
VITA TECHNICAL BULLETIN

GRAIN MILL FOR HOME USE

by

Walter B. Booher

The grinder detailed here is made almost entirely of 1" lumber and can be constructed easily by someone used to working with wood. It will grind corn, wheat and other grains to coarse or fine texture.

The designer of this grain mill, Walter B. Booher, has been a VITA Volunteer for 11 years. For some time Booher, who has been a machine shop tool designer and high school teacher, owned and operated a small factory. Now retired, Booher remains an active technical participant in VITA programs.

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HAND-POWERED GRAIN MILL

TOOLS AND MATERIALS

Tools - Materials -
Hammer 12 feet of 1" x 6" seasoned sheathing
Hand cross cut saw lumber
Auger brace and 1/4, 1/2 and 7/8 2 feet 1" x 10" sheathing lumber
inch auger bits 2 feet 2" x 8" framing lumber
Round file 3 feet 2" x 4" framing lumber
Coping saw or key hole saw 1 piece 1/2" x 14" cold rolled steel
Breast drill and 1/8" twist drill 12 - 1 1/2" x 8" flat head wood
One flat file screws
One-three corner file 3 - 1/2" steel washers
1/2" x 13" die and die handle 4 - 1" x 4" carriage bolts

5/61" die 1 - 1/2" wing nut
Wood chisel 1 - 3/8" x 5" carriage bolt
Half round wood file 2 - 1" thick flat stones large
Tin shears enough to scribe a 4 1/2"
Screw driver disc

<Fig. 1>

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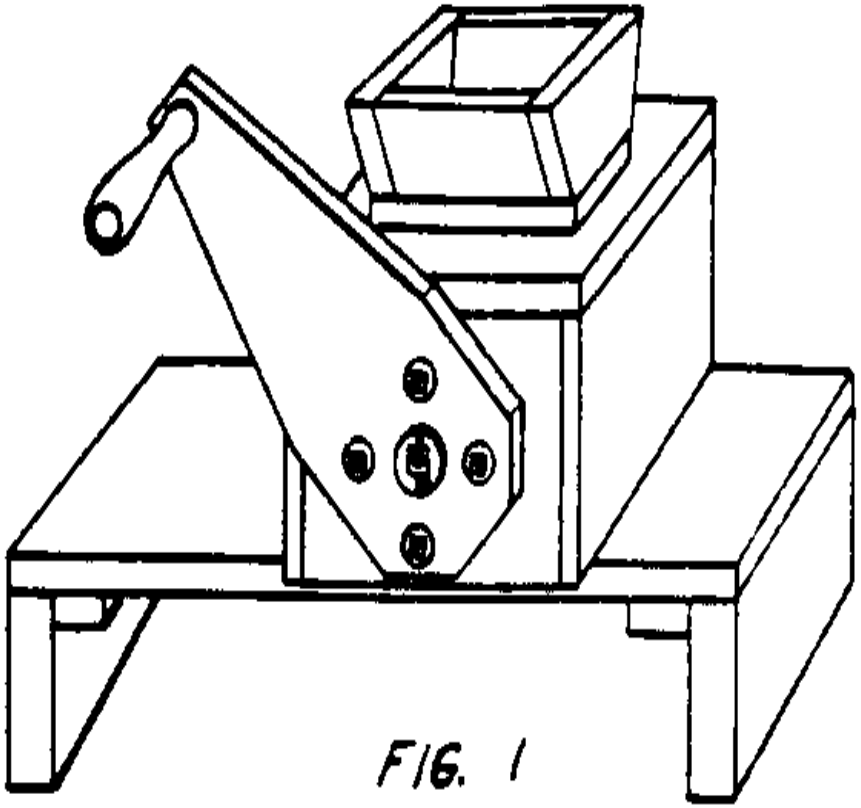

FIG. 1

DETAILS

Through the following discussion 1" lumber refers to the standard board thickness for surfaced sheathing lumber in the United States. It actually measures only about three quarters of an inch in thickness. All dimensions are in inches. Lumber used should be flat and well seasoned. The numbers in the next

section refer to part numbers shown in Figure 2 and subsequent detailed

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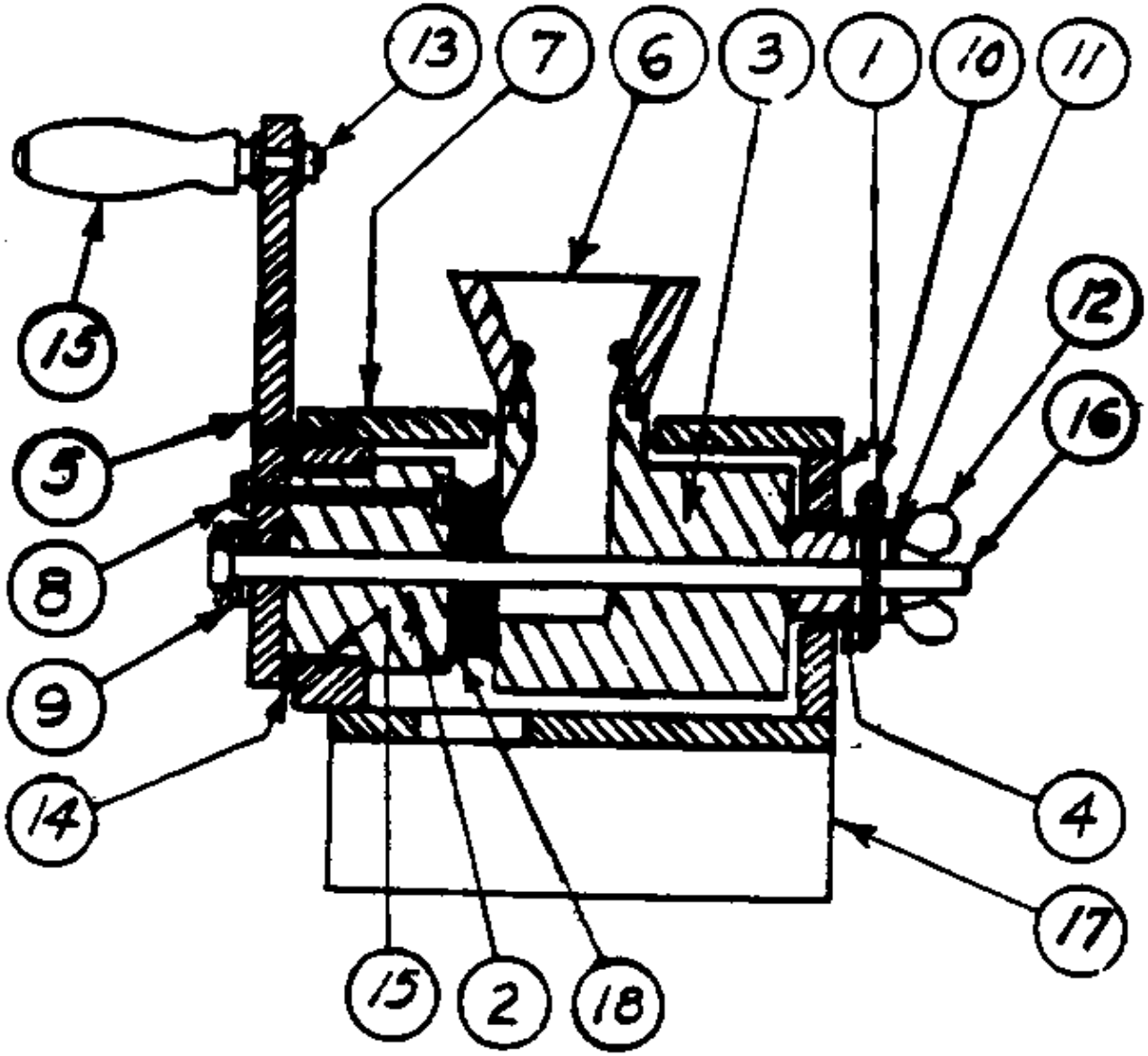

FIG. 2. ASSEMBLY DWG.

part sketches.

1. Grinder Body - make of 1" x 6"

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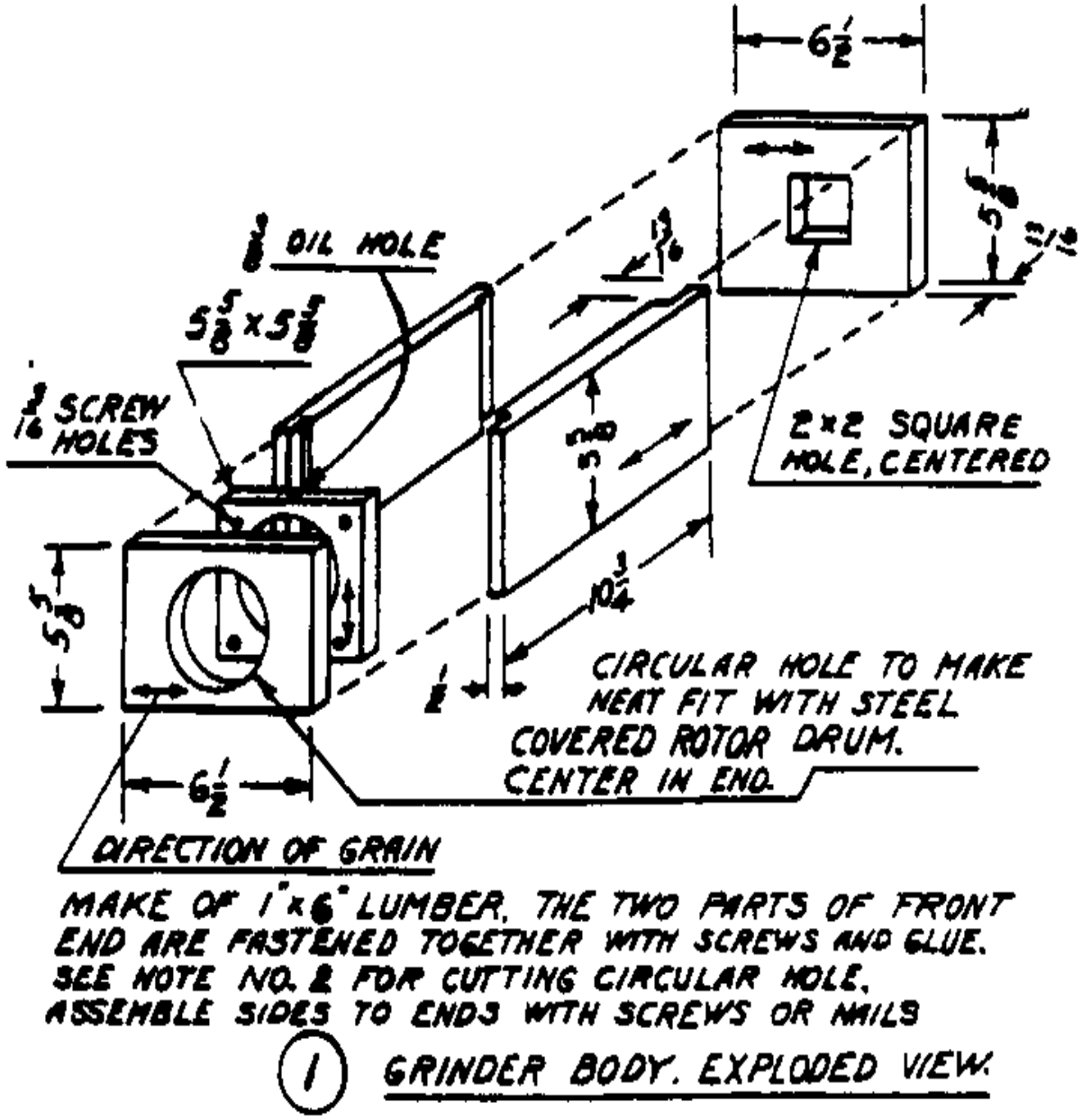

(1) GRINDER BODY. EXPLODED VIEW.

pine or hard wood lumber. Circular hole can be cut with coping saw or jig saw but for a better and quicker

way to cut see Notes 1 and 2, Figures 3 and 4.

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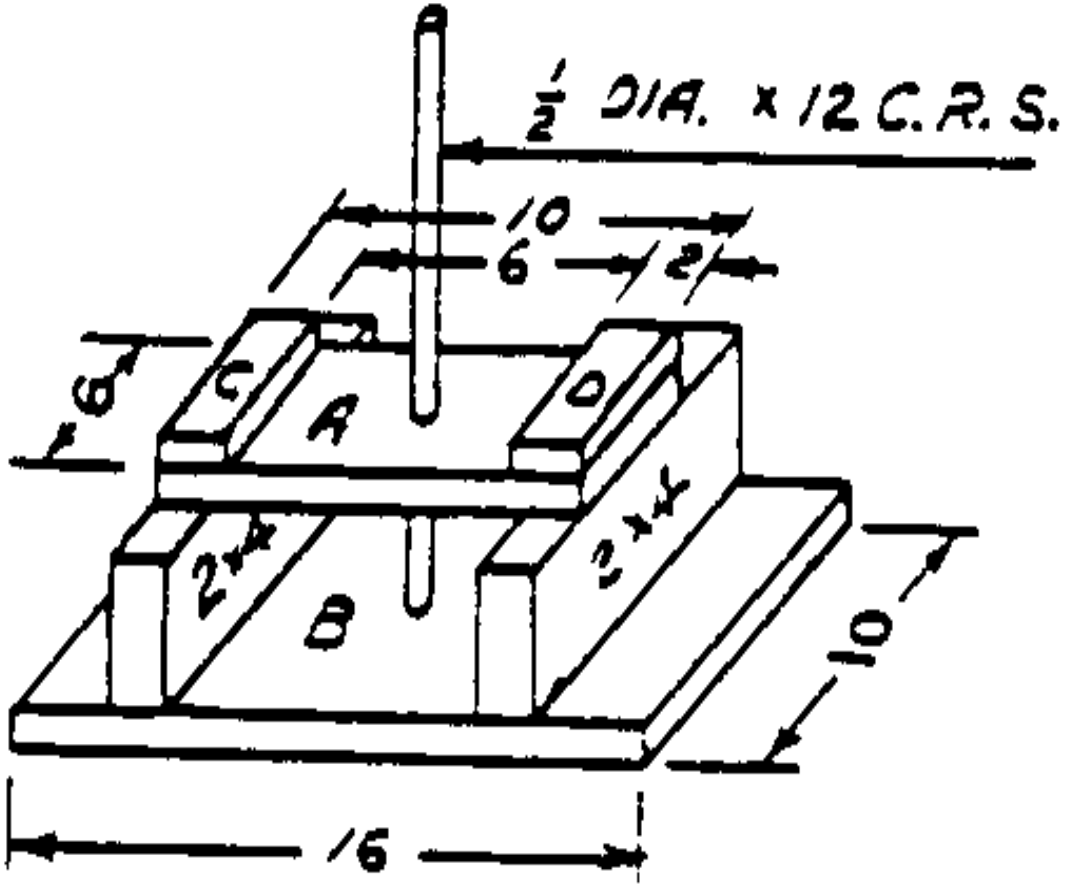

ALL WOOD PARTS ARE 1" LUMBER
EXCEPTING THE 2 PARTS MARKED 2x4.

FIG. 3. ASSEMBLY POST

2. Rotor - See Note 2. Take care to

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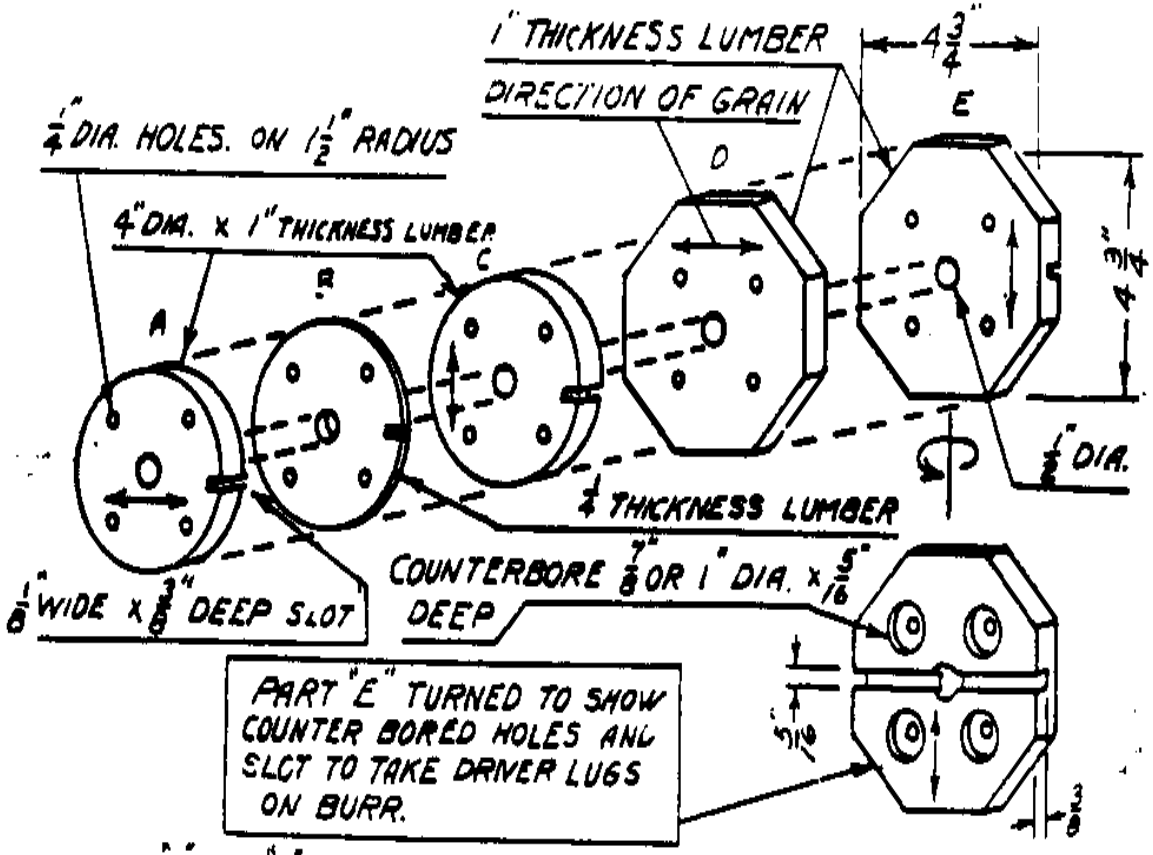

DISCS "A" AND "C" ARE CUT FROM FRONT END BOARDS OF GRINDER BODY USING CIRCLE CUTTER. SEE FIG. 4. CUT DISC. "B" FROM 1/4" PLYWOOD OR PLAIN 1/4" THICK LUMBER. BORE 1/2" DIA. HOLES IN CENTER OF EACH PIECE, THEN STARTING WITH PART "E," PLACE OVER ASSEMBLING POST WITH SLOT DOWN. ASSEMBLE OTHER PARTS AS SHOWN. USE 1 1/2" NAILS AND GLUE. MAKE COUNTER-BORES AND 1/2" HOLES AFTER ASSEMBLING. PUT THE FOUR 1/2" BOLTS IN HOLES WITH HEADS IN COUNTER-BORES. ATTACH BURR WITH 1 1/2" x 8 WOODSCREWS.

(2) EXPLODED VIEW OF ROTOR

bore the 1/2" holes thru each part

where required accurately and at right angles to the surface of the part. If when placed on the assembly post, it does not lay flat to the assembly post surface marked "A" in Figure 3 or against

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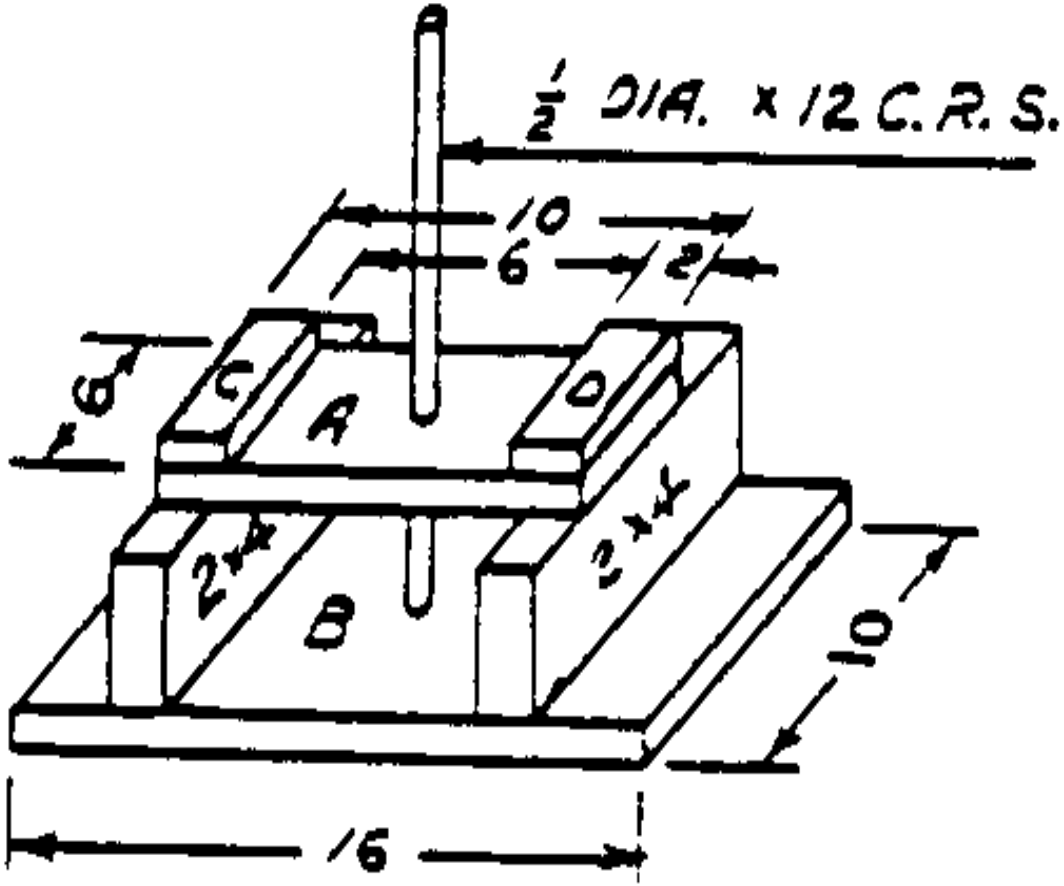

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FIG. 3. ASSEMBLY POST

an adjacent part because the hole is not bored straight, remove it from the

assembly post and use a round file in the hole carefully until it will lay flat. Use a few spots of glue between parts. Be careful in nailing so nails will not interfere with boring the 1/4" holes later. Keep the nails within 1" of the center post. 1 1/2" finishing nails are about right.

It is a help in getting the metal band snugly on the rotor drum to form the 3/8" lip on one end first, then bend the band around some round object that is about 3" in diameter. Next put it on the rotor drum with the one lip engaged in the slot. Use strong twine or flexible wire to pull band snugly around drum and mark position of the second lip. Remove from rotor, form the second lip and cut off excess. The band may need to be formed a little with the fingers. It should now fit snugly.

3. Stationary Burr Holder - In boring 1/2" holes and assembling follow

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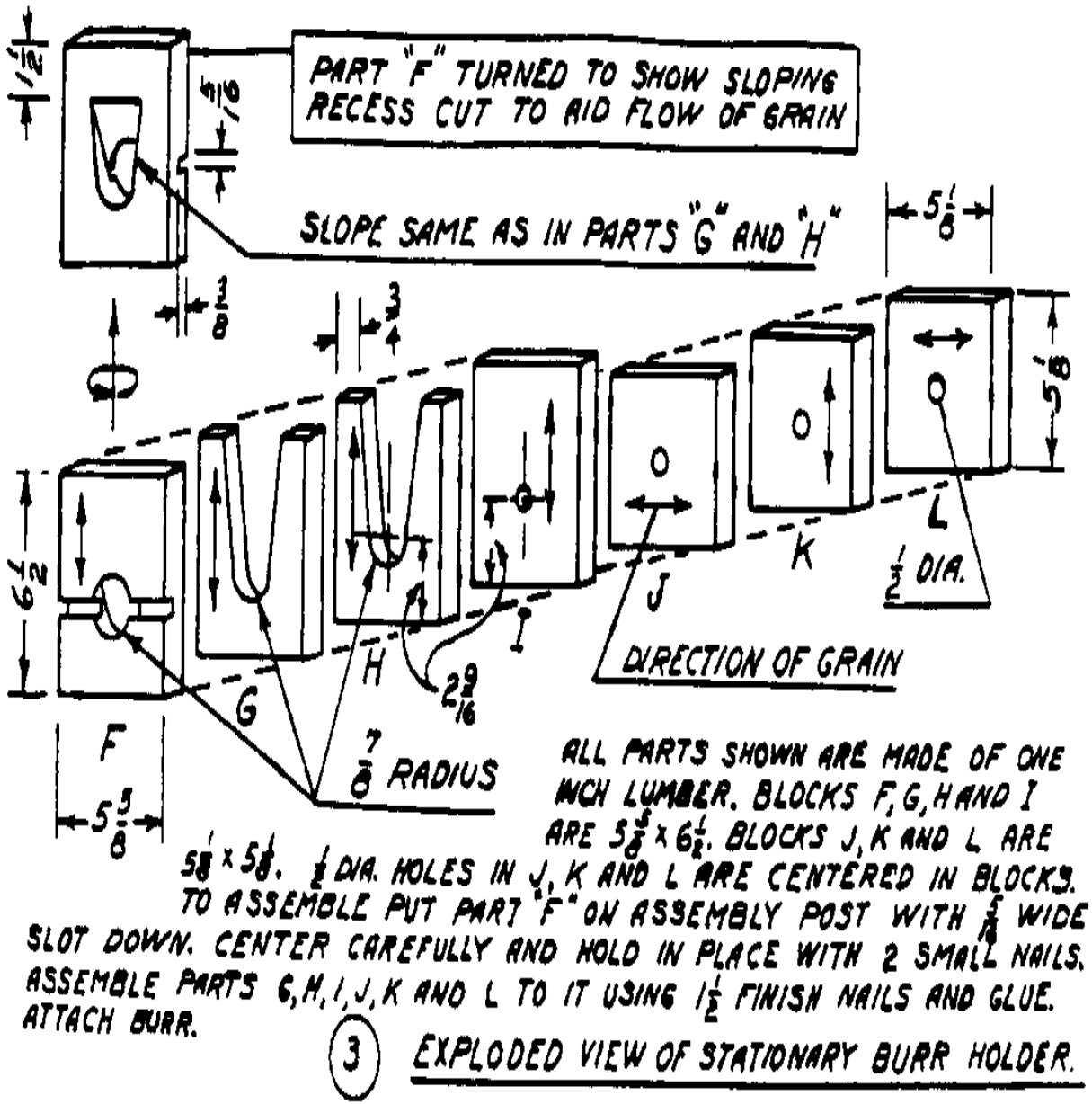

3 EXPLODED VIEW OF STATIONARY BURR HOLDER.

the instructions given under (2). Assemble he parts using a few spots of glue and nails. 1 1/2" finishing nails are about right.

4. Follow instructions under (2) Rotor for assembling parts of the thrust block.

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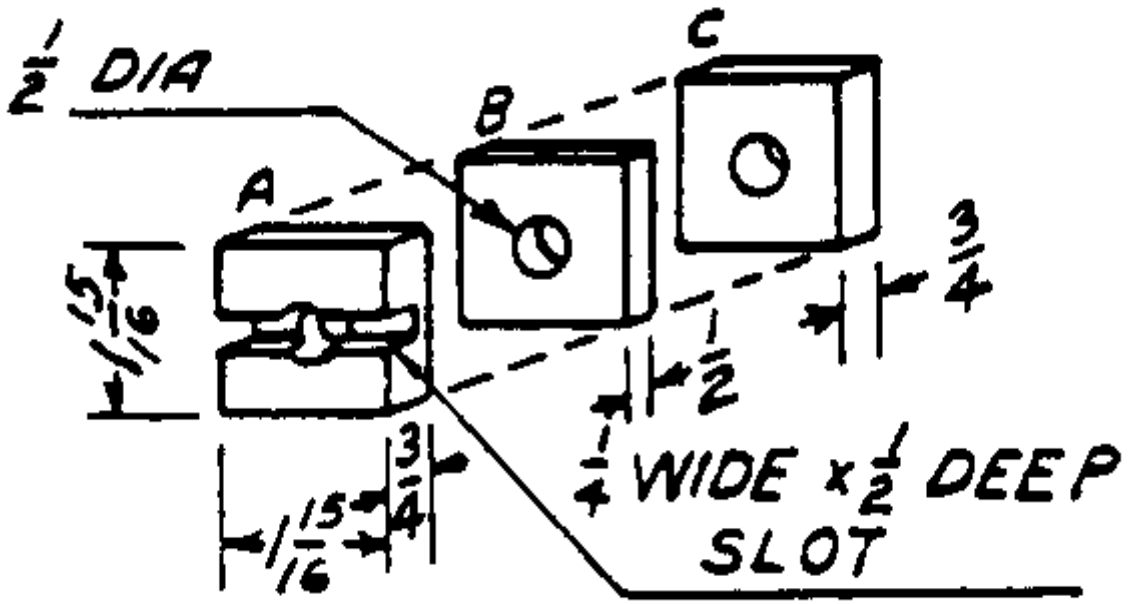

AFTER BORING HOLES AND CUTTING SLOT, ASSEMBLE PARTS A, B AND C USING SMALL NAILS AND GLUE. TOTAL THICKNESS OF A, B AND C IS 2"

(4) EXPLODED VIEW OF THRUST BLOCK.

5. The 1/4" holes can best be located by placing the rotor and crank all

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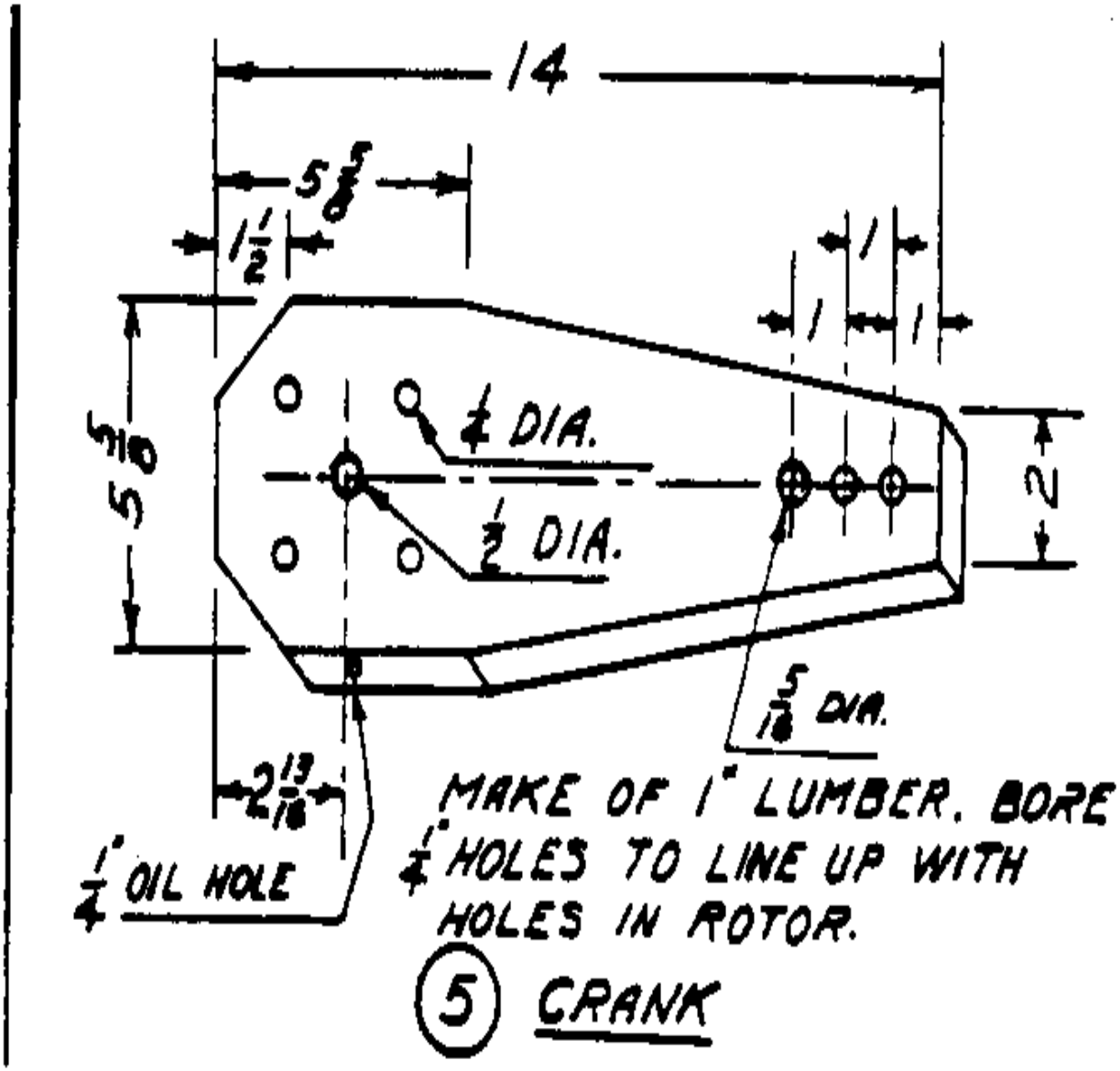

on the assembly post. With bolts in lace thru rotor mark location

**for holes on crank
by tapping with
a hammer. Oil
hole in the
crank is bored
to reach the
1/2" hole. This
will supply oil
to the steel
shaft.**

6. Attach hopper to top of stationary burr holder with screws. See

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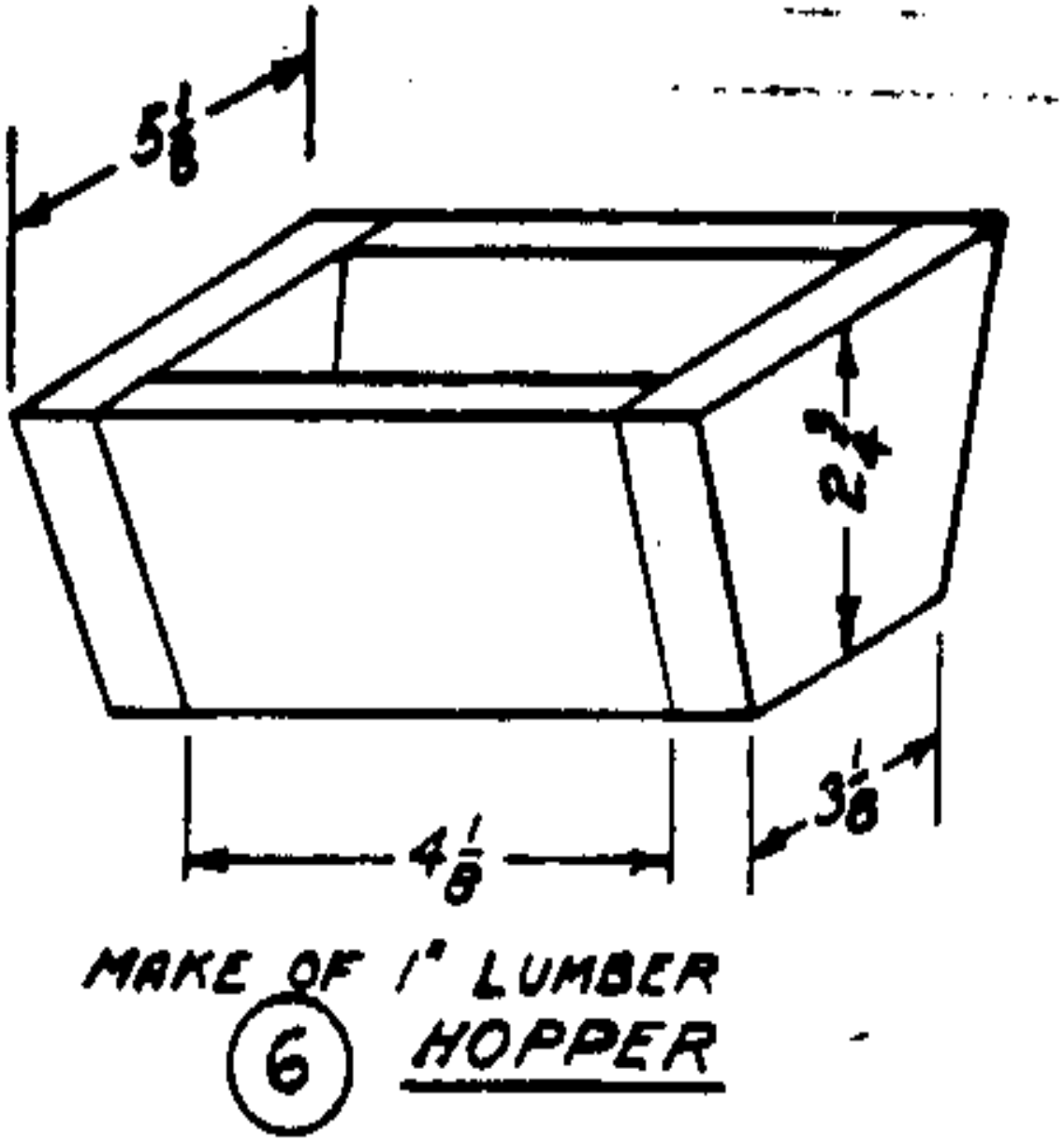

Figure 2.

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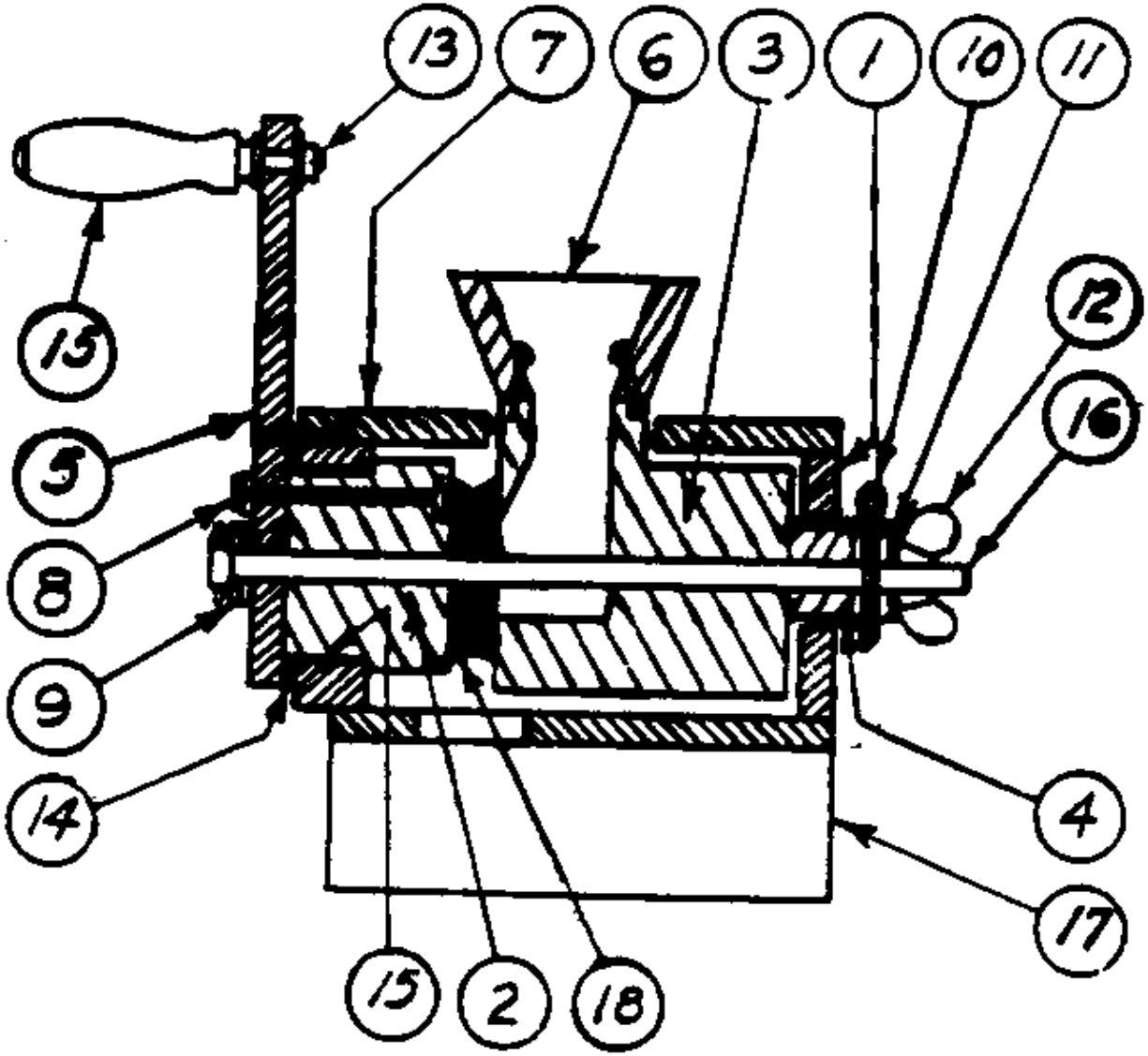

FIG. 2. ASSEMBLY DWG.

7. Cover

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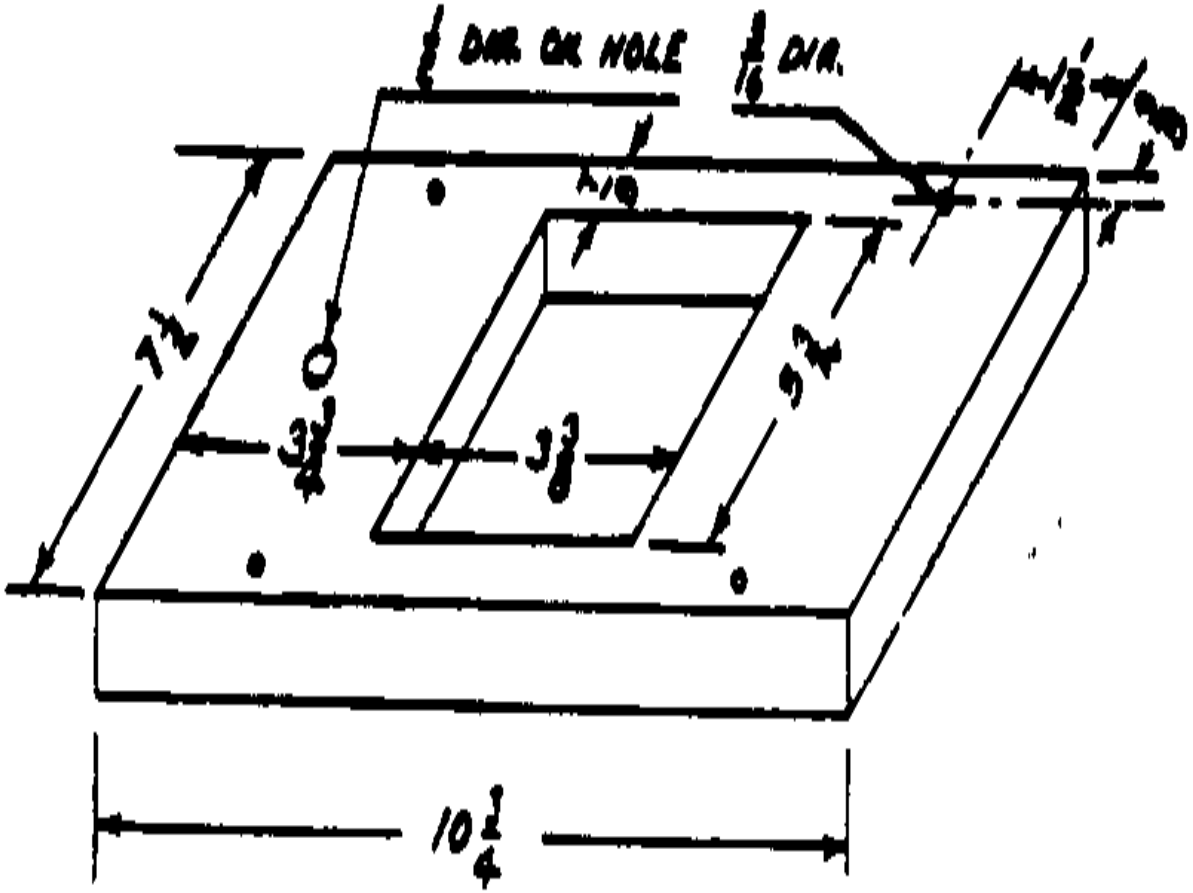

MAKE OF 1" LUMBER. LOCATE OIL HOLE TO LINE UP WITH OIL HOLE IN GRINDER BODY

(7) COVER

8. Four 1/4" x 4 1/2" carriage bolts wit nuts and 8 washers.

9. Two steel washers for 1/2" diameter bolts.

10. Two 1/8" diameter x 2" cotter key. If a larger diameter cotter key is used, drill the hole to suit. The hole should not in any case be more than 5/32".

11. Three steel washers for 1/2" bolt.

12. One 1/2" winged nut.

13. One 5/16" diameter carriage bolt threaded 1 1/2". File square shank under head to roundness. Length 4 1/2".

14. Clearance Block - The purpose of

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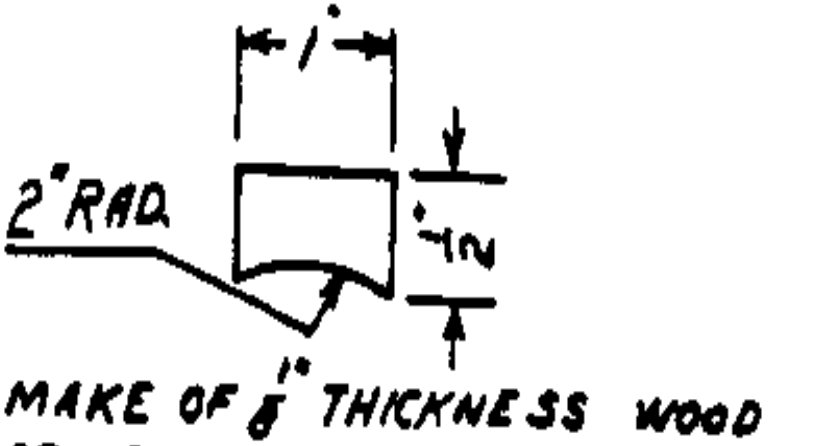

(14) CLEARANCE BLOCKS

the clearance block is to keep the crank from rubbing the front of the grinder. Locate the clearance blocks at even quarters around circular opening in front of grinder body.

15. Rotor Drum Band

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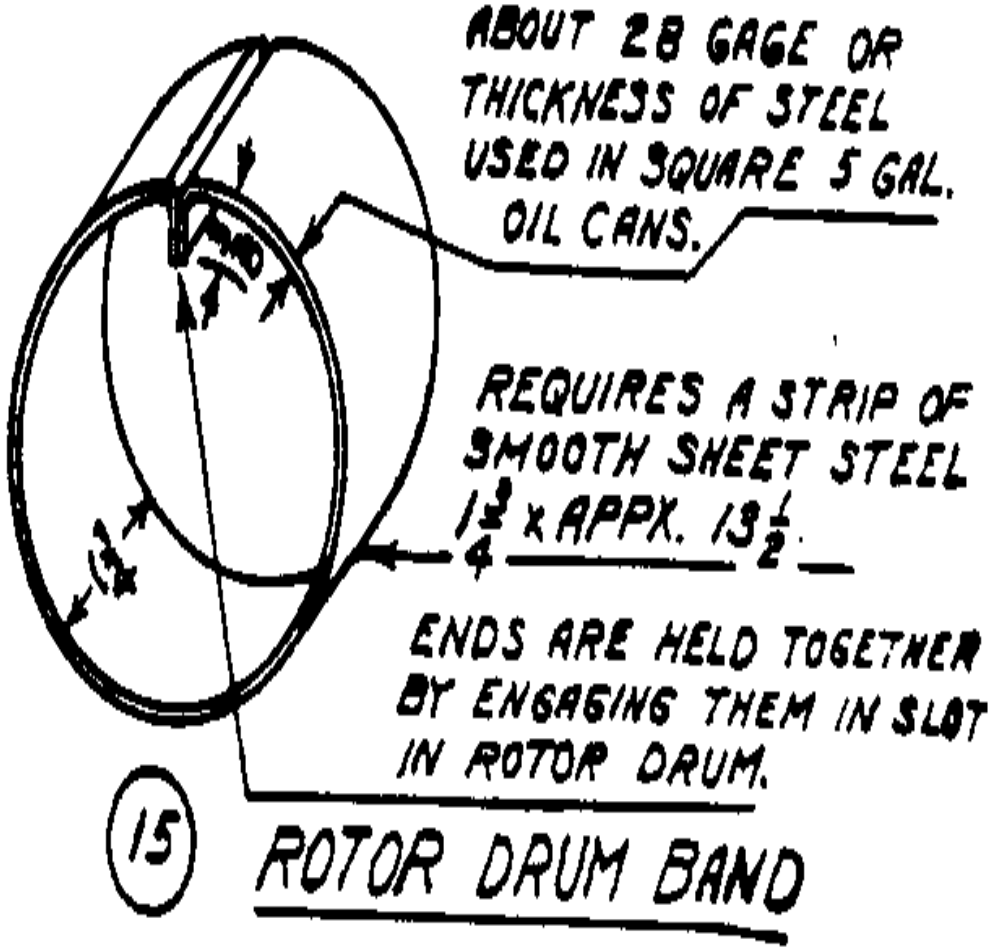

In making this part and attaching it to rotor read the discussion under Rotor (2).

16. Steel Shaft - Threading

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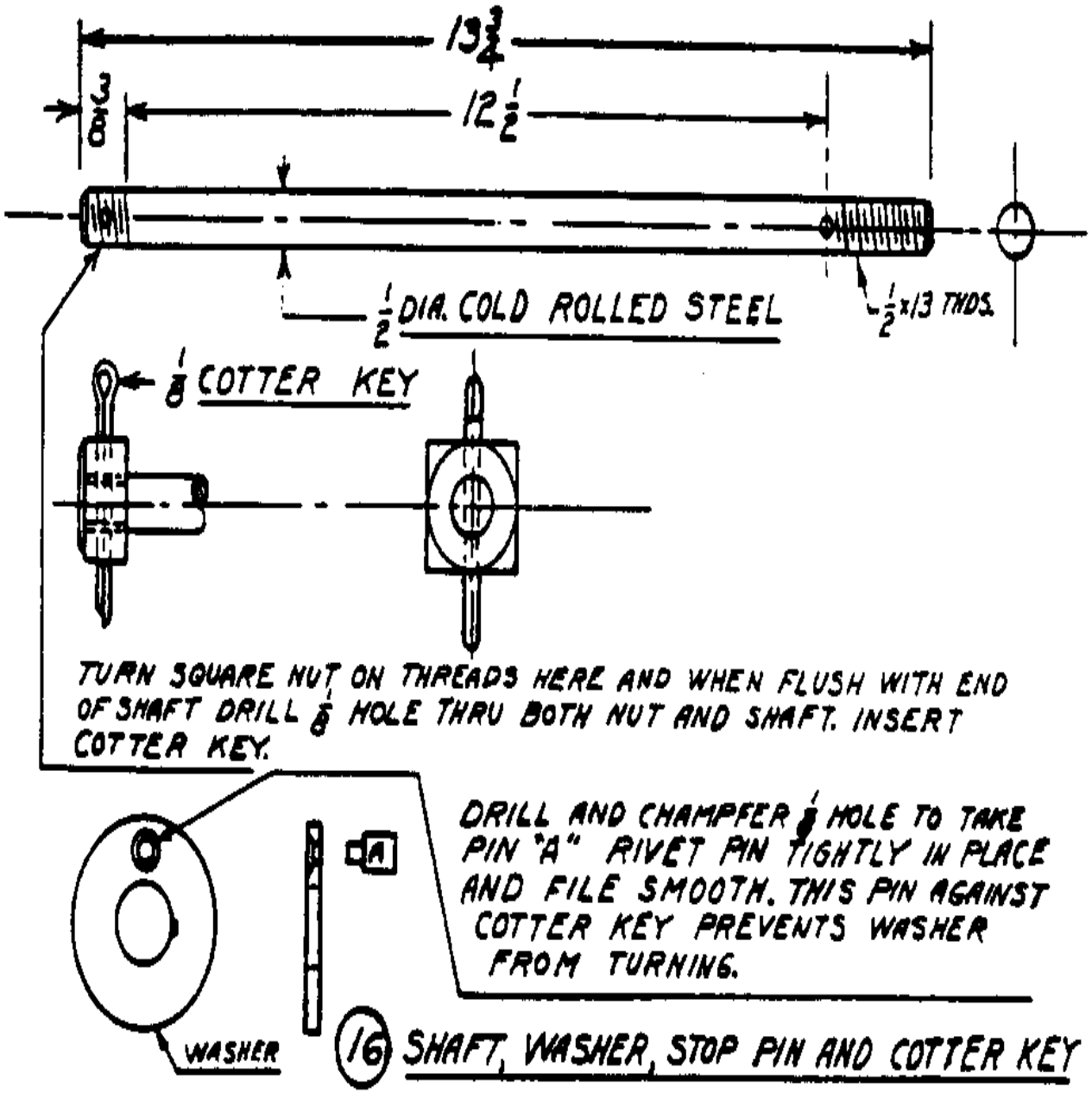

is U.S. standard, 1/2" x 13 threads per inch.

17. Grinder Stand.

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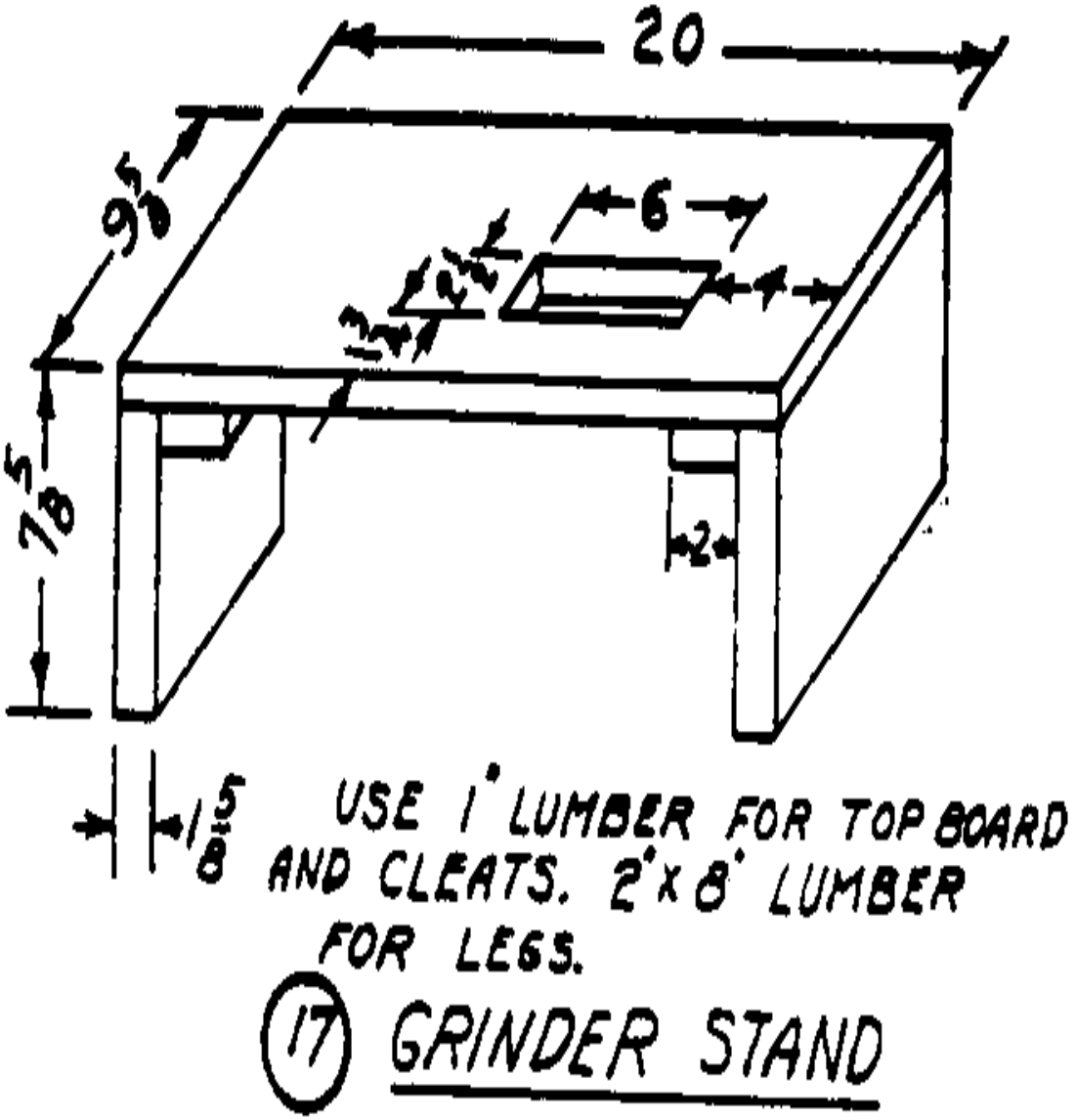

(17) GRINDER STAND

18. Two cast iron burrs. See materials.

FINAL ASSEMBLING

After all parts are completed the next step is to fully assemble the mill. The rotor with burr attached is placed in its position in the circular opening. Attach the crank. Next put the stationary burr holder in position and insert the steel shaft thru both parts. Put the thrust block In place, insert the cotter key, put on steel washer and run up the winged nut. In making the final adjustment it may be necessary to add one or more steel washers between thrust block and burr holder or to shorten the thrust block. When the winged nut is tight, there should be a little play between the cotter key and the bottom of the slot in thrust block.

Before putting on the cover turn the rotor and observe the burrs carefully. They should remain flat to each other when rotor is turned. If there is an opening which travels around as the rotor turns, a shim is needed under the burr on the rotor. Mark the place and note thickness of shim required. If the opening remains stationary a shim is needed under the burr on the burr holder. Remove he necessary part and add a shim. Of course, both burrs may need shims. A little glue under the shim makes a permanent job.

NOTES -
The purpose of the following is to facilitate and speed up the job

of making the mills. It is assumed the mills will be made in a carpenter shop as a business. The notes along with Figures 3 and 4 describe

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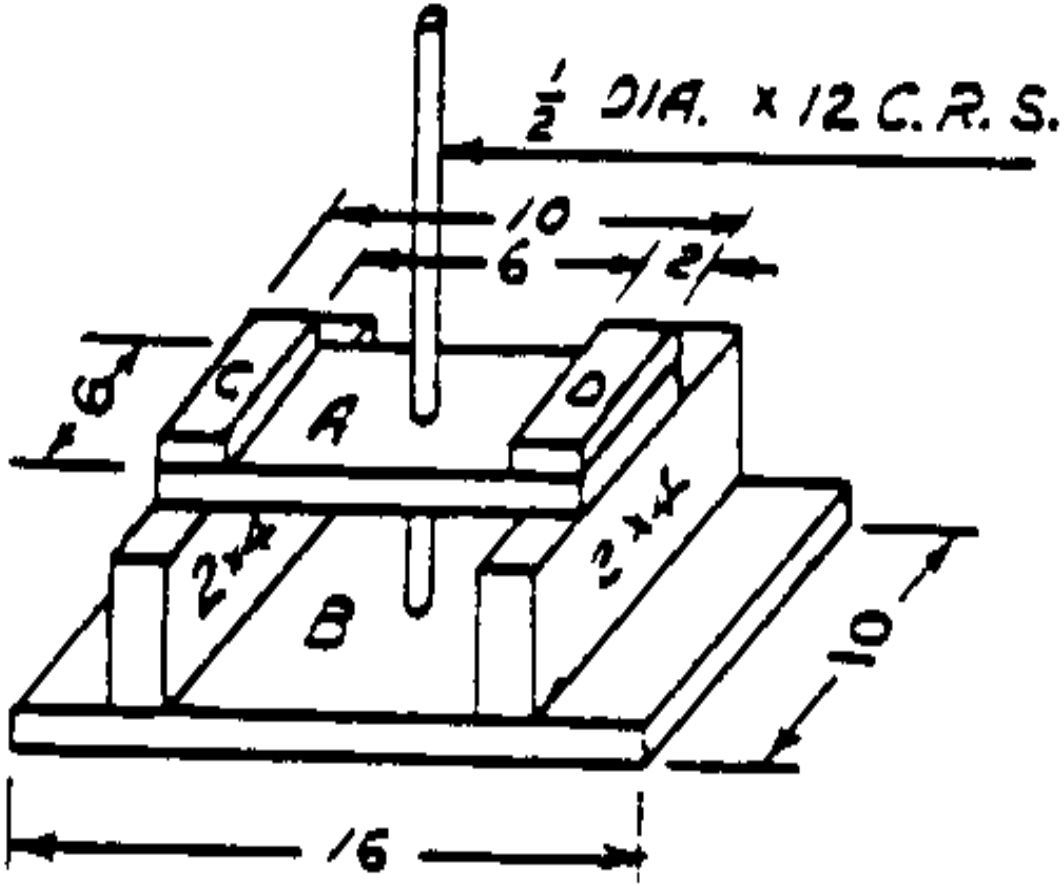

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FIG. 3. ASSEMBLY POST

two devices that will be found very useful in shops making these mills.

NOTE 1 - See Figure 3. The use of

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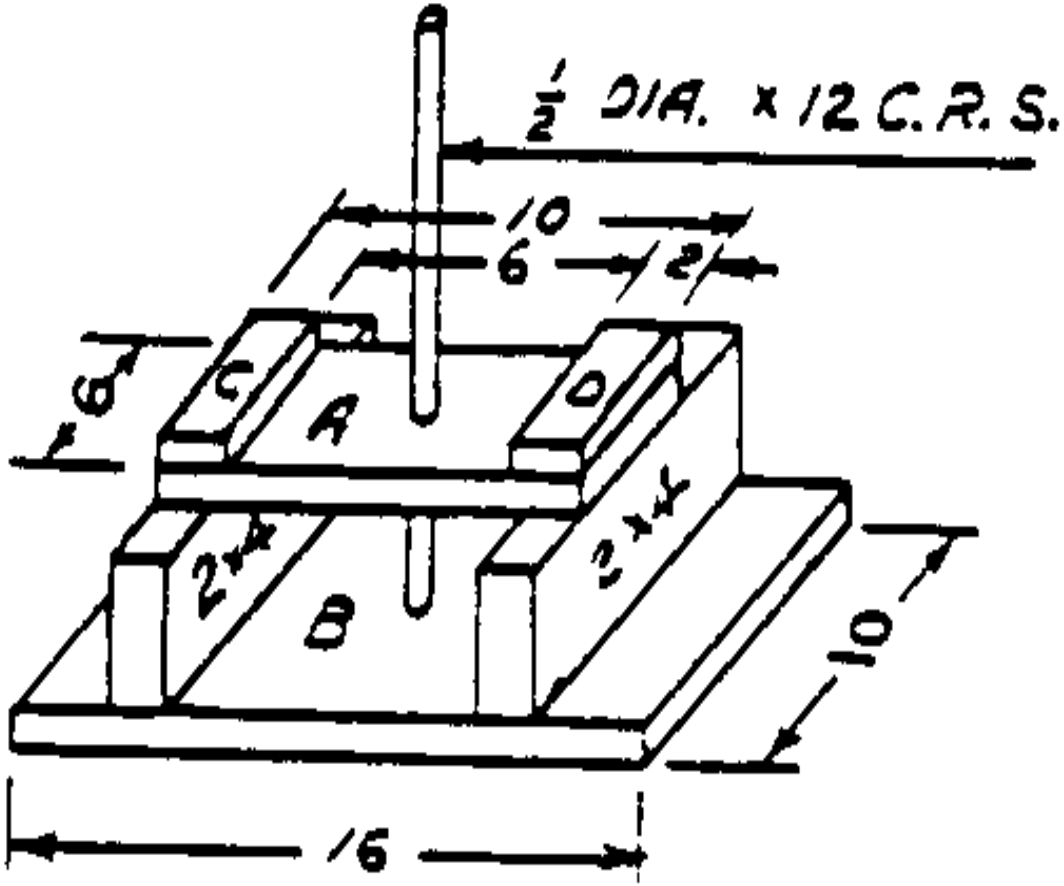

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FIG. 3. ASSEMBLY POST

the assembly post is described under (2) and (3). In constructing the assembly post, care should be taken

to make it very solid and strong and the steel post must be square with the surface marked "A" in Figure 3. A good way is to build the entire wood part of the device "C" and "D" before boring the holes for the steel post. When ready to bore these holes, bore thru "A" first, then push the bar thru to "B" and testing carefully with a square move top of bar until it tests square both ways then strike the bar on its top end to mark position of the auger hole in "B". Last, put on "C" and "D".

NOTE 2 - See Figure 4. The

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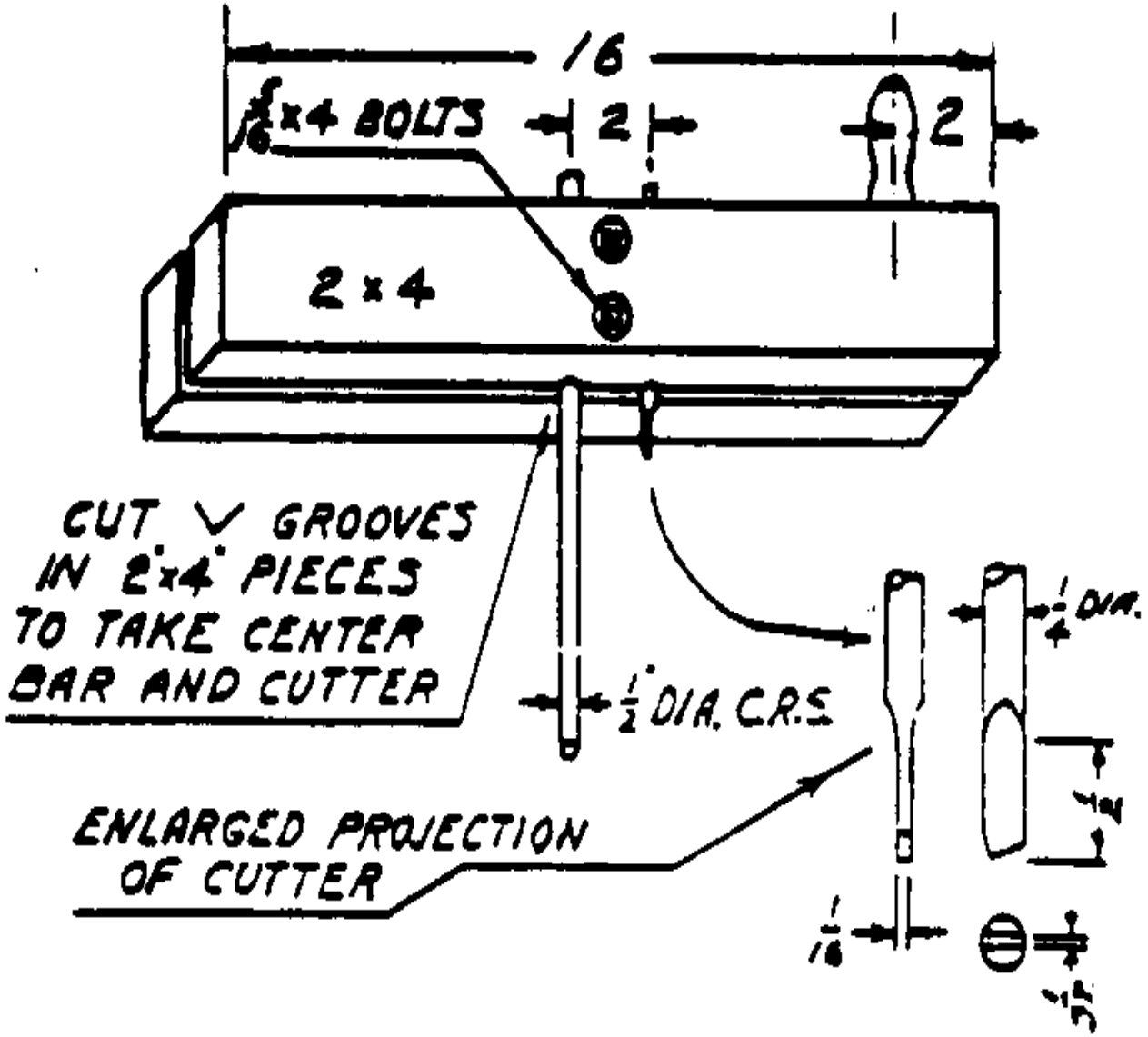

FIG. 4 DISC CUTTER

purpose of this device is to cut the circular discs out of the end boards of the grinder body. Test

each on the assembly post to be sure the holes are square thru these members. Use a round file if the member does not lay flat on "A" of the assembly post. Place the pieces one at a time on the rod of the disc cutter. Remove the steel rod from the assembly post and pass the steel rod of the disc cutter thru both holes of the assembly device. The assembly device with disc cutter in place should now be held in a bench vise or fastened to a wall so the shaft is horizontal and at a convenient height for turning. Turn the crank and exert a gentle pressure to bring the cutter into play.

The steel cutter should be of tool steel. A six inch length of drill rod is excellent. If this is not available, a screw driver with approximately a 1/4" diameter shank can be shaped up with a file to do the job. In operating the disc cutter cut only half way thru the member then reverse and complete from other side.

For greater strength the cutter can be made more then 1/16" in thickness. This will make the discs that compose the rotor drum fit too loosely even after the steel band is on but the difficulty is easily corrected by giving the drum several turns of heavy wrapping paper before the steel band is applied. The paper should be glued to the drum.

The stone buhrs. Make them from suitable stone that can be found along

lake shores, river banks and in open fields. Sandstone and shale are too soft; some granite is too hard to work. As a test, you should be able to drill a hole readily with a masonery bit. Many kinds of stone, including most limestone, are suitable for buhrs. It will pay to spend considerable time hunting for just the right two stones that will not require too much labor to complete. The stones should be betewen 3/4" and 1 1/8" thickness, have one flat side and be large enough to scribe a 4 1/2" diameter circle on them. Of course, you probably won't find stones with perfectly flat sides, and it will help to work a side flat by rubbing it hard over well hardened cement walks or slabs. Some hard sand sprinkled on the slab will make the cutting easier. It is safer not to use a hammer and cold chisel on the stone until it is firmly mounted on its buhr holder.

<Step 1>

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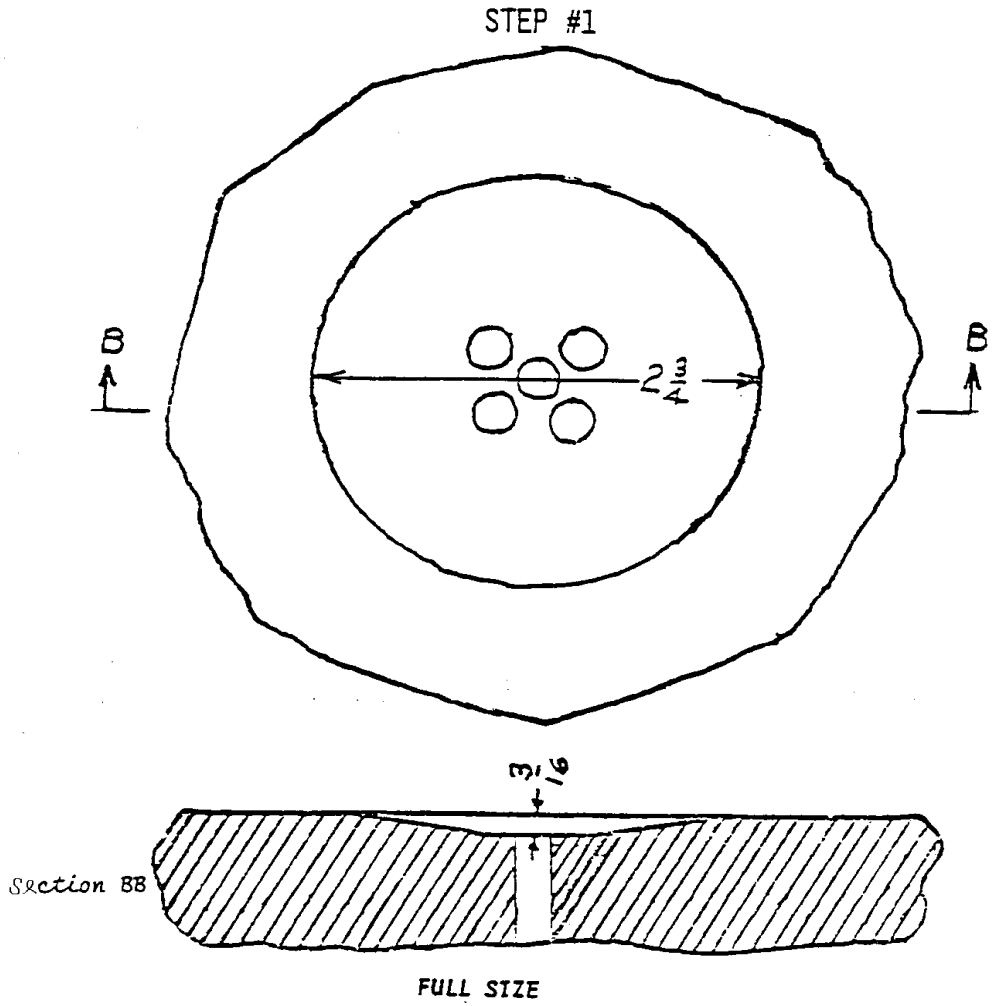

After smoothing and mounting the buhrs, use chisel to form a 3/16" deep basin which is 2 3/4" diameter.

Make 2 identical buhrs. The outer edge does not have to be perfectly round but edges should be trimmed sufficiently so they are balanced when running.

When mounting the stones on the buhr holders, be sure to have the flat surface of each buhr in a parallel plane with the flat surface of its buhr holder. If the surface being mounted against the buhr holder is irregular, hollow out sane areas of the mounting block to conform with the irregular areas of the stone. Use epoxy to cement the stones to their mounting blocks. Use epoxy freely. After it has set overnight, fill in any visible openings around the edges of the stone and mounting block. It is well to have the center hole drilled in each but all chisel work should be done after mounting. In working stone by hand some variations are inevitable but if you hold a close approximation to the plan shown in detail #16 your stone should grind high grade flour.

<Step 2>

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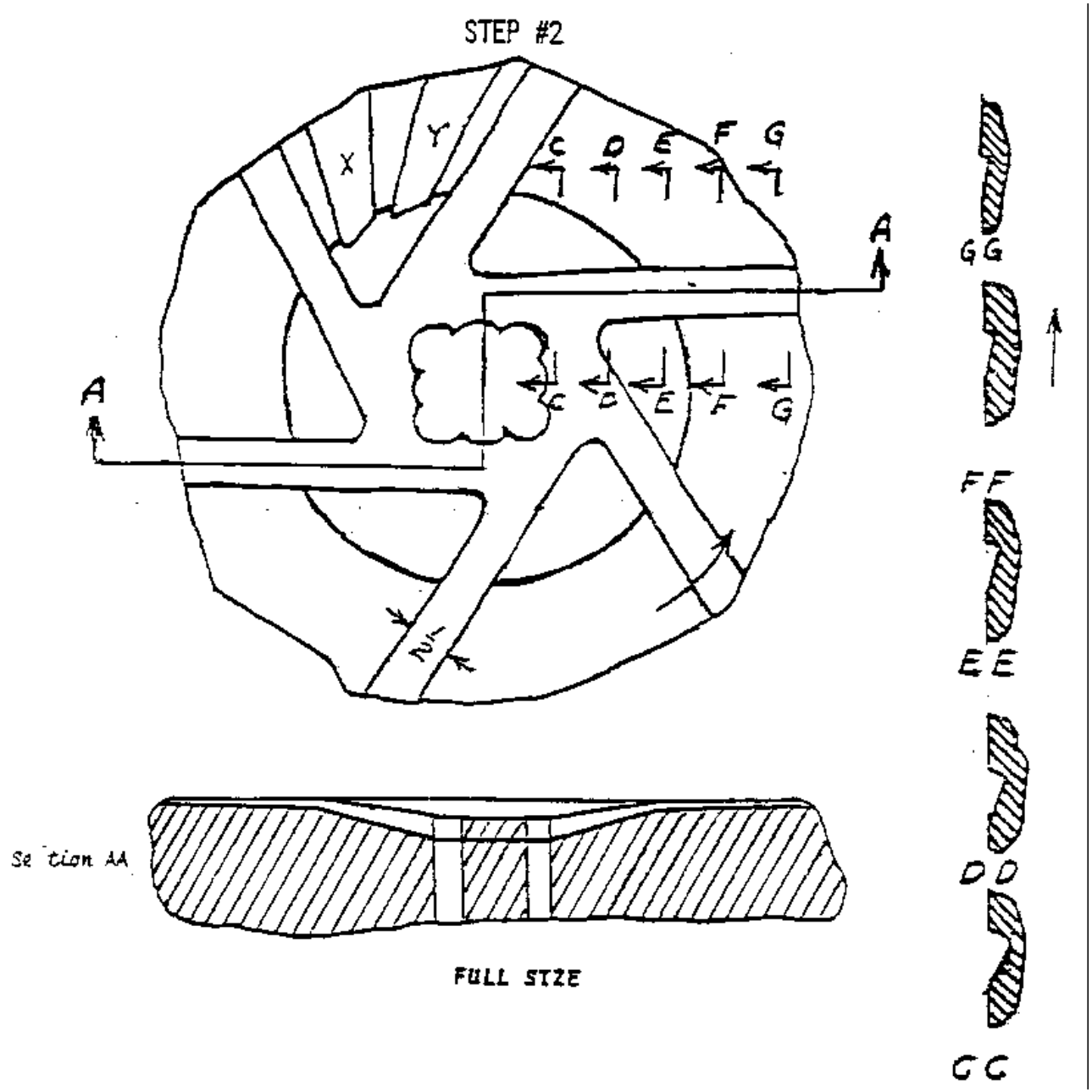

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