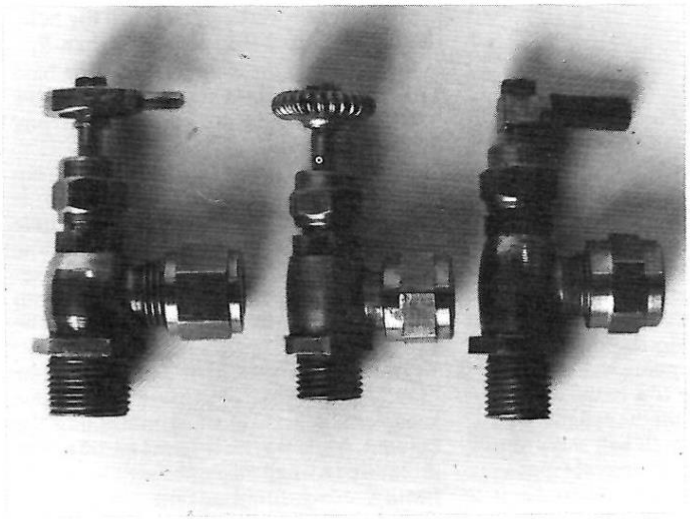
VALVES - My Way

by J. Coulson

Over many years, I have been annoyed by the makeshift methods adopted by too many model engineers and builders of various steam driven models to control the passage of steam, water and oil between various parts of their models, and I know that I am not alone in this situation. All of us have, at some time or another, driven traction engines or locomotives which require high tensile,



A trio of valves.

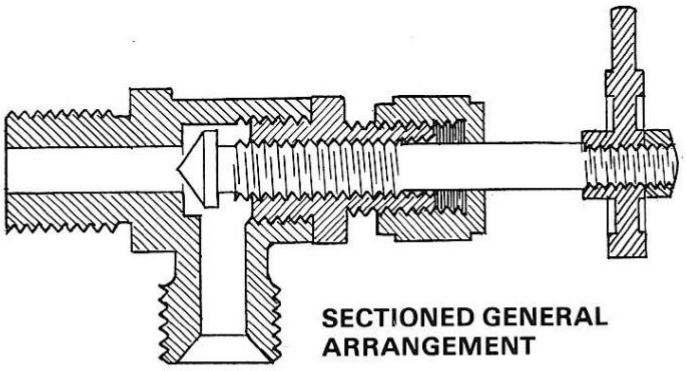
heat insulated fingers to control the various valves.

So many excellent articles have been written about valves by many writers — Roy Amsbury's spring to mind — I hesitated to rush into the fray. What finally drove me to write this article was the production at our Club meeting by one of our newer members, of a set of plans for his chosen first attempt at locomotive building. These plans are supposed to be up to date. I will not name the producers of these plans, suffice to say they do not come from Birmingham or Hemel Hempstead. If made as shown on the plans, the valves would have had spindles which would pick up the gland packing on the screw thread when unscrewed sufficiently to pass steam. If they were unscrewed a wee bit further, the spindles would come right out of the valve.

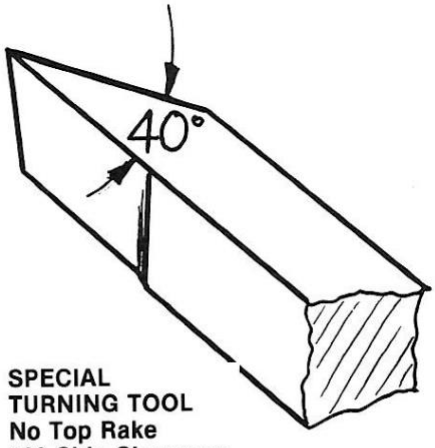
These are faults which should not be perpetuated in this day and age. Long ago I determined that all the valves that I made must open and shut easily without picking up the gland packing; they must be neat and have very near scale size and appearance; they must be easy to make and have interchangeable components. (I like to carry spare bits and pieces and besides, they look professional in your kit box).

To make valves conforming to these requirements demands considerable accuracy in the manufacturing, and one must not depend on the accuracy of the lathe. Most modeller's lathes have faults, and whatever methods are used in the construction must negate these faults. I am lucky — I have a pre-war Milnes lathe which I would not swop for any modern tooling, but other modellers probably are not so fortunate. If you follow these instructions, you will have made a valve which opens and shuts positively without undue force or finger burning.

The first requirement is a turning tool made as shown in the drawing, it must be sharp and oil stoned after grinding to shape. You must also ensure that it is set exactly at lathe centre height. The general arrangement drawing will show you what we are about, so having ground, stoned and set up the special tool, let's get cracking.



SECTIONED GENERAL ARRANGEMENT



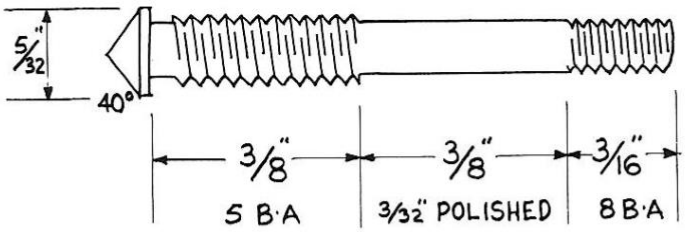
SPECIAL TURNING TOOL
No Top Rake
10° Side Clearance

SPINDLE

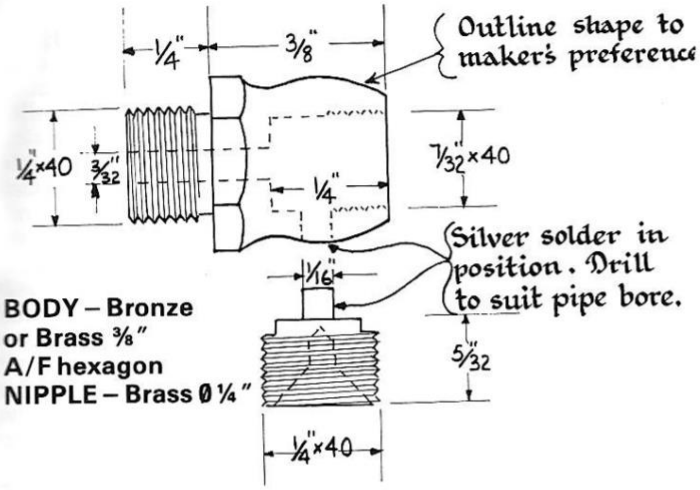
The heart of any valve is the spindle, and to ensure accuracy all the machining on this components MUST be performed at one operation.

Mount in the chuck, a piece of 3/16" round stainless steel, monel metal, drawn phosphor bronze or even Sifbronze with 1 3/8" protruding. Turn a 9/16" length down to 3/32" and polish it. Put on an 8 BA thread for the first 3/16" and neatly round off the end. Turn the next 3/8" to .120" diameter, but reduce the diameter to 3/32" for 3/16" length adjacent to the formed shoulder. Put a slack fitting 5 BA thread on this portion, preferably with the die in a tailstock die holder. When you are satisfied that the 8 BA thread is a tight fit to a nut, and the 5 BA thread is a nice running fit to a nut, you can turn the next 1/4" down to 5/32" diameter.

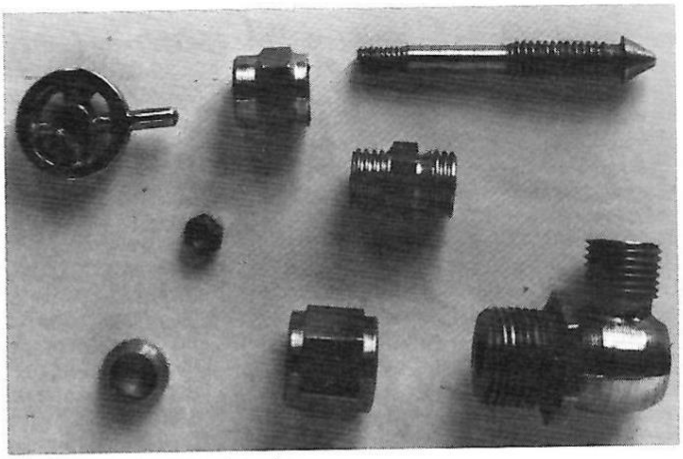
Now comes the very crucial step, part-



SPINDLE – Stainless Steel or Bronze



BODY – Bronze or Brass 3/8" A/F hexagon NIPPLE – Brass Ø 1/4"



The component parts of a valve.

ing off to form the cone for the valve head. This cone must be perfect so use a fine feed and high speed. I must be honest and admit that, instead of completely parting off, I settle for an excellent cone leaving the merest whisker to hold the spindle to the parent metal, and then just break it off. The resultant minute pip does not matter, it is the cone that counts.

You should now have a perfect spindle, and if you have cannily kept a note of the lathe dial settings, then go ahead and make another dozen — they take very little time after you have made the first.

BODY

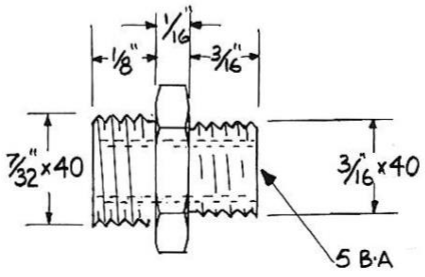
There are so many profiles for valve bodies that I do not intend to describe all of them — I leave it to the maker's preference. I will be content to outline the essential working parts.

Mount a piece of 3/8" A/F hexagon bronze or gunmetal bar in the chuck with one inch protruding, and turn down to 1/4" diameter for 1/4" and thread it 1/4" × 40. Do not forget to relieve the thread adjacent to the shoulder — this ensures the body will seat home nicely. Part off, leaving the hexagon portion 3/8" long, put on one side, and then make as many more as your spindles will need.

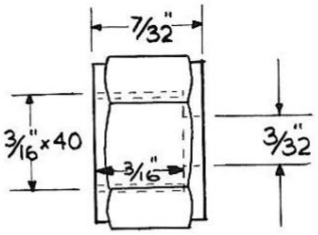
Mount a piece of 1/4" diameter brass rod in the chuck with 3/4" protruding, centre drill with small centre drill to give a nice cone that will take a coned pipe nipple. Put on a 1/4" × 40 thread for about 5/16" then with a stiff parting tool, turn down the chuck end to 1/16" leaving 5/32" of thread, and then part off to leave the 1/16" portion 1/8" long. You will need as many of these nipples as you have bodies, so proceed and churn them out.

Mount a piece of 1/2" diameter brass rod in the chuck with about 3/4" showing. Carefully centre drill, follow with a 7/32" drill, tap 1/4" × 40, and face off the end. **This is a screwed mandrel or chuck.** Screw in one of the body blanks tightly up to the shoulder, and turn the outside to the shape you have decided upon. Remove from brass chuck and turn the rest of the bodies. DO NOT remove the chuck. Now drill the sides of the bodies for the 1/16" pip on the screwed nipples, the hole is midway on the length of the body, 3/16" from the shoulder. Do all the bodies the same and then silver solder the parts together. For 'itsy bitsy' jobs like this, I use the very thin solder obtainable from Whistons and some other model engineering suppliers.

Re-mount a body in the brass chuck, and with a 3/16" 'D' bit bore the valve body to a depth of 1/4"; follow this with a centre drill, then a number 31 drill right through the body and finish with a 1/8" reamer. You must have a knife edge for the valve head seat so if you are not happy with



GLAND – Brass 1/4" A/F Hexagon

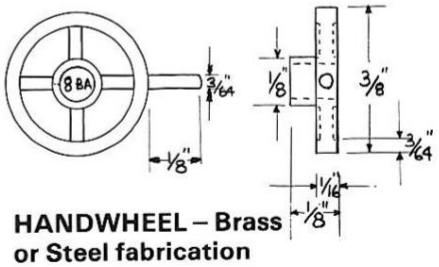


GLANDNUT – Brass 1/4" A/F Hexagon

what you have done, then the merest skim with the 'D' bit should correct matters. The hole is now tapped 7/32" × 40 to a depth of 5/32".

Remove the body from the chuck and drill through the centre drilled nipple with a 3/32" drill, and clean up the 7/32" threaded portion. Carry on and do all the remainder of the bodies.

If you are frugal, you can save the brass chuck or mandrel by marking it opposite your favourite chuck jaw. I wish I could follow my own advice, but I usually end up making a new brass chuck for every batch of valves, and I console myself by thinking that I am sure of accuracy by using a chuck that is still in situ from machining. In truth, I just lose them (or have thrown them at passers-by who are non modellers).



HANDWHEEL – Brass or Steel fabrication

GLAND

You will need another brass chuck for this item so you could use the other end of the one just discarded, if you haven't already lost it. Mount a piece of 1/4" hexagon brass bar with about 3/4" showing, and turn down to 7/32" diameter for 1/8" and put on a 7/32" × 40 thread, part off leaving 1/4" of hexagon then put on one side, and make as many more as you have valves. NOW mount the 1/2" brass rod in the chuck, centre drill, follow up with a 3/16" drill to 3/8" depth and tap it 7/32" × 40. Screw in one of the gland blanks, and turn down to 3/16" diameter leaving 1/16" of hexagon intact, and put on a 3/16" × 40 thread. Accurately centre drill, follow with a number 36 drill right through the gland blank, and tap the hole 5 BA. Unscrew it from the brass chuck and you have a finished gland. Don't forget all the rest you have to do, so don't put the kettle on just yet. Wait till you have finished the gland nuts, then you can be assembling the valves whilst you are having a cuppa!

The gland nuts are made from 1/4" hexagon brass, so chuck a piece, bore with a 5/32" 'D' bit going 3/16" deep and tap 3/16" × 40. Centre drill the bottom of the hole and follow with a 3/32" drill, and part off leaving the nut 7/32" long. I usually mount these nuts (ALL unions too) on a bit of screwed rod and remove the hexagon with a round nose tool for about 1/32" at each end. This makes them pretty, and there isn't much beauty in the world now!

You can now have that cup of whatever, and whilst you are drinking it you can assemble the valves using a few strands of graphited yarn to seal the glands. You ought to be surprised at the ease at which they cut off without wrenching, even though there are no handles to give leverage. If you are anything like me you will be shocked to find that you have 13 spindles, 14 bodies, 16 glands and 20 gland nuts. Still, they will come in for summat, won't they!

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HANDWHEELS

After reading and digesting many articles on this subject, I must admit to having a fetish about handwheels. I have seen those lumps of knurled brass we see posing as valve wheels and recoiled. I have now got to the state that at exhibitions I tend to ignore the big model, and just look at the handwheels. It has been said many times, but is still none the less true, that it is just as easy to make scale wheels as to make the knurled knob type.

With the valves just described there is minimum heat passage through the 3/32" spindles, so we may as well help reduce the heat to fingers by having the minimum of metal in the handle.

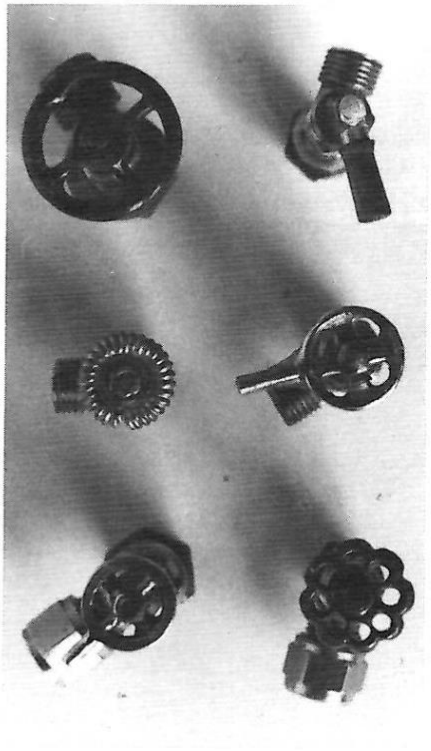
To make a good average type of wheel, mount a piece of 3/8" round brass bar in the chuck, with an inch showing, and face it off. With a narrow tool, bore into the face to a depth of 1/4" leaving a 3/64" wall and 1/8" diameter boss. Remove from the chuck and cross drill the four 3/64" holes for the spokes through the rim and the boss. Put in four 3/64" brass wire spokes and, using the absolute minimum of solder, silver solder the assembly.

Cut off the protruding ends of the three spokes, and file flush with the rim. Leave one spoke sticking through the rim 1/8" or 5/32". Re-chuck the embryo wheel, centre drill, follow up with a number 50 drill to 1/4" depth, and tap the hole 8 BA. Part off the rim to as narrow a width as you can, and part off the boss 1/8" long. You can now either polish it up, or dip it into stoving paint to the colour of your choice — red being almost universally used, but I don't know why.

The handles are fitted to the valves nice and tight, and securely locked with a small nut made from a 10 BA nut drilled number 50, and tapped 8 BA. The small hexagon looks much neater than the standard one.

You should now have several (I have lost count) nice valves, so you now have all the rest of the week to make a locomotive to fit them to. The valves I have described can be modified to suit bigger applications with a little thought and pencil work to fix suitable dimensions. The permutation of body styles is limitless. Try making a body with about a 7/16" × 1/32" flange and put in four dummy hexagon head bolts, say 16 BA to simulate a flange fitting — they look great on locomotive and traction engine backheads, but first make sure they are correct for your model.

A selection of Handwheels.



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I have used this method of making valves for many years with great success.
Dimensions can be altered to suit your own requirements, but the methods used are key to success.