Engine Specifications

Decarbonizing

Removing the Engine

Engine Assembly Procedure

Engine Cooling System

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Engine Specifications Decarbonizing Removing the Engine Engine Assembly Procedure

The Type 100B and B2 engine of 'Bristol' manufacture is an overhead valve six cylinder unit of 2 litres capacity. Bore 66 m/m (2.598 inch). Stroke 96 m/m (3.779 inch). Capacity 1971 c.c. Compression Ratio 8.5 to 1. RAC rating 16.2 H.P. Maximum power 105 bhp. at 5.000 rpm. Cylinder Block fitted with 'Brivadium' dry liners. Aluminium alloy cylinder head with steel 'shrunk-in' inserts for valves and bronze inserts for sparking plugs. Polished hemispherical combustion chambers. Overhead valve inclined at 80° operated by vertical and cross-head rods. K.L.G. P. TEN. L.70 Sparking Plugs.

Camshaft mounted in four pressure lubricated bearings and driven by a duplex chain.

Three multiple jet down draught carburettors fitted with air cleaner.

Aluminium alloy pistons and forged steel connecting rods. Forged steel crankshaft, nitride hardened and statically and dynamically balanced. Fitted with lead indium shell type steel backed bearings. Torsional vibration damper incorporating fan drive fitted to front end of crankshaft.

Fan and positive pump water circulation cooling system with thermostatic control. Thermo syphon circulation from head to block.

High pressure lubrication by Hobourn Eaton type oil pump to all engine bearings via full flow oil filter with provision for external oil cooler.

Maintenance of the engine is dealt with in two categories.

Decarbonizing.

Each component or section of the engine in its detailed form.

Decarbonizing

It is recommended that the following joints and gaskets should be obtained before starting this work.

N.310200	Joint Push Rod Cover.
N.321310	Joint - Rocker Box Section.
N.321330	Joint - Rocker Box - Exhaust.
N.321970	Joint - Rocker Box - Inlet.
N.322880	Gasket - Cylinder Head.
N.350240	Joint - Water Pump-Head.
N.350250	Joint - Water Pump - Pump.
N.360740	Joint - Oil Filter.
N.370030	Gasket - Exhaust Manifold (2)
N.370170	Joint - Carburettor Adaptor (3)
N.373320	Joint - Carburettor (3)
N.380110	Joint - Distributor Drive Casing.

This set of Gaskets is known as DEC.3. and can be ordered as such from a 'Bristol' Distributor or agent or direct from the works.

Dismantling, Decarbonizing and Reassembly

Disconnect the negative terminal from the battery.

Drain the water from the engine by opening the drain tap on the radiator and the drain tap on the left hand side at the rear of the cylinder block.

Remove the Hose connections between the radiator and the water pump.

Withdraw the sparking plug leads.

Detach the oil feed pipe and the revolution drive cable from the distributor drive casing by unscrewing the union nuts.

Detach the distributor drive casing complete with the Distributor by removing the two 5/16" BSF Bolts and the two lower nuts & washers.

NOTE. Care must be taken to ensure that the distance piece behind the casing at the bolt location is not mislaid. This is selective for thickness.

Disconnect the throttle and mixture controls from the engine end.

Disconnect the fuel pipe connections from the carburettors.

Detach the return spring on the carburettor control shaft unit and slacken off both fulcrum adjusting screws until the ball ends of the screws are clear of the sockets.

Detach the three carburettors, together with the three joint washers by removing the six 5/16" BSF nuts and spring washers. The H.T. clip can also be removed at this stage.

Detach the two fulcrum brackets and the centre adaptor unit together with the three joint washers by removing the six 5/16" BSF countersunk head screws.

Continuation of procedure after Carburettors have been removed.

Detach the oil transfer pipe connecting the cylinder head and block.

Detach the exhaust pipes from the cylinder head.

Remove the fan belt.

Unscrew and remove the fourteen nuts securing the cylinder head to the block using special spanners N.600121 Box Spanner (with Tommy Bar N.600131) and N.600161 Ring Spanner and the sequence given in Fig.1 for tightening and loosening the nuts.

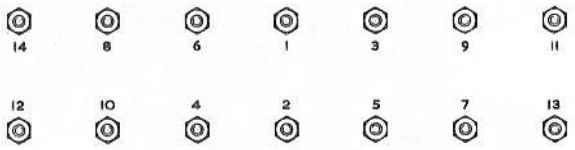


Fig. 1. Sequence of cylinder head nuts.

Work the cylinder head loose gently and lift off, care being taken to ensure that the push rods remain in position in the block otherwise they may be damaged if caught up in the head.

Remove and discard the Cylinder Head gasket.

Remove the Water Pump. This is not essential but will considerably facilitate the handling of the cylinder head on the bench.

Using special Plug Spanner N.600010 (with Tommy Bar N.600131) remove the sparking plugs.

Detach the rocker covers by unscrewing the eight knurled hand nuts. Remove the joints and the small rubber seals at the ends of the cylinder head.

Detach the seven rocker spindle caps securing each rocker shaft by removing the fourteen special nuts.

Lift out the rocker shafts holding the rockers at each end to prevent them from being pushed outwards against the action of the compression springs. After removal insert a pin into the hole at each end to retain the rockers on the shafts.

Remove the auxiliary push rods.

Using a valve spring lifter compress the valve springs and remove the split valve cotters, the valve springs, the valve spring seatings and the valves.

Important.

All of the parts of this assembly should be retained together and should be assembled back into its identical position at a later date.

With all the valve removed proceed to remove carbon from the combustion and exhaust ports of the cylinder head.

Remove the carbon from the valve guides using a small bristle brush.

Remove the carbon from the valves which should then be polished.

Using a rubber suction cup and suitable 'coarse' and 'fine' valve grinding paste, grind in the valve ensuring that a matt finish is obtained on the valve seatings. Bright rings or any signs of 'pitting' on the seatings would not be good enough.

The maximum width of the seating should be .060 inch Inlet and .080 inch Exhaust and if in excess of this the valve seats should be recut.

When the valves are satisfactory it would be advisable wherever possible to lap the face of the cylinder head. Using a medium grade lapping compound (not coarse which will score the aluminium) on a surface plate lap the face until a good even matt finish is obtained.

The carbon should be removed from the top of the pistons the surrounding cylinder block being carefully covered to prevent the carbon deposit from falling into any part of the engine.

Parts should then be washed thoroughly and all traces of grinding compound or any foreign matter should be removed.

Assembling

All valve springs and rocker compression springs should be carefully examined for fractures or damage. If considered necessary the valve springs could be checked to the figures given in the data of the valve operating group.

Replace the valves back into their original positions in the cylinder head and fit the springs, seatings and cotters. See that the variable pitch valve springs are assembled close-coiled end downwards.

Insert the auxiliary push rods.

Fit the exhaust rocker assembly to the head using assembly plates Fig.2 and ensure that the spindles locate on the dowel in the front of the cylinder head and with the dowel hole in the shaft. A slot is provided at the rear end of each shaft and a screwdriver can be used to rotate the shaft for positioning. The shaft should then be secured by the seven rocker spindle caps.

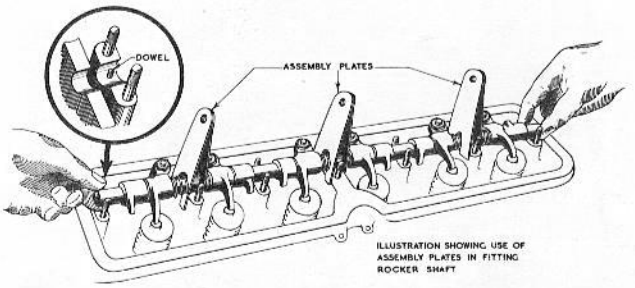


Fig. 2. Rocker shaft assembly showing use of plates.

The Assembly plates can be made up to the dimension given in Fig. 3

The Inlet rocker assembly can be assembled to the head using the same procedure as the exhaust side and finally attached with the seven rocker spindle caps.

Clean and check the sparking plugs which should have a

gap of .018 inch to .020 inch and screw them into the head.

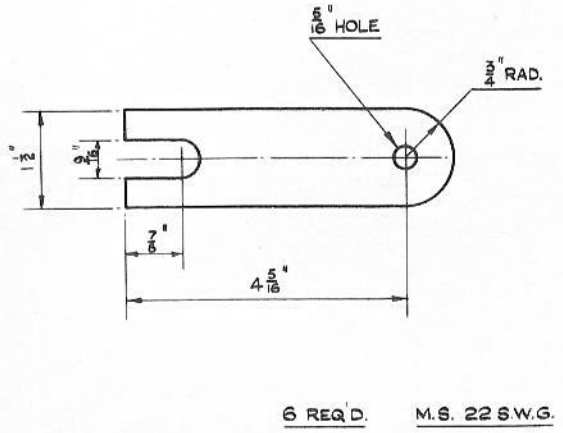


Fig. 3. Assembly plate sketch.

Attach the water pump to the head using new joints slightly smeared with grease.

Before fitting the cylinder head to the block the twelve vertical push rods should be removed and also each of the tappet bodies. Frequently tappets may be removed by hand two holes being provided for a simple hook extractor. However, a carbon deposit may form around the base of the tappet in which case a special extractor tool is illustrated in use at Fig.4 and a fully dimensioned drawing at the end of this Engine Section.

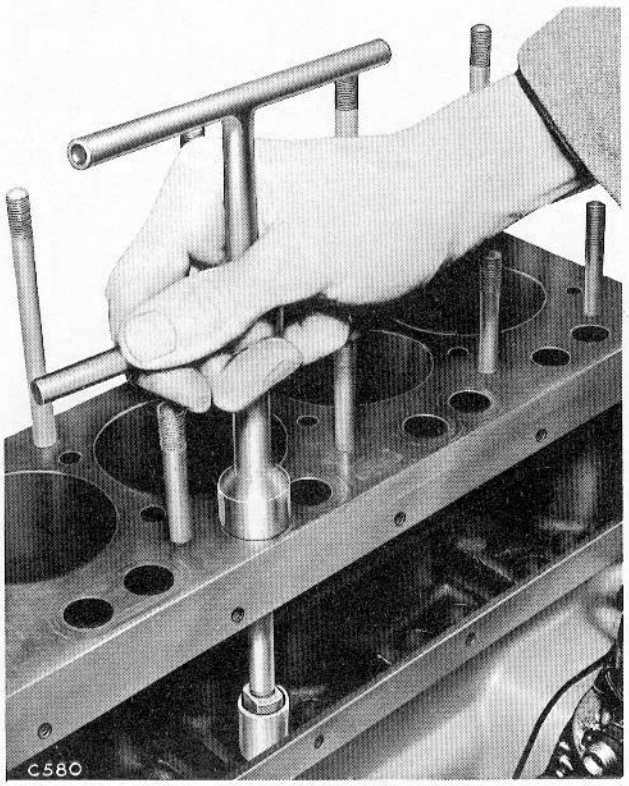


Fig. 4. Tappet withdrawing.

Examine the tappet base and very slight initial pitting which may have taken place early in the life of the engine is not considered to be serious but it is important to examine whether even this slight pitting is deep or whether there is any likelihood of minute pieces having been broken away, in which case a new tappet should be fitted. In all cases of extensive pitting new tappets should be fitted.

Refit the tappets and the vertical push rods.

Fit a new cylinder head gasket and fit the cylinder head to the block, carefully ensuring that the vertical push rods are not damaged or bent as the head is lowered into position.

When the auxiliary and vertical push rods are positioned and the cylinder head is seating on its face, replace and tighten the fourteen holding down nuts gradually using the correct spanners (as for loosening) and the correct sequence given. The nuts should first be tightened so that they are just pinching the head and thereafter one sixth of a turn at a time through the sequence given until all nuts are fully tightened.

A torque loading figure is not considered practical due to the inaccessability of the cylinder head nuts and it is therefore recommended that the correct 'Bristol' ring and box spanners should be used.

The valves can now be adjusted to the correct settings. The correct clearance between the rockers arms and the valve is most important. Valve clearances should be set to .005 when cold. This setting should give a clearance of .012 which should be checked on the Exhaust and Inlet sides when the engine has attained an indicated temperature of 70°C to 75°C.

Turn the engine with the starting handle until No.6 Inlet Valve is fully open. No.1 Inlet Valve will then be fully closed. Slacken the locknut on No.1 Inlet valve rocker screw and adjust the screw to obtain a clearance of .005 between the rocker arm and the face of the valve. See Fig. 5 Hold the adjusting screw, tighten the locknut and recheck. Check the remaining valves in a similar manner. The valve open and closed positions being given on Page 6.

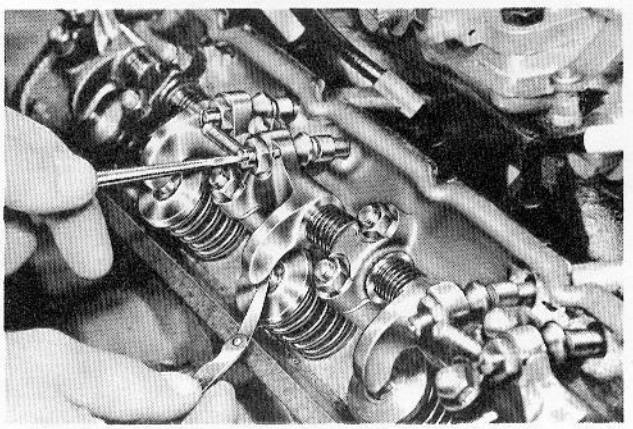


Fig. 5. Tappet adjustment.

When the valve settings have been finally adjusted replace the half round rubber seals in the ends of the

cylinder head. Using new joints assemble the rocker covers into position and secure with the eight hand nuts.

Inlet		Exhaust	
Valve open	Valve closed	Valve open	Valve closed
No.6	No.1	No.6	No.1
No.5	No.2	No.5	No.2
No.4	No.3	No.4	No.3
No.3	No.4	No.3	No.4
No.2	No.5	No.2	No.5
No.1	No.6	No.1	No.6

Valve open and closed positions.

Fit the fan belt and adjust to the correct tension of 1" deflection inwards, by hand, on its upward run see Fig. 6

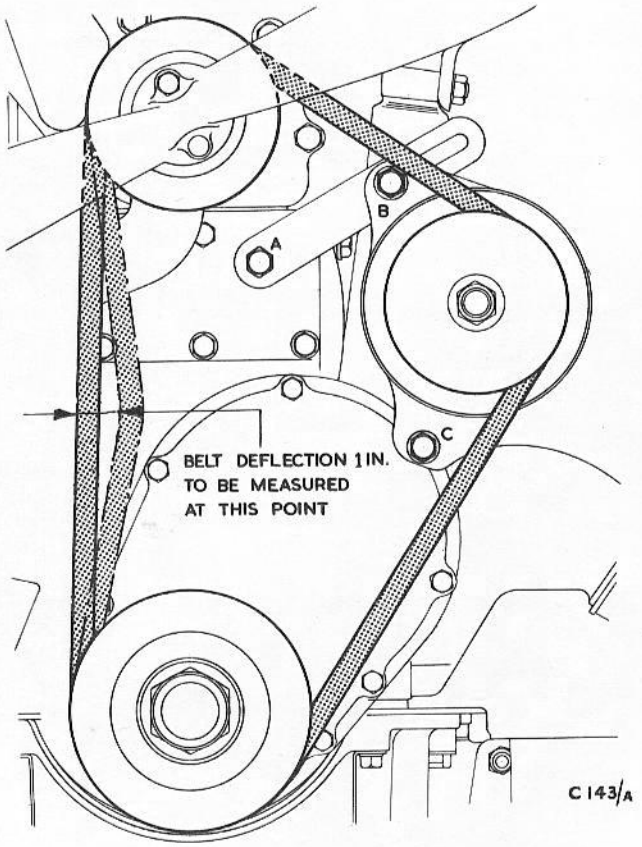


Fig. 6. Fan belt adjustment.

Using new gaskets attach the exhaust manifolds.

Attach the oil transfer pipe connecting the cylinder head with the block.

Attach the carburettors by reversing the procedure given for removing.

Connect the fuel pipe to the carburettors.

Connect the mixture and throttle controls.

Attach the Distributor and its drive shaft assembly to the block and head. Use a new joint on the lower facing and ensure that the driving tongue of the shaft is meshing correctly before tightening the nuts. See also that the selective distance piece is correctly positioned behind the top bolt location before tightening the two bolts Fig. 7

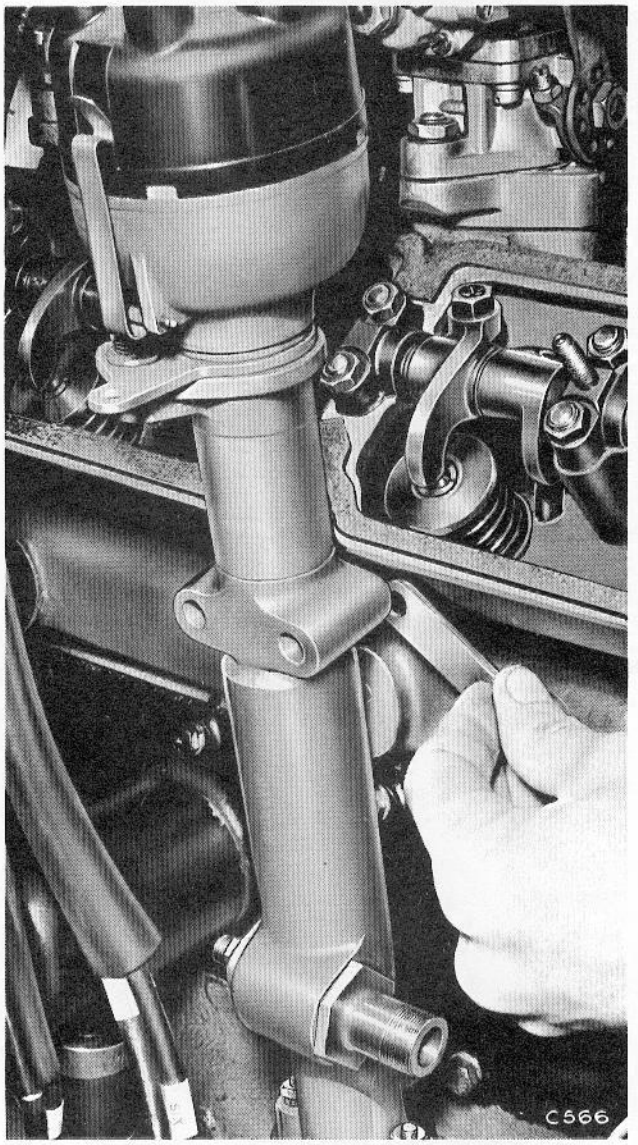


Fig. 7. Distributor drive distance piece.

Check and adjust the contact points to give a clearance of .014 to .016 inch.

Attach the spark plug adaptors to the plugs.

Attach the hose connections to the radiator and water pump.

Fill the radiator with water and connect the negative terminal to the battery.

Removing the Engine

Drain the water from the cooling system at the radiator and cylinder block taps.

Disconnect the battery.

Remove the sump drain plug and allow the oil to drain. Refit the plug. Remove the oil temperature thermometer bulb from the sump and stow it, with its capilliary tube on the chassis frame to avoid damage.

Disconnect the leads from the dynamo.

Disconnect the coil H.T. and L.T. leads from the distributor and tie them to the bulkhead clear of the engine.

Disconnect the tachometer drive from rear end of the distributor drive casing.

Disconnect the oil pressure gauge pipe from its union just aft of the dipstick.

Slacken the dynamo mounting and adjusting bolts, press the dynamo as far as possible towards the engine and remove the fan belt. Do not attempt to ride the belt off the pulleys or the core of the belt may be damaged. Retighten the bolts.

Disconnect the mixture control wire.

Turn off the fuel tap to prevent possible tank syphoning and disconnect the flexible pipe from the front of the fuel pump.

Disconnect both Radiator hoses from the water pump and radiator. Disconnect the rear heater connection and remove the copper pipe complete with its connections and the radiator hose. Disconnect the Trico windscreen washer connection from the front of the cylinder head.

Break the locking wire and slacken the exhaust down pipe ring nuts but do not release them.

Disconnect the water thermometer bulb unit from the side of the cylinder block (between the exhaust manifolds) and stow it with the capillary tube on the chassis face to avoid damage.

Remove the vertical throttle control rod (passing through the rear manifold) and replace the nuts on their respective ball joints for safe keeping.

Disconnect the cable from the starter motor.

On earlier cars the radiator has a fixed fan guard jutting out from the header tank and if this should be the case it will be necessary to completely remove the water pump.

On later cars the fan guard of the radiator is detachable. This should be removed and the water pump allowed to remain in position.

Unscrew the ring nuts from the exhaust down pipes. It is advisable to support these pipes to prevent straining the front silencer joints when the lower clip is released subsequently.

Fitting the Engine Sling

Fit the engine lifting sling TFN.5029 to a hoist a convenient height above the engine. Pass the free end of the short (front) cable around the front end of the crankshaft (behind the pulley) and hook it to the front ring of the lifting bar. Pass the free end of the long (rear) cable beneath the sump at the rear just forward of the clutch housing and hook to the rear of the lifting bar. See Fig. 8

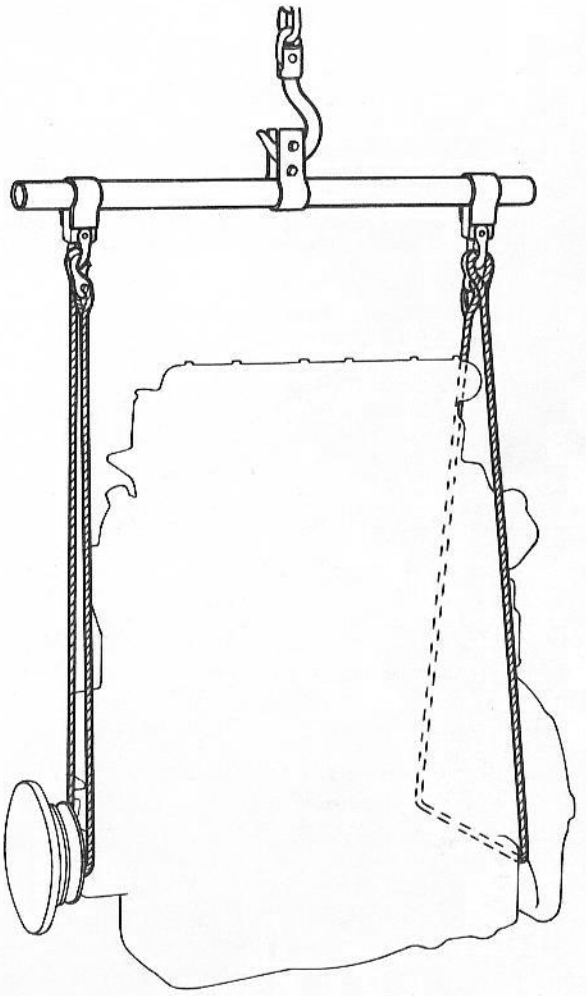


Fig. 8. Engine lifting sling in use.

Raise the hoist until the weight of the engine is taken on the sling.

Remove the gearbox from the car as described in Section 5.

Remove the nuts and bolts securing the front engine mounting blocks to the chassis.

Raise the engine carefully from the car and manoeuvre clear while lifting.

To instal the actual engine reverse the removal procedure.

To instal a replacement engine it should be prepared

for installation in accordance with the removal procedure i.e. removal of the water pump if the radiator has a fixed fan guard and removal of the fan belt with the dynamo in its fullest inward position.

Referring to Modifications in this book it is important to note that an engine with a Viscous damper may not fit into any Type 404 Car or any Type 405 Car up to Chassis 4051. At Chassis 4052 the front cross member and front spring attachment was redesigned to provide clearance for the Viscous Damper.

Engine Assembly Procedure

Assuming that an engine is being completely rebuilt using a new or reconditioned Cylinder Block or Crankshaft then the following sequence of operations should be broadly used. The various operations are dealt with in detail throughout this section of the manual.

With the cylinder block resting on its top face:

(1) Check the crankshaft end float by fitting the crankshaft and a temporary sleeve to the front end.

It is not usual for this end float to be outside of the limits but it is recommended that this is checked should the crankshaft or the block have to be rejected.

(2) Check the camshaft end float.

When these checks have been made and are satisfactory the parts should be removed and the cylinder block thoroughly washed off.

(3) Fit the camshaft and the distributor drive pinion.

(4) Swing the Connecting Rods on the crankshaft journals without the pistons and when satisfactory remove them.

(5) Assemble the pistons to the connecting rods.

(6) Check the piston ring gaps in the bore and assemble to the piston.

(7) Fit the piston and connecting rod assemblies to the block.

(8) Fit the crankshaft.

(9) Fit the drive sprockets, chain, camshaft drive cover and engine damper and assemble the connecting rods to the crankshaft.

(10) Fit the Oil Pump and Sump complete with baffles.

(11) Fit the Flywheel and Clutch Cover assembly.

(12) Reverse the engine to rest on the sump.

(13) Fit the Cylinder Head with the carburettors and Air Filter manifold.

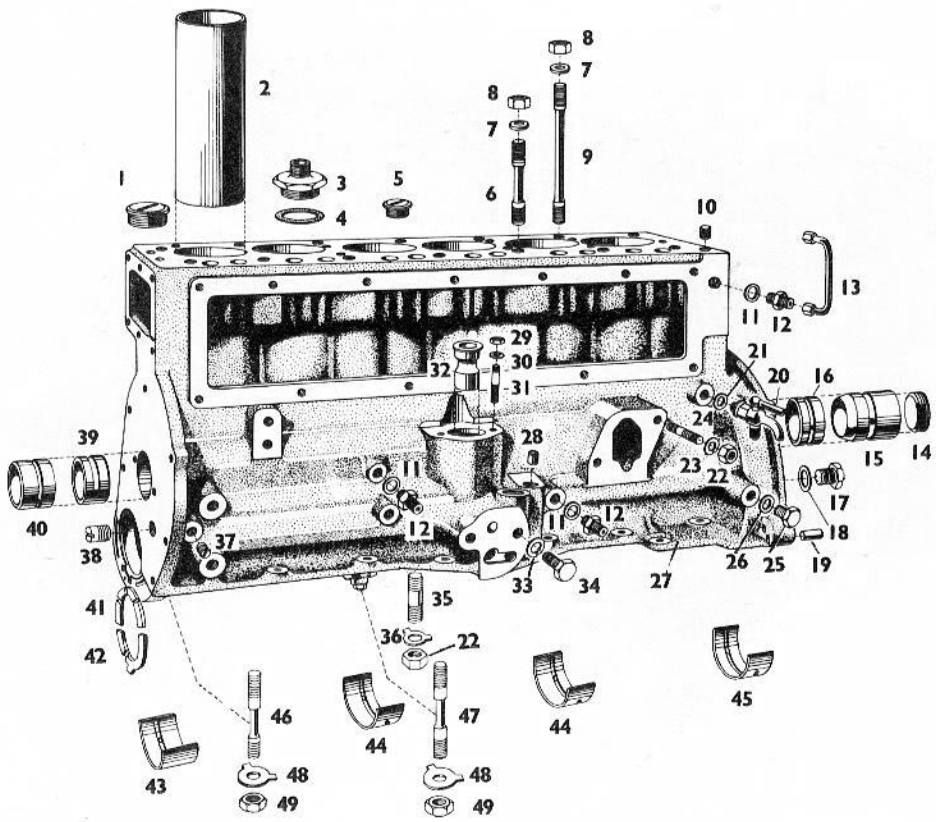
(14) Fit the Distributor Drive assembly and Air Cleaner.

(15) Fit the Oil Filter, Petrol Pump, Sump Breathing System, Dynamo, Starter etc.

Cylinder Block Group

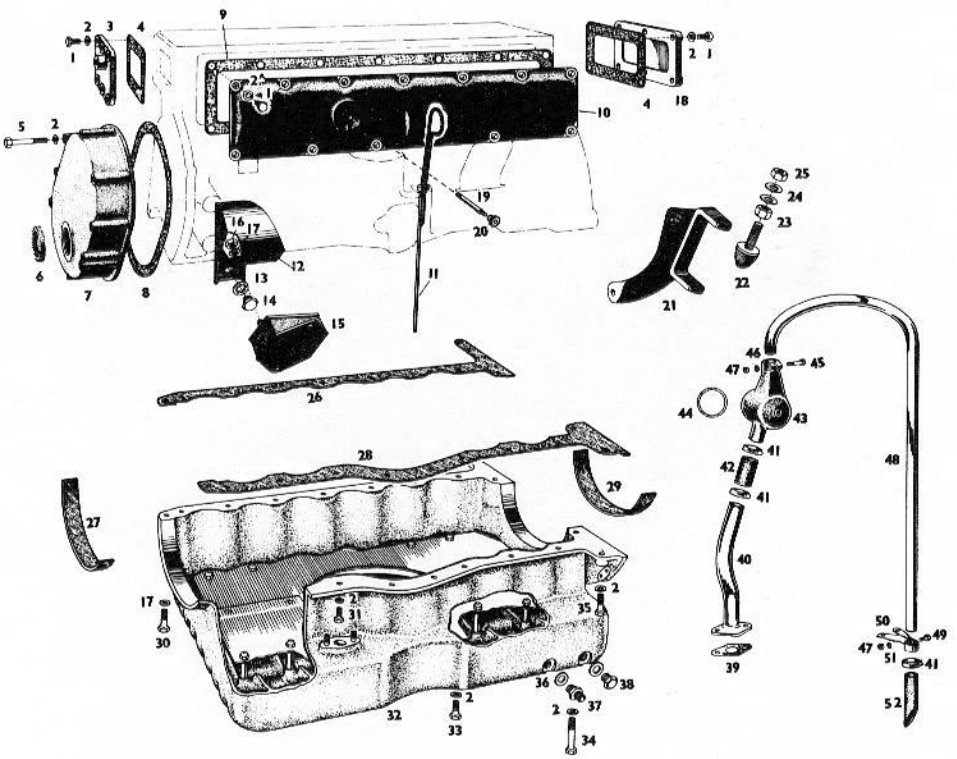
CYLINDER BLOCK GROUP BLOCK. MAIN BEARINGS.

Part No.	Item	Description	No. off per car	Part No.	Item	Description	No. off per car
N.310480	1	Core Plug - large	1	N.312800	34	Bolt - Oil Cleaner	2
N.312750	2	Cylinder Liner	6	N.312600	35	Stud - Oil Pump	2
N.311540	3	Thermo Union	1	N.310380	36	Tabwasher - Oil Pump	2
N.311760	4	Thermo Union Washer	1	FBS.361/J	37	Blank Plug - Oil Gallery	1
N.310490	5	Core Plug - small	2	FBS.361/P	38	Blank Plug - Oil Gallery	1
N.314560	6	Stud - Cyl. Head Securing - short	7	N.311360	39	Camshaft Bearing - Mid-Front	1
N.312420	7	Washer - Cylinder Head	14	N.312410	40	Camshaft Bearing - Front	1
N.311680	8	Nut - Cylinder Head	14	N.313590	41	Thrust Plate - Top Half	2
N.314550	9	Stud - Cyl. Head Securing - long	7	N.313770	-	Thrust Plate - Top Half + .0025 thickness	-
FBS.361/G	10	Blank Plug	1	N.313790	-	Thrust Plate - Top Half + .005 thickness	-
N.310910	11	Washer (Union)	3	N.313600	42	Thrust Washer - Bottom Half	2
N.311730	12	Union	3	N.313780	-	Thrust Washer - Bottom Half +.0025 thickness	-
N.311520	13	Oil Transfer Pipe Unit	1	N.313800	-	Thrust Washer - Bottom Half + .005 thickness	-
N.311420	14	Blank Plug - Camshaft Bearing	1	N.313130	43	Main Bearing - Front Starboard	2
N.310680	15	Camshaft Bearing - Rear	1	N.313220	-	Main Bearing - Front .010 Undersize	-
N.311370	16	Camshaft Bearing - Mid-Rear	1	N.313230	-	Main Bearing - Front .020 Undersize	-
FS.109/4D	17	9/16" Setscrew	1	N.314470	-	Main Bearing - Front .030 Undersize	-
N.310510	18	Alum. Washer	1	N.314480	-	Main Bearing - Front .040 Undersize	-
FBS.379/G6	19	Dowel - Bearing Cap & Clutch Casing	10	N.313940	44	Main Bearing - Centre - Starboard	4
N.312010	20	Drain Tap	1	N.314320	-	Main Bearing - Centre .010 Undersize	-
FBS.515	21	Washer - Drain Tap	1	N.314330	-	Main Bearing - Centre .020 Undersize	-
FN.105/L	22	Nut - Petrol Pump & Oil Pump	4	N.314510	-	Main Bearing - Centre .030 Undersize	-
AGS.585/E	23	Spring Washer - Petrol Pump	2	N.314520	-	Main Bearing - Centre .040 Undersize	-
N.312580	24	Stud - Petrol Pump	2	N.313930	45	Main Bearing - Rear - Starboard	2
N.310450	25	Blank Plug - Oil Gallery	2	N.314300	-	Main Bearing - Rear .010 Undersize	-
N.310460	26	Washer - Blank Plug - Oil Gallery	2	N.314310	-	Main Bearing - Rear .020 Undersize	-
N.313370	27	Cylinder Block Unit	1	N.314490	-	Main Bearing - Rear .030 Undersize	-
N.311580	28	Bush - Dipstick	1	N.314500	-	Main Bearing - Rear .040 Undersize	-
FN.104/L	29	Nut - Distributor Bracket	2	N.313580	46	Stud - Main Bearing - Front	2
AGS.585/D	30	Spring Washer - Distributor, Bracket	2	N.312680	47	Stud - Main Bearing	6
N.312590	31	Stud - Distributor Bracket	2	N.310360	48	Tabwasher - Main Bearing	8
N.310710	32	Distributor Drive Gear Bush	1	N.312700	49	Nut - Main Bearing	8
AGS.585/F	33	Spring Washer	2				



CAMSHAFT DRIVE COVER SUMP

Part No.	Item	Description	No. off per car	Part No.	Item	Description	No. off per car
WS. 104/5D	1	Setscrew - Push Rod Cover	25	N. 310160	27	Joint - Front - Sump	1
AGS. 585/D	2	Spring Washer	48	N. 313280	28	Joint - Inlet Side - Sump	1
N. 430371	2A	Fibre Washer	13	N. 312360	29	Joint - Rear - Sump	1
N. 311130	3	Blanking Plate - Front	1	WS. 105/10D	30	Setscrew - Sump Rear	2
N. 311140	4	Gasket - Blanking Plate	2	N. 312640	31	Bolt - Sump	15
WB. 104/17D	5	Bolt - Camshaft Drive Cover	8	N. 313150	32	Sump Unit	1
N. 312550	6	Felt Washer	1	WB. 105/10D	33	Bolt - Sump - Rear	1
		Used up to Chassis 4136		WB. 105/18D	34	Bolt - Sump - Rear	2
N. 313910	-	Felt Washer	1	WB. 105/8D	35	Bolt - Sump - Rear	1
		Used on and after Chassis 4137		FBS. 517	36	Washer - Thermo Union	1
N. 311181	7	Camshaft Drive Cover	1	N. 314450	37	Magnetic Drain Plug complete with Washer	1
		Used up to Chassis 4136		N. 312240	38	Thermo Union	1
N. 314440	-	Camshaft Drive Cover	1	N. 313320	39	Sump Pipe Gasket	1
		Used on and after Chassis 4137		N. 313630	40	Drain Pipe - Separator Box to Sump	1
N. 311170	8	Joint - Camshaft Drive Cover	1	-	41	Clip - Jubilee No. 1	3
N. 310200	9	Joint - Push Rod Cover	1	N. 313690	42	Hose - Drain from Separator	1
N. 313410	10	Push Rod Cover	1	N. 313650	43	Separator Box	1
N. 310930	11	Dipstick Unit	1	N. 313700	44	Joint Washer - Rubber	1
N. 314540	12	Dipstick Unit - LHD Cars only	1	FB. 104/12D	45	¼" BSF Bolt	1
N. 311490	12	Mounting Bracket - Nearside	1	-	46	¼" Shakeproof Washer	1
N. 311500	-	Mounting Bracket - Offside	1	FN. 104/L	47	Nut ¼" Hex.	2
-	13	7/16" Shakeproof Washer	4	N. 314280	48	Extractor Pipe R.H.D.	1
FS. 107/6D	14	7/16" BSF Setscrew	4	N. 314290	-	Extractor Pipe L.H.D.	-
N. 311270	15	Mounting Block	2	FB. 104/8D	49	Bolt ¼" BSF	1
FN. 105/L	16	5/16" BSF Nut	4	N. 313740	50	Clip complete	1
AGS. 585/E	17	Spring Washer	8	-	51	¼" Spring Washer	1
N. 312370	18	Blanking Plate - Rear	1	N. 313710	52	Hose - Extractor Pipe	1
N. 313670	19	Stud for Separator Box	1				
N. 313660	20	Retaining Nut	1			On later Engines a long Dipstick was	
N. 311220	21	Torque Buffer Bracket	1			introduced together with a Clip and	
N. 311280	22	Torque Buffer	2			Revised Extractor pipe	
FN. 107/L	23	7/16" BSF Nut	2				
AGS. 585/G	24	Spring Washer	4	N. 314650	-	Dipstick	1
FN. 207/L	25	7/16" BSF Locknut	2	N. 314660	-	Clip	1
N. 313290	26	Joint - Exhaust Side - Sump	1	N. 314640	-	Extractor Pipe	1



Cylinder Block Group

General Data

Material	Cast Iron.
Cylinder Liners	'Brivadium Dry'
Interference of Liner in Bore	.003 to .004 inch (0.080 to 0.1 m/m)
Load required to press in Liners	4 to 6 tons. (4.06 to 6.09 tonnes)
Finished Bore size	Controlled by Piston See Piston Clearance. Crankshaft Group.
Camshaft Bearing Material	Phosphor Bronze

Camshaft Bearing location in Piston Block.

Front	1.675 + .0007 inch. (42.55 + .018 m/m)
Mid-Front	1.695 + .0007 inch. (43.05 + .018 m/m)
Mid-Rear	1.715 + .0007 inch. (43.55 + .018 m/m)
Rear	1.735 + .0007 inch (44.05 + .018 m/m)

Interference fit of Camshaft Bearings in Cylinder Block.

Front, Mid-Front & Mid-Rear	.0016 inch to .0028 inch. (.04 m/m to .07 m/m).
Rear	.0026 inch to .0038 inch. (.065 m.m to .096 m.m).

Finished Bore of Camshaft Bearings.

Front	1.460 + .001 inch. (37.084 + .025 m/m).
Mid-Front	1.440 + .001 inch. (36.576 + .025 m/m).
Mid-Rear	1.420 + .001 inch. (36.068 + .025 m/m).
Rear	1.260 + .001 inch. (32.00 + .025 m/m).

(see sectional view of Cylinder Block)

Replacements

Service replacement Cylinder Blocks are available from the manufacturer. They are supplied subject to the return of the removed cylinder block which is accepted for normal wear only. Cracked cylinder blocks, even considered repairable, are not accepted in exchange.

A works reconditioned cylinder block is supplied complete with all bushes and studs and with the exception of the insertion of some studs (omitted for transport purposes) the block is ready to fit to the engine. If pistons are required they should be ordered with the replacement block in order to control the specified piston clearance.

Reboring

Cylinder liners may be rebored to one oversize only which is .010 above nominal size and pistons are available for this size. For general checking purposes, to see if the bore will 'clean up' a size of 2.608 inch (66.254 m/m) should be used but the finished bore should be honed to give the specified piston clearance. See Re-sleeving.

Re-Sleeving

The cylinder liners can be removed by two methods.

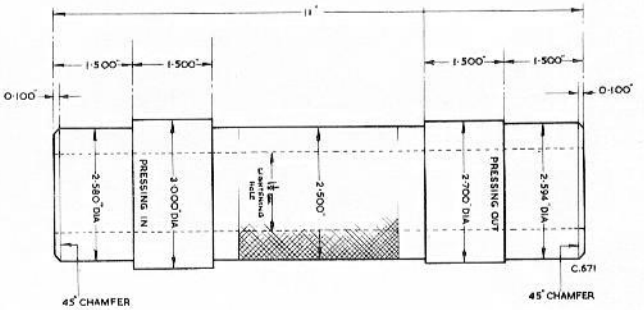


Fig. 9. Spigot for removing liners.

(A) Using a hand press only and a special spigot Fig. 9 as illustrated in Fig.10

(B) By offsetting the bore in boring machine and cutting down the side of the liner until it can be collapsed and taken out. It should be noted that the wall thickness is only approximately .050 inch (1.27 m.m) when new and careful boring is necessary to avoid cutting past the liner into the cylinder block.

Fitting New Cylinder Liners

Check the cylinder bores and if necessary carefully stone any scores.

Check the internal diameter of the bore and the external diameters of the new liner to ensure that the recommended interference given in General Data is obtained.

Lightly oil the cylinder bore and the external surface of the liner and with the assembly beneath the ram of a press capable of exerting the load given in General Data, press the liner steadily into the cylinder bore until level with the cylinder block face. See Fig.10

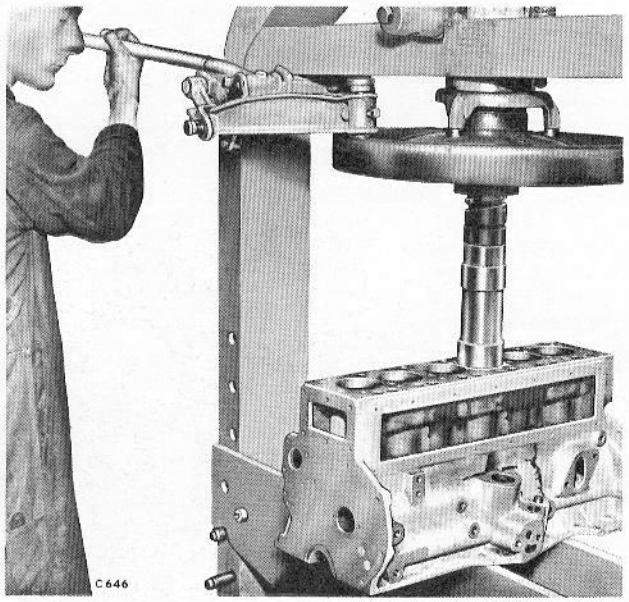


Fig. 10. Removing and refitting cylinder liners.

After fitting the liners, skim grind the top face of the block to ensure a flat face.

Carefully blend each valve head cut-away, to a good surface finish, to conform with that of the cylinder block. See Fig.11 Machine the two connecting rod clearance slots, in each liner, inside the cylinder block.

Bore and hone the liner to give the correct Piston clearance as follows:

Clearance in cylinder bore checked cold on thrust face at bottom of skirt.	.0022 to .0026 inch (.056 to .066 m/m)

Finally attention should be paid to the cleanliness of the block and in particular to the oilways.

Camshaft Bearings

If resleeving of the Cylinder Block is being carried out due to normal wear then it would follow that the Camshaft bearings would need attention. Check the bores as given in General Data and if the clearance for the camshaft journals is in excess of .002 to .003 inch (.051 to .076 m/m) they should be replaced to avoid low oil pressure.

To replace the bearings proceed as follows:

(1) Unscrew the blanking plug from the rear bearing.

(2) Using a suitable drift, drive out the bearings.

(3) Check that each bearing location is clean and free from scores and burring.

(4) Check the outer diameter of each new bush and its relevant bore in the cylinder block to ensure that the correct interference is obtained. See General Data.

Camshaft Bearings .002 (.051 m/m) oversize on the

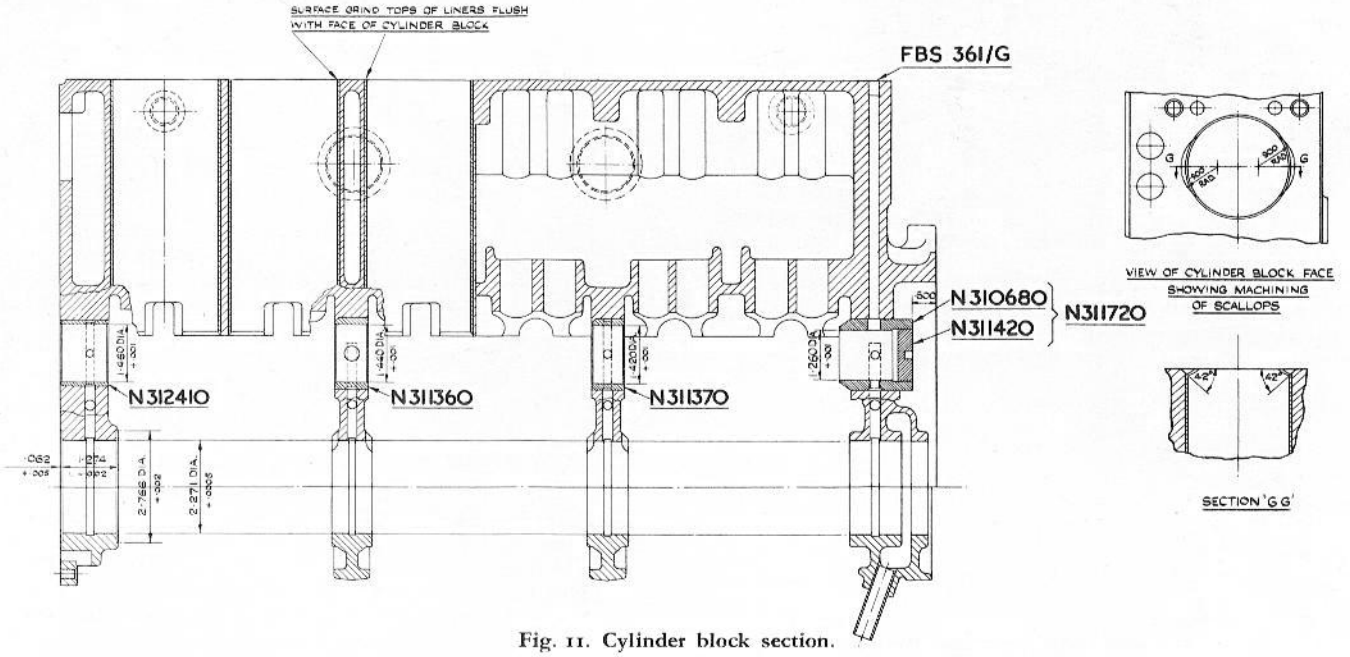


Fig. 11. Cylinder block section.

outside diameter are available although not listed in the Spare parts.

(5) To insert a bearing, freeze for 5 to 10 minutes and insert them, chamfered end towards the front of the block in each instance. If necessary use a soft metal drift to tap them into position.

When fitting the mid-front bearing, make certain that the oil holes are aligned correctly with the holes in the block, the larger hole must align with the oil feed port at the bottom and the smaller hole with the port towards the outer wall of the block.

When fitting the rear bearing ensure that the larger hole is aligned with the oil feed port at the top.

See Sectional view of Cylinder Block Fig.11

Sizing the Camshaft Bearings

At the works the bearings are reamered to size using a hand line reamer comprising of the arbor T.181646 and the four detachable reamers T.185379-81 and 82 given in a fully dimensioned drawing at the back of this Section.

Where reamering facilities are not available the bearings should be scraped to size using the camshaft for alignment and finally checking with actual camshaft diameters to see that the correct running clearance is obtained. See Fig.12

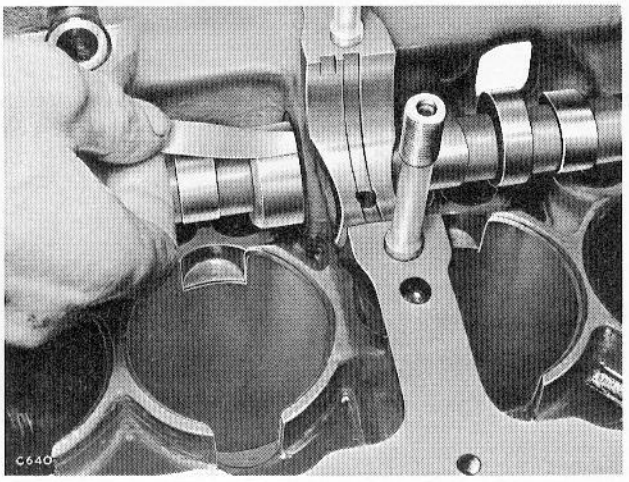


Fig. 12. Camshaft. clearance.

Whichever operation takes place it is essential that particular attention is paid to the cleanliness of the oil-ways to the extent of unscrewing the plugs of the oil galleries.

Fit a new blanking plug to the rear camshaft bearing as follows. Coat the threads of the plug with jointing compound and screw in the plug leaving 1.1/2 to 2 threads standing proud. Lightly peen the plug around the thread root diameter. Screw the plug further in until about 1 thread is proud then peen again to lock it firmly.

Replacing Bearing Caps

Bearing caps are not supplied as spares as they are fitted to the cylinder block and line bores in position being finally stamped for identification and position on each block. A bearing cap from any one position would not interchange from block to block.

However in the event of loss or breakage a bearing cap, unfinished in the bore, but machined ready to attach to the block can be supplied.

The block would then have to be set-up in a boring machine and accurately bored to the existing half bore in the cylinder block. See the sectional view of the Cylinder Block Fig.11 and do not bore above the size given in order to retain the correct fit for the shell bearings.

Replacing Distributor Drive Bushes

Bushes for this location in the cylinder block are supplied to size. The existing bush can therefore be driven out and a new bush inserted by freezing or carefully driving into position with a suitable soft drift.

Sump

Removing (engine installed) See Fig.13

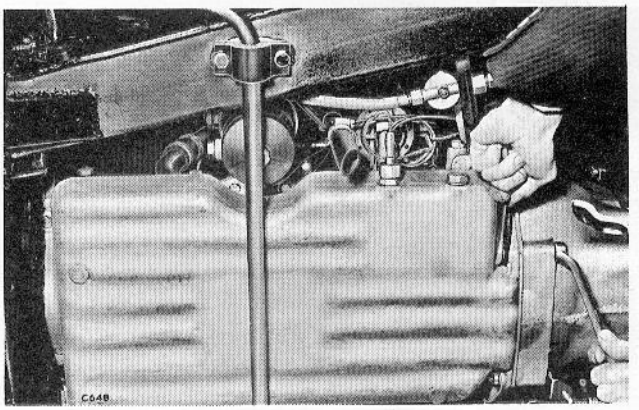


Fig. 13. Sump removing.

Remove the drain plug from the sump allow the oil to drain and refit the plug.

Remove the nuts of the lower bolts securing the clutch casing to the sump flange and detach the exhaust pipe clip on the right hand side and the lower fixture of the torque buffer bracket on the left.

Remove the two nuts and washers securing the oil separator to sump pipe and slacken the pinch bolt of the oil separator to atmosphere sufficiently to slide within the clip.

Unscrew the union nut and withdraw the oil thermometer bulb from its location forward of the sump drain plug. Take care to prevent damage to the bulb and capillary tube and ensure that the small joint washer is not lost.

Remove the nut and bolt securing the upper end of the torque buffer bracket, pull the buffers clear of the chassis frame and remove.

Remove the nuts and spring washers securing each anti-roll bar attachment to the chassis and allow the anti-roll bar to hang downwards.

Remove the nineteen set-bolts and spring washers from the sump flange and move the separator pipe bracket clear.

Lower the rear end of the sump and pull its rearwards and downwards clear of the engine.

It may be more convenient to remove the oil filter during this operation but this is not essential.

Finally remove and discard the four sump face joints.

Refitting

Before refitting the sump ensure absolute cleanliness of the sump flange face and its corresponding face on the engine.

Apply an even coating of good quality jointing compound to the joint faces of the sump and allow it to set "sticky".

Fit two new side joints and press firmly into position, followed by new joints at each end, approximately 1/8" inch (3.18 m/m) of each side of the end joints should stand proud of the side joints. This surplus should remain in order to obtain a tight seal when the joints are compressed into position.

If necessary fit a new joint at the flange attachment of the separator pipe.

Smear an even quantity of grease over the exposed surfaces of the sump joints and offer up the sump into position on the engine.

Locate the separator pipe flange on the studs in the sump.

Fit the nineteen set bolts and spring washers and, with the separator pipe bracket in its correct position, tighten the bolts evenly.

Fit the nuts and spring washers to the separator pipe flange and tighten. Tighten the pinch bolt of the separator box.

Refit the torque buffer mounting bracket to the left hand side and the bolts to the right hand side with the exhaust pipe support clip and tighten securely.

Fit the oil thermometer bulb with its sealing washer and secure it with the union nut.

Position the anti-roll bar and secure the attachments.

Refill the sump to its correct level with the recommended oil.

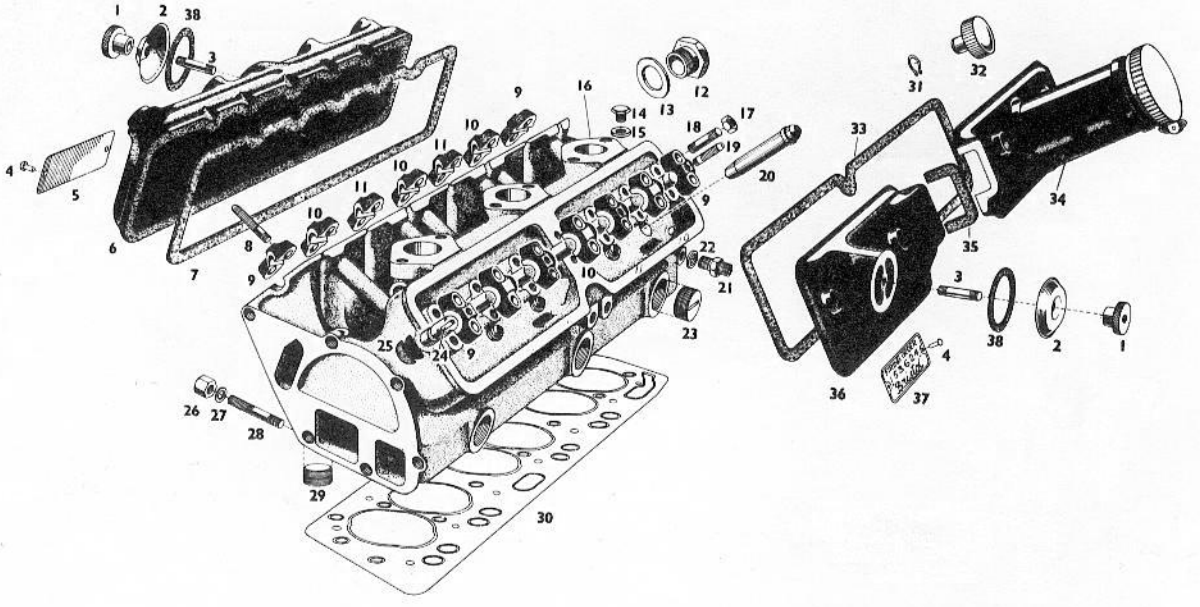
After running the engine for a while, check the joints for satisfactory fitting.

To remove and refit the sump with the engine removed from the car refer to the appropriate paragraphs of the foregoing procedure with engine installed.

Cylinder Head and Valve Operating Group

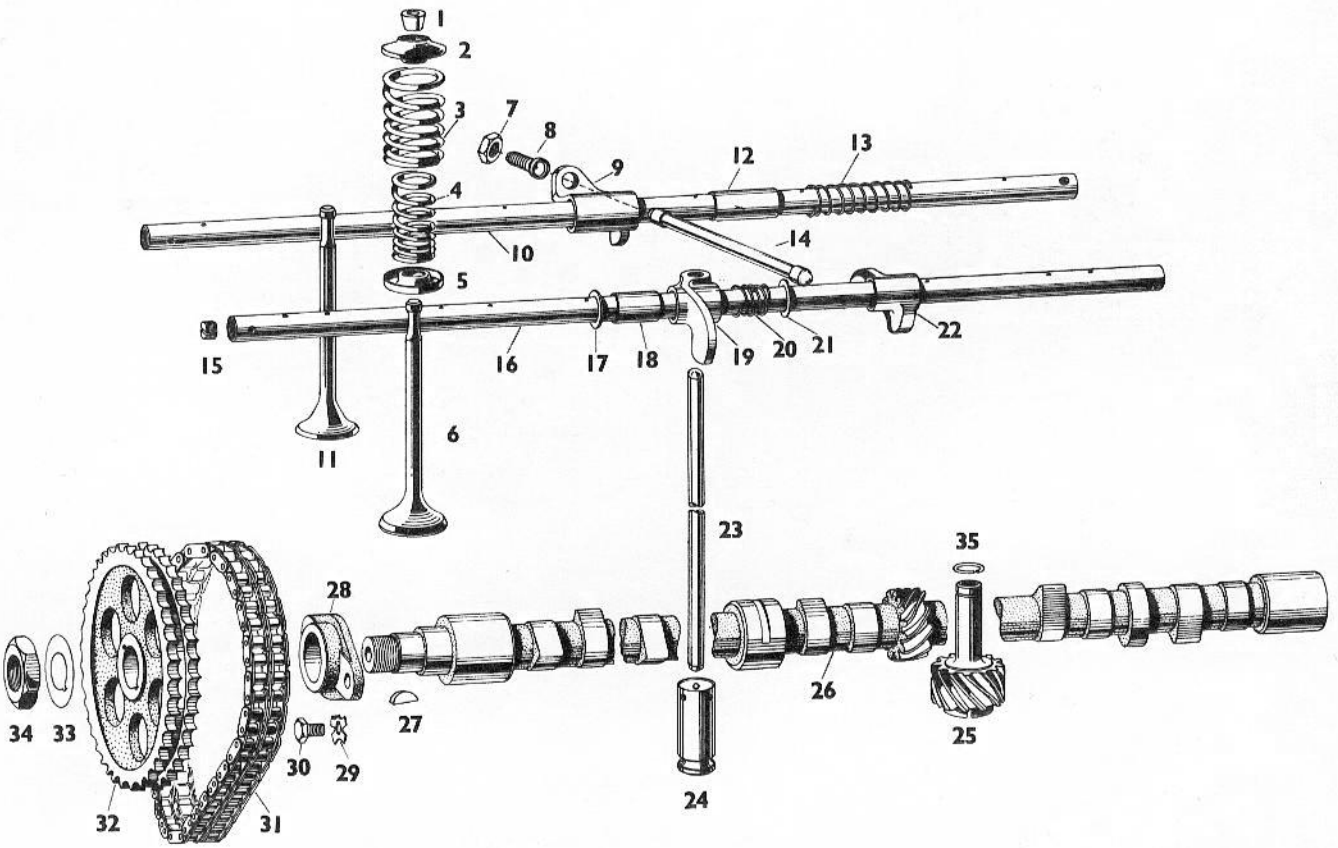
CYLINDER HEAD GROUP

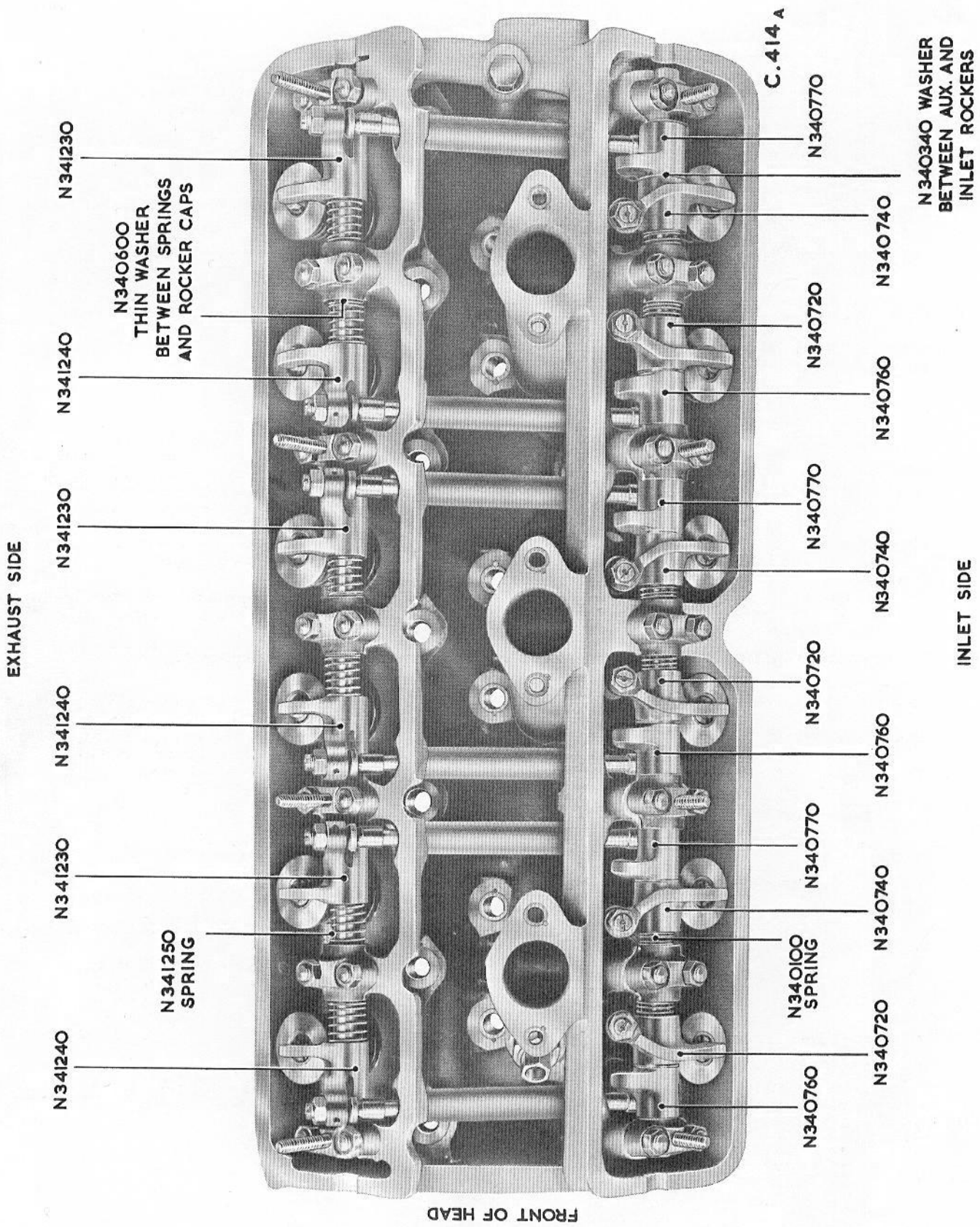
Part No.	Item	Description	No. off per car	Part No.	Item	Description	No. off per car
N.320310	1	Nut - Blanking Plate	2	N.321580	-	Valve Guide + .010 o/d	-
N.320740	2	Blanking Plate	2	N.322230	-	Valve Guide + .030 o/d	-
N.321780	3	Stud - Blanking Plate	2	N.311730	21	Union - Oil Transfer	1
N.321360	4	Rivet - Snap Head	4	N.310910	22	Washer - Oil Transfer	1
	5	Engine Number Plate	1	N.320150	23	Core Plug - Large	3
N.321080	6	Cover - Rocker Box - Exhaust	1	FBS.579/B4	24	Dowel - Rocker Spindle	2
N.321330	7	Joint - Rocker Box - Exhaust	1	N.320110	25	Seal - Rocker Box	4
N.321730	8	Stud - Rocker Spindle Cap	4	N.370060	26	Nut - Exhaust Manifold	8
N.320170	9	Rocker Spindle Cap	4	AGS.585/E	27	Spring Washer	8
N.320190	10	Rocker Spindle Cap	6	N.321750	28	Stud - Exhaust Manifold	8
N.320200	11	Rocker Spindle Cap	4	N.320160	29	Core Plug - Small	2
N.321110	12	Plug	1	N.322880	30	Gasket - Cylinder Head	1
FBS.537	13	Washer	1	(N.321980)			
FS105/3D	14	Setscrew	1	N.320220	31	Circlip - Retaining Nut	8
N 320460	15	Washer	1	N.321640	32	Retaining Nut	8
N.322690	16	Cylinder Head Unit (100 B Engine)	1	N.321970	33	Joint - Rocker Box - Inlet	1
N.322080	-	Cylinder Head Unit (100 B2 Engine)	-	N.321001	34	Inlet - Rear - Rocker Box - Cover	1
N.320340	17	Nut - Rocker Spindle Cap	28	N.321310	35	Joint - Rocker Box Section	1
N.321770	18	Stud - Rocker Spindle Cap	28	N.320071	36	Inlet - Front - Rocker Box Cover	1
N.321710	19	Stud - Rocker Spindle Cap	4	N.320850	37	Plate - Ignition Timing	1
N.321381	20	Valve Guide - Std. Size	12	N.320300	38	Joint - Breather Pipe	2



VALVE OPERATING GROUP

Part No.	Item	Description	No. off per car	Part No.	Item	Description	No. off per car
N.340300	1	Valve Cotter - in halves	12	N.340720	19	Inlet Rocker Unit R.H. Bushed	3
N.340280	2	Spring Seating - Upper	12	N.340740	-	Inlet Rocker Unit L.H Bushed	3
N.341560	3	Valve Spring - Outer	12	N.340100	20	Compression Spring - Short	6
N.341550	4	Valve Spring - Inner	12	N.340340	21	Washer	6
N.340620	5	Spring Seating - Lower	12	N.340760	22	Aux. Rocker Unit L.H. Bushed	3
N.340880	6	Inlet Valve	6	N.340770	-	Aux. Rocker Unit R.H. Bushed	3
N.341260	7	Locknut	12	N.342140	23	Push Rod Unit. (Also N.342250)	12
N.341700	8	Rocker Adjusting Screw	12	N.341710	24	Tappet	12
N.341240	9	Exhaust Rocker Unit R.H. (Bushed)	3	N.340330	25	Distributor & Oil Pump Drive Pinion	1
N.341230	-	Exhaust Rocker Unit L.H. (Bushed)	3	N.341800	26	Camshaft	1
N.340840	10	Exhaust Rocker Spindle	1	N.332620	27	Key	1
N.341510	11	Exhaust Valve	6	N.340420	28	Retaining Plate - Camshaft	1
N.340310	12	Rocker Bush	6	N.341210	29	Tabwasher	2
N.341250	13	Compression Spring - Long	6	WS.104/4D	30	Setscrew ¼" dia. x ½" long	2
N.342390	14	Aux. Push Rod Unit	6	N.340580	31	Chain	1
N.340650	15	Rocker Spindle Plug	4	N.342000	32	Chain Wheel	1
N.341220	16	Inlet Rocker Spindle	1	N.340440	33	Washer	1
N.340600	17	Washer - Rocker Spindle	12	N.340430	34	Nut	1
N.340140	18	Rocker Bush	12	N.340830	35	Circlip	1





Plan view of cylinder head showing the inlet and exhaust rocker assembly

Cylinder Head and Valve Operating Group

General Data

Cylinder Head

Material.	Aluminium Alloy.
Valve Seats.	Shrunk in 'Brimol' inserts.
Valve seat angle.	45°
Valve seat location bore in head	.4787 + .0005 inch. (12.159 + .013 m/m).
Interference fit of valve guide in Cylinder Head	.0008 to .0018 inch. (.02 to .04 m/m).

Valve Guides and Valve stems-Inlet and Exhaust.

Valve Guide bore diameter	.3125 inch (7.94 m.m)
Valve Stem diameter	.3105 inch (7.89 m/m)
Desired Clearance between valve stem and guide-cold	.002 to .0028 inch (.05 to .07 m/m)
Inlet and Exhaust Valve Seat Angle.	45

Valve Springs-Outer - N.341560.

Free length.	1.678 (42.85 m/m)
Length when loaded to 54 ± 4 lb.	1.028 inch (26.111 m/m)
(24 .5 ± 1.8 Kg)	

Valve Springs-Inner N.341550

Free length	1.625 inch (41.275 m/m)
Length when loaded to	
47.5 ± 4 lb. (20.6 ± 1.8 Kg.)	1.028 (26.111 m/m)

Rocker Spindle and Rockers.

Rocker Spindle diameter	.509 inch (12.93 m/m)
Rocker Bush Bore diameter	.510 inch (12.95 m/m)
Desired clearance between Spindle and Bush	.001 to .0018 inch (.03 to .04 m/m)

Tappets

Bore in Cylinder Block	.787 + .0005 inch (19.99 + .01 m/m)
Tappet outside diameter	.7865 - .0005 (19.96 - .01 m/m)
Tappet in Cylinder Block desired clearance.	.0005 to .0015 inch (.01 to .038 m/m)

Cylinder Head Replacements

Service replacement Cylinder Heads are not available from the manufacturer. In the event of cracking on the face between the combustion chambers or corrosion of the water holes the cylinder head can be sent to the manufacturer, by arrangement, for possible repair. No liability can be accepted for this work as after pre-heating, welding, machining and final pressure testing the head may be considered as scrapped.

In the event of cracking within the combustion chambers the head should be considered as scrap.

Replacement of Valve Seats

In the event of the 'Brimol' valve seats needing replacement the head should be returned to the manufacturer wherever possible. Where it is not practicable to return the head oversize seats are available but they will only be issued without liability and on request only.

They are shrunk into position and torque tested with special tools and equipment.

Fitting Replacement Valve Guides

Replacement valve guides are available as follows:

N.321381	Valve Guide-Std. .481 inch o/d.
N.321580	Valve Guide +.010 inch o/d.
N.322230	Valve Guide +.030 inch o/d.
N.322850	Valve Guide +.040 inch o/d (Rough turned).

Remove the old valve guide from the head with a stepped drift and a hammer. Should they be tight the bore should be drilled out carefully to reduce the wall thickness as the soft aluminium of the head can easily pick-up and score badly.

To fit a new guide first measure the bore in the head and check with the figures given in General Data of this section. In many instances a standard valve guide will prove satisfactory particularly if the old guide has been carefully removed.

Do not attempt to ream or enlarge the bore in the cylinder head or mal-alignment will occur.

Should a standard guide be too small select an oversize valve guide and grind the outside diameter to give the correct interference fit required.

It is preferable to freeze replacement guides for insertion but failing this the guide should be drifted carefully into position.

The bore of the valve guide is in all instances supplied in a broached finished size and if fitted correctly should accept the valve stem to give the desired clearance.

Replacing Rocker Bushes

Press out, rather than drift out, the existing bushes.

Replacement bushes are supplied undrilled. After pressing new bushes into position they should have the oil holes drilled through the bush from the rocker. At the ends of the rocker are half round oilways approximately .020 inch deep. The new bushes should be filed out to conform to these grooves.

The bores of the new bushes will be tight to a new spindle and should be scraped or reamed out to the figure given in the General Data of this section.

The tightness of the bores however may be used to advantage on a worn spindle.

For Removal, Dismantling and re-assembly of the Cylinder Head see DECARBONIZING.

For the inspection and replacement of tappets see DECARBONIZING.

Valve Timing

Checking the valve timing should be carried out using the Valve Timing Diagram Fig.15 shown overleaf.

On Type 404 Engines and on Type 405 Engines up to Chassis 4066 it will be necessary to determine the T.D.C. positions as described in IGNITION TIMING.

On Type 405 Cars Chassis 4067 onwards provision has been made for checking the valve timing by clear markings on the flywheel at 10^{o} before T.D.C. and also at T.D.C. These markings can be positioned using a central marking on an aperture which is located at the top right hand side of the clutch housing and is covered by a swing cover.

Replacing the Timing Chain

This cannot be carried out with the engine installed in the car, it is therefore recommended that the chain is replaced at overhaul intervals rather than running it to the limits of its life and thus destroying the timing wheel and sprocket tooth formation.

If however the chain has to be replaced remove the engine, remove the camshaft drive cover and dismantle the front of the crankshaft and camshaft as given in the crankshaft and the camshaft groups. The engine need not be inverted.

Camshaft

Removing

With the engine removed from the chassis, remove the cylinder head and the distributor drive. Remove the push rod cover and extract the vertical push rods and the tappets.

Remove the engine damper and carrier pulley with the camshaft drive cover.

Detach the sump and from inside remove the circlip from the spindle of the distributor and oil pump drive pinion. Withdraw the pinion from the top through the distributor drive casing aperture.

Remove the chain wheels together with the chain and remove the camshaft retaining plate.

The camshaft can then be removed from the front of the block.

Refitting the Camshaft

Fit the camshaft and check the clearance in the bores as shown in Fig.12 This should be .002 inch to .003 inch and any excess of this would result in loss of oil pressure.

Check the end float by temporary attaching the camshaft retaining plate and tightening the two setscrews. Fit the chain wheel and tighten the retaining nut. Check the end float as shown in Fig.14 which should be .004 inch to .0062 inch.

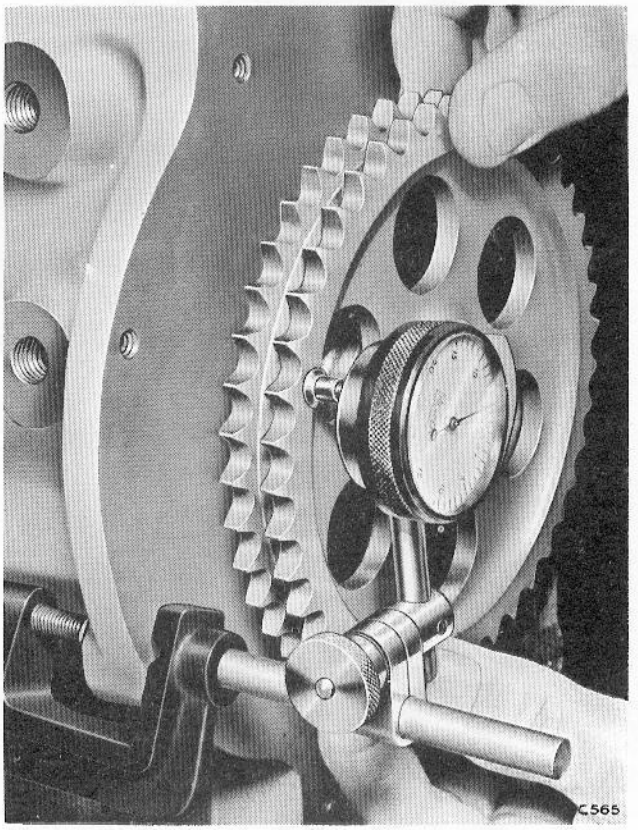


Fig. 14. Camshaft end float.

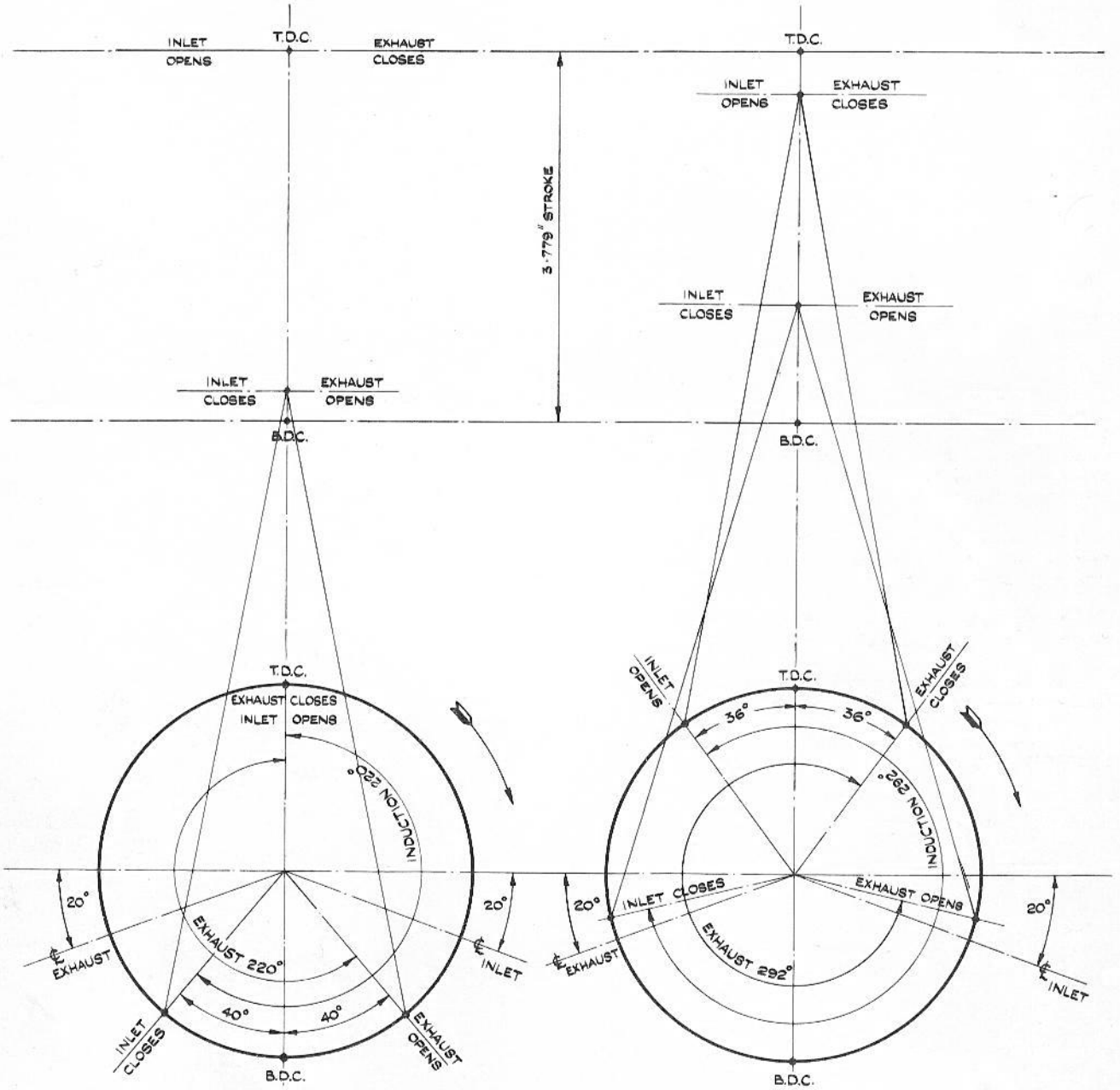


DIAGRAM I

FOR POSITIONING CAMSHAFT.
Nº 1 CYL.ª INLET & EXHAUST VALVE
CLEARANCE SET TO ·044" (COLD)

DIAGRAM II

SHOWING VALVE TIMING UNDER RUNNING
CONDITIONS WITH THE INLET & EXHAUST VALVE
CLEARANCES SET TO ·012" (HOT)

VALVE TIMING DIAGRAMS
FOR CAMSHAFT N341800

Fig. 15. Valve timing diagram. N.341880 Camshaft.

No adjustment is provided here and should the end float be incorrect then the camshaft spigot faces or the retaining plate should be ground.

When correct remove the nut and chain wheel fit tabwashers to the retaining plate setscrews and tighten and lock.

Fit the distributor and oil pump drive pinion and from the inside of the block fit the circlip. The end float of the pinion in the bush should be .0066 inch to .016 inch.

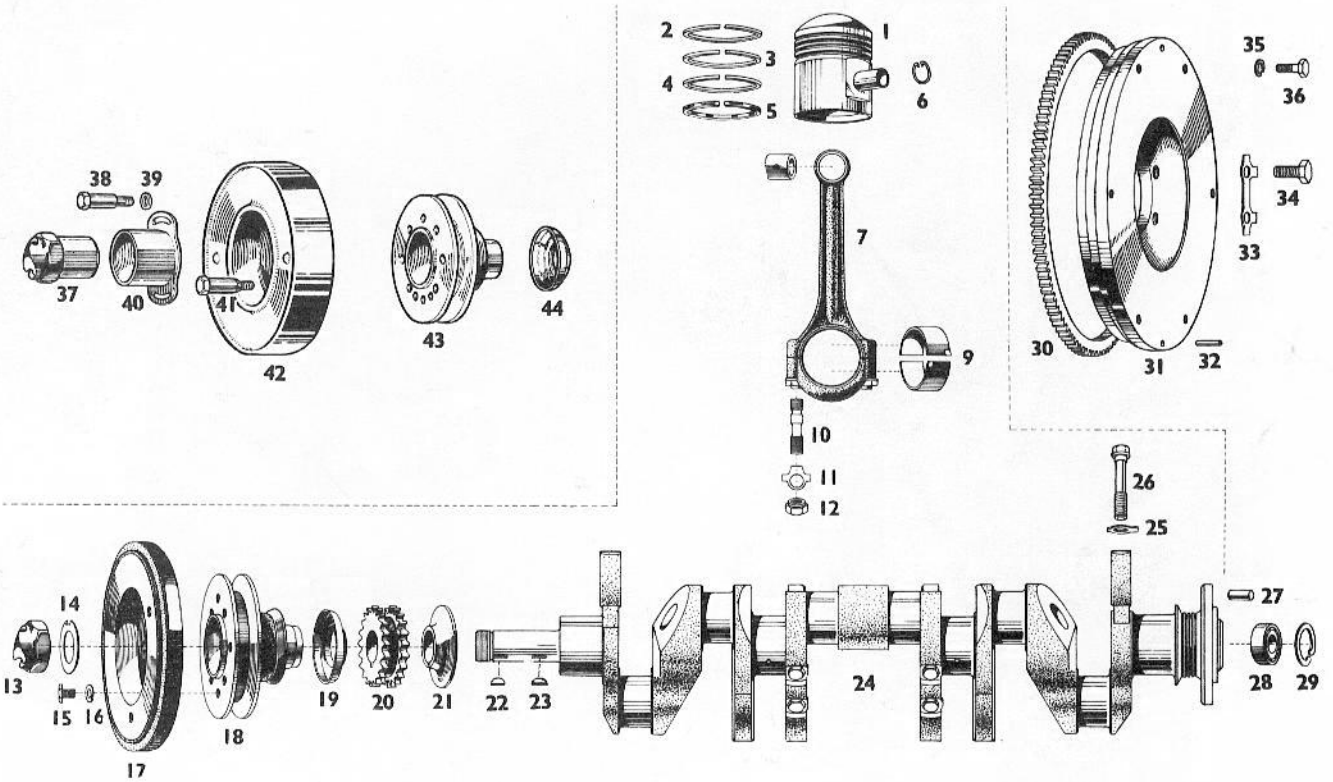
Re-assemble the front end and refit sump distributor drive, cylinder head etc.

Crankshaft Group

CRANKSHAFT GROUP. USE UP TO CHASSIS 4136

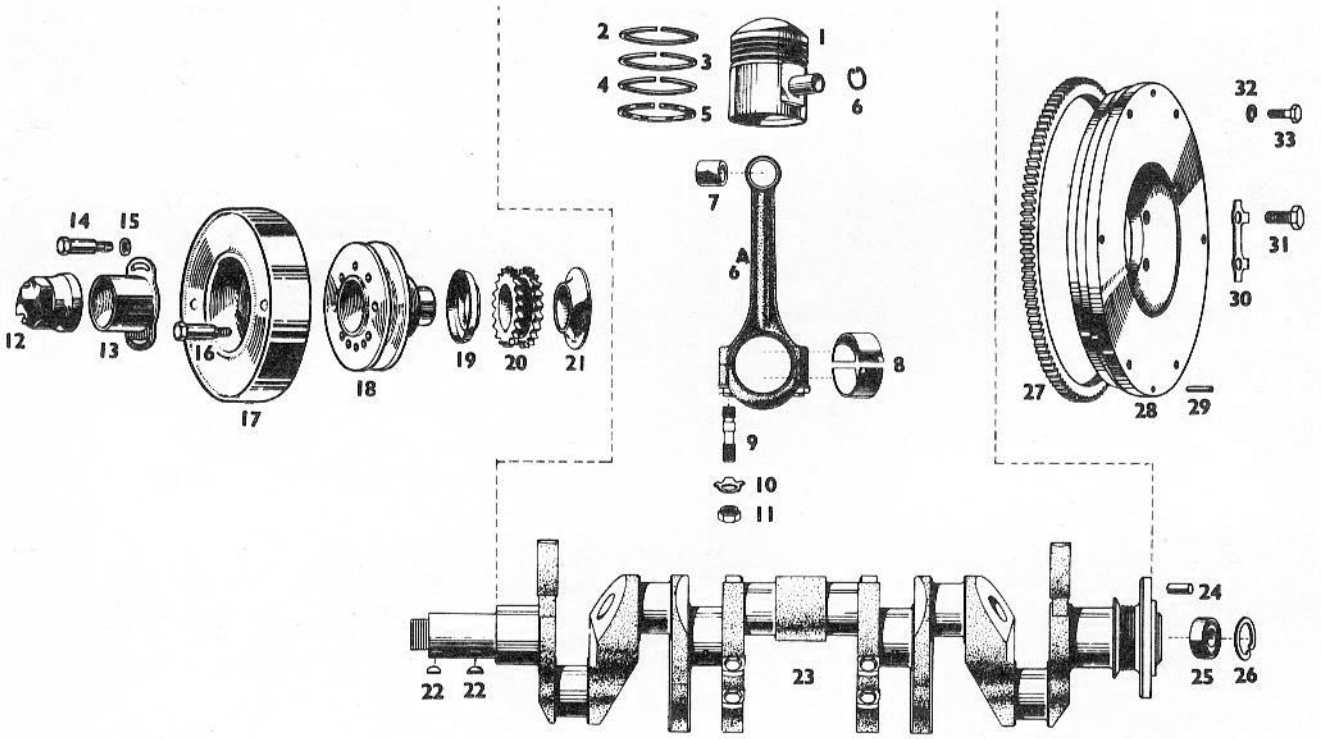
Part No.	Item	Description	No. off per car
N.332030	1	Piston Unit - Std size (Gudgeon Pin selectively fitted)	6
N.331710	-	Piston Unit .010 oversize (Gudgeon Pin selectively fitted)	-
N.331200	2	Top Compression Ring - Std.	6
N.331300	-	Top Compression Ring .010 oversize	-
N.333200	3&4	Centre & Bottom Compression Ring - Std.	12
N.333270	-	Centre & Bottom Compression Ring .010 oversize	-
N.331220	5	Scraper Ring - Std.	6
N.331310	-	Scraper Ring .010 oversize	-
N.330100	6	Circlip - Gudgeon Pin	12
N.331930	7	Connecting Rod Unit	6
N.330180	8	Gudgeon Pin Bush	6
N.331090	-	Gudgeon Pin Bush + .020 o/d	-
N.330490	9	Connecting Rod Bearing - Std.	12
N.331110	-	Connecting Rod Bearing .010 undersize	-
N.331120	-	Connecting Rod Bearing .020 undersize	-
N.331240	10	Stud-Con Rod	12
N.330170	11	Tabwasher - Con Rod	12
N.331410	12	Nut - Con Rod	12
N.330260	13	Starter Dog)Used	1
N.332010	14	Tabwasher - Starter Dog)on	1
WS.105/4D	15	Engine Damper Retaining Screw)Chassis	8
AGS.585/E	16	Spring Washer)up to	8
N.330200	17	Engine Damper Unit)4051	1
N.330690	18	Engine Damper Carrier Unit. (with 1/8" width keyway).	1
N.333320	-	Engine Damper Carrier Unit. (with 5/32" width keyway).	-

Part No.	Item	Description		No. off per car
N.330410	19	Oil Baffle (used on Chassis up to 4051).		1
N.332630	20	Drive Sprocket		1
N.330450	21	Thrust Plate		1
N.332620	22	Key - 1/8" thickness		2
N.332600	23	Key - 5/32" thickness		-
N.331970	24	Crankshaft Unit (with 1/8" width keyway).		1
N.332580	-	Crankshaft Unit (with 5/32" width keyway).		-
N.331510	25	Tabwasher - Balance Weight		12
N.351500	26	Bolt - Balance Weight		12
FBS.379/J6	27	Dowel - Flywheel		1
N.330770	28	Ball Bearing		1
N.330780	29	Circlip		1
N.33160	30	Starter Ring		1
N.331590	31	Flywheel Unit		1
FBS.379/E8	32	Dowel		2
N.331040	33	Locking Plate		3
N.332060	34	Flywheel Retaining Bolt		6
AGS.585/E	35	Spring Washer		6
N.332100	36	Clutch Retaining Setscrew		6
N.333470	37	Starter Dog)		1
N 333430	38	Securing Bolt Engine) Damper)		2
ND	39	5/16" Plain Washer)	Used on	2
N.333450	40	Locking Plate complete)	Chassis	1
N.333420	41	Securing Bolt - Engine) Damper)	4052 to	6
N.333460	42	Engine Damper)	4166	1
N.333490	43	Damper Carrier)		1
N.333500	44	Oil Baffle)		1



CRANKSHAFT GROUP. CHASSIS 4137 ONWARDS

Part No.	Item	Description	No. off per car	Part No.	Item	Description	No. off per car
N.332030	1	Piston Unit. Std. Size (Gudgeon Pin selectively fitted)	6	N.333450	13	Locking Plate complete	1
				N.333430	14	Securing Bolt - Engine Damper	2
N.331710	-	Piston Unit -010 oversize (Gudgeon Pin selectively fitted)	-	-	15	5/16" Plain Washer	2
				N.333420	16	Securing Bolt - Engine Damper	6
N.331200	2	Top Compression Ring - Std.	6	N.333460	17	Engine Damper	1
N.331300	-	Top Compression Ring .010 oversize	-	N.333540	18	Damper Carrier	1
N.333200	3&4	Centre & Bottom Compression Ring - Std.	12	N.333400	19	Oil Baffle	1
N.333270	-	Centre & Bottom Compression Ring .010 oversize	-	N.333370	20	Drive Sprocket	1
				N.333380	21	Crankshaft Thrust Plate	1
N.331220	5	Scraper Ring - Std.	6	N.332520	22	Key	2
N.331310	-	Scraper Ring .010 oversize	-	N.333520	23	Crankshaft Unit	1
N.330100	6	Circlip	12	FBS.379/J6	24	Dowel - Flywheel	1
N.333700	6A	Connecting Rod Unit	6	N.330770	25	Ball Bearing	1
N.333050	7	Gudgeon Pin Bush	6	N.330780	26	Circlip	1
N.333680	-	Gudgeon Pin Bush + .020 o/d	-	N.331990	27	Starter Ring	1
N.332330	8	Con. Rod Bearing - Std.	12	N.331590	28	Flywheel Sub-Unit	1
N.332950	-	Con. Rod Bearing .010 undersize	-	FBS.379/E8	29	Dowel	2
N.332960	-	Con. Rod Bearing .020 undersize	-	N 331040	30	Locking Plate	3
N.331240	9	Stud - Con. Rod	12	N.332060	31	Flywheel Retaining Bolt	6
N.332910	10	Tabwasher - Con. Rod	12	AGS.585/E	32	Spring Washer	6
N.331410	11	Nut - Con. Rod	12	N.332100	33	Clutch Retaining Setscrew	6
N.333690	12	Starter Dog	1				



Crankshaft Group

General Data

Main Bearings

Number.	4 (8 half-bearings).
Type.	Lead Indium Shell Type steel backed.
Torque loading of Main Bearing Cap Nuts.	28 to 30lb.ft. (4.167 to 4.464 Kg/m)
Main Bearing Journal diameters.	See Crankshaft re-grinding table.
Running clearance-Crankshaft to Main Bearings.	.002 to .0025 inch (.05 m/m to .06 m/m)
Mal-alignment limit.	.002 (.05 m/m)
Journal hardness	900 V.P.N.
Crankshaft Journal Width.	
Front.	1.466 - .002 inch (37.24 - .05 m/m)
Mid-Front & Mid Rear.	1.181 ± .010 inch (30.00 ± .025 m/m)
Rear.	1.418 ± .010 inch (36.02 ± .025 m/m)
Radius on front spigot, Main and Crankpin Journals.	
Crankshaft N.331970 N.332580	.060 Rad. (1.52 m.m)
Crankshaft N.333520 On front spigot and Front Main Journal.	.060 Rad. (1.52 m/m)
All other Main and Crankpin Journal.	.100 Rad. (2.54 m/m)
Thrust taken on.	Thrust Plate on Front Journal.
End Float of Crankshaft.	
New.	.002 to .008 inch (.05 to .20 m/m)
Worn.	.004 to .012 inch (.010 to .030 m/m)
Top and Bottom Thrust Plate Thickness.	See Crankshaft re-grinding table.
Crankpin Diameter.	See Crankshaft re-grinding table.
Torque loading of Crankshaft Balance Weight Bolts.	36 lb.ft. (5.367 Kg/m)

Connecting Rod and Pistons

Connecting Rod

Material.	Steel Forging.
Distance between centres.	6.4567 ± .002 inch (164.01 ± .05 m/m)
Small end of Rod.	
Gudgeon Pin Bush Location.	.830 + .0005 (21.08 m/m + .01 m/m)
Gudgeon Pin Bushes.	
Material.	Phosphor Bronze.
Inteference fit - Bush to Con Rod.	.001 to .002 inch (.03 to .05 m/m)
Bush Bore finished diameter.	.7097 to .0004 inch (18.026 + .010 m/m)
Gudgeon Pin to Bush clearance.	.0006 to .001 inch (.02 to .03 m/m)
Con Rod Big End Bearings.	
Type.	Lead Indium Shell Type steel backed.
Running clearance on Journals.	.0012 to .0022 inch (.03 to .05 m/m)
End Float of Con Rod on Crankshaft	.008 to .0116 inch (.020 to 2.95 m/m)
Torque loading of Con Rod Cap Nuts.	30 to 32 lb.ft. (4.46 to 4.76 Kg/M)

Pistons

Material	Aluminium Alloy. Press Forged.
Clearance in Cyl. Bore checked cold on thrust side	.0022 to .0026

at bottom of skirt.	(.056 to .066 m/m)
Number of Piston Rings to each Piston.	4
Gap when fitted to cylinder bore.	.010 to .015 inch (.25 to .38 m/m)

Replacement Crankshafts

Replacement fully balanced, reground and nitride hardened crankshafts are available from the works. They are supplied subject to the return and inspection of the removed crankshaft which will only be accepted in exchange of normally worn and not below the minimum sizes quoted in the Crankshaft regrinding table.

Inspection of Crankshaft in situ

Consistent low oil pressure, after normal adjustment of the relief valve, is usually the sign of excessive clearance between the crankshaft and the bearings.

The crankshaft cannot be removed with the engine in the car as the front bearing cannot be removed. Inspection of the three remaining bearings and the connecting rod bearings will indicate that wear and this can be carried out as follows.

Remove the sump. See procedure in this section.

Remove the two centre and the rear main bearing caps. Inspect the crankshaft for ridging and with care it can be measured for size with a vernier or micrometer and compared with the sizes given in the crankshaft regrinding table and the running clearance given in the General Data of this Section.

If favourable remove the caps and check the connecting rod bearings and journals and if these are also favourable for appearance and size then fit new bearings shells of the appropriate size to the connecting rods and the three only main bearings.

The existing half bearings will slide out from round the journals and new ones can be inserted likewise.

Replace the bearings caps, tighten to the correct torque loading figure and lock with the tabwashers.

Carried out carefully this procedure can be effective in correcting the oil pressure and save considerable time.

Removing Crankshaft from the Engine

For procedures and methods of removing assemblies and parts refer to the index.

Remove the gearbox and then the engine.

Remove the cylinder head as in Decarbonizing.

Remove the dynamo then detach the push rod cover and remove the tappets and vertical push rods.

Detach the oil filter.

If a suitable mounting stand is not available to facilitate stripping, arrange wood blocks and turn the engine so that it rests on the cylinder block face.

(1) Remove the clutch assembly followed by the flywheel.

(2) Remove the sump.

(3) Remove the oil pump and oil pump drive shaft.

Dismantle the front of the crankshaft using the following procedures.

Rubber bonded type damper. (Type 404 and early Type 405 Cars).

Release the tabwasher and remove the starter dog. R.H. thread. Then remove the complete damper and carrier complete by pulling off by hand or by careful tapping. This assembly is balanced and should not be separated unless damaged.

Viscous Type damper (later Type 405 Cars).

Break the locking wire and unscrew the eight bolts retaining the damper to the carrier. Take away the starter dog locking plate and guide tube. Carefully remove the heavy viscous damper from its spigot on the carrier. Unscrew the starter dog. R.H. thread.

Using an extractor TFN.5083 withdraw the damper carrier from the spigot of the crankshaft.

Then proceed as follows:

Remove the camshaft drive cover.

Release the tabwasher and remove the nut securing the camshaft chain wheel.

Take off the oil baffle and withdraw the chain wheel and drive sprocket complete with the chain. The chain wheel and drive sprocket are both a push fit and they should pull or prise off their respective shafts.

Take off the thrust plate and the upper and lower thrust plates from the front main bearing. Label these plates 'front' if they are not being renewed.

Remove the oil pump.

Release all tabwashers then remove the main bearing and connecting rod caps. All caps are stamped for positioning.

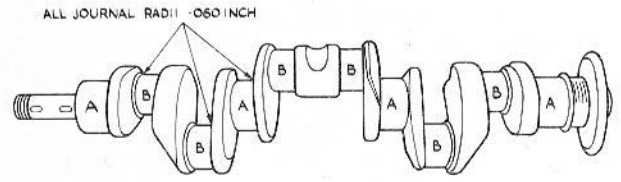
Lift the crankshaft from the block. Take the lower and upper thrust plates from the rear of the front bearing and label them 'rear' if they are not being renewed.

Inspection of Crankshaft

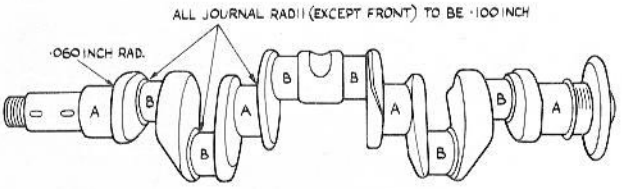
Referring to the crankshaft regrinding table check the journals for size. It will be noted that the smallest diameter undersize of the connecting rod journals is .020 inch below new and the smallest undersize of the main journals is .040 inch below new. Shell bearings are available in various stages down to these sizes and the largest possible diameter should be considered to retain the 'life' of the crankshaft.

If the crankshaft is cracked, worn, grooved or scored

below the minimum sizes given then it is scrap. No schemes, such as the chrome plating of the diameters is recommended.



CRANKSHAFT N.332580



CRANKSHAFT N.333520

MAIN DIAMETERS. A.	HALF BEARING PART Nº		
	FRONT	CENTRE	REAR
2.1245 – 0·0005 INCH (STANDARD)	N.313130	N.313940	N.313930
2.1145 – 0·0005 INCH (·010 U/SIZE)	N.313220	N.314320	N.314300
2.1045 – 0·0005 INCH (·020 U/SIZE)	N.313230	N.314330	N.314310
2.0945 – 0·0005 INCH (·030 U/SIZE)	N.314470	N.314510	N.314490
2.0845 – 0·0005 INCH (·040 U/SIZE)	N.314480	N.314520	N.314500

CONNECTING ROD DIAMETERS. B.	HALF BEARING PART Nº	
	FOR CRANKSHAFT N.332580	FOR CRANKSHAFT N.333520
1.771 – 0·0005 INCH (STANDARD)	N.330490	N.332330
1.761 – 0·0005 INCH (·010 U/SIZE)	N.331110	N.332950
1.751 – 0·0005 INCH (·020 U/SIZE)	N.331120	N.332960

THRUST PLATES	PART Nº	
	TOP	BOTTOM
0·093 – 0·002 INCH (STANDARD)	N.313590	N.313600
0·0955 – 0·002 INCH (+·0025 OVERSIZE)	N.313770	N.313780
0·098 – 0·002 INCH (+·005 OVERSIZE)	N.313790	N.313800

Crankshaft re-grinding table

If the crankshaft is satisfactory for size an exchange replacement can be obtained from the works or where this is not practicable it can be reconditioned.

Check thoroughly for cracks with magnaflux if available but otherwise visually.

Mount the shaft on 'V' blocks at the front and rear main bearing journals and check for alignment.

Remove the circlip from the recess in the rear of the crankshaft and using a standard puller remove the ball bearing. Check the ball race for wear.

Regrinding the Journals

Crankshafts are nitrogen hardened and they should be nitrogen hardened after each regrind therefore facilities should be available for this process.

The balance weights which are already stamped for correct positioning should be removed.

It is the practice at the works to grind all diameters to a pre-determined size depending on the condition of the journals i.e. all main journals to say .010 inch undersize and all connecting rod journals to say .020 inch undersize. This practice however is not essential and the crankshaft could be ground as required providing that the correct bearings are ordered.

During the regrinding operation care should be taken to retain the correct radii as given in the General Data and Crankshaft regrinding table.

Recheck for cracks after the grinding operation.

Nitriding

Prepare the shaft for nitriding by washing the shaft clean of all grease and protect the starter dog threads by an anti-nitriding agent or by covering the thread with a blanking cap.

Nitride the shaft for 12 hours at 495° C (922° F).

Lighly polish the 'bloom' from all journals. Recheck the alignment and re-check for cracks.

Finally ensure absolute cleanliness of all oil ducts.

Refit a ball race to the recess and secure with the circlip.

Refitting the Crankshaft to the Engine

With the cylinder block resting on its top face fit the correct main half bearings into position and also the top thrust plate, bronze face to crankshaft, to the rear of the front bearing.

It is important to note that all bearings are supplied carefully packed to avoid scratching or damage to the inner bearing faces. Apart from washing off the protective lanolin they are supplied ready for use and no attempt should be made to scrape them.

Lubricate the bearing surfaces and fit the crankshaft into position.

Fit a bottom thrust plate, bronze face to crankshaft, to the rear of the front bearing cap, fit half bearings to all the caps and fit the caps into the correct position as stamped.

Fit tabwashers and nuts, and temporary tighten in order to check the end float.

Fit the top and bottom thrust plates, bronze face outward, to the front of the front bearing and position the crankshaft thrust plate.

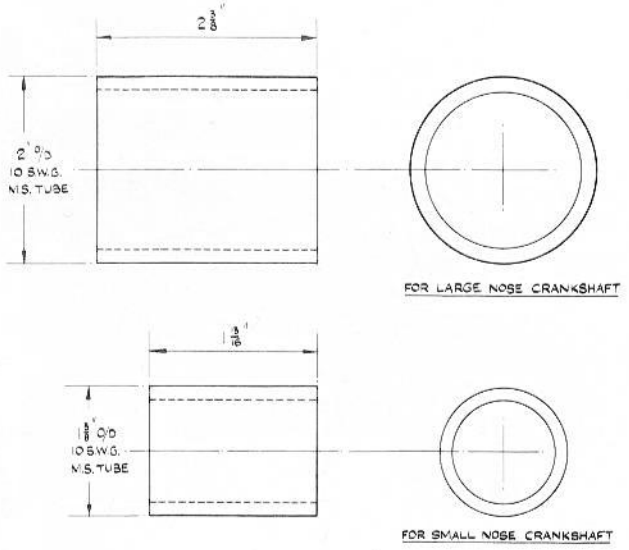
Using a temporary sleeve Fig.16 to take the place of the engine damper carrier, fit the starter dog and tighten.

With a dial indicator check the end float of the crankshaft as shown in Fig.17 using the figures given in General Data. If incorrect select and fit thrust plates from the sizes given in the crankshaft regrinding table. When satisfactory remove the starter dog and the temporary sleeve.

Tighten the bearing cap nuts to the torque loading

figure given and lock the nuts.

Remove the crankshaft thrust plate from the front of the crankshaft taking care that the thrust plates do not drop out of position.



TEMPORARY SLEEVES FOR CHECKING CRANKSHAFT END FLOAT

Fig. 16. Temporary sleeves for checking crankshaft end float

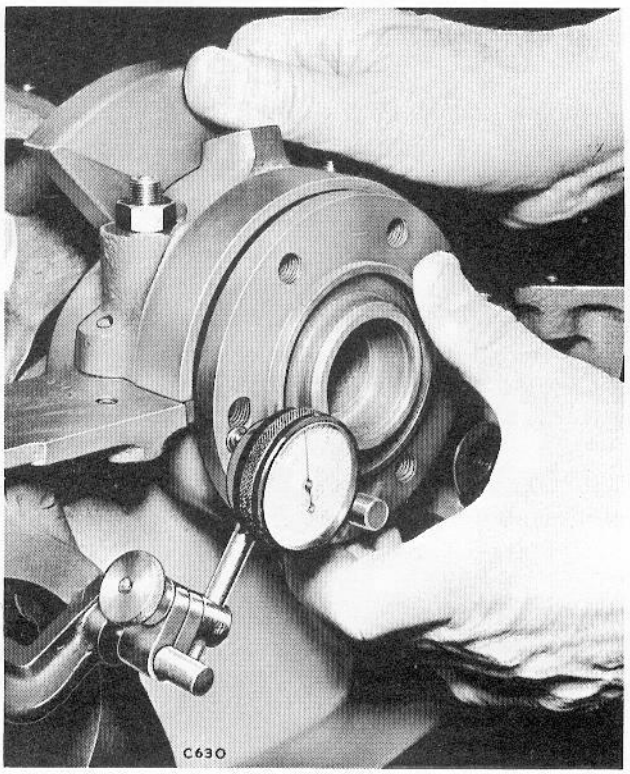


Fig. 17. Crankshaft end float

Fit the rear key and fit the crankshaft thrust plate back into position.

Read the directions for fitting the damper carrier to see if the crankshaft requires marking before proceeding further.

Refit the key to the camshaft if it has been removed.

Fit the drive sprocket and chain wheel inside the chain so that the timing marks on each coincide, see Fig.18 and fit this assembly to the crankshaft and camshaft holding the camshaft forward as shown in Fig.19 and also prevent the crankshaft from moving backwards and so releasing the thrust plates from the rear of the front bearing.

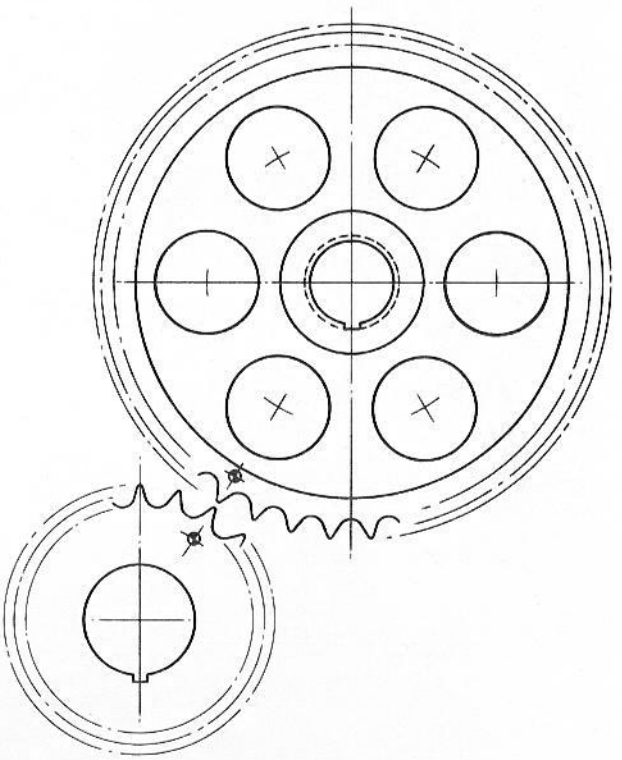


Fig. 18. Timing marks on chain wheels

Fit the oil baffle dished face outwards and fit the front key to the crankshaft.

Thoroughly oil a new felt washer and fit it into the recess of the camshaft drive cover. Fit a joint washer to the camshaft drive cover using a jointing compound on both faces.

Fit the damper carrier unit into the felt washer and offer up this assembly to the engine.

On crankshafts with a small front spigot (1.065 dia.) it is possible to locate the keyway on to the key and then drive the damper carrier on to the shaft. On the later crankshaft with the larger front spigot (1.699 dia.) this is not possible, as the carrier is an interference fit and the key is back from the front edge of the spigot. It is therefore necessary to either (a) carefully mark the position of the keyways before the drive sprocket is fitted by laying a straight edge along the keys on both

sides and marking the front edge of the spigot (b) use special tool TFN.5082 for aligning the keyways.

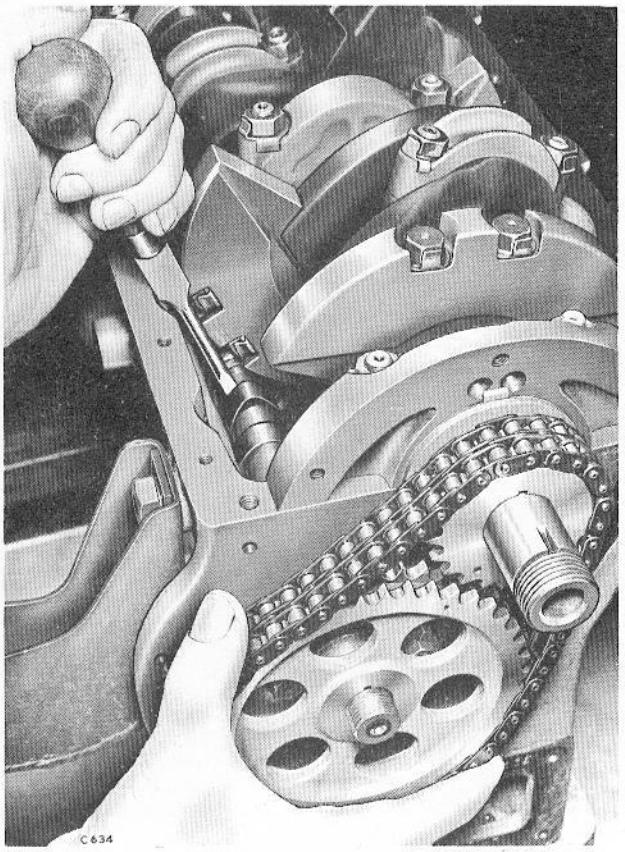


Fig. 19. Holding camshaft forward

When the keyways are carefully aligned drive the damper carrier into position using an aluminium drift similar to TFN.5080. It is essential that the crankshaft is prevented from moving backwards during this operation and thus allowing the front thrust plates to drop out of their locations.

On earlier engines with the rubber bonded crankshaft damper the carrier and damper is bolted together and balanced before offering to the crankshaft. When this assembly has been positioned on the crankshaft fit a new tabwasher and screw and tighten the starter dog, finally locking the tabwasher.

Proceeding with the assembly of the viscous type damper, fit the starter dog and finally tighten.

Locate the viscous engine damper on to its spigot on the carrier and insert and tighten progressively the six taper bolts.

Fit the guide tube and locking plate into a locking position on the hexagon of the starter dog, fit two 5/16" plain washers on the remaining two flat faced bolts and finally screw them into position.

Wire lock the eight damper securing bolts using the holes provided for this purpose.

Refit the oil pump, sump, flywheel and clutch, turn the engine on to the sump face and complete the assembly of the tappets, vertical push rod, cylinder head etc.

Pistons and Connecting Rods

Removing a Piston or Pistons with the Engine in the car.

Remove the cylinder head.

Remove the sump.

Remove the cap of one connecting rod only.

Revolving the crankshaft as necessary, push this connecting rod upwards until the piston gudgeon pin is clear of the bore.

Remove the gudgeon pin circlips and with the connecting rod supported, to prevent it dropping, lightly tap out the gudgeon pin. This gudgeon pin is a selective fit to the piston and should remain with it. Withdraw the connecting rod from below.

Repeat this process on each piston and rod in turn. If pistons and rings are to be refitted keep them in their correct positions.

To refit a new Piston or Pistons to the cylinder block as above i.e. to a used block in situ.

All new pistons supplied by the manufacturers have a gudgeon pin selectively fitted.

Gap the rings in the bore. Insert the connecting rod and support with the small end protruding through the top of the bore and the numbering on the rod. (Fig.20.) facing the camshaft.

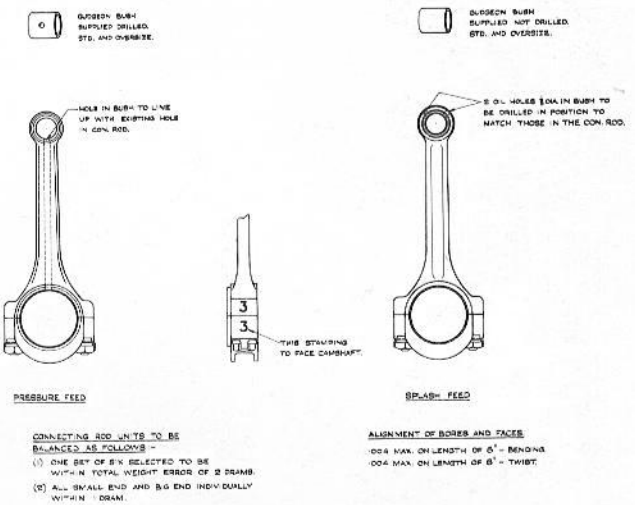


Fig. 20. Con. rod identification and numbering

Warm the piston with its gudgeon pin in boiling water and push back the gudgeon pin to allow the small end to enter. Fit a circlip to the piston, locate the piston over the connecting rod and push in the gudgeon pin. Fit the other circlip to its groove to retain the gudgeon pin.

Fit the piston rings and insert the piston. With the shell bearings in position oil and assemble the big end to its crankpin and lock the tabwashers.

Note. It is vitally important that the connecting rods are fitted the correct way round owing to the offset of the small ends.

This is noted in manufacture by facing the stamping on the connecting rod Fig.20 to the camshaft but it is always worth a careful check.

To fit new Pistons to a block with the engine dismantled.

If used pistons are being fitted to a new or re-sleeved block or, vice versa, if new pistons are being fitted to a used block, first check the piston clearance. This should be not more than the figures given in general data and clearance above the .0026 inch maximum will result in piston slap.

Check the gaps of the rings in the bores and of necessary gap to the figures given.

Heat the pistons with gudgeons pins in boiling water and push the pin clear of the connecting rod location but not out of the piston. Fit a circlip and locate the piston over its connecting rod and while still warn push the gudgeon pin through the small end through to the circlip. Fit the other circlip.

Fit the pistons rings and the assembly is then ready for inserting into the underside of the block.

Connecting Rods Fig.20.

Connecting rods are built into each engine as a balanced set of six and are stamped 1 to 6. Should a single connecting rod or less than a set be required they will be supplied but they must be balanced with the existing rods.

Engines up to Chassis 4136 were fitted with pressure oil feed to the small end via a hole drilled through the centre of the rod. From Chassis 4137 onwards the small end is lubricated by splash feed i.e. no central hole.

It is important then that pressure or splash feed rods are specified should less than a set be required for replacement otherwise balancing will not be practicable.

Gudgeon Pin (small end) Bushes

Standard size outside diameter bushes and .020 inch oversize outside diameter bushes are available as spares. Standard size bushes are usually suitable for replacement but should the bore be over .830 it would be advisable to grind the .020 bush to obtain the interference fit given in General Data.

Press or drift out the old bush but it is recommended that the new bush is positioned by freezing. This ensures squareness with the rod and is easier to align the hole in the bush with the lubrication hole in the centre of the rod. If the bush is pressed in without freezing care must be taken to see that the holes are aligned as there are no facilities for drilling once the bush is positioned.

On splash feed rods this point is not important as the two oil holes have to be drilled after the bush is inserted.

The bore of the bush should be sized to the figure given in General Data and this operation should be carefully carried out in a machine or standard alignment fixture. Never hand ream which would result in misalignement.

Finally scrape the sharp edges from the oil holes.

Big End Bearing

See the Crankshaft regrinding table. These bearings are supplied standard and undersize in the bores only. The outside diameter is constant so that a connecting rod that has become mis-aligned cannot be corrected by the slightest enlargement of the big end bore.

Piston Sizes

Standard and .010 inch oversizepistons are available. The oversize piston is only recommended where a score or bad bores may have occurred at any time early in the life of the engine.

At engine overhaul when pistons are being replaced it is recommended that resleeving back to standard size takes place and at the same time inspection of the camshaft bushes for wear and cleanliness of the oilways.

Flywheel and Starter Ring

Service replacement Flywheels complete with starter ring are not available from the manufacturer. In the event of a starter ring needing replacement a new ring should be fitted to the existing flywheel.

Flywheel Starter Ring

The starter ring is shrunk on to a machined location on the forward side of the flywheel rim. Assuming that the flywheel has been removed the old ring can progressively be removed with a suitable drift and hammer. After removal examine the ring location and if necessary dress off any scores or burrs.

To fit a new ring proceed as follows:

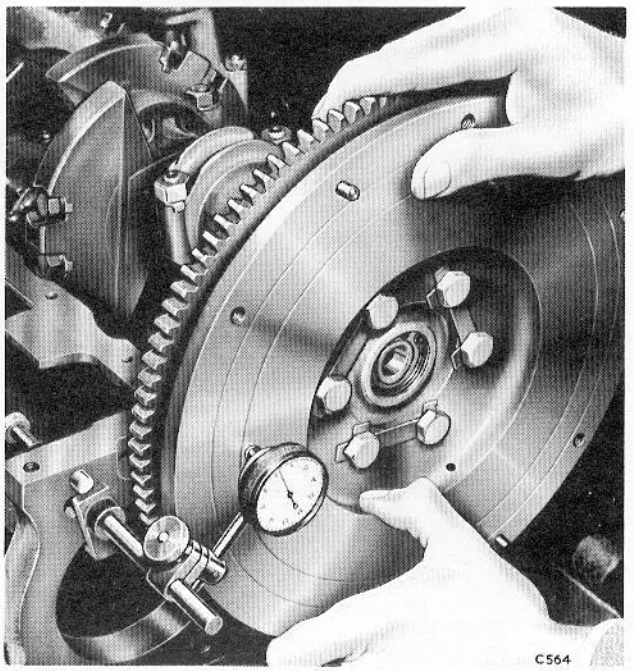


Fig. 21. Flywheel run out

Heat the new ring in oil at 160° C (320°F) for at least 10 minutes.

With the flywheel lying flat on the clutch plate contact face, place the ring on to its location and progressively press it or tap it into position. Carry out this operation as quickly as possible to ensure that the ring does not tighten on the flywheel before it is in its correct position.

As the ring is uniform throughout it is not necessary to re-balance the flywheel unit.

Flywheel

The material is cast iron. Should the clutch contact face be scored or heat cracked it should be ground, removing only the minimum amount necessary.

The nominal thickness of the flywheel is 1.125 inch (28.58 m/m) and this should not be reduced to less than 1.075 (27.3 m/m).

If grinding is carried out with care a number of facing operations can take place before the minimum dimension is reached and the flywheel scrapped.

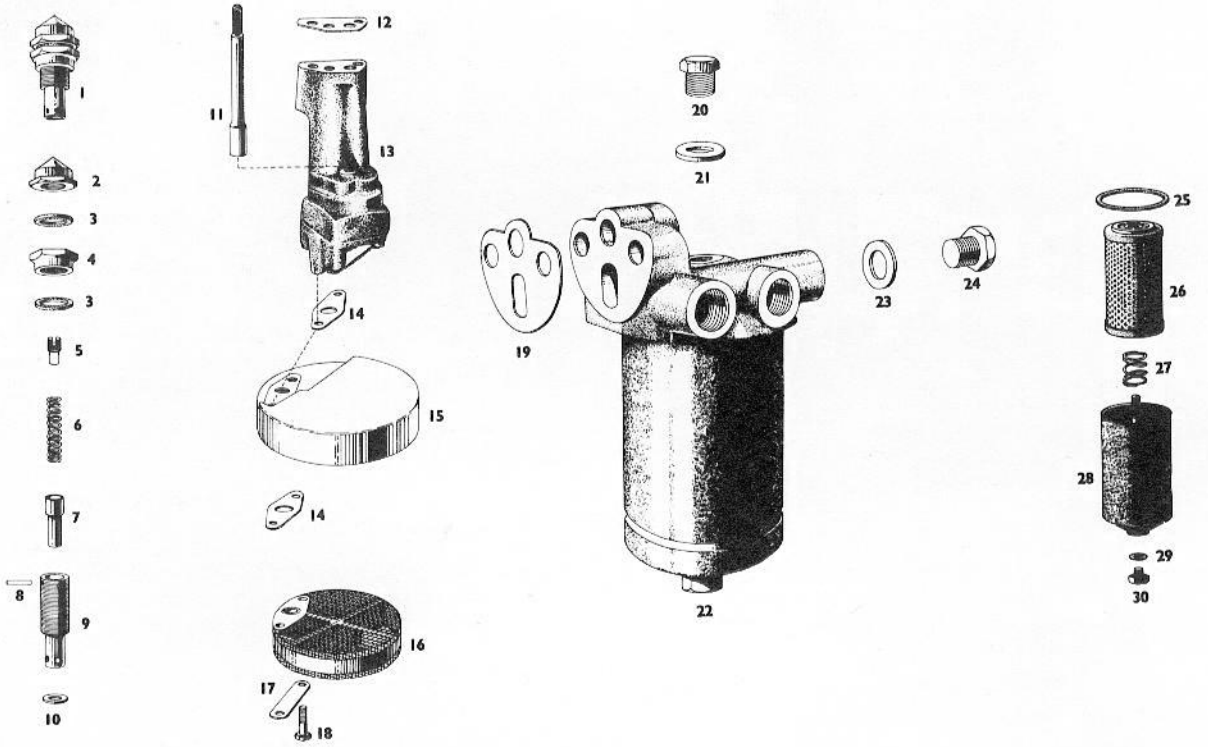
Checking Flywheel 'run out'

In all instances when a flywheel is fitted it is advisable to check the face for truth. Locate the flywheel on its dowel pin fit the locking plates and screws and tighten. Check the face for run-out as shown in Fig.21 which should not exceed .002 inch (.05 m/m). If satisfactory lock the bolts.

Oil Pump, Relief Valve and Oil Filter

OIL PUMP AND OIL FILTER

Part No.	Item	Description	No. off per car	Part No.	Item	Description	No. off per car
N.361460	1	Oil Relief Valve Unit	1	N.360460	16	Oil Filter Sieve Unit	1
N.360030	2	Relief Valve Cap	1	N.360220	17	Oil Filter Sieve Locking Plate	1
N.360050	3	Relief Valve Washer	2	N.360830	18	Oil Filter Sieve Cover Bolt	2
N.360020	4	Relief Valve Locknut	1	N.360740	19	Gasket	1
N.360060	5	Relief Valve Adjusting Screw	1	N.361050	20	Sleeve Nut	1
N.361450	6	Relief Valve Spring	1	N.360710	21	Washer	1
N.360070	7	Relief Valve	1	N.361000	22	Oil Cleaner Assy.	1
N.360080	8	Relief Valve Retaining Pin	1	N.360870	23	Washer - Cleaner Head	3
N.361310	9	Relief Valve Body	1	FBS.53	24	Plug - Cleaner Head	3
N.361030	10	Washer - Oil Relief Valve Joint	1	N.360690	25	Joint Ring	1
N.361830	11	Oil Pump Drive Shaft Unit	1	N.360650	26	Insert Assembly	1
N.361440	12	Oil Pump Casing Joint	1	N.361060	27	Spring	1
N.361430	13	Oil Pump Assembly	1	N.360640	28	Case Assembly	1
N.361530	14	Oil Filter Sieve Cover Joint	2	N.360700	29	Washer	1
N.361520	15	Oil Filter Sieve Cover	1	N.360670	30	Drain Plug	1



Oil Pump, Relief Valve and Oil Filter

Lubrication System

The Engine Lubrication System is shown diagrammically in Figs.22 and 23

Engine Oil

It is most important to use the recommended grade of oil according to the season and climate conditions.

Maintain the level of the oil at the correct level as shown on the dipstick. Avoid overfilling as this will result in high oil temperature and consumption.

Adjusting Oil Pressure

The oil pressure should be 60 p.s.i. (4.22 Kg/cm) at 70° C and if the pressure is incorrect and cannot be traced to other causes proceed as follows.

Run the engine until the oil temperature is 70° C then open up to 3,000 rpm.

Remove the relief valve cap, sealing washer and retaining pin, then screw OUT the adjusting screw to decrease the pressure, or screw IN to increase the pressure, see Fig.24

When the pressure is correct, refit the retaining pin, fit the sealing washer and then screw on and tighten the cap securely.

Removing and Refitting Relief Valve

If the operation of the relief valve is suspect remove the complete assembly and inspect it. The relief valve components are shown in the spares illustration of this section.

To remove slacken and screw off the cap and remove the fibre washer, screw the cap back on, not tight, and slacken the locknut attaching the relief valve to the block.

Using two spanners tighten the locknut to the cap and then screw out the complete assembly from the cylinder block.

Discard the aluminium seating washer fitted in the cylinder block recess.

Holding the locknut loosen the cap then remove the cap, locknut and fibre washer.

Extract the adjuster retaining pin, unscrew the adjusting screw and withdraw the valve and spring.

Clean all the parts thoroughly. Check that the outlet ports in the body are not obstructed and inspect the valve for scoring or high spots, if necessary dress such areas by light stoning.

Never lap the valve to the body. Trial fit the valve in the body where it should be an easy sliding fit. When this is satisfactory re-assembly as follows.

Fit the valve, spring and adjuster to the relief valve body screwing in the adjusting screw until the retaining pin can be inserted.

Fit a new aluminium seating washer into the recess in the cylinder block.

Fit the locknut and cap, without a fibre washer between, to the body, lock them together and screw the valve body into the cylinder block. Make sure that the valve body is screwed down firmly to its seating washer or loss of oil pressure may result.

Separate and remove the locknut and cap. Fit the fibre sealing washer over the body and lock the assembly into position with the locknut.

Before fitting the cap set the oil pressure as described previously and finally fit the fibre washer and screw on and tighten the cap.

Oil Filter

The 'Vokes' full flow type oil filter houses a replacement element known as the 'insert assembly'. A seating washer is attached to the upper end cap of the insert assembly, a spring located beneath the assembly holding this against a seating on the head thus providing a by-pass in the event of the assembly becoming sludged.

To service, slacken the sleeve nut at the top of the filter head, hold the casing while the nut is unscrewed then remove the casing. Drain the oil then withdraw the insert assembly and spring. Do not attempt to clean the insert assembly which should be renewed every 5,000 miles.

Make sure that the casing is clean check the condition of the spring and the joint washer for the sleeve nut. Fit the spring to the casing and then the insert assembly. Examine the rubber joint washer in the filter head and replace if necessary. Fill the casing, with the insert, with clean approved engine oil to ensure an immediate supply to the engine, fit the casing to the head and secure firmly with the sleeve nut and its joint washer.

To remove the complete filter from the block release the two bolts and washers.

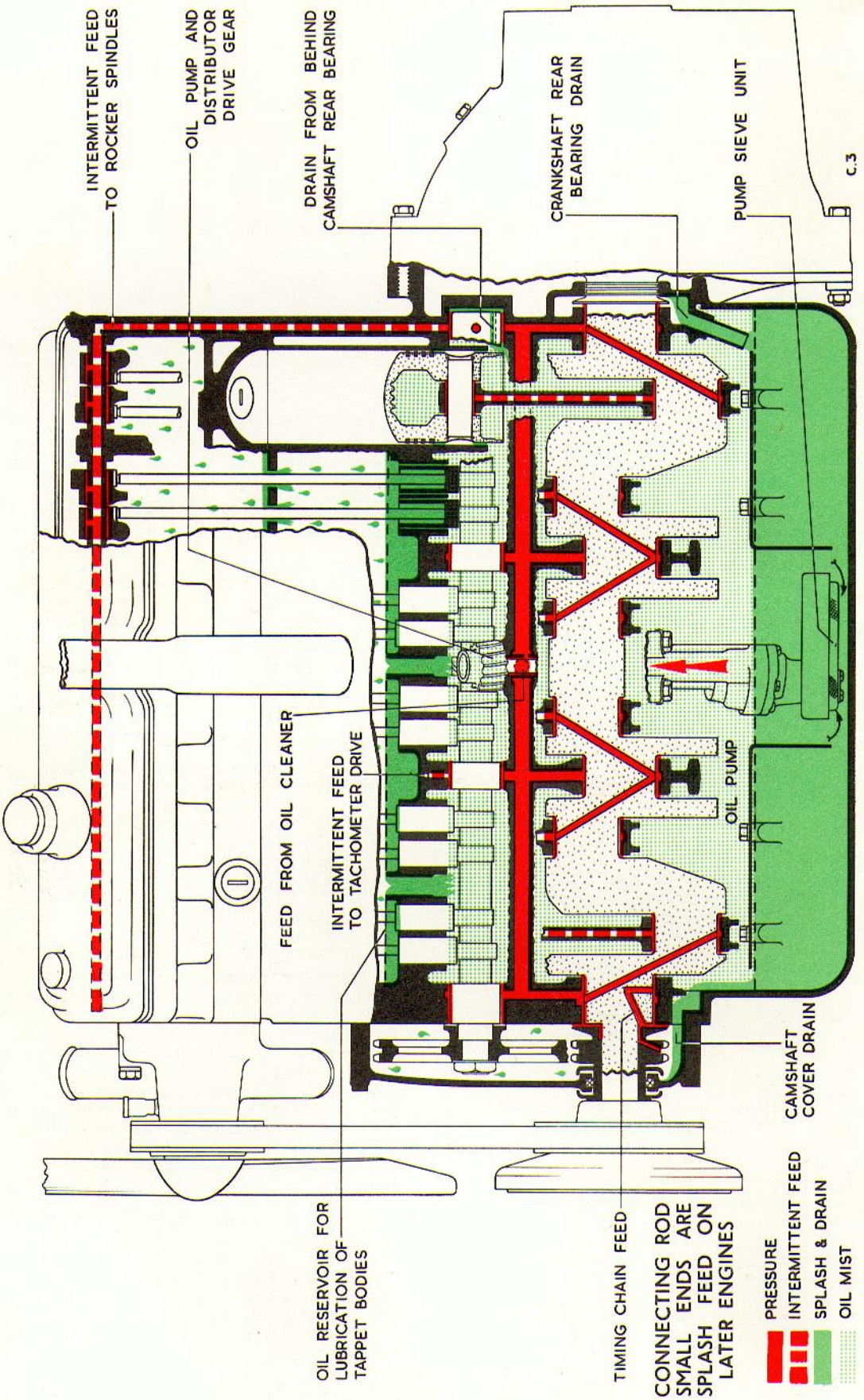


Fig. 22. Engine lubrication diagram Sheet 1

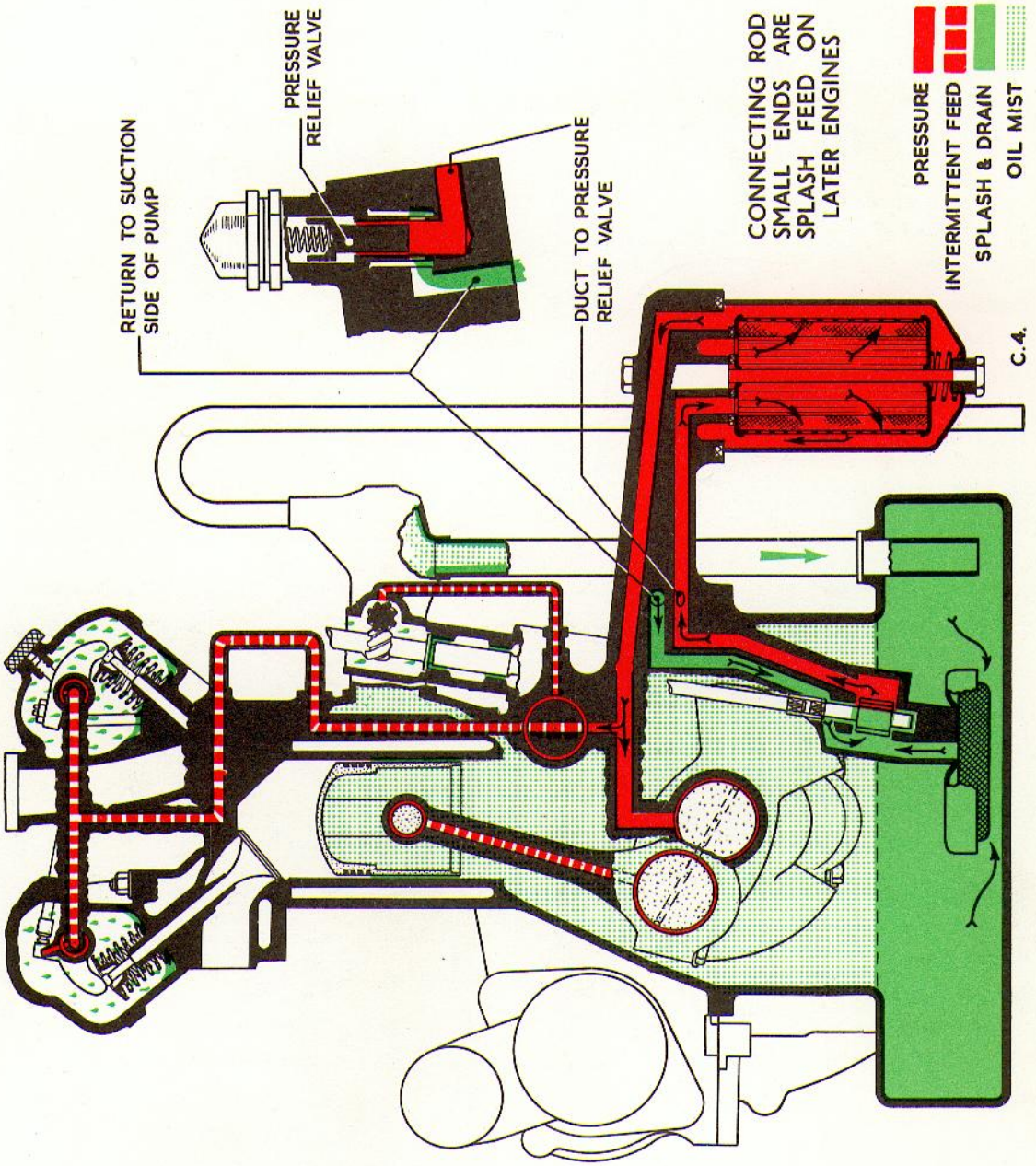


Fig. 23. Engine lubrication diagram Sheet 2

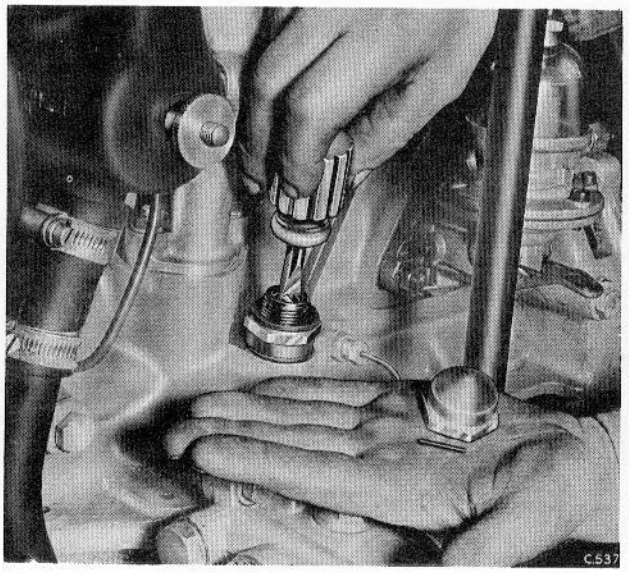


Fig. 24. Oil pressure relief valve

To refit, make sure that the joint faces are clean, use a new joint washer, but do not use jointing compound. Make sure that the joint washer is fitted correctly as shown in Fig.25 fit the bolts and spring washer and tighten.

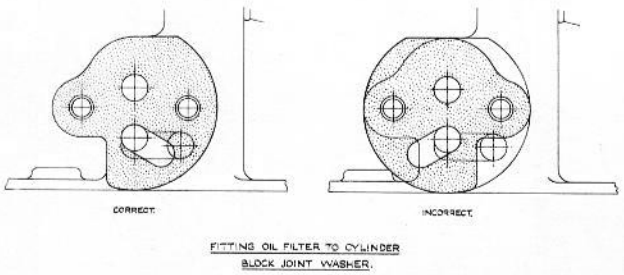


Fig. 25. Oil filter joint washer - correct fitting

It is a common fault to fit the joint washer incorrectly by offering it to the filter and not to the block.

Oil Pump

Replacement serviced oil pumps are not available, neither are detail parts available as spares. In the event of general wear which could be causing loss of oil pressure a new oil pump should be fitted.

Removing the Pump

Drain and remove the sump.

Release the tabwashers, unscrew the two nuts and withdraw the pump from the two studs together with its driving shaft.

Dismantling

Release the tabs of the locking plate, remove the two bolts securing the sieve unit then remove the locking plate, sieve and sieve cover.

Cut the locking wire, remove the bolts securing the pump cover, then remove the cover and withdraw the inner and outer rotors.

Clean and dry the components paying particular attention to the oilways and sieve.

Examine all parts of the pump assembly. To check the rotors for wear fit them back into the pump body then check the clearance between the inner and outer rotors as shown in Fig.26 This clearance should be .0045 to .0065 inch (.117 to .168 m/m) and if in excess of this a new pump should be considered.

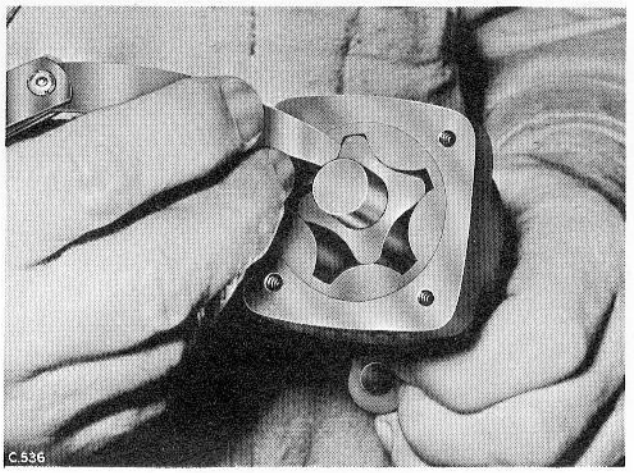


Fig. 26. Oil pump rotor clearance

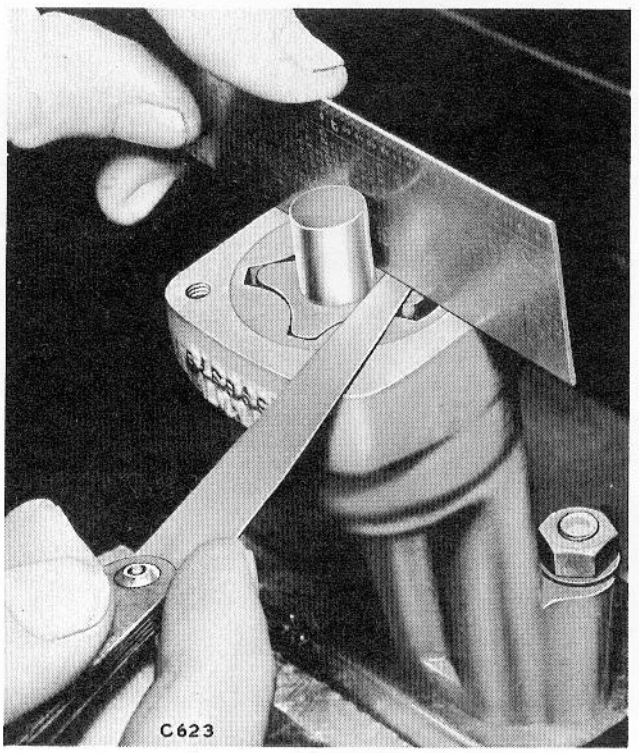


Fig. 27. Oil pump end float

Check the end float of the rotors to the casing as shown in Fig.27 and this should be .0005 to .0015 inch (.01 to .038 m/m). Check that the pump body and cover are seating correctly and lap if necessary to obtain a good face.

Assembling

Make sure that all parts are scrupulously clean, then lubricate the outer rotor and assemble it to the pump body, chamfered edge inwards.

Lubricate the inner rotor and fit it to the outer rotor, with the squared end of the spindle projecting through the body.

Fit the pump cover and secure with its bolts and plain washers. No joint washer or jointing compound is used on the joint face. Test the pump for freedom of rotation. If the pump is tight, and the end float is correct, release the bolts, re-position the cover slightly on the bolts, then re-tighten and retest.

When this is satisfactory, wire-lock the bolts.

Finally re-assemble the joint washer, sieve cover, another joint washer, sieve and locking plate and secure with the two bolts.

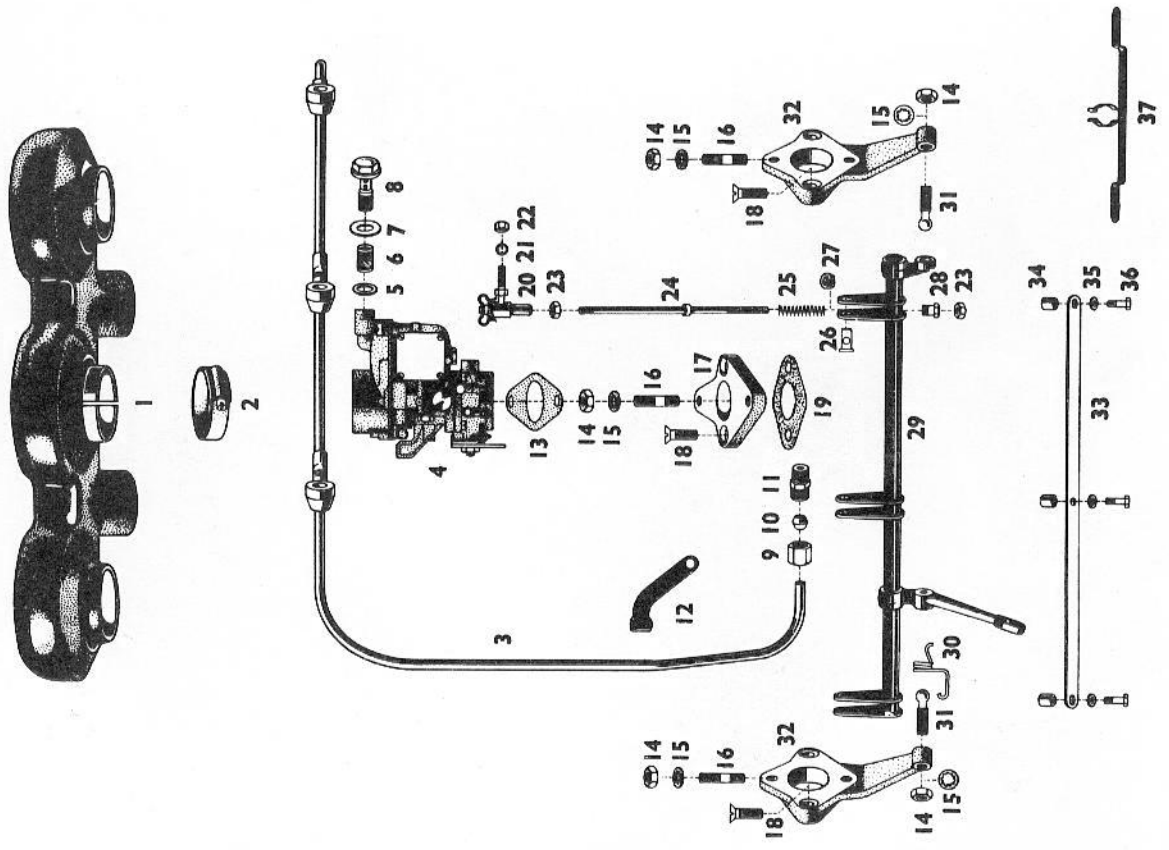
Tighten the bolts and turn up the ends of the lockplate to lock the bolts.

Solex Carburettors, Air Manifold, Carburettor Controls

Petrol Pump, Exhaust Manifold and Air Cleaner

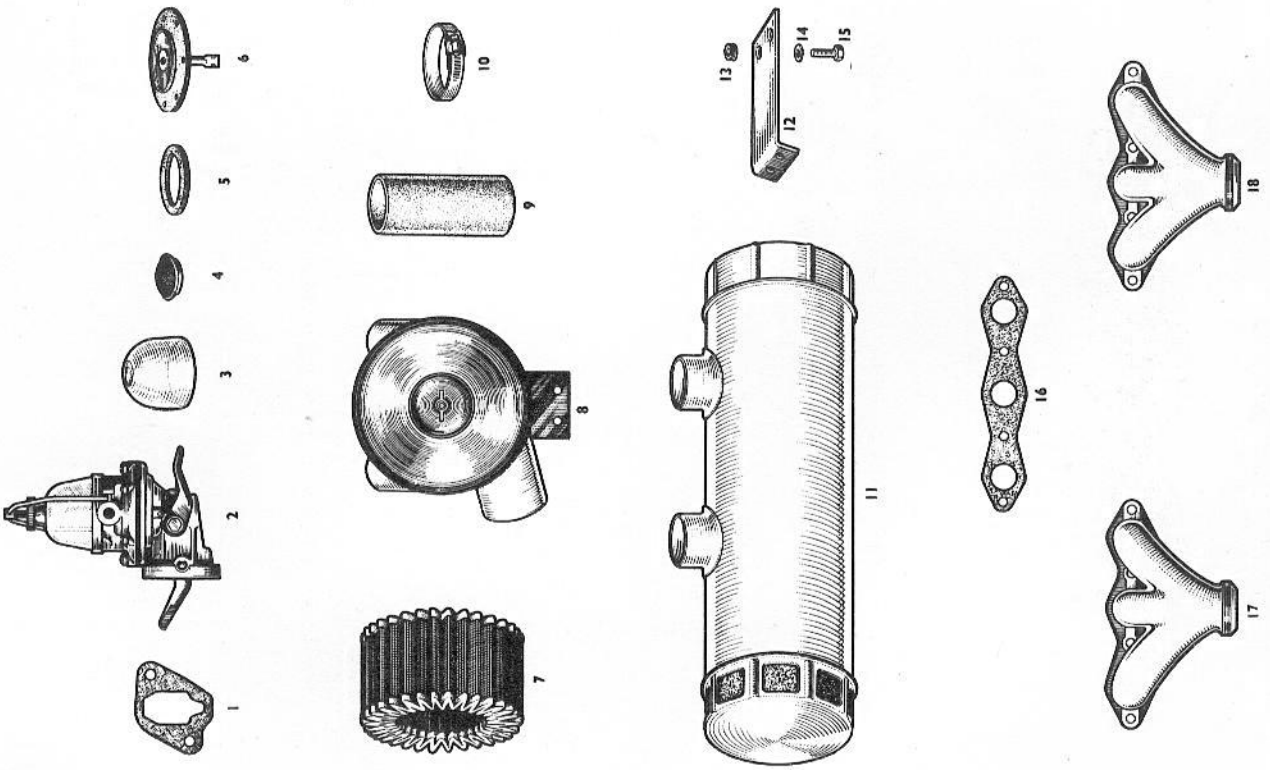
SOLEX CARBS. AIR MANIFOLD. PETROL PIPE

Part No.	Item	Description	No. off per car	Part No.	Item	Description	No. off per car
N.373150	1	Air Filter Manifold	1	-	21	Shakeproof Washer 2BA	3
N.371850	2	Clip	1	-	22	Nut 2BA Std.	3
N.373160	3	Fuel Pipe Assembly	1	-	23	Locknut 2BA	6
N.374530	4	Carburettor - Solex - Centre) Used up to Chassis 4058	1	N.373030	24	Control Rod Unit.) Used up to Chassis 4136	3
N.374540	-	Carburettor - Solex - Inner & Outer)	2	N.374900	-	Control Rod Unit.) Used on & after Chassis 4137	3
N.374920	-	Carburettor - Solex) Used on & after Chassis 4059	3	N.373080	25	Retaining Spring	3
				N.373090	26	Pivot Pin	3
N.372510	5	Fibre Washer - Small	3	N.373060	27	Spring Retainer	3
N.372490	6	Filter - Petrol Pipe	3	N.373110	28	Adjusting Screw	3
N.372500	7	Fibre Washer - Large	3	N.373140	29	Control Shaft Unit.) Used up to	1
N.372480	8	Banjo Bolt	3	N.373460	30	Return Spring) Chassis 4136	1
N.371820	9	Union Nut	1	N.374870	-	Control Shaft Unit.) Used on & after	1
N.371830	10	Olive	1	N.374890	-	Return Spring) Chassis 4137	1
N.371810	11	Single Ended Union	1	N.373000	31	Fulcrum Adjusting Screw	2
N.373450	12	Fuel Pipe Clip	1	N.372990	32	Fulcrum Bracket.) Used up to Chassis 4136	2
N.373320	13	Joint - Carburettor	3				
FN.205/L	14	Nut 5/16" BSF	8	N.374850	-	Fulcrum Bracket.) Used on & after Chassis 4137	2
-	15	Shakeproof Washer 5/16"	8				
N.321760	16	Stud	6	N.373120	33	Tie Rod	1
N.373220	17	Centre Carb. Adaptor	1	N 373040	34	Distance Piece	3
N.373360	18	Screw 5/16" Csk. Hd. M.S.	6	FBS.72C	35	Washer	3
N.370170	19	Joint - Adaptor	3	-	36	Bolt 2BA 11/16" long	3
N.373470	20	Ball Joint	3	N.373370	37	H.T. Wire Clip	1



PETROL PUMP EXHAUST MANIFOLD AIR CLEANER

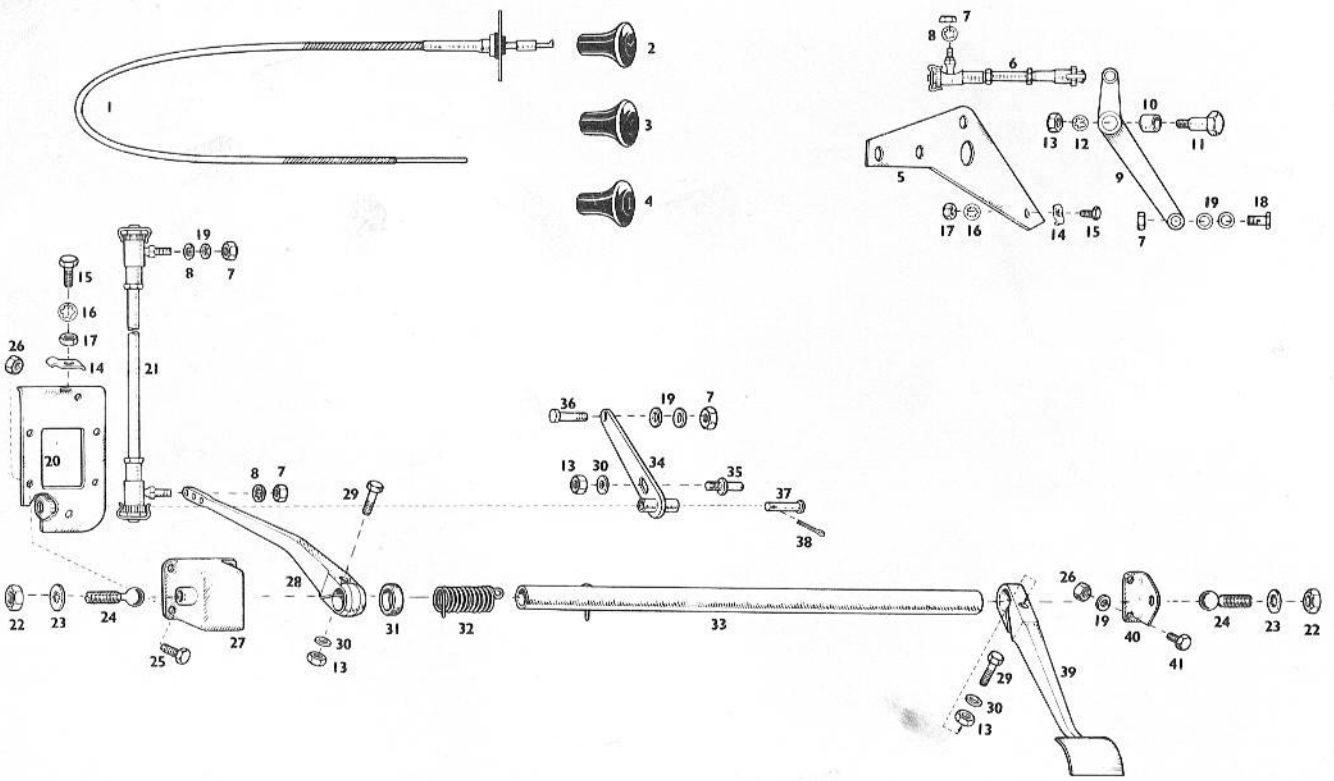
Part No.	Item	Description	No. off per car	Part No.	Item	Description	No. off per car
N.370040	1	Joint - Petrol Pump	1	N.374820	11	Air Cleaner)	1
N.370450	2	Petrol Pump	1	N.374830	12	Steady Bracket)	1
N.370480	3	Filter Cover	1	N.374840	13	Grommet) Chassis 4037	2
N.370490	4	Filler	1	-	14	Washer 5/16" Plain) onwards	2
N.370500	5	Gasket	1	FS105/6D	15	Setscrew 5/16" BSF)	2
N.370470	6	Diaphragm	1	N.370030	16	Gasket - Exhaust Manifold	2
N.371770	7	Element - Air Cleaner	1	N.370010	17	Exhaust Manifold LH.) 100 B2 Engine	1
N.374010	8	Air Cleaner Unit) Used up to	1	N.370020	18	Exhaust Manifold RH.)	1
N.374640	9	Intake Hose from Cleaner) Chassis 4036	2	N.374560	-	Exhaust Manifold (Six Branch)	
N.371850	10	Clip - Jubilee 2.3/8" Bore	4			(100 B Engine)	



TYPE 405. ENGINE CONTROLS R.H.D. AND L.H.D.

Part No.	Item	Description	No. off per car
-	1	Throttle Control)	1
		Lucas WG/16I/KD47/32119F) Used up	
-	-	Mixture Control) to	1
		Lucas WG/16C/KD47/32350) Chassis	
-	-	Ignition Control) 2028	1
		Lucas WG/16I/KD47/32119F)	
-	-	Throttle Control)	1
		Lucas WG/16T/KD54/32398A) Used on	
-	-	Mixture Control) and from	1
		Lucas WG/16M/KD54/32399A) Chassis	
-	-	Ignition Control) 2029	1
		Lucas WG/16I/KD54/32397A)	
404-1-63010/1	2	Operating Knob - Engraved 'M'	1
404-1-63010/2	3	Operating Knob - Engraved 'T'	1
404-1-63010/5	4	Operating Knob - Engraved 'I'	1
N.710060	5	Mounting Plate	1
N.710061	6	Ignition Control Rod complete	1
-	7	Nut 2BA Plain	6
-	8	Washer 2BA Shakeproof	4
N.710054	9	Ignition Lever	1
N.540251	10	Oilite Bush	1
N.540271	11	Bolt	1
-	12	Washer ¼ dia. Shakeproof	1
FN.104/K	13	Nut ¼ BSF	4
N.710037	14	Cable Clamp	1
-	15	Bolt 4BA Hex Hd 3/8 long	1
-	16	Washer 4BA Shakeproof	1
-	17	Nut 4BA Simmonds B.P.I.	1
N.710052	18	Pin	1
-	19	Washer 2BA Plain	7

Part No.	Item	Description	No. off per car
N.710034	20	Backplate	1
N.710050	21	Throttle Control Rod complete Used up to Chassis 4136	1
405-1-27010	-	Throttle Control Rod complete Used on and after Chassis 4137	1
FN.205/L	22	Nut 5/16 BSF	2
-	23	Washer 5/16 Shakeproof	2
N.373000	24	Fulcrum Adjusting Screw	2
-	25	Bolt 2BA Hex Hd ½ long	4
-	26	Nut 2BA Simmonds C.P.I.	6
N.710039	27	Control Box	1
N.710042	28	Throttle Control Lever Used up to Chassis 4136	1
405-1-27012	-	Throttle Control Lever Used on and after Chassis 4137	1
FB.104/8D	29	Bolt ¼ BSF 1 long	2
-	30	Washer ¼ dia. Plain	2
N.710047	31	Sealing Washer	1
N.710041	32	Return Spring - RH Drive	1
N.710057	-	Return Spring - LH Drive	1
N.710036	33	Control Shaft complete	1
N.710035	34	Hand Throttle Control Lever	1
N.710058	35	Throttle Lever Lift	1
N.710052	36	Pin	1
N.710044	37	Pivot Pin	1
-	38	Split Pin 1/16 dia. ½ long	1
404-1-27001	39	Accelerator Pedal Used up to Chassis 4136	1
405-1-27011	-	Accelerator Pedal Used on and after Chassis 4137	1
N.710038	40	Control Shaft Bracket	1
-	41	Bolt 2BA Hex Hd 5/8 long	2



Solex Carburettors, Air Manifold, Carburettor Controls

Petrol Pump, Exhaust Manifold and Air Cleaner

Removing and Refitting Carburettors

Loosen the hose clip connecting the air filter manifold to the centre carburettor and the hose clips connecting the hoses to the air cleaner and remove the manifold.

Detach the petrol pipe from the carburettors carefully retaining the fibre washers, gauze filters and banjo bolts.

Disconnect the throttle controls rods from the control shaft by removing the locknuts and retaining nuts. Replace the nuts after removal for safe keeping.

Disconnect the Bi-starter control wire and clip from the centre carburettor and remove the tie rod from all the carburettors.

Preferably mark each carburettor so that it can be refitted to the same flange, then remove the six flange nuts and spring washers. Lift the ignition H.T. leads and clip away and lift off each carburettor together with its throttle linkage.

Before refitting the carburettors check that the cylinder head and carburettor flanges are clean and flat. Then proceed as follows:-

Fit a new gasket to each flange.

Refit the carburettors into their original positions with the control rods lying above the control shaft. Position the H.T. leads and clip between the front and centre carburettors then fit the spring washers and nuts and tighten.

Refit the Bi-starter tie rod and fit the control rod to the centre carburettor. Adjust the wire so that the levers are against their stops before the dashboard knob is seating.

Connect the throttle control rods to each lever on the control shaft.

Connect the petrol pipe to the carburettors. Be sure that the banjo filters are clean and that the fibre washers are in good condition.

Refit the air filter manifold and tighten the hose clips.

Finally check the synchronisation of the throttle. This is essential.

Carburettors

Type.....Solex 32BI.

Settings

All Type 404 Cars and Type 405 Cars up to Chassis 4058.

Centre Carburettor. Solex 32BI/1705		Inner & Outer Carburettor. Solex 32BI/1704	
Choke	26	Choke	26
Main Jet	120	Main Jet	115
Correction Jet	190	Correction Jet	190
Pilot Jet	45	Pilot Jet	45
Air Bleed	1.0	Air Bleed	1.2
G.A. Jet	2.0 m/m	G.A. Jet	2.0 m/m
G.S. Jet	95	G.S. Jet	95
Emulsion Tube	No.10	Emulsion Tube	No.10
Needle Valve	1.5	Needle Valve	1.5

Type 405 Car Chassis 4059 onwards.

All 3 Carburettors are similar. Solex 32BI/1763

Choke	26
Main Jet	115
Correction Jet	200
Pilot Jet	45
Air Bleed	1.0
G.A. Jet	2 m/m
G.S. Jet	95
Emulsion Tube	No.10
Needle Valve	1.5

With the possible exception of Jet sizes all three carburettors are identical, each incorporates a Solex Bi-starter, the starter controls being interconnected and controlled in unison by a knob on the dashboard marked "M".

Each stage of carburation (i.e. starting, slow running and running) has its own petrol jet and air jet, this enables mixture corrections to be made to any one "stage" without disturbing the other two, but each stage must be "blended" into the next by final adjustment.

The three sections of the main carburettor are bolted together and comprise:-

1. The top, consisting of the float chamber cover containing the needle valve assembly, the intake extension and Bi-starter air ducts.

2. The centre which contains the choke tube, air and petrol jets and the float chamber.

3. The base, which is the throttle valve chamber and contains the volume control screw for slow running, as well as the starter delivery ducts.

Bi-starter

The Bi-starter housing is secured to the left-hand side of the carburettor body. The assembly is illustrated in Fig.28 and shown diagrammatically in Fig.29 The Bi-starter valve is mounted in the chamber formed between the housing and the carburettor body, the valve spindle being operated by a lever. A spring holds the valve against its seating on the body, a spring-loaded ball locating the valve in its intermediate setting.

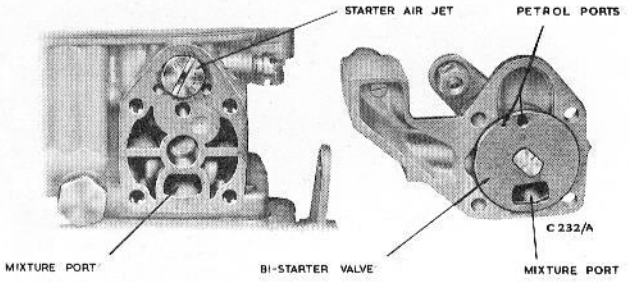


Fig. 28. Bi-starter assembly

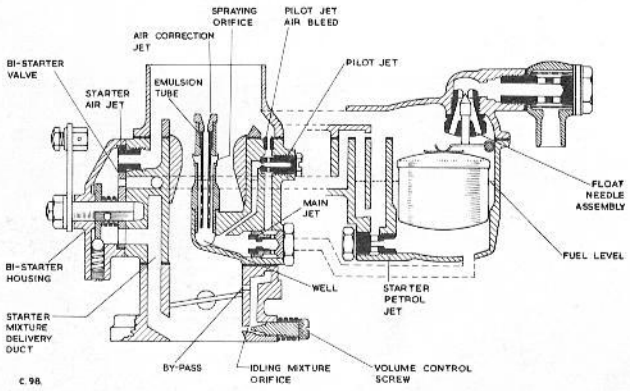


Fig. 29. Diagram of carburettor

The control knob on the dashboard actuates an enclosed push/pull wire connected to No.2 (centre) carburettor, a coupling bar linking this carburettor with the other two carburettors. There are three distinct positions of the control i.e.

Full out.....Full rich for cold starting.

Intermediate.....Initial warming-up period to enable driving off on a cold engine.

Full in.....Bi-starter out of action.

The valve has two adjacent petrol ports, while diametrally opposite is the mixture port, see Fig. 28 When the valve is turned to the "cold starting" position, the larger port registers with the petrol delivery port in the carburettor body, and the full output of petrol from the starter petrol jet enters the Bi-starter chamber. This jet is situated at the base of the float chamber, adjacent to the Bi-starter assembly. When the valve is turned to the intermediate position, the smaller petrol port registers with the petrol delivery port and restricts the flow of petrol from the jet. The volume of air for both valve positions is controlled by the starter air jet, the air enters the chamber and the resultant petrol/air mixture passes through the mixture port and enters the induction system below the carburettor throttle butterfly, see Fig.29 It is thus imperative for the correct functioning of the Bi-starter that the throttle is fully closed otherwise the necessary depression in the Bi-starter will not be obtained. The richest mixture is required only for the initial start. When the engine has fired and "picked-up" the starter well becomes empty and the supply is then restricted to the output of the starter petrol jet. At the same time, with the increase in r.p.m., a larger volume of air is drawn through the starter air jet thereby weakening the mixture to its correct proportions and counteracting any tendency to over dose the engine cylinders.

Slow-running

Referring to Fig.30 petrol is drawn from the well through the vertical channel is the choke housing leading to the pilot jet which meters the petrol drawn into the air stream entering the pilot jet air bleed above it. The petrol/air mixture then passes downwards to emerge into the main induction tract through the slow-running mixture orifice below the throttle butterfly.

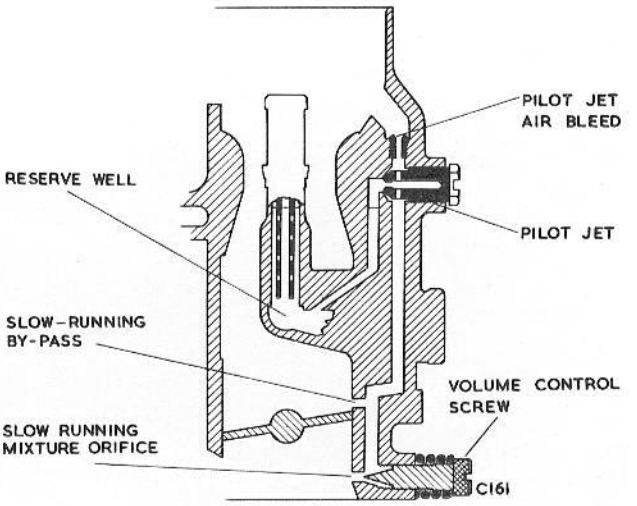


Fig. 30. Diagram of slow running

The effective area of the slow running mixture orifice is controlled by the spring-loaded volume control screw, the slow-running of the engine is thus controlled without disturbing the succeeding mixture range. Turn the volume control screw IN (clockwise) to weaken, and OUT (anti-clockwise) to richen the mixture.

When the throttle is closed to the slow-running position, the slow-running by-pass is on the atmospheric side of the butterfly and therefore is not subject to induction depression. Under these conditions, air enters the by-pass and further emulfifies the mixture. When the throttle is opened wider, the by-pass becomes subject to induction depression and its function changes, the by-pass now acting as a delivery orifice in addition to the slow-running mixture orifice, thus preventing a flat spot which might otherwise intrude.

Main Throttle Range

For the main throttle range control, the choke tube size should not be altered except for specialised requirements, and then only after consultation.

The sequence of operation in this range is as follows:

Referring to Fig.29 when the engine has been started and the throttle opened beyond the slow-running range, air is drawn through the choke tube venturi. The depression in the venturi draws petrol from the spraying assembly through the spraying orifices and the resultant mixture passes to the induction system.

As the throttle is opened further, the depression at the choke tube venturi increases, lowering the level of petrol in the spraying assembly until the upper holes in the emulsion tube are uncovered. Air is now drawn down the emulsion tube through the air correction jet, emerges from the upper holes and passes up the outside of the emulsion tube to emerge through the spraying orifice, thus maintaining the correct petrol/air ratio.

Progressive opening of the throttle increases the depression in the choke and more petrol is drawn from the well, but as the petrol level in and around the emulsion tube is lowered, the emulsion tube holes are uncovered progressively, permitting more air to enter and balance the mixture to its correct proportions. When the well is empty, the fuel supply is governed by the main jet alone. Fig.29 indicates that the air will discharge through the emulsion tube at right angles to the upward flow of petrol from below, thus offering resistance to the output of petrol from the well.

Dismantling Carburettors

It is advisable to replace the gaskets during dismantling, the necessary gaskets are:-

Solex Part No. 52787. Float Chamber Cover Gasket.
Solex Part No. 52788. Throttle Chamber Gasket.

1 of each required per Carburettor.

To dismantle, remove the float chamber retaining screws and lift off the cover see Fig.31, if necessary unscrew and remove the needle valve assembly.

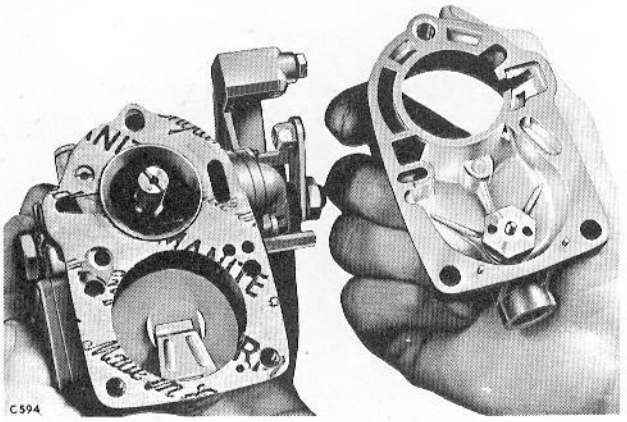


Fig. 31. Removing carburettor float chamber cover

Lift out the float toggle, spindle and float.

Unscrew the air correction jet see Fig.32 and extract

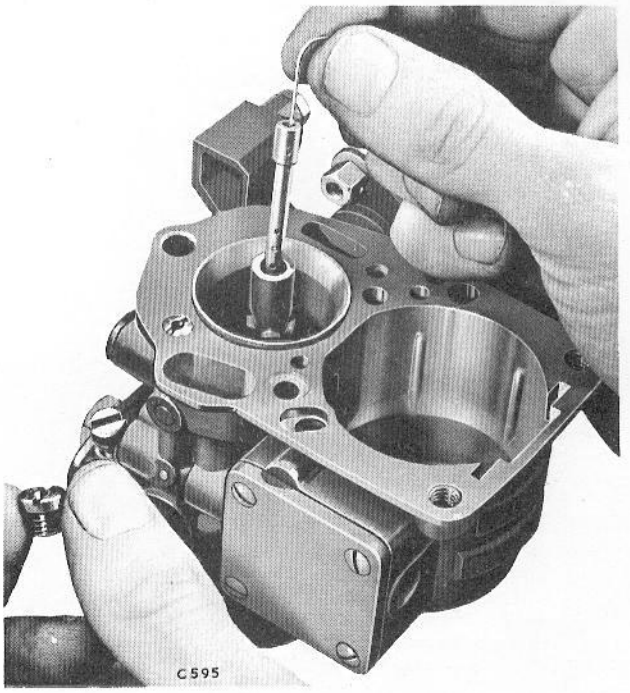


Fig. 32. Extracting correction jet and emulsion tube

the emulsion tube. Slacken off the choke locating screw and remove the choke Fig.33 Unscrew the pilot jet air

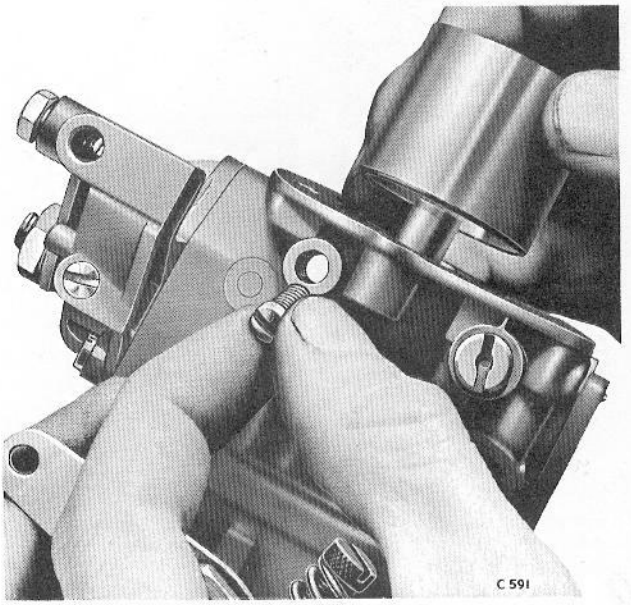


Fig. 33. Removing choke

bleed and the pilot jet. Remove the main jet holder and from it unscrew the main jet. Remove the Starter jet. See Fig.34. Remove the four cheese head screws securing the Bi-starter assembly and remove the assembly, no

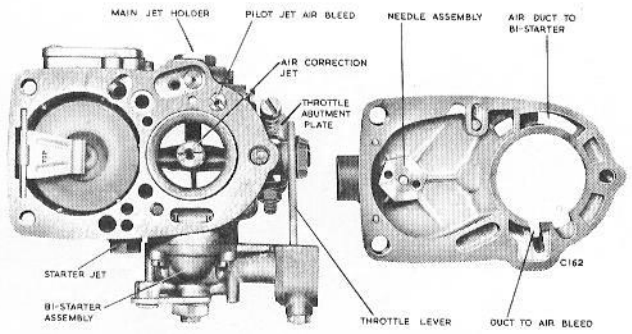


Fig. 34. Jet and float chamber arrangement

gasket is fitted. Fig.35

Remove the starter air jet from the Bi-starter attachment face.

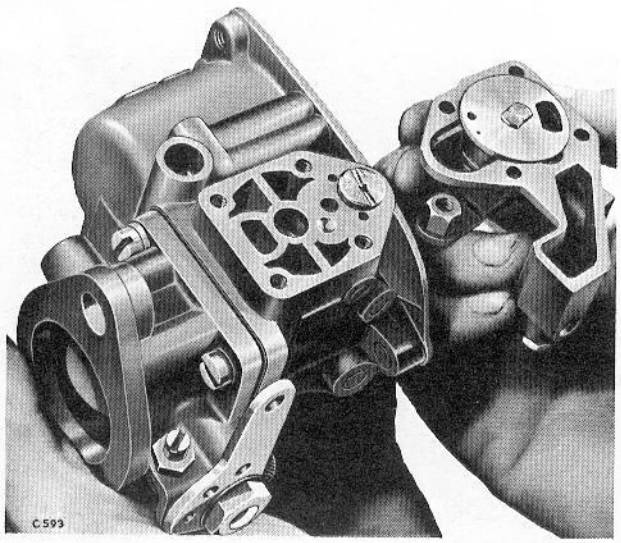


Fig. 35. Removing bi-starter from carburettor

Separate the throttle chamber from the float chamber assembly by removing the four cheese head screws. If the two sections will not easily separate, lever gently between the bottom of the float chamber and the throttle spindle boss. Fig.36 Dischard the gasket.

Remove the volume control screw and its spring.

Reconditioning

Thoroughly wash off and clean all the parts. Replace such parts as worn butterfly spindles. Examine the volume control screws and replace any with the point bent or scored.

Check all mating faces for flatness together. Particularly check the face of the Bi-starter brass plate on to its contact face and if necessary lap with lapping compound until a good face is obtained. This is an important point and will repay careful attention. Wash away all traces of abrasive.

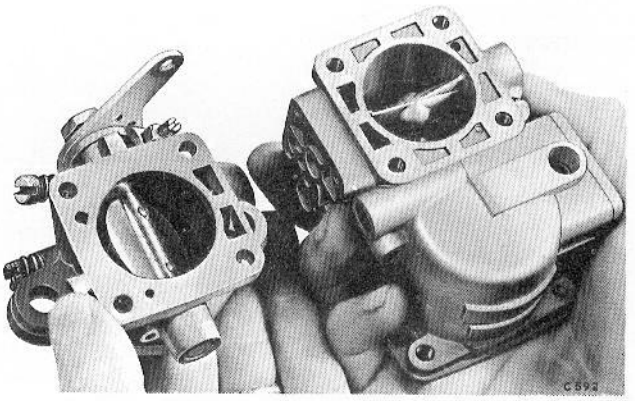


Fig. 36. Separating float and throttle chambers

Re-assembly

Lightly oil the threads then fit the volume control screw and spring.

Assemble the throttle chamber to the float chamber assembly, using a new gasket and secure with its four screws. The gasket may be fitted either way round. Insert the choke with the numbered end to the top and insert and tighten the choke locating screw.

Refit the startet jet (marked Solex starter) and refit the starter air jet (marked Solex Air 2)

Refit the Bi-starter assembly, no gasket is fitted. Ensure that it is inserted in the housing the correct way up, i.e. with the slot to the bottom and the lever facing upwards, see Fig.28

Refit the Main Jet to its holder (marked main jet holder) and refit to the carburettor. Fit the pilot air bleed.

Refit the pilot jet. It is most important to ensure that the inner end seats before the head abuts the housing. If it does not, relieve the casting by careful filing to provide a clearance between the head and the housing as shown in Fig.37

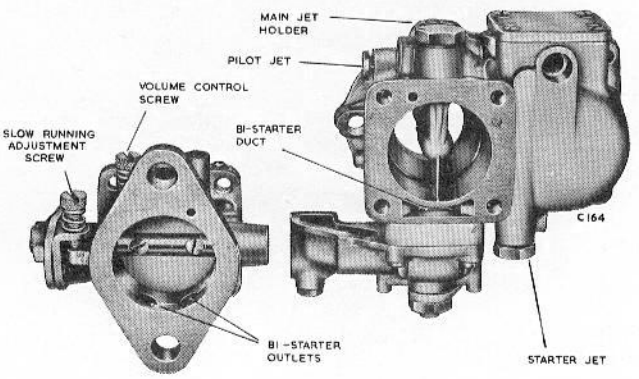


Fig. 37. Pilot jet

Insert the emulsion tube into the spraying well and fit the air correction jet above it.

Replace the float, it will only fit correctly one way.

Fit the spindle to the float toggle and position in its location slots, one side of the toggle is marked "TOP".

Check that the fibre washer is in good condition and fit the needle valve assembly to the float chamber cover.

Fit a new float chamber cover gasket and replace the float chamber cover, ensuring that the two small dowel pegs enter their location holes correctly and that the cover is correctly positioned before tightening the three slotted hexagon head screws.

With the butterfly held closed by its lever set each slow running adjusting screw until the screw just touches its stop and then turn in 1 turn further.

Set each throttle to the full open position, then set the stop screw to about its stop with the throttle parallel with the choke axis, when set, tighten the stop screw locknut.

Carburettor Tuning and Synchronisation

Refitment of the carburettors may alter the carburettor positions relative to the control shaft, for this reason it is most important to check the synchronisation of the throttles. Check also that the Bi-starter control lever on each carburettor is against its fully closed stop before the control knob "M" abuts the instrument panel.

Any adjustment made to one carburettor must also be made on the other two.

It cannot be emphasized too strongly that it is useless to attempt to adjust and synchronise multiple carburettors unless other adjustments are perfect, i.e. the tappets set correctly and the contact breaker points clean, dry and set to their correct gap, the sparking plugs must also be in good order, clean and the gaps set correctly.

In the normal course of events, the choke tubes, petrol and air jets should not be altered unless the car is to travel in barometric conditions differing from those of the British Isles, or a different quality fuel is used.

Caution:- Some grades of fuel produced a hard crust-like deposit in the carburettors, remove this from time to time, and keep the petrol filters in good condition.

With increase in altitude, the carburettor mixture becomes richer. In theory, this amounts to a 17.1/2% increase in mixture strength for every 6,000ft. altitude gained. Varying qualities of fuel must also be taken into account. In practice, and as a guide, it may be taken that the standard setting of jets remains effective up to 3,000ft. thereafter for every additional 3,000ft. of altitude, a main jet one size smaller may be used with a possible corresponding increase in the size of the air correction jet. Loss of power is inevitable as altitude is increased, this cannot be regained by carburettor adjustment.

The following sequence is given as a guide to the correct selection of jets etc:-

Starting

If the engine does not start almost immediately when it is cold and the Bi-starter control is fully OUT (full rich), alter the petrol starter jets only. Do not alter the air jets inside the Bi-starter assemblies since these jet sizes are determined on a cylinder capacity basis.

Should the starting mixture suddenly appear excessively rich, check that the startet air jet on one or more carburettors (or the two small holes on either side of it) are not obstructed.

Never use the full rich position to start a warm engine. If the engine will not start with the Bi-starter control in the off (IN) position, use the intermediate position, which can be felt by the "click" of the spring-loaded ball in the assembly.

Slow-running

The essential feature of the slow-running speed setting is to obtain exact synchronisation of the three throttles. Two methods of setting the slow-running are given below, Method "A" being recommended when specialised equipment is not available, and method "B" which is that employed by the Company. With both methods, refer to Fig.38

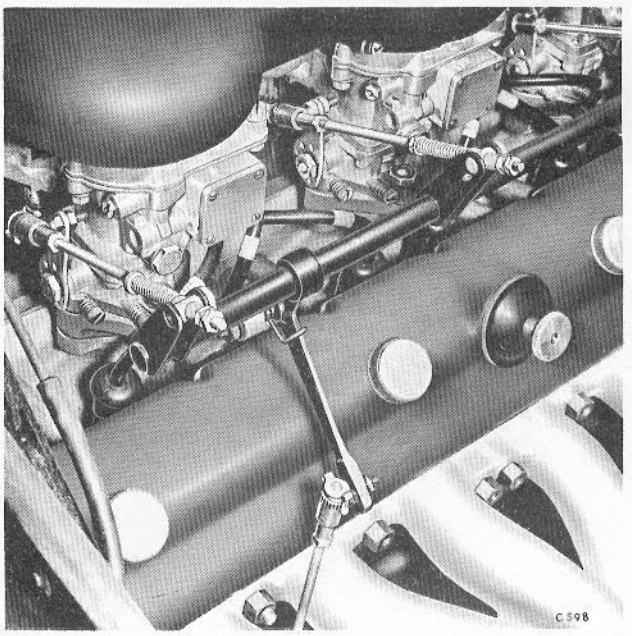


Fig. 38. Throttle control adjustment

Method "A".

Disconnect the spring-loaded ends of the three control rods from the control shaft and check that there is no backlash at the ball-joint ends on the carburettor throttle levers. If there is backlash, tighten the adjustments fully then loosen one "click". Check that there is at least 1/8 in. clearance between the manually operated throttle control lever and its point of contact with the accelerator control arm when the control knob "T" is fully in.

Remove the air cleaner manifold then check that each throttle butterfly is fully open when its lever is against its fully open stop.

Close each throttle in turn by finger-pressure, screw back each slow-running adjustment screw until it is just

clear of its abutment then, with a strip of thin paper inserted between the screw and its abutment, turn in the screw until the paper is just nipped. Then turn each screw IN one complete turn.

Note: Do not use feeler gauges for this purpose, since on used carburettors, the slow-running screws may have caused indents on their respective abutments to a varying degree.

Insert No. 3 control rod into its pivot pin on the control shaft lever and, with the accelerator pressed lightly to the floor, screw the adjusting nut on to the control rod until it just abuts the pivot pin, at this setting, the spring should just be nipped. Fit the locknut to the control rod, but do not tighten at this stage.

With the accelerator pressed hard down to the floor, check that when the throttle (No.3) is against its fully open stop, the spring on its control rod is compressed sufficiently only to relieve the load on the adjusting nut. Release the accelerator.

Connect No.2 control rod to the layshaft and, with a strip of paper between the spring-loaded slow-running adjustment screw and its abutment, tighten the control rod adjusting nut until the paper strip is just nipped. Fit the locknut but do not tighten at this stage. Repeat on No.1 carburettor.

Open the throttles fully by means of the control shaft lever and check that each throttle is against its respective stop at the same moment. Check also that when the accelerator is pressed hard to the floor, each spring at the control rod adjustment is compressed to the same extent, i.e. just relieving the load on the nuts.

With a strip of thin paper trapped between each slow-running adjustment screw and its abutment, carefully open the throttles by the manual control (pull out knob "T" on instrument panel) to an extent where the 3 strips of paper can be withdrawn with the same "feel" of resistance. If any one strip of paper is gripped more tightly than its neightbour, adjust only on the adjustment nut of the relevant control rod. When all three are satisfactory, secure the control rod adjusting nuts with the locknuts, and re-check. The throttles are now synchronised.

Turn each volume control screw right home (do not use force or the seatings will be damaged) and then turn each back 1 turn.

Start up the engine and adjust the manual throttle control to give approximately 1,000 r.p.m. and run at this setting until 70°C water temperature is reached.

Note:- If the slow-running mixture is obviously wrong after the Bi-starter control has been pushed fully home, adjust the volume control screws by equal increments as necessary. A weak mixture is indicated by a tendency to stall after erratic running, an overrich mixture causes "hunting", a strong smelling exhaust, and the engine rocking violently in its mountings. Turn the volume control screws IN (clockwise) to weaken and OUT (anti-clockwise) to richen the mixture.

When the water temperature has reached 70°C, push home the throttle knob on the dashboard and adjust each slow-running adjustment screw by equal amounts one way or the other as necessary to give an idling speed of 750 to 800 r.p.m. Then adjust each volume control screw by equal amounts until smooth idling is achieved within this range of r.p.m. The exact idling speed obtainable is dependent on the general condition of the engine, e.g. presence of carbon etc.

Caution:- Never adjust the slow-running adjustment screw and the volume control screw on one carburettor at a time, but adjust each slow-running adjustment screw in turn and then each volume control screw in turn.

Once the throttles have been synchronised, there is no need to disturb the linkage. For normal adjustment to the slow-running, merely re-set the three slow-running adjustment and the three volume control screws.

Method "B"

The panel illustrated in Figs.39 & 40 provides a visual indication which enables accurate carburettor synchronisation to be obtained, it can be made locally to the dimensions shown in the illustrations of special tools and equipment.

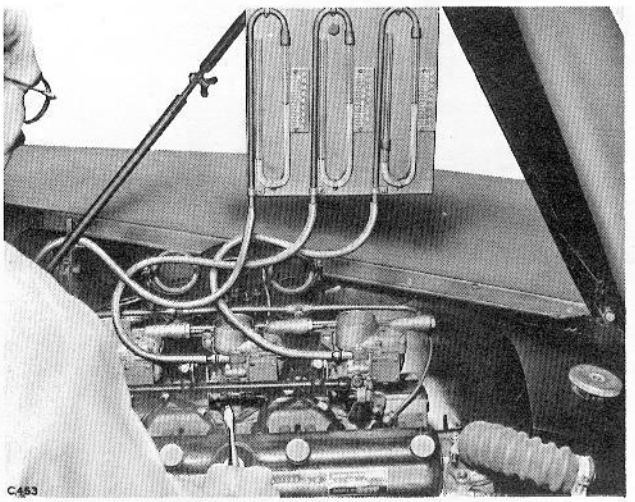


Fig. 39. Carburettor synchronising panel

The panel carries three "U" tubes on its front face, the scale at the side of each tube being calibrated according to the specific gravity of the fluid employed in the tubes. Red-X is recommended for the purpose, and the scale readings quoted are obtained with this fluid. It should be noted however, that the readings will also depend on the condition of the engine.

Behind the panel are a number of brackets to carry the necessary adaptors, the master pilot jets etc.

Remove the air cleaner and manifold.

Working from the right hand side of the engine, screw the volume control screws on all carburettors right home, then screw them out one complete turn.

Caution:- Do not force these screws home or the seatings may be damaged.

At the carburettor end of each of the three control

rods, tighten the ball joint adjuster, then slacked it one notch. Check that there is at least 1/8 in. clearance between the manually-operated throttle control lever and its point of contact with the accelerator control arm when the control knob "T" is fully in.

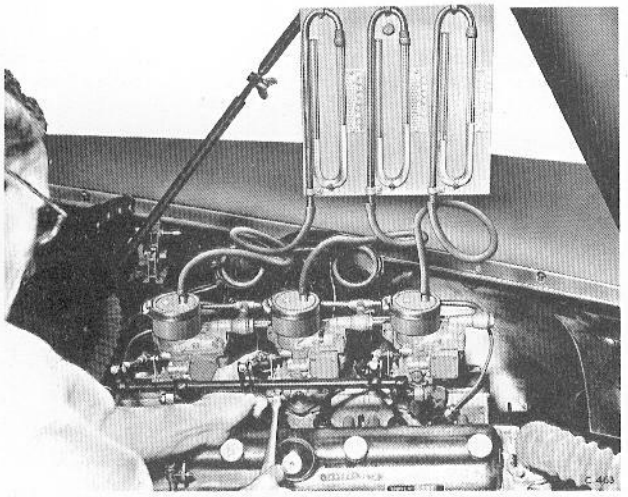


Fig. 40. Carburettor synchronising panel

Start the engine and run at about 1,000 r.p.m. until the water temperature is not less than 70°C. When this temperature has been reached, shut down the engine to about 800 r.p.m., if necessary, temporarily adjusting the slow-running adjusting screws.

Note:- During the process of tuning, the water temperature will probably rise, it is advisable therefore to ensure free entry of air to the radiator. Do not allow the water temperature to rise above 90° C.

Fit the relevant adaptor over each carburettor intake and connect each adaptor to one of the "U" tubes with rubber tubing.

Starting on the centre carburettor, apply finger-pressure to the end of the control rod ball joint and turn back the adjusting nut at the outer end just to release the load on the spring. Hold the throttle against its slow-running stop, and, with a screwdriver, turn the slow-running adjustment screw of the carburettor as necessary until the lever of fluid in the relevant "U" tube registers exactly with the second graduation mark of its scale. Still retaining finger-pressure on the control rod end, screw down the adjusting nut on the outer end of the rod until it abuts the pivot pin. Release the finger-pressure on the rod, but check that in doing so, the reading on the "U" tube does not alter, if it does, re-apply the finger-pressure and screw down the adjusting nut very slightly and re-check the reading on the "U" tube. When satisfactory, secure the adjusting nut with its locknut.

Repeat this process on the other two carburettors and check finally that the fluid in all three "U" tubes gives the same reading, i.e. exactly on the second graduation mark. The throttle settings on all three carburettors are now synchronised.

Note: When screwing down the adjusting nuts on either of the two outer control rods, take great care not to overtighten them since this will result in slight opening of one or both of the remaining throttles, and so upset the true synchronisation as indicated on the scale readings.

Stop the engine, detach the tubing then remove the adaptors.

Remove the pilot jet from each carburettor, fit the kit master pilot jets and connect the rubber tubes from the "U" tubes to the master jets.

Start the engine. With the water temperature at not less than 70°C. and the engine slow-running, adjust the volume control screw of the centre carburettors until the level of fluid in the "U" tube registers exactly with the eighth mark on its scale. Repeat on the other two carburettors. The settings of the volume control screws on the three carburettors are now synchronised.

Stop the engine, remove the master pilot jets and refit the pilot jets.

Refit the adaptors to the carburettor air intake and re-check the throttle settings. If necessary re-adjust the throttle synchronisation.

The setting should produce an idling speed of approximately 800 r.p.m. dependent on the general condition of the engine. If the engine has been run-in correctly and is in good condition, it should be possible to obtain a slow-running speed of 750 r.p.m. if required. If, however, the slow-running speed is too high, adjust each slow-running adjusting screw by equal increments as required, then repeat the throttle synchronisation check described previously. Should the scale reading drop below two graduations to obtain the desired idling speed, 8 graduations must be retained when using the master pilot jet. Any variation from this setting will either richen or weaken the mixture and upset normal running.

The synchronisation completed, remove all test equipment and refit the manifold and air cleaner.

Running

Open the throttles smartly and note that the engine responds without spitting back, consistent spitting indicates weakness in mixture. If this cannot be adjusted on the volume control screws try a main jet one size larger.

The remainder of the throttle should be checked on the road preferably with a gradient which is well known. The fitment of a larger size main jet may upset the performance at wider throttle openings or consumption may be too great. In this case, try a size larger air correction jet. Fig.41 shows diagrammatically the sphere of influence of the main jet and air correction jet in relation to throttle position. It will be noted from the diagram that the petrol supply fed from below is represented by the total area below the heavy centre line, while the air supply fed from above is represented by the total area above the centre line. The shaded portions show respectively the influence of difference sizes of main jet and air correction jet. Thus a larger size main jet will increase the total area, i.e. the sum of the areas above and below the centre line by adding to the petrol side (enrichement) at smaller throttle openings. At the wider throttle positions, the mixture is corrected on the air correction jet, and alters the total area on the air side of the diagram.

Each successive stage of carburation must 'blend' into the next.

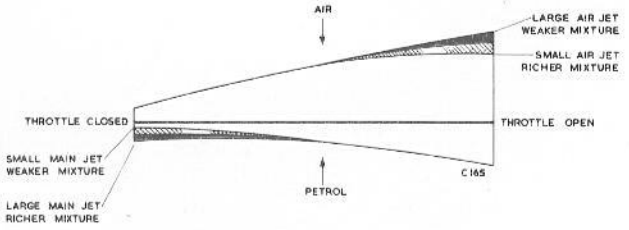


Fig. 41. Diagram of jet effect

Adjustment to the "top end" and "middle" is by selection of jets, but the extreme lower end (being adjustable) must be set to give a steady idling at 750 to 800 r.p.m. and at the same time enable the car to accelerate smoothly. Should hesitation with intermittent spitting back occur, turn each volume control screw OUT by increments of 1/4 of a turn at a time until no hesitation occurs on "pick-up". However, of the engine runs unevenly at small throttle openings but with no "spitback", this can often be overcome by setting No.1 and No.3 volume control screws IN about 1/2 a turn each, i.e. slightly rich setting on No.2.

Air Cleaner

A 'Vokes' dry element air filter is fitted to all Type 404 Cars and to Type 405 Cars up to Chassis 4036.

With this type of filter the element is contained in a large circular housing in two halves, held together by a central wing nut.

The filter should be cleaned every 10,000 (16,000 kilometers). Remove the element from its casing and clean out the inside of the half cases. Hold the element with the dirty side down and tap sharply to dislodge loose particles. If available clean with compressed air. Under no circumstances should liquid of any sort be used.

On Type 405 Cars Chassis 4037 onwards an AC. Combined Air Cleaner and Carburettor Intake Silencer was fitted.

This is illustrated in Fig.42

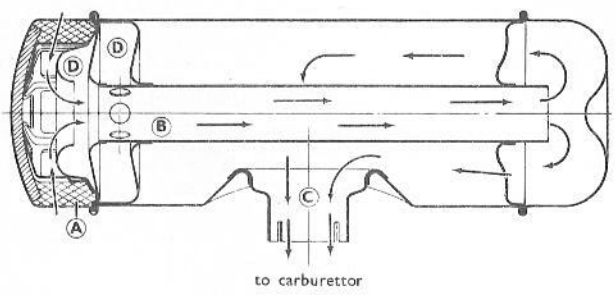


Fig. 42. A.C. combind air cleaner and carburettor intake silencer

Air entering the carburettors passes through an oil-wetted woven mesh (A), air tube (B) and central tube (C). Sound waves ordinarily would pass out of the carburettor into the car in the reverse way. In the AC. intake silencer, they pass into the main air chamber, the internal diameter and length of which, together with the carburettor and air tube characteristics, form a tuned silencer, and in addition into resonator chambers (D) each of which contributes towards eliminating or smoothing out the sound waves.

Cleaning and Re-oiling

See Fig.43 Each 5,000 miles the oil-wetted air cleaner portion needs cleaning and re-oiling.

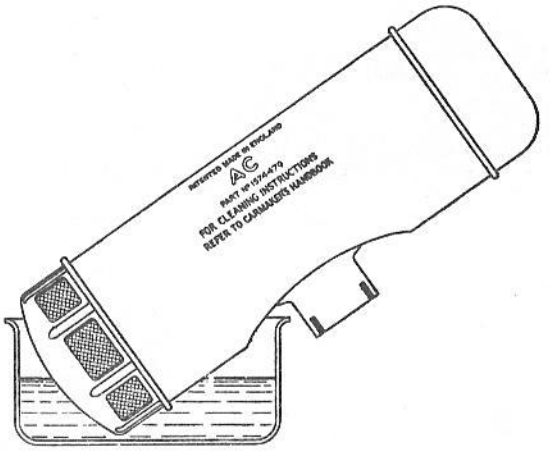


Fig. 43. Air cleaner servicing

This is best done by swilling the windowed end of the cleaner in a shallow pan of paraffin. After drying, the mesh should be lightly re-oiled with engine oil, allowing any surplus to drain off before refitting to the engine.

Petrol Pump

The petrol pump is a cam-driven A.C. type with a glass dome covered filter and hand priming lever.

No attention is normally required beyond periodically cleaning out the glass cover, cleaning or replacing the filter and replacing the cork gasket seating of the glass bowl. These operations can be carried out in situ by unscrewing the nut of the clamp retainer, see Fig.44

Should the pump be in poor condition a new or makers reconditioned unit is recommended.

Parts normally required for pump maintenance are:-

Bristol Part No.	A.C. Part No.	Description
N.370450	1524516	Petrol Pump Unit.
N.370470	856966	Diaphragm.
N.370480	1524247	Filter Glass Cover.
N.370490	1524250	Filter Gauze.
N.370500	1524246	Cork Gasket.

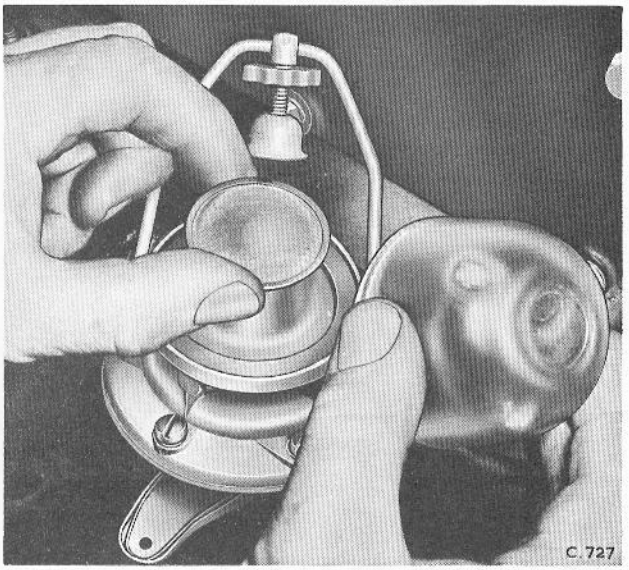


Fig. 44. Removing petrol pump filter

Removing the Pump from the Engine

Turn off the petrol supply at the chassis end of the pump flexible pipe.

Disconnect the flexible and fixed petrol pipes, then remove two nuts and spring washers securing the pump to the engine.

Dismantling to Replace the Diaphragm

Remove the six cheese head screws securing the two halves of the pump together Fig.45

To remove the diaphragm ease the edges from the body with a knife, press down firmly on the steel centre plate and twist either way about half a turn. This will release the diaphragm spindle from its slot in the operating lever and it will be forced up by the pressure of the spring.

Before fitting a new diaphragm check the faces of the two halves together and file or lap if necessary.

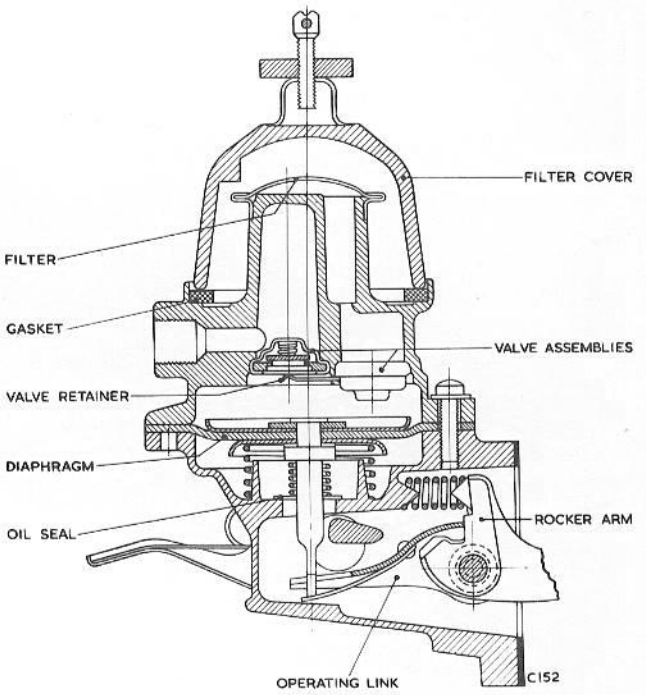


Fig. 45. Petrol pump assembly

Replace the smaller spring, cup and oil seal washer on the new diaphragm, position the pump pressure spring and press the diaphragm down and rotate it to locate it in the operating lever slot. The diaphragm and lower pump body have a small protruding piece to indicate their relative positions.

Replace the top half and tighten the six screws evenly.

Refitting the Pump to the Engine

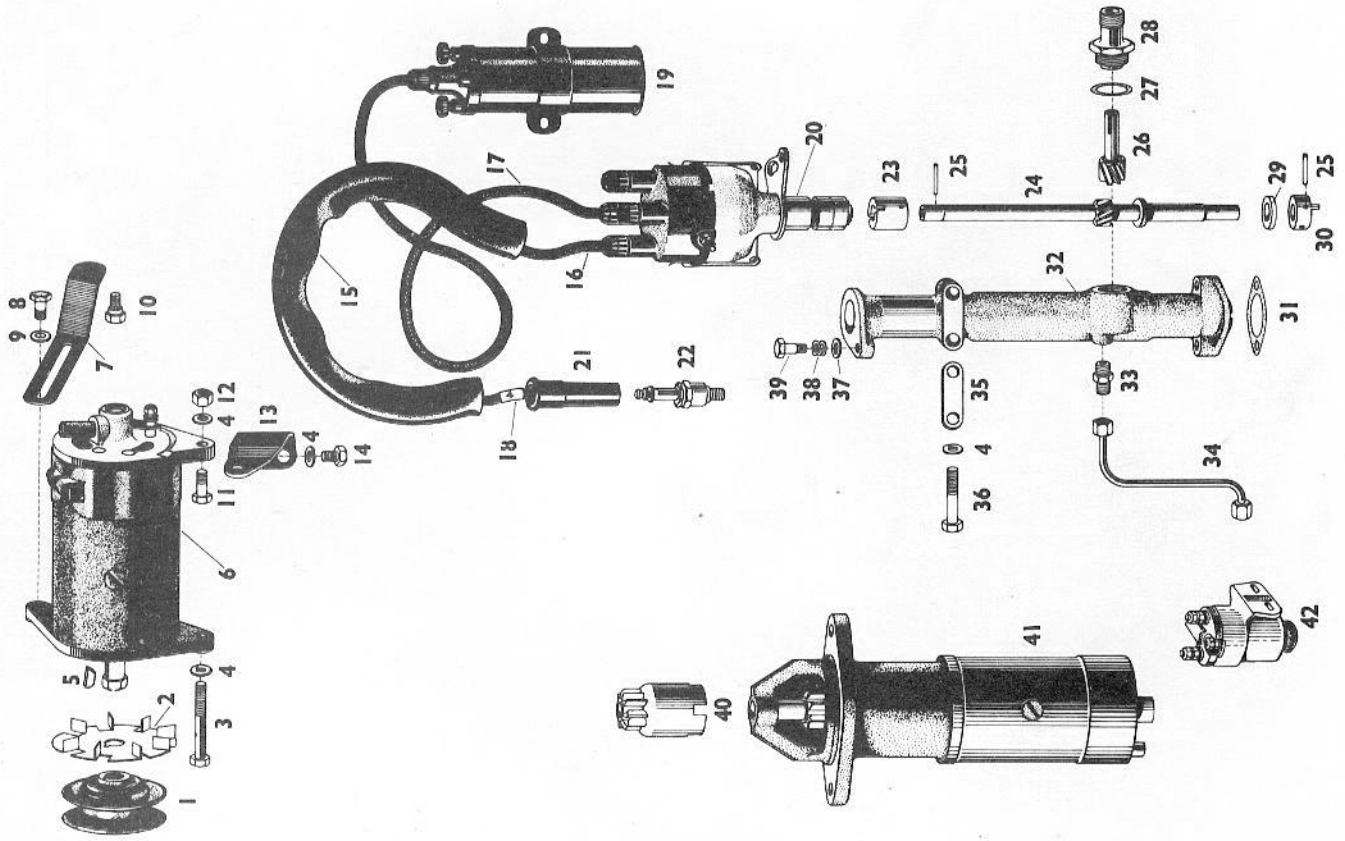
Before refitting the pump be sure that both the cylinder block and pump faces are clean. Smear a new gasket with grease and position on the block. Fit the pump and spring washers and tighten the nuts evenly.

Connect the fuel pipes, turn on the petrol supply and hand prime the supply to the pump.

Engine Electrical Group

DYNAMO. STARTER. DISTRIBUTOR. COIL.

Part No.	Item	Description	No. off per car	Part No.	Item	Description	No. off per car
N.390610	1	Dynamo Pulley Unit	1	-	22	Spark Plug KLG type P/TEN/L70	6
N.390580	2	Fan (Dynamo)	1	N.380430	23	Driving Dog (top)	1
WB.105/21D	3	Dynamo Securing Bolt	1	N.380450	24	Distributor Drive Shaft	1
AGS.585/E	4	Spring Washer	6	N.380420	25	Driving Pin	2
N.390320	5	Key (Dynamo)	1	N.380090	26	Rev. Counter Drive Shaft	1
N.390740	6	Dynamo - Lucas C39.PV/2	1	N.380100	27	Rev. Counter Drive Joint	1
N.390560	7	Dynamo Adjusting Bracket	1	N.380080	28	Rev. Counter Drive Body	1
N.390490	8	Fulcrum Bolt	1	N.380380	29	Thrust Washer .105 thickness	as reqd
N.390500	9	Fulcrum bolt Washer	1	N.380390	-	Thrust Washer .102 thickness	"
N.390050	10	Dynamo Bracket Screw	1	N.380400	-	Thrust Washer .099 thickness	"
FB.105/7D	11	Fulcrum Bracket Bolt	1	N.380410	-	Thrust Washer .095 thickness	"
FN.105/L	12	Fulcrum Bracket Nut	1	N.380440	30	Driving Dog (bottom)	1
N.390570	13	Fulcrum Bracket	1	N.380110	31	Distributor Casing Joint	1
WS.105/5D	14	Fulcrum Bracket Securing Screw	2	N.380010	32	Distributor Drive Casing	1
N.390380	15	HT. Lead Casing	2	N.380250	33	Union	1
N.390290	16	HT. Lead (Plug)	6	N.380340	34	Oil Feed Pipe complete	1
N.390300	17	HT. Lead (Coil)	1	N.380180	35	Distance Piece	1
N.390400	18	Identification Tab (HT. Lead) No.1.	1	FB.105/15D	36	Bolt, 5/16" BSF	2
N.390410	-	Identification Tab (HT. Lead) No.2.	1	N.380240	37	Washer, 5/16" dia.	1
N.390420	-	Identification Tab (HT. Lead) No.3.	1	N.380070	38	Spring	1
N.390430	-	Identification Tab (HT. Lead) No.4.	1	N.380060	39	Shoulder Screw	1
N.390440	-	Identification Tab (HT. Lead) No.5.	1	N.390360	40	Starter Pinion - Lucas 291069	1
N.390450	-	Identification Tab (HT. Lead) No.6.	1	N.390710	41	Starter - Lucas Model M.35G/1 Type WG.3 (Less Solenoid)	1
N.390890	19	Coil - Lucas 45054D	1				
N.380780	20	Distributor - Lucas 40489A	1	N.390700	42	Solenoid - Lucas ST.950 (Attached to Bulkhead)	1
N.390840	21	Spark Plug Adaptor Unit with Suppressor	6				



Engine Electrical Group

General Data

Distributor Drive Casing Assembly

Clearance of shaft in casing.	.0003 to .0013 inch (.008 to .03 m/m)
Shaft end float.	.002 to .004 inch (.05 to 0.1 m/m)
Clearance of Rev. Counter Drive Shaft in bush.	.0004 to .0016 inch (.01 to .04 m/m)
Rev. Counter drive shaft end float.	.005 to .014 inch (.13 to .35 m/m)

Engine Electrical System

System.	12 volt with constant voltage control.
Battery.	51 ampere/hours. Lucas GTW/9A.
Dynamo.	Lucas C39. PV-2.
Coil.	Lucas HA. 12
Starter.	Lucas M35G/1. Type WG3.
Distributor.	Lucas. Model DX6A Ref.40489A. Advance Curve ECM.617.
Contact Breaker Gap.	.014 to .016 inch. (0.35 to 0.4 m/m).
Sparking Plug.	KLG.P.Ten L.70 (Long Reach).
Sparking Plug Gap.	.018 to .020 inch (.46 to .51 m/m)

Distributor Drive Casing Assembly

Removing

Remove the distributor cover and disconnect the L.T. lead.

Disconnect the manual control and remove the shouldered screw securing the clamp plate to the casing and lift out the distributor body complete with the clamp plate.

Disconnect the hose clips to the air cleaner, disconnect the revolution drive cable and also the oil pipe feed. Loosen the pipe at its lower connection and swing it clear.

Remove the two bolts attaching the drive casing to the cylinder head taking care to retain the selective distance piece. These two bolts will also release the air cleaner and the manual ignition control bracket.

Remove the two nuts and spring washers from the lower attachment flange and lift out the casing unit.

Dismantling and Re-assembling the Distributor Drive Casing Assembly

Unscrew the revolution drive body and withdraw the revolution counter drive shaft. see Fig.46.

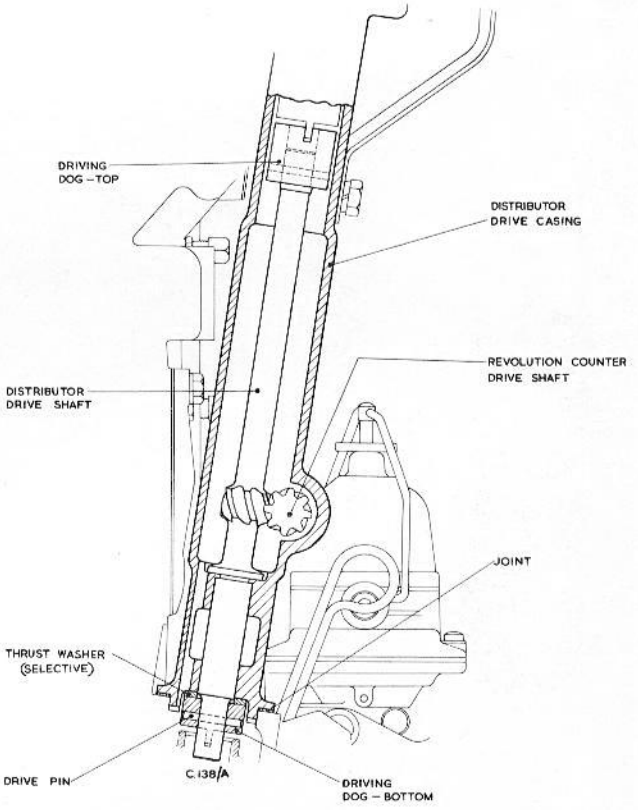


Fig. 46. Dismantling and re-assembling the distributor drive casing assembly

Punch out the driving pin securing the bottom driving dog and remove the driving dog and the selective thrust washer.

Withdraw the shaft from the casing and if necessary punch out the driving pin securing the top driving dog.

Rebuild the assembly, with any new parts which may be required, by reversing the foregoing procedure. Check that the end float is with the figures given in General Data and if necessary fit a selective thrust washer available in four thicknesses. See Spares list.

Fit a new washer to the revolution drive body.

When the assembly is completed refit to the engine by fitting a new joint to the lower flange face. Insert the lower end of the casing assembly into its location, turning the shaft until the tongue and slot location is aligned. Fit the nuts and spring washer but do not tighten.

Fit the top two bolts through the air cleaner bracket, manual control bracket the casing and its selective distance piece and lightly tighten.

Tighten the lower flange nuts and finally tighten the upper bolts.

Connect the revolution drive cable and the oil feed pipe.

Fit the distributor turning the rotor to engage with the top driving dog. The slot of the driving dog and the tongue of the distributor are offset from the centre and will only engage correctly one way.

Fit the shouldered bolt and its washer through the slot of the clamp plate and tighten.

Connect the L.T. lead. Check and set the ignition timing and fit the distributor cover.

Note. The lower driving dog is not offset, it can therefore be fitted 180° out of its correct setting. If this should have occured remove the H.T. leads from the cover and reposition them in their correct 'firing' sequence.

Ignition Timing (Initial Setting)

All Engines fitted to Type 404 Car.

All Engines fitted to the Type 405 up to Chassis 4066.

The above engines have no provision to indicate Top Dead Centre which can only be determined from the actual piston by removing a sparking plug.

On Chassis 405/4067 the flywheel is clearly marked at 10° before T.D.C. and at T.D.C.

These markings can be positioned using a central marking on an aperture which is located on the top right hand side of the clutch housing and is covered by a swing cover.

On engine without marking obtain the 5° before Top Dead Centre as follows:

Remove the front (No.1) Sparking Plug and turn the engine over with the starting handle until No.1 piston is rising on the compression stroke. This is readily obtained by counting five compressions and then turning steadily on the sixth phrase.

Insert a clean rod, not less than 9 inches in length, and obtain the top dead centre position. This should be suitable for intial setting.

On engines with markings on the flywheel a halfway distance between the 10° before T.D.C. and T.D.C. should be sighted which will give a fairly accurate 5° before T.D.C.

When the above settings are determined set the distributor clamping plate hard against the shouldered screw so that the elongation is in its fully retarded position.

Slacken the clamp screw of the distributor and rotate the distributor until the contacts are just breaking. Tighten the clamp screw.

Now swing the distributor body forward to the full extent of the elongation in the clamp plate which will then give the engine starting position and the manual control position.

To obtain the final ignition setting.

Start the engine.

When the normal running temperatures are reached open up to say 2,000 rpm using the hand throttle control.

With the manual control in the fully advanced position loosen the clamp bolt and turn the distributor body until maximum r.p.m. are obtained at that throttle opening.

Tighten the clamp bolt.

Distributor Contact Breaker

The contacts are available as a set to Lucas Part No. 407050

To recondition the points or to replace the set first remove the distributor cover and lift of the rotor. Release the nut and disconnect the H.T. lead at the side of the distributor body. Slacken the locknut 'A' in Fig. 47 to release the slotted end of the rocker spring 'C' lift off the rocker arm from its pivot post, and take off the insulating washer. Remove the screws 'B' and washers and lift off the fixed contact plate.

To dress the contacts use a fine grade carborundum stone but take care to keep the faces as flat as possible as shown in Fig. 48 When all traces of 'pitting' have been removed clean off thoroughly.

To fit the contact set refit the contact plate and secure lightly with the washers and screws. Fit the insulating washer over the rocker post, lightly oil the rocker post, fit the rocker and secure its spring by attaching the slotted end to the terminal and tightening the locknut. Attach the L.T. lead.

To Set the Points

Turn the crankshaft with the starting handle until the

rocker is on the peak of one of the distributor cam lobes. Slacken the two screws 'B' sufficient to be able to move it and adjust it Fig. 49 until the feeler gauge .014 to .016 inch is a good sliding fit between the points. Tighten the screws turn the starting handle a few turns to locate on another cam lobe and finally check the gap. Lightly lubricate the cam then refit the rotor and cover.

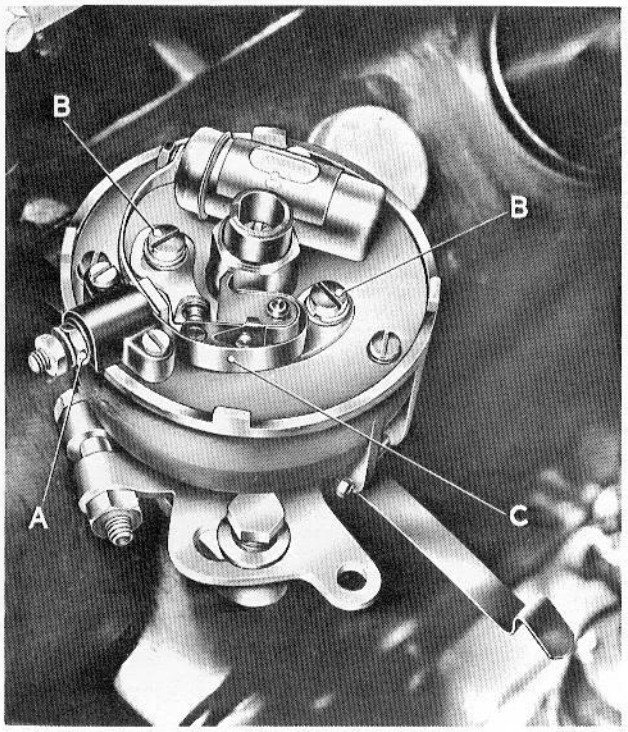


Fig. 47. Contact breaker details

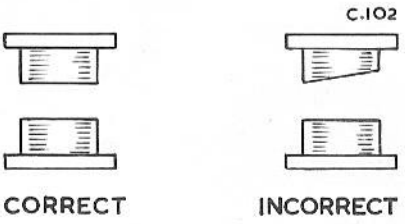


Fig. 48. Contact faces

Distributor Cover and Rotor

At the same time as cleaning and setting the points it is advisable to clean the rotor and the segments in the distributor cover. With the rotor removed scrape the contact face with a knife. Do not use emery cloth to clean the rotor or distributor cap segment.

Clean the six segment studs in a similar manner and thoroughly clean the inside of the cover. Make sure that the central carbon contact is free in its location. To lubricate the distributor shaft apply three or four drops of lubricating oil around the exposed screw head.

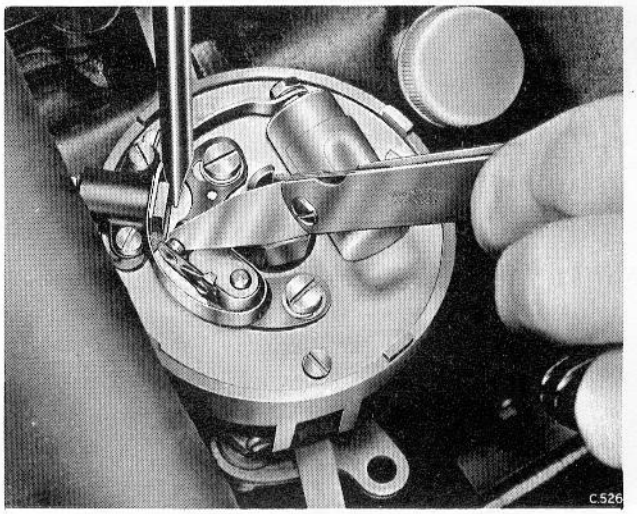


Fig. 49. Setting contacts

Checking the Ignition System

A systematic check of the ignition system can be made as follows:

Disconnect each H.T. wire in turn from its sparking plug, and position the end of the cable about 1/4" inch away from any bare metal part of the engine. With the ignition switched on turn the engine, if a spark occurs the defect is in the sparking plug. If no spark occurs proceed to check as follows;

Disconnect the centre lead (i.e. coil to distributor from the distributor. With the distributor cover removed turn the engine with the handle to close the contacts. Position the disconnected end of the centre lead about 1/4 inch away from same bare metal part of the engine and switch on the ignition. Manually open and close the contact breaker points when a spark should occur at the end of the lead on opening the points. No electric shock will be felt at the contact breaker since it is in the L.T. circuit (12 volts).

If no spark occurs check that the L.T. and H.T. connections to the coil are secure and clean. Then repeat the check. If no spark occurs a defective coil is indicated.

To check this disconnect the L.T. lead (SW) on the coil, to eliminate the ignition switch circuit, then connect the SW direct to the negative terminal of the battery with a separate insulated wire. Recheck the opening and closing of the contacts and if no spark occurs a faulty coil is confirmed. If a spark does occur then the fault would be between the coil and the ignition switch. Disconnect the temporary wire from the battery.

If on checking for spark a strong discharge is noted between the points as they open, it indicates a faulty condenser, but it is unlikely that a condenser will fail completely and suddenly.

Replacing Condenser

The condenser part is Lucas 407044.

Lift off the distributor cover and the rotor and dis-

connect the connecting strip at the head of the condenser.

Remove the screw and shakeproof washer from the clip which will release the condenser.

Clean off and fit the replacement.

Sparking Plugs

A special long reach universal joint spanner Part No. N.600011 should be used to fit or remove the 10 m/m sparking plugs. The spanner has a rubber insert which grips the top of the plug for lifting out. When removing and refitting plugs always use this spanner and its tommy bar N.600130. Do not screw in the plug too tightly, finger pressure on the tommy bar is sufficient.

The plugs should be serviced at least every 3,000 miles and the gaps reset. When it is no longer possible, due to the wear of the electrodes, to adjust the gap the plugs should be replaced.

The K.L.G. Plugs are of the detachable type and can be dismantled for cleaning purposes. Alternatively, the plugs may be cleaned by the use of proper sand-blasting equipment. Care should be taken to see that all abrasive is cleaned from inside the plug, this is most readily done by dismantling the plug.

To take the plug to pieces refer to Fig.50

The Gland nut (B) should be unscrewed from the body (D) so that the insulated electrode assembly (A) may be withdrawn. This operation is best carried out by using two box spanners which fit the respective hexagons without slackness. Grip the box spanner for the gland nut in the vice while the other box spanner is used to unscrew the body.

If the insulation is oily, wash in petrol or paraffin, then with fairly coarse glass paper remove the carbon deposit and wash again. The firing point (F) should be cleaned with fine emery cloth.

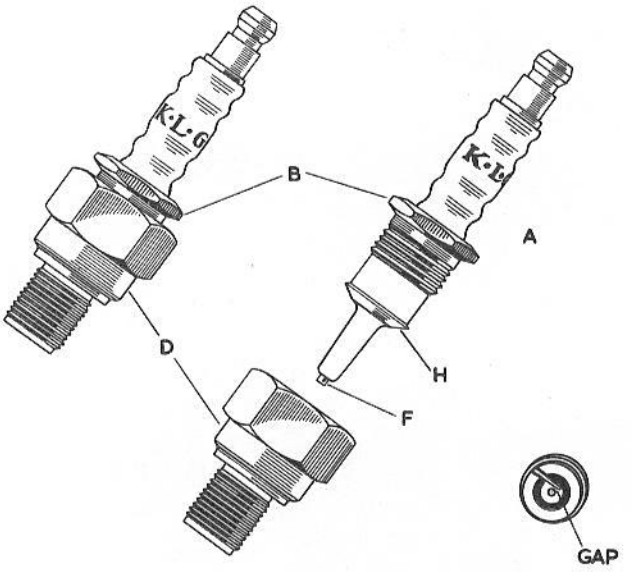


Fig. 50. Sparking plug dismantling

The plug body (D) should be scraped clean internally with a knife or wire brush, paying particular attention to the earth electrode, and finally washed off in petrol.

The internal washer (H) should be lightly smeared with thin oil. Make sure that it is properly seated in the plug body before inserting the central electrode assembly. Screw in the gland nut and tighten sufficiently to give a gas-tight joint.

Finally adjust the gap to .018 to .020 inch carefully moving the earth electrode only to obtain this figure with a feeler gauge.

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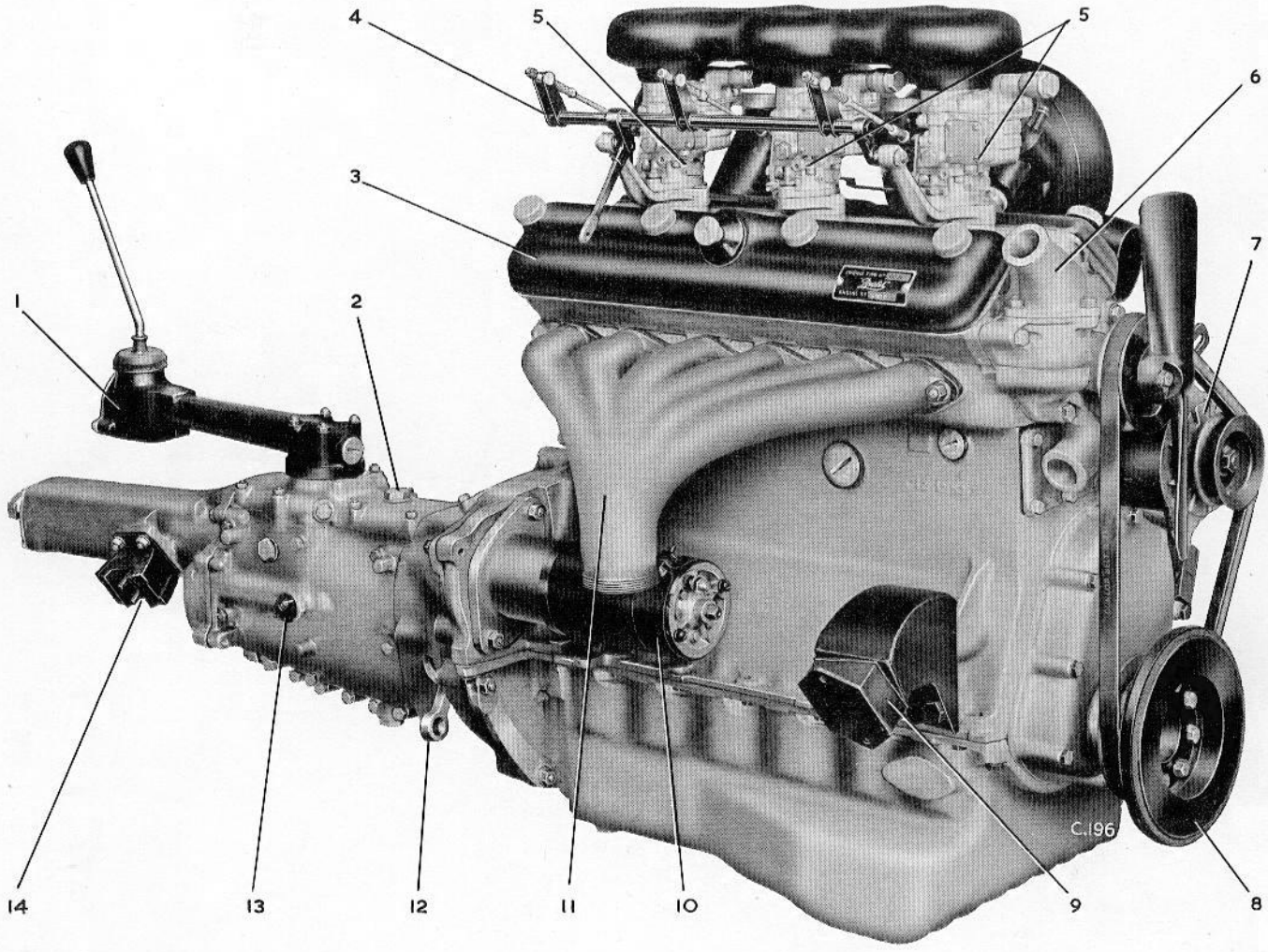
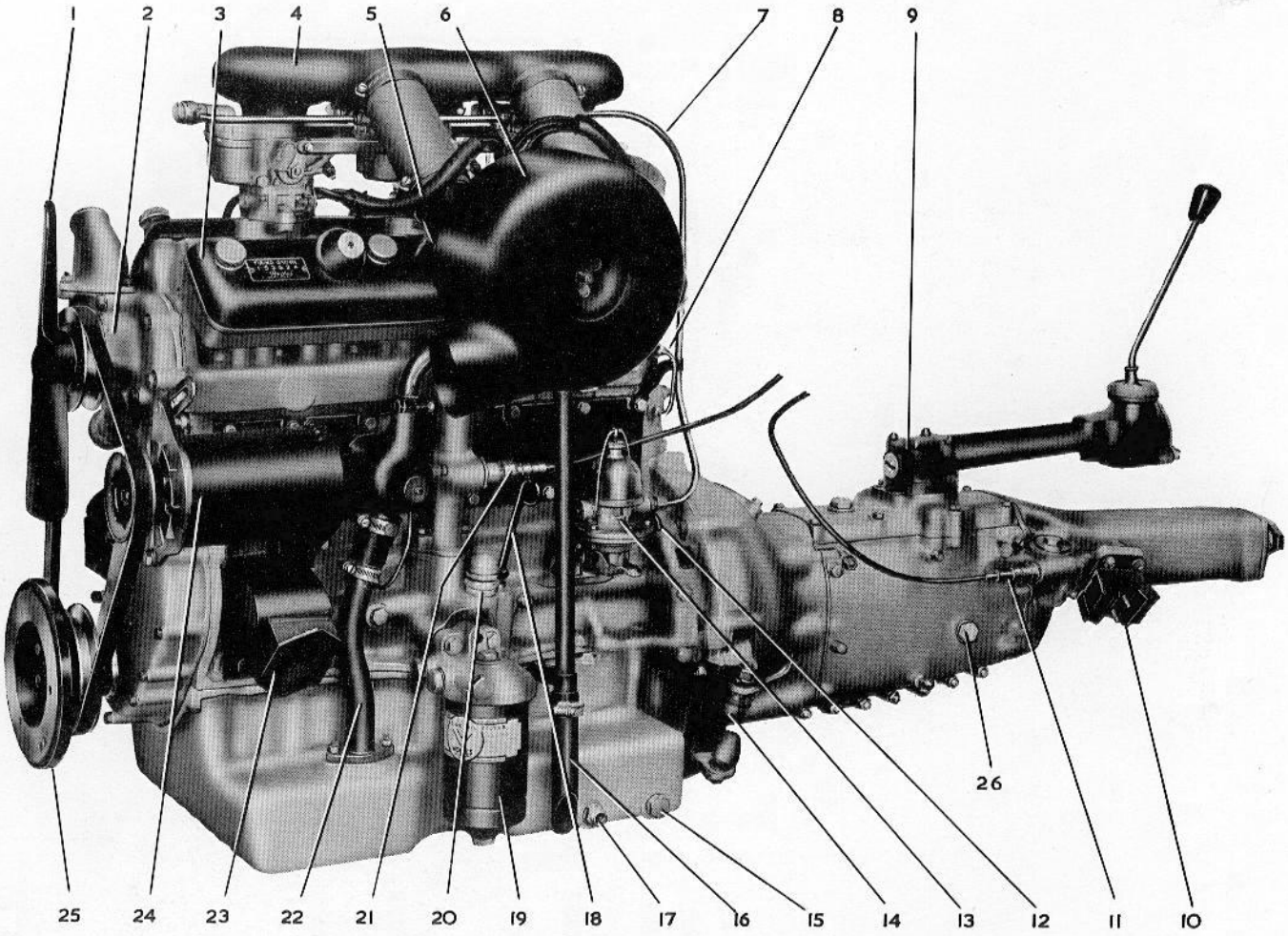


Key

1. Gearbox remote control.
2. Gearbox filler plug.
3. Exhaust rocker cover.
4. Throttle control layshaft.
5. Carburettors.
6. Water pump thermostat.
7. Dynamo cooling fan.
8. Vibration damper.
9. Engine front mounting.
10. Starter.
11. Exhaust manifold.
12. Clutch operating lever.
13. Reversing light switch.
14. Rear mounting.

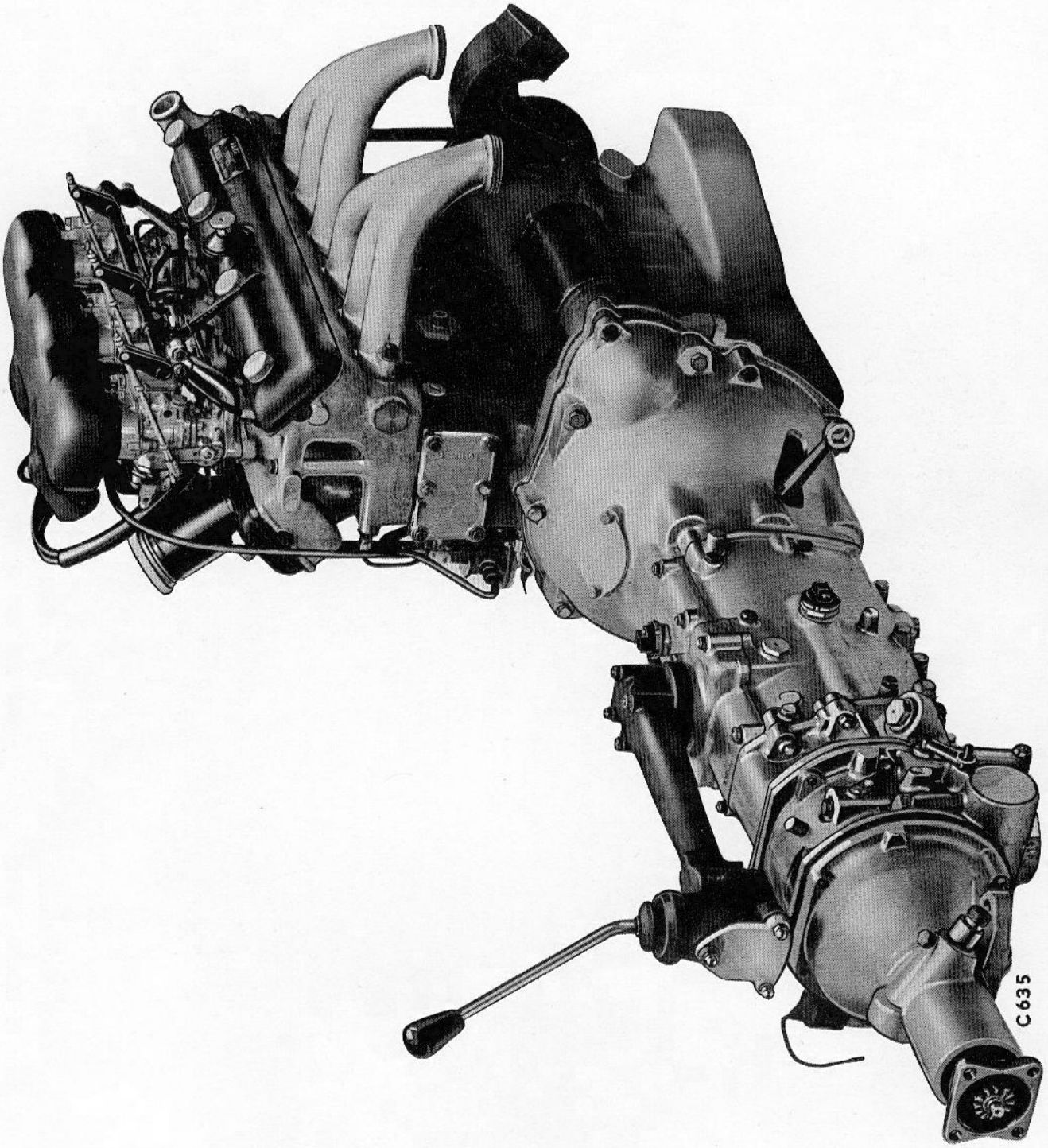
Type 100B Engine with BWCR7 Gearbox. R.H. Side



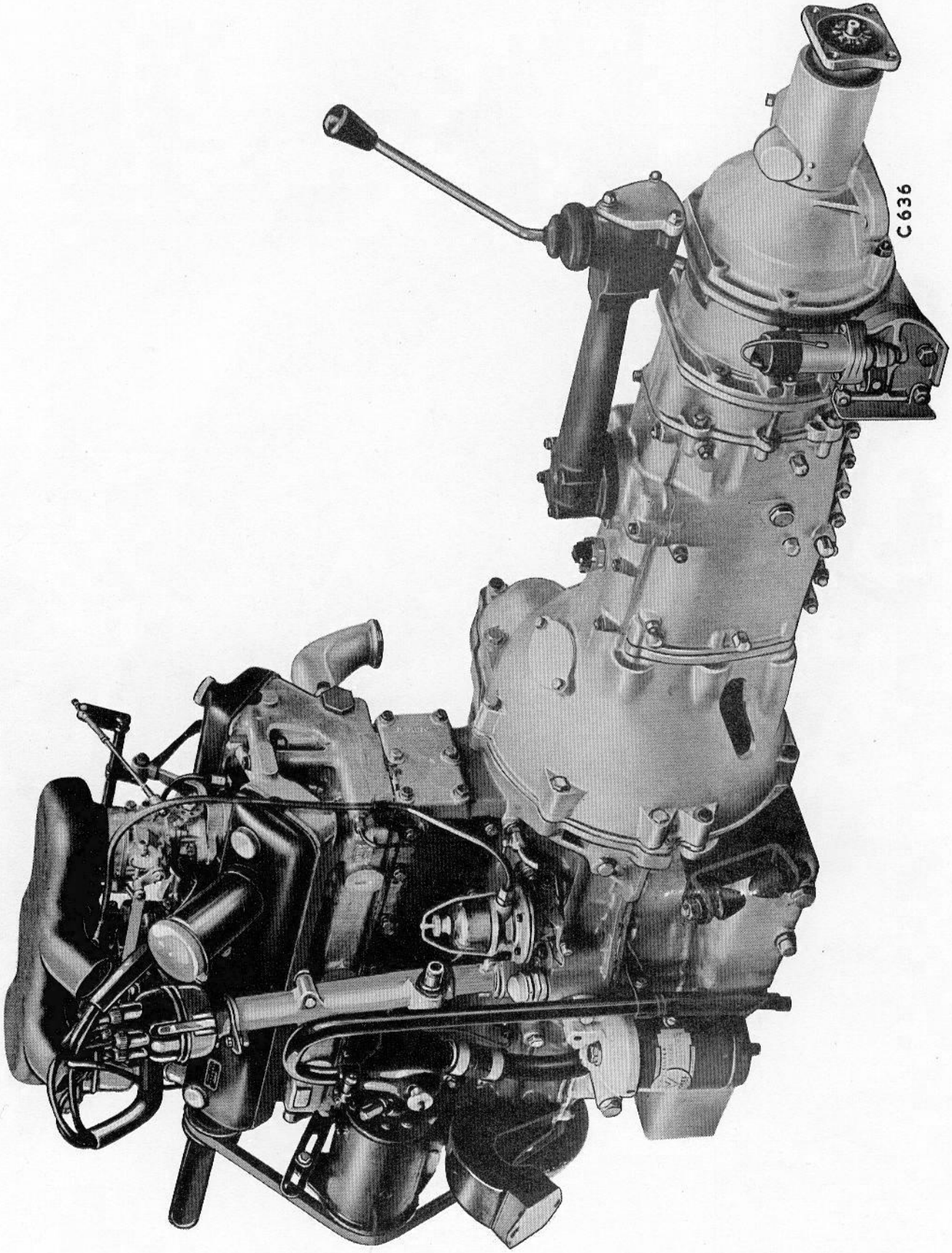
Key

1. Fan.
2. Water pump.
3. Inlet rocker cover.
4. Air intake manifold.
5. H.T. leads.
6. Air cleaner.
7. Petrol feed pipe (pump to carbs).
8. Oil feed pipe to rockers.
9. Gearbox remote control.
10. Rear mounting.
11. Speedometer drive.
12. Cylinder drain cock.
13. Petrol pump.
14. Torque buffers.
15. Sump drain plug.
16. Engine breather pipe.
17. Oil thermometer connection.
18. Dipstick.
19. Oil filter.
20. Oil pressure relief valve.
21. Engine speed indicator drive.
22. Oil return pipe separator.
23. Engine front mounting.
24. Dynamo.
25. Vibration damper.
26. Gearbox level plug.

Type 100B Engine with BWCR7 Gearbox. L.H. Side



Type 100/B2 Engine and BWCR11 Gearbox. R.H. Side

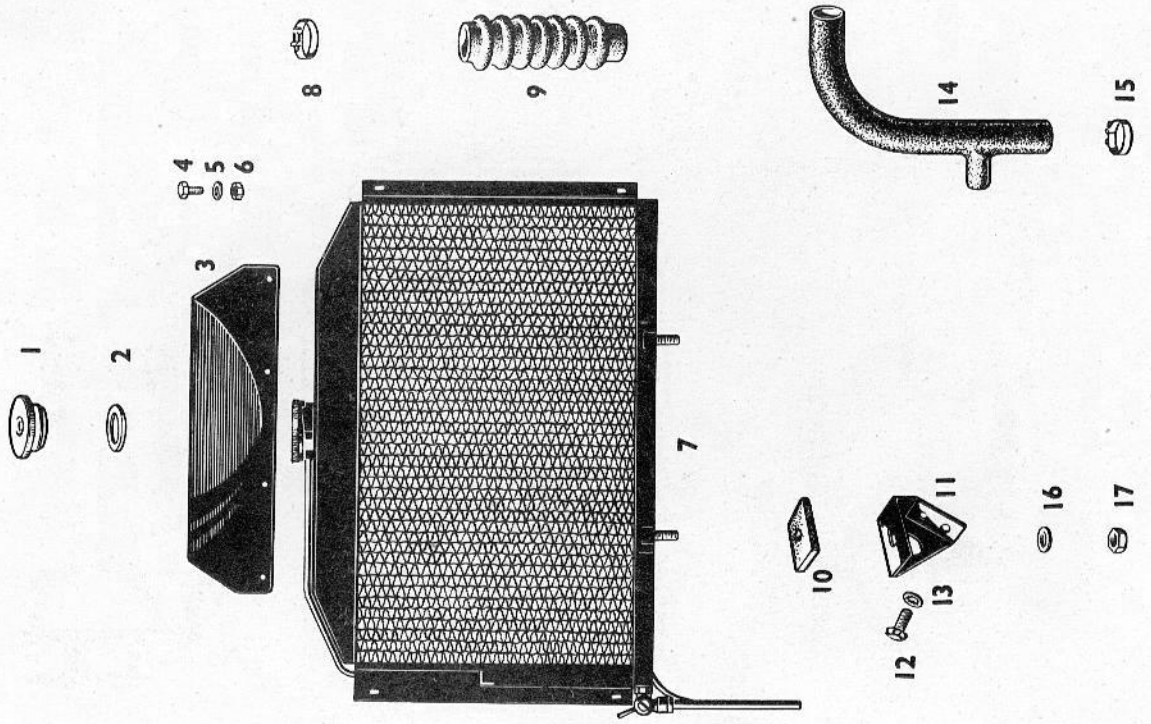


Type 100/B2 Engine and BWCR11 Gearbox. L.H. Side

Engine Cooling System

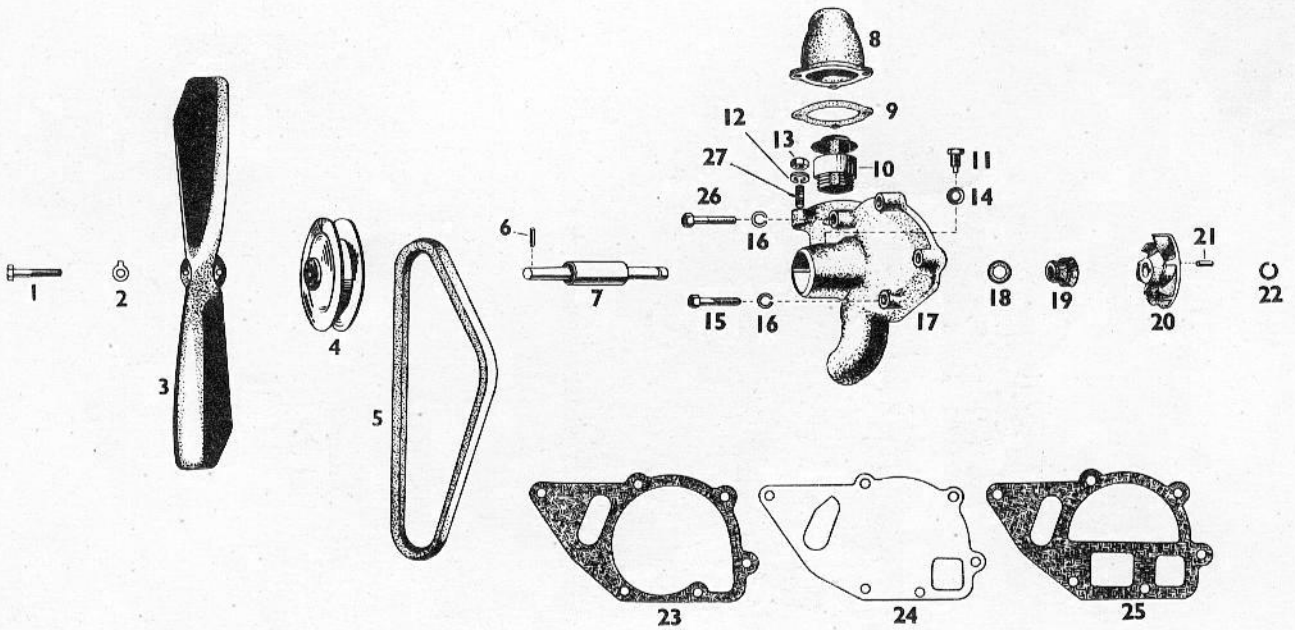
RADIATOR.

Part No.	Item	Description	No. off per car	Part No.	Item	Description	No. off per car
405-1-20154	1	Filler Cap	1	404-11-20160	11	Radiator Support Bracket LH.	1
404-1-20155	2	Filler Cap Washer	1	404-11-20161	-	Radiator Support Bracket RH.	1
405-1-20156	3	Fan Guard	1	FS105/4D	12	5/16" BSF Setscrew	4
FS. 104/4R	4	Screw ¼" BSF Hex Head ½" long	4	-	13	5/16" Shakeproof Washer	4
-	5	Shakeproof Washer ¼" dia.	4	405-1-20025	14	Radiator Hose - Bottom - Long Return	1
FN104/A	6	Nut ¼" BSF	4	405-1-20026	-	Radiator Hose - Bottom - Short Return	-
405-1-20157	7	Radiator Assy.	1	N. 410081	15	Clip - Bottom Hose	2
N. 704172	8	Clip - Top Hose	2	-	16	7/16" Plain M.S. Washer.	2
404-1-20118	9	Radiator Hose - Top	1	-	17	7/16" BSF Simmonds Nut	2
N. 410021	10	Rubber Pad	2				



WATER PUMP GROUP

Part No.	Item	Description	No. off per car	Part No.	Item	Description	No. off per car
WB. 104/8D	1	Bolt - Fan	2	FB. 105/14D	15	Bolt 5/16" BSF 1¾" long	5
N. 350120	2	Tabwasher - Fan (Also N. 350990)	2	AGS. 585/E	16	5/16" Spring Washer	6
N. 350610	3	Fan	1	N. 350460	17	Water Pump Casing	1
N. 350680	4	Fan Pulley	1	N 350690	18	Thrower	1
N. 350640	5	Belt	1	N. 350410	19	Oil Seal	1
N. 350580	6	Locating Pin	1	N. 350470	20	Impellor	1
N. 350710	7	Water Pump Shaft	1	N. 350540	21	Locking Dowel - Impellor	1
N. 350620	8	Outlet Pipe	1	N. 350700	22	Circlip - Shaft	1
N. 350630	9	Joint - Outlet Pipe	1	N. 350250	23	Water - Pump	1
N. 350780	10	Thermostat	1	N. 350230	24	Blanking Plate	1
N. 350490	11	Bearing Retaining Screw	1	N. 350240	25	Washer - Head	1
AGS. 585/D	12	Spring Washer	3	FB. 105/19D	26	Bolt 5/16" BSF. x 2.3/8" long	1
FN. 104/K	13	Nut - Outlet Pipe	3	N. 453120	27	Stud	3
	14	5/16" Dia. Washer	1				



Radiator

Description

The cooling system of the Type 404 and 405 cars is similar.

Water drawn from the radiator, by the centrifugal pump mounted on the front of the cylinder head, is impelled around the inlet valve seats into the cylinder block jacket. The return flow passes around the exhaust valve seats to the pump and finally to the radiator via a thermostat valve incorporated into the pump.

The radiator is of the cellular matrix type, the system being sealed with a steam pressure relief valve incorporated in the filler cap.

The thermometer bulb of the water temperature gauge is located on the right hand side of the cylinder block.

The thermostat valve in the water pump operates in the following manner. When the engine is cold the valve seals the outlet to the radiator. Water is then circulated through the cylinder block and head, enters the valve housing and passes to the impellor to be re-circulated. A small bleed hole in the valve head prevents excessive water pressure. As the water temperature reaches 75° C (167° F) the valve is lifted from its seat permitting a flow via the outlet elbow to the radiator header tank.

At normal running temperature the valve is fully open and full water circulation operates. This system promotes the rapid warming of the engine in cold weather.

Draining the System

Warning. Never remove the radiator cap while the engine is running since water may be ejected through the filler neck under pump pressure. After stopping a hot engine remove the cap slowly to release any steam pressure.

To drain the system, ease the radiator cap and open the taps at the bottom right hand side of the radiator and on the rear left hand side of the cylinder block. No tap is provided for the heater system since this is at the highest point.

Flushing

Flush the system at intervals depending upon the local water conditions and the type of operation to which the car is subjected. Always flush the system after the removal of water containing anti-freeze compound or if the car has been standing for a considerable period with the cooling system empty.

Any proprietary brand of flushing solution may be used provided that it is not harmful to aluminium.

Removing and Refitting the Radiator

Remove the bonnet, drain the system and disconnect the radiator hoses. Remove the two bolts on either side at the top of the radiator and remove the angle clamping plate and the rubber packing. Fig. 95

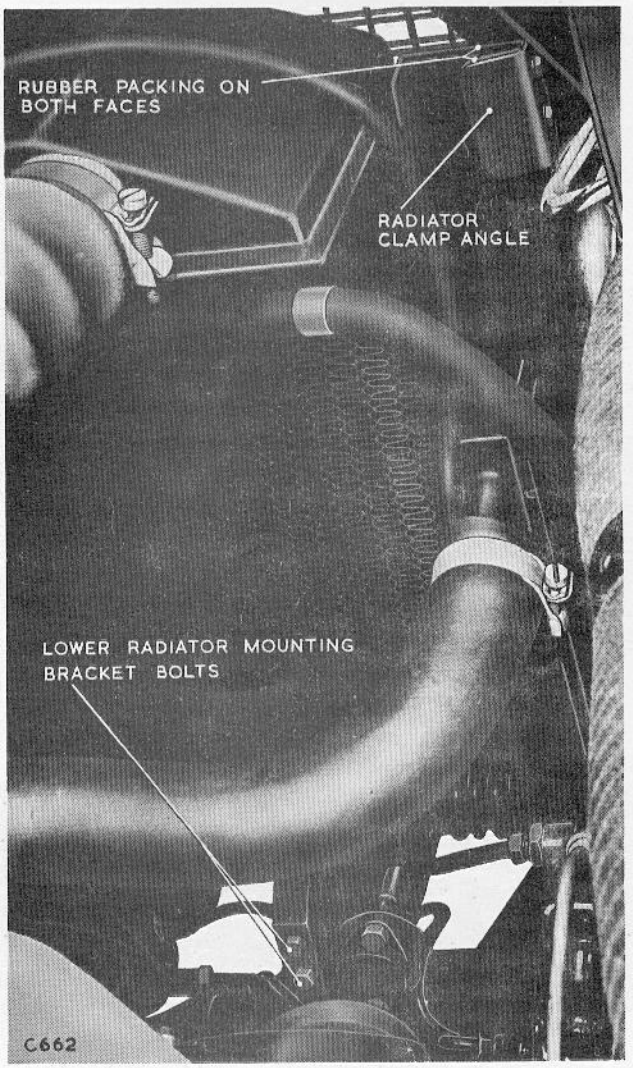


Fig. 95. Radiator attachment points

Remove the two bolts on either side securing the lower radiator mounting brackets and lift the radiator out complete with the brackets.

Note. The lower mounting brackets and rubber mounting blocks are parts of the car and not parts of the radiator. They are detached with the radiator for ease of removal only. If a replacement radiator is to be fitted transfer these parts from the removed radiator.

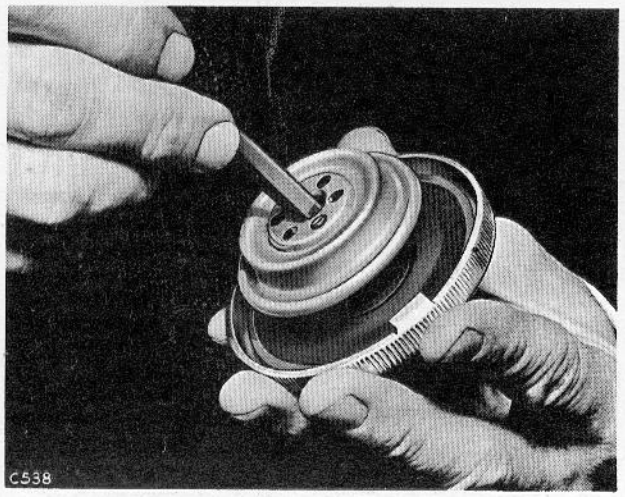


Fig 96. Checking radiator pressure release and overflow valve

To refit the radiator reverse the removal procedure.

Radiator Cap

Incorporated in the radiator cap is a steam pressure release and overflow valve. It is advisable to check periodically that the spring loaded valve is free by pressing it open through the hole in the centre of the cap as shown in Fig. 96.

Fan Belt Tension

The belt is tensioned correctly if it can be deflected inwards by hand approximately 1 inch on its upward run. If the belt is slack, release the dynamo adjusting and mounting bolts as shown at A, B and C in Fig.11 together with the mounting bolt located at the rear of the dynamo.

Note. A suppressor mounting bracket is secured to the rear dynamo bolt when radio is installed.

Move the dynamo away from the cylinder block to obtain the correct tension and tighten the attachments.

Water Pump

Replacements

Service replacement Water Pumps are available from the manufacturer. They are supplied subject to the return of the removed water pump which is accepted for normal wear and corrosion only.

It should be noted that replacement pumps are supplied without the fan and with the two lower bolts in position. If needed order the two joint washers and the two tab-washers for the fan when replacing a pump.

Removing the Water Pump

Ease the radiator cap and drain the radiator and block.

Disconnect the radiator hoses from the pump.

Slacken the dynamo belt adjustment and mounting bolts, press the dynamo towards the engine as far as possible and detach the belt.

Release the six bolts securing the pump to the cylinder head and remove the pump complete with its blanking plate and joint washers.

The two lower bolts of the pump cannot be withdrawn because of the pulley. See Replacements.

Dismantling

Detach the fan by unlocking the tabwashers and removing the two bolts.

Tap out the 1/8 inch dia. parallel pin securing the pulley to the pump spindle and detach the pulley using the extractor T.186444 (Fig. 97).

Cut the locking wire and remove the bearing retaining screw and washer. Press or drive the spindle and bearing assembly complete with impellor from the body

It will be noted that the impellor spindle retaining circlip and vertical dowel are rusted together and it would be preferable to stand this end in a 'freeing' solution.

The circlip should be removed, the oil seal broken away, to allow support for the impellor, and the spindle pressed or driven from the impellor.

Withdraw the rubber thrower from the spindle. Remove the three nuts and washers and detach the outlet elbow with its joint washer.

Lift out the thermostat.

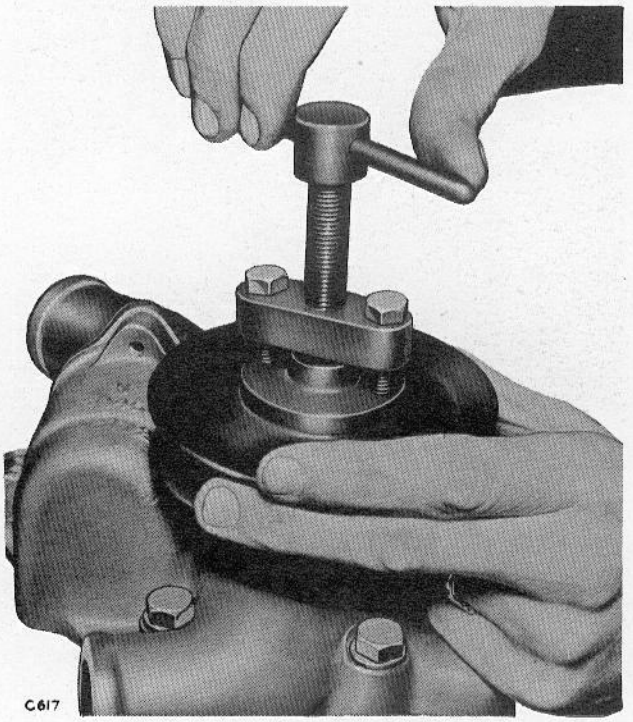


Fig. 97. Removing water pump pulley

Reconditioning

Pump Body

Clean out all water passages and the impellor chamber, removing all corrosion. This is best carried out by sand blasting the whole pump except the spindle bore.

Corrosion can be very extensive but if the aperture and bolt holes have not been penetrated, see Fig. 98 then the body is usually good enough for further use. If the aperture and holes have been penetrated a portion of the material should be cut away to give some thickness and the wall should be built up by welding, using a Aluminium Silicon Rod (7% Silicon).

Surplus weld should then be filed away back to the original face.

Irrespective of whether welding has taken place the locating face should be filed and finally lapped until flat removing the minimum amount to maintain the correct clearance with the impellor.

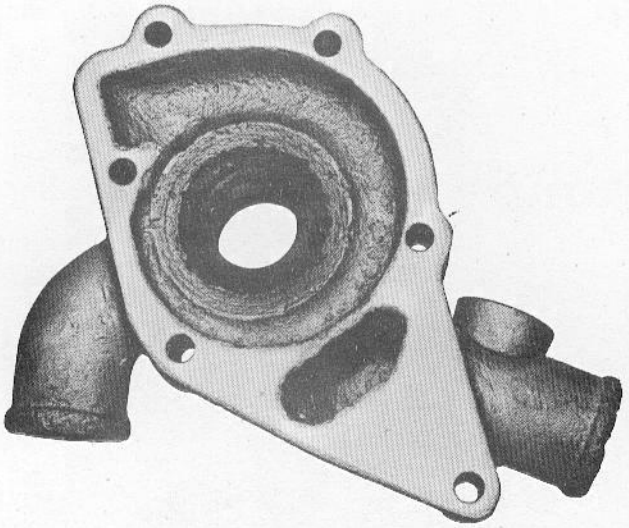


Fig. 98. Water pump body corrosion

Impellor

The seal face should be carefully lapped to give a smooth finish.

Spindle and Bearing Assembly

Remove any corrosion from the spindle using fine grade emery cloth and paraffin.

This assembly is a complete unit and cannot be separated. If the bearings are excessively worn fit a new assembly.

Thermostat

If the bellows are punctured, this will be indicated by the entry of water, discard as unserviceable.

Ease the valve of its seat by pressing the outer bellows rim upwards Fig. 99 and check that the valve returns to its seat on release of the pressure. If the movement is stiff and the assembly corroded, soak it in thin machine oil and carefully remove excessive corrosion to ease the valve action. Make sure that the valve seating and valve face are clean.

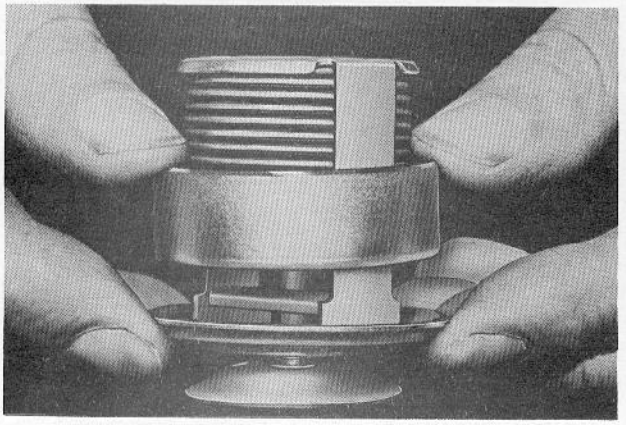


Fig. 99. Checking thermostat valve seat

To check the action of the bellows immerse into boiling water and the valve should lift clear of its seating.

Re-assembling

Immerse the pump body in boiling water and allow it to remain until heated throughout. Smear the external surface of the spindle bearing with grease. Remove the pump body from the water and locate it face downwards on a suitable fat surface.

Insert the spindle and bearing assembly, grooved end downwards and align the retaining screw hole in the bearing with the screw hole in the body.

Lightly drive the assembly into position using a hollow drift or tube locating on the outer edge of the bearing Fig.100 until the retaining holes are in line.

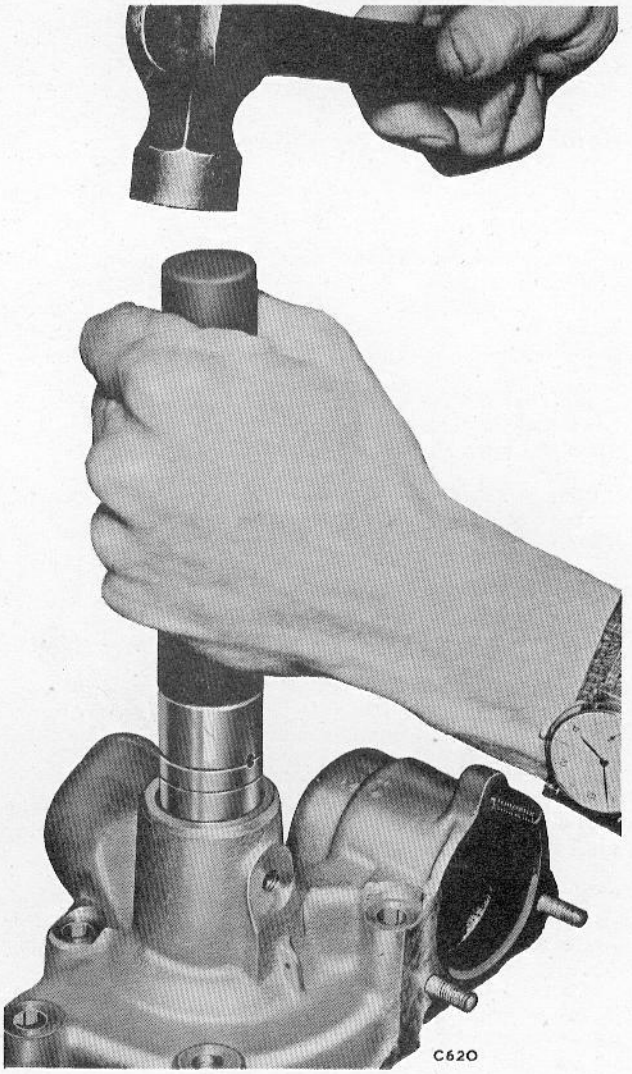


Fig. 100. Inserting water pump bearing

Fit the retaining screw and washer and tighten securely.

At the impellor end fit the rubber thrower over the spindle and on to the face of the bearing.

Coat a new seal with anti-freezing rubber containing 'Dag' colloidal graphite and locate it carefully in the recess in the body, carbon face outermost.

Aligning the dowel hole of the impellor with the flat on the spindle drive on the impellor until the top face is level with the lower edge of the circlip groove. Do not drive the impellor beyond this point otherwise it will be difficult to withdraw. Insert the dowel.

Fit the impellor retaining circlip making sure that it fully seats in the groove.

Using feeler gauges check the clearances of the vanes and face of the impellor to the figures shown in Fig.101 Providing that the components are in a satisfactory condition these clearances are usually obtained.

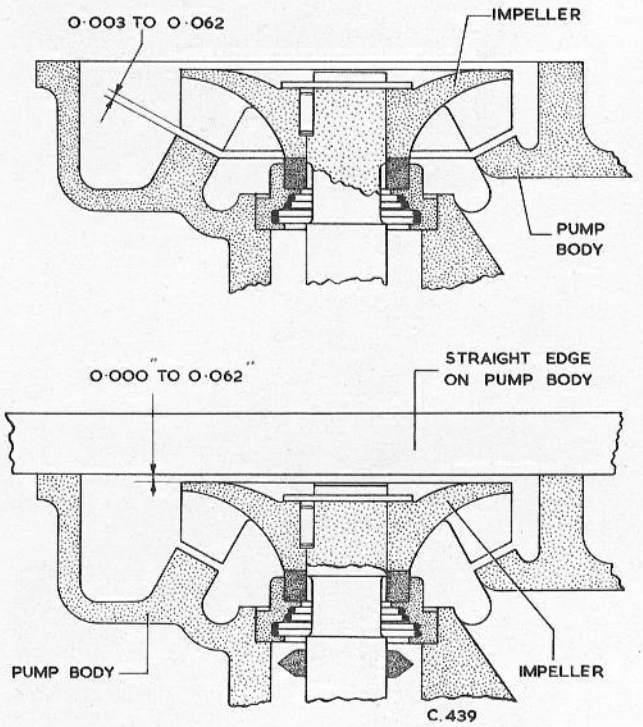


Fig. 101. Checking pump impellor clearances

When the clearances are satisfactory, tighten and wire-lock the bearing retaining screw.

Fit securing bolts and spring washers to the two lowest holes in the pump body. This is important since these cannot be fitted once the pulley is assembled.

Carefully mark the top of the spindle showing the location pin centres then fit the pulley to the pump spindle aligning the locating pin holes with the marking on the spindle. Fig.102. Support the other end of the spindle during this operation otherwise the pressure will be put on to the ball bearings and the bearing retaining pin. A noisy bearing can result from this.

Insert the locating pin.

Fig. 102. Fitting water pump pulley

Fit the fan to the front of the pulley and secure it with the bolts and tabwashers.

Fit the thermostat Fig.103, positioning it so that the side pieces do not obstruct the transfer passage.

Lightly grease the outlet joint faces, fit a new joint and attach and secure the outlet elbow with its three nuts and spring washers.

Refitting Water Pump to Engine

See that the pump attachment face at the front of the cylinder head is clean and flat. Smear the face with grease and fit a new joint washer (Part No. N.350240).

Clean the blanking plate faces and check for flatness.

Grease the face of the pump body and fit a new joint washer (Part No. N.350250).

Smear the blanking plate with grease and assemble the pump to its location screwing in the two lower bolts, finger tight.

Fit the four remaining bolts and spring washers and tighten all bolts evenly.

Refit the fan belt and adjust to the correct tension.

Fit the radiator hoses and fill the cooling system.

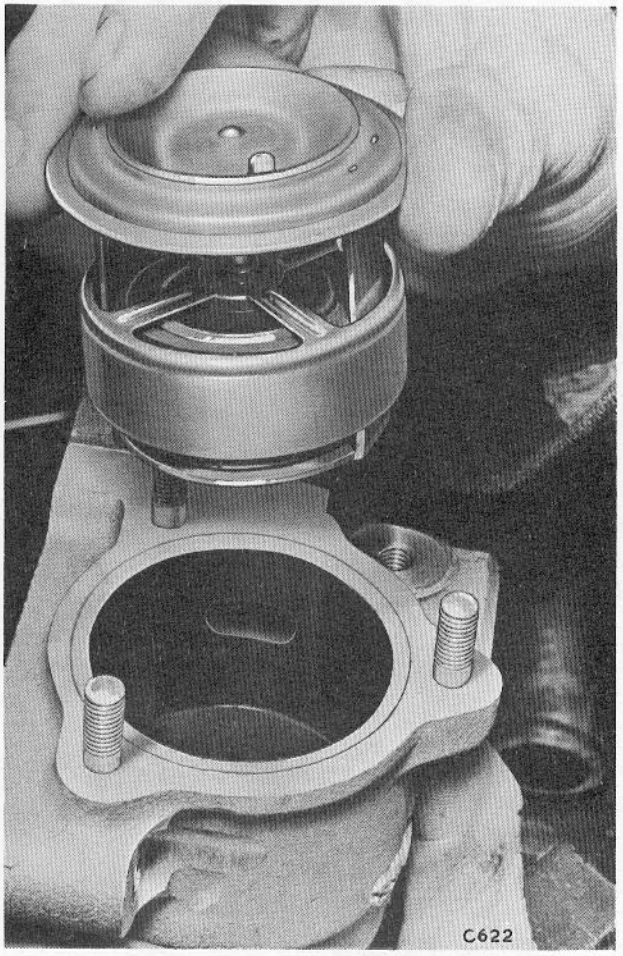


Fig. 103. Fitting thermostat to water pump