

Fig. A.19

The special impulse extractor attachment for Service tool 18G 374 in position for extraction of the crankshaft pulley

Lower the engine onto the rubbers.

The replacement operation now continues in the reverse manner to the removal procedure.

Refill the engine with oil to Ref. A (page P.2).

Section A.12

REMOVAL AND REPLACEMENT OF POWER UNIT

The removal of the power unit does not present any serious difficulty if the operations are carried out in the following sequence. It is not necessary to remove the bonnet, but the clevis pin securing the prop to the bonnet lid must be removed and the bonnet secured safely in the open position.

Remove the front bumper assembly by unscrewing the two nuts securing it to the frame.

Drain the oil from the engine and gearbox.

Drain the water from the radiator by means of the drain tap located in the right-hand side of the radiator bottom tank. If Bluecol or other anti-freeze mixture is in use it should be drained into a suitable clean container and carefully preserved for future use, using a rubber extension pipe on the tap.

Disconnect the battery by removing the flexible lead from the negative battery terminal. Disconnect the cable from the starter motor.

Release the radiator mask by removing the nuts and spring washers securing the grille surround to each wing.

On earlier models with combined head and pilot lamps turn the bulb holder in an anti-clockwise direction and withdraw it from the back of the lamp unit. Withdraw the main bulb from its holder and disconnect the earth wire from the terminal below the bulb carrier.

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On later models with separate sidelamps it is necessary to release the sidelamps from the grille panel by removing the glass and withdrawing the three attachment screws.

Undo the seven nuts and bolts securing the lower edge of the grille panel to the frame.

Release the clips from the top and bottom water hoses and separate the hoses from their connections.

Disconnect the bonnet lock tensioner spring and withdraw the split pin and flat washer from the forward end of the bonnet catch operating rod. Remove the two $\frac{3}{8}$ in. nuts and bolts securing the radiator top rail to each wing.

Lift out the radiator and grille assembly.

Detach the throttle return spring from the air intake pipe and remove the air silencer and air intake pipe assembly by undoing the $\frac{3}{8}$ in. bolt and spring washer from the air cleaner support bracket and the two $\frac{1}{4}$ in. bolts with spring washers locating the air intake pipe to the carburetter flange.

Disconnect the throttle and mixture control from the carburetter and release the throttle control steady bracket from its attachment on the cylinder head by undoing the $\frac{3}{8}$ in. fixing bolt.

Release the flexible petrol pipe from the pump and detach the carburetter from the manifold.

Disconnect the high-tension cables from the sparking plugs and the low-tension cable from the distributor. Remove the two leads from the dynamo and lift off the distributor cap with the wires attached. Detach the starter cable from the starter motor by undoing the terminal nut with spring washer. Detach the earth cable from the cylinder head.

Disconnect the oil gauge pipe from its connection on the cylinder block and release it from the clip on

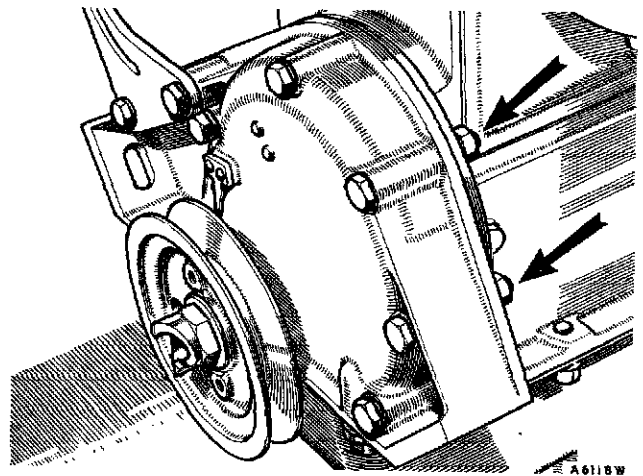


Fig. A.20

The location of the two $\frac{1}{4}$ in. bolts with retaining nuts at the back of the engine bearer

the tappet cover. Remove the two $\frac{5}{16}$ in. nuts, bolts, and spring washers from the exhaust manifold flange and remove the flange gasket.

Remove the front floor mat and remove the left-hand-side front seat by undoing the four $\frac{1}{4}$ in. bolts and clips locating the seat to the floor of the car.

Unscrew the gear lever knob from the gear lever after slackening the locknut and remove the gearbox rubber cowl.

Remove the gearbox cover-plate and floorboards by undoing the $\frac{3}{8}$ in. brass bolts securing them. Note that the two bolts on each side of the gearbox tunnel are longer than the rest and screw into the gearbox support member.

Disconnect the speedometer cable from the drive assembly at the rear of the gearbox.

Extract the split pin and anti-rattle washer from the clutch operating lever link and disconnect the link from the lever.

Unscrew the nuts from the four $\frac{1}{4}$ in. bolts on the front universal joint driving flange and remove the bolts. The nuts are of the patent self-locking type.

Remove the gearbox cover, care being exercised to ensure that the three selector lock balls and their springs in the rear wall of the box are not lost in the process or dropped into the box. Place a temporary protecting cover over the gearbox to exclude any foreign matter.

Support the engine with suitable lifting tackle. If a lifting ring is employed it should form part of a plate which can be fitted under two of the stud nuts.

Undo the two bolts securing each mounting rubber to the gearbox casing. Remove the two $\frac{5}{16}$ in. nuts and washers securing the front engine mounting rubbers to the timing cover.

The power unit may now be raised and manoeuvred forward clear of the car.

Reassembly is carried out in the reverse order to that of dismantling.

Refill the engine and gearbox with oil to Refs. A and B (page P.2).

Section A.13

REMOVAL OF TIMING COVER

To carry out this operation with the engine in the frame it is necessary to remove the radiator core and grille assembly as in Section A.12, and the fan belt.

Release the engine from its forward mounting rubbers by removing the two $\frac{1}{2}$ in. nuts and washers.

Support the front of the engine with suitable lifting tackle.

Removing the timing cover

Remove the starting-handle dog nut, washer, and shims, taking care of the shims to ensure their replacement.

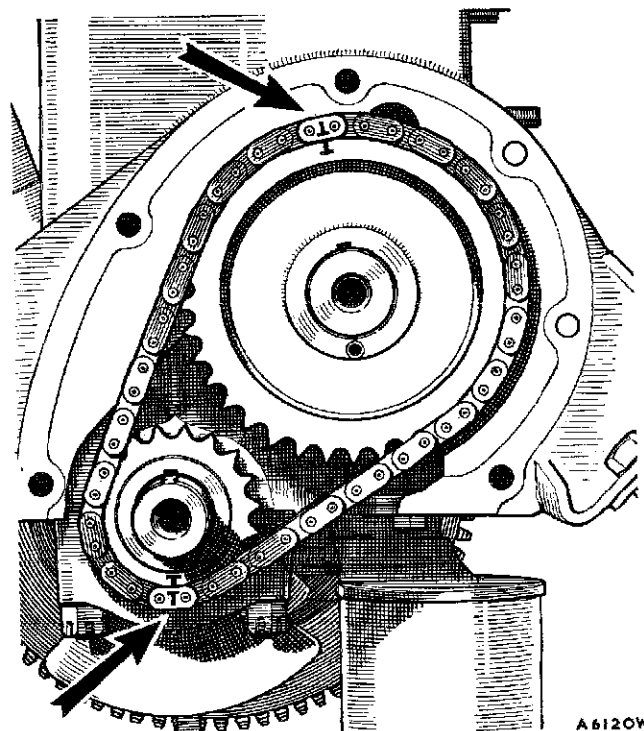


Fig. A.21

This clearly shows the position of the marked teeth on the sprockets and bright links on the timing chain when set correctly for the replacement of the timing chain

Remove the crankshaft fan pulley with a suitable extractor (Service tool 18G 374, with attachment 18G 374 A).

Remove the six $\frac{1}{4}$ in. bolts securing the timing cover to the cylinder casting, observing that the two near-side bolts do not actually screw into the casting, but are provided with $\frac{1}{4}$ in. nuts.

Remove the two $\frac{3}{16}$ in. bolts locating the timing cover to the sump.

Remove the timing cover.

IMPORTANT.—Care should be exercised to ensure that the sump gasket is not damaged during removal of the timing cover. If it is damaged the sump must be removed and the gasket replaced by a new one.

Section A.14

REPLACEMENT OF TIMING COVER

To ensure oil-tight joints it is essential:

- (1) That a new gasket is fitted between the cleaned faces of the timing cover and the engine.
- (2) That a new timing case top packing is fitted.

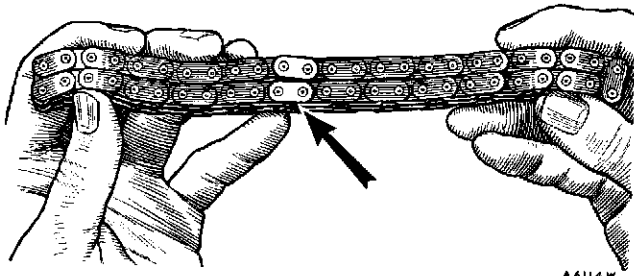


Fig. A.22

The bright links of the timing chain brought together prior to chain replacement

(3) That the sump gasket is not damaged and is smeared with grease.

The following points also need special attention:

(4) That the oil thrower is in position on the crankshaft, with its concave side forward.

(5) That the fan driving pulley key is in position.

(6) That the spacing shims for the starting-handle dog nut are replaced.

Place the timing cover in position, first locating all the securing bolts and nuts loosely and then tightening them up.

Examine the new timing case top packing and fan driving pulley key to ensure that they are fitted correctly. Slide the fan driving pulley home on the shaft.

Replace the starting-handle dog nut shims, washer, dog nut, and radiator assembly.

Section A.15

REMOVAL AND REPLACEMENT OF TIMING CHAIN

To carry out this operation with the engine in the frame it is necessary to drain and remove the radiator, complete with the radiator case, as detailed in Section A.12, to remove the timing cover, as detailed in Section A.13, and to support the engine before the timing cover has been removed.

Drain and remove the sump as detailed in Sections A.1 and A.2.

Remove the dished oil thrower washer from the front of the crankshaft, having noted that it is fitted with its concave side forward.

Tap back the lock washer from the $\frac{3}{8}$ in. set screw locating the camshaft sprocket and remove the screw, together with the lock washer and plain steel washer.

The timing chain and sprockets are now extracted by easing each chain wheel forward a fraction at a time with suitable small levers.

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Replacement

When replacing the timing chain set the camshaft with its keyway approximately 7° B.T.D.C. and the crankshaft with its keyway at T.D.C.

Double the timing chain, bringing both bright links together. This gives a long and short portion of the chain on either side of the bright links.

With the shorter part of the chain on the left (the bright links facing the operator) and the longer on the right, engage the camshaft sprocket tooth marked 'T' with the top bright link and the crankshaft sprocket with the tooth marked 'T' coinciding with the other bright link.

Place the sprockets in their respective positions on the camshaft and crankshaft complete with the chain and push the assembly home. Carefully keep the sprockets in line with each other all the time to avoid straining the chain.

When replaced in the engine the bright links and the marked teeth should take up the positions shown in Fig. A.21.

The engine valve timing is such that with the engine cold and the valve clearance set at $\cdot 018$ in. ($\cdot 46$ mm.) the inlet valves open 8° B.T.D.C. and close 52° A.B.D.C. The exhaust valves open 52° B.B.D.C. and close 20° A.T.D.C.

Reassembly of the remaining parts is carried out in the reverse order to that of dismantling.

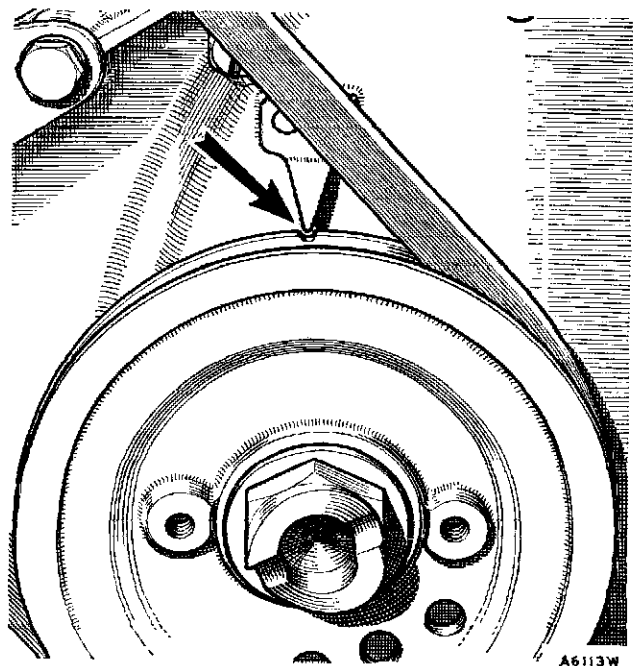


Fig. A.23

The timing marks on the chain case and crankshaft pulley which coincide when No. 1 piston is at T.D.C.

Section A.16

REMOVAL AND REPLACEMENT OF
CARBURETTER

Detach the throttle control return spring from the air intake pipe.

Detach the air intake silencer (or cleaner) bracket from the cylinder head by unscrewing the $\frac{5}{16}$ in. bolt equipped with a spring washer, and unscrew the two $\frac{1}{2}$ in. fixing bolts and spring washers attaching the intake pipe to the carburetter flange. The air intake pipe complete with silencer or cleaner may now be removed.

Disconnect the mixture control from the carburetter by removing the $\frac{5}{16}$ in. split pin and flat washer from the clevis pin on the inner cable and slackening the clip on the outer cable.

Disconnect the throttle control from the carburetter by removing the $\frac{5}{16}$ in. split pin from the clevis pin locating it to the throttle spindle.

Release the flexible petrol pipe at the $\frac{5}{16}$ in. union nut on the petrol pump.

Remove the two $\frac{5}{16}$ in. nuts and spring washers holding the carburetter to the inlet manifold and remove the carburetter.

Refitting of the carburetter is a reversal of the above procedure, but if the carburetter flange is damaged the respective faces should be cleaned, levelled, and a new gasket fitted.

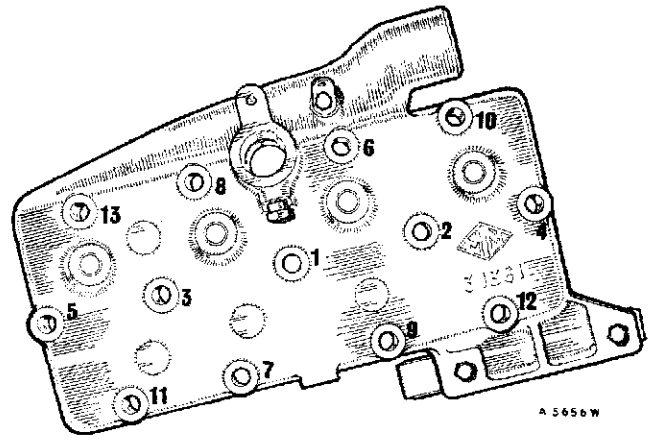


Fig. A.25

The correct order of loosening and tightening the cylinder head stud nuts

Release the exhaust pipe from the manifold by removing the two $\frac{5}{16}$ in. bolts, spring washers, and nuts, observing that a copper-asbestos gasket is fitted between the two flanges. Remove the manifold by unscrewing the four $\frac{1}{2}$ in. elongated stud nuts.

Refitting the manifold is a reversal of the above procedure, but before doing so any excessive carbon should be cleaned from the faces and a new gasket fitted with its perforated side away from the cylinder block and in contact with the manifold.

Section A.17

REMOVAL AND REPLACEMENT OF INLET
AND EXHAUST MANIFOLD

Remove the air silencer (or cleaner) and carburetter as detailed in Section A.16.

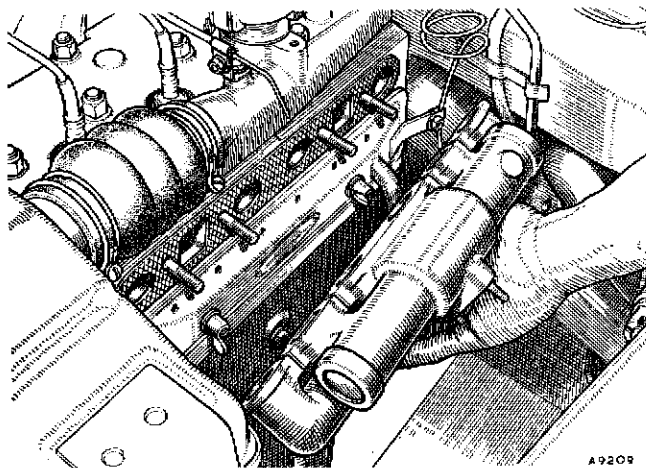


Fig. A.24

Withdrawing the induction and exhaust manifold

Section A.18

REMOVAL AND REPLACEMENT OF
CYLINDER HEAD

Raise the bonnet of the car. Remove the split pin from the clevis pin securing the prop to the bonnet lid and secure the lid in the open position, using a suitable piece of cord attached to some convenient point.

Drain the water from the cooling system by means of the drain tap located on the right-hand side of the radiator bottom tank. If Bluecol or other anti-freeze mixture is in use it should be drained into a suitable clean container and carefully preserved for future use, using a rubber tube extension on the drain tap.

Disconnect the negative cable from the battery by extracting the terminal screw and removing the cable lug from the battery terminal.

Release the clips from the top water hose and separate the hose from its connections.

Disconnect the low-tension wire from its terminal on the side of the distributor. Slacken the $\frac{1}{4}$ in. dynamo attachment bolt providing belt tension adjustment, together with its plain steel washer. Remove the two $\frac{1}{2}$ in. bolts, nuts, and spring washers locating the dynamo to its bracket on the cylinder head on early models. In

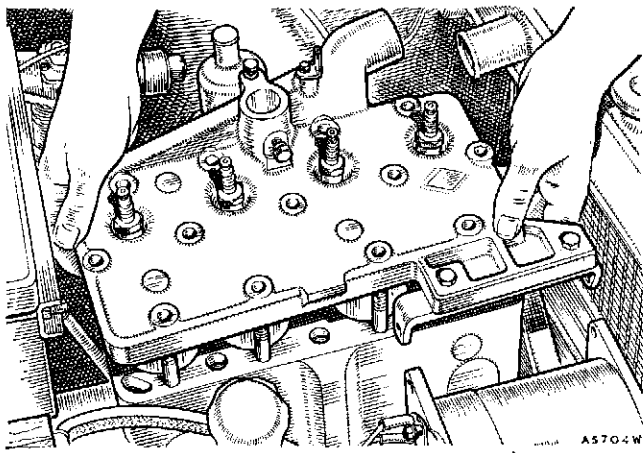


Fig. A.26

Raising the cylinder head

the case of later models the dynamo support bracket is cast with the cylinder block and there is no need to disturb the dynamo for cylinder head removal.

Disconnect the high-tension wires from the sparking plugs; extract the lock wire from the dowel bolt locating the distributor clamp plate assembly to the cylinder head on early models and remove the bolt. If the pinch-bolt on the clamp plate assembly is not disturbed the ignition setting will not be altered. On later models mark the distributor body and the face of the housing to enable the distributor to be replaced in the same position, release the cotter bolt nut, and gently tap back the cotter bolt to release the distributor. The distributor assembly may now be withdrawn from the cylinder head.

Detach the air intake silencer (or cleaner) from the cylinder head by unscrewing the $\frac{3}{16}$ in. attachment bolt and remove the air silencer (or cleaner) by slackening the screw in the clip retaining it to the air intake pipe.

Remove the throttle control bracket from the cylinder head by undoing the $\frac{1}{8}$ in. set screw with shakeproof washer, and release the controls from the carburetter throttle lever by removing the $\frac{3}{32}$ in. (2.5 mm.) cotter pin from the clevis pin.

Undo the 13 $\frac{5}{8}$ in. cylinder head stud nuts and slacken each half a turn at a time until they are all quite free. This will avoid any tendency for the head to be distorted. Observe that the engine earthing cable is located under the rearmost nut. The cylinder head may now be lifted clear of the studs and placed aside for cleaning.

Extract the distributor drive shaft from its housing. Its drive tongue is offset to ensure that it is replaced correctly without disturbing the timing.

The cylinder head gasket should be examined carefully and if damaged in any way should be replaced by a new one. No jointing is required with a new gasket.

A.20

The gasket should be guided over the cylinder head studs evenly to avoid damage. A piece of tubing or a box spanner is useful for this purpose.

To ensure the correct alignment of the distributor shaft tunnel in the head and in the cylinder block when refitting the cylinder head the distributor shaft itself must be used.

The distributor shaft must be inserted in the distributor shaft housing in the cylinder head and in the cylinder block before the head is tightened down. The cylinder head studs should then be tightened, half a turn at a time, in the sequence shown in the illustration (Fig. A.25) until they are all quite tight. The tool should then be extracted and the distributor drive shaft placed in position.

Reassembly of the remaining parts takes place in exactly the reverse order to that of dismantling.

Run the engine until it is properly warmed up, then tighten the cylinder head nuts again in the proper sequence.

Section A.19

REMOVAL AND REPLACEMENT OF CAMSHAFT

With the engine in the car it is necessary to remove the radiator grille and the radiator assembly as detailed in Section A.12.

Undo the two $\frac{5}{8}$ in. engine mounting nuts and support the engine so that the timing cover may be removed.

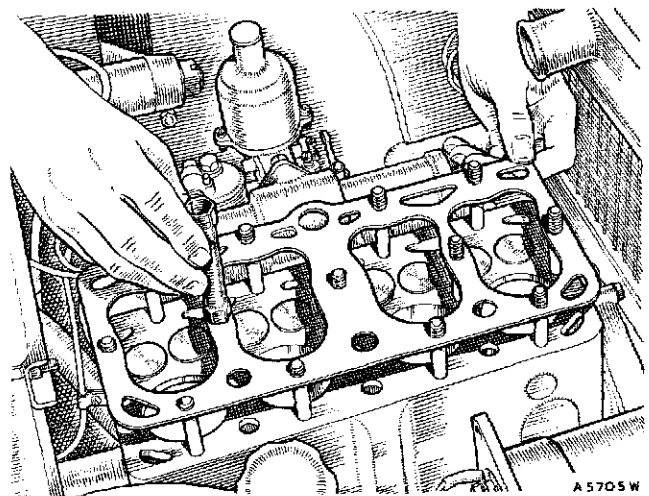


Fig. A.27

Replacing the cylinder head gasket with the help of a box spanner to avoid distortion

Slacken the $\frac{3}{16}$ in. pinch-bolt locating the fume pipe to the tappet cover, remove the $\frac{3}{16}$ in. bolt, nut, and spring washer from the pipe bracket on the clutch housing, and detach the pipe. Release the oil pipe from the clip on the tappet cover.

Drain and remove the sump as detailed in Sections A.1 and A.2.

Remove the cylinder head as detailed in Section A.18.

Remove the timing cover as detailed in Section A.13.

Remove the timing chain as detailed in Section A.15.

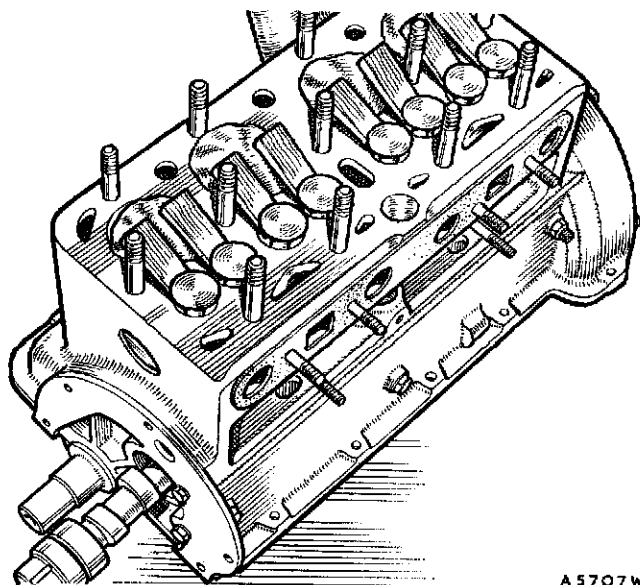
Remove the inlet and exhaust manifold as detailed in Section A.17.

Undo the two wing nuts on the tappet cover fixing studs, and withdraw the fibre washers, tappet cover, and gasket. Raise the engine valves from their seatings as far as possible, and secure them in the open position with suitable wooden wedges, as illustrated in Fig. A.28.

Extract the distributor drive bush dowel. This is equipped with a 5 mm. tapped hole, into which a 5 mm. screw may be entered to enable the dowel to be withdrawn. Alternatively a small extractor can be made, as illustrated in Fig. A.29.

The distributor drive gear assembly is now eased upwards and extracted from the top of the cylinder block.

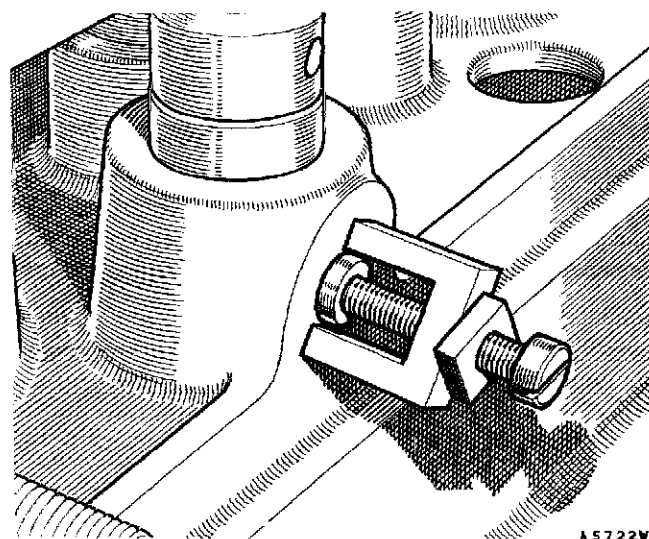
The tappets may now be raised to their fullest extent and the camshaft withdrawn from the front of the engine, taking care not to chip the edges of the cams or tappets through contact between them.



A5707W

Fig. A.28

The use of wooden wedges under the valve heads to keep them clear of the tappets



A5722W

Fig. A.29

A simple extractor can be made to withdraw the dowel of the distributor drive spindle bush

Replacement is in the main a reversal of the foregoing instructions, though reference should be made to the appropriate sections when reassembling.

To refit the distributor drive gear

Turn the engine until No. 1 piston is at T.D.C. on its compression stroke. This can best be effected by turning the engine and observing the valves. When the valves are 'rocking' (i.e. exhaust just closing and inlet just opening) on No. 4 cylinder No. 1 piston is at the top of its compression stroke. If the engine is set so that the groove in the crankshaft pulley is in line with the pointer on the timing cover the piston is exactly at T.D.C.

Set the oil pump shaft so that the slot points to the 12 o'clock position, i.e. at right angles to the camshaft, insert the gear with the tongue at the tip pointing at 11 o'clock, observing that the tongue is offset and the widest portion is directed to the rear of the engine. Care must be exercised to see that the dowel hole in the distributor drive gear bush is lined up to correspond with the hole in the cylinder block.

The gear is then pushed home, when the slot at the top will take up a position at one o'clock. If the distributor drive shaft and the distributor are then offered up it will be found that the rotor points between the seven and eight o'clock positions and the engine is set for firing on No. 1 cylinder.

The distributor is set with its points just opening at T.D.C. as a preliminary setting, but final adjustment should be made on a road trial, when an appreciable advance from this setting will usually be found to give the best results.

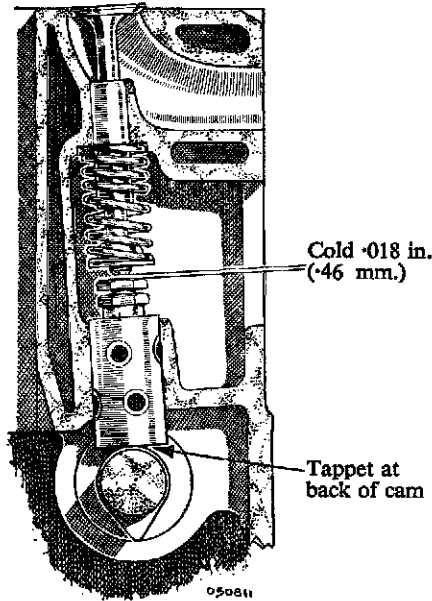


Fig. A.30

When setting the valve tappet clearance it is essential to see that the tappet being adjusted is bearing on the back of the cam exactly opposite to the peak

Section A.20

REMOVAL AND REPLACEMENT OF TAPPETS

- Remove the carburetter as in Section A.16.
- Remove the exhaust manifold as in Section A.17.
- Remove the cylinder head as in Section A.18.
- Remove the appropriate valve as in Section A.26.
- Remove the valve guide as in Section A.29.

The tappet can now be lifted out of its housing.

New tappets should be fitted by selective assembly so that they just fall through their guides under their own weight when lubricated with engine oil.

Assembly is the reverse of the above operation, but care should be taken to replace the valve guide exactly in accordance with Section A.29.

In the unlikely event of it being necessary to renew all the tappets it is advisable to remove the camshaft as in Section A.19, and to remove the tappets from the bottom of their guides in order to leave the valve guides undisturbed and reduce the amount of work involved.

Section A.21

TAPPET ADJUSTMENT

If the engine is to give its best performance and the valves are to attain their maximum useful life it is essential to maintain the correct tappet clearance. The

A.22

clearance for both inlet and exhaust valves is .018 in. (.46 mm.) when cold.

IMPORTANT.—When the clearance is being set it is essential that the tappet should then be on the back of its cam, i.e. exactly opposite the peak.

As this cannot be observed easily, the adjustment is best carried out as indicated below, which also avoids turning the engine more than is necessary:

Adjust No. 1 tappet with No. 8 valve fully open

”	”	3	”	”	6	”	”	”
”	”	5	”	”	4	”	”	”
”	”	2	”	”	7	”	”	”
”	”	8	”	”	1	”	”	”
”	”	6	”	”	3	”	”	”
”	”	4	”	”	5	”	”	”
”	”	7	”	”	2	”	”	”

From this table it will be realized that one can ascertain that a valve is at the back of its cam by observing that the corresponding valve paired with it is in the fully open position.

Three spanners are required for the tappet adjustment operation, one to hold the tappet and the other two to deal with the adjusting screw and its locknut, as shown below.

It is essential to hold the tappet and the adjusting

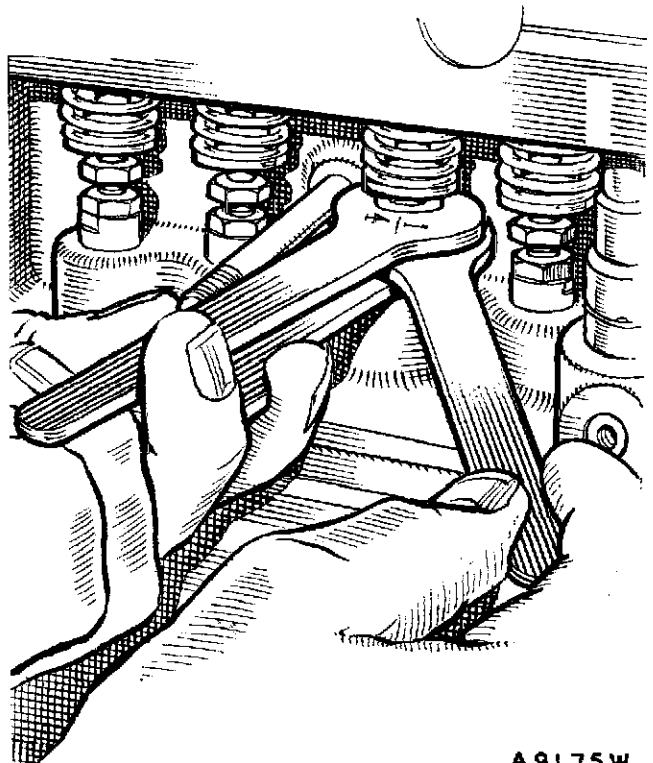


Fig. A.31

Locking the tappet screws with three spanners

screw in their correct relative positions while the locknut is tightened with the third spanner.

Tappet adjusting spanners of the correct size are available as a Service tool under Part No. 18G 334.

Section A.22

CHECKING VALVE TIMING

Set No. 1 cylinder inlet valve to $\cdot 023$ in. ($\cdot 58$ mm.) clearance when cold, and then turn the engine until the valve is about to open.

The indicating groove in the rear flange of the crankshaft pulley should then be opposite the pointer on the timing cover, i.e. the No. 2 valve should be about to open at T.D.C. and No. 4 piston will be at T.D.C. on its compression stroke.

NOTE.—Do not omit to reset the tappet to the correct running clearance of $\cdot 018$ in. ($\cdot 46$ mm.) (cold) when the timing check has been completed. The clearance of $\cdot 023$ in. ($\cdot 58$ mm.) is necessary to bring the opening position of the valve to T.D.C. as the normal valve opening is 8° B.T.D.C.

Section A.23

REMOVAL AND REPLACEMENT OF FLYWHEEL

(Engine Out of Car)

Drain and remove the sump as in Sections A.1 and A.2. Remove the clutch assembly as in Section E.2.

Remove the rear main bearing cap and bottom half bearing.

Extract the locking wire and remove the four $\frac{1}{8}$ in. flywheel attachment bolts.

Detach the flywheel from the crankshaft flange with a suitable extractor or by tapping it with a copper hammer towards the rear of the engine, slowly rotating the crankshaft so that the flywheel is driven off evenly.

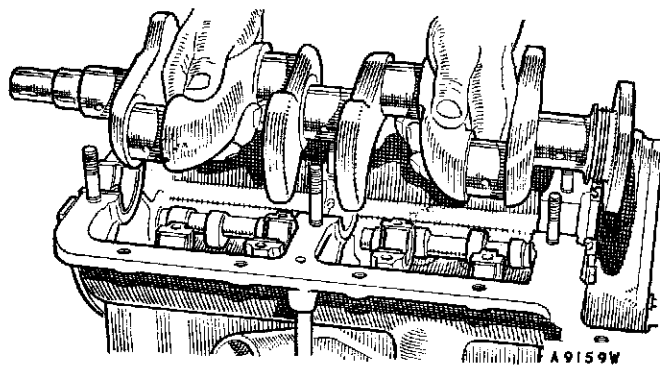


Fig. A.32

Removal of the crankshaft from the cylinder block

Reassembling is carried out in the reverse order to the above, making sure that the locating dowel is in proper register.

Section A.24

REMOVAL AND REPLACEMENT OF CRANKSHAFT

(Engine Out of Car)

Drain and remove the sump as detailed in Sections A.1 and A.2.

Remove the oil pump as detailed in Section A.3.

Remove the timing cover as detailed in Section A.13.

Remove the timing chain as detailed in Section A.15.

Remove the flywheel as detailed in Section A.23.

Remove the pistons and connecting rods as detailed in Section A.5.

Unscrew the two securing nuts from each main bearing and remove the caps.

NOTE.—Mark each bearing cap and bearing to ensure that they are reassembled to the correct journal, taking care, in the case of bearings, that they are not damaged or distorted when marking. Punches should not be used for this purpose. Electrical engraving tools are the best for this.

Lift the crankshaft out of the bearings.

Replacement of the crankshaft is the reversal of the above operations.

IMPORTANT.—Before replacing the crankshaft thoroughly clean out all the oilways.

The clearance between the oil return thread on the crankshaft and the oil thrower cover should be $\cdot 004$ in. ($\cdot 10$ mm.). Clearances in excess of this may lead to oil leaks from the crankcase.

Normally no wear should take place at this point, as there is no contact between the surfaces, but running with excessively worn bearings can produce wear which will lead to oil leakage into the clutch.

Section A.25

REGROUNDING OF CRANKSHAFT

If on examination the crankshaft is found to be worn, scored, or oval, it must be reground to one of the following undersizes.

Reground sizes

R1	..	$-0\cdot 30$ mm. ($-0\cdot 12$ in.)
R2	..	$-0\cdot 50$ mm. ($-0\cdot 20$ in.)
R3A	..	$-0\cdot 75$ mm. ($-0\cdot 30$ in.)
R4	..	$-1\cdot 00$ mm. ($-0\cdot 40$ in.)

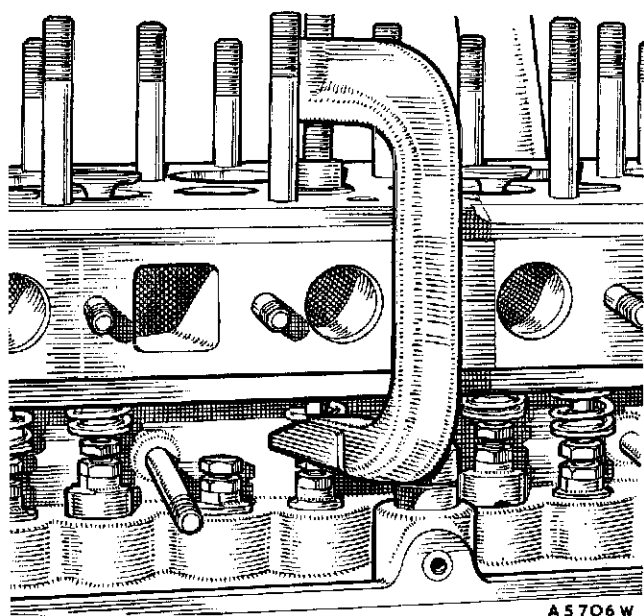


Fig. A.33

The special valve spring compressing tool in use

Standard sizes

The standard main journal diameter is 42 mm. (1.654 in.).

The standard big-end journal diameter is 40 mm. (1.575 in.).

The reground size is clearly stamped on all reground crankshafts between No. 3 and No. 4 big-end journals.

Undersize bearings are supplied to definite dimensions, with the requisite clearance of .030 mm. (.001 to .0015 in.) and do not require any adjustment by scraping or fitting of the caps before assembly into the engine. It is, however, essential to make sure that the correct size of bearing is being used.

Section A.26

REMOVAL AND REPLACEMENT OF VALVES

Remove the cylinder head as detailed in Section A.18.

Remove the carburetter as detailed in Section A.16.

Remove the inlet and exhaust manifold as detailed in Section A.17.

Slacken the $\frac{3}{16}$ in. pinch-bolt on the clip locating the fume pipe to the tappet cover, remove the $\frac{3}{16}$ in. bolt, nut, and spring washer from the pipe bracket on the clutch housing, and detach the pipe. Release the oil pipe from the clip on the tappet cover. Undo the two wing nuts on the tappet cover fixing studs and remove the fibre washers, cover, and gasket.

Before extracting the valves it is advisable to plug the two holes in the floor of the tappet chamber with

A.24

clean rag to prevent the possibility of the cotters dropping into the engine base.

The valve cotters may now be extracted by compressing the valve spring with compressor 18G 270 (see Fig. A.33).

Remove the valves, and ease out the valve springs and caps.

Replacement is the reversal of the above operations.

NOTE.—Oil the valve stems and the guides before refitting them. Replace the valves in their original positions. They will be found to be numbered on their heads, No. 1 being at the front of the engine. Number any new valves on their heads when new ones are necessary.

The valve springs are of the progressive pitch type and should be refitted with the close coils at the top.

Make sure that the top end of the valve spring is seating properly in its recess. In order to ensure this later engines are fitted with a special spring collar at their upper end (Part No. 168339), and these should be fitted when reassembling engines not so fitted (see Section A.32).

The tappet cover gasket is fitted with the two small holes at the bottom to allow trapped oil to drain back into the crankcase and the large breather holes at the top.

Section A.27

DECARBONIZING

Remove the carburetter as detailed in Section A.16.

Remove the inlet and exhaust manifold as detailed in Section A.17.

Remove the cylinder head as detailed in Section A.18.

It is recommended that as much of the carbon deposit as possible is cleaned off the piston crown, top of the cylinder block, and exhaust ports before detaching the tappet cover and extracting the valves. This reduces the risk of foreign matter finding its way into the tappet chamber and then into the engine base. A ring of carbon should be left round the periphery of the piston crown, and the rim of carbon round the top of the cylinder bore should not be touched. To facilitate this an old piston

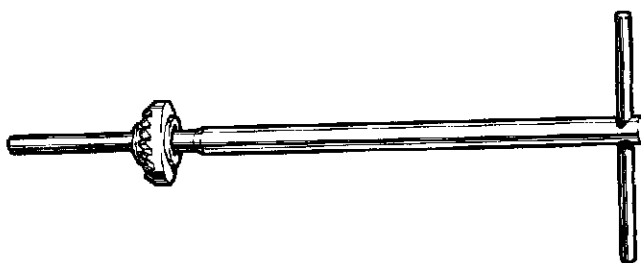


Fig. A.34

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In cases of badly pitted valve seatings they should be cleaned up with a special cutter before grinding

ring can be sprung into the bore so that it rests on top of the piston.

Where special equipment is not available for the purpose of decarbonizing it will be necessary to scrape the carbon deposit from the piston crowns, cylinder block, and cylinder head, using a blunt scraper. Before commencing this operation the waterways and distributor drive housing should be plugged with clean rag.

Remove the valves as detailed in Section A.26.

When the valves and the springs are withdrawn the carbon deposit should be cleaned from the valve ports and all traces of carbon removed by compressed air or by the vigorous use of a pair of household bellows.

The cylinder head is next given attention. The sparking plugs must be removed, cleaned, and adjusted, the carbon deposit scraped from the combustion spaces, and the head thoroughly cleaned in paraffin, and, when dry, again cleaned with compressed air.

Section A.28

GRINDING AND TESTING VALVES AND SEATINGS

Each valve must be cleaned thoroughly and carefully examined for pitting. Valves in a pitted condition should be refaced or, alternatively, replaced by new valves.

Valve seats showing signs of pitting or unevenness

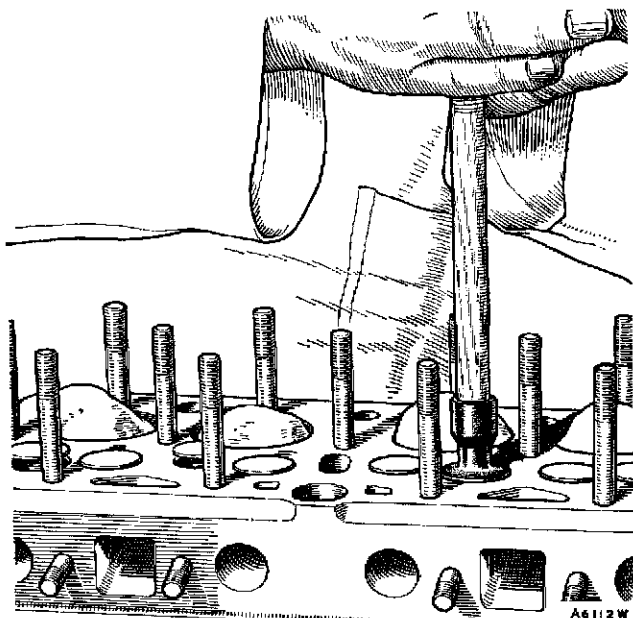


Fig. A.35

The special suction-type valve-grinding tool in use. The use of a light spring under the valve head greatly facilitates the grinding-in process

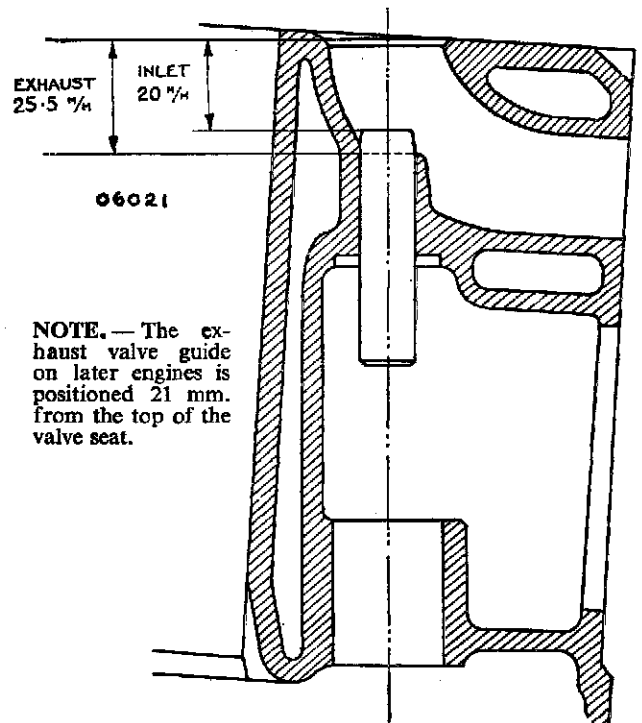


Fig. A.36

When replacing valve guides make sure that they are correctly located

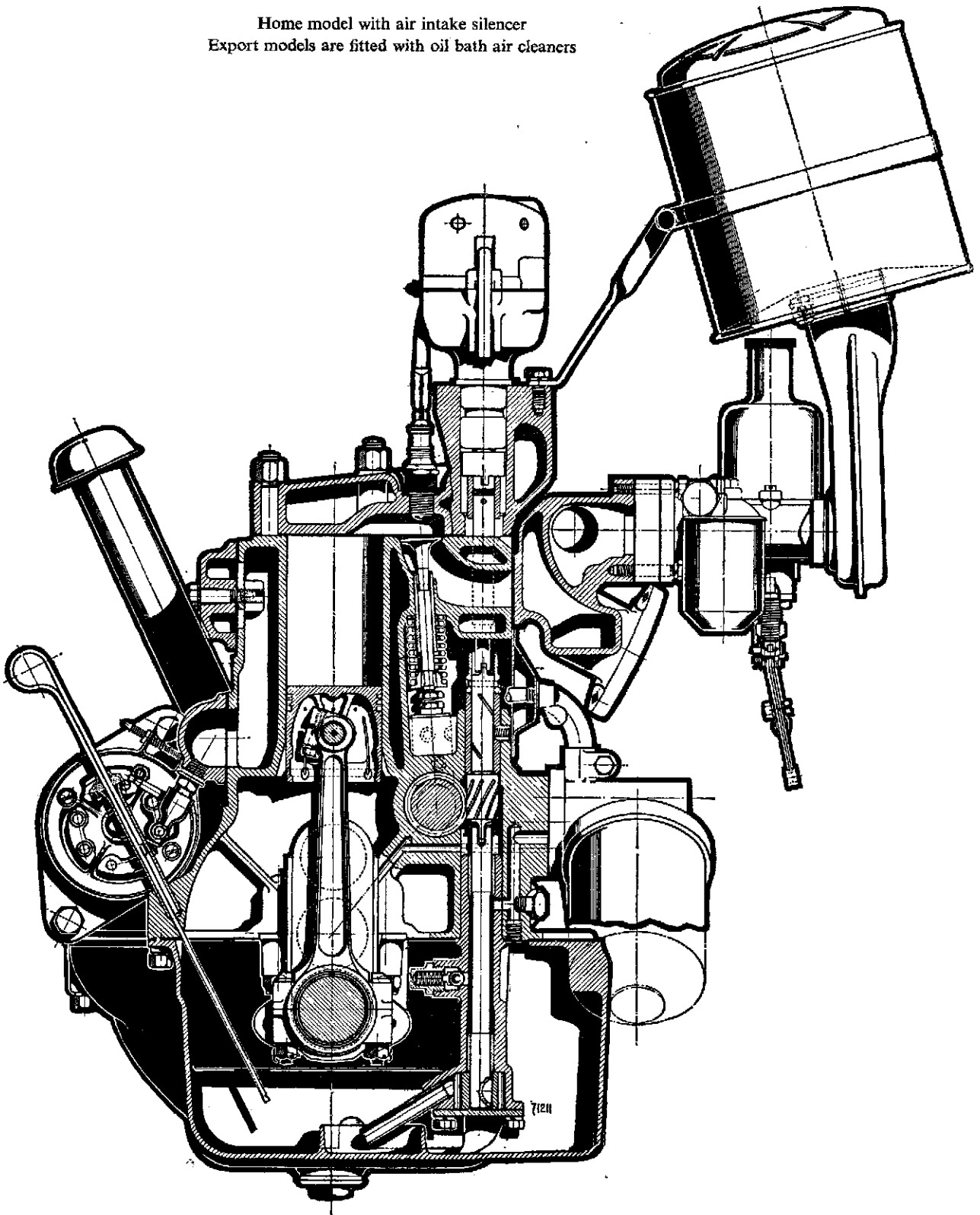
should be trued by the use of a suitable grinder or valve seat narrowing cutter. When using this tool care should be exercised to remove the minimum amount of metal necessary to ensure a true surface.

All valves when fitted at the Factory are numbered on their heads from 1 to 8 and should be replaced in the corresponding valve ports, No. 1 valve being fitted to the port nearest the front of the engine. When replacement valves are fitted they should be numbered to identify the port to which they belong. The tappet head must be slackened back three or four turns before commencing to grind the valves, and care must be taken to see that the tappet for the valve being ground is on the back of its cam (see Section A.21).

The valve face should be lightly smeared with fine- or medium-grade carborundum paste, then ground to its seat, using a suction grinder. A light coil spring placed under the valve head will assist considerably in the process of grinding. The valve face should be lapped to its seat with a semi-rotary motion and occasionally allowed to rise by the pressure of the light coil spring. This assists in spreading the paste evenly over the valve face and seat. It is only necessary to carry out the grinding operation until a dull, even, mat surface is produced on the valve seat and face. If the valve seat is found to be wide it should be reduced with a 30° cutter to a width of 2 mm. (.080 in.).

THE MORRIS MINOR (Series MM) ENGINE

Home model with air intake silencer
Export models are fitted with oil bath air cleaners



On completion the valve seats and ports should be washed with paraffin, dried, and thoroughly cleaned by compressed air. The valves should be washed in paraffin and all traces of grinding paste removed.

Section A.29

REMOVAL AND REPLACEMENT OF VALVE GUIDES

Remove the carburetter as in Section A.16.

Remove the exhaust manifold as in Section A.17.

Remove the cylinder head as in Section A.18.

Remove the appropriate valve and spring as in Section A.26.

Release the $\frac{1}{2}$ in. tappet adjustment locknut and remove the tappet screw from the tappet. (Service tool 18G 307.)

Rotate the crankshaft until the tappet is resting on the back of the cam, i.e. at its lowest position (see Section A.21).

Using a suitable drift, the valve guide may now be removed by driving it downwards until it is clear of the block. It can then be withdrawn over the tappet.

When refitting a valve guide care must be exercised to ensure that it is inserted into the top of its housing with the chamfered end downwards. The guide is then driven into position with a suitable drift, taking care to see that it is driven in to the correct distance.

The distance from the top face of the block to the valve guide should be:

Inlet 20 mm. (.79 in.). Exhaust (Part No. X 15866 up to Engine 77000) 25.5 mm. (1.0 in.). From Engine 77001, Exhaust (Part No. X 31635) 21 mm. (.83 in.).

Section A.30

OIL PRESSURE

Under normal running conditions the oil should not drop below 40 lb./sq. in. (2.8 kg./cm.²) on the gauge at normal road speeds, whilst approximately 20 lb./sq. in. (1.4 kg./cm.²) should be shown when the engine is ticking over.

Should there be a noticeable drop in pressure, the following points should be checked over:

- (1) That there is a good supply of the correct grade of oil in the engine sump.
- (2) That there is a complete absence of air leakage on the suction side of the pump and that the gears are in order with the correct gear clearances (see Section A.4).
- (3) That the gauze oil pump filter is clean and not choked with sludge.

- (4) That the bearings on the delivery side to which oil is fed under pressure have the correct working clearances. Should the bearings be worn and the clearances excessive, the oil will escape more readily from the sides of the bearings, particularly when the oil warms up and becomes more fluid. This will cause a drop in pressure on the gauge as compared with that shown when the bearings are in good order.

NOTE.—The automatic release valve in the pump deals with any excessive oil pressure when starting from cold. When hot the pressure drops as the oil becomes more fluid.

Cold running and the unnecessary use of the mixture control are often the cause of serious oil dilution by petrol and a consequent drop in pressure.

New engines with new oil will give considerably higher pressure readings than those given in the first paragraph of this section.

Particular attention is called to the recommended change of oil at the specified intervals.

Section A.31

LOCATING TROUBLES

Engine will not start

- A. If the starter will not turn the engine check the following:
 - (1) Battery discharged and/or defective.
 - (2) Disconnected or broken leads.
 - (3) Faulty starter switch.
 - (4) Faulty starter motor.
 - (5) Starter cables shorting to earth.
 - (6) Battery terminals badly corroded or battery leads loose.
 - (7) Undue stiffness in engine.
- B. If starter turns engine very slowly check:
 - (1) Partly discharged battery.
 - (2) Loose terminals or connections.
 - (3) Dirty or corroded connections.
 - (4) Faulty insulation on starter cables.
 - (5) Tightness in engine.
- C. If starter turns the engine smartly but it will not fire check:
 - (1) Plugs not sparking.
 - (2) Spark at the coil. If the coil gives good spark check:
 - (a) Gaps in plugs too wide or too close.
 - (b) Plugs oiled up.
 - (c) Plug insulators damaged or excessively dirty.

- (3) If poor spark at coil check:
- (a) Low-tension or high-tension leads from coil to distributor loose or corroded.
 - (b) Distributor points dirty, worn, or out of adjustment.
 - (c) Carbon brush not making contact.
 - (d) Rotor cracked.
 - (e) Faulty condenser (substitute a condenser known to be in order).
 - (f) Faulty coil (substitute a coil known to be in order).
- (4) Check carburetter for petrol supply. If no petrol in float-chamber check:
- (a) Functioning of the petrol pump.
 - (b) Air leak in pipe line, indicated by rapid action of the pump.
 - (c) Float-chamber needle sticking.
- (5) If petrol is reaching float-chamber check:
- (a) Choked jet.
 - (b) Water in the petrol.
 - (c) Dirt in carburetter.
 - (d) Air leak in induction system.
 - (e) Adjustment of carburetter control.

If engine starts but runs erratically

- A. Check the following ignition points:
- (1) Loose high-tension leads to sparking plugs or corroded connection.
 - (2) Incorrect setting of plug points.
 - (3) Damaged plug or moisture on plugs.
 - (4) Loose connection on battery or in ignition circuit.
 - (5) Faulty high-tension leads.
 - (6) Battery charge low.
 - (7) Battery connections faulty.
 - (8) Defective contact breaker.
 - (9) Defective distributor.
 - (10) Faulty condenser.
- B. Check the following carburetter points:
- (1) Water in float-chamber.
 - (2) Choked filters in carburetter or petrol pump, indicated by slow pumping of petrol pump.
 - (3) Action of petrol pump. Suspect if sluggish.
 - (4) Jet partially choked.
 - (5) Carburetter set too rich, indicated by sooty exhaust.
 - (6) Petrol tank filler cap vent choked.
 - (7) Obstruction in fuel feed pipe lines.
 - (8) Air leak into induction system.

- C. Check the following mechanical points:
- (1) Sticking valves.
 - (2) Incorrect valve tappet clearance.
 - (3) Burnt or broken valves.
 - (4) Incorrect valve timing.
 - (5) Incorrect ignition timing.
 - (6) Broken or weak valve spring.
 - (7) Valve guides worn, causing air leaks.
 - (8) Faulty cylinder head gasket.
 - (9) Back-pressure due to damaged exhaust system.

If engine starts and stops

- A. Check the following ignition points:
- (1) Loose low-tension leads.
 - (2) Loose distributor clamp screw.
 - (3) Faulty ignition switch contact.
- B. Check the following carburetter points:
- (1) Incorrect setting of carburetter controls.
 - (2) Blocked petrol pipe.
 - (3) Water in float-chamber.
 - (4) Sticking needle valve.
 - (5) Petrol pump failing to function regularly.
 - (6) Air leak into petrol line.
 - (7) Fuel level low in tank.

If engine will not idle or run slowly

- A. Check the following carburetter points:
- (1) Throttle stop screw incorrectly set.
 - (2) Throttle controls incorrectly set.
 - (3) Weak mixture or over-rich mixture.
 - (4) Faulty functioning of petrol pump.
- B. Check the following mechanical points:
- (1) Sticking valves.
 - (2) Incorrect valve tappet clearance.
 - (3) Air leak in induction system.
 - (4) Burnt or broken valves, indicated by loss of compression.
 - (5) Broken valve spring.
 - (6) Damaged cylinder head or gasket.
- C. Check the following ignition points:
- (1) Loose high-tension leads.
 - (2) Incorrect setting of plug points.
 - (3) Damaged plugs or moisture on plugs.
 - (4) Loose connections on battery or in ignition circuit.
 - (5) Faulty high-tension leads.
 - (6) Battery charge low.
 - (7) Battery connections faulty.
 - (8) Defective contact breaker or burnt points.
 - (9) Defective distributor.
 - (10) Defective condenser.

Engine fails to give full power

- A. Check the following carburettor points:
- (1) Faulty or insufficient petrol supply.
 - (2) Air leaks in induction pipe or petrol pipe.
 - (3) Partly choked jet.
- B. Check the following mechanical points:
- (1) Incorrect valve tappet clearance.
 - (2) Burnt valves or badly seating valves.
 - (3) Cylinder head stud nuts not tight.
 - (4) Damaged cylinder head gasket.
 - (5) Valve timing incorrect.
 - (6) Broken or weak valve spring.
 - (7) Excessive carbon deposit.
 - (8) Excessively worn pistons and cylinders.
- C. Check the following ignition points:
- (1) Ignition retarded too far.
 - (2) High-tension leads shorting or loose.
 - (3) Dirty sparking plugs.
 - (4) Sparking plug points incorrectly set.
 - (5) Contact breaker points incorrectly set.
 - (6) Contact breaker points pitted.
 - (7) Faulty coil.
 - (8) Faulty condenser.
 - (9) Low-tension connection or leads faulty.
 - (10) Battery run down or faulty.

- (10) Clearance between rotor arm and distributor studs excessive.
- (11) Coil defective or wet.
- (12) Defective condenser.
- (13) Plugs overheated, unsuitable, or points incorrectly set.

- B. Check the following carburation points:
- (1) Jet choked or restricted.
 - (2) Jet incorrectly set, causing weak mixture.
 - (3) Water in petrol.
 - (4) Choked petrol filters.
 - (5) Inlet manifold joint leaking or manifold cracked.
 - (6) Air cleaner passages blocked.
 - (7) Engine running temperature too cold.
 - (8) Throttle not closing completely (indicated by engine backfiring when proceeding downhill with throttle shut).
- C. Check the following mechanical points:
- (1) Valve timing incorrect.
 - (2) Valve tappet clearance incorrectly set.
 - (3) Valves sticking.
 - (4) Valve seats pitted or faulty.
 - (5) Valve spring weak or broken.
 - (6) Valve guides excessively worn, causing air leaks.
 - (7) Timing chain excessively loose.
 - (8) Excessive carbon deposit.

Engine knocks

- A. Check the following:
- (1) Ignition timing too far advanced.
 - (2) Excessive carbon deposit.
 - (3) Fuel unsuitable or weak mixture.
 - (4) Loose or worn bearings or pistons.
 - (5) Defective or unsuitable plugs.
 - (6) Valve timing incorrect or tappet clearance incorrect.

Engine backfires

- A. Check the following ignition points:
- (1) High-tension cables defective or connections loose.
 - (2) High-tension leads incorrectly fitted.
 - (3) Low-tension wiring defective or connections loose.
 - (4) Switch contact faulty.
 - (5) Distributor gap incorrect or points pitted or dirty.
 - (6) Contact breaker arm sticking or defective.
 - (7) Distributor cover cracked or loose.
 - (8) Distributor not correctly timed.
 - (9) Rotor carbon brush pick-up defective or worn.

Section A.32

FITTING VALVE SPRINGS

The deep water jacketing round the valve ports of the Morris Minor engine masks the upper seating for the valve spring and it is most important to take special care to ensure that the valve spring enters the recessed seating machined in the upper face of the valve chamber properly and that it seats squarely.

If the spring is assembled carelessly it is possible for it to ride on the edge of the machined recess, with consequent distortion, producing a side-thrust on the valve leading to rapid wear of the stem and speedy deterioration of the valve guide and valve seating. This is clearly shown in Fig. A.37.

In view of the difficulty of observing the upper seating for the valve spring when the engine is in position in the car a special valve spring collar (Part No. 168339) has been designed, the use of which will ensure that the spring will be guided onto its seating properly and without difficulty. This is shown in position in Fig. A.38.

The introduction of these special valve spring collars is strongly advised whenever the springs are replaced after valve grinding, or any other operation, as a safe-

guard and in order to avoid the possibility of excessive wear of the valve and guide.

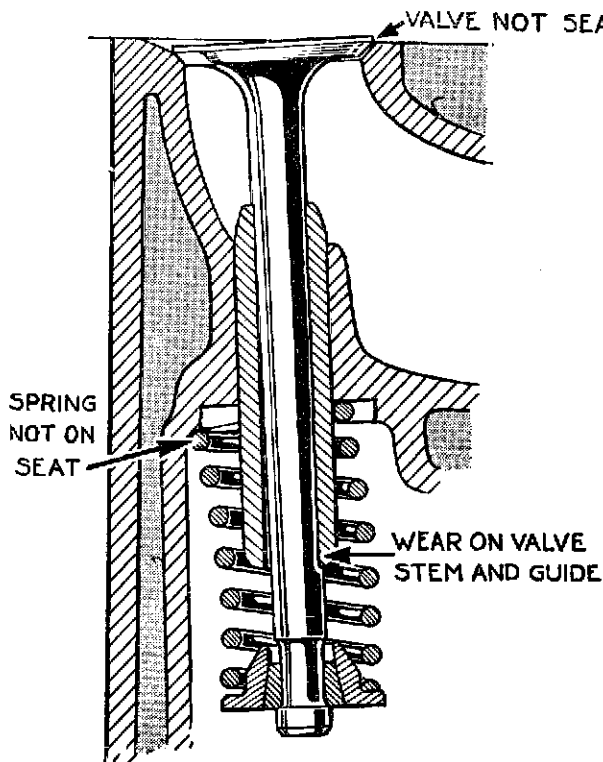


Fig. A.37

A badly fitted valve spring seating on the edge of the seating counterbore. This produces a side-thrust which causes rapid valve wear

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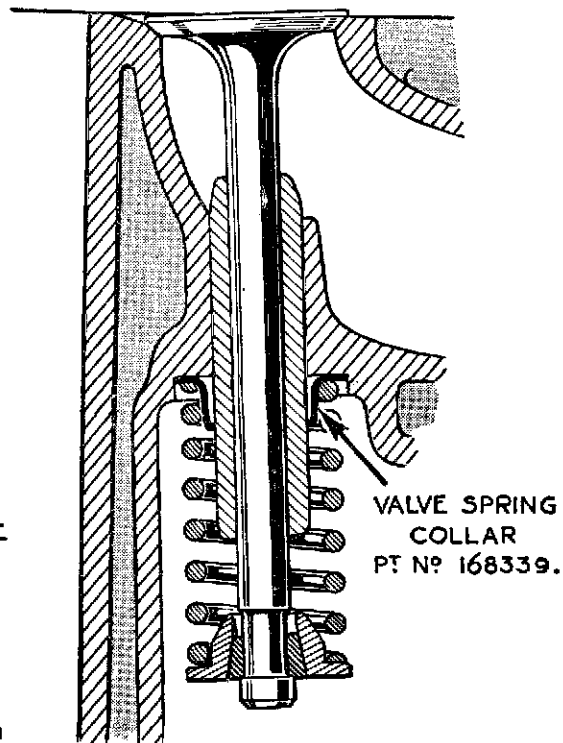


Fig. A.38

In order to ensure that the valve spring is seating properly the special valve spring collar shown in this illustration should be used when refitting the valve