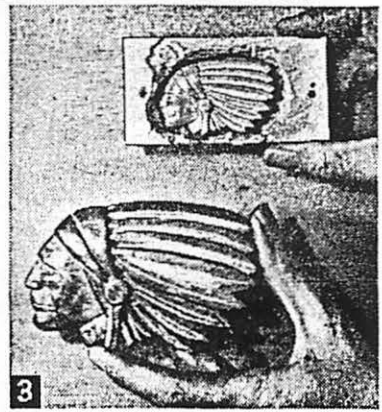
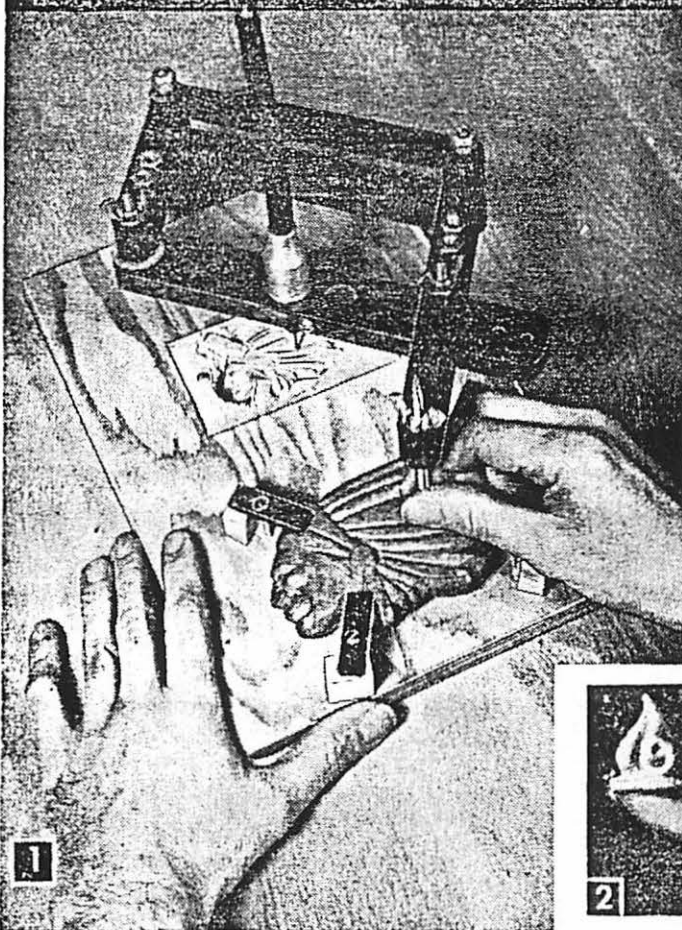
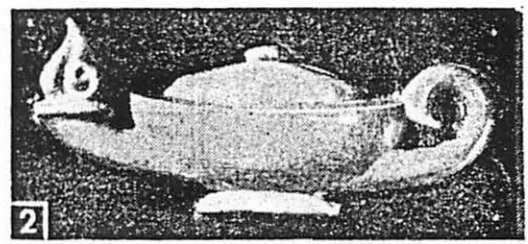


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FREE Blueprint

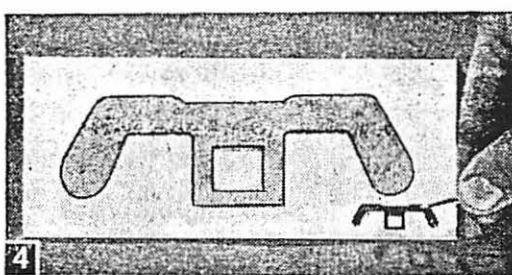


Above, comparison of Indian head master and finished birch carving.



Left, pantograph being used to carve head from master pattern to one-half actual size. Right below, Aladdin's lamp master pattern, and above it, 1/4-size ebony wood brooch and 1/2-size wood carving made by the pantograph from the master carving.

Making and Using a Carving Pantograph



Small electrical part for model railroad made with pantograph from 4 to 1 cardboard pasteup. Making parts this way frequently saves industry the cost of expensive blanking dies until final designs are approved.

THE photos shown here and on page 141 are only a few samples of the type of reduced size, three-dimensional carvings you can make with this \$10 duplicator.

Such pantographs are ideal for carving templates, brass molds for plastic injection molding, name plates, and form dies for small ornamental metal parts. Jewelers use pantographs for engraving tiny lettering and signatures. HO-gage model railroaders can make highly detailed models up to four times gage size, and then pantograph-carve them down to gage size very accurately.

It is an ideal tool for linoleum block carving

Continued on page 141

How to build a...

3-D CARVING PANTOGRAPH

You can make accurate reduction carvings from almost any three-dimensional object within the moving limits of this comparatively simple pantograph carving machine.

You may either build the pantograph from scratch or assemble it from a kit of pre-cut and finished parts. The kit includes fully-machined rock maple arms protected with a warp-resistant ebony finish, all hardware washers, the stylus and a professional router bit tapered to match stylus, with all bearings ready for lubrication and assembly. You may obtain the complete kit from Bench-Craft, Dept. SM, Rolling Meadows, Illinois, for \$9.75 plus 25¢ for postage. The kit does not include the plywood bed (which you can make from scrap) and, of course, the powered hand grinder or flexible shaft.

To build this pantograph accurately from scratch, you will need to have access to a good circular saw and drill press, a sharp letter "D"-size drill, a left-hand 1/4-in. spiral reamer, a 15/32-in. counterbore with 1/4-in. pilot, and a circle cutter with 1/4-in. pilot drill.

Make the Bed from 5/8-in. fir plywood. Since it is a work surface to which you will screw fasten many projects, don't finish or polish it.

From "rock" maple (required for accuracy), carefully saw the various arms and brackets to shape. Then, starting with the pivot block, carefully drill and counterbore the holes shown. Although the patterns were drawn full scale for your convenience, it's wise to actually check all dimensions, in case slight alterations have occurred when the plans were printed.

Drilling the arms requires the utmost accuracy. For best results, lay out a template on a piece of 1/8 x 3/4-in. steel or aluminum bar stock for the locations of the various holes in the individual arms. Clamp the template in place on one arm, then with the letter "D" drill, drill the end hole and insert a 1/4-in. bolt. Drill the hole in the opposite end and insert another 1/4-in. bolt. Then drill the rest of the

holes in that arm. Drill the various holes in the other arms similarly, using the template for accuracy.

This pantograph can be adapted to almost any flexible shaft or small hand grinder with a straight shank and an rpm between 7,500 to 27,000. Just adjust the large hole in the tool holding bar for a snug fit on the tool you plan to use. By cutting a slot to a smaller hole and using a nut and bolt (see Motor Bar drawing) the carving tool can be clamped securely in this bar.

Swab the bearing holes in the arms with SAE 20 oil. Then ream all bearing holes with the left hand 1/4-in. spiral reamer. Then re-oil the reamed holes and allow to stand for two days. Repeat this process three times. This will saturate each bearing with oil and give satisfactory bearings for accurate carving.

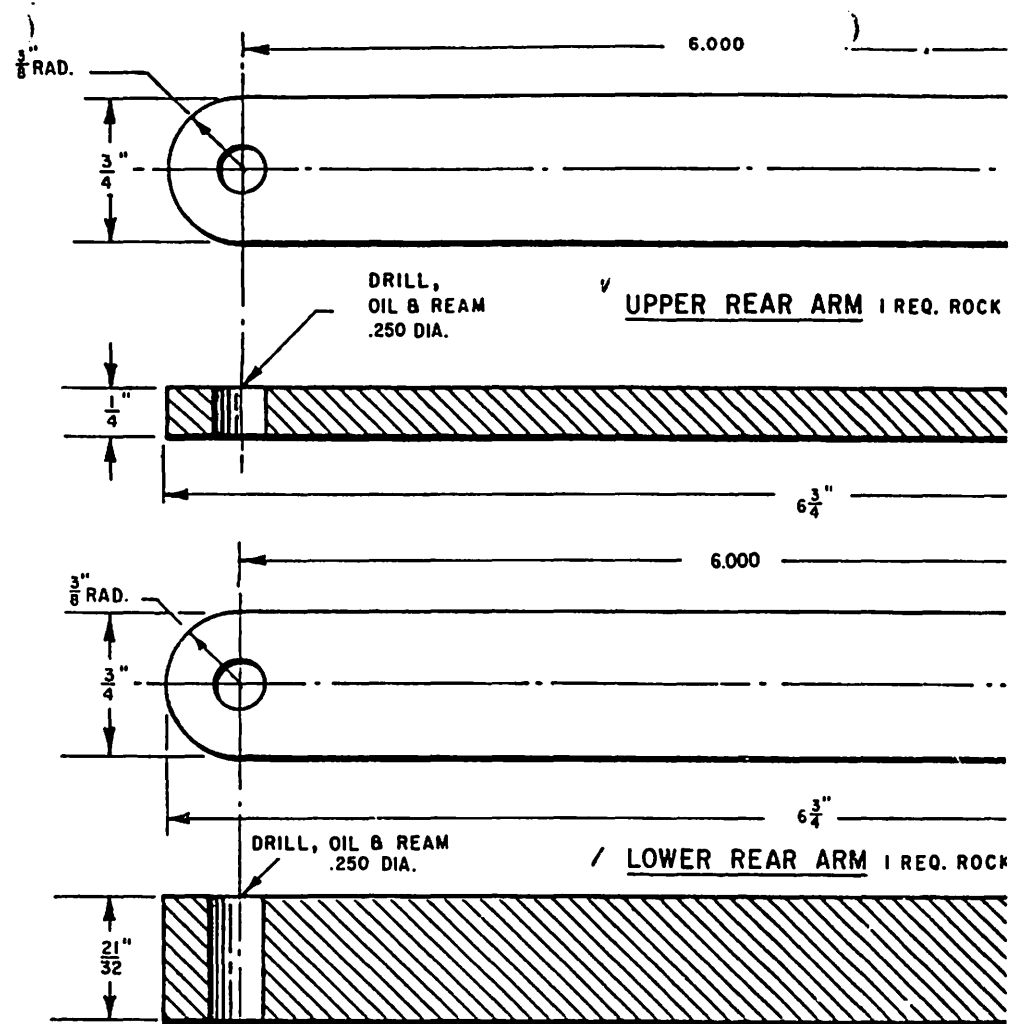
Insert all of the 1/4-in. bolts and nuts that must be press-fitted into the arms. To seat the parts, tap lightly with a small hammer. Re-swab holes heavily with oil and assemble all but the motor bar. Add a drop of oil on each nylon washer at assembly.

Adjusting the Arms. Starting with the hinge, adjust bolt so hinge will work snugly without sticking. Carefully adjust bolts in each arm individually so that the arms work snugly without binding. If arms are too tight, they will not move; if too loose, they will cause sloppy work. After the arms are adjusted they should not require readjustment for various reduction settings.

Attach the motor bar and make final adjustments at the motor bar only. Add the flexible shaft and stylus and you are ready to go to work.

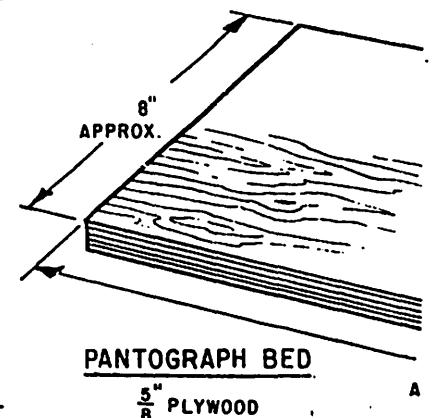
Make the Stylus from 1/4-in. -20 threaded rod, tapering one end for a fine point cutter and rounding the other end for ball-shaped cutters.

If nylon washers and lock nuts are not available, you may obtain a complete set of 12 washers, three nuts and a tracing stylus by sending \$1 to Bench-Craft, Dept. SM, Rolling Meadows, Illinois.



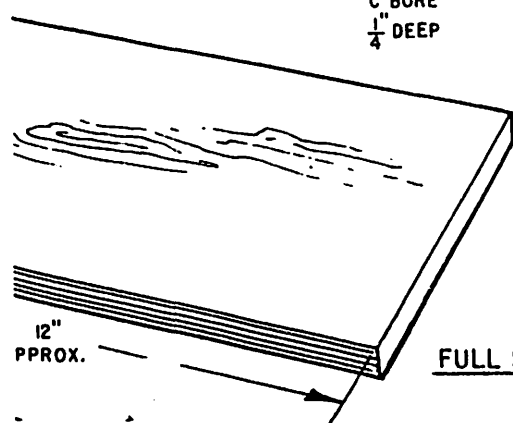
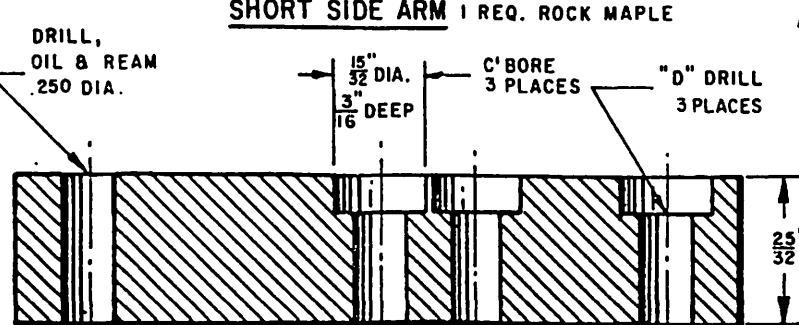
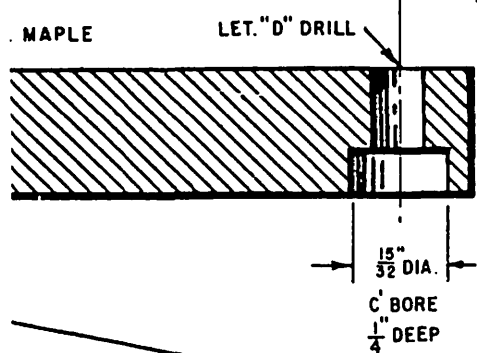
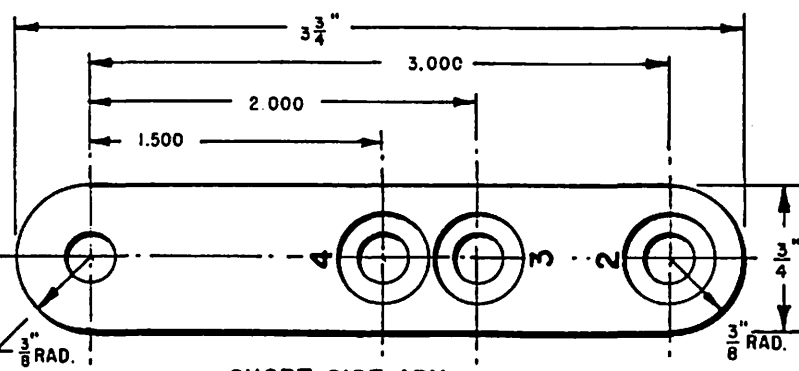
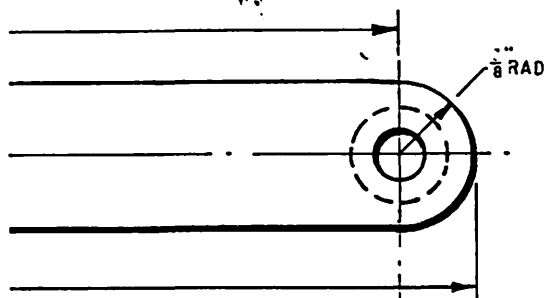
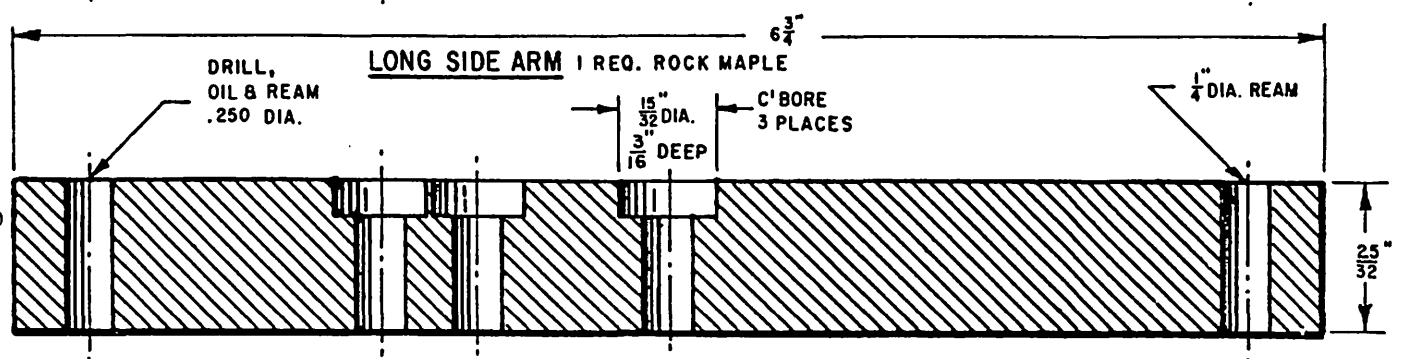
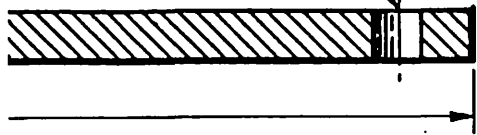
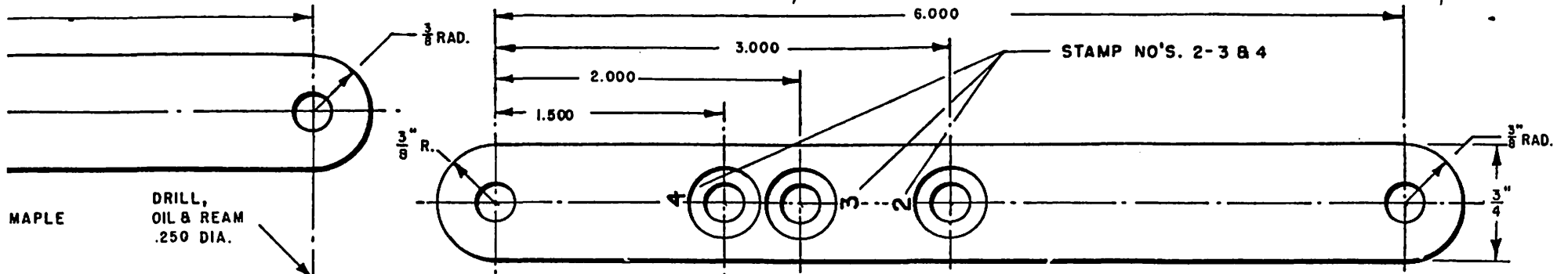
MATERIALS LIST — CARVING PANTOGRAPH

No. Req'd	Size and Description
2	1 1/8" O.D. x 17/64 I.D. x .060 thick 1" dia. nylon washer
10	9/16 O.D. x 17/16 I.D. x .060 thick nylon washer
2	9/16 O.D. x 9/32 I.D. x 3/64 thick steel washer
3	1/4" A.S.A. medium lock washer
3	1/4" 20 N.C. lock nut (plastic insert)
7	1/4" 20 N.C. standard hex nut
3	1/4" 20 N.C. standard wing nut
1	8-32 N.C. standard hex nut
2	1/4" 20 x 1 1/4" N.C. hex head cap screw
1	1/4" 20 x 2" N.C. hex head cap screw
1	1/4" 20 x 2 3/4" N.C. hex head cap screw
1	1/4" 20 x 3" N.C. hex head cap screw
1	6-32 x 1 1/4" rh machine screw
2	#8 x 1 1/4" rh wood screw
1	1/4" -20 x 4" threaded rod
Lumber Required	
1	1 x 6 x 14" clear rock maple — planed two sides to 3/4" thick
1	5/8 x 8 x 12" fir plywood — good one side
Cut clamps and blocks from scrap maple as needed	

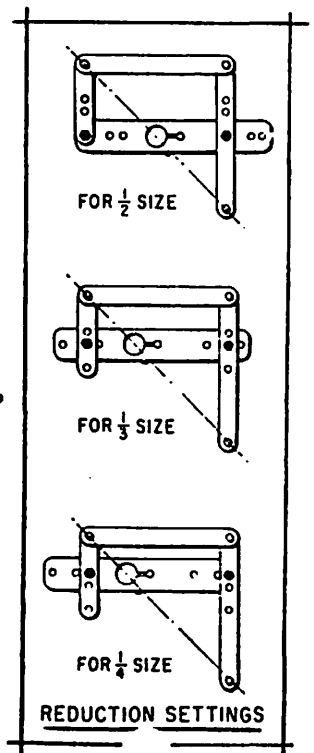
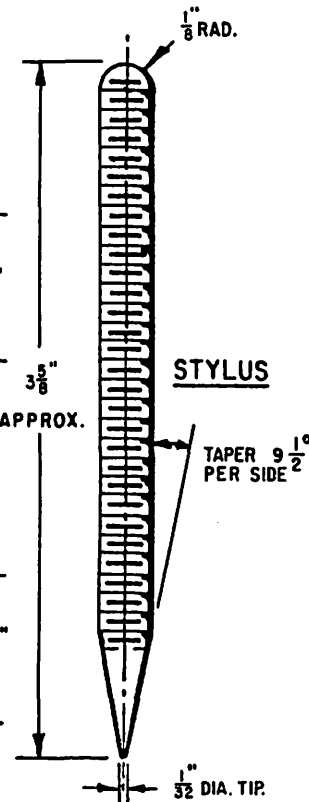


PANTOGRAPH BED

5/8 PLYWOOD



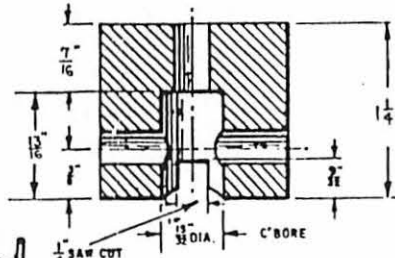
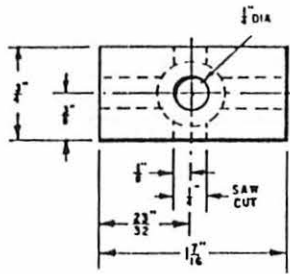
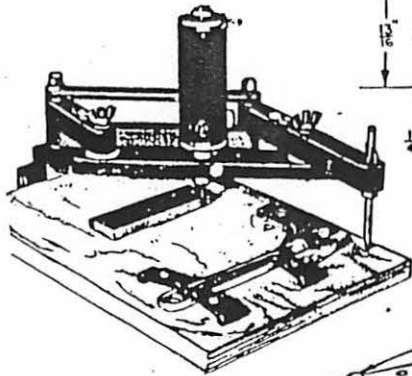
FULL SIZE ARM PATTERNS BUT SCALE DIMENSIONS TO INSURE ACCURACY



3-D Carving Pantograph

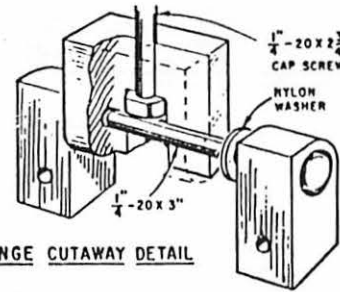
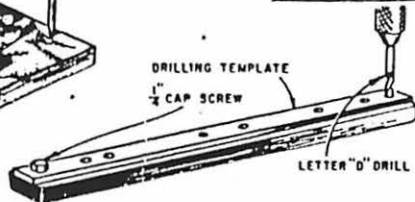
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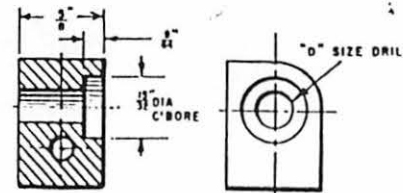


HINGE BLOCK 1 REQ. (ROCK MAPLE)

DRILLING DETAIL

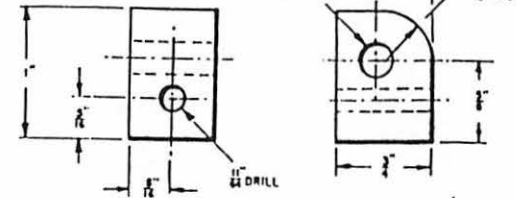


HINGE CUTAWAY DETAIL

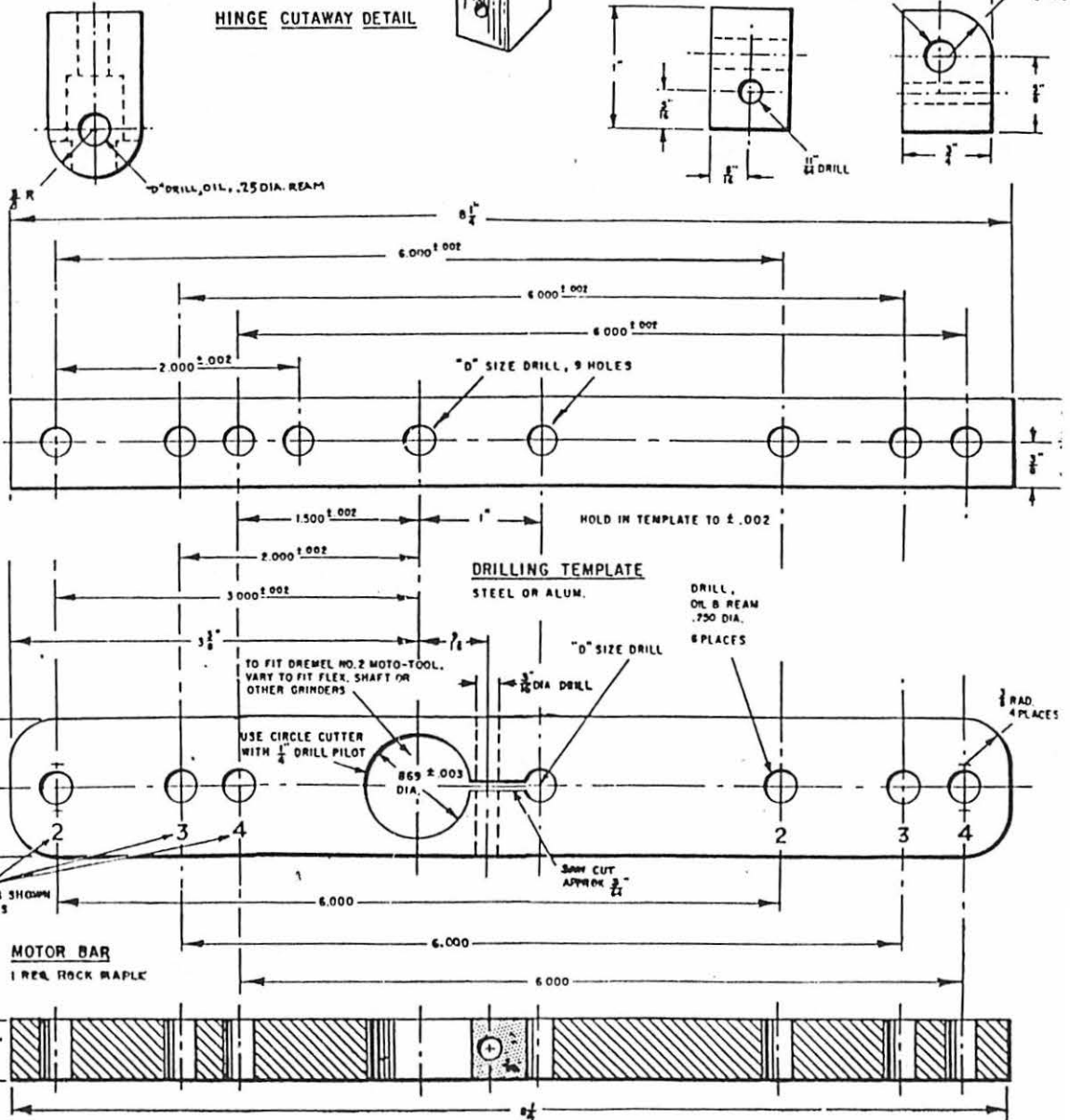
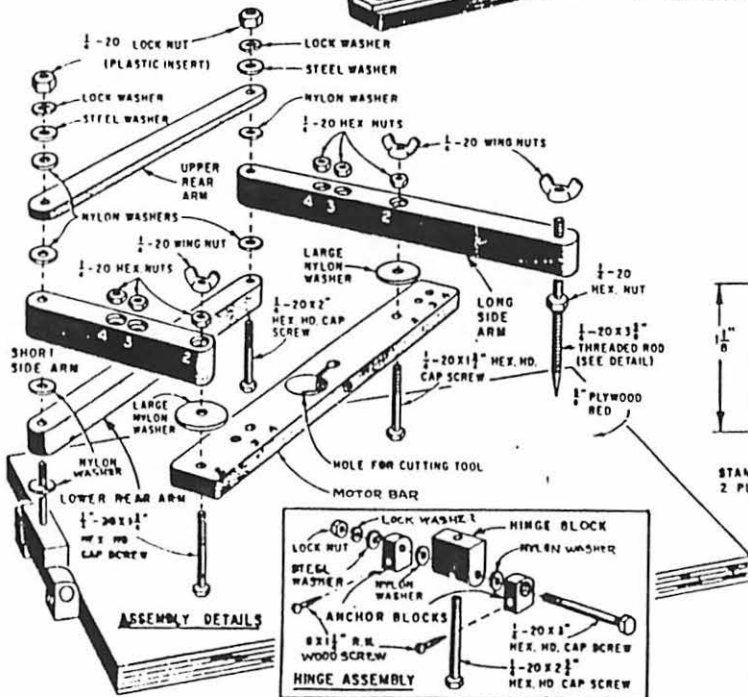


ANCHOR BLOCKS

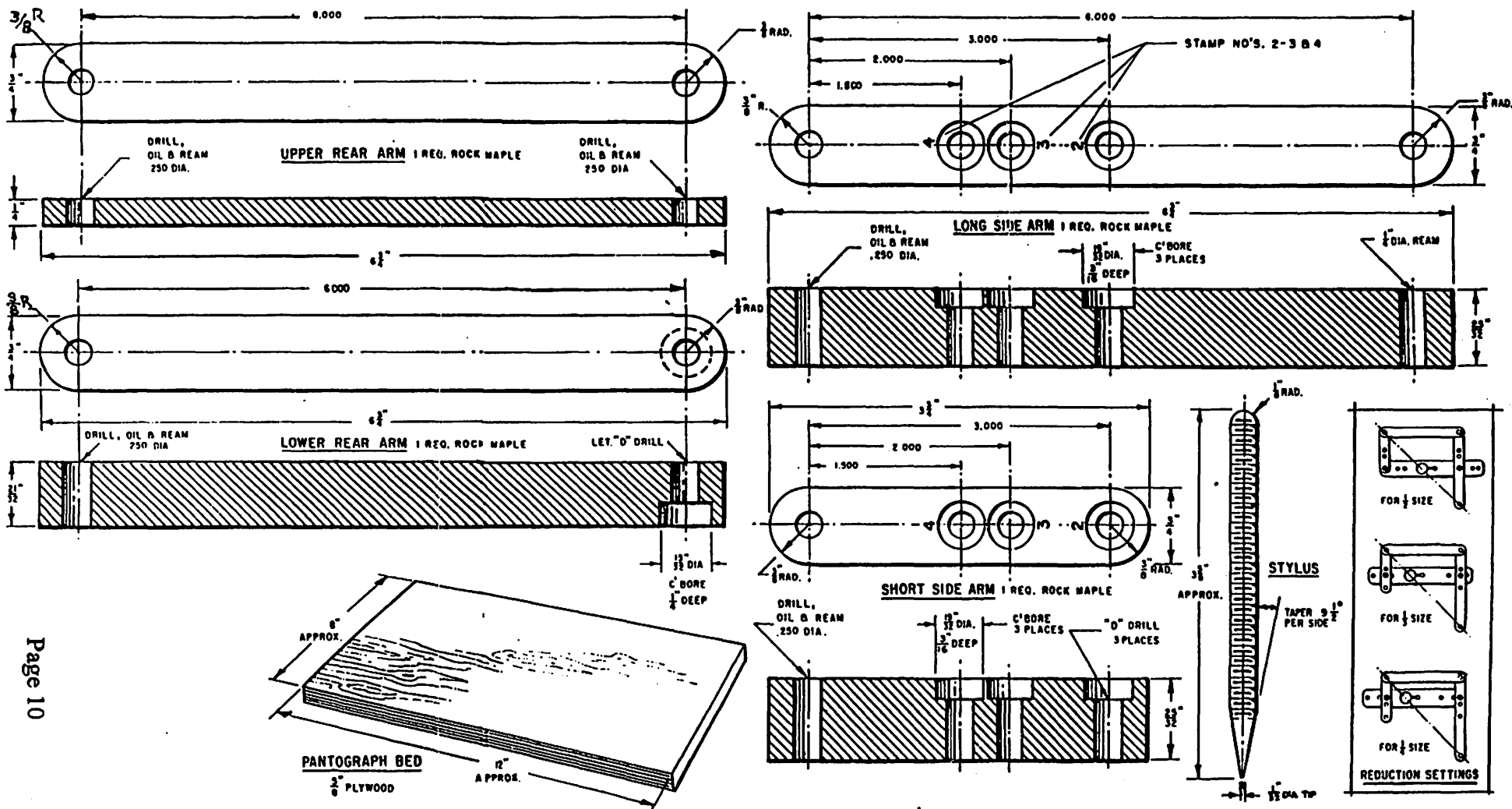
2 REQ. (ROCK MAPLE) "D" DRILL



Page 9



3-D Carving Pantograph



Page 10

MATERIALS LIST — CARVING PANTOGRAPH

No. Req'd	Size and Description	No. Req'd	Size and Description	No. Req'd	Size and Description
2	1 1/8" O.D. x 17/64" I.D. x .060 thick 1" dia. nylon washer	2	1/4" - 20 x 1 3/4" N.C. hex head cap screw	1	1 x 6 x 14" clear rock maple — planed two sides to 3/4" thick
10	9/16" O.D. x 17/16" I.D. x .060 thick nylon washer	1	1/4" - 20 x 2" N.C. hex head cap screw	1	3/8 x 5 x 12" fir plywood — good one side
2	9/16" O.D. x 9/32" I.D. x 3/64" thick steel washer	1	1/4" - 20 x 2 3/4" N.C. hex head cap screw		Cut clamps and blocks from scrap maple as needed
3	1/4" A.S.A. medium lock washer	1	1/4" - 20 x 3" N.C. hex head cap screw		
3	1/4" 20 N.C. lock nut (plastic insert)	1	8-32 x 1 1/4" rh machine screw		
7	1/4" 20 N.C. standard hex nut	2	3/8 x 1 1/4" rh wood screw		
3	1/4" 20 N.C. standard hex nut	1	1/4" - 20 x 4" threaded rod		
1	8-32 N.C. standard hex nut				

Lumber Required

- 1 1 x 6 x 14" clear rock maple — planed two sides to 3/4" thick
 - 1 3/8 x 5 x 12" fir plywood — good one side
- Cut clamps and blocks from scrap maple as needed