4 Workshop Hints

4.1 General

A full description of workshop techniques is outside the scope of the 0 Gauge Manual as they have been described exhaustively elsewhere, notably in the books and articles by Martin Evans, the late LBSC and many others. Reference to Appendix A will give a list of further reading for those wishing to follow up in this area. However, three jobs crop up regularly in model locomotive building and, as a quick reference, are described below. Newcomers to machining should practice using scrap material initially and always remember to use some form of eye protection, (experienced members should remember to use eye protection automatically).

4.2 Milling Angle

It is often necessary to mill a fair amount of angle when building locos, particularly odd shaped angle and those sizes not available commercially. The following procedure describes the production of some

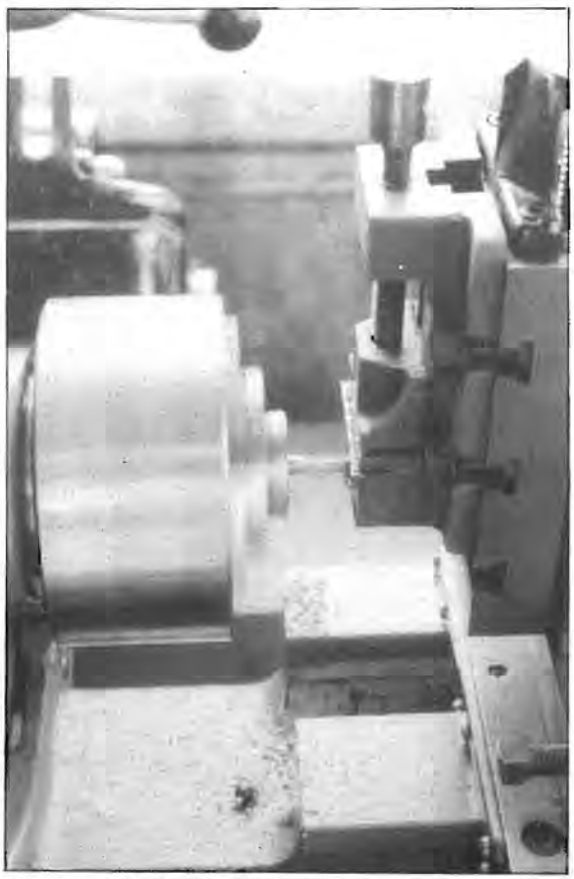

Photo 4.1 Milling the 3/32" square step in the front edge of the 1/8" mild steel plate. (Photo T. Hughes).

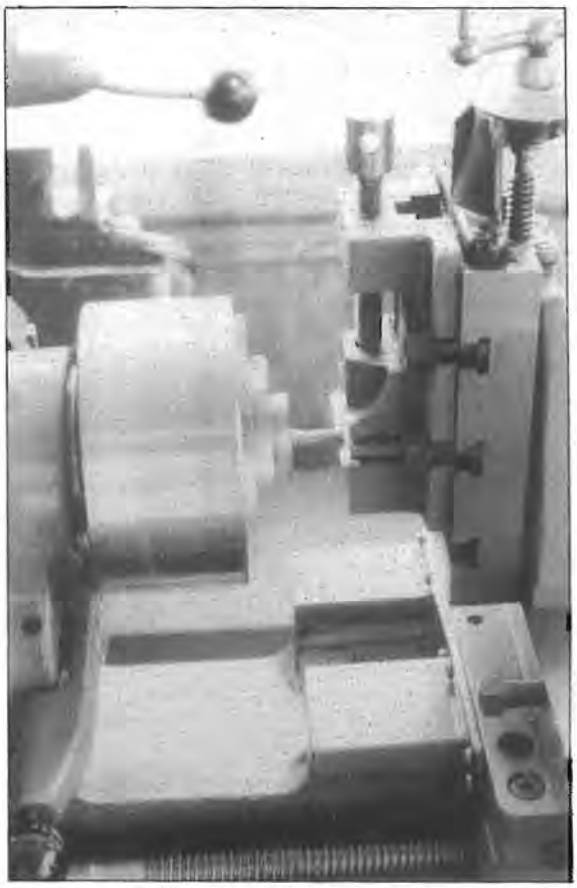

Photo 4.2 Milling the back of the angle after sawing it off the main workpiece. (Photo T. Hughes).

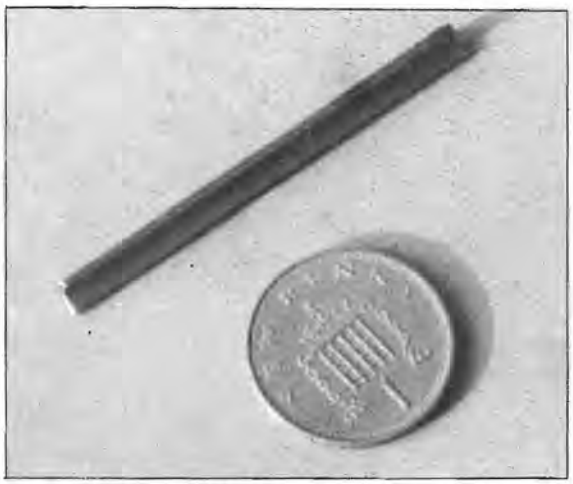

Photo 4.3 The finished angle compared with a 1p piece. (Photo T. Hughes).

1/8" x 1/8" x 1/32" angle of the type used for horn guides for the 4-4-0 which will form part of a future publication and can be adapted for all those occasions when milling is required.

Set up the vertical slide facing the lathe chuck. Clamp a piece of 1/8" mild steel plate in the machine vice on the slide and using a 3/16" (or thereabouts) end mill take a light facing cut across the front edge of the plate.

Photo 4.4 A driving wheel casting held in the three jaw chuck while the back is faced off to expose the spokes. (Photo T. Hughes).

Adjust the cutting height to mill a 3/32" square step in the edge of the plate. When the full depth has been reached, remove the plate and saw off a strip about 5/32" wide from the edge of the plate and including the step. (If you become the proud owner of a slitting saw then cutting off the strip in situ would minimise, or even eliminate, the cleaning up and would be far less hard work). Clamp the thin end of the step in the vertical slide and mill the hacksawed face to reduce it to 1/32" thick. Remove the angle from the vertical slide, clean off the sharp edges and you will have a lovely piece of steel angle 1/8" x 1/8" x 1/32", smooth, accurate and ready to use. A similar procedure is used for other sizes as required.

4.3 Turning Wheels

There are a number of methods that can be used for turning wheels and these have been described many times by more expert pens than mine, but to save you ferreting through piles of old Gazettes here is a quick resume of the approach I normally use.

First, take each wheel casting in turn and file off the flash and any rough patches on the wheel treads. Sometimes you may be unlucky and get a hard casting that has been 'chilled' after pouring. These are virtually unmachinable and the supplier will normally replace them without question. Alternatively, if you have an open fire, throw the chilled casting on to the hottest part of the fire, cover with coal and leave it for the night. When the casting is recovered from the cold ashes next morning, lo and behold it will be soft and easily machined.

A carbide tipped tool is the weapon for wheel turning. A knife shaped tool and the lathe running at the lowest open speed (about 200 rpm depending on the type of drive) should enable you to get a good finish. Chuck the first wheel by the tread with the back facing outward and face off the back until the spokes are just exposed. When the spokes are revealed, lock the lathe saddle and wind the tool out of the way using the cross slide. This will preserve the facing setting for the other wheels allowing them to be skimmed in one cut. With the drill chuck in the tailstock, centre the casting using a No 1 centre drill, open out with a No 14 drill and follow up with a 3/16" reamer.

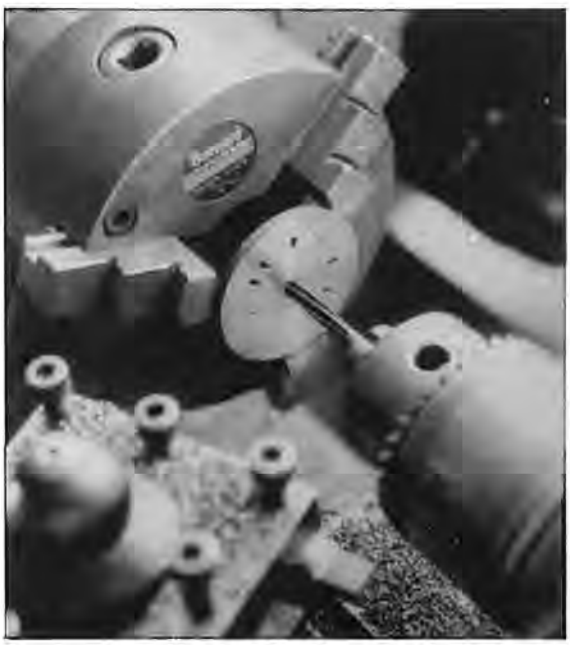

Photo 4.5 Reaming the axle hole in the backed off wheel. Note the spoke holes just showing. (Photo T. Hughes).

Here I must put out a storm warning!! **Don't** - repeat **don't** - push the reamer right through. As we are aiming at a press fit for the wheels this would be disastrous. Take a micrometer reading on the tapered portion of the reamer and mark the spot where the diameter is half a thou less than 3/16". A spot of paint will do or, alternatively, make a collar, slide it up to that point and lock it into place with a setscrew. When following up with the reamer, push it through until the paint spot or the collar reaches the surface of the casting and stop. It is also possible to obtain a special reamer from AGH Engineering which is cut to exactly half a thou under 3/16"; they are not particularly cheap but can save a lot of fiddly work. When used in combination with axles made from 3/16" silver steel or ground mild steel they produce the required results with comparative ease.

Once the first wheel is reamed, follow up by repeating the facing, drilling and reaming operations on the other wheels.

Note: An alternative, mainly found on ready turned wheels, is the square hole designed to fit a square and shouldered axle. These are not easy for the amateur to produce accurately and are best purchased in this form.

4.3.1 A wheel mounting plate

In order to machine the treads and flanges you will need a simple backplate that can be held in the 3-jaw chuck. A chunk of 2" dia. mild steel about 1" thick will do perfectly. (Try a nearby light engineering works for an offcut; they will probably almost give it to you, especially if you take the partially completed engine along for them to see. Alternatively a trip to a model engineering supplier should prove productive.) You will only need one of these backplates as it can be used over and over again.

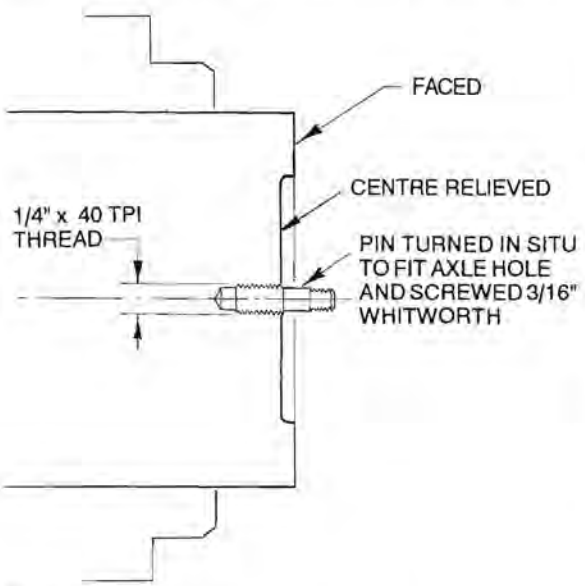

Fig 4.1

Sketch of a wheel mounting plate.

Grip the bar in the 3-jaw chuck on the lathe and face off. Clean off any 'arris' with a file, reverse in the chuck and face off the other side. Put to one side for the moment. (An arris is the sharp edge that appears between two machined surfaces. Its removal is sometimes referred to as 'fettling'). Now take a length of 1/4" round mild steel - 3/4" will be about right - mount it in the chuck and thread the first 1/4" of it 1/4" x 40 tpi using the tailstock dieholder if possible. Re-mount the backplate bar in the chuck and skim a couple of thou off it to true it up. Relieve it slightly in the centre to enable the wheel rim to sit firmly against it and drill out the centre 7/32" or No 2 to a depth of 3/8". Tap the hole 1/4" x 40 tpi and screw in the stub of mild steel, using the tailstock chuck to steady it and adding a smear of Loctite 601 Retaining Compound to the thread. Leave it to set and then turn the projecting stub to be a good sliding fit in the axleholes in the wheels. Leave sufficient plain stub to accommodate the full depth of the wheel and thread the rest 3/16" Whitworth. Before removing the backplate from the chuck, mark the plate with a centre punch adjacent to No1 chuck jaw to ensure that you are able to replace it in the same spot each time it is used. Adding a 3/16" Whitworth nut will finish matters. (For those using metric taps and dies there is no direct comparison with the ME threads; 6mm ISO Fine (33 tpi) is the nearest to 1/4" x 40 tpi and 2 BA could be substituted for 3/16" Whitworth. The other dimensions need to remain in Imperial measure).

Having equipped ourselves with a backplate we can now proceed with the next stage. Mount one of the wheels on the backplate with its faced-off rear against the machined true surface, secure with the 3/16" Whitworth (2 BA) nut and face off the front of the tread to its full width (4 mm for Fine Stan dard). Repeat for all wheels. The overall diameter can then be machined using the same setting for each wheel. To turn the treads, lock the saddle and set the top slide over to give a 3^{0} taper. Using the top slide only, carefully turn the tread to the required dimension, leaving the flange intact of course! A moments absent-mindedness here can be disastrous. I once cheerfully machined the wheel flange off a casting through letting the mind wander and was reduced to fitting a steel wheel tyre and other troublesome dodges in order to retrieve the situation.

Photo 4.6 The wheel mounted on the special mounting backplate for tread turning. (Photo T. Hughes).

Photo 4.7 The wheel replaced in the three jaw chuck and the back being undercut to fully expose the spokes. (Photo T. Hughes).

4.4 Hard (Silver) Soldering

Detailed descriptions of the various soldering, silver soldering and brazing processes are available in book form and listed in further reading (Appendix A). However, some brief notes on basic silver soldering have been included here.

The first step is to ensure that all parts to be joined are as clean as possible. Most of the work we will be doing will be with copper, brass or bronze which are fairly easy to clean up using some form of abrasive, e.g. wire wool, but don't forget to ensure that the abrasive material itself, together with any oil or grease, has also been cleaned off.

The majority of 0 Gauge silver soldering can be done using best grade silver solder and a borax based flux (I use Easy-Flo No 2 solder and Easy-Flo flux) which can be obtained from all major model engineers suppliers. The flux is mixed with clean water into a creamy consistency, and if it covers all joints completely will make certain that the solder gets every chance to penetrate the joints fully. Bushes and tubes inserted into plates should be a light push fit for the best results.

The next step is to heat things up, so out should come the propane torch with a medium sized burner. A useful tip when heating components ready for silver soldering is to carry out the work in subdued light. In this way it is easier to see the colour of the hot metal as the temperature rises. Place the assembly on a piece of firebrick and bring its temperature up evenly until it is a dull red colour. At this temperature the flux will melt and you can begin to feed in the silver solder. If all is well the solder will flash into a neat fillet around the joint, filling it completely. If the solder refuses to run, either the flux has not been correctly applied or the job is not hot enough. The remedies for these deficiencies are fairly obvious. When you are satisfied that the solder has penetrated the joint, and it is most important that it has done so, allow the block to cool and then pop the assembly into an acid pickle bath to clean it up.

While a lot of people do without an acid pickle bath I find one of great value and would certainly recommend builders to acquire one. All you need is a plastic or rubber bucket, a gallon of water and about 3/4 pint of commercial quality sulphuric acid. You might be able to get this from a garage but I

obtained mine from a local chemist and, by the way, finished up paying over the odds for laboratory quality acid; but then it's not something one buys every day, is it? Incidentally, in the UK, be prepared to sign for this in the chemist's book.

Warning:

When handling acid ensure that the skin and eyes are protected from splashes. Essential protection is to wear safety glasses or goggles and domestic rubber gloves. If the skin is splashed, irrigate the area with plenty of cold water to wash away the acid as quickly as possible. Then treat as for a burn. If the eyes are splashed; irrigate and seek medical advice immediately.

When preparing the pickle bath put the water in the bucket first and slowly add the acid. Always put acid into water and not the other way round. Don't hurry the job as a certain amount of heat is generated by the reaction of the water and the acid and going too fast could cause the heat to soften the bucket. Make a wooden cover for the bucket as things can inadvertently fall in and this is not something to be encouraged. This type of work should preferably take place out of doors and in the open air if possible - not in the kitchen. You should also have a safe storage place in your workshop for the bucket; one where it is out of reach of children and cannot be inadvertently be knocked over. Acid pickle is a great help but must be treated with respect.

When the assembly has been in the acid pickle bath for about 20 minutes it can be taken out, (use tongs or a pair of strong tweezers if they are big enough) and rinsed under the tap. Dry it off and check to make sure that the silver solder has penetrated all the joints and run right through.

Note: When renewing an acid bath, the 'spent' acid should be got rid of at a suitable disposal point. Check with the local Council Waste Disposal Site - they usually have provision for receiving noxious and toxic waste materials. Do not just empty it down the drains; it can cause damage to your household system.