BOOK No. 48·3

(Supersedes Book No. 48, 48·1 & 48·2)

GARDNER

DIESEL ENGINES

LW & HLW
LW20 & HLW20

WORKSHOP TOOLS, EQUIPMENT, and INSTRUCTIONAL DRAWINGS

Printed in England.

Price £2.00 each

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(Supersedes Books Nos. 48, 48.1 & 48.2)

GARDNER

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LW20 & HLW20

WORKSHOP TOOLS, EQUIPMENT, and INSTRUCTIONAL DRAWINGS

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LW, HLW, LW20 & HLW20 ENGINES

WORKSHOP TOOLS AND EQUIPMENT

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LW, HLW, LW20 & HLW20 ENGINES

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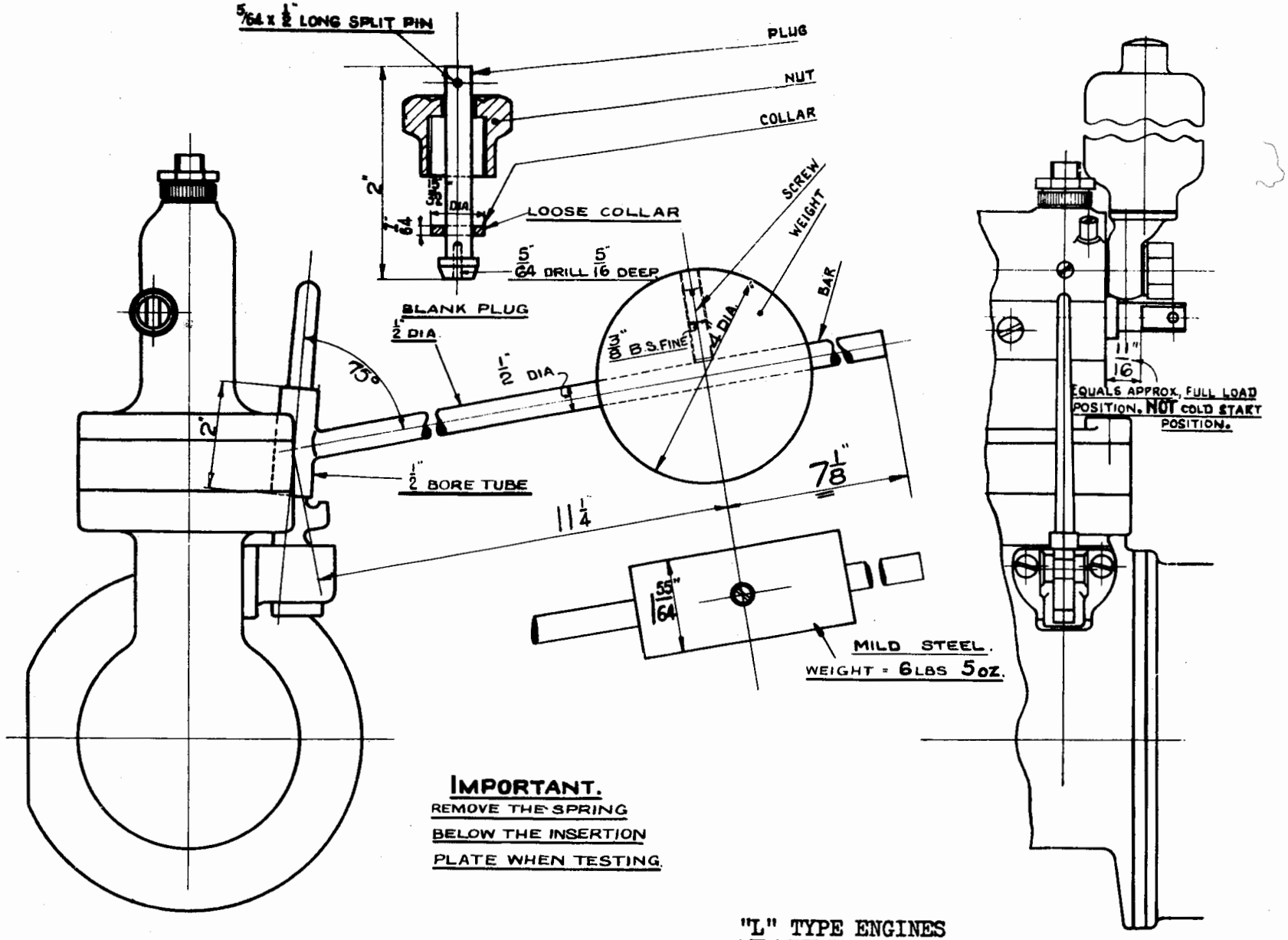


"L" TYPE ENGINES

Fuel Pump Element Testing Tool

Illustration No. S.A. 2134

GARDNER

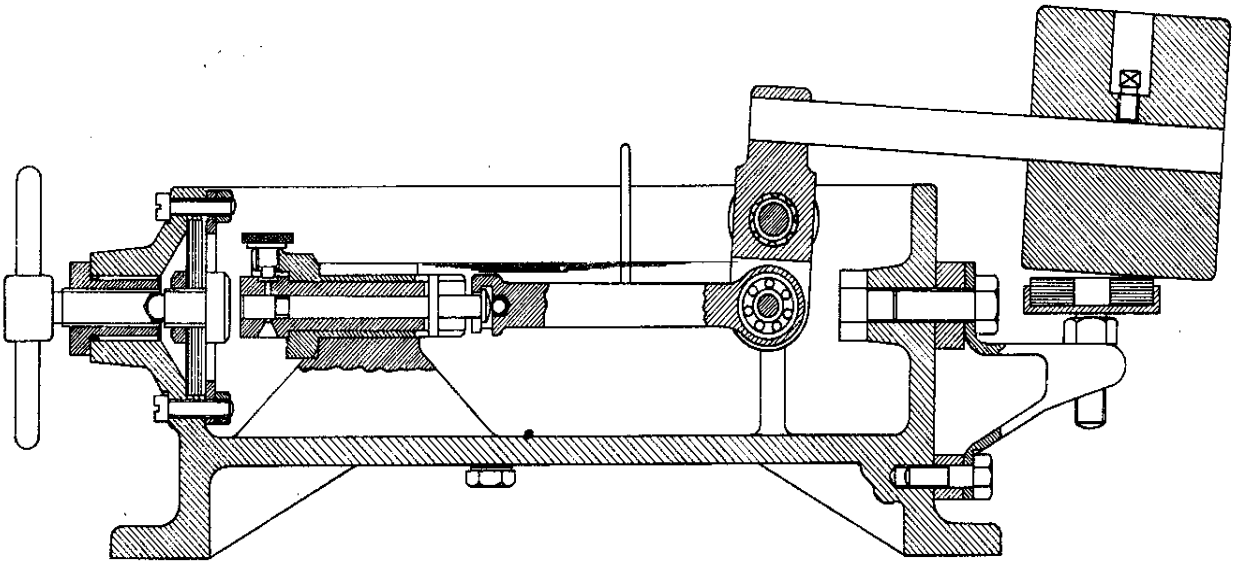
"L" TYPE ENGINES

FUEL PUMP ELEMENT TESTING TOOL

Illustration No. S.A. 2134

PURPOSE. For testing the fuel leakage past the ram in a worn element without dismantling the pump unit.

METHOD. Remove the pump from the cam box and remove the tappet spring from the lower side of the 1" thick insertion plate. Refit pump and insertion plate to cam box and couple up fuel pipe. Remove all air from fuel pump and operate priming lever until all air bubbles cease to flow from the delivery stock. Fit solid plug to delivery stock and tighten union nut. Set slider bar in position shown on page 4 and fit drop weight arm over priming lever. This weight will fall slowly until spill ports are uncovered, at this point the weight will fall rapidly. The slow portion of the travel represents the stroke of the ram used for the actual injection when piped up to the sprayer. The more wear which is present in an element the more rapidly will fuel leak from the delivery side to the suction side of the ram and, consequently, the more rapidly will the weight fall during this part of the stroke. This slow portion of the stroke should be timed on at least three tests and if the average time required is less than 10 seconds the element must be regarded as badly worn and requiring replacement.



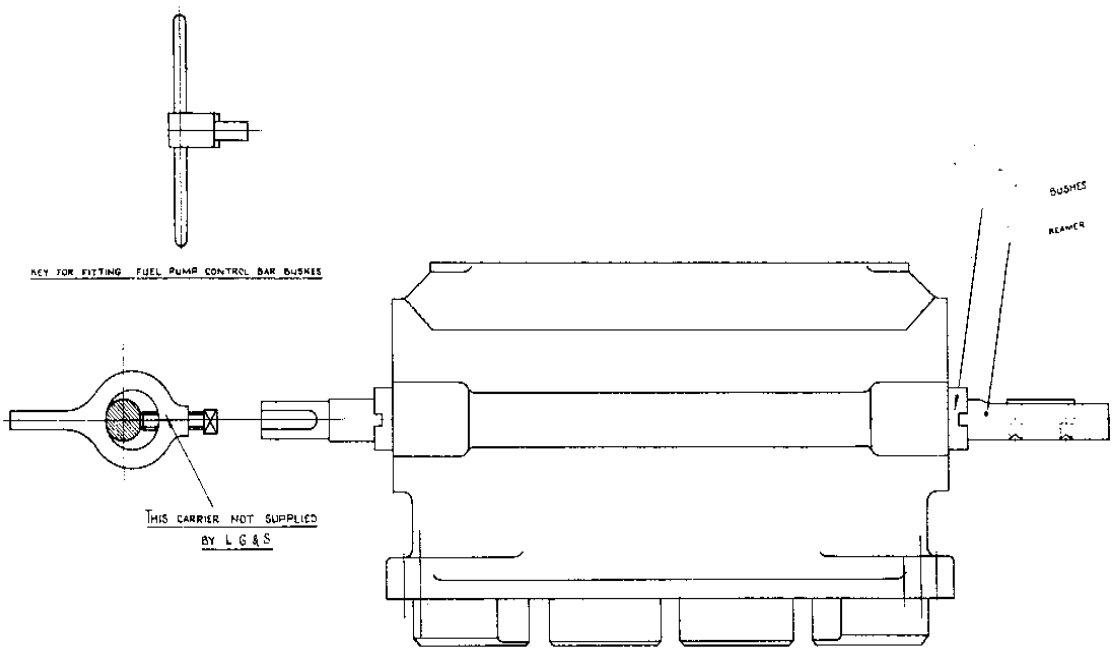
"L" TYPE ENGINES

FUEL PUMP ELEMENT TESTING FIXTURE

Illustration No. 11667

PURPOSE. For testing fuel pump elements when not fitted in a pump body.

METHOD. Fit element in fixture as shown above and firmly tighten blanking screw in end of box. Lift weight lever and allow it to fall. Time the duration of the slow portion of its travel exactly as described for element testing tool on previous page, and in this case the minimum time permitted is also 10 seconds below which the element should be rejected.



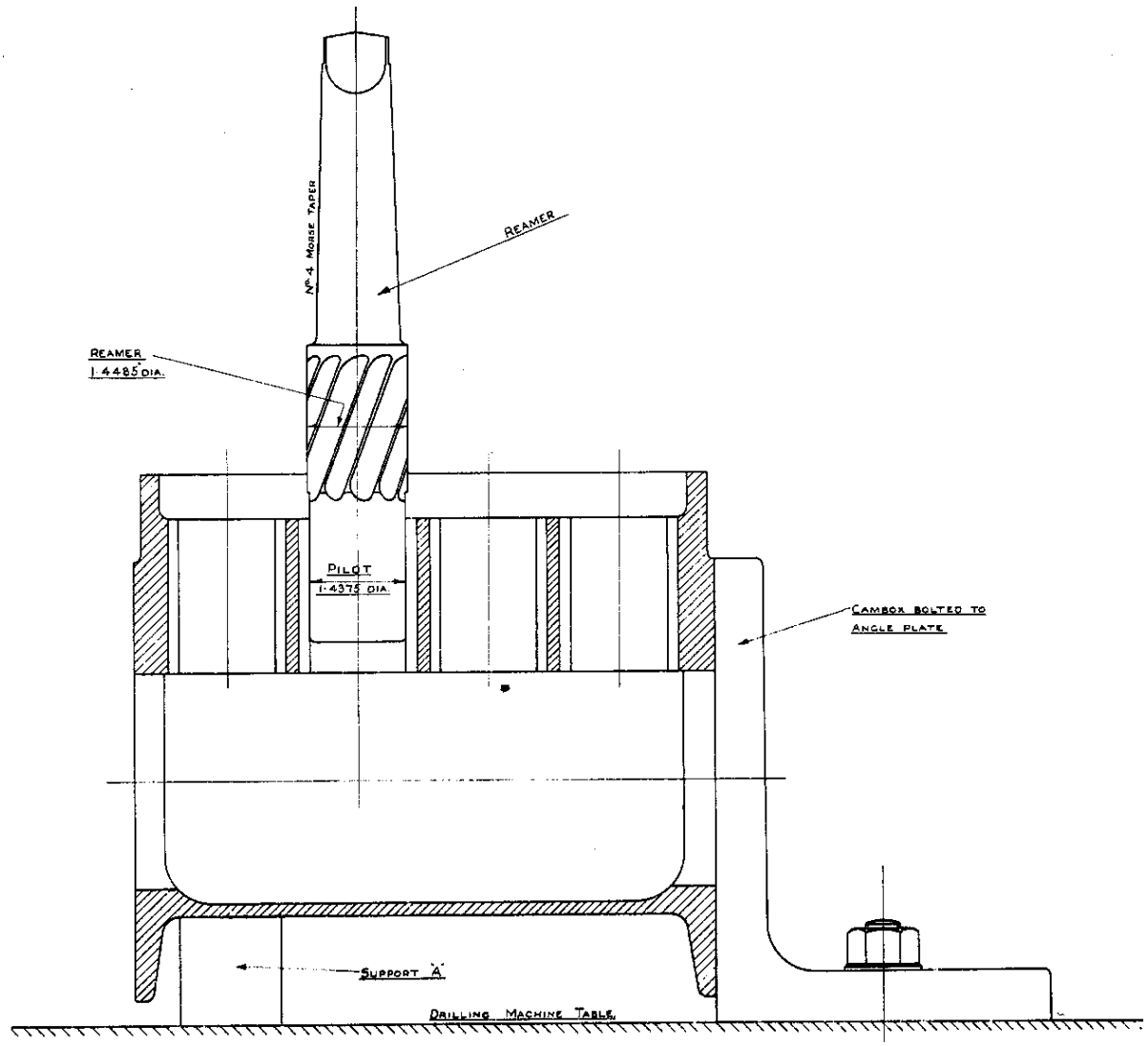
"L" TYPE ENGINES

FUEL PUMP CONTROL BAR BUSH REAMER AND FITTING KEY

Illustration No. 2684F

PURPOSE. To fit and ream the control bar bushes to ensure that they are in alignment.

METHOD. Having screwed new bushes into pump body by means of the key shown above, enter the plain end of the reamer bar through both bushes until the bar projects from one end. Fit a carrier to this end of the bar and ream the bush at the other end, gradually drawing the bar through the body. When this bush has been reamed the carrier should be removed and the bar withdrawn from the body and entered at the other end to ream the second bush.



"L" TYPE ENGINES

Fuel Pump Cambox Reamer

Illustration No. 3971H

"L" TYPE ENGINES

FUEL PUMP CAMBOX REAMER

Illustration No. 3971H

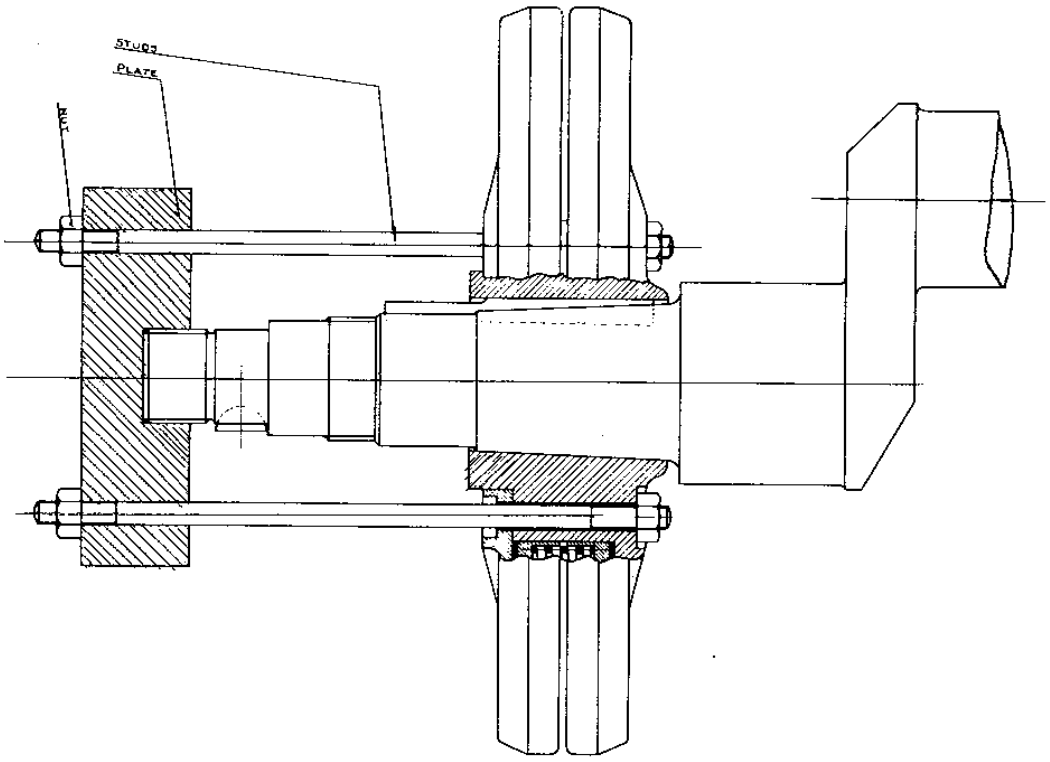
PURPOSE. For re-sizing worn cambox bores to receive ·010" oversize fuel pump tappets. This process is desirable when wear is such that a new standard size tappet has ·006" clearance in a worn bore.

METHOD. Mount the worn cambox on an angleplate as illustrated, on the table of a good vertical drilling machine with a support "A".

Before starting to remove metal, check that the reamer and drilling spindle are free to rotate by hand when the pilot portion of the reamer is fully entered into the tappet bore. This ensures that the reamer is in correct alignment with the original hole.

Use paraffin or fuel oil as a lubricant when cutting. When fitting the new ·010" oversize tappets care must be taken to check that they are absolutely free to slide in the new bores just produced.

It may be found that the projecting flatted portions of the tappet roller pin are preventing free movement of the tappet due to slight interference with the sides of the keyway. In such cases the sides of the keyways should be carefully filed to permit free movement.



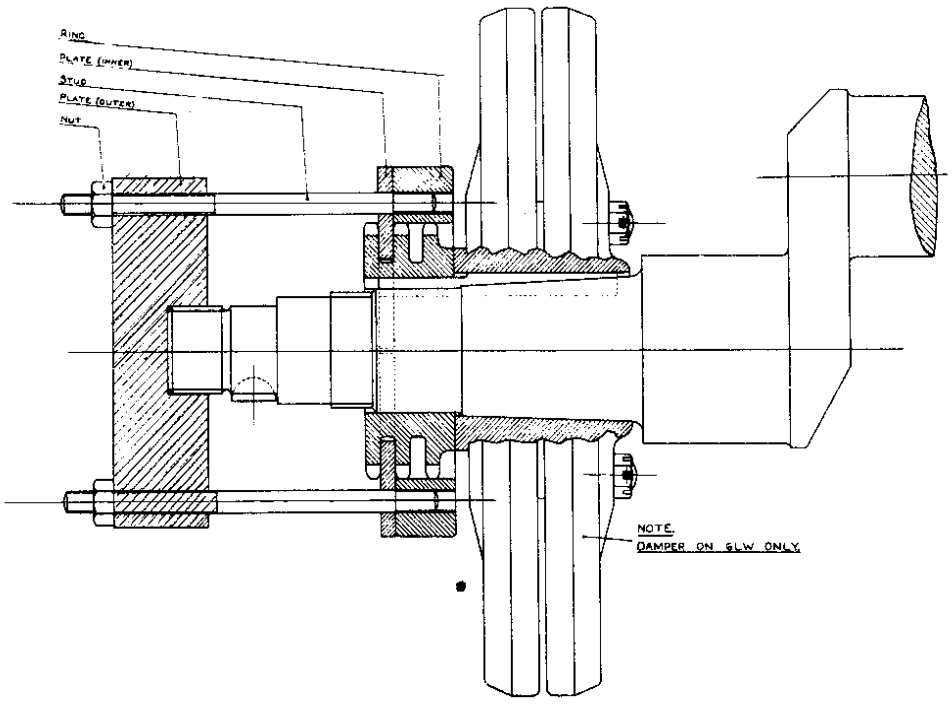
6LW, 6HLW, 6LW20 & HLW20 ENGINES

CRANKSHAFT DAMPER WITHDRAWAL TOOL

Illustration No. 2685F

PURPOSE. To remove the damper from its taper fit at the forward end of the crankshaft.

METHOD. Remove three evenly spaced bolts from damper body and fit the three studs and plate as shown above. Evenly tighten the three nuts on the outer end of the screwed bolts. When a fair tension has been applied strike a light blow on the end face of the drawing plate.



LX, HLX, LXB, HLXB, LW, HLW, LW20 & HLW20 ENGINES

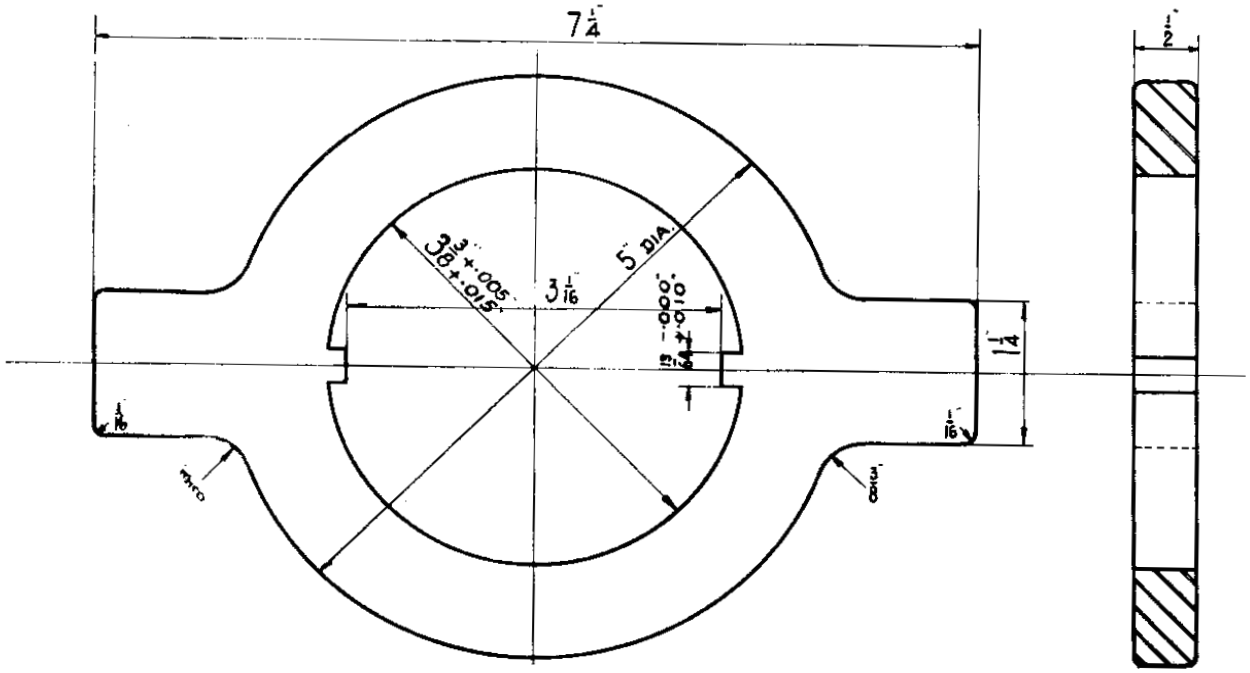
CRANKSHAFT SPROCKET WITHDRAWAL TOOL

Illustration No. 2699F.

PURPOSE. To remove chain sprocket from forward end of crankshaft.

METHOD. Pass the large diameter cast iron ring over the sprocket and fit the two halves of the split ring in the groove between the first and second row of teeth. Pass the two screwed rods through the split rings and screw into cast iron ring. Fit the draw plate up to the end of the crankshaft with the two rods passing through the two diametrically opposite holes. Screw up both nuts evenly.

NOTE: This tackle makes use of the same draw plate as for the crankshaft damper withdrawal tool.



LW, HLW, LW20 & HLW20 ENGINES

CRANKSHAFT SPROCKET NUT SPANNER

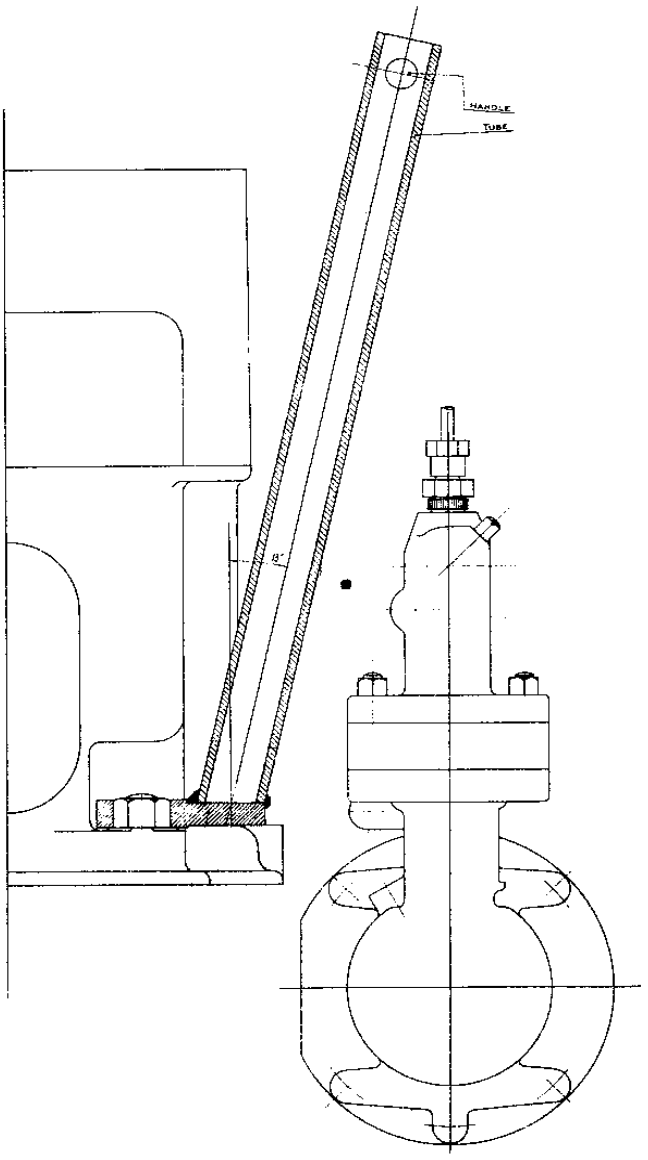
Illustration No. J6902

PURPOSE. To remove and retighten the large nut at the forward end of the crankshaft.

METHOD. 6LW & 6HLW ENGINES (fitted with taper mounted crankshaft dampers). Tighten the nut until it just makes solid contact with the sprocket by lightly tapping the spanner. From this position the nut must be tightened a further 120° and locked in this position. Nine teeth on the sprocket corresponds to 120° and so form a convenient means of measuring this angular travel.

LX, HLX, LXB, HLXB, LW, HLW, LW20 & HLW20. In these engines the sprocket is held up against a square shoulder on the crankshaft so that the nut just requires to be firmly knocked up solid and locked.

In spanners of this type it is always desirable to hold a heavy weight in contact with the face of the arm diagonally opposite to that being struck by the hammer.



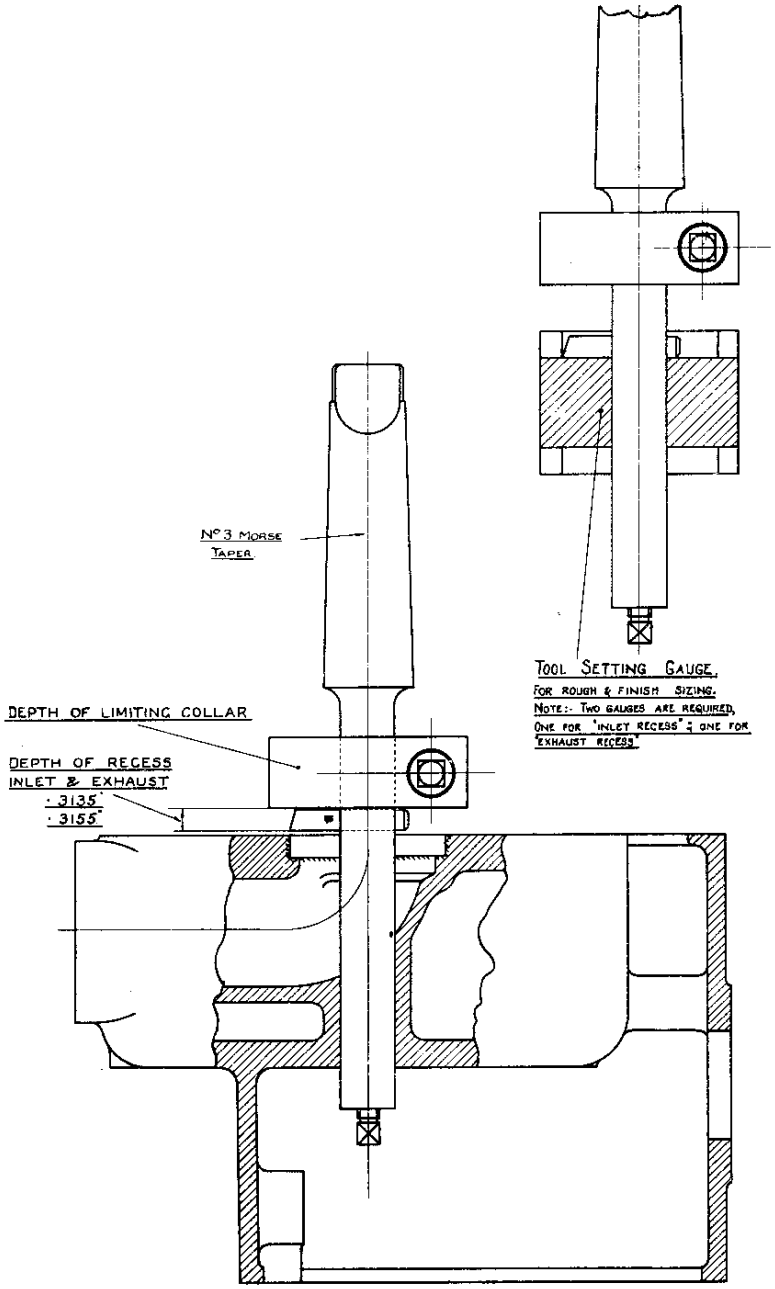
LW, HLW, LW20 & HLW20 ENGINES

CYLINDER FOOT NUT SPANNER

Illustration No. 3498H

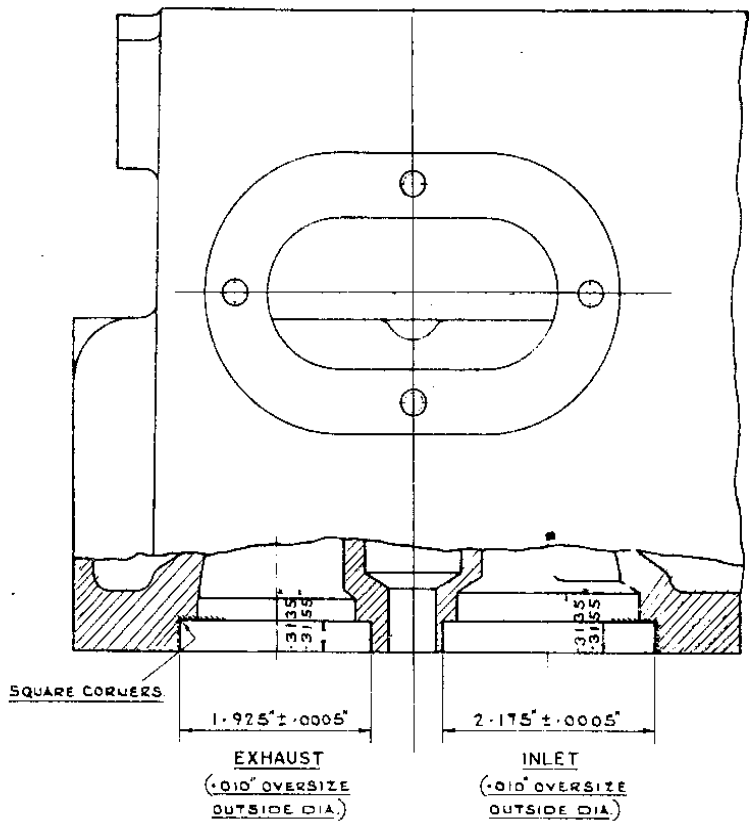
PURPOSE. Removing and retightening nuts at the forward and near side of the engines without removal of fuel pump or cam box.

METHOD. Apply as illustrated above.



LW, HLW, LW20 & HLW20 ENGINES - OVERSIZE VALVE INSERT RECESSES MACHINING TOOL

Illustration No. 2676F



LW, HLW, LW20 & HLW20 ENGINES

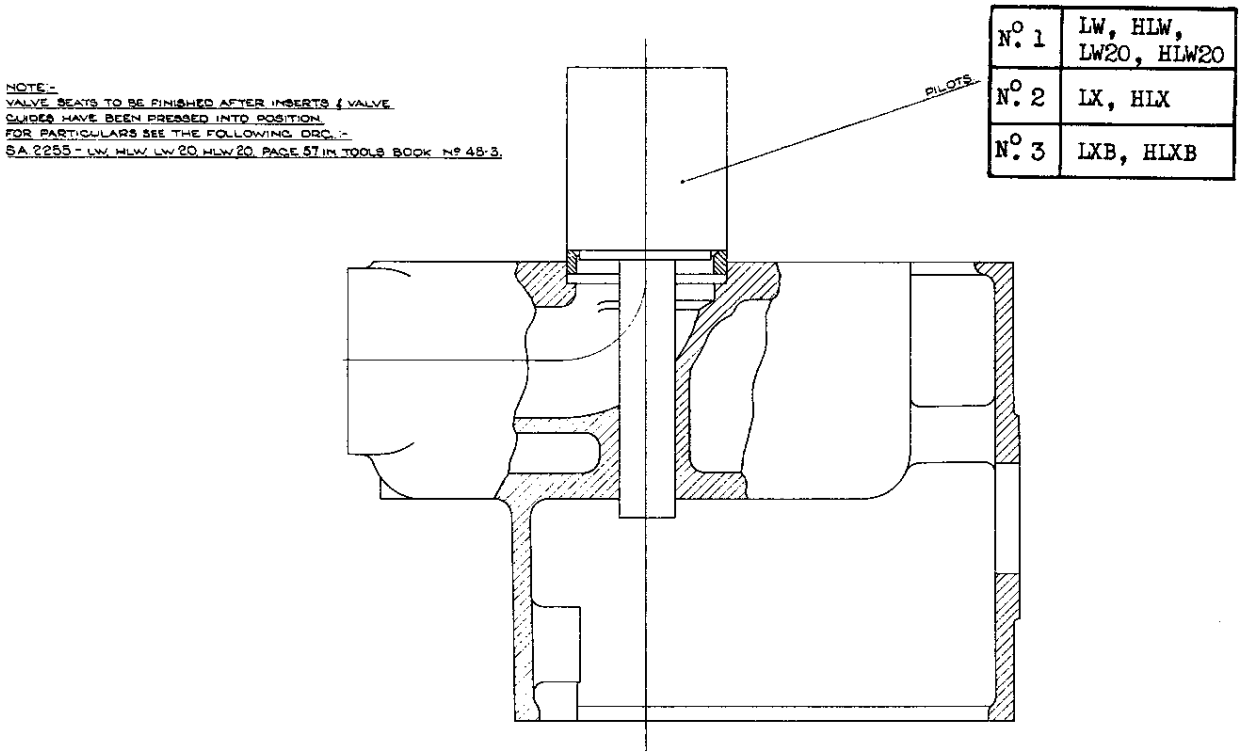
TOOL FOR PRODUCING RECESSES TO RECEIVE OVERSIZE VALVE SEAT INSERTS

Illustration No. 2676F & J3385

(See also Drawing No. S.A. 2255, page 57 for assembly of inserts in head).

PURPOSE. To bore recesses in cylinder head to receive valve seat inserts.

METHOD. Fit the tool to any suitable drilling machine spindle and produce the recesses as shown above. It should be noted that the bores for the inlet and exhaust inserts are different but have the same depth. Use the gauges as shown on page 16 for setting the tool to cut the appropriate diameter of recess and set to stop to give the correct depth.



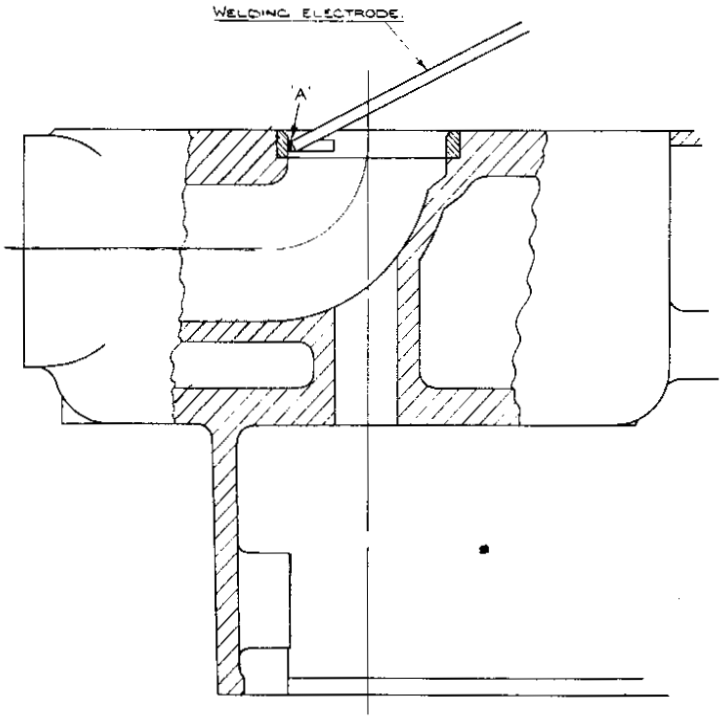
LX, HLX, LXB, HLXB, LW, HLW, LW20, HLW20 ENGINES

VALVE SEAT INSERT PILOT

Illustration No. 7097F

PURPOSE. To ensure that valve seat insert is pressed in square to cylinder head.

METHOD. Remove valve guide and fit insert and pilot as shown above and press into position. When finally pressed in the pilot should be given a sharp blow whilst the weight of the press is still operating. This ensures that the insert stays in firm contact with the bottom of the recess.



LX, HLX, LXB, HLXB, LW, LW20, HLW20, L3 & L3B ENGINES

VALVE SEAT INSERT WITHDRAWAL TOOL

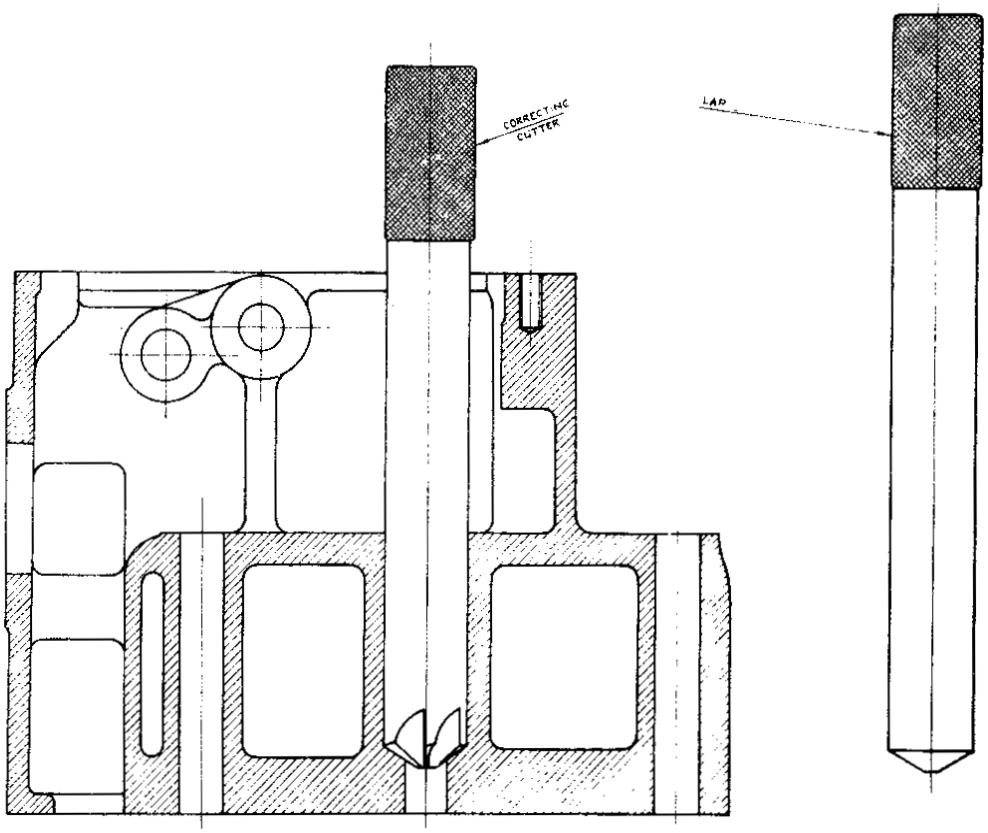
Illustration No. K4240

PURPOSE. For withdrawing worn valve seat inserts from the cylinder head.

METHOD. To remove valve seat inserts from a cylinder head apply a welding electrode as shown above. Deposit a small thickness of weld as shown in section at "A" for about a quarter of the circumference of the insert bore. The insert will then collapse and can be lifted out.

NOTE: The arc must not be allowed to strike the metal below the insert and any metal particles which have adhered to the valve port must be carefully removed.

"CAUTION" When undertaking this operation it is considered necessary to have some form of shield to protect the operator as on occasions the valve seat insert can spring out of the cylinder head with considerable force.



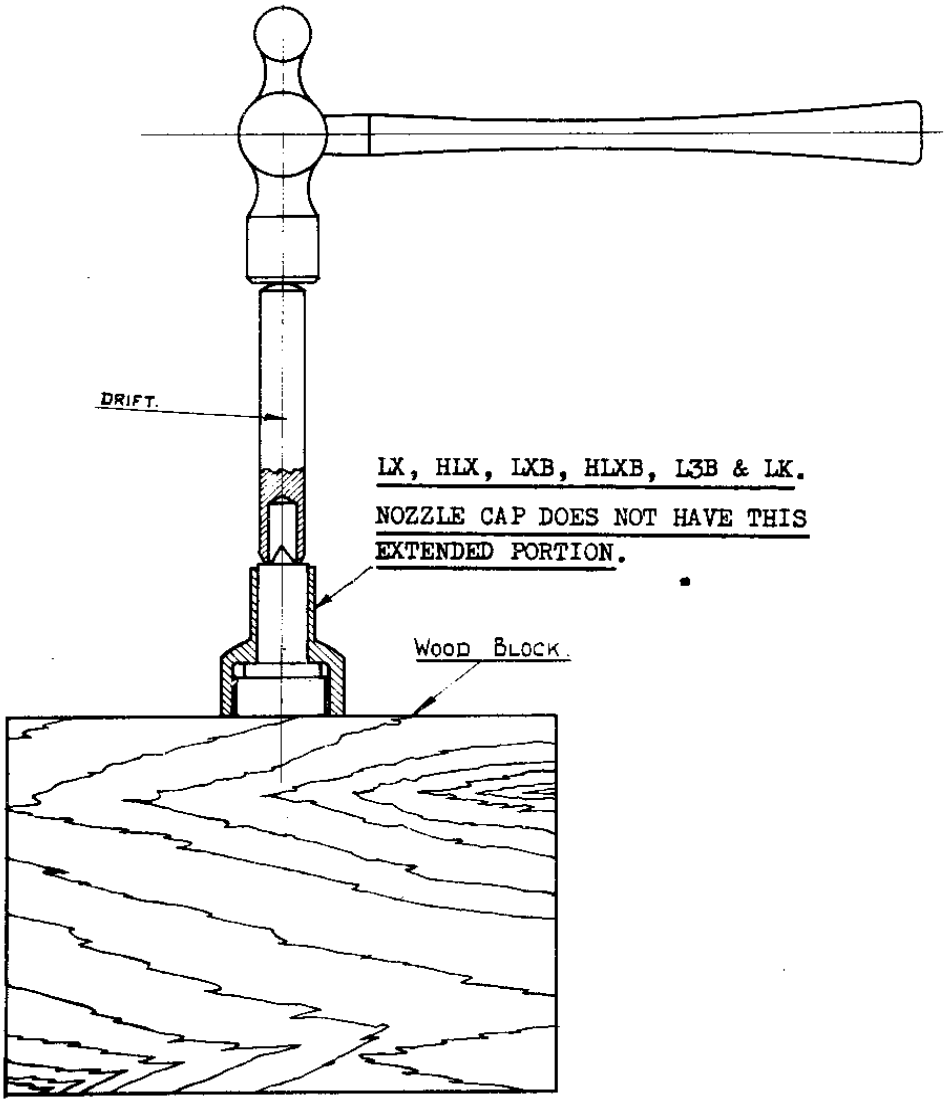
LW, HLW, LW20 & HLW20 ENGINES

SPRAYER SEAT CUTTER AND LAP

Illustration No. 2683F

PURPOSE. To restore the sprayer seat at the point where it makes a gas-tight joint in the cylinder head.

METHOD. Fit cutter to sprayer hole in the head and rotate with care in a clockwise direction. Cut away as little metal as is necessary to remove damaged portion of the seat. To finish seat use lap and ordinary valve grinding paste. It should be noted that this work does not represent routine attention and, in fact, will only be required under exceptional circumstances.



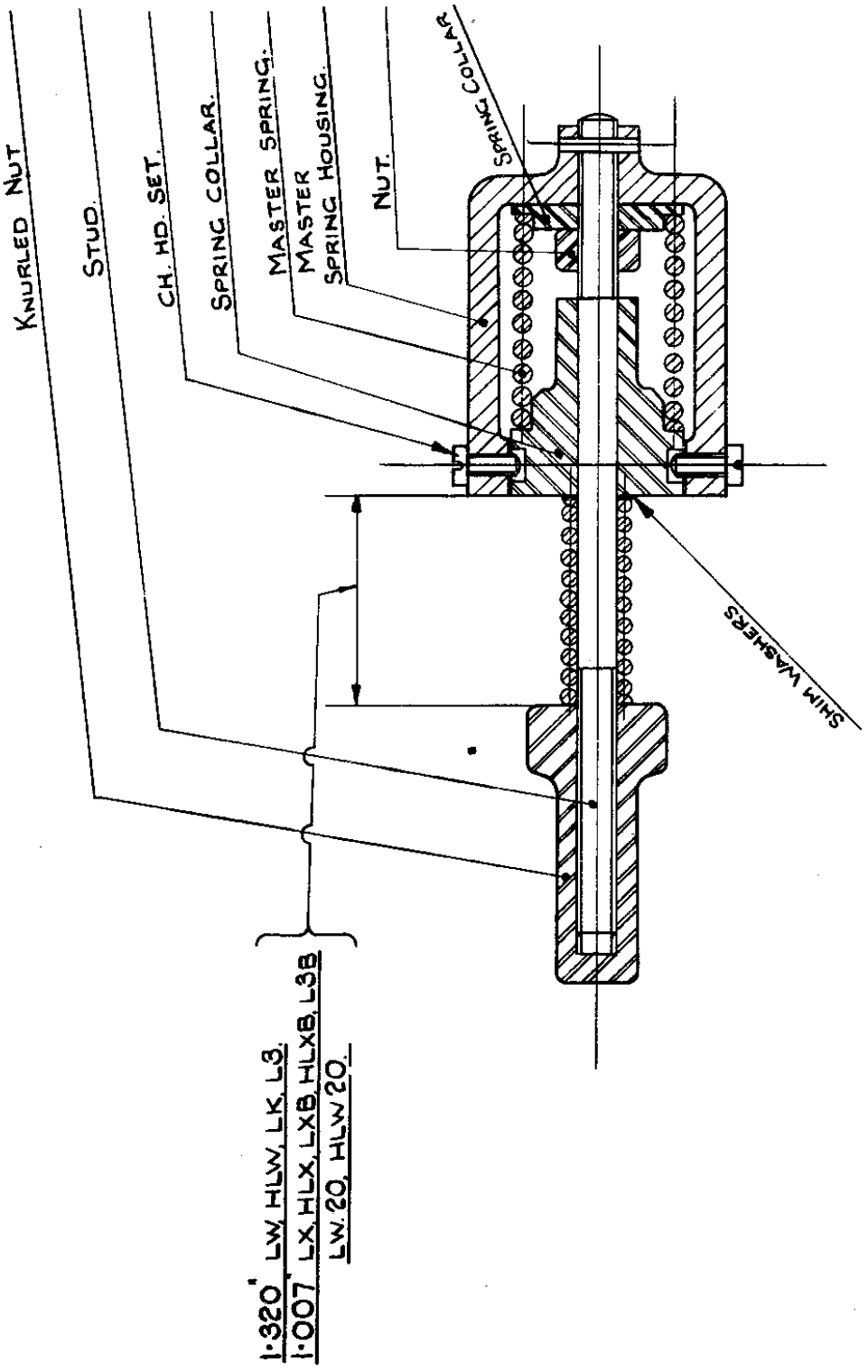
"L" TYPE ENGINES

SPRAYER NOZZLE DRIFT

Illustration No. S.A. 2729

PURPOSE. To drive the sprayer nozzle from the sprayer cap nut without damage to the spray holes.

METHOD. Place hollow end of drift against the sprayer nozzle and tap out, (with sprayer cap nut removed from sprayer).



"L" TYPE ENGINES

SPRAYER VALVE SPRING COMPARATOR

Illustration No. S.A. 3344

"L" TYPE ENGINES

Sprayer Valve Spring Comparator

Illustration No. S.A.3344

PURPOSE. To provide a ready means of comparing sprayer valve springs with a master spring and thereby ascertaining how many shim washers are required to give correct load when assembled in the sprayer.

METHOD. Unscrew knurled nut, and fit sprayer valve spring in position shown on page 24. Refit knurled nut and screw up as far as it will go by light finger pressure only.

If the valve spring is exerting correct load, the face of the spring collar and end face of master spring housing will be level one with the other, i.e. there will be no step apparent between the collar face and spring housing face.

If the face of the spring collar stands proud of the end face of the housing this indicates that the load exerted by the valve spring is too low and shim washers of sufficient thickness must be fitted at one end of the sprayer valve spring in position shown on page 24 until these two faces are level. A very light tap on the side of the main spring housing will be found to settle the spring collar in its true position.

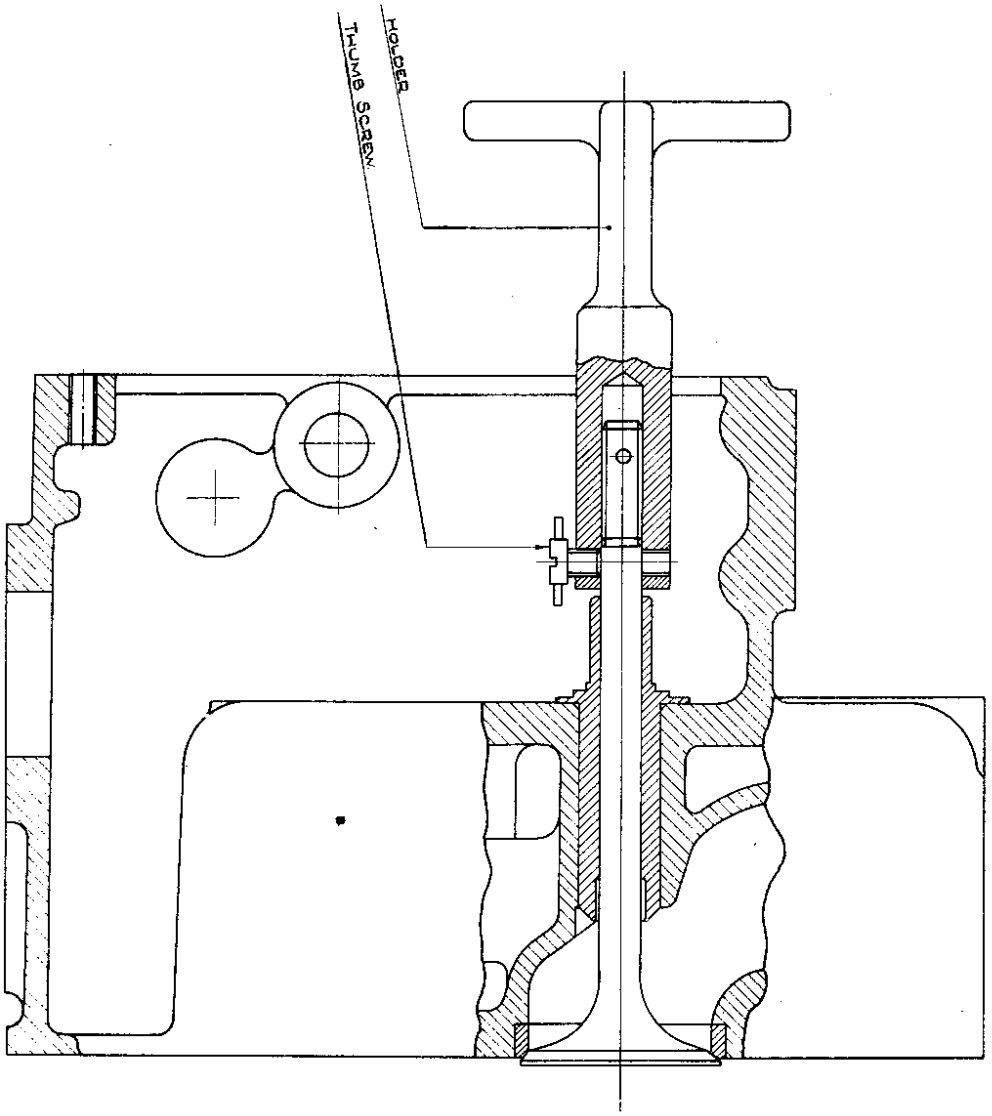
"Gardner" standard shim washers are available in thicknesses of ·007".

NOTE: These tools must be used for testing only those sprayer valve springs for which they are set and stamped by the Factory: when ordering it is therefore necessary to state for what sprayers the tool is required.

The following table shows the spring load required for the various sprayers:

LX, HLX, LXB & HLXB current type 68·3 lb.
L3 current type 59–61 lb.
L3B current type 65 lb.
LW, HLW & 1L2 current (K) type 61·0 – 61·5 lb.
LW20 & HLW20 current type 68 lb.
LK current type 58·5 – 59·5 lb.
L2 & LW old (E & E1) type 55 – 57 lb.

LW (E1K), (E1 converted to E1K when works overhauled) 61·0 – 61·5 lb.



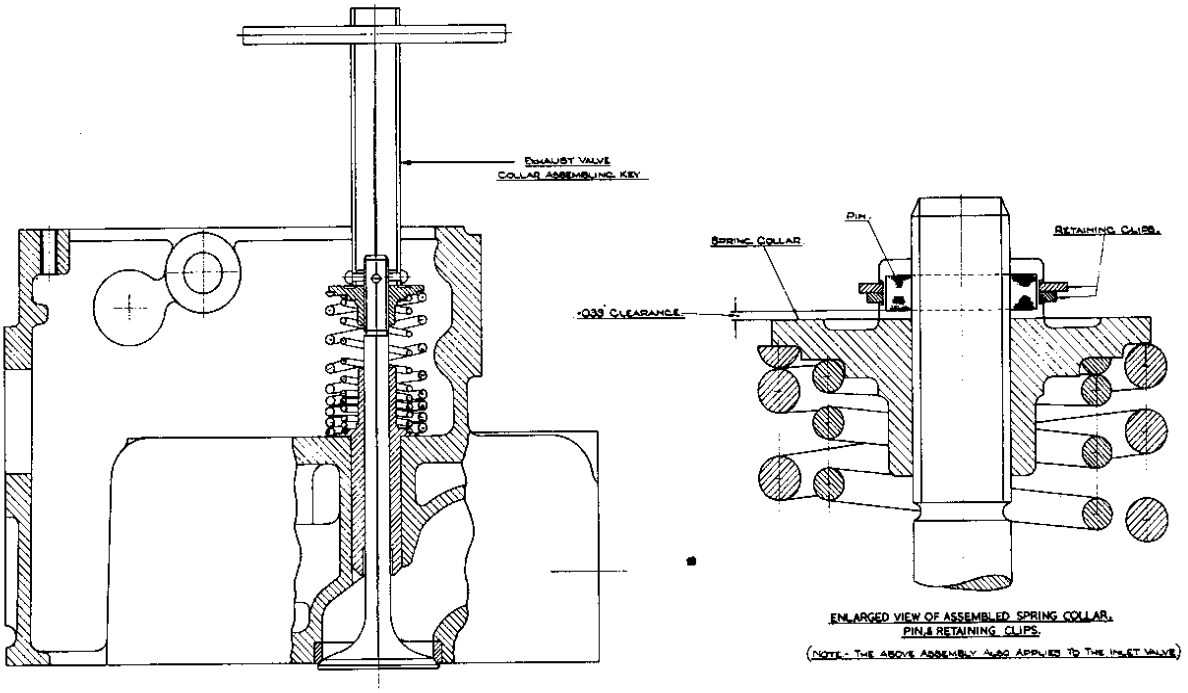
"L" TYPE ENGINES (EXCEPT L3 & L3B)

EXHAUST VALVE "LAPPING IN" TOOL

Illustration No. 7103F

PURPOSE. Holder for "lapping in" exhaust valve which does not have a screwdriver slot in head.

METHOD. Apply holder as illustrated above.



LW, HLW, LW20, HLW20, LX, HLX, LXB & HLXB ENGINES

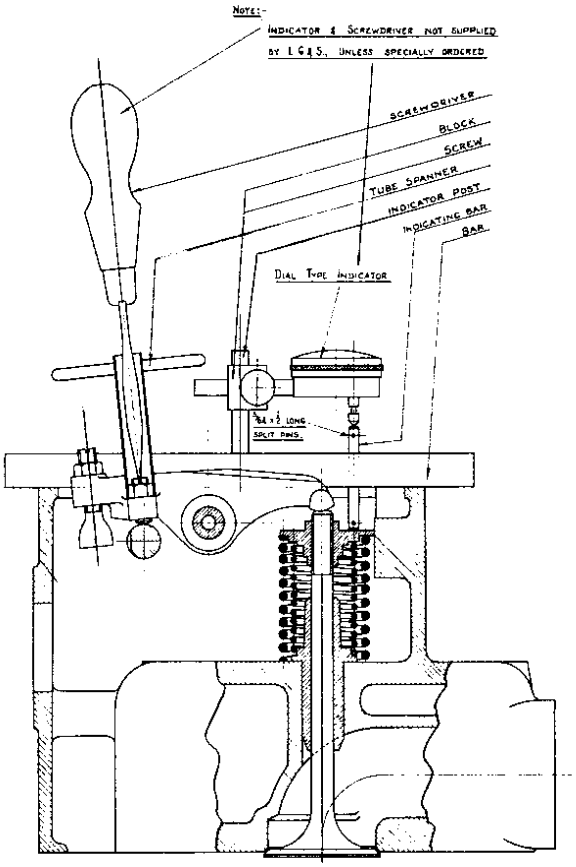
EXHAUST VALVE COLLAR & SPRINGS ASSEMBLING TOOL

Illustration No. 7104F

PURPOSE. To assemble exhaust valve springs collar and springs, on to a valve which does not have a screwdriver slot in head.

METHOD.

1. First ensure that the collar can be screwed down the valve by hand.
2. Insert valve into cylinder head screw on collar and compress the springs as much as possible by hand.
3. Use special assembling key and continue to screw on collar until the relative position of the pin hole in the valve stem to the face on the collar is as shown in enlarged view of collar, pin, and clips assembly, i.e. ·033" clearance between bottom of hole and collar face and fit pin.
4. Fit lower retaining clip with gap at 90° to slot in collar.
5. Fit upper retaining clip with gap at 180° to gap in lower clip.



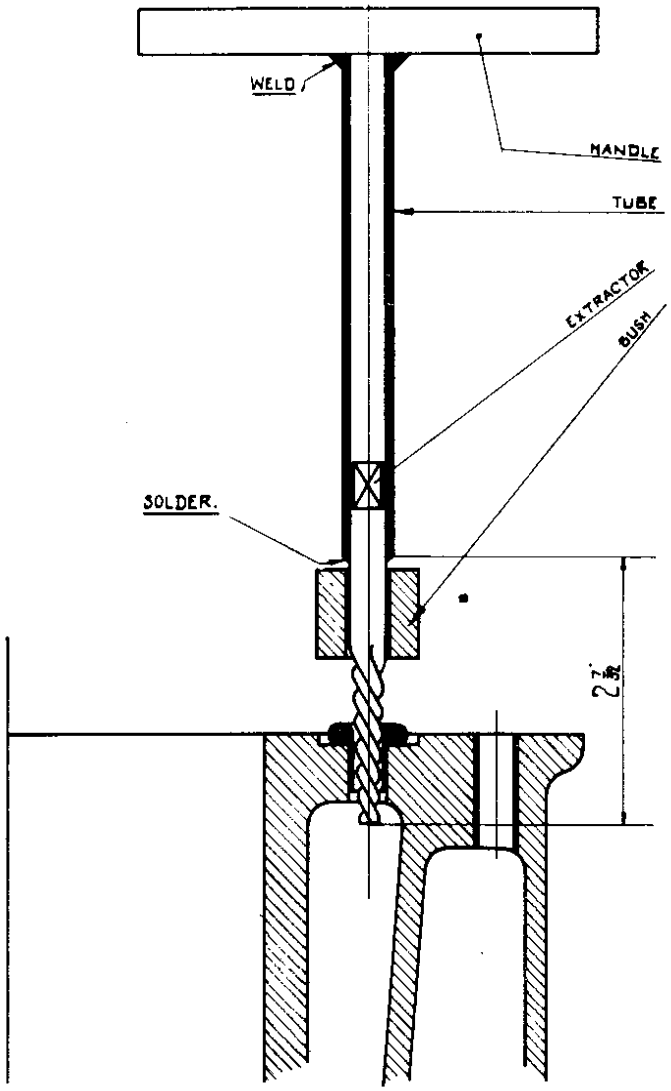
LW, HLW, LW20 & HLW20 ENGINES

SPECIAL BOX SPANNER AND MEANS TO INDICATE DECOMPRESSION LIFT OF INLET VALVE

Illustration No. 2678F

PURPOSE. To adjust lift of inlet valve for decompression and to provide convenient means of indicating lift.

METHOD. Rotate decompression shaft to correct position for decompression and slack off decompression screw until it is clear of the shaft. Apply dial type indicator and set to zero. Screw up decompression screw until the valve has lifted ·040" as shown on the indicator and lock the nut.



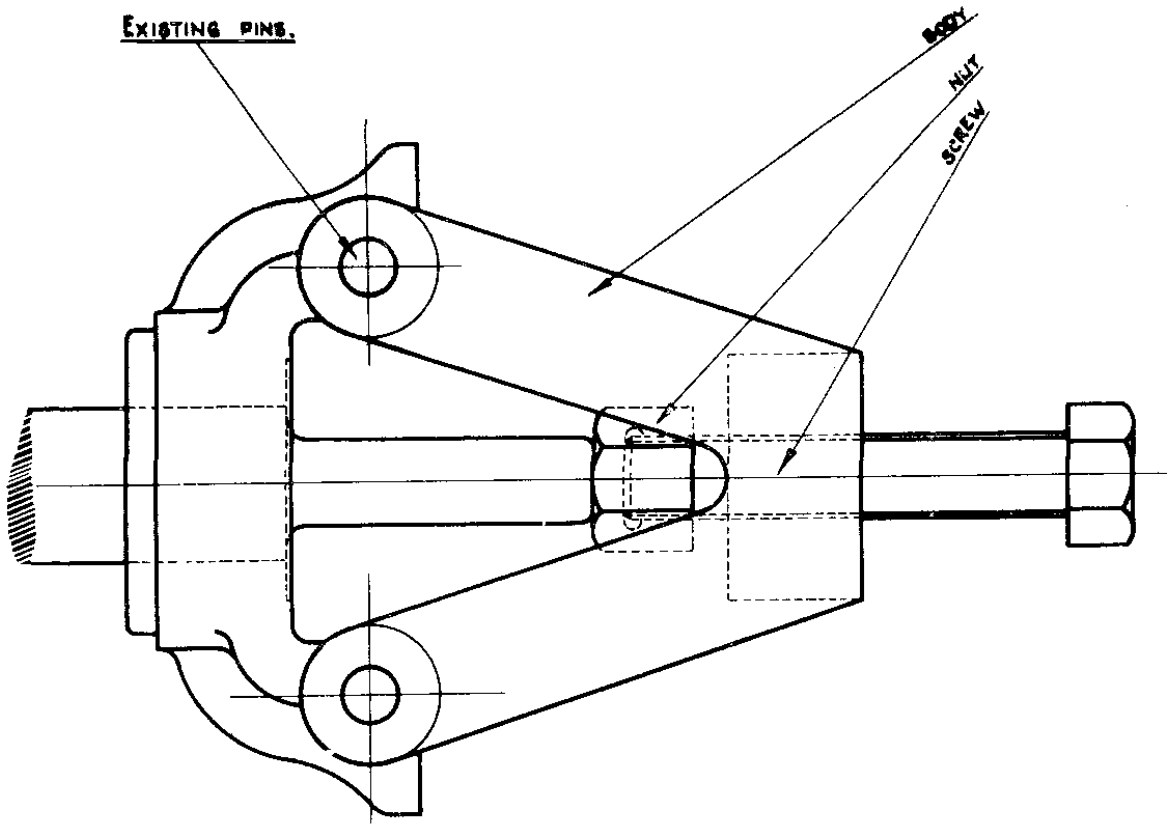
"L" TYPE ENGINES

EXTRACTOR FOR CYLINDER TO HEAD WATER CONNECTING TUBES

Illustration No. S.A. 2724

PURPOSE. For the removal (without damage) of the small tubes fitted in the top of the cylinder block.

METHOD. Screw tool (left handed) into tube and pull out. Tube can then be tapped off tool by means of loose collar.



LW. HLW. 2 - 6L2. LK. 3 to 6L3 & 6L3B ENGINES

GOVERNOR BODY WITHDRAWAL TOOL

Illustration No. S.A. 2728

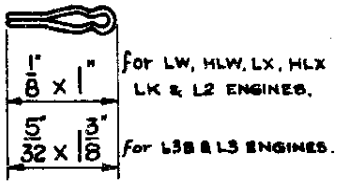
PURPOSE. For removing the governor body from the fuel pump camshaft.

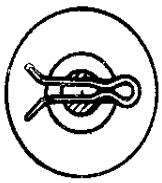
METHOD. Remove the pointed set screw from governor body. Fit tool as shown above using the two governor weight hinge pins to connect the tool to the governor body and draw off by means of the jacking screw.

LX, HLX, LW, HLW, LW20, HLW20, LK, L3B, L3 & L2 ENGINES

FITTING OF SPLIT COTTER PINS TO INLET & EXHAUST VALVES & COLLARS

Always use new split pins of correct length and size with equal legs of the drive open type or of standard type bent to this shape before fitting. Open the legs equally to approx. 90° between legs after fitting as shown below. Tap in lightly only.

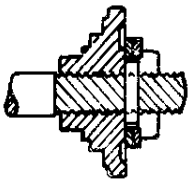




LX & HLX ENGINES.
The above arrangement superseded by arrangement below after engine number 134715.

LX, HLX, LXB & HLXB ENGINES

FITTING OF SPRING CLIPS TO INLET & EXHAUST VALVES & COLLARS

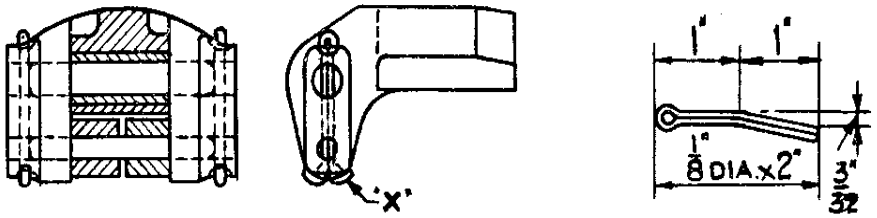


Screw collar on valve until bottom of groove is level with pin hole in valve. Fit pin and assemble spring clips with the gaps diametrally opposite each other and at 90° to pin. It is desirable that the sharp edge face of the clip be upwards.

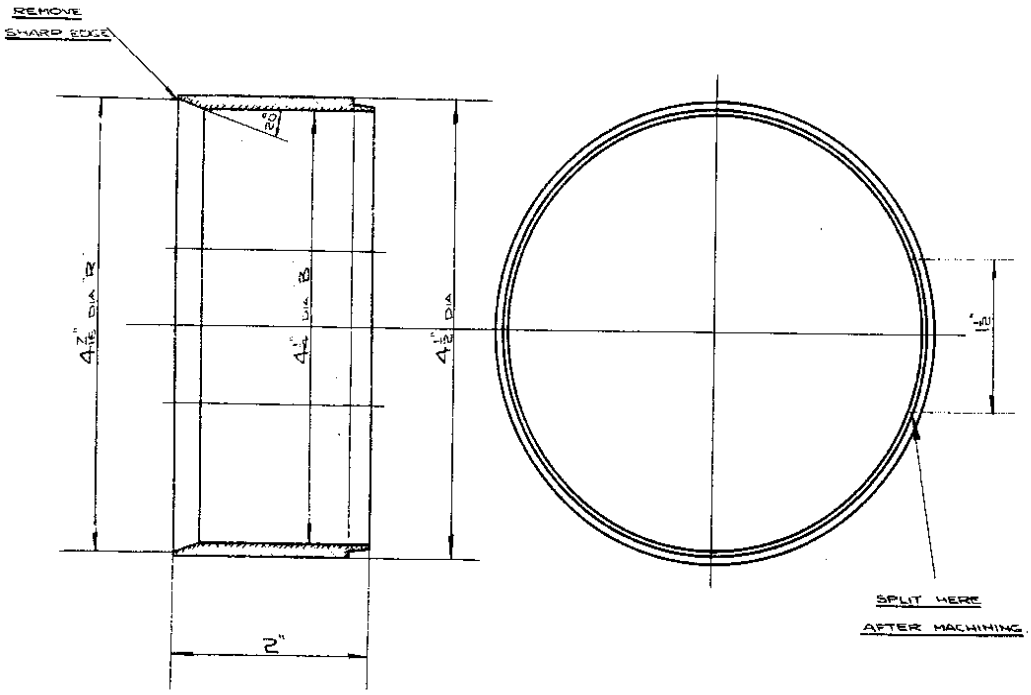
This arrangement fitted to all engines after number 134715.

"L" TYPE ENGINES

FITTING OF SPLIT COTTER PINS – TYPE 3 GOVERNOR WEIGHTS



Before fitting the split pins bend as shown to ensure that they fit tightly in their holes.
Always use new split pins of correct length and size with equal legs.
After fitting open legs as shown at "X" to ensure that the split pins do not rotate.



LW, HLW, LW20 & HLW20 ENGINES

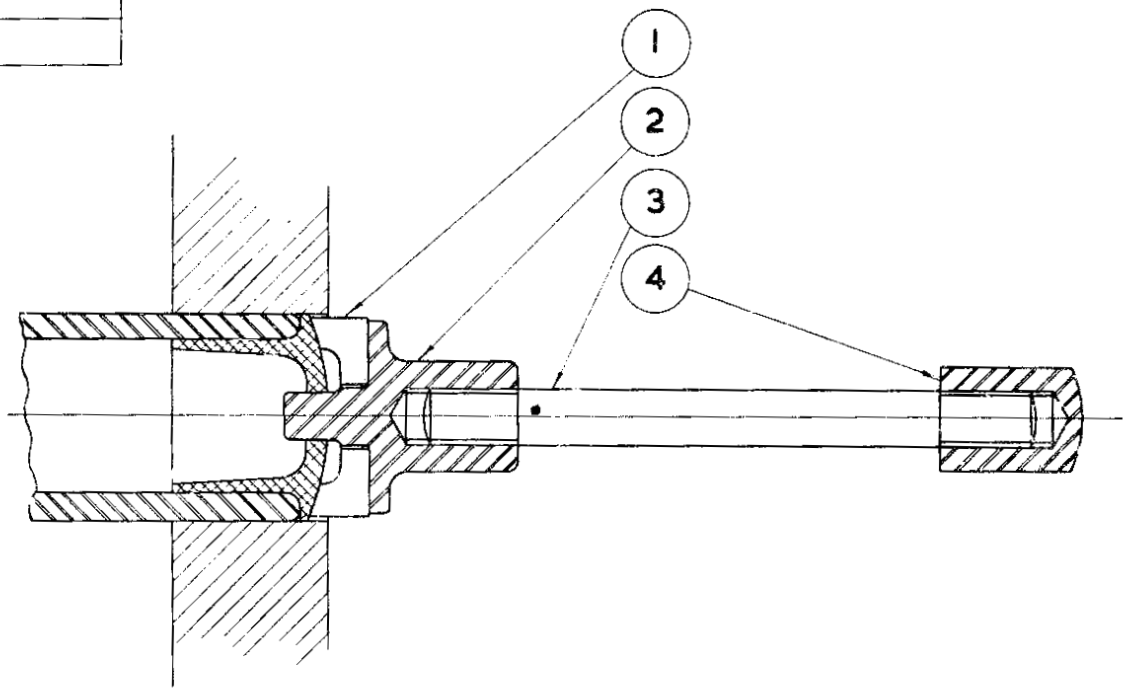
PISTON ENTERING GUIDE

Illustration No. E9364

PURPOSE. To enter piston rings into cylinder block when the sump is not fitted to the engine.

METHOD. Fit the guides over the piston and lower the block on to the pistons, the guides are then pushed down on to the connecting rod, and can be removed from the lower side of the crankcase. These guides can also be used for entering the pistons into the cylinder bores from the underside of the engine.

1	FIBRE PAD
2	SPIGOT
3	STUD
4	NUT.



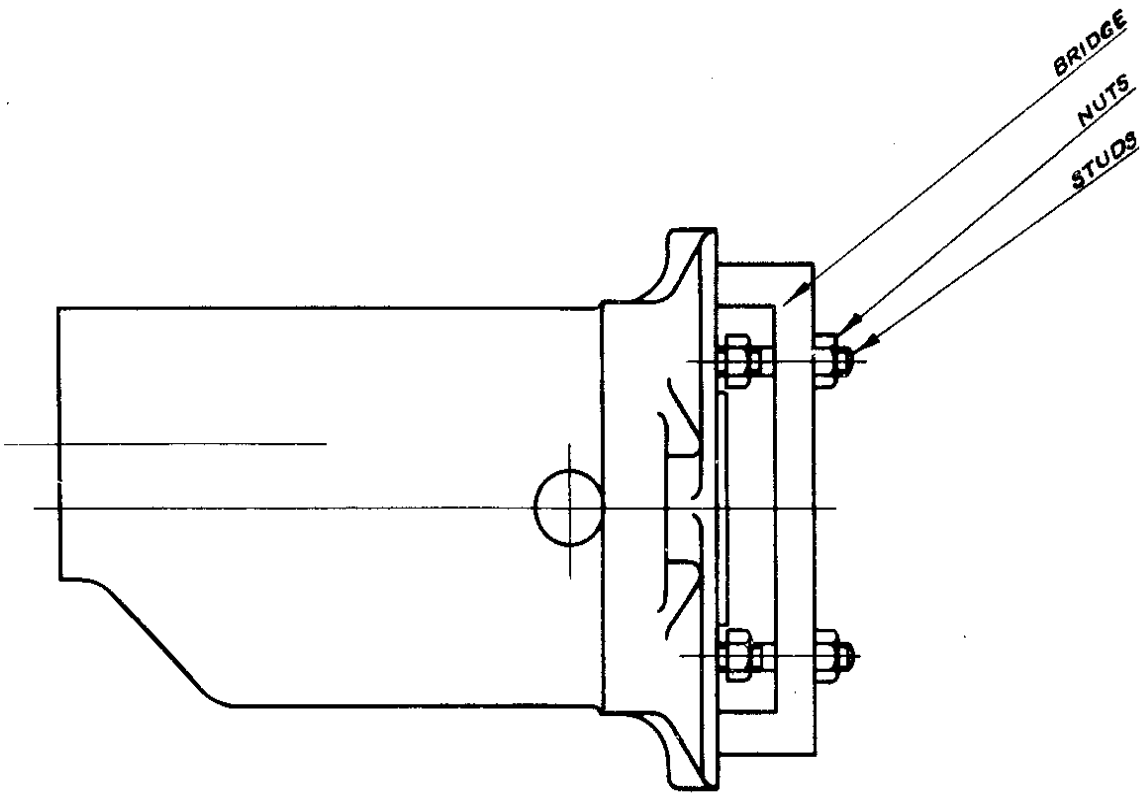
LW, HLW, LW20, HLW20, LX, HLX, LXB & HLXB ENGINES

GUDGEON PIN DRIFT

Illustration No. S.A. 5294

PURPOSE. To remove gudgeon pins from pistons wnere prolonged service has produced carbon deposit, which tends to fasten the pin, when moved slightly from its working position.

METHOD. Use as an ordinary drift. Push the piston lightly against the connecting rod in the direction opposite to that in which the pin is being driven, thus relieving the connecting rod assembly of side strain.



"L" TYPE ENGINES

EXTRACTOR FOR THERMOSTAT UNIT OF THE "BELLOWS" TYPE ONLY

Illustration No. S.A.2965

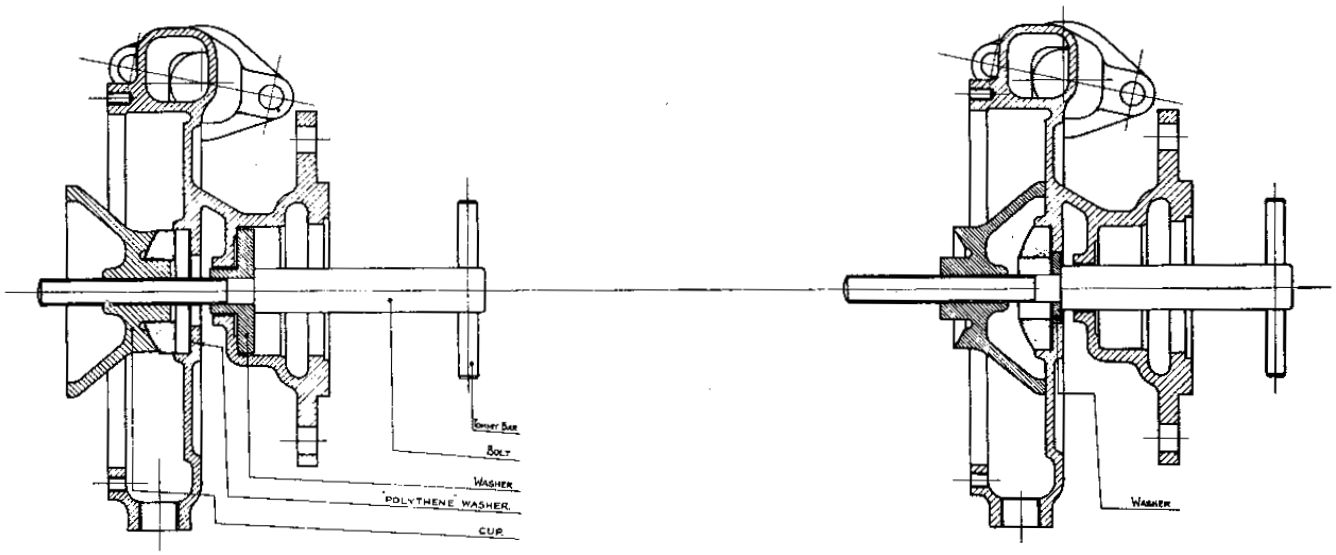
PURPOSE. For extracting thermostat unit from aluminium housing.

METHOD. Remove outlet hose connection from forward end of housing. Fit extractor as shown above. Screw loose studs into tapped holes in brass thermostat unit.

Screw up outer nuts until unit is withdrawn.

NOTE: The two nuts shown adjacent to the unit are provided as a means to retain the studs when tool is not in use.

NOTE:- Above extractor tool not required for the "WAX" type thermostat unit.



TOOL IN POSITION FOR INSERTING CARBON RING.

TOOL IN POSITION FOR EXTRACTING CARBON RING.

LW, HLW, LW20, HLW20, LX, HLX, LXB, HLXB, L2 & LK ENGINES

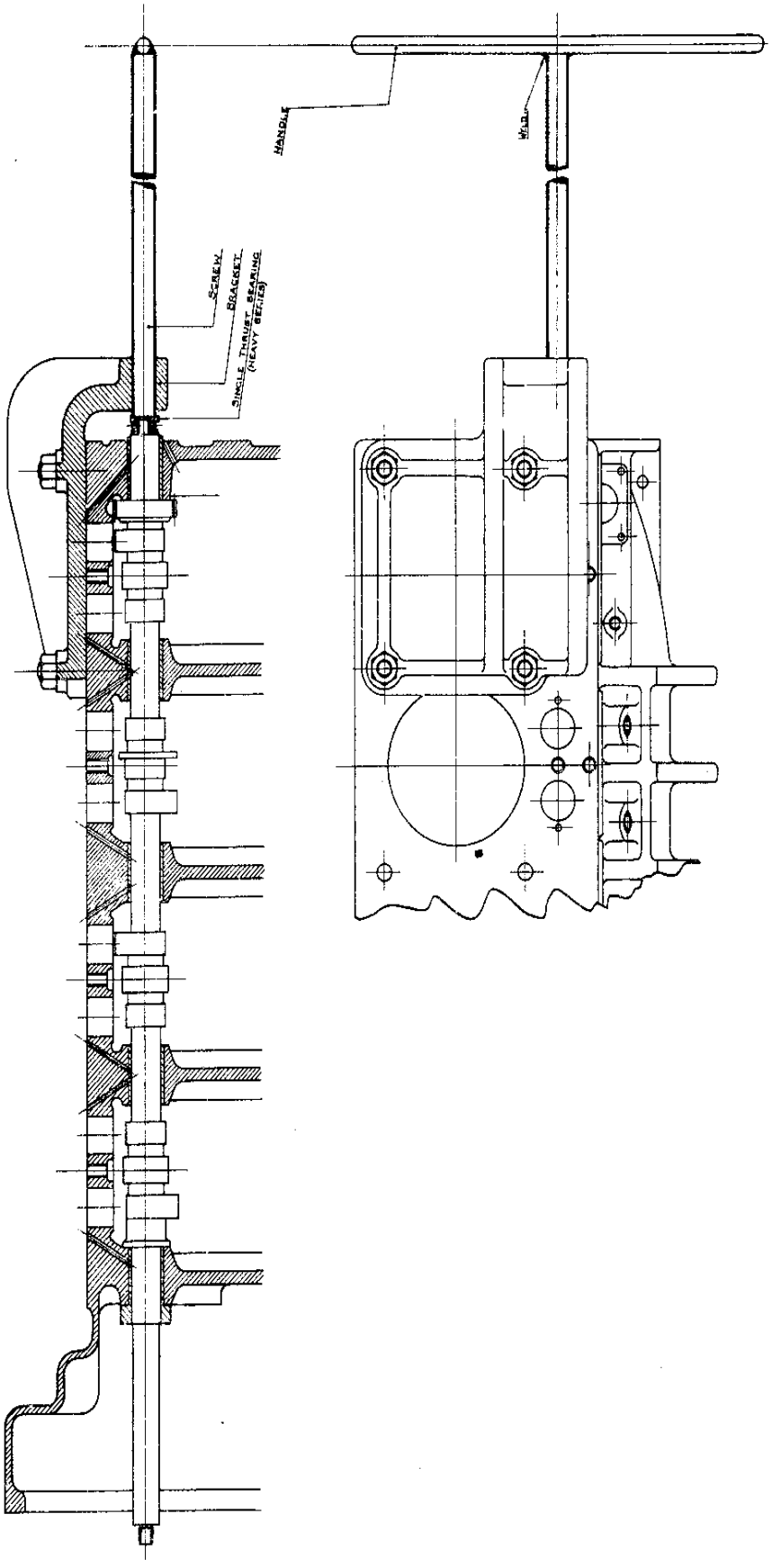
WATER PUMP CARBON GLAND FITTING AND EXTRACTING TOOL
(Not required for Unit Seal)

Illustration No. 3496H

PURPOSE. For extracting and refitting carbon gland to water pump body.

METHOD. TO EXTRACT THE CARBON RING. Pass the small steel washer up the water drain opening on the engine side of the pump body and into position adjacent to carbon ring. Insert the tee handle bolt through ball race housing in pump body and through the steel washer. Screw cup, large side first, on to projecting bolt until it makes contact with the pump body, as shown in right hand view above. Screw in bolt until carbon ring is forced out.

TO FIT A NEW CARBON RING. Clean and paint recess in pump body and fit special plastic washer to bottom of recess. Fit large spigoted washer into ball race housing. Pass tee handle bolt through this washer and through carbon ring, which has been entered into this recess, by hand. Screw cup, small side first, on to projecting bolt until it makes contact with the carbon ring. Screw up bolt until carbon ring is forced up to the bottom of its recess.



LW, HLW, LW20, HLW20, LX, HLX, LXB & HLXB ENGINES

Valve Camshaft Withdrawal Fixture

Illustration No. 3494H

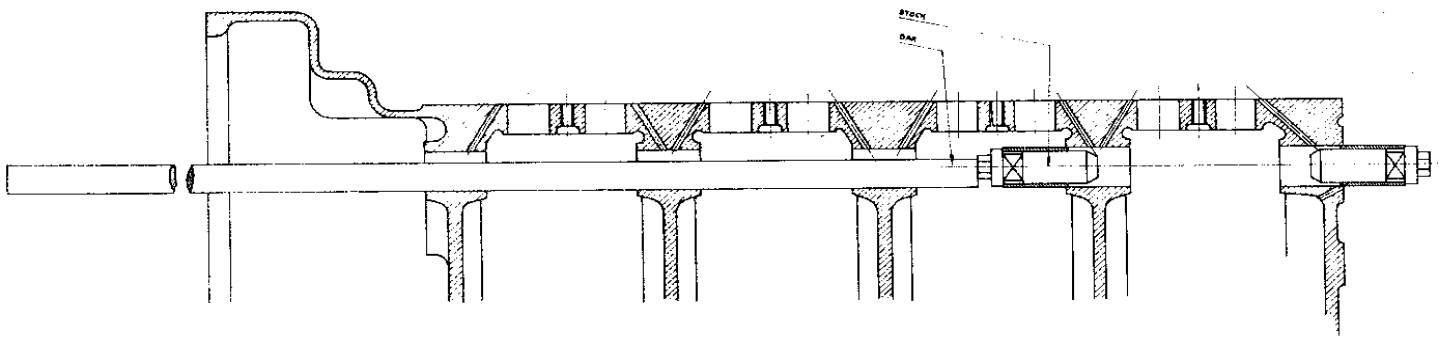
LW, HLW, LW20, HLW20, LX, HLX, LXB & HLXB ENGINES

VALVE CAMSHAFT WITHDRAWAL FIXTURE

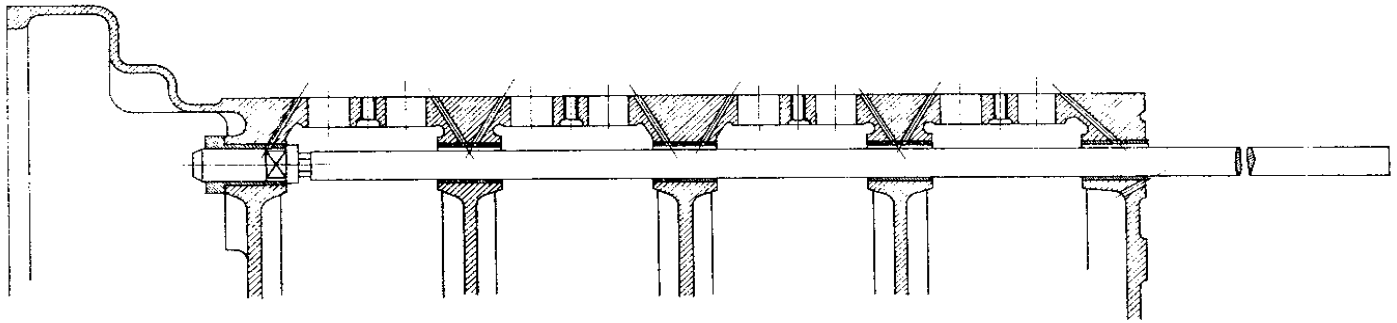
Illustration No. 3494H

PURPOSE. To remove valve camshafts after long service where carbon deposits and tight fit of cams on the shafts prevents the shaft being withdrawn by hand.

METHOD. Remove pointed setscrews from all cams and remove cover from camshaft bush at flywheel end of crankcase. Bolt cast iron bracket to top of crankcase at flywheel end as shown on page 36. Force out camshaft by means of jack screw. Keep screw thread lubricated.



TOOL IN POSITION FOR INSERTING BUSHES.



TOOL IN POSITION FOR EXTRACTING BUSHES.

LW, HLW, LW20, HLW20, LX, HLX, LXB & HLXB ENGINES

Valve Camshaft Bush Extracting and Inserting Stock and Bar

Illustration No. 3495H

LW, HLW, LW20, HLW20, LX, HLX, LXB & HLXB ENGINES

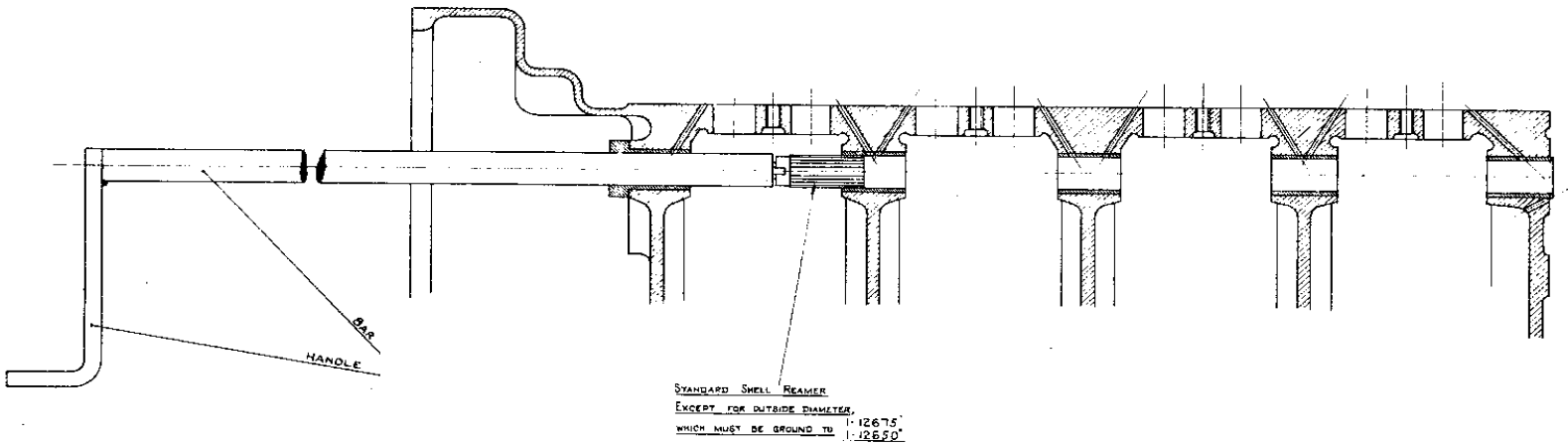
VALVE CAMSHAFT BUSH EXTRACTING AND INSERTING

STOCK AND BAR

Illustration No: 3495H

PURPOSE. To remove and to fit camshaft bushes.

METHOD. Remove all bush locating screws, fit hexagon head stock to each bush in turn and use bar to drive out. It should be noted that the key in the stock engages with the oil groove in the bush. When fitting new bushes use stock and bar as for removal but during this operation it is necessary to fit each bush so that its oil groove lies at the top of the bush. The bushes can be turned to obtain this condition by means of the hexagon stock and a spanner applied while the bush is being pushed into position. Having set the bushes in their correct position it is then necessary to transfer the locating screw holes from the crankcase into the bushes. The oil feed hole to the flywheel end bush should be transferred through into the bush. The other crankcase oil holes (if present) do not need transferring.



LW, HLW, LW20 & HLW20 ENGINES. VALVE CAMSHAFT BUSH REAMER AND BAR

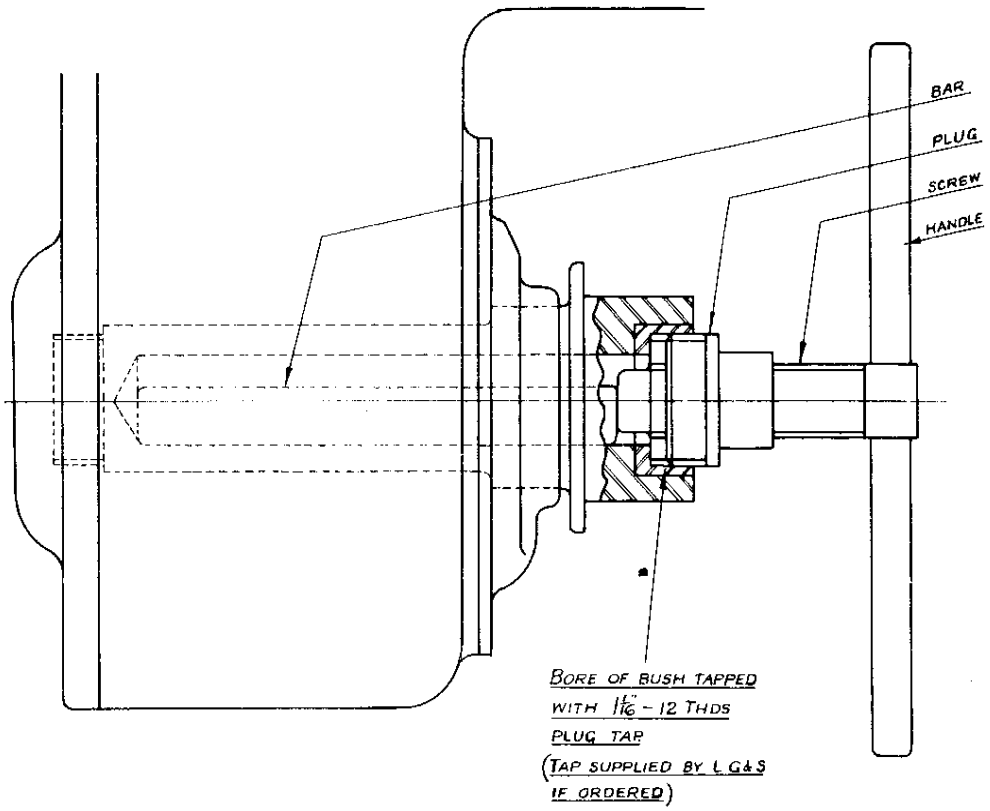
Illustration No. 3497H

PURPOSE. To ensure alignment of all bushes when fitted to crankcase.

METHOD. As all bushes are pre-finished in their bore and as there is only a small interference fit between the bushes and the crankcase there is very little white metal to be removed by this tool.

Pass bar only through forward end bush until it projects sufficiently to receive the shell reamer. By slowly rotating the bar and applying slight hand pressure pass the reamer through each bush. This operation is primarily to ensure that all bushes are in axial alignment.

NOTE: The reamer is not passed through the forward end bush.



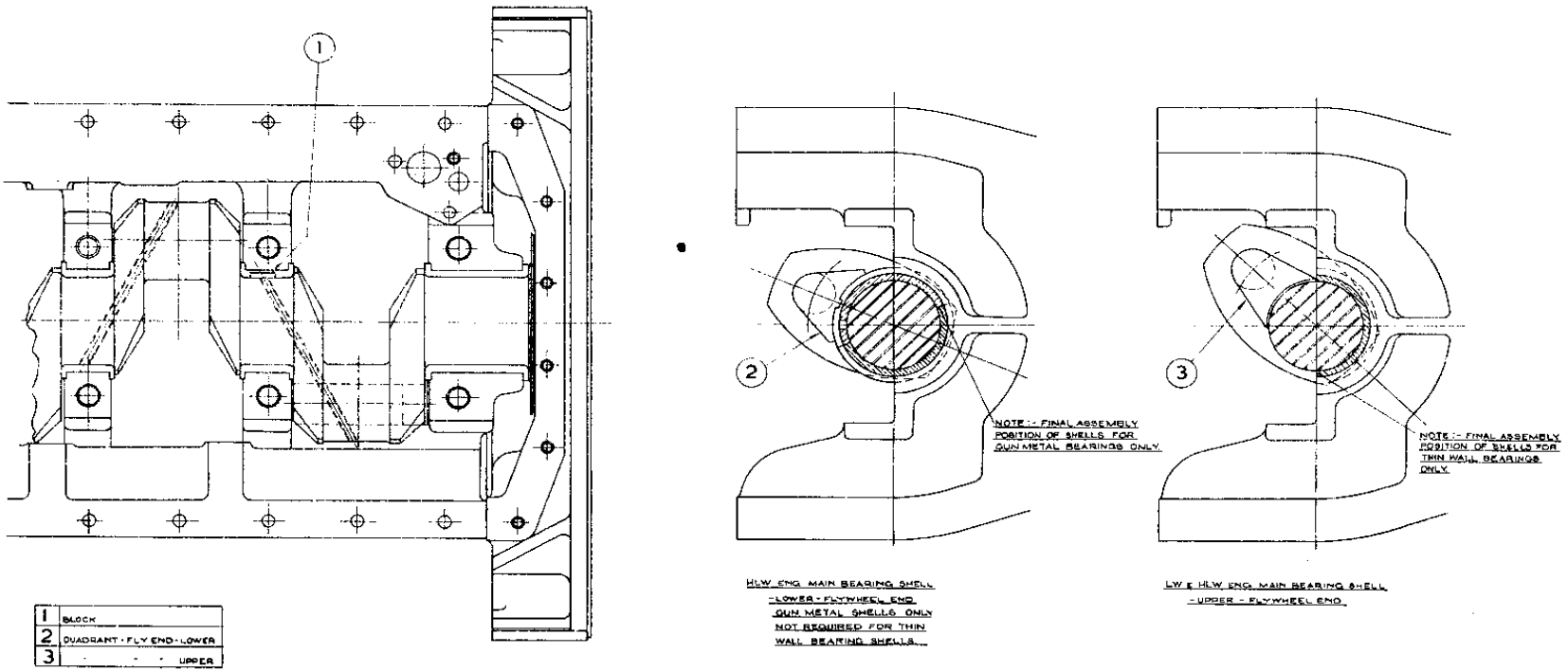
LW, HLW, LW20, HLW20, LX, HLX, LXB & HLXB ENGINES

DYNAMO COUPLING SPIGOT BUSH EXTRACTOR

Illustration No. S.A. 2949

PURPOSE. To extract the gun metal bush which is a light press fit in the dynamo drive shaft where this part projects from the timing case.

METHOD. Tap out the bush about three or four threads deep using the $1\frac{1}{16}$" - 12 Thds. plug tap. Push the $\frac{1}{2}$" dia. bar into the hollow driving shaft, screw extractor plug into bush, turn extractor handle until bush is jacked out. Remove $\frac{1}{2}$" dia. bar. Current type driving shafts are not hollow, therefore the $\frac{1}{2}$" dia. bar is not required.



LW, HLW, LW20 & HLW20 ENGINES

MAIN BEARING SHELL (UPPER) INSERTING AND EXTRACTING TOOL

Illustration No. 5503H

LW, HLW, LW20 & HLW20 ENGINES

MAIN BEARING SHELL INSERTING AND EXTRACTING TOOL

Illustration No. 5503H

PURPOSE. To facilitate the extraction and refitting of main bearing shells.

METHOD.

ALL MAIN BEARING SHELLS EXCEPT FLYWHEEL END.

Remove bearing cap and cap half bearing shell. Fit block (1) into oil hole in crankshaft journal and slowly rotate crankshaft until the block makes contact with the butt face of the bearing shell, which will then rotate with the crankshaft until it can be lifted away.

HLW Gun Metal Bearing Shells Only.

FLYWHEEL END MAIN BEARING SHELL – CAP HALF.

Remove bearing cap, fit quadrant (2) in the hole in the crankpin next to the bearing to be removed, with the projecting key in the slot on the bearing flange. Slowly rotate crankshaft until bearing shell butt face is in line with crankcase faces. Remove quadrant, and then remove bearing shell.

LW & HLW Gun Metal Bearing Shells Only.

FLYWHEEL END MAIN BEARING SHELL – CRANKCASE HALF.

Fit quadrant (3) in the hole in the crankpin of the next bearing, and slowly rotate crankshaft until quadrant makes contact with the butt face of the bearing shell, which will then rotate with the crankshaft until it can be lifted away.

LW, HLW & LW20 Thin Wall Bearing Shells Only.

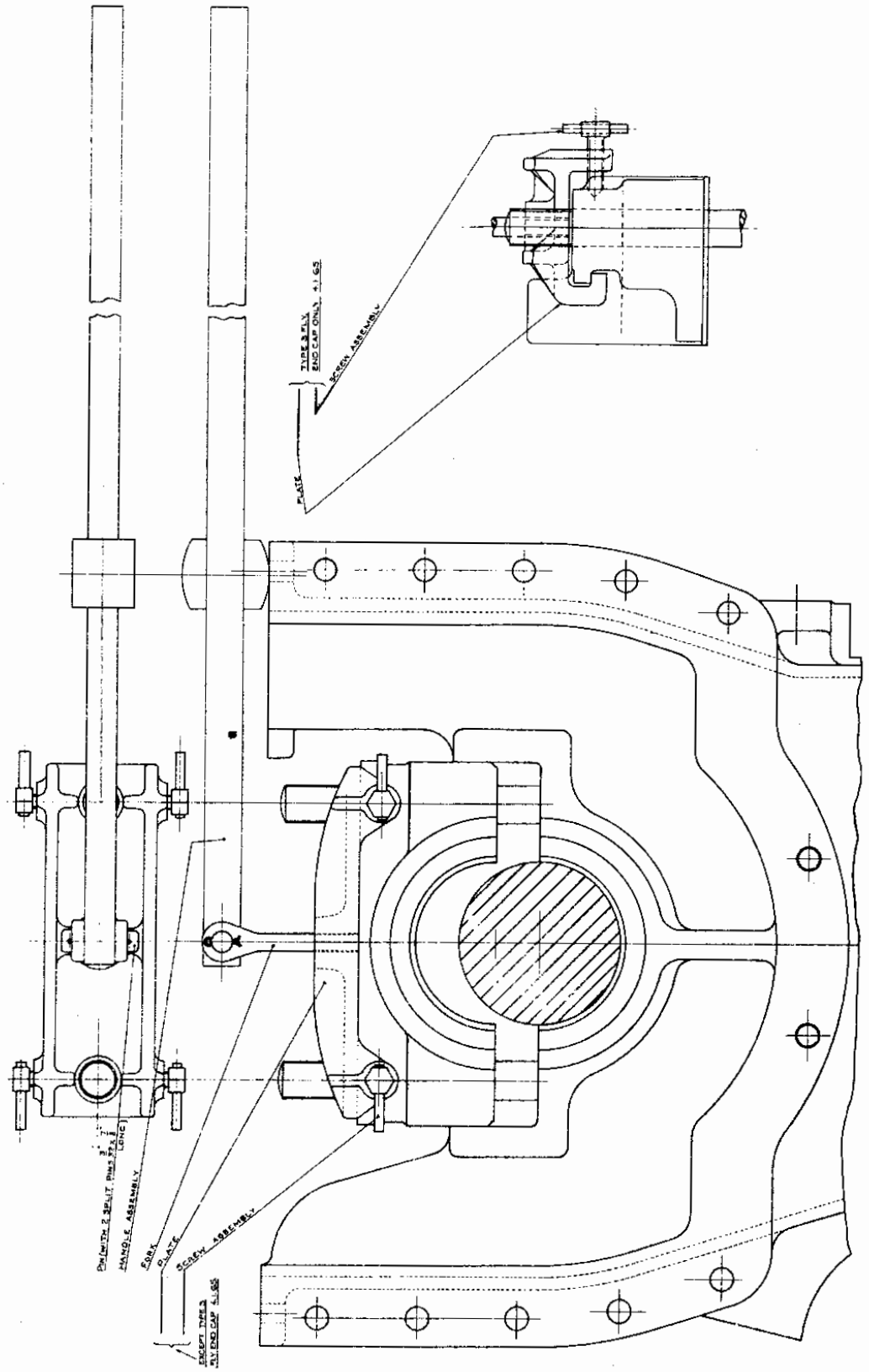
FLYWHEEL END MAIN BEARING SHELLS.

Remove thrust washers from centre locating bearing. Remove bearing cap and cap half bearing shell. Fit quadrant (3) in the hole in the crankpin of the next bearing and slowly rotate crankshaft until quadrant makes contact with the butt face of the bearing shell, which will then rotate with the crankshaft until it can be lifted away.

LW, HLW, LW20, & HLW20 ENGINES

MAIN BEARING CAP WITHDRAWAL TOOL

Illustration No. 3515H



LW, HLW, LW20 & HLW20 ENGINES

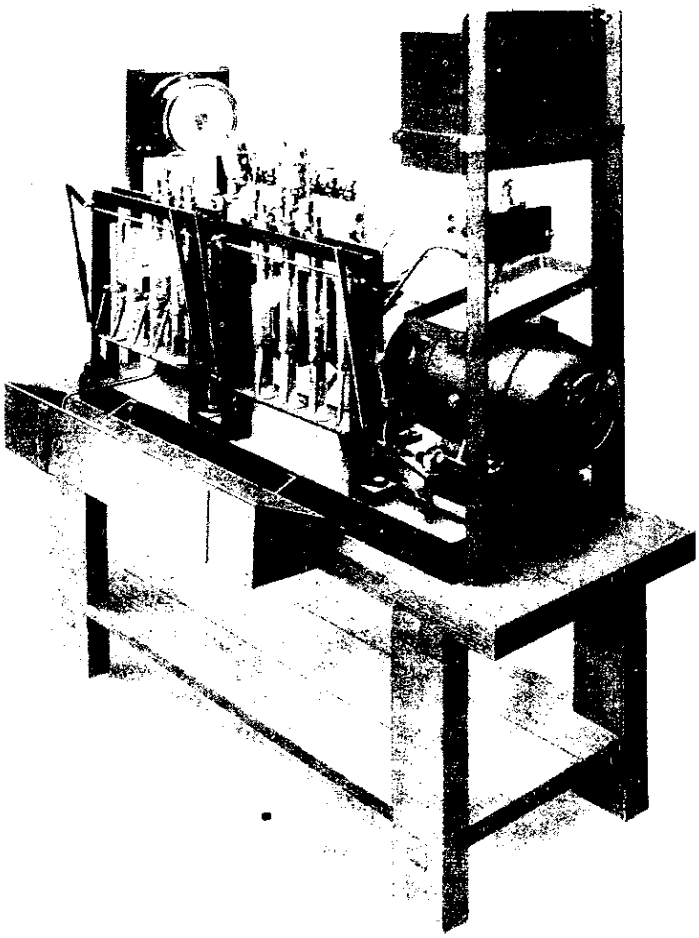
MAIN BEARING CAP WITHDRAWAL TOOL

Illustration No. 3515H

PURPOSE. For withdrawing main bearing caps from close fitting engagement in crankcase.

METHOD. Remove main bearing castle nuts and steel bridge pieces. Fit extracting tool clamp plate over cap studs and screw pointed set screws into firm contact with the bearing cap. The short tommy bar provided in each screw provides ample leverage – a spanner should not be necessary.

Swing lever bar into contact with machined sump face at either side of crankcase and lever cap out of position.



VIEW OF CALIBRATING MACHINE SHOWING MEASURING GLASSES, SPEED INDICATOR AND FUEL COLLECTING TROUGH.

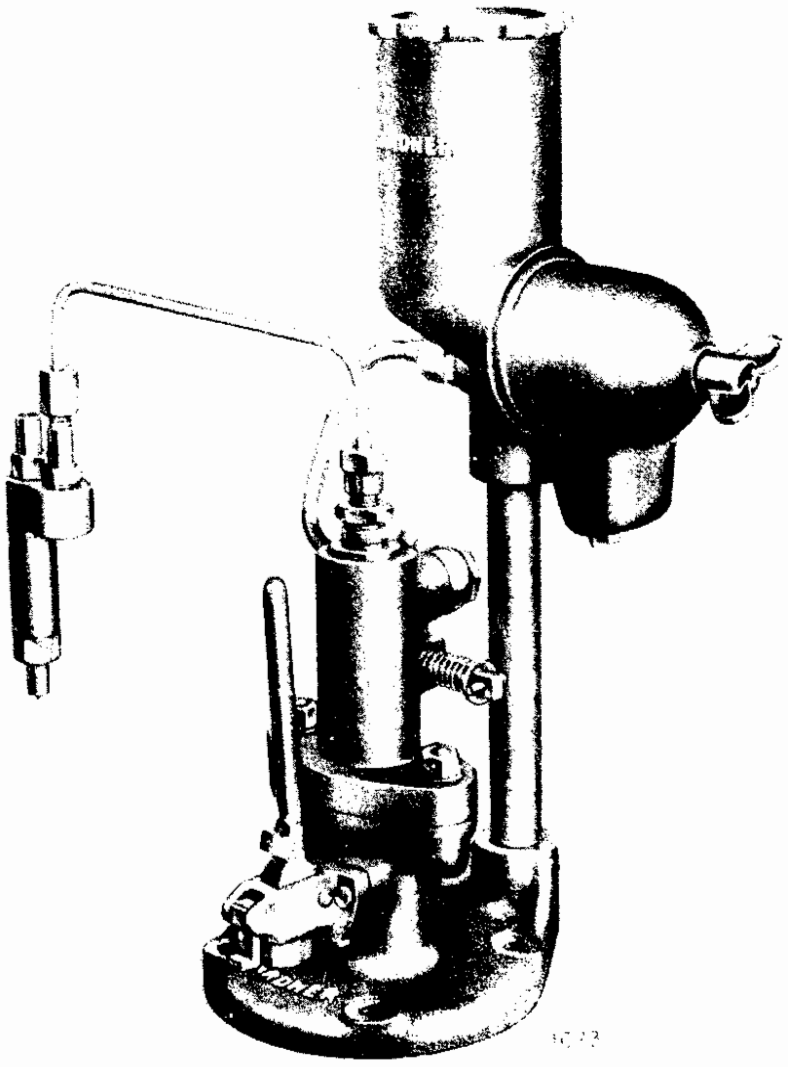
"L" TYPE ENGINES

FUEL INJECTION PUMP CALIBRATING MACHINE

Illustration No. 1610

PURPOSE. For the calibration and setting of maximum output of fuel injection pumps.

METHOD. This is fully described in the Instruction Book supplied with each machine.



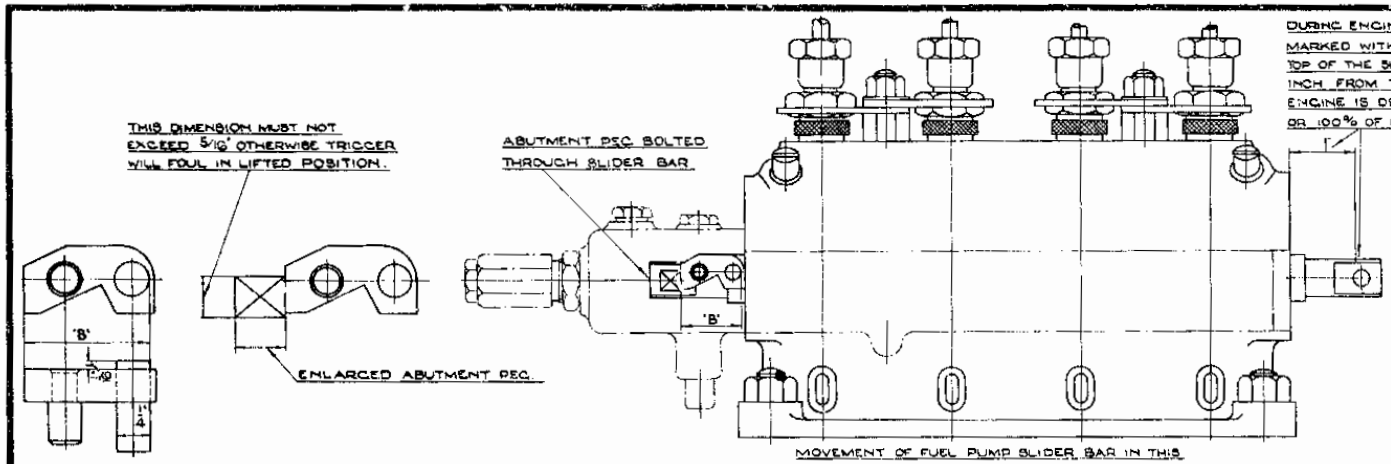
"L" TYPE ENGINES

SPRAYER TESTING APPARATUS

Illustration No. 1673

PURPOSE. For the hand testing of sprayers when on the bench.

METHOD. This is fully described in the Engine Instruction Book.



TRIGGER DIMENSION 'B' MAY BE INCREASED PREFERABLY BY THE FITTING OF A NEW TRIGGER, OR BY THE FOLLOWING.

(1) ADDITION OF WELDED METAL TO THE END OF THE EXISTING TRIGGER.

(2) BRAZING OR CAREFULLY SOLDERING A STEEL SHIM TO THE END OF THE EXISTING TRIGGER. (AFTER HEATING, CARE MUST BE TAKEN TO ENSURE THAT THE 1/4" DIA. PEG PRESSED AND RIVETTED IN THE TRIGGER HAS NOT BECOME LOOSE)

(3) FITTING A NEW ENLARGED ABUTMENT PEG, SO THAT A MICROMETER MAY BE USED TO ACCURATELY MEASURE DIMENSION 'B'. IT IS NECESSARY TO INSERT A FITTING PARALLEL 1/4" DIA. PIN INTO THE HOLE IN THE TRIGGER THE ORIGINAL DIMENSION 'B' IS STAMPED ON THE SIDE OF EACH TRIGGER.

AMOUNT BY WHICH TRIGGER DIMENSION 'B' HAS TO BE INCREASED TO REDUCE B.H.P.

INCREASE IN TRIGGER DIMENSION 'B'	PERCENTAGE OF FULL POWER AVAILABLE & APPROXIMATE PERCENTAGE OF FULL POWER FUEL SUPPLY								
	LK	LW(E)	LW(K)-HLW	LW20-HLW20	LX-HLX	LXB-HLXB	L3 800 & 900 R.P.M.	L3 1200 R.P.M.	L3B 1000-1900 R.P.M.
0	100	100	100	100	100	100	100	100	100
·010"	97·5	98·0	97·6	98·7	97·5	97·6	96·1	97·2	97·3
·020"	96·0	93·5	95·3	97·0	95·3	95·5	91·2	95·0	94·1
·030"	94·1	90·2	92·7	95·1	92·5	93·0	87·1	90·8	90·8
·040"	91·4	88·2	90·7	93·0	89·9	90·6	82·5	87·9	87·6
·050"	87·8	85·4	88·2	90·6	87·0	88·3	78·7	84·5	84·6
·060"	85·2	83·1	85·7	88·2	84·2	86·0	75·7	81·0	81·2
·070"	81·4	79·7	83·3	85·5	81·2	83·5	71·7	77·3	78·0
·080"	78·2	76·2	80·8	82·7	78·3	80·6	68·5	72·7	74·9
·090"	75·2	72·5	78·5	79·8	75·4	78·6	64·7	69·0	71·6
·100"	72·9	67·9	76·3	76·5	72·5	76·0	60·9	65·3	68·5

FOR CURVES SHOWING ENGINE PERFORMANCE AT HIGH ALTITUDE, AND HIGH ATMOSPHERIC TEMPERATURE, SEE S.A. 3514.

NOTE: A REDUCTION IN THE TRIGGER DIMENSION (OR INCREASE IN THE FUEL SUPPLY) MUST IN NO CIRCUMSTANCES BE EFFECTED.

L. GARDNER & SONS LTD, PATRICROFT, Nr. MANCHESTER

TYPE:- 'L' TYPE ENGINES

DESCRIPTION:- POWER REDUCTION BY LENGTHENING OF FUEL LIMITING TRIGGER.

SCALE:-

MATERIAL

MACHINED

SUPERSEDES

SUPERSEDED BY

PR

RE-DRAWN BY A.L.O.

INDEXED BY

TRACED BY A.B.

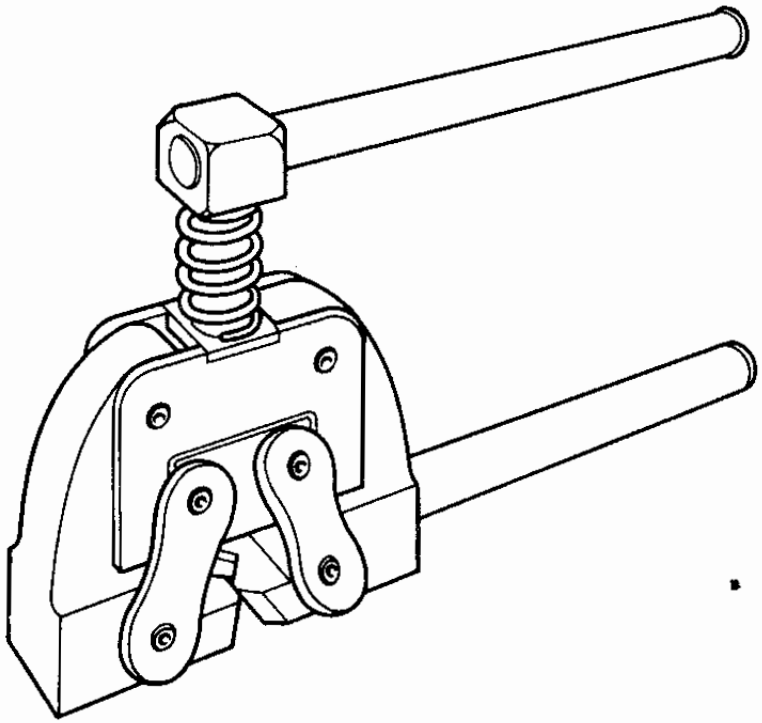
DATE MAR/70

CHECKED BY

DWG. No. 3276 F

S. No.

GARDNER



USE 'RENOLD' EXTRACTOR TOOL No. 311 006.

L. GARDNER & SONS, LTD.
PATRICROFT.

TYPE
'L' TYPE.

DESCRIPTION
REMOVAL OF TIMING CHAIN SIDE PLATE

SCALE

MATERIAL

HEAT TREATMENT

MACHINED

DATE 17-11-78.

SUPERSEDES

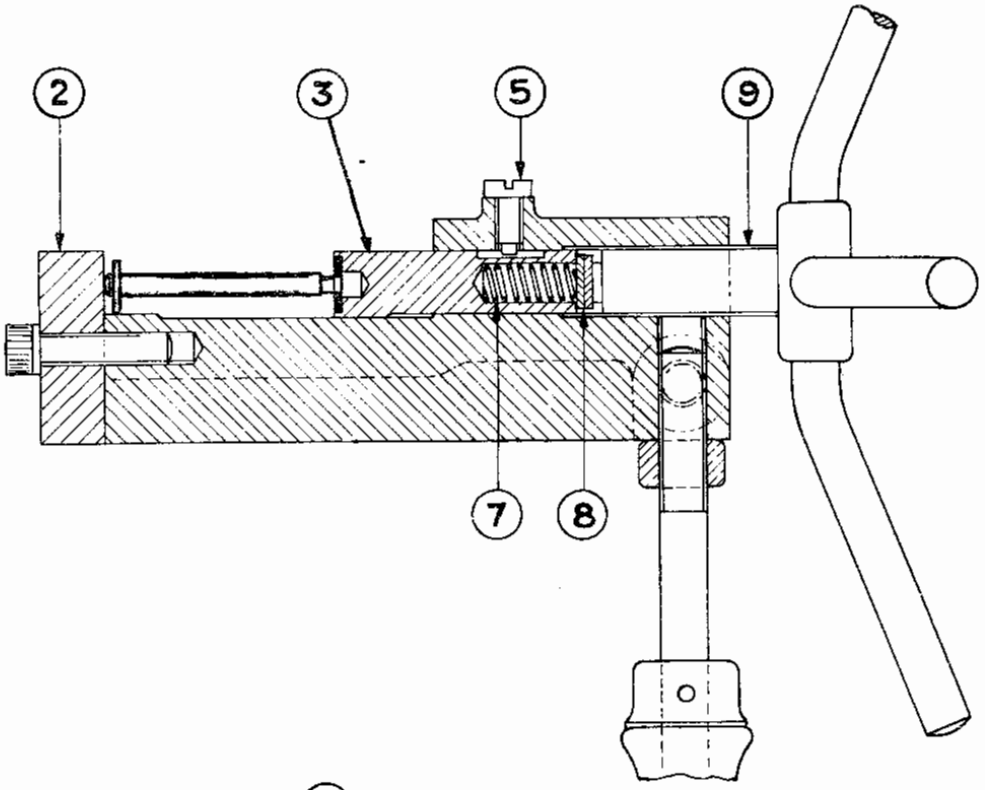
SUPERSEDED BY

DRAWN BY
TRACED BY P.A.A.
CHECKED BY T.S.P.
INDEXED BY E.L.

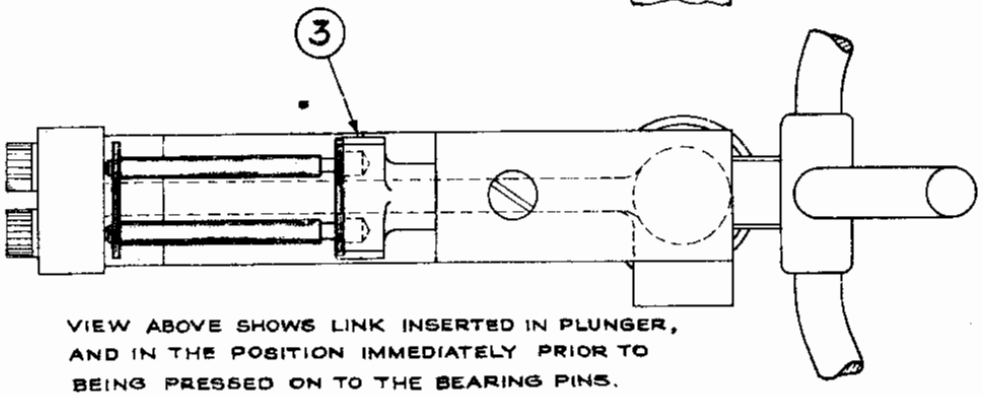
S.P. No.

PART No.
SA5666

A

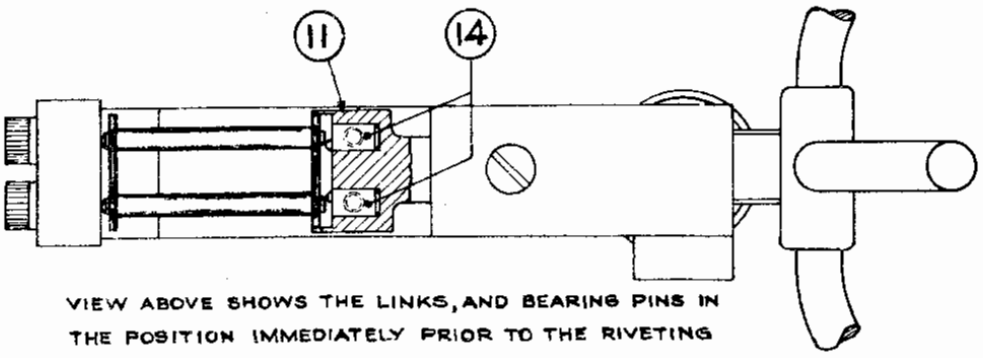


B



VIEW ABOVE SHOWS LINK INSERTED IN PLUNGER, AND IN THE POSITION IMMEDIATELY PRIOR TO BEING PRESSED ON TO THE BEARING PINS.

C



VIEW ABOVE SHOWS THE LINKS, AND BEARING PINS IN THE POSITION IMMEDIATELY PRIOR TO THE RIVETING OVER OF THE INSIDE EDGE OF EACH PIN.

LX, HLX, LXB, HLXB, LW, HLW, LW20, HLW20, L3 & L3B ENGINES

TIMING CHAIN SIDE PLATE PRESS TOOL & STUD RIVETING TOOL.

PURPOSE. When joining the ends of a chain which has been fitted to an engine this tool should be used to press the side plate firmly and squarely up to the shoulders on the two studs. By changing press plunger for the riveting plunger the two stud ends can be riveted to provide additional means of retaining side plate in position.

METHOD (as PRESS TOOL):

Apply a little stiff grease to recess in end of plunger (3) and place side plate in this recess; the plate will be retained by grease.

The spring load on the plunger will press the side plate on to the ends of the two studs; by slight movement of the tool it will be felt when the two holes in the side plate have registered with the ends of the studs.

The plunger is spring loaded so that when it is pressed against the forward side of the chain, the plunger will recede into the boss of tool, allowing the end plate (2) to take up a position behind the chain as shown at "B".

Having attained this position, force the plate on to the studs by means of the large fine thread screw (9) until the plate is felt to be firmly in contact with the shoulders on the studs. Release screw and remove tool.

METHOD (as RIVETING TOOL):

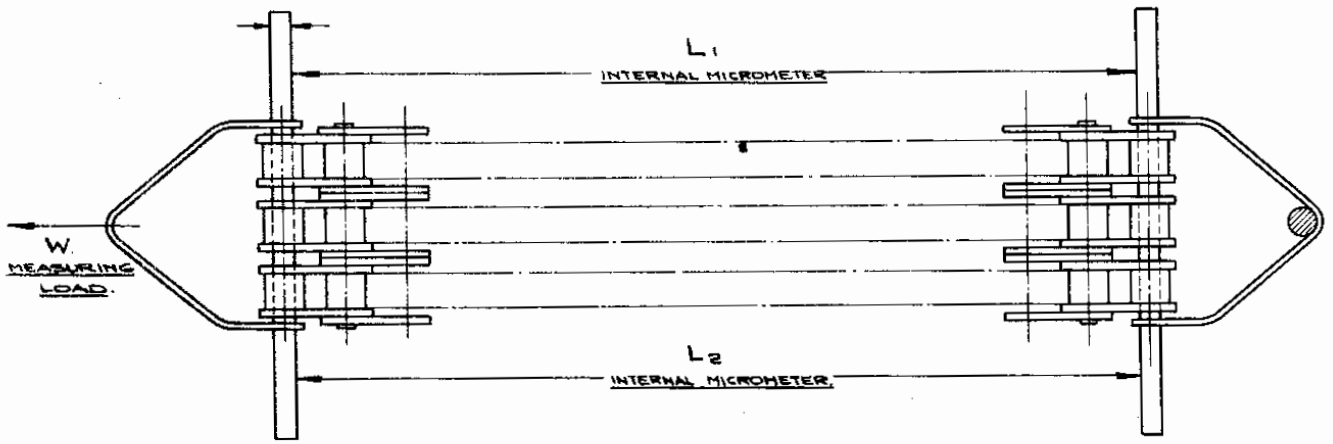
Remove retaining screw (5) in boss of tool, remove press plunger (3) and replace by riveting plunger (11), taking care to refit spring (7) and two hardened steel discs (8) as shown at "A". Apply tool to the chain in the same way as described for pressing side plate. Screw up fine thread screw, until definite resistance is felt, and rotate screw a further $\frac{1}{2}$ to $\frac{3}{4}$ of a turn. This forces the two punches (14) into the ends of the two studs sufficiently to turn over the metal at one point on the end of each stud. This provides a means, in addition to that of interference fit, of retaining the side plate.

NOTE:— Where a number of engines are involved the operator may wish to have two tools, one permanently fitted with the press plunger, and the other permanently fitted with the riveting plunger.

NOTES. 1. TO OBTAIN ACCURATE MEASUREMENT OF LENGTH CHAIN SHOULD BE WASHED & EITHER HUNG VERTICALLY OR LAID ON FLAT SURFACE WITH CORRECT LOAD APPLIED.

2. THE METHOD SHOWN OF ANCHORING THE CHAIN & APPLYING THE MEASURING LOAD IS DIAGRAMMATIC. ANY OTHER CONVENIENT ARRANGEMENT MAY BE USED BUT BENDING OF THE PINS MUST BE AVOIDED.

IMPORTANT.
WHEN RECONDITIONING AN ENGINE FOR A FURTHER LONG PERIOD OF USE, IT IS RECOMMENDED THAT A NEW CHAIN BE FITTED IF THE LENGTH OF THE OLD CHAIN UNDER THE MEASURING LOAD EXCEEDS THAT GIVEN IN THE TABLE.



ENGINE TYPE.	CHAIN. MAKERS' NO.	CHAIN. TYPE.	CHAIN. PITCH IN.	CHAIN. No. OF PITCHES.	PIN DIAMETER D. IN.	MEASURING LOAD W. LB.	MICROMETER READING = $\frac{L_1+L_2}{2}$. NEW NOMINAL LENGTH	MICROMETER READING = $\frac{L_1+L_2}{2}$. WORN PERMISSIBLE LENGTH - MAX.	
L.K.	116510.	TRIPLEX.	·4375	92 94	·155	63	IN. 39·658 40·533	IN. 39·857 40·736	SINGLE IDLER. DOUBLE IDLER.
2-4L2.	110046	SIMPLE.	·50	68	·175	28	33·325.	33·493	
5-6L2 2-4L2 (SPECIAL)	114046	DUPLEX				56			
LW-HLW-LW20-HLW20. LX-HLX. LXB-HLXB. L3-L3B.	116046	TRIPLEX	·50.	96 98	·175	84	47·325 48·325	47·563 48·568	SINGLE IDLER. DOUBLE IDLER.

L. GARDNER & SONS, LTD.
PATRICROFT.

L3, L3B, TYPE LK, 2-4L2, 5-6L2, LW, HLW, LW20, HLW20 LX, HLX, LXB, HLXB.

DESCRIPTION. PERMISSIBLE CHAIN STRETCH.

SCALE.

MATERIAL.

MACHINED.

DATE. 6.4.36.

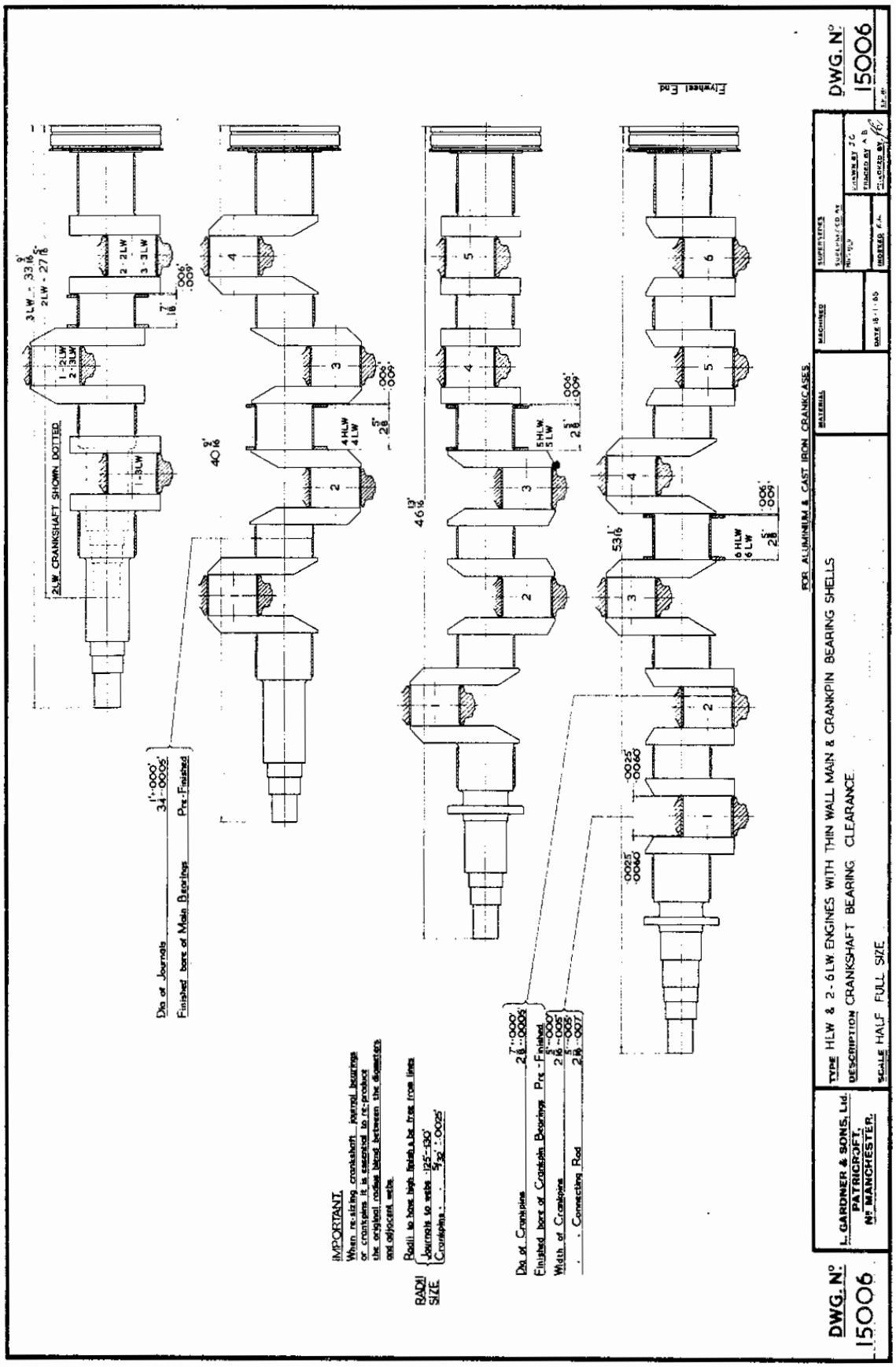
SUPERSEDES. SA.1759.

SUPERSEDED BY.

DRAWN BY EH.
TRACED BY FP.
CHECKED BY AL.O.
INDEXED BY L.R.

PART No. SA1885

GARDNER


DWG. N° 15006
L. GARDNER & SONS, Ltd. PATRICROFT, Nr MANCHESTER.
TYPE HLW & 2-6LW ENGINES WITH THIN WALL MAIN & CRANKPIN BEARING SHELLS
DESCRIPTION CRANKSHAFT BEARING CLEARANCE
SCALE HALF FULL SIZE
FOR ALUMINIUM & CAST IRON CRANKCASES
Flywheel End
3LW - 33 1/8"
2LW - 27 1/8"
2LW CRANKSHAFT SHOWN DOTTED
40 5/8"
46 1/8"
53 1/6"
Dia of Journals 1"·000" / 34"·0005"
Finished bore of Main Bearings Pre-Finished
Dia of Crankpins 1"·000" / 28"·0006"
Finished bore of Crankpin Bearings Pre-Finished
Width of Crankpins
" " Connecting Rod
RADII SIZE
Radii to have high finish & be free from lines
Journals to webs .125"-.130"
Crankpins " 5/32" .005"
IMPORTANT
When re-sizing crankshaft journal bearings or crankpins it is essential to re-produce the original radius blend between the diameters and adjacent webs.

GARDNER

END CLEARANCE MUST BE CHECKED BY THE FOLLOWING PROCEDURE

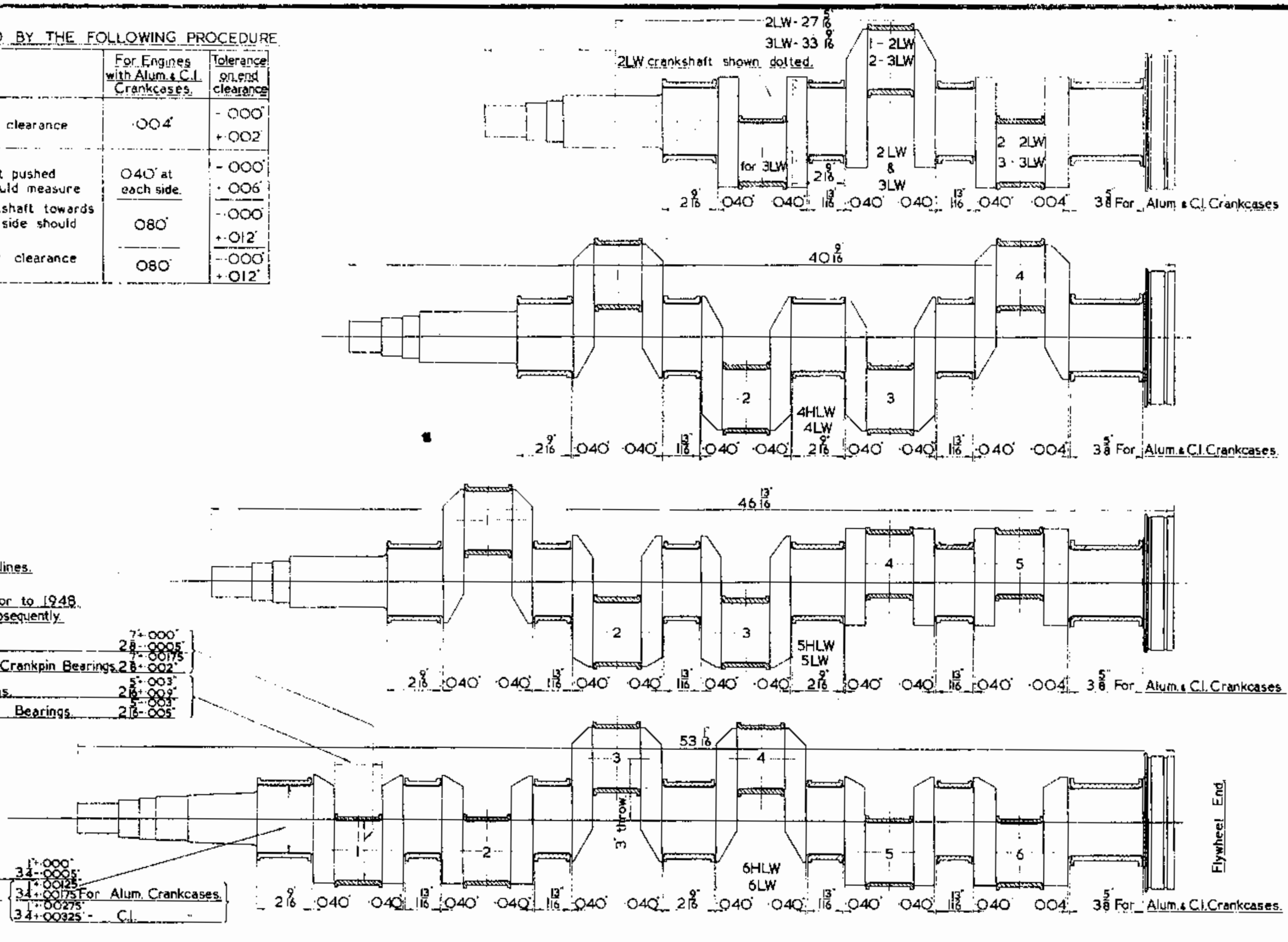
	For Engines with Alum. & C.I. Crankcases.	Tolerance on end clearance
FLYWHEEL END BEARING. With all bearings in place crankshaft end clearance should indicate.	·004"	-·000" +·002"
ALL OTHER MAIN BEARINGS. With all bearings in place and crankshaft pushed towards chaincase, feeler clearance should measure	·040" at each side.	-·000" +·006"
Remove flywheel end bearing, push crankshaft towards chaincase, feeler clearance at chaincase side should measure	·080"	-·000" +·012"
Push crankshaft towards flywheel, feeler clearance at flywheel side should measure.	·080"	-·000" +·012"

IMPORTANT.
When re-sizing crankshaft journal bearings or crankpins, it is essential to re-produce the original radius blend between the diameters and adjacent webs.

Radii to have high finish & be free from lines.

RADII SIZE.
- Journals to web ·125"-·130"
- Crankpins ·125"-·130" prior to 1948.
- " ·154"-·159" subsequently.

Dia. of Crankpins.	$2\frac{7}{8}$" +·000" -·0005"
Finished bore of Crankpin Bearings.	$2\frac{7}{8}$" +·00175" +·002"
Width of Crankpins.	$2\frac{5}{16}$" +·003" +·009"
" " Bearings.	$2\frac{5}{16}$" -·003" -·005"
Dia. of Journals.	$3\frac{1}{4}$" +·000" -·0005"
Finished bore of Main Bearings.	$3\frac{1}{4}$" +·00125" +·00175" For Alum. Crankcases.
	$3\frac{1}{4}$" +·00275" +·00325" " C.I. "

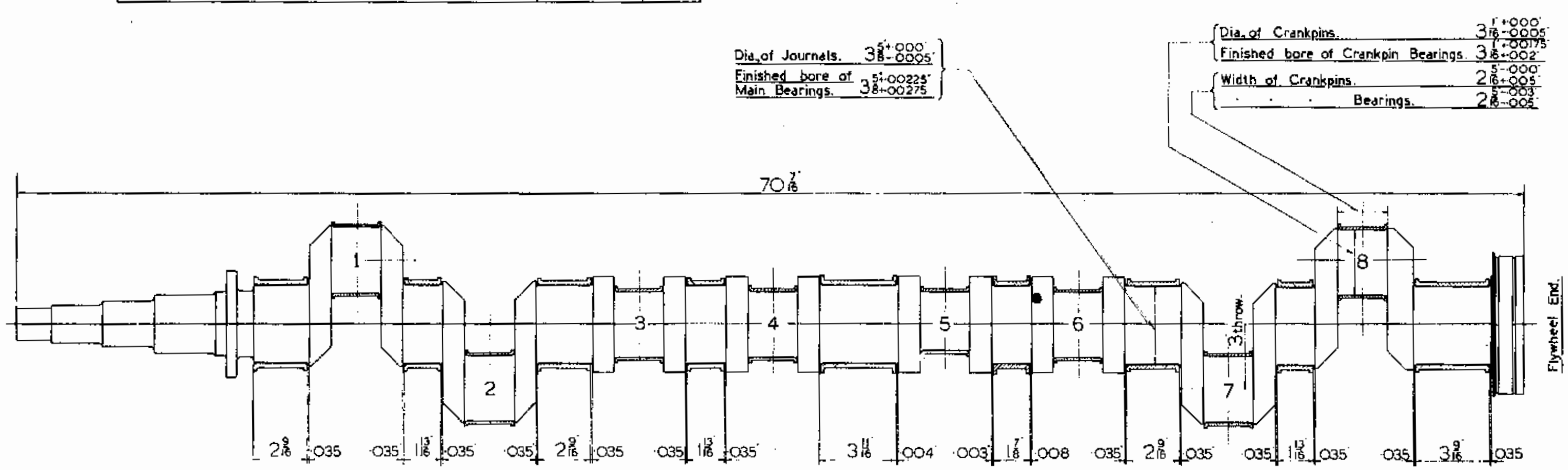


For tolerance on end clearances see table above.

DWG. No. 14753	L. GARDNER & SONS, Ltd. PATRICROFT. Nr. MANCHESTER.	TYPE: HLW & 2-6LW ENGINES. - WITH GUN METAL MAIN BEARING SHELLS. DESCRIPTION: CRANKSHAFT BEARING CLEARANCES. SCALE: HALF FULL SIZE	NOTE: Crankshaft is located by the Flywheel End Bearing only.
R.D. 393-1	DWG. No. 14753	DATE 8-5-63	

END CLEARANCE MUST BE CHECKED BY THE FOLLOWING PROCEDURE		Tolerance on end clearance
CENTRE LOCATING BEARING. With all bearings in place crankshaft end clearance should indicate.	·004"	+·000" +·002"
SECOND LOCATING BEARING. With all bearings in place and crankshaft pushed towards flywheel end, feeler clearance should measure.	·008" at Flywheel side. ·003" at Chaincase side.	+·000" +·002"
Remove centre locating bearing and push crankshaft towards flywheel end, feeler clearance at flywheel side should measure.	·011"	+·000" +·004"
ALL OTHER MAIN BEARINGS. With all bearings in place and crankshaft pushed towards flywheel end, feeler clearance should measure.	·035" at each side.	+·000" +·004"
Remove centre locating bearing and second locating bearing, push crankshaft towards flywheel end, feeler clearance at flywheel side should measure.	·070"	+·000" +·008"
Push crankshaft towards chaincase, feeler clearance at chaincase side should measure.	·070"	+·000" +·008"

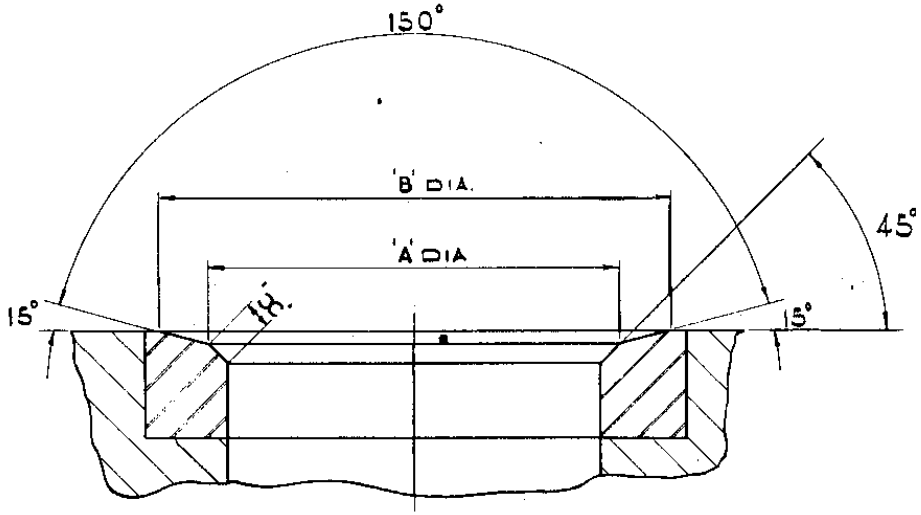
IMPORTANT.
When re-sizing crankshaft journal bearings or crankpins, it is essential to re-produce the original radius blend between the diameters and adjacent webs.
Radii to have high finish & be free from lines.
RADII SIZE. Journals to webs 1/8" ±·0025"
Crankpins 5/32" ±·0025"



For tolerance on end clearances see table above.

R.D. 136·1

DWG. Nº 12175	L. GARDNER & SONS, Ltd. PATRICROFT, Nr. MANCHESTER	TYPE: 8LW ENGINE. DESCRIPTION: CRANKSHAFT BEARING CLEARANCES. SCALE: HALF FULL SIZE.	DATE 26·3·45	DWG. Nº 12175



LW, LW20, HLW & HLW20 ENGINES.
RECONDITIONING CYLINDER HEAD VALVE SEATS.

DURING THE WORKING LIFE OF THE ENGINE THE VALVE SEATS WILL REQUIRE RE-SURFACING. WHEN RE-SURFACING THE SEATS THE WIDTH ie. DIMENSION 'C' & THE DIMENSION 'A' ARE IMPORTANT & MUST BE CAREFULLY MAINTAINED. IN MAINTAINING THESE DIMENSIONS IT WILL BE NECESSARY TO PRODUCE A 150° COUNTERSINK & A DIMENSION 'B'.
AT EACH SUBSEQUENT RE-SURFACING OPERATION DIMENSION 'B' WILL INCREASE IN SIZE & EVENTUALLY WILL REACH A SIZE WHERE MAXIMUM PERMISSIBLE AMOUNT OF METAL HAS BEEN REMOVED. THIS WILL BE ATTAINED WHEN DIMENSION 'B' MEASURES MAXIMUM FIGURE SHOWN IN THE TABLE.

ENGINE TYPE	INLET VALVE SEAT			EXHAUST VALVE SEAT		
	'C'	'A'	'B'	'C'	'A'	'B'
LW, HLW LW20, HLW20	.086"	2"	UP TO 1 2/8" MAX.M	.086"	3 1/4"	UP TO 1 7/8" MAX.M

IMPORTANT.

THESE DIMENSIONS FOR 'B' MUST NOT BE EXCEEDED. AFTERWARDS THE INSERT RINGS MUST BE REPLACED.

L. GARDNER & SONS, LTD., PATRICROFT

TYPE: LW, HLW. LW20, HLW20

DESCRIPTION: RE-CONDITIONING CYLINDER HEAD VALVE SEATS.

SCALE: NOT TO SCALE

MATERIAL:

HEAT TREATMENT:

MACHINED:

DATE 4.3.70

SUPERSEDES SA 2948 1ST AMEND TIW4435

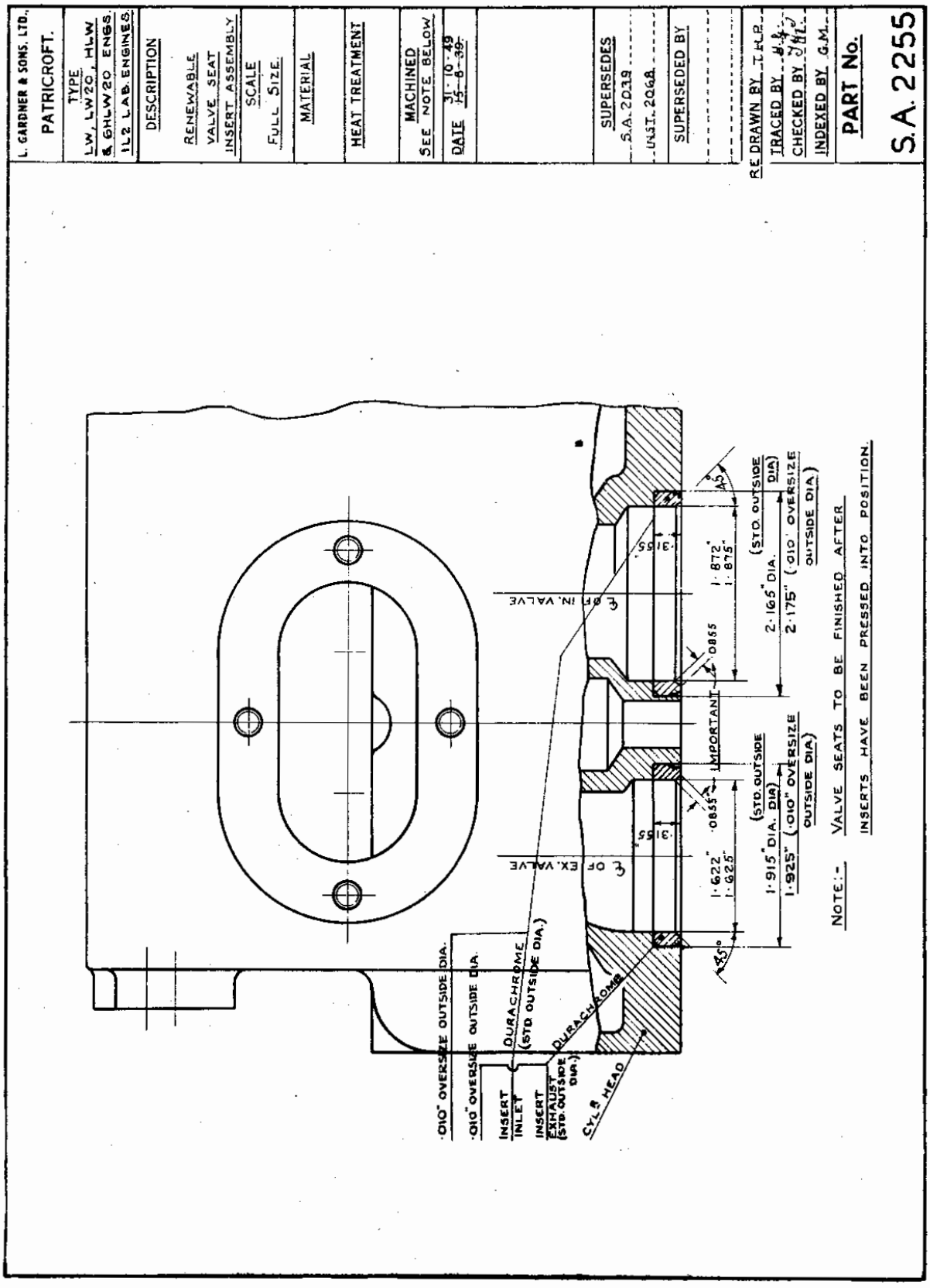
SUPERSEDED BY:

DRAWN BY A.L.W.
TRACED BY S.P.
CHECKED BY M.O'R/RS
INDEXED BY N.H.D.

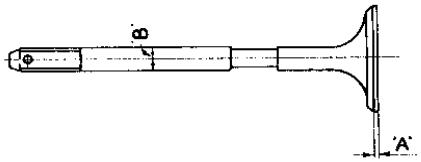
S.P. NO:

PART No.
SA5424

GARDNER


L. GARDNER & SONS, LTD.
PATRICROFT.
TYPE
LW, LW20, HLW & 6HLW20 ENGS. 1L2 LAB. ENGINES.
DESCRIPTION
RENEWABLE VALVE SEAT INSERT ASSEMBLY
SCALE
FULL SIZE.
MATERIAL
HEAT TREATMENT
MACHINED
SEE NOTE BELOW
DATE 31-10-49 15-6-39
SUPERSEDES
S.A.2039
UNIT 2068
SUPERSEDED BY
RE DRAWN BY T.H.B.
TRACED BY
CHECKED BY
INDEXED BY G.M.
PART No.
S.A.2255
·010" OVERSIZE OUTSIDE DIA.
·010" OVERSIZE OUTSIDE DIA.
INSERT INLET
INSERT EXHAUST (STD. OUTSIDE DIA.)
DURACHROME (STD OUTSIDE DIA.)
DURACHROME
CYL? HEAD
IN. VALVE
EX. VALVE
·3155
·3155
·0855
·0855
IMPORTANT
1·622"
1·625"
1·915" DIA. (STD. OUTSIDE DIA)
1·925" (·010" OVERSIZE OUTSIDE DIA)
·0855
1·872"
1·875"
2·165" DIA. (STD. OUTSIDE DIA)
2·175" (·010" OVERSIZE OUTSIDE DIA)
45°
45°
NOTE:- VALVE SEATS TO BE FINISHED AFTER INSERTS HAVE BEEN PRESSED INTO POSITION.

GARDNER



WHEN RE-ASSEMBLING AN ENGINE FOR A FURTHER LONG PERIOD OF USE, REPLACE THE INLET & EXHAUST VALVES, WITH NEW GENUINE 'GARDNER' COMPONENTS IF ANY OF THE FOLLOWING CONDITIONS OBTAIN.

	LXB. HLXB.	LX. HLX	LW-HLW. LW20. HLW20.	LK.	
1. EXHAUST VALVE HEAD THICKNESS 'DIMENSION A' MEASURES LESS THAN	·070"	·037"	·037"	·037"	AFTER RE-SURFACING.
2. INLET " " " " " " "	·078"	·045"	·045"	·045"	" "
3. EXHAUST VALVE STEM WEAR SUCH THAT 'DIMENSION B' IS LESS THAN.	·370"	·370"	·370"	·370"	
4. INLET " " " " " " " "	·371"	·371"	·371"	·371"	

5. FLAT FACE OF HEAD SHOWS ANY DISTORTION WHEN TESTED ON LAPPING PLATE.

6. SURFACE OF STEM, NECK & FLAT FACE, EXHIBIT IMPERFECTION OF SURFACE FINISH, SCALING, PITTING, CORROSION.

7. MAGNETIC FLUX FLAW DETECTION REVEALS ANY DEFECTS.

NOTE:- ALWAYS FIT NEW VALVE GUIDES WHEN FITTING NEW VALVES.

L. GARDNER & SONS, LTD.,
PATRICROFT.

TYPE
LXB-HLXB
LX-HLX. HLW20.
LW-HLW-LW20
LK ENGINES.

DESCRIPTION
RE-CONDITIONING, OR RE-PLACEMENT OF INLET & EXHAUST VALVES.

SCALE

MATERIAL

HEAT TREATMENT

MACHINED

DATE 11-4-69.

SUPERSEDES
S.A.3340
1/W4746

SUPERSEDED BY

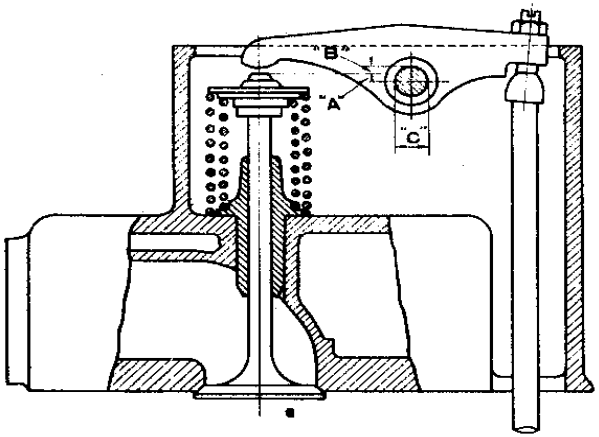
DRAWN BY A.L.O.
TRACED BY A.B.
CHECKED BY A.L.O.
INDEXED BY

S.P.No.

PART No.
S.A.5360

RENEWAL OF ENGINE VALVE SPRINGS & FUEL PUMP PLUNGER AND TAPPET SPRINGS

Series	Spring	Type	No. of Coils	Renew when free length is less than:-
VALVE SPRINGS				
LX	Outer	Current	$7\frac{1}{2}$	$2\frac{3}{8}$"
HLX	Inner		$9\frac{1}{2}$	$2\frac{11}{32}$"
LXB	Outer	Early (prior to Engine N°. 169152)	$7\frac{1}{2}$	$2\frac{3}{8}$"
HLXB	Inner		$9\frac{1}{2}$	$2\frac{11}{32}$"
LXB	Outer	Current (subsequent to above)	9	$2\frac{5}{16}$"
HLXB	Inner		$11\frac{1}{2}$	$2\frac{7}{32}$"
LK	Outer	Early	9	$2\frac{1}{2}$"
		"	8	$2\frac{1}{2}$"
		Current	$6\frac{1}{2}$	$2\frac{11}{32}$"
	Inner	Early	10	$2\frac{3}{8}$"
		Current	8	$2\frac{1}{4}$"
LW HLW LW20 HLW20	Outer	Current	$8\frac{1}{2}$	$2\frac{1}{2}$"
	Inner	Early LW & HLW	$11\frac{1}{4}$	$2\frac{9}{16}$"
		Current	$9\frac{1}{2}$	$2\frac{3}{8}$"
L3	Outer	Early	$10\frac{1}{2}$	$3\frac{15}{16}$"
		Current	$7\frac{1}{2}$	$3\frac{3}{8}$"
L3B		Current	$7\frac{1}{2}$	$3\frac{1}{4}$"
L3	Inner	Early	12	$3\frac{3}{8}$"
		Current	$9\frac{1}{2}$	$3\frac{1}{8}$"
L3B		Current	$9\frac{1}{2}$	$3\frac{5}{32}$"
FUEL PUMP SPRINGS				
LX, HLX LK LW, HLW LW20, HLW20 L3 L3B	Plunger	Current	10	$2\frac{1}{4}$"
	Tappet	Current	8	$1\frac{29}{32}$"
L3	Plunger	Early	$8\frac{1}{2}$ & 8	2"



ENGINE.	DIA. OF ROCKER SHAFT "C"	INLET VALVE. DIMENSION "A"	INLET VALVE. DIMENSION "B"	EXHAUST VALVE. DIMENSION "A"	EXHAUST VALVE. DIMENSION "B"	
L.K.	9/16"	·222"	·059"	·183"	·098"	
LW & HLW	"	·230"	·051"	·198"	·083"	SUPERSEDED DESIGN
L.2.	"	·198"	·083"	"	"	
L.3.	11/16"	·299"	·045"	·267"	·076"	
LX8 & HLX8 LX & HLX	9/16"	·280"	0"	·280"	0"	
L3B	11/16"	·320"	·024	·320"	·024"	
LW & HLW LW20 & HLW20	9/16"	·238"	·043"	·207"	·074"	

L. GARDNER & SONS, Ltd.
PATRICROFT.

TYPE.
"L" ENGINES.

DESCRIPTION.
RELATION OF END OF INLET AND EXHAUST VALVES TO ROCKER SHAFT

SCALE.
/

MATERIAL.
/

MACHINED.
/

DATE 8-5-39.

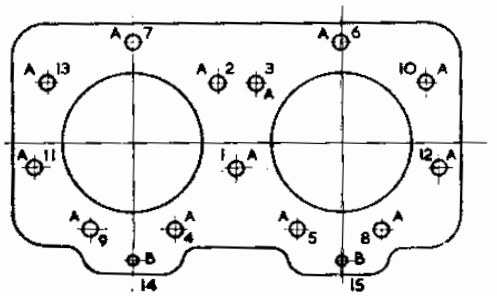
SUPERSEDES.

SUPERSEDED BY.

DRAWN BY T.H.P.
TRACED BY
CHECKED BY T.H.P.
INDEXED BY

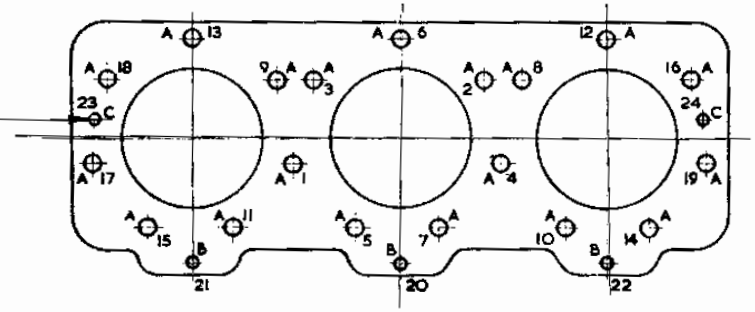
PART No.
S.A. 2206

GARDNER



2 CYL., BLOCK

NUTS 'C' FOR LX, HLX, GLXB, HLXB, ENCS, ONLY.



3 CYL., BLOCK

NOTE:- THE TIGHTENING UP MUST BE CARRIED OUT IN THREE STAGES, i.e. THREE DEGREES OF TIGHTNESS.

1ST: SCREW UP LIGHTLY IN ORDER STATED

2ND: SCREW UP MEDIUM TIGHT IN ORDER STATED.

3RD: SCREW UP IN ORDER STATED TO CORRECT TIGHTENING TORQUE.

LW, HLW, LW 20, HLW 20	NUTS	'A'	1/2 B.S.F.	CORRECT TIGHTENING TORQUE	1000 LB. INCHES
" " " " "		'B'	3/8 "	" " "	350 " "
LX, HLX, GLXB, HLXB.		'A'	1/2 "	" " "	1200 " "
" " " " "		'B'	3/8 "	" " "	350 " "
" " " " "		'C'	3/8 "	" " "	450 " "

L. GARDNER & SONS, LTD.,
PATRICROFT.

TYPE
LW, HLW, LW 20, HLW 20, LX, HLX, GLXB, HLXB. ENGINES.

DESCRIPTION
ORDER OF TIGHTENING UP THE CYLINDER HEAD NUTS.

SCALE
NOT TO SCALE

MATERIAL

HEAT TREATMENT

MACHINED

DATE MAR/70

SUPERSEDES
S.A. 2445.
1/W 4746

SUPERSEDED BY

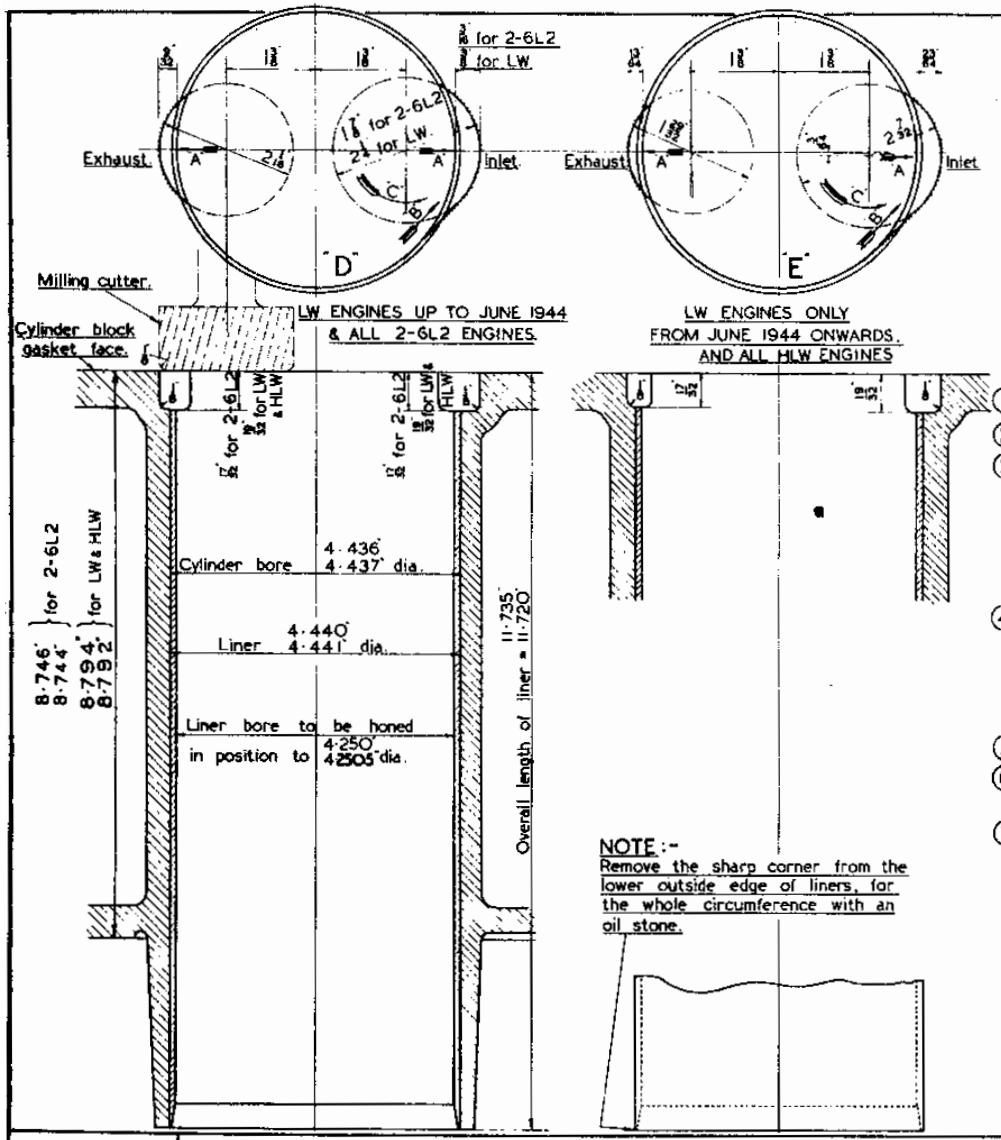
DRAWN BY A.L.O.
TRACED BY A.B.
CHECKED BY A.L.O.
INDEXED BY NM

S.P.No

PART No.
S.A.5402

GARDNER

GARDNER



NOTE :-
In order to avoid breakage of the liner when milling valve recesses, take small radial cuts in direction of arrows A A with small vertical feeds of the cutter. Carry out the milling of the tangential portion of the inlet valve recess as a separate operation with the cutter rotating in the direction shown by arrow C, feeding the cutter into the recess in the direction of arrow B with small vertical feeds.
Endeavour to reproduce accurately the designed dimensions.

INSTRUCTIONS.

1. Press out the existing liners.
2. Remove the sharp corners on the liners as indicated in view below.
3. Smear tallow liberally over the surface of each cylinder bore and the external surface of each liner.
   It is important that tallow is used and not lubricating oil. Press in the liners until the upper edges are level with the gasket face of the cylinder block. The approximate pressure required is a maximum of six tons and a minimum of four tons.
4. Mill away the valve recesses in each liner as indicated to dimensions view 'D' for LW engines up to June 1944 and all L2 engines and to dimensions view 'E' for LW engines from June 1944 onwards & all HLW engines
   Avoid milling LW cylinder blocks machined to view 'E' to the increased dimensions of view 'D'.
5. Hone the bore of each liner to finished size = 4¼" size to +·0005" dia.
6. If found necessary re-surface the gasket face of the cylinder block by surface grinding.
7. A new cylinder head gasket should be fitted after renewing the liners.

R.D. 142·1

L. GARDNER & SONS LTD. PATRICROFT MANCHESTER.

TYPE :- HLW, LW & 2-6L2 ENGINES.
DESCRIPTION :- INSTRUCTIONS FOR THE RENEWAL OF CYL., LINERS.
SCALE :- FULL SIZE.

SUPERSEDES DWG Nº 2199H.
SUPERSEDED BY AS1AH FOR 1L2 ONLY 6H3420
INDEXED BY SJO. DATE 18-5-45
DRAWN BY T.H.P
TRACED BY
CHECKED BY

DWG. Nº 3513H

LW, LW20 & HLW20 ENGINES

UNDERSIZE MAIN & CRANKPIN BEARING SHELLS

The following is a list of the standard undersize bearing shells together with the range of undersize covered by each class.

MAIN BEARING - GUN METAL SHELLS (LW & HLW SUPERSEDED DESIGN).

Class F1 Suitable for line boring to original STANDARD size.
" F2 " " " " for Journals of ·005" to ·030" UNDERSIZE
" F3 " " " " " " " ·035" to ·090" "

CRANKPIN BEARING - GUN METAL SHELLS (LW & HLW SUPERSEDED DESIGN).

Class F1 Suitable for boring to original STANDARD size & ·005" UNDERSIZE
" F2 " " " for Crankpins of ·010" to ·050" "
" F3 " " " " " " ·055" to ·095" "

Both main and crankpin bearings can of course be supplied already bored to suit a specified size of crankshaft within the above ranges when required.

RE-METALLING OF EXISTING BEARING SHELLS IS NOT RECOMMENDED

MAIN BEARING - THIN WALL SHELLS (LW, LW20 & HLW).

These are pre-finished main bearing shells and are not therefore to be bored when fitted to the crankcase. The bearings are available in various undersizes to suit re-conditioned crankshafts as follows:-

Class	H5	Suitable for crankshaft journal				(3·2500"	+ ·0000" − ·0005"	− ·0050"	= 3·2450"	+ ·0000" − ·0005")
"	H10	"	"	"	"	(	"	− ·0100"	= 3·2400"	")
"	H20	"	"	"	"	(	"	− ·0200"	= 3·2300"	")
"	H40	"	"	"	"	(	"	− ·0400"	= 3·2100"	")
"	H60	"	"	"	"	(	"	− ·0600"	= 3·1900"	")

CRANKPIN BEARINGS (LW, LW20 & HLW).

These are pre-finished big end bearing shells and are not, therefore, to be bored when fitted to the rods. The bearings are available in various undersizes to suit re-conditioned crank pins as follows:-

Class	H5	Suitable for crankpins			(2·875"	+ ·0000" − ·0005"	− ·0050"	= 2·8700"	+ ·0000" − ·0005")
"	H10	"	"	"	(	"	− ·0100"	= 2·8650"	")
"	H20	"	"	"	(	"	− ·0200"	= 2·8550"	")
"	H40	"	"	"	(	"	− ·0400"	= 2·8350"	")
"	H60	"	"	"	(	"	− ·0600"	= 2·8150"	")

L2, L3, L3B, LK, LW, HLW, LW20, HLW20 ENGINES

Gun Metal Main Bearing Shells

INSTRUCTIONS FOR THE CORRECT TIGHTENING OF MAIN BEARING CAP NUTS

As the procedure for the tightening of the above nuts has a slight but highly important effect on the bearing bore size and shape, it is essential that these nuts are re-tightened in exactly the same order and to the same degree of tightness every time the bearings and caps are assembled. FOR THIS PURPOSE IT IS NECESSARY TO ESTABLISH A STANDARD PROCEDURE, WHICH MUST BE OBSERVED BY EVERY OPERATOR AT EACH STAGE OF THE JOB.

This standard procedure must be as follows:-

1st STAGE. Run each pair of nuts down until they just slightly nip the bearing cap (or steel bridges in the case of the LW & HLW)

2nd STAGE. Tighten number side nut to about half the final tightness.

3rd STAGE. Tighten opposite side as above.

4th STAGE. Tighten number side to final tightness.

5th STAGE. Finally tighten opposite side.

NOTE: the 8LW engine incorporates a four-bolt centre main bearing and the correct procedure for this particular bearing is as follows:-

1st STAGE. Run each pair of nuts down until they just nip the steel bearing bridges.

2nd STAGE. Tighten nut No. 9 followed by nut No. 11, to about half final tightness.

3rd STAGE. Tighten nut No. 10, followed by nut No. 12, as above.

4th STAGE. Tighten nut No. 9, followed by nut No. 11 to final tightness.

5th STAGE. Tighten nut No. 10, followed by nut No. 12 as above.

General use of this method will ensure that the size and shape of the bearing bore as produced by line boring, or hand scraping, will be maintained, which is of course vital.

The correct tightness for these nuts on the various engines is as follows:-

L2	-	1500 lb. in.
L3, L3B	-	2100 lb. in.
LK	-	1500 lb. in.
LW, HLW, LW20, HLW20	-	2100 lb. in. ($\frac{1}{2}$" B.S.F. at Fly.End - 700 lb. in.)

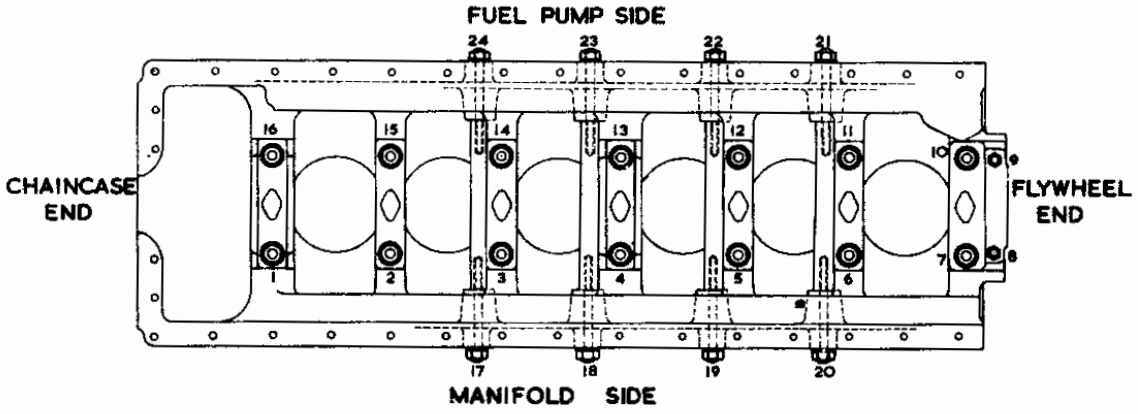
2 – 6LW and HLW type engines.

Prefinished thin wall main bearing shells.

Instructions for the correct tightening of main bearing caps and cross strut nuts.

The size and roundness of the shell bore are dependent on the tightening procedure and it is essential that these nuts are re-tightened in exactly the same order and to the same degree of tightness every time the bearing caps and cross struts are assembled.

The outline sketch and table below show the order and manner of tightening respectively.

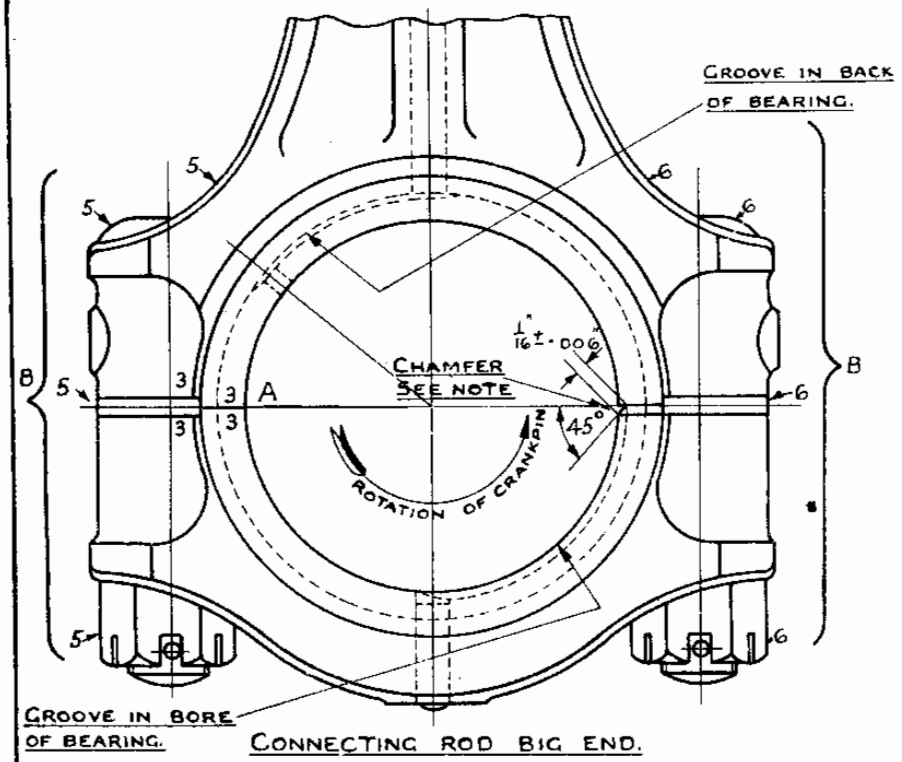


Sequence of operations.	Method of Tightening.	Main bearing cap nut torque. lb.in. Aluminium and cast iron crankcases.	
		Nuts 1 – 7 and 10 – 16. 3/4" B.S.F.	Nuts 8 and 9. 1/2" B.S.F.
1st.stage.	Using fingers only.	Fingertight.	Fingertight.
2nd.stage.	Nip with ratchet spanner.	25 approx.	50 approx.
3rd.stage.	1st. nip with "T" spanner.	175 approx.	150 approx.
4th.stage.	2nd. nip with "T" spanner.	500 approx.	250 approx.
5th.stage.	Half tight with torque spanner.	1050.	350.
6th.stage.	Full tight with torque spanner.	2100.	700.
		Cross strut nut torque lb.in. Nuts 17 – 24.	
		Aluminium crankcase. 7/16" B.S.F.	Cast iron crankcase. 1/2" B.S.F.
7th.stage.	Nip with "T" spanner.	75 approx.	75 approx.
8th.stage.	Half tight with torque spanner.	275.	200.
9th.stage.	Full tight with torque spanner.	550.	400.

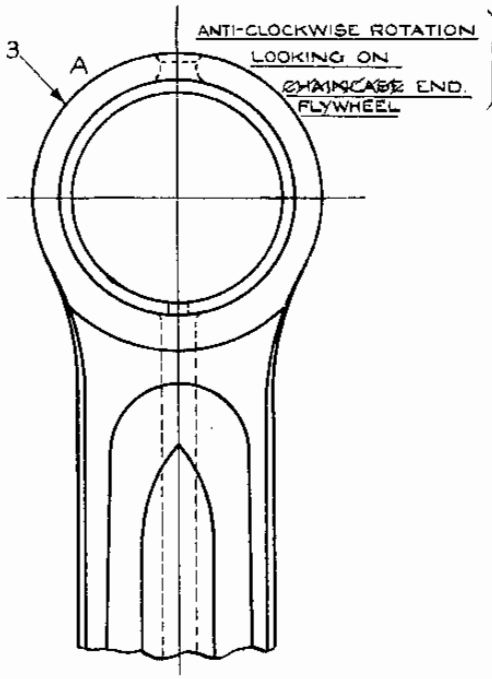
In the case of the 2, 3, 4 and 5 cylinder engines the order and method of tightening are to follow the same pattern as the 6 cylinder engine described above.
Cross struts are only fitted to 4, 5 and 6 cylinder aluminium engines and the 6 cylinder cast iron engine.

Tightening torques.

3/4" B.S.F. main bearing cap nuts 2100 lb.in. Cast iron and aluminium crankcase.
1/2" B.S.F. main bearing cap nuts 700 lb.in. Cast iron and aluminium crankcase.
1/2" B.S.F. cross strut nuts. (400 lb.in. cast iron crankcase).
7/16" B.S.F. cross strut nuts. (550 lb.in. aluminium crankcase).



CONNECTING ROD BIG END.



CONNECTING ROD SMALL END.

CONNECTING ROD BODY, CAP & BEARINGS.

THE CYLINDER NUMBER TO WHICH THE ASSEMBLY BELONGS IS STAMPED IMMEDIATELY ABOVE AND BELOW THE SPLIT IN THE BIG END, AND ON THE OUTSIDE DIAMETER OF THE SMALL END, AS SHOWN AT "A". No. 3 ROD IS SHOWN ABOVE.

THE CONNECTING ROD IS TO BE ASSEMBLED INTO THE ENGINE WITH THESE MARKINGS ON THE TAPPET SIDE. THE FIGURES ON THE BIG END ARE THEN ON THAT SIDE OF THE ROD, WHICH IS TOWARDS THE FLYWHEEL END OF THE ENGINE.

IMPORTANT.

1/16 ± .006" CHAMFER FULL WIDTH OF BEARING & ROUND FLANGE FACE AT EACH END OF CAP HALF HAS TO BE FILED ON THE OIL GROOVE SIDE OF THE BEARING TO THE DIMENSIONS SHOWN, AFTER FINISH BORING TO THE REQUIRED SIZE.

RADIUS. THE RADIUS AT EACH SIDE OF THE BEARING WILL ALSO HAVE TO BE RESTORED TO ITS ORIGINAL SIZE (.16") AFTER BORING.

BOLTS, NUTS & SHIMS.

THESE ARE NUMBERED CONSECUTIVELY IN SETS, AS SHOWN AT "B" WITH CORRESPONDING MARKINGS ON THE CONNECTING ROD BODY ADJACENT TO THE BOLT HEAD, TO FACILITATE REASSEMBLY INTO THEIR ORIGINAL POSITIONS. THUS IN A 6LW ENGINE THE NUMBERS ARE FROM 1 TO 12.

R.D. 166/1

L. GARDNER & SONS, LTD.
PATRICROFT

TYPE.
L.W. ENGINE.
HLW "

DESCRIPTION.
CONNECTING ROD LOCATING NUMBERS

SCALE.

MATERIAL

MACHINED

DATE 26-9-49

SUPERSEDES

SUPERSEDED BY.

DRAWN BY A.L.Q.
TRACED BY H.J.
CHECKED BY J.H.P.
INDEXED BY R.V.R.

PART No.

S.A. 2737

GARDNER

"L" TYPE ENGINES

INSTRUCTIONS FOR THE CORRECT TIGHTENING OF CONNECTING ROD BIG END NUTS

As the procedure for the tightening of the above nuts has a slight but highly important effect on the bearing bore size and shape, it is essential that these nuts are re-tightened in exactly the same order and to the same degree of tightness every time the bearings and caps are assembled. FOR THIS PURPOSE IT IS NECESSARY TO ESTABLISH A STANDARD PROCEDURE, WHICH MUST BE OBSERVED BY EVERY OPERATOR AT EACH STAGE OF THE JOB.

This standard procedure must be as follows:-

LW, HLW, LW20, HLW20, LK & LX - 2 BOLT ROD

1st STAGE. Run each pair of nuts down until they just slightly nip the bearing cap.

2nd STAGE. Tighten odd number side nut to about half the final tightness.

3rd STAGE. Tighten opposite side as above.

4th STAGE. Tighten odd number side to final tightness.

5th STAGE. Finally tighten opposite side.

L3B, L3, LX, HLX, LXB & HLXB - 4 BOLT ROD

NOTE: These engines incorporate a four-bolt connecting rod and the correct procedure for this particular bearing is as follows:-

1st STAGE. Run each pair of nuts down until they just slightly nip the bearing cap.

2nd STAGE. Tighten nut No. 1, followed by nut No. 3, to about half final tightness.

3rd STAGE. Tighten nut No. 2, followed by nut No. 4, as above.

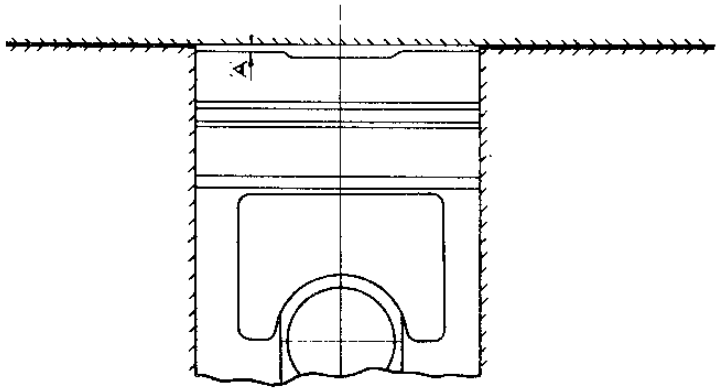
4th STAGE. Tighten nut No. 1, followed by nut No. 3, to final tightness.

5th STAGE. Tighten nut No. 2, followed by nut No. 4, as above.

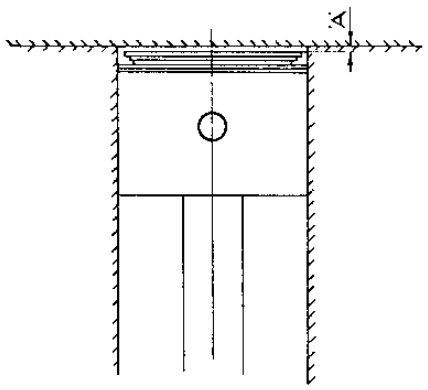
General use of this method will ensure that the size and shape of the bearing bore will be maintained, which is of course vital.

The correct tightening torque for these nuts on the various engines is as given by the following table:-

L3, L3B	- 980 lb. in.		
LK	- 980 lb. in.		
LX, LW, HLW, LW20 & HLW20	- 1250 lb. in.	-	2 Bolt Rod
LX, HLX, LXB & HLXB	- 600 lb. in.	-	4 Bolt Rod



ENGINE PISTON.



AIR EXHAUSTER PISTON.

ENGINE	CYLINDER HEAD TO PISTON CLEARANCE DIMENSION 'A'		
	NOMINAL	MAXIMUM	MINIMUM.
L2	·0444"	·0544"	·0364"
LK	·0575"	·0645"	·0515"
LW - HLW.	·0444"	·0514"	·0384"
LW20-HLW20	·030"	·037"	·023"
L3	·083"	·096"	·072"
L3B.	·050"	·059"	·041"
LX - HLX	·029"	·036"	·022"
LXB-HLXB.	·032"	·039"	·025"

ENGINE	CYLINDER HEAD TO PISTON CLEARANCE DIMENSION 'A'		
	NOMINAL	MAXIMUM	MINIMUM.
LW-HLW LX	·0156"	·0266"	·0116"
LK.	·0312"	·0412"	·0272"

NOTE:- THE ABOVE CLEARANCES SHOULD OBTAIN WHEN THE PACKING QUOTED BELOW ARE FITTED.

ENGINE	CYLINDER HD PACKING THICKNESS	CYLINDER FOOT PACKING THICKNESS.
L2	·0625"	·004"
LX - HLX LXB - HLXB.	·014"	NONE
LW - HLW. LW20 - HLW20	·013"	·004"
L3	NONE	·004"
L3B	NONE	NONE
ALUM 4LK CYL BLOCK	·013"	NONE
CAST IRON 4LK CYL BLOCK	·013"	·004"

L. GARDNER & SONS, LTD., PATRICROFT.

TYPE
'L' TYPE

DESCRIPTION
CYL. HD. TO PISTON CLEARANCES

SCALE

MATERIAL

HEAT TREATMENT

MACHINED

DATE MAR/70

SUPERSEDES
S.A. 3434
1/W 4746

SUPERSEDED BY

DRAWN BY A.L.O.
TRACED BY A.B.
CHECKED BY A.L.O.
INDEXED BY N/A

S.P. No

PART No.

SA5403

GARDNER

PISTON RINGS

"L" TYPE ENGINES

LW, HLW, LW20, HLW20, LX, HLX, L2, L3 & L3B ENGINES. Please note, sets of spare piston rings include two pressure rings only, and one scraper ring. The ring fitted to the No.1 groove is chromium plated on its periphery and side faces. The ring fitted to the No. 2 groove is plated on its periphery only, and can be identified by a phosphated etched section on each side of the gap. These rings should not be interchanged.

LXB & HLXB ENGINES. The ring fitted to Nos. 1 & 2 grooves are the same, and are plated on the periphery and side faces.

See table for location of rings and respective part numbers:—

SPARE PART NUMBER

LOCATION	LW,HLW LW20,HLW20	LX,HLX	LXB,HLXB	L2	LK	L3,L3B
Groove N°.	3 Groove Piston	3 Groove Piston	3 Groove Piston	3 Groove Piston	3 Groove Piston	3 Groove Piston
N°. 1	MA 618	LX/3/3012	LX/3/3012	MA 618	LK/3/223	L3/8/148
N°. 2	MA 168	LX/3/3013	LX/3/3012	MA 168	LK/3/136	L3/8/78
N°. 3 (Scraper)	MA 807	LX/3/3064	LX/3/3064	MA 807	LK/3/229	L3/8/160

"L" TYPE ENGINES

INSTRUCTIONS FOR THE ASSEMBLING OF PISTONS IN ENGINE

L2, LW, LW20, L3, L3B & 6LX ENGINES.

Different pistons are required for engines rotating in clockwise or anti-clockwise direction (as viewed on flywheel end of engine).

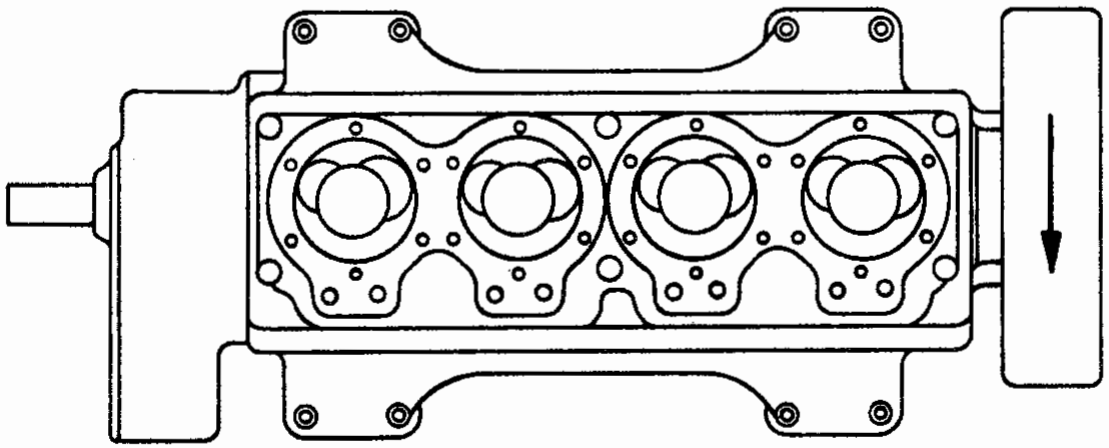
The pistons are distinguished by an "Engine Rotation" arrow stamped on piston top faces in addition to the words "Tappet Side".

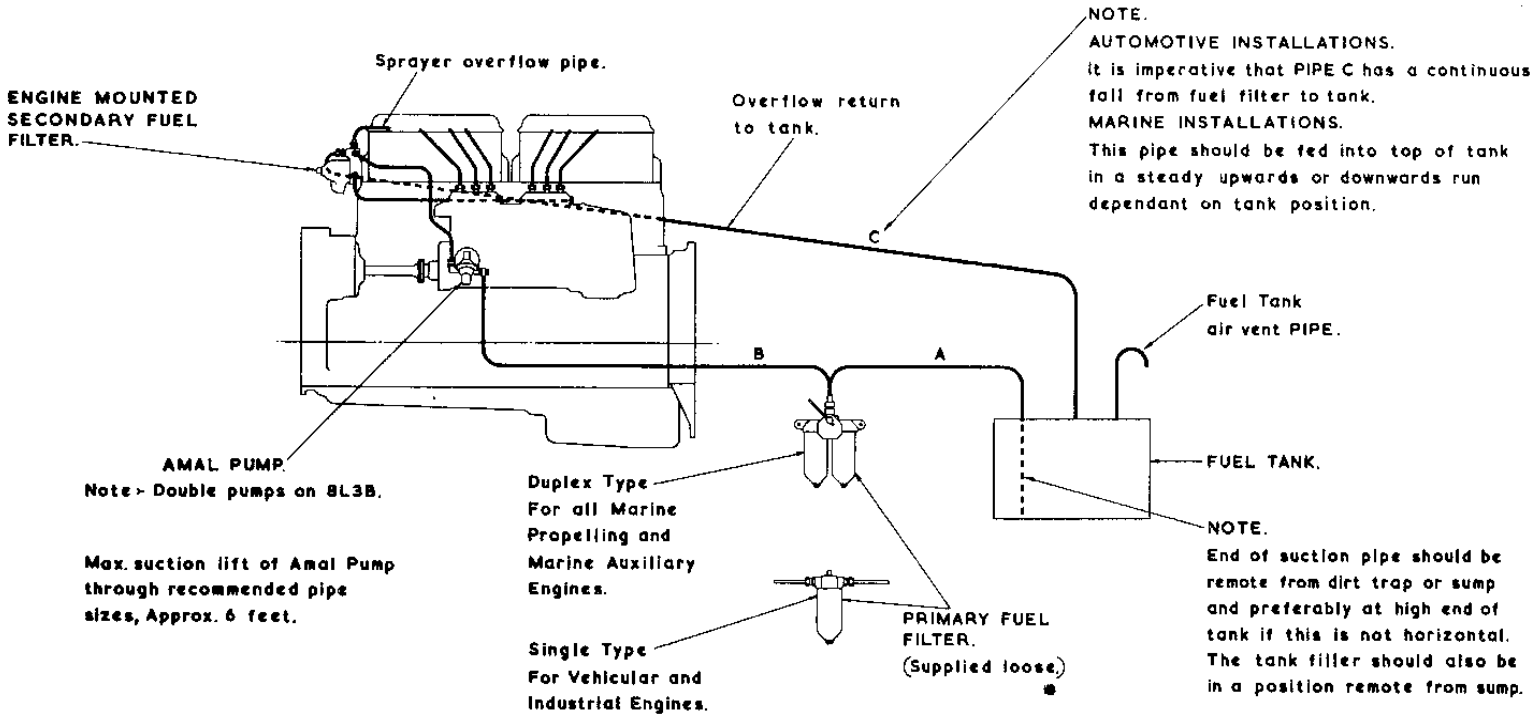
The correct pistons are those on which the "Engine Rotation" arrow points in the direction of rotation of the crankshaft when assembled in the engine and viewed in plan as illustrated in sketch. "Tappet Side", of course, being also correctly positioned.

HLW, HLW20, HLX, HLXB, 6LXB & 8LXB ENGINES

There is only one type of piston for each of these engines as they rotate in one direction only, i.e. anti-clockwise when viewed on flywheel end.

Thus, it is only necessary to ensure that pistons are assembled in an engine in accordance with the words "Tappet Side" stamped on the top face.





ENGINE TYPE	A	B	C
6LX, 6LXB 6HLX, 6HLXB & 8LXB.	1/2" O.D. 16s. Gauge	3/8" O.D. 18s. Gauge	3/8" O.D. 18s. Gauge
8L3B Engines.	5/8" O.D. 16s. Gauge	5/8" O.D. 16s. Gauge	3/8" O.D. 18s. Gauge

R.D.150·2

L. GARDNER & SONS LTD. PATRICROFT, MR. MANCHESTER.

TYPE:- 'L' TYPE ENGINES. (DRAWN FOR LX ENGINE)

DESCRIPTION:- DIAGRAMMATIC ARRANGEMENT OF FUEL SYSTEM WITH MECHANICAL FUEL LIFT PUMP.

SCALE:-

MATERIAL

MACHINED

SUPERSEDES DWG. 6883 H

SUPERSEDED BY

P.R. DRAWN BY A.D.P.

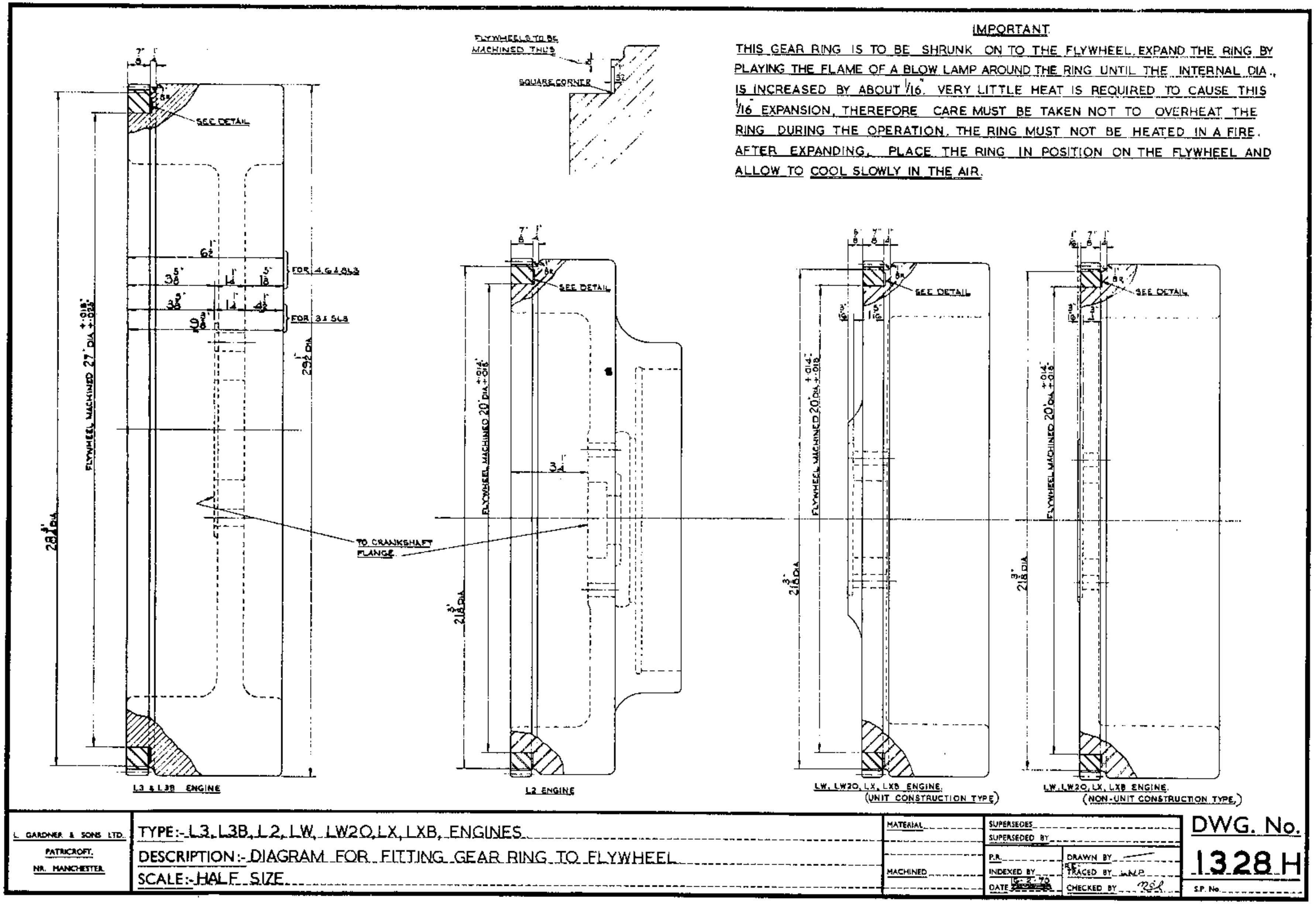
INDEXED BY E.L. TRACED BY S.P.

DATE 13.12.79 CHECKED BY

DWG. No. 7221 H

S.P. No.

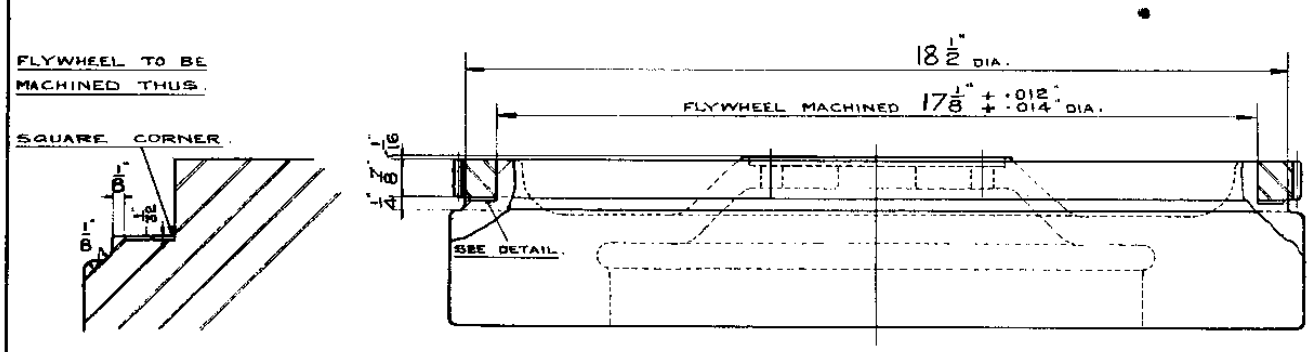
GARDNER


FLYWHEELS TO BE MACHINED THUS
SQUARE CORNER
IMPORTANT
THIS GEAR RING IS TO BE SHRUNK ON TO THE FLYWHEEL. EXPAND THE RING BY PLAYING THE FLAME OF A BLOW LAMP AROUND THE RING UNTIL THE INTERNAL DIA., IS INCREASED BY ABOUT 1/16". VERY LITTLE HEAT IS REQUIRED TO CAUSE THIS 1/16 EXPANSION, THEREFORE CARE MUST BE TAKEN NOT TO OVERHEAT THE RING DURING THE OPERATION. THE RING MUST NOT BE HEATED IN A FIRE. AFTER EXPANDING, PLACE THE RING IN POSITION ON THE FLYWHEEL AND ALLOW TO COOL SLOWLY IN THE AIR.
SEE DETAIL
FOR 4G & 6L3
FOR 3 & 5L3
FLYWHEEL MACHINED 27" DIA +.018" +.028"
28 3/8" DIA
29 1/2" DIA
TO CRANKSHAFT FLANGE
FLYWHEEL MACHINED 20" DIA +.014" +.018"
21 3/8" DIA
L3 & L3B ENGINE
L2 ENGINE
LW, LW20, LX, LXB ENGINE. (UNIT CONSTRUCTION TYPE)
LW, LW20, LX, LXB ENGINE. (NON-UNIT CONSTRUCTION TYPE.)
L. GARDNER & SONS LTD. PATRICROFT, NR. MANCHESTER
TYPE:- L3, L3B, L2, LW, LW20, LX, LXB, ENGINES
DESCRIPTION:- DIAGRAM FOR FITTING GEAR RING TO FLYWHEEL
SCALE:- HALF SIZE
MATERIAL
MACHINED
SUPERSEDES
SUPERSEDED BY
DRAWN BY
TRACED BY
INDEXED BY
DATE
CHECKED BY
DWG. No.
1328 H
S.P. No.

THE GEAR RING IS TO BE SHRUNK ON THE FLYWHEEL.
THE PROCEDURE IS AS FOLLOWS :-
EXPAND THE GEAR RING BY PLAYING THE FLAME OF A
BLOW LAMP AROUND SAME UNTIL THE INTERNAL DIA. IS
INCREASED BY ABOUT 1/16". VERY LITTLE HEAT IS REQUIRED
TO CAUSE THIS EXPANSION, THEREFORE CARE MUST BE TAKEN
NOT TO OVERHEAT THE RING DURING THIS OPERATION.
AFTER EXPANDING, PLACE THE GEAR RING IN POSITION ON
THE FLYWHEEL AND ALLOW IT TO COOL SLOWLY IN THE AIR.

IMPORTANT ;

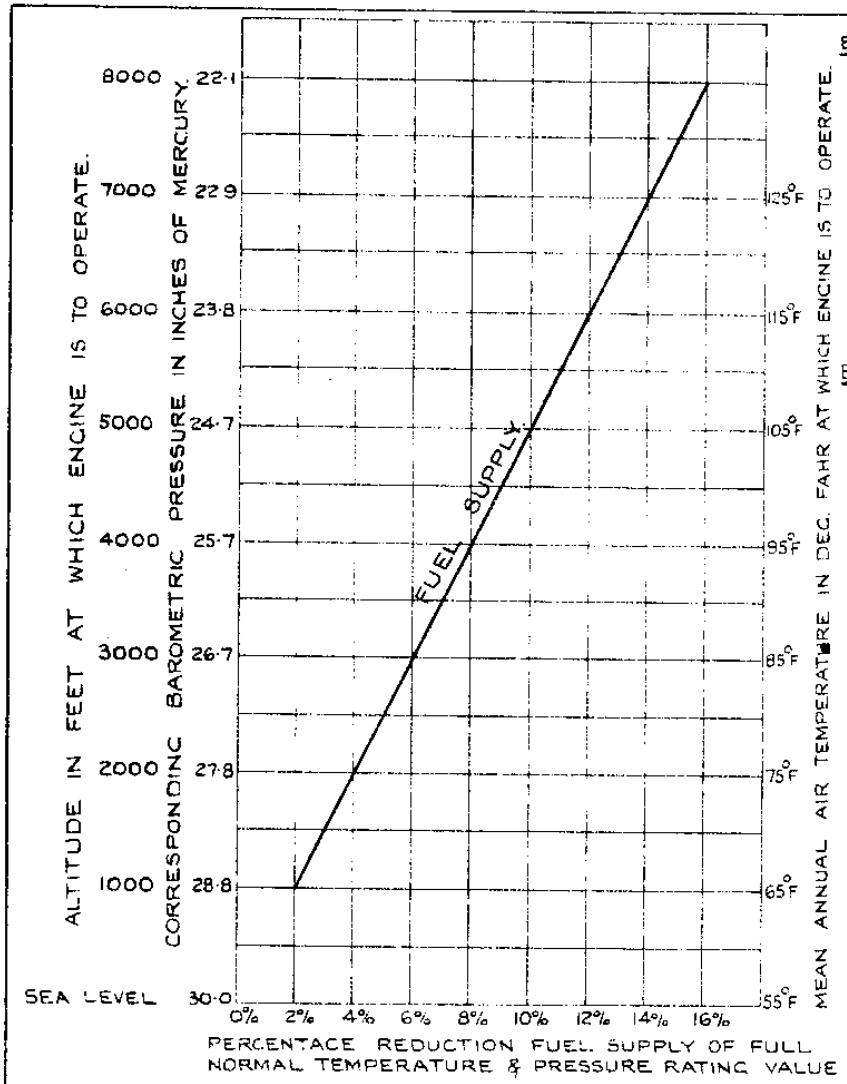
THE GEAR RING MUST NOT BE HEATED IN A FIRE.



L.GARDNER & SONS LTD. PATRICROFT. Nr MANCHESTER.	TYPE:-LK, HLW, HLW20, HLX, HLXB, ENGINES.	MATERIAL	SUPERSEDES	DWG. N°.
	INSTRUCTIONS FOR FITTING GEAR RING ON FLYWHEEL.		SUPERSEDED BY	2958 F
	SCALE:- HALF SIZE.	MACHINED	P.R. INDEXED BY E.M. DATE 6.1.47	DRAWN BY J.A.J. TRACED BY E.A.L. CHECKED BY

GARDNER

GARDNER



REDUCTION IN FUEL SUPPLY FOR ALTITUDE AND TEMPERATURE CONDITIONS.

EXAMPLE:-GIVEN THAT AN ENGINE HAS TO OPERATE AT 2000 FT. ALTITUDE WITH A MEAN ANNUAL ATMOSPHERIC TEMPERATURE OF 75° F, FROM THE GRAPH ON THE LEFT HAND SIDE WE READ THE FOLLOWING REDUCTIONS:-

FOR ALTITUDE 4%

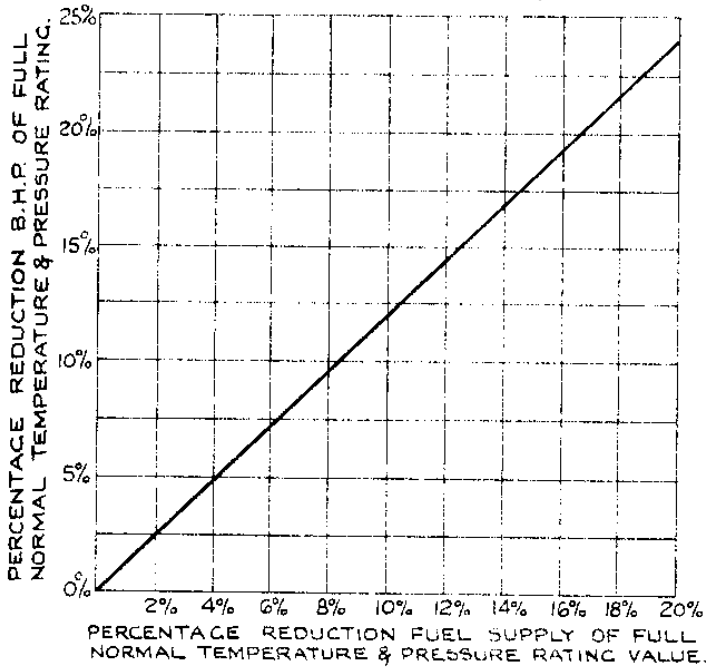
FOR TEMPERATURE 4%

COMBINED REDUCTION 8% OR 0·92 NORMAL TEMPERATURE AND PRESSURE RATING FUEL SUPPLY.

THE GRAPH ON THE RIGHT HAND SIDE SHOWS THE APPROXIMATE REDUCTION IN B.H.P. WHEN THE FUEL SUPPLY IS REDUCED UNDER ALTITUDE AND TEMPERATURE CONDITIONS.

EXAMPLE:-COMBINED REDUCTION FUEL SUPPLY 10%.

REDUCTION B.H.P. OF FULL N.T.P. RATING 12%



REDUCTION IN B.H.P. WHEN FUEL SUPPLY REDUCED UNDER ALTITUDE AND TEMPERATURE CONDITIONS.

ENGINE PERFORMANCE AT HIGH ALTITUDE & HIGH ATMOSPHERIC TEMPERATURE.

DRAWN BY T.H.P TRACED BY H.C 20-4-56. SUPERSEDES S.A.1922.

S.A. 3514.

ENGINE PERFORMANCE AT HIGH ALTITUDE AND HIGH ATMOSPHERIC TEMPERATURE

As is well known, the density of air is lower at both high altitude and high temperature and since a given amount of fuel requires a given amount of air for its combustion, it is necessary that the injected fuel supply to an engine operating under conditions of lower air density be restricted to a value satisfactory for combustion and operation with a smokeless exhaust.

Engine Catalogue powers are known as the 100% rating, and are those developed with a satisfactory fuel/air ratio under conditions of normal temperature and pressure. These conditions, namely, a barometric pressure of 30" HG., and an atmospheric temperature of 55°F. normally obtain at the manufacturer's works at Patricroft, Lancashire.

Conditions of reduced air density encountered both as a result of high altitude and high atmospheric temperature, each separately have an effect on engine performance such that for every 1000ft. altitude and each 10°F. increase over sea level and 55°F. mean annual temperature respectively, it is appropriate to reduce the fuel supply 2%.

When it is intended that an engine shall operate permanently at 1000ft. altitude or 65°F. mean annual ambient temperature, or in excess of either of these figures, it is necessary that the length of the fuel pump output control trigger be increased in order to reduce the injected fuel supply appropriately according to altitude and temperature shown on the graph.

When site operating conditions are known, new engines are appropriately set during test at the makers works, and the setting clearly stamped on the fuel pump rating plate. When, however, it is necessary to adjust spare or reconditioned fuel pumps the work can be accomplished only by use of the Gardner fuel pump calibrating machine and by observing precisely the provisions of Instruction Book 45·3. On page 9 of Book 45·3 will be found the average delivery from each plunger in cubic centimetres and the values quoted are to be reduced according to the graph.

6LX, 6LXB, LW, LW20 & 4LK ENGINE TESTING EQUIPMENT

PARTS WHICH CAN BE SUPPLIED BY L. GARDNER & SONS, LTD. FOR USE WITH HEENAN & FROUDE HYDRAULIC DYNAMOMETER TYPE DPX4 OR DPY4 FOR 6LX, 6LXB, LW, LW20 & 4LK ENGINES ALTERNATIVE TYPE DPX5 OR DPY5 FOR 8LW ENGINES.

For Testing 6LX, 6LXB, LW – LW20 Engines.

1 Flywheel to Dwg. No. 1060H.
1 Adaptor to Dwg. No. 3225F.
6 Nuts J8176.
(Dynamometer DPX4 or DPY4) 1 Adaptor to Dwg.No. 3226F (6LX, 6LXB, LW, LW20 & 4LK).
(Dynamometer DPX5 or DPY5) 1 Adaptor to Dwg.No. 3227F (8LW ONLY).
6 Bolts J8177.
1 "Layrub" No. 60 X 1¼" 6/6 series Propeller Shaft.
Manufactured by The Laycock Eng.Co.Ltd.,
Victoria Works, Millhouses, Sheffield, 8.
(Outline Dwg. to L.Gardner & Sons, Ltd.
Dwg. No. 3218F).

Additional items for testing 4LK Engine.

1 Flywheel to Dwg.No. J7.
1 Adaptor to Dwg.No. 3228F.
6 Studs J15
6 Nuts E2797.

All as per assembly drawing No. 12672.

A copper fuel feed flask complete with glass sight tube to Drawing No. 8972 can also be supplied.

We recommend a "Hasler" or similar hand tachometer.

HLW, HLW20, 6HLX & 6HLXB ENGINE TESTING EQUIPMENT

PARTS WHICH CAN BE SUPPLIED BY L. GARDNER & SONS, LTD. FOR USE WITH HEENAN & FROUDE HYDRAULIC DYNAMOMETER TYPE DPX4 OR DPY4

For Testing Engine

1 Flywheel to Dwg. No. 3925H
1 Adaptor to Dwg. No. 3225F
6 Nuts J8176
1 Adaptor to Dwg. No. 3226F
6 Bolts J8177
1 "Layrub" No. 60 X 1¼"6/6 series Propeller Shaft.
Manufactured by The Laycock Eng.Co.Ltd.,
Victoria Works, Millhouses, Sheffield. 8.
(Outline Dwg. to L.Gardner & Sons, Ltd.
Dwg. No. 3218F).

1 Rear End Support to Dwg. No. 3920H, comprising
1 Packing Plate J8130
1 Bolt SA.3002
2 Nuts J9253
1 Plain Washer, 1" bore
1 Rear Support Bracket Dwg. No. 3205F

1 Front End Support Bracket to Dwg. No. 3204F
1 Set of Torque Reaction Equipment to Dwg. No. 13395

A copper fuel feed flask complete with glass sight tube to Drawing No. 8972 can also be supplied.

We recommend a "Hasler" or similar hand tachometer.

GARDNER

NOTE:- ALL TORQUE INDICATING SPANNERS SHOULD BE CHECKED REGULARLY BY MEANS OF A SPRING BALANCE, USED TO APPLY A KNOWN LOAD ON THE HANDLE OF THE SPANNER, AT A KNOWN DISTANCE FROM THE NUT CENTRE.

LETTER 'E' INDICATES THAT USE OF A TORQUE SPANNER IS ESSENTIAL.

NUT	THREAD SIZE		CORRECT TIGHTENING TORQUE : LB. INS.
CRANKCASE - CLAMP - VALVE TAPPET GUIDE	3/8" WH.		280
" - VALVE CAMSHAFT - FORWARD END (3-6LW) SINGLE CYLINDER & NON-EXHAUSTER	1/2" B.S.F.		800
" - " " - " " (HLW, 8LW) TWIN CYLINDER & 3-6LW & NON EXHAUSTER	9/16" B.S.F.		900
" - POINTED SCREW - VALVE CAM	7/16" - 20 THD/1"		600
" - CHAINWHEEL - VALVE CAMSHAFT	3/8" B.S.F.		400
" - CROSS BOLT	1/2" B.S.F.	E	400
" - END PLATE TO CRANKCASE - CROSS STRUT - ALUMINIUM ENGINES.	7/16" B.S.F.	E	550
" - NUT - MAIN BEARING CAP	3/4" B.S.F.	E	2100
" - NUT - MAIN BEARING CAP - FLYWHEEL END	1/2" B.S.F.	E	700
" - SETSCREW - LUB. OIL MAIN-PIPE TO BEARING CAP BRIDGE	3/8" B.S.F.	E	400
CRANKSHAFT - CONNECTING ROD - BIG END	5/8" B.S.F.	E	1250
" - FLYWHEEL TO CRANKSHAFT	9/16" B.S.F.	E	1900 DAIMLER "FLEETLINE" 1500
" - DAMPER TO CRANKSHAFT - (5LW (6HLW) INTERNAL SPRING TYPE	7/16" B.S.F.		600
" - " " " - (8LW)	7/16" B.S.F.		650
" - " " " - EXTERNAL SPRING TYPE	7/16" B.S.F.	E	650
" - BALANCE WEIGHT TO CRANKSHAFT (2-3LW)	1/2" B.S.F.	E	1100
" - " " " " (5LW & 5HLW)	7/16" B.S.F.	E	800
" - STARTING DOG	1 1/2" - 12 THDS./1"		2500
CYLINDER - FOOT	5/8" B.S.F.	E	1300
" - HEAD	1/2" B.S.F.	E	1000
" - CYLINDER HEAD (TAPPET SIDE STUD)	3/8" B.S.F.	E	350
CYLINDER HEAD - MANIFOLD CLAMP	3/8" WH.		250
" " - SPRAYER CLAMP	5/16" WH.		80
" " - UNION STOCK - SPRAYER DELIVERY	3/8" B.S. PIPE THD	E	625
" " - CAP - SPRAYER NOZZLE	3/4" - 14 THDS./1"		380
" " - ADJUSTER - VALVE TAPPET	5/16" B.S.F.		200
" " - POINTED SCREW - VALVE LEVER SHAFT	1/4" - 28 THDS./1"		175
DYNAMO/ALTERNATOR - CLAMP STRAP	3/8" WH.		150
" " - FLEXIBLE COUPLING TO DRIVE SHAFT & FLANGE COUPLING	5/16" B.S.F.		280
ELECTRIC STARTER - CLAMP STRAP	3/8" WH.		180
FAN - SPINDLE (2-6LW, LW20)	1/2" B.S.F.	E	800
FLYWHEEL - BOLT ON TYPE GEAR RING	3/8" B.S.F.		350
FUEL PUMP - DRIVEN GEAR	5/16" B.S.F.	E	400
" " - VALVE HOLDER - DELIVERY	20 X 1 1/2 mm	E	720
" " - SPRAYER PIPE - UNION (PUMP END)	18 X 1 1/2 mm		450
" " - " " - " (SPRAYER END)	1/4" B.S. PIPE THD		450
" " - LOCKNUT - CAMBOX TAPPET SCREW	3/8" - 24 THDS./1"		300
" " - POINTED SETSCREW - CAMSHAFT	5/16" - 28 THDS./1"		350
" " - SCREW (SCREWDRIVER SLOT) - CONTROL QUADRANT & SLEEVE	4·5 X ·75 mm	E	150
FUEL SECOND FILTER - UNION STOCK - SPRAYER OVERFLOW	1/4" B.S. PIPE THD		750
" " " - CAP NUT TO FILTER COVER	3/8" WH.		180
GOVERNOR BODY - POINTED SETSCREW	3/8" - 24 THDS./1"		550
LUB. OIL DELIVERY FILTER - SQUARE HEAD PLUG TO BODY (3-6LW ALUM.)	1/2" B.S. PIPE THD		610
" " " " - HEX. CAP NUT TO COVER	7/16" WH.	E	350
" " " " - COVER (ALUMINIUM) (8LW)	1 1/16 - 12 THDS.		800
" " " " - DRAIN PLUG	3/4" B.S. PIPE THD		450
" " SUMP - DRAIN PLUG	3/4" B.S. PIPE THD		450
" " EXTERNAL COOLER PUMP	1/2" B.S.F.	E	500
" " PUMP - PUMP TO CRANKCASE	3/8" WH.	E	300
REAR FLEXIBLE ENGINE SUPPORT - SETSCREW - (HLW)	3/4" B.S.F.	E	2100
WATER PUMP DRIVE - CENTRIFUGAL TYPE PUMP	7/16" B.S.F.	E	500

DWG. No. 6951 F

SUPERSEDES SA 2736

SUPERSEDED BY

DRAWN BY

RE-TRACED BY L.M.C.

CHECKED BY

P.R.

INDEXED BY E.A. 30-1-73

DATE 30-10-73

S.P. No.

MATERIAL

MACHINED

TYPE:- LW20, LW, HLW20 & HLW ENGINE.

DESCRIPTION:- CORRECT TIGHTENING TORQUE FOR VARIOUS NUTS.

SCALE:- ———

L. GARDNER & SONS LTD. PATRICROFT, NR. MANCHESTER.

GARDNER

LW, LX, L3 & L3B MARINE ENGINES

Engine and Propeller Shaft Alignment Shims

for

fitting between Engine and Bearers.

GARDNER ENGINES (SALES) LTD.

Head Office and Works:

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To obtain alignment within •003" and to obtain a total thickness of shims between •003" and $\frac{1}{16}$" with steps not greater than •003", it is necessary to have available shims of the thickness and quantity quoted below for each individual foot on the Engine Reverse Gear Unit.

4	off	shims	•003" thick
3	"	"	•007" "
2	"	"	•032" "

With these shims it is possible to obtain a total thickness as per the table below.

TOTAL THICKNESS OF SHIMS	QUAN. OF SHIMS TO BE USED			TOTAL THICKNESS OF SHIMS	QUAN. OF SHIMS TO BE USED		
	•003"	•007"	•032"		•003"	•007"	•032"
•003"	1	–	–	•035"	1	–	1
•006"	2	–	–	•038"	2	–	1
•007"	–	1	–	•039"	–	1	1
•009"	3	–	–	•041"	3	–	1
•010"	1	1	–	•042"	1	1	1
•012"	4	–	–	•044"	4	–	1
•013"	2	1	–	•045"	2	1	1
•014"	–	2	–	•046"	–	2	1
•016"	3	1	–	•048"	3	1	1
•017"	1	2	–	•049"	1	2	1
•019"	4	1	–	•051"	4	1	1
•020"	2	2	–	•052"	2	2	1
•021"	–	3	–	•053"	–	3	1
•023"	3	2	–	•055"	3	2	1
•024"	1	3	–	•056"	1	3	1
•026"	4	2	–	•058"	4	2	1
•027"	2	3	–	•059"	2	3	1
•030"	3	3	–	•062"	3	3	1
•032"	–	–	1	•064"	–	–	2
•033"	4	3	–				

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LW, LX & LXB ENGINES

Location of Shims	Dimensions of Shim	Dwg. No.	Number of Supporting Feet	Total number of Shims to be supplied per each Engine Reversing Gear Unit. 2LW & U.C.Gear	3LW & U.C.Gear	4LW & U.C.Gear	5LW & U.C.Gear	6LX 6LW & U.C.Gear	6LX & Twin Disc Gear	6LXB & Twin Disc Gear
Engine Side Supporting Feet	4" X 8 1/8" X .003"	J7253	2			8	8	8	8	8
	" X .007"	J7254				6	6	6	6	6
	" X .032"	J7255				4	4	4	4	4
	5 3/4" X 2 1/4" X .003"	J7259	2	8	8					
	" X .007"	J7260		6	6					
	" X .032"	J7261		4	4					
2 U.C. Reversing Gear Supporting Feet	5 5/8" X 8" X .003"	J7256	2	8	8	8	8	8		
	" X .007"	J7257		6	6	6	6	6		
	" X .032"	J7258		4	4	4	4	4		
Twin Disc Reversing Gear Supporting Feet	7 3/4" X 1 15/16" X .003"	K6072	2						8	8
	" X .007"	K6573							6	6
	" X .032"	K6574							4	4

L3 & L3B ENGINES

Location of Shims	Dimensions of Shim	Dwg. No.	Number of Supporting Feet	Total number of Shims to be supplied per each Engine Reversing Gear Unit. 3L3 & U.G.Gear	4L3 & U.G.Gear	5L3 & U.G.Gear	6L3B 6L3 & U.G.Gear	8L3B 8L3 & U.G.Gear
Engine Supporting Feet	9 5/16" X 2 5/8" X .003"	J7247	None for 3L3, 4L3 & 5L3 Four for 6L3 & 8L3 6L3B & 8L3B				16	16
	" X .007"	J7248					12	12
	" X .032"	J7249					8	8
	8" X 2 5/8" X .003"	J7244	Four for 3L3, 4L3 & 5L3 None for 6L3 & 6L3B Two for 8L3 & 8L3B	16	16	16		8
	" X .007"			12	12	12		6
	" X .032"	J7246		8	8	8		4
UG Reversing Gear Supporting Feet	5 15/16" X 2 5/8" X .003"	J7250	2	8	8	8	8	8
	" X .007"	J7251		6	6	6	6	6
	" X .032"	J7252		4	4	4	4	4