Part 6.

A Gauge 0 Steam Loco for Beginners.

Wheels and Axles.

By "1121."

To deal with wheels and axles the following additional tools and materials will be required:—

Tools. Drills Nos. 13 and 31.
Reamers. 3/16" and 1/8".
Dies. 2 B.A. and 8 B.A.
Taps. 6 B.A. taper and plug.

Materials. 2 driving wheels castings to machine to $1\frac{7}{16}$" dia.
2 coupled wheel castings to machine to $1\frac{7}{16}$" dia.
2 trailing wheel castings to machine to 1" dia.
1/8" dia. mild steel rod for crankpins.
3/32" x 3/8" mild steel strip for crank webs.

You can, of course, buy any standard finished wheels of the right diameter, although they should be iron castings, not die-cast wheels fixed with nuts, or you can get the special castings as advertised for the job. The original "Aladdins" wheels were machined from ordinary "standard" castings—the special ones had not been produced at the time. Those now being advertised by our "Official Suppliers" have been made from special patterns, with the right number of spokes and correct balance-weights and bosses.

Do each operation right through all six wheels, the first being to face the backs. Here you must do a little calculation—you can, of course, machine your wheels to any "standard" thickness you like, but if you choose the finer standard you must make sure you face the back down sufficiently to ensure that you don't get down to the spokes when facing the front of the rim to thickness later on. Nothing looks worse than the fronts of the spokes half faced away. The castings are being made plenty thick enough to allow for a wide tread if this is desired. You must measure the thickness of the spokes to see how much to take off the back to leave the right amount at the front for your own pet tread width. The dimensions involved are shown in Fig. 29.

To face the backs, hold the wheels by the tread one by one in the three-jaw chuck. You may have to use "outside" jaws if your chuck is a small one. Adjust the casting until the back runs reasonably true. Cast-iron needs a very slow turning-speed—about 60 revolutions per minute for this size of wheel would be right. Back-gear is the thing, of course, if your lathe has it. If it hasn't, get it running just as slow as you can, or it will take the edge off your tool before you start. With the lathe revolving slowly like this, it has a good bit of power, which means that a deeper cut is within its capacity than would be the case with a faster speed. A deep cut, in any case, is desirable with cast iron, especially on the surface, so that you avoid rubbing the cutting-edge of the tool across the rough outside of the casting, with all its stray sand and other impurities. Aim to remove the whole uneven surface at one fell swoop, however slowly you have to feed the tool across. Then continue with lighter cuts until you are down to your predetermined thickness, and don't forget that the centre boss comes down at the same time to the same level. Before disturbing the wheel in the chuck, carefully centre with the slocomb and drill through with a small drill, opening out afterwards with No. 13. Finish the hole with a

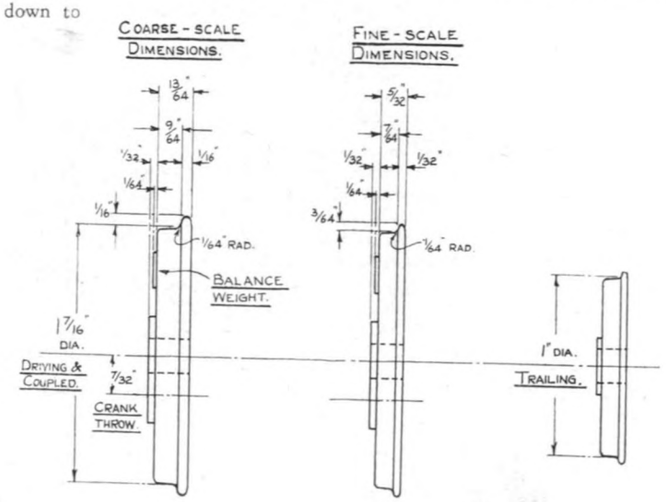


Fig. 29.

Wheel dimensions—fine and coarse standards. Certain slight liberties have been taken with the B.R.M.S.B. figures in converting them all to the nearest fractional equivalents. This has been done to keep the dimensioning in line with accepted steam practice, the standard sizes of materials used in such work always being measured in fractions of inches. We have known people put off from starting model work by the mixtures of decimal, metric and other systems to be found on certain drawings.

Note:
Drawing actual size.

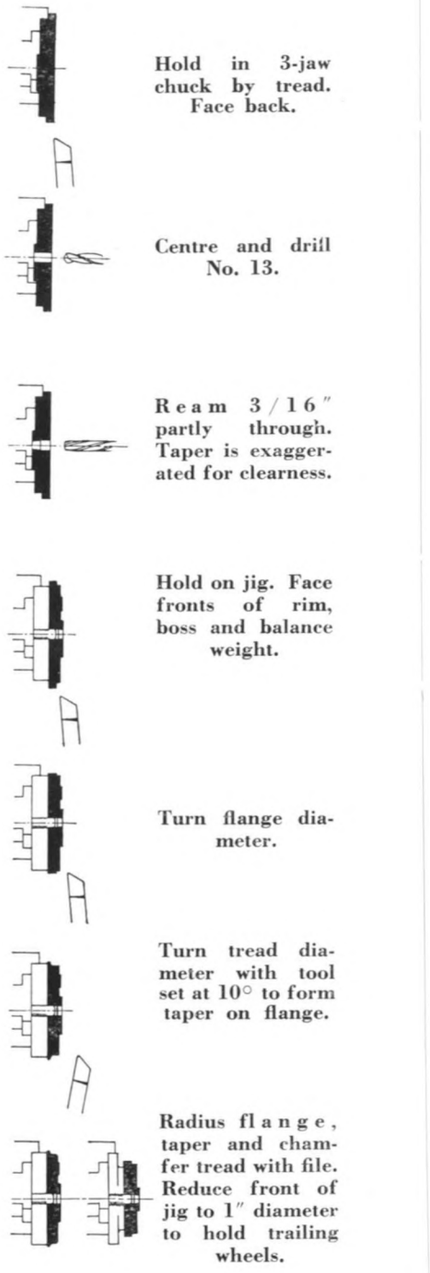
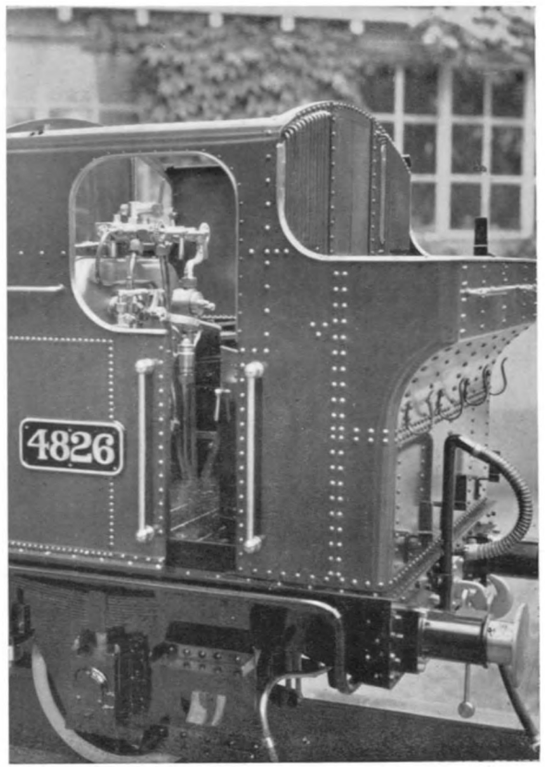


Fig. 30. Sequence of operations for turning wheel castings.

3/16" reamer, but *don't put it right through*, or the wheel will be loose on the axle. The end of a reamer has a slight "lead" or taper, and we shall use this to produce a slightly tapered hole into which to press the axle. Use a bit of your axle-steel as a gauge, making sure it has no burr on the end, trying it in the hole until you can push it about two-thirds of the way through the wheel with your fingers. Remove the wheel from the chuck, and do the same with the others, including the two trailing wheels.

For the next operation a simple jig is required, consisting of a short length of $1\frac{1}{2}$" round bar, or a $1\frac{1}{2}$" blank, $\frac{1}{4}$" or so thick, and it can be of steel, brass, aluminium, or anything else you can dig up. Even an old wheel casting will do, if it has no hole through the middle.

First screw the end of a bit of 3/16" rod, in the lathe, with the die held in the tailstock die-holder, The thread can be 2 B.A. or 3/16" Whitworth, for a length of about $\frac{1}{4}$". Hold the blank, or whatever you are using for the jig, in the three-jaw chuck, and face it off flat. This will automatically show you where the centre is. Take it out of the lathe, and lay one of your partly-machined *trailing* wheels on its faced surface, so that the faced surface of the jig and the faced back of the wheel are in contact, and get the wheel as nearly central as you



Cab fittings of the $7\frac{1}{4}$" Gauge G.W.R. 0-4-2 Tank built by James S. Beeson. Photo: A. S. Taylor.

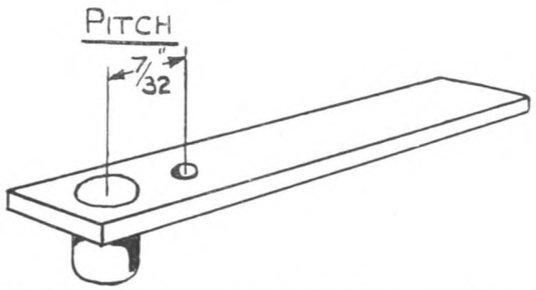


Fig. 31. Jig for drilling crankpin holes in wheels.

can judge. Make a little mark with the scriber on the jig, in between two spokes of the wheel, out fairly close to the rim. Do the same over the opposite side of the wheel, so that you have two marks roughly diametrically opposite, and approximately the same distance from the centre, In these positions will go a couple of screws to hold the wheel on to the jig.

Now put one of your driving (or coupled) wheels on, and make sure that the two marks are again visible between spokes. If they aren't make two more somewhere else to be used for the larger wheels. Centre-pop on the two (or four) marks, and drill and tap 6 B.A. holes. Put the jig back in the chuck, running as true as you can judge, and then face over it again to make sure it is absolutely true. *It must not be moved again until all your wheels are finished.* Centre with the Slocomb, from the tailstock chuck, and drill and tap to suit the screwed rod. Screw this tightly into the hole, and saw it off, leaving about 1/8" projecting from the jig. Remove burrs from the end. Now you have a true running jig and spigot, the latter locating in the hole in the wheel, ensuring that its outside diameter will be truly concentric with the axle, and the faced surface of the jig ensures that the wheel will run "flat," without side-wobble.

Fix a wheel to the jig with a couple of 6 B.A. countersunk screws, the heads of which will come down below the machined surfaces, so that they won't get in the way of the tool.

You can now finish each wheel right off in turn (Large wheels first)—we suggest first facing the rim to your selected thickness, remembering previous instructions for machining cast-iron. Stop as soon as you reach the diameter where the rim joins the spokes—don't face across the balance-weight at this stage. Now face the centre boss and the balance-weight together, to be 1/32" thicker than the rim. (You can check this by measuring with a rule from the faced rim to the point of the tool as you wind the tool back towards you). Now face the surface of the balance-weight down to project 1/64" only from the rim.

Next turn the edge of the flange to the correct diameter to give you your pet flange depth, checking it with calipers set, of course, to tread diameter plus twice flange depth. Finally turn the tread. This should be checked carefully, preferably with another pair of calipers which you can leave set. The precise diameter of the wheels is not vital, but whatever it is they *must* all be the same—wheels of all different sizes cause slipping of the engine. If you have only one pair of calipers, we suggest leaving them set for the flange diameter, and finishing each wheel only this far, replacing them on the jig again for the final operation, with the calipers re-set for the tread diameter.

If you set the tool round at angle of about ten degrees when doing the treads, it will produce the proper tapered shape to the flange, as shown in the "sequence of operations" diagrams Fig. 30. The tool is shown at the right angle, so the drawing can be used for comparison if you have no other means of setting the tool. The edges of the flange can finally be rounded off with a file, and a slight chamfer put on the front edge of the tread in the same way. If you want to be very correct, file the tread to a very slight taper, but do it carefully so as not to take too much off the diameter.

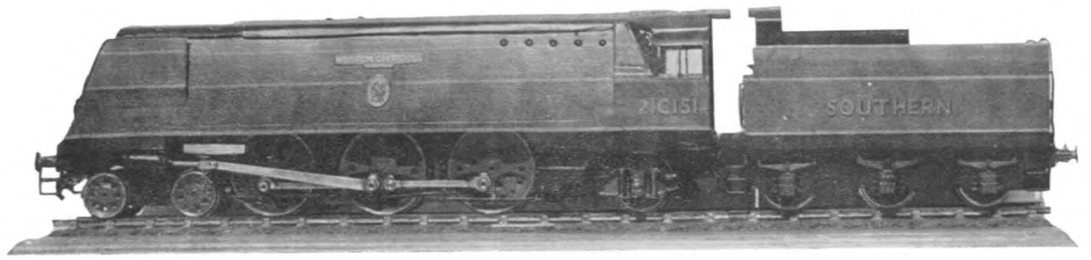
Aim to get a decent machine-finish on the treads and flanges, but don't do any fancy polishing—real wheels aren't polished, and ours will grip the rails much better for a bit of roughness. The models with a "chromium-plated" finish never pull so well!

Finally turn the outside diameter of the jig down to about 1", for a short distance, to leave room for manoeuvring the file when finishing off the flanges of the trailing wheels.

To drill the crankpin holes another simple jig is required, to ensure that all four wheels are made with the crankpin exactly the same distance out from the centre. What that distance actually is is not vital, but it is vital that they all the same, otherwise the coupling-rods will not run freely, or may jam up altogether. The jig is merely a bit of steel strip or plate, say not less than 1/16" thick, with a couple of holes in it, 7/32" apart. Drill them both some small size—your No. 43 would do. Open out one hole with your No. 13 drill.

Put a piece of 3/16" axle-steel in your lathe chuck, and gently file it, while revolving, to a very slight taper, with a smooth flat file, until your bit of plate will push on to the end. Force the plate right on by screwing the tailstock barrel out against it, until the tapered end of the rod is sticking out 1/8" or so. Saw off the rod flush with the other side of the plate. You will now have a plate with a projecting peg, the diameter of which is reduced so that it will enter the hole in the front side of the wheel, which, you will remember, is smaller than 3/16", as the reamer was not put right through.

Scibe a line down the centre of the crankpin boss of each wheel, push the peg of the jig into the front side of the first one, and put the toolmaker's clamp right over wheel and jig, so that it clamps the jig squarely to the boss. Before finally tightening it up, get the scribed line on the boss of the wheel showing central across the other hole in the jig. Now drill into this hole with the same small drill, and right through the wheel, making sure that the wheel is held down flat so that the drill goes through squarely. Remove the jig, open out the hole in the wheel No. 31, and finally ream 1/8" partly through, just as was done for the axle holes, only from the front this time, so that the crankpins can be pressed in tightly. The jig is shown in Fig. 31.



A 7 MM. SCALE "BATTLE OF BRITAIN" LOCO.

By R. W. INKSTER *(Manchester M.R.S.)*

This machine is the first O Gauge locomotive I have made with any pretensions to accuracy to the modern formula. The Bulleid Pacifics are, I think, somewhat harder to model than the more conventional types, and this one has given me some valuable experience in many forms of metal-working to fairly fine limits.

The main frames and cross members are brass, and the "can" (Spam?) is made from brass, copper, nickel silver, phosphor bronze and monel metal, each metal being used where its own particular properties would prove useful.

The driving wheels are mild steel, the tyre and back of each wheel being one piece, and the part with the clover-leaf holes and boss being another. The back part is bored out to receive the front part, with about .005" interference. The pairs were pressed together in the vise, with a bit of pipe on the vise-handle. Bogie, pony truck and tender wheels are straight turnings, with lots of drill holes of various sizes.

All wheels excepting the geared drivers are sprung. On the unsprung pair the axleboxes are "dovetailed" into the horns and locked in place by the keep plates. This somewhat complicated arrangement is to enable the wheels to be dropped out for cleaning and maintenance. All wheels and gears are force-fitted on their axles and spindles. The coupled wheels run in sprung cannon boxes, which also act as valuable oil reservoirs. The carrying wheels also run in rather simpler cannon boxes, soldered to flat leaf springs.

Several years ago the M.M.R.S. acquired some tiny motor-generators, ex-U.S.A.F. These are beautifully-made and came in blocks of six, all geared together—something to do with constant voltage for electronic work, I believe. Anyone requiring one just sawed one off the block! Amongst other unusual features, they had solid silver commutator bars. One of these, somewhat rebuilt, and with its seven-pole armature rewound by my friend George Leech, forms the smooth, quiet, but very powerful motor for this model, which it drives by a polished steel worm, P/B worm wheel and two spur gears (out of Mk.