A Gauge O Steam Loco for Beginners.

Part 4.

By " 1121."

Sharpening Drills.

Don't be afraid of this drill-grinding business—a lot of people make a great science of it, with wonderful patent jigs, and what-not. Hold the cutting edge of the drill against the periphery of the grinding-wheel, at a tiny bit *above* the centre-height of the wheel. With your left hand holding the drill near the point, the fingers resting on the support, and your right hand holding the tail end of the drill and resting inside your left hand, the whole thing will look like Fig. 14, while a spectator viewing the proceedings from your left would see Fig. 15. Now you must perform three motions simultaneously—lift the point of the drill, keeping it in contact round the surface of the wheel with the left hand, bring the shank downwards and to the left with the right hand, and twist the drill round with the fingers of the right hand, in a clockwise direction Figs. 16 and 17 show the same two views after you have completed this movement. What you must aim at is making the end of the drill, on either side of the point, slope back away from the cutting edge or " lip," (Fig. 18) *especially close to the point.* Obviously, the cutting-edges must get down to the bottom of the hole first, otherwise the drill will rub and not cut. The angle of the point produced on the drill will depend, of course, on the angle at which it is offered to the grinding-wheel.

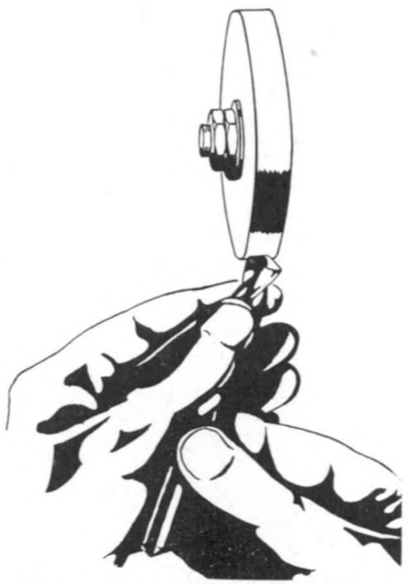

Fig. 14. Drill Grinding. The beginning of the movement seen from above.

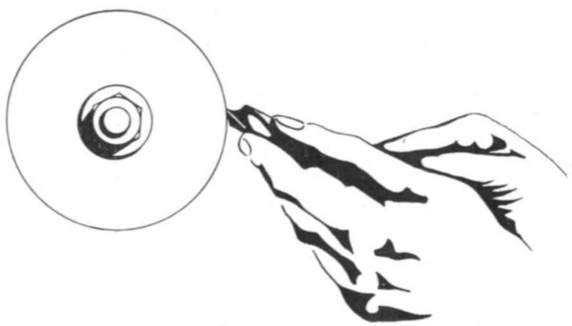

Fig. 15. Drill Grinding seen from the left.

All this sounds a bit complicated, and takes a lot of words to explain, but it is really very simple once you get the hang of it, and we thought it worth while to deal with it fully at the outset—few things cause more misery in this world than trying to make holes with blunt drills. Furthermore, they heat up, and soften or even burn themselves in the process, and then no amount of sharpening will make them cut.

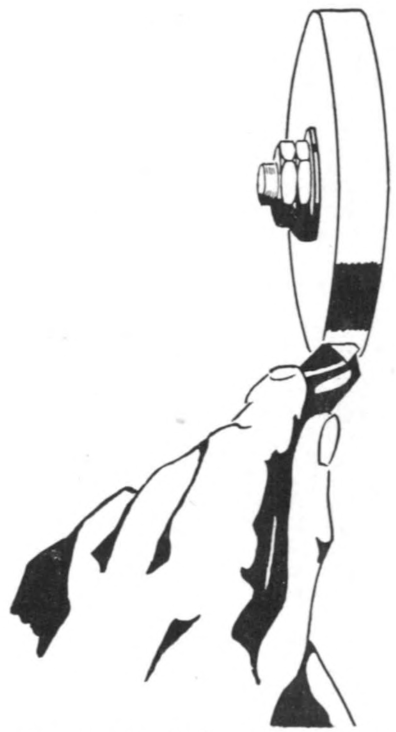

Fig. 16. The finish of the movement seen from above.

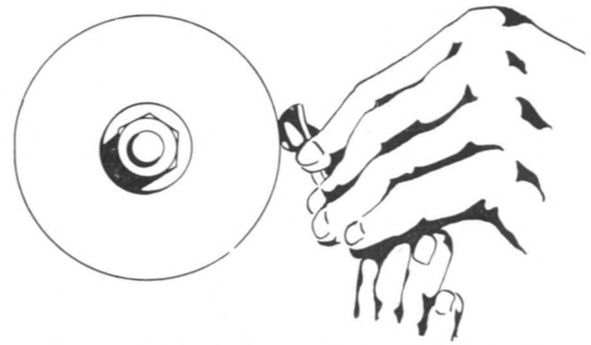

Fig. 17. Finish of the movement seen from the left.

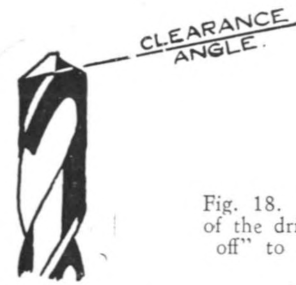

Fig. 18. The cutting edges of the drill must be "backed off" to provide clearance.

Before you start sharpening, take the biggest drill you have that's been properly ground, and hold it against the *stationary* grinding-wheel, in the position shown. Now try to follow the movements as described, at the same time watching how the surface of the wheel follows round the form of the end of the drill. Do this a few times, and you will soon see what you are after. Don't forget that the drill must be ground so that the point is in the middle, if you get our meaning, not with one cutting lip longer than the other. This would make it cut over-size, a fact which, however, is sometimes useful in providing side-clearance for a drill when drilling very deep holes.

Axle Bushes.

We shall need to make four little bushes as bearings for the driving and coupled axles. Ordinary brass rod would do, but phosphor bronze s best.

We remember reading in these pages some time back that phosphor bronze was terrible stuff to machine. Don't you believe it! It's just a matter of knowing how. True, the biggest mistake is to treat it as a particularly obstinate kind of brass—it is a "sticky" kind of metal, but if you operate on it with good, sharp tools, with plenty of clearance and " rake," it will cut nearly as easily as mild steel.

The bush is shown in Fig. 19, and is made from 5/16" rod. Hold a piece tightly in the three-jaw chuck, with only just enough sticking out to make one bush. Face the end with a tool set as shown in Fig. 20. This tool should be ground to a point, and then have the extreme tip removed to form a very tiny radius. A dead-sharp point will never produce a smooth surface. Make sure the tip of the tool is at the height of the centre of the bar—you will soon discover whether you are right or not when you face into the centre. If you are, you will be able to face the bar right off flat without leaving any " pip." Leaving such a pip is not disastrous in itself—it can always be removed with a flat file, but the complete absence of pip indicates that the tool is at the correct height for turning the diameter of the bush without difficulty later on.

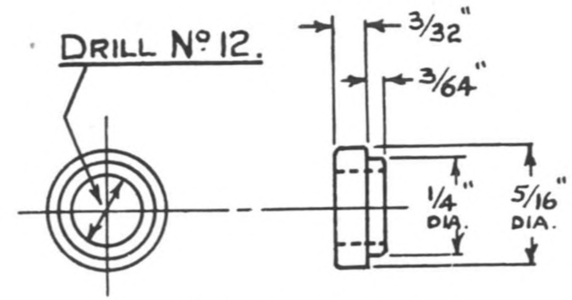

Fig. 19. The axle bush.

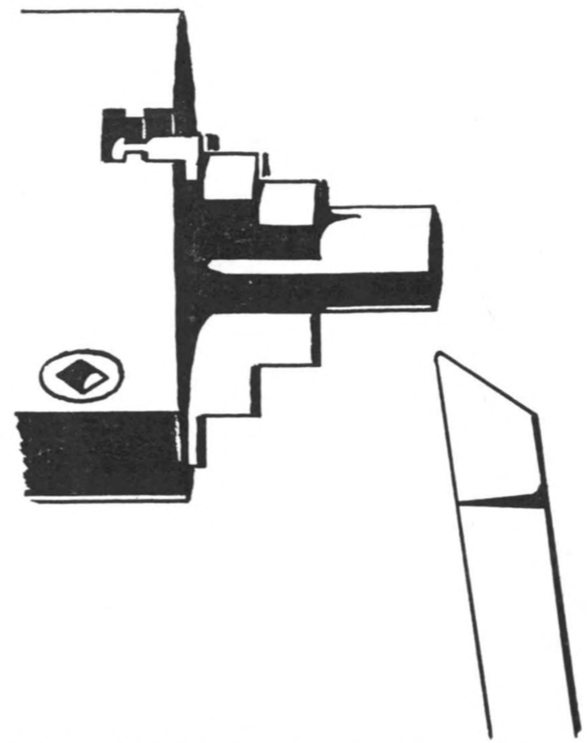

Fig. 20. A tool this shape can be used for facing and turning at the same setting.

Hold a small centre-drill, of the type known as a " Slocomb," or the short stub of a broken drill re-ground to a point, in the tailstock drill-chuck, and centre the end of the bar. If the barrel of your tailstock wobbles a bit as most do, steady it by tightening the barrel clamping screw until the barrel is fairly stiff to screw out. Next put in a small "pilot" drill for about 5/16" deep withdrawing frequently to clear chips, and finally open out with a No. 12. You will find paraffin makes a very good cutting lubricant, applied with a brush, for "sticky" metals like bronze or aluminium, and in fact it can be used for your mild steel turning if you don't want to go to the trouble of obtaining proper cutting-oil. Don't use any lubricant on ordinary brass when turning—only when drilling.

Now, without changing the setting of the tool, turn the bush down to ¼" diameter. It won't matter a lot if you get it slightly small for the hole in the frame—you can always solder it in, but it's much nicer to make it a press fit, and is useful exercise for more important work to come. If you haven't a micrometer, you can turn it to calipers set from a piece of ¼" diameter rod, or the shank of a ¼" drill gradually reducing the diameter of the job until the calipers push over it with just a tiny bit tighter "feel" than they do over the ¼" rod or drill, indicating that the job is just a few "thous" over the ¼" diameter. Slightly chamfer the end of the job with a flat file, and try the frame on it, without altering the cutting depth of the tool. If it will just begin to push on, you're right. If it still seems tight, running the tool over the job again without increasing its depth should be enough to remove the "gnat's whisker" required. Experience will tell you more than we can here, as so much depends on the amount of "springiness" in your job and tool, and your "feel" with the calipers. When making the last cut, run the point of the tool well into the corner under the "head" of the bush, without jamming it in roughly enough to cause a "dig-in," and then wind the tool out so as to face the underside of the head off flat. This will leave a slight burr, which should be removed at this stage with the flat file.

You can please yourself now whether you saw off the bush or part it off. Sawing would undoubtedly be quicker than changing the tools over, if you haven't a parting-off blade permanently set up on the back of the cross-slide. If you really want to part it off, however, remember that the great secret is rigidity—maximum rigidity of the tool, minimum slackness in the cross-slide and headstock mandrel, and minimum overhang of job from chuck jaws. Whichever way you elect to remove the bush from the the bar leave a little bit on the thickness of the head for facing off afterwards. Even a good parting-tool can rarely be relied on to leave a smooth or flat surface, and a hacksaw certainly can't!

Now pull the bar far enough out of the chuck to do the next bush. You should find a dimple already there, left by the point of the drill. Face the end of the bar off flat and observe whether this mark is running dead true. If it is, or can be persuaded to do so by gentle tapping of the bar to one side or the other, you can go straight ahead with your pilot again. If it won't, you will have to face the dimple right away and re-centre, and proceed as before.

Finish all four bushes to this stage, and then hold them one by one on the ¼" diameter, and face off the heads to thickness. Put a slight chamfer on the corner with the file, touch a large drill in the hole to remove the burr, and there you are. Don't hold them too tightly in the chuck, as the wall is only 1/32" thick, and you may squash the hole. Likewise you will have to do the facing *very* carefully, to avoid hooking the job out of the chuck, particularly if you have an uneven sawn-off surface to deal with.

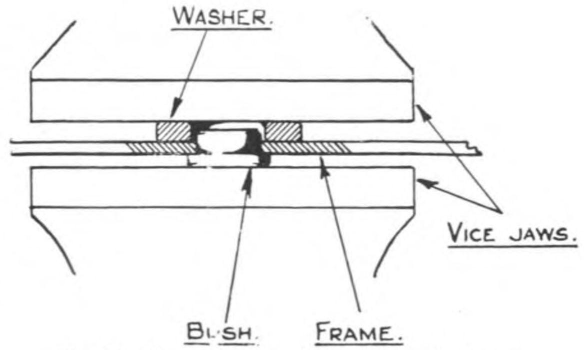

Fig. 21. Pressing the axle bush into the frame.

Before you press the bushes into the frames make sure that the holes in the frames have a slight chamfer to receive any small radius which you may have left under the heads of the bushes. Start the bush in the hole by hand, remembering the head comes on the *outside* of the frame. Hold a thick washer or something similar with a hole in it slightly bigger than ¼" diameter, against the inside of the frame, so that the end of the bush can come through into it, and squash the whole thing up together in the vice. (Fig. 21).

In our next instalment we shall be dealing with the buffers and the following tools and materials, additional to those previously listed, will be required. All or any are available from Crescent Industries, 1, Blenheim Crescent, London, W.11.

Tools.

Drills, 5/32" or No. 22
11/64" or No. 17
1/8" or No. 30.
Tap, 2 B.A. plug.
Soldering iron.

Materials.

5/16" square brass or steel bar.
3/8" dia. steel bar.
3/16" dia. steel bar.
"Easiflo" silver-solder.
"Easiflo" flux.
Soft solder.
Flux ("Baker's Fluid" recommended.)
1/32" brass sheet, or strip 5/32" wide.

To the Editor.

G.W.R. 1400 Class Loco.

Dear Sir,

We note with interest the excellent photographs of the G.W.R. 1400 class Locomotive which appeared in your last three issues (June, July and August).

It may be of interest to your readers to note that among the range of Sayer Chaplin photo engraved loco. parts which we distribute there is a set of parts for this particular Loco.

In view of the fact that your magazine appeals to the more proficient modeller where that extra detail counts, we would point out that the parts available for constructing the 1400 class produce a finished body with all the details shown in these photographs.

Yours faithfully,
R. G. Bradshaw.
GEORGE BRADSHAW (SUSSEX), LTD.

Electric Firing for Small Steam Locos.

By **M. DRINKWATER.**
(Merseyside M.R.S.)

The writer's interest in steam operation dates from 1925, when, at a comparatively tender age, he acquired one of the first of Bassett-Lowke's famous "Moguls," and it is this original locomotive that has formed the subject of the experiments described herein.

In the early days "13000," subjected to the enthusiasm and inexperience of its youthful owner, must have covered many miles circling the bedroom floor before the unhappy day when a major derailment at speed resulted in a large scorch mark on the carpet. The court of enquiry which followed this disaster ruled that either the railway should be banished to the garden or it should revert to clockwork propulsion. The former alternative was unhesitatingly accepted, and thus the pleasures of outdoor operation were savoured for the first time. A major disappointment, however, was the complete unreliability of the steam loco in the open air, due to the impossibility of keeping the lamp alight and burning properly even in the calmest weather, and "13000" accordingly assumed a place of honoured retirement. At one time it was even offered for sale at £2. 10. 0. but fortunately there were no takers.

Recently, construction of the writer's Gauge O L.M.S. system has commenced in earnest. This will eventually embrace a fairly lengthy outdoor section, and it is primarily designed for 24 volt stud-contact operation. Steam being the first love, however, it was decided to see what could be done with an electric immersion heater unit fitted to the "Mogul" in the place of the spirit lamp, and the results have been most encouraging. The conversion has been carried out with simple tools, has cost only a few shillings and required nothing more than a reasonable competence with a soldering iron, but before going into details it might be as well to have a look at the pros and cons of this system of firing. There are several major advantages.

Firstly the loco is completely draught-proof and will function perfectly well out of doors whatever the weather, subject to reasonable track cleanliness. Secondly, there is no burning of the paintwork, no smell, and no danger of fire or damage to the boiler in the event of derailment, and finally there is a considerable measure of remote control to be attained after a little practice in regulating the heater current. With the heat sufficiently turned down, the engine can be kept stationary while in steam for as long as may be desired without any overheating or blowing off, and when required to move off full pressure can be obtained in a few seconds with the heat turned up to maximum.

There are, however, some difficulties to be overcome, the main one being the supply of the heater current. The power consumed is much in excess of that taken by a comparable electric locomotive, and either the voltage or the current, or both, must be much greater.

Experiments were first carried out with various heater units in an open trough of the same basic dimensions as the "Mogul" boiler and so far as could be judged by the time taken to boil a given quantity of water a 150 watt heater element gave approximately the same performance as the original spirit lamp, but as, within reason, the more heat the better, a 250 watt element was decided upon for the loco itself.

Without delving too deeply into electrical theory, the relationship between the applied voltage (E), the current in amps. (i), the resistance in ohms. (R), and the power consumed in watts (W) in any electrical circuit, or any part of it, are given by the standard equations $E = iR$ and $W = iE$.

By substitution, any one of these four quantities can be expressed in terms of any two of the others, and the most convenient forms for our calculation are:—

$$R = \frac{E^2}{W}, \quad i = \frac{W}{E} \quad \text{and } i = \sqrt{\frac{W}{R}}$$

Hence it can be seen that for a 250 watt heater and a supply voltage of 24 say, the resistance of the heater must be $\frac{24^2}{250}$ or 2.3 ohms, and the full current taken from the supply will be $\frac{250}{24}$ or 10.4 amps!

Such a current requires a fairly sizeable power unit by ordinary model standards, though this need only consist of a transformer if A.C. mains are available as A.C. or D.C. may be used at will. However, it also requires properly bonded track, and track feeders of not less than 14 s.w.g. copper, and correspondingly hefty windings on the controller. I am using this voltage at present as I happened to have a suitable transformer available, but have decided to change the supply voltage to 50 or 60 when opportunity offers, as a reasonable compromise between safety and efficiency.

A 250 watt heater at 50 volts would require to have a resistance of 10 ohms and would take a current of 5 amps on full load. 18 s.w.g. copper would suffice for track feeders, and it will be seen that by doubling the voltage the current has been halved and the resistance of the

Fig. 1. Sectional Elevations of Modified Boiler.