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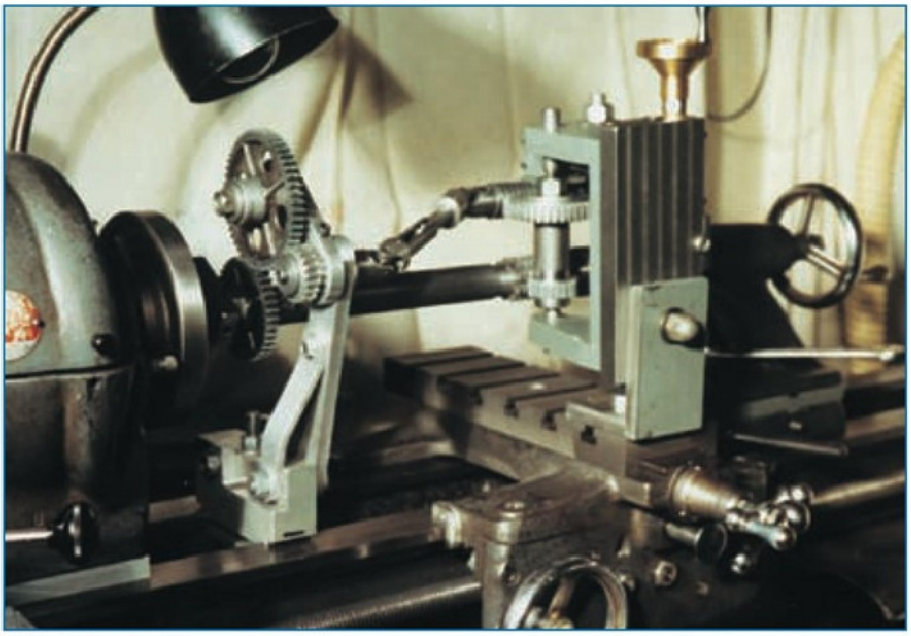
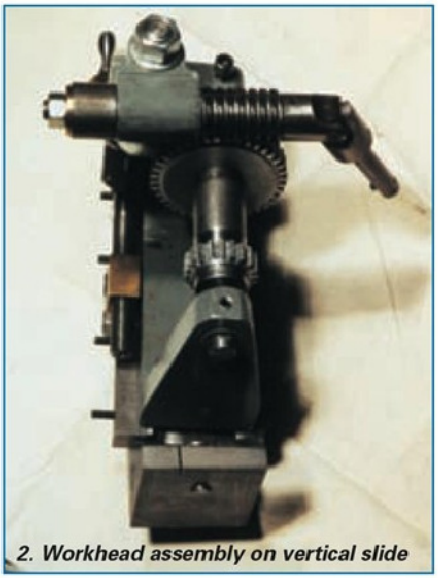


1. Hobbing device set up on lathe.

John Whalley describes an easily made but versatile attachment

Protracted evolution

I made a start at gear hobbing around 1967 when I purchased a copy of an American publication "*Complete Metal working Manual*" by R. H. Cooley, which included a gear hobbing attachment that was supposed to generate worm, spur and helical gears. Although lacking a complete understanding of what was necessary at the time, I decided nevertheless to have a go and build the device. I made the casting and all the parts, including the hob, which was to be hand relieved. The hob was a lot of work and could only be sharpened once or twice before the relief was lost and it had to be renewed.



2. Workhead assembly on vertical slide

Dr. Giles Parkes excellent attachment described in MEW Iss. 57 pg. 37 solved the hob-forming problem. The gear hobbing attachment made use of the topslide as the vertical feed, and providing that you had a gear of the same number of teeth as was needed, would make usable spur gears. The expanding gear train did not allow worm gears, and helicals were not possible either. In addition, the overall rigidity was far from perfect.

Back in 2001 I wrote to ' Scribe a Line ' in MEW Iss. 74 with a brief mention of a hobbing attachment that worked rather well. This device, shown in **Photo 1** is the final evolution of the above.

It is very easy to build and use, takes no space, can be set up in less than five minutes, does not require a worm gear, and costs next to nothing to make. The change gears of the lathe can be used initially until replacements are made. It cuts worm gears, spurs, and when I master the maths, will make helicals too. I have cut countless gears in tufnol, brass, cast iron and aluminium. They have been used in all sorts of applications and have worked very well. For those who question the wisdom of using a spur gear instead of a worm gear for the index gear. I will say that my aluminium index gear has worked for six years, cut over fifty gears and yet shows no wear that I can see. However if it ever does wear the device will readily produce a worm for those who want to go that route. The drawings have not been completely detailed, (for example the simple bolt and bush pivot for the idler gear), but in conjunction with the photographs, should convey sufficient information for most would be constructors. The slide shown, with the outboard leadscrew reduces the overhang by about 1.125in. from that provided by my topslide and goes a long way to reducing the rigidity problem if an angle bracket that is at least ⅞in. thick is used. Gears of about 5½in. dia. can be made. I might add that when very small worm gears are required that use a hob that is too small to fit on the mandrel in the usual manner. I mount the hob in a chuck and drive the attachment from the tailstock end with a chain and small sprockets driven from the leadscrew to a long universal shaft that connects to the boss on the tail stock side of the worm that drives the index gear. The necessary gearing is mounted on the headstock quadrant, and sometimes gears are needed to clear the tailstock handwheel. I mention this only as an insight to what can be accomplished with a little perseverance.

The work head casting

In the original publication this was made from cast iron. I changed several dimensions to serve my needs and moved the mounting boss for the brackets to the opposite side of the casting. Since I have a small foundry it was no problem to cast in aluminium and has proved to be up to the job.

The casting needs to be milled flat on the top and bottom of the mounting boss, and the left rear side where the vertical

3. Change gear quadrant assembly

ATTACHMENT
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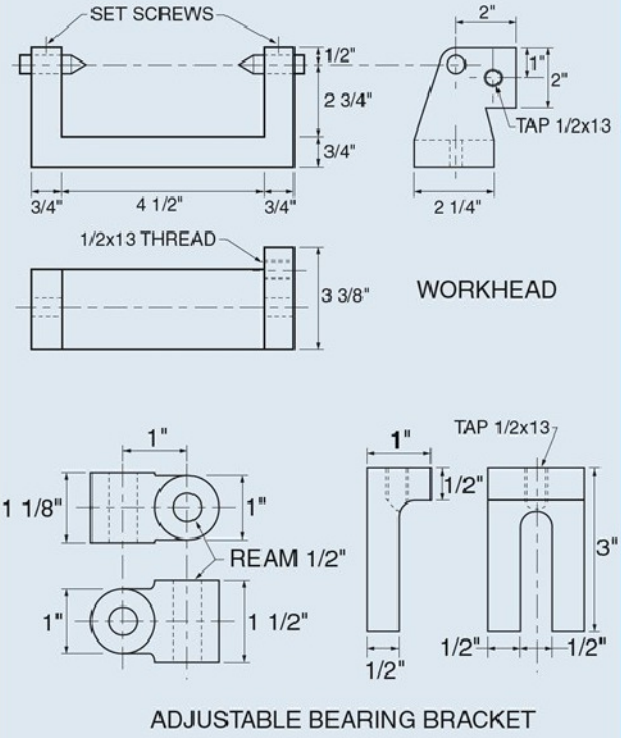


Fig. 1 Cast components

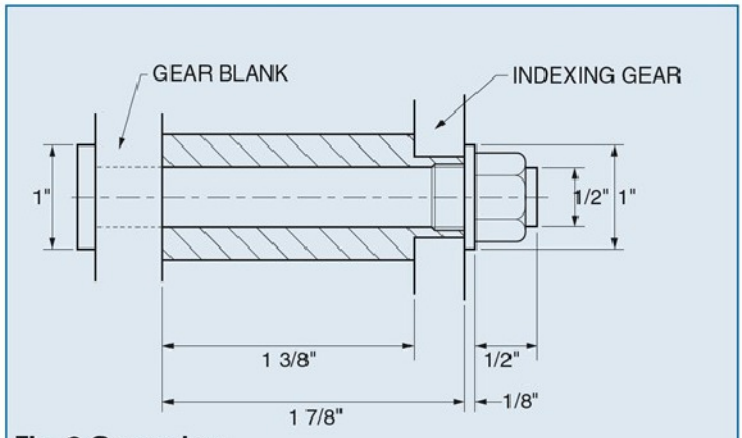


Fig. 2 Gear arbor

4. Mandrel with hob and drive gear.

slide is fixed, needs to be parallel to the line taken by the centres to enable accurate setting to the helix angle of the hob. The other brackets were sawn and milled from the solid as this seemed quicker than making patterns.

The worm to fit the indexing gear is a standard DP worm to run with whatever change gears are being used. Mine was 16 DP, 14½ deg. pressure angle needing a pitch of 0.1964in. and a depth of 0.135in.

The gear arbor as illustrated fits my change gears. I might add that I have made several also to hob ⅜ and ⅞ in. gears. With a smaller lathe such as a ML 7 it may be better to have a bronze bearing on the bottom instead of working between centres to allow the blank to be positioned lower in relation to the hob. The arrangement of the workhead, with worm, wheel, arbor, and workpiece can be seen in **photo 2**.

The change gear quadrant

Mine was made from aluminium bolted to a block that fits between the shears. It serves to provide the ratios need to form a gear. If a 40T gear is required the blank needs to make one complete turn to 40 turns of the hob. You can either use a 40T index gear as I did and use the appropriate ratio to cut whatever you need, or as the brackets are adjustable, provide a 1:1 ratio and mount a gear of the required number of teeth to mesh with the worm.

The universal joints are not mentioned as they have been published so many times. Some constructors may choose to buy them instead of making them. It is worth mentioning that the shaft needs to be able to be able to telescope to allow movement of the vertical slide.

The quadrant assembly is illustrated in **photo 3**.

The mandrel

This part (**photo 4**) serves a double purpose as a mount for the hobs when cutting gears, and a mount for the hob blanks when using Dr. Giles Parkes relieving attachment to actually form the hob in the first place. Note that I have designed the driving gear end to suit my change wheels. These details should be checked on your own equipment, and amended accordingly.

Vertical slide and various parts

I did not do a verbal description of these parts as they will have to be adapted to fit whatever size and type of lathe that will be

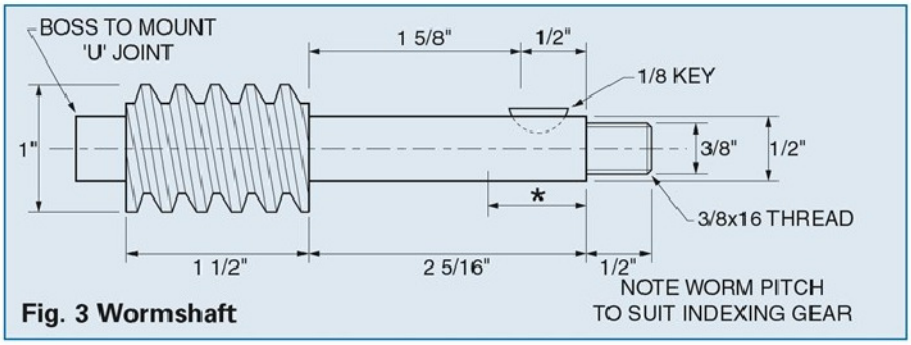


Fig. 3 Wormshaft

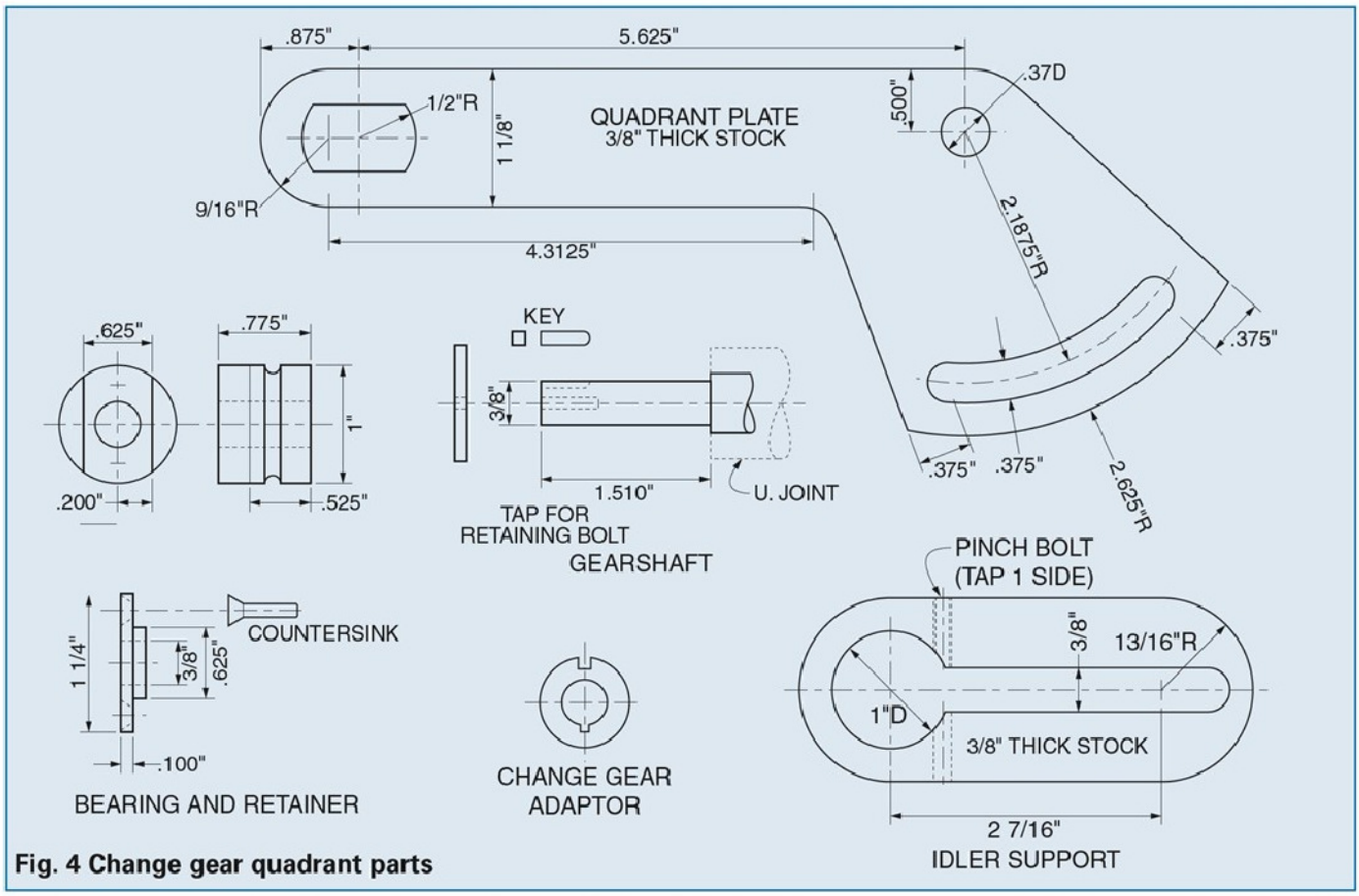


Fig. 4 Change gear quadrant parts

used, and many of you will find a way that no doubt suits you better. My arrangement of the vertical slide appears in **photo 5**. All running surfaces are in bronze bushings, which are not shown. The rather protracted arrangement of the change gear quadrant and various parts is to allow it to be assembled either in front of or behind the mandrel as may be required to produce very small wormwheels along the lines previously mentioned.

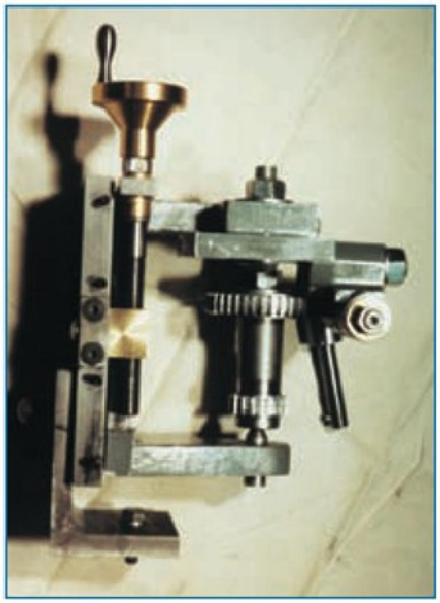
Operation and set-up

With reference to the photos assemble the work head casting on the vertical slide with a very rigid angle bracket (at least 7/16in. thick, ½in. is better) vertically on the cross slide so that the blank will be at the helix angle of the hob and able to be fed up and down parallel with it. It is worth mentioning that while the topslide can be used as a vertical slide, a purpose built one with much less overhang will work much better particularly when larger dia. gears are being hobbed.

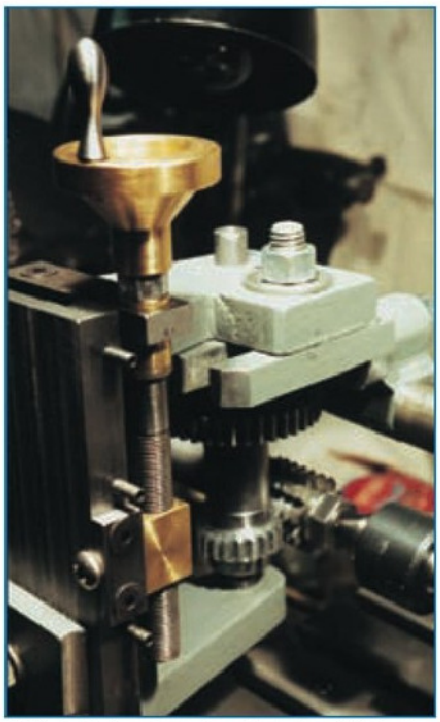
The gear blank to be cut must revolve counter clockwise as seen from above with a right hand threaded worm. (Hence the idler gear in the photos).

The blank works best 0.010in. undersize from normal dimensions usually used in gear cutting calculations. (feed in 0.005 in. less than root dia.)

Verify the helix angle of your hob with both a maths calculation and by placing a



5. Workhead assembly showing vertical feed screw.



6. Detail of set up also showing tailstock support.

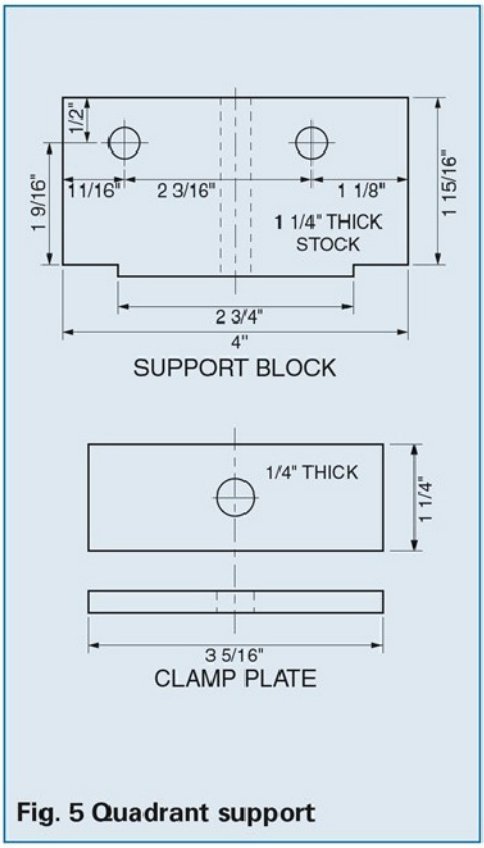


Fig. 5 Quadrant support

slender rod in the hob thread to check that you are set up correctly. (The vertical slide and the casting must be at the helix angle of the hob and travel parallel with it).

Before cutting a gear (say a 20T spur gear) start the machine in motion and verify the following:

- That you have 20 turns of the hob to one of the blank.
- Turn in the cross slide until the centre of the blank just touches the revolving hob (set the cross slide at zero) and make sure that you have 20 notches cut on the blank. (if you don't you have either got your gear ratio wrong, or if the notches are not clearly defined, the blank is not revolving in the correct direction and will not generate a gear).
- Wind the vertical slide up past the hob giving it time to cut all around and verify that the marks are at 90 deg. to the blank. (if not, correct this situation by adjusting the helix angle as required).
- Wind back down, feed in the cross slide the root dia. minus 0.015in. (Lock the cross slide and I might mention the saddle must be locked also). Mark the gear blank with a felt pen, to give a visual indication of completed revolutions.

Running the lathe just a bit slower than the usual milling speed advance the vertical feed about 0.050in. every turn of the blank, or whatever feed works best, allowing time for the hob to cut all around until you feed out of contact with the hob. Wind back down to the starting point (out of contact with the hob). Remove the gear arbor, marking it's position with a felt pen so that it can be replaced in exactly the same place as it was before. Measure the root dia. and replace. Feed in the necessary amount to finish the gear. Start the machine and check that everything lines up, then proceed to finish cutting the gear.

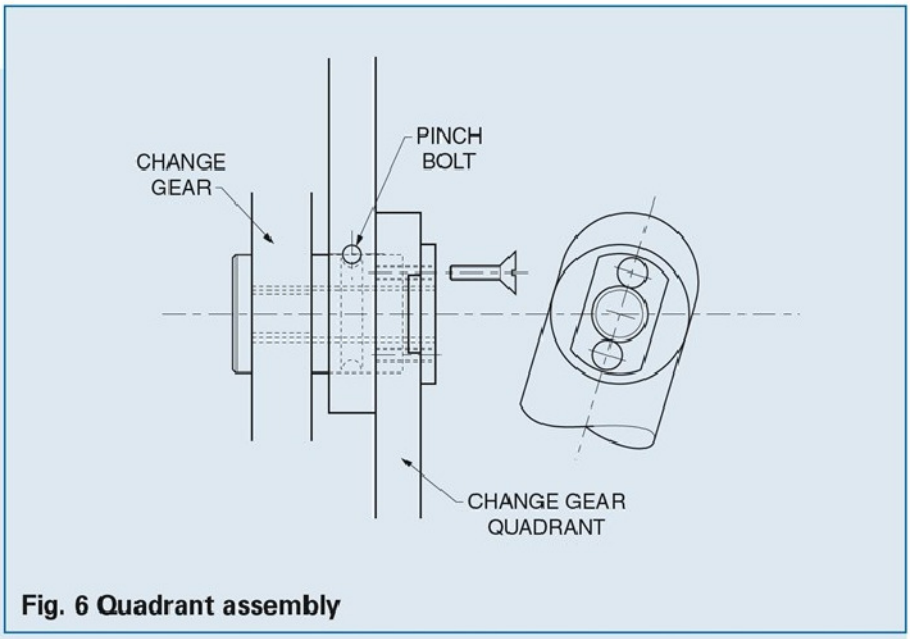


Fig. 6 Quadrant assembly

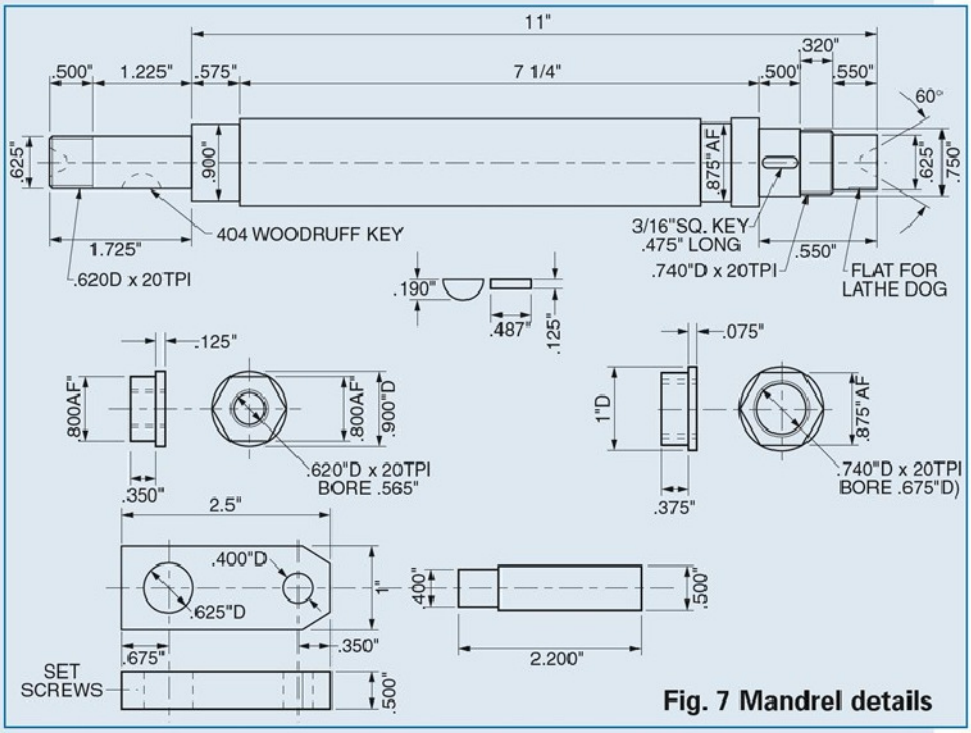


Fig. 7 Mandrel details

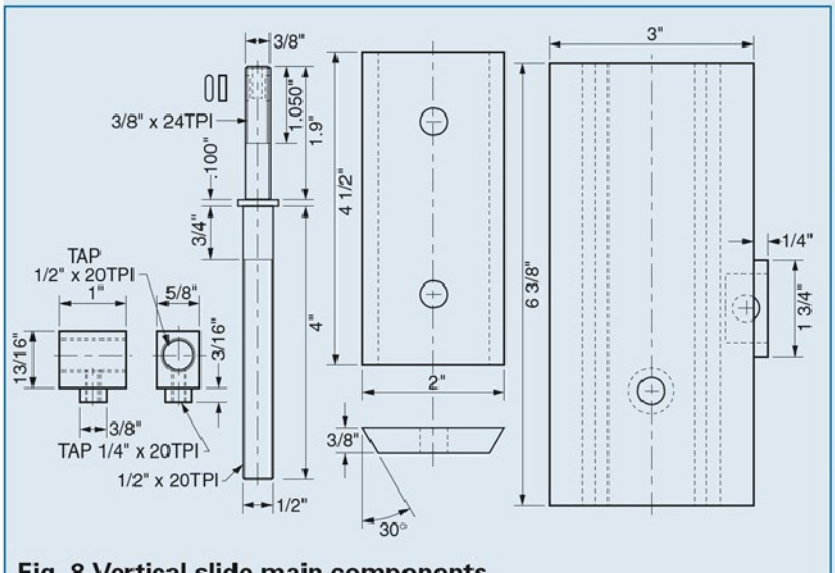


Fig. 8 Vertical slide main components

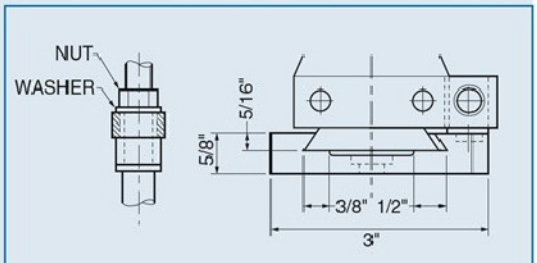


Fig. 9 Vertical slide part assemblies