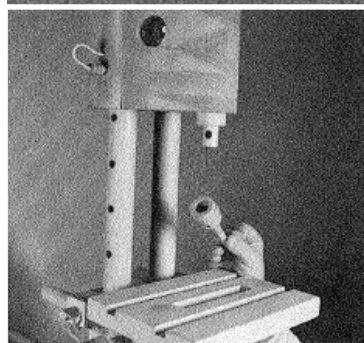
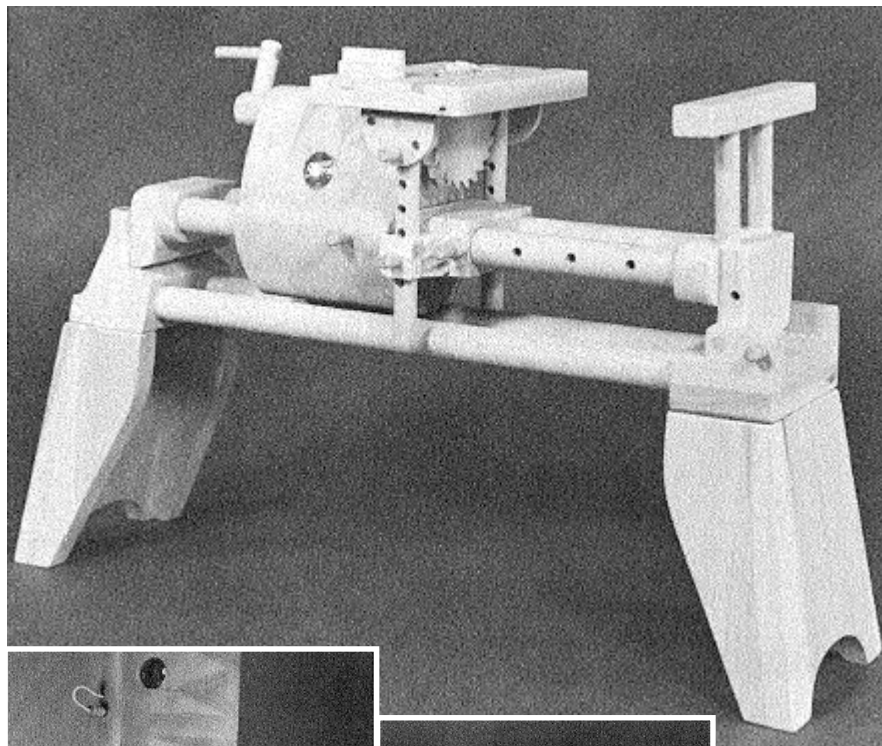


Shopsmith Mark .5

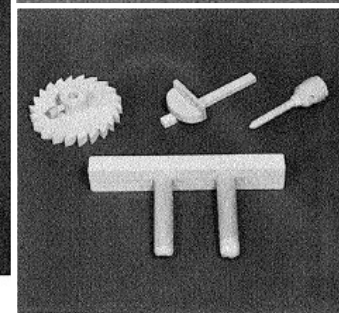
By Nick Engler and Jim McCann

In late summer of 1979, I had just published the very first issue on *Hands On!* magazine. It was an ambitious project, a one-advertiser magazine for Shopsmith, Inc. meant to show that the unique Shopsmith system – the multipurpose Mark V and its various accessories -- was as capable as a shop full of single-purpose tools. That first issue had been a back-breaker and it was evident that I needed help in the shop. Before I could hang out the help-wanted sign, a young man showed up with a woodworking portfolio that an experienced craftsman three times his age would have been proud of. Jim McCann joined our team and we got busy on the second issue.

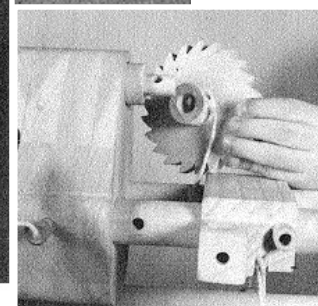
The November/December 1979 *Hands On!* – the Christmas issue – would be full of stuff for kids. I had designed about a dozen traditional wooden toys. About half-way through the build, someone remarked that we should have some toy tools. Jim and I immediately had the same idea: a toy Mark V! Trouble was, the issue was already packed tight. But I took the idea to Shopsmith Marketing anyway and they jumped on it. They would give the plan away at Shopsmith demonstrations during the Holidays. We designed the toy, and then Jim built it while I put the plans together. We decide to call it the Shopsmith Mark .5 – it was the first of many Shopsmith project plans.



Drill Chuck assembly



Accessories

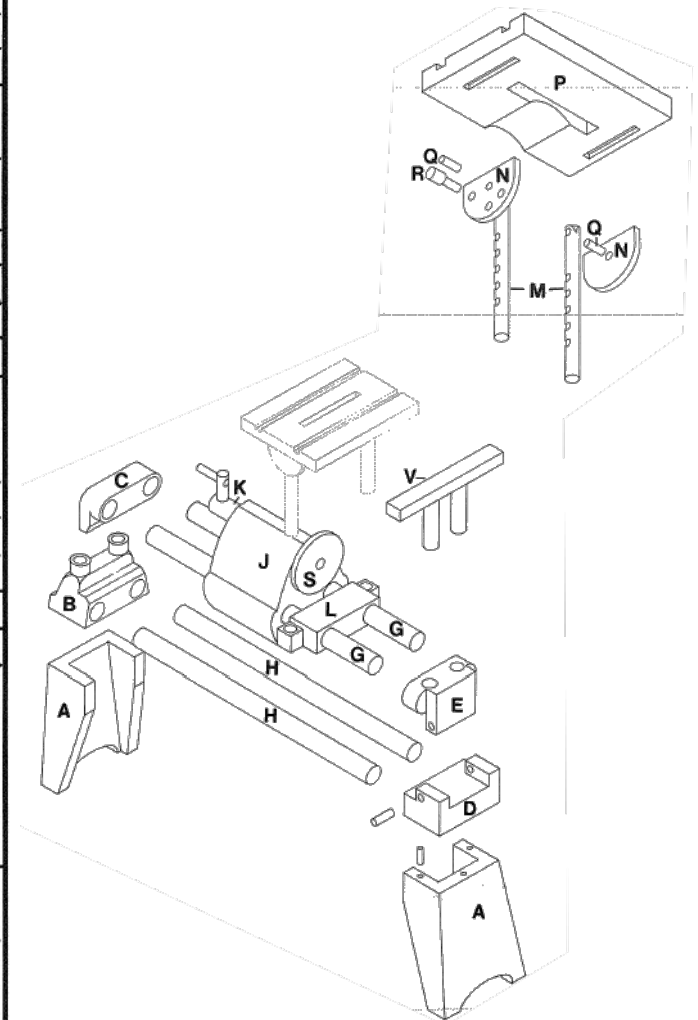


Saw Blade assembly



BILL OF MATERIALS

# PCS	DESCRIPTION	PART NAME	SIZE	# PCS
2	A Bench End	Face	3/4 x 6-1/2 x 7-1/2	2
		Side	3/4 x 3-1/2 x 7-1/2	4
1	B Headrest		3/4 x 3-1/2 x 4-1/2	4
1	C Tie Bar		3/4 x 2-1/2 x 3-3/4	2
1	D Pivot Arm Base	Bottom	3/4 x 2-3/4 x 3	2
		Side	3/4 x 2-1/8 x 2-3/4	2
1	E Pivot Arm	Front	3/4 x 1-1/2 x 4	2
		Back	3/4 x 2-5/8 x 3	1
2	F Hinge Pin		3/8 DIA. x 1-1/4	2
2	G Upper Ways		1" DIA. x 17-1/2	2
2	H Lower Ways		1" DIA. x 17-3/4	2
1	J Headstock		3/4 x 4-1/2 x 6	7
1	K Spindle Crank	Crank	1" DIA. x 7-1/2	1
		Arm	5/8 DIA. x 2	1
		Handle	3/8 DIA. x 2	1
1	L Carriage		3/4 x 2 x 5-1/2	2
2	M Vertical Table Support		5/8 DIA. x 6	1
2	N Protractor Tilt Stop		1/8 x 2-1/4 x 1-3/4	2
1	P Table		3/4 x 4-1/2 x 6-1/2	1
2	Q Pivot Pin		3/8 DIA. x 1-1/2	1
8	R Stop Pin	Saw Pin	3/8 DIA. x 3/4	1
		Table Support Pin	3/8 DIA. x 1"	2
		Headstock, Protractor & Carriage Pins	3/8 DIA. x 1-1/2	3
		Tie Bar Pin	3/8 DIA. x 2	1
		Pivot Arm Pin	1/2 DIA. x 1-1/2	1
1	S Saw Blade		3/16 x 3-1/2 x 3-1/2	2
1	T Drill Chuck		1" DIA. x 4-1/2	1
1	U Miter Gauge	Face	1/8 x 5/8 x 1-3/4	1
		Base	1/4 x 3/4 x 1-3/4	1
		Bar	1/4 x 3/8 x 4	1
1	V Extension Table	Legs	5/8 DIA. x 3-3/4	2
		Top	3/4 x 1 x 6-1/2	1

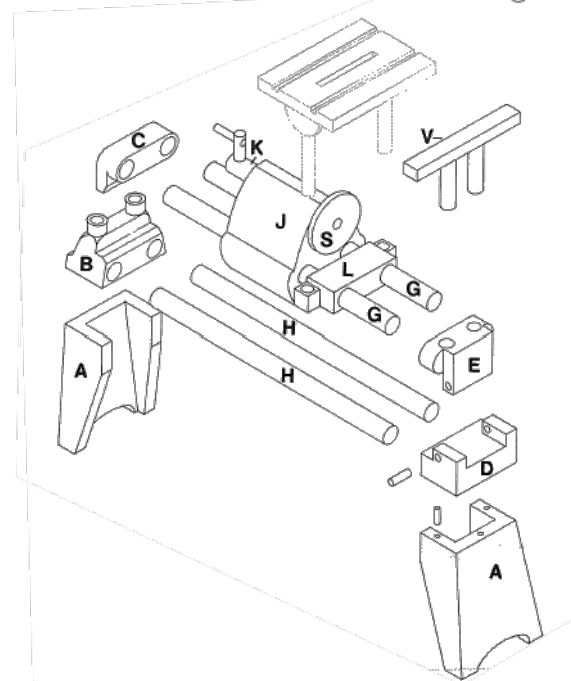
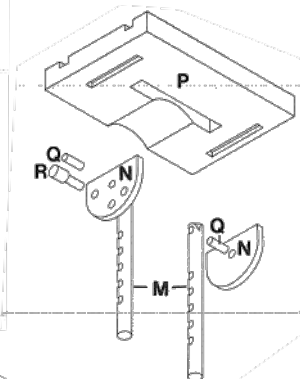


CONSTRUCTION PROCEDURE

1. Cut all stock to rough dimensions
2. Glue up stock for Headrest "B", Tie Bar "C", Pivot Arm Base "D", Pivot Arm "E", Headstock "J", and Carriage "L"
3. Bench End "A" — Make two, 6 pieces total
 - a. Cut angles on Bench End faces (2) and sides (4)
 - b. Cut contour on lower end of Bench End face
 - c. Assemble (w/glue), set aside
 - d. Round corner on Bench End sides (4)
 - e. (After dry) cut 10° angle on top and feet of Bench End "A"
 - f. Drill dowel holes for assembly in top of Bench Ends
4. Ways (Upper and Lower "G" & "H" — Two Each)
 - a. Cut to length
 - b. Turn Upper Ways "G" to 15/16" dia. — leaving 3/4" original diameter at ends
 - c. Mark and drill Stop Pin holes in Upper Way
5. Headrest "B"
 - a. Mark contours and centers of holes
 - b. Drill holes (small diameter first)
 - c. Cut contours
 - d. File and sand smooth
6. Tie Bar "C" (Same as #5)
7. Pivot Arm Base "D" (Same as #5) DO NOT drill Pivot Pin holes
8. Pivot Arm Base "E" (Same as #5) DO NOT drill Pivot Pin holes
9. Headstock "J" (Same as #5)
10. Carriage "L" (Same as #5)
11. Table "P"
 - a. Mark slots, grooves, and recessed areas
 - b. Machine slots, grooves and recessed areas
12. Protractor Tilt Stop "N"
 - a. Resaw lumber — 4 pieces 3/16" thick x 1-3/4" x 2-3/8"
 - b. Glue face to face with opposing grain pattern
 - c. Sand face and back to remove saw marks
 - d. Mark center lines for holes and rounded contour
 - e. Drill holes
 - f. Cut radius
 - g. Sand edges
13. Table Support Bar "M"
 - a. Cut to length
 - b. Drill Pivot Pin hole ONLY
 - c. Assemble Protractor Tilt Stop "N" to Bar "M" with Pivot Pin "G"
 - d. Drill Stop Pin hole using Protractor as guide
 - e. Remove Protractor and mark remaining holes
 - f. Drill remaining Stop Pin holes
 - g. Round top of Support Bar
14. Spindle Crank "K"
 - a. Cut 1" dowel to 1" over length
 - b. Turn spindle arbor, then cut off
 - c. Cut 3/8" and 1/4" dowels to length
 - d. Drill holes, small diameter first
 - e. Assemble
15. Stop Pins "R"
 - a. Cut dowel rod to 1" over length
 - b. Mount in chuck on lathe
 - c. Mark and turn shank
 - d. Score and chamfer knob
 - e. Cut off
16. Saw Blade "S"
 - a. Resaw stock to 3/16" thick (2 pieces)
 - b. Glue face-to-face, using opposing grain pattern
 - c. Mark center, major diameter, minor diameter, and teeth
 - d. Cut out teeth
 - e. Drill 1/2" arbor hole in coupler
 - f. Drill 1/4" Pin hole in Saw Arbor
 - g. Glue arbor coupling at center on back of Blade
 - h. Finish drilling 1/2" arbor hole through saw
17. Drill Chuck "T"
 - a. Cut dowel 1" over length
 - b. Mark and drill 3/16" chuck key holes
 - c. Mount on lathe and turn to contour given
 - d. Drill 1/2" arbor hole
18. Miter Gauge "U"
 - a. Cut stock to size
 - b. Round base piece
 - c. Assemble pieces w/glue
19. Extension Table "V"
 - a. Cut Table top to size
 - b. Mark and drill two holes in bottom of table
 - c. Cut dowels to length
 - d. Glue dowels in holes

20. Assembly

- a. Drill Pivot Pin holes in Pivot Arm Base "D" and Pivot Arm "E" while assembled in vertical position
- b. Round Pivoting Edge of Pivot Arm "E"
- c. Assemble Bench End "A" to Headrest "B" using dowels
- d. Assemble Bench End "A" to Pivot Arm Base "D" using dowels
- e. Glue Protractor Tilt Stops "N" in recess of Table "P"
- f. Glue Table Pivot Pins "G" into the Table Support Bar "M"
- g. Slide Headstock "J" and Carriage "L" on Upper Ways "G" and insert Pins
- h. Glue Upper and Lower Ways "G" & "H" in proper positions and clamp from both ends
- i. Slide in Spindle Crank "K" and attach Saw Blade "S"
- j. Slide in Table Assembly and pins. You now have completed your Mark .5! Easy, wasn't it?



MARK .5 CONSTRUCTION PROCEDURE

The miniature Mark V toy, the Mark .5 as we call it, appears at first glance to be a difficult project, but with closer examination, you will see all the pieces are relatively simple to build and assemble. There is a total of only 3-1/4 board feet of lumber in this toy. A board 7' long by 6-1/2" or 7" wide will be sufficient; along with three 1" dia., one 5/8" dia., and one 3/8" dia., dowel rods. The Mark .5 will take about forty hours to build.

To start this project you must cut to rough size all parts. (The rough dimensions can be found in the Bill of Materials - the finished dimensions are found in the detail drawings.)

First, glue up stock for the Headrest "B", Tie Bar "C", Pivot Arm Base "D". The grain pattern on the sides of the Pivot Arm Base "D" should be vertical. Also, glue up Pivot Arm "E", Headstock "J", and Carriage "L". Set these pieces aside to dry COMPLETELY before you start machining them.

Now, make the Bench Ends "A" (legs). Start by marking, then cutting the 7° angles on the Bench End faces. They can be cut on either the table saw, bandsaw, or by hand. Then cut the elliptical contour at the bottom of the face to form feet. Next, mark and cut the angles on the sides of the Bench End similarly to the way you cut the face angles, and then round the front corner of each leg. Assemble each bench end using glue and clamps to hold pieces in place. After the glue has dried, place bench ends face down on the table of your saw, adjust it to cut a 10° angle and cut both the top and feet so all pieces are flush and both Bench Ends are the same length. Now set your drill press and drill the three assembly pin holes in the top of each Bench End. You might need to make a 10° backup board to steady the Bench End while drilling.

Next, take care of the Upper Ways "G" and Lower Ways "H". Cut each piece exactly to length from as straight of a one-inch diameter dowel as you can find. Then turn down the center section of each of the Upper Ways to 15/16" diameter, leaving a 3/4" length of original diameter at each end of the dowel. Now, drill series of 1/4" holes 1/2" deep in one Upper Way EXACTLY on center. It is important to get the holes on center so the Stop Pins will work smoothly.

The Headrest "B", Tie Bar "C", Pivot Arm Base "D", Pivot Arm "E", Headstock "J", and Carriage "L" are all made using similar construction techniques. First, you must mark the outlines of the finished piece and the center lines of the holes drilled, being careful to mark all 1" holes accurately. Then the holes are drilled - small holes first. Again, drill the 1" holes EXACTLY where marked. Finally, the outside contours are cut into the blocks. When cutting out the Headrest "B" on a bandsaw, cut the front-to-back contours first and save your scraps to be taped back on the block to give a flat square surface on the sides to cut the left-to-right contours. (Front-to-back and left-to-right are the directions the blade is moving.) Finally, file and sand the pieces to their finished shape.

All that has to be done to the Table "P" is to mark and then machine the saw blade slot, the two miter gauge slots and the two recesses on the bottom for the Protractor Tilt Stop "N". The miter gauge slots can be cut with a dado head, a router, or with a back saw and then the scrap chiseled out. The saw slot and the two recesses can be cut with the router, mortiser, or with chisels.

Each Protractor Tilt Stop "N", for strength, must be made from two pieces sandwiched, or laminated, together with the grain of one piece running horizontally and the grain of the second running vertically. To accomplish this, the 3/4" lumber must be resawed or split into two pieces 3/16" thick. This resawing is done on the bandsaw usually, but can also be done carefully by hand with a back saw. Next, glue up the pieces needed as mentioned above. After drying, sand the rough saw marks from the surfaces and mark the center lines for the holes and the lower rounded contour. Next, drill the holes, cut the outside contour and then sand the edges smooth.

The Table Support Bars "M" are fairly simple pieces but, once again, accuracy is essential. First, cut the 5/8" dowel to

length, then drill a 1/4" hole EXACTLY on center, 1/4" from the end. Assemble the Protractor Tilt Stop "N" you just made with a Pivot Pin "G" to the front Table Support Bar. The lower Stop Pin hole gives you an exact mark to drill your Stop Pin hole in the Table Support Bar. This hole must be exactly on center so the table will set level. Remove the Protractor and Pivot Pin. Mark and drill the remaining Stop Pin holes, making sure the rest of the holes are EXACTLY in line with, and parallel to, the first two. Finally, round the top of the Table Support Bar "M" so the table will tilt.

Now, after that demanding piece, you can make one of the easiest. The Spindle Crank "K" has four dowel rods of four diameters and is self-explanatory. Be careful to turn the arbor exactly to the dimensions given so there will be no problem fitting the saw blade and the drill chuck to the crank. Do not drill the 1/4" Arbor Stop Pin hole yet.

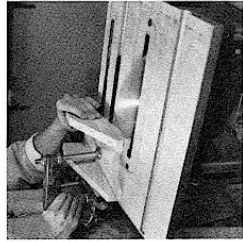
The various sized stop pins are the next task. There are eight pins of five different sizes. All the pins are made from 3/8" dia. dowel rod except for the Pivot Arm Locking Pin, which is turned from a 2-1/2" long piece of 1/2" dowel. To make the pins, mount the 1/2" drill chuck to the lathe headstock, cut the dowels one inch longer than drawings to allow room for chuck to grip dowel without marking the finished pin. Mark the shank on the outside end and the knob toward the drill chuck. Mark and score the knob using the skew. Then turn the shank to the exact dimension stated on the drawings. The shank dimension is important because if it is too loose the pins will fall from their holes, and if too tight a child won't be able to remove them easily. Finally, after the pin is turned properly, cut it off using your parting tool. To prevent loss of the small pins, drill a small hole in the knob to insert and glue a short piece of cord. This cord should be attached in a similar way to a location near to where the pin is used.

The saw blade is made from the same thin stock as the Protractor Tilt Stop "N" and glued with the same opposing grain pattern, giving added strength to the thin stock. After the wood is glued up, mark center, major diameter and minor diameter of saw teeth. Also, it might be handy to mark, for later reference, the position of the 1" saw arbor coupling. Now lay out the 18, 10° radial lines across the saw. Draw in the teeth, then cut out saw blade. Next cut a 3/4" long piece of 1" dowel and drill EXACTLY to the dimensions given the 1/4" stop pin hole. The 1/4" hole in the crank arbor and 1/4" hole in the saw blade coupler must line up exactly. This can be accomplished by drilling the 1/2" hole in the center of the coupler for the arbor, sliding the coupler over the arbor and drilling both 1/4" pin holes simultaneously. After this is accomplished, glue the coupler to the saw blade. After the glue has dried, complete drilling the 1/2" arbor hole through the blade.

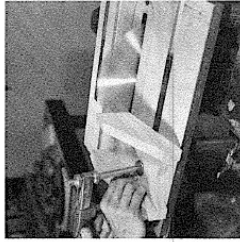
The drill chuck is turned from a piece of 1" dia. dowel, 4-1/2" long. All measurements and angles are given on the drawing. First, before turning, three 3/32" holes should be drilled evenly around the piece, 11/16" from the top of the chuck. These holes are strictly cosmetic and may be omitted. After turning, drill 1/2" hole for crank arbor.

The final two parts, the Miter Gauge "U" and the Extension Table "V" are made from your scraps and the drawings are self-explanatory.

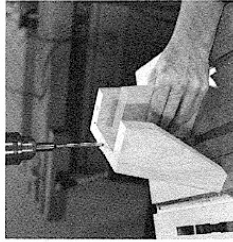
At this point, you have completed all nineteen construction steps and are ready to start assembly. The first assembly step is to drill the pivot pin holes in the Pivot Arm Base "D" and Pivot Arm "E". This is done with the two pieces clamped together and the Pivot Arm in the vertical position (lying down). After drilling, unclamp and round the pivoting edge of the Pivot Arm "E". Next, glue the Bench Ends "A" to their mating parts, the Headrest "B" and Pivot Arm Base "D", set aside and let dry. Now glue the Protractor Tilt Stop "N" into the recesses you cut into the bottom of the Table "P" and glue Table Pivot Pins into the Table Support Bar "M". You MUST slide the Carriage "L" and the Headstock "J" on the Upper Ways and insert their stop pins to hold the front Upper Way in proper alignment. Apply glue to the ends of all four ways and insert into their holes. Clamp this assembly with bar clamps running from end to end. After the glue dries, remove the clamps, insert the spindle, attach the blade w/pin, slide the Table Support Bars into the Carriage, put the pins in place and you are finished!



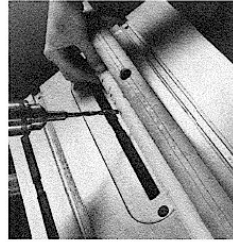
Cutting 10° angle of Bench End Feet



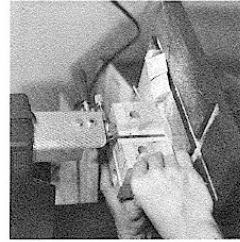
Cutting 10° angle of Bench End Top



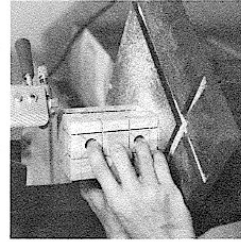
Drilling Assembly Pin Holes



Drilling Upper Way Pin Holes



Primary compound cutting of Headrest



Secondary sawing of Headrest

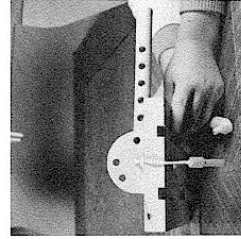
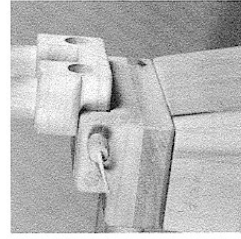


Table Support Bar alignment



Pivot Arm and Base assembly

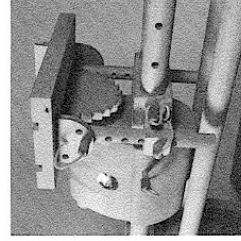
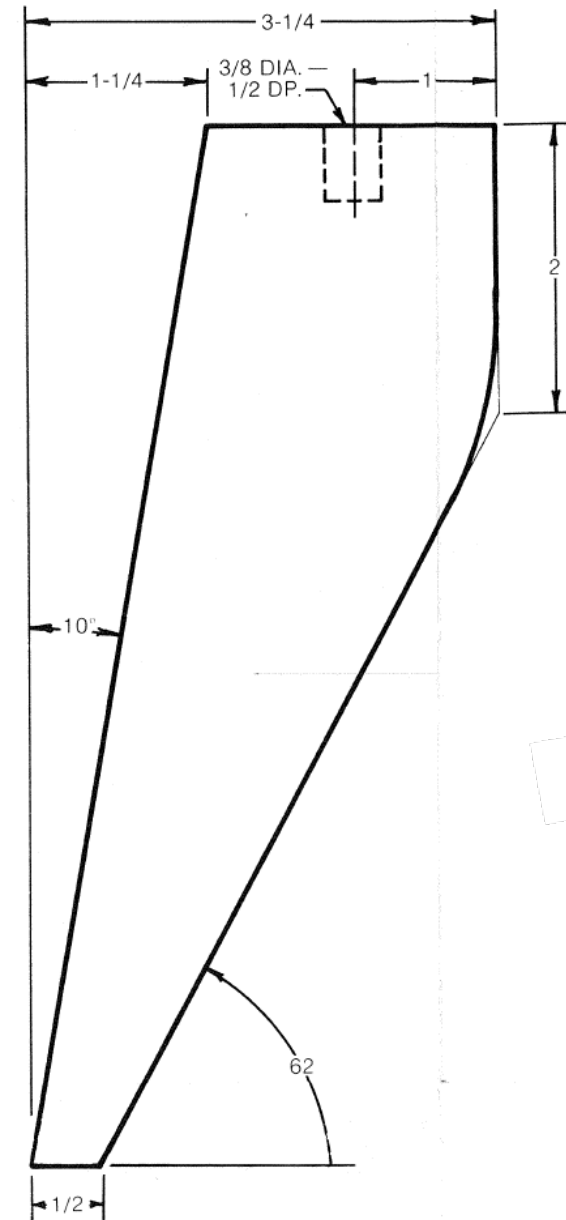
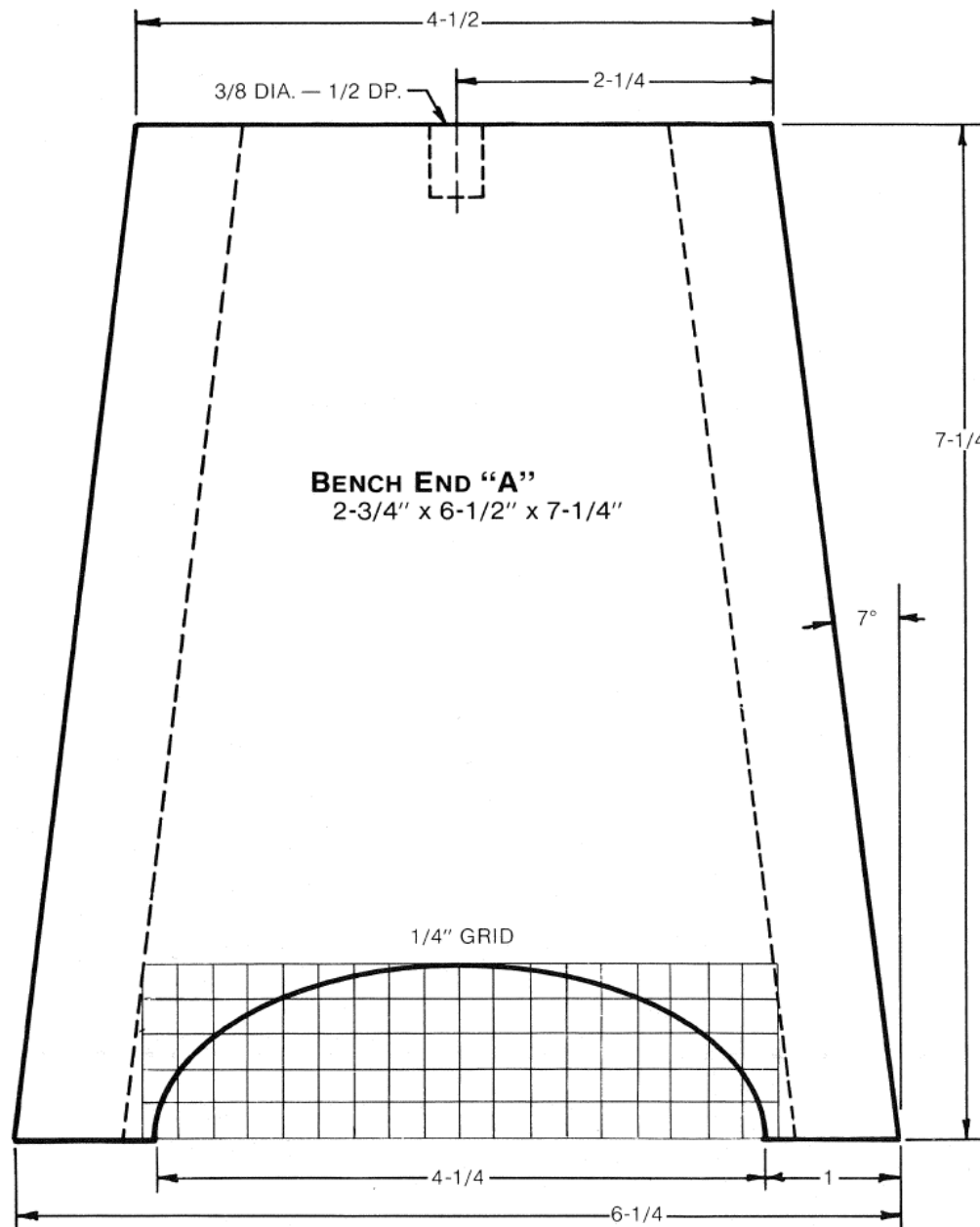
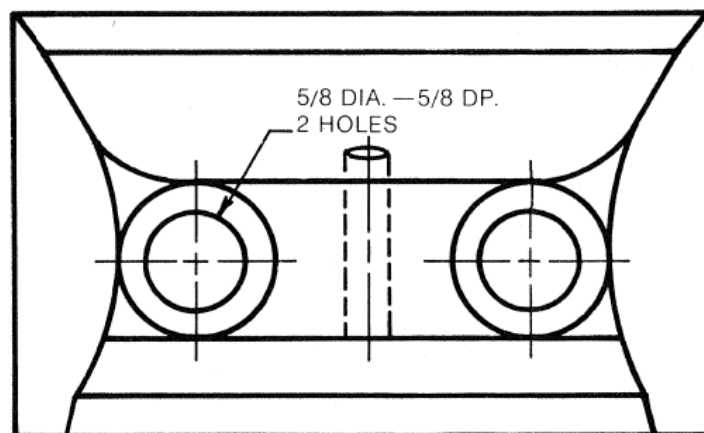
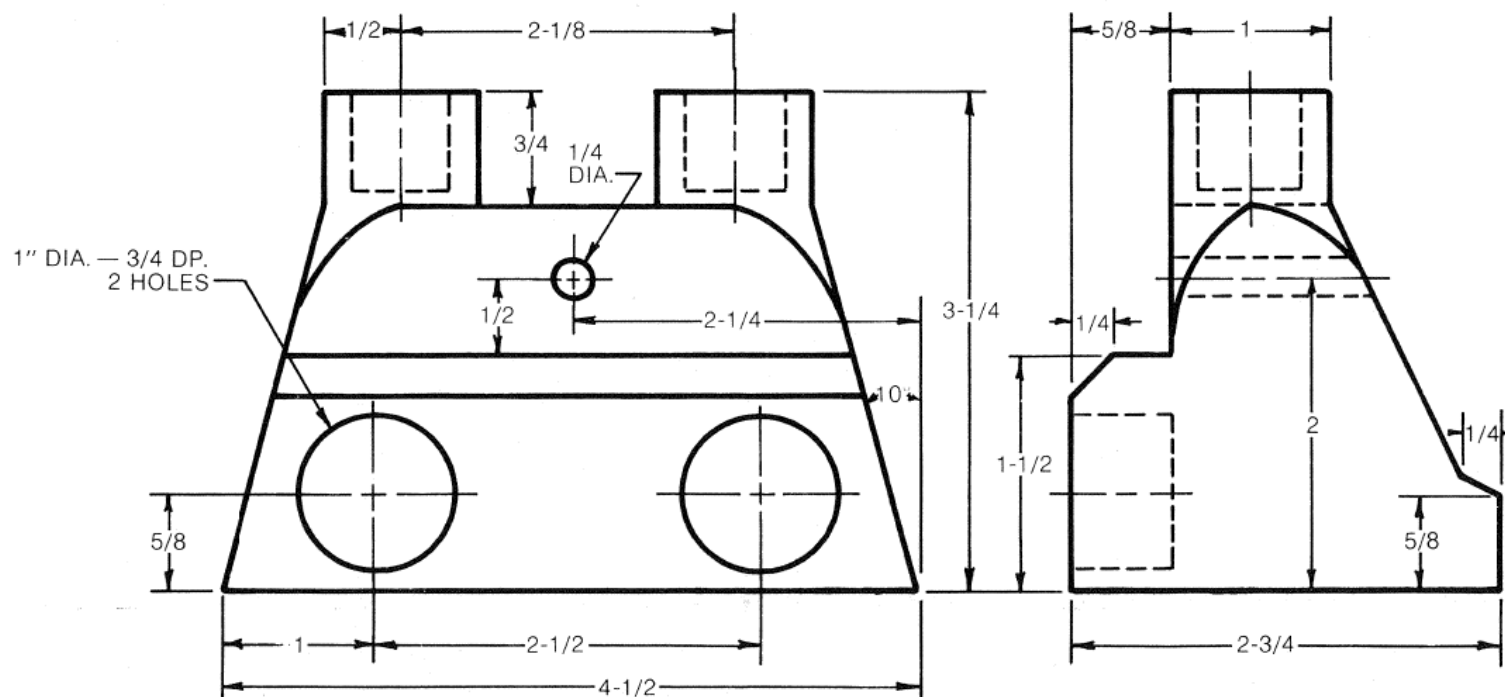


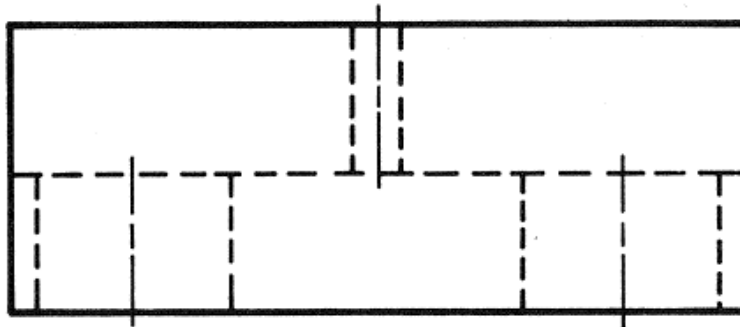
Table and Carriage assembly



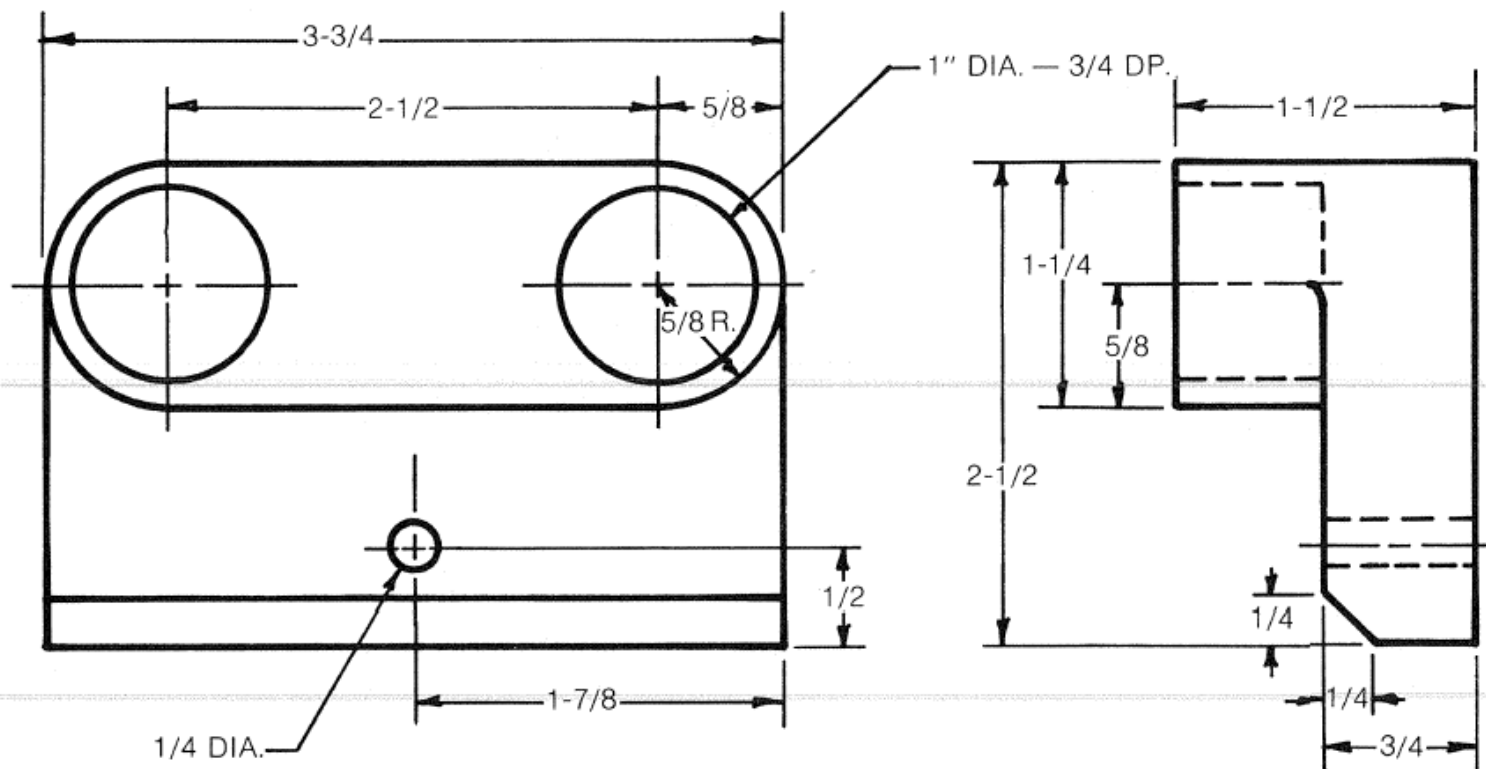


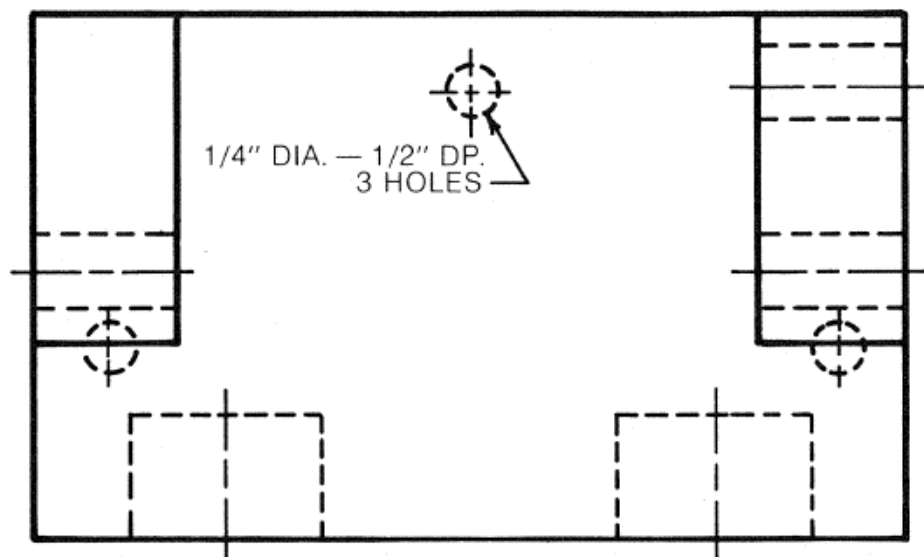
HEADREST "B"
2-3/4" x 3-1/4" x 4-1/2"



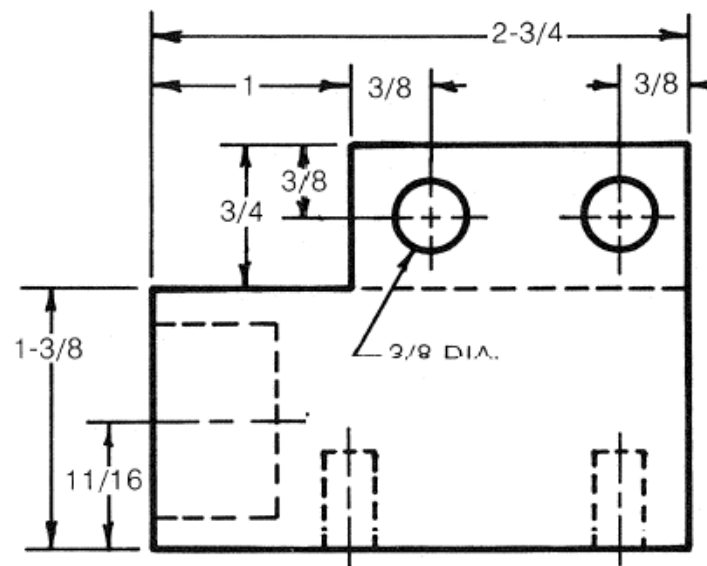
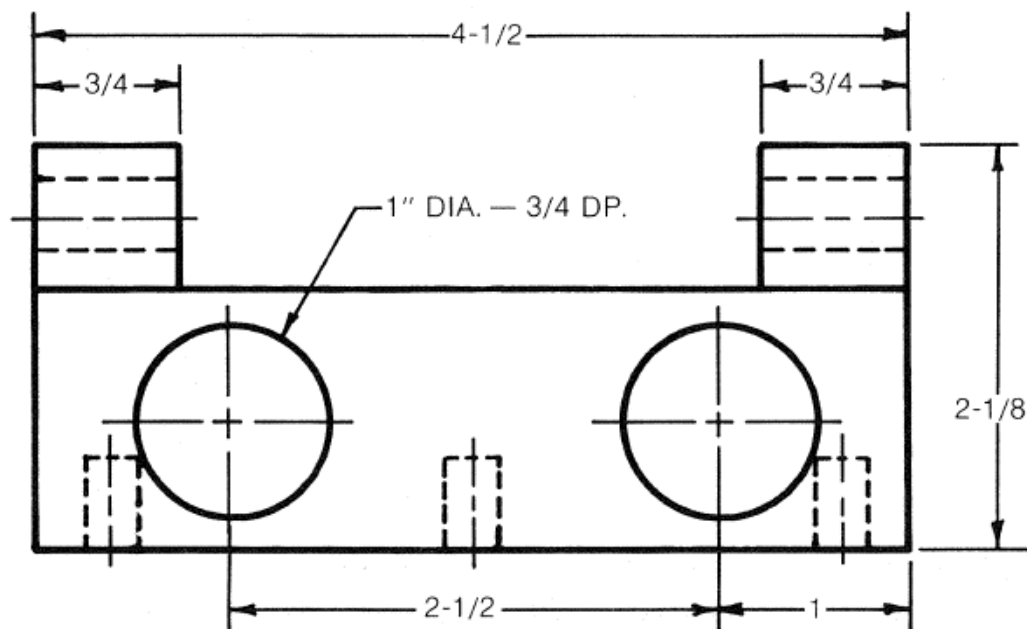


TIE BAR "C"
1-1/2" x 2-1/2" x 3-3/4"

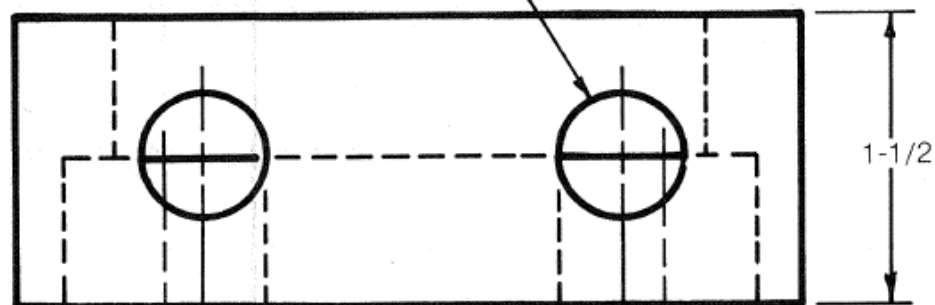




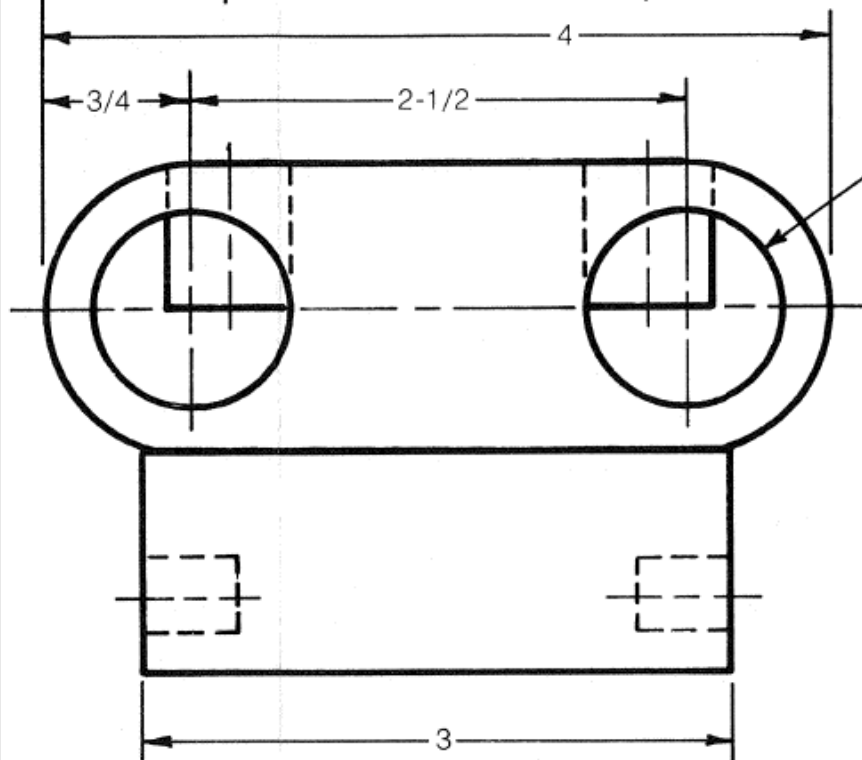
PIVOT ARM BASE "D"
2-1/8" x 2-3/4" x 4-1/2"



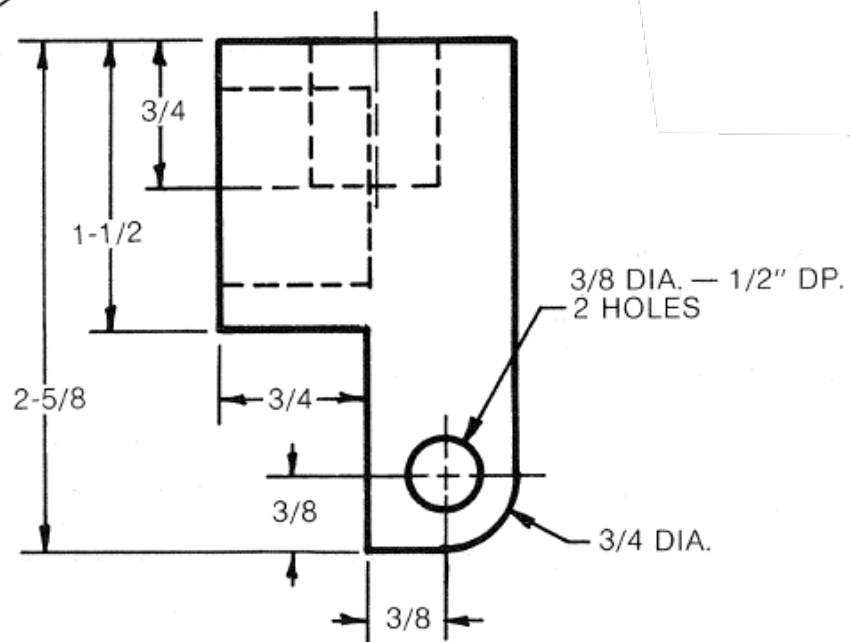
5/8 DIA. — 3/4 DP. 2 HOLES

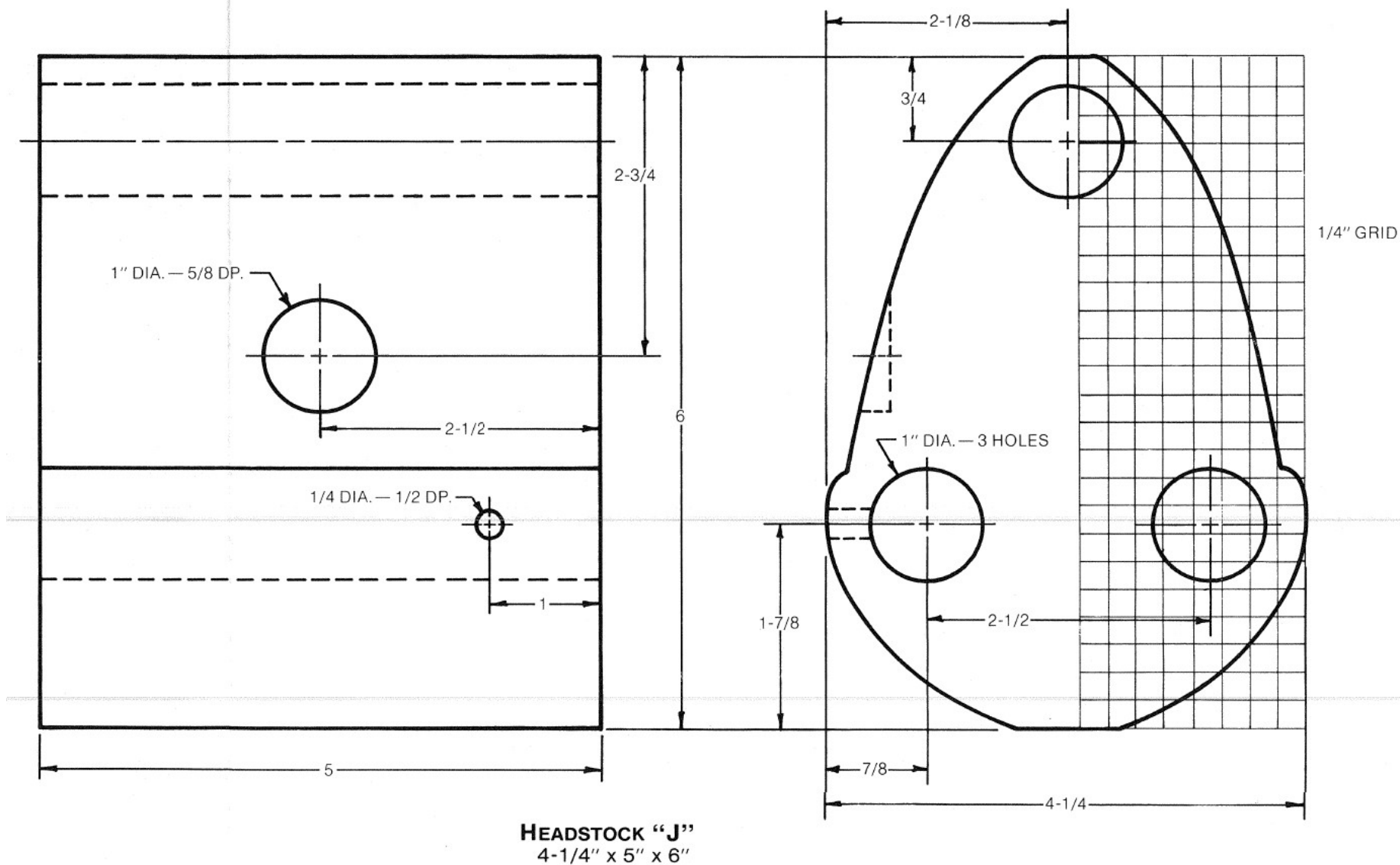


PIVOT ARM "E"
2-1/8" x 2-3/4" x 4"

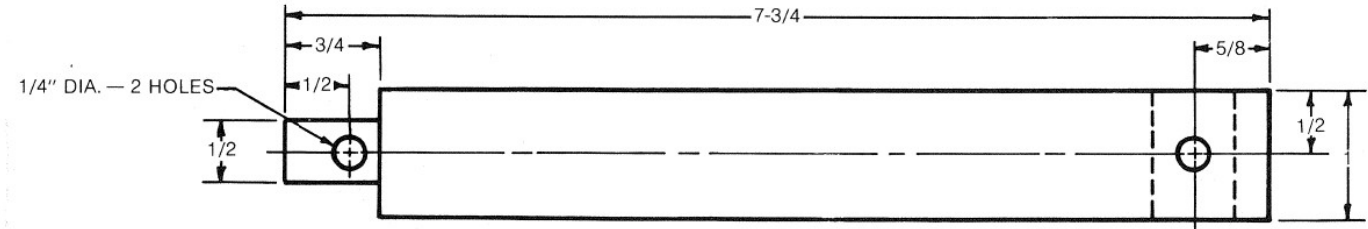
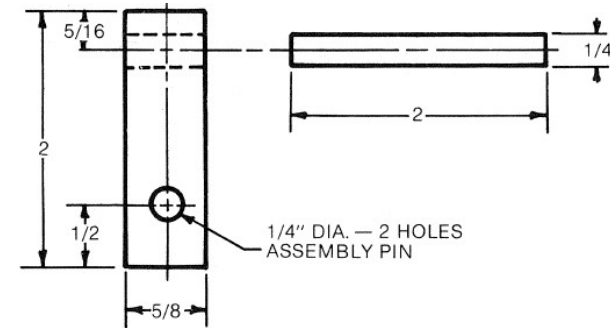


1" DIA. — 3/4 DP. 2 HOLES

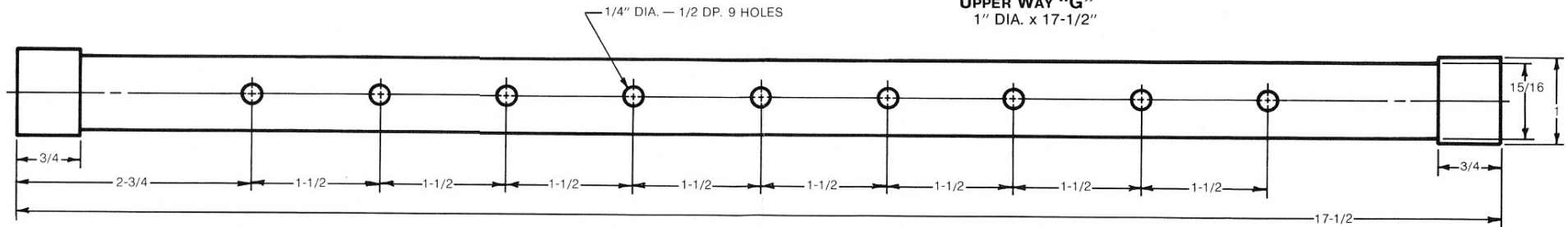


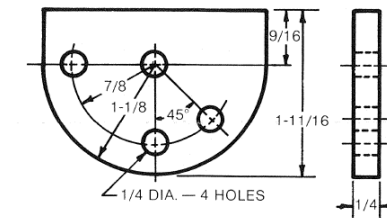
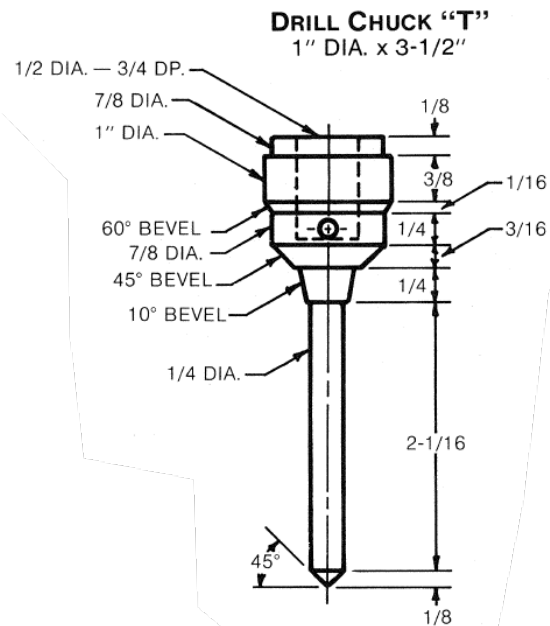


SPINDLE CRANK "K"
7-3/4" x 2" ASSEMBLED

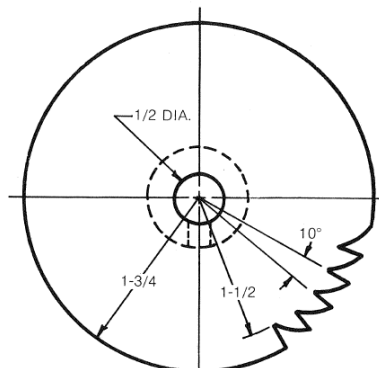


UPPER WAY "G"
1" DIA. x 17-1/2"

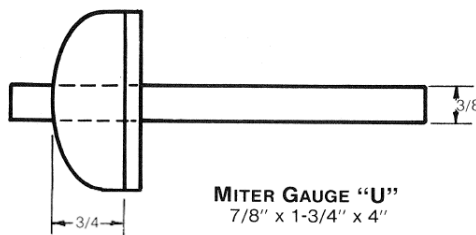




PROTRACTOR TILT STOP "N"
1/4" x 1-11/16" x 2-1/4"



SAW BLADES "S"
1/4" x 3-1/4" DIA.



MITER GAUGE "U"
7/8" x 1-3/4" x 4"

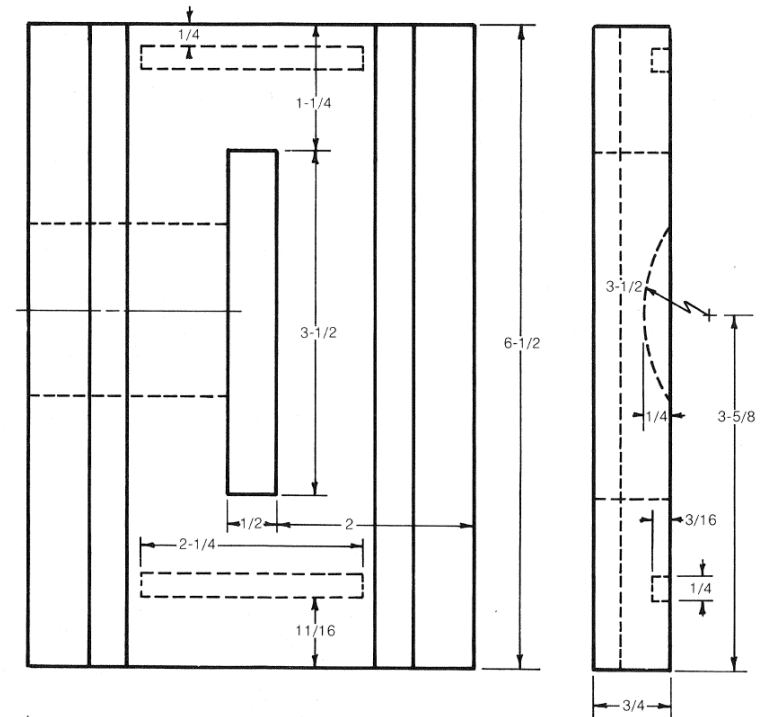
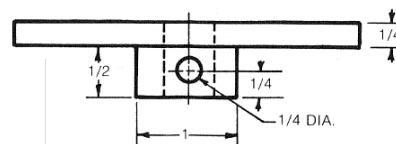


TABLE "P"
3/4" x 4-1/2" x 6-1/2"

