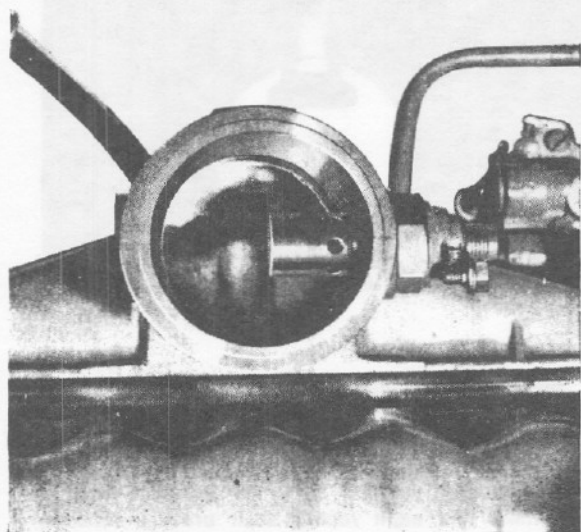


SECTION E

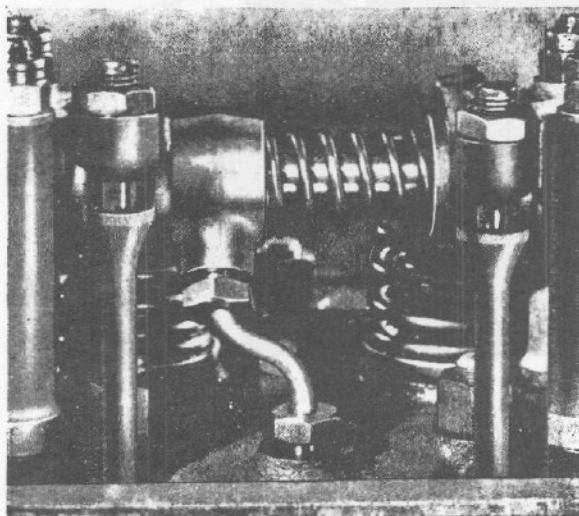
Cylinder Head



E1

Before commencing to overhaul the cylinder head ensure that all joints, gaskets and any other parts expected to be required are available.

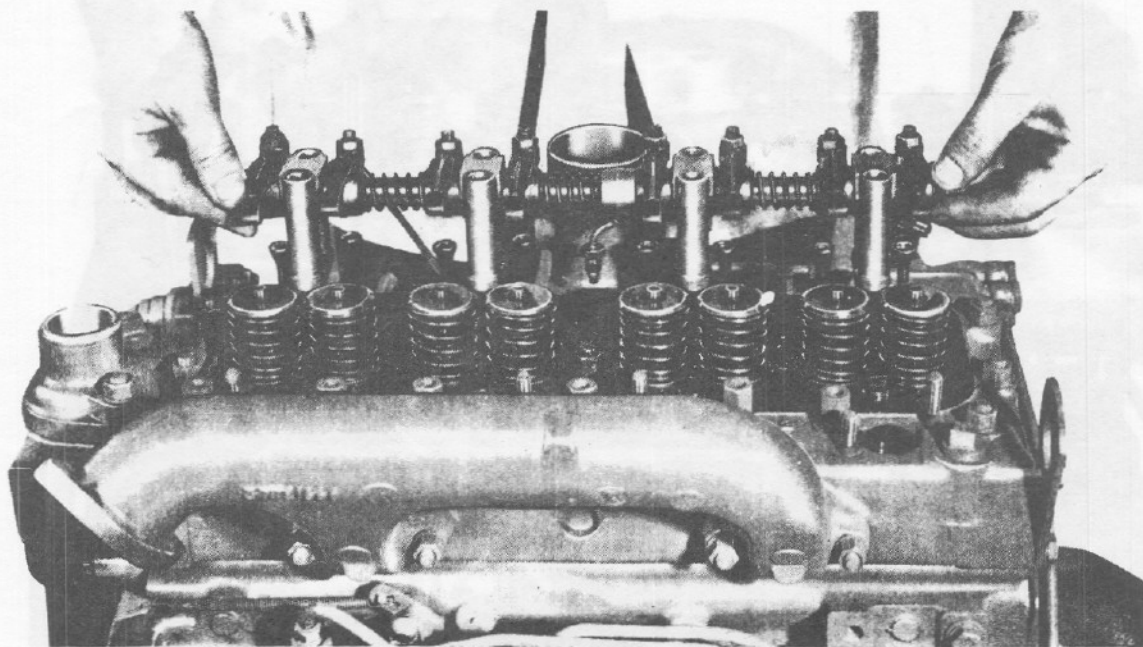
Remove any external components from the vicinity of the cylinder head cover, atomisers and fuel pump.



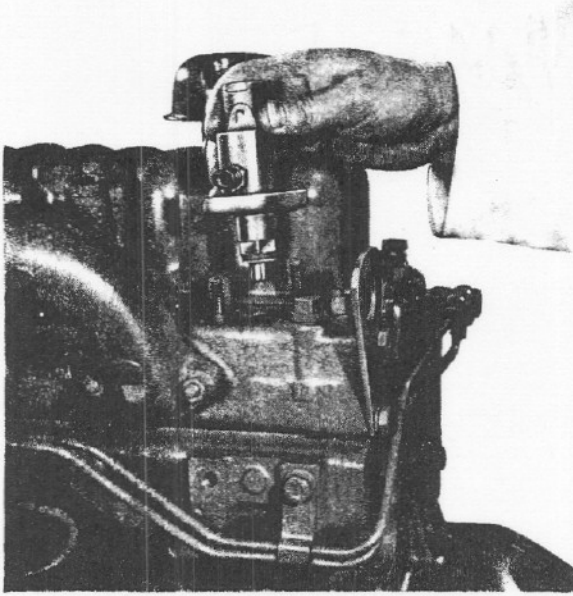
E2

To Remove the Cylinder Head

1. Completely drain the cooling system.
2. Disconnect the battery terminals.
3. Remove the securing nuts and detach the exhaust pipe from the exhaust manifold. Blank off the end of the exhaust pipe to prevent entry of any foreign matter.

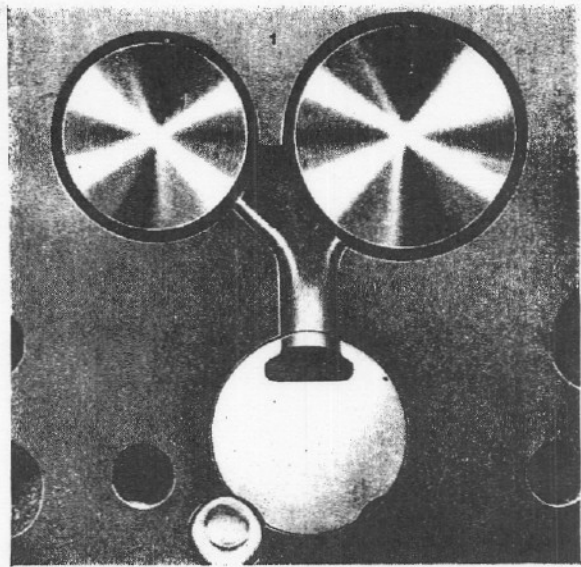


E3



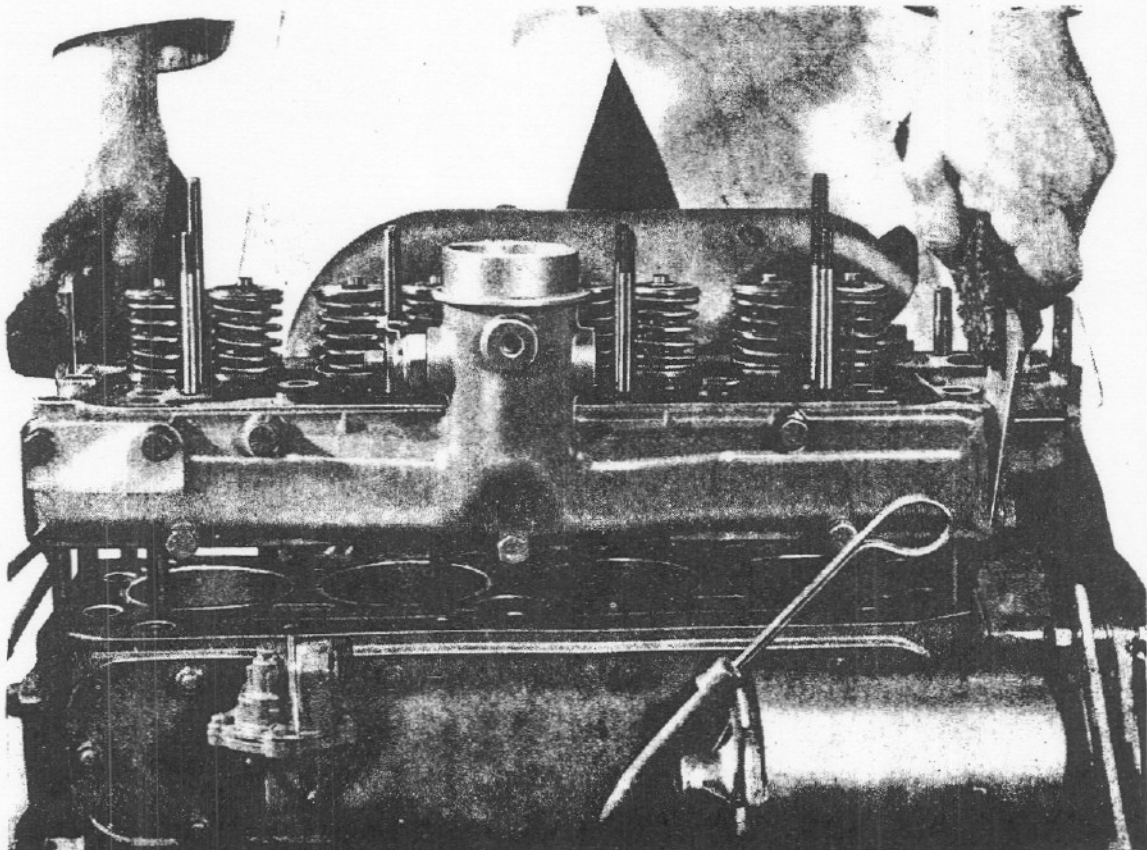
E4

4. Uncouple the water outlet connection on the front of the cylinder head.
5. Remove the air cleaner and place somewhere level ready for servicing.
6. Disconnect the fuel pipe and electrical connection to the starting aid located in the induction manifold. (Refer to Fig. E.1).

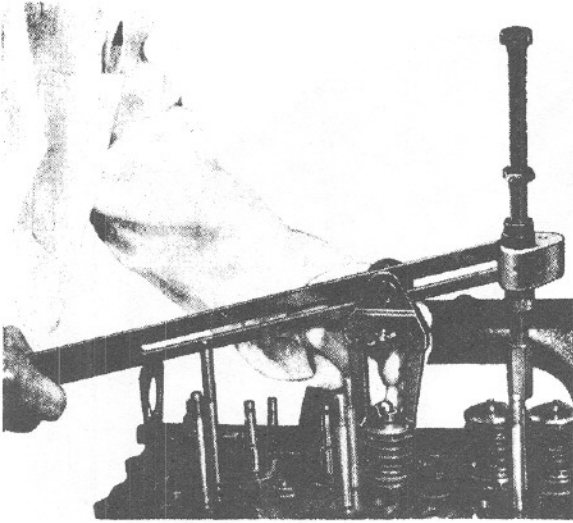


E6

7. Remove the cylinder head cover together with the breather pipe.
8. Unscrew the oil feed pipe to the rocker shaft at the cylinder head end. (Refer to Fig. E.2 for its location).
9. Remove the eight rocker shaft bracket securing nuts **evenly** and remove the rocker shaft complete with the oil feed pipe. (Refer to Fig. E.3).

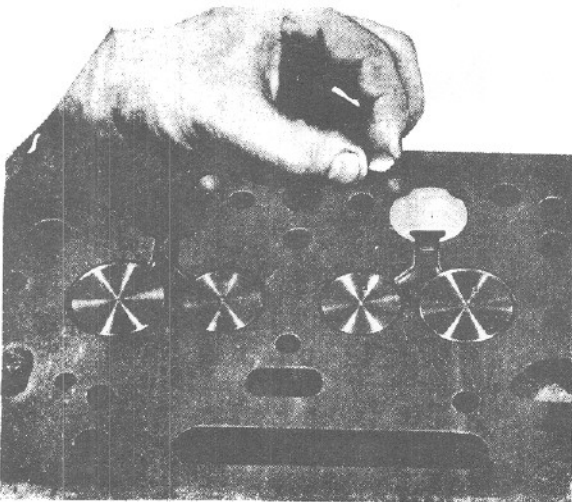


E5

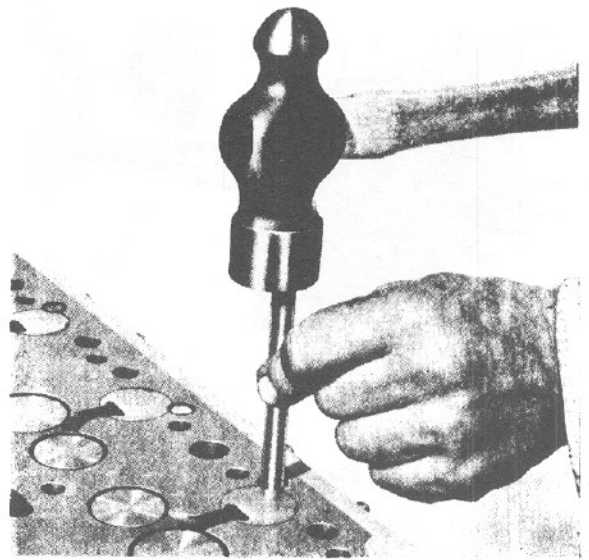


E7

10. Remove the eight push rods and place somewhere safe (possibly in the cylinder head cover) to avoid the possibility of any being accidentally bent.
11. Unscrew the small banjo bolts on the tops of the atomisers and remove the leak-off pipe by unscrewing the union on top of the fuel filter.
12. Remove the low pressure fuel pipes between the fuel filter and the fuel pump, remove the fuel filter after disconnecting the feed pipe from the lift pump, blank off all pipes and ports to prevent ingress of foreign particles.
13. Remove the four high pressure fuel pipes from the fuel pump to the atomisers. Blank off fuel pump outlet ports.
14. Remove the atomiser securing nuts and carefully remove the atomisers. (Refer to Fig. E.4). Blank off the exposed ports on the atomisers.
15. Uncouple the dynamo or alternator adjusting link.



E8



E9

16. Remove the cylinder head securing nuts and lift off the cylinder head complete with inlet and exhaust manifolds. (Refer to Fig. E.5).

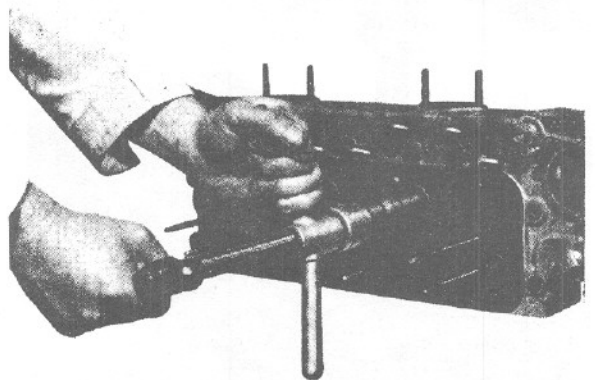
NOTE: On 4.99 and 4.107 engines, to prevent liner movement should the engine be turned with the cylinder head removed, it is suggested that the liners are held in position by suitable tubing placed over two of the cylinder head studs and locked with nuts and washers.

To Remove the Valves

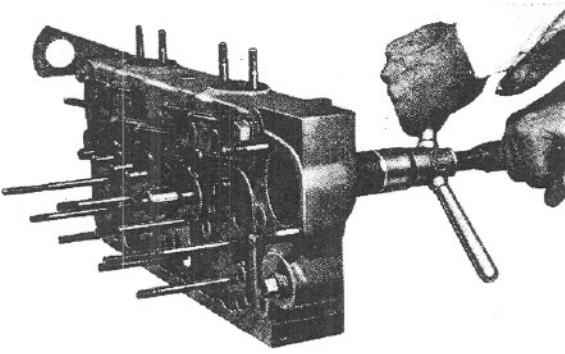
With earlier engines, the valves were numbered and the cylinder head was marked with corresponding numbers (see fig. E.6).

With current engines, the valves and seats are not numbered and where a valve is to be used again, it should be suitably identified to ensure it is replaced in its original position.

1. Remove collets by compressing the valve springs as shown in Fig. E.7.
2. Remove the spring caps, springs, seals (where fitted) and spring seats. Remove valves.



E10



E11

COMBUSTION CHAMBER INSERTS

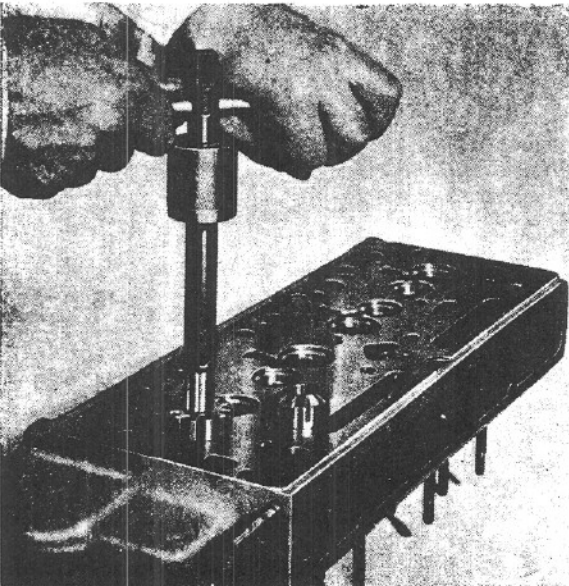
These can be gently tapped out of their locations by means of a short length of curved bar through the atomiser bore. When refitting they must be located by means of expansion washers in the recesses provided, as shown in Figs. E.8 and E.9.

Cleaning

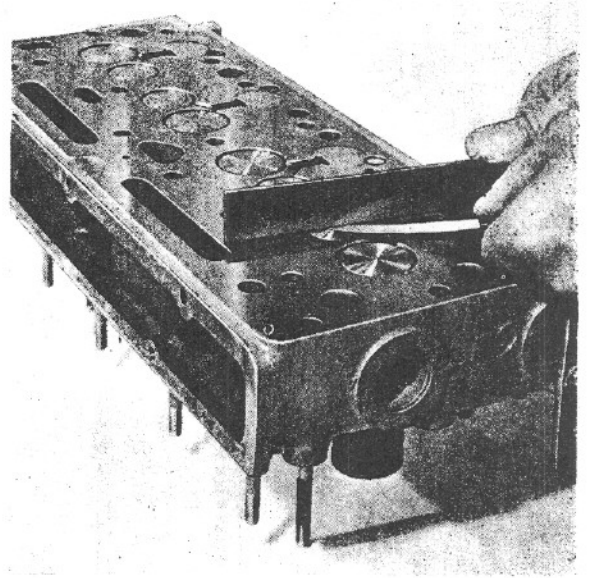
Remove any carbon from the cylinder head. If the water jacket within the cylinder head shows signs of excessive scale, then a proprietary brand of descaling solution may be used, if possible the cylinder head should be tested for water leakage after such treatment at the pressure given on Page B.7.

VALVE SPRINGS

It is advisable to fit new valve springs whenever the engine undergoes a major overhaul. Where a top overhaul only is being carried out the springs should be examined, paying particular attention to squareness of ends and pressures developed at specific lengths, the details of which can be found on Page B.8.



E12

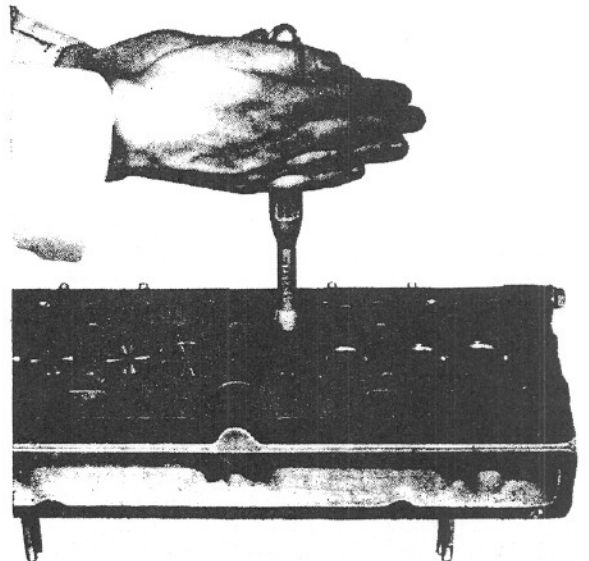


E13

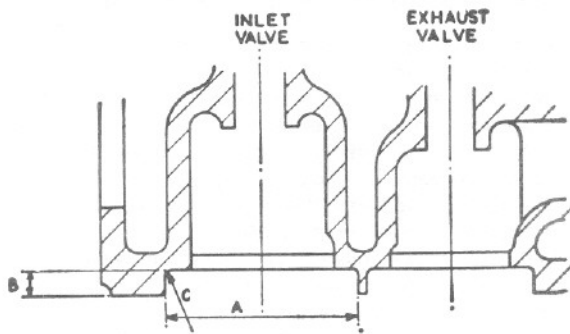
VALVE GUIDES

The worn guides should be removed either by means of a press and a suitable "dolly" or the valve guide removal tool shown in Fig. E.10. Before fitting the new guides remove any burrs from the cylinder head parent bores, then smear the bores with clean oil and either press in the new guides or pull them in by means of the tool shown in Fig. E.11, until the guide protrusion above the head top face is that quoted on Page B.7.

NOTE: Special care should be exercised during this operation as the guides, being made of cast iron, are therefore comparatively brittle.



E14



E15

Inlet

- A—1.530 in to 1.531 in
 B—0.3125 in to 0.3175 in
 C—0.015 in chamfer at 45° (Max.)

Exhaust

- A—1.296 in to 1.297 in
 B—0.3125 in to 0.3175 in
 C—0.015 in chamfer at 45° (Max.)

VALVES AND VALVE SEATS

The valves should be checked in their respective guides for wear and replaced if wear has taken place, (ensure that the wear is in fact on the valve stem and not in the guide bore before replacing the valve).

The valve and valve seat faces should be reconditioned in the normal way using specialised equipment or with grinding compound, according to their condition. A valve seat (hand operated) cutting tool is shown in Fig. E.12. Valves should always be refitted to their original seats and any new valve fitted should be suitably marked to identify its position if removed at a later date. (Refer to Fig. E.6 for illustration of valve numbering).

Before refitting the valves it should be ascertained whether the valve head depth relative to the cylinder head face is within the limits given on Page B.2. This depth can be checked, as shown in Fig. E.13, by placing a straight edge across the face of the cylinder head, then by careful selection of feeler gauges measuring the distance between the straight edge and the head of the valve.

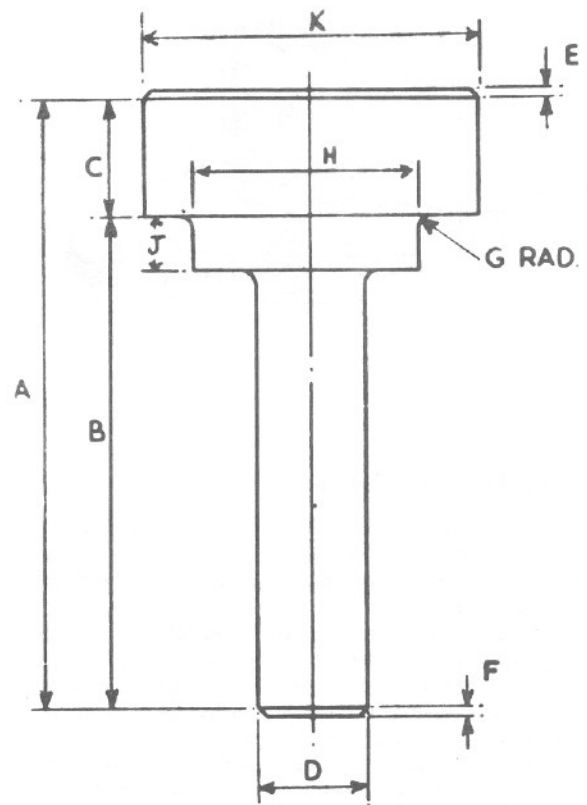
Where vehicle engines have to conform with the smoke density regulation B.S.AU 141a : 1971, then valve depths must not exceed production limits as given on page B.8.

Where this depth exceeds the maximum limit and even the fitting of a new valve does not reduce this depth below the maximum limit, then the remedy is to fit a valve seat insert as detailed later.

When refacing valves or valve seats care should be taken to see that only the minimum amount of metal necessary to obtain a satisfactory seat is removed, and that as narrow a valve seat as possible is maintained.

Hand Grinding

When grinding or lapping-in valves make certain that all signs of pitting are removed from the seats.



E16

Material EN32A Case Hardened and Ground

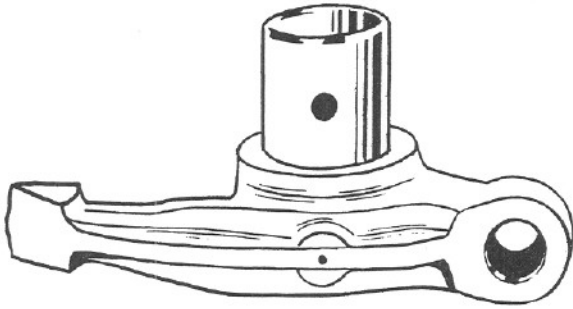
Inlet Dimensions

- A—2.75 in
 B—2 in
 C—0.75 in
 D—0.309 in to 0.310 in
 E—1/16 in at 45°
 F—1/16 in at 45°
 G—1/32 in Radius
 H—1.238 in to 1.239 in
 J—0.222 in to 0.225 in
 K—1.523 in to 1.533 in

Exhaust Dimensions

- A—2.75 in
 B—2 in
 C—0.75 in
 D—0.309 in to 0.310 in
 E—1/16 in at 45°
 F—1/16 in at 45°
 G—1/32 in Radius
 H—1.018 in to 1.019 in
 J—0.222 in to 0.225 in
 K—1.287 in to 1.297 in

After all the valves have been lapped in the valve head depths relative to the cylinder head face should be checked to ensure that they are within the limits given on Page B.8.



E17

VALVE SEAT INSERTS

Valve seat inserts are not fitted to production engines, but may be fitted in service.

When fitting inserts ensure that only genuine Perkins parts are used.

In order to fit these inserts proceed as follows:

1. Fit new valve guides as described on Page E.4.
2. Using the new valve guide bore as a pilot, machine the insert recess in the cylinder head face to the dimensions shown in Fig. E.15.
3. Remove all machining swarf and thoroughly clean the insert recess (removing any burrs which may be present).
4. Using the valve guide bore as a pilot once again press the insert home with the inserting tool, this tool is shown fully dimensioned in Fig. E.16.
NOTE: The insert must not under any circumstances be hammered in, neither should any lubrication be used.
5. Visually inspect to ensure that the insert has been pressed fully home, i.e. is flush with the bottom of the recess.
6. Recut the valve seat at an included angle of 90° (which will give the normal 45° seat) until the valve head depth reaches the minimum limit which is given on Page B.8. Lightly lap the valve to its new seat.

To Dismantle the Rocker Shaft Assembly

1. Remove the retaining circlips from each end of the rocker shaft.
2. Withdraw the rocker levers, springs and support brackets from the rocker shaft.
3. Unscrew the oil feed pipe from the banjo and remove the banjo. (When refitting this feed pipe it should be noted that the end of the pipe locates the banjo position on the shaft).

Examine the rocker bushes and shaft for wear. The rocker levers should be an easy fit on the rocker shaft without excessive side play.

New rocker levers are supplied complete with bush fitted and reamed to size.

NOTE: When fitting new bushes ensure that the oil feed holes are in alignment before pressing home, and when pressed fully home that the holes coincide. (Refer to Fig. E.17).

To Re-Assemble the Rocker Shaft Assembly

1. Refit the oil feed banjo and locate with the feed pipe.
2. Refit the rocker levers, springs and support brackets in the opposite order to which they were removed. Lightly oil the components during re-assembly and ensure that each rocker lever does not bind on the shaft. The assembly should now be as shown in Fig. E.18.

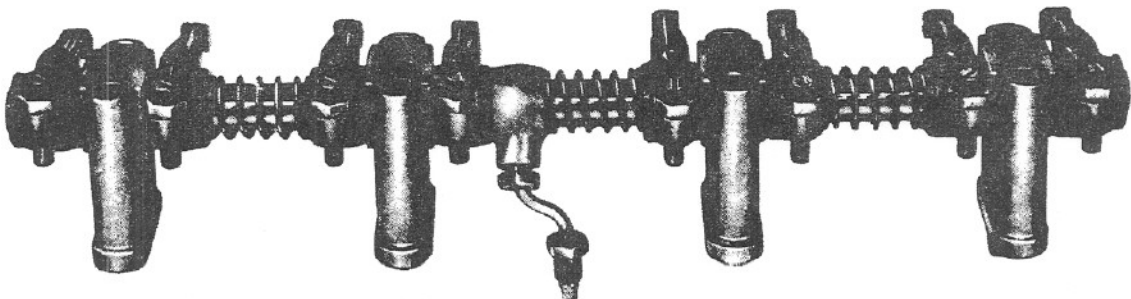
PUSH RODS

Check the push rods for straightness, if any are bent then fit new replacements.

To Refit the Valves

Lightly oil the valve stems to provide the initial lubrication.

Replace valves, springs, spring plates, washers, collars and collets, taking care that the numbers on the valves correspond to the numbers stamped adjacent to the valve seat (see Fig. E.6).



E18

NOTE: Valve springs incorporate a damper coil and care should be taken to ensure that this damper coil is to the bottom of the spring, i.e., nearest the cylinder head when fitted.

Inner valve springs are not required for engines rated at 3,000 rev/min and below.

4.108 engines and 4.99 vehicle engines are fitted with rubber sealing rings on inlet valves only.

All latest 4.107 and 4.99 agricultural and industrial engines incorporate oil deflectors on both inlet and exhaust valves.

In the case of earlier 4.107 and 4.99 agricultural and industrial engines which incorporate rubber sealing rings on the inlet valves only, oil deflectors should be fitted to both inlet and exhaust valves after the valve assembly has been dismantled. With this arrangement, a different valve spring seating washer is required for exhaust valves.

Where a groove is cut on the inlet valve stem, a rubber sealing washer should be fitted in addition to the deflector to stop the latter from becoming canted on the stem.

Oil deflectors should not be fitted to 4.99 vehicle and 4.108 engines.

CYLINDER HEAD GASKET

Always use a new cylinder head gasket. Ensure that the correct type is used.

4.108 Engines

With this engine, the gasket is made of a black composite material and is known as the Klinger type. It **MUST** be fitted **DRY** and on no account should jointing compound be used.

It is very important that the gasket is placed correctly, otherwise the steel beading may be nipped between the cylinder head face and the top of the liner.

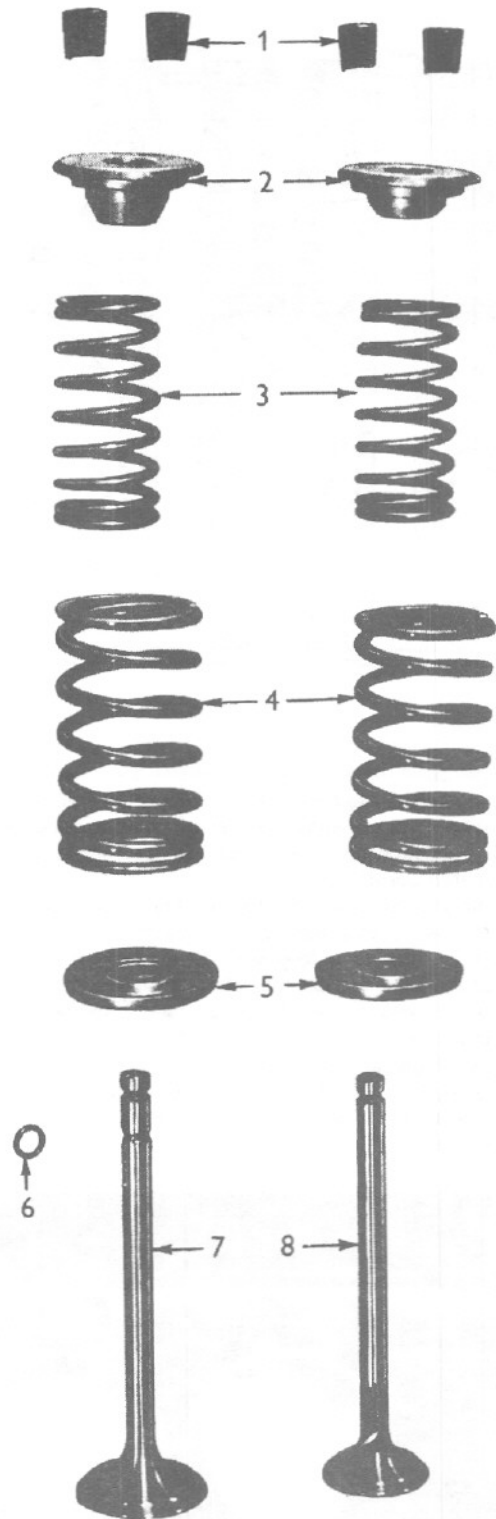
4.107 and 4.99 Engines

These engines use a copper and asbestos or a copper, steel and asbestos gasket. These gaskets should be fitted with a light coating of Perkins (Hylomar) jointing compound on both sides.

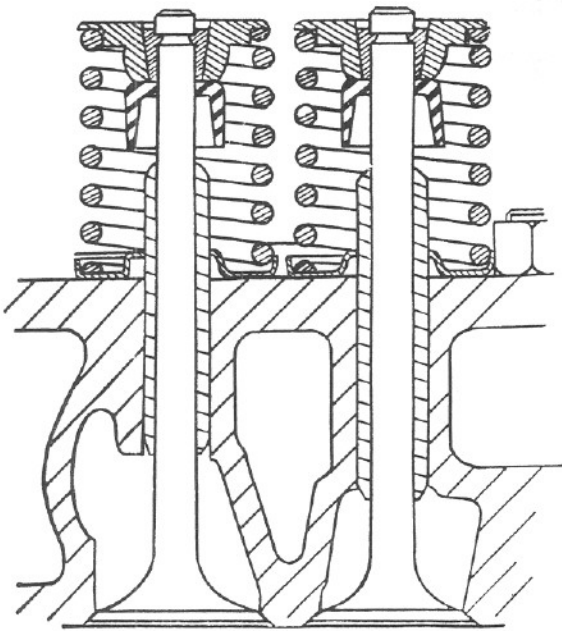
To Refit the Cylinder Head

1. Place the cylinder head gasket carefully in position on the cylinder block top face (the gasket is marked "TOP FRONT" to indicate how it should be fitted). (Refer to Fig. E.22).
2. Lower the cylinder head into position on top of the gasket ensuring that it lays perfectly level.
3. Lightly lubricate both cylinder head studs and nuts with engine oil, then tighten the nuts progressively in three stages in the sequence shown in Fig. E.23 to the torque given on page B.2. This final torque tightening stage should be repeated to ensure that no loss of tension has taken place on any studs earlier in the sequence.

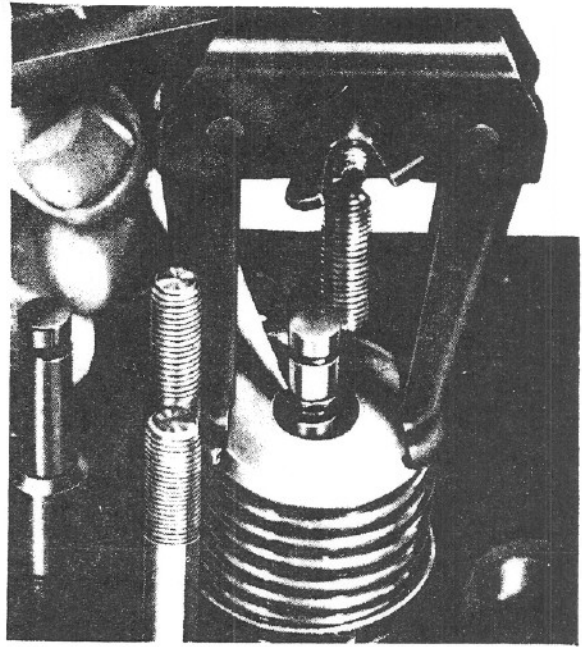
With current engines, washers are fitted under the cylinder head nuts which necessitates longer cylinder head studs. The cylinder head tightening torque remains unaltered.



1. Retaining Collets
2. Spring Caps
3. Inner Valve Springs
4. Outer Valve Springs
5. Spring Seating Washers
6. 'O' Sealing Ring (Inlet Valves only)
7. Inlet Valve
8. Exhaust Valve



E20

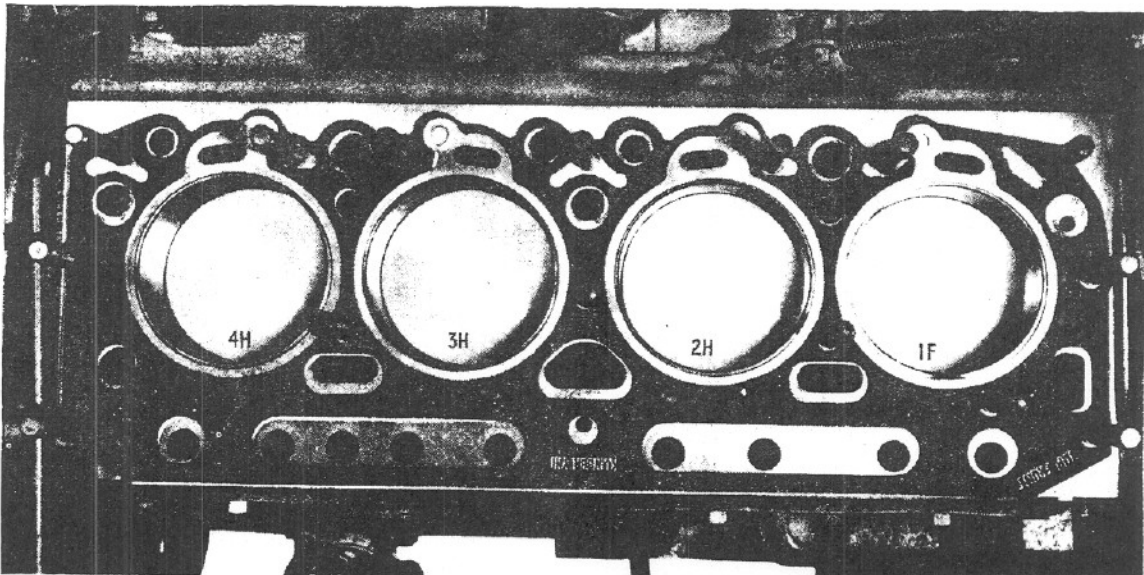


E21

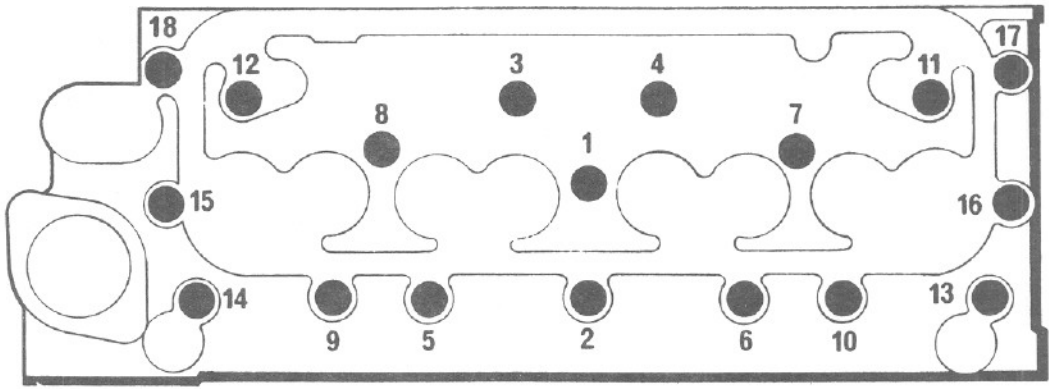
4. Fit the push rods in their locations then carefully fit the rocker shaft assembly, noting that the valve adjusting screw ends locate in their respective push rod cups and the oil feed to the rocker shaft is located correctly.
5. Locate the oil feed pipe nut just finger tight at this stage, then evenly tighten the rocker shaft bracket securing nuts to a torque of 12 - 15 lbf ft (1.7 - 2 kgf m) now tighten the oil feed pipe nut. When correctly located the oil feed pipe will be as shown in Fig. E.2.

NOTE: If the oil feed pipe nut is tightened before the rocker shaft bracket securing nuts, the pipe will either be strained or the olive pulled off the feed pipe.

6. Adjust the valve clearances to 0.012 in (0.3 mm) as follows:—
Turn the engine so that the valves of No. 1 cylinder are in the position of 'valve overlap', i.e., the period between the opening of the inlet valve and the closing of the exhaust valve. In this position, adjust the clearances of No. 4 cylinder valves: similarly, with the valves of No. 3 cylinder in the overlap position, adjust the valves of No. 2 cylinder. With valves of No. 4 in the overlap position, adjust the valves of No. 1 cylinder and finally with valves of No. 2 cylinder in overlap position, adjust valves on No. 3 cylinder.
7. Replace the dynamo or alternator adjusting link and tension the fan belt (Refer to Page N.1).



E22



E23

8. Replace the atomisers (Refer Page P.9) but do not tighten the securing nuts.
9. Replace the leak off pipe assembly and four high pressure fuel pipes to the atomisers. Tighten the the atomiser securing nuts.
10. Replace the fuel oil filter and the low pressure fuel pipes between filter and lift pump and filter and fuel pump.
11. Reconnect the electrical and fuel supplies to the starting aid.
12. Reconnect the exhaust pipe to the manifold.
13. Reconnect the water outlet connection at the front of the cylinder head.
14. Fill the cooling system with clean water ensuring the drain taps are turned off. Check for water leaks.
15. Bleed the air from the fuel system as described on Page P.10.
16. Reconnect the battery.

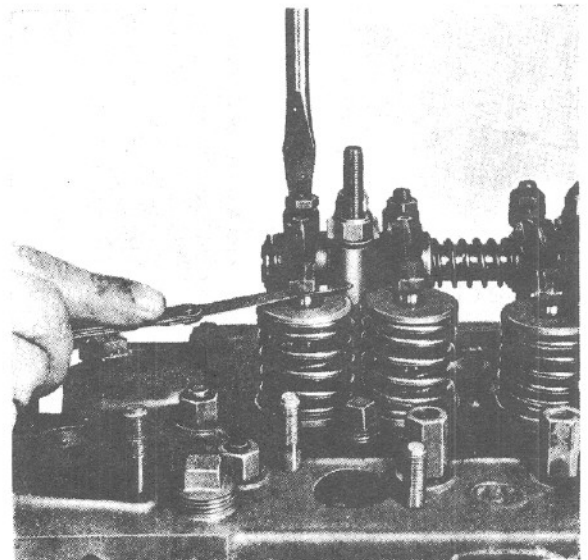
Starting the Engine

Proceed as instructed on Page P.11, with the engine running at a fast idle check that the oil pressure is satisfactory and that the oil reaches the rocker assembly and oozes gently from the rocker levers at this speed.

After the engine has been thoroughly warmed up it should be shut down, the rocker shaft removed and the cylinder head nuts checked, so that any loss of torque tension can be corrected by tightening the nuts to the torque given on Page B.2 and in the order shown in Fig. E.23.

Replace the rocker shaft as previously described and set the valve clearances to 0.012 in (0,30 mm) COLD. Start engine and check oil flow to rocker levers, if satisfactory refit cylinder head cover and air cleaner. Finally check for oil leaks and rectify immediately if any are visible.

It is important that the cylinder head nuts are re-tightened to the correct torque, in the correct sequence, after the engine has completed between 250/500 miles (400/800 km) or 6/12 hours service following head fitment.



E24