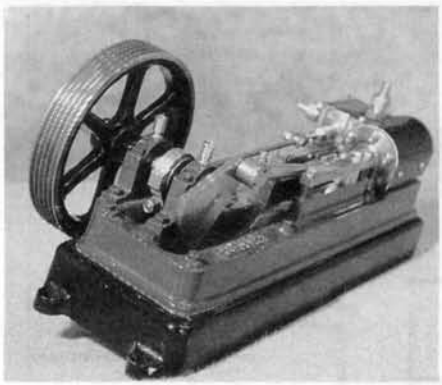


SALLY

Completing the cast ironwork

Tubal Cain completes the cast iron work for this engine by describing how to deal with the steam chest and cylinder covers and offers builders a simple method for accurately indexing six positions for the cylinder cover fixings.

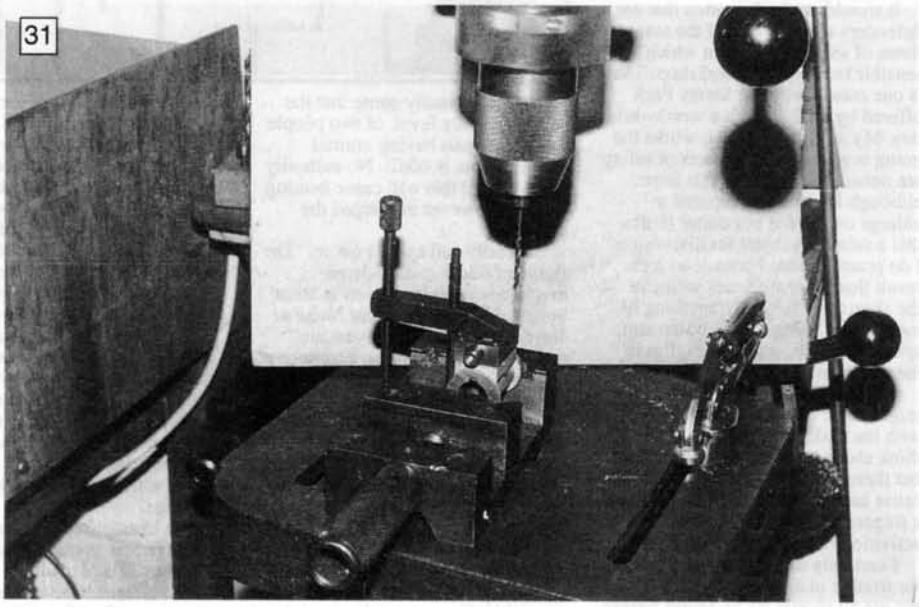
● *Part V continued from page 618 (20 November 1992)*

Steam chest cover

Part 27, **Fig.28.** Set up in the 4-jaw, front outwards, with a piece of packing behind to allow it to project by about 40 thou or so. Tap well back and centre carefully to the boss in the middle. Tap it back again but I suggest that you ease the packing out before starting work. Machine the face, taking off half the machining allowance then centre with a slocumbe drill. Now, the drawing shows ¼in.x32 TPI, but if you intend to run much on steam you will need a lubricator here. The Stuart No.155 is quite adequate, but is threaded 3/16in. x 40 TPI, as are the 5/32in. stop-valves. So, I suggest you drill 4.2mm and tap 3/16in. x 40 TPI and lightly countersink the hole. Guide the tap from the tailstock, as before; then reverse with parallel packing behind to machine the back. The sides can then be filed to match the steam chest, but try to keep the sides parallel to the edges of the recesses on the front.

Mark out for the 6 holes which work out at 7/64in.from the edges – but err on the high side rather than low. Centre-pop carefully, since any which are out of line will show and drill 2.7mm to give easy clearance for 7BA.

Clamp the cover to the steam chest, making sure that this is right way round. Spot through all 6 holes but note that the centre holes in the chest are **tapping size**, not clearance. Drill four holes 2.8mm and those in the centre 2.1mm. Don't tap them yet, wait until the cylinder is drilled. The chest must again be clamped, right way round to the cylinder and with a very slight overlap at the sides, so that the cleading (lagging cover) on the cylinder finishes flush with the steam chest. **Fig.31**. Spot through 2.8mm and then drill 2.1. Set your depth stop if you have one, so that the drill goes down no more than 3/16in. to the point. The chest and cylinder may now be tapped. The tap must be guided vertically, important for these long studs. It can be held in a pin-vice with a normal tapwrench on the shank which will need a small flat to grip on, and guided from the drilling machine chuck. In passing, the Stuart schedule calls for setscrews in the cover centre holes. This is quite wrong - they should all have **studs**. You will have to make these by threading a length of 5/32in. (or 2.5mm) steel rod and cutting to size. Put a bevel on each at one end, and round the other - this end carries the nut.

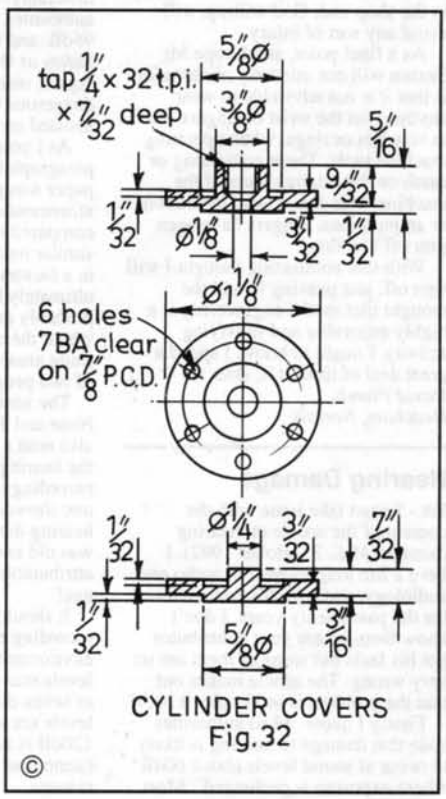


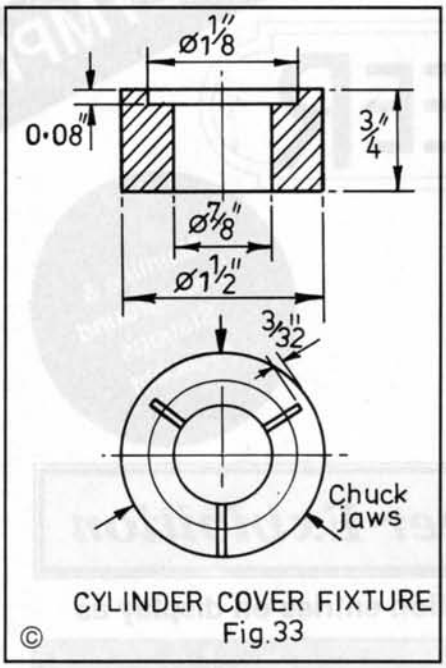
31: ***Spotting through from the steam chest to the cylinder block with the drill held in an Albrecht type keyless drill chuck.***

Cylinder covers

Parts 6 & 16. **Fig.32.** You are supplied with a piece of easy-machining cast iron for these parts. Chuck in the 4-jaw, set true with just over half protruding and, after facing the end, take off about 5/32in. from the diameter as far as you can reach. A roughing cut of 25-30 thou, 200 rpm and perhaps 0.005 in./rev feed. Then reverse, leaving ¾in. projecting and true the other end. This ensures that when all is finished you will have a piece of machined cast iron useful for other purposes. Now reduce the diameter to 1.125in., honing the finishing tool for the final cut, which should not be less than 0.003 in. The exact diameter is not critical, but get it as near as may be. Polish the surface.

Set up a sharp knife tool, point slightly ahead of the body, to form the spigot at 5/8in. dia. x 5/32in. Lock the saddle and use the topslide to measure the depth, which should be 0.030 in. until you get to the 5/8in. diameter, (a good fit to the cylinder). When you get this far, feed in an extra thou and then withdraw the tool slowly with the cross-slide to face the flange. If your lathe is in good condition you should be able to take cuts about 1/16in. at a time - it does not take long. Now part off to leave the piece a shade over 3/16in. thick, measured from the flange. (5/32in.+ from the spigot.) You need have

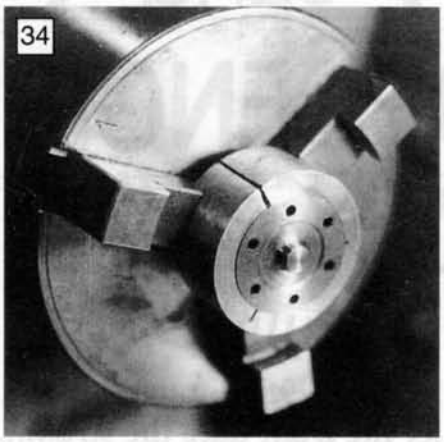




CYLINDER COVER FIXTURE
Fig.33

no fears over this operation; the material cuts very smoothly and there is no problem of swarf jamming in the cut as with some steels. But make sure that your tool is dead square across the bed, and that it is sharp. Face the end of the stock and repeat to form the spigot of the other cover. Centre with a slocumbe and then drill 3.2mm x 3/16in. deep. Run fairly fast for this and feed the drill slowly and steadily. Then part off, this time measuring a shade over 9/32in. from the flange. (5/16+ total.)

You must now make a fixture to hold the covers for the second operations - **Fig.33.** If you have no material large enough you can use the residue of the cast iron, but it would be better if it were a little longer; my own is made from a scrap piece of aluminium alloy. Set in the chuck to drill the centre hole, which must then be bored out to, say 7/8in. dia. Make the three sawcuts, one going right



34: ***The cylinder cover fixture in use - a finished cover has been inserted into the fixture for the purpose of this photo.***

through. (If using the piece of cast iron, drill a 3/16in. hole at the end of the two others. Find a piece of packing which is an easy but not slack fit in the slit and then set in the 3-jaw chuck, the front projecting about 1/16in., and grip firmly. Face the end and bore out the recess to fit the cylinder cover - both will be the same diameter. Very gently release tension on the chuck jaws until you can push out the packing. Then fit the larger cover into the recess and tighten the jaws firmly. Tap the cover back to make sure that it seats truly. The job is now securely held, and both spigot and hole should be concentric, as you machined them at the same setting as the O.D. Face the end. See **Fig.34.**

Drill 5.7mm x 1/2in. deep, and tap 1/4in. x 32 TPI, guiding the tap from the tailstock drill-chuck. Then form the boss, roughing first with a knife-tool, but finish with a small round-nose to form both the recess and the fine finish of the boss. Fine finish the flange also, and polish if you have a mind to. Gently ease the chuck to release the workpiece, then fit the second cover. Not to worry if the jig moves a little, or even comes right out, for there is no need for **accurate** concentricity with the back cover. The procedure is the same - rough out with a knife tool, then form the profile with a round-nose finishing tool and polish.

Fixing holes

To mark these out, set the cover in the fixture again, inside out. Adjust your scribing block exactly to centre-height and then use a spirit level on each chuck jaw in turn to set it dead level. Scribe across both sides of the flange. Do both. Then reset the scriber to 1/16in. below centre-height to mark the other way - this time the chuck jaws should be vertical, either above or below the centre. Treat both covers this way. You can now take out the jig and use it to hold the covers whilst centre-popping and then again in the drilling vice. Use a 2.7mm drill, to give good clearance on 7BA.

Now to spot through to the cylinder. Take care (a) that you get the right cover at the right end; (b) that the bolt-holes will lie at the right attitude with an opposite pair truly vertical on the cylinder centreline. Check this carefully. And finally, (c) that the cover does not move whilst spotting through. To achieve this last requirement, spot through one hole only; drill it tapping size (2.1mm) tap, and fit a bolt. Check that the cover still lies in the correct position, then spot through all the other holes. Do the same at the other end. You can then tap all the holes, again using the drilling machine chuck to keep the tap upright. Mark each cover and an adjacent surface on the cylinder so that they go back the right way when erecting.

Interval

You have now finished working in cast iron, and can clean down the machine and, if it has felt saddle wipers, take these out and clean them. Then go over all work that has been finished, removing sharp edges, lightly countersinking bolt-holes etc, and oil all machined surfaces. Then, for safety, assemble the cylinder set with as few studs or bolts as needed, and set aside in a safe place. Do not set out to drill the bedplate securing bolts just yet; that comes later. ● *To be continued*

HISTORICAL NOTE

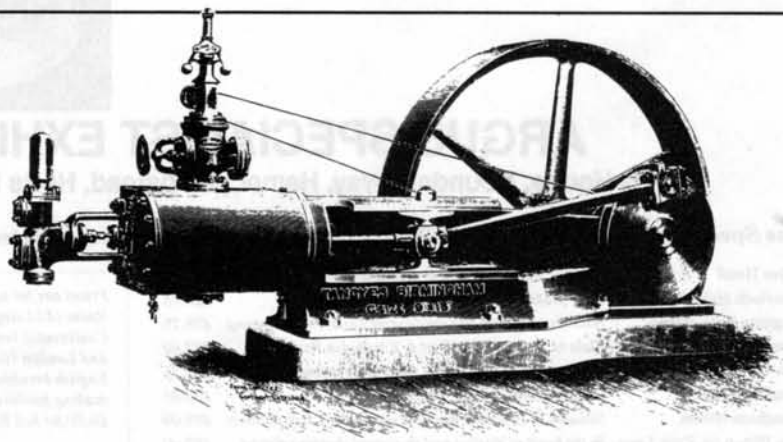
Tubal Cain's *Sally*, using the Stuart Models S50 kit, represents a horizontal steam engine typical of the period and manufactured by a number of suppliers in a variety of capacities. To place the engine in context, as it were, we have made space during Tubal Cain's Interval to consider one version of this ubiquitous breed from Tangyes' 1891 catalogue.

Designed to run on 80 lb maximum steam pressure this particular engine, in common with many others, was available in either right- or left-handed configuration. The bed casting was of box section and the cylinder and steam chest cast as a single unit, lagged with sheet steel and fitted with drain cocks and lubricator. The steel valve rod and wrought iron piston rod worked in gun-metal bearings and the piston was fitted with cast-iron "spring rings".

The steel crankshaft was finished over-length to permit the fitting of a pulley alongside the flywheel and ran in gunmetal bearings lined with "plastic" metal – at the time Babbit metal was the subject of a patent application and reference to it was avoided.

The fitted governor was of the *Soho* type with combined equilibrium throttle and stop valves and so designed that, in the event of belt failure steam would be shut off and the engine brought to a stand.

Supplied with each engine was a feed pump, governor belt, holding down bolts with nuts and washer plates and a set of spanners. All bearings were fitted with oil cups. Every engine was run under steam before leaving the works.



From a Photograph of the 9 - 18 ins. size, right hand.

Readers may be interested to know that potential contemporary customers were obliged to use "telegraphic codes" to specify their requirements when enquiring for prices and spares, etc. The 9 in. x 18 in. engine illustrated here was coded *Palustres*, *Pammachum* referred to a left hand version whilst *Pampilhos* and *Pampinari* indicated similar right- and left-hand engines without fitted feed pump.