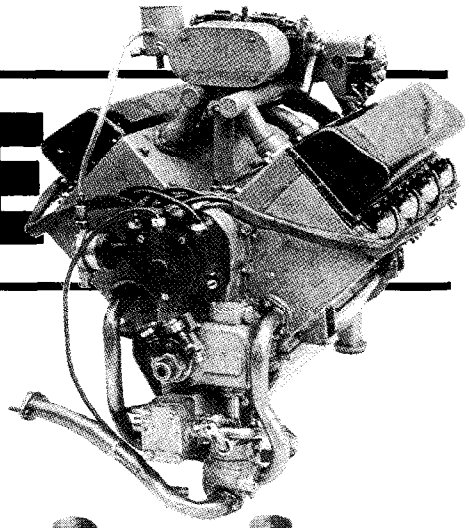
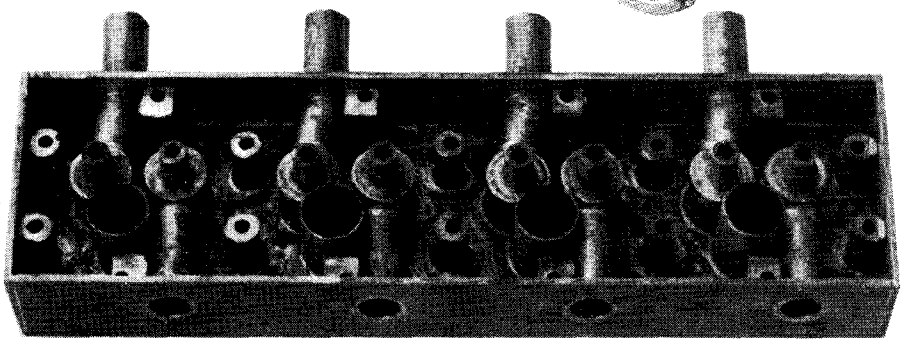
# V8 ENGINE



**Roy Amsbury describes and details the building of a 120cc V8 i.c. engine which he developed for use with his 5 in. gauge Hymek locomotive. The engine could well have other traction applications** *Part v, from page 747*

*Last time we dealt at length with the special set-ups and procedure for making the camshaft.*

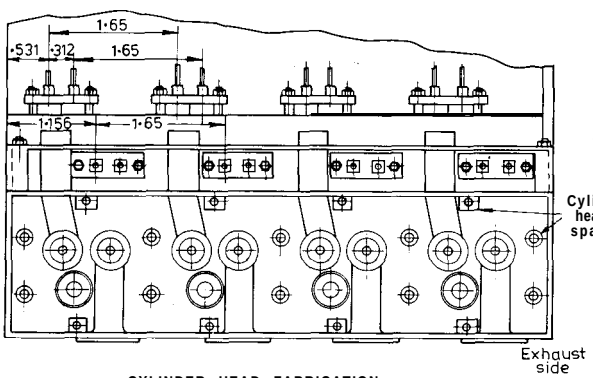


***The cylinder head prior to fittng the top cover.***

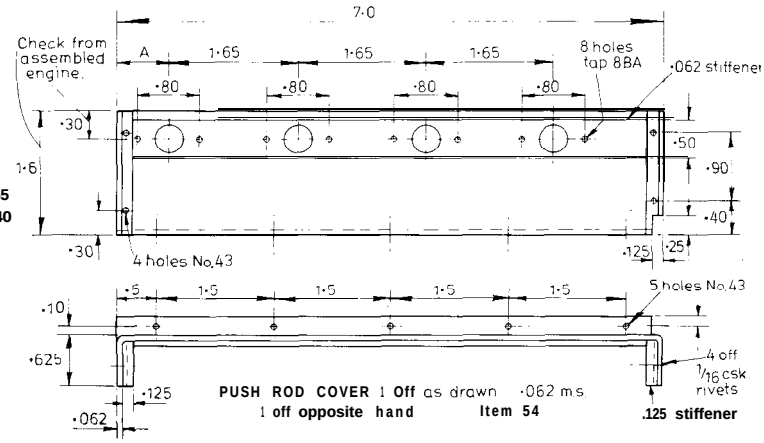
## Cylinder Heads

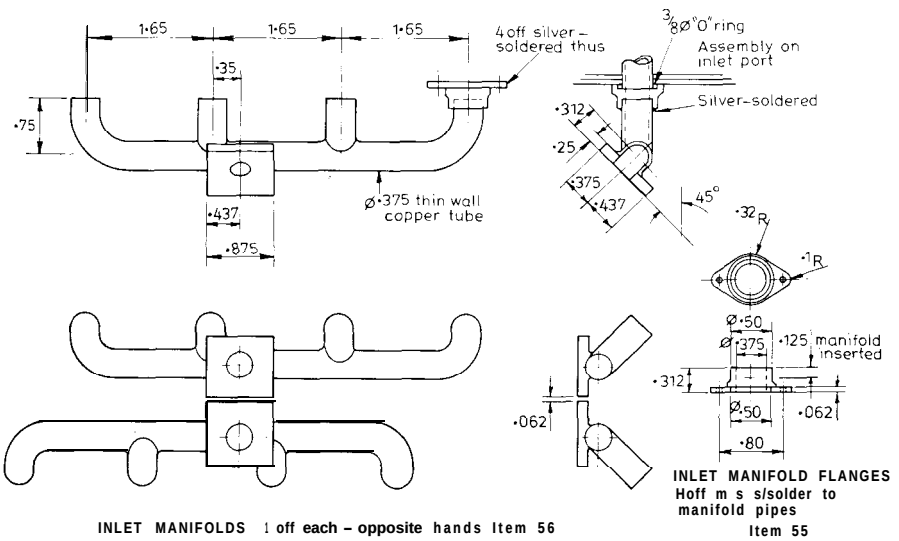
This is the next part to make, first machine the base plate and drill the various holes for the valve cages and sparking plugs – don't thread them yet though. The combustion spaces will have to be set up individually in the four jaw for machining out. Cut the various side plates and make the valve cages, cover supports and inlet and exhaust pipes - the latter out of 3/8in. OD thin wall copper tube. Valve cages need a bit of special work – machine the OD, part off and then machine the bores and drill the cross hole. Now make up a stub mandrel, a tight push fit in the 0.165 in. dia. bore. Fit each cage on in turn, and with a small boring tool, machine the valve seating at 45 deg. and not more than 0.020 in. wide. I have done it this way to ensure that the seating is concentric with the valve stem, small drills nearly always wander. Fit the four side plates to the base using 10 BA bronze screws and assemble all the internal components. Put a ring of 1 mm silver solder wire around all the joints where it can be persuaded to stay, flux everything, and proceed in the usual way to silver solder all the joints. Cool and pickle and then make a really good examination of all joints – reflux and go over any suspicious joints – they are difficult to seal when the cover plate is soft soldered on.

When the silver soldering is complete the heads can be trimmed up and the bolting



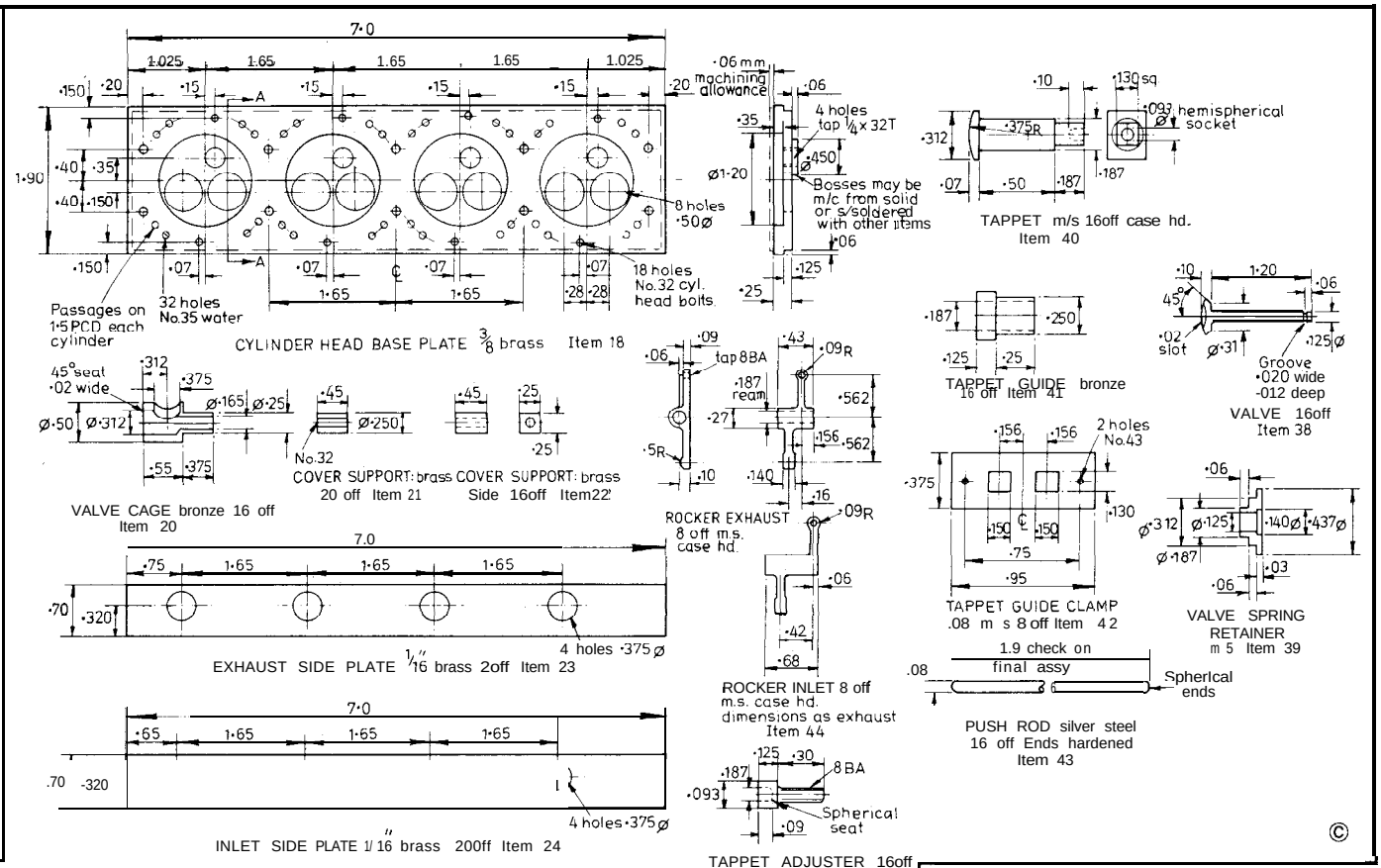

**CYLINDER HEAD FABRICATION WITHOUT TOP COVER 2 off**




**INLET MANIFOLDS 1 off each – opposite hands Item 56**

**INLET MANIFOLD FLANGES Hoff m s s/solder to manifold pipes Item 55**

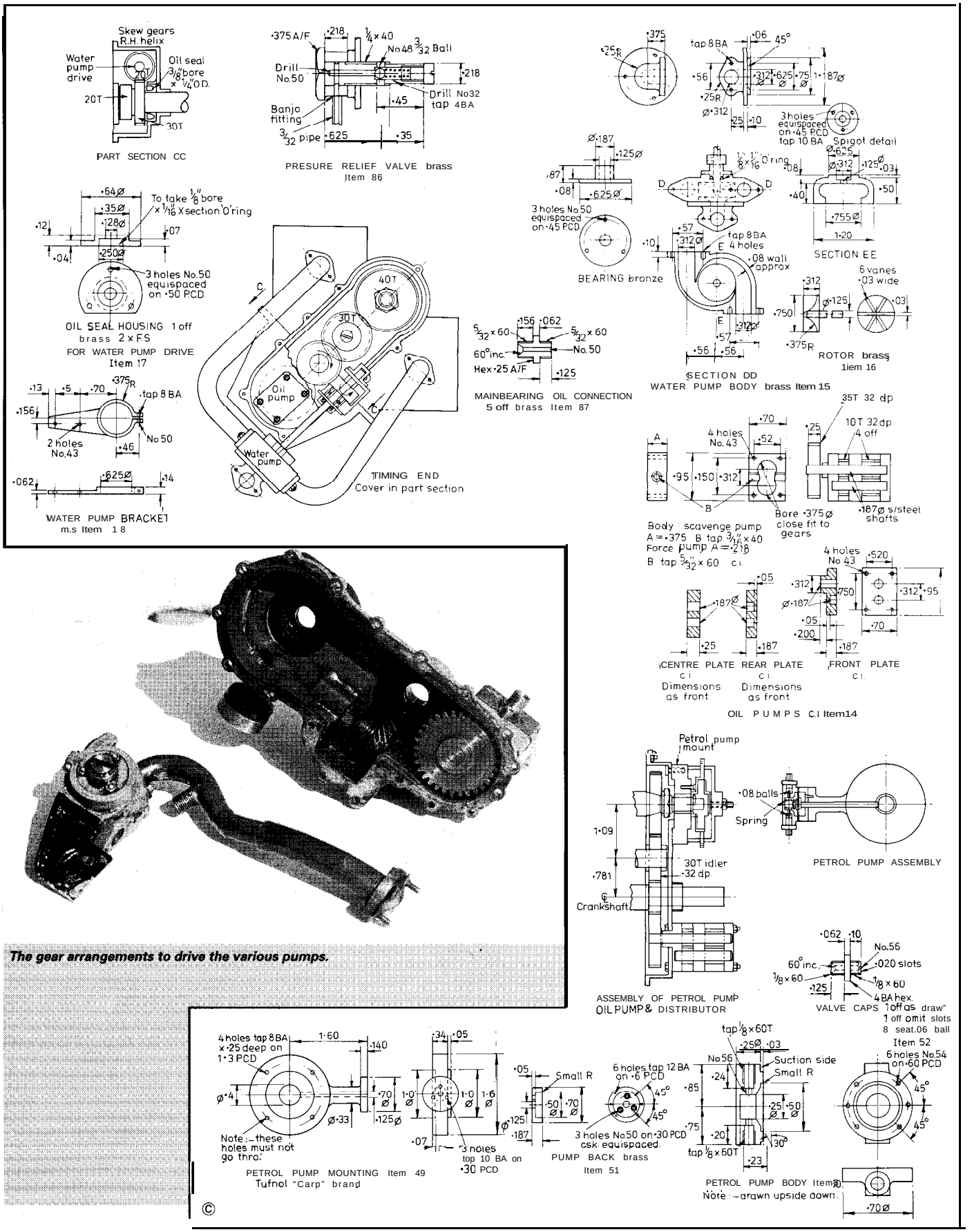



face machined truly flat. The cast iron bushes for the valve guides can now be made. Machine the O.D. of these bushes on a mandrel to ensure concentricity, and press home. Plug holes can be threaded and the cylinder head bolt holes and water passage holes can now be drilled. A template will need to be made for these to be able to transfer the positions to the cylinder block.

All the various valve gear parts can now be made and I don't think these all need detailed machining operations. The valves can be made from mild steel, although it is better if a few ex lorry engine valve stems can be obtained to machine up – they are rather long and will need a back centre for support, but the centre will have to be removed from the completed valve. A small slot is required in the head to enable them to be bedded to the valve seat.

Valve rockers are a tedious set of components to make involving a good deal of milling and filing to remove surplus material. The valves are retained by a small circlip, each made from one coil of a spring, it is retained by a recess in the cap. Valve springs are best obtained commercially, as they all need to be the same. Mine are 8 turns of 0.020 in. dia. with a free length of approx. 0.75 in. wire – I paid a visit to a local small spring manufacturer and obtained a large bag full from their surplus stock for practically nothing.

Note that the tappet guides are retained by a plate which has slots for the top end of the tappet to engage – this prevents the tappets rotating. It is wise to drill the bolt holes for these plates with tappets in position to ensure that they work freely when clamped in place. The length of the top section of the tappet guides must also all be the same.




*The gear arrangements to drive the various pumps.*

## Pumps

There are four pumps to be made – two oil pumps, water pump and petrol pump. Starting with the oil pumps, they are identical, apart from the length of the gears, the longer one being the scavenge pump of course.

The important thing is to get the gear centres for the casing and the end plates exactly the same and of course correct for the gears you are using. (Muffet 32 D.P. again). To this end it is easiest to use the vertical miller and set out the centres from the traverse index. If you don't have such luxuries, then you will have to resort to

toolmakers buttons and clamp the various parts to the lathe faceplate to set the buttons true in turn. As the lathe mandrel bore will cause problems with these small components, either a special faceplate will be needed or a suitable cover plate fitted over the normal faceplate. This can be drilled at any convenient point for clamping bolts.

The gears can be fitted to the shafts by making them a press fit or they can be fixed with Loctite; but keeping the Loctite out of the bearings is a bit tricky. The pumps are held to the timing case by long studs through the whole assembly. The gears must fit the casing, both on the circumference and lengthways – the easiest way to do the latter is to face off the gears to length whilst in the housing against a temporary bottom cover. A thin gasket made from cigarette paper will then provide a working clearance between the gears and end plates.

## Oil Pipework

The scavenge pump suction must be connected to the sump and it is wise to incorporate a good filter in this line. I made one from a cut down car filter. This was cut to about a third of its original length and a new cardboard end cover stuck on with rubber "bath seal" material and it was fitted in a steel container with a suitable inlet and outlet. Scavenge pump delivery goes to the oil tank of course. The force pump takes its feed from this tank and is piped to a banjo fitting on the outside of the sump and to the pressure relief valve, also on the sump side – this discharges into the sump. The feed banjo screw is tapped into a fitting on the inside of the sump (which is not attached to the sump) and the oil pipe then is tee'd off to each main bearing with 3/32in. dia. copper pipe. I also took a tapping from the remote end of this pipe back through the sump via another banjo fitting to the pressure gauge connection. The relief valve was set to give an oil pressure of 10 psi and this never seems to vary much during normal running.

## Water Pump

The water pump can be made from a solid block of brass. Bore out the recess for the impeller to size, then drill the two water outlets as far as the centre line – make sure you get the correct hand – it's easy to get it wrong and check against the spiral drive gear rotation. The outlet volutes can best be done by a ball ended end mill or rotary file about 1/8in. or 3/16in. dia. held in an electric drill or preferably one of the small high speed ones which are not very expensive – mine is home made from a surplus D.C. motor. The external shape is easily done by filing. The mounting bracket from the crankcase is fitted to the top face of the pump body. The impeller should be milled with a 3/4in. dia. Woodruff cutter or similar about 0.06 in. wide, the centre of the impeller will be removed for a short distance but that is not important. Do this machining on the end of a piece of 3/4in. dia. bar first then drill up the centre and part off to length, it can be Loctited to the shaft. The shaft is of stainless steel and sealed with an "0" ring. The bolts holding the pump bracket to the sump should be drilled when the pump unit is assembled and fitted to the timing cover. The length of the pump shaft is also best determined at this stage as well. An Oldham coupling is incorporated in the shaft to cater for any small alignment errors.

Water pump pipework is obvious – one feed from each pump outlet to each cylinder block in 3/8in. OD pipe. Both outlets from the cylinder heads are tee'd together and fed to the radiator. I used an ex-car heater radiator, it is about 8 in. x 5 in. x 3 in. deep. It is fan cooled by a 5 in. dia. fan electrically driven – but the method of driving the fan depends on the engine application. A small header tank with filler cap is fitted in the feed between cylinder heads and radiator, the system is not pressurised hence a vent is needed.

## Petrol Pump

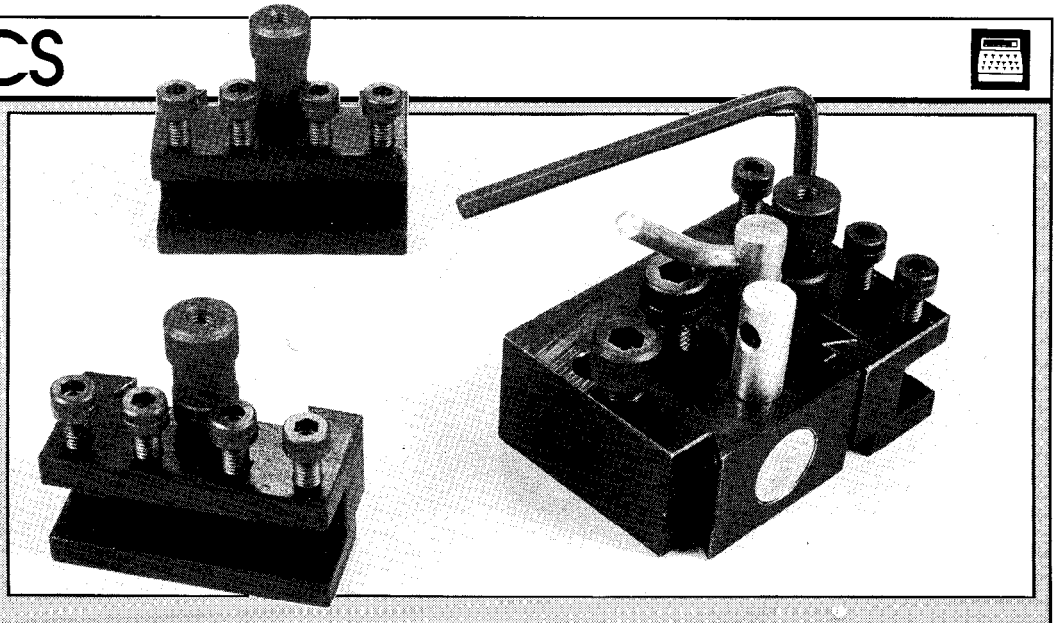
The petrol pump is the last of the bunch, I have found that a pumped feed with overflow back to the tank is much more reliable than a miniature float system for small engines. Starting with the mounting plate, this is made of Tufnol to reduce heat transfer to the pump, a block of material is required 3/4in. thick by 1.7 in. x 2.5 in. First set up in the four jaw and machine the bolting face, spigot and bore, then reverse, set to run true and machine the opposite face. The block can then be set at 90 deg. to machine the stalk and drill its centre. The curved section can be filed or milled to shape. Machine the back piece (Item 51) next, line it up by a peg in the bore, drill the holes for the fixing screws and tap them out care-fully. The six fixing holes for the body are best located from the body which should be made next. It can either be machined from the solid or fabricated.

The depth of the valve bores should be carefully controlled to give a clearance for the ball of about 0.025 in. The diaphragm should be made from a standard petrol pump diaphragm to get the right material, the holes can be punched with small "leather" punches. The ball valves can be seated in the usual way with a light tap. I used 0.08 in. dia. balls out of a scrapped ball race - 3/32in. dia. are a bit tight in the bores. A fine filter, again ex-car pump is fitted between the petrol tank and pump inlet.

*To be continued*

# TRADE TOPICS

## Easi Lock Q.E.P. Tool Change System from Chronos



A recent introduction from Chronos is this quick change tooling system. It fits directly to the topslide of the lathe. The set we examined was for the popular Hobbymat lathe, other versions are available for other lathes, please state when ordering. The holder consists of a double dovetailed steel block which fits direct to the topslide with no machining. Onto this drops the toolholder, with matching dovetails and a built-in height adjuster. Once the tool has been positioned to centre height it will reset at that position at any time, either in the in feed mode, or at 90 deg. for such jobs as boring etc. There are three toolholders supplied, these can be interchanged at will. Locking of the toolholder in the ready position is by way of a cam, operated by a plated cranked lever which is supplied as part of the kit.

Steel used is zinc plated and then blackened to give a smart appearance and long life.

Price of the unit is normally £150 inc. VAT and P&P. As a special offer to readers of this magazine the set is offered for a limited period at a price of £125 including VAT and P&P.

This tooling, together with a wide range of other tooling and equipment for the model engineer is available from Chronos Ltd, 95 Victoria Street, St. Albans, Herts AL1 3TJ, tel. 0727 832793.