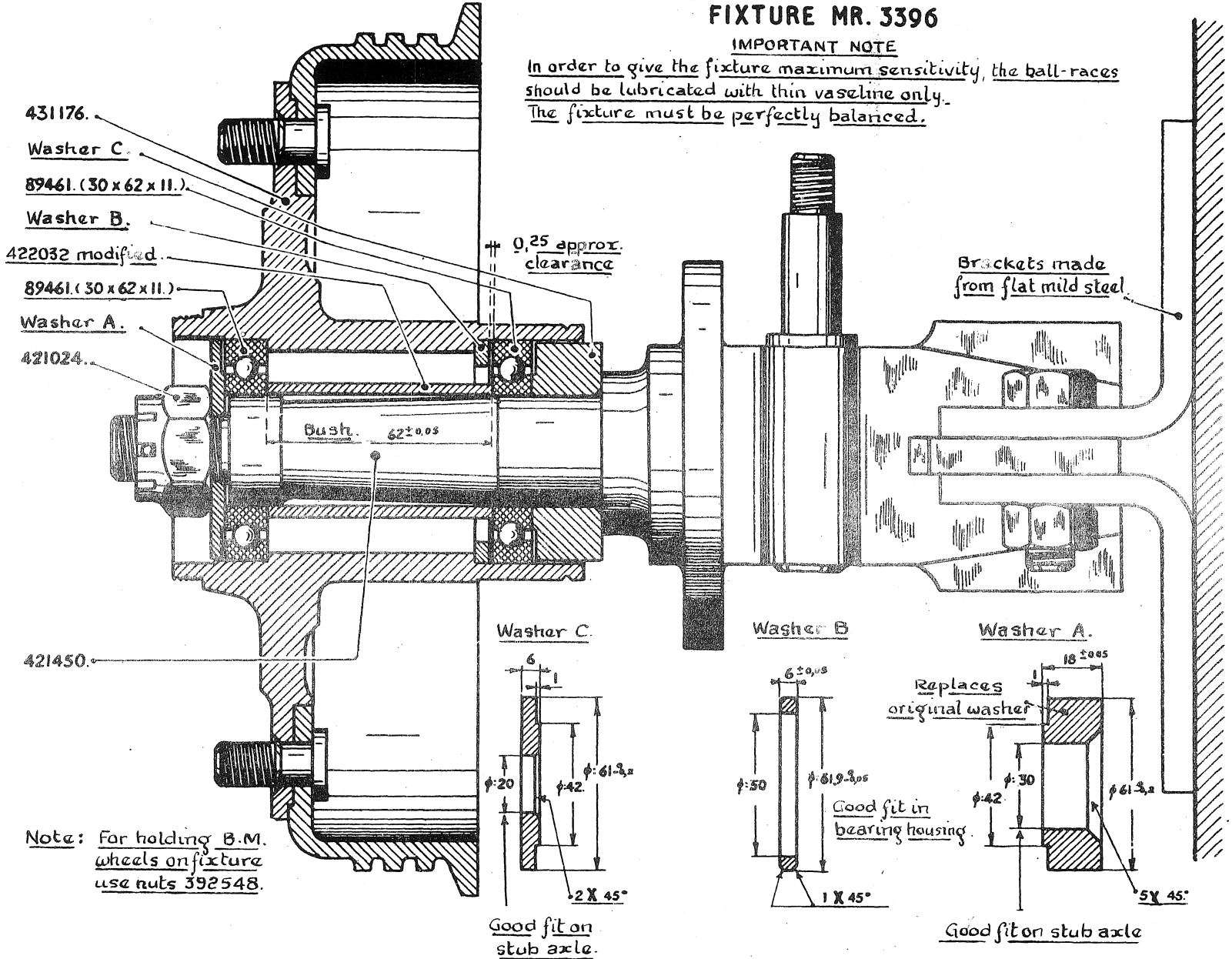


— ADJUSTMENTS —
— CHECKING BALANCE OF WHEELS —

FIXTURE MR. 3396

IMPORTANT NOTE

In order to give the fixture maximum sensitivity, the ball-races should be lubricated with thin vaseline only.
The fixture must be perfectly balanced.

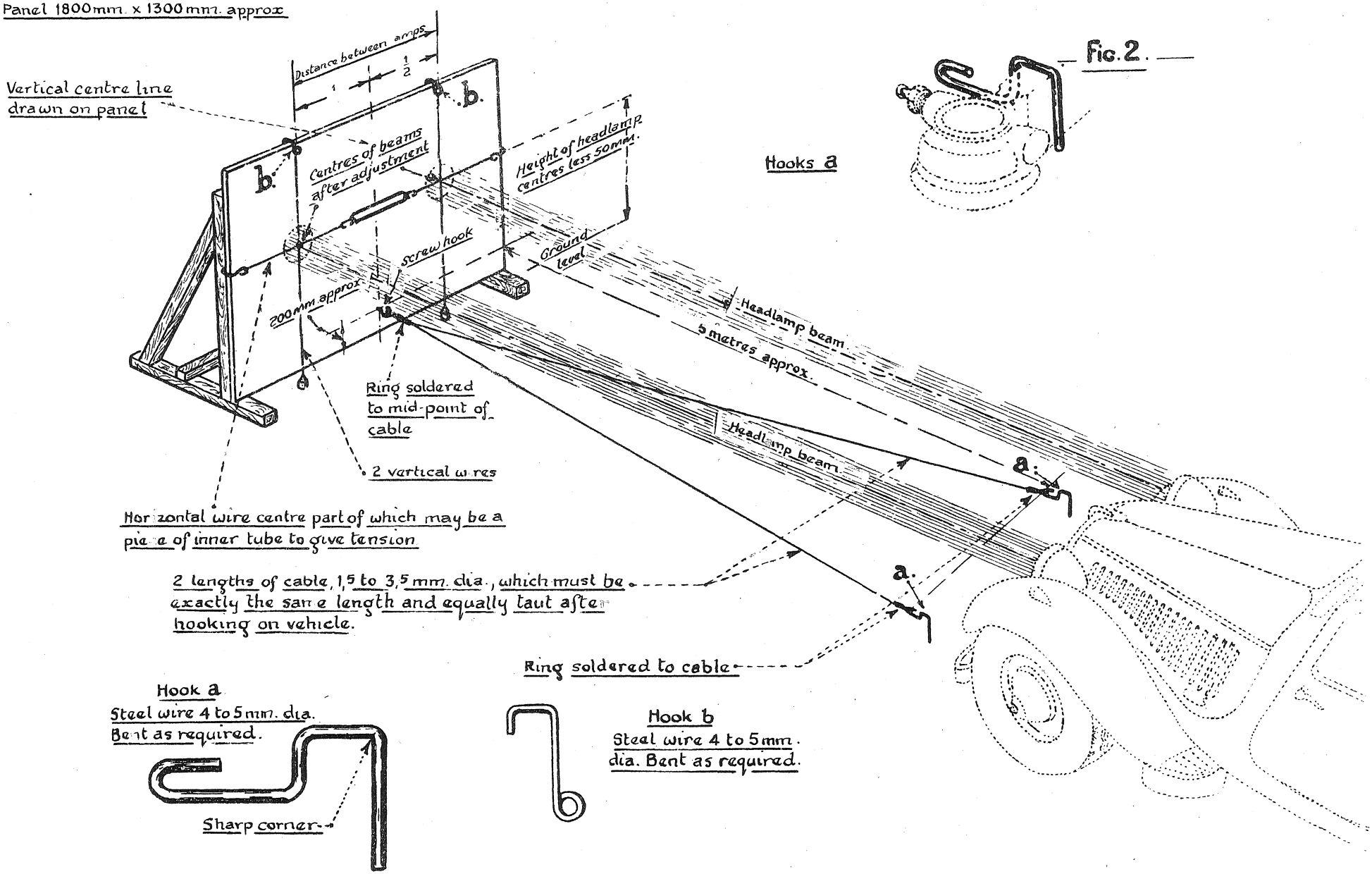


Note: For holding B.M. wheels on fixture use nuts 392548.

ADJUSTMENTS
HEADLAMP ADJUSTMENT

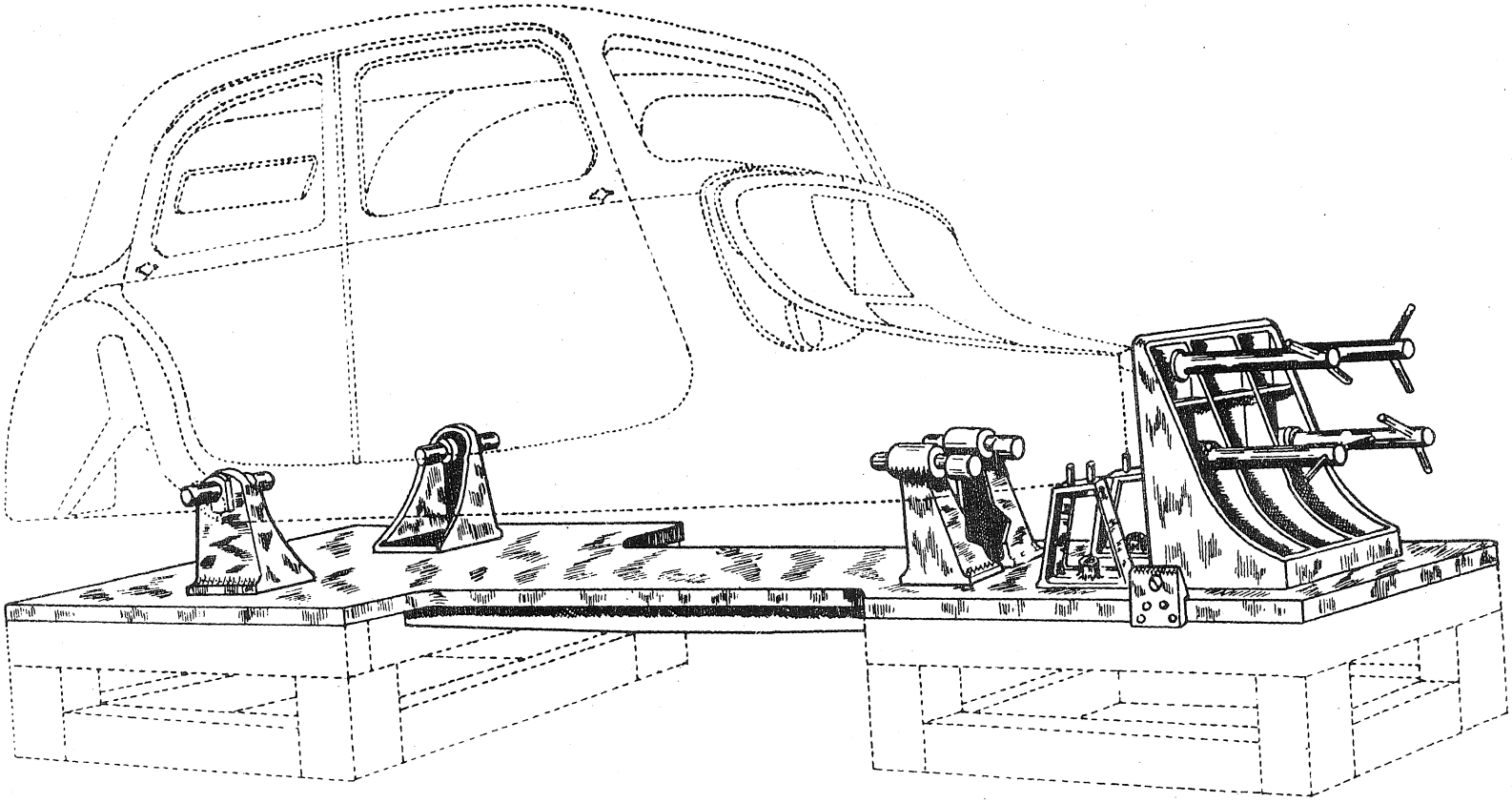
SCREEN MR. 1572

Panel 1800mm. x 1300mm. approx



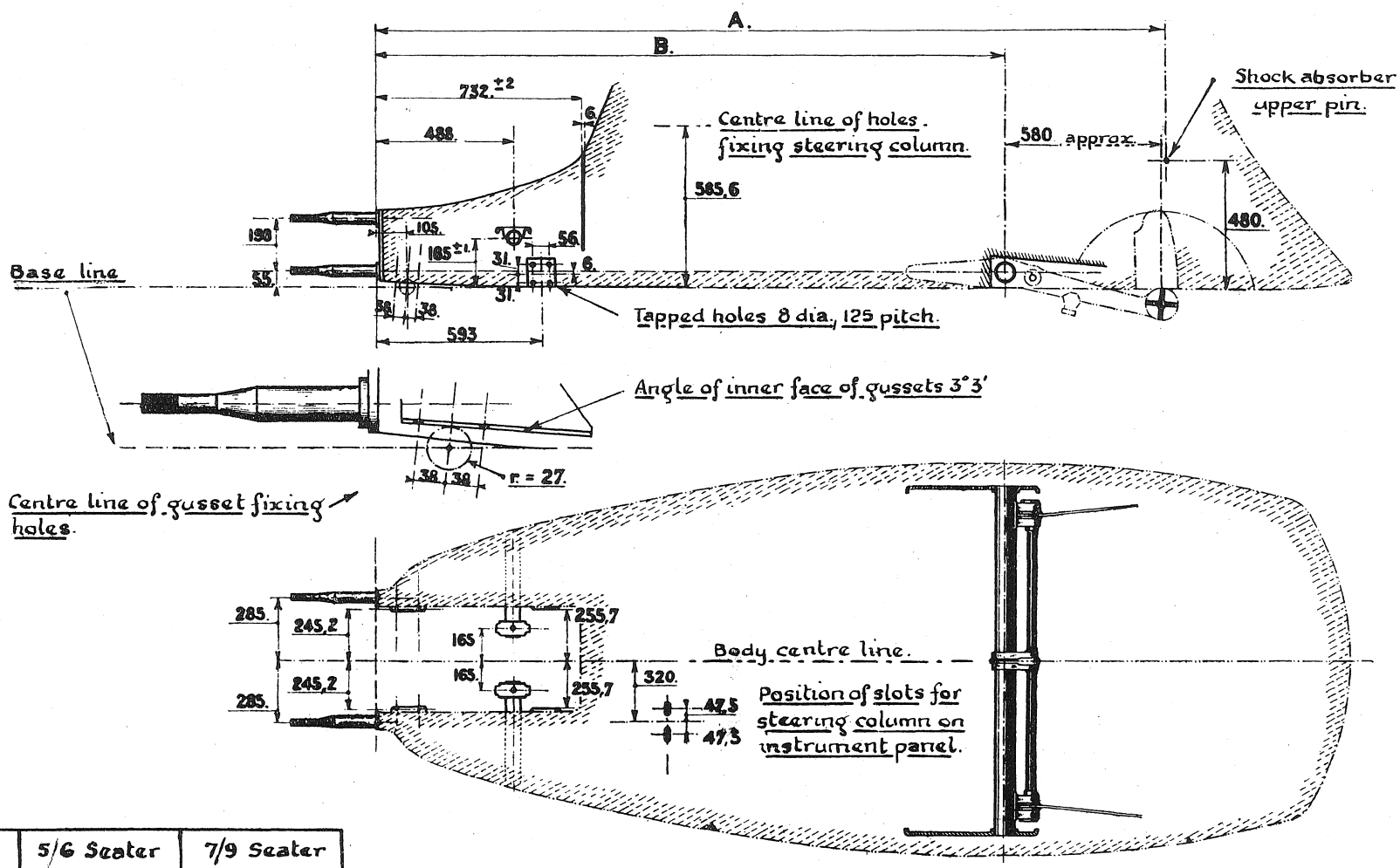
— BODYWORK —
— REALIGNMENT OF HULL —

USE OF JIG 2600-T



— BODYWORK —

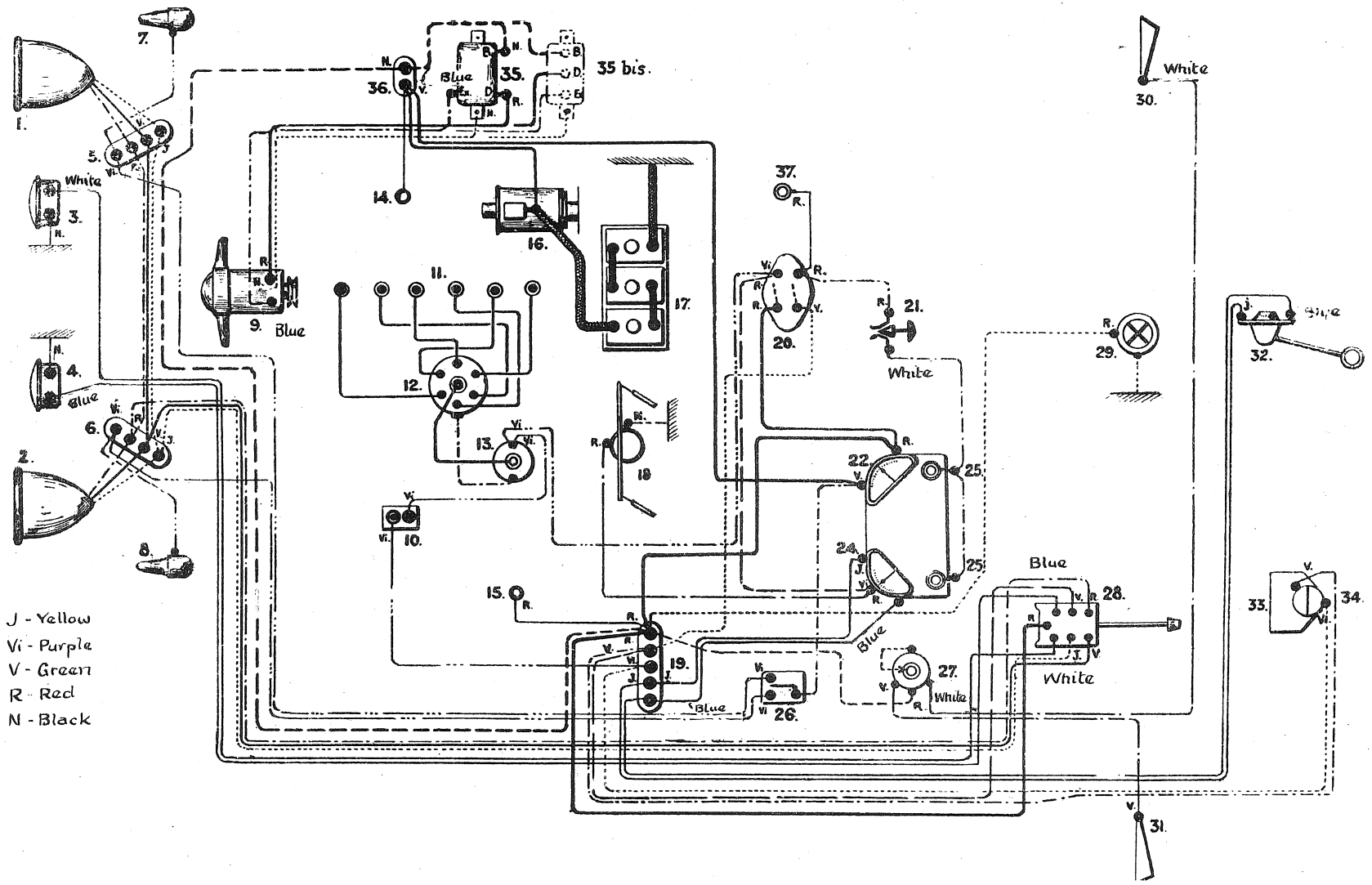
— REALIGNMENT OF HULL —



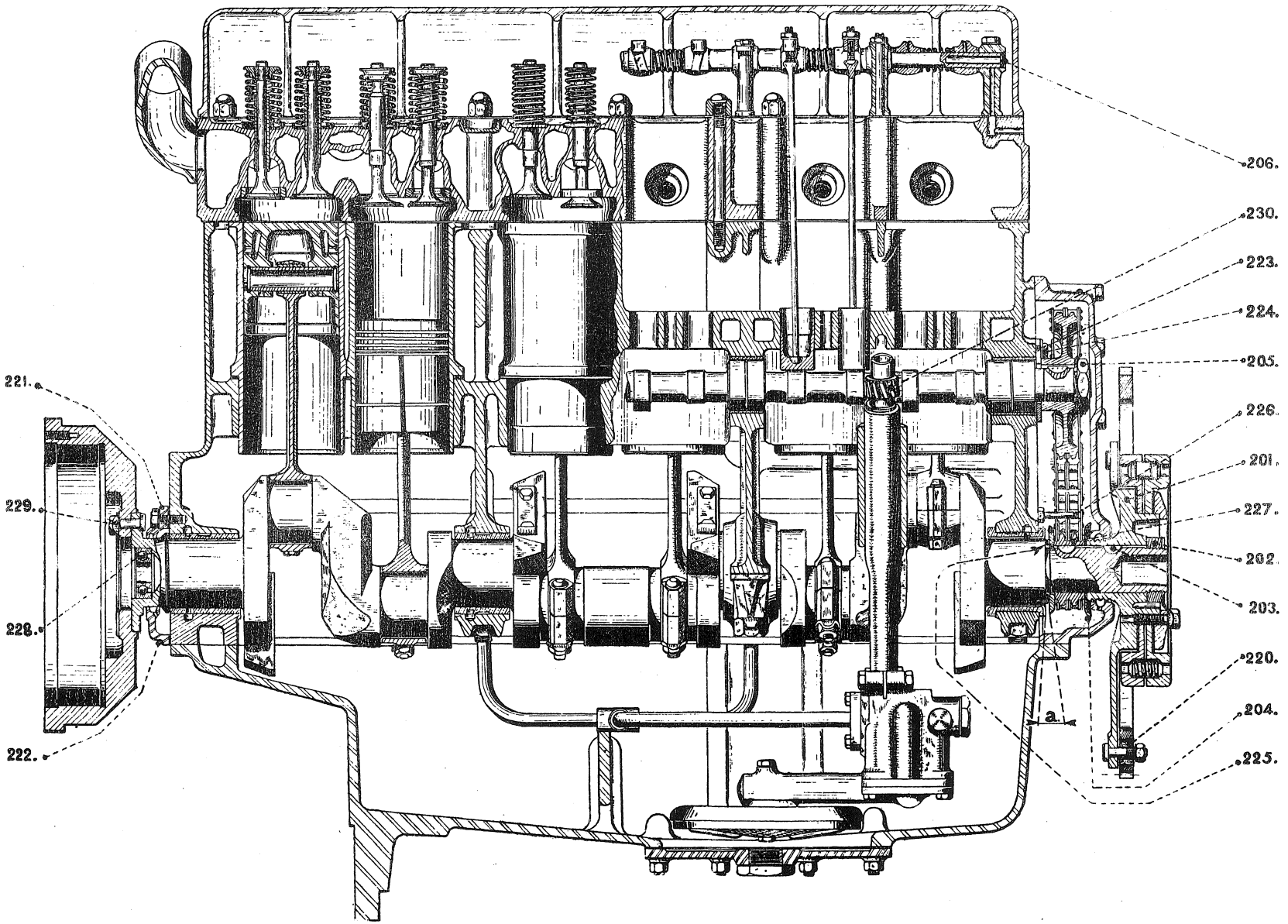
	5/6 Seater	7/9 Seater
A	3030	3215
B	2439	2624

— ELECTRICAL —
— WIRING DIAGRAM —

1. Headlamp R.H.
2. Headlamp L.H.
3. Horn R.H.
4. Horn L.H.
5. Junction box, front R.H.
6. Junction box, front L.H.
7. Wing lamp R.H.
8. Wing lamp L.H.
9. Dynamo.
10. Stop lamp switch.
11. Spark plugs.
12. Distributor.
13. Ignition coil.
14. Inspection lamp socket, R.H.
15. Inspection lamp socket, L.H.
16. Starter motor.
17. Battery, 6 volt, 90 amp.h.
18. Windscreen wiper.
19. Junction box.
20. Ignition switch.
21. Panel lights switch.
22. Ammeter.
23.
24. Petrol gauge.
25. Panel lights.
26. Wing lamps switch.
27. Trafficator switch.
28. Horn and lighting switch.
29. Interior lamp.
30. Trafficator R.H.
31. Trafficator L.H.
32. Petrol gauge tank unit.
33. Tail lamp.
34. Stop lamp.
35. Ducellier regulator.
35 bis. Citroen regulator.
36. Two-pole junction box.
37. Map lamp.



— ENGINE —
— LONGITUDINAL SECTION —



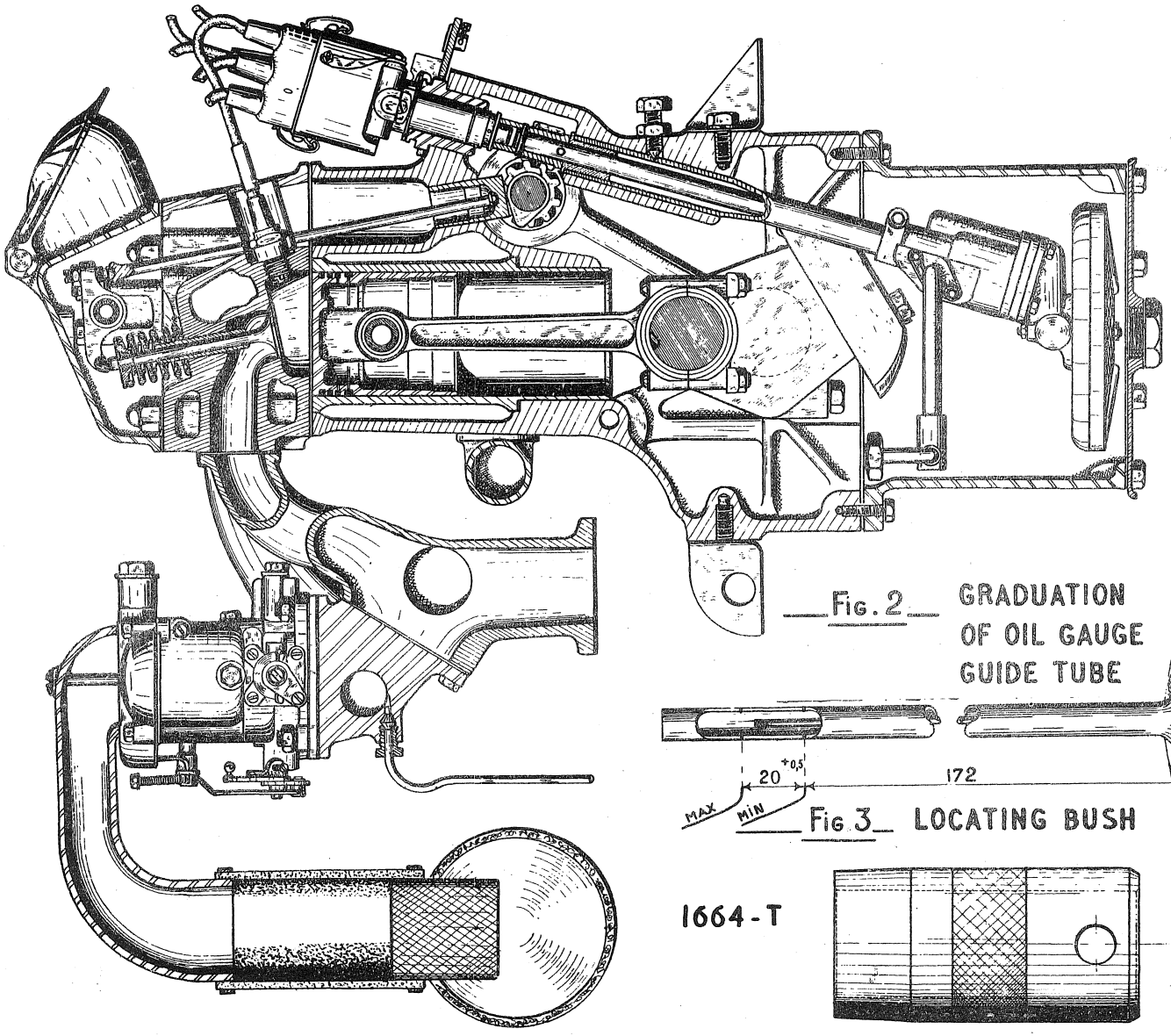


Fig. 2 GRADUATION OF OIL GAUGE GUIDE TUBE

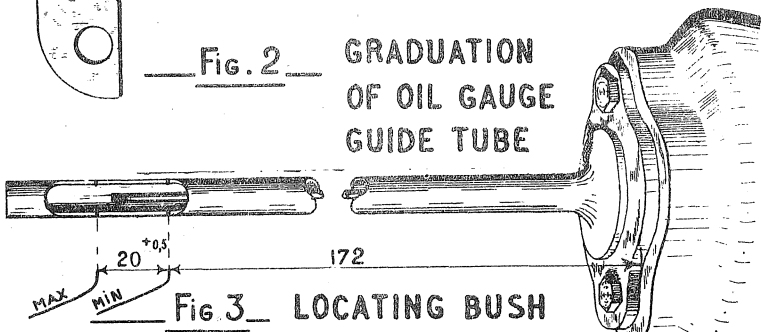
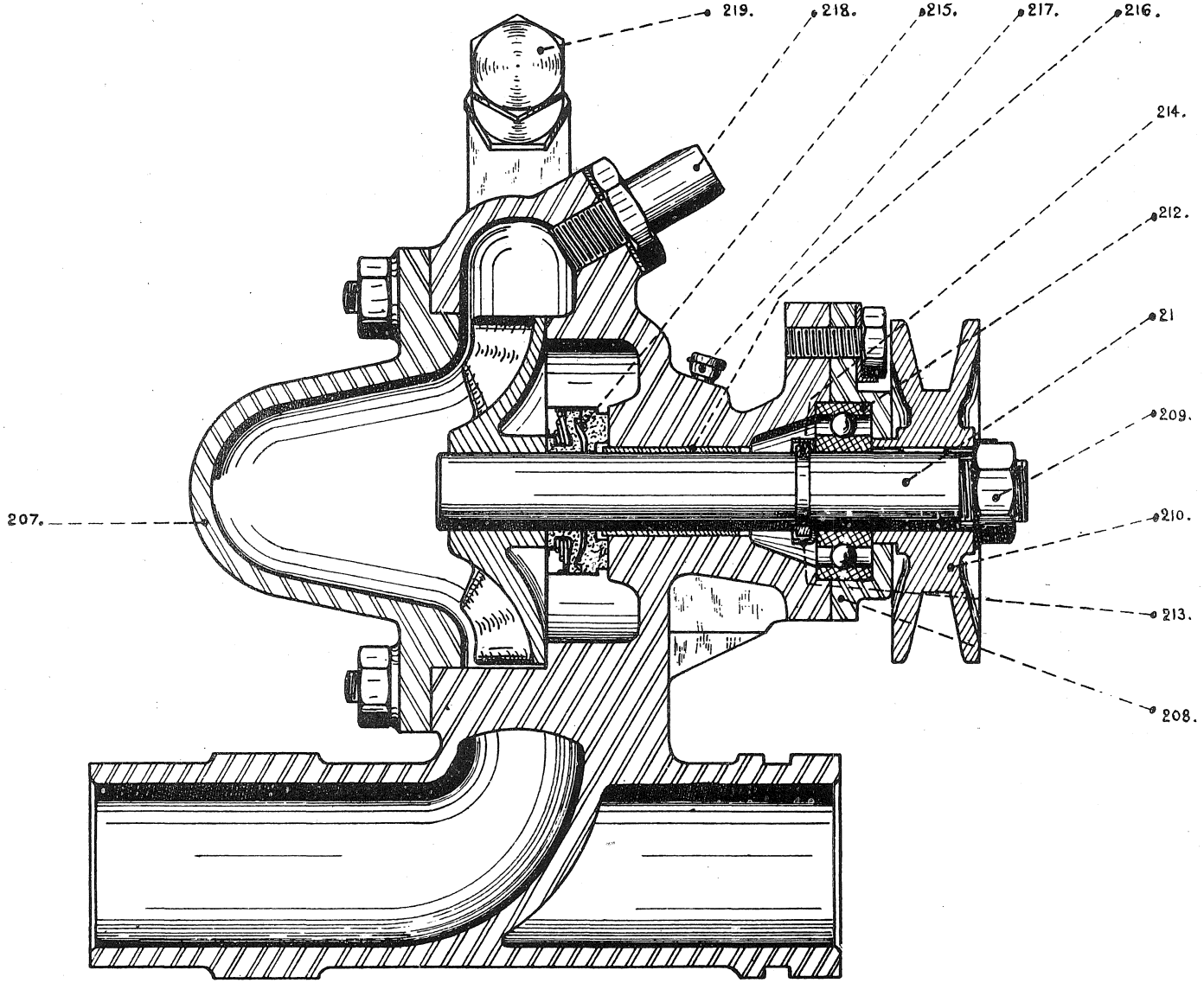


Fig. 3 LOCATING BUSH

1664-T

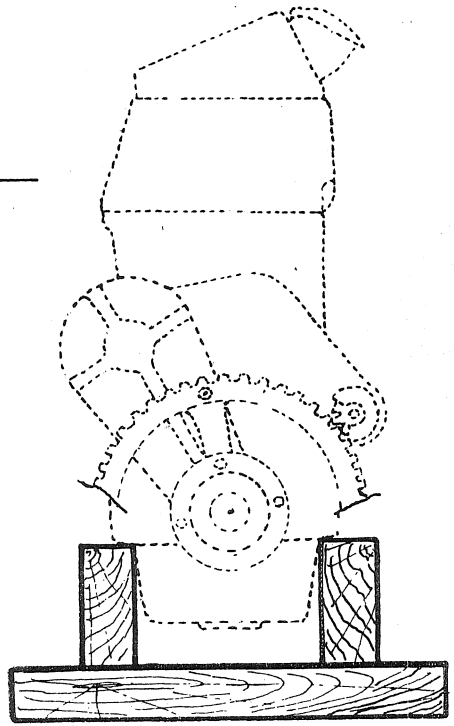
ENGINE
WATER PUMP



USE OF STAND

Fig. 1

REAR VIEW



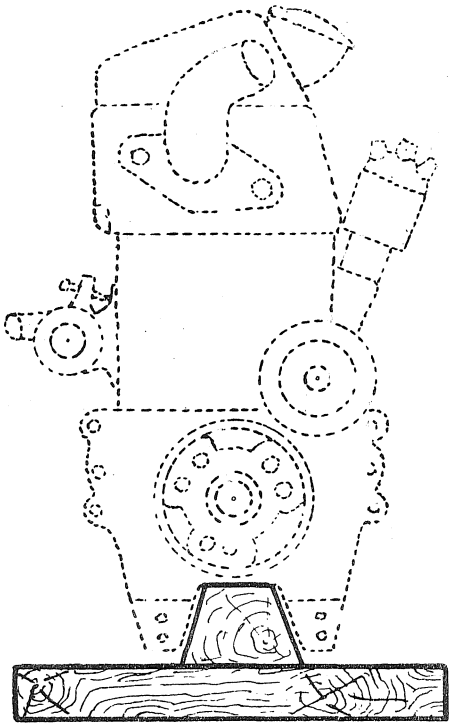
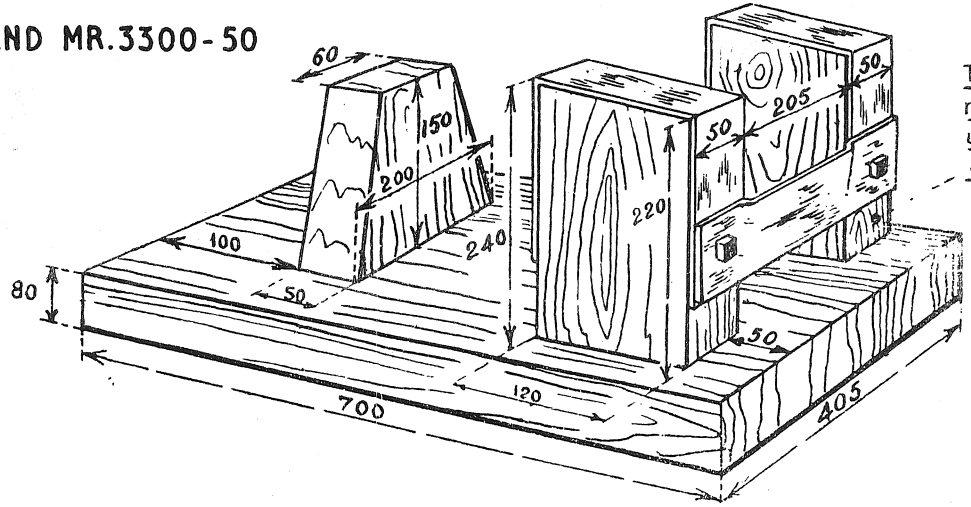


FIG. 2. FRONT VIEW

FIG. 3. STAND MR.3300-50



Three blocks fit in
reces es 20mm deep
in base and a e secured
oy woodscrews.

— CARBURETTOR —
— VARIOUS VIEWS —

Fig. 1.

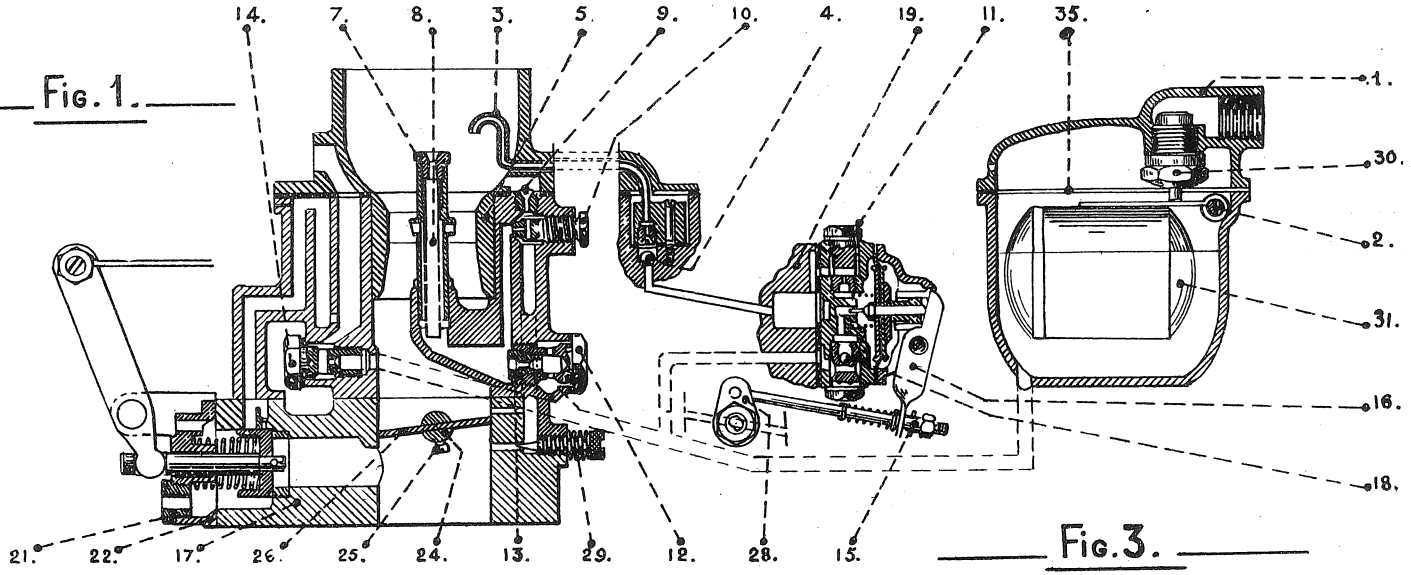
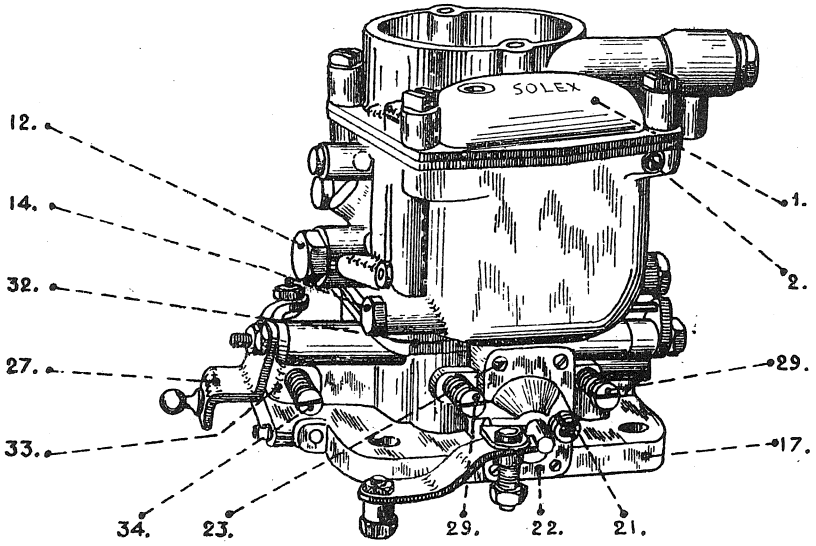
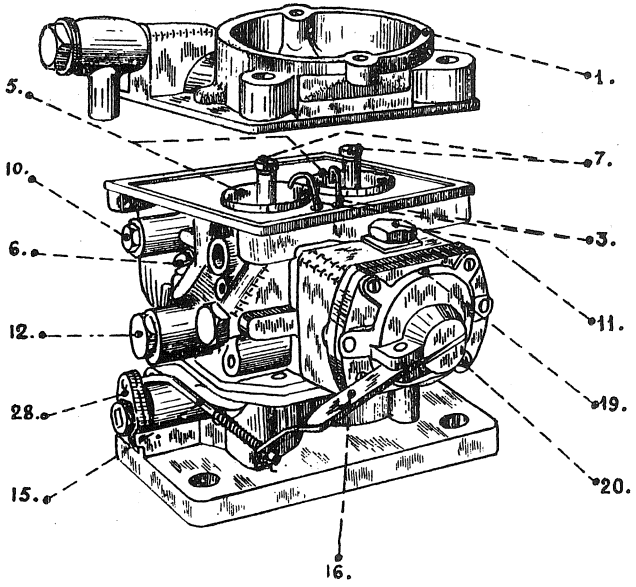


Fig. 3.

Fig. 2





CLUTCH ASSEMBLY

FIG. 1. LONGITUDINAL SECTION

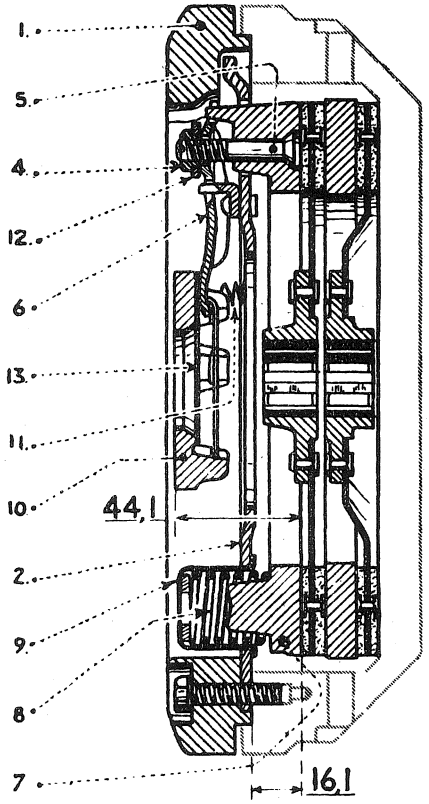
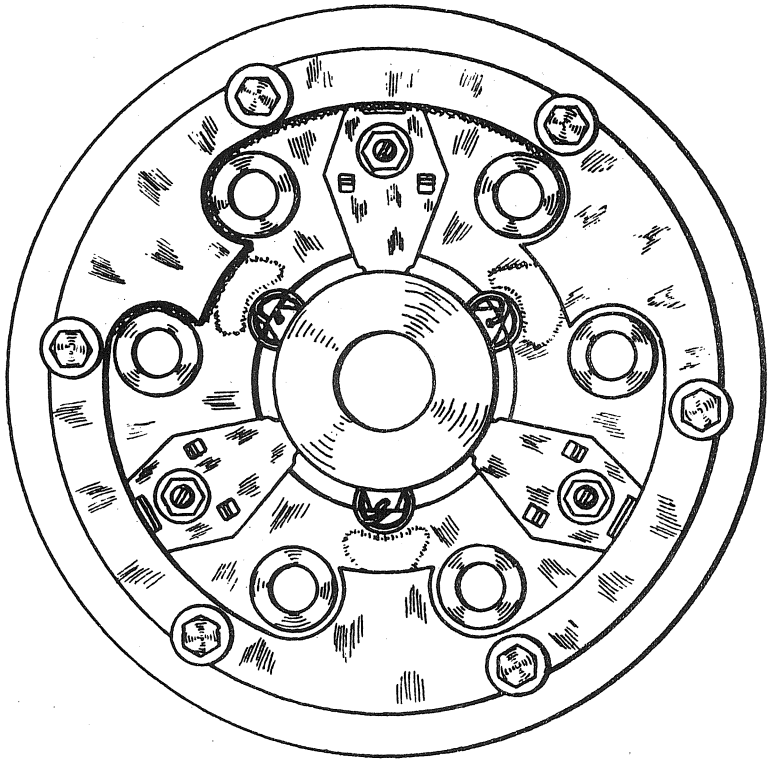


FIG. 2. VIEW OF TOGGLES



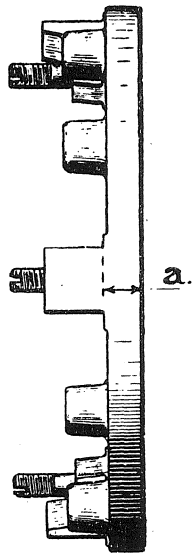
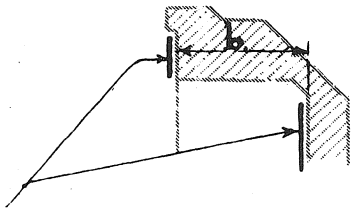


FIG. 3.

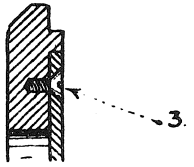
The outer face of the slot for the fulcrum bracket must be chamfered.

FIG. 4.



Remove the same amount from both faces.

FIG. 5.

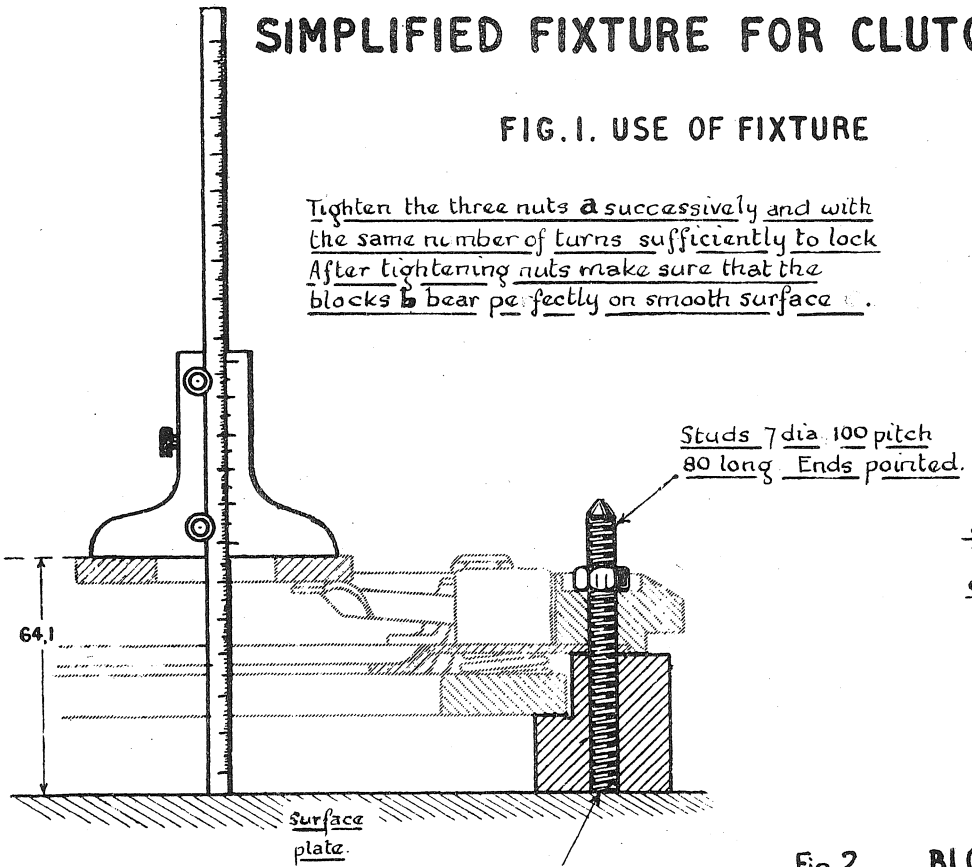


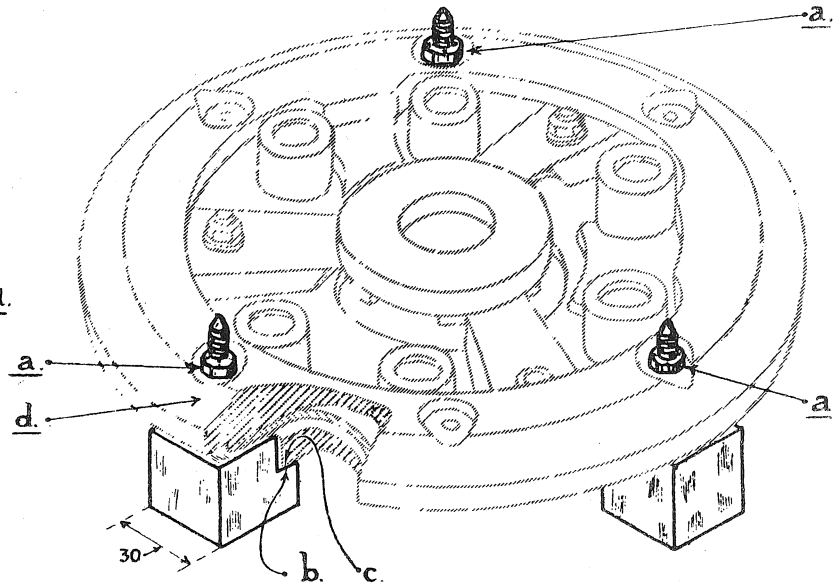
— CLUTCH —

SIMPLIFIED FIXTURE FOR CLUTCH TOGGLE ADJUSTMENT —

FIG. 1. USE OF FIXTURE

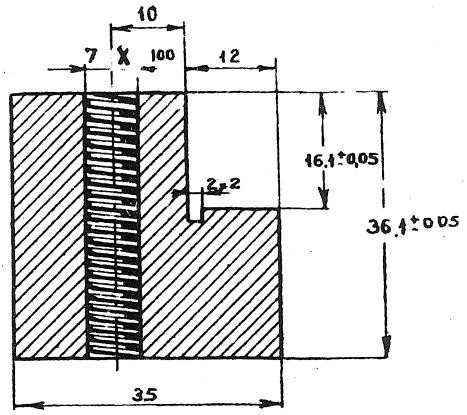
Tighten the three nuts **a** successively and with the same number of turns sufficiently to lock. After tightening nuts make sure that the blocks **b** bear perfectly on smooth surface.





For adjustment the clutch is assembled with the auxiliary flywheel **d**.

— Fig. 2. — BLOCKS MR. 3457-7



3 off.

— STAND FOR GEARBOX —

FIG.1. USE OF STAND

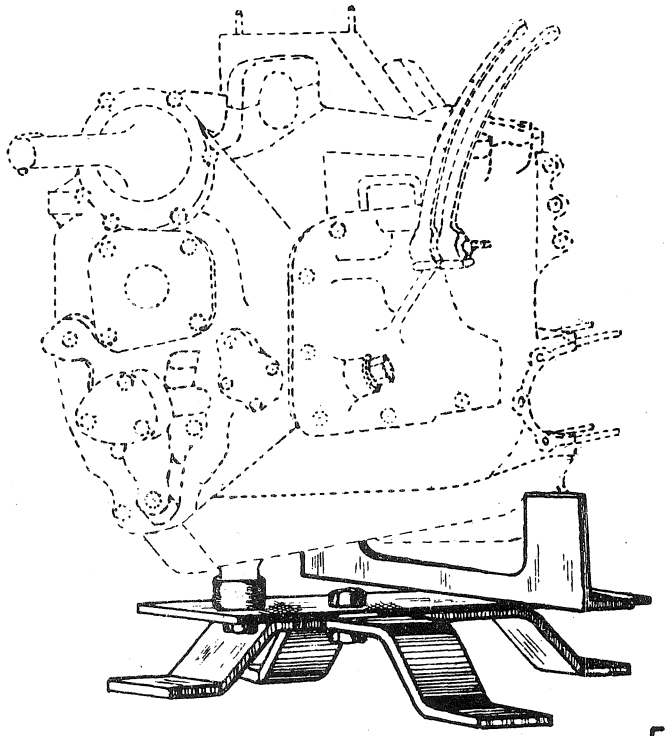


FIG.2. STAND MR.3053-10

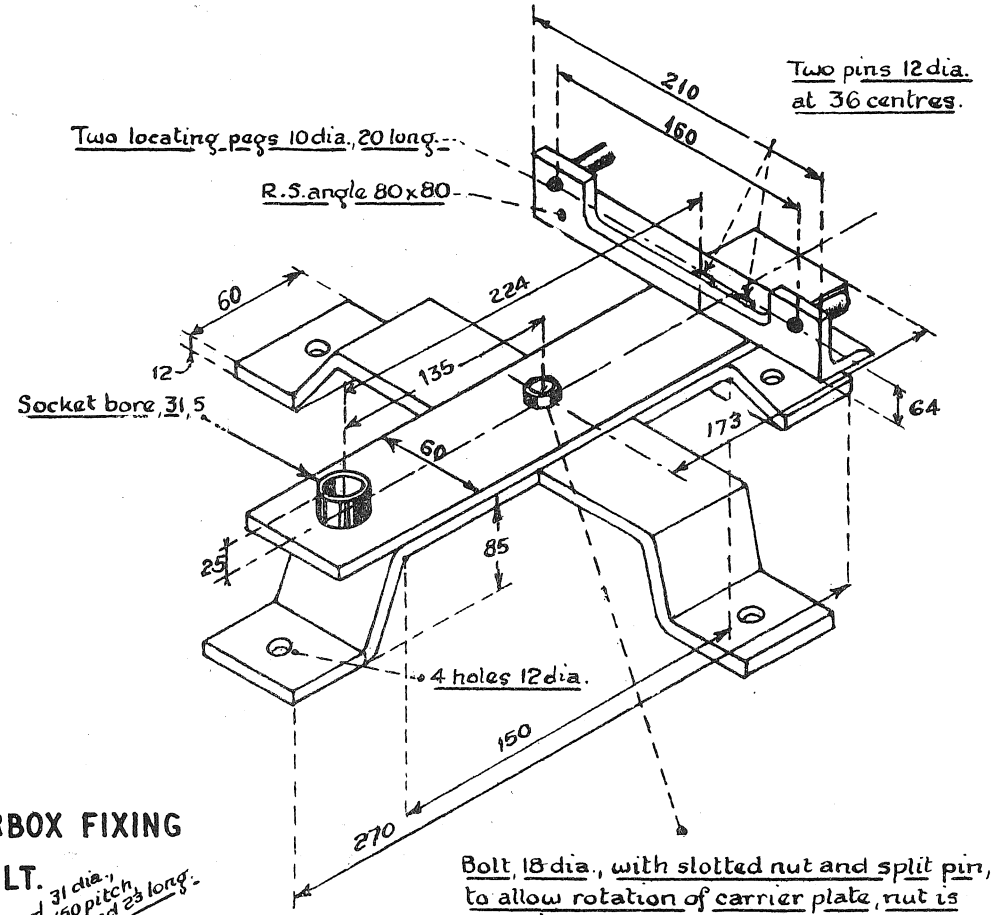
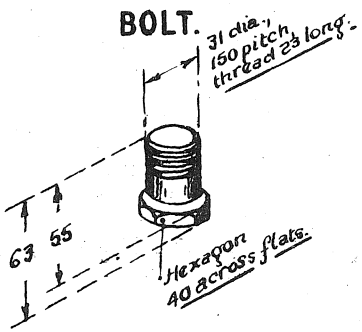


FIG.3. GEARBOX FIXING BOLT.



— GEARBOX —

— LONGITUDINAL SECTION —

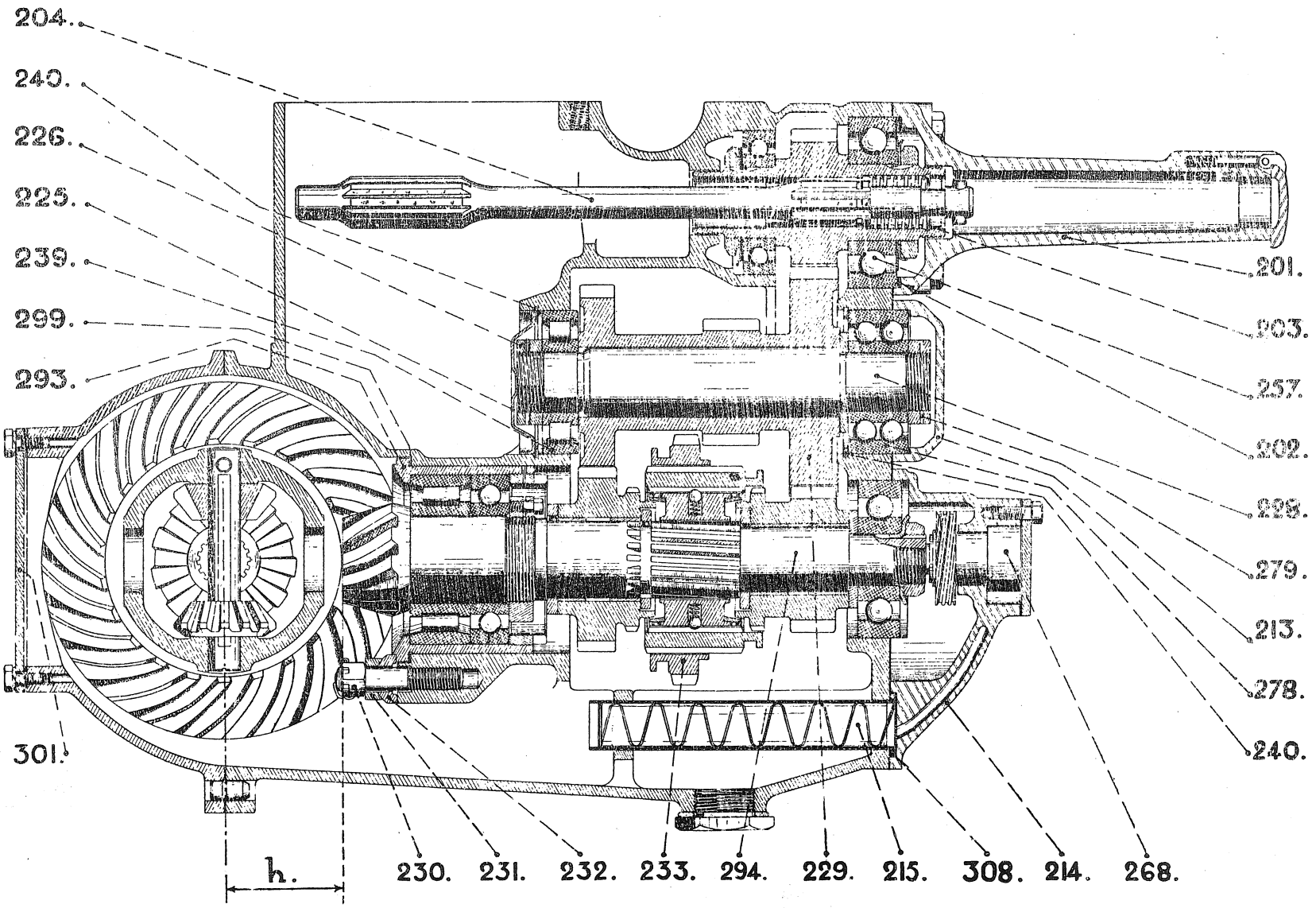


Fig.1 SECTION THROUGH BEVEL PINION (FORMING LAYSHAFT)

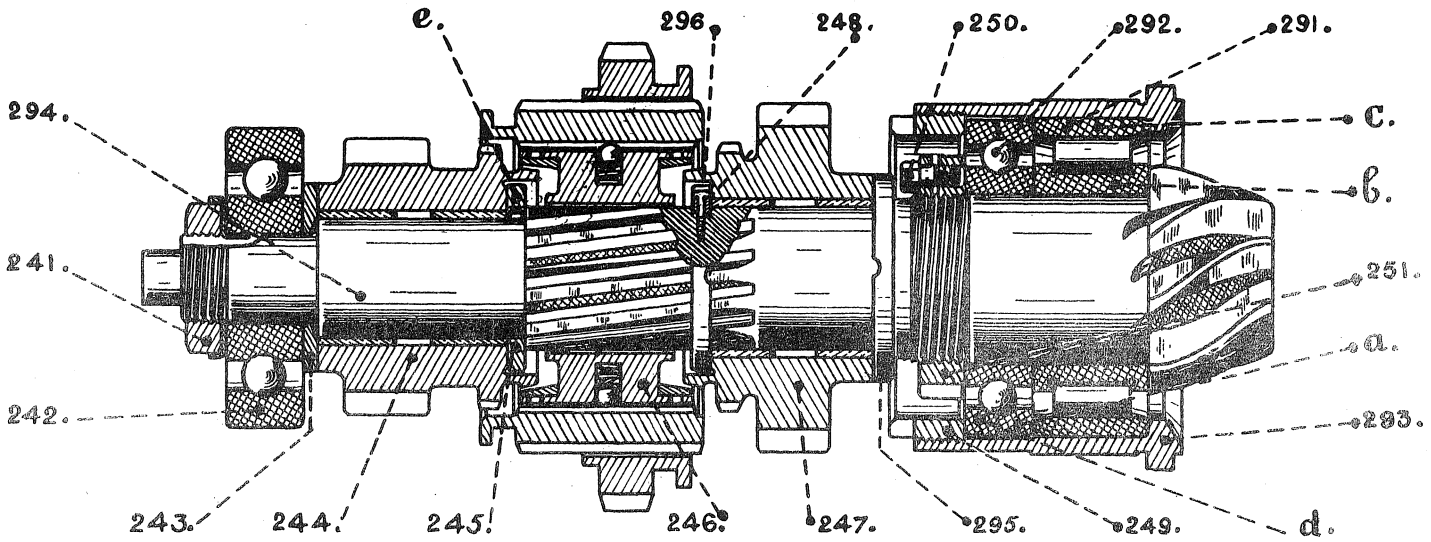
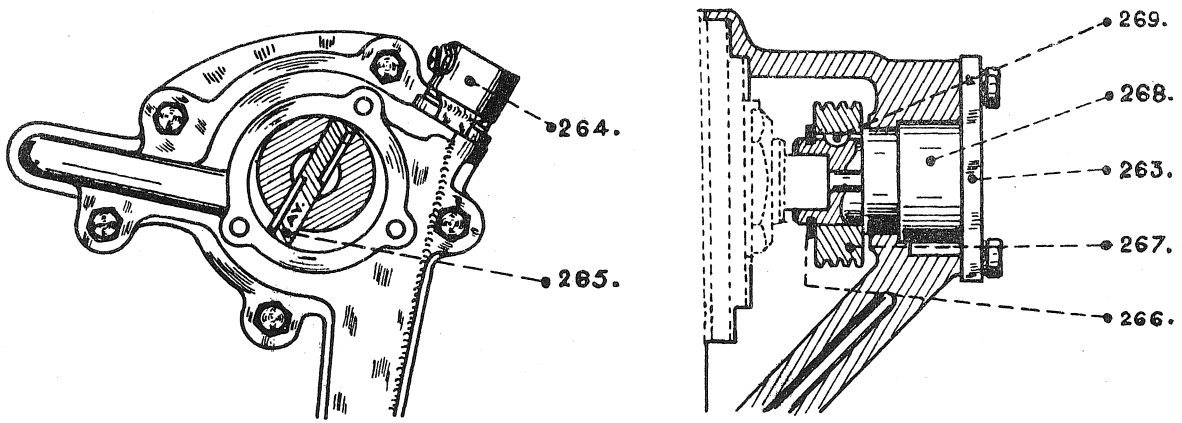


Fig. 2 OIL PUMP



— GEARBOX —
— VARIOUS VIEWS —

Fig.1 SECTION THROUGH MAINSHAFT

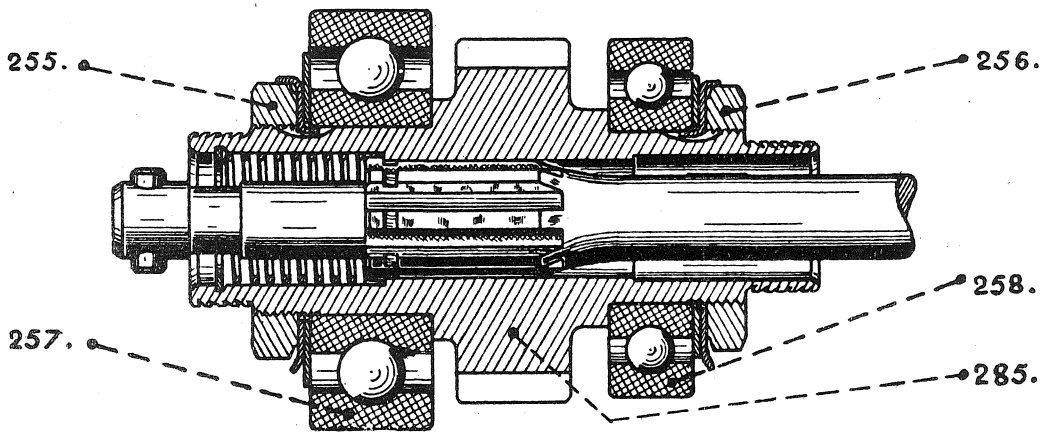
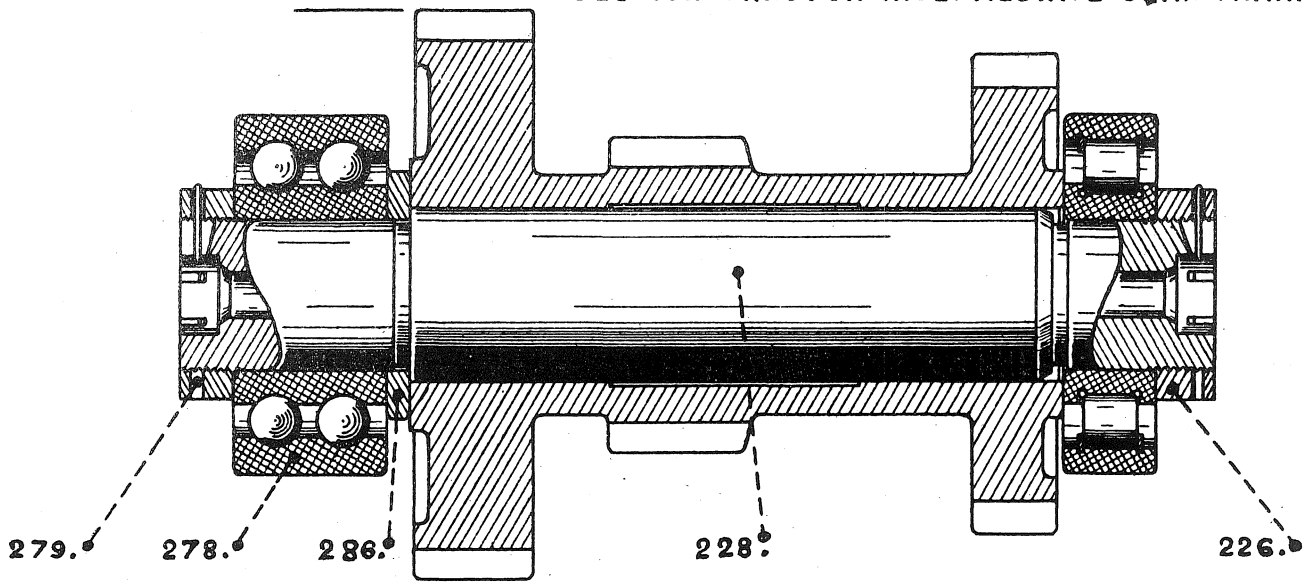
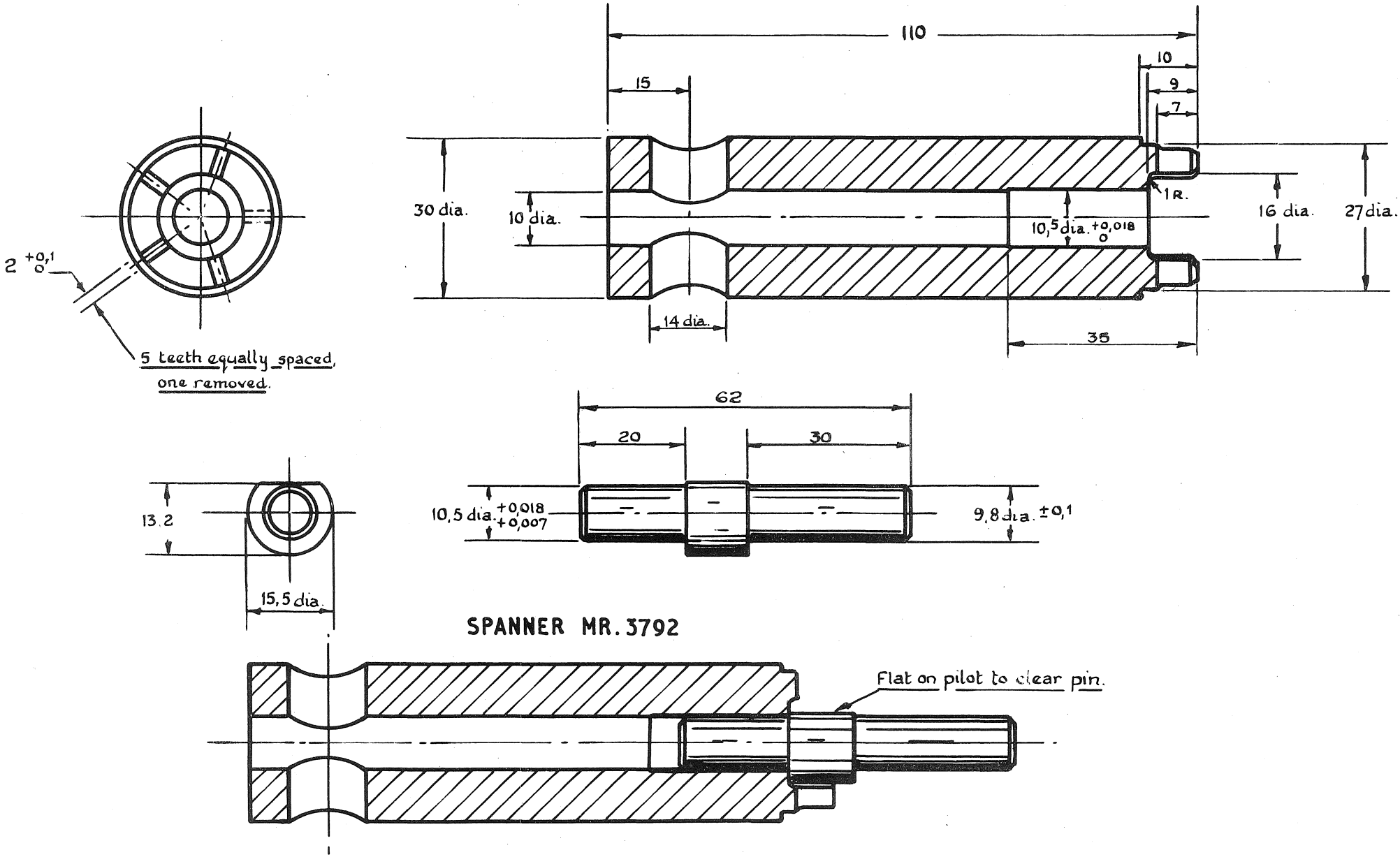


Fig.2 SECTION THROUGH INTERMEDIATE GEAR TRAIN

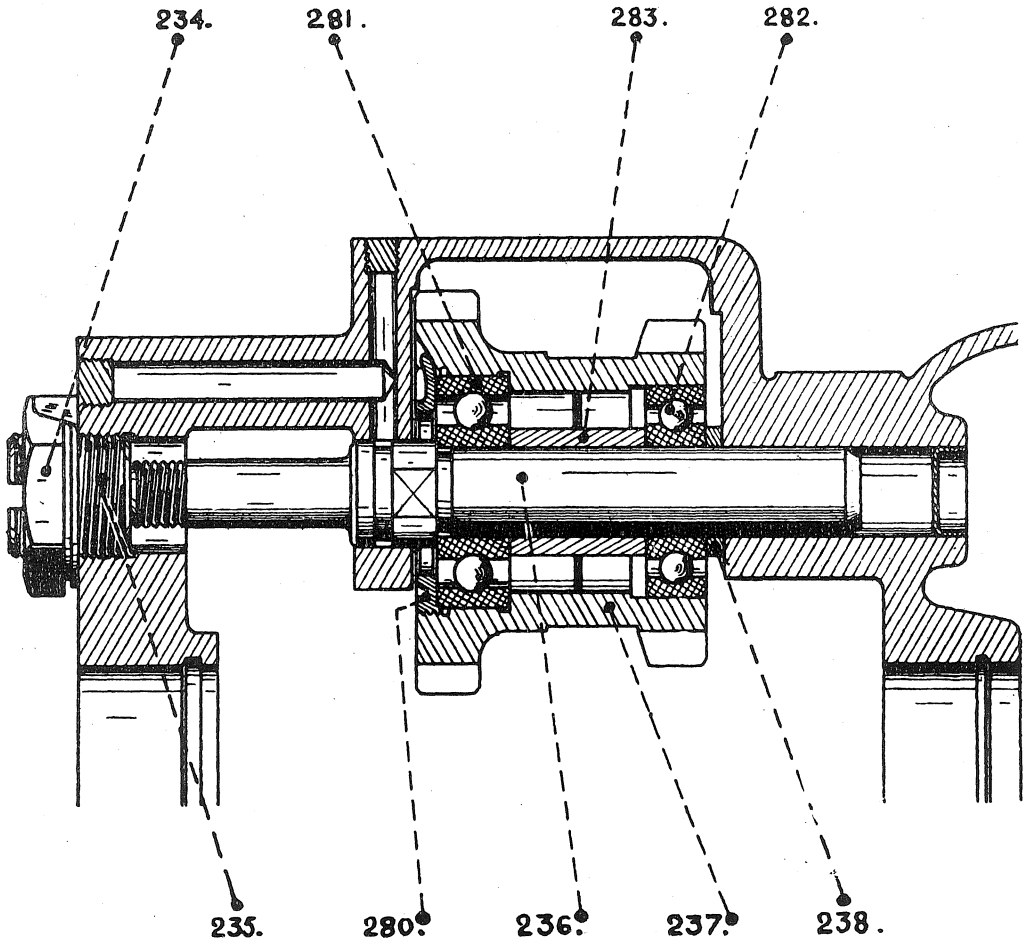


— SPANNER FOR HOLDING INTERMEDIATE GEAR SHAFT —

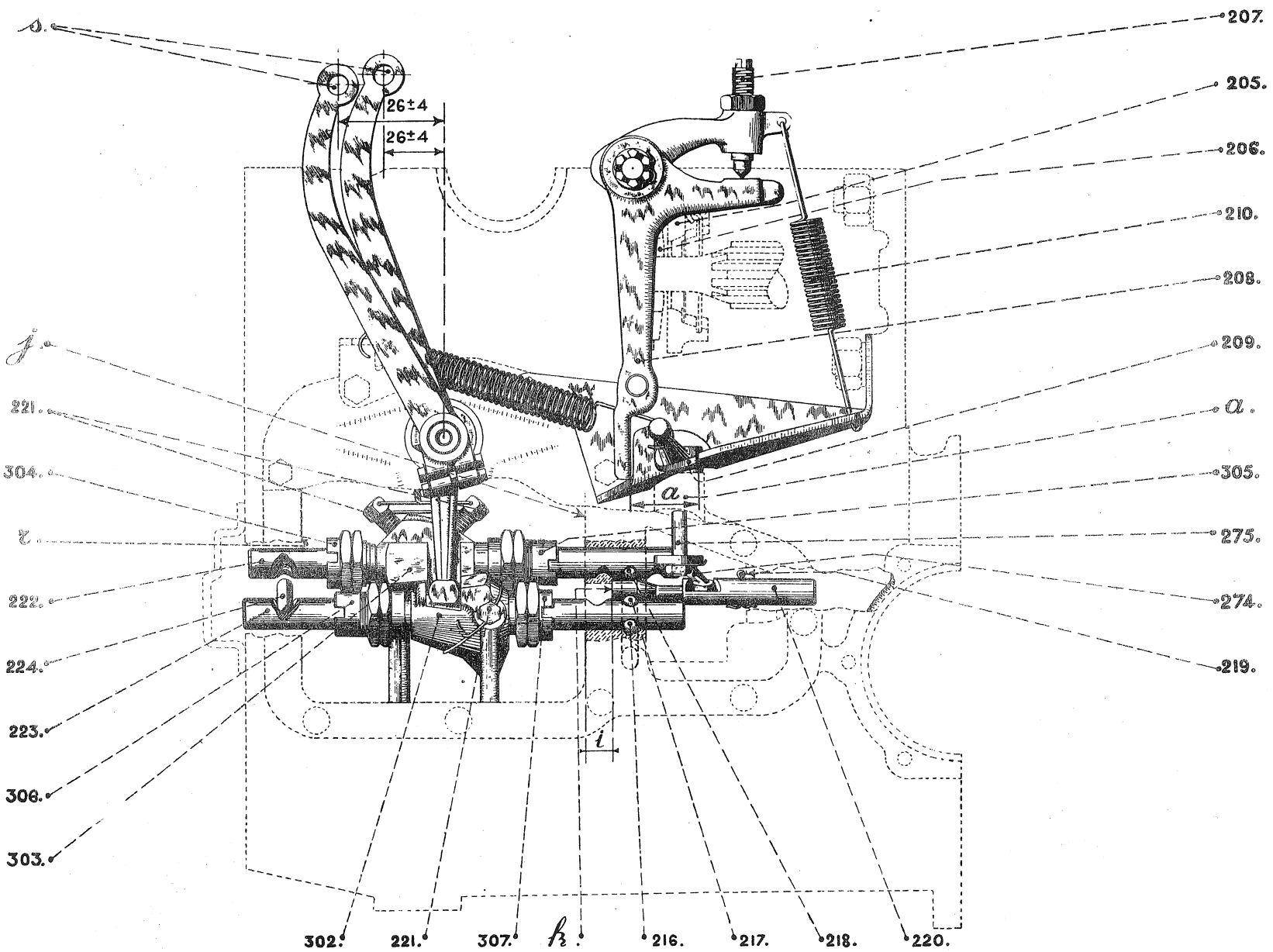


— GEARBOX —

— SECTION THROUGH REVERSE GEAR INTERMEDIATE TRAIN —



— GEARBOX —
— ADJUSTMENT OF CONTROL LEVERS —



— GEARBOX —

— VARIOUS TOOLS —

SPANNER 1732-T FOR MAINSHAFT FRONT AND REAR NUTS.

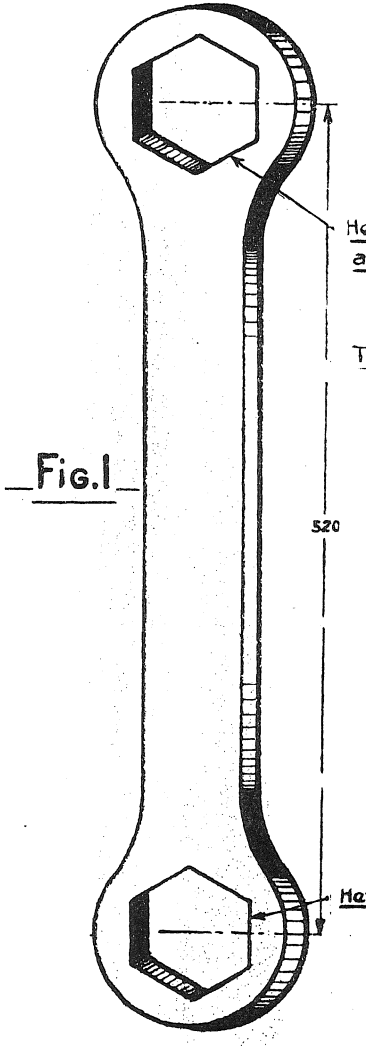


Fig.1

SPANNER 1731-T FOR INTERMEDIATE SHAFT FRONT NUT.

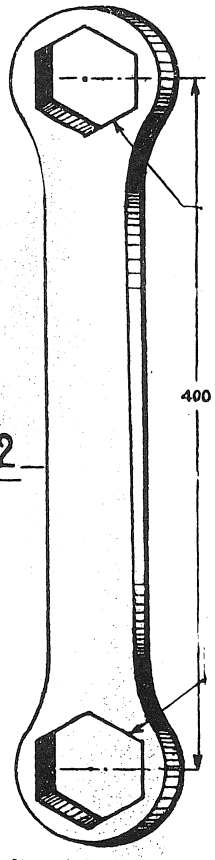


Fig.2

SPANNER 1734-T FOR BEVEL PINION FRONT BEARING NUT.

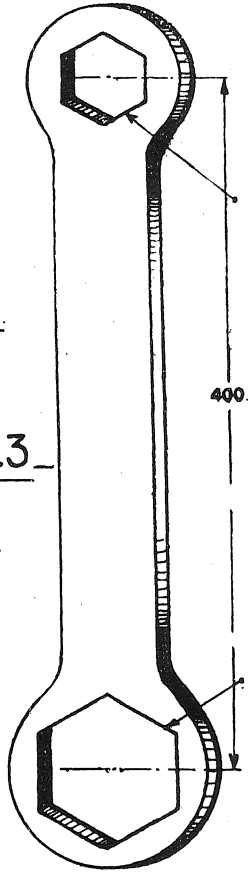


Fig.3

SPANNER 1733-T FOR HOLDI BEVEL PINION BY FLATS AT _

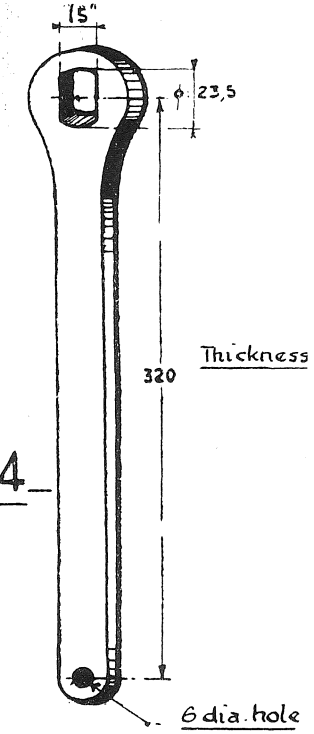


Fig.4

MANDREL
MR.3428

Fig.5

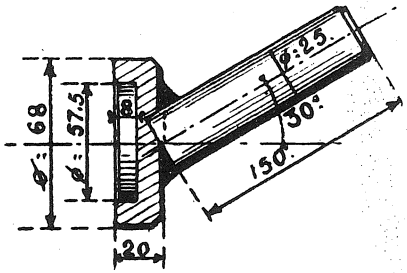


FIG. 1. PEG SPANNER 1758-T FOR DIFFERENTIAL SHAFT BEARING LOCK NUT.

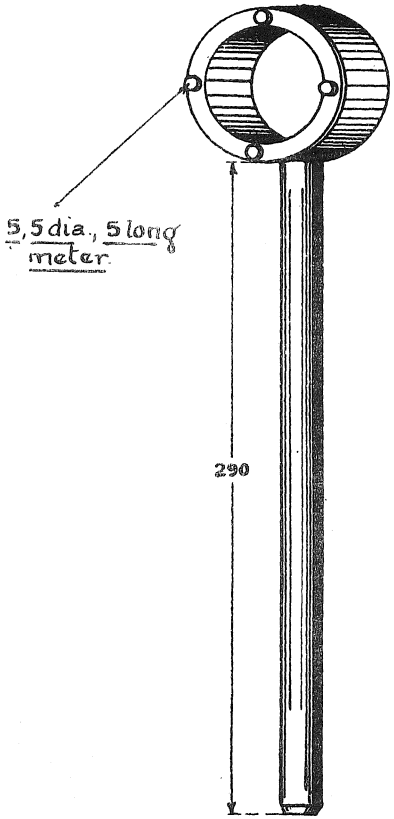


Fig. 2 SCREWDRIVER MR. 3458.

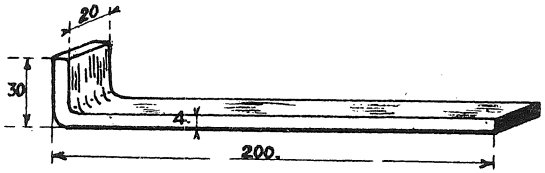


Fig. 3 SPANNER MR. 3461.

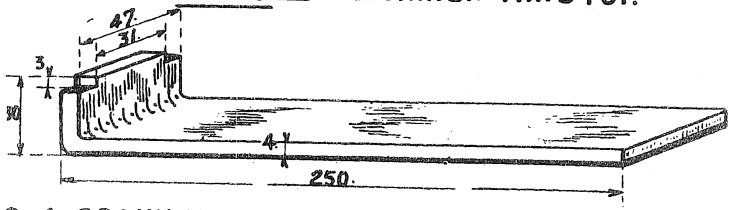


FIG. 4. SPANNER 1780-T FOR SELECTOR FORK DISTANCE PIECE NUTS.

Two spanners are required.

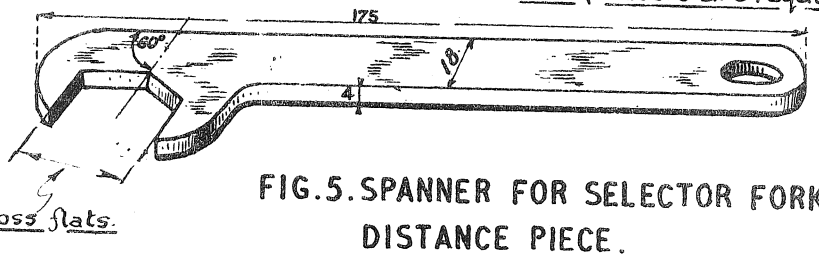


FIG. 5. SPANNER FOR SELECTOR FORK DISTANCE PIECE.

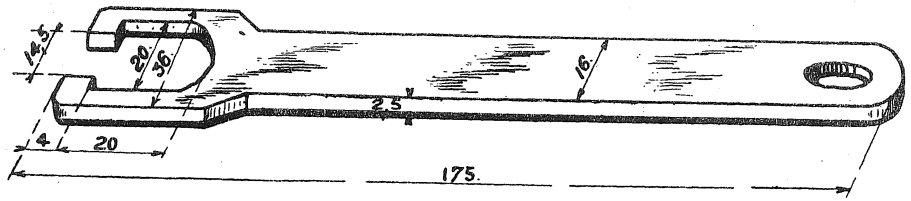


FIG. 6. SPANNER FOR BEVEL PINION BEARING NUT.

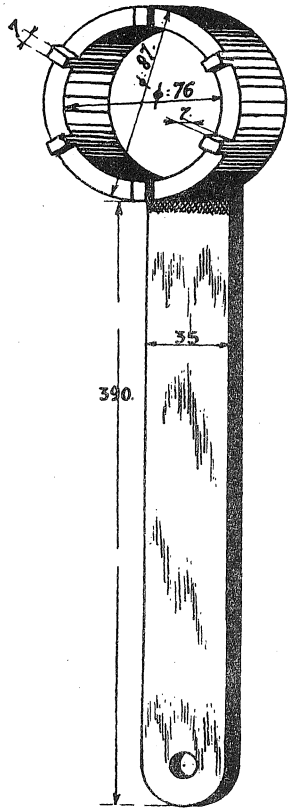


Fig.1 USE OF EXTRACTORS.

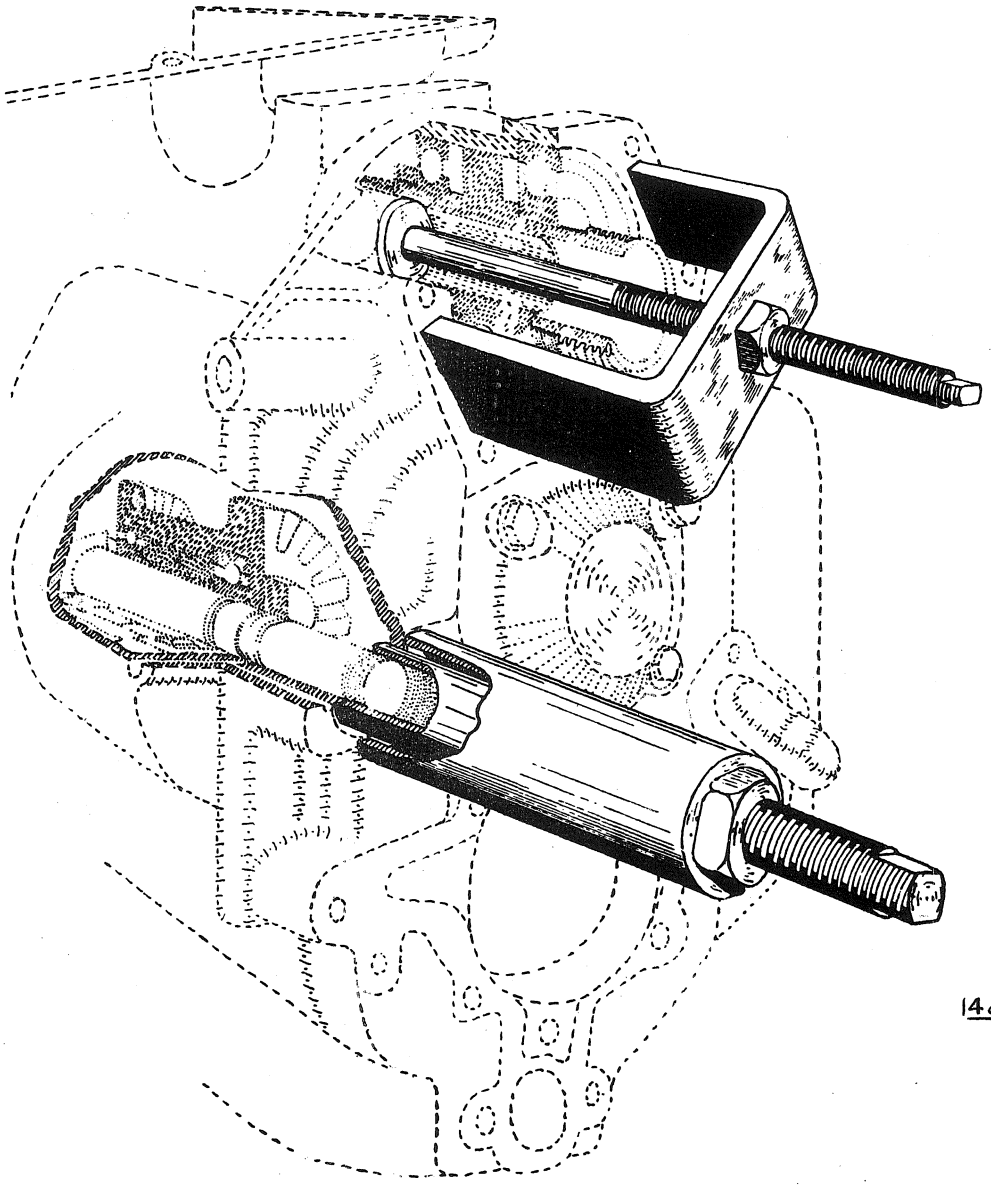


FIG.2. EXTRACTOR MR 7

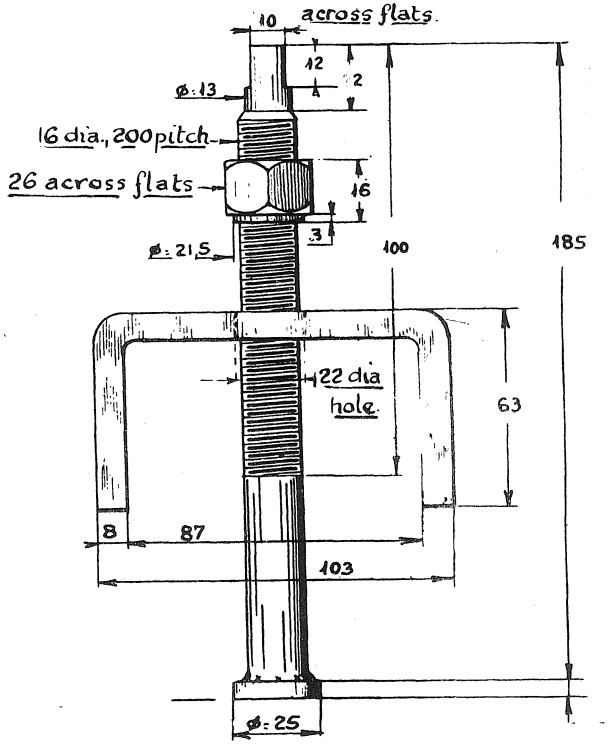
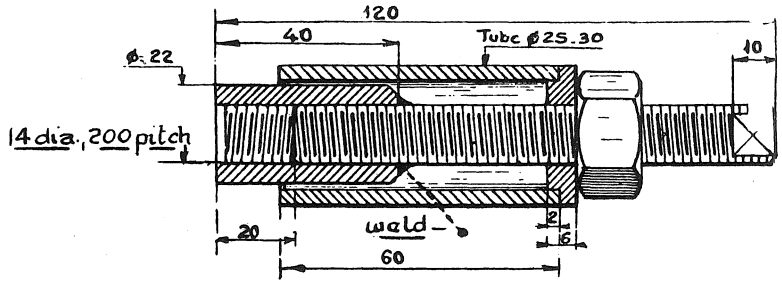


Fig.3 EXTRACTOR MR.3459



GEARBOX
HOLDING BEVEL PINION

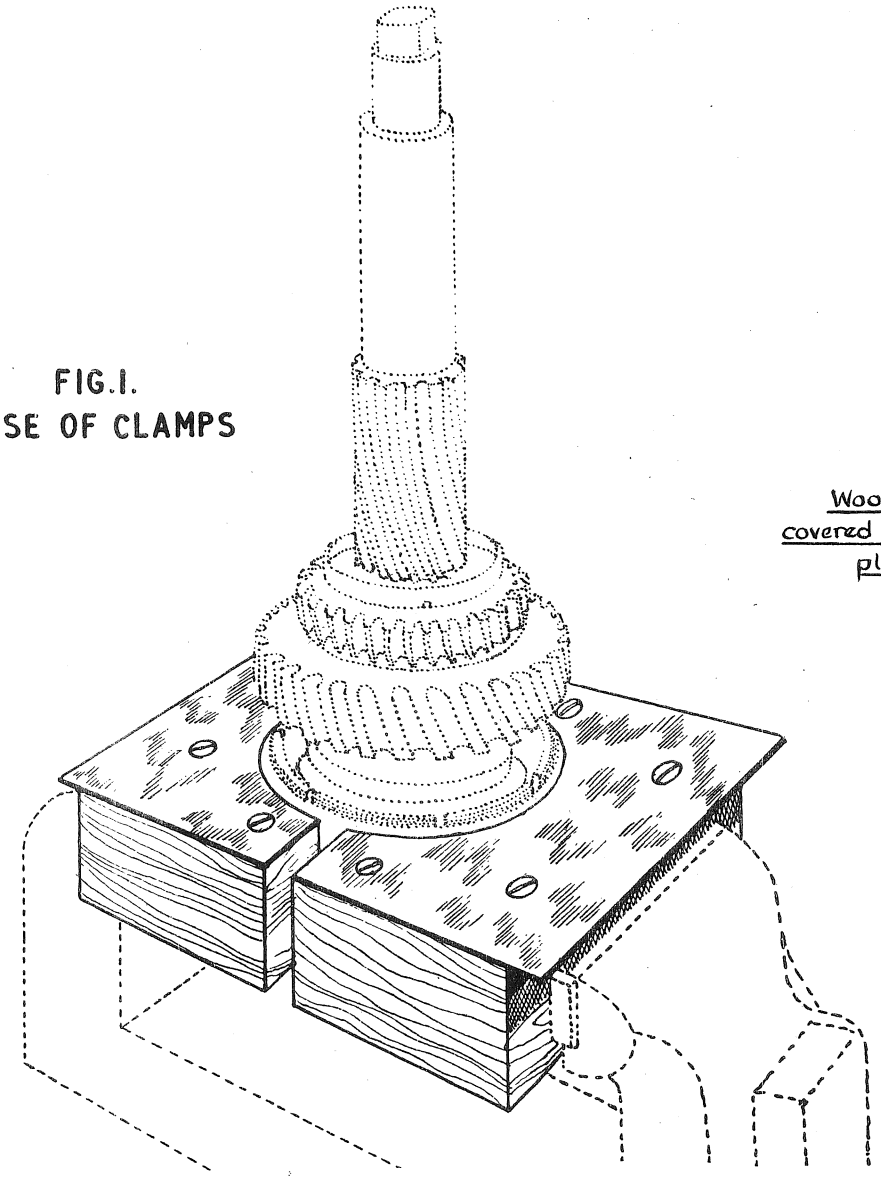
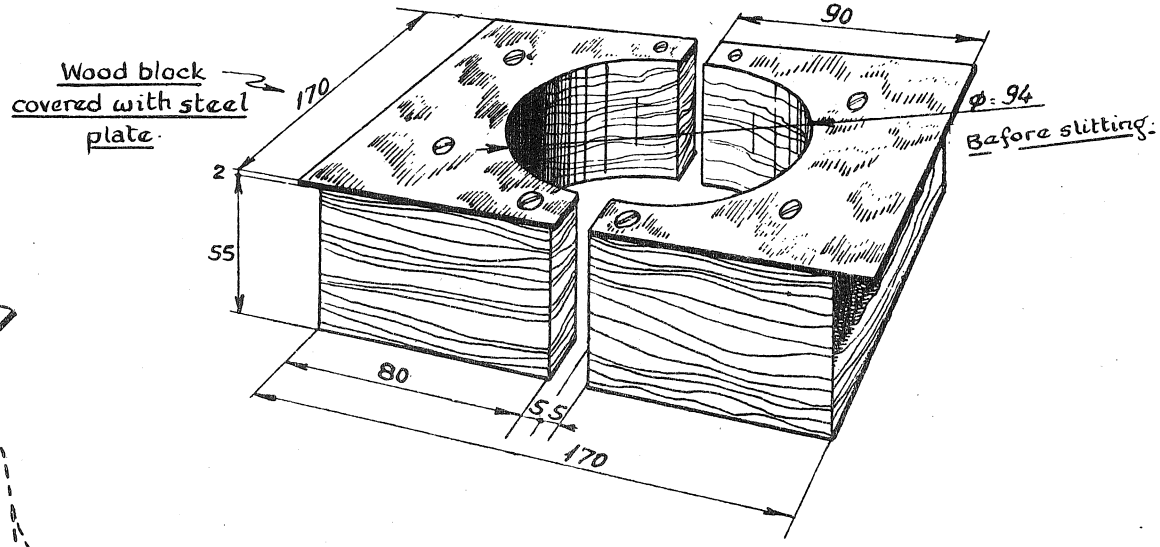


FIG.I.
USE OF CLAMPS

Fig 2 CLAMPS MR.3407



— GEARBOX —
EXTRACTION OF BEVEL PINION SHAFT REAR BEARING

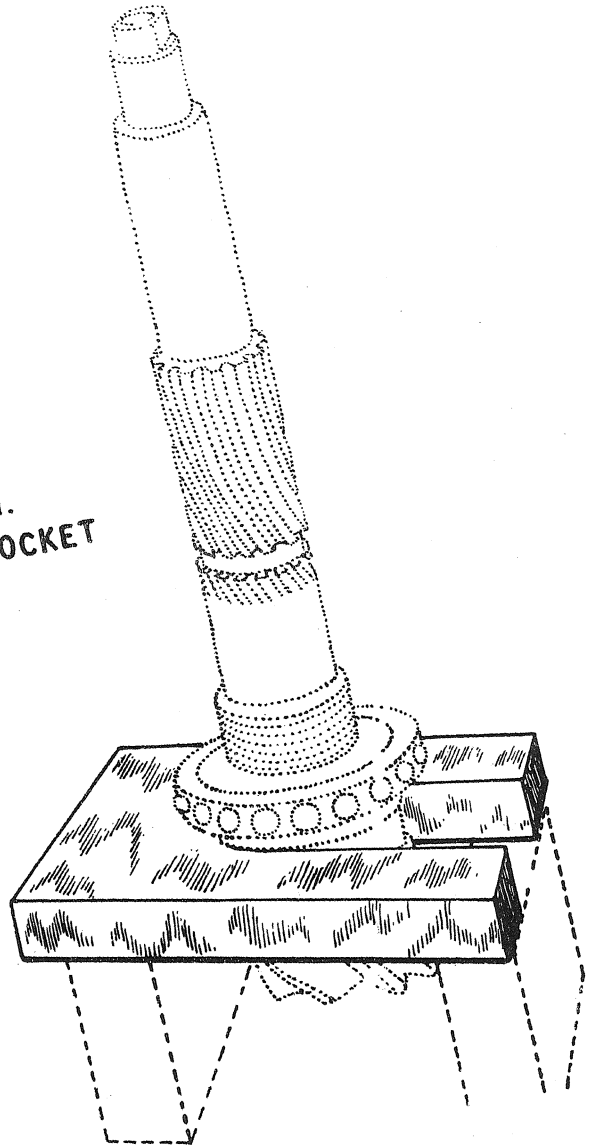
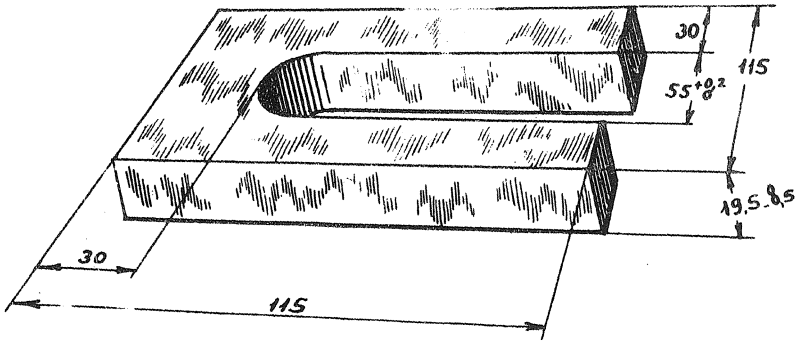


FIG.1.
USE OF SOCKET

F G.2.SOCKET MR 3460



— GEARBOX —
— SECTION THROUGH OILWAYS —

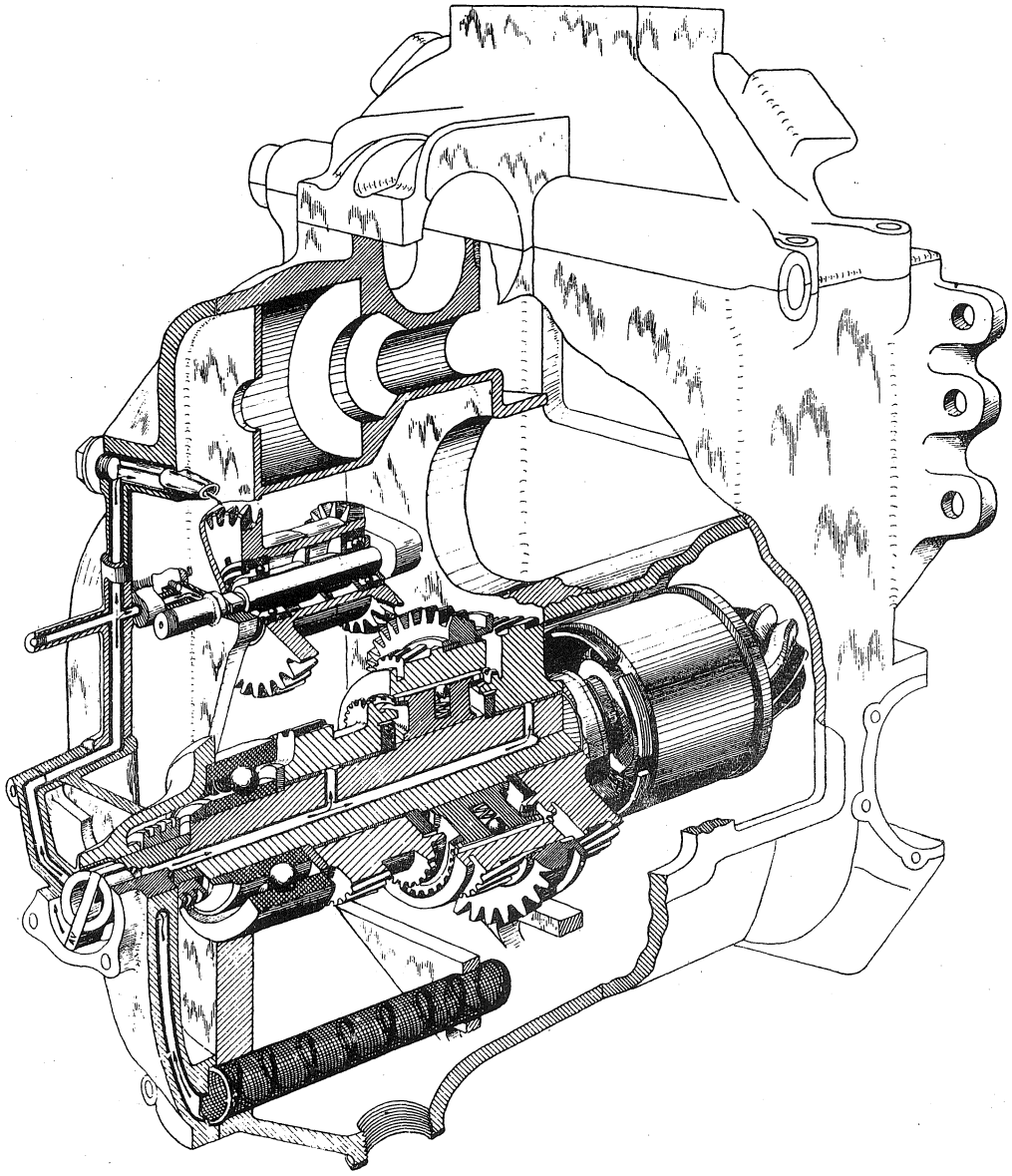


Fig.1 SECTION ON CENTRE LINE

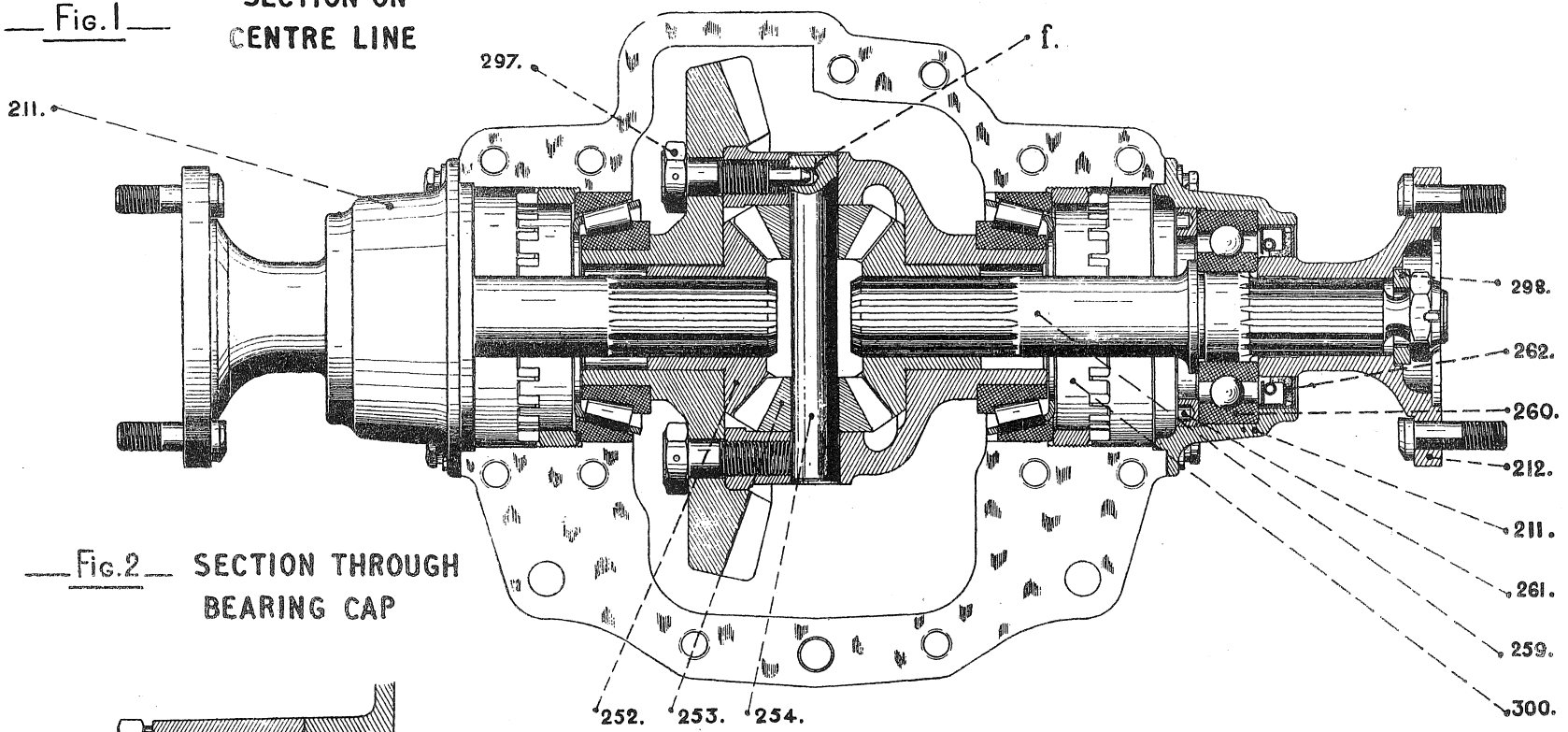


Fig.2 SECTION THROUGH BEARING CAP

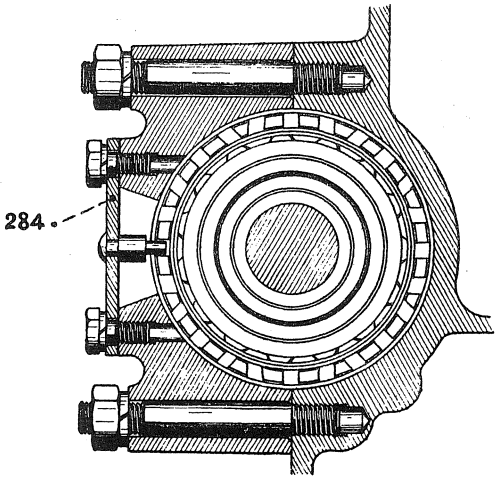
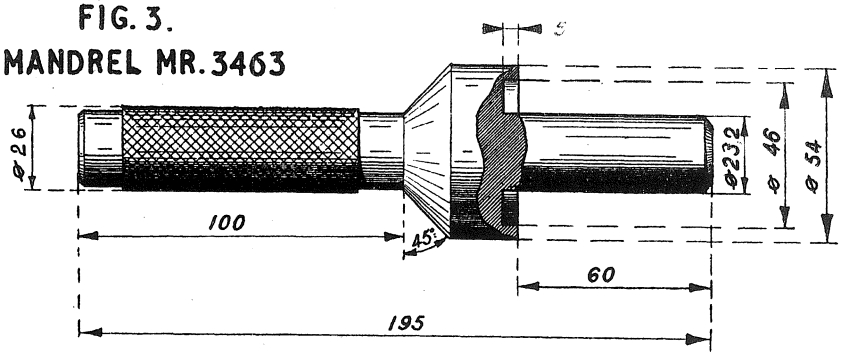


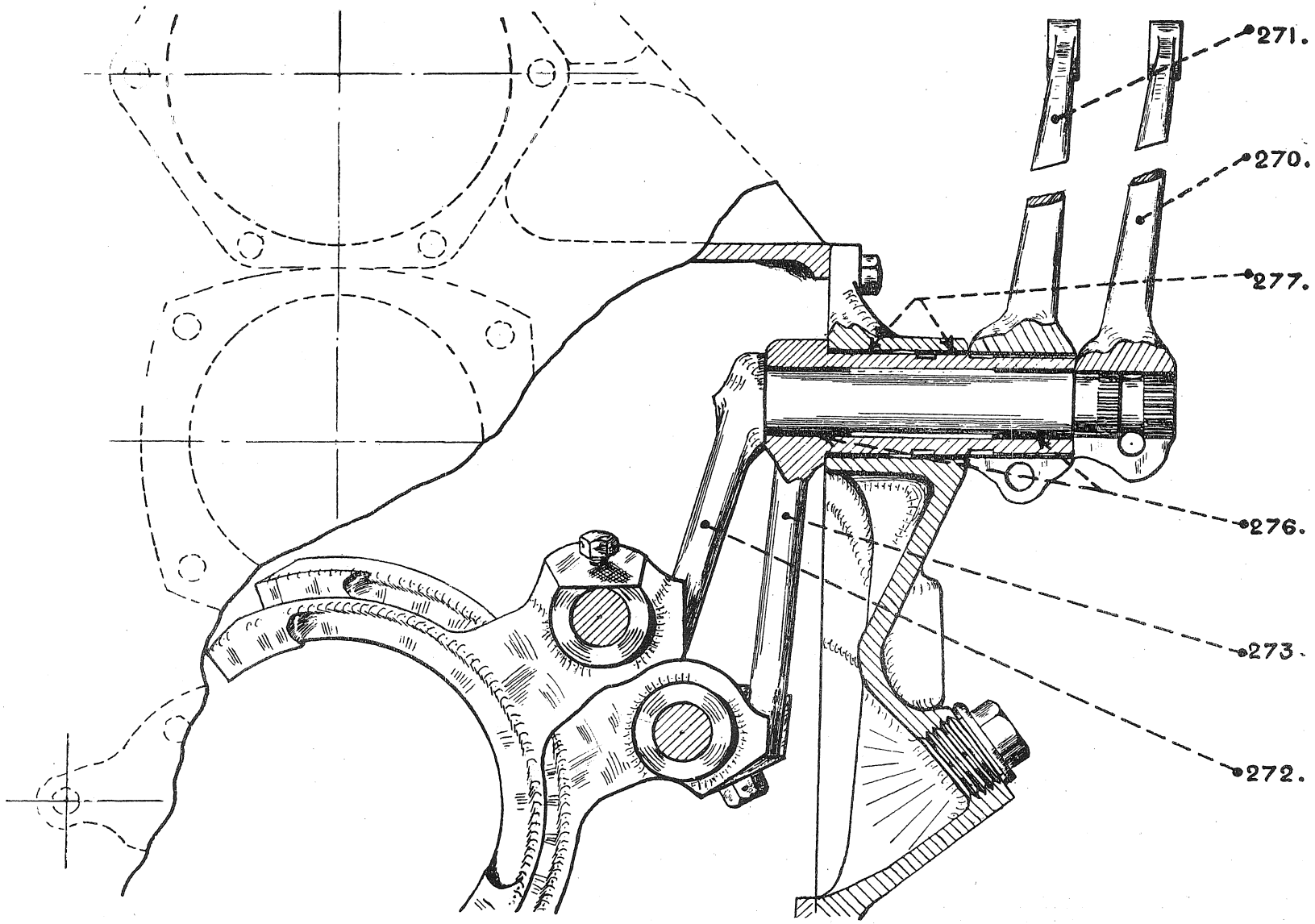
FIG. 3.
MANDREL MR.3463



— GEARBOX —

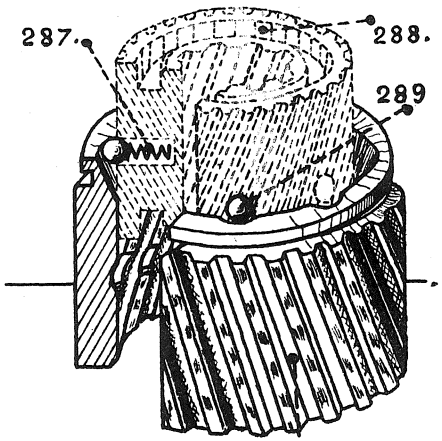
— GEARBOX COVER —

SECTION THROUGH CHANGE SPEED LEVER SHAFT



— GEARBOX —
— FITTING SYNCHROMESH GEAR —

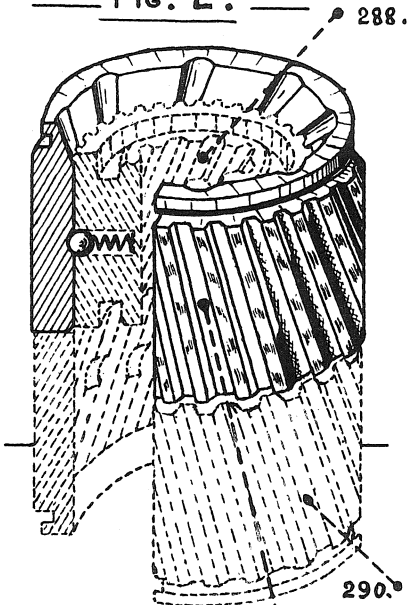
Fig. 1.



MR-3464.

Place synchromesh hub in tool. Place springs and balls in position. Press hub into ring.

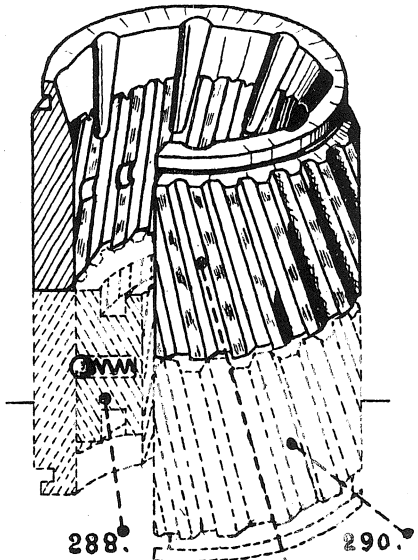
Fig. 2.



MR-3464.

Place assembly from Fig. 1 on synchromesh ring. Press hub into ring and thereby carry balls through.

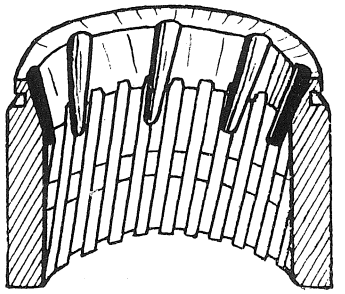
Fig. 3



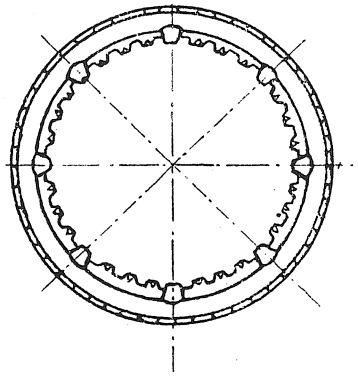
MR-3464.

Push hub completely into ring in order to free tool.

Fig. 4.



TOOL MR. 3464



The tool is made by modifying a synchromesh ring as follows:-

1. Anneal part.
2. Machine 8 grooves to receive balls.
3. Ease off teeth to give free fitting of ring on hub.

GEARBOX
BEVEL PINION ADJUSTMENT

Fig.1 ADJUSTMENT OF PINION DEPTH.
APPARATUS 2040-T

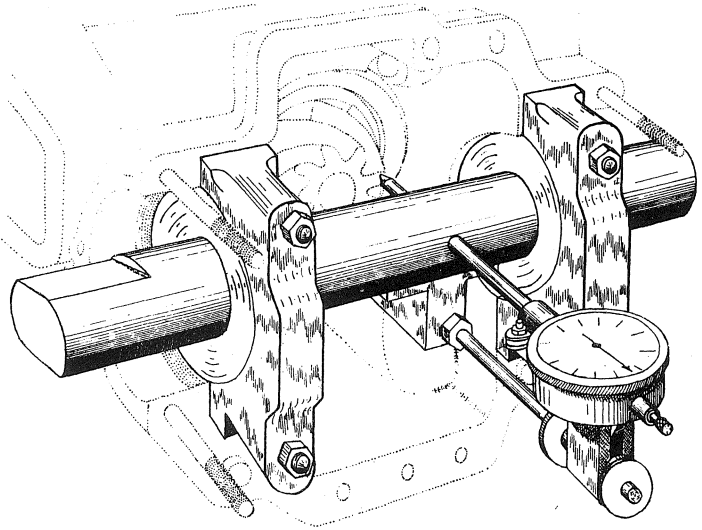


Fig.2 ADJUSTMENT OF MESH
BRACKET 2041-T FOR CLOCK GAUGE

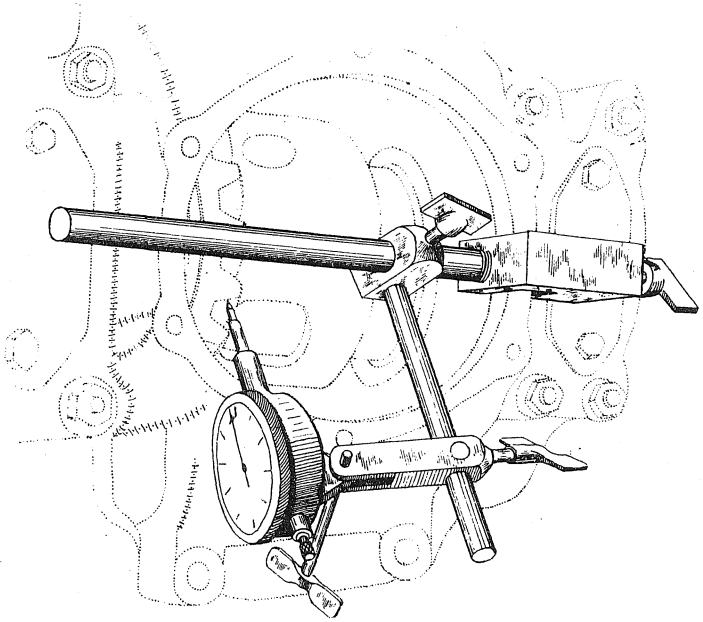


Fig.3 PINION

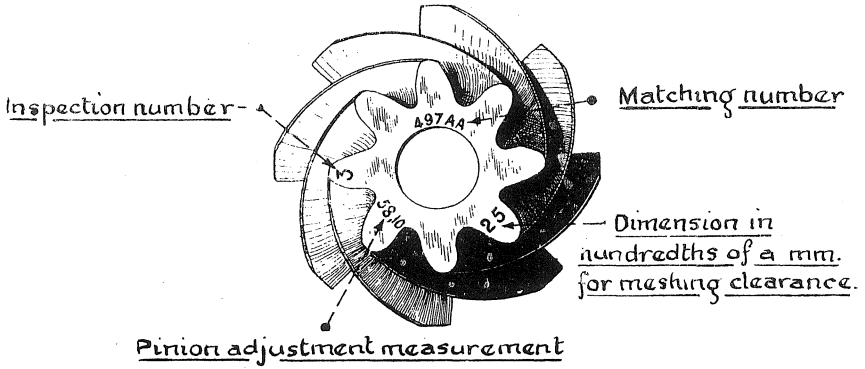
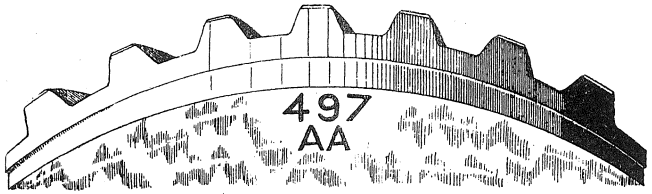


Fig.4 CROWN WHEEL



Explanation of inscriptions (on pinion and crown wheel shown).

58,10 - Pinion setting dimension (etched on pinion).
25 - Meshing clearance (etched on pinion).
497AA - Matching number (etched on pinion and crown wheel).

— GEARBOX —
— ADJUSTMENT OF SYNCHROMESH —

Fig.1.

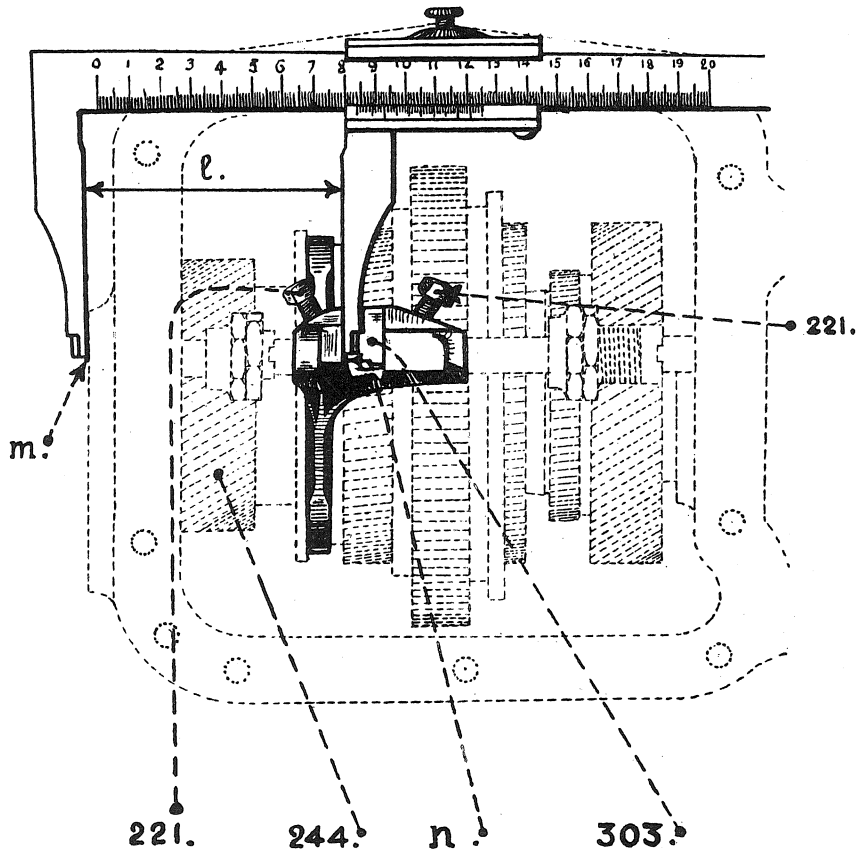
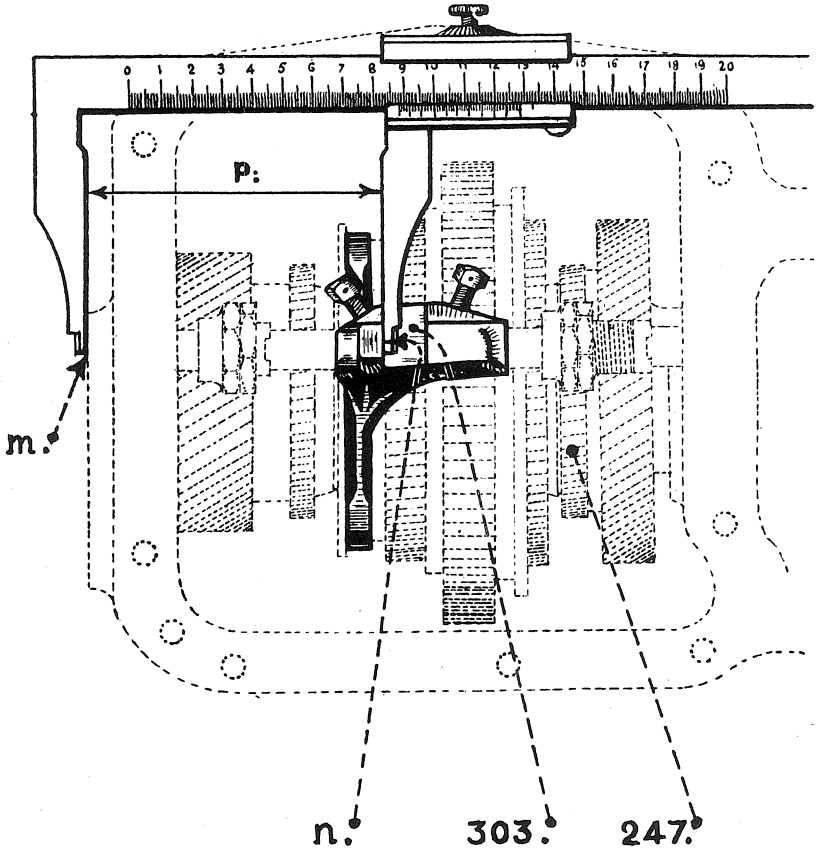
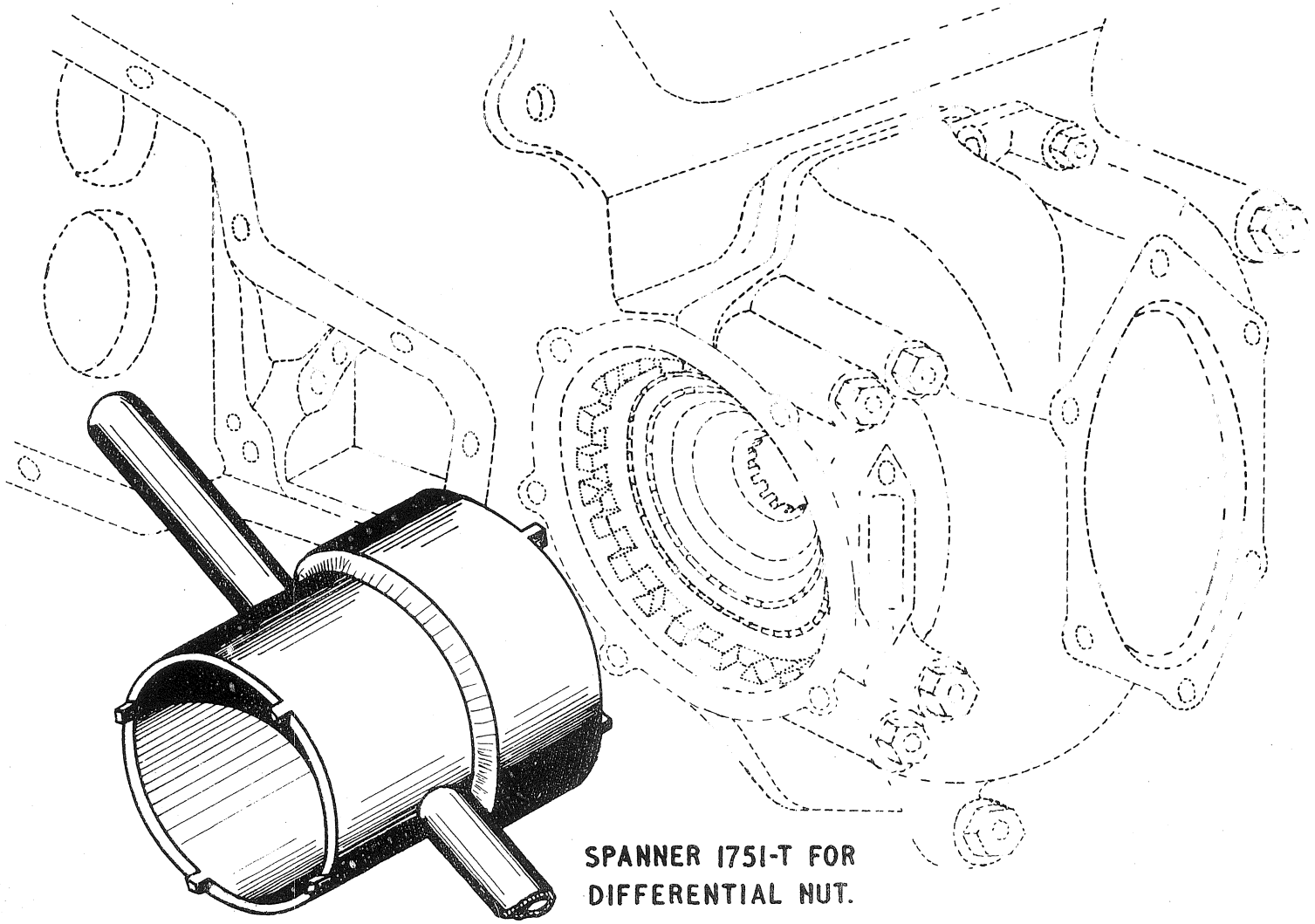


Fig.2.

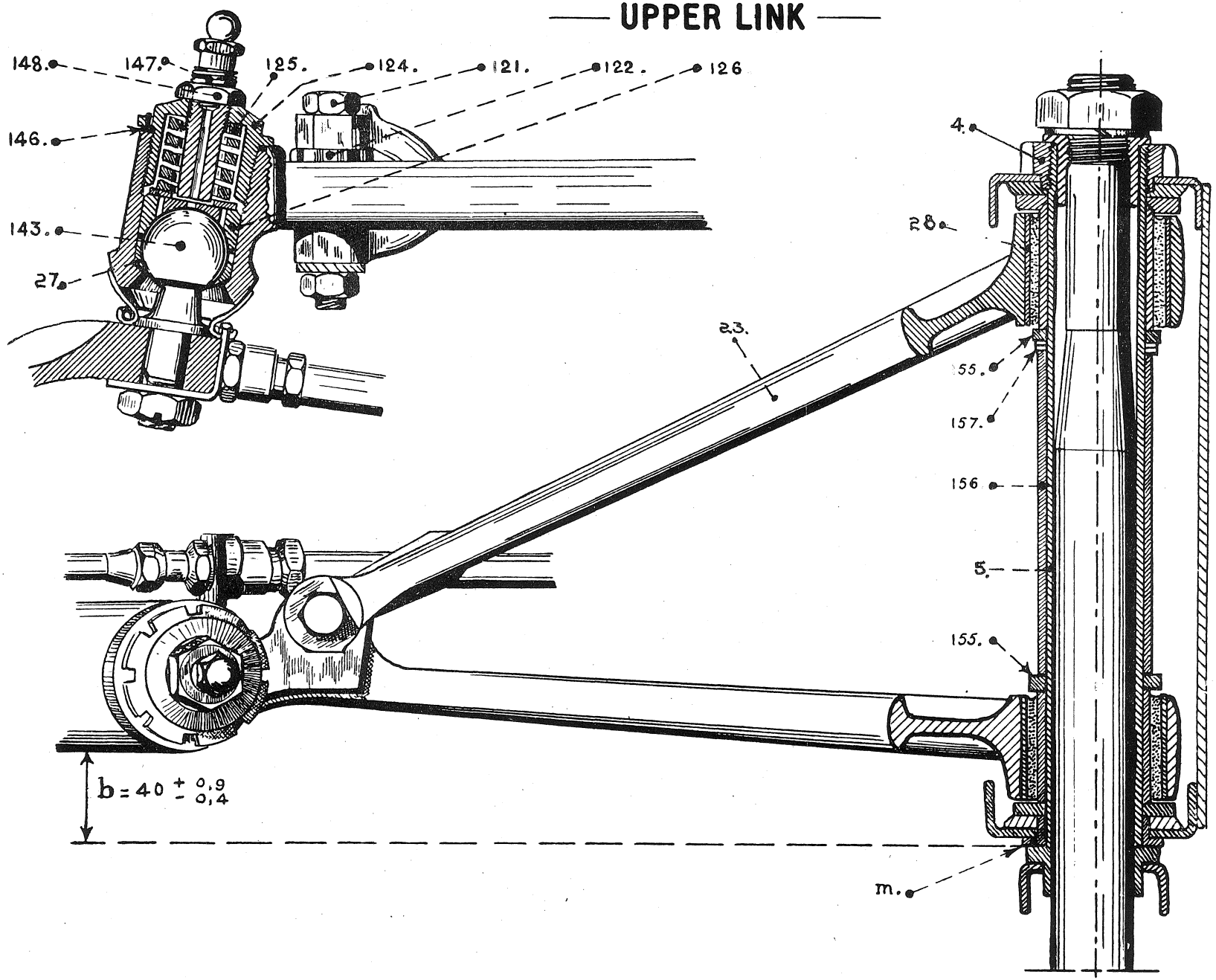


— TIGHTENING DIFFERENTIAL BEARING LOCK NUTS —

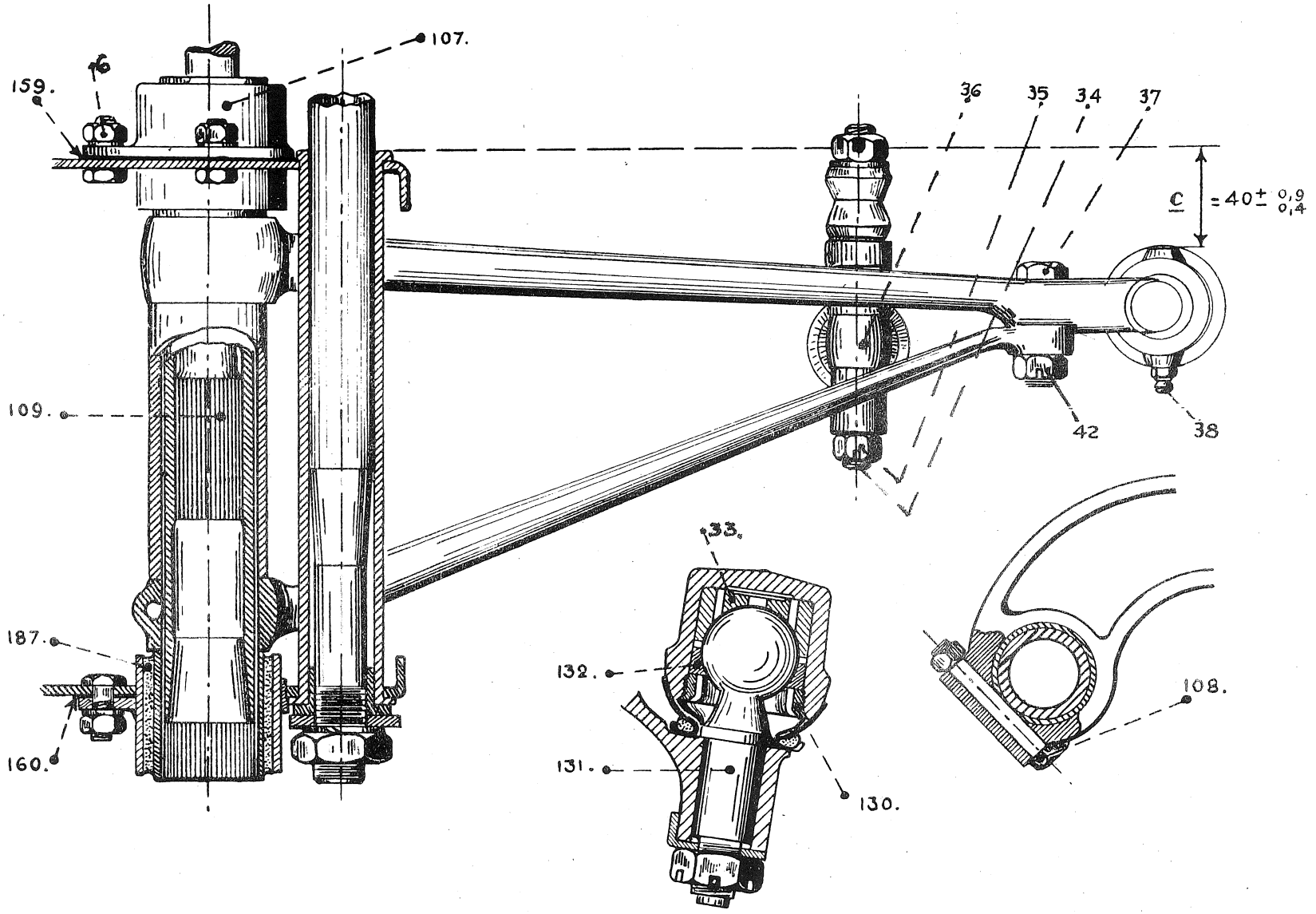


SPANNER 1751-T FOR
DIFFERENTIAL NUT.

FRONT AXLE
UPPER LINK



— FRONT AXLE —
— LOWER LINK —



GEAR CHANGE
SELECTOR

Fig.1

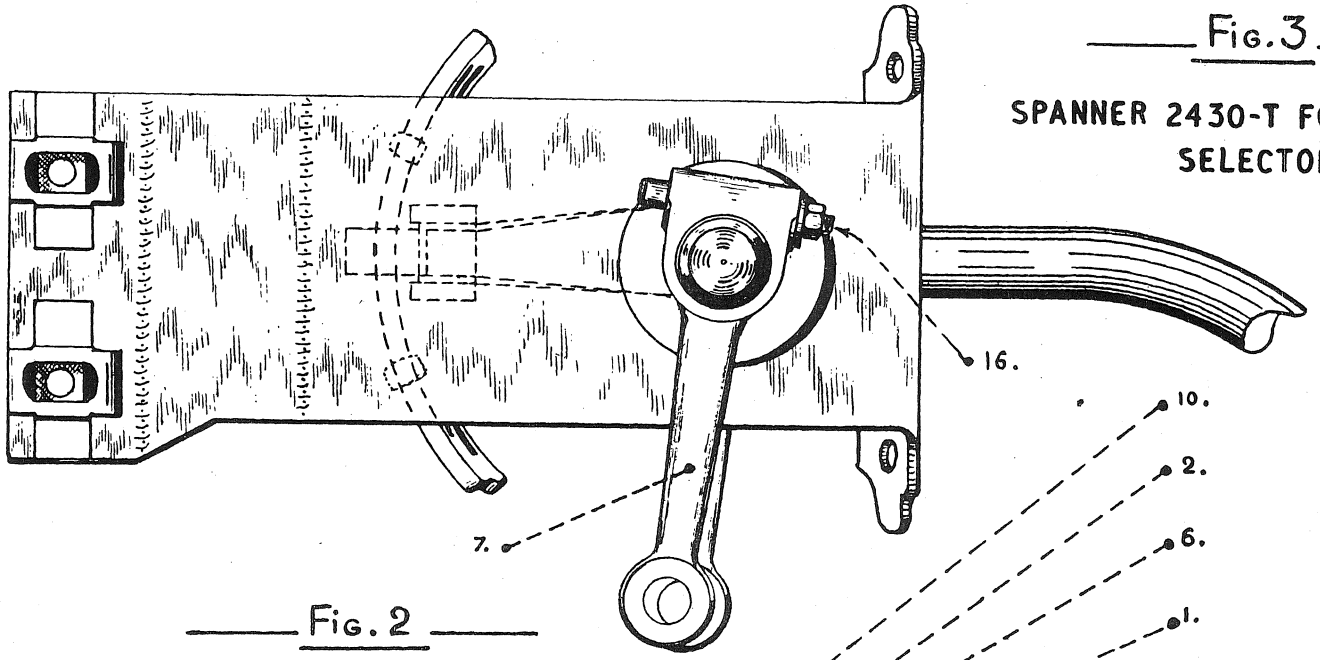


Fig.2

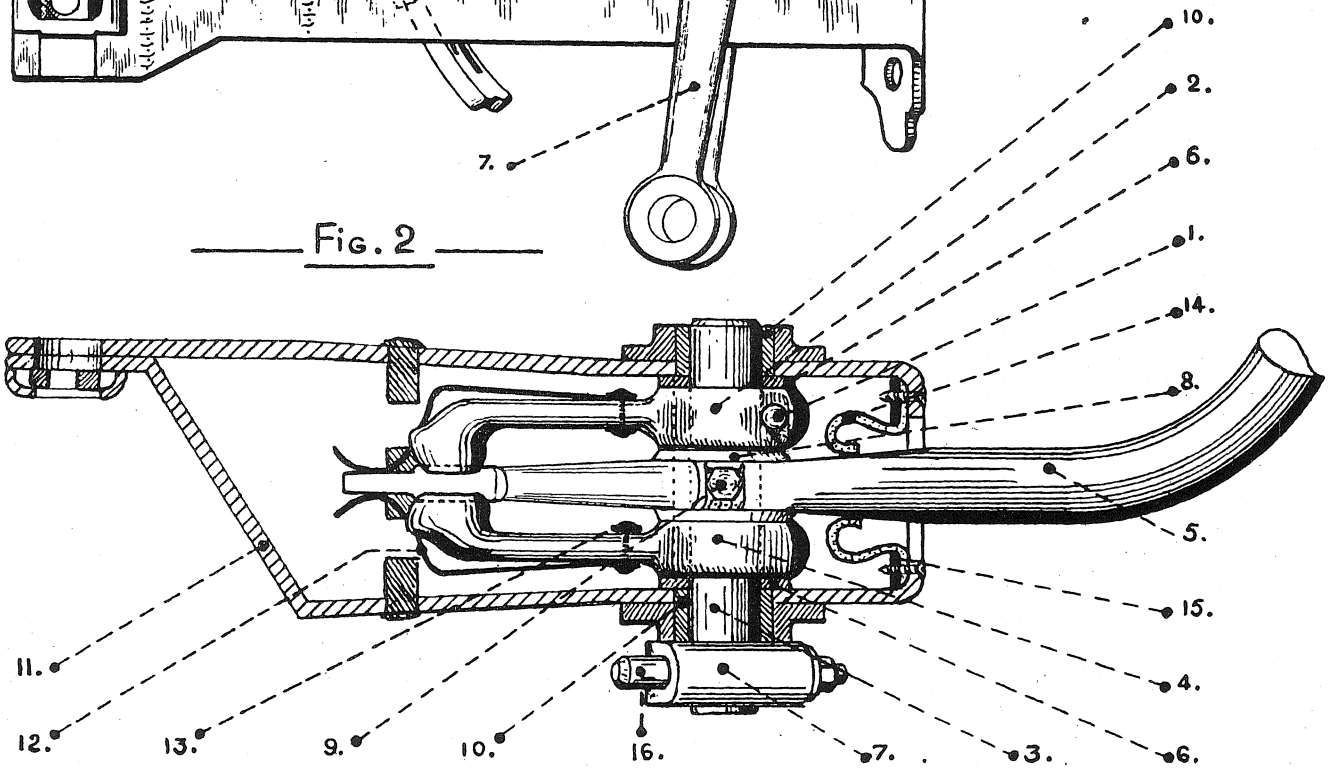
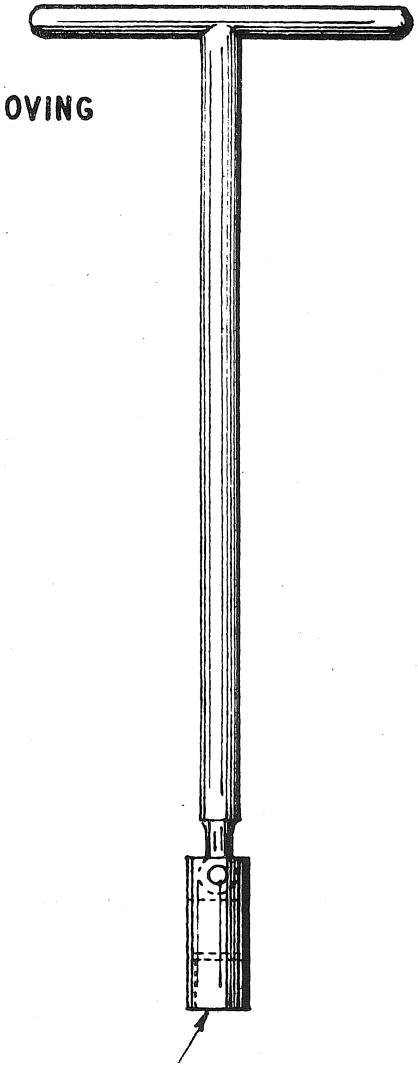


Fig.3

SPANNER 2430-T FOR REMOVING SELECTOR



Hexagon socket 8,4 across flats

ELECTRICAL EQUIPMENT
SECTION THROUGH BENDIX GEAR

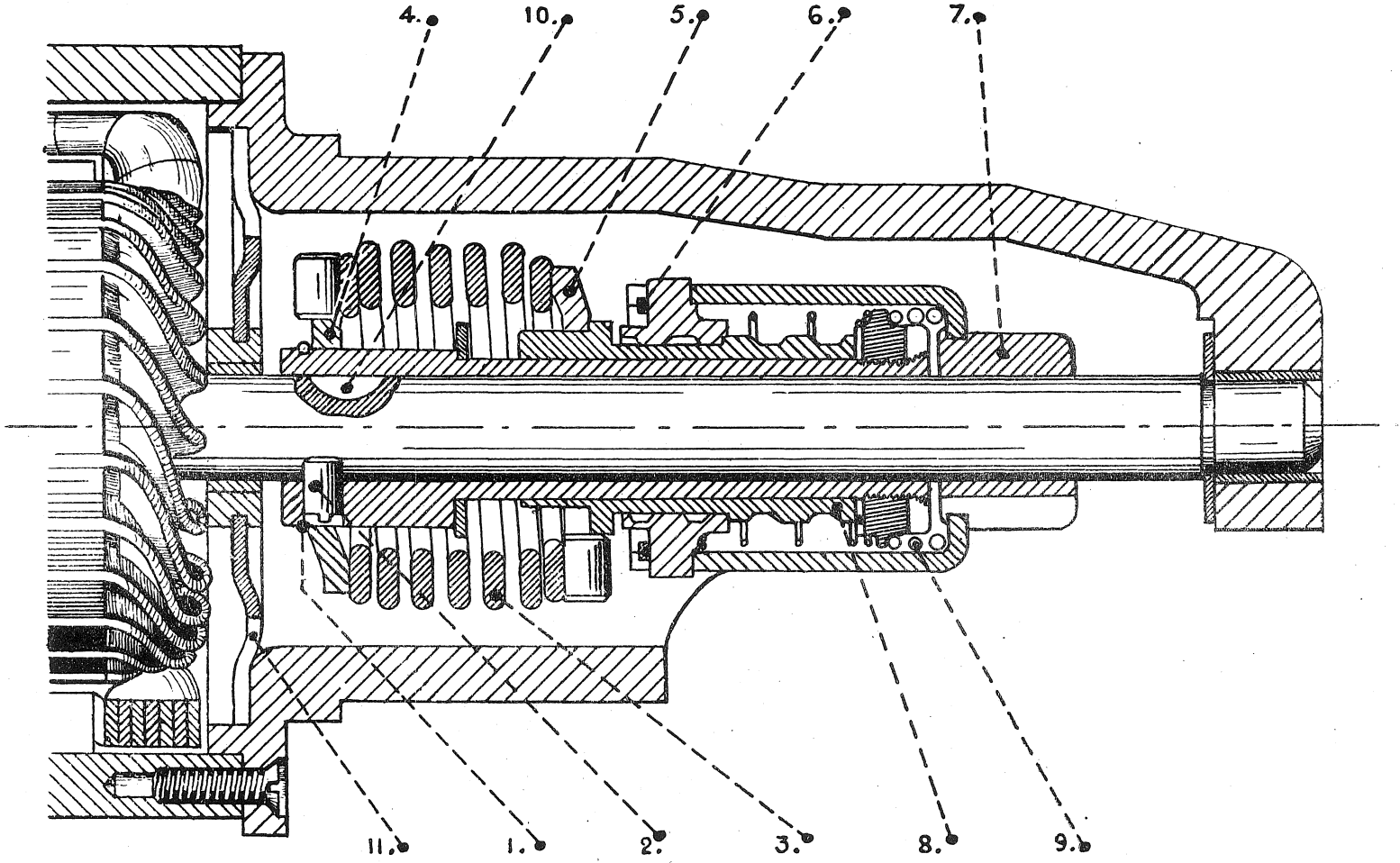
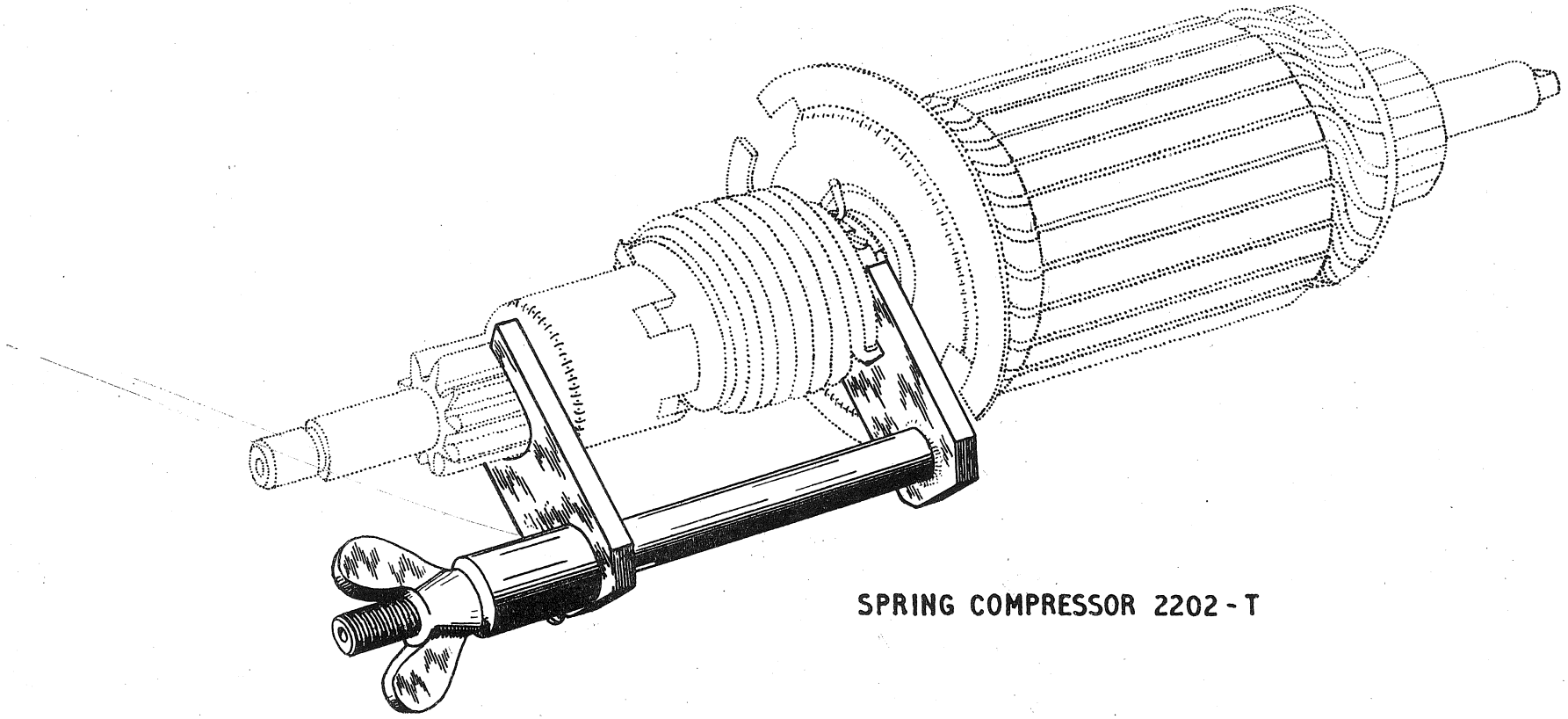


Fig.1 USE OF COMPRESSOR FOR BENDIX SPRING



SPRING COMPRESSOR 2202 - T

Page	Paragraph	Line	Modification
4			Add under "GEARBOX" : "124A - Spanner for holding intermediate gear shaft - MR.3792.
7			Add under "ADJUSTMENTS" : "Spanner for rear torsion bar adjusting rod nuts - 2304-T"
14	13d	4	Read : "368 mm., plus or minus 0.25 mm." instead of "363 mm., plus or minus 0.25 mm."
55	32	1	Read : "3 litres - 5¼ pints" instead of "3.5 litres - 6 pints."
56	8b	1, 2	Read : "....holding the shaft (228) by means of a spanner (use spanner MR.3792, see Drawing 124A)." instead of : ".... holding the shaft .... see Drawing 127, fig. 2).
		2	Add in margin : "Spanner MR.3792."
60	27	1	Read : "First case : shaft without key. Fit washer (286) on shaft. Fit bearing (278) by means of a press. Grip the shaft in a vice fitted with soft jaws. Tighten nut (279), (using spanner 1731-T, see Drawing 127, fig. 2) so that it becomes flush with the front face of the shaft. This tightening determines the position of bearing (278). Secure nut with a split pin NOTE - Proceed in this manner whether or not the shaft is chamfered. Second case : shaft with key. Proceed as above. Fit key in shaft." instead of existing paragraph.
61	29a	2	Add after (291) "the face with the oil grooves must be opposite the pinion."
62	29c	5	Add : "or centre punched at the bottom of the groove."
66	40a	3	Add between paragraphs a and b : "First case : shaft without key."
	40c	1	Read : "shaft (228)" instead of : "front nut (279).
			Read : "spanner MR.3792, see Drawing 124A" instead of : "spanner 1731-T, see Drawing 127, fig. 2)."
			Read in margin : "Spanner MR.3792" instead of : "Spanner 1731-T."
		2	Add after paragraph 40c : "Second case : shaft with key. (d) Introduce shaft (228), fitted with key, through front face of gearbox into rear bearing. If necessary use a copper mallet.

Page	Paragraph	Line	Modification
			(e) Engage two pinions. Tighten up rear nut (226) and secure with split pin. Return two pinions to neutral position."
			Add in margin : "Box spanner 42."
66	41d	1,2,3	Read : "To bring the crown wheel into contact with the bevel pinion move the differential assembly in the manner necessary to give correct meshing clearance." instead of : "Unscrew nuts ..... bevel pinion face."
67	41e	2	Delete : "screw up second nut (300) and then." Add after : "unscrew" "nut D."
77	18b	1	Add after : "spring (125)" "adjusting washers (161)."
		2, 3	Read : "stop" instead of "adjusting bolt."
		5	Add : "Obtain correct adjustment by modifying thickness of adjusting washers (161). Choose washers of the necessary thickness from those in the range sold by our Spare Parts Department.
77	19d	4	Add: "To ensure locking of the brake drum on the hub during this operation, fit a washer 4 mm. thick on each stud and secure with wheel nuts tightened to a tension of 5 mkg. (36 foot pounds)."
86	1	2	Add in margin : "Box spanner 32."
91	15b	1	Add after : "movable bracket (2)" : "This bracket has a tapped hole which must face to the rear."
	15d	1, 2	Read : "To fit this stud it is necessary to compress the spring (35). To do this, fit the damper spring (29) in the retaining tube (15). Provisionally screw up this tube and fit the stud (18). Tighten up stud nut against a copper washer. Unscrew the retaining tube. Grease and fit ball pin (17)" instead of : "Tight stud nut ..... as far as : ball pin cup (28)."
	15e	1	Delete : "Fit retaining tube (15), damper spring (29) and"
100	17	2	Add after : "with a clock gauge." "To ensure locking of the brake drum on the hub during this operation fit a washer 4 mm. thick on each stud and secure with wheel nuts tightened to a tension of 5 mkg. (36 foot pounds)."
103	1d	2	Add : "NOTE - The right-hand torsion bar fouls the radiator drain cock at the end of its withdrawal. To completely disengage the bar it is necessary to remove the front silentbloc. Completely disengage the b by hand by taking it downwards and towards the right of the vehicle."

Page	Paragraph	Line	Modification
	2e	2	Add : "NOTE - See note under paragraph 1d."
123	14e	2	Add : "NOTE" Transpose the three lines constituting this NOTE under the title "Para. 15, Prepare end plate carrying brush gear."
125	4	2	Add after : "secure with nuts" : "tightened to a tension of 4.5 mkg. (32½ foot pounds)."
134	2	2	Add : Engine speed must be in the region of 500 R.P.M.
140	1	6, 7	Read : "Front height is measured from centre of the front torsion bar silentbloc to the ground. Rear height is measured from the underside of the rear floor, between the tubular crossmember and the axle beam, to the ground." instead of : "Front height is measured ..... rear hull floor to the ground."
	2	1, 2	Read : "at the rear under the body side seams and at the front under the axle cradle (use special jack head MR.3300-90, see Drawing 67)." instead of : "(using special jack ..... see Drawing 67)."
		2	Delete in margin : "MR.3300-110 and."
		4	Add : "(Use spanner 2304-T)."
		4	Add in margin : "Spanner 2304-T."

ADDENDUM TO SIX CYLINDER REPAIR MANUAL - EDITION DECEMBER 1950.

ADJUSTMENT OF SINGLE-DISC CLUTCH

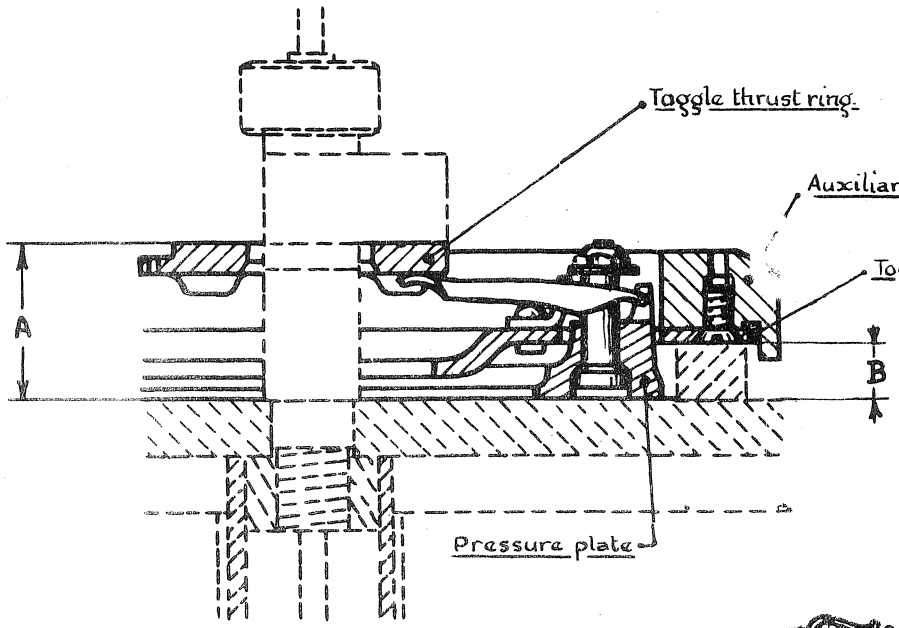
I) Adjustment of the mechanism (Fig.I)

When the assembly is in the "clutch engaged" position, the measurements to be obtained are:

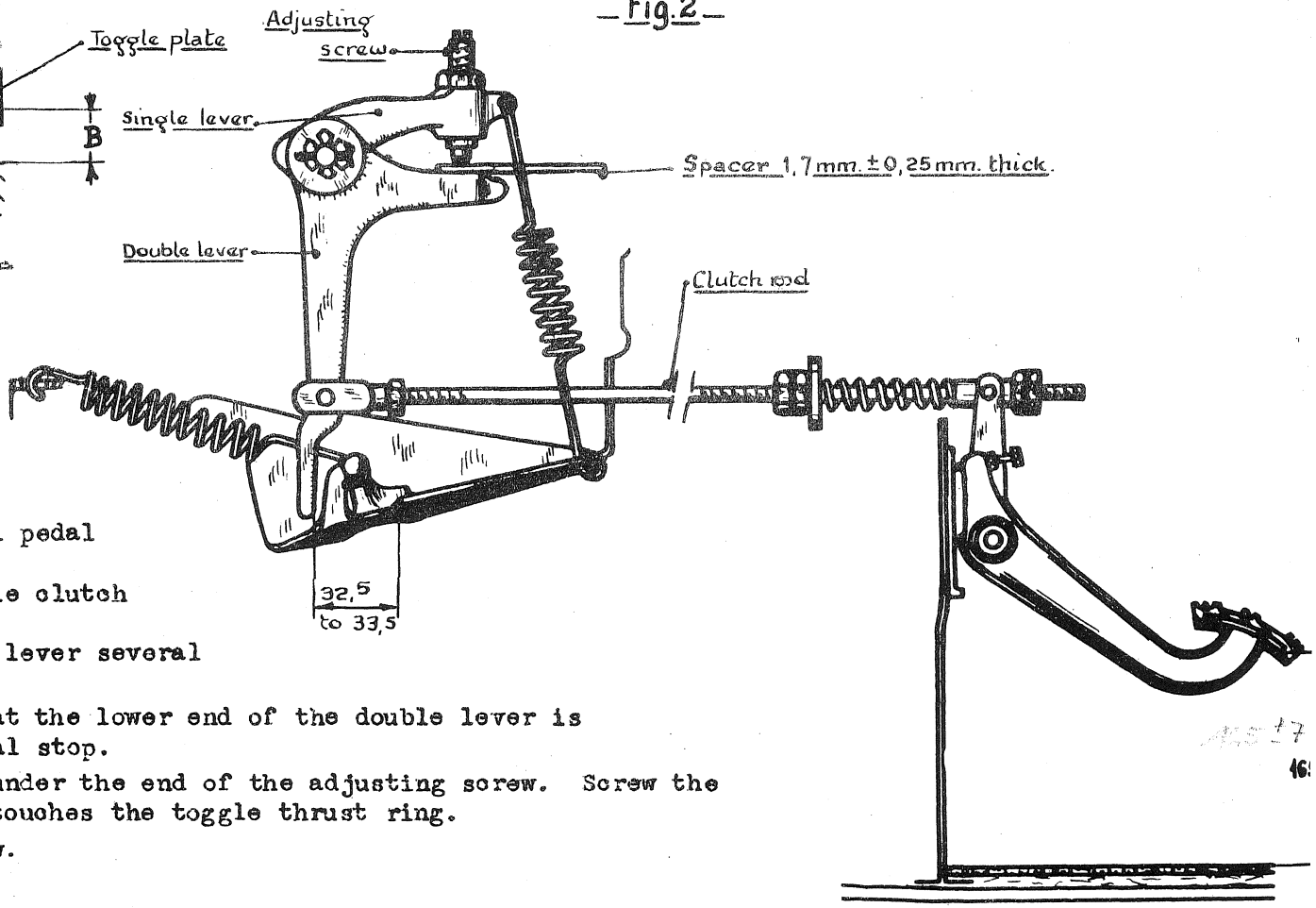
A : 44.5 mm. $^{+1.5}_{-0}$: measured from the upper face of the toggle thrust ring to the lower face of the pressure plate.

B:: 17.8 mm. measured from the bearing face of the toggle plate to the lower face of the pressure-plate

— Fig.1 —



— Fig.2 —



Adjustment on the car : (Fig.2)
(Left Hand Drive Models Only).

(a) Set the clutch pedal height to 165 ± 7 mm. (measured from the lowest point of the metal pedal pad to the carpet);

(b) Adjust the positions of the single and double clutch levers :

- Unscrew the adjusting screw of the single lever several turns.
- Adjust the length of the Clutch Rod so that the lower end of the double lever is 32.5 to 33.5 mm. from the edge of the metal stop.
- Put a spacer, 1.75 mm. ± 0.25 mm. thick, under the end of the adjusting screw. Screw the latter in until the graphite thrust ring touches the toggle thrust ring.
- Tighten the locknut of the adjusting screw.

REPAIR MANUAL

CITROEN

FRONT WHEEL DRIVE
SIX CYLINDER MODEL

FRENCH DESIGNATION ..... 15-SIX (15 CV)
BRITISH DESIGNATION ..... "SIX" (22.6 H.P.)

CITROEN CARS LIMITED,
TRADING ESTATE,
SLOUGH,
ENG.

SEPTEMBER 1957

TEXT

FOREWORD

The contents of this Repair Manual refer to the Six Cylinder Citroen car, left hand drive, manufactured in France. British made Citroen Six Cylinders, right hand drive, 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 models.

MODELS

This manual contains information relevant to Model DV manufactured after March 1948. Although much of the information is also applicable to the previous models (Model G, manufactured between 1938 and October 1947, and Model DB, manufactured between October 1947 and March 1948), the French edition of the Manual should be consulted when undertaking repairs to the earlier types.

USE OF REPAIR MANUAL

ORDER OF OPERATIONS

The sequence of operations for removing, fitting, and re-assembling has been carefully outlined in order that best results may be achieved 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 separate 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 included in the Manual.

OBSERVATIONS

Generally the most suitable 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.

rg.No.	Description	Fixture or Tool No.		Remarks
	ENGINE			
1	Extractor for battery cable terminal.		2200-T	See Electrical
67	Special jack head for lifting front axle.	MR.3300-90		See Front Axle
-	Spanner for front axle mounting stud nuts.		1880-T	
1	Spanner for nuts fixing exhaust pipes to manifold.		1626-T	
2	Chain sling for lifting engine.	MR.3320-30		
5	Height gauge for adjusting rear flexible mountings.	MR.3450		
18	Torsion wrench.		2470-T	
1	Spanner for carburettor fixing nuts.		1621-T	
-	Spark plug spanner.		1601-T	
-	Stud extractor.		2410-T	
6	Spanner for crankshaft nut.		1669-T	Use with 1810-T
6	Extractor for damper hub.		1668-T	
-	Valve spring compressor.		1611-T	
8	Mandrel for valve guides.	MR.1620		
8	Mandrel for fitting valve seat.	MR.3098-B		
11	Spring testing apparatus.		2420-T	
-	Valve guide reamer.		1615-T	
12	Tool for fitting spark plug housings.		1604-T	
13	Test rig for oil pump.	MR.1811		
-	Clock gauge.		2440-T	
15	Tool for boring oil baffles.		1665-T	
16	Spanner for fitting gudgeon pin circlips.	MR.1610		
-	Surface plate for straightening connecting rods.		2480-T	
17	Apparatus for measuring height of cylinder barrels.	MR.3377		
4	Engine stand (engine inverted).	MR.3300-20		
19	Guide bush for piston rings.		1656-T	
21	Centralizing bush for oil sealing cap.	MR.3421		
117	Bush for centralizing timing cover on crankshaft.		1664-T	
119	Engine stand.	MR.3300-50		
	CLUTCH			
26	Clutch toggle clamp.	MR.3451		
11	Spring testing apparatus.		2420-T	See Engine

LIST OF SPECIAL TOOLS SHOWN IN MANUAL

Drg.No.	Description	Fixture or Tool No.		Remarks
28	Clutch toggle adjusting fixture.		1701-T	
120-B	Simplified fixture for clutch toggle adjustment.	MR.3457		
	GEARBOX			
37	Extractor.		1750-T	
37	Collets and block for differential extractor.		1753-T	Use with 1750-T
121	Stand for gearbox.	MR.3053-10		
127	Spanner for intermediate shaft front nut.		1731-T	
127	Spanner for mainshaft front and rear nuts.		1732-T	
127	Spanner for holding bevel pinion by flats at end.		1733-T	
127	Spanner for bevel pinion front bearing nut.		1734-T	
127	Mandrel for inserting intermediate shaft plug.	MR.3428		
128	Screwdriver for reverse gear shaft plug.	MR.3458		
128	Spanner for nut for intermediate reverse gear train.	MR.3461		
128	Spanner for selector fork distance piece nuts.		1780-T	Set of two
128	Spanner for selector fork distance piece.		1781-T	
128	Spanner for bevel pinion bearing nut.		1757-T	
129	Extractor for mainshaft.	MR.3404		
129	Extractor for reverse gear shaft.	MR.3459		
130	Clamp for bevel pinion.	MR.3407		
131	Socket for removing bevel pinion rear bearing.	MR.3460		
133	Mandrel for differential Timken bearing.	MR.3463		
135	Tool for assembling synchromesh gear.	MR.3464		
	FRONT AXLE - TRANSMISSION			
67	Special jack head for lifting front axle.	MR.3300-90		
-	Spanner for adjusting heights.		2302-T	
50	Spanner for upper link spindle slotted ring nut.		1861-T	
46	Spanner for stub axle nut.		1810-T	Use with 2472-T
48	Mandrel for removing lower link splined shaft.	MR.3432		
54	Extractor.		1750-T	
54	Collets, ring and block for front hub bearing extraction.		1827-T	
60-A	Spanner for drive shaft couplings.		1832-T	
55	Spanner for upper link ball pin cap.		1853-T	

rg. No.	Description	Fixture or Tool No.		Remarks
48	Mandrel for removing ball pin lower bearing.	MR.3431		
56	Sleeve and ram for upper link silentbloc.	MR.3440		
55	Spanner for lower link ball pin nut.		1855-T	
55	Spanner for pivot lever nut.		1863-T	
57	Fixture for replacement of wheel studs.	MR.3445		
58	Mandrel for rectification of front brake drums	MR.3441		
59	Fixture for peening over brake shoe cam pins.	MR.3444		
60	Spanner for adjusting brake cams.		2120-T	
-	Apparatus for checking centering of brake linings		2105-T	
-	Spanner for eccentric pin nut.		2121-T	
55	Spanner for caster angle adjustment.		1854-T	
46	Gauge for mounting lower link arm.	MR.3447		
-	Torsion gauge.		2472-T	
64	Ball spindle extractor.		1900-T	
64	Collet for spigot ball (stem 16).		1913-T	
65	Three-point gauge for inner ball position.		1908-T	
65	Bearing housing gauge.		1910-T	
66	Socket for fitting ball pin spindle.		1904-T	
66	Gauge for checking position of circlips.		1909-T	
	STEERING			
67	Special jack head for lifting front axle.	MR.3300-90		See front axle
68	Steering wheel extractor.		1950-T	
69	Ball-pin extractor.		1964-T	
68	Locating bush for steering column.	MR.3102		
72	Fixture for holding steering gear.	MR.1561		
-	Spanner for steering rack tube cap.		1975-T	
73	Spanner for adjusting tube retaining ring nut.		1976-T	
73	Spanner for adjusting ball pins.		1870-T	
74	Gauge for adjusting length of track rods.	MR.3446		
	REAR AXLE			
75	Special jack head for lifting rear axle.	MR.3300-110		
76	Gauge for positioning rear axle.	MR.3338		
1	Spanner for nuts fixing exhaust pipes to manifold		1626-T	See engine
79	Driving blocks for removing torsion bars.	MR.1578		See suspension

Drg. No.	Description	Fixture or Tool No.		Remarks
80	Gauge for checking lateral adjustment of axle.		2051-T	
82	Pliers for fitting or removing brake shoe return spring.		2110-T	
84	Apparatus for checking camber and toe-in of rear axle.		2052-T	
59	Fixture for peening over brake shoe cam pins.	MR.3354		
57	Fixture for replacement of wheel studs.	MR.3445		See front axle
85	Mandrel for rectification of brake drums.	MR.3381-2		
86	Socket and plunger for replacement of silentblocs.	MR.3335		
78	Fixture for holding link arms during mounting.	MR.3336		
87	Gauge for checking concentricity of brake linings.		2103-T	
87	Pointer for gauge 2103-T.		2104-T	
60	Spanner for adjusting brake cams.		2120-T	
	SUSPENSION			
-	Spanner for adjusting heights.		2302-T	See front axle
1	Spanner for nuts fixing exhaust pipes to manifold.		1626-T	See engine
79	Driving blocks for removing torsion bars.	MR.1578		
76	Gauge for positioning rear axle.	MR.3338		See rear axle
-	Weighing machine for checking weight distribution.		2310-T	
75	Special jack head for lifting rear axle.	MR.3300-110		
88A	Funnel for refilling SPICER shockabsorbers.	MR.3382		
88	Fixture for draining and refilling SPICER shockabsorbers.	MR.3552		
	CONTROLS			
1	Extractor for battery cable terminal.		2200-T	See electrical
91	Spanner for master cylinder inlet union.		2130-T	
91	Socket spanner for three-way union bolt on master cylinder.		2131-T	
68	Steering wheel extractor.		1950-T	See steering
-	Spanner for removing master cylinder.	-	Facom	Ideal type 240 :
	EXHAUST			
1	Spanner for nuts fixing exhaust pipes to manifold.		1626-T	See engine

Fig. No.	Description	Fixture or Tool No.		Remarks
	ELECTRICAL			
97	Screwdriver for removing pole piece screw.	MR.1601-4		
97	Mandrel for packing dynamo field coils.	MR.1601-2		
1	Extractor for battery cable terminal.		2200-T	
97	Mandrel for packing starter motor field coils.	MR.1601-1		
97	Socket dynamo and starter motor casings.	MR.1601-3		
106	Screen for headlamp adjustment.	MR.1572		
143	Compressor for starter motor bendix spring.		2202-T	
	ADJUSTMENTS			
100	Apparatus for checking caster angle.	MR.3449		
55	Spanner for caster angle adjustment.		1854-T	See front axle
101	Gauge for checking track rod length.	MR.1590		
-	Spanner for steering rack tube cap.		1975-T	See steering
102	Steering lock gauge.		1890-T	
103	Gauge for checking wheel camber.		2314-T	
67	Special jack head for lifting front axle.	MR.3300-90		See front axle
75	Special jack head for lifting rear axle.	MR.3300-110		See rear axle
-	Lockheed system drain pipe.		2140-T	
-	Spanner for adjusting heights.		2302-T	See front axle
-	Gauge for checking heights.		2300-T	
-	Weighing machine for checking weight distribution.		2310-T	
105	Fixture for checking wheel balance.	MR.3396		
	BODYWORK			
107	Jig for realignment of hull.		2600-T	

	REMOVING ENGINE AND GEARBOX ASSEMBLY	
1	Drain water from radiator, and meanwhile, take off the bonnet.	
2	Take out the battery. (Use extractor 2200-T, see Drawing 1, fig. 1 for removing cables from terminals.) Take out the battery tray.	Extractor 2200-T Box spanner 12 Flat spanner 10
3	Remove air intake silencer. (Disconnect the pipe from the carburettor and remove fixing screws on hull.)	Flat spanner 12
4	Jack up vehicle at the front. Block it up under lower link arms. (Use special jack head MR.3300-90, see Drawing 67.)	Special jack head MR.3300-90
5	Disconnect wiring to horns, lamps, dynamo, starter motor, and ignition coil.	Flat spanners 8-14
6	Remove the assembly of radiator shell and front wings.	Universal spanners 10-12-14 Brace spanner 10-12-14
7	Remove the assembly of bumper brackets and radiator without disconnecting radiator from the tie-bar between bumper brackets. Unscrew the nuts from the front axle lower mounting studs. (Use spanner 1880-T). Uncouple radiator hoses at engine end.	Spanner 1880-T Box spanner 14-17
8	Uncouple the two gear selector control rods from the relay levers (on timing case.) Disconnect clutch cable from lever at forward end.	Flat spanner 10
9	Uncouple the drive shaft inner flanges from the gearbox coupling flanges but do not disengage. (Use spanner 1832-T, see Drawing 60.A.)	Spanner 1832-T
10	Disconnect exhaust pipe from engine exhaust manifold. (Use spanner 1626-T, see Drawing 1, fig. 2)	Spanner 1626-T Universal spanner 17
11	Disconnect accelerator control from carburettor by sliding off the spring retaining clip to release ball pin. Disconnect starter carburettor control wire, starter motor switch control wire, variable ignition control, and speedometer drive cable at gearbox end. Disconnect feed pipe from petrol pump.	Box spanners 8-10 Small adjustable spanner Flat spanners 8-14
12	Uncouple engine from rear rubber mountings and the engine front support tube from the front axle cradle.	Universal spanner 24 Flat spanner 26

13	Remove the engine and gearbox assembly from car. (Use chain sling MR.3320-30, see Drawing 2.) To prevent fouling gear selector rods, place change speed lever in reverse position. (As the chains are not equal in length, the rear of the engine will disengage from the coque first.) Lift slowly and disengage rear suspension brackets from studs. Disengage drive shaft inner flanges from the gearbox coupling flanges one after the other. Pull the engine forward to disengage the front support tube from the studs on the front axle cradle. Take out the engine completely.	Chain sling MR.3320-30
14	Place the engine on a stand. (Use stand MR.3300-50, see Drawing 119). Remove the sling.	Stand MR.3300-50
	REFITTING ENGINE AND GEARBOX ASSEMBLY	
15	Adjust the heights of the rear rubber mountings. (Use gauge MR.3450, see Drawing 5, figs. 3 and 4).	Gauge MR.3450
16	Raise the vehicle at the front and block it up under the lower link arms. (Use special jack head MR.3300-90, see Drawing 67.)	Special jack head MR.3300-90
17	Sling the engine. (Use chain sling MR.3320-30, see Drawing 2.)	Chain sling MR.3320-30
18	Offer up engine to hull, lower slowly and engage drive shaft inner flanges with gearbox coupling flanges. Fit engine front support tube on studs on front axle cradle and screw on nuts, with spring washers under, provisionally. Allow the engine to rest on rear brackets. Remove the chain sling. Tighten nuts fixing engine front support tube. Tighten nuts of rear suspension brackets. Between nut and bracket fit a plain washer and a spring washer (see Drawing 5, fig.2).	Flat spanner 26 Universal spanner 23
19	TIGHTEN WELL THE NUTS OF THE DRIVE SHAFT COUPLINGS, fitting a 'Bloefort' type washer under each nut. (Use spanner 1832-T, see Drawing 60.A.)	Spanner 1832-T
20	Fit the exhaust pipe with a C and A gasket between flanges. TIGHTEN NUTS WELL. (Use spanner 1626-T, see Drawing 1, fig. 2.)	Spanner 1626-T
21	Offer up the clutch cable. Adjust its length to obtain an idle pedal movement of 15 mm. to 20 mm. before graphite bush (206) of clutch fork strikes toggle thrust plate (205) (see Drawing 126.)	Flat spanner 14
22	Connect two gear selector rods to relay levers. Set rods to correct length so that there is no pull on the levers when fitting. Ensure that the change speed lever does not foul in the selector on lateral movement. Fit split pins to clevis pins.	Flat spanners 10-14
23	Fit speedometer drive cable, tightening fixing screw fitted with a spring washer under head. Fit variable ignition control. Connect ignition coil leads. Fit flexible metal braided pipe to petrol pump. Fit starter carburettor control. Connect the accelerator control rod. Fit starter motor switch control.	Flat spanners 8-14

24	Fit the assembly of radiator block and bumper brackets. Tighten bolts fixing bumper brackets after fitting a plain and a spring washer under each nut. Tighten nuts, fitted with spring washers, on front axle lower mounting studs. (Use spanner 1880-T). Line up starting handle opening in radiator by adjusting its position on tie-rod between bumper brackets. Tighten 'U' bolts fixing radiator. Tighten radiator upper fixing plates. Connect hoses to radiator and fit and tighten hose clips. Make sure that the radiator drain cock is closed. Fill radiator with water.	Spanner 1880-T Universal spanner 17 Flat spanner 17 Box spanners 10-14-17
25	Place the group of headlamp and horn wires along the engine front support tube and fix by means of clips. Tighten the two earth wires under one of the bumper bracket fixing bolts.	Box and flat spanners 14
26	Fit the assembly of wings and radiator shell. With a flat washer and spring washer fitted under each screw, tighten by hand only. Offer up the bonnet and position wings and radiator shell assembly in correct relation. With wing piping correctly fitted tighten screws fixing wings and shell. Remove the bonnet.	Flat spanner 14 Box spanners 10-12-14
27	Connect wiring to headlamps, horns, dynamo, and starter motor (see Drawing 110). Fit battery and connect cables.	Box spanners 8-12 Flat spanner 14
28	Fit air intake silencer. Fit a Hugo-Reintz joint between manifold (4) and carburettor air intake flange. Tighten the screws. Tighten silencer fixing brackets between two rubber washers and fit split pins in fixing bolts.	
29	Fit car interior heating tube.	Flat and box spanners 12
30	SET IGNITION ADVANCE Remove air vent cover on clutch housing. Turn engine to bring it to the end of compression stroke. Rotate slowly in reverse direction. Introduce a 6 mm. diameter pin in the hole provided in the clutch housing. Slowly turn the engine in the direction of its normal rotation sufficiently for the pin to drop into slot in engine flywheel marked 'ALLU'. NOTE. THERE ARE HOLES IN THE FLYWHEEL FOR BALANCING PURPOSES. TAKE CARE THAT THE PIN DOES NOT FALL INTO ONE OF THESE. At this point the engine is at 8 deg. advance. Connect a test lamp lead to the distributor condenser terminal and earth the lamp holder. Close the contacts. Turn the distributor body until the segment for No.1 plug lead corresponds with the rotor face. Next find the exact point of opening of contacts, at which moment the lamp will light. Set the slot in the bracket in the mid-way position and tighten the bracket. Remove the test lamp. IMPORTANT NOTE. REMOVE LOCATING PIN.	Flat spanner 12 Box and flat spanners 10

31	Lower vehicle to the ground. (Use special jack head MR.3300-90, see Drawing 67.)	Special jack head MR.3300-90
32	Fill the engine with oil (7 litres - 12¼ pints.)	
33	Fill the gearbox with oil (3½ litres - 6 pints.) USE ONLY SPECIAL OIL FOR HYPOID GEARS (similar to Mobiloil GX.)	Flat spanner 21
34	Start the engine and let it idle (500 R.P.M. approx.) for fifteen minutes.	
35	Remove the cylinder head cover. Retighten the cylinder head bolts in the order advised (see Drawing 18) to a tension of 5 mkg. (Use torsion wrench 2470-T, see Drawing 18, fig.2.)	Box spanner 12 Torsion wrench 2470-T Socket 17
36	Adjust valve tappet clearances to 0.15 mm. (0.006 ins.) for inlet and 0.20 mm. (0.008 ins.) for exhaust. Fit cylinder head cover.	Box spanner 12 Flat spanner 14 Set of feeler gauges.
37	Adjust carburettor for slow running (see Operation 747 - CARBURETTOR ADJUSTMENT.)	
38	Fit the bonnet.	

	REMOVING ENGINE ACCESSORIES (see Drawing 122)	
1	Suspend the engine and gearbox assembly (use chain sling MR.3320, see Drawing 2.)	Chain sling MR.3320-30
2	Drain oil from engine.	Adjustable spanner 50
3	Place engine on stand (use stand MR.3300-50, see Drawing 119.)	Engine stand MR.3300-50
4	Remove the two rods between gear levers, petrol pipe between pump and carburettor, petrol drain pipe, and petrol pump.	Flat spanners 12-14
5	Remove the carburettor (use spanner 1621-T, see Drawing 1, fig.3.) Remove carburettor shield.	Spanner 1621-T Flat spanner 8
6	Remove distributor by unscrewing bolt fixing bracket to socket. Remove spark plugs. (Use spanner 1601-T.)	Spanner 1601-T
7	Remove dynamo and starter motor.	Flat spanner 17 Universal spanner 21
8	Remove cap (201) forming support for starting handle. (NOTE: DO NOT DISPERSE ADJUSTING SHIMS (202)). Remove circlip (203), with the aid of round nose pliers, and disengage the mainshaft (204) towards the front.	Brace spanner and extension 12
9	Remove clutch housing cover. Unhook return spring from clutch withdrawal fork lever. Remove clutch withdrawal fork with thrust bush assembled.	Brace spanner and extension 17
10	Uncouple gearbox from cylinder block and from distance piece of sump.	Universal spanner 21 Flat spanner 17
11	Remove the clutch. Check, before removing, that the position of the clutch in relation to the flywheel is indicated by markings (letter or figure). If no indication of position is evident mark the position as the assembly is balanced during manufacture. Remove the clutch discs, intermediate pressure plate, and pressure plate springs.	Brace spanner 12
	REFITTING ENGINE ACCESSORIES	
12	FIT THE CLUTCH (see Drawings 27 and 122). (a) Ensure that the pressure faces on the flywheel, intermediate pressure plate, and clutch plate are in perfect condition. Ensure that the intermediate pressure plate slides freely between the flywheel driving pegs. Mark the position giving the best sliding, to be noted on	

	assembly. NOTE. For precautions when assembling see Operation 714, paragraph 6, Remark, and paragraph 8. (b) Fit spring (1), locating intermediate pressure plate, between two flywheel driving pegs (see fig.6). Fit the first clutch disc (2) with offset plate, and position as indicated in fig.1. Fit the intermediate pressure plate, previously marked (see paragraph 12a), offer up the second clutch disc (3), with flat plate, and position as indicated in fig.1. Engage a mandrel or gearbox mainshaft in the clutch discs for centering in relation with the flywheel bearing. Fit the clutch in the position previously determined and marked. Tighten holding bolts (4), fitted with spring washers, to a tension of 2 mkg., plus 0.250 mkg., minus 0 mkg. (14½ foot-pounds, plus 2 foot-pounds, minus 0). During tightening, ensure that the mandrel (or shaft) slides freely, thereby indicating correct centering of discs. Remove mandrel.	Shouldered mandrel, small dia. 17, length 25, large dia. 21, length 300 Brace spanner 12
13	FIT THE GEARBOX. If the box or distance piece has been replaced, unscrew the bolts from the sump. (a) Fit the locating dowels in the cylinder block. Offer up the gearbox to cylinder block, engage on dowels, fit two fixing bolts but do not tighten. Fit distance piece and all fixing bolts. Fit spring washers and nuts to bolts and tighten. If necessary tighten sump bolts. (b) Fit the clutch withdrawal fork with thrust piece assembled, SO THAT GRAPHITE THRUST BUSH FACES TOGGLE THRUST RING, and the lower end of double lever (208) is to the front of outer gear lock control lever (see Drawing 27, fig.1 and Drawing 126). (c) Fit gearbox mainshaft (204) turning by hand to engage with splines in clutch disc hubs. Fit mainshaft retaining spring and circlip (203) with the aid of round nose pliers. (d) Position the engine front support tube. Turn the tube so that threaded holes 'a' for radiator block upper fixing plates are towards the front. Check that the dimension from the centre of the rubber bush (62) to the centre line of the left hand fixing eye on the tube is 363 mm., plus or minus 0.25 mm. Obtain this dimension by using packing washers (63) (sold by our Spare Parts Department) between thrust washer (64) and welded collar (see Drawing 5, fig.1). (e) Fit clutch housing cover. Coat with 'Hermetical', the three forward fixing screws and the box flange in the screw zone. Fit bolts with spring washers under heads and tighten. AFTER TIGHTENING SCREWS ENSURE THAT THE WITHDRAWAL FORK SHAFT TURNS FREELY.	Universal spanner 21 Flat spanners 17-21 Universal spanner 17
14	Fit mainshaft front bearing cap (201) AND, IF NECESSARY, FIT SHIMS (202) REMOVED WITH CAP. Coat paper gaskets with 'Hermetical'. Tighten screws.	Brace spanner with extension 12
15	Fit the starter motor, tighten nuts, turn back tabs of lockwashers. Fit the dynamo, tighten nuts with a plain and spring washer fitted under each. Adjust the fan belt without excessive tension. Fit the petrol pump with a paper gasket. Tighten nuts with spring washers under. Fit hose between water pump and water inlet pipe.	Flat spanners 12-17 Box spanner 21

16	(a) Fit carburettor shield and tighten two fixing nuts on inlet manifold studs. (b) Position the lower fixing strap and tighten the nuts fitted with shakeproof washers. (c) Fit and tighten bolts assembling shield and fixing strap. (d) Place on the inlet manifold flange in the following order:- 1 Hugo-Reintz gasket (centres of inlet holes 38 mm.) 1 thick distance piece (on this part the inlet holes are cut obliquely. Fit the face with the inlet hole centres at 38 mm. against the preceding gasket.) 1 Hugo-Reintz gasket (centres of inlet holes 35 mm.) (e) Offer up the carburettor and tighten fixing nuts with shakeproof washers under. (Use spanner 1621-T, see Drawing 1, fig.3). (f) Fit petrol pipe, with a fibre washer either side of banjo union, and tighten unions.	Flat spanners 14-18 Spanner 1621-T Flat spanner 8
17	FIT THE DISTRIBUTOR Remove the distributor head. Fit the distributor in socket and turn the rotor to ensure that the driving dog is correctly seated in slot on drive shaft. Tighten fixing screw. (If the distributor has been dismantled or changed, it will be necessary to set the ignition timing after refitting (see Operation 701, paragraph 30.)	
18	Fit spark plugs. (Use spanner 1601-T.) THE FIRING ORDER IS 1-4-2-6-3-5.	Spanner 1601-T
19	ADJUST THE CLUTCH (see Drawing 126) (a) Bring the graphite bush (206) into contact with the toggle thrust plate (205) and keep in this position with the clutch fork. (b) Screw the adjusting stud (207) to obtain a clearance 'a' of 27 mm., plus or minus 1 mm., between the face of the lower end of the double lever (208) and the notch on bracket (209). Tighten lock nut of adjusting stud (207), and hook on return spring (210).	Flat spanner 17
20	Fit the two gear lever rods to the relay levers at the rear only. Fit split pins to clevis pins.	

	DISMANTLING ENGINE (see Drawings 116 and 117.)	
1	Place the engine, with accessories removed (see Operation 702), on a stand. (Use stand MR.3300-50 see Drawing 119.)	Stand MR.3300-50
2	Remove exhaust and inlet manifolds.	Brace spanner 12
3	Remove the water pump with hoses assembled. Take off drive belt.	Flat spanner 17 Brace spanners 12-17
4	Remove cylinder head cover, lubrication pipe, cylinder head nuts and washers, cylinder head, push rods, and tappet cups.	Brace spanners 12-17
5	Unscrew cylinder head studs. (Use extractor 2410-T.)	Stud extractor 2410-T
6	Invert the engine and rest it on top flange. Remove the sump.	Brace spanner with extension 12
7	Remove the oil pump with pipes, disengage conical unions from cylinder block.	Flat spanners 14-16-17-26
8	Place a wood block between cylinder block and a crankshaft web to prevent the latter from turning.	
9	Remove the spider (201), carrying the starter gear ring, but unscrewing nut (202. (Use spanner 1669-T, see Drawing 6, fig. 2). Remove the damper. (Use extractor 1668-T, see Drawing 6, fig. 1 if the part is difficult to remove.	Brace spanner 14 Extractor 1668-T Spanner 1669-T
10	Remove the timing cover, key for spider hub (203), and oil baffle (204).	Brace spanner 12
11	Unscrew nut (205) at rear end of camshaft also nut of double pulley at front end. Remove both timing wheels and chain as an assembly (with the aid of a screwdriver or small lever.) Remove the oil baffle (56), key, and oil baffle washer (57) (see Drawing 21, fig.2.) (TAKE CARE OF THE PACKING WASHERS WHICH POSITION THE DOUBLE PULLEY AS THEIR THICKNESS HAS BEEN CAREFULLY DETERMINED DURING MANUFACTURE) Remove the camshaft thrust flange and take out the camshaft.	Cranked spanners 26-38 Brace spanner 12
12	Remove the engine flywheel. Take out wood block.	Brace spanner 14
13	Remove the main bearing caps (mark caps and housings according to assembly.) Disengage the crankshaft, connecting rods, and pistons assembly. Lay the cylinder block on one side and remove cylinder barrels.	Universal spanner 23
14	Remove oil baffle halves from cylinder block and bearing cap. Unscrew front and rear oil	Universal spanner 19-21

	circulation plugs. Remove the timing chain lubricator, timing cover locating dowels, and side brackets.	Flat spanners 6-12
15	Dismantle connecting rods from crankshaft (MARK THE CONNECTING RODS AND CAPS SO THAT WHEN RE-ASSEMBLING, EACH ROD WILL RECEIVE ITS ORIGINAL CAP.)	Universal spanner 14
16	Remove pistons from connecting rods. If the pistons are to be used again, remove the gudgeon pins by heating assembly to a temperature of approximately 60°C. (140°F.) (either by plunging parts in an oil bath or by heating them in an oven.) DO NOT MIX THE GUDGEON PINS. THESE HAVE BEEN WEIGHED AND MATCHED WITH THE PISTONS.	
17	Remove the connecting rod small end bushes. (Use a shouldered mandrel.)	Mandrel:- small dia. 20, length 20, large dia. 23, length 130.
18	DISMANTLE THE CYLINDER HEAD (a) Remove the valves. (Use valve spring compressor 1611-T.) Use a block of wood about 15 mm. thick under heads of valves to prevent them depressing under the action of the compressor.	Valve spring compressor 1611-T
	(b) Remove the rocker shaft assembly.	Box spanner 14
	(c) Remove studs fixing rocker shaft and inlet and exhaust manifolds.	Stud extractor 2410-T
	(d) Remove the valve guides. (Use mandrel MR.1620, see Drawing 8, fig. 4.)	Mandrel MR.1620
	(e) Dismantle rocker arms and brackets from shaft. Extract expanding washers (206) from rocker shaft. For this operation. pierce the washers with an awl or similar tool and prise out. (New washers must be fitted after each dismantling.	
	(f) Remove the water outlet pipe.	Box spanner 14
19	DISMANTLE THE OIL PUMP (see Drawing 9) (a) Remove pump filter (6) and oil pipe.	Box spanner 12
	(b) Remove the pump base (7) and the idler pinion (8).	Box spanners 10-12
	(c) Drive out the two pins (9) fixing driving pinion (10). Remove shaft (11) from pump body. Slide fixed pinion (12) along shaft to release locking segments (13). Remove key and pinion (12).	
	(d) Remove shaft column (14), drive out idler pinion spindle (15). Remove release valve plug (16), spring (17), and ball (18) (fig. 2.)	Box spanner 14 Flat spanner 23

	(e) Remove bush (19) from shaft column with the aid of a mandrel and holding the column lightly clamped in a vice.	Mandrel 15 dia., 250 long
20	DISMANTLE THE WATER PUMP (see Drawing 118) (a) Remove the water inlet pipe by disconnecting the hose from the pump.	
	(b) Take off the pump cover (207). Unscrew nut (209). Remove pulley (210) (by hand), and take out key. Remove bearing cap (208).	Brace spanner 12 Box spanner 17
	(c) Drive shaft (211) for 5 mm. to 6 mm. towards the bearing and then return the shaft to its original position. (This operation allows the fitting of the extractor on the bearing.) Extract the bearing (212.) (Use battery cable terminal extractor 2200-T, see Drawing 1, fig. 1.) Remove locking ring retainer (213), locking ring halves (214), and take out the shaft.	Extractor 2200-T
	(d) Remove the sealing ring (215) from the shaft (by hand.)	
	(e) Knock out bush (216) from pump casting with the aid of a shouldered mandrel. Take out the greaser (217) and water circulation union (218.) Remove belt tension adjusting screw (219.)	Shouldered mandrel small dia. 14.75, large dia.1 Flat spanners 11-21 Brace spanner 17
21	Disconnect the damper from the hub of the starter gear ring carrier. Mark the position of the starter gear ring in relation to the carrier (or spider), so that the balance of the assembly, determined during manufacture, will be maintained when re-assembling. Remove the starter gear ring. Knock out silentblocs from gear ring.	Box spanner 17 Brace spanner 12
22	Remove the sump inspection plate. Remove drain plug.	Brace spanner 12 Adjustable spanner 50
23	Remove the oil level float.	Box spanner 12
24	Disconnect the inlet and exhaust manifolds.	Box spanner 12
25	Clean parts.	

ASSEMBLING ENGINE

26 ASSEMBLE ROCKER SHAFT (see Drawing 116)

(a) Carefully clean the bore of the shaft with the aid of a wire brush and ensure that oil holes and those of the rocker arms are clear. — Wire brush

(b) Coat the seatings of the expanding washers (206) with Hermetical. Fit the washers in the ends of the shaft and lock them in position by flattening with a hammer.

(c) Oil the shaft and then fit brackets, rocker arms, springs, and washers in the order indicated below. The end of the shaft with the keyway is fitted at the rear (this end also has the oil inlet hole.) THE HOLES IN THE SHAFT FOR LUBRICATING THE ROCKER ARMS FACE DOWNWARDS. THE BRACKETS ARE FITTED SO THAT THE SLOTS ARE TOWARDS THE SPARKING PLUG HOLES.

Commence building up at the rear end:-

1. One bracket
2. One washer 1 mm. thick
3. One rocker arm, R.H.
4. One washer 1 mm. thick
5. One spring
6. One washer 1 mm. thick
7. One rocker arm, L.H.
8. One distance piece 3.5 mm. thick
9. One bracket
10. One distance piece 3.5 mm. thick
11. One rocker arm, R.H.
12. One washer 1 mm. thick
13. One spring
14. One washer 1 mm. thick
15. One rocker arm, L.H.
16. One distance piece 18.5 mm. long
17. One bracket
18. One distance piece 18.5 mm. long
19. One rocker arm, R.H.
20. One washer 1 mm. thick
21. One spring
22. One washer 1 mm. thick
23. One rocker arm, L.H.
24. One distance piece 3.5 mm. thick
25. One bracket (centre)
26. One distance piece 3.5 mm. thick
27. One rocker arm, R.H.
28. One washer 1 mm. thick
29. One spring
30. One washer 1 mm. thick
31. One rocker arm, L.H.
32. One distance piece 18.5 mm. long
33. One bracket
34. One distance piece 18.5 mm. long
35. One rocker arm, R.H.
36. One washer 1 mm. thick
37. One spring
38. One washer 1 mm. thick
39. One rocker arm, L.H.
40. One distance piece 3.5 mm. thick
41. One bracket
42. One distance piece 3.5 mm. thick
43. One rocker arm, R.H.
44. One washer 1 mm. thick
45. One spring
46. One washer 1 mm. thick
47. One rocker arm, L.H.
48. One washer 1 mm. thick
49. One bracket

27 ASSEMBLE CYLINDER HEAD:

(a) Fit the valve guides. (Use mandrel MR.1620, see Drawing 8, fig. 5). This mandrel limits the projecting portion of the guides to 17 mm., plus or minus 0.25 mm., measured from the seating face of the valve spring. Turn the chamfered portion of the guide towards the combustion chamber (the conical portion of the guide then stands above the upper face of the cylinder head.)

Mandrel MR.1620-1
Ferrule MR.1620-4

(b) Ream the inlet and exhaust valve guides to 9 mm., plus 0.015 mm., minus 0.010 mm. (Use an expanding reamer.) If a 'GO' and 'NOT-GO' gauge is not available, check the reaming with a valve stem. (Excessive clearance in the guides is likely to increase the oil consumption.)

Expanding reamer 9 mm.

(c) Rectify the valve seats. The width of the seat face must be between 1.7 mm. and 2.1 mm. for inlet and between 2.2 mm. and 2.5 mm. for exhaust valves. If the seat face is too wide, cut down the upper portion with a 150° grinding wheel or milling cutter of the same angle, and reduce the lower portion with a 60° grinding wheel or cutter (see Drawing 8 fig. 3.)

Valve seat rectifying tool of the "Vibro-Centric" type
Grinding wheel 40 dia., 120° angle
Grinding wheel 40 dia., 150° angle
Grinding wheel 40 dia., 60° angle

(d) Reface the valves. (Use a valve rectifying tool similar to the Black and Decker type)

Valve rectifying tool

(e) Grind in the valves. (Use valve grinder 1615-T. This can be operated by hand or driven by a portable electric tool.)

Valve grinder and suction cup 1615-T

(f) CAREFULLY CLEAN THE CYLINDER HEAD, AND ENSURE THAT THERE ARE NO TRACES OF EMERY DUST IN THE COMBUSTION CHAMBERS AND PORTS Too much care cannot be taken over this operation, as the presence of emery dust in the engine will cause rapid wearing of parts.

(g) To extract a valve seat insert (only in the case of the part being broken or bent) see Drawing 8, fig. 1.
AT ONE POINT ONLY, heat the insert to be extracted with a blow-pipe fitted with a 350 jet. Stop heating when the insert begins to melt. Allow to cool for approximately three minutes then extract the insert by levering out with a screwdriver (bent if necessary.)

(h) To fit a new valve seat insert.

Mandrel MR.3098-B

Ensure that the recess and the insert are quite clean and remove all burrs. Dip the new insert for fifteen minutes in liquid nitrogen. Do not touch the liquid with the fingers. Fit the insert in place. (Use mandrel MR.3098-B, see Drawing 8, fig. 2).
WHENEVER A NEW INSERT IS FITTED ALWAYS RECTIFY THE SEATING FACE.

	(i) Fit the exhaust and inlet manifold studs and also those for the rocker shaft brackets.	Stud extractor 2410-T
	(j) Test the valve springs. (Use spring testing apparatus 2420-T, see Drawing 11.) The free length of the INNER SPRING should be 43 mm. Under a load of 16 kg., plus or minus 0.750 kg. (35¼ lbs., plus or minus 1½ lbs.), the length should be 37 mm. The free length of the OUTER SPRING should be 46.5 mm. Under a load of 29½ kg., plus or minus 2 kg. (65 lbs., plus or minus 4½ lbs.), the length should be 29 mm. and under a load of 14.6 kg., plus or minus 1 kg. (32 lbs., plus or minus 2¼ lbs.), the length should be 37 mm.	Spring testing apparatus 2420-T
	(k) Fit the rocker shaft assembly. Fit a paper gasket under each rocker shaft bracket and a spacing washer in the slots in the brackets. THE BRACKETS MUST BE FITTED SO THAT THE SLOTS FACE TOWARDS THE PUSH RODS. Tighten the nuts to a tension of 1.2 mkg. (8½ foot-pounds). Turn back lockwasher tabs against flat of nuts.	Box spanner 12
	(l) Fit the valves having first oiled the stems and valve seats. Fit the valve spring cups and valve springs. (Use spring compressor 1611-T). Ensure that the valve cotters are well positioned.	Valve spring compressor 1611-T
	(m) Fit the washer outlet pipe. Coat the joint with Hermetical. Tighten nuts. Turn back lock washer tabs against flat of each nut.	Box spanner 12
	(n) Reset the spark plug housings. (Use tool 1604-T, see Drawing 12). This operation need only be carried out in the case of oil leaking into the spark plug recess.	Tool 1604-T
28	ASSEMBLE OIL PUMP (see Drawing 9) (a) Fit bush (19) into shaft column (14). (Use a screw press).	
	(b) Use a mallet to drive the idler pinion spindle (15) into the pump body. Fit the idler pinion (8), ensuring that it turns freely. Offer up the fixed pinion (12). Place a straight edge across the lower flange face of the pump body. By means of feeler gauges measure the clearance between the lower faces of the pinions and the straight edge. The clearance should not exceed 0.05 mm. Remove the fixed pinion (12).	Straight edge Set of feeler gauges
	(c) Fit the key for the fixed pinion in the shaft (11). Slide the fixed pinion along the shaft sufficiently to allow the fitting of the locking segments (13). After fitting the segments return the pinion (12) to its normal position. Engage the shaft (11) into the pump body. Fit the shaft column (14), tighten the pump body clamp bolt nut to a tension of 2.5 mkg. (18 foot-pounds) and secure with a split pin.	Box spanner 14
	(d) Fit the driving pinion (10) on the shaft (11). If the shaft has been replaced it will be necessary to drill it for the fitting of the driving pinion fixing pins. Position the pinion so as to obtain a clearance of 0.2 mm. between the pinion and the bush (19). Drive in the pinion fixing pins. Ensure that shaft rotates normally and that the end play does not exceed 0.2 mm.	

	After checking rivet over the ends of the driving pinion fixing pins.	
	(e) Between the lower flange of the pump body (35) and the rectangular plate (36), fit a gasket (37) the same shape as the pump body flange. Between the rectangular plate (36) and the pump base (7), fit a gasket (38) the same shape as the pump base flange. Fit screws with spring washers and tighten to a tension of 1.3 mkg. (9½ foot-pounds).	Box spanner 12
	(f) To the pump base intake orifice fit a cork gasket, filter upper cover (39), upper plate (40) for filter (with six 30 mm. diameter holes), upper filter (with 30 mm. diameter eyelet), filter spacer (41), lower filter (with 11 mm. diameter eyelet), and lower plate (42) for filter (with six triangular holes). Tighten the central bolt to a tension of 1.3 mkg. (9½ foot-pounds) and secure with lock nut.	Box spanner 12
	(g) Fit ball (18), spring (17), and adjusting plug (16).	
	(h) Adjust the pump on a test bench. With oil at a temperature of 60°C., plus or minus 5°C., (140°F., plus or minus 16°F.), adjust the plug (16) to obtain an oil pressure of 2.500 kilograms per square centimeter (35.5 lbs. per square inch) at 1,000 R.P.M., with the pump discharging through a 2.8 mm. jet. Tighten the plug lock nut and turn back lock washer tab against flat of nut. (if a test bench is not available use the simplified rig MR.1811, see Drawing 13).	Test rig MR.1811
	(i) Connect oil pipes to pump fitting a 'Vellumoid' gasket between pipe and pump flanges. Tighten screws and turn back lockwasher tabs.	Box spanner 12
29	ASSEMBLE WATER PUMP (see Drawing 118) NOTE. The water pump bush is of porous bronze. Before fitting, soak the bush for about twenty four hours in a bath of engine oil, or similar oil, to thoroughly impregnate the bronze.	
	(a) Fit bush (216) in the pump body using a shouldered mandrel. The bush should extend 1.5 mm., plus or minus 0 5 mm. beyond the inner face of the pump body.	Shouldered mandrel small dia. 14.75 mm. large dia. 18 mm.
	NOTE. The bush (216) should not be reamed as this will destroy the qualities of permeability of the material. THE BUSH MUST NOT BE DRILLED	
	(b) To the water pump shaft, fit sealing ring (215) (see Drawing 118 for position). Oil the shaft and fit into pump body. Stick the locking ring halves (214) into the shaft groove with grease and fit retainer (213). Lubricate bearing (212), with grease similar to Mobilgrease 5, and fit by means of a press and tube. Knocking the bearing in position is liable to cause the locking ring halves to jump out	Tube inside dia. 16 mm., 100 mm. long

	(c) Fit the bearing cap (208), coat the gasket with Hermetical, tighten bolts, turn back lock washer tabs. Fit the pump cover (207), coat the gasket with Hermetical, tighten nuts.	Box spanner 12
	(d) Fit pulley key in keyway on shaft. Fit pulley (210) (see Drawing 118 for position), tighten nut (209), turn back lockwasher tab.	Box spanner 17
	(e) Fit greaser (217), water circulation union (218) with a C. and A. gasket, and belt tension adjusting screw (219).	Flat spanners 11-17-21
	(f) Fit water inlet pipe without tightening hose clips.	
30	Fit silentblocs (220) in the starter gear ring. The front face of the silentblocs must be on a level with the front face of the gear ring (that is the side of engagement of the teeth). Fit the gear ring according to the position marked when dismantling Fit the damper on the gear ring carrier spider, tighten bolts, turn back lockwasher tabs.	Box spanners 12-17
	PREPARATION OF PARTS FOR BUILDING UP CRANKSHAFT ASSEMBLY Any work on the connecting rods, bearings or crankshaft, MUST ONLY BE UNDERTAKEN WHEN PROPER EQUIPMENT FOR THIS CLASS OF WORK IS AVAILABLE to give precision finish of parts ('GO' and NOT-GO' gauges for connecting rods and bearings, boring bar for bearings, and aligning rod). Failing this, it is preferable to replace the parts by a new assembly, obtainable from our Spare Parts Department and ready to be fitted. It is better still to exchange the entire engine for another overhauled by us. If the bearing caps have been carelessly filed it is not possible to fit a standard assembly. In this case the cylinder block should be replaced or the bearings rebored in line. For this, proceed as follows:-	
31	On a surface table check the bearing cap joint faces to see if they are both in the same plane. If necessary file or better still, mill the faces to give the necessary condition. Fit the bearing caps (without bearings) to the cylinder block and tighten nuts to a tension of 12 mkg. (87 foot-pounds). Measure the diameter "a" (see Drawing 15, fig. 2). (Use clock gauge 2440-T). The dimension "a" measured at one end of the bearing should be the same as dimension "b" measured at the opposite end. If this is not so the bearing cap joint faces are not parellel to the crankshaft centre-line. If necessary correct the bearing cap by filing or, better still, milling. The difference between the two dimensions "a" and "b" must not exceed 0.01 mm. After rectification take a new measurement at "a". The difference between this last reading "a" and the original dimension of 65.014 mm., plus 0.025 mm., minus 0.mm. gives the thickness of shims "e" to be fitted between the bearing cap and cylinder block. $e = 65.014 \begin{smallmatrix} + 0.025 \\ - 0 \end{smallmatrix} - a$	Torsion wrench 2470-T socket 23. Clock gauge 2440-T

The shims must be very carefully machined. Their faces must be parallel within 0.01 mm. Fit the bearing caps again (without bearings) but with shims in position. Tighten the cap nuts to a tension of 12 mkg. (87 foot-pounds) and take a new measurement "a". This should be 65.014 mm., plus 0.025 mm., minus 0 mm. If otherwise touch up the shims the necessary amount to give the correct figure.
We strongly advise this method, while though appearing lengthy, will enable the fitting of the standard crankshaft assembly available from our Spare Parts Department. We strongly advise against any alteration of the standard tolerances, which have been established during manufacture, as there will be a risk of breakdown.

(a) Rebore the oil baffles (see Drawing 15, fig. 1).
IMPORTANT NOTE - The leak of oil from the engine, flywheel end, can only be ensured against if the oil baffle bores are concentric with the crankshaft, and if the clearance between the crankshaft and baffle is within the tolerance allowed during manufacture.
Never must the portion of the crankshaft that corresponds to the oil baffle be reduced in diameter. The original dimension of this portion holds during the life of the crankshaft.
Because of this, and the oil baffle having a constant bore, it has been possible to provide a milling cutter corresponding to the diameter of the baffle bore of 55.1 mm., plus 0.1 mm.
IT IS NECESSARY TO REPLACE THE OIL BAFFLE HALVES AT EACH RECTIFICATION OR REPLACEMENT OF THE CRANKSHAFT. OIL BAFFLE HALVES SUPPLIED BY OUR SPARE PARTS DEPARTMENT MUST BE BORED AFTER FITTING.
The boring of the baffles must only be undertaken after the crankshaft main bearings have been fitted.

(b) Fit the oil baffle halves (221 and 222) (see Drawing 116) with cork gasket, tighten the screws at opposite points to a tension of 1.3 mkg. (9½ foot pounds), and turn back lock washer tabs against flats of nuts. — Box spanner 12

(c) Fit bushes "c" of tool 1665-T in main bearings, fit a paper gasket between two halves of oil baffles, tighten bearing caps, ream oil baffles. Remove bearing caps, bushes and bearings (see Drawing 15, fig. 1). — Tool 1665-T; Universal joint spanner 23

32 FIT CONNECTING ROD SMALL END BUSHES
Fit bushes by press and ream. (Use a 20 mm. diameter expanding reamer). If a "GO" and "NOT-GO" gauge is not available check the reaming with a new gudgeon pin. The bore of the bushes must be 20 mm., plus 0.015 mm., plus 0.020 mm., and this can only be guaranteed by the use of precision tools.

33 FIT PISTONS TO CONNECTING RODS
As the gudgeon pin is a slight taper fit in the piston, care must be taken to fit the pin the correct way. The piston boss with the large bore bears a mark in greasy crayon, and the larger end of — Spanner MR.1610; Surface plate 2480-T

gudgeon pin is marked likewise at the end. When assembling make sure that the markings coincide. Warm the pistons to about 60°C. (140°F.) by dipping in an oil bath or placing in an oven. This will allow the gudgeon pin, previously oiled, to be fitted by hand. (DO NOT MIX THE GUDGEON PINS AS THEY HAVE BEEN WEIGHED AND PAIRED WITH THE PISTONS.) Fit the gudgeon pin circlips. (Use spanner MR.1610, see Drawing 16, figs. 1 and 3.) Ensure that the circlips are right home in the piston recesses.
Check the alignment of connecting rods and pistons. (Use surface plate 2480-T).

34 FIT AND ADJUST HEIGHT OF CYLINDER BARRELS. FIT CYLINDER HEAD.
(a) Ensure the seatings in the cylinder block and also on the barrels are smooth and perfectly clean.
The cylinder barrel height is of very great importance. If the barrels are too high above the cylinder block top flange they will be distorted when the cylinder head is tightened down. On the contrary, if they are too low, there will be a leak of water or gas.

(b) Offer up the barrels without seating joints and check to ensure that they do not bind in the top flange and that they have a slight clearance in the lower bores of the cylinder block.

(c) Check that the top faces of the barrels are from 0.41 mm. to 0.43 mm. below the upper surface of the cylinder block flange and that the faces of both block and barrels are parallel within a tolerance of 0.05 mm. For this, a good straight edge and feeler gauges should be used. Check successively with the straight edge placed on the longitudinal and transverse centre lines of the cylinder block. It is much better to use a rig fitted with a clock gauge. (Use apparatus MR.3377, see Drawing 17, figs. 1 and 3.)

Straight edge
Set of feeler gauges
Apparatus MR.3377

(d) USE ONLY HUGO-REINTZ JOINTS sold by our Spare Parts Department. Choose joints of a necessary thickness TO ALLOW THE BARRELS TO STAND FROM 0.08 MM. TO 0.12 MM. ABOVE THE FACE OF THE CYLINDER BLOCK UPPER FLANGE. Carefully measure the amount the barrels stand proud. (Use apparatus MR.3377, see Drawing 17, fig. 2.)
Pair up the barrels and fit the Hugo-Reintz joints lightly coated with linseed oil. Engage the barrels in the cylinder block in pairs. The barrels must fall into position under their own weight and without restriction from the joints.

Apparatus MR.3377

(e) Fit the cylinder head studs and tighten to a tension of 2 mkg. (14½ foot pounds.) (Use stud extractor 2410-T.) The shorter length of stud thread is screwed into the cylinder block.

Stud extractor 2410-T

(f) After oiling the bearing surfaces, fit the camshaft. Fit the thrust plate (223), tighten screws (224) to a tension of 2.5 mkg. (18 foot pounds.) Turn back lockwasher tabs against flats of screw heads.
Oil the tappets and fit into cylinder block.

Box spanner 12

	(g) Fit the cylinder head locating dowel. Coat the cylinder head gasket with engine oil and fit with the smooth side on the cylinder barrels. Fit the cylinder head, which must fall into position under its own weight, and then spring washers on the studs. Tighten cylinder head nuts according to the order shown on Drawing 18. (First tightening to 2 mkg. (14½ foot pounds) tension, second tightening to 5 mkg. (36 foot pounds) tension.) The correct tightening is of great importance and for this reason it is most necessary to use a torsion wrench. (Use torsion wrench 2470-T, see Drawing 18, fig. 2.) THE SEQUENCE OF TIGHTENING MUST BE STRICTLY OBSERVED.	Torsion wrench 2470-T socket 17
	(h) Fit the push rods, after oiling the balls and cups, by depressing the valves. (Use valve spring compressor 1611-T.)	Valve spring compressor 1611-T
	(i) Invert the engine and place it on a stand. (Use stand MR.3300-20, see Drawing 4 figs. 1 and 2.)	Stand MR.3300-20
	(j) Check the cylinder barrels for distortion. (Use clock gauge 2440-T). Any distortion of the bores of the barrels must not exceed 0.03 mm. except in the bottom 20 mm. where 0.05 mm. distortion is permitted. If distortion is in excess of these tolerances, remove the cylinder head and fit thinner cylinder barrel joints. Refit the cylinder head and again check for distortion. When correct fitting of the barrels has been achieved DO NOT REMOVE THE CYLINDER HEAD AGAIN. The clearance between the piston and barrel must be between 0.05 mm. and 0.07 mm. The measurement of this clearance entails the use of a high precision instrument (such as a fluidometer) as used during manufacture. UNDER NO CIRCUMSTANCES MUST A PISTON AND BARREL ASSEMBLY, sold by our Spare Parts Department, BE DISMANTLED AND PAIRED UP WITH OTHER PISTONS OR BARRELS.	Clock gauge 2440-T
35	FIT CONNECTING RODS TO CRANKSHAFT. Oil the journals WITH A CAN (Using oil similar to Mobiloil BB) Never apply oil with a brush as it may carry impurities and have loose bristles. Fit the connecting rods so that the slot in the pistons is on the camshaft side. FIT LOCKWASHERS ON BOLTS OF CONNECTING ROD CAPS SO THAT THEY WILL PREVENT THE NUTS TURNING IN THE DIRECTION OF UNSCREWING (see Drawing 16, fig. 2.) Tighten nuts to a tension of 3 mkg. to 4 mkg. (21½ foot pounds to 29 foot pounds.) Turn back rounded tab of lockwashers against flat of nuts.	Torsion wrench 2470-T socket 14
36	FIT CRANKSHAFT AND PISTONS ASSEMBLY IN CYLINDER BLOCK (a) Fit the main bearing upper halves after ensuring that the housings are smooth and clean. Oil the bearings WITH A CAN (using oil similar to Mobiloil BB.)	
	(b) Oil the pistons (WITH A CAN.) Turn the second and fourth piston rings so that the gaps are at 150° to those of the first and third rings. Fit piston ring guide bushes. (Use bushes 1656-T, see Drawing 19, fig. 2.)	Piston ring guide bush 1656-T

(c) Fit the crankshaft, fitted with the flywheel fixing screws, carefully guiding the pistons into barrels to prevent breaking of rings. Remove guide bushes.

(d) Fit the lower main bearing halves in bearing caps. Coat cork strips (48) with Hermetical and fit into slots of front bearing cap. Fit paper gaskets (49), coated with Hermetical, between oil baffle halves (see Drawing 19, fig. 1), ENSURING THAT NEITHER THE GASKETS NOR HERMETICAL OBSTRUCT THE OIL RETURN GROOVES. Oil the lower bearing halves (BY CAN.) Fit the main bearing caps tightening nuts to a tension of 12 mkg. (87 foot pounds.) (Use spanner 2470-T.) Turn back tabs of lockwashers.

Torsion wrench 2470-T
socket 23

37 ADJUST LATERAL PLAY OF CRANKSHAFT (see Drawing 116)

Fit a washer (225) thickness 0.05 mm., crankshaft thrust washer (226), crankshaft timing wheel (227) (without key), and starter gear ring carrier. Prevent the crankshaft from turning by placing a block of wood between a crankshaft web and cylinder block. Tighten nut (202) to a tension of 20 mkg. (145 foot pounds.) (Use spanner 1669-T, see Drawing 6, fig. 2.) Remove the block of wood. Push the crankshaft to the rear (towards timing gear end), with the aid of a lever or wedge applied between a web of the crankshaft and cylinder block. Measure at "a" (between thrust washer and bearing) the clearance. This clearance must be from 0.15 mm. to 0.20 mm. Add adjusting washers (sold by our Spare Parts Department) to give this condition. Remove parts and the wedge. (an easy method of determing the adjustment is to use a sleeve equivalent in length (and replacing) to the thrust washer, timing wheel, and starter gear ring carrier.)

Spanner 1669-T
Sleeve with bore 40, length 80

38 ASSEMBLE TIMING GEAR (see Drawing 20)

(a) Fit the timing chain lubricator (53) with the discharge hole facing towards the part of the chain travelling upwards. Tighten lubricator to a tension of 1 mkg. ($7\frac{1}{4}$ foot pounds) and lubricator lock nut to a tension of 1.4 mkg. (10 foot pounds.) Fit oil duct plugs with copper washers and tighten.

Flat spanners 6-12
Box spanners 21-26

(b) Place timing wheels (crankshaft and camshaft) on a bench. Position both according to timing markings (either centre punch or machined line.) For this, place a straight edge across the centres of both wheels and turn the camshaft timing wheel so its timing mark also coincides with the line of the straight edge. The crankshaft wheel is marked either; 1, on a tooth, or 2, between teeth. In the first case, the wheel must be turned so that the mark is half a tooth to the right of the straight edge running across the wheel centres. In the second case the mark must coincide with the straight edge. Next fit the timing chain to the wheels without disturbing their setting. Rotate the crankshaft so that cylinders Nos. 1 and 6 are at top dead centre. Without removing the chain, fit the timing chain and wheels assembly, taking care that the keys on both crankshaft and camshaft are correctly fitted. Tighten the camshaft nut to a tension of 13 mkg. (94 foot pounds.) Turn back tab of lockwasher.
To check the timing, bring the piston of the first cylinder to top dead centre at the end of the

Box spanner 38

compression stroke. Timing marks should now line up according to Drawing 20.

IMPORTANT NOTES (see Drawings 116 and 21)
The oil tightness of the engine at the point where the crankshaft passes through the timing cover can only be ensured if the hole in the cover is concentric with the oil return grooves (machined in the starter gear ring carrier (201.) It is therefore essential to ensure concentricity when fitting the timing cover.
It is equally essential that the sealing cap (56) is concentric with the oil thrower of the camshaft pulley (58) in order to prevent leakage.

(c) FIT TIMING COVER
To the crankshaft fit oil return washer (204) see Drawing 116.) Fit locating dowels for the timing cover into the cylinder block. Coat the cylinder block timing cover flange and also the flange of the actual timing cover with Hermetical. Fit the paper gasket. Offer up the timing cover and screw in fixing bolts BUT DO NOT TIGHTEN. Fit the locating bush. (Use bush 1664-T, see Drawing 117.) **Tighten screws and remove the bush.**

Bush 1664-T
Brace spanner 12

(d) To the front of the camshaft (double pulley end) fit oil thrower (55) (see Drawing 21) and the key. Fit the sealing cap (56) with a paper gasket coated with Hermetical, and centralize. (Use centralizing bush MR.3421, see Drawing 21, fig. 1.) Tighten screws and turn back tabs of lockwashers.
Fit a number of packing washers (57) identical to those removed during dismantling.
The amount taken up by these washers has been determined during manufacture.
They serve to ensure correct alignment of the double pulley with the dynamo pulley and give also a dimension of 95.5 mm., plus or minus 0.25 mm., from the centre line of the large pulley groove to the centre line of dynamo fixing studs on the clutch housing cover (see Drawing 21, fig. 2)
Fit the double pulley (58) and the lockwasher. Tighten nut to a tension of 5.5 mkg. (40 foot pounds.) Turn back lockwasher tab against flat of nut.

Centralising bush MR.3421
Brace spanner 12
Box spanner 26

39 FIT THE STARTER GEAR RING CARRIER with damper connected. Tighten the slotted nut (202) to a tension of 30 mkg. (217 foot pounds.) (Use spanner 1669-T, see Drawing 6, fig. 2.) Fit the lockwasher and lock it on damper. Turn back a tongue of the lockwasher into a slot of nut (202).

Spanner 1669-T

40 FIT THE ENGINE FLYWHEEL (its location determined by an offset bolt.) Fit bearing (228) after lubricating with grease (similar to Mobilgrease 5.) Fit the bearing retaining circlip, lockplate (229), and tighten nuts to a tension of 2.5 mkg., plus 0.25 mkg., minus 0 mkg. (18 foot pounds, plus $1\frac{3}{4}$ foot pounds, minus 0 foot pounds.) Turn back lockplate tabs against flats of nuts.
NOTE. On certain engines the flywheel is fixed by bolts. This must be tightened to the same tension as the nuts.

Torsion wrench 2470-T
Extension 14

41	FIT OIL PUMP (see Drawing 116) (a) Rotate crankshaft to bring engine at top dead centre on first cylinder at the end of compression stroke. Fit conical unions in cylinder block.	
	(b) Fit the oil pump so that the slot of the driving pinion (230) is parallel to the engine centre line and is offset towards the engine. Tighten pointed screw to a maximum tension of 1.5 mkg. ($10\frac{1}{2}$ foot pounds) to prevent crushing the column, and tighten lock nut to a tension of 3 mkg. ($21\frac{3}{4}$ foot pounds.) Tighten union nuts to a tension of 6 mkg. ($43\frac{1}{2}$ foot pounds), and lock nuts to a tension of 4 mkg. (29 foot pounds.)	Flat spanners 14-16-17-26
42	Fit the sump cork gasket, offer up the sump and fit screws with lockwashers but do not tighten (the tightening will be carried out after the gearbox is fitted.) Fit the inspection plate with a cork gasket, and tighten nuts fitted with spring washers. Fit drain plug with a C. and A. washer and tighten.	Brace spanner with extension 12 Adjustable spanner 50
43	Return engine to its normal position and place on a workshop stand.	
44	Provisionally adjust the tappets to 0.20 mm. (0.008 in.) for inlet and 0.25 mm. (0.010 in.) for exhaust (the final setting of 0.15 mm. (0.006 in.) and 0.20 mm. (0.008 in.) respectively is made after tightening the cylinder head with the engine hot.)	Flat spanner 14 Set of feeler gauges
45	Oil the valve springs and tappet balls. Fit the cylinder head cover with the joint coated with Hermetical on the cover side only.	Box spanner 12
46	FIT WATER PUMP (see Drawing 118) (a) Fit the dynamo driving belt in the larger groove of the double pulley. Next fit the water pump driving belt.	
	(b) Offer up water pump, fitted with water inlet pipe, in housings. Fit a Klingerite gasket coated with Hermetical between the flanges. Tighten flange nuts with spring washers fitted under.	Brace spanner 12
	(c) Fit the rear housing cap and provisionally tighten the nuts. (The housing cap receiving the eccentric screw is mounted at the front.) Tension the belt correctly by means of adjusting screw (219). Line up, by use of a straight edge, the water pump pulley with the driving pulley by adjusting pump in its housings. Tighten the rear housing cap and lock nut of adjusting screw (219).	
	(d) Turn the eccentric screw so that the point protrudes about 3 mm. on the inside of the front housing cap. Offer up the housing cap and turn the screw so that it registers in the circular groove of the tubular portion of the pump. Tighten the cap. Tighten the lock nut of the eccentric screw at the same time holding the flats of the latter.	Box spanners 12-17

	(e) Tighten clips of pump hose connections.	
47	FIT EXHAUST AND INLET MANIFOLDS Assemble the two manifolds fitting the steel plate between the two Hugo-Reintz gaskets. Tighten bolts with spring washers under heads. The faces of the nine flanges must be in the same plane. Check for alignment with the aid of a straight edge and set of feeler gauges. If the faces are more than 0.1 mm. out of line, true up with a grinder or a file. (After trueing up the faces remove all traces of swarf and emery dust from the ports by compressed air.) Fit the manifold assembly using gasket between flanges and cylinder head. Tighten nuts.	Box spanner 12 Straight edge Set of feeler gauges
48	Fit the oil float tightening the nuts fitted with spring washers under. ENSURE THAT THE ROD SLIDES FREELY IN THE GUIDE TUBE. Ensure that the graduations are according to the dimensions indicated on Drawing 117, fig. 2.	Box spanner 12
49	Fit the breather pipe, pointing downwards, with the flange shield fitted between two paper gaskets. Tighten bolts. Fit side suspension brackets. Tighten bolts fitted with spring washers under heads.	Universal joint spanner 21 Box spanner 12
50	Fit the oil feed pipe to the cylinder head placing a vellumoid gasket between pipe flange and head. Fit screws with spring washers and tighten to a tension of 2 mkg. ($14\frac{1}{2}$ foot pounds.) Tighten union nut fitted with fibre washers to the same tension.	Box spanners 12-17
51	Paint engine.	

	REMOVING CYLINDER HEAD	
1	Drain water from radiator and at the same time remove the bonnet.	
2	Disconnect positive cable from battery. (Use battery cable terminal extractor 2200-T, see Drawing 1, fig. 1.)	Extractor 2200-T Flat spanner 10
3	Remove the carburettor (see Operation 708, paragraphs 1, 2 and 3.)	
4	Remove nuts and clamps fixing inlet and exhaust manifolds to cylinder head. Remove manifold assembly from cylinder head with the aid of a small lever.	Box spanner 14
5	Disconnect radiator hoses and the oil feed pipe flange at the cylinder head. Remove spark plugs (Use spanner 1601-T.)	Flat spanner 12 Spark plug spanner 1601-T
6	Take off cylinder head cover.	Box spanner 12
7	Take off cylinder head and remove cylinder head gasket.	Universal joint spanner extension 17
	REFITTING CYLINDER HEAD	
8	Make sure that the cylinder head fixing studs and also the cylinder block and cylinder head joint faces are in perfect condition. Ensure that there is no foreign matter in the cylinder bores.	
9	Lightly oil the cylinder barrels. Coat the cylinder head gasket with engine oil and fit part on studs (the smooth side against the barrels.) Offer up the cylinder head which must fall into position under its own weight. Fit washers on studs. TIGHTEN CYLINDER HEAD NUTS IN THE ORDER INDICATED (see Drawing 18), FIRST TO A TENSION OF 2 MKG. (14½ FOOT POUNDS), AND THEN AGAIN TO A TENSION OF 5 MKG. (36 FOOT POUNDS.) (Use torsion wrench 2470-T, see Drawing 18, fig. 2.) The degree of tightness is of great importance and for this reason, a reliable torsion wrench is essential. The order of tightening must be adhered to.	Torsion wrench 2470-T socket 17
10	Fit push rods, having previously oiled ball ends, by depressing valves (use valve spring compressor 1611-T). Adjust tappet clearances to 0.20 mm. (0.008 in.) for inlet and 0.25 mm. (0.010 in.) for exhaust. (The final setting of 0.15 mm. (0.006 in.) for inlet, and 0.20 mm. (0.008 in.) is made with the engine hot after final tightening of the cylinder head.)	Compressor 1611-T Set of feeler gauges Flat spanner 14
11	Fit the oil feed pipe to the cylinder head, placing a vellumoid gasket under flange. Fit screws, with spring washers under heads, and tighten to a tension of 2 mkg. (14½ foot pounds.)	

12	Fit manifold gasket and then manifold assembly on studs. Fit spring washers and fixing nuts, and tighten down.	Box spanner 14
13	Fit the carburettor (see Operation 708, paragrapns 4, 5 and 6.)	
14	Fit water hoses. Fit spark plugs. (Use spanner 1601-T). Connect positive cable to the battery.	Spark plug spanner 1601-T Flat spanner 12
15	Make sure that drain tap is shut and then fill radiator with water.	
16	Start engine and let it idle (approximately 500 R.P.M.) for fifteen minutes.	
17	Finally tighten cylinder head nuts in the order indicated (see Drawing 18) to a tension of 5mkg. (36 foot pounds.) (Use torsion wrench 2470-T, see Drawing 18, fig. 2.)	Torsion wrench 2470-T socket 17
18	Adjust valve tappet clearances to 0.15 mm. (0.006 in.) for inlet and 0.20 mm. (0.008 in.) for exhaust.	Flat spanner 14 Set of feeler gauges
19	Fit cylinder head cover, with the cork gasket coated with Hermetical on the cover side only.	Box spanner 12
20	Fit the bonnet.	

	REMOVING ROCKER SHAFT	
1	Remove cylinder head cover.	Box spanner 12
2	Remove rocker shaft assembly.	Box spanner 14
	DISMANTLING ROCKER SHAFT	
3	See Operation 703, paragraph 18e.	
	ASSEMBLING ROCKER SHAFT	
4	See Operation 703, paragraph 26.	
	REFITTING ROCKER SHAFT	
5	(a) Fit a paper gasket under each rocker shaft bracket and a spacing washer in the bracket clamping slots. Tighten bracket fixing nuts to a tension of 1.2 mkg. ($8\frac{3}{4}$ foot pounds.) Turn back lock washer tabs against flat of nuts.	Box spanner 14
	(b) Adjust tappet clearances to 0.15 mm. (0.006 in.) for inlet valves and 0.20 mm. (0.008 in.) for exhaust valves.	Flat spanner 12 Set of feeler gauges
6	Fit cylinder head cover with the cork joint coated with Hermetical on the cover side only.	Box spanner 12

	REMOVING MANIFOLDS	
1	Take off the carburettor (see Operation 708, paragraphs 1, 2, and 3.)	
2	Disconnect manifold flanges from cylinder head. (Use spanner 1626-T. see Drawing 1. fig. 2.) Disconnect exhaust pipes and let them rest on the floor.	Spanner 1626-T
3	Remove petrol drain pipe. Remove manifold assembly from the engine.	Flat spanner 12 Box spanner 14
4	Disconnect inlet manifold from exhaust manifold	Box spanner 14
	REFITTING MANIFOLDS	
5	PREPARE MANIFOLDS (a) Assemble the two manifolds fitting a steel gasket between the two Hugo-Reintz flange gaskets. Tighten bolts fitted with spring washers under heads.	Box spanner 14
	(b) The faces of the nine flanges must be in the same plane. Check for any misalignment by using a straight edge and feeler gauges or on a surface plate. If the assembly is more than 0.1 mm. out of alignment true up the faces by grinding or with a file. After trueing up remove all traces of swarf or emery dust with a compressed air blower	Straight edge Set of feeler gauges
6	Fit the manifold C. and A. gasket on the manifold studs. Fit the assembly of manifolds and tighten fixing nuts, fitted with spring washers	Box spanner 14
7	Fit exhaust pipes to exhaust manifold using C. and A. gaskets between the flanges. SECURELY TIGHTEN THE NUTS. (Use spanner 1626-T see Drawing 1 fig. 2.)	Spanner 1626-T
8	Fit petrol drain pipe	Flat spanner 12
9	Fit carburettor (see Operation 708, paragraphs 4, 5 and 6.)	

	REMOVING WATER PUMP (see Drawing 118)	
1	Drain water front radiator.	
2	Remove the air intake silencer. Remove the pipe (4) from the carburettor and the fixing on the hull (see Drawing 23).	Flat spanner 12
3	Disconnect hoses and the pipe between pump and cylinder head.	Flat spanner 17 Box spanner 12
4	Unscrew adjusting bolt (219). Remove housing caps fixing pump and take out pump.	
	REFITTING WATER PUMP	
5	Offer up the water pump in its housing, fit the rear housing cap, provisionally tightening the nuts. (The cap with the eccentric bolt is fitted at the front.) Ensure correct tensioning of driving belt by operating adjusting screw (219). Line up, with the aid of a straight edge, the water pump pulley with the driving pulley by moving the pump backwards or forwards in its housing. Tighten nuts of rear housing cap and lock nut of adjusting screw (219). Turn the eccentric screw so that the point protrudes about 3 mm. on the inside of the front housing cap. Offer up the housing cap and turn the screw so that it registers in the circular groove of the tubular portion of the pump. Tighten nuts fixing the cap. Tighten the lock nut of the eccentric screw at the same time holding the flats of the latter.	Box spanners 12-17
6	Fit the hose connections and the pipe between pump and cylinder head (without using Hermetical). Tighten hose clips.	
7	Fit the air intake silencer. Fit a Hugo-Reintz gasket between pipe (4) and the carburettor. Fix brackets between two rubber washers and split pin the bolts (see Drawing 23).	Flat spanner 12
8	Fill the radiator with water.	
	NOTE. To overhaul pump see Operation 703, paragraphs 20 and 29.	

	REMOVING CARBURETTOR	
1	Remove pipe between carburettor and air intake silencer.	
2	Disconnect petrol pipe from carburettor, starter carburettor control (choke). Disconnect throttle control at carburettor end by sliding spring to free ball pin.	Flat spanners 8-14-18
3	Take off the carburettor. (Use spanner 1621-T, see Drawing 1, fig. 3).	Spanner 1621-T
	REFITTING CARBURETTOR	
4	FIT THE CARBURETTOR (a) With the aid of a straight edge or surface plate make certain that the carburettor flange is true. If necessary, touch up the flange face with a file after stuffing the main orifice with a rag.	
	(b) Fit the carburettor shield and tighten two fixing nuts on inlet manifold studs. Position the shield lower fixing strap and tighten nuts fitted with shakeproof washers. Fit and tighten bolts assembling shield and fixing strap. Place on inlet manifold in the following order:- One Hugo-Reintz gasket (centres of inlet holes 38 mm.) One thick distance piece (on this part the inlet holes are cut obliquely. Fit the face with centres of inlet holes at 38 mm. against the preceding gasket). One Hugo-Reintz gasket (centres of inlet holes 35 mm.) Offer up carburettor and tighten fixing nuts with shakeproof washers under. (Use spanner 1621-T, see Drawing 1, fig. 3).	Flat spanner 14 Spanner 1621-T
5	Fit petrol pipe, starter carburettor control, and throttle control.	Flat spanners 8-18
6	Fit pipe between carburettor and air intake silencer using a round Hugo-Reintz gasket. Tighten the screws.	

	DISMANTLING CARBURETTOR (see Drawing 120)	
1	Remove the float chamber cover (1), take out the float (31) by removing screw (2).	Flat spanner 10
2	Remove pump injectors (3), disengage paper gasket and two balls (4). Remove screws (6) to permit taking out choke tubes (5). Take out correction jets (7) and emulsion tubes (8). Remove air jets (9), slow running jets (10) and pump jet (11).	Flat spanners 8-12
3	Remove main jet carrier plugs (12) and unscrew main jets (13). Remove starter petrol jet (14).	Flat spanner 14
4	Remove split pin from rod (15) and disengage rod from pump lever (16).	
5	Disconnect throttle chamber (17) from float chamber.	
6	Remove pump valve (18). Remove the pump (19) by taking out four screws (20). Take off paper gasket (32). Remove starter air jet (21). Remove starter (22) by taking out four screws (23).	
7	DISMANTLE BUTTERFLY VALVES FROM THROTTLE SPINDLE (a) Remove the screws (25) fixing butterfly valves. Take out valves (26). Unscrew the two mixture screws (29).	
	(b) Take off the throttle lever (27) from the throttle spindle (24).	
	(c) Take out spindle (24), and remove pump control lever (28).	Flat spanner 12
8	Remove needle valve (30). Take off paper gasket (35) fixed by two screws to the float chamber cover (1).	
9	Clean parts. Use compressed air to blow out ducts and jets.	
	ASSEMBLING CARBURETTOR (see Drawing 120)	
10	Screw needle valve (30), fitted with a fibre washer, into float chamber cover (1). Fit the paper gasket (35) to the float chamber cover and fix by two screws.	
11	ASSEMBLE BUTTERFLY VALVES AND THROTTLE SPINDLE (a) Fit lever (28) to spindle (24) and tighten nut.	Flat spanner 12
	(b) Engage spindle (24) into throttle chamber (17), assemble butterfly valves (26), tighten screws (25)	

	(c) Fit bracket (33) for throttle stop screws on spindle, fit lever (27), tighten nut and lock nut.	Flat spanner 14
12	Provisionally screw in the mixture screws (29). Fit the starter (22) and tighten the four screws (23). Screw in the air jet (21).	
13	Fit the pump (19) and tighten four screws (20). Screw in the pump jet (11), fitted with a fibre washer, and screw in valve (18). Screw in starter petrol jet (14), fitted with a fibre washer, slow running air jets (9), and slow running jets (10). Screw main jets (13) into carrier plugs (12). Fit the plugs (12) with fibre washers. Fit in place the two emulsion tubes (8), and screw in the correction jets (7). Place the float (31) into the float chamber and tighten screw (2). Fit the two choke tubes (5) and tighten screws (6). Fit the two balls (4) of the injectors (3). Fit the injectors (3) using a paper gasket.	
14	Connect the throttle chamber (17) to the float chamber using a paper gasket (32). Engage rod (15), fitted with a small spring, in pump control lever (16). Tighten the four assembly screws. Split pin the rod (15).	
15	Fit the float chamber cover (1) and tighten screws.	Flat spanner 10
	NOTE If after considerable service the pump appears to be defective, general cause being a hole in or leak at the pump base, at first make sure that a blocked pump jet (11) or injector (4) is not the cause (see paragraph 13). If the pump has really deteriorated, do not try to dismantle or repair it as it is preferable to replace the unit by a new pump complete.	

	DISMANTLING SILENCER (See Drawing 23)	
	NOTE. It is important to clean the filter and felt constituting the filtering and silencing elements every 6,000 km. (3,700 miles).	
1	Take off end plate (1) by unscrewing the nuts (2). Take out the filter (3).	Box spanner 8
2	Remove pipe (4) and hose (5) by taking off hose clips.	
3	Clean parts. Clean the felt (7) with a wire brush and remove all dust with a compressed air blower. Wash the perforated tube (8) and the filter (3) in petrol and finish off cleaning with compressed air. Make sure that the vents in the cylindrical casing are clear and have an opening of 2.5 mm. (see fig. 4).	
	ASSEMBLING SILENCER	
4	Fit the filter (3), end plate (1), and tighten nuts (2) fitted with spring washers.	Box spanner 8
5	Fit hose (5) to casing outlet, fit pipe (4) in hose, and tighten both clips (6).	

	DISMANTLING PETROL PUMP (see Drawing 24)	
1	Take off the glass cover (1), remove filter (2), and disconnect halves of pump (3 and 4).	Flat spanner 10
2	Using a screwdriver, extract lockwashers (5) of the two priming lever guide nuts (6). Unscrew the two nuts, take out the priming lever (7), the actuating lever (8) and its fork (9).	Flat spanner 12
3	Dismantle diaphragm from pump actuating rod (10), remove resin-coated washers (11), and spring (15).	Flat and box spanners 10
4	Remove retaining plate (12) for flow (13) and return (14) valves. Remove valves and springs.	
	ASSEMBLING PETROL PUMP (see Drawing 24)	
5	Fit flow (13) and return (14) valves, fit cork gasket for retaining plate (without using Hermetical or similar compound), fix the plate by three screws.	
6	Fit set of diaphragms to actuating rod (10), tighten nut, and turn back lockwasher tab. To prevent petrol seeping through the nut thread, load a little solder to the face of the nut (as at "a"). Fit the regulator spring (15) and cup. Then fit resin coated washers (11) to ensure petrol proofing. These washers are slit for easy assembly. When assembling, do not allow slits to coincide, each should be staggered at about one third of the circumference.	Flat and box spanners 10
7	Place actuating lever spring (16) on locating boss in pump casting, fit diaphragm assembly, hook actuating lever (8) on actuating rod (10). Fit lever fork (9), fit priming lever (7), tighten guide nuts (6), fit lockwashers (5), drive in the rivets.	Flat spanner 12
8	Connect two halves of pump (3 and 4). THE DIAPHRAGM MUST BE FITTED WITHOUT USING HERMETICAL OR SIMILAR COMPOUND. Tighten assembling screws.	
9	Fit the filter (2), cork washer (WITHOUT USING HERMETICAL), glass cover (1), and tighten locking screw.	Flat spanner 10
	NOTE. After every re-assembly of pump check for leaks (see Operation 712).	

CHECKING FOR LEAKS (see Drawing 25)

1 Use a plug threaded 12 dia., 100 pitch to close the pump outlet to the carburettor.

2 Fit a petrol pipe to the pump inlet from petrol tank. Tighten the pipe with a biconical union and union nut as normally used on the car.

3 Totally submerge the pump in a suitable receptacle containing petrol only.

4 Apply compressed air at a pressure of 100 to 300 grams per sq. cm. ($1\frac{1}{2}$ to 4 pounds per sq. in.) via. the petrol pipe.
At first air bubbles may occur due to movement of the diaphragm.

5 Maintain air pressure for a while.
If air bubbles escape from the actuating lever recess the diaphragm is faulty and must be replaced.
If air bubbles escape at the joint of pump halves or from the screws assembling halves of pump, either the joint faces are defective or the diaphragm is not properly tightened. If air bubbles escape between the glass cover and pump, either the cork washer is faulty or the cover is not sufficiently tightened.

	REMOVING CLUTCH (see Drawings 122 and 126)	
1	Drain water from radiator. Meanwhile remove the bonnet.	
2	Remove radiator shell and radiator lower shield.	Box spanners 10-12 Flat spanners 12-14
3	Disconnect right and left hand side brackets from radiator. Slacken the bolts fixing brackets to engine suspension tube in order to disengage radiator. Remove lower radiator hose and disconnect upper radiator hose. Remove "U" bolts fixing radiator to bumper bracket spacing bar. Remove the radiator.	Box spanner 12 Universal joint spanner with extension 16 Flat spanner 17
4	Remove dynamo without disconnecting leads and place it on right of engine.	
5	Remove clutch housing cover. Remove front bearing cap (201). NOTE. DO NOT DISPERSE ADJUSTING SHIMS (202). Take out circlip (203) retaining spring, with the aid of round nose pliers. Disengage mainshaft (204) by pulling forwards.	Brace spanner with extension 12
6	Unhook return spring (210). Take out clutch fork and thrust race assembly.	
7	Fit clamps to retain clutch toggles. (Use clamps MR.3451, see Drawing 26). Take out the clutch. (Before removing, ascertain the position of the clutch, this being indicated by either a letter or figure. If there is no indication mark the position of the clutch so that it can be re-assembled in the same location and so preserve the balance determined during manufacture.) Take out clutch discs and intermediate pressure plate.	Clamps MR.3451 Universal joint spanner 12
	REFITTING CLUTCH	
8	FIT THE CLUTCH (see Drawings 27 and 122) (a) Make sure that the thrust faces of the flywheel, intermediate pressure plate, and clutch plate are in perfect condition. Ensure that the intermediate pressure plate slides freely between the flywheel driving studs. Mark the position giving the best result for re-assembling.	
	(b) Fit clamps to retain toggles. (Use clamps MR.3451, see Drawing 26). Fit pressure plate retaining spring (1) between two flywheel driving studs (see fig. 6).	Clamps MR.3451 Shouldered mandrel small dia. 17, length 25, large dia. 21, length 300 Brace spanner 12
	Fit offset clutch disc (2) in flywheel, positioned as indicated in fig. 1. Fit intermediate pressure plate in position already determined (see paragraph 8a), fit flat clutch plate (3) also according to position indicated in fig.1. Engage a mandrel or spare gearbox mainshaft in order to locate the clutch discs in relation to the crankshaft bearing. Fit the clutch pressure plate assembly by lining up markings on pressure plate and flywheel. Tighten bolts (4), fitted with	

	spring washers under heads, to a tension of 2 mkg., plus 0.250 mkg., minus 0 mkg. (14½ foot pounds, plus 1¾ foot pounds, minus 0 foot pounds). During tightening make sure that the mandrel (or mainshaft) slides freely, and thus indicates correct centering of discs. Remove mandrel and take off clamps MR.3451.	
9	Fit clutch fork and thrust race assembly WITH THE GRAPHITE BUSH FACING THE TOGGLE THRUST RING. Place the end of the double lever on the clutch fork shaft in front of the outer gear lock control lever.	
10	Fit the gearbox mainshaft and turn by hand to engage splines. With the aid of round nose pliers fit circlip (203) for spring retaining mainshaft.	
11	Fit clutch housing cover. Coat the threads of the three forward fixing screws and the flange face in the corresponding zone with Hermetical. Fit spring washers under heads of bolts, and tighten. MAKE CERTAIN, THAT AFTER TIGHTENING, CLUTCH FORK SHAFT TURNS FREELY.	Universal joint spanner 17
12	Fit front bearing cap (201), AFTER REPLACING SHIMS (202) TAKEN OUT DURING DISMANTLING. Coat paper gaskets with Hermetical and tighten bolts.	Brace spanner with extension 12
13	ADJUST CLUTCH OPERATION (see Drawing 126) (a) Bring clutch fork thrust ring (206) into contact with toggle thrust ring (205) and keep in this position with the clutch fork.	
	(b) Turn the adjusting screw (207) to obtain a clearance "a" of 27 mm., plus or minus 1 mm., between the end of the double lever (208) and the stop on plate (209). Tighten lock nut of adjusting screw (207). Hook on return spring (210).	Flat spanner 17
14	Fit the dynamo. Tighten nuts, each fitted with a plain and a spring washer. Adjust tension of driving belt.	
15	Fit the radiator and, after locating in relation with the starting handle sleeve, tighten up fixing. Fit radiator hoses and tighten clips.	
16	Fill radiator with water.	
17	Fit radiator shell and adjust wing piping.	Flat spanners 12-14 Box spanner 10
18	Fit the bonnet.	

DISMANTLING CLUTCH (see Drawing 120A)

1 Uncouple auxiliary flywheel (1) from clutch carrier plate (2) by removing the four bolts (3) (see fig. 5).

2 With a hack saw remove metal from the nuts (4) punched into slots of toggle bolts (5). Remove clutch toggles (6) by unscrewing adjusting nuts (4). Box spanner 14

3 Remove clutch pressure plate (10), springs (8), and cups (9).

4 Remove thrust ring (10) from toggles by unhooking springs (11) from the carrier plate and toggles. Remove toggle thrust ring plate (13).

ASSEMBLING CLUTCH (see Drawing 120A).

5 True up surface of clutch plate (7) in a lathe. (It is preferable to use a grinding attachment but the work can be carried out with a finishing tool).

NOTE. 1. Any metal removed from the pressure surface causes a decrease in pressure from the clutch springs. Consequently shims, corresponding in thickness to the amount of metal removed, must be fitted under the springs. On a new plate the dimension at "a" is 11 mm., minus 0.3 mm., plus 0 mm.
2. CHECK THE DIAMETER OF THE HOLES IN THE PRESSURE PLATE FOR THE TOGGLE BOLTS (5). THESE SHOULD BE 8.6 mm. DIA., PLUS OR MINUS 0.1 mm. IF HOLES ARE UNDERSIZE OPEN OUT WITH AN 8.5 mm. DIA. REAMER.

6 True up the intermediate pressure plate in a lathe.

NOTE. We advise against carrying out this operation however. It is essential that the two thrust faces be parallel (within 0.05 mm.) and that the slots for the driving studs be strictly square with the pressure surfaces. These conditions can only be obtained by using a special fixture.
If the plate is scored it is preferable to replace it.
If the plate has been rectified, fit washers under the pressure springs equivalent in thickness to the amount of metal removed in order to maintain spring pressure.
The original thickness of the plate is 10.5 mm., plus 0.1 mm., minus 0 mm.

7 True up engine flywheel (according to instructions in paragraph 5 for the clutch plate).

NOTE. When the flywheel pressure surface is machined in a lathe a corresponding amount of metal must be removed from the face of the flange which the auxiliary flywheel fits against (see fig. 4). Both surfaces must be machined at the same lathe setting in order to preserve the parallelism of

	both faces. Dimension "B" must be 44.1 mm., plus 0.2 mm., minus 0 mm.	
8	Carefully clean and polish with emery paper, the inner bore of the flywheel between driving pegs, and also the peg faces. This operation is necessary to ensure good sliding of the intermediate pressure plate in the flywheel. Offer up the pressure plate in the flywheel and select the position giving the best sliding. Mark this position for reference when finally assembling.	
9	Check clutch springs. (Use spring testing apparatus 2420-T, see Drawing 11). IT IS NECESSARY ON THIS TYPE OF CAR TO USE ONLY SPRINGS PART NO. 491053 WHICH CARRY A BLACK IDENTIFICATION MARK. These springs have a free length of 44 mm., plus or minus 1 mm., and a length of 29.5 mm., under a load of 68 kg., plus or minus 2 kg. (150 lbs., plus or minus 4½ lbs.). In the absence of suitable checking apparatus the springs should be replaced at each dismantling of the clutch. IMPORTANT NOTE. TO PRESENT CLUTCH SLIP IT IS ABSOLUTELY ESSENTIAL TO USE ONLY MODIFIED TOGGLES (SOLD EXCLUSIVELY BY OUR SPARE PARTS DEPARTMENT). TO IDENTIFY THESE SEE DRAWING 120A, FIG. 3. IT IS EQUALLY IMPORTANT TO USE THE NEW TYPE CLUTCH CARRIER PLATE, that is to say, the carrier plate with square fulcrum brackets for the modified toggles (see Drawing 120A. fig. 1).	
10	Hook return springs (11) on carrier plate, fit toggle thrust ring and hook on springs (11). Assemble auxiliary flywheel (1) and carrier plate (2). Tighten screws (3). Fit clutch springs (8) on pressure plate (7). Fit if required on the springs, washers of the thickness established in paragraphs 5 and 6 and the spring cups (9). Offer up the auxiliary flywheel and carrier plate assembly on the springs. Put in place the toggles (6) and fit the plate (13) between toggle thrust ring and the toggles.	
11	Offer up the whole assembly on an assembly and adjusting fixture. (Use the fixture 1701-T, see Drawing 28, fig. 1). Compress the assembly and fit on the toggle bolts the pivot washers (12). Tighten nuts (4) to bring the toggle thrust ring into contact with the central pivoting finger of the fixture (see Drawing 28, fig. 3). Under these conditions (clutch engaged with engine) the dimensions obtained are, 44.1 mm. between face of thrust ring and face of pressure plate, and 16.1 mm. between face of pressure plate and face of carrier plate (see Drawing 120A, fig.1). Lock the toggle bolt nuts by punching metal from nuts into slots of toggle bolts. NOTE. If fixture 1701-T is not available, it is possible to obtain the correct adjustment by using the simplified fixture MR.3457 (see Drawing 120B). It is necessary to ensure correct positioning of toggles. Before locking the adjusting nuts compress and then allow the toggles to return to the normal position. (Use a screw press or drilling machine).	Box spanner 14 Fixture 1701-T Box spanner 14 Fixture MR.3457

IMPORTANT NOTE.

THE CLUTCH CAN ONLY BE ADJUSTED WHEN UNDER NORMAL OPERATING CONDITIONS. These conditions are obtained by using the fixtures shown on Drawings 28 and 120B. THE DIMENSIONS INDICATED CAN ONLY BE OBTAINED WITH THE AID OF THE FIXTURES.
When the clutch is not in one of the fixtures, THE TOGGLE THRUST RING MAY REST ON AN UNEVEN SURFACE AND ACCURATE DIMENSIONS WILL NOT BE OBTAINABLE.
Any attempt at adjusting the clutch must not be made when the unit is fitted to the engine.

	REMOVING GEARBOX (See Drawing 122)	
1	Drain water from the radiator and meanwhile remove the bonnet.	
2	Raise the vehicle at the front. (Use jack attachment MR.3300-90, see Drawing 67). Block up under ends of lower link arms.	Jack attachment MR.3300-90
3	Disconnect cable from battery negative terminal. (Use extractor 2200-T, see Drawing 1, fig. 1). Disconnect leads from horns, headlamps, dynamo, starter motor and ignition coil.	Extractor 2200-T Flat spanners 8-14
4	Remove radiator shell and front wings as an assembly.	Universal joint spanner 10-12-14 Brace spanner 10-12-14
5	Remove the air intake silencer by disconnecting pipe from carburettor and fixing bolts on hull.	Flat spanner 12
6	Remove the front bumper brackets assembly and radiator without disconnecting radiator from tie-bar between bumper brackets. Slacken and remove nuts from four front axle mounting studs. (Use spanner 1880-T).	Box spanner 14-17 Spanner 1880-T
7	Disconnect the two gear selector rods from relay levers on timing cover and the two control rods from levers on gearbox. Disconnect clutch cable from lever at the front. Remove speedometer drive cable at gearbox end.	Box spanner 10
8	Uncouple drive shaft flanges from gearbox but do not disengage. (Use spanner 1832-T, see Drawing 60A).	Spanner 1832-T
9	Disconnect exhaust pipe from engine exhaust manifold. (Use spanner 1626-T, see Drawing 1, fig. 2).	Universal joint spanner 17 Spanner 1626-T
10	Disconnect accelerator control rod from carburettor by sliding retaining spring along rod to release ball pin. Disconnect starter carburettor, starter motor and variable ignition controls. Disconnect petrol pump inlet pipe.	Small adjustable spanner Box spanners 8-10 Flat spanners 8-14
11	Uncouple engine from rear flexible mountings, and the engine front bearer tube from front axle cradle.	Universal joint spanner 24 Flat spanner 26
12	Take out engine and gearbox assembly from the car. (Use chain sling MR.3320-30, see Drawing 2). (In order to allow the rear of the engine to be raised first, the chain legs are of unequal length). To prevent fouling the gear selector rods place the gear change lever in "REVERSE" position. Slightly raise the engine, disengage from rear mountings, and disengage drive shafts,	Chain sling MR.3320-30

	one after the other, from gearbox flanges. Pull engine forward to disengage the front bearer tube from studs on front axle cradle. Completely disengage unit from vehicle	
13	Place the engine on a stand. (Use stand MR.3300-50, see Drawing 119).	Stand MR.3300-50
14	Take off the dynamo.	Flat spanner 17
15	Remove bearing cap (201) forming bracket for starting handle. NOTE. TAKE CARE NOT TO DISPERSE THE SHIMS (202) THAT MAY BE FITTED. With the aid of a pair of round nose pliers take out circlip (203) retaining the spring. Disengage the mainshaft by pulling forwards.	Brace spanner and extension 12
16	Take off clutch housing cover, unhook return spring from clutch fork lever, and remove clutch fork with thrust ring.	Brace spanner and extension 17
17	Uncouple gearbox from cylinder block.	Universal joint spanner 21 Flat spanner 17
	REFITTING GEARBOX (see Drawing 122) NOTE. If the gearbox or spacer has been replaced, it is essential to slacken the sump fixing bolts to refit the gearbox. This operation is necessary to avoid any strain on the gearbox fixing plates or the sump. Tightening of the sump fixing bolts will be carried out after tightening bolts fixing gearbox and spacer.	
18	Make sure that the gearbox locating dowels are correctly fitted in the cylinder block. Offer up the gearbox, engage it on locating dowels, fit two bolts but do not tighten. Fit the spacer, put all fixing bolts in position, fit spring washers under nuts, and tighten. If necessary, tighten sump fixing bolts.	Universal joint spanner 21 Flat spanners 17-21
19	Fit the clutch withdrawal fork, with thrust ring assembled, SO THAT THE GRAPHITE BUSH FACES THE CLUTCH TOGGLE THRUST RING, and the end of the double lever is in front of the outer locking control lever.	
20	Fit mainshaft pinion. Engage pinion with splines of mainshaft by turning the latter by hand. Fit the circlip for retaining spring (203) by using a pair of round nose pliers.	
21	Fit the bearing cap (201) forming starting handle bracket, FITTING, IF NECESSARY, SHIMS (202) TAKEN OUT DURING GEARBOX REMOVAL. Coat the paper gasket with Hermetical and tighten bolts fixing bearing caps.	Brace spanner and extension 12

22	Fit the engine front bearer tube (see Drawing 5, fig. 1). Turn the tube so that the threaded holes "a" for bolts fixing radiator upper brackets are towards the front. Make sure that the distance between the centre of the rubber bush (62) and the centre of the left hand fixing eye of the tube is 353 mm. If necessary, use packing washers, sold by our Spare Parts Department, between thrust washer (64) and ring welded on tube, to obtain this dimension.	
23	Fit the clutch housing cover. Coat the threads of the three forward fixing screws and the flange in the corresponding zone with Hermetical. Fit spring washers under heads of bolts and tighten. MAKE CERTAIN, THAT AFTER TIGHTENING, CLUTCH FORK SHAFT TURNS FREELY.	Universal joint spanner 17
24	Fit the dynamo. Fit a plain and a spring washer under each nut, and tighten.	Flat spanner 17
25	ADJUST DOUBLE LEVER (208) (see Drawing 126) (a) Position double lever (208) to obtain a dimension "a" of 27 mm., plus or minus 1 mm. between the end of lever and stop on plate (209). (b) Adjust screw (207) so that with the double lever in the above position the graphite bush of the clutch fork thrust ring is in contact with the toggle thrust ring. (c) Tighten adjusting screw lock nut. Hook on return spring (210). NOTE. Clutch toggle clearance is obtained by adjustment of the clutch pedal after the engine is in position in car.	Flat spanner 17
26	Check and adjust the height of the engine rear flexible mountings. (Use template MR.3450, see Drawing 5, figs. 3 and 4).	Template MR.3450
27	Raise the vehicle at the front. (Use jack attachment MR.3300-90, see Drawing 67). Block it up under ends of lower linkarms.	Jack attachment MR.3300-90
28	Suspend the engine. (Use chain sling MR.3320-30, see Drawing 2).	Sling MR.3320-30
29	Lower engine into hull. Engage drive shaft couplings with gearbox flanges. Fit engine front bearer tube on studs on front axle cradle, provisionally screwing nuts, with spring washers under, on studs. Lower engine on rear mountings. Remove the chain sling. Tighten front bearer tube nuts. Tighten engine rear mounting nuts. Fit a plain and spring washer between nut and mounting bracket.	Flat spanner 26 Universal joint spanner 23
30	WELL TIGHTEN nuts of drive shaft flanges using a "Blocfort" lockwasher under each nut (Use spanner 1832-T, see Drawing 60A).	Spanner 1832-T

31	Fit exhaust pipe using a C. and A. gasket between pipe and manifold flanges. TIGHTEN THE NUTS WELL. (Use spanner 1626-T, see Drawing 1, fig. 2).	Spanner 1626-T
32	Connect clutch cable. Adjust cable to give an idle movement of 15 mm. to 20 mm. to the highest position of the clutch pedal. This movement corresponds to a necessary clearance of 1.5 mm. to to 2 mm. between clutch fork graphite bush and the toggle thrust ring. After adjusting the cable tighten the lock nut and fit split pin to trunnion pin.	Flat spanner 14
33	Connect the two gear control rods and fit split pins to fork and pins. Connect the two gear selector rods to the relay levers. Set these rods to an exact length so that no pull is applied to the levers. Make sure that the gear change lever does not catch in its lateral movement in the selector. Fit split pins to the fork end pins.	
34	Fit speedometer drive cable and tighten bolt with a spring washer fitted under head. Fit variable ignition, starter motor, and starter carburettor controls. Connect ignition coil wires. Fit flexible pipe on petrol pump. Connect accelerator control.	Small adjustable spanner Flat spanners 8-14
35	Fit the assembly of radiator and front bumper brackets. Tighten bumper brackets, using a plain washer and a spring washer under each bolt. Fit shouldered bushes, previously oiled, for aligning front axle cradle. Tighten front axle cradle fixing nuts with spring washers under. (Use spanner 1880-T) Line up the radiator with the gearbox bearing cap, which forms the starting handle bracket, by positioning radiator on bumper bracket tie-bar. Tighten "U" bolts and radiator upper fixing plates. Tighten hose clips. After making sure that drain plug is shut, fill the radiator with water.	Spanner 1880-T Universal joint spanner 17 Box spanners 10-14-17
36	Clip the group of headlamps and horn wires to the engine front bearer tube. Connect the two earth wires under one of the bolts under each bumper bracket.	Box and flat spanners 14
37	Fit the assembly of radiator shell and front wings. Fit a plain washer and a spring washer under all the fixing bolts and screw in a few turns only. Offer up the bonnet and line up parts in relation to one another. Fit wing piping and tighten the fixing bolts.	Flat spanner 14 Box spanners 8-12
38	Connect wiring to headlamps, horns, dynamo, and starter motor. Connect positive and negative cables to battery.	Box and flat spanners 12
39	Fit the air intake silencer. Use a Hugo-Reintz gasket between the upper flange of the carburettor and the inlet silencer. Fit the silencer fixing plates with a rubber washer on either side. Fit screws and secure with split pins.	Flat and box spanners 12
40	Fit interior heater tube.	Flat spanner 12

41	Lower vehicle to the ground. (Use jack attachment MR.3300-90, see Drawing 67).	Jack attachment MR.3300-90
42	Fill gearbox with oil (3.5 litres - 6 pints approximately). Use only special hypoid gear oil (similar to Mobiloil GX). Tighten filler plug fitted with a C. and A. washer.	Flat spanner 21

NOTE. It is recommended to remove the engine in order to detach the gearbox. However it is possible to remove the gearbox only if means are not available for taking out the engine (for example, absence of suitable lifting tackle). In this case the clutch must be removed as well.

REMOVING GEARBOX (see Drawing 122)

1	Drain water from the radiator and meanwhile remove the bonnet.	
2	Raise the vehicle at the front. (Use jack attachment MR.3300-90, see Drawing 67). Block up under ends of lower link arms.	Jack attachment MR.3300-90
3	Disconnect positive cable from battery. (Use extractor 2200-T, see Drawing 1, fig. 1). Disconnect horn, headlamp, and dynamo wires.	Extractor 2200-T Flat spanners 8-14
4	Remove the assembly of wings and radiator shell.	Universal joint spanners 10-12-14 Brace spanners 10-12-14
5	Remove the air intake silencer. (Disconnect pipe from carburettor and remove fixing bolts from hull).	Flat spanner 12
6	Remove the front bumper brackets and radiator brackets as an assembly without dismantling radiator block from bumper bracket tie bar. Unscrew for four nuts on front axle cradle fixing studs. (Use spanner 1880-T).	Box spanner 14-17 Spanner 1880-T
7	Uncouple the two gear control rods from levers on gearbox. Disconnect clutch cable from front lever. Disconnect speedometer drive cable from gearbox.	Box spanner 10
8	Remove the dynamo.	Flat spanner 17
9	Block up the engine under the sump with a hand operated jack. Apply the jack between the steering rack tube and tie bar across hull, USING A BLOCK OF WOOD BETWEEN SUMP AND JACK HEAD.	
10	Take off clutch housing cover.	Brace spanner with extension 17
11	Remove front bearing cap (201). TAKE CARE NOT TO DISPERSE SHIMS. With the aid of a pair of round nose pliers remove the circlip (203) of the spring. Disengage mainshaft (204) by pulling towards the front.	Brace spanner with extension 12
12	Unhook return spring and take out the clutch fork with its thrust ring.	

13	Fit clamps to hold clutch toggles. (Use clamps MR.3451, see Drawing 26). Remove the clutch. Make sure before removing if the clutch position, in relation to the flywheel, is indicated (either by a letter or figure). If there is no indication of location mark the position of the clutch so that it can be re-assembled in the same position and thus preserve the balance established during manufacture. Take out clutch discs and pressure plate.	Clamps MR.3451 Universal joint spanner 12
14	Remove the engine flywheel. Hold the flywheel with a pin engaged in one of the balancing holes when slackening nuts or bolts fixing flywheel.	Universal joint spanner 12
15	Disconnect drive shafts from gearbox flanges. (Use spanner 1832-T, see Drawing 60A). Disconnect drive shafts at the flexible coupling by tapping the parts lightly with a mallet, and if necessary prising apart with a screwdriver or small lever.	Flat spanner 14 Spanner 1832-T
16	Disconnect from cylinder block WITHOUT UNCOUPLING SUMP SPACER. Take out all gearbox fixing bolts.	Universal joint spanner 21 Flat spanner 21
17	Take out gearbox from car. To do so, disengage gearbox drive shaft flanges from front axle cradle one after the other.	
	REFITTING GEARBOX	
18	Offer up gearbox to car by engaging drive shaft flanges in front axle cradle one after the other. Fit engine front support tube (see Operation 702 paragraph 13d for position and adjustment). Couple up gearbox, fit spring washers under nuts and tighten. Tighten the front support tube.	Universal joint spanner 21-24 Flat spanner 21
19	Connect drive shafts to gearbox flanges. TIGHTEN SECURELY THE NUTS OF THE UNIVERSAL COUPLING FLANGES, using a 'Blocfort' type washer under each nut. (Use spanner 1832-T, see Drawing 60A). Connect drive shafts at the flexible coupling. To ensure constant velocity of the universal joints the crosshead pins of the single joint must be parallel with those in the double joint. Tighten up bolts using a 'Blocfort' type washer under heads.	Spanner 1832-T Flat spanner 14
20	Fit the engine flywheel (position located by an offset bolt). Fit lockwasher, tighten nuts to a tension of 2.500 mkg., plus 0.250 mkg., minus 0 mkg. (18 foot pounds, plus $1\frac{3}{4}$ foot pounds, minus 0 foot pounds). (Use torsion wrench 2470-T, see Drawing 18). Turn back lockwasher tabs against flats of nuts.	Torsion wrench 2470-T and socket 14
21	FIT THE CLUTCH (see Drawing 27) (a) Make certain that the thrust faces on the flywheel, intermediate pressure plate and clutch pressure plate are in perfect condition. Ensure that the intermediate pressure plate slides freely between the flywheel driving studs. Mark the position which gives the best result for re-assembling.	

	(b) Fit the intermediate pressure plate retaining spring (1) between two flywheel driving studs (see fig. 6). Fit the first clutch disc (2), with offset hub, positioned according to fig. 1. Fit the intermediate pressure plate in the position previously marked (see paragraph 21a). Offer up the second clutch disc (3), flat type, positioned according to fig. 1. To centre the clutch discs in relation to the flywheel bearing use a mandrel or spare gearbox mainshaft. Fit the clutch so that markings on plate and flywheel register. Fit bolts (4), with spring washers under heads, and tighten to a tension of 2 mkg., plus 0.250 mkg., minus 0 mkg. ($14\frac{1}{2}$ foot pounds, plus $1\frac{3}{4}$ foot pounds, minus 0 foot pounds. During tightening make certain that the mandrel (or mainshaft) slides freely and so indicating correct centering of discs. Remove the mandrel and toggle clamps MR.3451.	Shouldered mandrel, small dia. 17, length 25, large dia. 21, length 300. Brace spanner 12
	(c) Fit the clutch fork, with thrust ring assembled, SO THAT GRAPHITE BUSH FACES THE TOGGLE THRUST RING, and the end of the double lever is in front of the outer locking lever.	
	(d) Engage the gearbox mainshaft by turning by hand to engage the splines. Fit the shaft retaining spring circlip by using a pair of round nose pliers.	
22	Fit the clutch housing cover. Coat the threads of the three forward fixing bolts and the flange face in the corresponding zone with Hermetical. Fit bolts, with spring washers under heads, and tighten. AFTER TIGHTENING, MAKE SURE THAT THE CLUTCH FORK SHAFT TURNS FREELY.	Universal joint spanner 17
23	Stick the front bearing cap paper gasket to the gearbox flange with Hermetical. Fit the front bearing cap, WITH THE SHIMS REMOVED DURING DISMANTLING. Coat the bearing cap flange with Hermetical, fit, and tighten fixing screws.	Brace spanner with extension 12
24	ADJUST CLUTCH TOGGLE CLEARANCE (see Drawing 126) (a) Bring the clutch fork thrust ring (206) into contact with the clutch toggle thrust ring (205) and keep in this position with the clutch fork.	
	(b) Screw the adjusting stud (207) to give a clearance "a" of 27.5 mm. between the end of the double lever (208) and the stop on thrust plate (209). Tighten the locknut of stud (207). Hook on return spring (210).	Flat spanner 17
	(c) Connect the clutch cable and adjust length so that there is 15 mm. to 20 mm. idle movement on the pedal before clutch fork thrust ring (205) operates against toggle thrust ring.	Flat spanner 14
25	Fit the dynamo and tighten nuts after fitting plain washers and spring washers under each. Adjust the driving belt without excessive tension. Fit the speedometer cable.	Flat spanners 10-17
26	Fit the assembly of radiator and front bumper brackets. Tighten nuts fixing bumper brackets	Spanner 1880-T

	after fitting a plain washer and a spring washer under each. Using a spring washer under each, fit the four nuts on front axle cradle studs and tighten up. (Use spanner 1880-T). Position the radiator on the bumper bracket tie bar in order to line up the starting handle opening with the front bearing cap. Tighten 'U' bolts fixing radiator to tie bar. Tighten radiator upper fixing plates. Fit and tighten radiator hose clips. After making sure that the drain tap is closed, fill the radiator with water.	Universal joint spanner 17 Flat spanner 17 Box spanners 10-14-17
27	Train the group of headlamp and horn wires along the engine front bearer tube and use clips to keep them in position. Connect the two earth wires under one bolt of each bumper bracket.	Flat and box spanners 14
28	Fit the assembly of wings and radiator shell. Fit a plain washer and spring washer under the heads of all the fixing bolts and engage the latter for a few threads only. Offer up the bonnet and line up parts in relation to one another, and after correctly positioning the wing piping, tighten the fixing bolts. Take off the bonnet.	Flat spanner 14 Box spanners 10-12-14
29	Connect wiring to horns, headlamps, dynamo, and battery positive terminal.	Flat spanners 8-12-14
30	Fit the air intake silencer. Use a Hugo-Reintz gasket between the upper flange of the carburettor and the air intake tube (4) (see Drawing 23). Tighten the screws. Tighten fixing plates fitted between two rubber washers. Tighten up nuts and fit split pins.	Flat and box spanners 12
31	Lower the vehicle to the ground. (Use jack attachment MR.3300-90, see Drawing 67).	Attachment MR.3300-90
32	Fill gearbox with oil (3.5 litres - 6 pints). USE EXCLUSIVELY SPECIAL OIL FOR HYPOID AXLES (oil similar to Mobiloil GX).	Flat spanner 21
33	Fit the bonnet.	

1	Drain oil from gearbox.	Adjustable spanner 50
2	Place the gearbox on a stand. (Use stand MR.3053-10, see Drawing 121).	Stand MR.3053-10
3	Remove bolts fixing caps (211) of differential shafts. Disengage caps with shafts and coupling flanges assembled. Tap the back of the coupling flanges (212) with a copper mallet to free differential shafts for removal (see Drawing 133).	Brace spanner 12
4	Remove box forming differential bearing cap and remove differential from gearbox.	Brace spanner 17
5	Remove gearbox mainshaft bearing cap forming starting handle guide (201), the bearing cap (213) for gearbox intermediate shaft, and the oil pump (214). Take off clutch fork cover and the gearbox cover. Remove the oil filter (215) (see Drawing 122).	Brace spanner with extension 10-12
6	Remove the locking spring retaining plate and take out the spring and the ball (216). Take out split pin (219) limiting the stroke of the locking rod and move rod (220) towards the rear end of the gearbox to free the second locking ball (217) (see Drawing 126).	Box spanner 8
7	Unscrew selector fork locking bolts (221), disengage second and top speed selector fork shaft (222) and remove the fork. Disengage first and reverse speed selector fork shaft (223), the third locking ball (218), and the first and reverse speed selector fork. Remove the safety locking plunger (224).	Box spanners 10-12
8	REMOVE THE INTERMEDIATE GEAR TRAIN (see Drawing 122) (a) Knock out plug (225) by using a pin passing through the bore of the intermediate shaft.	Pin 10 dia., length 300
	(b) Remove split pin and take off rear nut (226) holding the shaft by the nut (279) at the front. (Use spanner 1731-T, see Drawing 127, fig. 2).	Spanner 1731-T Elbow spanner 42
	(c) Remove shaft and the front bearing from the gear train through the front of the box. If shaft is difficult to remove tap the rear end with a copper mallet.	
	(d) Take out gear train (229) from box.	
9	REMOVE THE BEVEL PINION (FORMING LAYSHAFT) (see Drawing 122). (a) Remove nuts (230) locking bearing cage retainers. Remove washers (231) and retainers (232).	Brace spanner 17
	(b) Remove the assembly of layshaft and pinions from the rear of the gearbox by tapping the shaft front end with a mallet. The first speed gear ring (233) remaining in the box. Next take out	

	first speed gear ring.	
10	Take out gear train of primary shaft from the box. (If necessary, use extractor MR.3404, see Drawing 129, figs. 1 and 2).	Extractor MR.3404
11	REMOVE THE REVERSE GEAR TRAIN (see Drawing 125) (a) Unscrew locknut (234) and take out reverse gear shaft thrust plug (235). (Use screwdriver MR.3458, see Drawing 128, fig. 2).	Screwdriver MR.3458 Elbow spanner 35
	(b) Withdraw the reverse gear shaft (236). (Use extractor MR.3459, see Drawing 129, figs. 1 and 3).	Extractor MR.3459
	(c) Disengage pinion (237) and thrust washer (238) from the box.	
12	Remove the rear bearing (239) of the intermediate shaft from its seating in gearbox. Remove front and rear circlips (240). Remove the oil duct plug and the two covers of the gearbox air inlet orifices. (See Drawing 122).	Brace spanner 12-14
13	DISMANTLE THE BEVEL PINION (FORMING LAYSHAFT) (see Drawing 123, fig. 1) (a) Hold the assembly in a vice. (Use clamps MR.3407, see Drawing 130, figs. 1 and 2).	Clamps MR.3407
	(b) Remove bearing locknut (241). (Use spanner 1734-T, see Drawing 127, fig. 3). Grip the shaft on flats at end. (Use spanner 1733-T, see Drawing 127, fig. 4).	Spanners 1733-T and 1734-T
	(c) Remove bearing (242) from shaft. (Use extractor 1750-T with collets 1753-T, see Drawing 37). Remove thrust washer (243), top speed pinion (244), spacing washer (245), and synchromesh (246).	Extractor 1750-T Collets 1753-T
	(d) Remove the second speed pinion (247). To do this, press down with a small thin screwdriver, the locking plunger (248) which is visible in a spline of the front thrust washer (296). Turn the thrust washer to bring its splines to coincide with those in the shaft. Remove the thrust washer KEEPING THE PINION (247) IN POSITION ON THE SHAFT. Take out the locking plunger (248) and its spring. AT THIS POINT ONLY remove the pinion (247), and afterwards, the washer (295). NOTE. THIS ORDER OF DISMANTLING MUST BE RIGIDLY ADHERED TO because if the pinion is slid along the shaft with the washer without removing the plunger, the latter, under pressure of its spring, will jam between the two pinion bushes. IT WILL NOT THEN BE POSSIBLE TO REMOVE THE PINION FROM THE SHAFT.	
	(e) Take out split pin and remove slotted ring nut (249) locking bearing. (Use spanner 1757-T, see Drawing 128, fig. 6). Disengage bevel pin from bearing cage. (Take care not to disperse the rollers).	Spanner 1757-T

	(f) Remove screw (250) locking bearing locknut (251). Remove bearing lock nut (251). (Use spanner 1734-T, see Drawing 127, fig. 3).	Spanner 1734-T
	(g) Remove the bearing inner races from the bevel pinion shaft by means of a press. (Use socket MR.3460, see Drawing 131, figs. 1 and 2).	Socket MR.3460
14	DISMANTLE THE DIFFERENTIAL (see Drawing 133) (a) Extract the tapered roller bearings. (Use extractor 1750-T with collets 1753-T, see Drawing 37).	Extractor 1750-T Collets 1753-T
	(b) Cut the locking wire of the assembly bolts and remove crown wheel from differential housing.	Universal joint spanner 19
	(c) Remove planet wheels (252), satellite wheels (253), and spindle (254) from housing.	
15	DISMANTLE MAINSHAFT PINION (see Drawing 124) (fig. 1) (a) Hold the assembly on an old mainshaft gripped in a vice and remove successively the nuts (255 and 256). (Use spanner 1732-T, see Drawing 127, fig. 1).	Spanner 1732-T
	(b) Remove bearing (257). Do this in a press with the ram bearing on the front end of the mainshaft and with two plates or a socket fork bearing behind outer race of bearing.	
	(c) Remove the rear bearing (258). Do this in a press with the ram bearing on the rear end of the pinion spigot and the bearing resting on two steel plates, 7 mm. thick, fitted between pinion and bearing.	
16	DISMANTLE DIFFERENTIAL SHAFTS AND CAPS (see Drawing 133). (a) Remove coupling flange (212) from shaft.	Universal joint spanner with socket 26
	(b) Remove shaft (259) from bearing (260) by means of a press.	
	(c) Remove bearing locknut (261). (Use spanner 1758-T, see Drawing 128, fig. 1). Take out bearing (260) from cap (it is easily removed).	Spanner 1758-T
	(d) Knock out oil seal (S.P.I. joint) from cap.	
17	DISMANTLE THE OIL PUMP (see Drawing 123, fig. 2). (a) Take off pump cover (263), speedometer cable socket (264), and take out drive pinion.	
	(b) Take out the pump impeller blade, remove speedometer drive worm circlip (266), and remove	

	worm (267) by knocking out the spindle (268) from the pump body. Take out key (269) from its recess.	
18	DISMANTLE THE SYNCHROMESH (a) Wrap the synchromesh assembly in a cloth to prevent dispersal of balls and springs when dismantling.	
	(b) Disengage synchromesh hub by pressing out by hand.	
19	DISMANTLE GEARBOX COVER (see Drawing 134). (a) Take off outer selector levers (270 and 271). Disengage inner levers (272 and 273) from cover.	Box spanner 12
	(b) Take off inner locking lever (274) and disengage outer lever (275) from cover (see Drawing 126)	Flat spanner 12
	(c) Remove the oil filler plug.	Box spanner 21
	(d) Knock out bushes (276) from inner lever (273). (Use a shouldered mandrel).	Mandrel, small dia. 16 large dia. 18, length 150
	(e) Knock out bushes (277) from cover. (Use a shouldered mandrel).	Mandrel, small dia. 24 large dia. 26, length 150
20	Remove front bearing (278) from intermediate shaft (see Drawing 124, fig. 2) by unscrewing nut (279). (Use spanner 1731-T, see Drawing 127, fig. 2). Remove shaft (228) from bearing by means of a press.	Spanner 1731-T
21	DISMANTLE REVERSE GEAR TRAIN (see Drawing 125) (a) Remove metal from the nut punched into the two pinion slots either with an awl or small punch.	
	(b) Unscrew nut (280) with a hammer and chisel. The nut must be replaced by a new one after each dismantling.	
	(c) Take out bearings (281 and 282) from the pinion (these are readily removed), and the distance piece (283).	
22	Remove differential nut covers. Remove locking plates (284) of differential nuts. (See Drawing 133, fig. 2).	Brace spanner 12
23	Remove gearbox casing from stand.	

24 Clean the parts.

ASSEMBLING GEARBOX

IMPORTANT NOTE. IN CASES WHERE THE PINION BUSHES ARE WORN IT IS NECESSARY TO REPLACE THE PINIONS. IT IS ESSENTIAL FOR THE BORE OF THE BUSHES TO BE EXACTLY CONCENTRIC WITH THE PINION PITCH DIAMETER. THE MANUFACTURE OF THESE PARTS IS SUCH THAT THE BORE OF THE BUSHES IS NOT CONCENTRIC WITH THE PINION PITCH DIAMETER. We give herewith a method to be strictly adhered to when replacing bushes.

Set up the pinion to be rectified on a mandrel FITTING THE WORN BUSH. (In the case of excessive ovality the pinion cannot be rectified).
True up the outside diameter of the pinion.
Remove the mandrel and change the bushes.
Centre the pinion in lathe using the rectified portion as a basis for concentricity.
Use lathe tool to bore the bushes.

25 PREPARE INTERMEDIATE REVERSE GEAR TRAIN (see Drawing 125)
(a) Fit bearing (281) into pinion, using a press if necessary.

(b) Fit distance piece (283) and bearing (282).

(c) Screw up and lock nut (280). (Use spanner MR.3461, see Drawing 128, fig. 3).
Use a chisel or punch to force metal from the nut into the two slots in the pinion..

26 PREPARE MAINSHAFT PINION (see Drawing 124, fig. 1)
(a) Fit bearings (257 and 258) to pinion with the aid of a press.

(b) Fit oil retaining washers and then lock washers on spigot ends of pinion. Engage tongues of lock washers into grooves and screw on nuts (255 and 256).

(c) Mount the assembly on an old mainshaft and hold the latter in a vice in order to prevent damage to the pinion teeth. Tighten nuts (255 and 256). (Use spanner 1732-T, see Drawing 127, fig. 1). Turn back lockwasher tabs against flats of both nuts. — Spanner 1732-T

27 PREPARE THE INTERMEDIATE SHAFT (see Drawing 124, fig. 2)
Fit washer (286) to shaft. By means of a press fit bearing (278). Grip the shaft in a vice, tighten nut (279) to a tension of 10 mkg. ($72\frac{1}{2}$ foot pounds), and fit split pin. (Use spanner 1731-T, see Drawing 127, fig. 2). — Spanner 1731-T

28 PREPARE SYNCHROMESH (see Drawing 135)

(a) Use modified synchromesh ring MR.3464 (fig. 4) — Tool MR.3464

(b) Place springs (287) in position. Fit synchromesh hub (288) in tool MR.3464. Engage the balls (289). Push the hub down until balls lock.

NOTE. THE SYNCHROMESH HUB AND RING ARE MARKED ACCORDING TO MACHINING. THE MARKING SYMBOL + IS STAMPED ON THE FACE NEAREST THE SELECTOR FORK GROOVE. WHEN RE-ASSEMBLING THE MARKINGS MUST COINCIDE IN ORDER TO ENSURE CONCENTRICITY OF THE TWO PARTS AND CORRECTLY LOCATE THE SYNCHROMESH CONES (THE TWO CONE ANGLES DIFFER).

(c) Place the assembly as made in paragraph 28(b) on synchromesh ring (290) previously oiled. Keep the parts together, to prevent the balls escaping, and slide the hub (288) right into the ring (290).

29 PREPARE THE BEVEL PINION (see Drawing 123, fig. 1)

(a) Fit bearings (291 and 292) and cage (293). Proceed as follows:-

1. Fit to bevel pinion (294), the inner race "b" of roller bearing (291) and then the inner race of thrust bearing (292), by means of a press.

2. Tighten bearing locknut (251) and lock the nut with screw (250). (Use spanner 1734-T, see Drawing 127, fig. 3). — Spanner 1734-T, Flat spanner 7

3. Hold the cage (293) in a vice. (Use clamps MR.3407, see Drawing 130). Tighten vice moderately only to prevent distorting cage. — Clamps MR.3407

4. Hold the bevel pinion vertically, the pinion end at the top. Position half ring "a" of thrust bearing (292). Stick in place with a little grease the rollers of bearing (291) to the inner race "b", and fit the outer race "c" over the rollers.

5. Introduce the assembly into cage (293). Fit the second half ring "d" of the thrust bearing (292) and tighten nut (249). (Use spanner 1757-T, see Drawing 128, fig. 6). Fit the split pin and FORCE THE HEAD WELL INTO THE HOLE IN THE CAGE SO THAT IT DOES NOT STAND PROUD. Open out ends of pin.

(b) FIT AND ADJUST SECOND SPEED IDLER PINION (see Drawing 123, fig. 1)

1. Fit second speed pinion adjusting washer (295) on shaft (the grease grooves on the pinion side). Fit second speed pinion (247) and the splined front thrust washer (296) turning the latter so that it is locked by the shaft splines.

2. Use feeler gauges to measure the clearance between washer (295) and the pinion. The clearance should be between 0.05 mm. and 0.15 mm. and is arrived at by using a washer (295) — Set of feeler gauges

from the range sold by our Spare Parts Department.	
3. After this adjustment remove the splined washer (296) and the second speed pinion (247). Fit the locking plunger spring and refit the second speed pinion (247) after oiling. Fit the locking plunger (248) in position.	
4. Fit splined front thrust washer (296) on shaft and against locking plunger. Press down the locking plunger with a small pin introduced in the hole in the tapered portion of the second speed pinion. Bring the splined washer (296) over the groove in the shaft and turn it so that the locking plunger (248) locates in the wide slot of the washer.	Pin 2.5 dia.
(c) FIT THE SYNCHROMESH, TOP SPEED IDLER PINION, ADJUST THE LATTER (see Drawing 123, fig. 1).	
1. Fit synchromesh, without first and reverse speed gear ring, on shaft and locating against the second speed pinion. NOTE. The shaft (294) bears a symbol on the portion which carries the top speed idler pinion (244). Fit the synchromesh so that the symbol + , marked on its face, lines up with the marking on the shaft.	
2. Fit the spacing washer (245) (grease grooves on pinion side) against shoulder on shaft and located on the peg "e".	
3. Fit top speed idler pinion (244) on shaft. Fit thrust washer (243) with grease grooves against pinion.	
4. For easy determination of the adjustment, use a tube equal in thickness to, and in place of bearing (242).	Tube 26 inside dia., 25 long
5. Fit the tube on the shaft, screw on nut (241), and tighten to an approximate tension of 15 mkg. (108½ foot pounds). (Use spanners 1734-T and 1733-T, see Drawing 127, figs. 3 and 4).	Spanners 1734-T and 1733-T
6. Use feeler gauges, measure the clearance between washer (243) and the pinion. This clearance must be between 0.20 mm. and 0.25 mm. From the range of spacing washers (245) sold by our Spare Parts Department, choose one of the necessary thickness to provide for the correct clearance between washer (243) and pinion (244).	Set of feeler gauges
7. After obtaining the correct adjustment, oil and finally fit the top speed idler pinion (244). Fit thrust washer (243). Fit bearing (242) to shaft by means of a press and a piece of tubing. (Assembling the bearing by knocking into position can cause the spacing washer (245) to jump off the locating peg "e".	Tube 26 inside dia., 100 long.

	8. Hold the assembly in a vice using clamps MR.3407 (see Drawing 130), fit lockwasher on end of shaft with tongue engage in shaft groove. Screw on nut (241) and tighten to a tension of 15 mkg. (108½ foot pounds). (Use spanners 1734-T and 1733-T, see Drawing 127, figs. 3 and 4). TURN BACK ALL LOCKWASHER TABS against flats of nuts.	Spanners 1734-T and 1733-T
	9. Remove the assembly from vice.	
30	PREPARE THE DIFFERENTIAL (see Drawing 133) NOTE. As the differential housing, planet and satellite wheels are precision machined, these parts can be fitted without the need of adjustment (tooth meshing or clearance). As it has not been possible to foresee the amount of wear in the assembly over a long period of use, we have not been able to determine sizes of packing washers that might be needed to take up any play that could possible occur.	
	(a) Hold the differential housing in a vice.	
	(b) Oil the satellite pinions and shaft (254).	
	(c) Mount planet wheel (252) and two satellite wheels (253) in the housing, press in the shaft (254), positioned so that the hole "f" lines up with the hole for locking screw (297).	
	(d) Turn the planel wheel by the shaft and make sure there are no high spots in the meshing. If there is tightness, find which satellite wheel has no tooth clearance and replace it. Make sure that the new wheel gives free rotation. If the high spot remains it may be caused by the planet wheel. In this case try another planet wheel.	
	(e) Mount the second planet wheel in the housing. Fit the crown wheel and tighten assembly bolts to a tension of 7.5 mkg. (54½ foot pounds). Turn the planet wheel and if high spots are present try another.	Universal joint spanner 19
	(f) Lock the bolts assembling the crown wheel with iron wire fitted so as to prevent any chance of loosening.	
	(g) Fit the taper roller bearings using a press. (Use mandrel MR.3463, see Drawing 133, fig. 3).	Mandrel MR.3463
31	PREPARE DIFFERENTIAL BEARING CAPS AND SHAFTS (see Drawing 133) (a) Fit the oil seal (262) in cap (211) by using a press. The leather rim of the oil seal faces towards the inside of the cap.	
	(b) Use a press to fit bearing (260) on shaft (259).	

	(c) Fit shaft with bearing assembled into cap (if necessary tap the end of the shaft with a mallet to complete the fitting).	
	(d) Tighten bearing locknut (261). (Use spanner 1758-T, see Drawing 128, fig. 1). Lock the nut (261) by using a chisel to punch some of the nut threads into the cap groove.	Spanner 1758-T
	(e) Fit coupling flange (212) on shaft. Fit thrust washer (298) by centering in the recess in the flange. Hold the flange in a vice and tighten nut to a tension of 20 mkg. (144 foot pounds). Secure nut with a split pin.	Universal joint spanner with extension 26
32	PREPARE THE OIL PUMP (see Drawing 123, fig. 2). (a) Place key (269) in shaft (268). Oil shaft and engage it in pump body. Fit the impeller (265) so that front edge marked "AV" is located according to fig. 2).	
	(b) Fit pump cover with a paper gasket, coated with Hermetical, under. Tighten fixing bolts fitted with spring washers under the heads.	Box spanner 12
	(c) Fit the speedometer drive worm (267) making sure that the key has not slipped out of the shaft meanwhile. Fit circlip (266).	
33	PREPARE THE GEARBOX COVER (see Drawing 134). (a) Fit bronze bushes (277) in bore in cover. (Use a shouldered mandrel).	Mandrel, small dia. 24, length 20 large dia. 26, length 130
	(b) Fit bronze bushes (276) in bore of first and reverse speed selector fork lever (273). (Use a shouldered mandrel).	Mandrel, small dia. 16 length 20 large dia. 18 length 130
	(c) Oil and fit levers (272 and 273). Provisionally fit the outer levers (271 and 270). (The position of these levers will be determined when the cover is fitted to the gearbox).	
	(d) Fit lever (275). Fit gear lock control lever (274), tighten the nut, turn back tabs of lockwasher (see Drawing 126).	Flat spanner 12
	(e) Provisionally screw in oil filler plug using a C. and A. washer under.	
34	Place the gearbox casing on stand MR.3053-10 (see Drawing 121, fig. 1).	Stand MR.3053-10
35	Fit circlips (240) for retaining intermediate shaft bearings in box (see Drawing 122).	
36	Fit intermediate shaft rear bearing (239) in box. Tap the bearing outer race lightly, with a	

	copper mallet, until bearing rests against the circlip (240).	
37	FIT THE INTERMEDIATE REVERSE GEAR TRAIN (see Drawing 125) (a) Oil the shaft (236).	
	(b) Offer up the reverse gear train in the box, position thrust washer (238) and hold it in place with the gear train.	
	(c) Fit the shaft (236) and turn it by hand to engage it in the thrust washer (238). The shaft has a chamfer at the end). Complete the fitting of the shaft by screwing in the plug (235). (Use screwdriver MR.3458, see Drawing 128, fig. 2). Fit on the plug the double tabbed lockwasher. Turn one tab against stop of gearbox. Screw on nut (234) and tighten. Turn back second lockwasher tab against flat of nut.	Screwdriver MR.3458 Elbow spanner 35
38	FIT THE MAINSHAFT GEAR TRAIN (see Drawing 122). (a) Oil the bearings.	
	(b) Offer up the assembly squarely with the gearbox bore and push in until it comes against the stop. If necessary, use a mallet to drive the assembly into position.	
39	FIT AND ADJUST THE POSITION OF THE BEVEL PINION (see Drawing 122) NOTE. THE ADJUSTING OF THE BEVEL PINION POSITION IS OF VERY GREAT IMPORTANCE. By giving the teeth correct meshing, silence and long service is assured.	
	(a) Etched on the bevel pinion face is a dimension (in millimetres) see Drawing 136, fig. 3) indicating the height of the bevel apex determined during machining. (The figure represents the distance "h" between the differential centre line and the end face of the bevel pinion).	
	(b) Fit the layshaft assembly (as prepared according to paragraph 29) in the box. On each fixing stud fit a retainer (232) and a thrust washer (231). Screw on and tighten nuts (230).	Brace spanner 17
	(c) Set up the apparatus 2040-T (see Drawing 136, fig. 1), establishing the dimension "h". Fit shims, chosen from the range listed by our Spare Parts Department, between the cage (293) and the box so that the measured dimension "h" is the same as that etched on the pinion. The adjustment must be made with the greatest precision, THE PART OF THE DIMENSION IN HUNDREDTHS OF A MM. MUST BE RIGIDLY OBSERVED. This justifies the use of a clock gauge SET UP ON A FIXTURE MOUNTED IN THE BORES OF THE DIFFERENTIAL BEARINGS. Do not measure from the flanges of the box as the machining tolerance here is several tenths of a millimetre.	
	(d) After establishing the correct adjustment, remove the layshaft assembly from the box.	

	To ensure concentricity when assembled, the first and reverse speed gear ring and the synchromesh are marked to indicate correct fitting. BOTH PARTS ARE CORRECTLY ASSEMBLED WHEN THE MARKINGS COINCIDE. Having determined the positioning of the parts, use chalk to mark the teeth of both items so they can be correctly mated on assembly. (On certain vehicles the parts are not marked).	
	(e) Offer up the layshaft assembly, with shims (299) fitted on cage (293), in bore of box. Introduce into the box, by way of the gearbox cover opening, the first and reverse speed gear ring, and engage it on the synchromesh. The teeth must mesh correctly in the way already determined and indicated by the chalk marks. Complete the fitting of the layshaft assembly by tapping the end of the bevel pinion with a mallet.	
	(f) On each fixing stud fit a retainer (232) and thrust washer (231). Tighten nuts (230) and secure with split pins.	Universal joint spanner with extension 17
40	FIT THE INTERMEDIATE GEAR TRAIN (see Drawing 122) (a) Engage the intermediate gear train (229) in the box, by inserting through cover opening, and hold in line for fitting shaft.	
	(b) Fit shaft (228) (prepared according to paragraph 27) through front end of box and in gear train (229). Use a mallet to tap the front end until front bearing rests against circlip (240).	
	(c) Hold the front nut (279). (Use spanner 1731-T, see Drawing 127, fig. 2). Tighten rear nut (226) and secure with split pin.	Spanner 1731-T Elbow spanner 42
41	FIT THE DIFFERENTIAL, ADJUST TOOTH CLEARANCE (see Drawing 136, fig. 2 and Drawing 133) (a) Read on the face of the pinion the dimension, expressed in hundredths of a millimetre, indicating the bevel pinion and crown wheel tooth clearance to be realised by adjustment (see fig. 3).	
	(b) Offer up the differential in housings in box with bearings fitted with outer races. Place bearing locknuts (300) on threads of bores in gearbox and against bearing outer races. Make sure that the threads are correctly engaged and that the locating dowels are fitted properly in the box. Coat the flange faces of the box and cover with Hermetical. Fit the differential box. Fit a spring washer on each stud, screw on nuts but do not tighten.	Universal joint spanner 17
	(c) Mount a clock gauge. (Use clock gauge bracket 2041-T, see Drawing 136, fig. 2).	Clock gauge bracket 2041-T
	(d) Tighten the two bearing locknuts (300). (Use spanner 1751-T, see Drawing 138). Unscrew nuts a quarter of a turn, and then screw up the one which will give the tooth clearance figure etched on the bevel pinion face. The clearance is measured by the clock gauge on the outside diameter of the crown wheel and tangentically to the flank of a tooth. Make four readings,	Spanner 1751-T

	spaced at approximately 90°, and take the average of the four. The difference between any two readings must not exceed 0.1 mm. Remove the clock gauge bracket.	
	(e) The Timken bearings must be fitted with slight clearance. Without altering the adjustment, screw up the second nut (300) and then unscrew one notch (equivalent to approximately 5 mm. on the outer circumference of the nut). (Use spanner 1751-T, see Drawing 138).	Spanner 1751-T
	(f) Finally tighten nuts of differential box.	Universal joint spanner 17
	(g) On the differential box, coat the lock plate (284) and closing plate (301) seating faces with Hermetical. Fit paper gaskets, and also coat the seating faces of the plates with Hermetical. Fit the lock plates by positioning the locking peg in one of the bearing locknut (300) castellations. Fit the closing plate (301). Coat the threads of the fixing screws with Hermetical and tighten screws after fitting spring washers under heads (see Drawings 122 and 133).	Universal joint spanner 12
42	FIT THE DIFFERENTIAL SHAFTS (see Drawing 133) (a) Coat the flanges of the differential shaft bearing caps and the corresponding flanges on the box with Hermetical. Fit paper gaskets to the caps.	
	(b) Engage differential shafts in planet wheels, fit spring washers under heads of bearing cap fixing bolts, and tighten.	Universal joint spanner 12
43	Coat the outer circumference of the intermediate shaft plug (225) with Hermetical and fit in place in box (see Drawing 122). (Use mandrel MR.3428, see Drawing 127, fig. 5).	Mandrel MR.3428
44	FIT AND ADJUST SELECTOR FORKS. ADJUST POSITION OF SYNCHROMESH (see Drawing 126) NOTE. Some gearboxes have been built with locking rods (220), having an adjusting screw at one end. This screw is intended for adjusting the length of the rod to obtain positive locking of the forks. At present the locking rods are of a fixed length and have no adjusting screw.	
	(a) If the locking rod has an adjusting screw, engage the rod in its bore in the gearbox and push right in until the head of the adjusting screw bears against the gearbox wall. By operating the adjusting screw obtain a sufficient length of rod to give a dimension at "i" of 16.5 mm. plus or minus 0.5 mm. (see Drawing 126) between the flange of the box and the end of the rod. After adjusting tighten locknut of screw.	Flat spanner 10
	(b) If the locking rod has no adjusting screw, oil the rod and fit into gearbox so that the front end of the rod "k" is flush with face "j" of the gearbox flange.	
	(c) Fit ball (218) in position by inserting it by way of the bore for the second and top speed selector fork shaft (222).	

(d) Fit the first and reverse speed selector fork (202) in the groove of the first and reverse speed gear ring carried by the synchromesh. Fit the second and top speed selector fork (303) in groove of the synchromesh. (The first and reverse speed gear ring and the synchromesh having previously been placed in the neutral position).	
(e) Oil the second and top speed selector fork shaft (222). Fit the shaft into its boring in the gearbox and force into place by fitting the short distance piece (304) (see Drawing 126 for location). Engage the shaft in the selector fork (303) and then in the long distance piece (305) positioning the latter as indicated on Drawing 126.	
(f) Fit the locking split pin (219) in the locking rod and open out ends. (The split pin is fitted to locking rods having no adjusting screw).	
(g) Fit the locking plunger (224) in position, using a little grease to hold it, by pushing it in with a 6 mm. diameter rod.	Rod 6 mm. diameter
(h) Fit ball (217) in place, using a little grease to hold it, by pushing it in with a 6 mm. diameter rod.	Rod 6 mm. diameter
(i) Oil the first and reverse speed selector fork shaft (223) and fit in gearbox. Force shaft into place by fitting the long distance piece (306) (see Drawing 126 for location). Engage the shaft into selector fork (302) and then in the short distance piece (307) positioning the latter as indicated on Drawing 126.	
(j) Fit ball (216) and its spring. Fit plate retaining the spring, tighten fixing bolt with a spring washer fitted under head.	Box spanner 12
(k) Tighten the pointed screw (221) fixing first and reverse speed selector fork (302). Lock the screw with wire SO AS TO PREVENT IT SLACKENING. Make sure that the wire does not foul BETWEEN THE SELECTOR FORK AND THE DISTANCE PIECES.	Flat spanner 10
(l) Adjust the position of the synchromesh.	
NOTE. The synchromesh has approximately 4 mm. clearance from the cones of the second and top speed pinions. This is necessary to prevent any possibility of friction between the cones when gears are in the neutral position. On the other hand, it is necessary to position the synchromesh at the mean point of its travel. Position the synchromesh according to the following operation (see Drawing 137).	
(m) Free the selector fork adjusting screw (221) and place the gear locking rod in the neutral position.	Flat spanner 10

By means of selector fork (303) slide the synchromesh towards the top speed pinion (244).
Using a caliper gauge, measure the distance "l" between the front face of the gearbox ("m") and the front inner wall of the throat of the selector, at "n" (see fig. 1). Say for example "l" = 84 mm.
Next, again by means of the selector fork (303) slide the synchromesh towards the second speed pinion (247).
Take a fresh dimension "p" between points "m" and "n", and say, for example, "p" = 88 mm.
The average of the two measurements is "l" + "p" divided by 2, say from the preceding examples 84 + 88 divided by 2 = 86 mm. This figure represents the distance from the front face of the box "m" to the front inner wall of the throat of the selector fork "n" when the synchromesh is at the mid-point of its travel.
Alter the position of the synchromesh, by turning the selector fork adjusting screw (one complete turn of the screw moves the synchromesh approximately 0.7 mm.), so as to obtain a dimension between points "m" and "n", measured with a caliper gauge, equivalent to l + p divided by 2 as in the preceding example, 86 mm.

(n) Engage successively top speed and then second speed. Make sure that in these positions the flanks of the synchromesh do not rub against the second and top speed pinions of the intermediate gear train. If there is fouling correct the positioning by the selector fork adjusting screw.

(o) Return gears to the neutral position. Turn the layshaft (294) and make sure that the synchromesh does not foul the second or top speed pinions (244 and 247). Lock the selector fork adjusting screws (221) with wire in such a way SO AS TO PREVENT ANY POSSIBILITY OF SLACKENING. Make sure that the wire does not FALL IN BETWEEN THE SELECTOR FORK AND DISTANCE PIECES.

(p) Adjust the second and top speed selector fork distance pieces (see Drawing 123, fig. 1 and Drawing 126). With the aid of a lever, push the synchromesh towards the top speed pinion (244) far enough to lock the shaft 222 with the ball. Lock the shaft by operating the locking rod. In this position, adjust the length of distance piece (304) so that the clearance between distance piece and face "r" of the gearbox is from 0.1 mm. to 0.2 mm. (Use two spanners 1780-T and one spanner 1781-T, see Drawing 128, figs. 4 and 5). — Spanners 1780-T and 1781-T
Withdraw the locking device. Push the synchromesh towards the second speed pinion (247) far enough for the selector shaft to be locked by the ball. Lock in position with the locking rod and adjust the length of distance piece (305) by the same method as before.

(q) Adjust the first and reverse speed selector fork distance pieces. (Operations are the same as for those of the second and top speed selector fork). — Spanners 1780-T and 1781-T

(r) Fit the selector fork shaft protecting plate. Coat the gasket with Hermetical, tighten fixing screws using spring washers under the heads. — Box spanner 10

45	FIT THE OIL PUMP (see Drawing 122) (a) Fit the cork gasket (308) on the filter (215) and engage the latter in the gearbox. (b) Stick the pump paper gasket on the face of the box with Hermetical. (c) Coat the exposed face of the gasket on the box with Hermetical. Turn the pump shaft (268) so that its slot is in line with the tongue on the end of the layshaft (294). Fit the pump. Coat threads of fixing screws with Hermetical and tighten up.	Universal joint spanner 12
46	FIT INTERMEDIATE SHAFT FRONT BEARING CAP (see Drawing 122) (a) Stick the paper gasket to the face of the box with Hermetical. (b) Make sure that the front bearing (278) is seating correctly against circlip (240) in the gearbox. (c) Measure the amount the bearing stands proud from the face of the gearbox. (Use a clock gauge mounted on bracket MR.3377, see Drawing 17, fig. 3). Place the straight edge on the bearing and let the finger of the gauge bear against the paper gasket previously stuck on the gearbox flange. (d) Measure the depth of the bearing housing in cap (213). (e) If the depth of the bearing housing is greater than the amount the bearing stands proud, choose adjusting washers from the range listed by our Spare Parts Department to take up the difference. Use grease to stick the washers in recess of cap. Fit cap (213). Coat the cap and the threads of the fixing screw with Hermetical. Tighten the screws.	Universal joint spanner 12
47	FIT MAINSHAFT FRONT BEARING CAP (201) FORMING STARTING HANDLE GUIDE (see Drawing 122). (a) Stick paper gasket to gearbox flange with Hermetical. (b) Make sure that the front bearing (257) is correctly positioned in the box. (c) Measure the amount the bearing stands proud, and the depth of its recess in cap (201) in the manner described in paragraphs 44(c) and (d). (d) Choose adjusting washers from the range listed by our Spare Parts Department to take up the difference in measurements. Use grease to stick the washers in the bearing cap (201). Provisionally fit the bearing cap (the final fitting is carried out after gearbox is connected to the engine).	
48	FIT THE GEARBOX COVER. ADJUST POSITION OF LEVERS (see Drawings 126 and 134) (a) Set the selector forks in the neutral position.	

	(b) Stick the paper gasket to the gearbox with Hermetical. Coat the cover flange with Hermetical Fit plain washers on bolts fixing the cover.	
	(c) Offer up the cover, engage inner levers (272 and 273) in selector forks, and control lever (274) in notch in gear locking rod (220). Fit the thrust bracket (209) (see Drawing 126) for the gear lock and the plate fixing locking rod return spring. Tighten bolts fixing cover. Hook on return spring.	Box spanner 12
	(d) Adjust the position of the outer control lever. With the selector forks in the neutral position, the centres of the holes "s" in the upper bosses of the levers must be 26 mm. plus or minus 4 mm. forward of a vertical line passing through the centres of the lower bosses of the levers. Tighten the lever clamp bolts fitted with spring washers under heads.	
49	Fit the oil circulation plug using a C. and A. gasket. Fit the two covers to the air inlet orifices.	Box spanner 12 and 14
50	Paint the unit.	
51	Remove gearbox from stand.	
52	Tighten the drain plug fitted with a C. and A. gasket.	Adjustable spanner 50

	REMOVING THE FRONT AXLE	
1	Remove the engine and gearbox assembly (see Operation 701, paragraphs 1 to 14).	
2	Block up the vehicle at a point under the scuttle pillars. (Use special jack head MR.3300-90) (Drawing 67).	Special jack head MR.3300-90
3	Take off the front wheels.	Wheelbrace
4	Disconnect track rods from axle pivot levers. (Use ball pin extractor 1964-T, see Drawing 69).	Universal joint spanner 21 Ball pin extractor 1964-T
5	Disconnect Lockheed pipes from unions on fixing plates on front axle cradle. Unscrew the nuts fixing the front axle cradle. (Use spanner 1880-T).	Spanner 1880-T
6	Unscrew the front torsion bar ball-headed adjusting screws. (Use spanner 2302-T). Remove circlips from rear end of torsion bars.	Spanner 2302-T
7	Remove the front axle from the four mounting studs. If necessary, use a large lever to assist the removal.	
	REFITTING THE FRONT AXLE	
8	Fit the torsion bars in the crossmember under engine (right hand bars have one paint identification mark and the left hand two) pushing them right through until they touch the hull closing plate. Fit circlip in the groove at rear end of bars. Fit also circlips at front end of bars.	
9	Oil the four front axle mounting studs on hull. Engage the front axle on the studs, guide the Lockheed brake pipes through the cradle, fit the upper centering bushes on mounting studs, fit spring washers under nuts and provisionally tighten the latter. (Use spanner 1880-T).	Spanner 1880-T
10	FIT THE TORSION BARS Using a large lever, lower one of the axle link arm and pivot assemblies in the limit permitted (approximately two splines), and engage the corresponding torsion bar in the forward splines (MAKE SURE THAT THE BALL HEADED ADJUSTING SCREW IS FULLY UNSCREWED AND IS BEARING ON THE ADJUSTING LEVER AT THE MOMENT THE TORSION BAR IS ENGAGED INTO FORWARD SPLINES). Carry out the same operation at the other side. Fit in place the circlips at the front end of the torsion bars.	
11	Connect Lockheed brake pipes.	Flat spanner 14

12	FIT TRACK RODS (see Drawing 71) Fit dust covers (5), with Belleville type washers and rubber washers, on tapers of track rod ball pins (4) (see fig. 4). Engage ball pins in tapered bores of axle pivot steering arms. Using feeler gauges, measure clearance "a" between lever boss face and the Belleville type washers. Fit at this point shims (6) to give a clearance of 0mm. to 0.25 mm. Tighten ball pin nuts and secure with split pins.	
13	Adjust brake shoes eccentric pins (see Operation 749, paragraph 2).	
14	Bleed the Lockheed brake system (see Operation 749, paragraph 5).	
15	Fit front wheels.	Wheelbrace
16	Fit engine in vehicle (see Operation 701, paragraphs 15 and 17 to 25).	
17	Adjust body heights under hull (see Operation 750, paragraphs 1, 2, and 3).	
18	Adjust weight distribution (see Operation 750, paragraphs 4, 5, and 6).	
19	Adjust caster angle (see Operation 748, paragraphs 1, 2, and 3).	
20	Adjust toe-out of axle (see Operation 748, paragraphs 4 and 5).	
21	Adjust steering lock (see Operation 748, paragraphs 6, 7, 8, and 9).	
22	Tighten slotted ring nuts (4) (see Drawing 139) locking upper link spindles (THE VEHICLE STANDING ON GROUND). (Use spanner 1861-T, see Drawing 50). Tighten nuts locking cradle on upper mounting studs (use spanner 1880-T).	Spanner 1861-T Spanner 1880-T
23	Fit the assembly of front wings and radiator shell (see Operation 701, paragraph 26).	
24	Connect wiring to headlamps, horns, dynamo, and starter motor (see Drawing 110). Fit battery and connect cables.	Box spanners 8-12 Flat spanner 14
25	Fit air intake silencer, using rubber washers on both sides of fixing plates. Tighten nuts and secure with split pins.	Flat spanner 12
26	Fit interior heater tube.	Flat spanner 12
27	Fit the bonnet.	

1	Fix the axle firmly in a suitable stand.	
2	Remove Lockheed brake pipes and brackets.	Flat spanners 10-14-17-19-21 Universal joint spanner 21
3	Take off the shockabsorbers.	
4	TAKE OFF HUB AND BRAKE DRUM ASSEMBLIES (a) Unscrew the slotted hub fixing nuts. (Use spanner 1810-T, see Drawing 46). The nut for the left hand hub is threaded right hand and the nut for the right hand hub left hand.	Spanner 1810-T
	(b) Unscrew the eight bolts (1) fixing bearing thrust plate (2). Use a box spanner passing through one of the holes "a" in the brake drum for this purpose.	Box spanner 14
	(c) Remove the transmission assembly from the drum by hand.	
	(d) Remove the brake drum. When it is difficult to remove, tap the hub from the inside. (Use mandrel MR.3436, see Drawing 48).	Mandrel MR.3436
5	Take off the brake back plate assemblies.	Universal joint spanner 17 Flat spanner 17 Box spanner 12
6	Take off the pivots by unscrewing the ball pin locking nuts (3). The stem of the ball pins is easily removed from the parallel bores of the upper and lower link arms.	Elbow spanner 29
7	TAKE OFF THE UPPER LINK ARMS (see Drawing 139). Unscrew the slotted nut (4) from the spindle (5). (Use spanner 1861-T, see Drawing 50). Withdraw the spindle. (Use extractor MR.3442, see Drawing 51).	Spanner 1861-T Extractor MR.3442
8	TAKE OFF THE LOWER LINK ARMS (see Drawing 140) (a) Remove the bolts (6) fixing silentblocs (187)	Universal joint spanner 17
	(b) Remove bolt (108) fixing splined shaft (see fig. 2)	Flat spanner 17
	(c) Knock out splined shaft (9). (Use mandrel MR.3432, see Drawing 48, fig. 1). Knock out shaft from second silentbloc.	Mandrel MR.3432
9	DISMANTLE THE BRAKE BACK PLATES (see Drawing 53) (dismantle both plates successively). (a) Remove the brake shoe anchor pins (10).	Universal joint spanners 17-21 Flat spanner 17

	(b) Unhook the brake shoe return springs.	
	(c) Remove bolts (11) fixing upper wheel cylinder.	
	(d) Take off the wheel cylinder outer plate (12), distance piece (13) between plates, and the two wheel cylinders assembled with connecting pipe.	
	(e) Clean off riveting and remove eccentric adjusting pins (15).	
10	Dismantle the wheel cylinders. (All parts can be removed by hand). Remove dust cover (16), piston (17), cup (18), and spring (19).	
11	Withdraw the hub bearing (47) (see Drawing 47). (Use extractor 1750-T with collets, ring, and block 1827-T, see Drawing 54). Take out bearing thrust plate (2) and from it remove the oil seal (20)	Extractor 1750-T Collets, ring and block 1827-T
12	DISMANTLE THE UPPER LINK ARMS (see Drawing 139) (a) Remove the eccentric pin (121), remove the front arm (23), and take out adjustment eccentric (by hand).	
	(b) Unscrew the pressure cap (124) for the ball pin spring. (Use spanner 1853-T, see Drawing 55). Take out spring (125) and upper bearing (126) of ball pin.	Universal joint spanner 17 Spanner 1853-T
	(c) Knock out the ball pin lower bearing (27). (Use mandrel MR.3431, see Drawing 48, fig. 3).	Mandrel MR.3431
	(d) Use a press to remove silentblocs (28). (Use sleeve and ram MR.3440, see Drawing 56).	Sleeve and ram MR.3440
13	DISMANTLE THE LOWER LINK ARMS (see Drawings 47 and 140) (a) By means of a chisel remove metal of nut (130) peened into grooves of link arm (the nut is replaced by a new one each time after dismantling).	
	(b) Unscrew bearing locknut (130). (Use spanner 1855-T, see Drawing 55). Take out ball pin (131) and lower bearing (132).	Spanner 1855-T
	(c) Prise out the expanding oil seal washer with a scraper. Remove the ball pin upper bearing by loading the bore with grease and sharply tapping in a good fitting bronze rod.	
	(d) Remove shockabsorber pin (34) by unscrewing nut (35).	Universal joint spanner 17

	(e) Take out jacking pad (36) forming distance piece by cutting away fillet of weld with a chisel. Remove bolt (37) assembling the two arms.	Universal joint spanner 17
	(f) Unscrew ball joint greaser (38).	Flat spanner 11
14	Remove steering arm (39) from pivot by unscrewing nut (40). (Use spanner 1863-T, see Drawing 55). Knock out the oil seal (41). (See Drawing 47).	Spanner 1863-T
15	Clean the parts.	
	ASSEMBLING FRONT AXLE	
16	PREPARE THE PIVOTS (see Drawing 47). (a)Fit steering arm (39). Use alcohol to clean grease from tapers of pivot bore and arm pin. Tighten nut (40) to a tension of 10 mkg. ($72\frac{1}{2}$ foot pounds). (Use spanner 1863-T, see Drawing 55). Secure nut with a split pin.	Spanner 1863-T
	(b) Fit the oil seal (41) in the pivot, the leather flange towards inside.	
17	PREPARE THE LOWER LINK ARMS (see Drawings 47 and 140) (a) Fit ball pin upper bearing (33) in bore in link arm. (Use mandrel MR.3431, see Drawing 48, fig. 3).	Mandrel MR.3431
	(b) Oil and fit the ball pin (131), fit ball pin lower bearing (132), and tighten the bearing locknut (130) to a tension of 0.3 mkg. to 0.5 mkg. ($2\frac{1}{4}$ to $3\frac{1}{2}$ foot pounds). The ball pin must rotate without play or evidence of high spots. (Use spanner 1855-T, see Drawing 55). Punch metal of the nut (130) into the two grooves in the link arm.	Spanner 1855-T
	(c) Coat the seatings of the expanding washer with Hermetical and fit into arm. Lock the washer by flattening with a hammer. Fit greaser (38).	
	(d) Connect the front and rear arms with the assembling bolt (37) and provisionally tighten the nut.	
	(e) Fit the jacking pad (36) forming distance piece. The pad must fit between the arms without play which would cause distortion when tightening up. The adjustment by means of a washer can only be made after the arm is assembled to the axle. Fit the shockabsorber pin (34) and tighten nuts (35 and 42) provisionally.	

18	PREPARE THE UPPER LINK ARMS (see Drawing 139) (a) Fit ball pin lower bearing (27) in bore of link arm by use of mandrel MR.3431, see Drawing 48 fig. 3.	Mandrel MR.3431
	(b) Oil and fit ball pin (143), fit ball pin upper bearing (126), spring (125), lock washer (146), and tighten pressure cap (124). (Use spanner 1853-T, see Drawing 55). Screw up adjusting bolt (147) and then slacken a quarter of a turn. Hold the adjusting screw and securely tighten locknut (148). (The movement of the ball pin measured during manufacture is from 0.2 mkg. to 0.3 mkg. ($1\frac{1}{2}$ to 2 foot pounds).	Spanner 1853-T Flat spanners 12-23
	(c) Fit silentblocs (28) in arms by means of a press. (Use sleeve and ram MR.3440 allowing the silentbloc bush to stand proud 7 mm., plus 0.6 mm., minus 0 mm. (see Drawing 56, fig. 2).	Sleeve and ram MR.3440
	(d) Assemble front and rear arms, oil and fit eccentric (122) in arm. Oil and fit pin (121) for eccentric, tighten nut with a spring washer fitted under.	Universal joint spanner 17
19	PREPARE HUB AND BRAKE DRUM ASSEMBLIES (see Drawing 47) (a) Replace the wheel studs. (Use fixture MR.3445, see Drawing 57). This fixture is necessary in order to ensure correct bearing of the drum when driving out studs and to prevent breaking the casting. NEVER COMPLETELY DISENGAGE THE HUB FROM THE BRAKE DRUM, REPLACE ONLY ONE OR TWO STUDS AT A TIME. Brake drums are trued up during manufacture with great precision and with the parts assembled. Faulty centering of the drum will cause the brakes to judder. Clinch in the wheel studs using a press of 8 to 10 tons capacity. (The studs may also be clinched over by hand using a hammer, though this method is not recommended.)	Fixture MR.3445
	(b) Drill hole for wheel stud dowel diametrically opposite to the old position. Make sure that dowel fits flush. Lock dowel with a centre punch.	
	(c) Fit oil seal (20) in bearing thrust plate (2) (the leather flange towards the inside). Place the bearing thrust plate on the hub and, by means of a press, fit bearing (47). (First lubricate the bearing with grease similar to Mobilgrease 5).	
	(d) True up the brake drum in a lathe. (Use mandrel MR.3441, see Drawing 58). THIS MANDREL CENTRES THE DRUM IN RELATION TO THE BEARINGS and not according to splined bore of hub. The maximum tolerance of ovality is 0.05 mm. Never increase the original diameter of 305 mm., plus or minus 0.1 mm., by more than 2 mm.	Mandrel MR.3441
20	PREPARE THE WHEEL CYLINDERS Use only alcohol or Lockheed fluid when cleaning the parts as any other substance will cause rapid deterioration of the rubber cups. Lubricate the cylinder and rubber cups with Lockheed	

	fluid before re-assembling. All items can be assembled by hand (see Drawing 53, figs. 2 and 3, for position of parts).	
21	PREPARE THE BRAKE BACK PLATES. (Assemble both plates successively, see Drawing 53).	
	(a) Fit connecting pipe (14), between upper and lower wheel cylinders, and pipe (48) from lower lower cylinder to axle pivot.	Flat spanners 12-17
	(b) Fit the eccentric adjusting pins (15) and peen over. (Use fixture MR.3444, see Drawing 59, figs. 1 and 2).	Fixture MR.3444
	(c) To the inner plate (49) fit the wheel cylinder assembly. Fit distance piece (13) and pins (50) for return springs. Fit the outer plate (12) and fit and tighten the two fixing bolts (11) of the upper wheel cylinder. Use spring washers under heads of bolts and under nuts. During tightening make sure that the holes in the distance piece and the plates are in line.	
	(d) Fit the brake shoes and eccentric bushes (51), previously oiled. Hook on the return springs (springs can be easily hooked on with a pair of universal pliers)	
	(e) Fit the assembly of plates and shoes on the brake back plate. Oil and fit the anchor pins (10) in the eccentric bushes (51). So that the eccentric bushes may be turned to adjust the brake shoes only tighten up the anchor pin nuts moderately. Fit the brake pipe protecting rubber washer (52).	Box spanner 17 Flat spanners 12-17
	(f) Fit the back plate on the pivot and tighten bolts with spring washers fitted under heads.	
	(g) Centre the brake shoes. (Use the checking fixture 2105-T and the adjusting spanner 2120-T, see Drawing 60). Tighten the anchor pin nuts using spanner 2121-T, Secure nuts with split pins.	Fixture 2105-T Spanner 2120-T Spanner 2121-T
22	FIT THE UPPER LINK ARMS (see Drawing 139)	
	(a) Turn up a pin with a pointed end.	Pin 35.8 mm. dia., 300 mm. long
	(b) Use grease to stick washers with studs (53) in the cradle.	
	(c) Offer up the arms to the cradle. Fit a thrust washer (155), distance piece (156), and a second thrust washer (155). Keep the parts in position with the pin turned with a pointed end. Determine the thickness of shims (157) to be placed between distance piece (156) and thrust washer (155) so that there is no end play and the arms have no play in the cradle. Choose	

shims (157) from the range sold by our Spare Parts Department (see Drawing 139).

(d) Remove the pin and the assembly of link arms, washers and distance piece.

(e) For easy assembly open out the cradle a few millimetres by means of a jack placed between the cradle inner flanges at a height where the arms are to be fitted.

(f) Finally fit the arms. To facilitate the operation engage the pin progressively while building up the parts. It is preferable to divide up the shims (157) selected on each side of the distance piece so that the arms are centralized in the cradle. Remove the jack and withdraw the pin.

(g) Fit the upper link spindle (5) and screw on spindle nut (4) without tightening. (Use spanner 1861-T, see Drawing 50). The final tightening will be made with the axle fitted to the car after the adjustment of body heights. This is in order to equalize the angular loading of the silentblocs. — Spanner 1861-T

(h) With a straight edge placed on the rear face of the collar "m", measure the distance "b" (see Drawing 139). This dimension must be 40 mm., plus 0.9 mm., minus 0.4 mm., and is obtained by adjusting the eccentric (122). (Use spanner 1854-T, see Drawing 55). Tighten the nut of the eccentric pin (121) with a spring washer fitted under. — Universal joint spanner 17
Spanner 1854-T

23 FIT THE LOWER LINK ARMS (see Drawing 140)
(a) Oil the splined shaft (109) and engage in arms so that it protrudes 5 mm. to 6 mm. at the other end.

(b) Offer up the shaft and arms assembly in the cradle and complete engagement of shaft in arms. (Use mandrel MR.3432, see Drawing 48, fig. 1). Fit shaft clamp bolt (108) using a lockwasher under head of bolt and under nut. Tighten the nut and turn back lockwasher tabs. — Mandrel MR.3432
Flat and box spanners 12

(c) Position the arms (use gauge MR.3447, see Drawing 46, to obtain a dimension of 340 mm. between centres of upper link spindle and the lower shockabsorber pin. — Gauge MR.3447

(d) Fit the rear silentbloc on the shaft using three shims (159), thickness 0.2 mm. between flange of silentbloc and the cradle. Provisionally tighten fixing bolts.

(e) Place the front silentbloc on the shaft but do not fix.

(f) Hold the link arm assembly with it resting on the rear silentbloc (107). Place a straight edge on the rear face of the lower mounting stud tube. Measure distance "c" between the straight edge and the machined boss on the arm. This dimension must be 40 mm., plus 0.9 mm.,

	minus 0.4 mm. and is obtained by varying the number of shims (159).	
	(g) Push the front silentbloc (187) against the arm. Measure the clearance between the flange of the silentbloc collar and the cradle. This clearance must be between 0.4 mm. and 2 mm. If there is need to modify the clearance fit shims (160) between the collar and the cradle. NOTE. Carefully observe this clearance to ensure the necessary tightness of the link arms between silentblocs (107 and 187). On the other hand do not damage the silentbloc rubbers with excessive tightness.	Flat and box spanners 17
	(h) Finally tighten the silentbloc fixing bolts using spring washers under the nuts.	
	(i) Check the new dimension "c". This must be the same as determined previously (in paragraph "f") If it is not too strong a pressure will be exerted on silentbloc hubs, and the thickness of the shims (160) must be corrected.	
24	FIT THE PIVOTS (see Drawing 47) (mount pivots successively). (a) Fit dust cover (60), rubber bush (61) and bush cup on ball pin stem.	
	(b) Fit pivot on ball pins, fit ball pin lockwasher (63), and tighten ball pin locking nuts (3) to a tension of 19 mkg., plus or minus 2 mkg. (137 foot pounds, plus or minus 14½ foot pounds). Never slacken the nut when fitting split pin. Turn back tab of lockwasher against flat of upper ball pin nut. Secure the lower ball pin nut with a split pin taking care not to damage the pins of the latter when opening.	Elbow spanner 29
25	FIT THE HUB AND BRAKE DRUM ASSEMBLY (see Drawing 47) (a) Stick the paper gasket (64) on the front face of the pivot bearing housing by using Hermetical.	
	(b) Fit the hub and brake drum assembly giving it a few light taps with a mallet to drive it right home if necessary.	
	(c) Tighten the bolts (1), fixing the bearing thrust plate, to a tension of 3 mkg. (21¾ foot pounds) using spring washers under heads. (Use a box spanner passing through one of the holes "a" provided in the brake drum.	Box spanner 14
26	FIT THE TRANSMISSION Engage the transmission shafts (splines lightly oiled) in the hubs. Grease the face of the nut and tighten to a tension of 30 mkg. (217 foot pounds). (Use spanner 1810-T and torsion gauge 2472-T, see Drawing 46). Secure nuts with split pins which must be opened out against flats of nuts.	Spanner 1810-T Torsion gauge 2472-T

27	Fit the shockabsorbers with silentblocs between two plain washers. Tighten nuts to a tension of 7 mkg. (50½ foot pounds) and secure with split pins.	Universal joint spanner 21 Box spanner 17
28	Fit brackets for Lockheed pipes and fit pipes also.	Flat spanners 10-14-17-19-21
29	Paint the axle.	
30	Remove axle from workshop stand.	

	REMOVING TRANSMISSION (see Drawing 62)	
1	Remove hub cap from wheel. Unscrew hub nut. (Use spanner 1810-T, see Drawing 46).	Box spanner 16 Spanner 1810-T
2	Jack up vehicle at the front and block it up under lower link arms.	
3	Unscrew bolts (24) assembling drive shaft and flexible coupling, and also the nuts fixing coupling flange to driving flange on gearbox. (Use spanner 1832-T, see Drawing 60A).	Spanner 1832-T Flat spanners 14-17
4	Separate the drive shaft (1) from the flexible coupling. When necessary, dismantle the parts by tapping lightly with a mallet and if necessary finally disengage with a screwdriver or small lever.	
5	Disengage the drive shaft from the hub and brake drum assembly. Next disengage the flexible coupling assembly and the sliding coupling.	
	FITTING TRANSMISSION (see Drawing 62)	
6	Fit the flexible coupling assembly and the sliding coupling to the gearbox driving flange and provisionally tighten nuts fitted with shakeproof washers under each.	Flat spanner 17
7	Engage drive shaft (1) in hub and brake drum assembly after having lightly oiled the stub axle splines. (To ensure constant velocity of the transmission joints, it is essential for one of the crosshead pins in the single cardan coupling to be parallel with one of the double cardan coupling).	
8	Fit drive shaft to flexible coupling, tighten bolts (24), and turn back lockwasher tabs.	Flat spanner 14
9	TIGHTEN UP HARD THE NUTS FIXING COUPLING FLANGE to the gearbox driving flange. (Use spanner 1832-T, see Drawing 60A).	Flat spanner 17 Spanner 1832-T
10	Lower vehicle to the ground.	
11	Lightly oil the face of the hub nut and tighten to a tension of 30 mkg. (217 foot pounds). (Use spanner 1810-T and torsion gauge 2472-T). Secure nut with a split pin.	Spanner 1810-T Torsion gauge 2472-T
12	Fit hub cap to wheel.	

	DISMANTLING TRANSMISSION (see Drawings 61, 63, and 64)	
1	Disconnect drive shaft (1) from "Bibax" (flexible coupling).	Box spanner 14
2	DISMANTLE SLIDING COUPLING FROM STUB AXLE Hold the assembly in a vice. Remove the four circlips (2) retaining the bearing cups (3) on the stub axle side. With a scraper remove burrs of metal and paint likely to impede the extraction of bearing cups (see fig. 1). By means of a bent screwdriver prise out the four sheet steel cups (4), thereby disengaging the needle bearing cups (3). Remove bearing cups with needles. (See fig. 2). Do not forget to remove the cork washers (5) fitted in cups (4), as well as the cups or the dismantling of the assembly will be obstructed (see Drawing 61). Tilt the crosshead (6) so that its trunnions emerge from the double yoke by way of the release aperture. The crosshead being free, draw out stub axle (7) together with crosshead (6) and the ball joint assembly (8) (see fig. 3).	
3	Remove drive shaft yoke. Remove bearing cups according to paragraph 2 (see figs. 1 and 2.) Remove the double yoke (9) by tilting crosshead (10), the latter remaining on the drive shaft (1) (see fig. 4).	
4	Remove crosshead (6) from stub axle (see Drawing 64). Unsolder cup (11) from the ball joint protecting cups at the stub axle side. This cup is soft soldered. Remove grease retaining cups to allow use of ball joint extractor. If protecting cups are unsoldered at the central joint it is still necessary to unsolder cup (11) (fig. 5). NOTE. THE BALL PINS ARE LOCKED BY EITHER DOWEL PINS OR GRUB SCREWS. THE PINS SHEAR THEMSELVES WITHOUT DIFFICULTY AT THE MOMENT OF EXTRACTION OF BALL PINS. GRUB SCREWS MUST BE REMOVED BEFORE EXTRACTING BALL PINS. (Grub screws are locked by centre punching at two points).	
5	Remove the ball pin (12) with ball (13) remaining in ball pin cup. (Use extractor 1900-T together with collets 1913-T, see fig. 6). To prevent distortion, place two bearing cups (3) without needles into bearing cup housings (see fig. 6).	Extractor 1900-T Collets 1913-T
6	Remove the crosshead (10) from drive shaft end. Use the method described in paragraph 5. (Use extractor 1900-T with collets 1913-T (see fig. 7).	Extractor 1900-T Collets 1913-T
	ASSEMBLING TRANSMISSION (see Drawings 61-64-65-66)	
7	PREPARE NEEDLE BEARING CUPS (3)	

Fill each needle bearing cup with grease similar to Mobilcompound. Fit twenty-five needles (15) in each cup.

8 PREPARE CROSSHEADS (6 and 10).
Fill the lubrication holes in each crosshead with grease similar to Mobilcompound.

9 PREPARE THE STUB AXLE (see Drawing 65)
Fit the crosshead (6). The hollow face "a" must be facing away from the stub axle (see fig. 9). — Three-point gauge 1908-T
Fit to the ball pin (12), equipped with its protecting cups (assembly (8) sold by our Spare Parts Department), the sliding ball (16), cork washer (17), plain washer (18), and the spring (19) (see fig. 10). Make sure that the central hole in the stub axle and the stem of the ball pin (12) are perfectly clean. — Bearing housing gauge 1910-T
By means of a press fit the ball pin (12) so that it is right home in stub axle (the pressure required may be as much as 12 tons). Use an old ball pin spindle (14) that has been modified. Grind down the diameter of the spindle ball so that it will pass easily into the protecting cups. Also grind away the corner radius at "b" to prevent the modified spindle seizing in the inner ball (13) on assembly (see fig. 11).
FIT THE ASSEMBLY IN THE VERTICAL POSITION TO PREVENT STRESS IN THE BALL PIN STEM. Check the position of the inner ball (13). (Use three-point gauge 1908-T and two bearing cup housing gauges 1910-T, see fig. 12).
If the ball pin is locked by a dowel, drill hole "c" into centre of stub axle. (Use a 4 mm. diameter drill and drill to 22.5 mm. deep (see Drawing 61). Drive in dowel pin and file off flush.
If the ball pin is locked by a grub screw, screw it right home and secure by centre-punching at two points.
Fill the protecting cups (8) with grease similar to Mobilcompound.

10 PREPARE THE DRIVE SHAFT (see Drawings 65 and 66)
Fit the crosshead (10). The hollow part "a" must be facing away from the drive shaft (see fig.13) — Socket 1904-T
Press the ball pin spindle (14) right home. (Use socket 1904-T, see fig. 14). FIT THE SPINDLE IN THE VERTICAL POSITION TO PREVENT STRESS IN THE STEM. Drill hole for dowel (4 mm. diameter drill to a depth of 17 mm.) or fit grub screw (see paragraph 4).

11 FIT THE DOUBLE YOKE
Fit the yoke (9) on the stub axle (7). If the double yoke has two different outside diameters fit it for preference with the larger diameter at the stub axle side (see fig. 15).

12 FIT THE DRIVE SHAFT
Fit drive (1) to the double yoke (9). This operation is best undertaken holding the parts vertically in a vice. Introduce a trunnion of the crosshead (10) on the drive shaft side into

the corresponding bearing cup housing of the double yoke (9). At the same time engage the ball pin spindle (14) into the inner ball (13) and position the second trunnion of the crosshead (10). This is a delicate operation and force must not be used. Make sure that the inner ball (13) is positioned correctly to receive the stem of spindle (14) (see fig. 16).

13 FIT THE NEEDLE BEARING CUPS (see fig. 17)
With the aid of a tube fit a sheet steel cup (4) fitted with a cork washer (5) coated with Hermetical. Fit the bearing cup MAKING SURE THAT THE NEEDLE BEARINGS ARE CORRECTLY PLACED. Fit circlip (2) and make sure that it is correctly seated. (Use gauge 1909-T, see fig. 18). Repeat these operations for the other bearing cups. Make sure, by operating by hand, that there is no play or tightness in the coupling.

Tube 20 x 24 x 100
Gauge 1909-T

RECONDITIONING CARDAN COUPLING ON GEARBOX SIDE

14 DISMANTLE COUPLING
Remove bearing cups, cork washers, sheet steel cups, and crosshead using the same method as for the drive shaft (see Drawing 63, figs. 1, 2 and 3, and paragraph 2).

15 ASSEMBLE COUPLING
Use same method as for assembling a drive shaft crosshead (see Drawing 66, figs. 17 and 18, and paragraphs 7, 8 and 13).

16 Fit "Bibax" flexible coupling to drive shaft (see Drawing 62)
Fit washer (20) for securing pins. Fit spring washers under heads of bolts and tighten. Fill the bore "d" of the sliding coupling with grease of the Mobilcompound type. Grease also the sliding coupling splines. Engage sliding coupling in flexible coupling.
To ensure constant velocity of couplings, IT IS ESSENTIAL that one of the crosshead pins of the single yoke is parallel with a crosshead pin of the double yoke. Tighten cap (21) fitted with felt washer (22) and splined washer (23). Lock the cap by centre punching on the outside diameter of the threaded portion.

	REMOVING STEERING (see Drawing 70)	
1	Raise the vehicle at the front and block it up about 550 mm. from the ground to allow taking out the steering. (Use special jack head MR.3300-90, see Drawing 67).	Special jack head MR.3300-90
2	Take off the steering wheel. (Use steering wheel extractor 1950-T, see Drawing 68). Take out key.	Steering wheel extractor 1950-T
3	Disconnect track rods (1) from front axle pivot levers. (Use ball pin extractor 1964-T, see Drawing 69).	Ball pin extractor 1964-T
4	Unscrew bolts fixing movable steering brackets (2) on hull.	Universal joint spanner 12
5	Remove the steering towards the front (the steering column fixed tube remaining in the vehicle).	
	REMOVING STEERING COLUMN FIXED TUBE	
6	See Operation 723, paragraphs 2, 3, 4, 5 and 6.	
	FITTING STEERING COLUMN FIXED TUBE	
7	See operation 723, paragraphs 7, 8, 9 and 11.	
	FITTING STEERING (see Drawing 70).	
	The vehicle being raised about 550 mm. from the ground at the front.	
8	Engage the steering column in the fixed tube. Fix movable steering brackets under hull. Provisionally mount the steering wheel and operate to both right and left to make sure there are no tight spots in the travel of the steering.	Universal joint spanner 12
9	ADJUST HEIGHT OF STEERING With the steering loose in brackets (2) and the fixed tube free in brackets on instrument panel and bulk head, position the steering wheel so that the lowest part of the rim is 505 mm., plus or minus 5 mm. from the carpet. Tighten the movable bracket clamp bolts (3) (fig. 3), the brackets on instrument panel and bulkhead. Adjust the height of the fixed tube so that it does not rub against steering wheel while fitting a few millimetres in wheel recess.	
10	CHECK CENTERING OF COLUMN IN FIXED TUBE	

	(a) Check centering. (Use bush MR.3102, see Drawing 68, figs. 1 and 2). Eccentricity must not exceed 4 mm. If necessary correct by adjusting fixed tube.	Box spanners 14-17 Bush MR.3102
	(b) Lock the movable bracket clamp bolts (3), and again operate the steering. Any tightness can only be caused through faulty centering of the column in the fixed tube. If necessary check centering again.	Box spanners 14-17
11	FIT TRACK RODS (see Drawing 71) To the ball pin stems (4) (see fig. 4), fit dust covers (5) assembled with Belleville type washer and rubber washer. Fit ball pin in tapered hole of lever. By means of feeler gauges measure the clearance "a" between face of lever and Belleville type washer. At this point fit shims (6) to leave a clearance of 0 mm. to 0.25 mm. Tighten nuts and use split pins to secure.	Box spanner 21
12	FIT STEERING WHEEL Turn the front wheels straight ahead. Fit the steering wheel with the key engaged in the keyway corresponding to a steering wheel arm. Tighten steering wheel nut. The two upper arms of the steering wheel should permit clear vision of the instruments.	Box spanner 32
13	Fit combined horn and lighting switch.	
14	Adjust front wheel "toe-out" (see Operation 748, paragraphs 4 and 5).	
15	Adjust steering lock (see Operation 748, paragraphs 6, 7, 8 and 9).	

	REMOVING FIXED TUBE	
1	Take off the steering wheel. (Use extractor 1950-T, see Drawing 68, figs. 3 and 4).	Box spanner 32 Steering wheel extractor 195[illegible]
2	Remove combined horn and lighting switch.	
3	Unscrew nuts fixing steering column bracket to instrument panel. Unscrew bolts fixing half-brackets on bulkhead, thereby releasing the rubber bush and permitting easy disengagement of tube. Remove steering column fixed tube.	Box spanner 14
4	Remove instrument panel bracket from tube (by hand).	
5	Remove half-brackets from bulkhead.	
6	Knock out inner rubber bush of fixed tube.	
	FITTING STEERING COLUMN FIXED TUBE	
7	Fit half-brackets with rubber bush on bulkhead. (In order to allow fitting of fixed tube do not tighten bolts).	
8	Fit the instrument panel bracket, with its rubber bush, on the fixed tube. Place bracket about 180 mm. from top end of tube.	
9	Fit the fixed tube and tighten up brackets on bulkhead and instrument panel.	Box spanner 14
10	Check the centering of the steering column in the fixed tube. (Use bush MR.3102, see Drawing 68, figs. 1 and 2). Eccentricity must not exceed 4 mm. If necessary correct by adjusting the fixed tube.	Bush MR.3102
11	Fit the rubber bush in the fixed tube after coating with Lockheed fluid (bush can be fitted by hand).	
12	Provisionally fit the steering wheel so that it does not rub on the tube. The tube must engage however, several millimetres in the wheel hub recess. If necessary, correct by slackening brackets on bulkhead and adjusting tube position.	
13	Fit the steering wheel (see Operation 722, paragraph 12).	Box spanner 32

14	Fit combined horn and lighting switch.	

	DISMANTLING STEERING (see Drawings 70 and 71).	
1	Hold the steering in a vice. (Use fixture MR.1561, see Drawing 72).	Fixture MR.1561
2	Remove right and left hand track rods. (Use ball pin extractor 1964-T, see Drawing 69).	Box spanner 21 Ball pin extractor 1964-T
3	Remove grease retaining rubber bush (8) from steering column. Remove the steering column (8).	Box spanner 14
4	Remove rack guide (9) and cover plate (10).	Box spanner 14
5	Remove thrust caps (11 and 12). (Use spanners 1975-T for removing cap (12).	Spanners 1975-T Flat spanner 14
6	Take off movable steering bracket (2) and the right hand rubber dust cover (accordion). Remove ball pin protector (13).	Box spanner 17
7	Slide the rack to the right. Remove split pin and unscrew slotted nut forming ball (14). Disengage tube (15) retaining ball pin cups. (Use spanner 1976-T, see Drawing 73, fig. 1) Remove ball pin cover plate (16) and disengage right hand ball pin (17). Bring stud (18) of rack sliding dust cover opposite release hole "b" in rack tube. Remove stud, take out left hand ball pin as well as the rack and sliding dust cover (19).	Box spanner 10 Spanner 1976-T
8	Remove left hand rubber dust cover (accordion).	
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. Slight expansion of the box will permit free withdrawal of cup without the use of a tool.	Blow pipe
10	DISMANTLE RIGHT AND LEFT HAND TRACK RODS Remove ball pin adjusting nuts (20). (Use spanner 1870-T, see Drawing 73, fig. 2). Take out cups (21) and unscrew track rod adjustable ends (22).	Box spanner 14 Spanner 1870-T
11	Clean parts.	
	ASSEMBLING STEERING (see Drawings 70 and 71)	
12	By means of a bronze drift fit the lower bearing cup in the steering box. MAKE SURE THAT THIS CUP IS CORRECTLY SEATED IN THE STEERING BOX AND HAS NOT CHIPPED DURING FITTING.	

	Fit thrust bearing on cup.	
13	Hold the steering box in a vice. (Use fixture MR.1561, see Drawing 72).	Fixture MR.1561
14	FIT AND ADJUST STEERING COLUMN (see Drawing 70, fig. 2). (a) Fit column (8) in box and then upper thrust bearing and cup (23). Adjust the bearings so they are FREE BUT WITHOUT PLAY. With the aid of feeler gauges, determine the thickness of shims to be placed between box flange and cover plate (25) to give correct bearing adjustment. (Choose shims from the range listed in our Spare Parts Catalogue).	
	(b) After adjustment fill the bearings with grease similar to Mobilcompound. Fit the cover plate (25). ONE FACE ONLY OF THIS PLATE IS MACHINED AND THIS MUST BE FITTED AGAINST THE UPPER BEARING CUP. Fit felt washer and retainer and tighten nuts fitted with spring washers.	Box spanner 14
15	FIT THE STEERING RACK (see Drawings 70 and 71) (a) If the ball nut (14) or the steering box has been replaced, make certain there is 0.05 mm. clearance between ball (14) and tube (26). Undertake the following operation (see Drawing 71, fig. 3). Provisionally fit and lock movable bracket (2) on tubular steering box and screw ball nut (14) on retaining tube (15). At the same time introduce a shim 0.05 mm. thick and 8 mm. wide into the box. The tube (15) serves to carry the ball nut and shim along a distance of about 140 mm. This distance represents the amount of rack travel). The ball nut and shim must slide freely but without play and there must be no tightness at the point where the movable bracket is clamped on the tube. Take off movable bracket (2).	
	(b) Fit the left hand movable bracket (2). Fit rubber dust cover (accordion) with small diameter against the bracket.	
	(c) Lubricate the rack (with grease similar to Mobilcompound) and fit. Fit sliding dust cover (19) (elongated hole on right hand side). Fit distance piece (34), washer 602345, spring (35), ball pin cup (28), ball pin (36), previously oiled, ball pin cup (37), with circumferential groove, and distance piece (38).	
	(d) Fit stud (18) of dust cover (19). Tighten stud nut against a copper washer. Fit ball pin cup (37), with circumferential groove, ball pin (17), and ball pin cup (28).	Box spanner 10
	(e) Fit retaining tube (15), damper spring (29), and tighten up tube (15). (Use spanner 1976-T, see Drawing 73). Tighten right up and then slacken one sixth of a turn. Check tightening of ball pins which must turn by hand without obstruction. Hold the retaining tube (15) and tighten ball nut (14). (Use spanner 1976-T, see Drawing 73, fig. 1). FIT SPLIT PIN WITHOUT SLACKENING NUT. If existing split pin hole does not correspond	Spanner 1976-T

	to a slot in the nut drill a new hole in line with the slot farthest from original hole. Prevent drilling swarf falling into steering box by plugging the tube aperture with a rag.	
16	ADJUST MESHING OF RACK AND PINION. POSITION STEERING WHEEL In order to obtain clear vision of the instrument panel between two arms of the steering wheel, adjust meshing in the following manner. (a) Fit steering wheel on column with key engaged in keyway in line with one of the steering wheel spokes. (b) Turn wheel so that this spoke is vertical and pointing downwards. (c) Mesh rack with pinion and turn steering wheel one and a half turns. At this point, if meshing is correct, the end of the rack will protrude 37 mm., plus or minus 2 mm. beyond flange of steering box tube (as at "c" see Drawing 70, fig. 1). If end of rack does not fall within this dimension set meshing backwards or forwards as required, by one tooth.	
17	ADJUST RACK GUIDE Engage rack guide (9) in steering box WITHOUT SPRING. Fit cover plate (10) with machined face against the box. Fit shims (30) to give normal meshing without play or obstruction. However, a play of 0.1 mm. to 0.2 mm. is necessary to prevent fouling at bottom of teeth. Therefore add a shim 0.1 mm. to 0.2 mm. thick to those already selected. Remove plate (10) and refit it with spring (31). Fit spring washers under heads of fixing bolts and tighten up. If the spring pressure is insufficient (steering too light), add washers (27) between spring and guide. If the pressure is too great (steering too heavy) it will be necessary to add another shim (30) between cover plate (10) and the steering box.	Box spanner 14
18	Fit the ball pin cover plate (16), the longer part to the right). Fit upper and lower ball pin protectors. After fitting, pinch and turn down slide ends of upper cover so that the lower slide is carried along by the upper with rack movement. Fit right hand rubber dust cover, small diameter against movable bracket, and movable bracket (2) but do not tighten as its position is determined when steering is mounted on car. Tighten rubber dust covers without use of a pin, to prevent scoring. Fit the dust cover clips in such a way that heads of tightening split pins protrude away from rubbers (as at "d" Drawing 70, fig. 1). This is necessary to avoid tearing rubber when tightening split pins.	
19	Fit locknuts (32) for thrust cap and use a lockwasher between nuts and cap. Fill thrust cap (12) with grease (similar to Mobilcompound) and screw on provisionally. HALF FILL ONLY, with grease of the same type, thrust cap (11). Fit this cap using a paper gasket and tighten bolts fitted with spring washers under heads. NOTE. The quantities of grease packed into the caps (340 grammes approximately, about twelve ounces) must not be exceeded or the steering will leak when working. Fit steering column grease	Flat spanner 14

	retaining rubber bush (7). Fit clip with split pin head away from the bush.	
20	PREPARE TRACK RODS (see Drawing 71, fig. 4). Loosen and articulate the adjustable sockets on the rods (if necessary touch up threads of rods and sockets using thread files and taps). Oil the track rod threads. Screw on the sockets as follows. (a) Provisionally adjust to give a centre distance of 557 mm. plus or minus 0.2 mm., between ball pins. (Use gauge MR.3446, see Drawing 74).	Taps and thread files 22 dia., 100 pitch Gauge MR.3446
	(b) The amount of thread engaged in sockets should be the same at both ends. Fit ball pins (4) and cups (21), previously oiled. Fit spring retaining ball pin cups. Tighten the adjusting nuts (20) to a tension of 8 mkg. (58 foot pounds). (Use spanner 1870-T, see Drawing 73, fig. 2). Unscrew nuts to a maximum of one eighth of a turn and fit split pins.	Spanner 1870-T
21	FIT TRACK RODS (see Drawing 71) Fit rubber sealing washers (33) on stems of steering rack ball pins. Use alcohol to clean tapers of ball pins and bores of sockets. Fit track rods, tighten nuts and secure with split pins.	Flat spanner 21
22	Remove steering from fixture MR.1561.	

	REMOVING REAR AXLE (see Drawings 77 and 78)	
1	Jack up the vehicle. (Use special jack head MR.3300-110, see Drawing 75). Block up car at a point approximate to the rear pillars.	Special jack head MR.3300-110
2	Remove both rear wheels.	Wheelbrace
3	Remove both rear shockabsorbers, replacing them with gauges MR.3338 (see Drawing 76). The axle assembly is held in balance better this way than with a jack.	Gauges MR.3338 Universal joint spanner 21
4	Remove the exhaust pipe. (Use spanner 1626-T, see Drawing 1, fig. 2) and silencer assembled, the tail pipe remaining fixed on the car.	Spanner 1626-T Flat spanners 12-14
5	Disconnect Lockheed feed pipe to three-way union on the tubular crossmember. Disconnect wheel cylinder feed pipes from brackets on rear axle arms.	Flat spanners 12-14
6	Remove rear axle tie rod.	Flat spanners 21-23
7	Remove torsion bar retaining plates (1). Disengage one torsion bar from centre bracket. (Use driving block assembly MR.1578, see Drawing 79). Repeat the method for the second bar. Remove bolts fixing rear link silentbloc brackets.	Box spanners 14-16 Universal joint spanner with socket 16 Block assembly MR.1578
8	Remove axle from car.	
	REMOVING TUBULAR CROSSMEMBER	
9	Disconnect petrol pipe from union and clip on hull and disengage towards the outside of the vehicle to give clearance for the crossmember.	Flat spanner 14
10	Remove trimming from both rear door sills.	
11	Remove bolts fixing crossmember to hull (three bolts on each flange removed from inside vehicle).	Box spanners 17-26-35
12	By means of a lever disengage tubular crossmember from hull.	
	FITTING TUBULAR CROSSMEMBER	
13	Fit tubular crossmember in hull. Tighten fixing bolts with spring washers fitted under heads.	

14	Fit trimming to both rear door sills.	
	FITTING REAR AXLE (see Drawing 77)	
15	Fit torsion bars in hubs (3) of rear link silentbloc brackets. Right hand torsion bars have one painted identification mark and the left hand bars two marks.	
16	Position axle assembly under vehicle. Locate the lower shockabsorber pins in the intermediate holes of gauges MR.3338 (see Drawing 76). IN THIS POSITION fit the rear link silentbloc brackets to the tubular crossmember. Tighten fixing bolts using spring washers under heads.	Gauges MR.3338 Universal joint spanner with socket 16
17	FIT THE TORSION BARS (a) Position lower shockabsorber pins in the gauge slots.	
	(b) With the torsion bars already engaged in hubs of rear link silentbloc brackets, raise the rear axle so that lower shockabsorber pins are at the top of the gauge slots. At this point engage the torsion bars in the splines of the centre bracket of the crossmember. If necessary for engagement move the axle in the traverse permitted by the gauge slots. Complete fitting of torsion bars. (Use driving block assembly MR.1578, see Drawing 79)	Block assembly MR.1578
	(c) Fit torsion bar retaining plates (1). Tighten nut securing bolt using a spring washer under.	Box spanner 14
18	Fit tie rod (4). Fit securing split pins.	Flat spanners 21-29
19	Fit Lockheed brake pipes, petrol pipe, exhaust pipe and silencer, SECURELY TIGHTEN FLANGE NUTS. (Use spanner 1626-T, see Drawing 1, fig. 2).	Spanner 1626-T
20	Fit and adjust handbrake cables. (See operation 749, paragraph 3).	Flat spanner 12
21	Remove gauges MR.3338. Fit shockabsorbers.	Universal joint spanner 21
22	Adjust transverse location of rear axle. (Use gauge 2051-T, see Drawing 80).	Flat spanners 21-29 Gauge 2051-T
23	Bleed the Lockheed brake system. (See operation 749, paragraph 5).	
24	Fit the two rear wheels.	Wheelbrace
25	Lower the vehicle to the ground. (Use special jack head MR.3300-110, see Drawing 75).	Special jack head MR.3300-110
26	Adjust body heights (see operation 750, paragraphs 1, 2 and 3).	

	REMOVING REAR AXLE BEAM (see Drawing 77)	
1	Jack up the vehicle. (Use special jack head MR.3300-110, see Drawing 75). Block up vehicle at a point approximate to the front end of the rear wings.	Special jack head MR.3300-110
2	Remove wheels and hub and brake drum assemblies.	Wheelbrace Adjustable spanner
3	Disconnect Lockheed brake pipes and unions from brackets on link arms.	Flat spanners 17-19-21
4	Remove brake back plates from axle (without taking off brake shoes and wheel cylinders). Use a wire brush to clean the brake cable sheaths and oil them to allow easy sliding in the guides. Remove back plates from axle without disconnecting brake.cables.	Brace spanner with extension 14 Wire brush
5	Remove axle tie rod (4).	Flat spanners 21-23
6	Disconnect shockabsorbers from the axle only.	Universal Joint Spanner 21
7	By means of a screwdriver, prise off the link arms from fixing studs on the axle. Locate a bodymakers screw jack with the jack heads bearing against the brake cable guide brackets. Open out the link arms by operation of the jack. Remove the axle beam and then take out the jack.	Bodymakers screw jack, capacity 1200 mm.
	FITTING REAR AXLE BEAM	
8	Locate a bodymakers screw jack as during the dismantling operation. Engage rear axle beam between link arms and remove the jack.	Bodymakers screw jack capacity 1200 mm.
9	Fit tie rod (4). Fit securing split pins.	Flat spanners 21-29
10	Fit shockabsorbers to axle.	Universal joint spanner 21 Flat spanners 17-19-21
11	Fit brake back plates. Fit Lockheed brake pipes and unions.	Brace spanner with extension 14
12	Fit hub and brake drum assemblies. Tighten nuts to a tension of 10 mkg. ($72\frac{1}{2}$ foot pounds) and then slacken about a quarter of a turn to give an end play of 0.05 mm. to 0.17 mm., WHICH ALLOWS THE NUTS TO BE TURNED BY HAND. Secure nuts with split pins. Fill each hub cap with 0.080 kg. ($2\frac{3}{4}$ ounces approximately) of grease of the Mobilgrease 5 type.	

	Tighten hub caps to a tension of 5 or 6 mkg. (36 or 43 foot pounds).	Adjustable spanner
13	Adjust transverse location of rear axle. (Use gauge 2051-T, see Drawing 80).	Flat spanner 29 Gauge 2051-T
14	Bleed the Lockheed brake system (See Operation 749, paragraph 5).	
15	Paint the axle.	
16	Fit the two rear wheels.	Wheelbrace
17	Lower the vehicle to the ground.	

	DISMANTLING REAR AXLE (see Drawings 77, 78 and 81)	
1	Place the rear axle assembly on a convenient stand.	
2	Take off the Lockheed brake pipes. Remove the rear axle buffers.	Flat spanners 12-14-17-19-21
3	Remove the hub and brake drum assemblies.	Adjustable spanner
4	Remove the brake back plate (6). (Use a wire brush to clean the brake cable sheaths and oil them to allow easy sliding in the guides). Remove the link arms from the axle.	Brace spanner with extension Wire brush
5	REMOVE LINK ARM SILENTBLOC BRACKETS (see Drawings 77 and 78). (a) Remove circlips (7) retaining pins (8 and 9) of adjusting rods (10). Knock out the pins.	
	(b) Remove "C" type circlips (11) retaining silentbloc bracket nuts. Unscrew the nuts (12) and with the aid of a mallet, knock out the hub (3).	Flat spanner 23 Adjustable spanner
6	DISMANTLE THE BRAKE BACK PLATES (see Drawing 81). (Dismantle plates successively). (a) Unhook the return spring (14). (Use pliers 2110-T see Drawing 82). Remove the brake shoes (15 and 16), the wheel cylinder and the brake cable.	Box spanners 10-14-21 Pliers 2110-T
	(b) Remove the guide studs and adjusting cams (17) Disconnect the handbrake cable lever (18) from shoe (16) and the rod (19).	
7	DISMANTLE THE WHEEL CYLINDERS (All parts can be removed by hand). Remove dust covers (20), pistons (21), cups (22), and spring (23).	
8	DISMANTLE THE HUB AND BRAKE DRUM ASSEMBLIES Knock out the inner bearing (which carries out the oil seal). Use a drift to knock out the bearing cups.	
9	Clean the parts.	
	CHECKING CAMBER AND TOE-IN OF CRUCIFORM AXLE BEAM (see Drawings 83 and 84).	
10	CHECK THE CAMBER (see Drawing 83) (a) Set up the axle to be checked in a lathe with centres at least 225 mm. above the bed and a capacity of 1800 mm. between centres. On one of the flanges where the link arm is fitted mount apparatus 2052-T (see Drawing 84) VERTICALLY, the axle being in its normal position, that is to say, with buffers at the top.	Apparatus 2052-T

(b) Rotate the axle a quarter of a turn to bring the lower arm of the straight edge of apparatus 2052-T into contact with an index plate mounted in the tool post.

(c) Rotate the axle an additional half turn to bring the other end of the straight edge opposite the index plate. Measure the gap between the straight edge finger and the index plate. This should be 11.3 mm., plus 0 mm., minus 4 mm. for a straight edge of 430 mm. long. This dimension corresponds to an angle of 1° to 1° 30'.

(d) If the required dimension is not realised, remove the axle from the lathe, and in the cold state, beat out the upper web if the camber is insufficient or the lower web if it is too great.

(e) Treat the other end of the axle in a similar manner.

11 CHECK THE TOE-IN (see Drawing 84)

(a) Set up the axle again in the lathe in its normal position (with buffers at the top) and mount apparatus 2052-T HORIZONTALLY on one of the link arm flanges.

(b) Bring the forward arm of the straight edge into contact with the index plate in the tool post.

(c) Rotate the axle half a turn to bring the other end of the straight edge opposite the index plate. The gap between the straight edge finger and the index plate should be 0 mm. to 0.5 mm. If necessary, set the beam by beating out, in the cold state, the rear web if the toe-in is insufficient and the front web if the toe-in is too great.

(d) Treat the other end of the axle in a similar manner.

IMPORTANT NOTE. REINFORCED AXLES CAN ONLY BE CORRECTED IN THE COLD STATE BY MEANS OF A PRESS. On certain axles the brake back plates are fixed by bolts instead of studs. In this case use one of the bolts for setting up apparatus 2052-T.

ASSEMBLING REAR AXLE

12 REPLACE SHOCKABSORBER PINS

(a) Chisel off fillets of arc welding.

(b) Unscrew pin — Flat spanner 26

(c) Fit new pin and tighten up hard (tension 15 mkg. approx. - 108.5 foot pounds). — Flat spanner 26

(d) Lock pin by a fillet of arc welding to avoid heating the axle.

13	PREPARE WHEEL CYLINDERS Use only alcohol or Lockheed fluid to clean the parts as any other substance will cause a rapid deterioration of the rubber cups. Lubricate cylinder and cups with Lockheed fluid (see Drawing 81 for order of re-assembling parts).	
14	PREPARE BRAKE BACK PLATES (Build up each plate successively (see Drawing 81). (a) Fit adjusting cams (17), rivet over pins. (Use fixture MR.3354, see Drawing 59, figs. 3 and 4). Fit guide studs (24), anchor pins (25), brake cable, and rod (19) to lever (18). Fit lever to brake shoe (16), tighten nut and secure with a split pin. (b) Fit brake shoes (15 and 16) (the linings must be perfectly dry and have no grease spots). Lightly oil adjusting washers (26) of the guide studs. Tighten nuts of anchor pins (25) to a tension of 3 mkg. ($21\frac{1}{2}$ foot-pounds) and secure with split pins. (c) Fit the wheel cylinder. Hook on the brake shoe return spring (14). (Use pliers 2110-T, see Drawing 82). Make sure that the shoes articulate normally and that there is sufficient thrust by the guide stud washers.	Fixture MR.3354 Box spanners 10-12-14 Box spanner 14
15	REPLACE WHEEL STUDS IN BRAKE DRUM (a) Use fixture MR.3445 (see Drawing 57) in order to ensure correct bearing of the drum when driving out studs and to prevent breaking the casting. NEVER COMPLETELY DISENGAGE BRAKE DRUM FROM HUB. REPLACE STUDS ONLY ONE OR TWO AT A TIME. The drum, after being assembled to the hub during manufacture, is machined with the utmost precision. Faulty centering of the drum will cause the brakes to judder. Clinch in the wheel studs by means of a press of 8 to 10 tons capacity. Although it is not recommended the studs may be clinched over with a hammer if a press is not available. (b) Drill hole for wheel stud dowel diametrically opposite to the old position. Drive in dowel and make sure that it fits flush. Lock dowel with a centre punch.	Fixture MR.3445
16	Fit bearing cups in hub with the aid of a drift. Make sure that cups are correctly seated.	
17	RECTIFY BRAKE DRUMS True up drum in a lathe. (Use Mandrel MR.3381-2, see Drawing 85). The maximum eccentricity allowed is 0.04 mm. This should be checked with a clock gauge. Never increase the original diameter of 305 mm., plus or minus 0.1 mm., by more than 2 mm.	
18	Pack the inner bearing (27) with grease (grease similar to Mobilgrease5) and fit. By means of a press, fit the oil seal (28) with the leather flange against the bearing (see Drawing 77).	

19	PREPARE LINK ARMS (see Drawings 77 and 78) (a) The silentblocs (29) are removed and fitted by means of a press. (Use socket and plunger MR.3335, see Drawing 86).	Socket and plunger MR.3335
	(b) Fit link arm (30) on hub (3). (The hub is positioned so that the inner splines are towards the outside). On both sides of the link arm fit levers (31), adjusting rod (10), with its pin (7), friction washers (32) (with chamfers facing hub splines), silentbloc brackets (33), and the locking nuts (12).	
	(c) Mount fixtures MR.3336, to hold silentbloc brackets during tightening so that their flanges are at an angle of 104° with the link arm centre line (see Drawing 78, figs. 2, 3 and 4.)	Fixtures MR.3336
	(d) Tighten the silentbloc bracket locking nuts to a minimum tension of 25 mkg. (180 foot pounds). After tightening make sure that the hub threads protrude an equal amount at each end.	Adjustable spanner
	(e) Remove the fixtures. Fit adjusting rod pin (8) and the circlips (7).	
	(f) Drill the silentbloc hub for fitting the "C" type circlip (11).	
20	FIT THE LINK ARMS AND BRAKE BACKPLATES (a) Oil the brake cable sheaths and fit in guides on link arms. Tighten nuts fixing brackets for cable sheaths to a tension of 2 mkg. ($14\frac{1}{2}$ foot pounds) using a spring washer under each. Tighten nuts fixing backplates to a tension of 2 mkg. ($14\frac{1}{2}$ foot pounds) using a spring washer under each.	
	(b) POSITION THE BRAKE SHOES Use gauge 2103-T and pointer 2104-T, see Drawing 87. Adjust cam pins (use spanner 2120-T, see Drawing 60, fig. 3).	Spanner 2120-T Gauge 2103-T Pointer 2104-T
21	FIT HUB AND BRAKE DRUM ASSEMBLIES Before fitting, pack the hub with 0.100 kg. ($3\frac{1}{2}$ ounces) of grease similar to Mobilgrease 5. Fit the outer Timken bearing also packed with grease. Tighten the hub nut to a tension of 10 mkg. ($72\frac{1}{2}$ foot pounds) and then unscrew about a quarter of a turn to give an end play of 0.05mm. to 0.07 mm. which will allow the nut to be turned by hand. Secure nut with a split pin. Fill hub caps with 0.080 kg. ($2\frac{3}{4}$ ounces) of grease similar to Mobilgrease 5. Tighten the hub caps to a tension of 5 or 6 mkg. (36 to 43 foot pounds).	Adjustable spanner
22	Fit the Lockheed brake pipes.	Flat spanners 14-17-19-21
23	Fit the rear axle buffers, tighten bolts and turn back lockwasher tabs.	Box spanner 12

24 Paint the unit.

25 Remove the assembly from the stand.

REMOVING A TORSION BAR

Torsion bar splines slide more or less easily in the silentbloc. According to the case the bar can be removed by three different methods.

FIRST CASE: torsion bar sliding easily.

1 (a) Jack up the vehicle at the front and block it up at a point level with the scuttle pillars so that there is no load on the torsion bar to be removed.

(b) Remove the rearmost circlip from the torsion bar. Completely unscrew the ball-headed screw of the adjusting lever. (Use spanner 2302-T.) — Spanner 2302-T

(c) Knock the bar towards the front of the car by striking the rear end with a hammer and drift (bent if necessary).

(d) Remove the second circlip and completely disengage the torsion from the front through the silentbloc splines.

SECOND CASE: to be adopted when the method above is not successful.

2 (a) Jack up the vehicle at the front and block it up at a point level with the scuttle pillars so that there is no load on the torsion bar to be removed.

(b) Remove the trimming from the hull bulk head and take out seat cushion on the side the torsion bar is to be removed.

(c) Cut a 45 mm. diameter hole in the hull bulkhead in line with the torsion bar to be removed. The centre of this hole should be approximately 225 mm. from the car longitudinal centre line and 45 mm. above the floor.

(d) Remove the rearmost torsion bar circlip and knock out bar towards the front using a drift passing through the hole cut in the bulkhead.

(e) Remove the second circlip and completely disengage the torsion bar from the front through the silentbloc splines.

THIRD CASE: If the torsion bar cannot be removed by the methods above.

(a) Jack up the vehicle at the front and block it up at a point level with the scuttle pillars so that there is no load on the torsion bar to be removed.

	(b) Remove the rearmost circlip from the torsion bar. Completely unscrew the ball-headed screw of the adjusting lever. (Use spanner 2302-T).	Spanner 2302-T
	(c) Remove the trimming from the hull bulkhead and take out seat cushion on the side the torsion bar is to be removed.	
	(d) Cut a 45 mm. diameter hole in the hull bulkhead in line with the torsion bar to be removed. The centre of this hole should be approximately 225 mm. from the car longitudinal centre line and 45 mm. above the floor.	
	(e) Disconnect exhaust pipe from exhaust manifold on engine (use spanner 1626-T, see Drawing 1, fig. 2) and let the exhaust pipe rest on the ground.	Spanner 1626-T
	(f) Remove the rear plate of the crossmember under engine carrying torsion bar rear end, Disconnect handbrake rod to relay lever at the front end to allow removal of crossmember rear plate. Remove the remaining torsion bar circlip.	Box spanner 14
	(g) Knock out the torsion bar towards the rear using a steel bar, approximately 800 mm. long and 25 mm. diameter, passing through front silentbloc splines. Take out bar from inside of vehicle.	Steel bar 800 mm. long,
	FITTING A TORSION BAR	
	Right hand torsion bars have one identification paint mark and the left hand two.	
	FIRST CASE	
4	(a) The vehicle being still blocked up under the scuttle pillars, insert the torsion bar to be fitted through the splines of the front silentbloc. Fit the front circlip to the bar.	
	(b) Use a large lever to lower the pivot and link arms assembly approximately two splines.	
	(c) Oil the torsion bar splines and engage bar in the adjusting lever making sure that the lever bears against the ball-headed adjusting screw which has been fully unscrewed.	
	(d) Fit the torsion bar rear circlip.	
	(e) Lower the car to the ground.	
	(f) Adjust body heights (see Operation 750, paragraphs 1, 2 and 3).	

(g) Adjust weight distribution (see Operation 750, paragraphs 4, 5 and 6).

SECOND CASE

5 (a) The vehicle being still blocked up under the scuttle pillars, insert the torsion bar to be fitted through the splines of the front silentbloc. Fit the front circlip to the bar.

(b) Use a large lever to lower the pivot and link arms assembly approximately two splines.

(c) Oil the torsion bar splines and engage bar in the adjusting lever making sure that the lever bears against the ball-headed adjusting screw which has been fully unscrewed.

(d) Fit the torsion bar rear circlip.

(e) Lower the car to the ground.

(f) From a sheet of steel 1 mm. thick, cut a plate 65 mm. diameter. Also cut a joint of the same diameter from rubber or cardboard. Place the plate and the joint over the hole cut in the bulkhead (see paragraph 2-c) and fix with two P K. type screws. Replace the bulkhead trimming and the seat cushion.

(g) Adjust body heights (see Operation 750, paragraphs 1, 2 and 3).

(h) Adjust weight distribution (see Operation 750, paragraphs 4, 5 and 6).

THIRD CASE

6 (a) Fit the rear plate of the crossmember under engine carrying torsion bar rear end. Tighten up bolts using spring washers under heads. Connect rod from handbrake relay lever at the front end, securing clevis pin with a split pin.

(b) The vehicle being still blocked up under the scuttle pillars, insert the torsion bar to be fitted through the splines of the front silentbloc. Fit the front circlip to the bar.

(c) Use a large lever to lower the pivot and link arms assembly approximately two splines. Oil the torsion bar splines and engage bar in the adjusting lever making sure that the lever bears against the ball-headed adjusting screw which has been fully unscrewed. Fit the torsion bar rear circlip.

(d) Connect the exhaust pipe to the manifold using a C. and A. gasket between the flanges. TIGHTEN NUTS UP HARD. (Use spanner 1626-T, see Drawing 1, fig. 2). Spanner 1626-T

(e) From a sheet of steel, 1 mm. thick, cut a plate 65 mm. diameter. Also cut a joint of the same diameter from rubber or cardboard. Place the plate and the joint over the hole cut in the bulkhead (see paragraph 2-c) and fix with two P.K. type screws. Replace the bulkhead trimming and the seat cushion.

(f) Lower the vehicle to the ground.

(g) Adjust body heights (see Operation 750, paragraphs 1, 2 and 3).

(h) Adjust weight distribution (see Operation 750, paragraphs 4, 5 and 6).

	REMOVING A TORSION BAR (see Drawings 77 and 78)	
1	Jack up the vehicle on the side the torsion bar is to be removed. Block up under the rear of the body and under the axle.	
2	Remove a wheel and shockabsorber on the side the torsion bar has to be removed. If taking out right-hand bar disconnect the exhaust pipe under hull from the tubular crossmember and the silencer from the tail pipe. Let the exhaust pipe and silencer assembly rest on the ground. If removing a left-hand torsion bar, disconnect the tie-rod (4) at the axle end only.	Wheelbrace Flat spanners 12-14 Box spanner 21
3	Remove the torsion bar retaining plates (1).	Box spanner 14
4	Disengage the torsion bar from the hub at centre of tubular crossmember. (Use block assembly MR.1578, see Drawing 79).	Block assembly MR.1578
5	Fit a gauge MR.3338 between upper and lower shockabsorber pins to hold the axle in position (see Drawing 76).	Gauge MR.3338
6	Remove silentbloc bracket from tubular crossmember by unscrewing the bolts (2).	Universal joint spanner with extension 16
7	Remove the torsion bar and take off the block assembly MR.1578. In cases where the torsion bar is broken close to the central hub it will be necessary to remove the second bar, in order to knock out the portion remaining.	
	REFITTING A TORSION BAR (see Drawings 77 and 78).	
8	Engage torsion bar in the silentbloc bracket (33) and let the outer splined end protrude from the bracket. Connect the silentbloc bracket to the tubular crossmember.	Universal joint spanner with extension 16
9	Locate the lower shockabsorber pin in the slot of the gauge MR.3338 by applying a heavy load on the link arm (see Drawing 76).	Gauge MR.3338
10	Engage the torsion bar in the central hub by moving the axle up and down, in the limit determined by the gauge slot, in order to engage splines. Fit the retaining plates (1), and tighten the bolts after fitting spring washers under nuts. In cases where the splines do not slide freely use block assembly MR.1578 to complete the engagement of the boss (see Drawing 79).	Box spanner 14 Block assembly MR.1578
11	Connect the tie (4) to the axle (when left-hand bar has been refitted).	Box spanner 21

12	Remove gauge MR.3338 and fit shockabsorbers.	Universal joint spanner 21
13	Fit the exhaust pipe and silencer assembly (when right-hand bar has been fitted).	Flat spanners 12-14
14	Fit the wheel.	Wheelbrace
15	Lower the vehicle to the ground.	
16	Adjust body heights (see Operation 750, paragraphs 1, 2 and 3).	
17	Check the weight distribution (see Operation 750, paragraphs 4, 5 and 6).	Weighing machines 2310-T

	REMOVING SHOCKABSORBERS	
1	Take off the front shockabsorbers (turn steering to right-hand lock to remove right-hand shockabsorber and to the left-hand lock to remove the left).	Universal joint spanner 21
2	Jack up and block up the car. (Use special jack head MR.3300-110, see Drawing 75). Remove the rear wheels.	Jack head MR.3300-110 Wheelbrace
3	Remove rear shockabsorbers.	
	REFITTING SHOCKABSORBERS	
	Shockabsorbers are marked by two letters and a figure stamped on the lower part of the upper protecting tube. The first letter indicates the location of the shockabsorber. Letter "R" indicates all types, FRONT. Letter "S" indicates five-seater, four-door saloon, REAR. Letter "T" indicates eight or nine-seater, 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. Shockabsorbers can also be identified by their respective lengths when compressed: 274 mm. plus or minus 2.5 mm. FRONT 330 mm. plus or minus 2.5 mm. REAR Shockabsorbers are always fitted with the filler plug pointing downwards. This position as well as the vertical position of the shockabsorber as a whole must be observed in the course of maintenance or when storing.	
4	Fit the shockabsorbers with rubber bushes between two plain washers. Tighten nuts to a tension of 8 mkg. (58 foot pounds) and secure with split pins. (a) Fit front shockabsorbers. (b) Fit rear shockabsorbers.	 Universal joint spanner 21 Universal joint spanner 21
5	Fit the rear wheels.	Wheelbrace
6	Lower vehicle to the ground. (Use special jack head MR.3300-110, see Drawing 75).	Jack head MR.3300-110

Unless there is a substantial leak, used shockabsorbers can be completely reconditioned by replacing the oil with oil of a greater viscosity. This operation can be easily carried out if fixture MR.3552 (see Drawings 88 and 88A) is used.

1	Remove the guarantee seal. Extend the shockabsorber to its maximum length and then remove the filler plug.	Box spanner 13
2	SLOWLY DRAIN the shockabsorber by compressing it to its minimum length, and then by alternately extending and compressing it until all of the oil has been drained and no resistance encountered.	
3	With the shockabsorber at its minimum length screw the funnel MR.3382 (see Drawing 88a, fig. 2). Pour into the funnel a quantity of oil according to the shockabsorber type. In this case 160 cc., plus or minus 5 cc., (9.76 cubic inches, plus or minus 0.31 cubic inches) for both front and rear. NEVER EXCEED THIS QUANTITY. Slowly compress and extend the shockabsorber until all of the oil is absorbed. (This operation is carried out with the shockabsorber tilted and the filler hole at the top. (See fig. 1). Remove the funnel and screw in the filler plug. When the shockabsorber has been replenished keep it in the vertical position, (filler plug pointing downwards) during the period of maintenance or storage.	Fixture MR.3552 Funnel MR.3382 Flat spanners 13-14
4	REPLACE RUBBER BUSHES (a) Prise out the rubber bush by inserting a screwdriver between the bush and the shockabsorber eye. (b) Fit the replacement bush (previously wetted with water or Lockheed fluid) by hand, and complete fitting with the use of a mallet or vice acting as a press.	

	REMOVING SELECTOR	
1	Remove the bonnet.	
2	Remove the battery. (Use battery cable terminal extractor 2200-T, see Drawing 1, fig. 1).	Extractor 2200-T Flat spanner 10 Box spanner 12
3	Disconnect relay lever rods from selector levers. Unscrew knob from gear change lever.	Box spanner 10
4	Remove the selector. Unscrew the two nuts fixing selector from behind the instrument panel. (Use spanner 2430-T, see Drawing 141, fig. 3, passing through holes in battery tray). Unscrew two bolts on left-hand side of battery tray fixing the selector to the hull.	Spanner 2430-T
	REFITTING SELECTOR	
5	Engage the selector by passing under the instrument panel. First tighten the two nuts behind the instrument panel (use spanner 2430-T) and then the two bolts on the hull.	Spanner 2430-T Box spanner 14
6	Connect the rods from the relay levers to the gear selector levers. With the gear change lever in the neutral position as well as the gearbox control rods, adjust the length of the relay rods so that they can be connected without moving the gear change lever and gearbox control rods. After this adjustment make sure that the gear change lever does not catch in its lateral movement.	Flat spanner 14 Box spanner 10
7	Fit the battery.	Flat spanner 10 Box spanner 12
8	Fit the bonnet.	

	DISMANTLING GEAR SELECTOR (see Drawing 141)	
1	Remove cotter (1) from second and top speed lever (2) in selector.	Box spanner 8
2	Remove the lever shaft (3), take out the two levers (2 and 4), change speed lever (5) and the thrust washers (6).	
3	Remove outer lever (7) from shaft (3) by taking out the cotter (16).	Box spanner 8
4	Remove bronze ball (8) from the gear change lever by unscrewing the two pegs (9).	
5	Use a shouldered mandrel to remove the two graphite bushes (10) from the bracket (11) and from first and reverse speed lever (4).	Shouldered mandrel small dia. 14, length 20, large dia. 17, length 100.
6	Remove the locking springs (12) by punching of the rivets (13).	
7	Remove the rubber protector (14) by taking off plate (15).	
	ASSEMBLING GEAR SELECTOR (see Drawing 141)	
8	Fit the locking springs (12) to the levers, and peen over rivets (13).	
9	By means of a bench press and the mandrel used for dismantling, press in graphite bushes (10) into the bracket (11) and the first and reverse speed lever (4). Ream the bushes to 14.1 mm. dia. (Use a shaft for gauging).	Shouldered mandrel small dia. 14, length 20, large dia. 17, length 100
10	Fit the bronze ball (8) on the lever (5), tighten the two pegs (9) and turn back tabs of lockwashers.	Box spanner 8
11	Fit the outer lever (7) on shaft (3). Fit the cotter (16) and tighten nut.	Box spanner 8
12	Fit rubber protector (14) and tighten plate (15).	
13	Oil the shaft (3) and engage in bracket. Fit one thrust washer (6), inner lever (4) for first and reverse speed, change speed lever (5), second and top speed lever (2), and a thrust washer (6). Fit cotter (1) into the second and top speed lever (2). Tighten the cotter nut using a plain washer under.	

	REMOVING HANDBRAKE CROSS-SHAFT (see Drawing 90)	
1	Disconnect brake cables (1), unhook return spring (2), from handbrake lever, disconnect relay rod (3) by removing pin (4) at cross-shaft end.	Box and flat spanners 12
2	Remove caps (5) from brackets of cross-shaft (6). Remove the shaft and take out brackets (7).	Box spanner 12
	REFITTING HAND BRAKE CROSS-SHAFT (see Drawing 90).	
3	Fit the two cross-shaft brackets (7) on fixing bolts on hull. Fit shaft (6) in bracket, fit caps (5), tighten nuts.	Box spanner 12
4	Adjust the handbrake (see Operation 749, paragraph 3).	

	REMOVING PEDAL GEAR	
1	Remove gear control rods from relay levers on timing cover. Remove the clutch cable and stop lamp switch operating rod.	Flat spanner 12
2	Remove pedal gear reinforcement.	Box spanner 12
3	Remove the Lockheed reservoir cap and introduce a conically pointed pin to plug the outlet union in order to prevent loss of fluid when disconnecting feed pipe.	Pin 10 dia.
4	Remove feed pipe from reservoir to master cylinder. (Use spanner 2130-T, see Drawing 91, fig.2). Unscrew the bolt fixing master cylinder three-way union. (Use spanner 2131-T, see Drawing 91, fig. 1).	Flat spanner 16 Spanners 2130-T and 2131-T
5	Unscrew bolt fixing pedal shaft (master cylinder bracket end) and bolts fixing master cylinder on hull.	Box and flat spanners 12 Flat spanner 21
6	Slacken the master cylinder and clutch control levers. Disengage master cylinder with bracket and both control levers. Remove keys from keyways.	Flat and box spanners 12
7	Unscrew bolt fixing pedal shaft (pedal end) and disengage pedal springs and shaft.	Flat spanner 21
8	REMOVE PEDAL GEAR BRACKET FROM BULKHEAD (for this operation it is necessary to remove the steering wheel and fixed tubular column with bracket from bulkhead). (a) Remove the steering wheel. (Use steering wheel extractor 1950-T, see Drawing 68, fig. 3).	Extractor 1950-T Box spanner 32
	(b) Remove the combined lighting and horn switch.	
	(c) Remove fixed tubular column and bracket from bulkhead.	Box spanner 14
	(d) Remove pedal gear bracket from bulkhead.	Box spanner 12
	FITTING PEDAL GEAR	
	IN CASES WHERE THE PEDAL GEAR BRACKET HAS BEEN REMOVED	
9	Fit pedals to bracket. Tighten left-hand bolt fixing pedal shaft and turn back tab of lockwasher.	
10	Offer up the assembly to the bulkhead without fixing so as to allow passage for the fixed tubular column bracket.	Flat spanner 21

11	Fit the fixed tubular column and bracket to bulkhead. Check the centering of the steering column proper in the tube. (Use bush MR.3102, see Drawing 68, fig. 1). The eccentricity must not be more than 4 mm. If necessary, correct the centering of the tube by repositioning the column fixing bracket on the instrument panel. Fit the combined lighting and horn switch.	Box spanner 14
12	Fit the steering wheel. Set the front wheels in straight ahead position. Fit key in keyway on steering column and fit the wheel so that the key engages in hub keyway in line with one of the spokes. Tighten nut. The two upper spokes must allow the driver clear vision of the instrument panel.	Box spanner 32
13	Tighten bolts fixing pedal gear bracket to bulkhead.	Box spanner 12
	IN CASES WHERE THE PEDAL GEAR BRACKET HAS NOT BEEN REMOVED	
14	Oil the pedal shaft and offer up in bracket the pedals and springs mounted on shaft. Tighten the left-hand fixing bolt and turn back tab of lockwasher.	
15	Fit the control levers in the following order:- thrustwasher lever key, master cylinder control lever, spacing washer, key and clutch control lever. Tighten lever clamp bolts using spring washers under nuts.	Flat and box spanners 12
16	Fit the bracket and master cylinder assembled, making sure that the rubber protector is positioned correctly. Tighten the bolts fixing the bracket using a spring washer under each nut. Fit the pedal gear reinforcement. Tighten the pedal shaft right-hand fixing bolt and turn back tab of lockwasher.	Flat spanners 12-21 Box spanner 12
17	Fit the Lockheed pipe. (Use spanner 2130-T, see Drawing 91, fig. 2). Tighten bolt fixing master cylinder three-way union. (Use spanner 2131-T, see Drawing 91, fig. 1).	Flat spanner 16 Spanners 2130-T and 2131-T
18	Fit the clutch cable and stop lamp switch operating rod. Fit gear control rods using split pins to retain clevis pins.	Flat spanner 12
19	Remove plug from Lockheed reservoir. Bleed the brake system. (See Operation 749, paragraph 5).	

	REMOVING MASTER CYLINDER	
1	Remove the Lockheed reservoir cap and introduce a conically pointed pin to plug the outlet union in order to prevent loss of fluid when disconnecting feed pipe.	Pin 10 dia.
2	Remove feed pipe from reservoir to master cylinder. (Use spanner 2130-T, see Drawing 91, fig.2).	Spanner 2130-T Flat spanner 14
3	Take out clevis pin at the front end of the clutch cable. Pull up the clutch cable without disconnecting it at the pedal end and lay it on hull. Loosen the pedal gear reinforcement. Take out the bolt fixing it to the hull, and (without removing its fixing bolt on the pedal gear) let reinforcement rest against hull closing plate.	
4	Unscrew bolt fixing master cylinder three-way union. (Use spanner 2131-T, see Drawing 91, fig.1)	Box spanner 12 Spanner 2131-T
5	Remove master cylinder from its bracket.	Spanner "Facom type Ideal" 240 x 12
	FITTING MASTER CYLINDER	
6	Fit cylinder to bracket and at the same time fit the push rod. Make sure that the rubber protector is correctly positioned. Tighten nuts using spring washers under.	Spanner "Facom type Ideal" 240 x 12
7	Screw in plug fixing master cylinder three-way union. (Use spanner 2131-T, see Drawing 91, fig. 1).	Spanner 2131-T
8	Fit pedal gear reinforcement and connect clutch cable.	Box spanner 12
9	Fit feed pipe from Lockheed fluid reservoir to the master cylinder. (Use spanner 2130-T, see Drawing 91, fig. 2).	Spanner 2130-T
10	Bleed the brake system (see Operation 749, paragraph 5).	

	DISMANTLING (see Drawing 92)	
1	Take out circlip (1) retaining the piston but hold the latter in place to prevent dispersion of parts under pressure from the spring.	
2	Take out piston (2), cup (3), spring (4) and valve (5). Unscrew the union (6).	Flat spanner 23
	CLEANING	
3	Use alcohol only to clean the parts. There must be no traces of rust or scoring in the master cylinder bore. If the bore is defective replace the casting. Make sure that the holes "a" and "b" are perfectly clear.	
4	With all the parts in perfect order re-assemble the master cylinder after dipping components in Lockheed fluid.	
	ASSEMBLING	
5	Fit valve (5), spring (4), cup (3) and piston (2) fitted with cup (7). Fit washer (8) and circlip (1). Tighten the union (6).	Flat spanner 23

1	REMOVE THE TAIL PIPE Remove the bolt fixing the rear clip. Disconnect tail pipe flange from silencer and remove pipe.	Box spanner 14
2	REMOVE THE SILENCER Disconnect silencer inlet flange from exhaust pipes under hull. Disconnect silencer outlet flange from tail pipe and take out silencer.	Flat and box spanners 14
3	REMOVE EXHAUST PIPE BETWEEN ENGINE AND SILENCER Disconnect exhaust pipe front flanges from exhaust manifold. (Use spanner 1626-T, see Drawing 1, fig. 2). Remove the bracket under hull and disconnect exhaust pipe rear flange from silencer inlet.	Spanner 1626-T Box spanners 12-14
4	FIT EXHAUST PIPE BETWEEN ENGINE AND SILENCER Use C. and A. type gaskets between both pairs of flanges. Tighten bolts on silencer inlet flange using spring washers under nuts. TIGHTEN UP HARD THE NUTS FIXING EXHAUST PIPE FLANGES TO MANIFOLD. (Use spanner 1626-T, see Drawing 1, fig. 2). Fit the exhaust pipe bracket under hull.	Spanner 1626-T Box spanners 12-14
5	FIT THE SILENCER Use C. and A. type gaskets at flanges. Fit spring washers under nuts and tighten.	Box and flat spanners 14
6	FIT THE TAIL PIPE Use a C. and A. type gasket between the flanges. Fit spring washers under the flange nuts and tighten. Fit bolt for rear clip using a spring washer and plain washer.	Box spanner 14

	REMOVING DISTRIBUTOR	
1	Disconnect ignition coil and spark plug leads.	Box spanner 8
2	Slacken clamp screw and take out distributor.	Flat and box spanners 10
	DISMANTLING DISTRIBUTOR (see Drawing 93).	
3	Dismantle the distributor head by removing screws (1) and terminal (2). Remove the condenser.	Flat spanner 9
4	Knock out pin (3) fixing driving dog. Disengage the shaft and centrifugal advance weights (4) by unhooking springs (5).	Pin punch 3
5	Disconnect wires from distributor cap.	
6	Clean the parts.	
	ASSEMBLING DISTRIBUTOR (see Drawing 93).	
7	Fit the centrifugal advance weights (4) and hook on springs (5). Offer up the shaft in distributor body and make sure there is no play in the bushes. If there is play replace the distributor body.	
8	FIT THE SHAFT (a) Oil the shaft and engage it in distributor body. (b) Fit a spacing washer on the lower end of the shaft and then the driving dog (6). THE DRIVING DOG TONGUE IS OFFSET. THE PART MUST BE FITTED SO THAT THE TONGUE IS OFFSET TOWARDS THE SIDE OPPOSITE THE CAM SLOT. With the driving dog fitted make sure that the shaft turns freely without end play. Should there be end play in the shaft take this up by using a thicker spacing washer. Peen over both ends of pin (3).	
9	Fit the contact carrier plate and the toggles. Adjust the contact gap to 0.4 mm., plus or minus 0.05 mm. Fit the condenser.	Flat spanner 9
10	Fit the spark plug and ignition coil leads to the distributor cap. Fit cap to distributor.	
11	BENCH TEST DISTRIBUTOR (a) Set up on the test bench and ignition coil of the same type as the distributor to be tested.	

Connect the negative terminal of the coil to the distributor primary terminal.

(b) Check the insulation of the secondary circuit. Set the test bench contacts gap to 15 mm. Connect ignition coil secondary terminal to the central terminal of the distributor cap. Connect the spark plug leads to the test bench contacts. Rotate the distributor for fifteen minutes at 1000 R.P.M.

(c) Check the firing points. The angular differences of the firing points read on the degree scale must not exceed $1^{\circ}5'$ at all speeds. (Maximum speed of distributor is 2000 R.P.M.)

(d) Check the adjustment of the automatic advance curve. The curve is as follows:-
0° at 250 R.P.M. (distributor speed) and 14.5° at 2000 R.P.M. (see Drawing 94 for tolerance).
To obtain this curve it is possible to modify the tension of the centrifugal weights by bending the spring carrier plates.

(e) Check the insulation of the primary circuit. Heat the distributor, WITHOUT CONDENSER to a temperature of 60° C. (140° F.). With the contact breaker open, apply an alternating current of 110 volts, 50 cyles, between positive terminal and earth with a lamp in series. Keep voltage applied for one minute. If lamp lights the insulation is faulty.

FITTING DISTRIBUTOR

12 See Operation 701, paragraph 30, and Operation 702, paragraph 17.

NOTE. Certain cars are fitted with fans that have the blades equally spaced. On these models, to remove the dynamo, it may be necessary to remove the air intake silencer, the air heater tube, and also to free the radiator on its brackets to move it a little forward.

REMOVING DYNAMO

1	Remove the air intake silencer. Disconnect the pipe from the carburettor intake and the silencer brackets from hull.	Flat spanners 12
2	Disconnect wires on dynamo.	Box spanners 8-14
3	Remove nuts fixing dynamo bracket on clutch housing cover.	Flat spanner 17
4	Take out the dynamo from the right of the engine. Turn the fan so that blades that are wider spaced clear the radiator.	

FITTING DYNAMO

5	Fit the dynamo from the right of the engine. Turn the fan so that blades that are wider spaced clear the radiator.	
6	Fit belt on dynamo pulley and adjust without excessive tension. Tighten the dynamo bracket fixing nuts after fitting one plain washer and one spring washer under each.	Flat spanner 17
7	Connect dynamo wires.	Box spanners 8-14
8	Fit the air intake silencer with the fixing plates between two rubber washers. Split pin the fixing bolts.	Flat spanner 12

	DISMANTLING DYNAMO (see Drawing 95)	
1	Remove the driving pulley (1), dust cover band (2), fan (3), and the end plate (4) (fan end), together with armature. Remove end plate (5) carrying brush gear.	Box spanners 8-21
2	Remove the dynamo bracket.	Flat spanner 21
3	Remove pole-piece fixing screws (6). (Use special screwdriver MR.1601-4 fitted in a bench press, see Drawing 97). Remove the pole-pieces (7), take out the terminals (8) and remove the field coils.	Screwdriver MR.1601-4 Bench press
4	Remove the end plate (4) from the armature by means of the bench press.	
5	Dismantle the end plate (5) carrying brush gear.	
6	Remove the bearing (12) from end plate (4) (fan end), by taking off the closing plate (13).	
7	Unsolder connections "a" of field coil leads (see Drawing 96).	
8	Clean parts.	
	ASSEMBLING DYNAMO	
9	Check the armature with suitable apparatus.	
10	True up the commutator. Do not decrease by more than 2 mm. the original diameter of 45 mm.	
11	After machining the commutator use a scraper or a piece of saw blade, ground to the width of the segment insulators, to clean the insulators and thus prevent "shorting" of the segments.	
12	Check the field coils with the aid of a test lamp.	
13	REPLACE DEFECTIVE FIELD COILS (a) When soldering field coil connections use only a resin paste flux. NEVER USE ZINC CHLORIDE (spirits of salts). (b) When fitting the field coils take care not to break or kink the connections.	
14	FIT THE FIELD COILS AND POLE PIECES (see Drawing 96) Make sure that the coils and pole pieces are correctly positioned in the dynamo casing (Use	Mandrel MR.1601-2

	Mandrel MR.1601-2, see Drawing 97). This mandrel will establish a clearance of 0.05 mm; between armature and pole pieces and thus prevent fouling.	
	(a) Fit the field coils and the insulating strips (14). Provisionally tighten the pole piece fixing screws (7). (See Drawing 95).	
	(b) Completely engage mandrel MR.1601-2 between the pole pieces by means of a press (see Drawing 97).	
	(c) Tighten the pole piece fixing screws. (Use screwdriver MR.1601-4 fitted in a bench press, see Drawing 97).	Screwdriver MR.1601-4
	(d) Take out the mandrel from the end opposite to its entry.	
	(e) Twist and solder the field coil leads (see Drawing 96), and connect to the terminals.	
	No greasers are fitted for the bearings. Before assembly coat the bearings with vaseline. No other lubrication should be necessary during the life of the dynamo. (Lubricatation points are not provided in order that neither oil or grease can cause dirty brushes or commutator).	
15	PREPARE END PLATE CARRYING BRUSH GEAR (see Drawings 95 and 96). (a) Rivet the negative brush holder (15) with its packing (16) and the positive brush holder (17) with its insulating plate (18). Use insulating on the rivets.	
	(b) Fit in the bearing housing of the end plate, oil retaining washer (11), bearing (10), a second oil retaining washer (11), bearing retaining washer (19) and circlip (9).	
	(c) Fit the brushes and brush springs. To allow the commutator to be fitted between the brushes hold the brushes in a "raised position" by the springs (as indicated on Drawing 96, fig. 3).	
16	PREPARE END PLATE (4), FAN END (see Drawing 95). (a) Fit in the bearing housing of end plate, oil retaining washer (20), bearing (12), a second oil retaining washer (20), paper gasket for closing plate and the closing plate (13). Tighten the three screws.	
	(b) Fit the thrust bush (21) on the armature, and fit the end plate with the aid of a small press.	
	(c) Engage the armature in the dynamo casing and fix the end plate by screws. Lock the screws by punching metal from the end plate into the slots of screw heads.	
	(d) Fit the fan (3) and tighten nut using a spring washer under.	Box spanner 21

17	Fit thrust bush (23) on armature and fit the brush gear end plate. Tighten the fixing screws. Connect the field coil wires to the positive brush as at "b".	
18	Fit the driving pulley (1) to shaft. Make sure that the shaft turns freely BUT WITHOUT END PLAY. If it is necessary to take up end play fit an adjusting washer (22) between bearing and pulley. Use a spring washer under the pulley nut and tighten the latter. Engage brushes with commutator. Fit the dust cover band (2).	Box spanners 8-21
19	Fit the dynamo bracket to the casing. Use spring washers under nuts and tighten.	Flat spanner 21
20	Check the output on a test bench. The dynamo commences charging at 700 to 800 R.P.M. The output at 2500 R.P.M. should be between 14.5 and 15 amperes the corresponding voltage being 6.2 to 7.2 volts, the dynamo discharging into a battery.	
21	Paint the unit.	

	REMOVING STARTER MOTOR	
1	Disconnect positive cable from battery. (Use extractor 2200-T, see Drawing 1, fig. 1).	Flat spanner 10 Extractor 2200-T
2	Disconnect starter motor switch control. Disconnect starter motor wires.	Box spanners 8-14
3	Remove starter motor housing cap. Take out starter motor.	Universal joint spanner 21
	FITTING STARTER MOTOR	
4	Fit the starter motor in its housing, making sure that the locating dowel is properly engaged. Fit the housing cap and secure with nuts and spring washers.	Universal joint spanner 21
5	Connect starter motor wiring. Fit the starter motor switch control.	Box spanners 8-14
6	Connect battery positive cable.	Flat spanner 10

	DISMANTLING STARTER MOTOR (see Drawing 98)	
1	Remove the switch, dust cover band (16), bendix housing (1), take out the armature and remove end plate (2) carrying brush gear.	Flat spanners 8-12
2	Remove the pole-pieces. (Use screwdriver MR.1601-4 fitted in a small bench press, see Drawing 97) Unsolder field coil and terminal (3) connecting strips and take out field coils (see Drawing 99, fig. 1).	Screwdriver MR.1601-4 Soldering iron
3	DISMANTLE BENDIX GEAR FROM ARMATURE SHAFT (see Drawing 142) (a) Compress the spring (3). (Use compressor 2202-T, see Drawing 143). Remove circlip (1), extract pin (2) with the aid of a pair of flat nose pliers (the pin comes out easily). Free the bendix assembly from the shaft. Remove the plate (11) for the intermediate bearing. (b) Remove compressor 2202-T from the spring. Remove washer (4) for spring (3). Unhook spring (3) from washer (5). (c) Remove circlip (6), disengage pinion (7) from shaft (8), take out spring (9) from bore of pinion (7).	Compressor 2202-T
4	Dismantle the brush gear end plate (2). Use a mandrel to knock out bushes (4 and 5) from end plate and bendix housing respectively.	Punch 3 dia. Mandrel 15 x 17 x 150
5	Dismantle the switch.	Flat spanner 14 Box spanner 8
6	Clean the parts.	
	ASSEMBLING STARTER MOTOR	
7	Check the armature shaft between centres. Check the armature windings on suitable test apparatus and the field coils with a test lamp.	
8	True up the commutator. (NEVER DECREASE THE ORIGINAL DIAMETER OF THE COMMUTATOR, WHICH IS 45 mm. BY MORE THAN 2 mm.)	
9	After rectification of the commutator clean out the insulators between the segments to ensure against "shorting". For this purpose use a scraper or piece of saw blade ground to the width of the insulating plates.	
10	BUILD UP THE END PLATE CARRYING BRUSH GEAR AND THE BENDIX HOUSING (see Drawing 98 and 99).	

	The bushes for the end plate and bendix housing are made of porous bronze. Before assembling soak the bushes for approximately twenty four hours in an oil bath (engine or similar oil) to thoroughly impregnate them. No means of lubricating the bushes after assembly is provided and the above method should suffice throughout the life of the machine. (The reason for this method is to prevent oil penetrating to the commutator and brushes).	
	(a) Fit the lubricated bearings (4 and 5) by means of a small bench press.	
	(b) To the end plate carrying brush gear rivet on negative brush holders (6) with packings (7) and the brushes (8). Rivet on positive brush holders (9) with insulating plates (10) using insulating sleeves (11) on rivets. Fit the positive brushes (15) and tighten screws.	
	(c) To allow the commutator to be fitted hold the brushes out as indicated on Drawing 99, fig. 2	
11	FIT FIELD COILS AND POLE PIECES	
	Make sure that the field coils and pole pieces are correctly positioned in the starter motor casing. (Use mandrel MR.1601-1 see Drawing 97). This mandrel will establish a clearance of clearance of 0.7 mm. maximum between armature and pole pieces and thus prevent fouling.	Mandrel MR.1601-1
	(a) Fit the field coils, insulating strips (12), screws fixing pole pieces and provisionally tighten.	
	(b) Place the terminal (3) with its insulating washers and solder field coil connecting strips (see Drawing 99, fig. 1)	Flat spanner 12
	(c) Completely engage mandrel MR.1601-1 between pole pieces by means of a press (see Drawing 97, fig. 1).	Mandrel MR.1601-1
	(d) Tighten the pole piece fixing screws using screwdriver MR.1601-4 fitted in a small press (see Drawing 97, fig. 2).	Screwdriver MR.1601-4
	(e) Take out the mandrel from the end opposite to its entry.	
12	ASSEMBLE SWITCH (see Drawings 98 and 99). Fit terminal (3) with its insulating washers. Fit the spring, positioned according to drawing, to ensure bearing against the cam (13). Fit the cam, retaining tube, and control lever.	Flat spanners 6-14-16
13	FIT BENDIX GEAR TO ARMATURE SHAFT (see Drawing 142) (a) Fit spring (9) in bore of pinion (7). Fit pinion on sleeve (8) and fit circlip (6).	
	(b) Fit the spring (3) by engaging the bent end in slot in washer (5) Fit washer (4) (with	

	the conical portion on the spring side) by introducing the bent end of spring (3) in washer slot.	
	(c) Compress the spring (3). (Use compressor 2202-T, see Drawing 143). Fit circlip (1) in groove of sleeve (8).	Compressor 2202-T
	(d) Put in position the intermediate bearing (11) and then the key (10) in keyway on shaft.	
	(e) Offer up the bendix assembly on armature shaft and fit pin (2) in its seating. Turn the ciclip (1) in groove on sleeve (8) to lock the pin (2). Remove compressor 2202-T.	
14	Fit the end plate (2) on starter motor casing. Connect the field coil terminal strips to the positive brushes (15). Tighten the screws using spring washers under heads. Engage the armature, fitted with thrust washers at both ends, and fit the bendix housing (1). Make sure that the armature turns freely without fouling and has an end play of 0.2 mm. to 1.3 mm. If necessary use thrust washers of a different thickness to give the correct end play. Bring brushes into contact with commutator. Fit the dust cover band (16). Fit the contact leaf (14) to the terminal and lock contact by turning back corners against flats of nut. Fit the switch TAKING CARE THAT CONTACT LEAF IS ABOVE THE SWITCH TERMINAL.	Flat spanner 8
15	Bench test motor. Current consumption under load is 180 to 200 amperes and with no load 50 to 75 amperes.	
16	Paint unit.	

HEADLAMP ADJUSTMENT

Use the screen MR.1572 according to instructions on Drawing 106.

Screen MR.1572

	REMOVING FRONT WINGS AND RADIATOR SHELL ASSEMBLY	
1	Remove the bonnet. Disconnect cable from battery positive terminal. (Use extractor 2200-T, see Drawing 1, fig. 1). Disconnect feed wires to lamps and horns from terminal blocks.	Flat spanner 10 Extractor 2200-T Box spanner 8-10
2	Remove bolts fixing wings to hull and to brackets. Remove bolts fixing radiator shell front panel. Disengage the assembly of wings and radiator shell from the car.	Flat spanner 10 Box spanners 12-14
	FITTING FRONT WINGS AND RADIATOR SHELL ASSEMBLY	
3	Offer up the assembly to the car. Using a plain washer and a spring washer under the heads of the bolts screw in the latter a few turns only. Offer up the bonnet and, after adjusting the parts in relation to one another and correctly fitting the wing piping, tighten the fixing bolts.	Flat spanner 10 Box spanners 12-14
4	Connect headlamp and horn wiring. Connect positive cable to battery.	Flat spanner 10 Box spanners 8-10
	REMOVING RADIATOR SHELL	
5	Remove the bonnet.	
6	Remove bolts fixing radiator shell to wings also those fixing radiator shell lower front panel to radiator.	Box spanners 10-12 Flat spanners 12-14
	FITTING RADIATOR SHELL	
7	Fit the radiator shell. Position the wing piping and tighten bolts using a plain washer and a spring washer under heads.	Box spanners 10-12 Flat spanners 12-14
8	Fit the bonnet.	
	REMOVING A FRONT WING	
9	Disconnect cable from battery positive terminal. (Use extractor 2200-T, see Drawing 1, fig. 1). Disconnect headlamps and horn wiring.	Box spanners 8-10 Extractor 2200-T Flat spanner 10

10	Remove bolts fixing wing to radiator shell, hull and wing bracket.	Flat spanner 10 Box spanners 12-14
	FITTING A FRONT WING	
11	Offer up the wing on the car. Using a plain washer and a spring washer under the heads of the bolts screw in the latter a few turns only. Correctly position the wing piping and tighten the fixing bolts.	Flat spanner 10 Box spanners 12-14
12	Connect headlamp and horn wiring. Connect positive cable to battery.	Box spanners 8-10 Flat spanner 10

	REMOVING PETROL TANK	
1	Jack up the vehicle at the rear and block up under rear link arms. (Use special jack head MR.3300-110, see Drawing 75).	Special jack head MR.3300-110
2	Remove the inspection plate in the rear luggage compartment floor. Disconnect wires on petrol gauge tank unit. Unscrew terminal nut from petrol tank outlet pipe and remove feed pipe from outlet pipe. Remove rubber grommet from petrol tank filler neck.	Box spanner 16
3	Disconnect the two straps holding the tank. Remove petrol tank.	Box and flat spanners 14
4	Unscrew the petrol tank outlet pipe. Remove the petrol tank gauge unit. Take off lower rubber grommet from tank filler neck.	Flat spanner 16
	FITTING PETROL TANK	
5	Fit the tank gauge unit with a cork gasket and tighten the three screws. Fit the petrol tank outlet pipe using a fibre washer on the tank flange. Fit the lower rubber grommet to the filler neck.	Flat spanner 16
6	Fit the tank to the car and tighten the straps.	Box and flat spanners 14
7	Fit the petrol feed pipe and connect wires to gauge unit (wires and gauge unit terminals are coloured blue and yellow according to way of connecting). Fit the inspection plate. Fit the upper rubber grommet to the filler neck.	Box spanner 16
8	Lower vehicle to the ground.	

VALVE TIMING

Crankshaft and camshaft timing wheels are marked.
With the engine at top dead centre on number one cylinder at the end of the compression stroke, the two marks and the centres of both wheels must be on the same straight line. Check with a straight edge (see Drawing 20).
For record purposes the valve timing is as follows:-

	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 fifteen minutes (speed 500 R.P.M. approx.) adjust the tappets to 0.15 mm. clearance on inlet and 0.20 mm. clearance on exhaust valves.

Flat spanner 14
Set of feeler gauges

IGNITION ADVANCE ADJUSTMENT

Remove air vent cover on clutch housing.
Crank engine slowly to bring the first cylinder to end of compression stroke and then turn back slightly. Insert a 6 mm. diameter pin in the hole provided in the right-hand side of the clutch housing cover and then turn engine again slowly in the normal direction of rotation until the pin falls in the flywheel slot marked ALLU. The engine is now at 8° advance on flywheel.
NOTE. THE FLYWHEEL HAS VARIOUS HOLES FOR BALANCING PURPOSES, MAKE SURE THAT THE PIN DOES NOT FALL INTO ONE OF THESE.
Fit a test lamp on the distributor and connect lead from lamp to condenser terminal.
Turn the distributor body so as to bring contact piece of first cylinder plug lead facing rotor.
Close the contacts. Now turn distributor to find the exact point of opening which is at the moment the test lamp lights. Set the distributor bracket in the mid-position of its travel and tighten.
Engine firing order is 1-4-2-6-3-5..

VERY IMPORTANT NOTE: WITHDRAW THE GAUGE PIN

CARBURETTOR ADJUSTMENT (see Drawing 120).

NOTE. The method of adjusting the SOLEX twin-carburettor is the same as for the single type. The twin-carburettor has only one float and starter section for feeding the two chambers, but the sections for adjusting slow-running and normal running are in duplicate.
The SOLEX downdraught twin-carburettor is fitted with a mechanically operated pump which has the function of supplying an extra quantity of petrol at the point of acceleration in order to overcome the "flat spot" when passing from slow to normal running.
The carburettor also has a progressive starter and complementory correction device which has the purpose of reducing the richness of the mixture when the throttle is fully open. The slow running screw operates on THE QUANTITY OF PETROL and not on the quantity of air.
Typical settings of the 30 P.A.A.I. type carburettor are as follows:-

Choke	Main Jet	Correction Jet	Slow-running jets		Starter jets		Float Weight	Needle	Pump Jet Petrol	Pump Air
			Petrol	Air	Petrol	Air				
24	120	280	45	100	140	5.5	21 grammes	2.5	50	100

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

(a) SLOW RUNNING ADJUSTMENT. Slow running adjustment is effected by:-
1. Adjusting screw (34) which will vary the engine speed.

2. Adjusting mixture regulating screws (29) which vary THE QUANTITY OF PETROL fed through the slow running jets. The action of these screws is very sensitive, therefore the adjustment must be made slowly and carefully. With the engine stopped, screw the two mixture regulating screws (29) right home and then unscrew one complete turn. Start the engine and wait until it has warmed up. If the engine "races" the mixture is too rich and both screws must be tightened THE SAME AMOUNT. On the contrary, if the engine "stalls" or stops easily, the richness must be increased by slackening both screws THE SAME AMOUNT.
NOTE. The mixture regulating screws (29) must never be screwed right home. Never modify the air jets (9), as their output depends on the bore size.

(b) SOME INDICATIONS OF POOR ADJUSTMENT
1. Spark plug colour white, engine backfires into carburettor; overheats and does not pull; MIXTURE TOO WEAK.

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

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

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

5. Low speed: CHOKES TOO SMALL, JETS TOO SMALL, CORRECTION JETS TOO LARGE, NEEDLE VALVE TOO SMALL, THROTTLE NOT OPENING FULLY.

6. Insufficient climbing power: CHOKES TOO LARGE OR TOO SMALL, JETS TOO SMALL, CORRECTION JETS TOO LARGE.

CASTER ANGLE ADJUSTMENT (see Drawing 100)

1 With front and rear body heights adjusted (see Operation 750, paragraphs 1, 2 and 3) and the tyres at correct pressure, place the vehicle on a LEVEL surface or elevated platform.

2 Remove the greasers on the upper and lower link arms (greasers for lubricating pivot ball joint). Fit the apparatus MR.3449 (see Drawing 100) by using the greaser holes. The plumb line must lie between the maximum and minimum gauge marks. The caster angle will then be $0^{\circ} \pm 15'$. — Apparatus MR.3449

3 If plumb line does not fall within gauge marks, correct the caster angle. To do this (see Drawing 139) unscrew the nut of the eccentric pin (121) and turn the adjusting eccentric (122) in the direction necessary to correct the plumb line reading. (Use spanner 1854-T, see Drawing 55). — Spanner 1854-T, Box spanner 21

After adjusting tighten the eccentric pin nut.
Proceed in the same manner for the other side of the axle.

"TOE-OUT" ADJUSTMENT

This adjustment must only be made after adjusting the caster angle. Use a gauge of the type commonly used in the trade for this purpose. At the height of the wheel centres measure the distance between the inner flanges of the wheel rims at the front. Mark the points measured with chalk. Rotate both wheels half a turn and measure, now at the rear, the distance between the chalk marks on the rim flange. THE WHEELS MUST "TOE-OUT", THE DIFFERENCE BETWEEN THE FRONT AND REAR MEASUREMENTS BEING 0 mm. to 4 mm.

4 To correct "toe-out", jack up the vehicle at the front. (Use special jack head MR.3300-90, see Drawing 67). Slacken the clamp screws of the track rod adjustable sockets. Using a wrench of the "STILLSON" type turn both track rods an equal amount. (WHEN ADJUSTED THE DIFFERENCE IN LENGTH OF THE TWO TRACK RODS MUST NOT EXCEED 1 mm.) Check track rod lengths. (Use gauge MR.1590, see Drawing 101). Make sure that the steering rack ball joints do not move during this operation or the adjustment will be affected. — Gauge MR.1590

5 Lower the vehicle to the ground. Check adjustment as before. Before locking track rod adjustable socket clamp screws make sure that steering rack ball pins are horizontal in order 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 (39) 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 the steering rack. (See Drawing 70). (Use spanners 1975-T). — Flat spanner 17, Spanners 1975-T

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

7 Set the length of the steering lock gauge 1890-T according to the wheel size (NOT THE TYRE SIZE). (See Drawing 102). — 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 the stub axle height. If rim and pointer do not coincide, jack up the vehicle again and adjust either the stop screw or the aluminium cover according to the side being checked. Lower vehicle to the ground again and check once more with the gauge.

9 Tighten the stop screw locknut and the locknuts of the aluminium cover. Turn back tabs of lockwasher (lockwasher being fitted between cover and first locknut) on both sides against flats.

WHEEL CAMBER INSPECTION

10 Wheel camber cannot be adjusted. It must be 1°, plus or minus 0°30'. To check this the vehicle must be standing on a level surface. The tyres must all be exactly at the same pressure and the body heights under hull carefully adjusted. (Use gauge 2314-T, see Drawing 103). If the camber is incorrect, check the front axle parts and the alignment of the hull. — Gauge 2314-T

1	Jack up the vehicle at the front and rear and place it on blocks. (Use special jack heads MR.3300-90 and MR.3300-110, see Drawings 67 and 75.)	Special jack heads MR.3300-90 and MR.3300-110
	ADJUSTMENT OF CAMS	
2	Turn the adjusting cam pin (hexagon head on rear wheels, square head on front wheels) in the direction indicated on Drawing 53, fig. 4, and at the same time revolve the wheel by hand. Adjust pin sufficiently to bring brake shoe just into contact with drum. Turn pin back slightly to free the wheel, and then carefully forward again until there is slight friction between the brake lining and the drum (never finish the adjustment on the backward movement of the brake shoe). The brake shoe must be set as closely as possible to the drum so that pedal travel is short. Carry out the same operation on the other shoe and to the other wheels.	Flat spanner 10 Universal joint spanner 17
	HANDBRAKE ADJUSTMENT (see Drawing 90)	
3	(a) Push the handbrake control (8) as far forwards as possible ("brake-off" position).	
	(b) Bring the two levers (9) of the cross-shaft (6) against the hull closing plate at "a".	
	(c) With the cable (10) having neither tension or slackness, adjust the length of the relay rod (3) so that there is no pull on the cross-shaft.	Flat spanner 12
	(d) Successively adjust the tension of the brake cables by the nuts (11), so that when the handbrake control is in the third notch the rear wheels brake evenly, and when in the fourth notch the wheels lock.	Flat spanner 12
	FOOTBRAKE PEDAL ADJUSTMENT	
4	The necessary clearance between push rod and master cylinder piston is obtained by adjusting the stop screw on the pedal. The clearance will allow the piston to return to its rearmost position and so clear the oil feed hole. The adjustment must give an idle pedal movement of 10 mm. before the push rod strikes the piston.	
	BLEEDING LOCKHEED BRAKE SYSTEM (see Drawing 47).	
	To ensure efficiency of the brakes it is absolutely essential that no air bubbles remain in the system.	
5	(a) Fill the Lockheed reservoir, check level of fluid, and if necessary, top up. On each wheel (the vehicle being still jacked up), remove the plug (66) from the pointed screw (65) of the wheel cylinder, and fit drain pipe 2140-T (rubber pipe with threaded end piece). Arrange for the	Drain pipe 2140-T Flat spanners 10-12

pipe to drain into a container, transparent for preference (glass or a bottle), and already containing a little Lockheed fluid.

(b) Slacken the pointed screw (65) half a turn. Have the brake pedal operated slowly by an assistant. With each pedal stroke a certain quantity of fluid will escape from the drain pipe 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 (65).

(c) Remove the drain pipe and replace plug (66). Flat spanners 10-12

(d) Carry out the same operations to each wheel.

DO NOT FORGET TO TOP UP LEVEL OF FLUID IN RESERVOIR

(e) After topping up it is necessary to check the sealing of the system. In the absence of special check instruments, used only by the manufacturers, press pedal down as hard as possible with the foot for thirty 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, probably at a union or in one of the pipes.

(f) Check also the Lockheed reservoir. If the fluid is forced back into the reservoir the master cylinder retaining cup is defective. It is then necessary to dismantle the master cylinder immediately.

(g) Lower the vehicle to the ground. (Use special jack heads MR.3300-90 and MR.3300-110, see Drawings 67 and 75). Special jack heads MR.3300 -90 and MR.3300-110

ADJUSTMENT OF HEIGHTS UNDER HULL

1 The heights are measured with the vehicle complete for the road but without passengers. Make sure that tyre pressures are normal.
FOR "PILOTE" TYRES 185 x 400, the pressures are: FRONT - 1.400 kg. per sq. cm. (20 lbs. per square inch), and REAR - 1.500 kg. per sq. cm. (22 lbs. per square inch).
Run the vehicle on to a level surface.
Use gauge 2300-T to check the heights. Front height is measured from the torsion bar centre line to the ground. Rear height is measured from the underside of the rear hull floor to the ground.
The following are the heights appropriate to the type of car.

Gauge 2300-T

"Saloon" (5 and 6 seater) - Front 275 mm., plus 5 mm., minus 0 mm.
Rear 295 mm., plus 11.5 mm., minus 0 mm.

"Family" (7 and 9 seater) - Front 275 mm., plus 5 mm., minus 0 mm.
Rear 313 mm., plus 11.5 mm., minus 5 mm.

The tyre size of both models is 185 x 400.

2 If the heights need adjustment, jack up the vehicle (using special jack heads MR.3300-110, see Drawing 75, and MR.3300-90, see Drawing 67) in order to take the load off the torsion bars. This will allow easy turning of the ball-headed adjusting screws of the front torsion bars (by using spanner 2302-T), and of the nuts of the rear torsion bar adjusting rods.

Special jack heads MR.3300-110 and MR.3300-90
Spanner 2302-T
Flat spanner 23

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

ADJUSTMENT OF WEIGHT DISTRIBUTION

4 Check tyre pressure and correct if necessary.

5 Run the vehicle on to a level surface.

6 With heights under hull correct, place weighing machines (2310-T) under each wheel. Centre the wheels very carefully on the machine platforms. If only one weighing machine is available, a block the same thickness as the machine MUST BE PLACED under the other wheel of the same axle. Note the weight indicated on the machine scale. The difference in weight between two wheels on the same axle MUST NOT EXCEED 30 kg. (66.6 lbs). If weights differ by more than this amount it is necessary to adjust the torsion bars.

Weighing Machines 2310-T
Flat spanner 23
Spanner 2302-T

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

(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 equally 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. One must however, ensure that the minimum heights stated are observed. If it is impossible to realise these conditions the hull is out of square.

CHECKING WHEELS (see Drawings 104 and 105)

7 CHECK WHEELS FOR DISTORTION AND ECCENTRICITY (see Drawing 104, fig. 4).
By means of a suitable rig check:-
(a) The eccentricity of the rim well,

(b) and that the distortion of the inner faces of the rim does not exceed 4 mm. If the wheel exceeds the tolerance allowed it must not be fitted on the front axle. Excessive eccentricity or distortion will cause wheel wobble in the same way as a badly balanced wheel.

8 WHEEL BALANCE
The method of detecting and correcting badly balanced wheels is given herewith. (Use fixture MR.3396, see Drawing 105).
A wheel must only be balanced when under normal tyre pressure and after being run for several miles to allow correct seating of outer cover and tube.
Carefully clean wheel and tyre.
Fit the wheel on fixture (see Drawing 104, fig. 2).
After several oscillations the wheel will come to rest with the heaviest part at the lowest point "a" (see 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" (see fig. 3) equivalent in weight to the putty, or 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 the plate to the rim.
The added weight must always be as near as possible to the centre line of the rim.
It is necessary to balance the wheel after each tyre change.

REPAIRS TO HULL

Straightening or replacement of hull parts can only be carried out if a special jig is available. (Use jig 2600-T, see Drawing 107).
The main dimensions locating the principle units are given on Drawing 108.