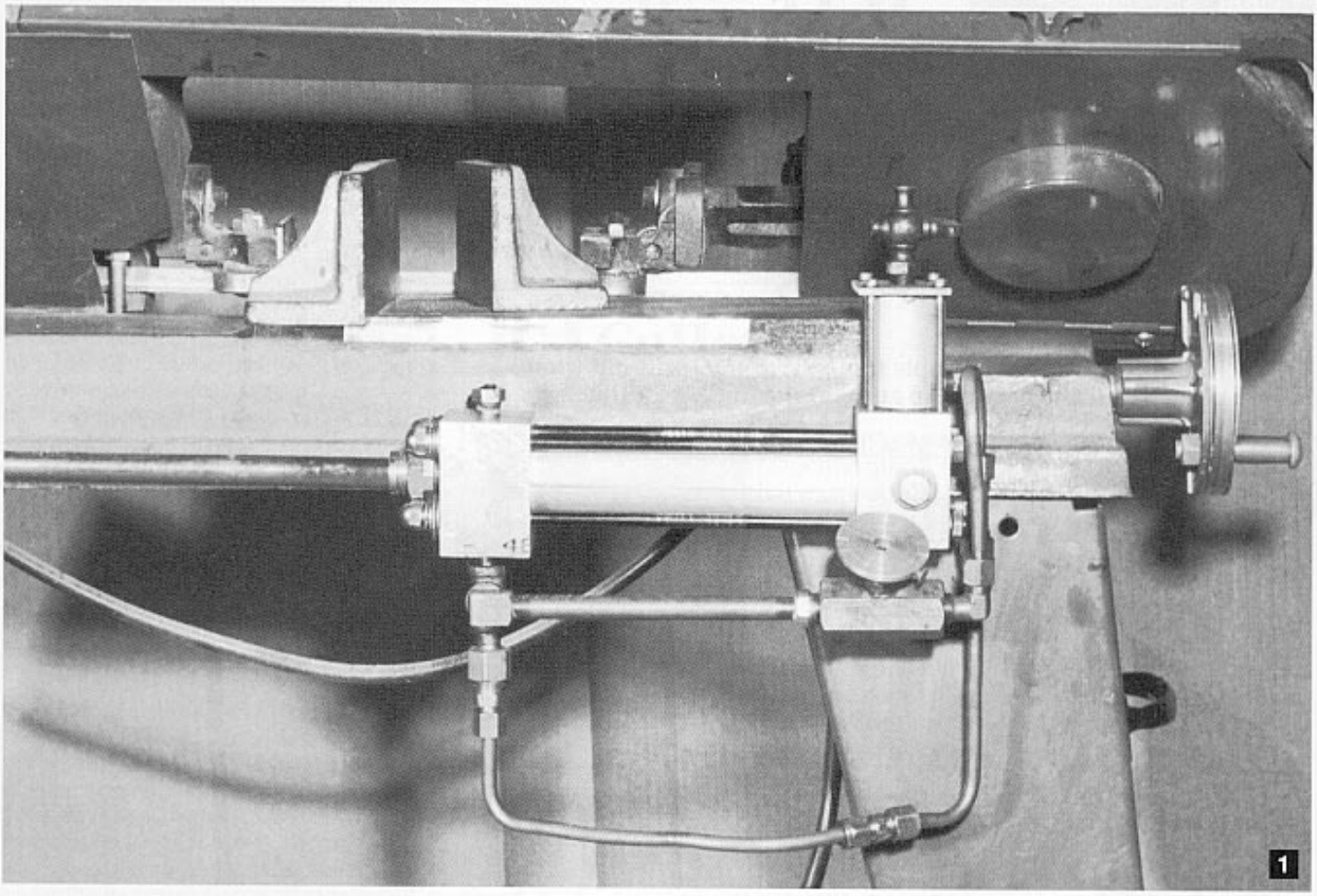
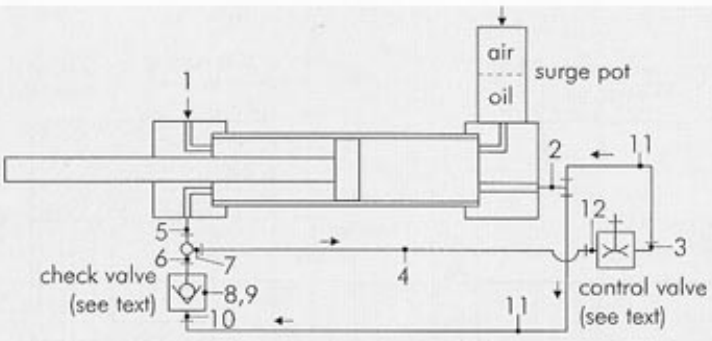
Sawfeed



by Jim Reynolds

A couple of years ago (June 1993) an article in *Projects In Metal* described the fitting of a surplus hydraulic cylinder to control the feed to a Taiwanese metal-cutting band saw. This is the type selling for $200 or less and using ½ × 64½" blades. The author suggested that it wouldn't surprise him if some of us opted to build our own. My decision to build was based on not being able to locate a suitable cylinder I could afford and having raw stock on hand to machine the parts. A search of the scrap box turned up a ½" polished shaft left over from a valve overhaul job, a block of aluminum 2" square, and a length of aluminum 1⅜ × 3/16" wall tubing, both bought at a Boeing surplus outlet a few years back for $1.60 a pound.

None of this, of course, does you any good so I'll suggest someplace like Nolan Supply for the 2" square aluminum (about $20 for a one-foot length) and also for the shafting (about $5 for a three-foot length of ½" dia. w-1 drill rod). You'll have to pay for shipping. This leaves the tubing to make the cylinder. You can use a length of 1" (nominal) PVC conduit 1 9/16" OD by slightly over an inch ID. Unlike PVC water pipe, this product – grey color – comes with a very smooth bore suitable for our purpose as is. From the Bill of Materials, you can see that everything else is hardware store or scrap box stuff. Of course, the more you can pull out of your scrap box the cheaper the cylinder gets. Depending on what you have on hand, you will want to look at the economics here. If you have no "scrap" and can find a suitable cylinder for $50 or $60, you may want to forego all this and refer to the original article. The photograph should serve the purpose of an assembly drawing. The figures should get you through the machining process. As evident, lathe operations are straightforward, and I did not see any point in showing photos of me drilling holes in the drill press which is the only other machine tool required.



ITEM		DESCRIPTION (F=female M=male T=tube)
1	Plug	1/8"NPT
2	Outlet tee	1/4"T x 1/4"T x 1/8"MNPT
3	Elbow	1/4"T x 1/4"MNPT
4	Nipple	1/4"NPT 5" long
5	Nipple	1/8"NPT x close
6	Tee	1/8"FNPT
7	Elbow	1/8"MNPT x 1/8" FNPT
8	Adapter	1/8"MNPT x 1/4" FNPT
9	Ball	1/4"or 3/8"dia.
10	Connector	1/4"MNPT x 1/4"T
11	Copper tube	1/4"OD
12	Bushing	1/4"x 1/8" NPT

FIGURE 2
SCHEMATIC

Figure 2 explains the operation of the device. The purpose of the surge pot is to make up for the difference in volumes between the head and rod ends of the cylinder. If this is not allowed for, an air pocket will have to exist in the cylinder head end. This was considered unacceptable. The check valve is built up from hardware store components (it really doesn't have to be bubble tight) and the control valve can be a 1/8" or 1/4" gate, needle, or globe. I used a hydraulic needle valve which (sorry) I just happened to have. I machined a large disk-type handle for it so I could scribe position marks I have never used.

Note: All drill depth dimensions shown begin when the drill tip touches the work.

Refer to *Figure 3*, the cylinder head end. Saw a piece of the aluminum block to the size shown. Unless your saw is pretty bad, this should suffice (no other parts mate with these surfaces). If your saw won't cut straight, true up the block in the lathe. Lay out and lightly

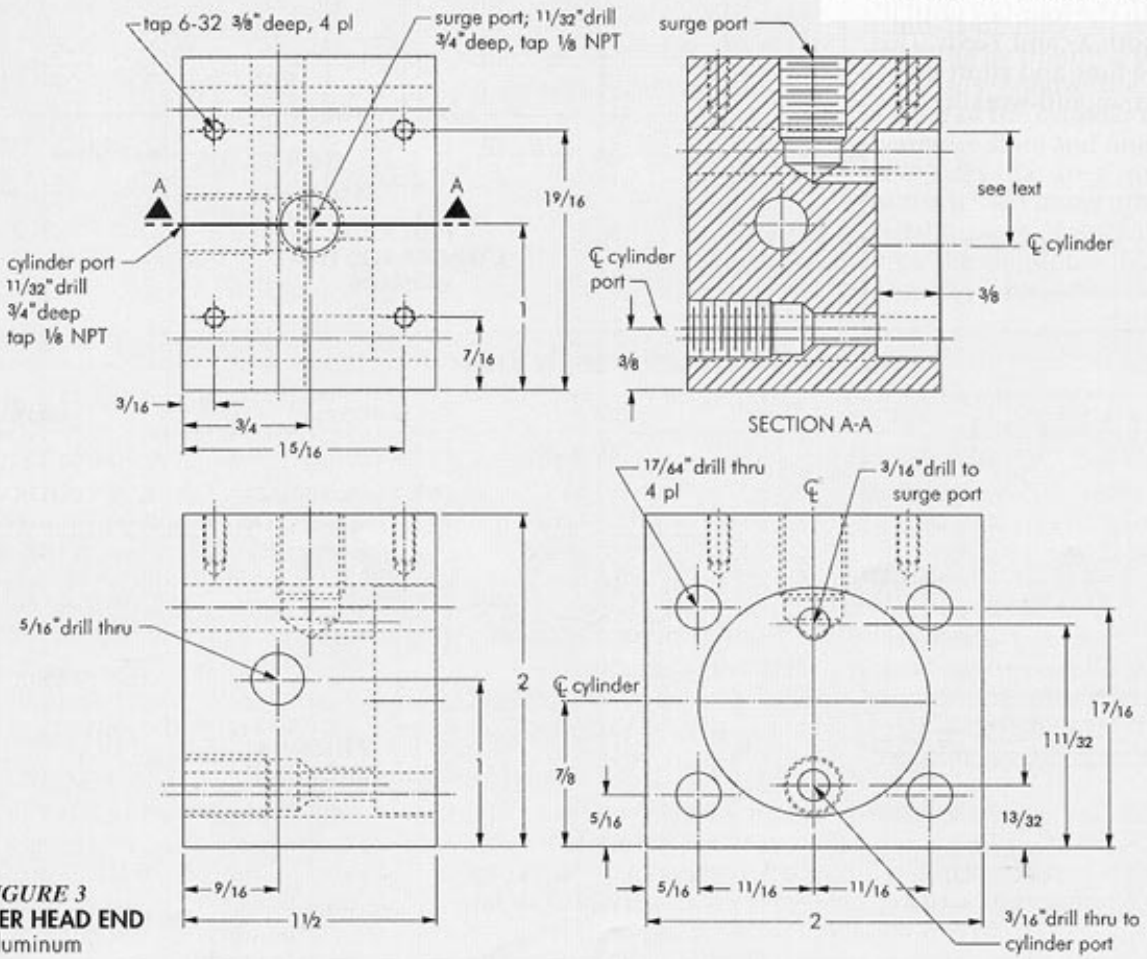


FIGURE 3
CYLINDER HEAD END
aluminum

center punch the cylinder center line point. Mount the block in the four-jaw using a center in the tailstock inserted in the center punch mark to establish position. If you're a purist, you can fine tune with a wiggler. Bore the hole to suit the ID of your cylinder tube. Remove the stock and drill the remaining holes on the drill press. Thread the ⅛" npt ports after tap drilling, using a center in the drill chuck to guide the tap. The surge pot screw holes will have to be bottom tapped.

Now look at *Figure 4*, the cylinder rod end. The procedure is the same as for the head end except that after boring the cylinder cavity, center drill, drill a hole that your boring bar will pass into, and bore the ½" hole to accept the rod. If you're uncomfortable with boring to size, bore undersize and finish with a reamer.

Now we have to flip the piece around to bore and thread the hole to accept the rod gland nut. To prevent subsequent binding of the nut, carefully indicate the ½" reamed hole in the four-jaw until it runs true in both X- and Y-axis. This will take some time and effort but is critical for a smooth-working

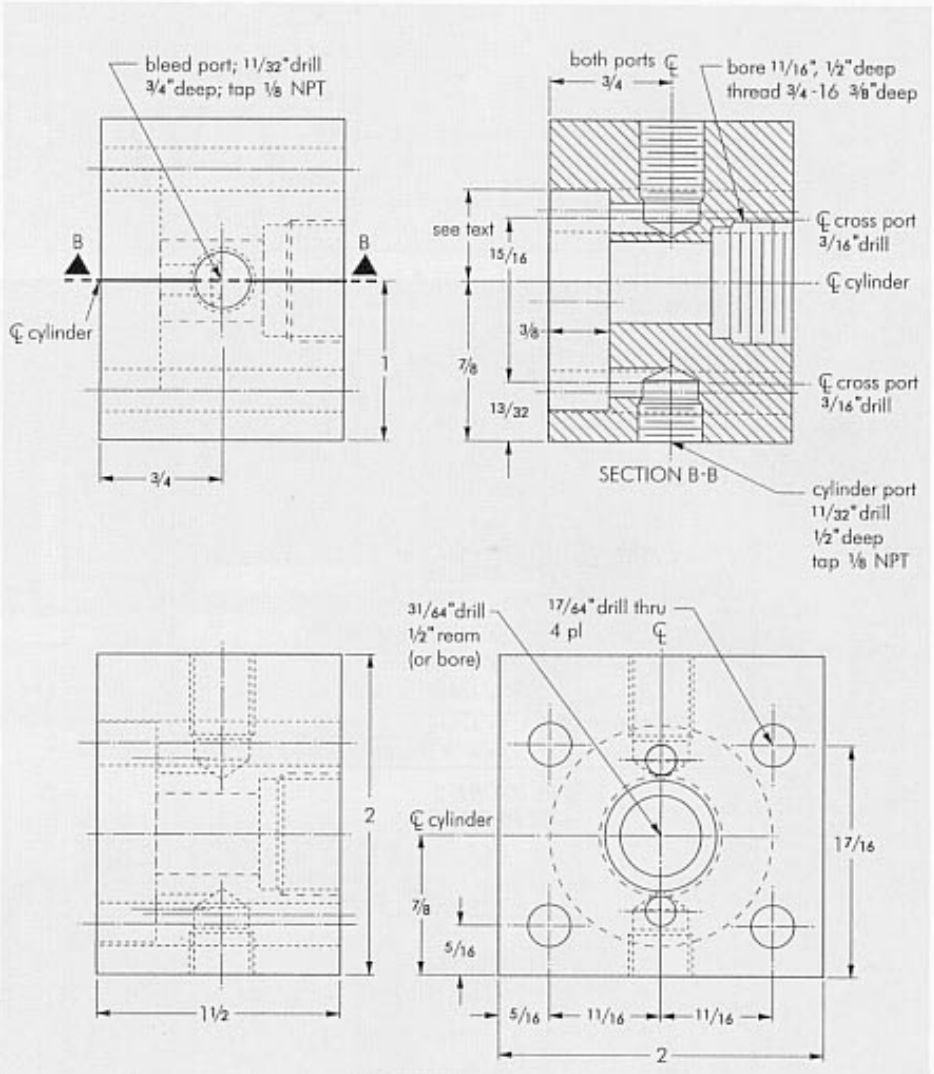


FIGURE 4
CYLINDER ROD END
aluminum

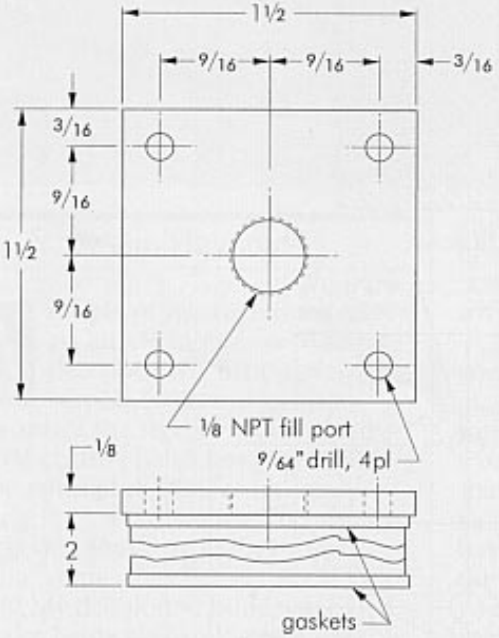


FIGURE 5
SURGE POT
scrap from cylinder

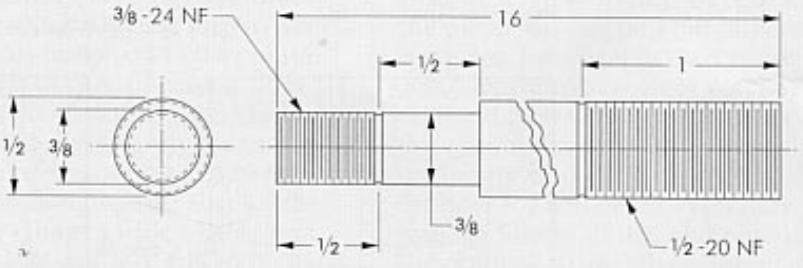


FIGURE 6
PISTON ROD
steel

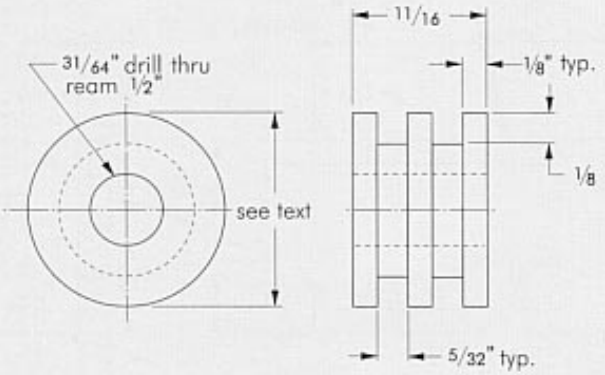


FIGURE 7
PISTON
(see text)

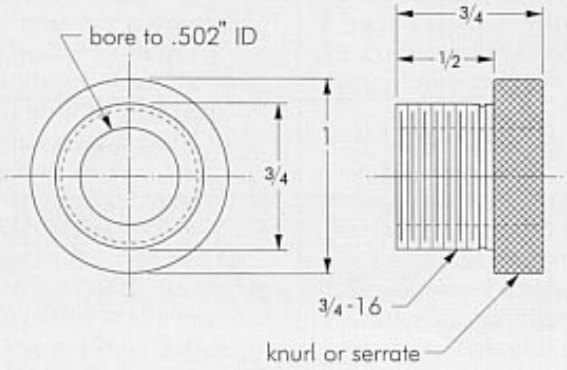


FIGURE 8
GLAND NUT
aluminum, brass or steel

cylinder. Now bore and cut the internal thread for the gland. This is not going to turn into one of those "gland nut must be at a certain position" situations since the gland need not be a bearing surface. Remove the stock and finish on the drill press as outlined for the head end. Note that the cylinder port depth allows the tap to cut only a few workable threads. At the pressures we are dealing with this is okay.

Referring now to *Figure 5*, the surge pot assembly: Cut off a piece from what is left of the cylinder tubing and face each end in the three-jaw. The cover can be made from anything you have. The four bolts are 6-32 about 2½" long. Gasket material can be cork or vellumoid available at the auto supply store.

Look now at the piston rod (*Figure 6*). Chuck the ½" stock in the three-jaw. Dial indicate, shimming if necessary, to run true. Turn the OD for the ⅜-24 thread. I suggest you cut this thread using the lathe. The ½-20 thread on the opposite end, for the clevis, can be done by hand. Jamb nuts can be made on the lathe by thinning standard nuts.

Figure 7 shows the piston. Take a piece of the cylinder tubing to the hardware store and find a couple of O-rings that are a snug sliding fit in the ID. Go home and chuck a suitable piece of stock in the lathe. It can be aluminum, brass, steel, or even plastic. Mike the ID of the

BILL OF MATERIALS

FIGURE	ITEM	QTY.	MATERIAL	SIZE	SOURCE	EST. COST
2	Schematic	lot	plumbing		hardward store	$14
2	Schematic	1	needle valve	¼" npt	hardware store	$4
3	Head end	1	aluminum	2 × 2 × 1½"	Nolan Supply, et al	$20/1 ft. long
4	Rod end	1	aluminum	2 × 2 × 1½"	Nolan Supply, et al	included above
5	Surge pot cover	1	aluminum or steel	⅛ × 1½ × 1½"	scrap	—
5	Surge pot	1	copper or polypropylene	same as cylinder	scrap	—
6	Piston rod	1	steel	½" dia. × 16" long	Nolan Supply, et al	$5/3 ft. long
7	Piston	1	aluminum/steel/brass	1⅛" dia. × 1" long	scrap	—
8	Gland nut	1	aluminum/steel/brass	1" OD × 1" long	scrap	—
9	Rod clevis	1	aluminum/steel/brass	1 × 1 × 2" long	scrap	—
10	Tie rod	4	steel	¼" dia. × 9" long	hardware store	$1.50/3 ft. long
11	Cylinder	1	PVC	1¼" OD × 1" ID × 6" long	hardware store	$5.50/10 ft. long
	Nuts, bolts, O-rings, etc.	lot	various	as required	hardware store	$5.50

cylinder tube and turn the OD of the piston a thousandth or two smaller. The dimensions of the seal lands shown suited the hardware store O-rings I used. You should check the diameter of the O-rings you're using against these dimensions. My O-rings measured about 9/64" in diameter. Face off, and machine the lands. Drill and ream, or bore, the rod hole. Test for fit in the cylinder, then part off leaving enough extra to turn the piece around and face off the opposite end. Lightly deburr where needed.

The gland nut (*Figure 8*) is a standard lathe operation. Cut the threads on the lathe to ensure concentricity. A clearance is used for the rod hole since this is not meant to be a bearing surface. I used an O-ring, backed up by packing, for a rod seal.

Refer to *Figure 9*, the rod end clevis. Aluminum material is shown as it is easy to work. The ¾" cavity can be made by sawing two drilled holes. Use a coping saw, or jig saw if you have one, to part off the scrap piece and file all sawed surfaces smooth.

To machine the tie rods (*Figure 10*) is obviously a bench work job and requires no discussion. The drawing shows the threads as if they were cut on the lathe, but this is not necessary.

For the cylinder (*Figure 11*), saw off an oversize length of stock and mount in the three-jaw for facing off. If you have a small lathe and can't support the work in the chuck to run true, use your steady rest. Wrap a turn of black electrician's tape clockwise around the tube to protect it. Use grease for lubricant. Don't worry if the cylinder isn't precisely 6" long. The fulcrum on the saw frame is about 2¾" which is all the cylinder stroke we really need. The 6" long cylinder is to provide plenty of bearing surface.

Figure 12 shows the check valve. A small hardware store will probably not have the ⅛" mnpt to ¼" fnpt adapter. Try a plumbing supply or auto parts store. The diameter of the ball depends on the ID of your tube fitting. This seems to vary. Mine was ¼" and had a nice rounded factory-made "seat" to accept a ⅜" diameter ball. You may

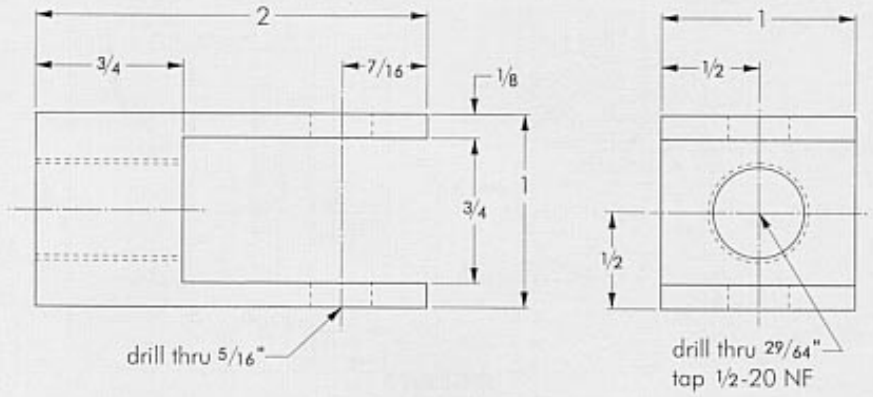


FIGURE 9
ROD END CLEVIS
aluminum

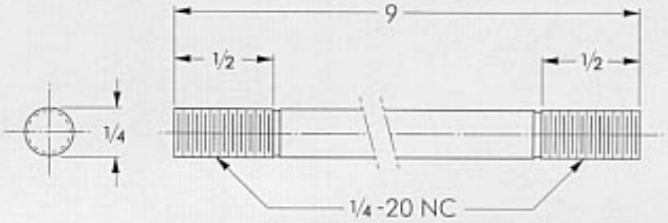


FIGURE 10
TIE ROD
steel
4 required

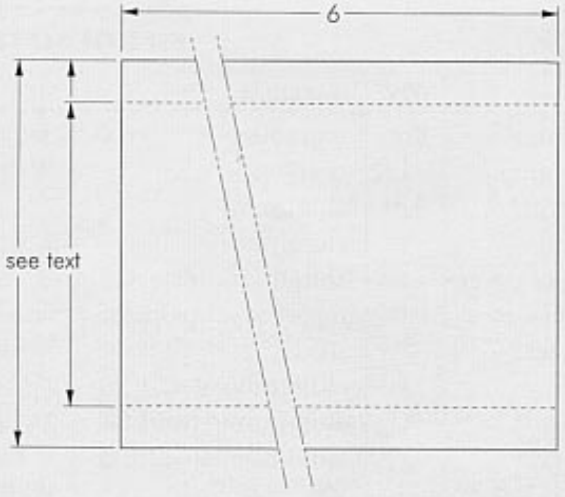


FIGURE 11
CYLINDER
PVC heavy wall conduit

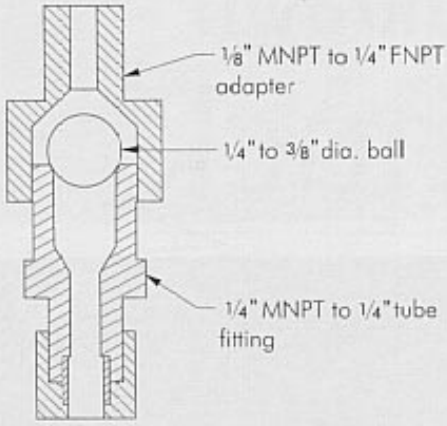


FIGURE 12
CHECK VALVE
(see text)

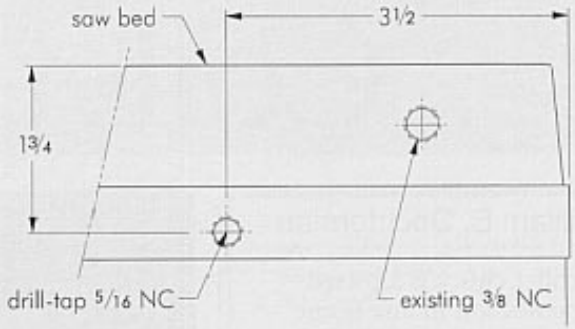


FIGURE 13
SAW BED MODIFICATION

have to machine a seat in your fitting. I didn't push for a super tight seal here because I didn't expect the cylinder to hold the saw frame up all night with no creep. Suit yourself with how picky you want to get with this.

The saw bed modification (*Figure 13*) simply shows where I located the hole in the saw bed to mount the head end of the cylinder. Tapping the hole allows the use of a jamb nut so the cylinder is free to rock on the bolt. The existing 3/8" NC hole cannot be used because the cylinder would then interfere with the work surface of the saw bed. At the cylinder clevis end, the hole in the saw frame fulcrum is as cast. I had to bush it with a piece of 3/8" copper tube to reduce the slop. *Some* slop is not a bother.

COMMISSIONING

The cylinder can be readied for operation on the bench or on the saw. The bench is easier. Fill the head and rod ends with auto transmission fluid and stroke the cylinder several times, refilling as necessary. This should evacuate all the air and the surge pot should continue to return to the same level. Retract the cylinder rod and fill the surge pot to within 1/2" from the top.

This design does not follow acceptable practice for hydraulic cylinders; O-rings are used for the piston and rod rather than chevron seals, and standard gasket material is used to seal the cylinder ends rather than O-rings. This is a low-pressure, light-duty cylinder so we can get away with it. A pressure gage installed in the rod end bleed port showed a maximum of 100 psig (I just wouldn't sit on the saw frame while the cylinder is supporting it). This device has been in use for over a year now performing as envisioned with no leakage.

Photos by Author

Tips & Tricks

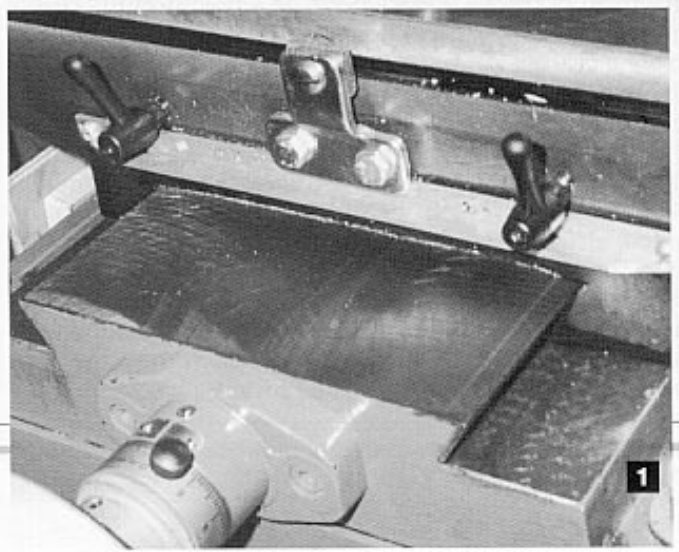
Helpful techniques from our readers

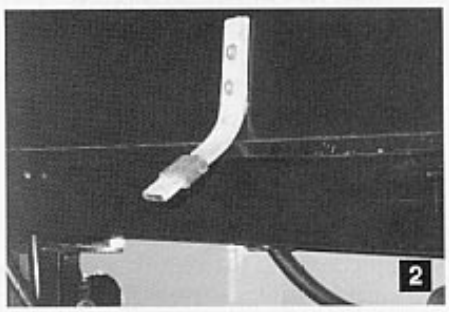
Mill-drill Improvements

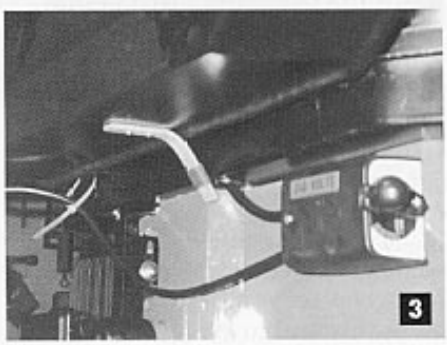
To keep my Y-axis dovetail clean and clear of chips, I developed a dovetail wiper (*Photo 1*). It features a piece of 2 × 11 × 1/8" neoprene secured by one piece of 1/8 × 1/8 × 1/8 × 11" aluminum angle.

Photos 2 and *3* show a stop for a hinged pulley cover. I made it from one piece of 5/8 × 1/8 × 5" steel bar pop riveted and bent to allow a 90°+ opening. A rubber tube sleeve eliminates any metal-to-metal contact.

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