Part 10.

A Gauge 0 Steam Loco for Beginners.

By "1121."

Cylinder Block.

This is a $\frac{3}{4}$ in. length of $\frac{5}{8}$ in. square phosphor bronze or gunmetal—preferably cast. Pistons and cylinder bores, valves and port faces, and so on, should always be made from dissimilar metals to improve their resistance to wear and possible seizing. Thus we prefer cast bronze or gunmetal, or even brass, for the cylinder block, and drawn brass rod for the piston and valve, although we have made a number of small pistons of duralumin, including that for the original "Aladdin," and it seems quite all right. If you use cast stock for the block it will undoubtedly be rough and over-size, so will require cleaning up all over. The easiest way to do this is in the lathe, holding the sawn-off piece of bar in the 4-jaw chuck, making sure it is pressed well back to maintain squareness. Face across each side in turn, remembering about removing burrs when you shift it, to avoid these producing false location and throwing the block out of square. Machine the surface which is to be the port face last, so that you won't risk marking the important face with a chuck jaw, and make sure it is nice and smooth and flat. Face the ends of the block, again in the 4-jaw chuck, but put a piece of soft packing —brass, copper, aluminium etc.— over the port face, so that it doesn't get marked by the jaw. Make sure that all jaws are down tight, so that the block is held true, and clean up the first end. Turn it round the other way, and face the second end down to finished length. Mark the position of the centre of the bore on this end, noting that it is *not* central with the width of the block (Fig. 50) and make a centre-pop there so that you can see the position easily. We suggest a centre-pop mark on the top side of the block, up close to the front end.

Now put your block back in the chuck again with the back end outwards (the end with the bore-centre marked on it) and adjust the chuck-jaws so that this mark runs as true as you can get it. Put a pilot-hole, say about $\frac{1}{8}$ in., right through, from the tailstock, and then open it out to $\frac{1}{4}$ in. or $\frac{5}{16}$ in. —the biggest you've got. Whether you propose to finish the bore with a $\frac{3}{8}$ in. reamer, or by boring, it is still advisable to true it up with a boring tool first. Your centre-pop, and therefore your hole, will be running dead true, and if a reamer is put through a hole running out of true it will produce a tapered bore. The exact *size* of the bore is not important, provided it is round and parallel and smooth, so if you have no $\frac{3}{8}$ in. reamer you only need to set your inside calipers to $\frac{3}{8}$ in. by your rule, or micrometer if you have one, and bore the block out until they just slip in.

Making a boring tool— hardening and tempering.

You can easily make a diminutive boring-tool, if you have not got one small enough, by the following method:-

Heat up the tip of the tang of an old flat or square file to red-heat, and bend it over as shown in Fig. 51. Harden it by heating again to bright red and plunging it into clean cold water. This will now be "dead hard," like glass and will need to be "tempered." Polish up one side of the tang with emery cloth until it is bright and start heating it again

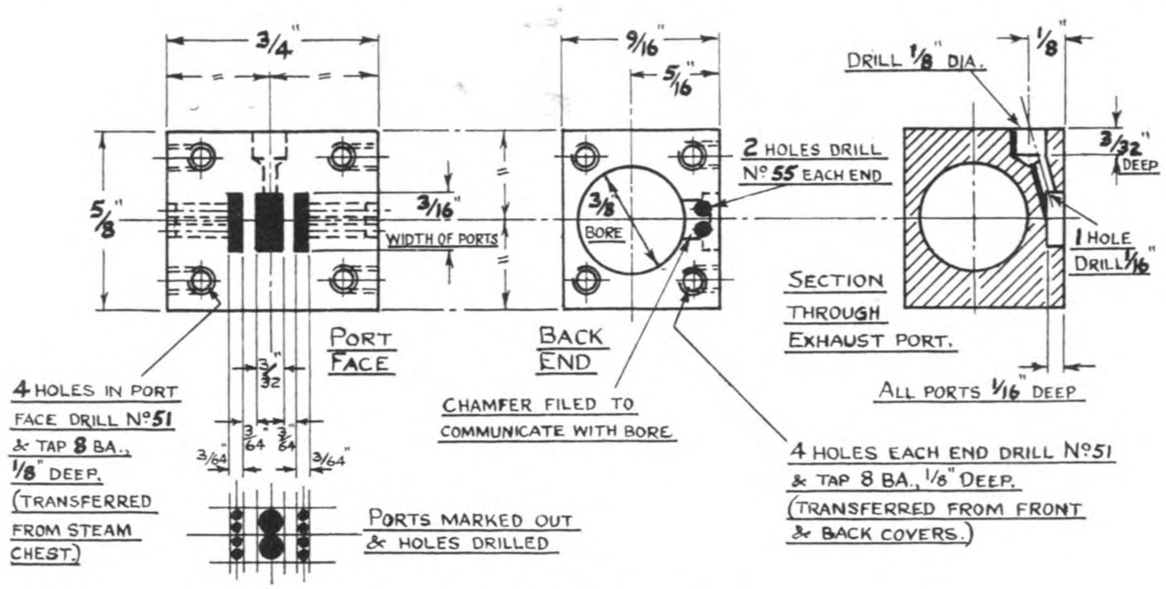


Fig. 50. The Cylinder Block.

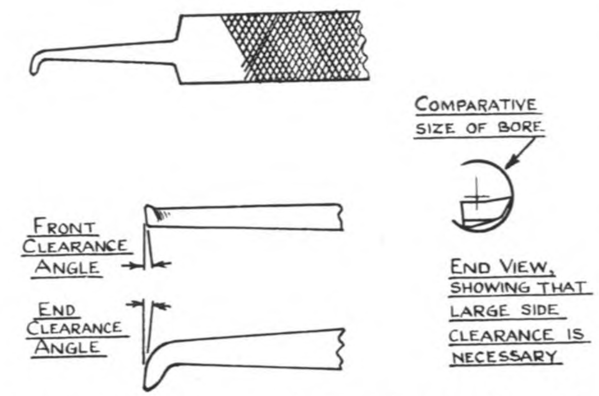


Fig. 51. A boring tool made from the tang of an old file.

about an inch or so back from the tip. After a little heating you will see colours appearing on the polished surface, and they will chase each other down towards the tip as the heat spreads along the metal. First there will come a barely-perceptible pale yellow, known officially as "light straw", gradually blending into a rich "dark straw". Behind this comes a purply sort of colour, followed by a deep blue. For most turning tools, such as this one, which are not expected to take sudden shocks, it is safe to temper at the light straw, this being, of course the nearest to dead hard. All you have to do is watch the colours move along following them up with the flame to keep them going if necessary As soon as the desired colour arrives at the extreme tip of the tool, quickly stick it in the water again. If you have been a bit premature, and the colour hadn't quite got there after all, another dose of heat and subsequent quenching will correct matters. If you have let the colours get too far, you will have to re-harden, re-polish and re-temper.

While on the subject we would mention that tools such as centre-punches, cold chisels, etc. which will get rather rougher treatment, should be tempered down to dark straw, which is still hard enough to cut but not so brittle as light straw, while things such as springs, which require to be definitely distorted in use, should be tempered down to blue. This is the general principle of hardening and tempering "carbon" steel, including the variety known as "silver steel," and although details of the method may vary slightly in individual cases, generally speaking this will be what we mean if we stipulate "harden and temper to dark straw"— or whatever it may be —in making tools in the future.

Our boring tool must now be ground to the correct shape, which, we hope, can be gathered from the sketches. Note that a boring tool requires a good "clearance" under the cutting edge, or it will rub in a small hole. Note also that the point should be slightly rounded, not dead sharp, in order to produce a finish in the bore. The shape of tool shown will enable you to bore right down to the bottom of a "blind" hole—not necessary for the present job, of course, but you may find it useful at some other time.

If you are going to finish your bore by reaming, you should bore the hole out as big as you dare without going too big—the secret of producing a mirror-like surface with a reamer is to make it remove as little metal as possible—just enough to make it clean out the marks left by the boring-tool. If you make the reamer take out an excessive amount of metal it will produce a rough bore probably worse than that left by the boring tool. As explained previously, a reamer has a slight taper at the front end, and the hole should be bored out until this will enter.

If you are finishing right off with the boring tool the last few cuts should be very light—in fact you can pass it through, very slowly, with the lathe running fast, to finish up with, without increasing the depth of the cut at all—there will be enough spring in the tool to give several fine cuts. Your phosphor-bronze, particularly if it is cast stick, will take the edge off your tool in a very short time, so even though this job may not involve enough work for this it is as well to bear in mind, so that if a mysterious deterioration of the finish takes place, you will be able to remedy matters by touching up the tool before taking the final cuts.

Put a little chamfer on each end of the bore, to make sure there is no burr projecting either in to the bore or out on the end of the face, and in the case of the back end to make sure the cover fits right down flat against the end—there may be a slight radius left when you turn the spigot on this cover later on.

Steam and Exhaust Ports.

These are carefully marked out on the port face, and lightly centre-popped for drilling the holes, as shown. Some people would make a special cutter to mill the ports, taking a couple of hours to make it, another half-hour to set up the block in the lathe to do the cutting, and about one minute to do the job. This is all right if you are anticipating making a dozen or more cylinder blocks, but for the moment we are assuming that most builders are only concerned with building one "Aladdin" and would rather spend the time on getting that one right. We suggest that only given unhurried care the ports can be chiselled out by hand quite successfully by anyone who is keen on making a good job of the engine. Make no mistake about it—these ports are about the most important part of

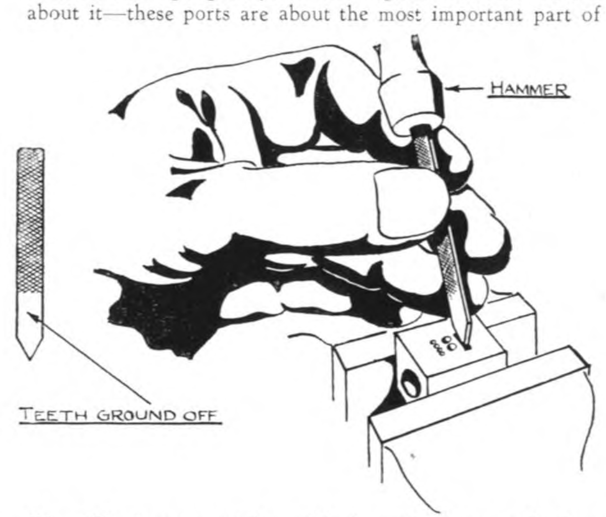


Fig. 52. A port-cutting chisel made from a broken piece of flat file and the chisel in use.

the whole engine, and are an example of what we were talking about in the very first paragraph of the first article in our old "Finding Fault" series— Page 46 March 1950, if anybody is interested in referring back.

The steam ports should be drilled some size well under 3/64 in. to make sure the holes don't encroach over the marked-out size should they be not quite on the centre-line of the port. No. 60 would be a good size to start with—you can always open them up with slightly bigger drills if you find you have room. The exhaust port can be drilled with a couple of No. 43 holes —its dimensions are not quite so vital as those of the steam ports, as it is virtually only a "way out" for the exhaust steam, and its edges don't do anything.

Our favourite chisel for cutting ports is ground from a broken bit of flat needle-file—there are plenty of these about in most workshops, including ours! grind both edges at one end until you have a nice square cutting edge, remove the teeth from either side near this end, and you will have a nice little chisel with a curled grip. (Fig.52). We show also the method of holding it while you tap the top end with a light hammer (practice alone will tell you where the top end is while you are looking at the point!) with the cylinder-block held in the vice. Always chisel towards yourself, as shown, turning the block round in the vice to deal with the other end of the port. Constantly check dimensions, not only of each port or "bridge" between them individually, but also of the 9/32 in. length over all three ports, and the 3/16 in. distance between the inner edges of the two steam ports, so that all possible combinations of dimensions still come out all right against your rule. When you are getting nearly out to size, the edges of the ports can be trimmed with a small file—there is no harm in the actual edge being a slight chamfer in a slightly narrower port.

Passage-ways.

Stand the block on end on your drilling-machine, first putting a couple of centre-pops alongside the bore, midway between it and the port face, and drill the passage-ways right down into the steam-port that end Be careful as your drill breaks into the port—if it breaks through a bit lop-sided it may snatch and snap off. If your machine has a depth-stop we recommend setting it to show you how deep you are getting, and prevent you from ploughing on into the exhaust port inadvertently. We have shown the passage-ways drilled No. 55, but this is not fussy, and any drill you have about this size will do. If the holes look a bit vague at the bottom of the port, dig around with your chisel until you have a nice clear way through.

File a little chamfer at the end of the block to connect the ends of the passage-ways with the ends of the bore, being careful to avoid continuing the chamfer out beyond the holes to the side of the block—you don't want steam going out that way. Turn the block over and deal with the other end in the same way.

The exhaust passage-way is a little more involved, as it goes in at an angle, and it is necessary that it misses the cylinder bore but still doesn't come out of the port face before it reaches the exhaust port. The method of tackling the job is shown in three stages in Fig. 53—the position of the exhaust-hole is marked and centre-popped —half-

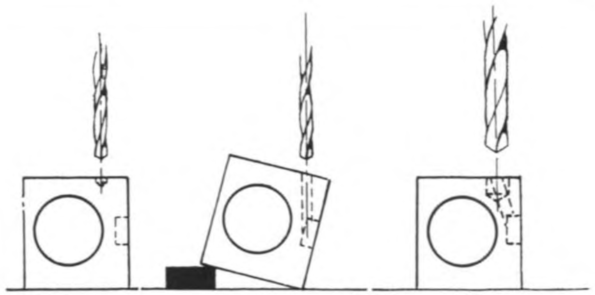


Fig. 53. Sequence of operations for drilling the exhaust passage way.

1. **Drill 1/16 in. for a short distance with block held flat.**
2. **Continue 1/16 in. hole through to exhaust port, with block tilted on ⅛ in. packing.**
3. **Open out to ⅛ in. for 3/32 in. deep, with block held flat.**

way along the length of the block and ⅛ in. in from the port-face. The 1/16 in. drill is then put in for a short distance just far enough to start it on the slope without the point side-slipping down the hill. The block is now cocked up on a bit of packing about ⅛ in. thick, which should bring it to about the right angle, but this should be checked by eye by pushing the drill down past the end of the block when you will be able easily to gauge whether or not the hole will take a nice line past the side of the bore and in the exhaust port. Finally lay the block flat again and open out the top end of the hole to ⅛ in. dia., 3/32 in. deep, for the end of the exhaust pipe to go in at a later date.

THE STORY OF 7 mm. SCALE W.D. 90618.

By H. Seaton.

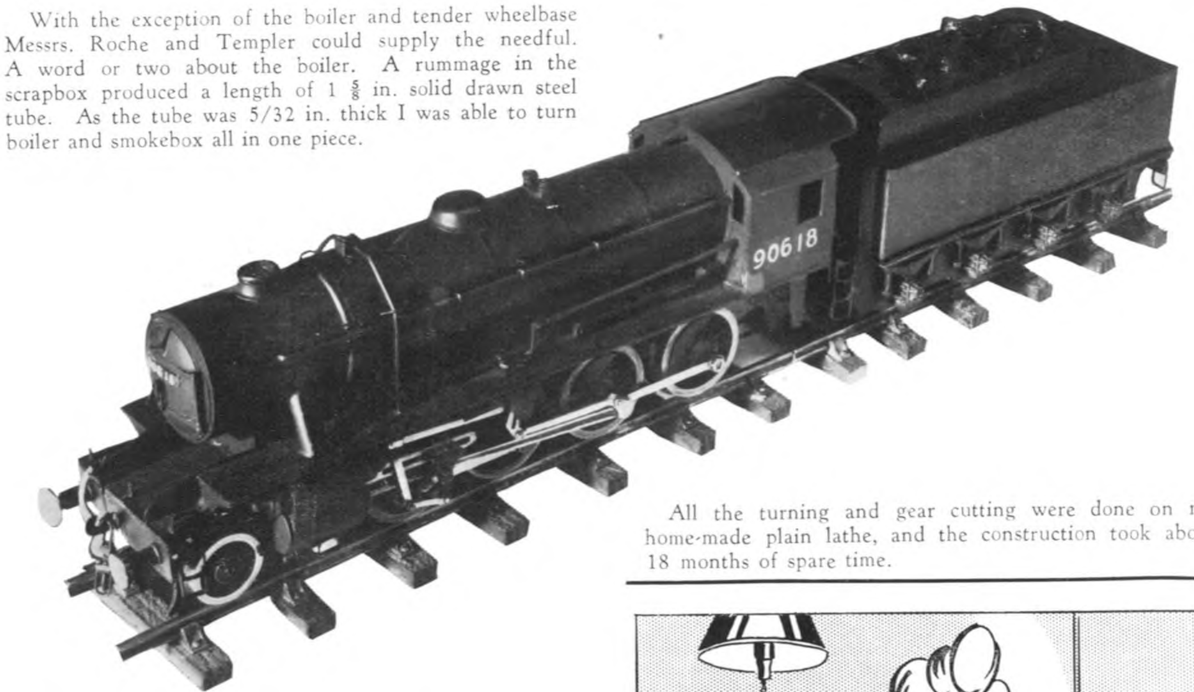
During the summer of 1950 I was fortunate enough to enjoy a trip on the footplate of W.D. 90618 and as I had just completed a 7 mm. scale model of a Tilbury tank I decided to commemorate the occasion by building the W.D. 2-8-0 in the same size.

Through the auspices of a friend, official drawings were procured and building commenced. Driving and coupled wheel castings (c.i.), also tender axleguards, were bought from Rocket Precision, Ltd., everything else being made from "scrap." The wheel castings supplied the first snag. Correct balance weights could not be supplied so I turned the original ones flush with the spokes and tried to sweat sheet metal ones, cut to shape, on top.

Ever tried tinning cast iron? It can be done! After several failures I was "tipped off" to use "Self Flux"—a solder paste This preparation will tin cast iron.

Pony truck and tender wheels were turned from 1 in. mild steel bar. As my lathe is too light to part off 1 in. mild steel bar I cut ten ¾ in. discs by hacksaw (much sweat here). The rest was just plain turning.

With the exception of the boiler and tender wheelbase Messrs. Roche and Templer could supply the needful. A word or two about the boiler. A rummage in the scrapbox produced a length of 1 ⅜ in. solid drawn steel tube. As the tube was 5/32 in. thick I was able to turn boiler and smokebox all in one piece.



All the turning and gear cutting were done on my home-made plain lathe, and the construction took about 18 months of spare time.

The firebox was turned sufficient to allow "tinplate" to be bent round and waisted to scale width frames. The motion work is made from stainless steel, being correctly forked and pinned with 14 B.A. nuts and bolts.

Slide bars were filed from the solid and press fitted into back cylinder covers. Cab, tender sides, running boards, etc., were made from 22 gauge leaded steel sheet. This material is just the "cats whisker" for the job. It works easily and takes solder well, also it is completely rust-proof. My own samples were "scrounged" and as my "contact" has disappeared into the blue, I cannot give any further gen about it.

A 24 volt home-made motor, housed in the tender, supplies the motive power through a 30-1 worm and wheel on the rear coupled axle. The connection between the two is by Woolworth's curtain spring. This is quite successful at low speed but tends to whip at a scale 40 m.p.h.

If any reader can supply me with information on tender drives I should be much obliged. I would like to add that the motor is complete with fly-wheel.

Spring buffers are fitted and the model is fully braked and the cab complete with fittings. Readers will have noticed that steel has been used throughout and as far as I am concerned, I'll never use brass again.

I would like to take this opportunity of thanking Mr. S. Devine for the remarkably fine photograph accompanying this article, also to his good lady for fixing the transfers. When you are "ham fisted" like me you simply have to farm such jobs out. Many thanks to Messrs. Roche and Templer. They certainly helped to improve the "breed."

"That's the third time I've put the soldering fluid in the Yorkshire pudding!"