6 Small Repairs

6.1 General

When overhauling model steam locomotives, particularly older models, it is sometimes necessary to replace worn parts. Pipe unions that are used to allow a model to be dismantled into its component parts often become worn and leak; check and pump valves no longer seat properly and meths systems show a tendency to dry up or flood. The following construction methods have proved satisfactory when building new models and are capable of being adapted for repair work.

6.2 Unions

It is often both difficult and tedious making small unions. Fig 6-1 shows a system which makes use of 1/8" a.f. (across flats) hexagon brass and 1/16" copper tube. It is a system copied from the oil feed system of a central heating boiler, (the central heating boiler system wasn't very efficient but the oil feed never leaked).

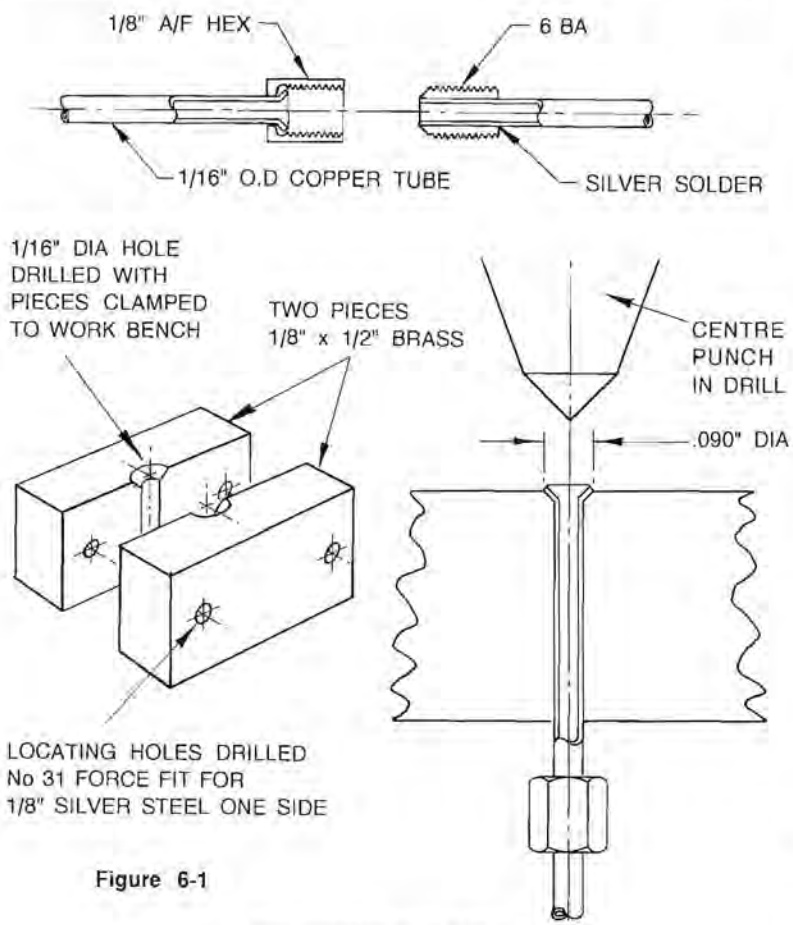

Figure 6-1

Manufacturing a pipe union.

One half of the union consists of a male cone screwed 6 BA and silver soldered to the copper pipe. In the other half the copper tube is belled out after the nut has been slid over it. The sketch shows a simple jig for belling the end of the tube evenly. When the nut is screwed onto the nipple it pulls the belled out end hard onto the cone. If the copper tube is soft it doesn't even need jointing compound, although a product such as Loctite 'Lock'n'Seal' does the job without any trouble.

6.3 Check Valves

When making small check valves or pump valves it is possible to buy 1/16" dia. stainless steel or bronze balls for use as the moving element. The system employed is to use a carefully turned seat which is truly circular and produce the valve seating with a light tap. In this small size, however, care is essential. It is preferable to make the valve seats separate from the body of the valve or pump on the grounds that if a seat fails it can be thrown away without having to discard all the other work. In addition it is possible to adjust the lift of the valve when a screwed separate seating is used. The maximum lift of a ball valve is usually given as 1/6th of the ball diameter and hence using a ball diameter of 1/16" dia. means that the maximum lift required is of the order of 0.010".

The screw used for the seating is a 6 BA and has an outside diameter of 0.110" and about 0.085" core diameter. This gives adequate area around the ball to form a seating and adequate space between the ball and the internal threads for the easy passage of the liquid. It is possible to get the whole thing into 1/8" thick material provided that care is taken to drill centrally.

The seatings themselves are turned out of drawn phosphor bronze rod. The rod is held in the three jaw chuck, faced, centred and drilled through about 0.040" or a little over as it is to be reamed later with a 3/64" reamer. The outside is turned and threaded 6 BA, (see Fig 6-2).

The end is faced using the top slide set over to an angle of about 20°, (see Fig 6-3). This produces a slightly conical shape to the valve

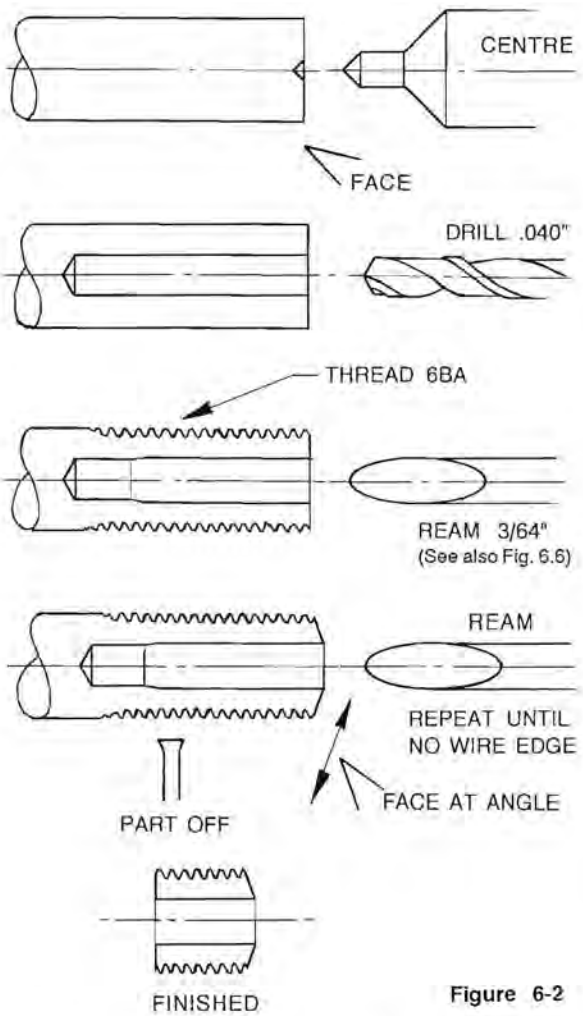

Figure 6-2

Steps in machining a valve seat face.

seat and reduces the chances of failure. The centre hole is reamed using a 3/64" toolmaker's reamer, (this is the classic reamer made from a length of silver steel rod - see Note on Page 9-1-29). By alternately facing and reaming, possibly four or five times, it is possible to get rid of the wire edge that tends to form. Once a satisfactory edge has been obtained, the seat is held in a jig, (see Fig 6-4) the ball placed over the hole and given a slight tap. The tap must be very light; a force equivalent to a 4 oz hammer head falling from about 3" under its own weight is about right.

If the arris, or raised ridge, produced can be seen with the naked eye the seat will almost certainly leak. To be successful the arris should be just visible using a watchmaker's eyeglass. The secret of success is undoubtedly to use a sharp facing tool, accurate

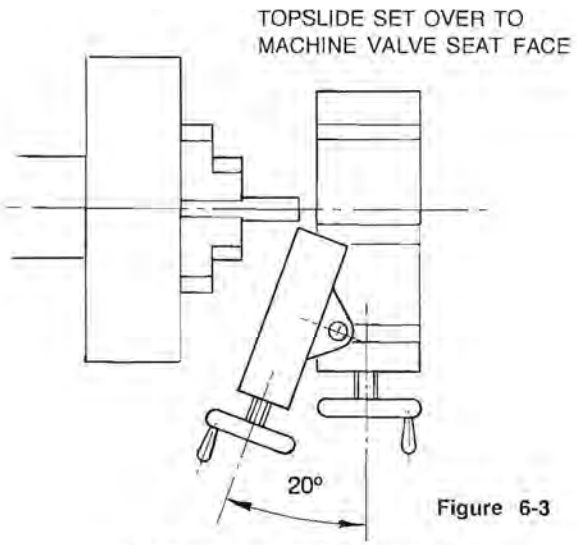

Figure 6-3

Machining the valve seat face.

reaming, repeated reaming and facing to get rid of the wire edge and finally a light tap on the ball when held in the correct position in the jig. Failures are inevitable, I'm afraid, but using the above technique I estimate that at least two out of every three seats will hold tight.

The final step is to hold the seat in a threaded block mounted in the vice and cut a screwdriver slot in the outer end, (see Fig 6-5). This will allow the seat to be adjusted in its casing to restrict the lift to the ball valve to the optimum movement.

They are tested using a length of tubing pushed over the seat and with a ball inside. With the end of the

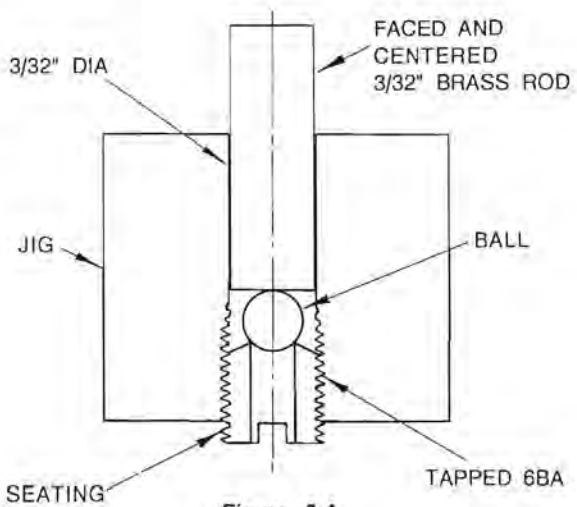

Figure 6-4

Setting up the valve seat contact face.

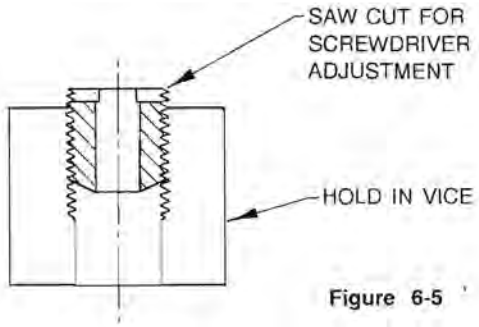

Figure 6-5

Cutting the screwdriver slot in the back of the valve seat.

tube containing the seat submerged in a bowl of water a good hearty blow at the other end should show no signs of air leakage in which case the valve can be considered satisfactory.

Note: The reamer referred to above is made from a length of 3/64" silver steel which has had the end ground down to a 'chisel' shape. Once the edge has been rounded off it is hardened and tempered to a light straw. (see Fig 6-6).

6.4 Miniature Fuel Sump

One of the problems with meths firing is getting the fuel to the feed pipe without using an excessively large sump. The commonest arrangement is the so called chicken-feed method. Fig 6-7 shows an alternative system using a valve controlled by a float, the valve being a 1/16" ball and seating as described above. The ball is glued with an epoxy resin like Araldite into a dimple machined in the end of a 1/16" rod and the whole supported by a cork float. The operation is simple and control of the meths level is precise.

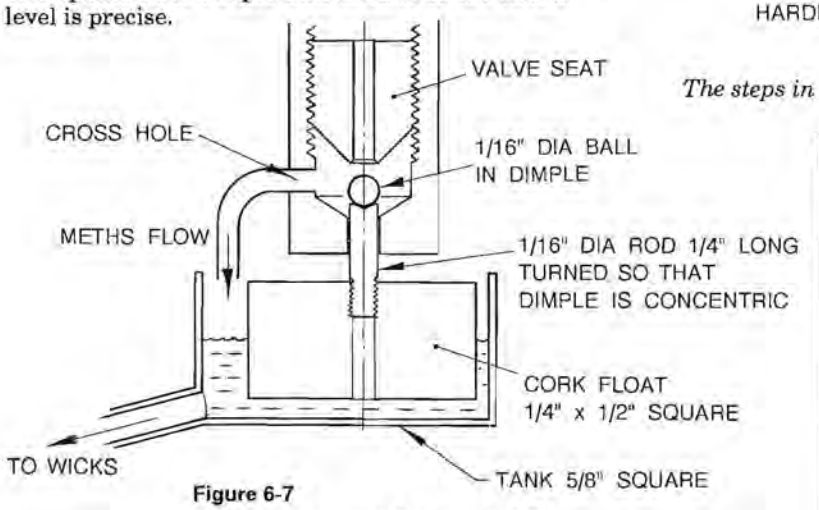

Figure 6-7

Basic design of a fuel control float.

The valve seat is constructed as described previously. The valve rod is best produced by turning to ensure that the dimple formed in the end is central to the outside diameter. The ball cannot be glued into the dimple in its 'as produced' state: it is necessary to hold it firmly in a pair of pliers and touch it against a grindstone. This will produce a minute flat which is rough and will provide an adequate key for the Araldite. A flat piece of cork 1/4" deep and 1/2" square when immersed in meths will provide sufficient thrust to support a rod 1/4" long with a 1/16" ball and seal against the valve seat. This means that the sump need only be 5/8" square and 3/8" deep for satisfactory operation, which is considerably smaller than the traditional arrangement.

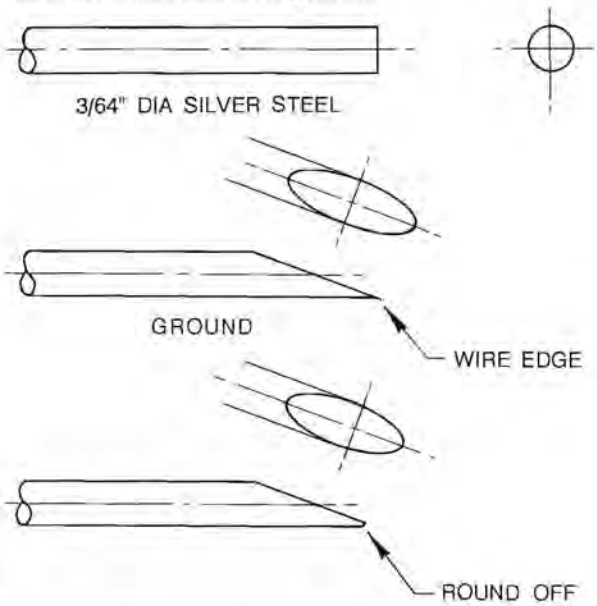

Figure 6-6

The steps in preparing a toolmaker's reamer.

Useful Valve Design Data

Full flow is obtained when valve is opened to an amount equal to a quarter of the seating diameter for flat valves and one sixth for ball valves.