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.

PUBLISHERS SALES SERVICE LTD.,
28-29 SOUTHAMPTON ST., STRAND, W.C.2.
TEL.: TEMPLE BAR 0186/7

ENG.

JUNE 1959.

ILLUSTRATIONS

2200-T EXTRACTOR FOR BATTERY CABLE TERMINAL

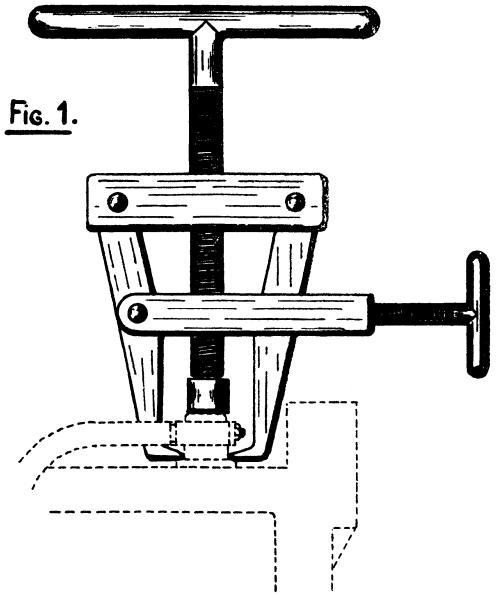
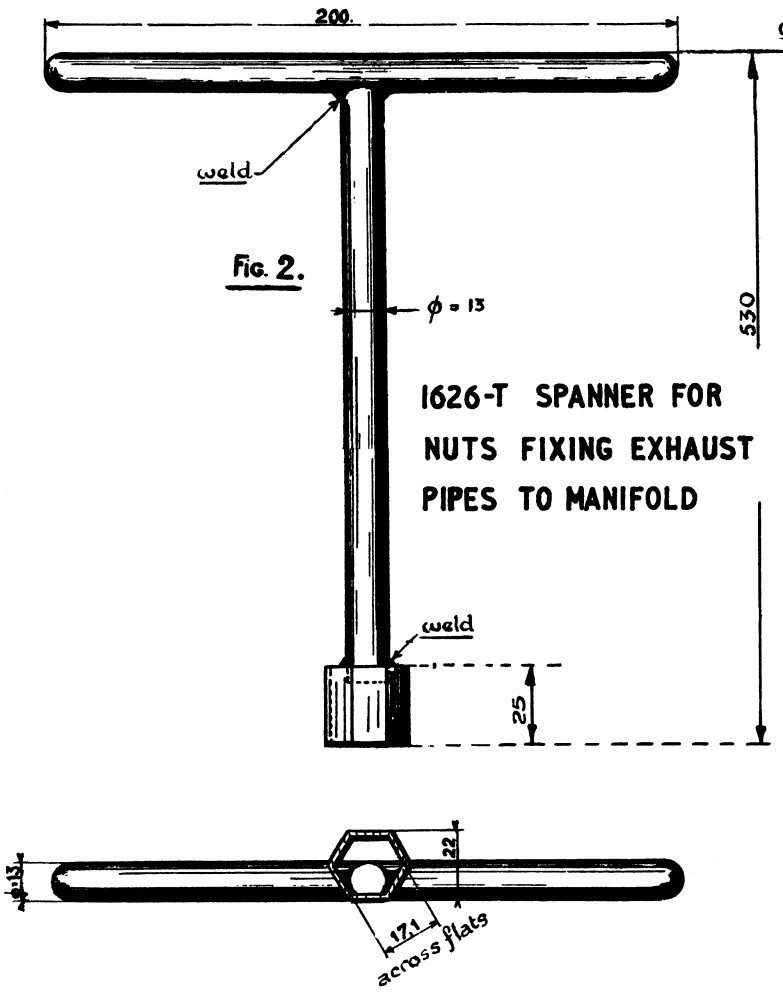
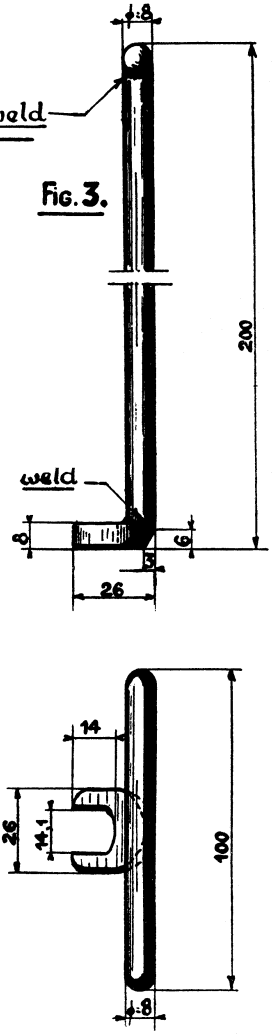


Fig. 1.

1626-T SPANNER FOR NUTS FIXING EXHAUST PIPES TO MANIFOLD



1621-T SPANNER FOR NUTS FIXING CARBURETTOR



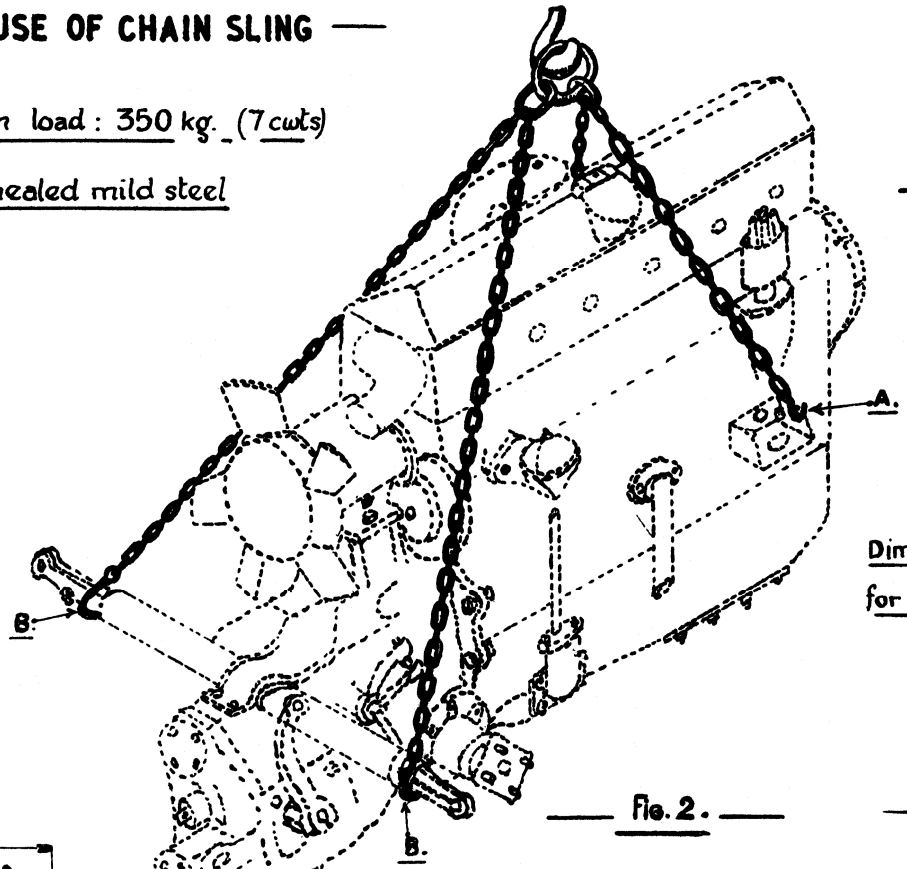
— ENGINE —

— LIFTING ENGINE —

— USE OF CHAIN SLING —

Maximum load : 350 kg. (7 cwts)

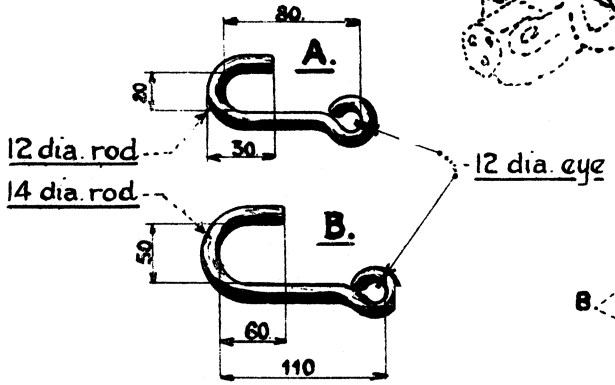
Annealed mild steel



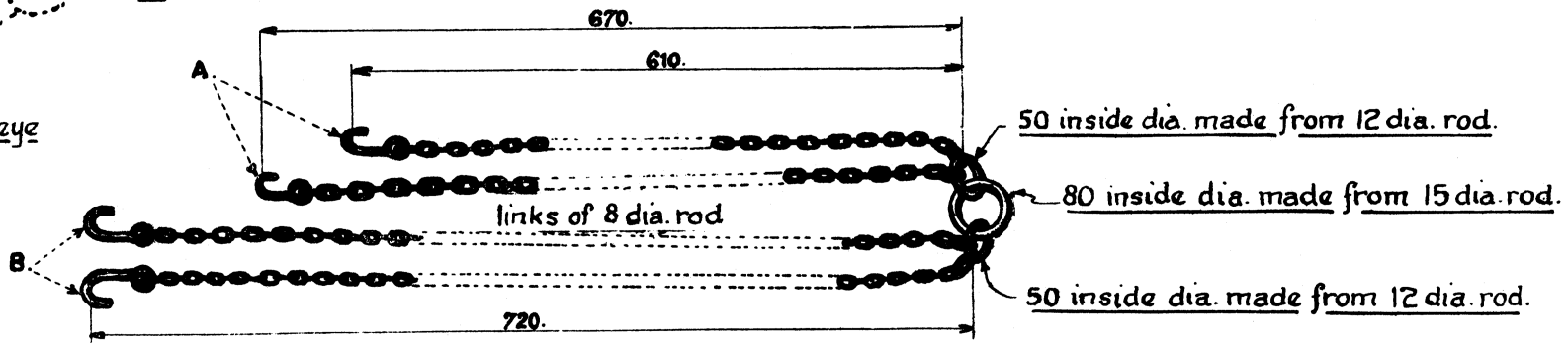
— Fig. 1. —

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

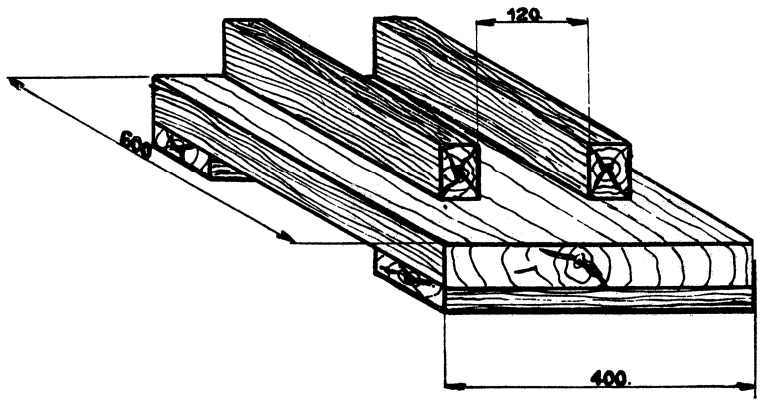
— Fig. 2. —



— CHAIN SLING MR. 3320-30 —

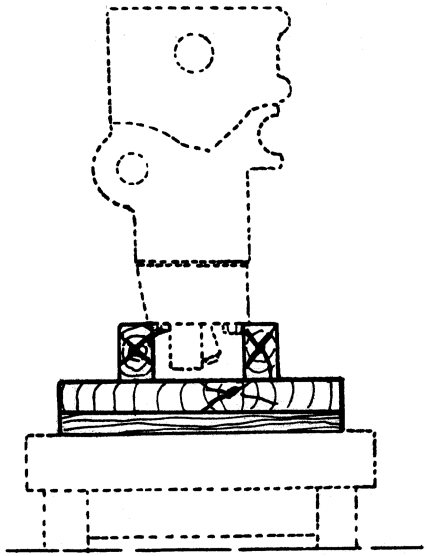


— ENGINE STAND —



— STAND MR.3300-20 —

Main dimensions

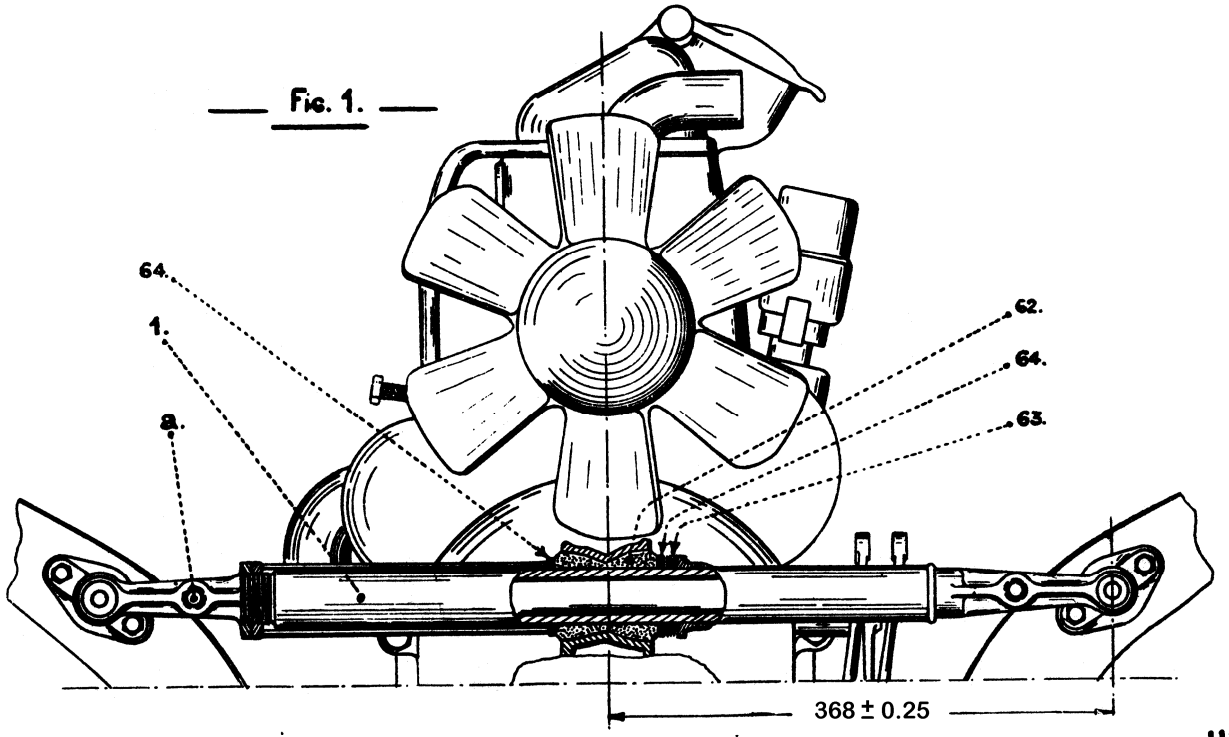


— USE OF STAND MR.3300-20 —

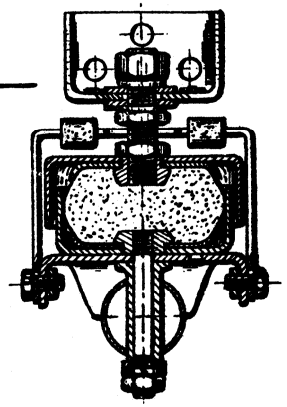
— ENGINE —

— FRONT AND REAR SUSPENSION —

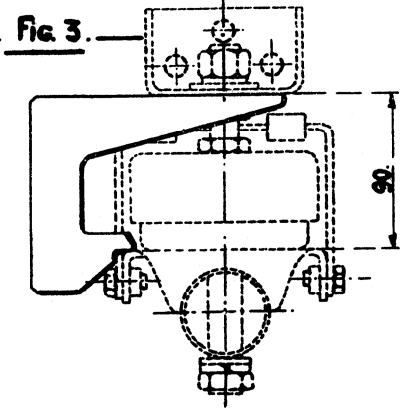
— Fig. 1. —



— Fig. 2. —

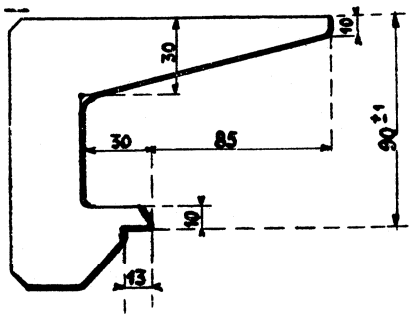


— Fig. 3. —

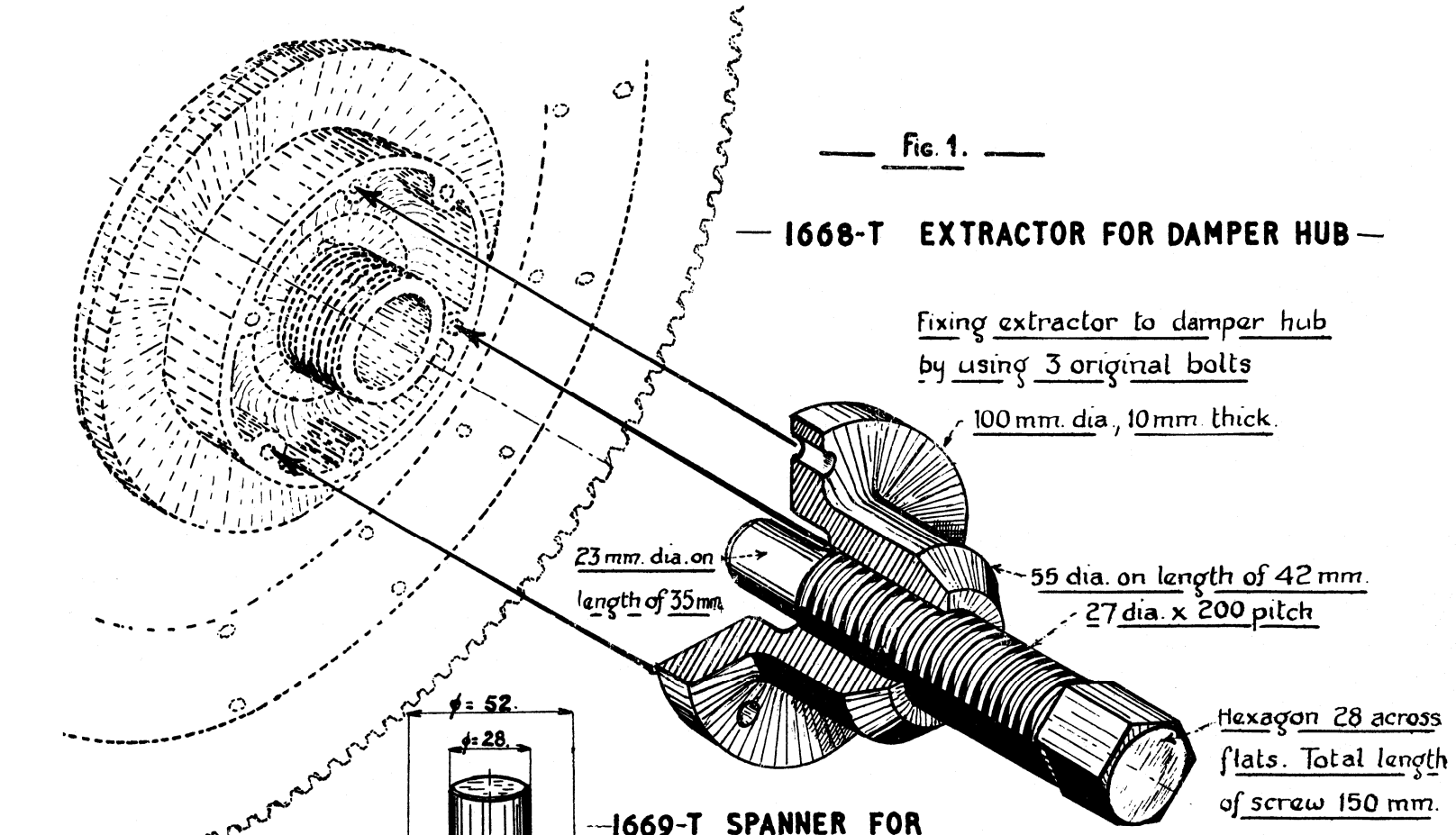


— HEIGHT GAUGE MR. 3450 —

— Fig. 4. —



— DISMANTLING DAMPER HUB —



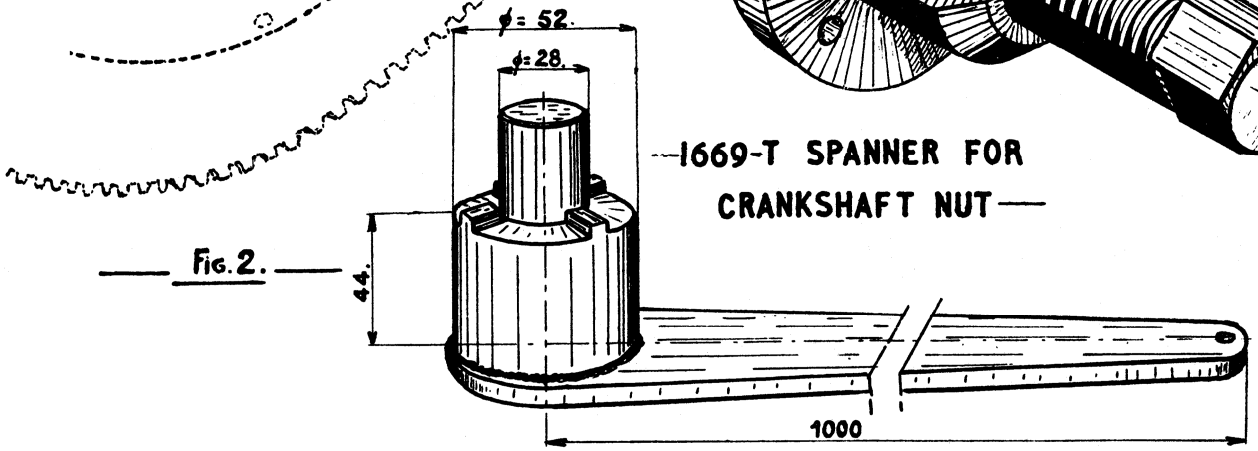


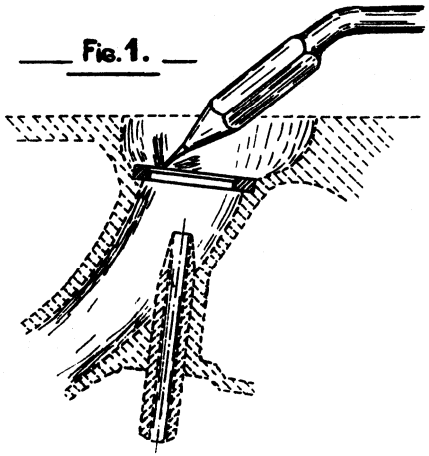
Fig. 2.

— ENGINE —

— REPLACEMENT OF VALVE SEATS AND GUIDES —

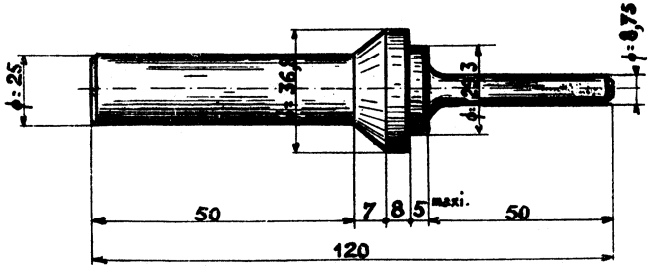
— REPLACEMENT OF A VALVE SEAT —

— Fig.1. —



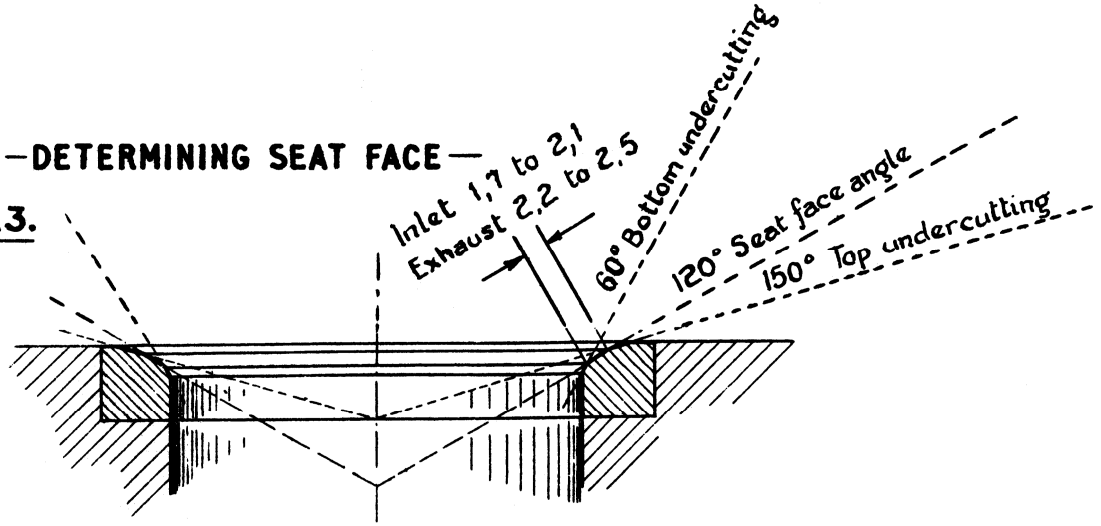
MR.3098-B MANDREL

— Fig.2. —



— DETERMINING SEAT FACE —

— Fig.3.

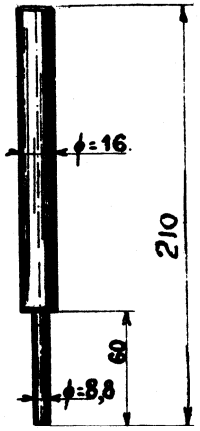


— REPLACEMENT OF A VALVE GUIDE —

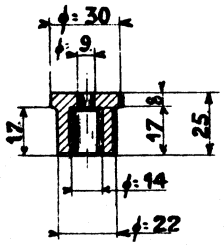
MANDREL & FERRULE FOR FITTING GUIDES

— Fig.4. —

MANDREL MR.1620-1

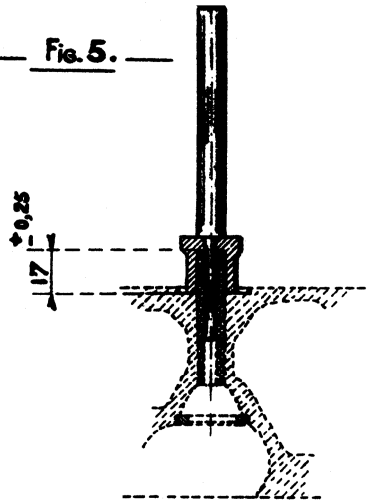


FERRULE MR.1620-4

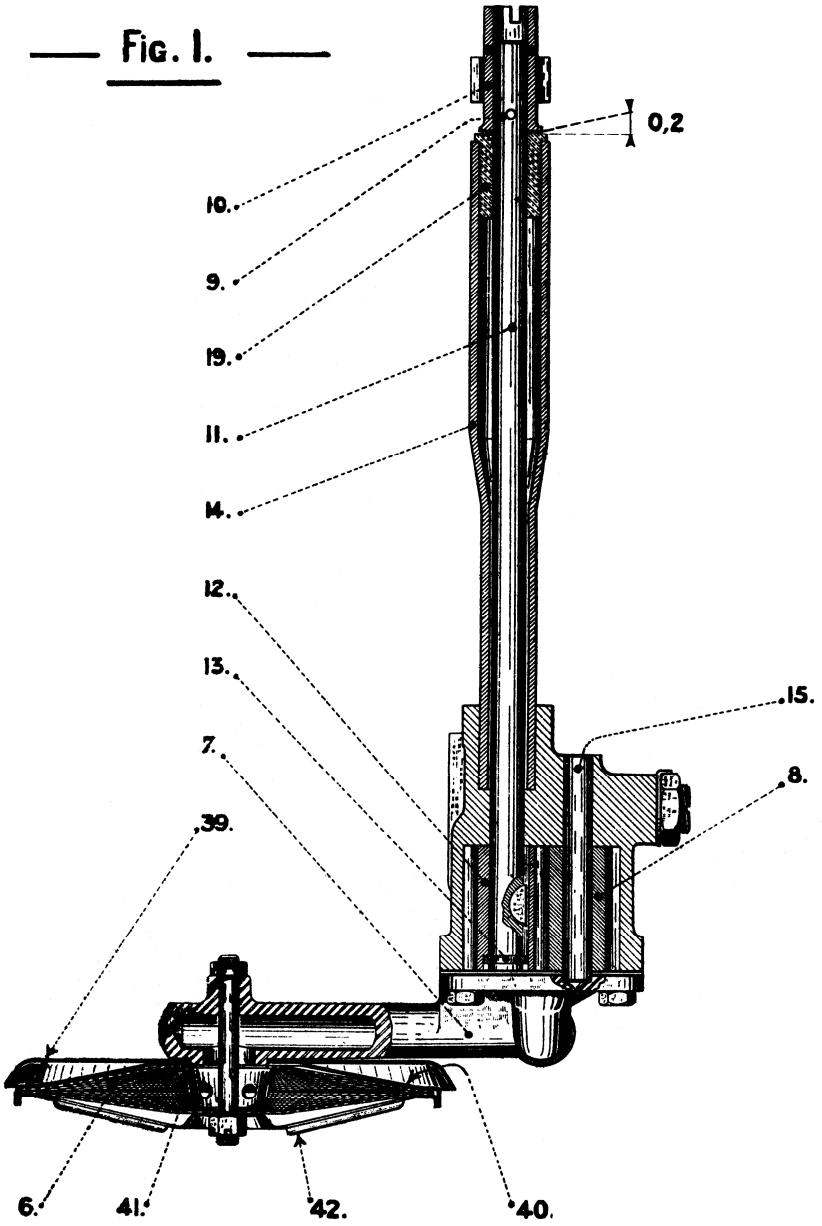


— USE OF MANDREL MR.1620 —

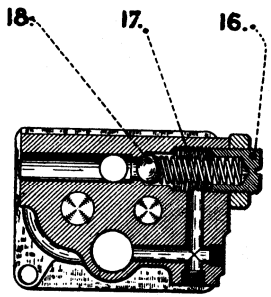
— Fig.5. —



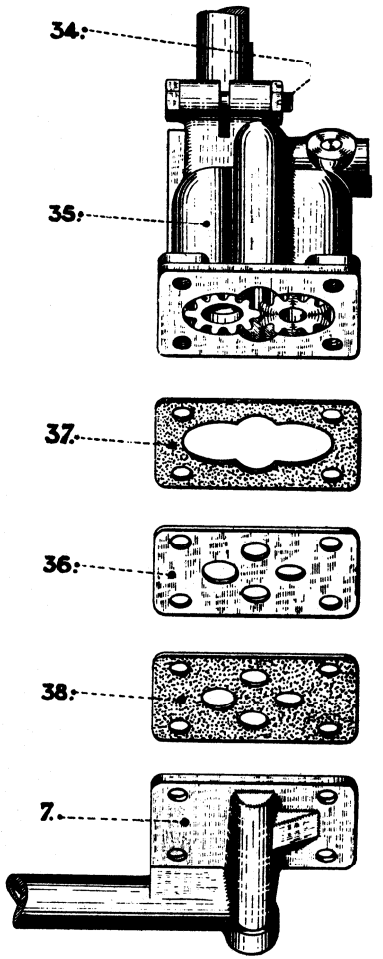
— Fig. 1. —



— Fig. 2. —



— Fig. 3. —



—ENGINE—

— SPRING TESTING —

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

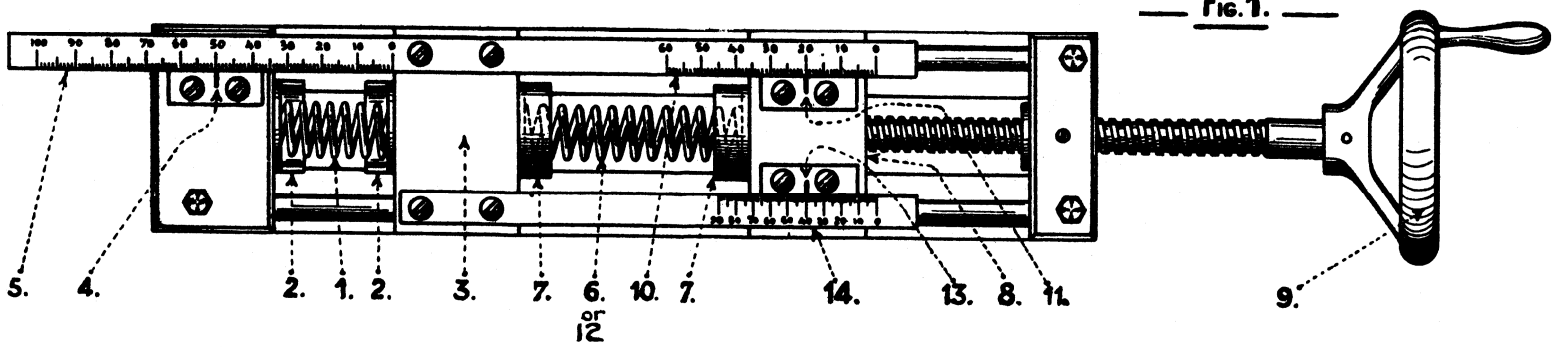
1. CHECKING FREE LENGTH OF SPRING. Place spring to be checked "1" between the guides "2". Draw slide "3" into contact. The line "4" comes opposite scale of lengths "5" indicating free length of spring "1".

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

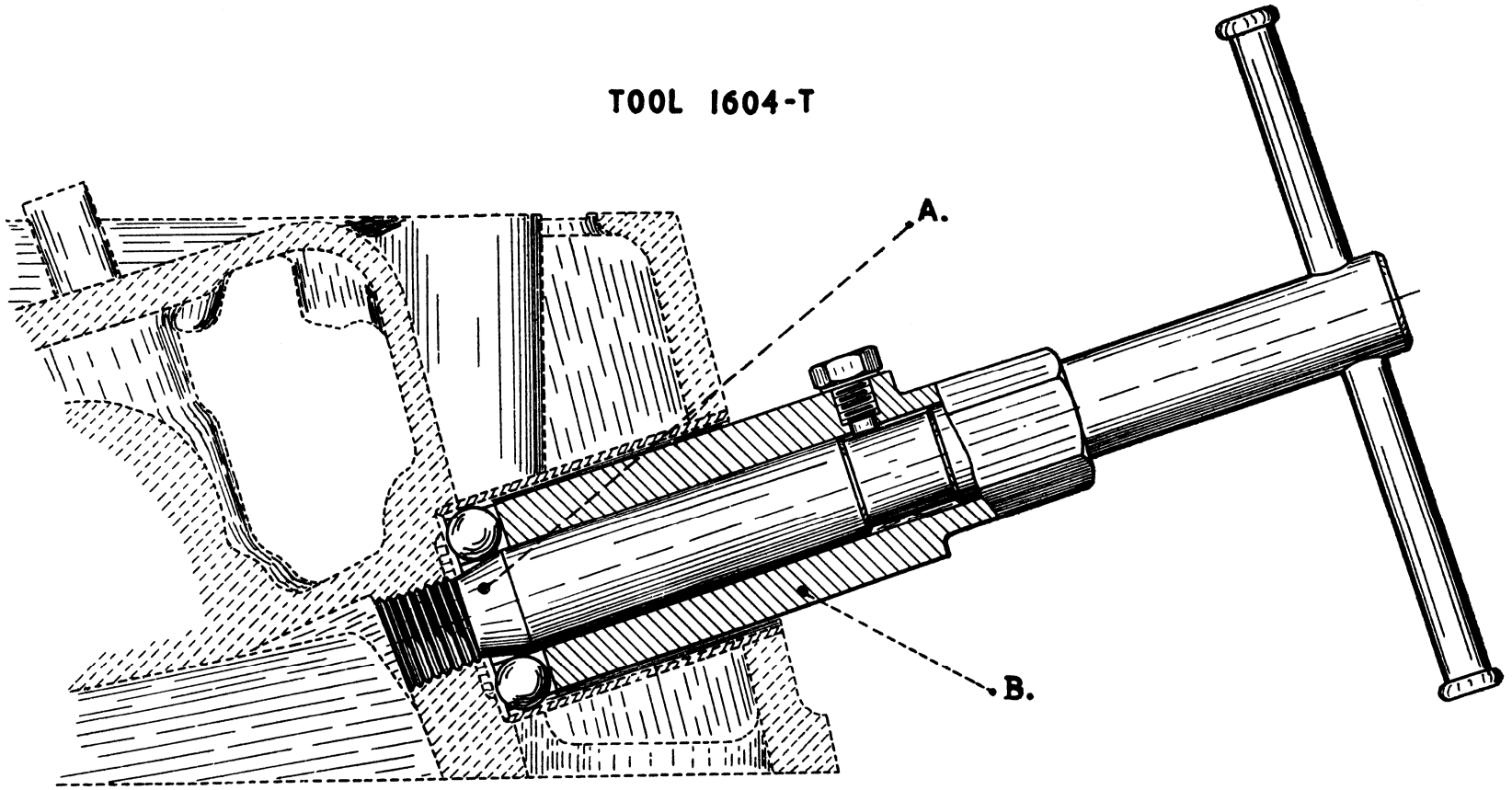
SPRING 2422-T — Fig.3. —

Spring deflection 1mm. par 2 kilogrammes.

THIS SPRING IS PAINTED RED

— FITTING SPARK PLUG HOUSINGS —

TOOL 1604-T

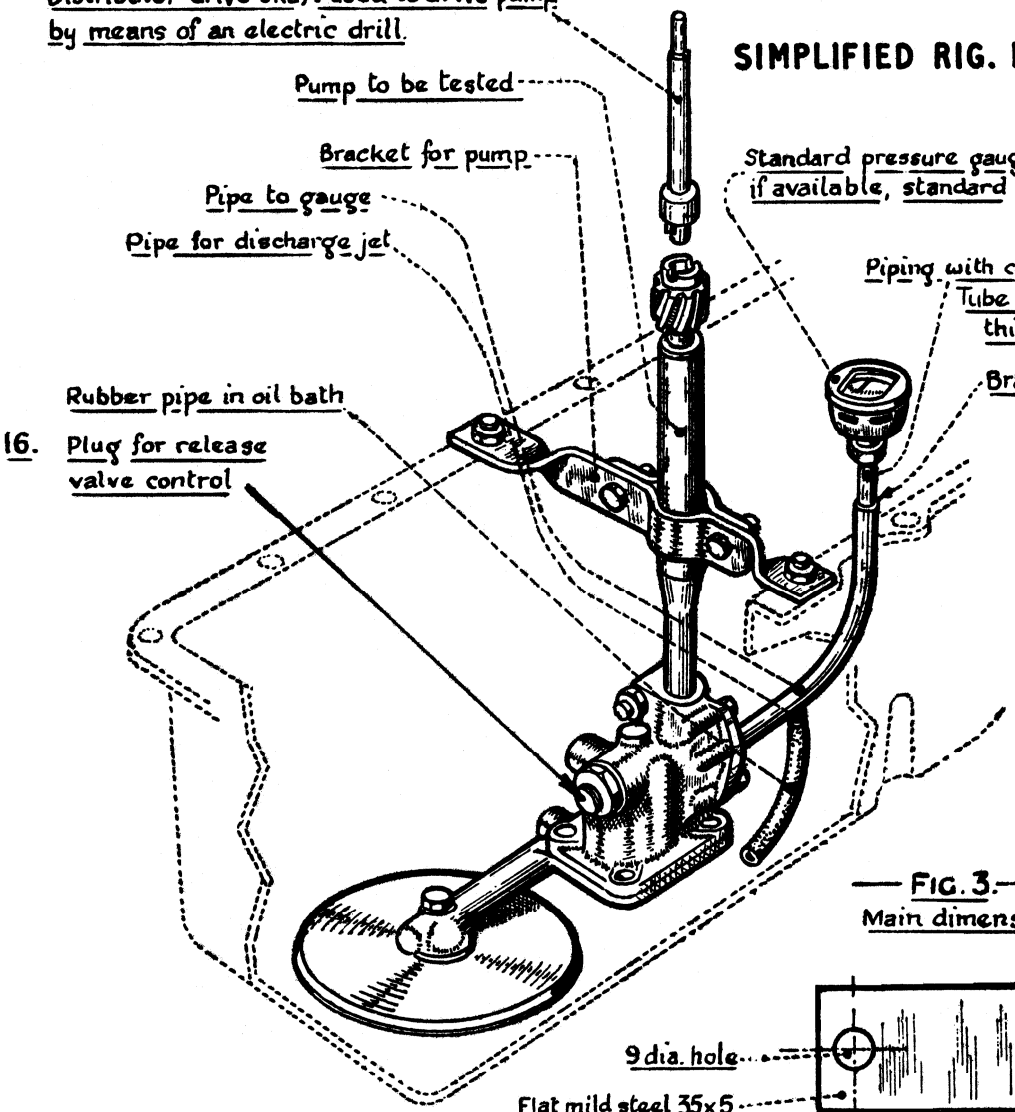


Push body "B" into spark plug housing.
Screw cone "A" into threaded hole for spark plug in order to exert pressure on the balls.
By means of a spanner, 19 mm across flats, rotate body "B" one revolution.
Screw in cone "A" again and then rotate body "B" another turn.
In general, two turns are sufficient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

— ENGINE —

— TESTING OIL PUMP —

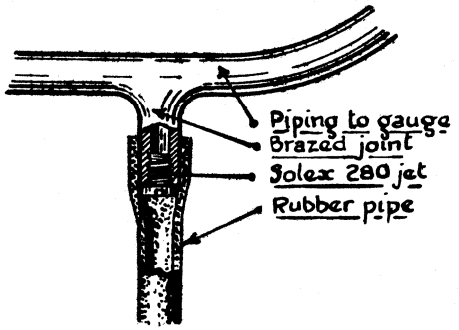
— FIG. 1. —



SIMPLIFIED RIG. MR. 1811

ASSEMBLY OF JET LIMITING DISCHARGE

— FIG. 2. —

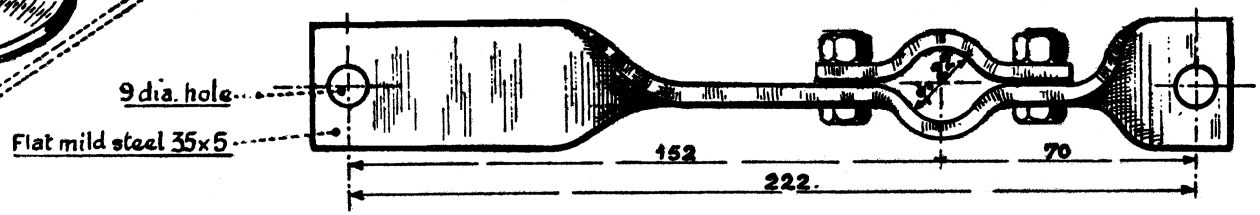


The pump to be tested is fitted on an engine sump and driven by an electric drill at a speed between 1000 and 1500 r.p.m. (Normal speed of machine and usually marked on maker's name plate).
Use winter grade oil similar to "MOBILOIL ARCTIC"
NOTE: If possible heat oil to 140° F. ± 9° F.
The gauge pressure 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.

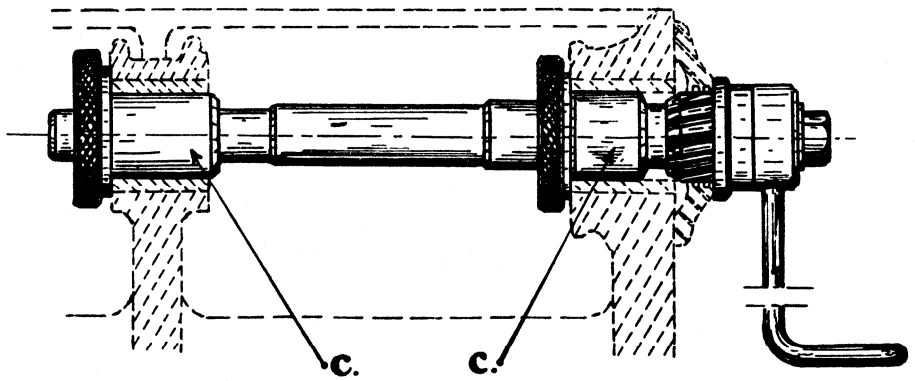


— CRANKSHAFT —

— BORING OIL BAFFLES —

BORING TOOL 1665-T

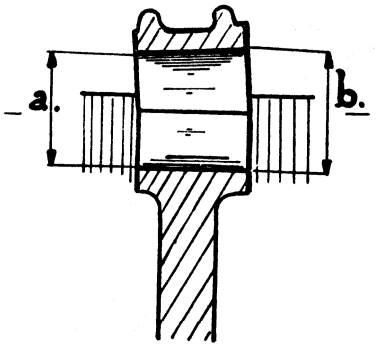
— Fig. 1. —



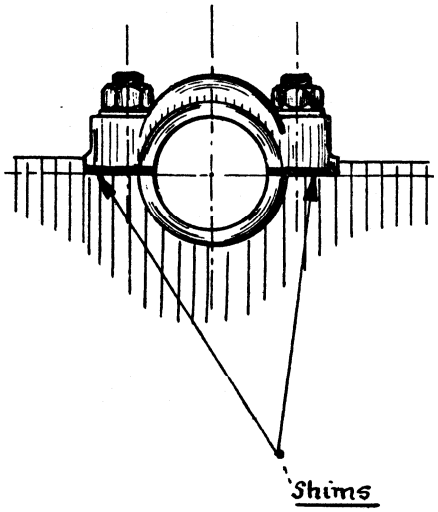
There are three sets of bushes "C"
1 : Outside diameter 50 (for bearings to the original size of crankshaft.
2 : Outside diameter 49,5 (for bearings of first regrind of crankshaft.
3 : Outside diameter 49 (for bearings of second regrind of crankshaft

— FITTING MAIN BEARING CAPS —

— Fig. 2. —



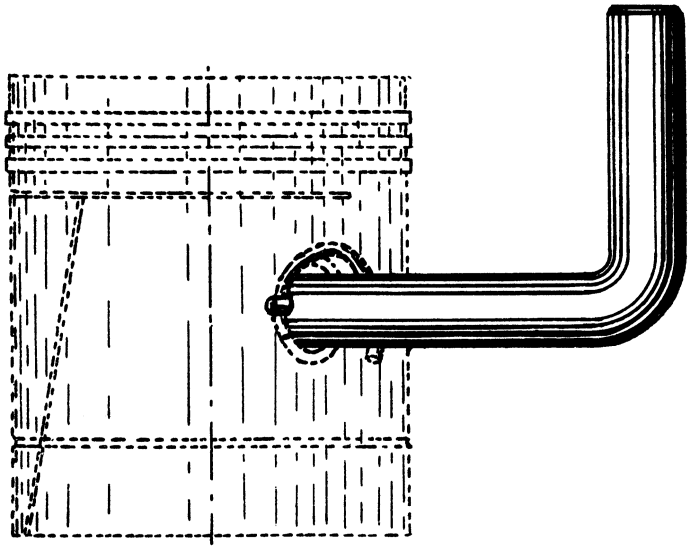
— Fig. 3. —



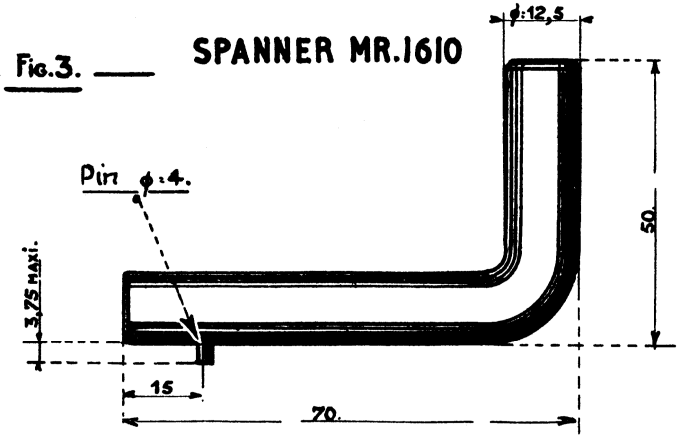
— FITTING GUDGEON PIN CIRCLIPS —

USE OF SPANNER MR.1610

— Fig.1. —

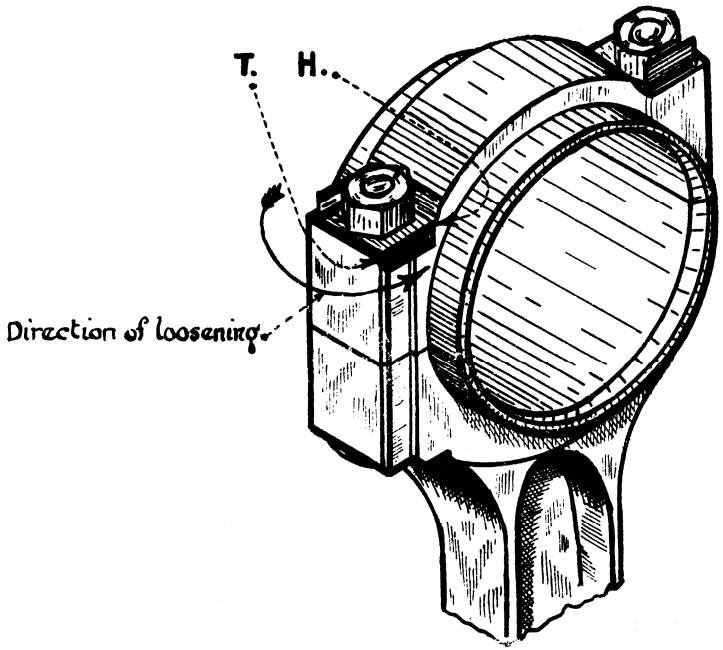


— Fig.3. — SPANNER MR.1610



— LOCKING CONNECTING ROD NUTS —

— Fig.2. —

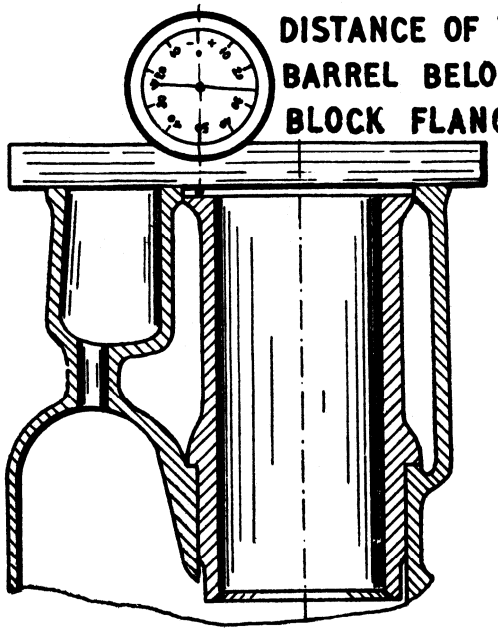


Tab 1 of each lockwasher must butt at "H" in order to prevent nuts turning in the direction of loosening.

— GAUGING HEIGHT OF CYLINDER BARRELS —

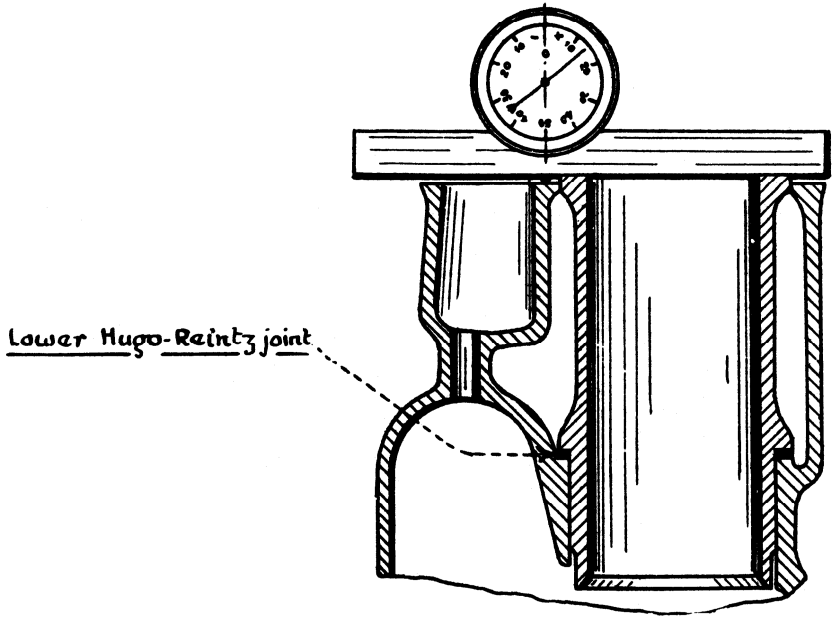
— Fig. 1. —

MEASURING THE DISTANCE OF THE BARREL BELOW BLOCK FLANGE



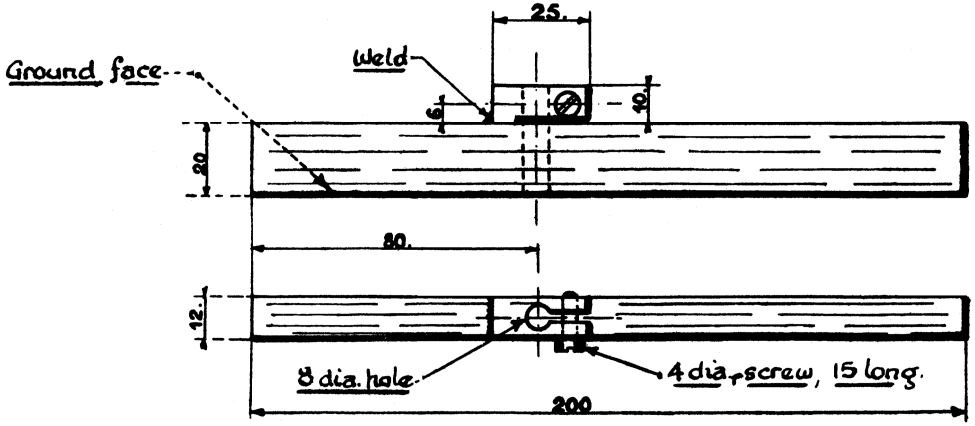
MEASURING THE AMOUNT THE BARREL STANDS PROUD OF BLOCK FLANGE AFTER FITTING LOWER JOINT

— 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.

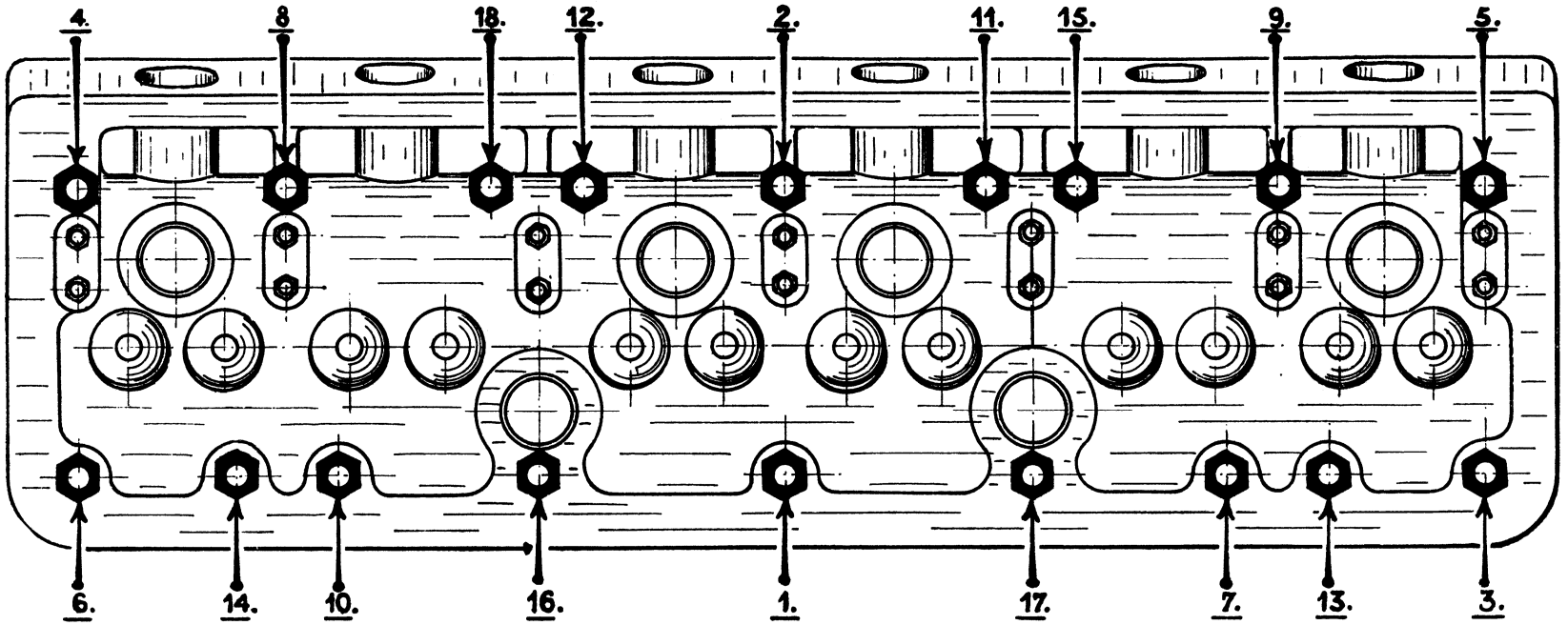
3. MEASURING HEIGHT OF BARREL (lower joint fitted) FIG. 2.

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. —



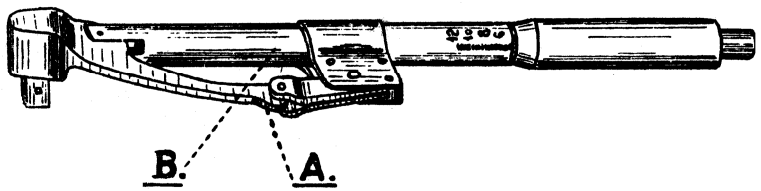
TIGHTNESS OF CYLINDER HEAD NUTS

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".

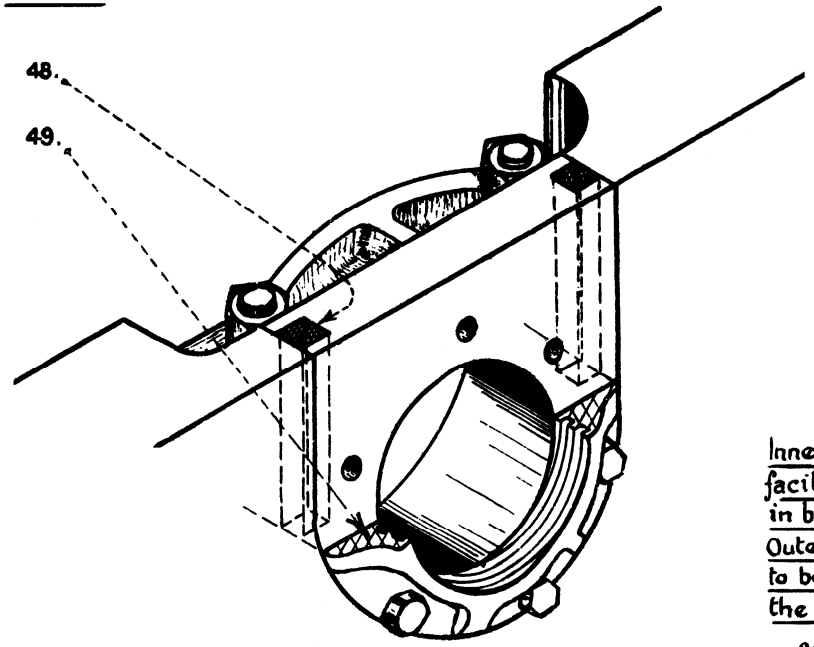
— Fig. 2. —

TORSION WRENCH
2470-T



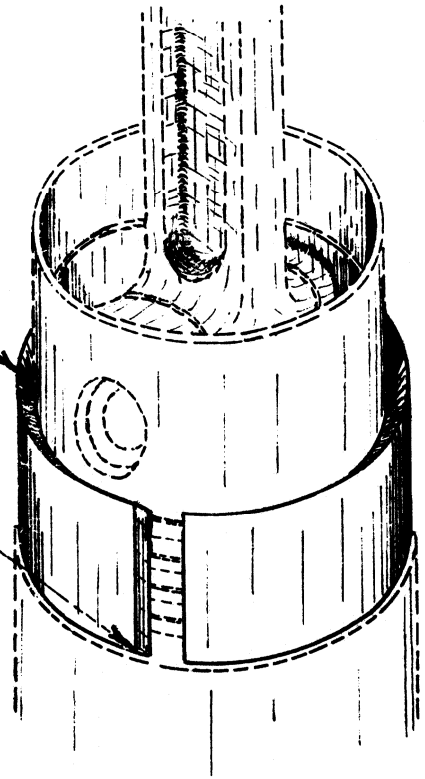
— FITTING MAIN BEARING CAP GASKETS —

— Fig. 1. —



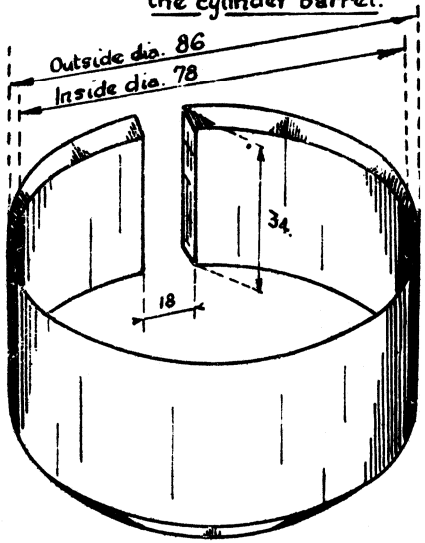
— FITTING PISTONS —

— Fig. 2. —



GUIDE BUSH FOR PISTON RINGS 1656 T

— Fig. 3. —



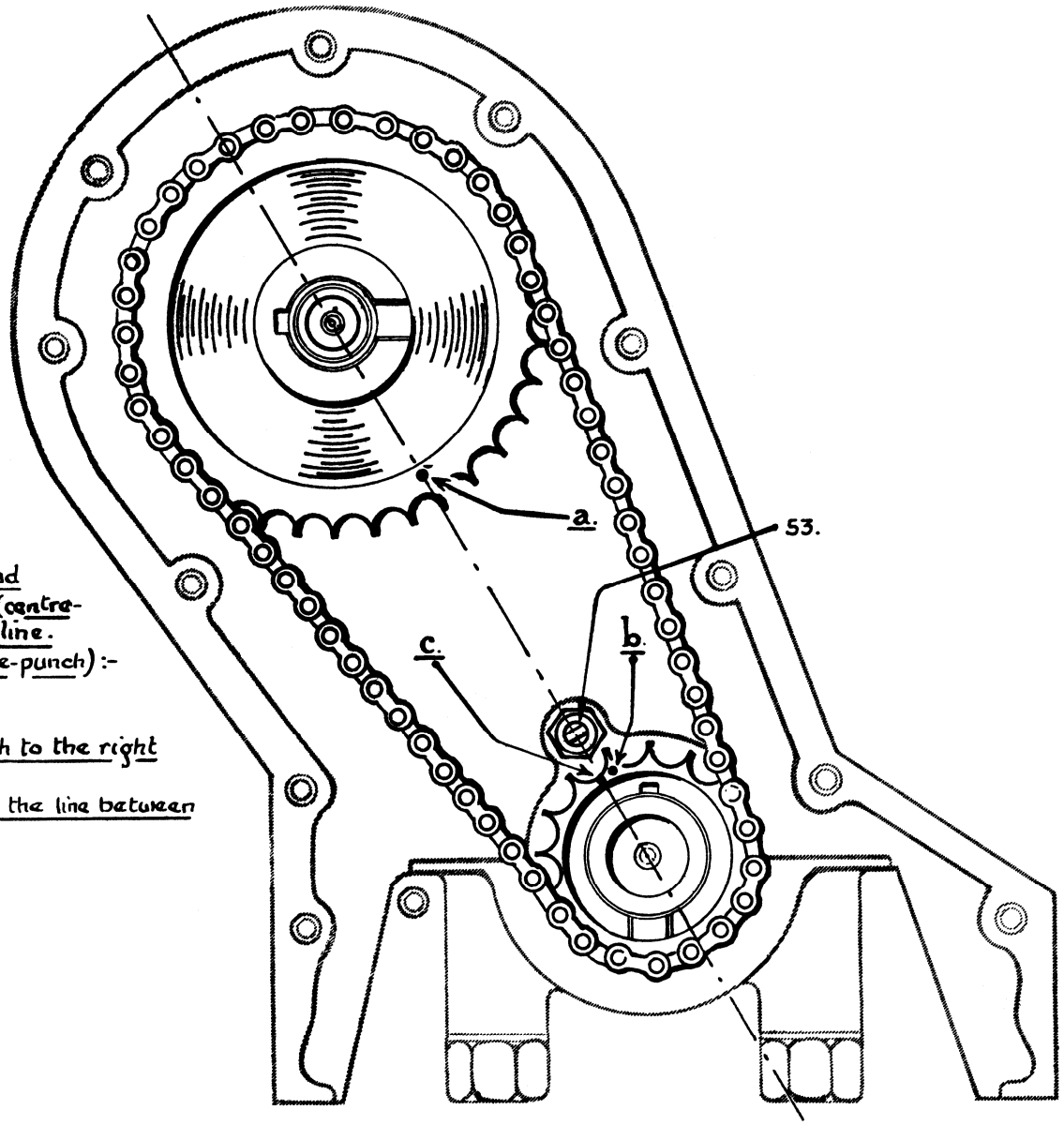
ENGINE

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.

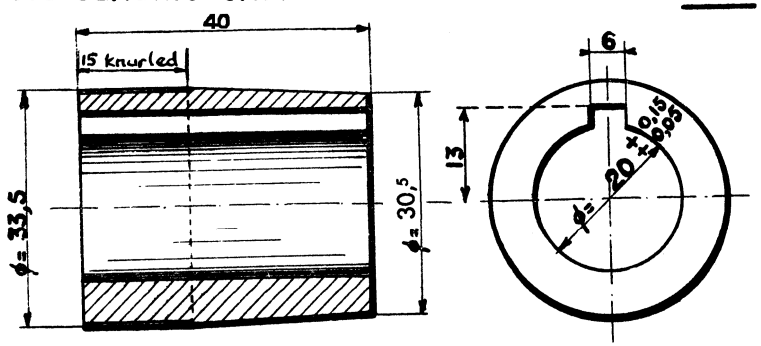


—ENGINE—

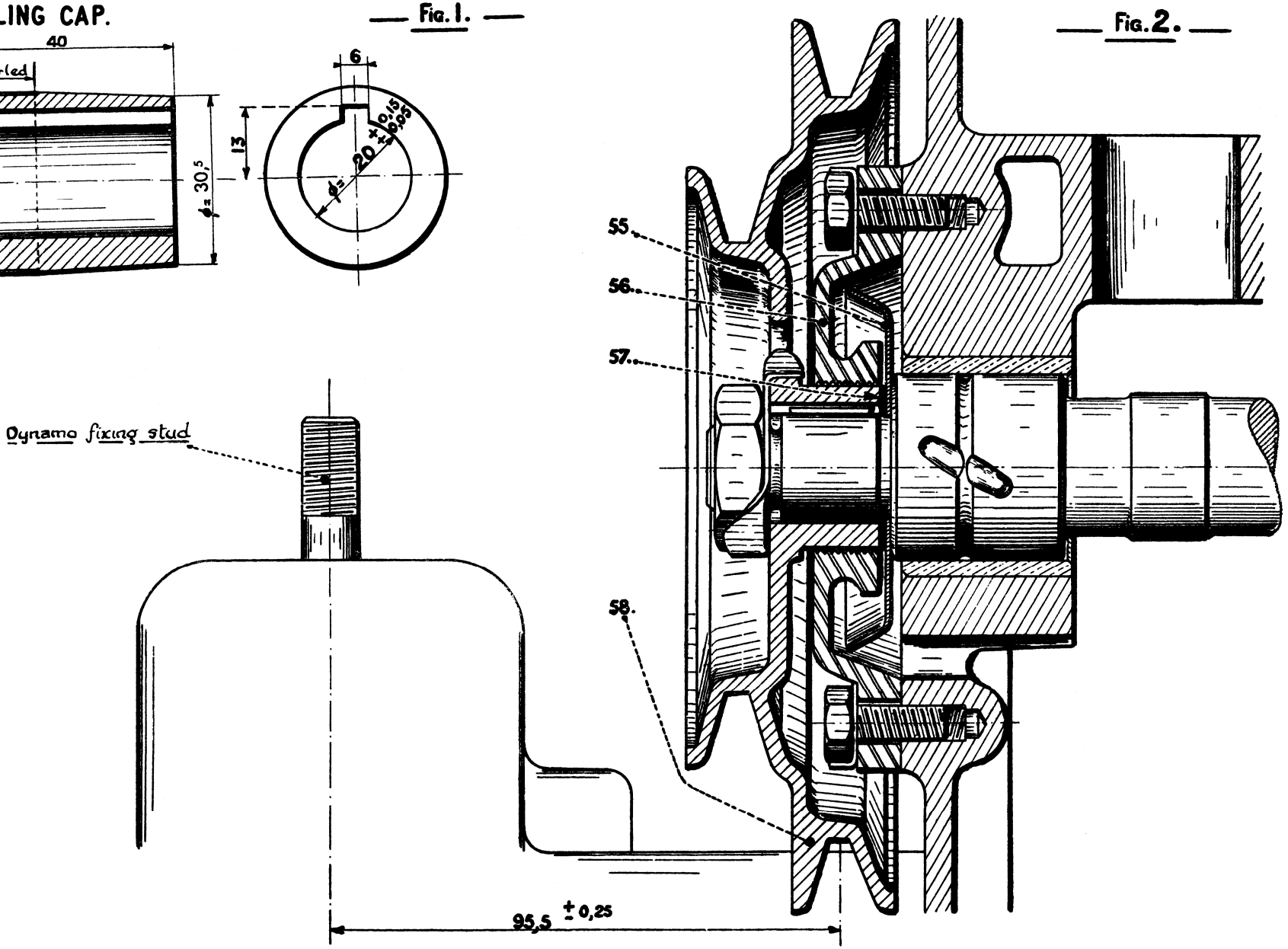
—ASSEMBLY OF DOUBLE PULLEY—

MR. 3421 CENTRALIZING BUSH
FOR OIL SEALING CAP.

— Fig. 1. —

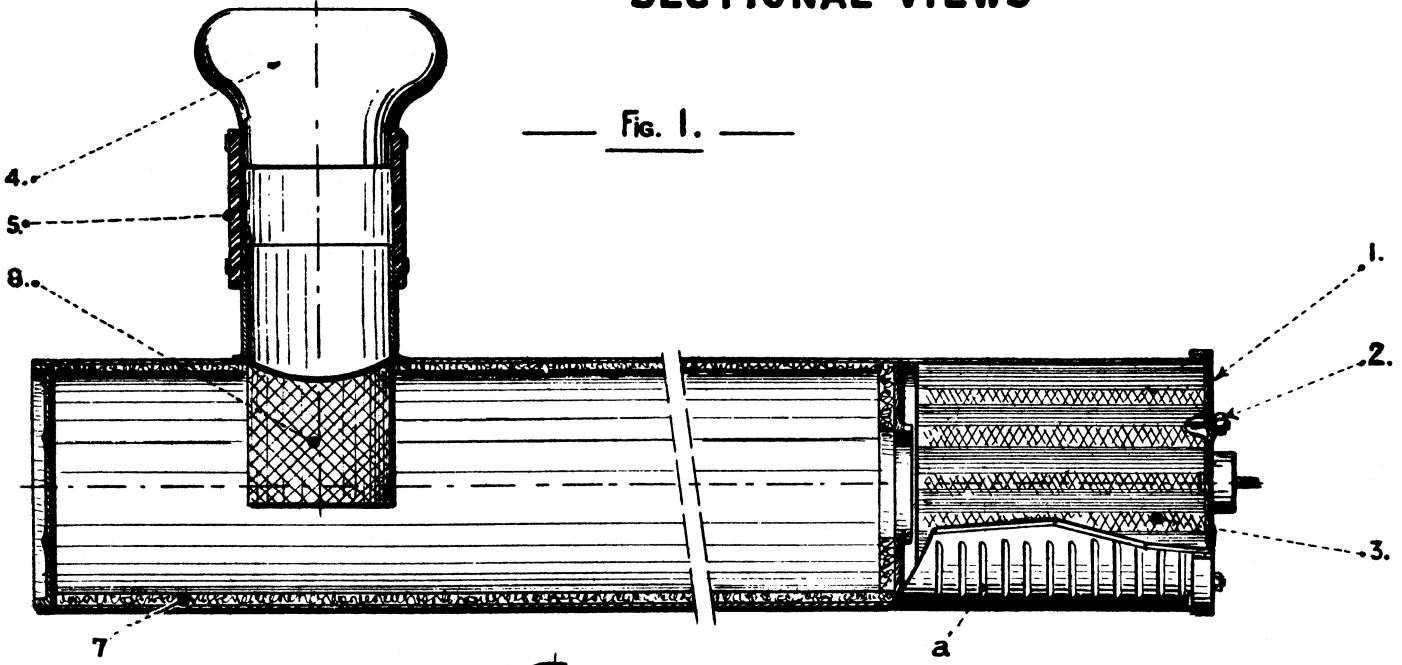


— Fig. 2. —

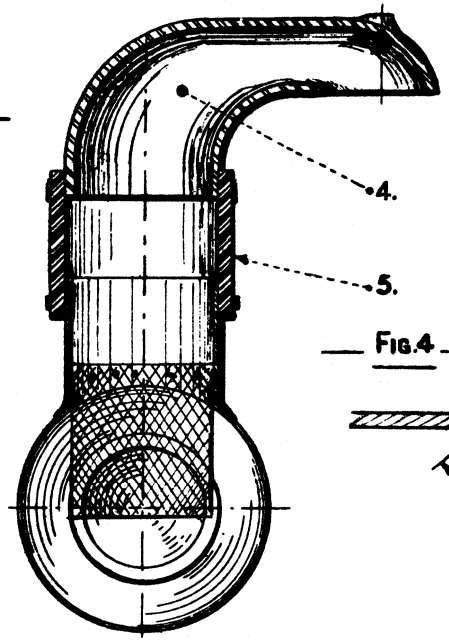


— AIR INTAKE SILENCER —
— SECTIONAL VIEWS —

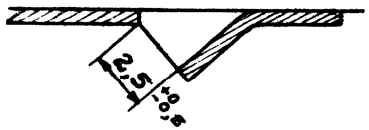
— Fig. 1. —



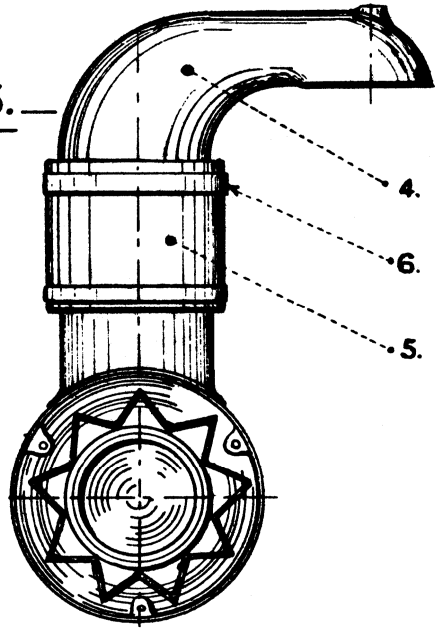
— Fig. 2. —



— Fig. 4 — DETAILS OF LOUVRE a

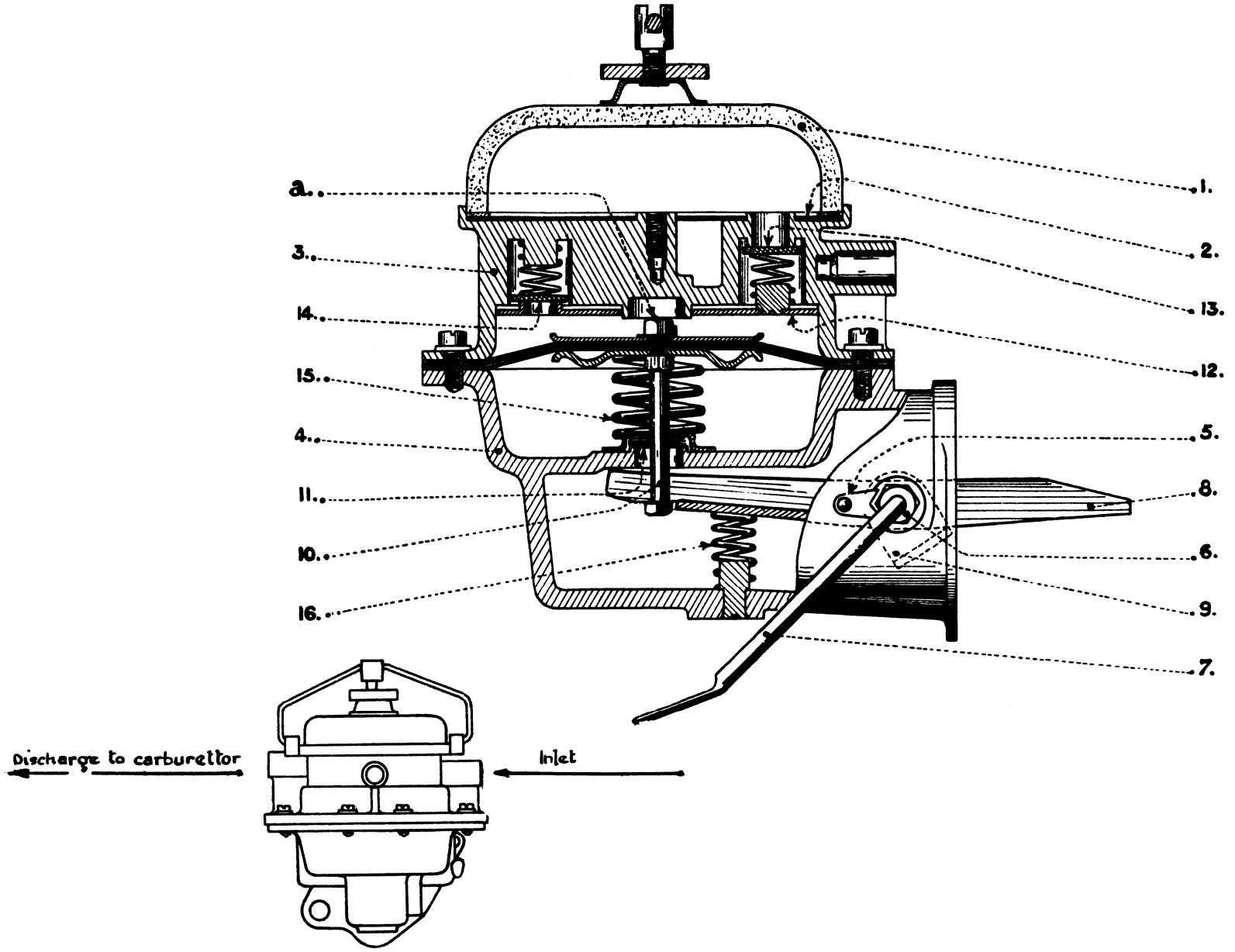


— Fig. 3. —



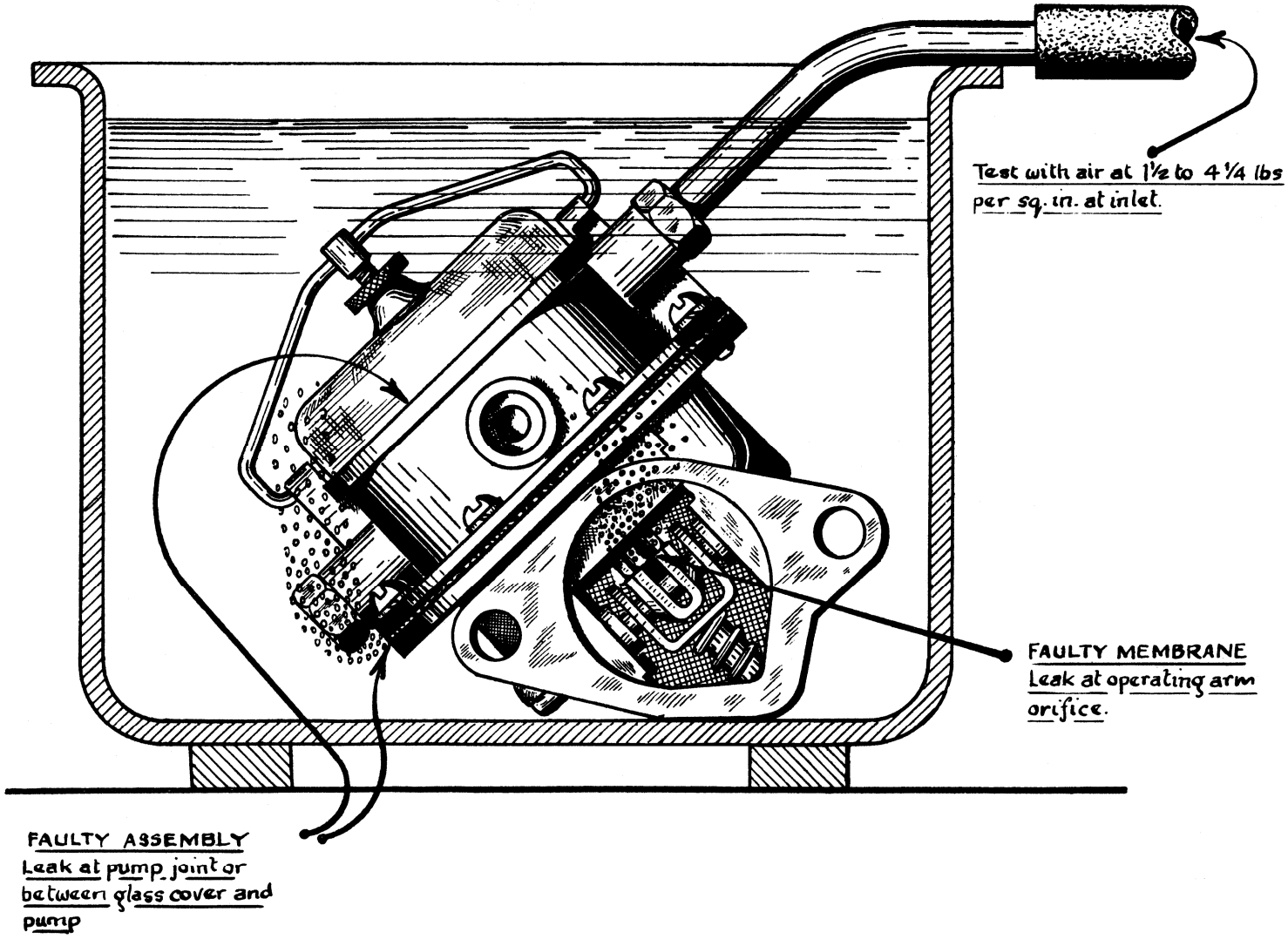
— PETROL PUMP —

— SECTION THROUGH S.E.V. TYPE PUMP —

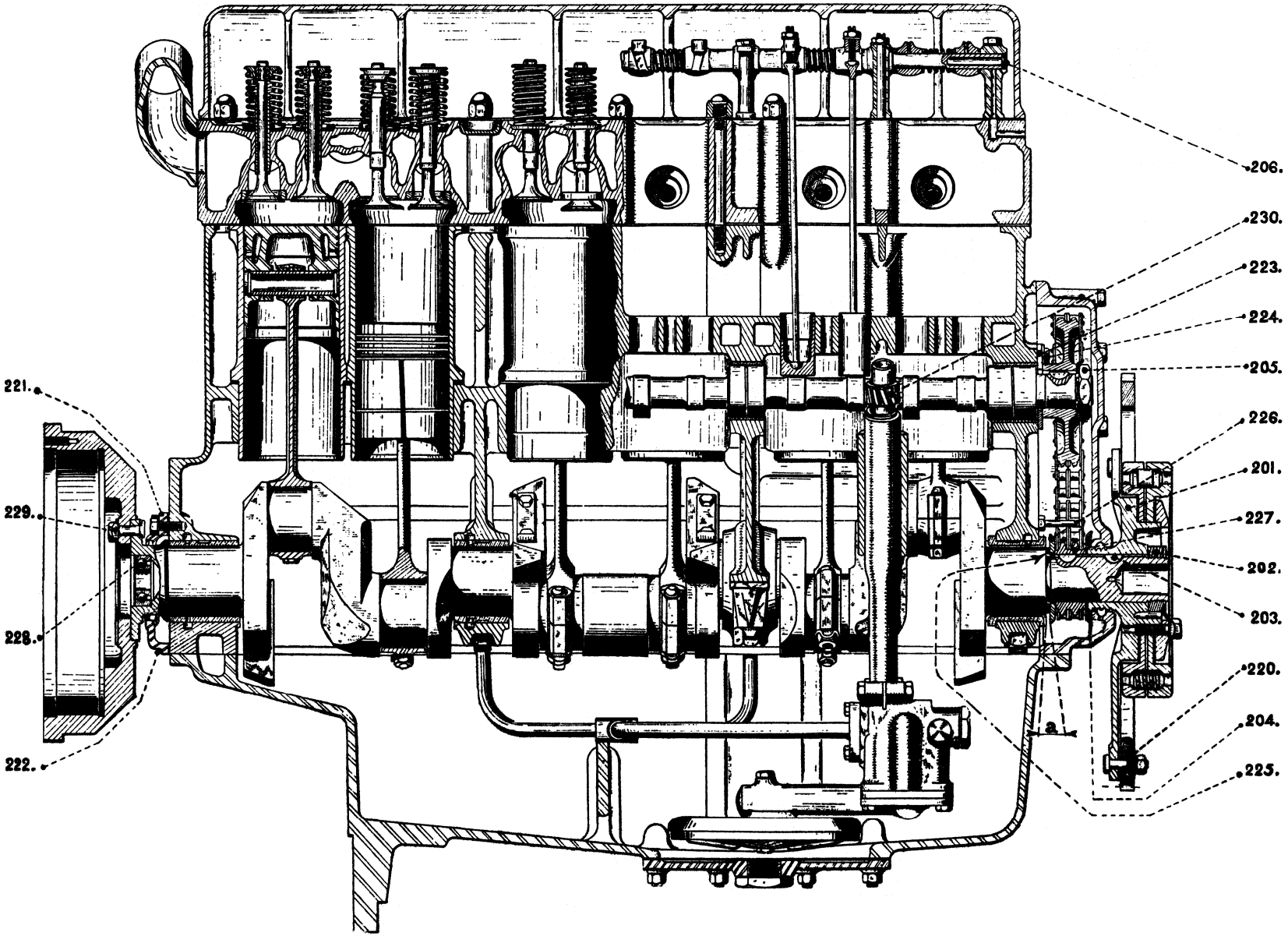


PETROL PUMP

CHECKING FOR LEAKS



— ENGINE —
— LONGITUDINAL SECTION —



—TRANSVERSE SECTION—

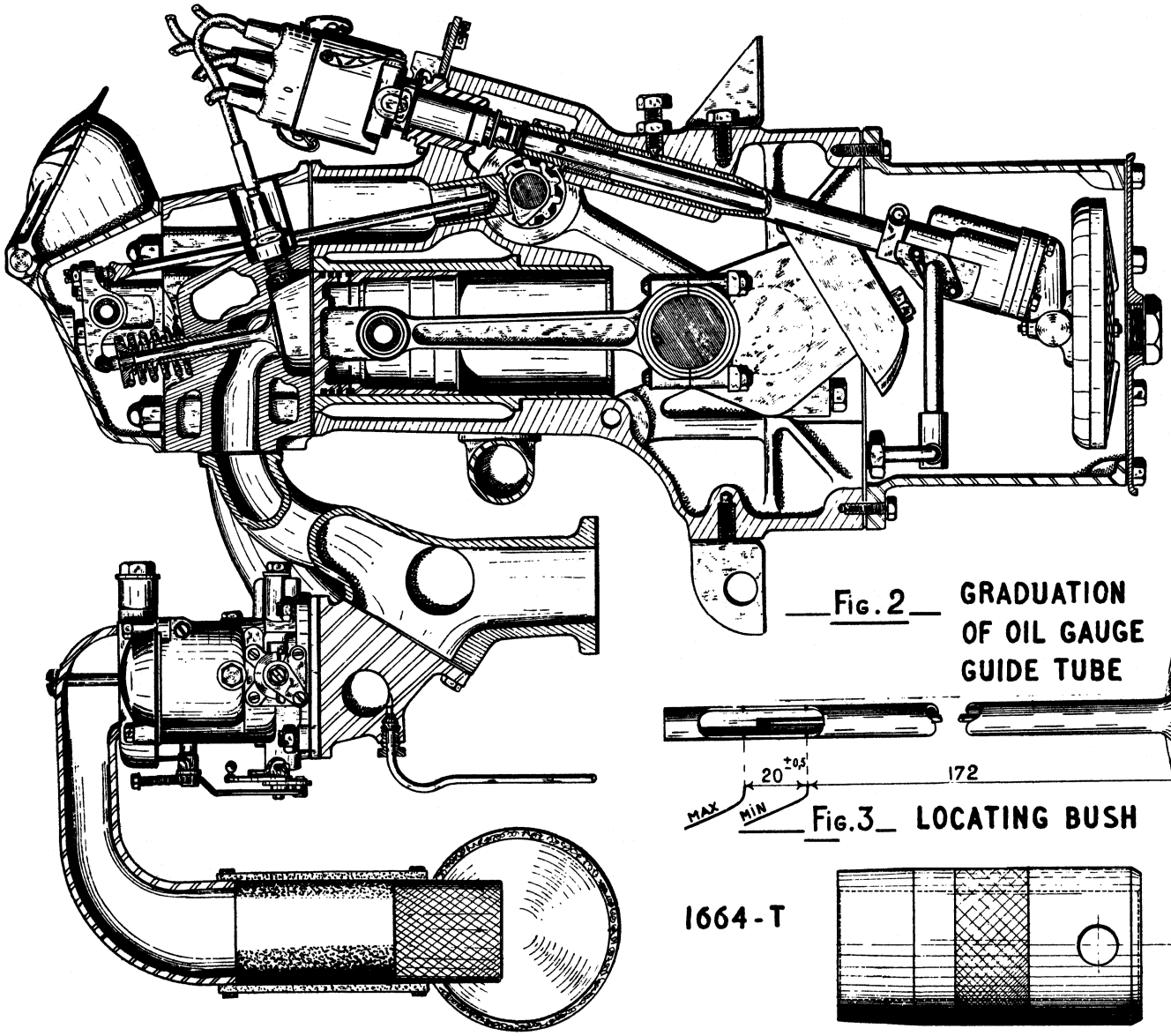


Fig. 2 GRADUATION OF OIL GAUGE GUIDE TUBE

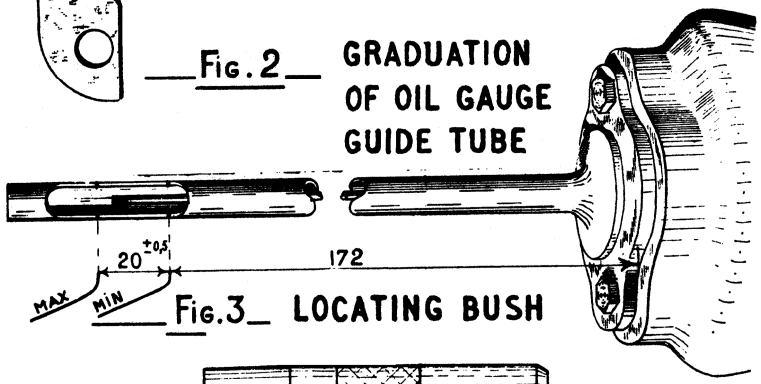
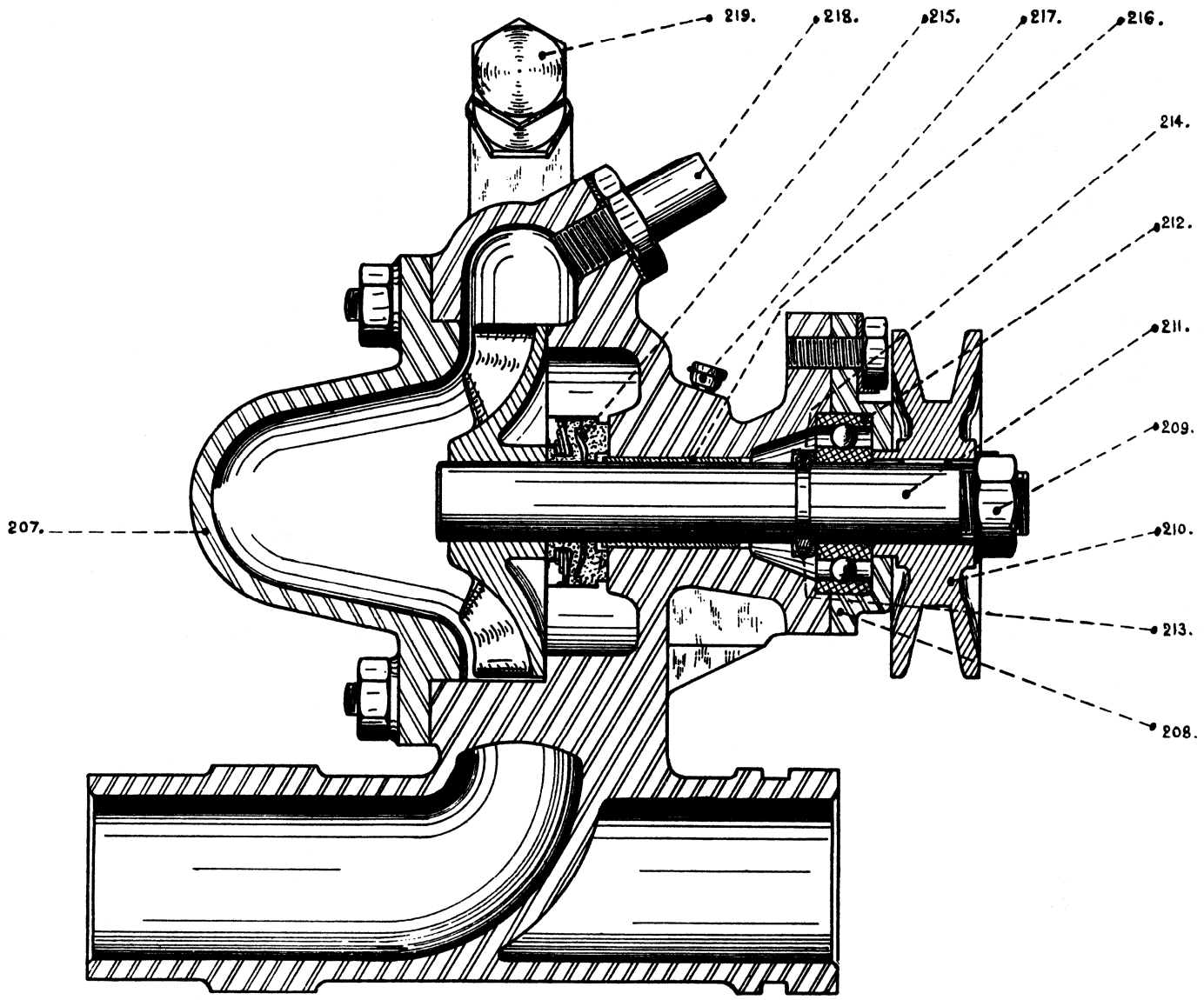


Fig. 3 LOCATING BUSH

1664-T

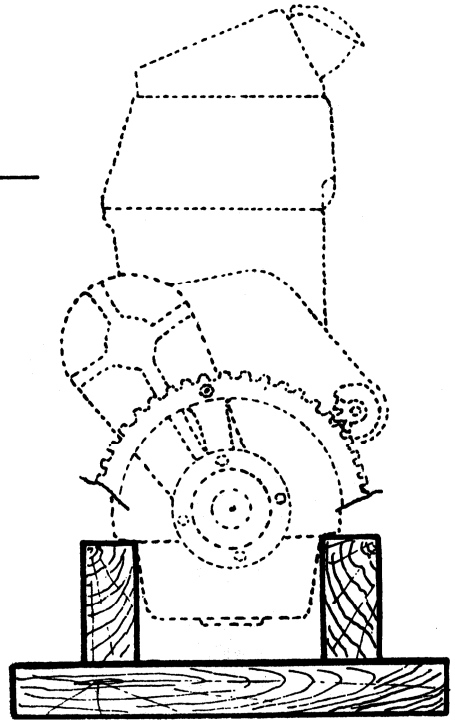
ENGINE
WATER PUMP



USE OF STAND

Fig. 1

REAR VIEW



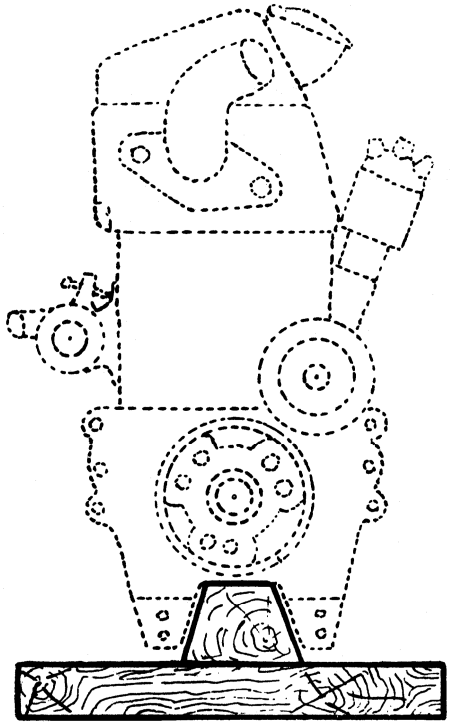
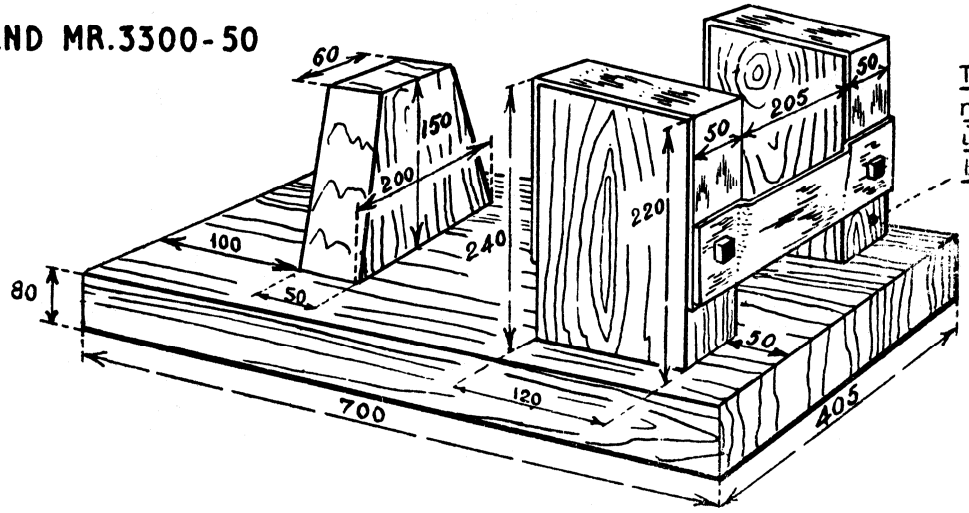


FIG. 2. FRONT VIEW

FIG. 3. STAND MR.3300-50



Three blocks fit in recesses 20mm. deep in base and are secured by woodscrews.

— CARBURETTOR —
— VARIOUS VIEWS —

Fig. 1.

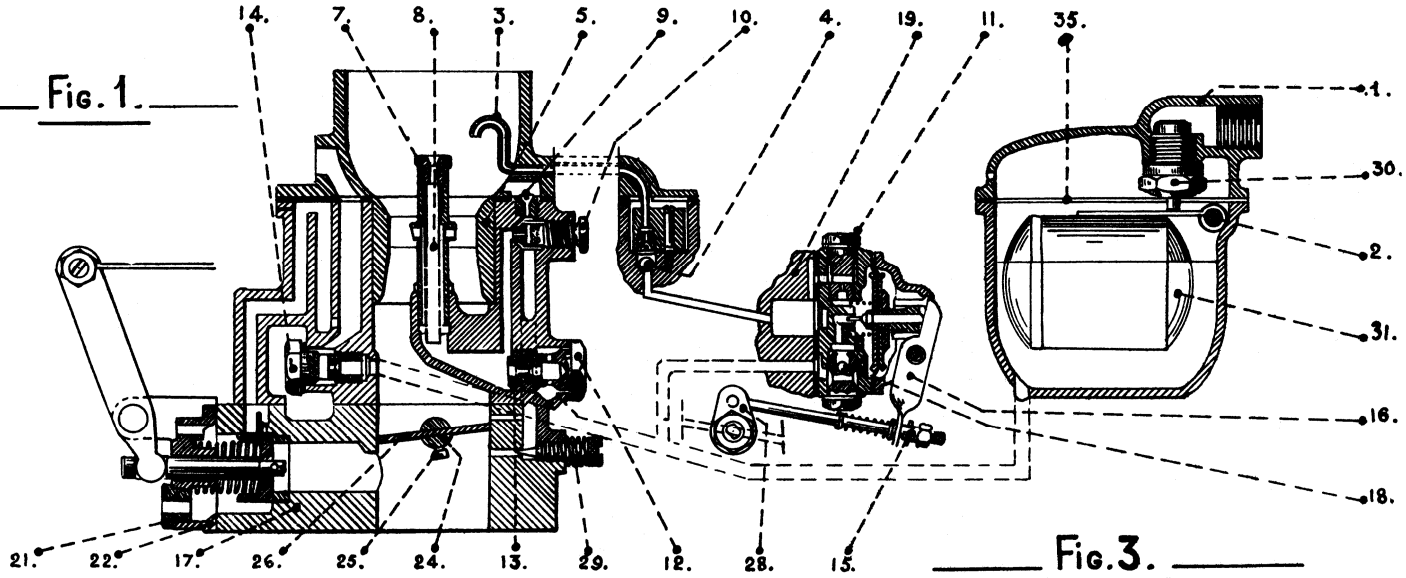
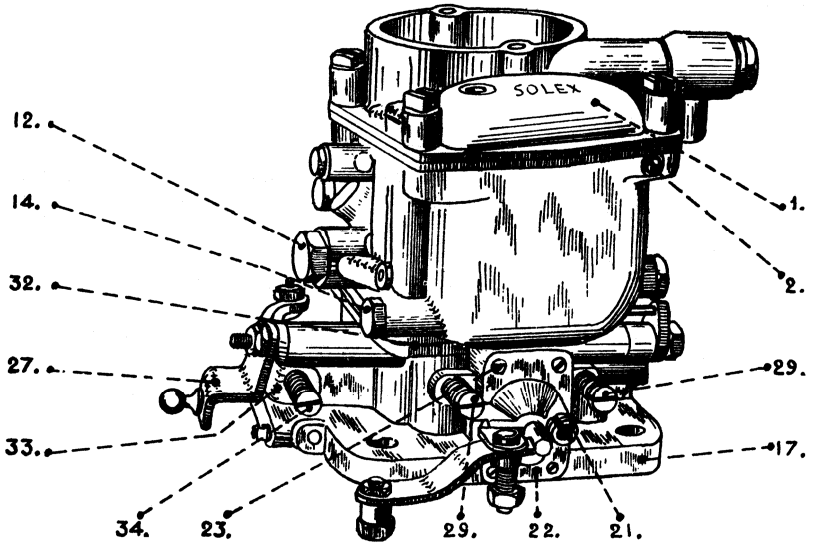
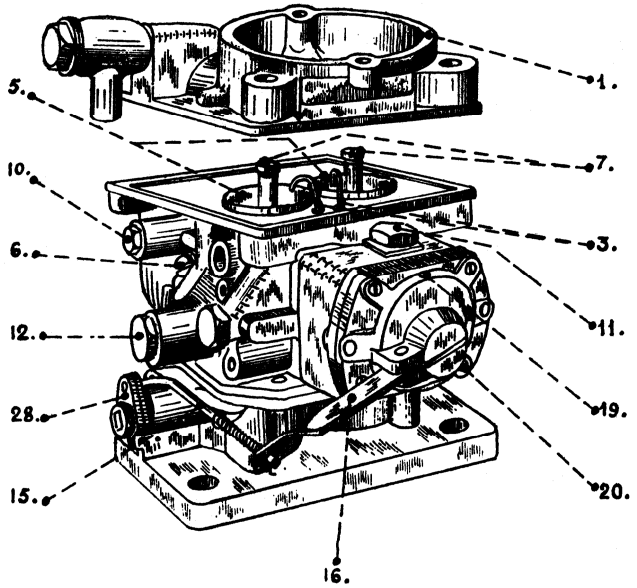


Fig. 3.

Fig. 2





	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 wring 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 tiebar 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 0F THE DRIVE SHAFT COUPLINGS, fitting a ‘Blocfort’ 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 m. to 20 mm, before graphite bush (206) of clutch fork strikes toggle thrust plate (205) (see Drawing 126)	Flat spanner L4
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 spanner 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 spanner 8-14
24	Fit the assembly of radiator block and bumper brackets. Tighten bo1ts 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 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 c1ips. 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 she1l 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 head lamps, 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 (a) 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 s1owly 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 0F 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.	Flat spanner 12 Box and flat spanners 10

	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.	Specia1 jack head MR.3300-90
	IMPORTANT NOTE. REMOVE LOCATING PIN.	
31	Lower vehicle to the ground. (Use special jack head MR.3300-90, see Drawing 67.)	
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 Mobil oil 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 oi1 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
6	Remove distributor by unscrewing bolt fixing bracket to socket. Remove spark plugs. (Use spanner 1601-T.)	Flat spanner 8 Spanner 1601-T
7	Remove dynamo and starter motor.	Flat spanner 17
8	Remove cap (201) forming support for starting handle. (NOTE: D0 NOT DISPERSE ADJUSTING SHIMS (202)). Remove circlip (203), with the aid of round nose pliers, and disengage the mainshaft (2O4) towards the front.	Universal spanner 21 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
11	Remove the clutch. Check, before removing, that the position of the clutch in relation to the f1ywhee1 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 p1ate, and pressure plate springs.	21 Flat spanner 17 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 p1ate, 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 p1ate, and position as indicated 1n 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 bo1ts. (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 368 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 bolt without excessive tension. Fit the petrol pump with a paper gasket. Tighten nuts with spring washers under.	Flat spanners 12-17 Box spanner 21

	Fit hose between water pump and water inlet pipe.	
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 manifo1d 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) 0ffer 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 B
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 p1ugs. (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 Flat spanner 17
3	Remove the water pump with hoses assembled. Take off drive be1t.	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 cy1inder 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 oi1 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 oi1 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 REASSEMBLING, 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.) D0 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 : - sma1l 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. Siide 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 unit (218). Remove belt tension adjusting screw (219).	Shouldered mandrel small dia. 14.75, large dia.18 F1at 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
23	Remove the oil level float.	Adjustable spanner 50
24	Disconnect the inlet and exhaust manifolds.	Box spanner 12 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 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	25.	One bracket (centre)
2.	One washer 1 mm. thick	26.	One distance piece 3.5 mm. thick
3.	One rocker arm, R.H.	27.	One rocker arm, R.H.
4.	One washer 1 mm. thick	28.	One washer 1 mm. thick
5.	One spring	29.	One spring
6.	One washer 1 mm. thick	30.	One washer 1 mm. thick
7.	One rocker arm, L.H.	31.	One rocker arm, L.H.
8.	One distance piece 3.5 mm. thick	32.	One distance piece 18.5 mm. long
9.	One bracket	33.	One bracket
10.	One distance piece 3.5 mm. thick	34.	One distance piece 18.5 mm. long
11.	One rocker arm, R.H.	35.	One rocker arm, R.H.
12.	One washer 1 mm. thick	36.	One washer 1 mm. thick
13.	One spring	37.	One spring
14.	One washer 1 mm. thick	38.	One washer 1 mm. thick
15.	One rocker arm, L.H.	39.	One rocker arm, L.H.
16.	One distance piece 18.5 mm. long	40.	One distance piece 3.5 mm. thick
17.	One bracket	41.	One bracket
18.	One distance piece 18.5 mm. long	42.	One distance piece 3.5 mm. thick
19.	One rocker arm, R.H.	43.	One rocker arm, R.H.
20.	One washer 1 mm. thick	44.	One washer 1 mm. thick
21.	One spring	45.	One spring
22.	One washer 1 mm. thick	46.	One washer 1 mm. thick
23.	One rocker arm, L.H.	47.	One rocker arm, L.H.
24.	One distance piece 3.5 mm. thick	48.	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 toward 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 8 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 2.6 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., 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. 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.	Mandrel MR.3098-B

	(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. (35½ lbs., plus or minus 1½ 1bs.), the length should be 37mm. 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 nm.	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 l2
	(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 wi1l 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. Insure that shaft rotates normally and that the end p1ay 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 f1ange. 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 l2
	(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 kg per square centimetre (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 l2
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 pipes 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 bearings, boring bar for bearing, 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 cups 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 rebore 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 parallel 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 readier "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. $E = 65.014 \pm \begin{matrix} 0.025 \\ 0.000 \end{matrix} - a$	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, wil1 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 baff1es, tighten bearing caps, ream oil baff1es. 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 gudgeon	Spanner MR.1610 Surface plate 2480-T

	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 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 1ow 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 b1ock.	
	(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 Drawings 17, fig. 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. 1 and 3.) 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 dowe1. 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 e1gine 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 0F 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 1655-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 determining 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 S1eeve 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, (7¼ 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. I 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 compression stroke. Timing marks should now line up cording to Drawing 20.	Box spanner 38

	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 lockwshers. 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 1¾ 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. (10½ foot pounds) to prevent crushing the column, and tighten lock nut to a tension of 3 mkg. (21¾ foot pounds.) Tighten union nuts to a tension of 6 mkg. (43½ 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 oi1 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 bo1ts. 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. (14½ 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. Flt spring washers and fixing nuts, and tighten down.	Box spanner 14
13	Fit the carburettor (see Operation 708, paragraphs 4, 5 and 6.)	
14	Fit water hoses. Fit spark p1ugs. (Use spanner 1601-T). Connect positive cable to the battery.	Spark plug spanner 1601-T
15	Make sure that drain tap is shut and then fill radiator with water.	Flat spanner 12
16	Start engine and let it idle (approximately 600 R.P.M.) for fifteen minutes.	
17	Finally tighten cylinder head nuts in the order indicated (see Drawing 18) to a tension of 5 mkg. (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. (8¾ 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 0peratlon 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 p1ate. If the assembly is more than 0.1mm. out of alignment true up the faces by grinding or with a fi1e. 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. Flt the assembly of manifo1ds 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 from 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.	
5	REFITTING WATER PUMP	
	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).	
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 tho bolts (see Drawing 23).	Flat spanner 12
8	Fill the radiator with water.	
9	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 m.) 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, starer 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 BUTTERTLY 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 sma1l 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 (3) 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).	
	ASSETIBLING 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 (5 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 a1low 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 leeks (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. (1½ 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.