

A Construction Manual
For
The Mirror-o-Matic 20



Dennis & Bob Rech

Mirror-o-Matic

A Construction Manual For The Mirror-0-Matic 20

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You can also send conventional mail to the above address.

Additional information, notices, updates and current
e-mail listserver information can be found at:
www.mirror-o-matic.com

This is plan set # CD Rom
Revision: 22 March 2004

Introduction

The Mirror-o-Matic 20 is my response to the many requests for a larger version of the original Mirror-o-Matic. It has been designed to fabricate concave mirrors up to 17.5 inches. There is room to expand the turntable up to 24 inches so that 20 inch mirrors can be accommodated.

For the many builders that have already constructed the original Mirror-o-Matic , the design allows for the reuse of the entire power head assembly, eccentric, eccentric push rod, swivel and rod assembly and hinges. Even the one inch blower shafts can be reused if they can be removed.

On this CD is the Conversion Manual. It explains how to convert the original machine into the larger version. Some people have also built both machines and just relocate the power head, eccentric, and pulleys from one to the other as needed.

The original Mirror-o-Matic had a turntable that doubled as a slurry drip pan. Because of the increased effort of removing larger, heavier mirrors on this new bigger machine, I have added a stationary drip pan under the turntable. This will allow washing the mirror in place and attaching a drain pipe to the pan. If you will be using this machine to make small mirrors up to 12 inches, you may want to incorporate the original lift off turntable design into this machine. The lift off turntable is much easier to clean.

The over-arm assembly has been modified to be more rigid and there is now a slot running the length of the arm to allow for tool positioning while figuring.

For those builders wishing DC motor drives, I have added a page showing one scheme to incorporate separate variable speed motors. Due to the cost and wide variety of dc motors and controllers, I have left the design pretty generic. With the large speed range of dc motors, one stage of belt reduction can be eliminated.

The biggest advantage of dc motors is that they can be slow started which greatly reduces the shock of the turntable suddenly ramping up to speed. However, the standard 1750 rpm motor specified will also work fine.

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Even though the machine is bigger and capable of handling larger mirrors, the recommended electric motor size is still 1/4 to 1/3 hp.

The advantages of this machine are similar to the original. It can be built for about \$400. It is constructed entirely of 3/4 inch plywood and hardware store items. It needs no machined parts and only basic tools are required for construction. Although this machine is physically larger than the original, it is still very compact for a grinding machine with its capacity. It can be broken down for storage and transportation very quickly.

None of the dimensions are very critical. Most are rather nominal and can be adjusted to meet your degree of woodworking skill.

Bolt sizes were picked mostly for convenience. Anything close will probably be just as good as what I have selected.

Please practice safe working habits. Keep children and pets away from the operating machine. It has moving parts that can really make their moving parts hurt if they should come in contact with each other..

Be especially careful with the placement of electrical switches so that the machine cannot be inadvertently turned on while being adjusted. Always unplug the machine when adjusting belts. The electrical circuit should have a ground fault interrupter if you are near a source of electrical ground.

Mostly, have fun building and grinding and do not be afraid to modify and improve the design. Join the Yahoo Groups E-mail list server. There is a whole lot of knowledge and experience accumulating there which will greatly smooth the learning curve.

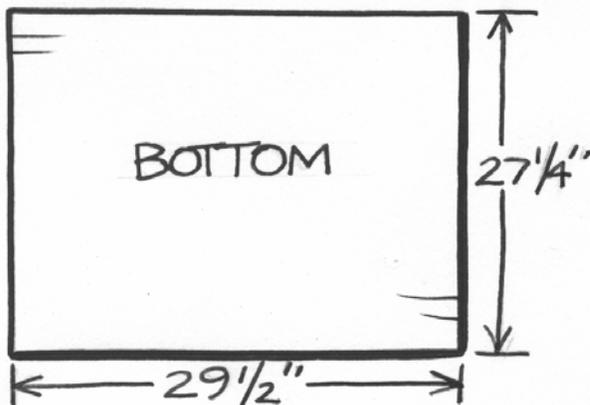
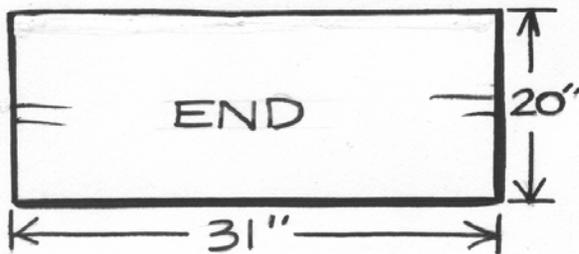
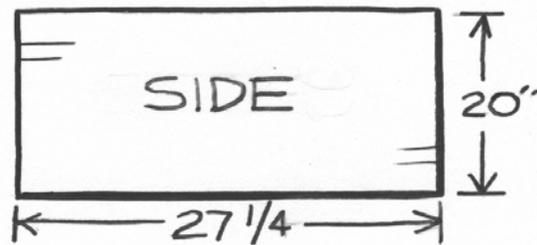
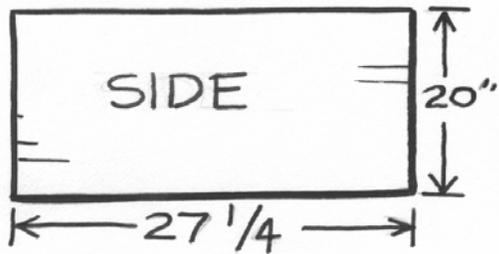
Please keep me informed of your progress.

Dennis

Building the Base Box

The base of the Mirror-o-Matic 20 starts with a simple three sided box with a bottom. The corners may be butted or mitered (adjust your cuts accordingly). Dimensions shown are for butted corners. The finished box should be 31 inches by 28 inches.

I recommend building the box and most other parts from 3/4 inch thick "cabinet grade" plywood. Seven ply birch works fine. So does the inexpensive generic hardwood sold by Home Depot. Typical fir construction plywood such as CDX grade is not very good because of the many voids which will compress when bolts are tightened into it.



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There is a fair amount of torque passing through the box, so be sure to glue all joints. I prefer using polyurethane glue. It is very viscous and swells slightly as it sets so small gaps will be filled. Align parts carefully. Once it sets, you will not be able to break the joints. Read the glue instructions for humidity requirements. Some glues require that the wood be dampened.

Use care, polyurethane glue will stain your hands and clothes a rich dark brown which will take a week to wear off.

Carpenter's glue or white glue such as Elmer's will also work.

Throughout the manual, all wood parts in this project can be nailed, screwed or clamped until the glue sets.

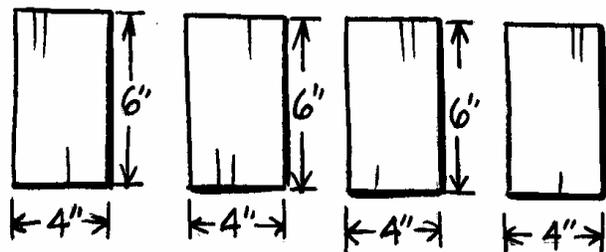
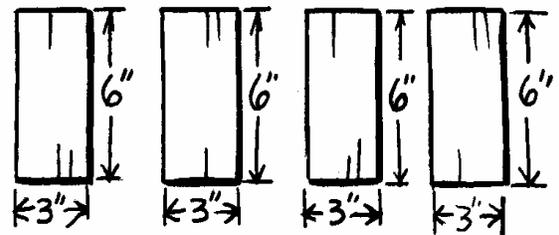
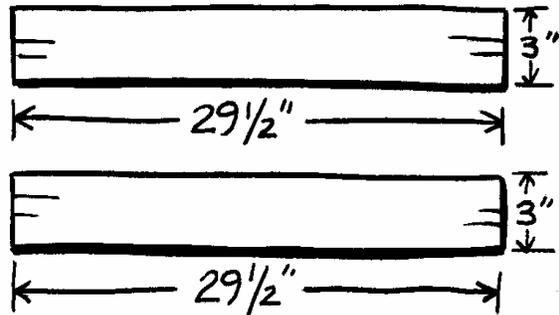


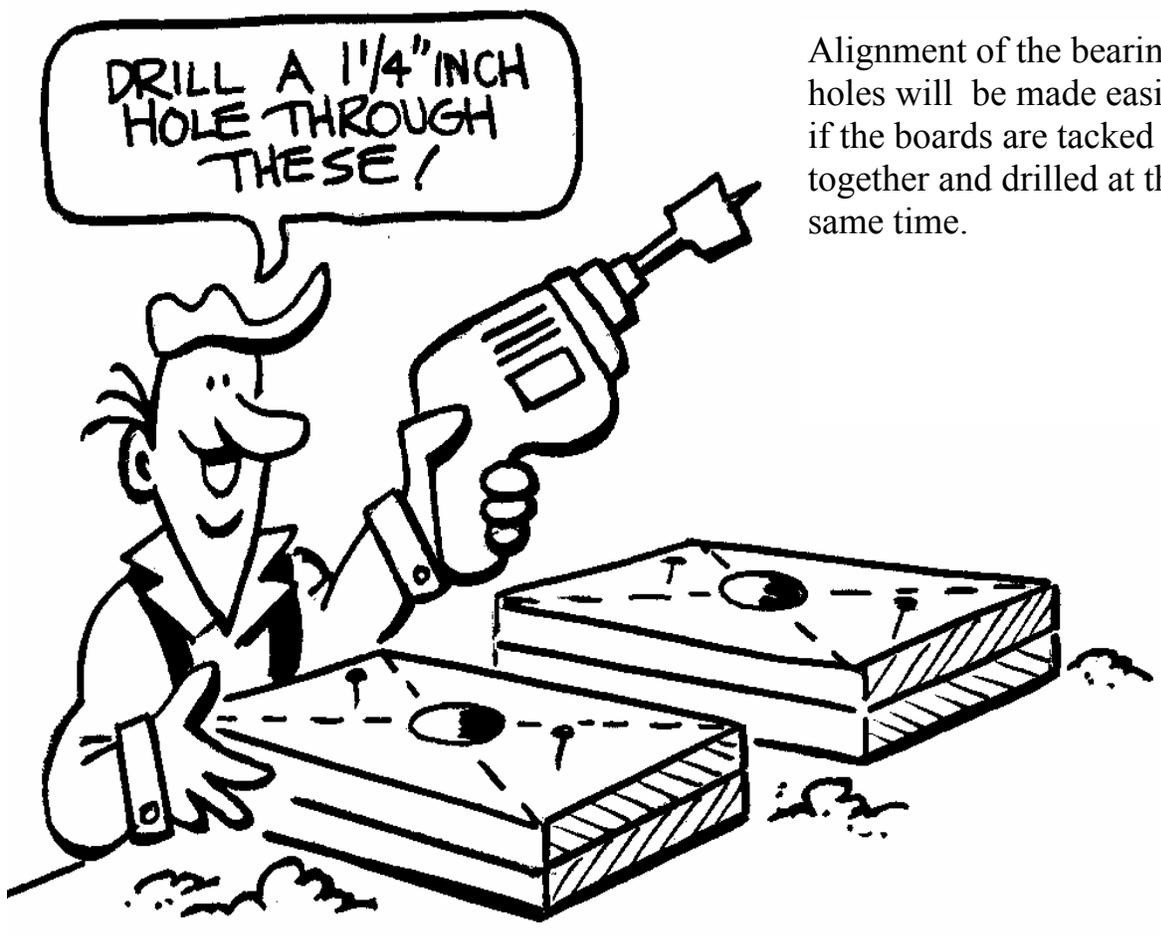
Building the bearing boxes.

The turntable and eccentric shafts are carried in simple 1" diameter x 3" long bronze bushings pressed into plywood boxes. These simple systems avoid having to buy expensive bearing assemblies. The length of the bushing prevents rocking and the need for self aligning bearings.

The drawings show constructing a plywood box. A solid piece of wood will also work if you have the ability to cut it out of a length of 4" X 6 inch stock. Take care to drill the 1-1/4" diameter hole square to the top of the box in both directions. Provisions have been made in the design to correct for small misalignments.

The 29-1/2" x 3" supports can be cut out of 3/4 inch plywood or 3/4" or thicker solid stock. Solid stock is the preferable material.





Alignment of the bearing holes will be made easier if the boards are tacked together and drilled at the same time.

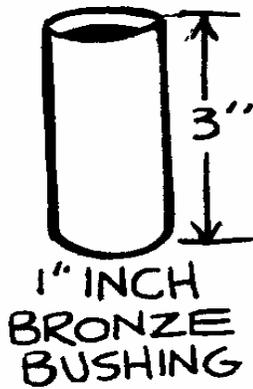
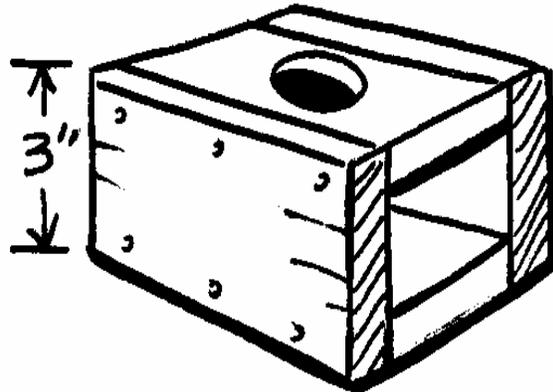
Mirror-o-Matic

PUT THEM TOGETHER LIKE THIS!

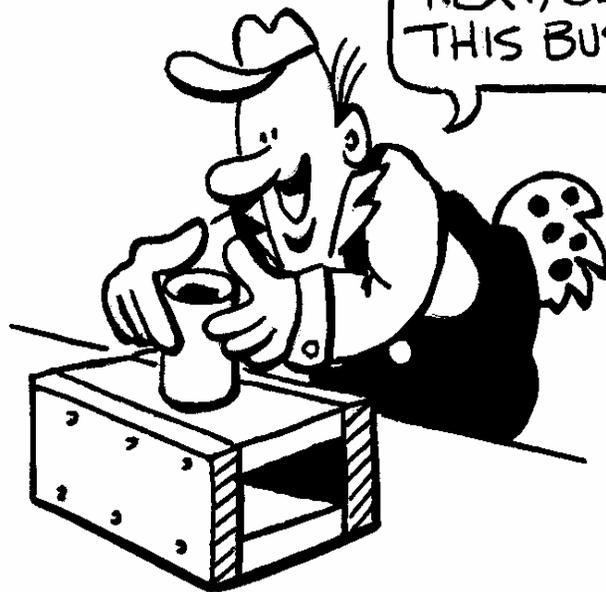


Glue and assemble the bearing box as shown. Check with a small builders square to assure that the top and sides are at right angles.

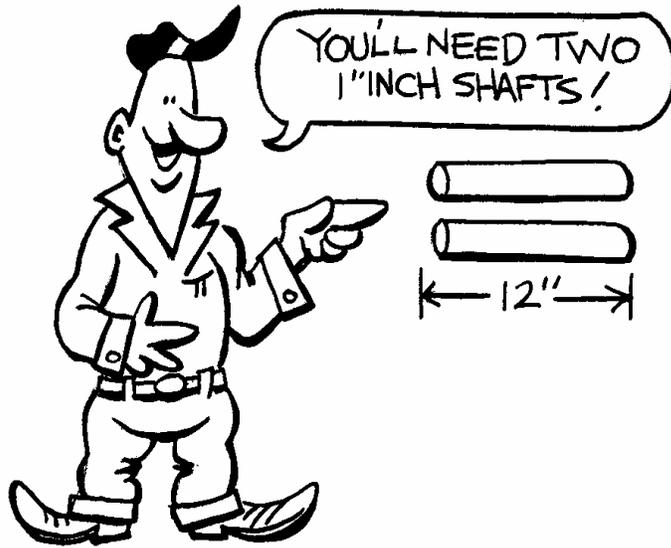
After the box sets up, smear some polyurethane in the 1-1/4 inch hole and insert the 1" x 3" long bronze bushing. If you cannot find a 3 inch long single bushing, two shorter bushings can be used. Insert a piece of 1 inch shafting into the bushings to hold them in alignment until the glue sets. Avoid getting glue inside the bronze bushing.



NEXT, GLUE IN THIS BUSHING!



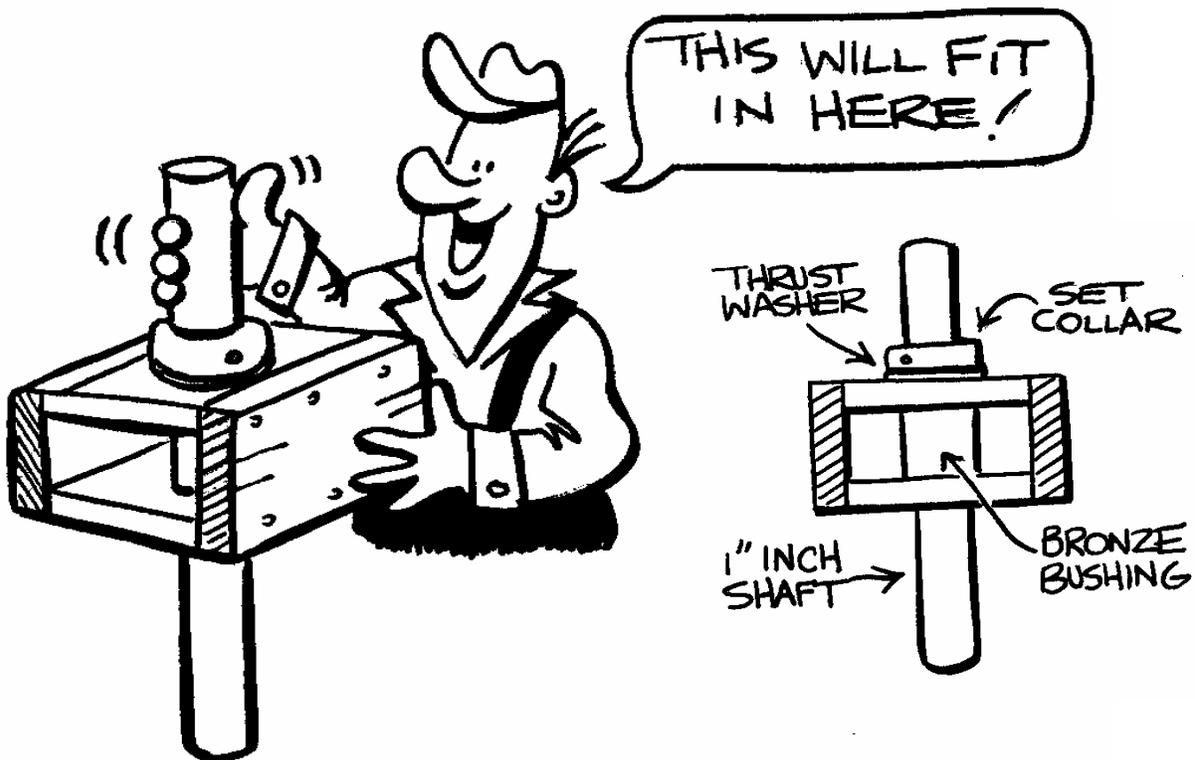
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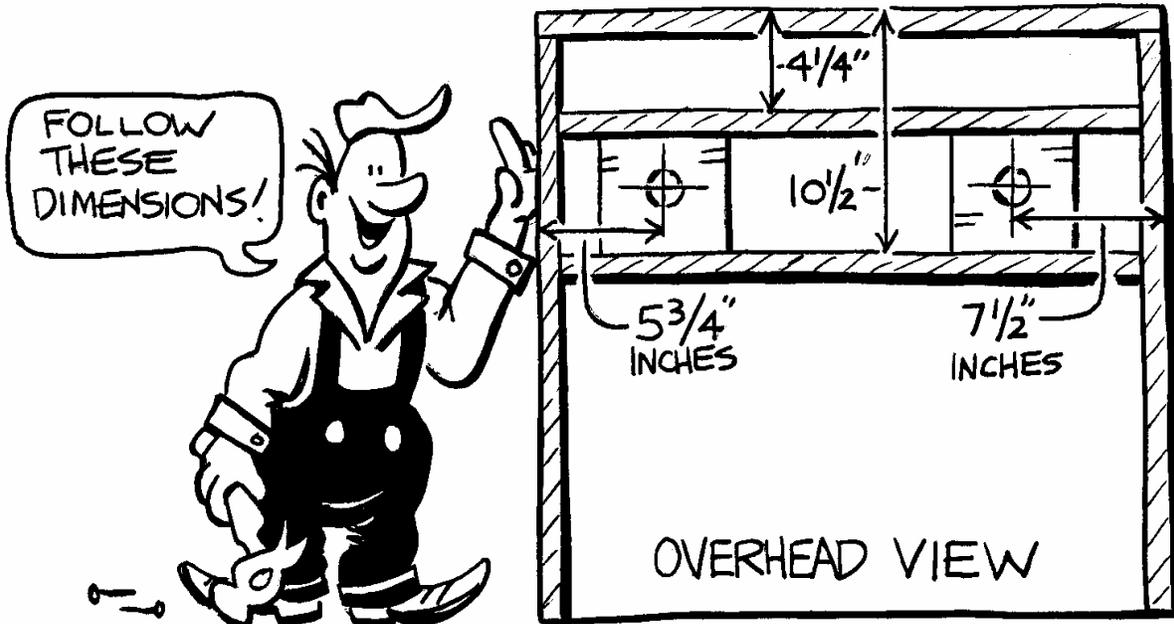
Shafts as short as 9-1/2 inches can be used. These short shafts will limit the amount of pulley adjustment that can be made under the tabletop. Longer shafts can also be used if they do not interfere with the power head in the box.



After the glue cures, loosely assemble the shaft assemblies as shown and insert into the bronze bushings. Lightly tighten the set screws on the shaft collars. This is a temporary trial fitting.



Installing the bearing boxes into the base.



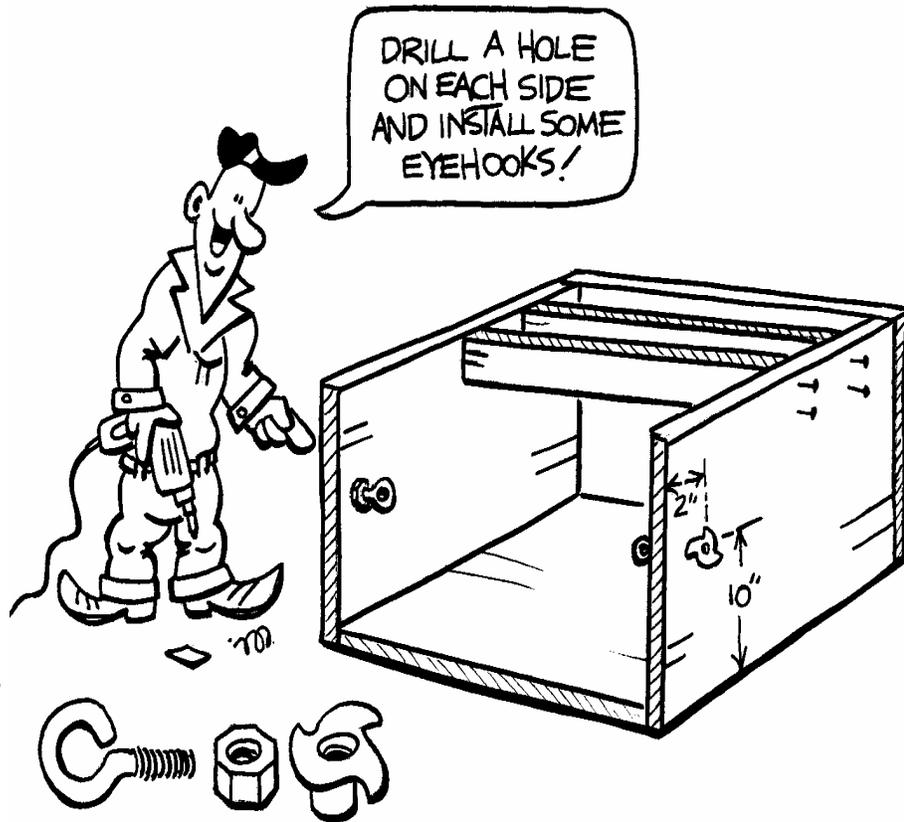
The previously cut 29-1/2" bearing box supports are next tacked into the base box. See the picture on the next page for a better overview of the process. Lightly tack or screw one support into place. Then set the second support the exact width of the bearing boxes. Do not set the nails or screws yet. They may need to be pulled and redone. Do not use glue. The supports can be adjusted up or down a bit to align the shafts. After everything is made square and plumb, additional fasteners can be added.



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Drill holes for the 3-pronged nuts that will hold the spring eyebolts. I used 1/4 inch plated eyebolts. Size the 3-pronged fasteners and their holes as required.

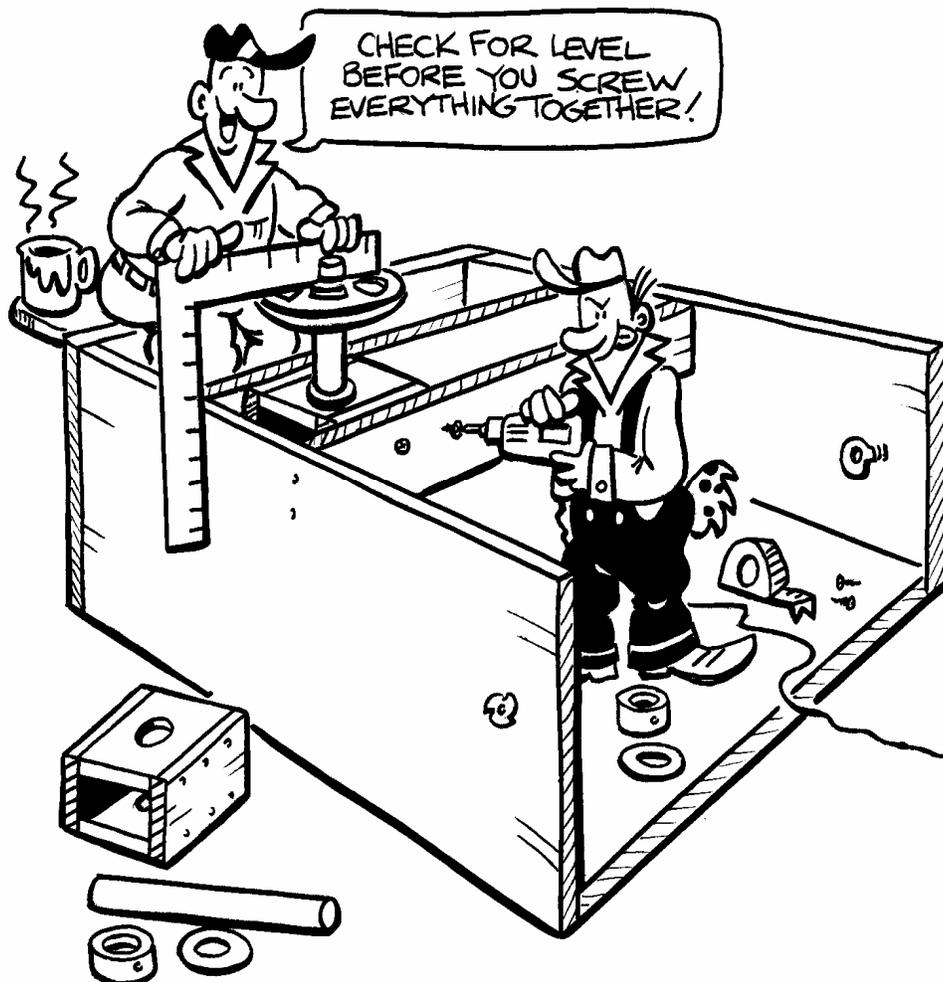
You can wait on the installation of the eyebolts until later to avoid scarfing your knuckles while working inside the cabinet on other assemblies. The springs will be attached to eyebolts in the power head assembly later.



The spring length is nominal. Springs from 5 to 10 inches will probably work. They should be fairly strong, but still stretchable.



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Screw into the bearing box through a support near the end of one of the bearing boxes. Install a pulley on the shaft and tighten the setscrew. Check that the shaft is parallel to the box edge with a builder's square laid across the pulley. Pivot the bearing box on the screw until it is square. Once it is, add a second screw at the other end to hold it in position.

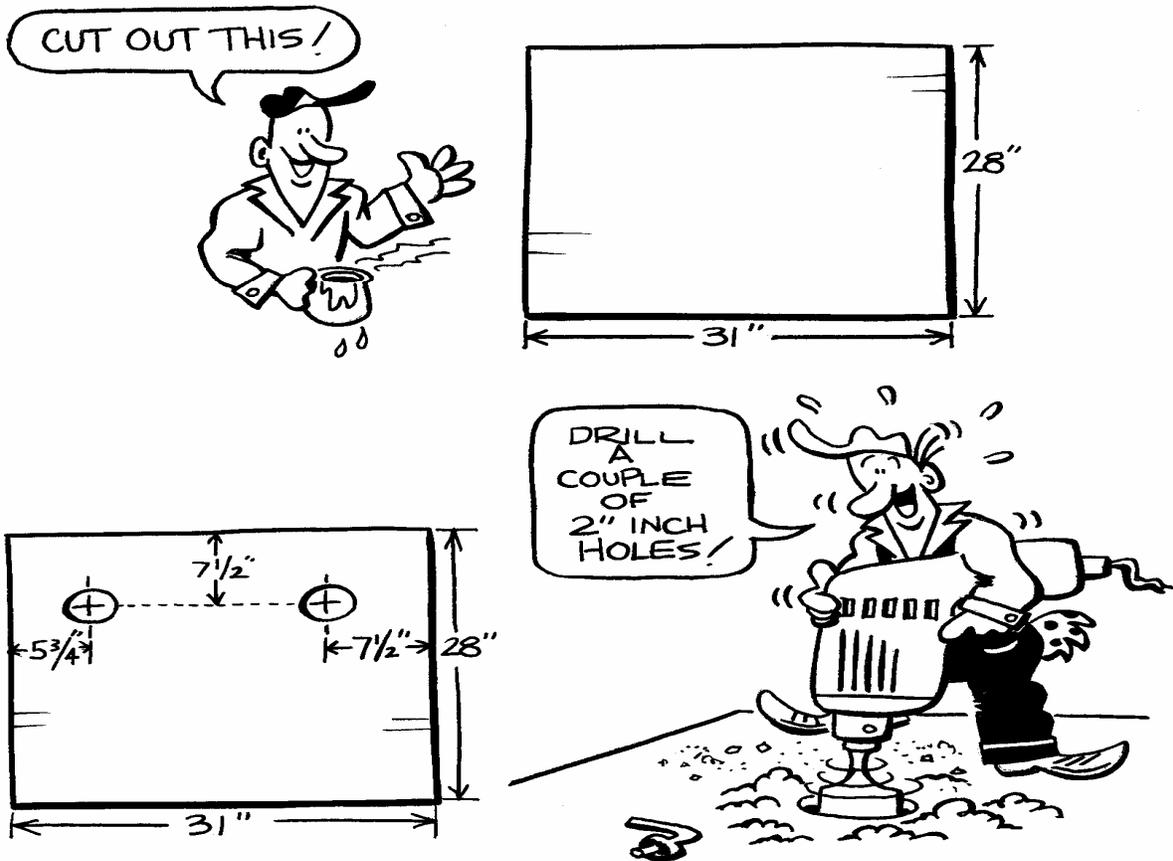
Check for square in the other direction in a similar fashion. Raise or lower one end of one support until the box is plumb in both directions.

Repeat with the other bearing box.

You may have to fidget back and forth with the adjustments a bit to get both shafts plumb.

Add several screws or nails to each bearing box and at the end of each support. An 8" block of 1"x2" wood can be nailed under the two supports for additional strength.

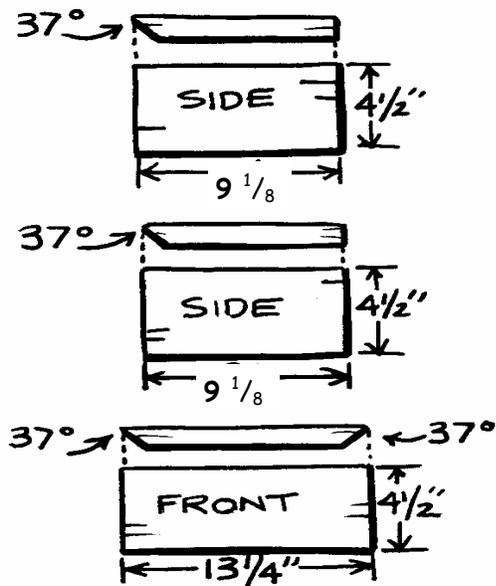
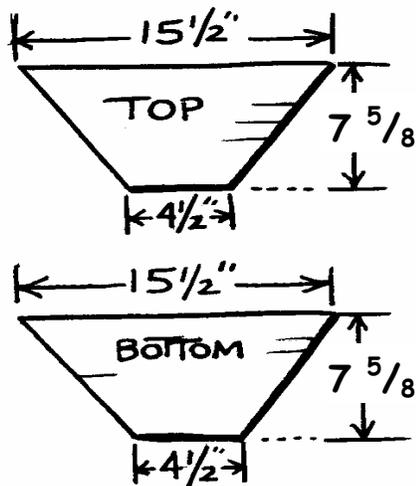
Building the over-arm platform.



Cut the platform out of 3/4 inch thick plywood. Verify your base box dimensions prior to cutting. The platform should be the same size as the outside of the base.

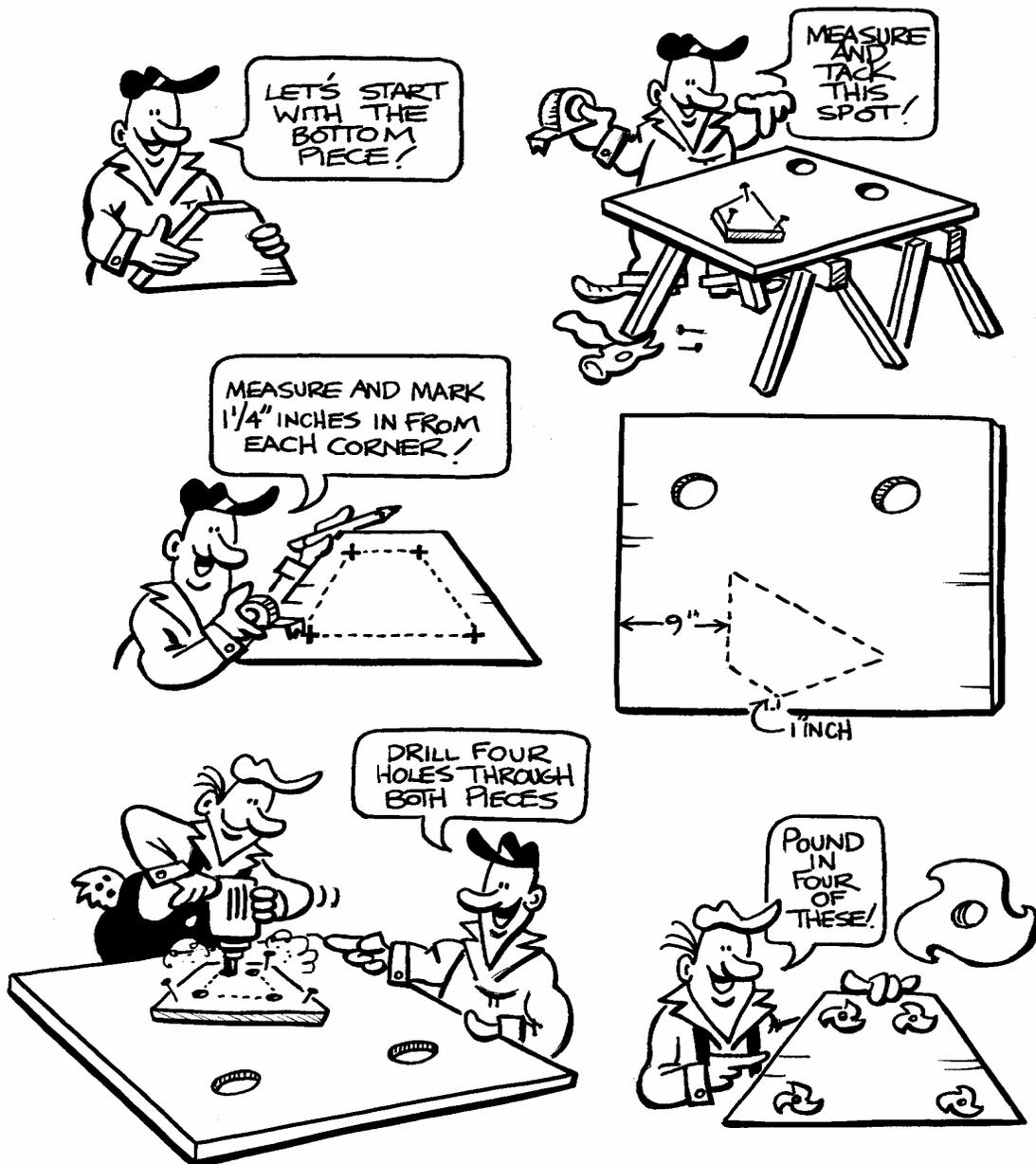
Verify the position of the shaft centerlines and drill the two inch diameter holes to match. If you are more than 1/4" off from the dimensions above, you should correct the location of the bearing boxes and supports. The platform layout is rather critical.

Building the over-arm tower

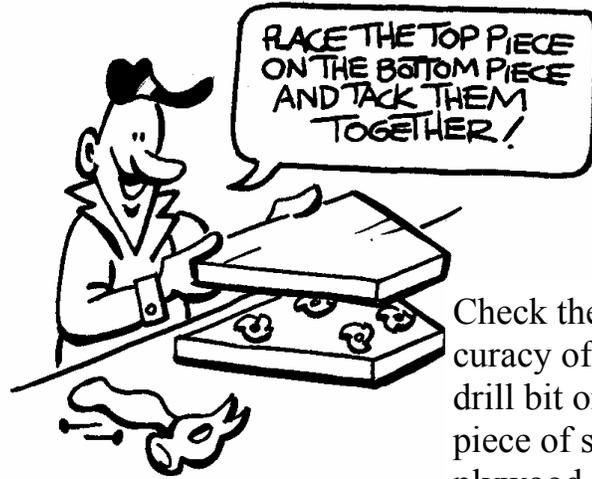


Once again, cut these pieces out of 3/4 inch plywood. I apologize for the 37 degree angle and miter cuts, but it is necessary for the proper function of the machine. If the aesthetics are not important, butted joints will work fine. This is one of the areas where the dimensions are nominal. You can adjust them slightly as necessary so that the sides fit the top and bottom.

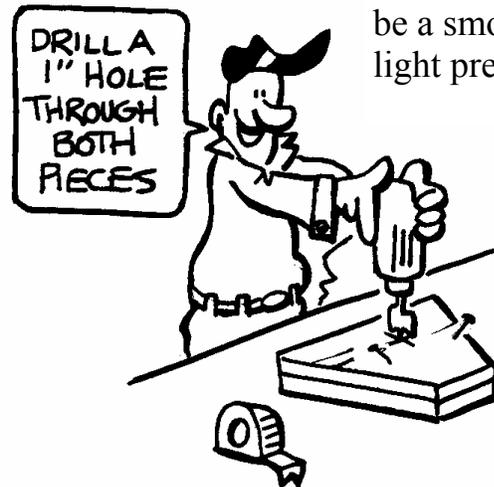
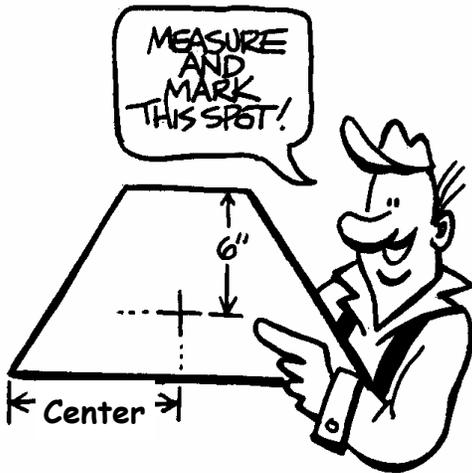
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The over-arm tower will bolt to the platform with 3/8" by 1-1/2" hex head bolts installed from the underside of the platform. The 3-pronged nuts are installed inside the tower. Layout the base of the tower as shown. It is important that the tower edge is 9 inches from the side as shown and that it is parallel to that side. After drilling through both pieces of wood with a 3/8" drill, re-drill the tower base up to the size of the 3-pronged nuts (probably 7/16"). Hammer the 3-pronged nuts into the topside of the tower base. Trial test bolting the tower base to the platform before finishing the tower. It will be difficult to change later.

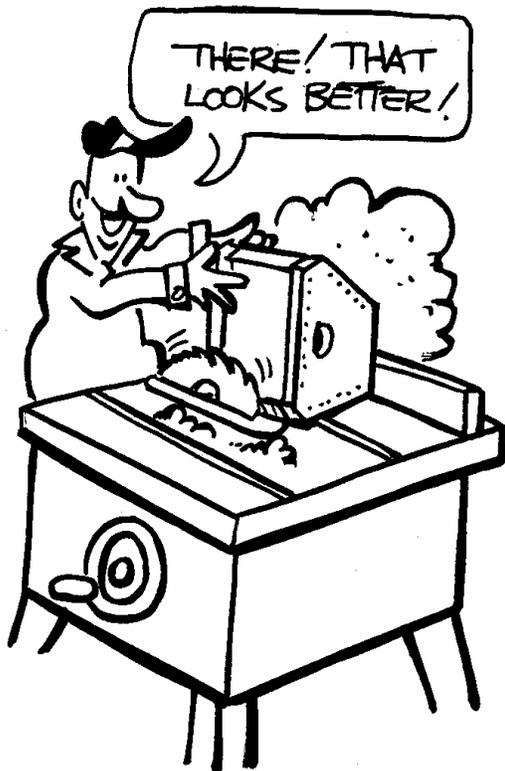


Check the accuracy of your drill bit on a piece of scrap plywood. The 1" diameter shafts should be a smooth, light press fit.

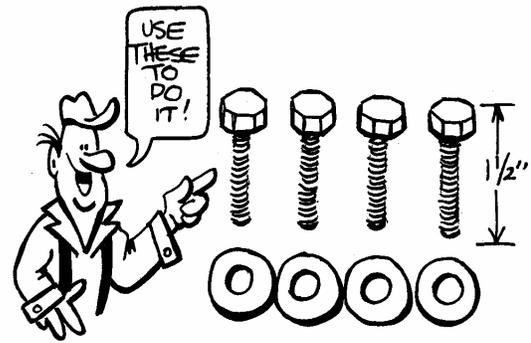




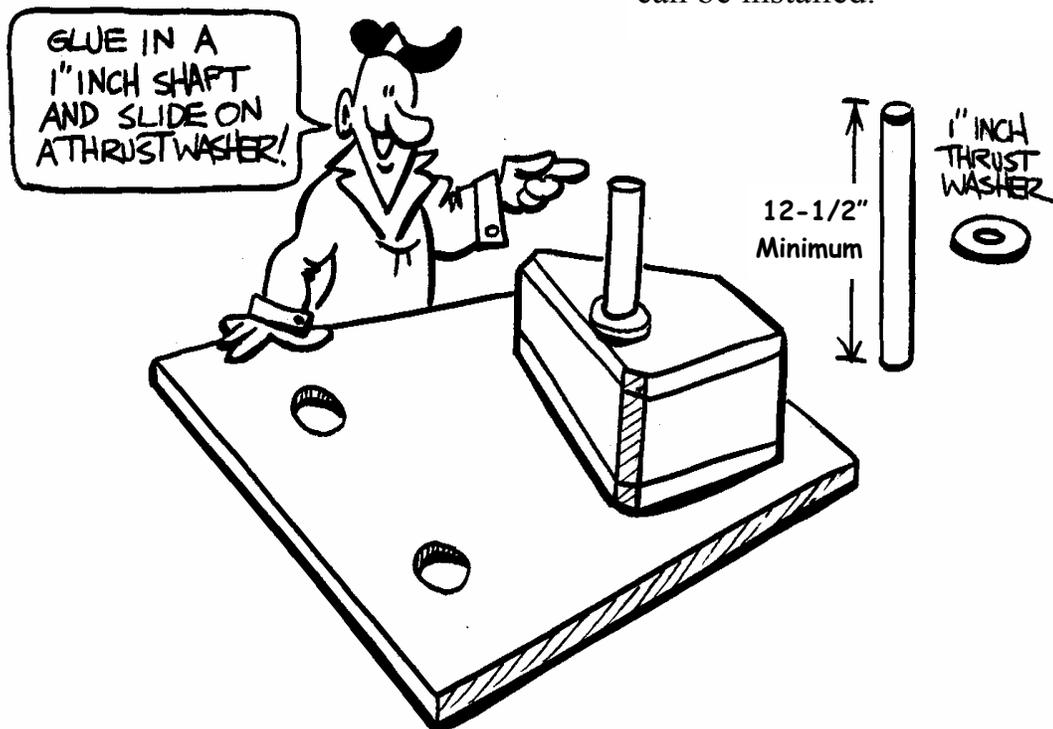
The pictures of the previous page and this one should be pretty self explanatory. After gluing and before fastening the top to the tower, insert the 12 inch piece of 1" diameter shafting into the holes in the tower. Check that the shaft is plumb with a square against the top and shaft. Move the top slightly until the shaft is plumb. Fasten the top and remove the shaft.



If the corners of the tower look a little rough, now is the time to touch them up with a disk sander or saw.



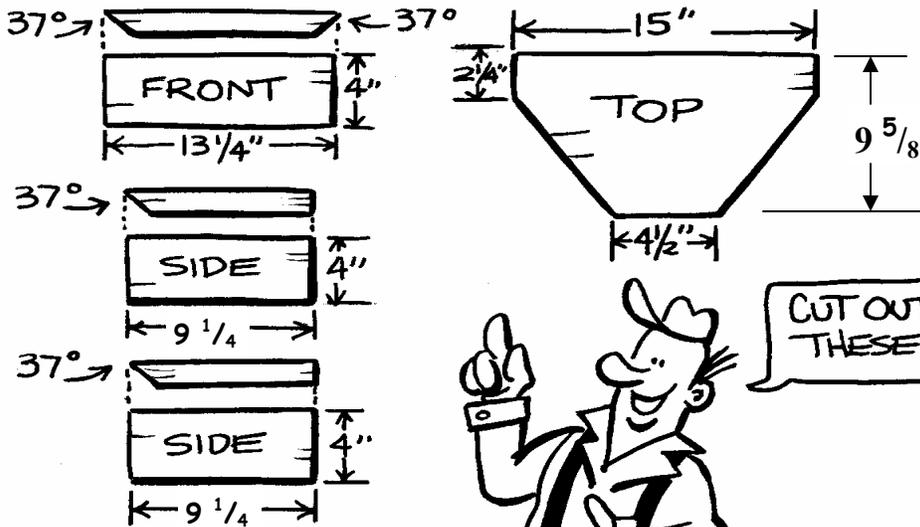
Coat the edge of the top and bottom holes in the plywood with polyurethane or epoxy glue. Insert the shaft into the holes. It should not protrude from the bottom. The shaft should be a snug fit. Once again verify that it is plumb. If not, pull the shaft out of the box, wipe the glue off and file the hole until a plumb shaft can be installed.



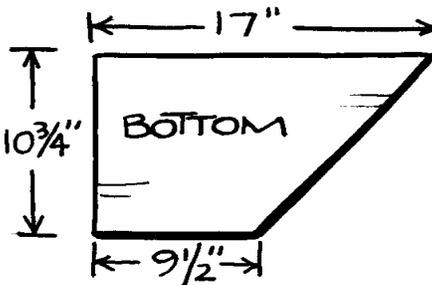
Building the over-arm support.

Once again, sorry about the bev-els. Dimensions are nominal. Adjust the side lengths to fit the top piece.

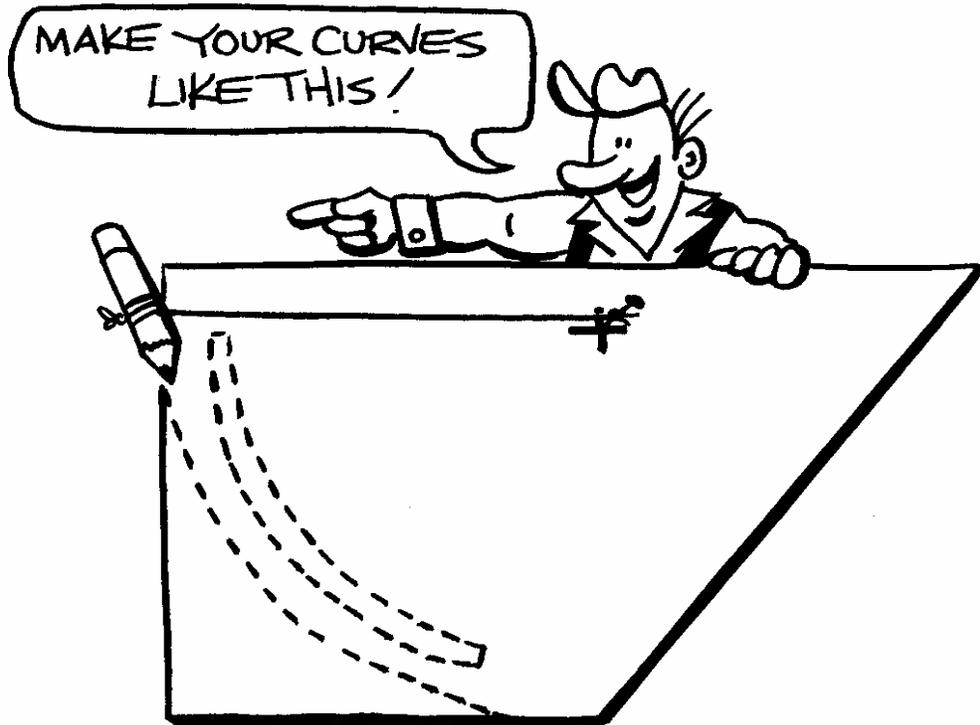
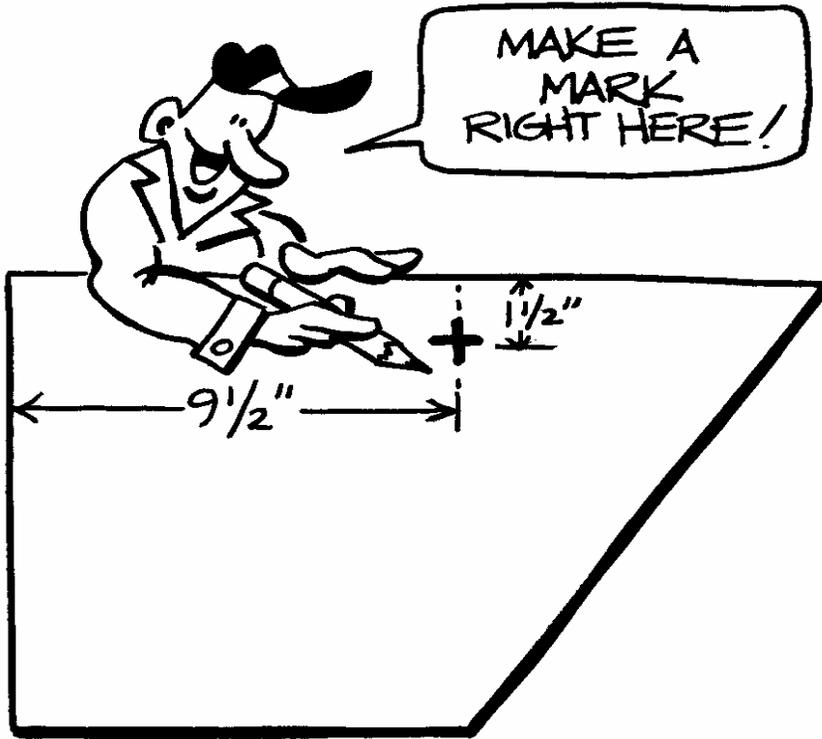
The 2-1/4" measurement on the top piece is the overhang.

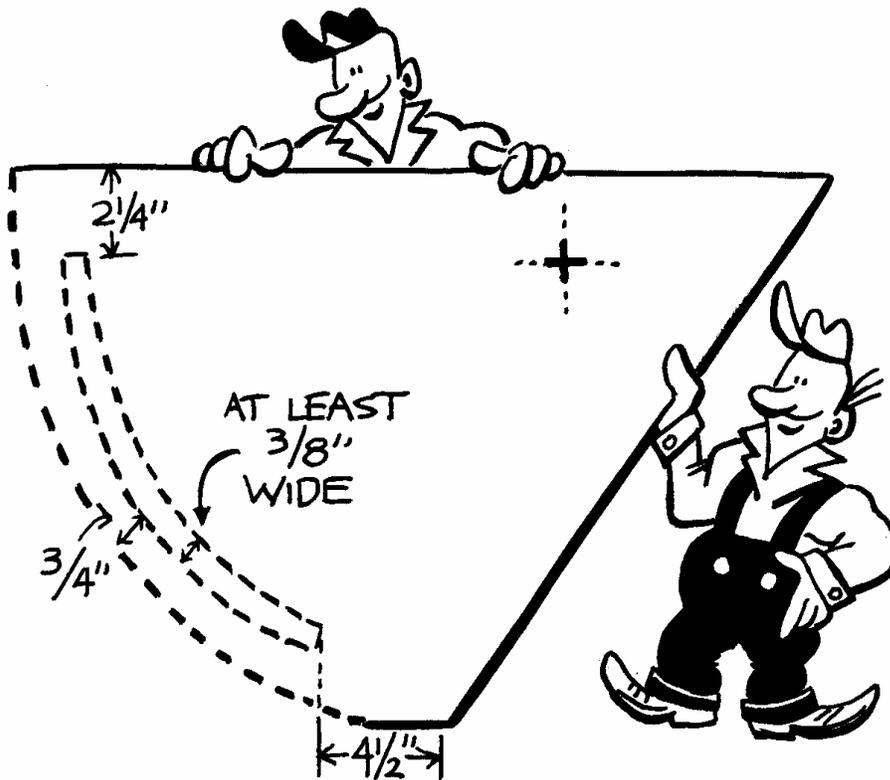


CUT OUT THIS BASK SHAPE FIRST!



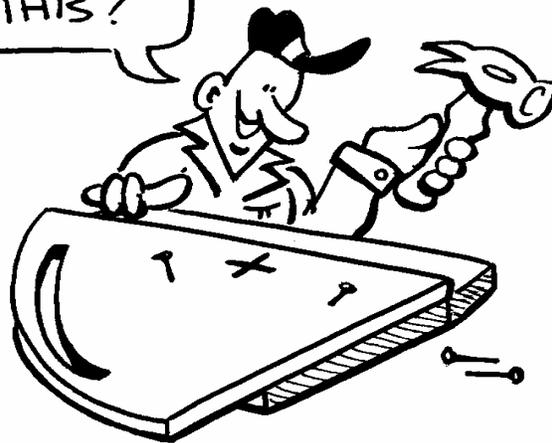
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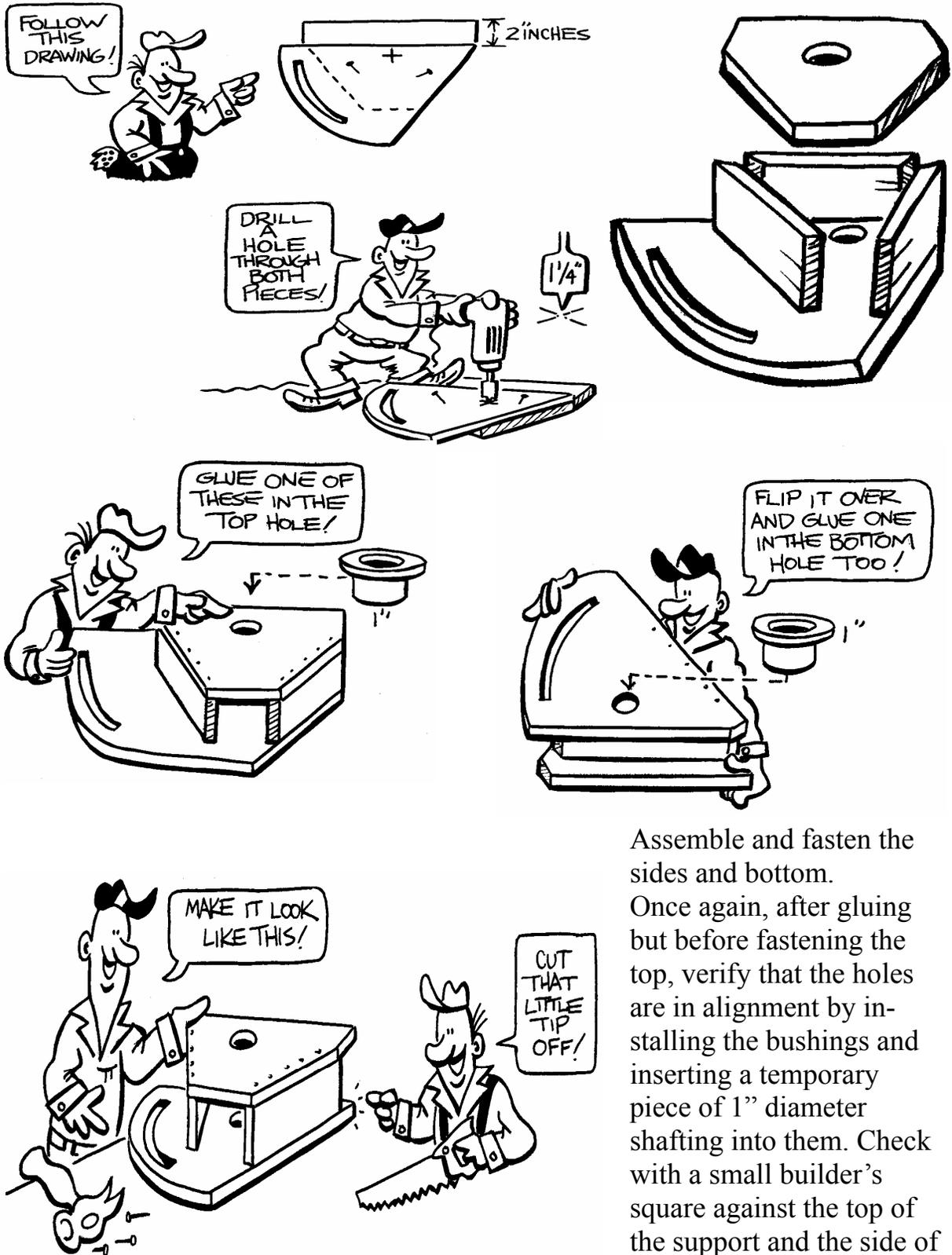
Cut the curves with a saber saw or router. A 3/8 inch bolt will slide in the slot as an adjustment for the over-arm position . It is important that the inside of the slot be smooth . Slide a 3/8 “ diameter bolt the entire travel of the slot. If it hangs or grabs anywhere, sand or file that part smooth. Avoid making the slot too wide as this will cause a lack of positioning accuracy.

TACK THE BOTTOM AND TOP TOGETHER LIKE THIS!



Temporarily tack the top and bottom of the over-arm support together as shown. This will assure that the 1-1/4” holes to be drilled are in alignment. Before drilling, check that the bits cut accurate holes. Drill a piece of scrap and assure that the bronze bearings are a smooth press fit.

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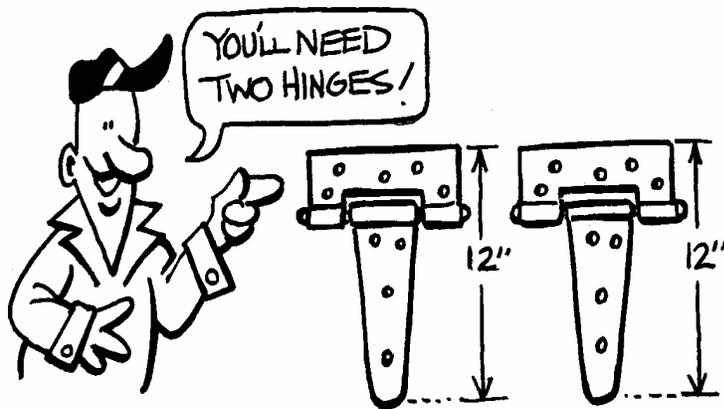
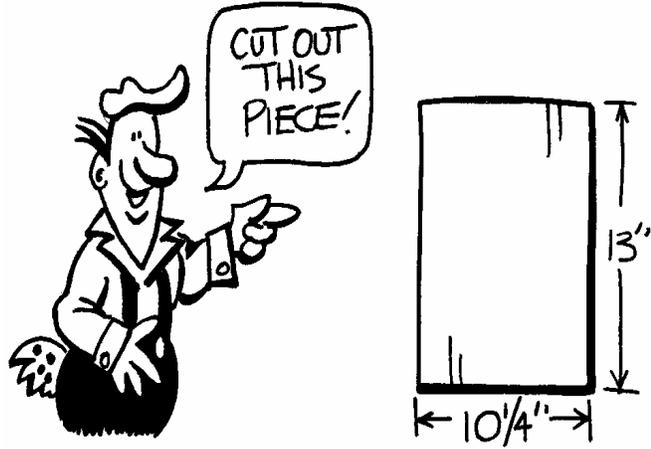


Assemble and fasten the sides and bottom.

Once again, after gluing but before fastening the top, verify that the holes are in alignment by installing the bushings and inserting a temporary piece of 1" diameter shafting into them. Check with a small builder's square against the top of the support and the side of the shaft.

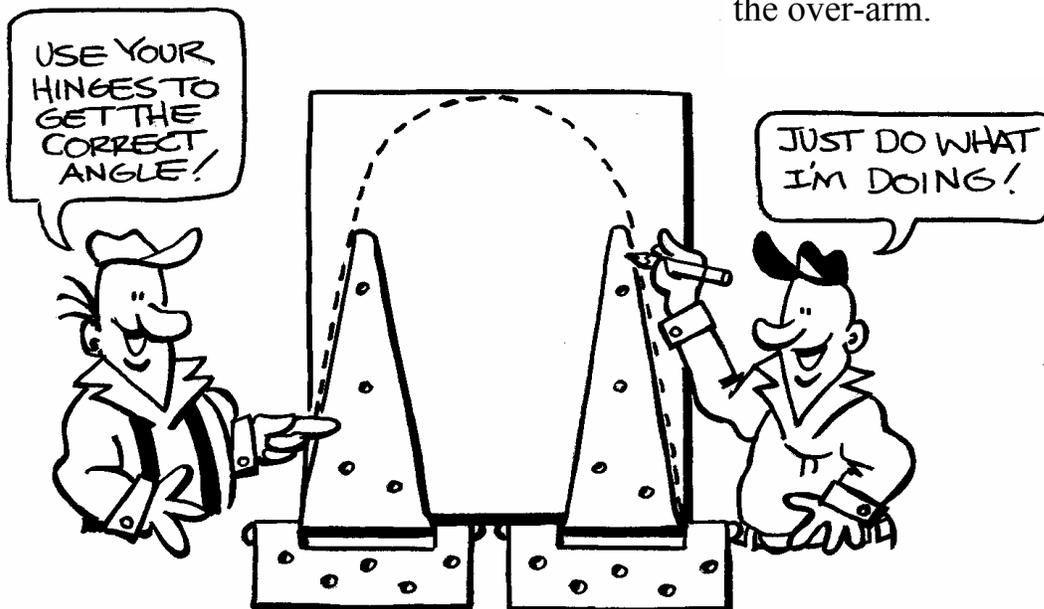
Constructing the over-arm.

The over-arm on this machine has a double hinge assembly for extra rigidity. The Stanley hinges specified have a plastic bushing that removes almost all of the slop found in lesser hinges. Try to avoid substituting them.



Layout the hinges as shown. Butt them together and make sure that they are tight up to the base of the over-arm. If the hinges are not parallel, binding will occur when the arm is raised.

Trace around the edges of the hinges and construct a smooth curve to the end of the over-arm.



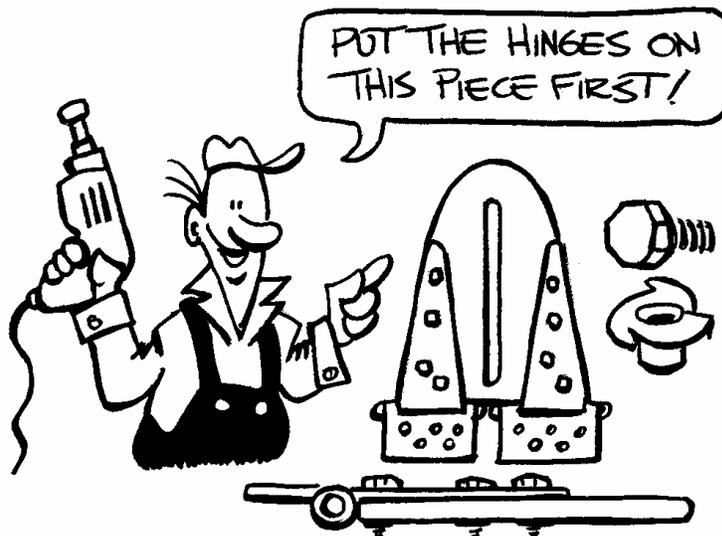
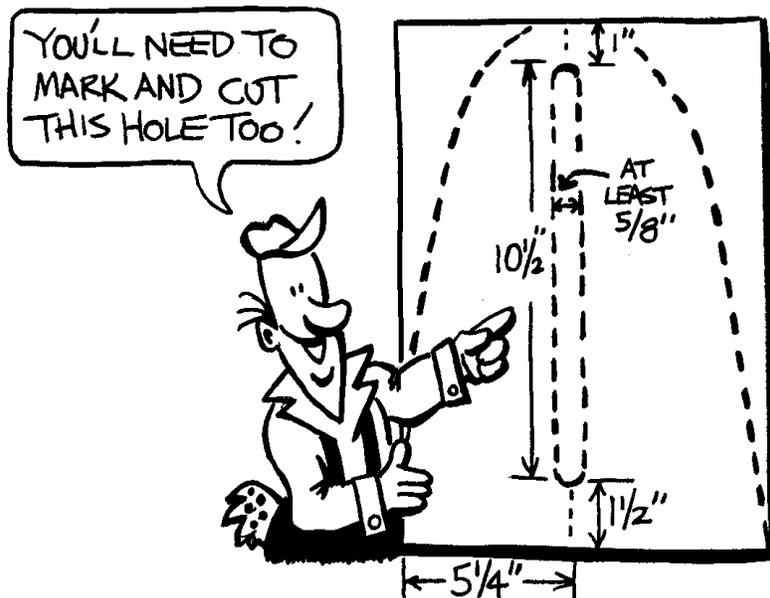
Mirror-o-Matic

Mark the $\frac{5}{8}$ " slot as shown and cut out the over-arm.

Use a saber saw or router and cut the slot. The inner edges of the slot should be smooth. Run a $\frac{5}{8}$ " bolt or threaded rod the length of the slot and make sure that the slot is correct.

Sand or file until the bolt can slide smoothly front to rear.

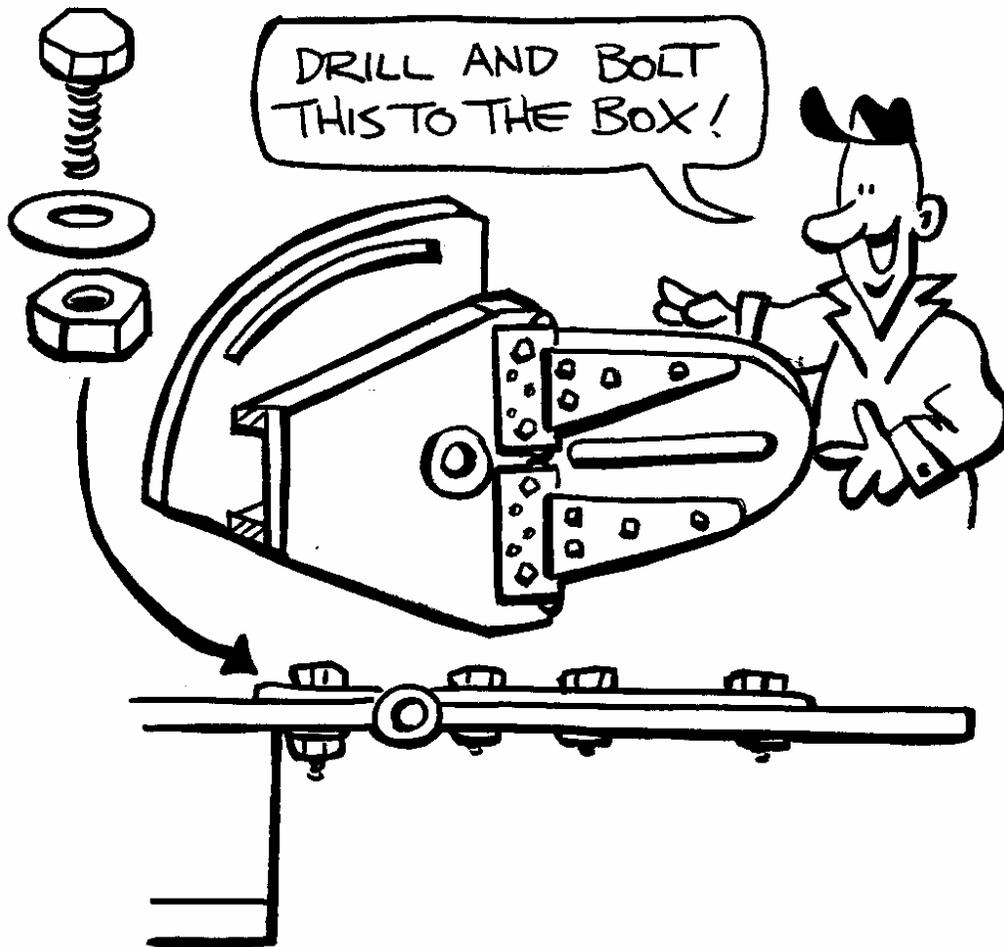
The slot can be a bit wide too wide so the bolt can still slide after painting.



Place the hinges in position on the over-arm and drill $\frac{3}{8}$ " diameter holes through the arm to match the holes in the hinges. Remove the hinges and re-drill the holes to the size required (usually $\frac{7}{16}$ ") for $\frac{3}{8}$ " 3-pronged nuts. Install the nuts in the bottom of the arm and bolt the hinges to the arm with $\frac{3}{8}$ " x 1" bolts.

The hinge pins can also be installed upwards if you want to have the arm lay further back when raised.

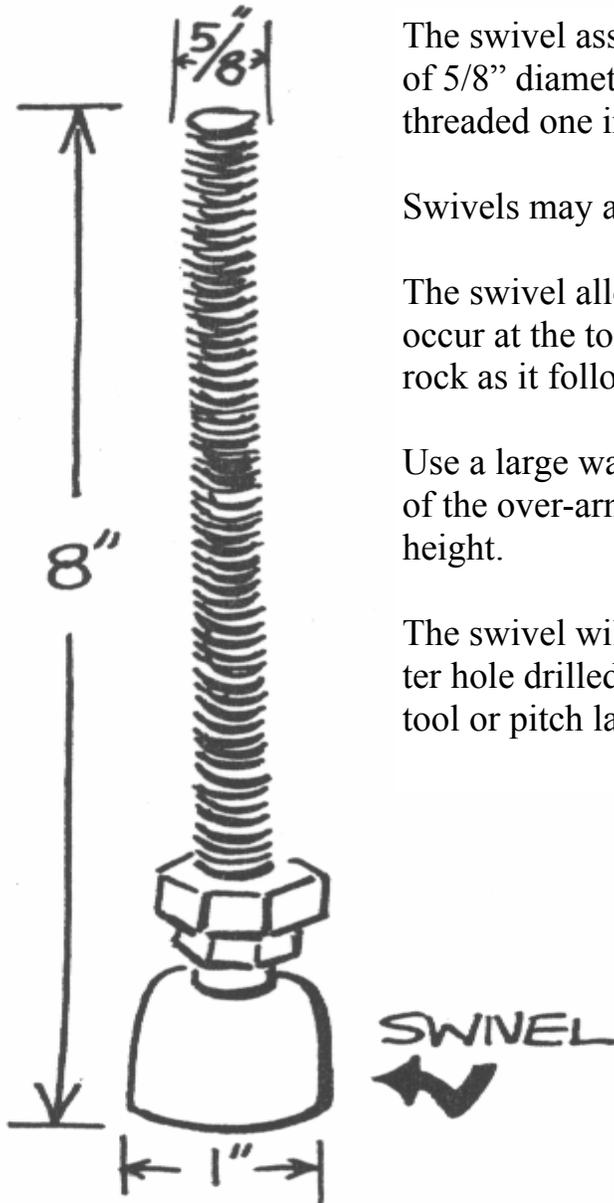
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Use 3/8" x 1-1/4" NC bolts washers and nuts to attach the over-arm to the platform. Make sure to put a straight-edge across the rear of the hinges to keep them in alignment. The arm should lift and drop easily. If the hinges are out of alignment, re-drill some of the bolt holes slightly oversize and try again. If the arm has too stiff of a motion, it will not follow the mirror blank if the turntable is not perfectly flat.

You can position the pivot either up or down so that the arm travel when lifted folds all the way back or stays upright.

The Swivel



The swivel assembly is made with a piece of $\frac{5}{8}$ " diameter UNC threaded rod and a threaded one inch diameter swivel.

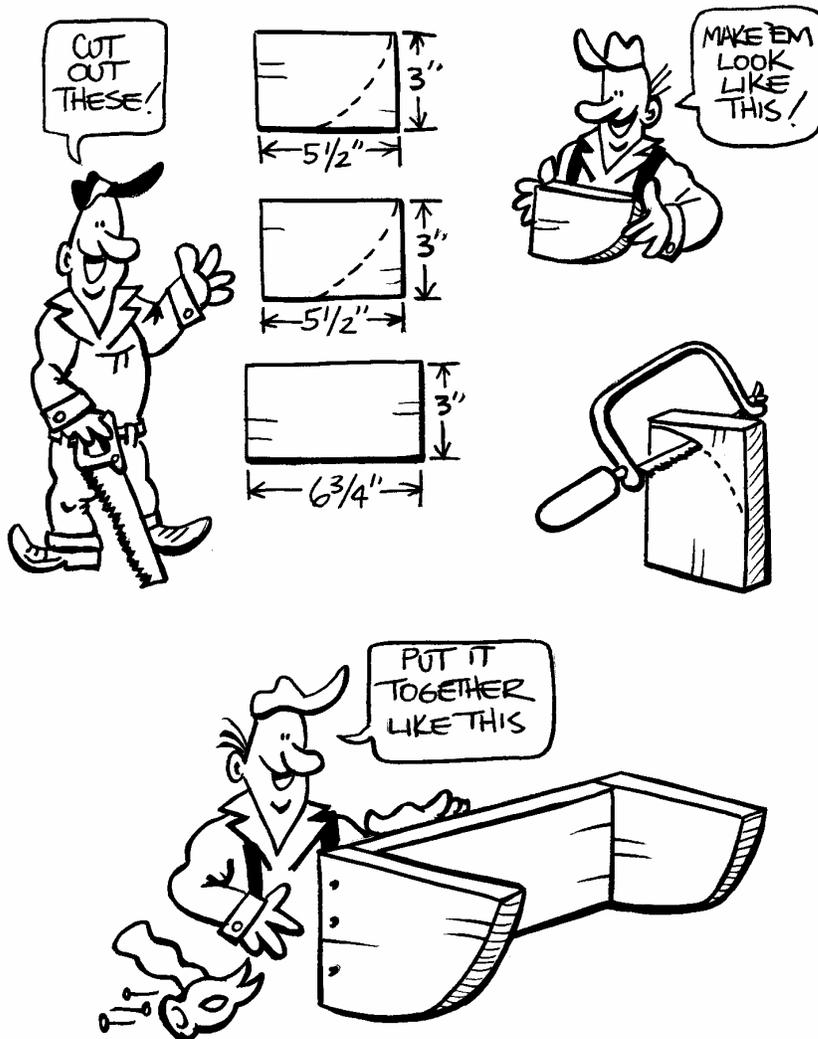
Swivels may also called leveling pads.

The swivel allows low friction spinning to occur at the tool and to allow the tool to rock as it follows the curve of the mirror.

Use a large washer and nut on each side of the over-arm to adjust the swivel height.

The swivel will fit into a one inch diameter hole drilled into the back of the tile tool or pitch lap.

The over-arm needs a stop.

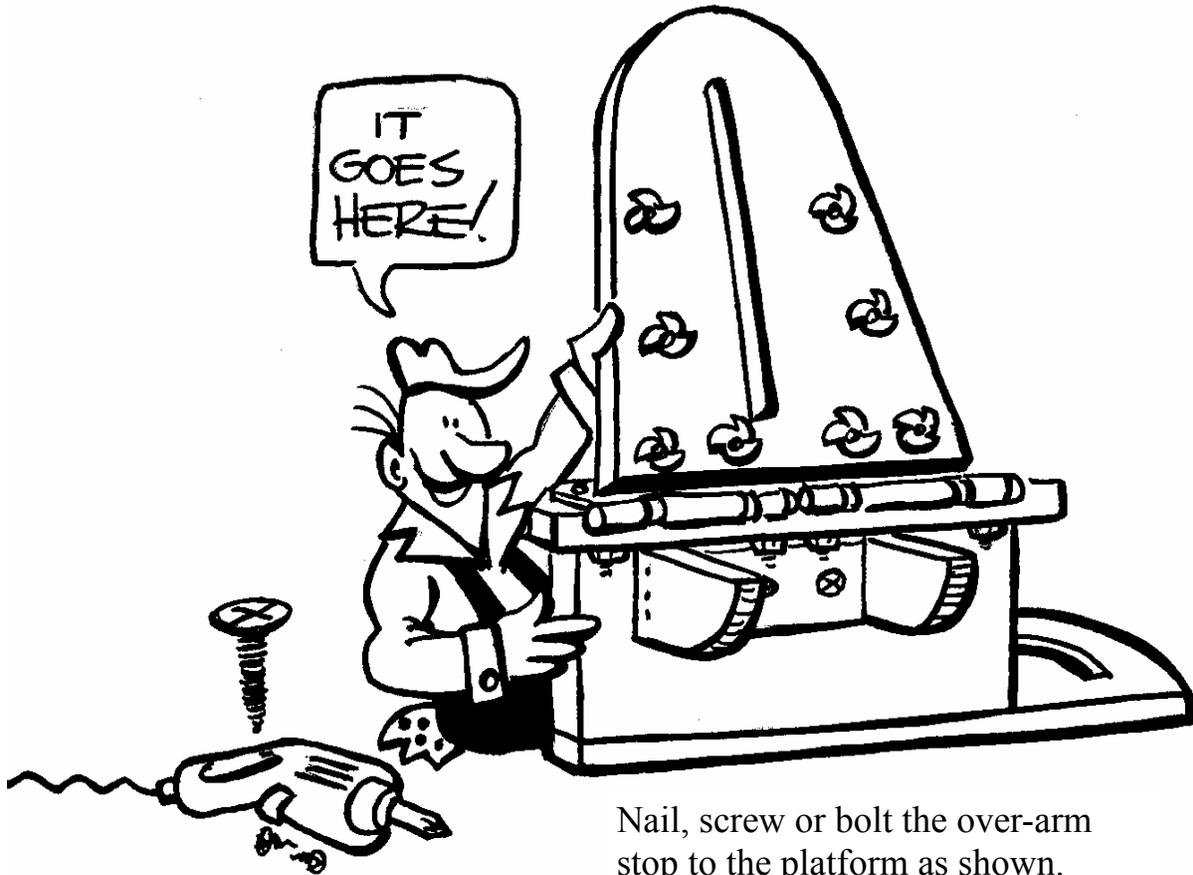


A stop must be added to prevent the over-arm from accidentally being dropped onto the mirror below.

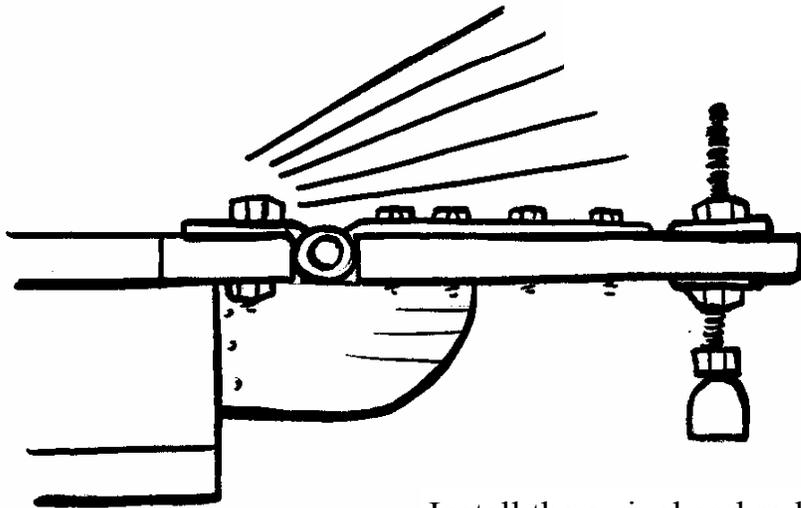
When grinding or polishing, never allow the slurry to dry out.

If this happens, the tool and mirror will stick to each other. The energy in the turntable will toss the tool out and the swivel will crash to the mirror below.

This stop will prevent this and accidental arm dropping from occurring.



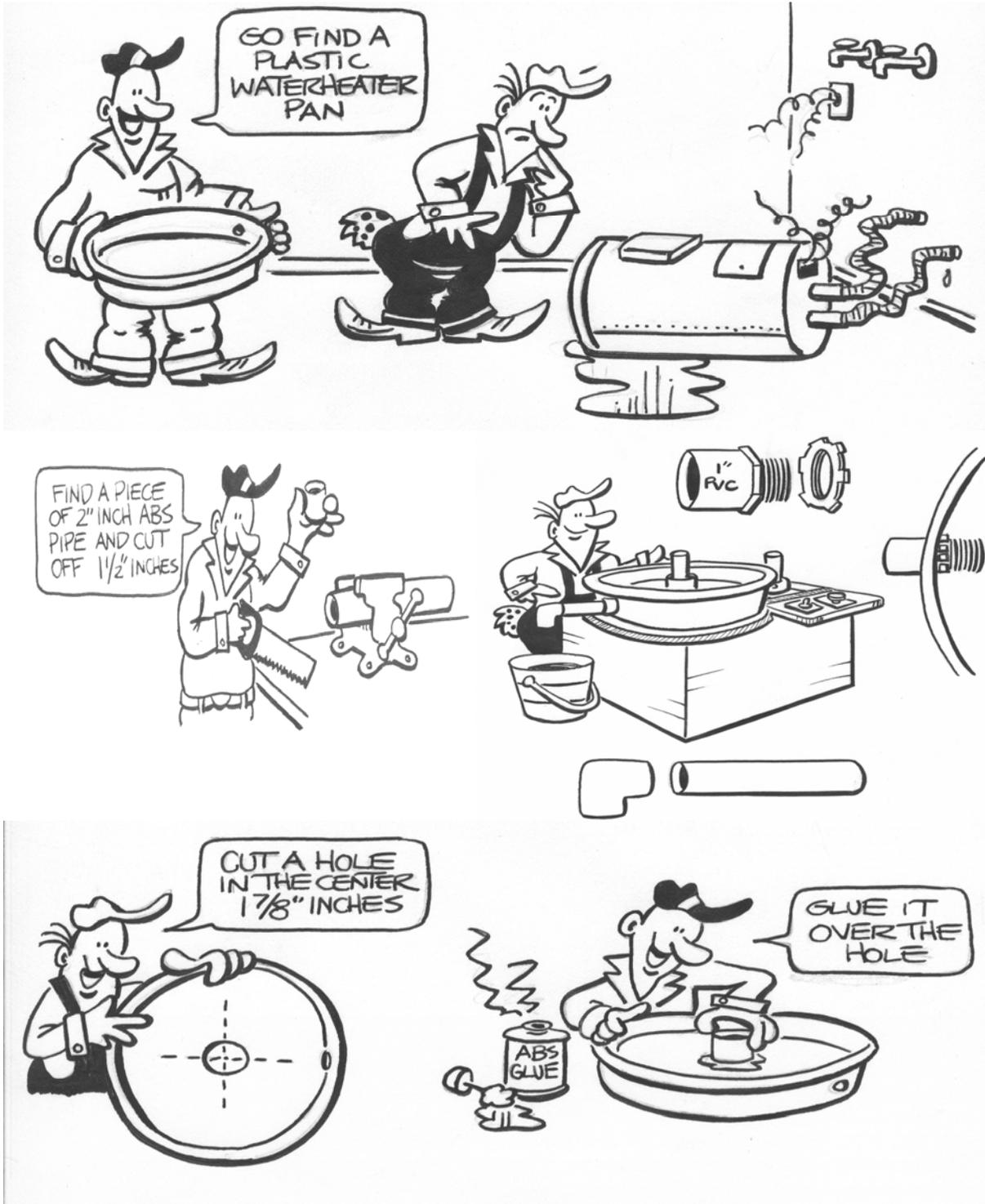
Nail, screw or bolt the over-arm stop to the platform as shown.



Install the swivel and rod into the over-arm with flat washers and 5/8" nuts on each side of the over-arm.

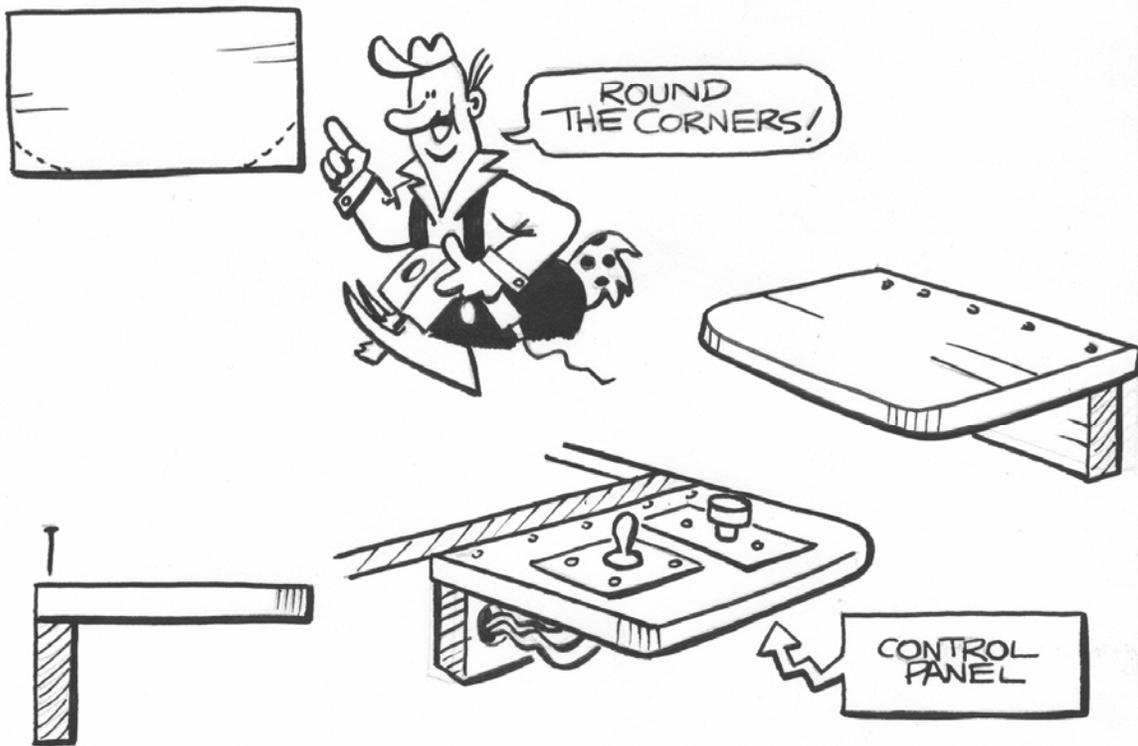
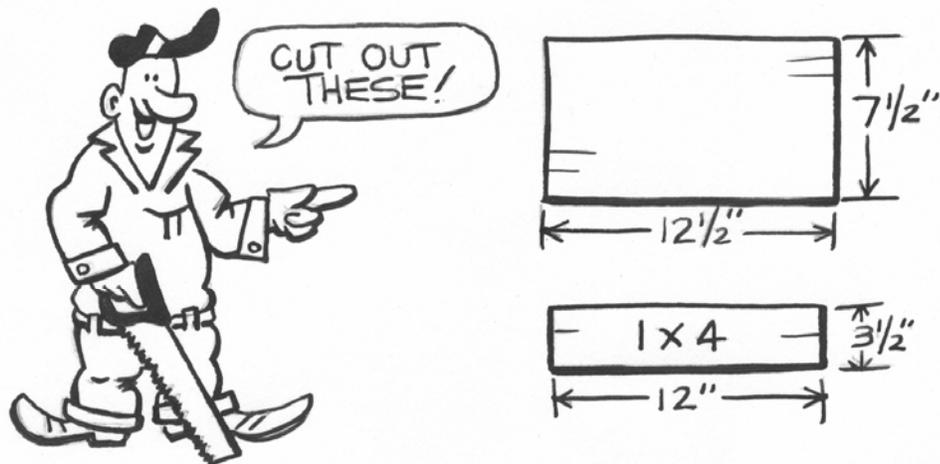
Building a drip pan

I used a 24 inch plastic water heater pan from Home Depot. This is the largest pan that I could find and is the largest pan that will fit on this machine. The ABS pipe is glued to the pan with ABS pipe glue.

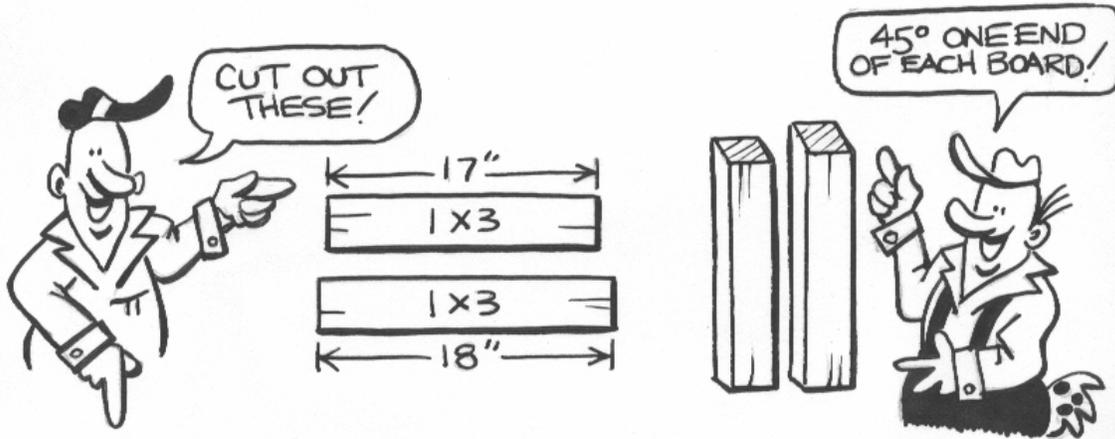


Building the control panel shelf

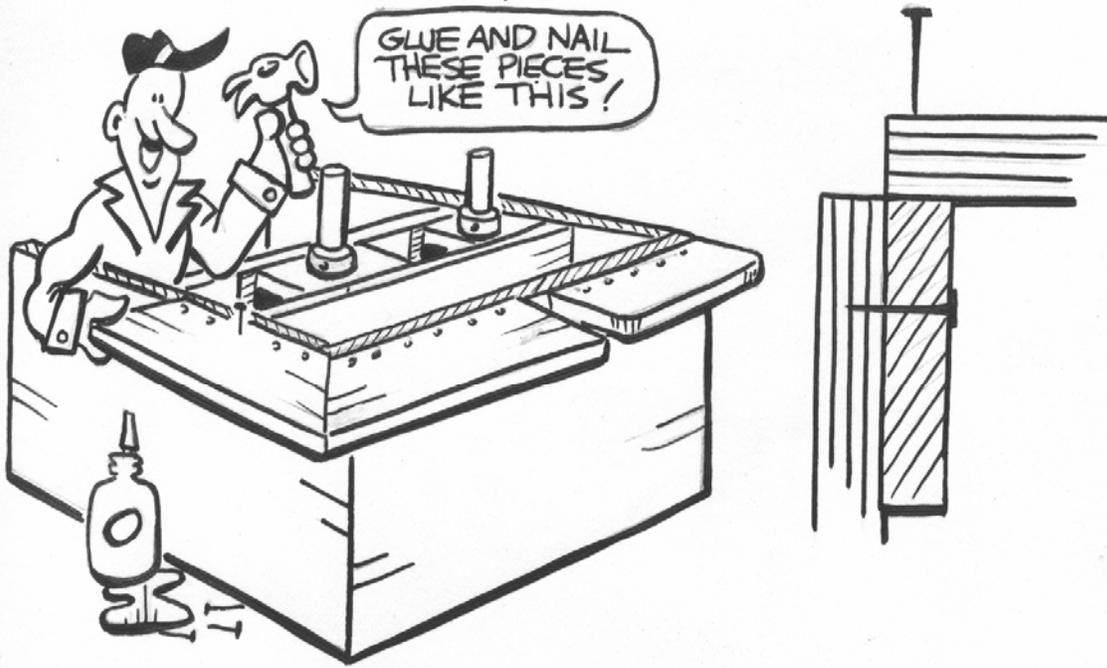
This is an optional shelf where you can add an off-on switch, timers or speed controls.



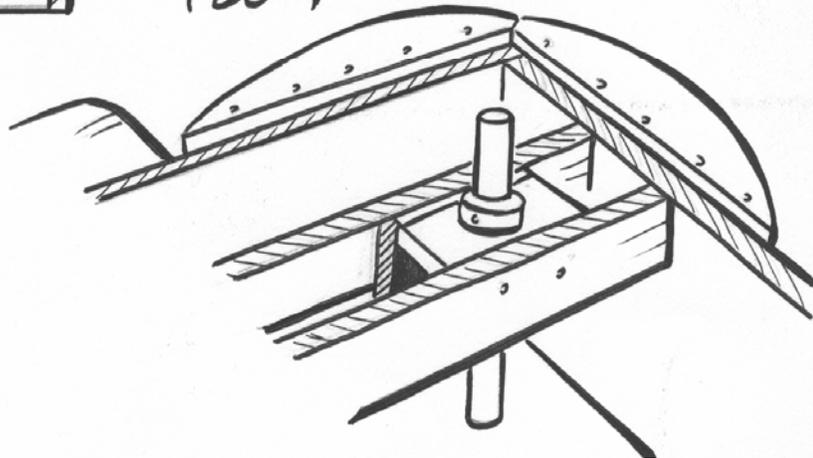
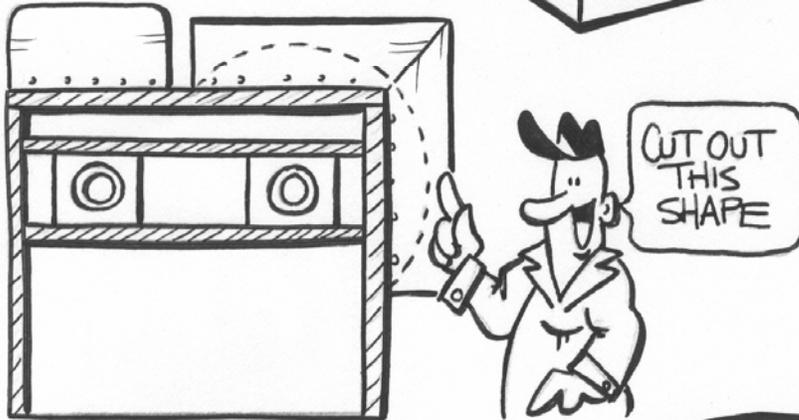
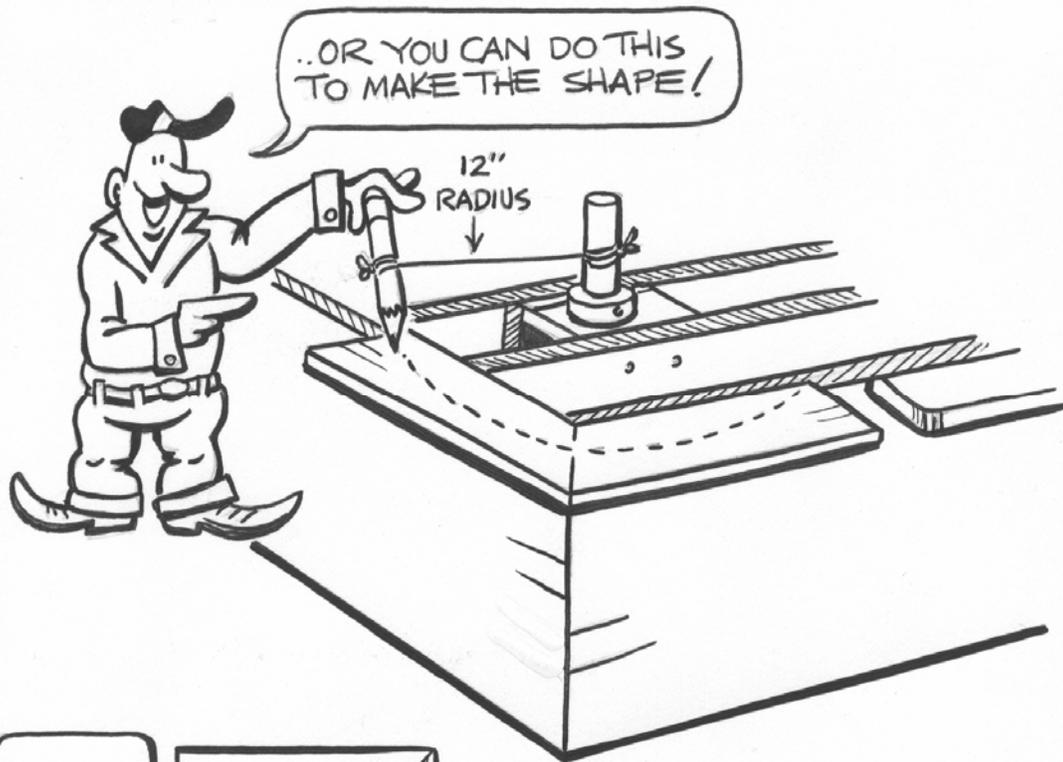
Drip pan support and control shelf installation.



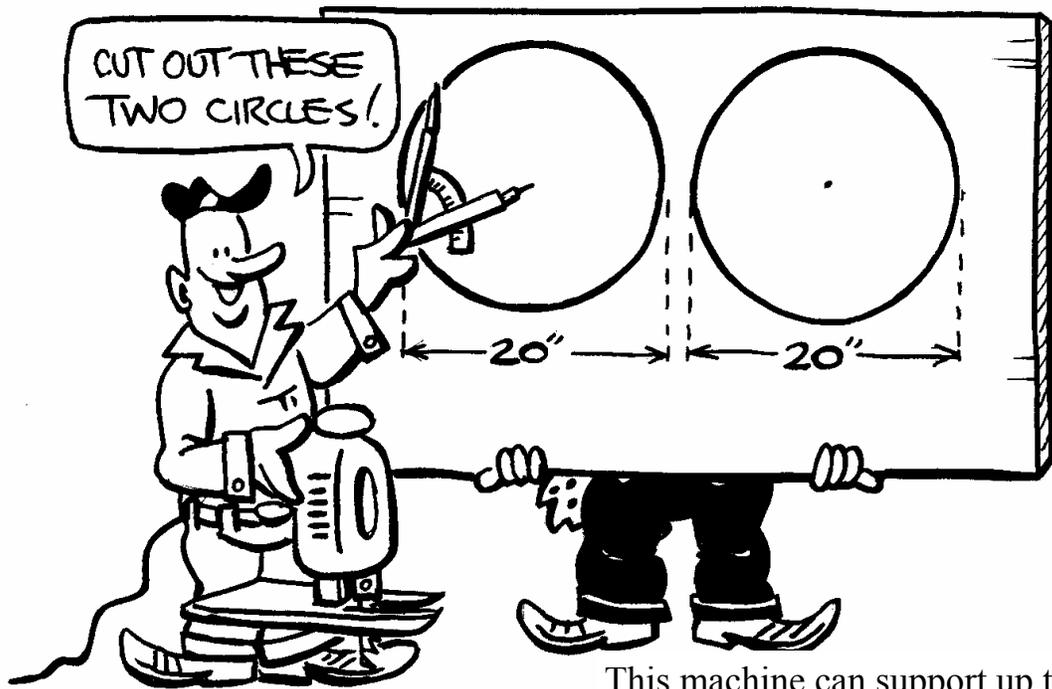
Mirror-o-Matic



Mirror-o-Matic



It's time for the turntable

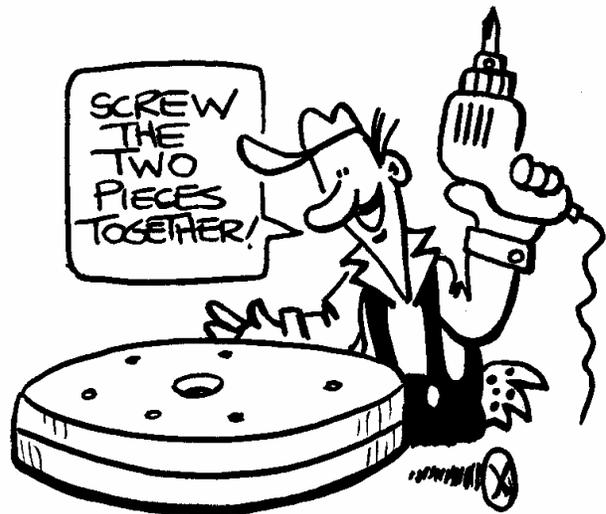


Paint all surfaces of the turntable with a waterproof resin before assembly. After assembly, caulk the seams to keep grit out.

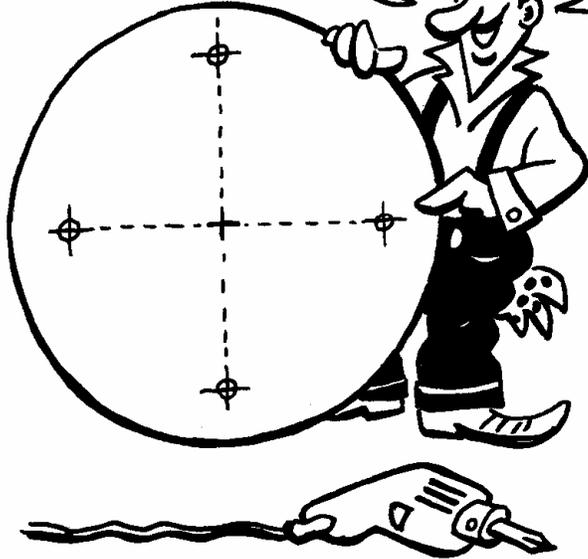
This machine can support up to a 24 inch turntable, although 20 inches is more practical. I would recommend a turntable 3 or 4 inches bigger in diameter than the mirror to be ground. A smaller turntable can be rested on a smaller supporting pulley. This results in less expense, a more rigid support and better containment of slurry.



Temporarily fasten the two circles together to assure alignment when drilling the holes on the next page.



MARK THE OTHER CIRCLE AND DRILL FOUR HOLES LIKE THIS!



2 1/4" INCHES IN

Draw a line on the side of the two turntable pieces to aid in assemble later.

Drill 3/8" holes through both pieces. Place the holes as required for the placement of the hold-downs. The mirror and turntable size will determine exact location.

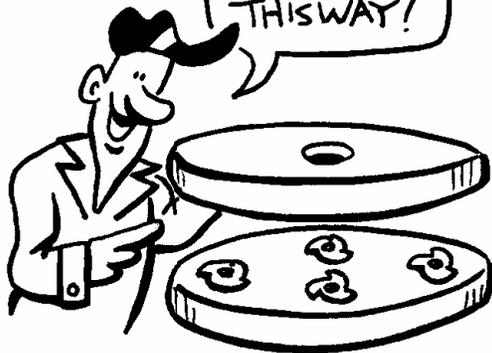
See the slotted blocks section a few pages aft for details

PUT IN FOUR OF THESE



Separate the two pieces and drill oversized holes (7/16") in the bottom piece to accommodate 3/8" pronged fasteners. If possible, sink the fasteners even with the surface to allow the turntable pieces to mate flush.

PUT THEM TOGETHER THISWAY!



Realign the top and bottom of the turntable with the edge line and install 4- 3/8 inch bolts to assure alignment. Caulk the edge seam to keep grit out.

Fasten the top and bottom together with 1-1/4" screws installed from the bottom.



Temporarily insert a 1" ID x 3/4" bronze bushing into the hole. Check the face of the drive pulley hub to see if it is recessed enough to not touch the bearing face when the rim is touching the turntable. If so, glue the bearing into the turntable. If not, recess the rim of the bearing far enough into the plywood to allow the rim to touch. You can also use a bronze bearing without the shoulder.

You may have to add a plywood ring to the edge of the pulley if the rim still does not touch.

The turntable platter sits on top of the driving pulley that will be attached to the 1 inch turntable shaft.

One to three driving dogs will be attached to the bottom of the turntable. They will fit between the pulley spokes.

Center the pulley on the turntable with a short piece of shaft. Trace between the spokes onto a small piece of scrap wood and cut out the dogs.

Screw the dogs onto the bottom of the turntable while the pulley is centered by the shaft.

CENTER A 12" INCH PULLEY
AND CUT OUT SOME DOGS
TO FIT HERE!



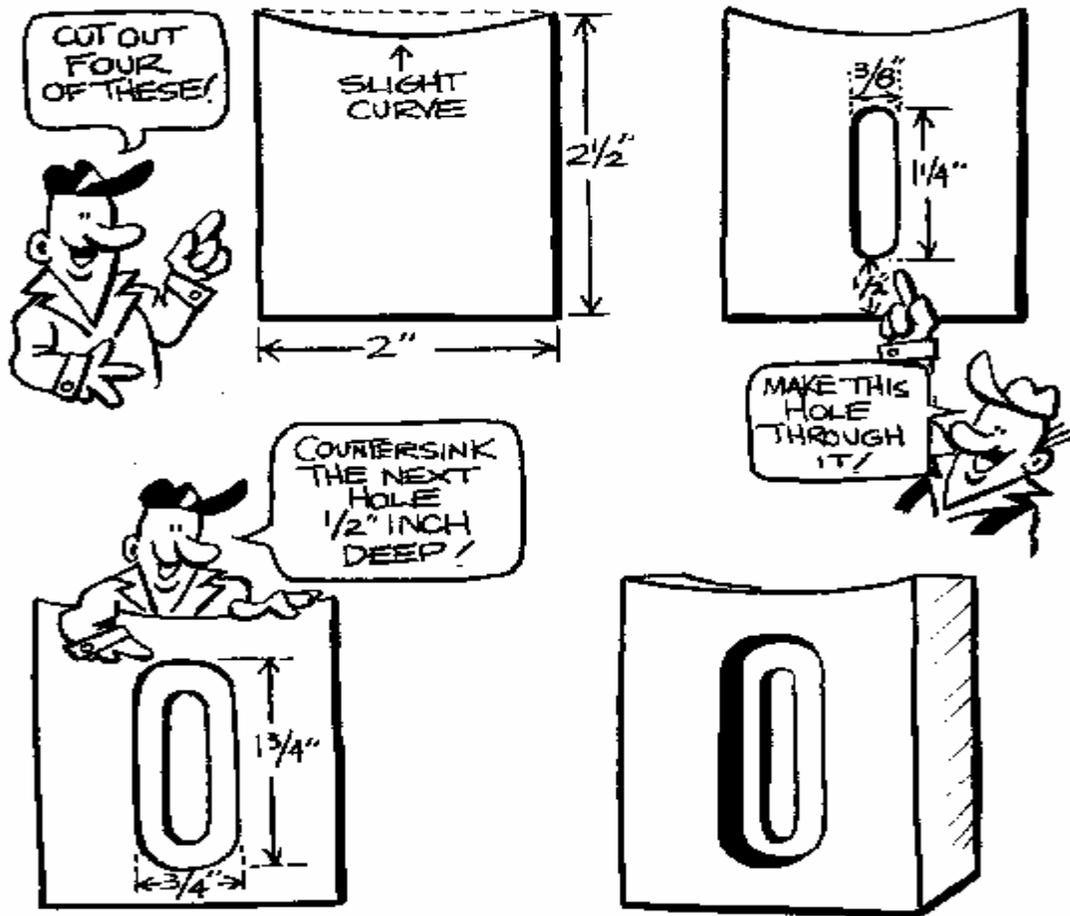
IT SHOULD
LOOK
SOMETHING
LIKE THIS!



FLIP THE
PLATTER
OVER
FOR THE
NEXT PART!



Mirror-o-Matic



The mirror blank will be held and positioned on the turntable with four slotted blocks. The slight curve should be of a smaller radius than the mirror and will assure that the blocks cannot twist on the edge of the blank.

Make the blocks of a size that will allow the mirror to be positioned on the turntable. A large mirror will need shallower blocks than shown.

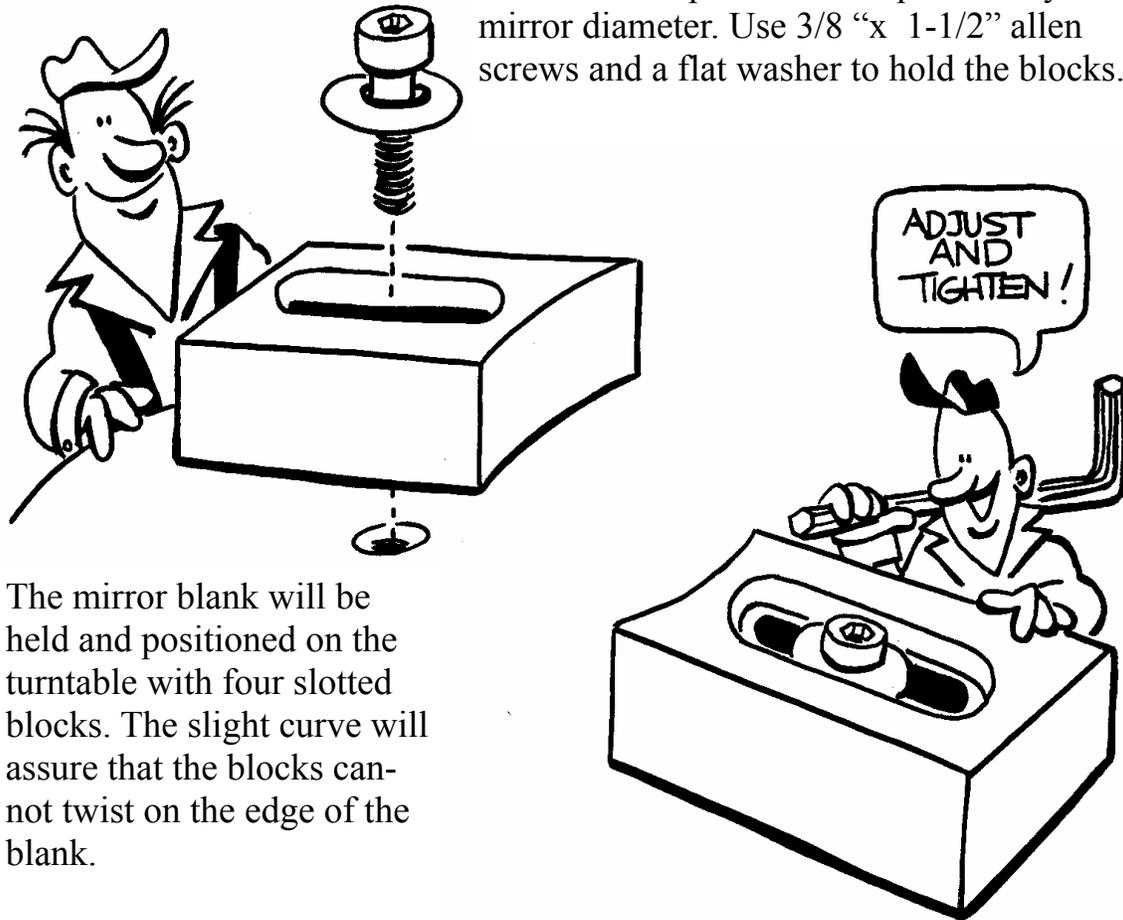
For safety, you can countersink the slot as shown to hide the allen screw head which will fasten the block to the turntable. This will catch grit however. You can also cut the countersunk slot clear through to the rear of the block to allow grit to be washed out.

The sizes shown are recommendations. The size of mirror used and the spacing of the threaded holes in the turntable will determine block length.

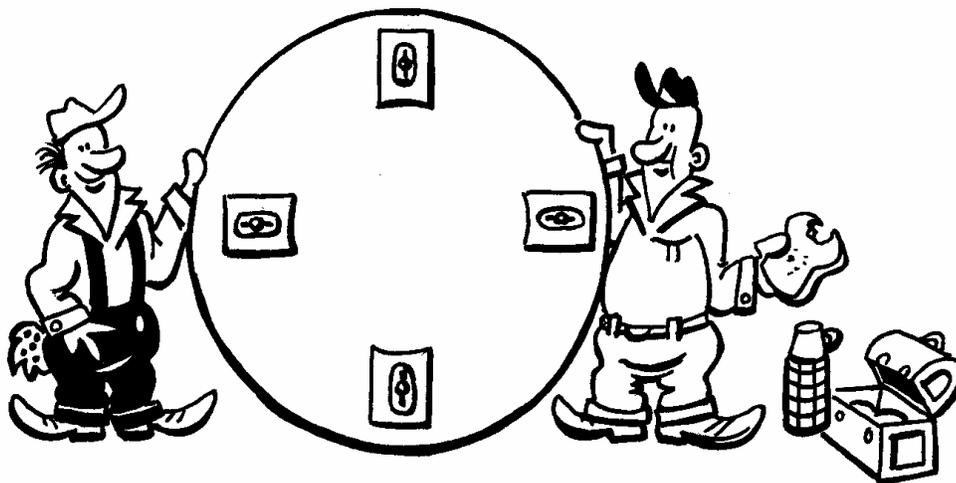
If the block length is as shown above is used, the threaded hole layout in the face of the turntable should be about 3 inches larger in diameter than the mirror diameter. Multiple holes can be drilled in the turntable if desired. If there is a large range of mirror sizes to be made multiple block lengths may be desirable.

Mirror-o-Matic

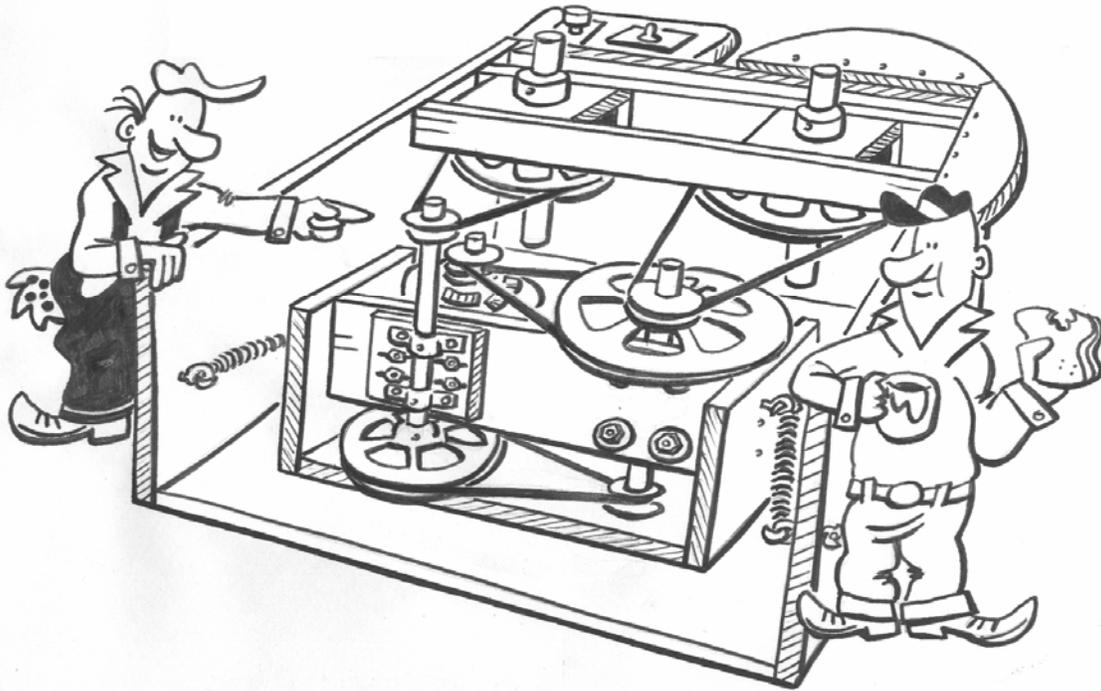
Adjust the block length, slot position and threaded hole position as required for your mirror diameter. Use 3/8 "x 1-1/2" allen screws and a flat washer to hold the blocks.



The mirror blank will be held and positioned on the turntable with four slotted blocks. The slight curve will assure that the blocks cannot twist on the edge of the blank.



Building the Power Head



The Mirror-o-Matic 20 uses the same power head assembly as the original. If you built the original you can reuse this system. As pictured above, the turntable will rotate quickly and the eccentric will be slow. This is correct for grinding and polishing. When figuring, the power head can be taken out and rotated 180 degrees so the speeds can be reversed.

The heart of the Mirror-o-Matic is the power head assembly. A single speed 1725 rpm 1/4 horse power motor is used along with a pair of belt reduction shafts and pulleys. By using different pulley-shaft-belt combinations, a wide variety of turntable and over-arm eccentric speeds can be achieved.

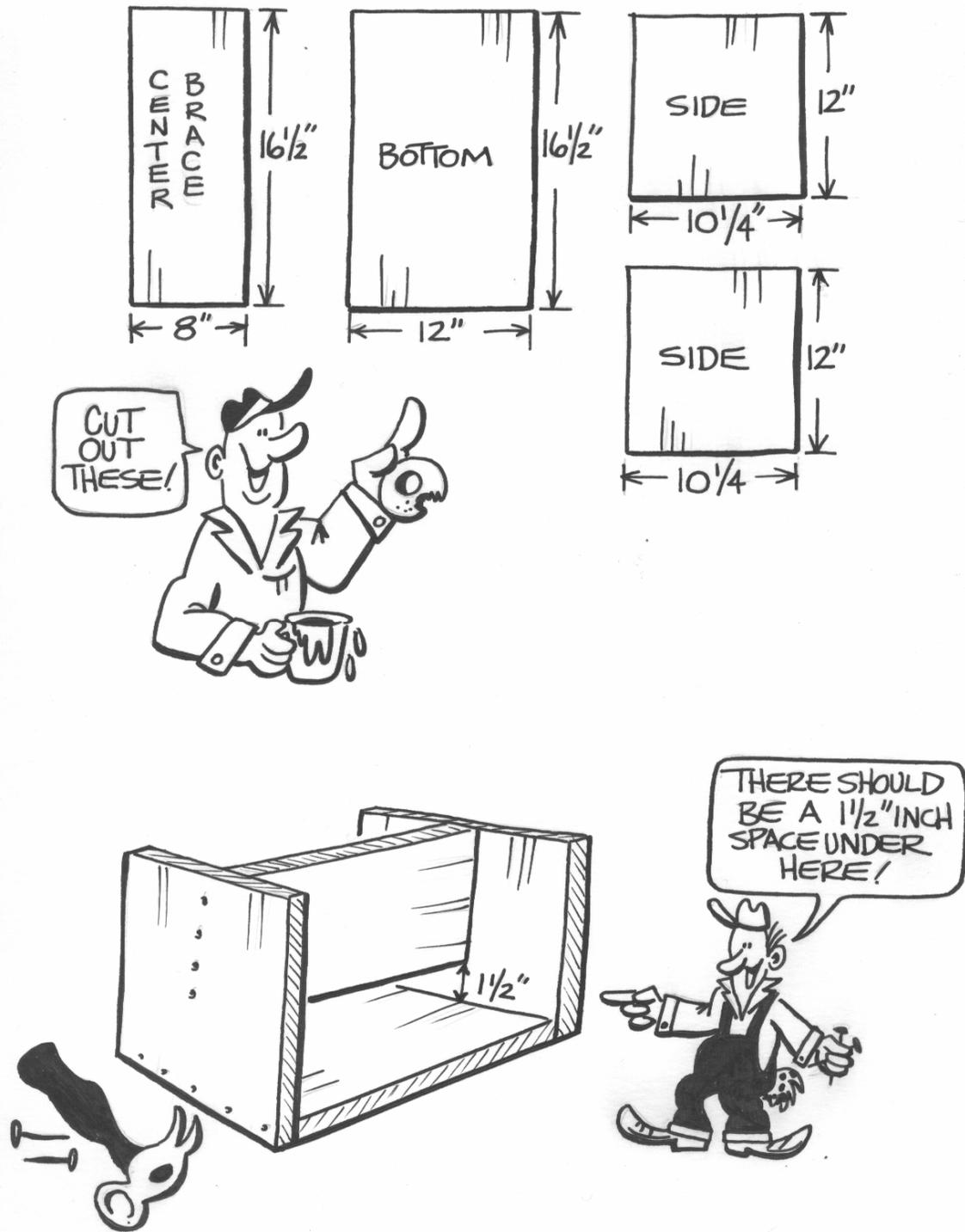
The power head assembly rides loose in the base box and a pair of tension springs self adjust the belt tension.

The motor is attached to a mount constructed of 3/4 inch plywood.

Mirror-o-Matic

Just follow the cartoons.

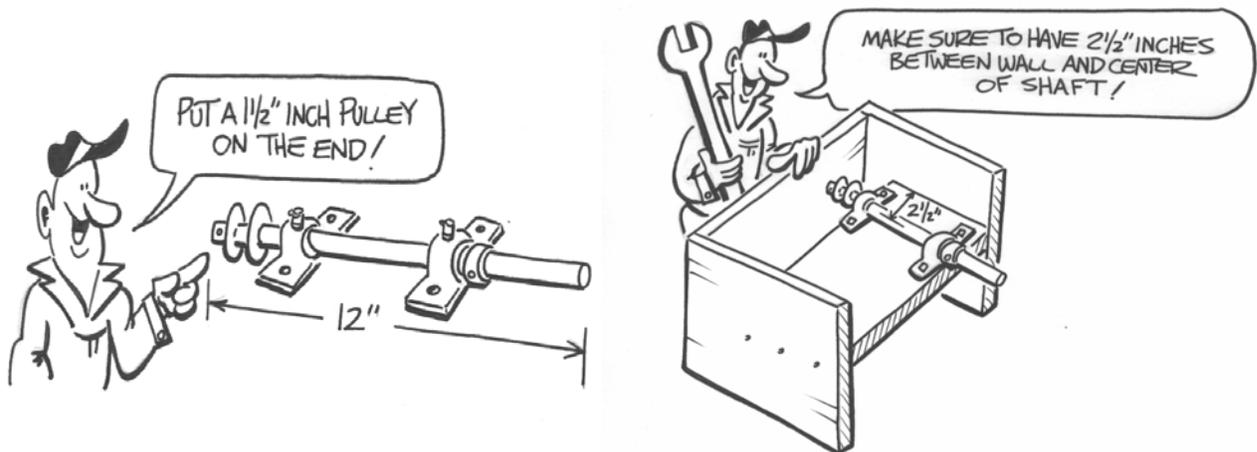
Cut out the following parts from 3/4 inch plywood and assemble them as shown.



Mirror-o-Matic

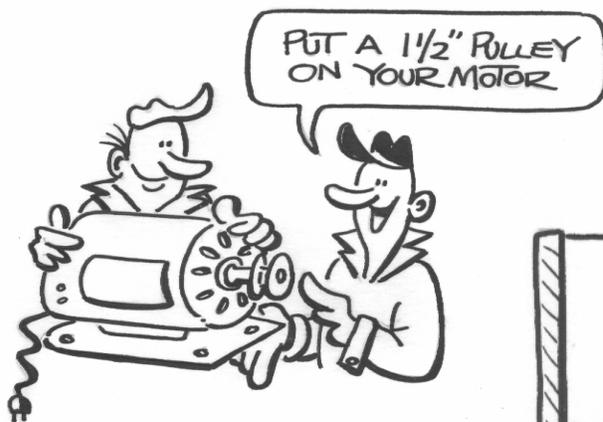
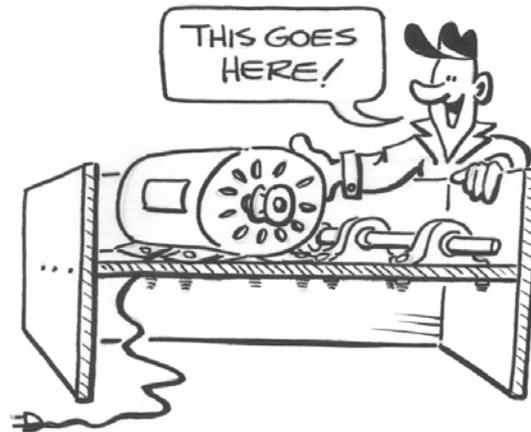


Attach a 1-1/2" pulley to the end of a 5/8" x 12" long shaft. Set the socket screw. This is the medium speed shaft. Slide this shaft through two bearing sets and bolt this assembly to the frame as shown. Leave 1/2" between the pulley and the bottom of the frame. Make sure that the shaft is square with the frame. Use 5/16"x1-1/2" bolts and nuts. Use a 5/8" locking collar to position the shaft. Mount a 10" pulley (not shown) to the other end of the shaft. Tighten the set screw only snug for now.

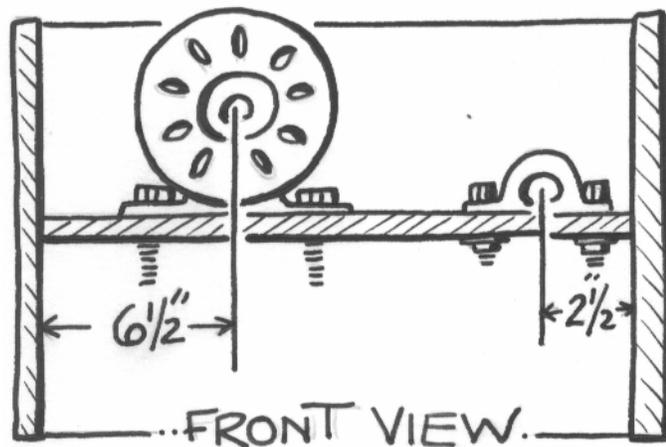


Mirror-o-Matic

Use a 1/4 hp clockwise turning motor with a type 48 or 56 frame. This frame has slotted holes in its base which are used to tighten the drive belt between the 1-1/2" motor pulley and the 10" intermediate drive shaft pulley.



Install a 1-1/2" motor pulley on the end of the motor shaft. Tighten the set screw.



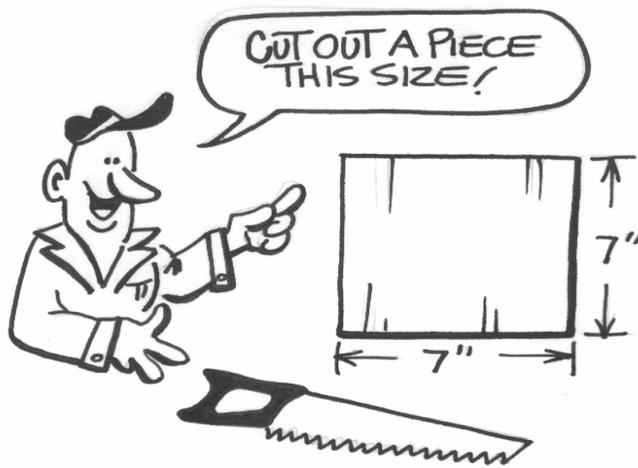
Position the motor as pictured. Make sure that the pulley sticks 1/2" above the top of the frame for belt clearance. Make sure that the motor is square with the frame.

Trace the four slots of the motor frame onto the plywood mount. Remove the motor and set it aside.

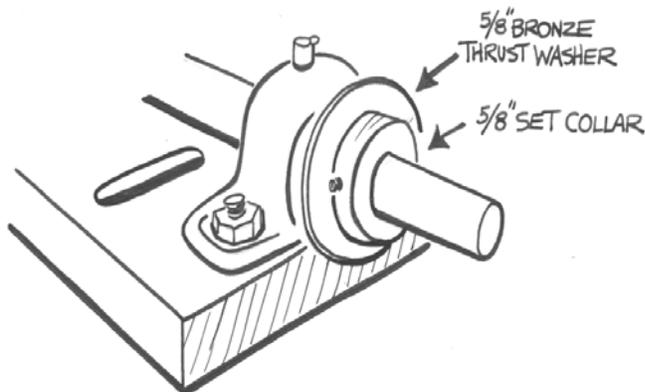
Drill (4) 5/16" holes in the frame on the side of the tracing away from the already mounted shaft.

Set the motor back on the mount and bolt the motor down with 5/16"x2-1/2" bolts, flat washers and nuts. Just snug the nuts for now.

Mirror-o-Matic

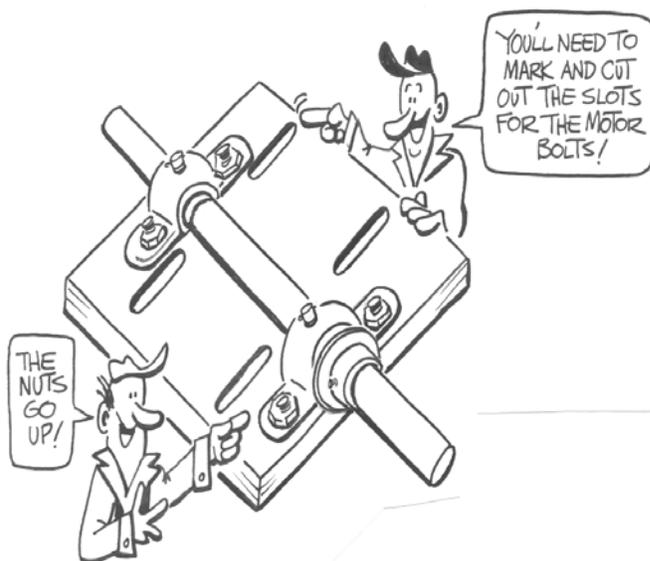


Cut the 7"x7" low speed shaft mount from a piece of plywood. You will also need a 5/8"x13" shaft and two bearing sets.



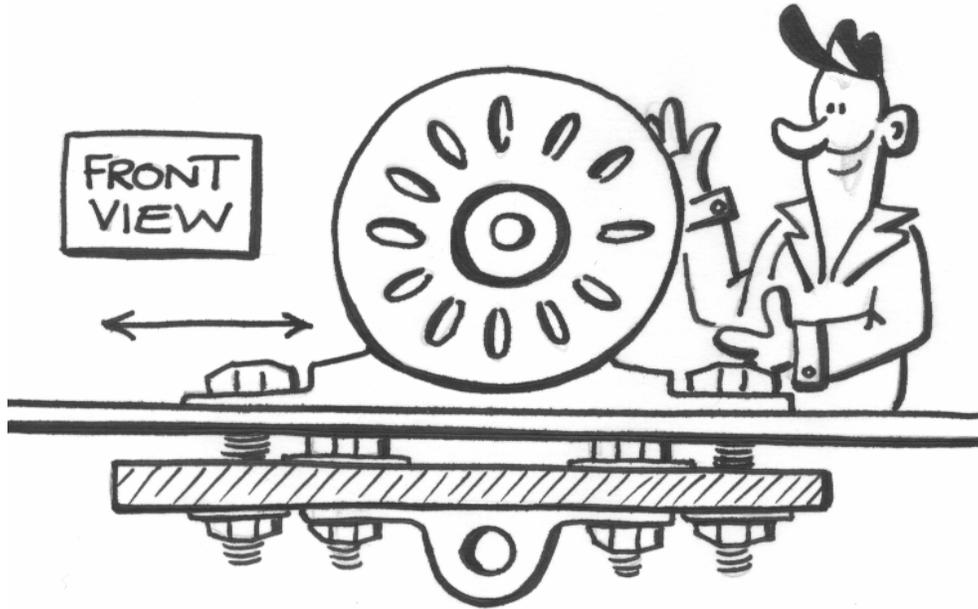
Measure the distance between motor bolts and layout 1-1/2" x 5/16" slots to match the motor bolt pattern. This assembly will slide on the 2-1/2" motor bolts and allow the low speed shaft belt to be tightened.

Cut the slots. Mount the 5/8"x13" shaft onto the 7"x7" mount with a bearing set as shown.

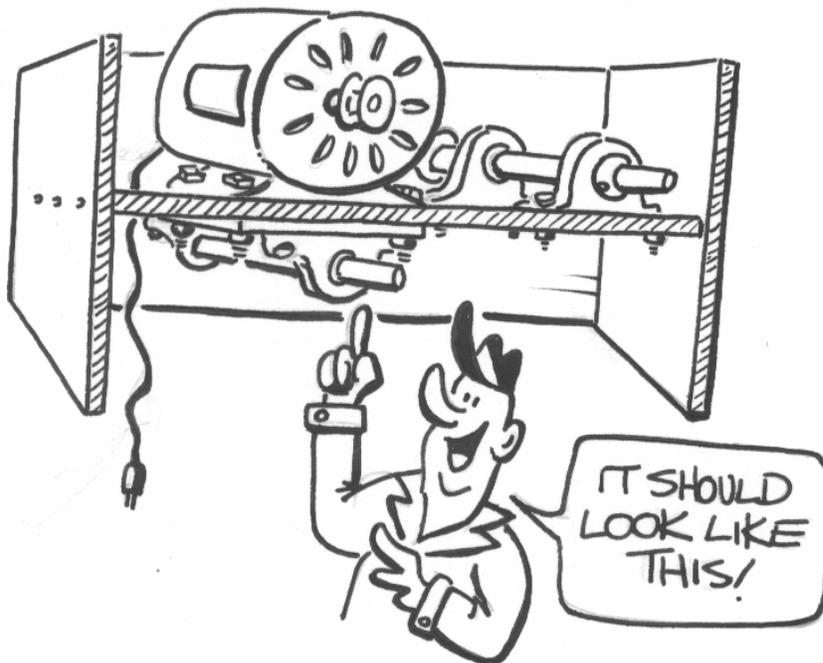


Set collars and thrust washers are required to keep the shafts from sliding down. Place them on all shafts as shown in the pictures.

Mirror-o-Matic

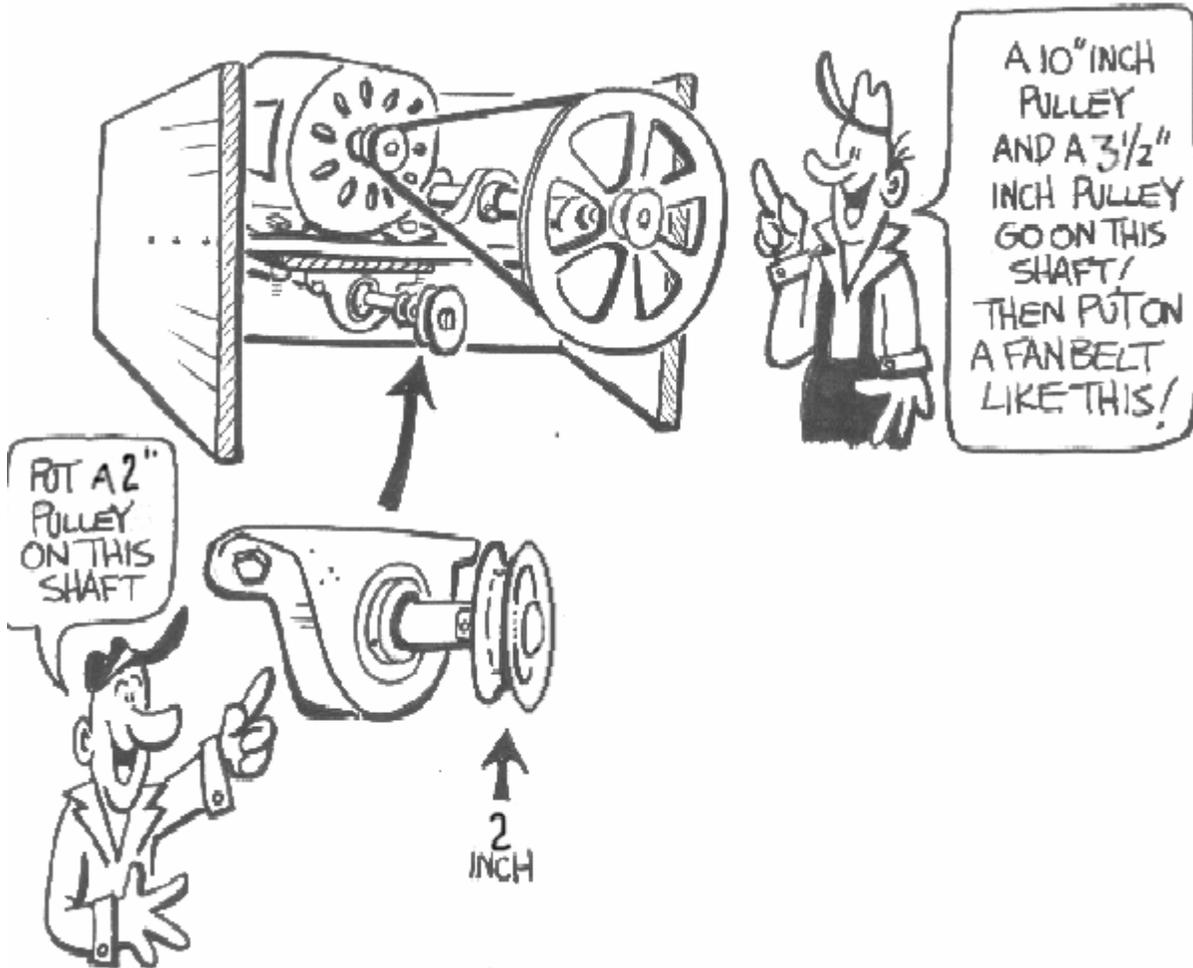


Mount the 7"x7" base onto the 2-1/2" motor bolts. Make sure that the base slides on the long bolts. Add 5/16" washers and nuts to the long bolts and tighten just barely snug.



Mirror-o-Matic

Place a 10" pulley on the intermediate shaft and trial fit a 4L36 belt on it and the 1-1/2" motor pulley. Slide the motor away from the shaft until the belt is tight. Hand tight is good enough or a bar clamp can be used to pull the belt tighter. Tighten the nuts.



The size of these pulleys determine eccentric and turntable speeds. See the operations manual before selecting.

Optional DC Motor Power Head

Requests have been made for a power head with DC motors. I personally do not think that they are worth the trouble and expense.

The advantages are:

- 1: Pulley and belt switching is eliminated.
- 2: The speeds can be slowly ramped up and down.
- 3: The turntable and drives can be independently varied.
- 4: The mirror can be spun dried after washing.

The disadvantages are:

- 1: DC motors and controllers are expensive, noisy and may cause the wife's television to get all fuzzy.
- 2: They vary in speed with load. The rpm will float as the lap dries out.
- 3: If the AC motor and drives are running at the correct speed, why do you want to vary it?

Attached is a layout which will allow the existing power head frame to be used for DC motors. The turntable drive can be powered by any combination of belts and pulleys to get about 100 rpm as a top speed.

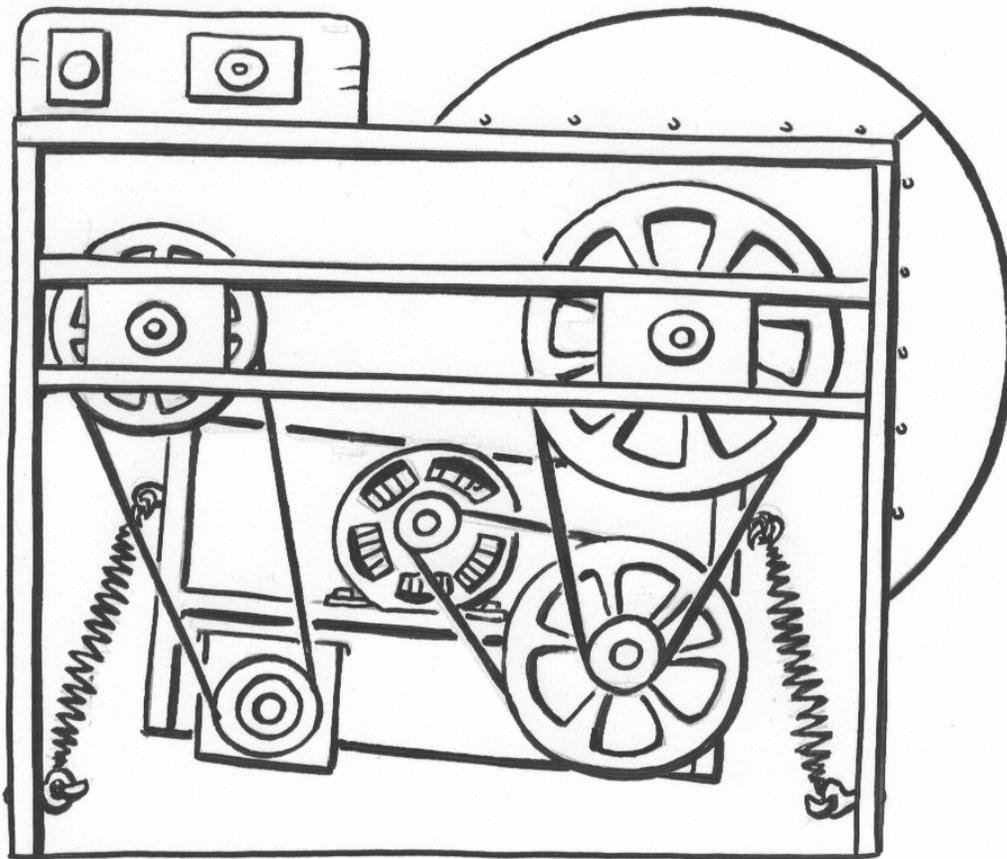
The eccentric motor is a geared head assembly running at 100 rpm. At least on stage of belt drive should always be used with a geared motor to smooth out the power and to allow a bit of slippage in case of tool sticking.

The belt will also take the eccentric side forces off the gear head which will prevent the gear head bearings from failing.

It is up to the builder to decide on DC motor controls. Variacs with a rectifier produce nice smooth power but will lose torque rapidly when run at low voltages. Light dimmers with a rectifier will work fine, but may introduce very jerky motion at very low speeds. Industrial controllers have high torque and smooth motion but are very expensive and may be electrically noisy.

All in all, I think that the simple Grainger AC motor is the best compromise.

Mirror-o-Matic

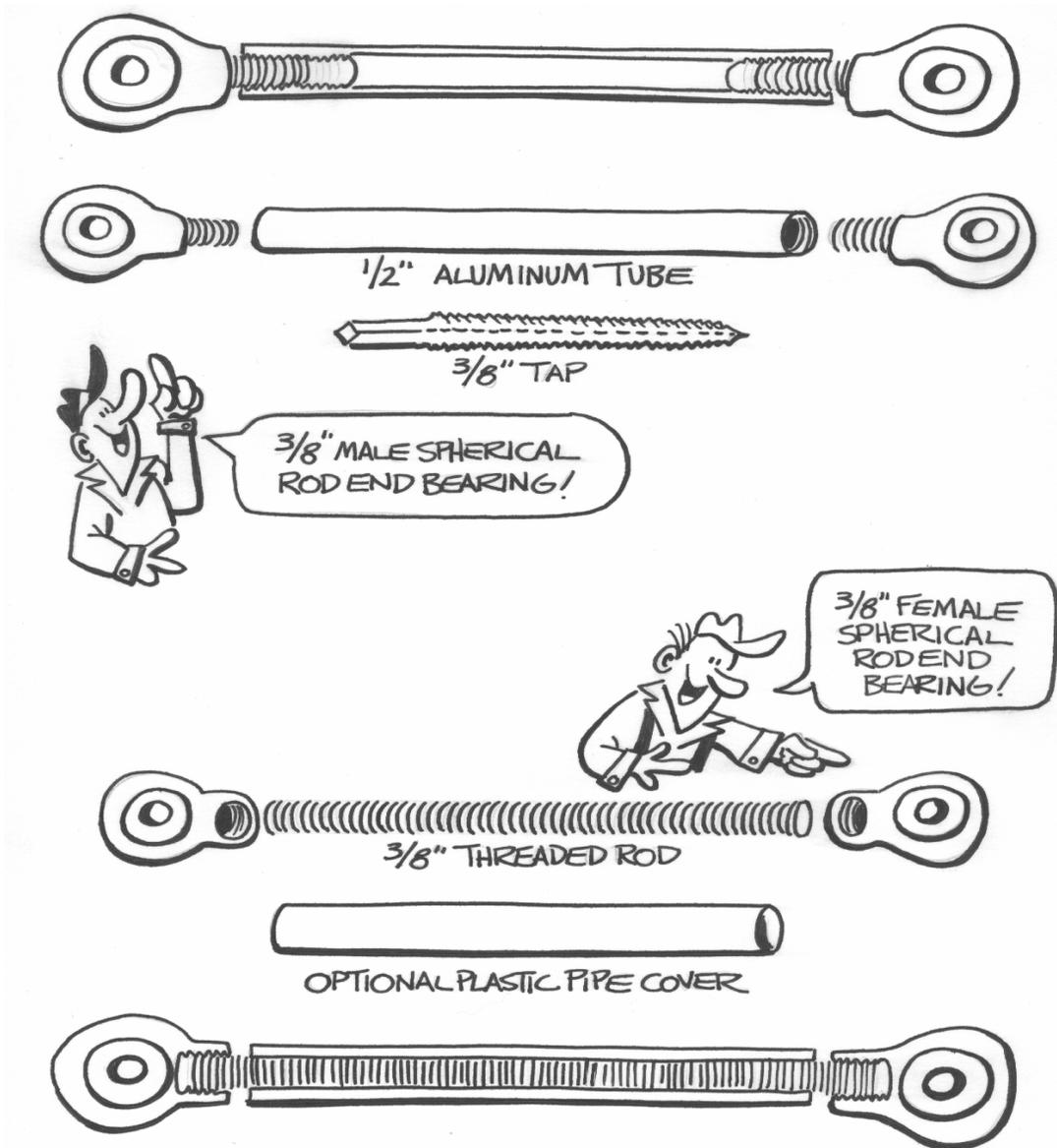


TOP VIEW
OPTIONAL DC. GEAR MOTOR

This view shows a 100 rpm gear motor on the right driving the eccentric and a 1750 rpm standard motor on the left driving the turntable. The gear motor has a single stage of belt reduction in order to eliminate side bearing loads. The turntable has two stages of reduction. A single dc motor can also be used in place of the AC motor shown on the plans.

Making an Eccentric Drive Rod

The eccentric drive rod is the same as the original Mirror-o-Matic.



The eccentric drive rod can be made with either male or female rod end bearings.

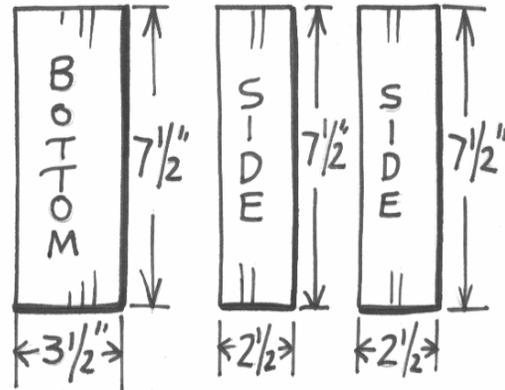
I used male rod ends and a piece of 1/2" aluminum tubing tapped for the rod ends.

A piece of 3/8" threaded rod will also work with female bearings.

No tap is required, but the threads should be covered to keep them from carrying grit onto the mirror.

Building the Eccentric

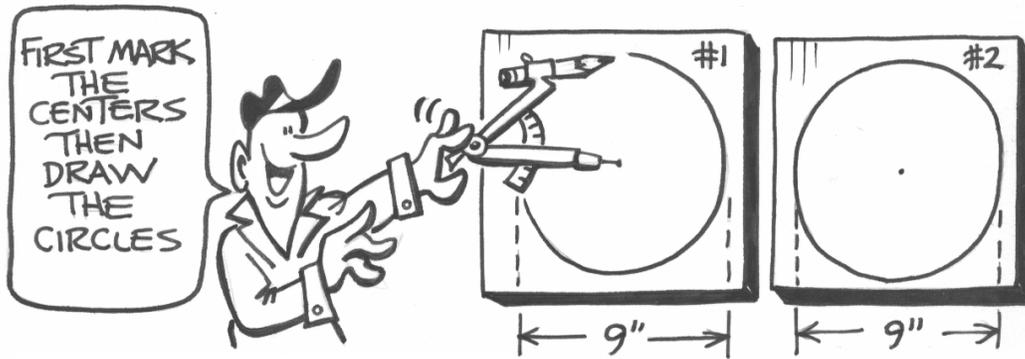
The eccentric is the same as on the original Mirror-o-Matic.



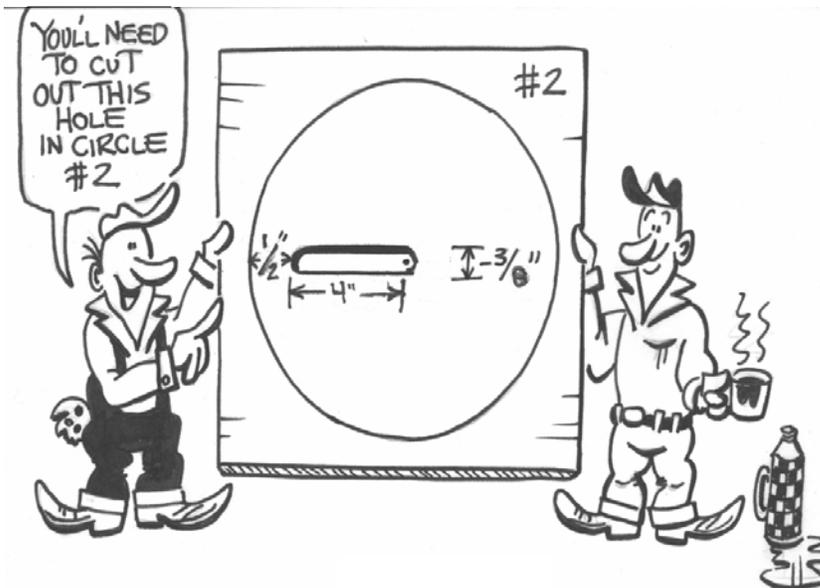
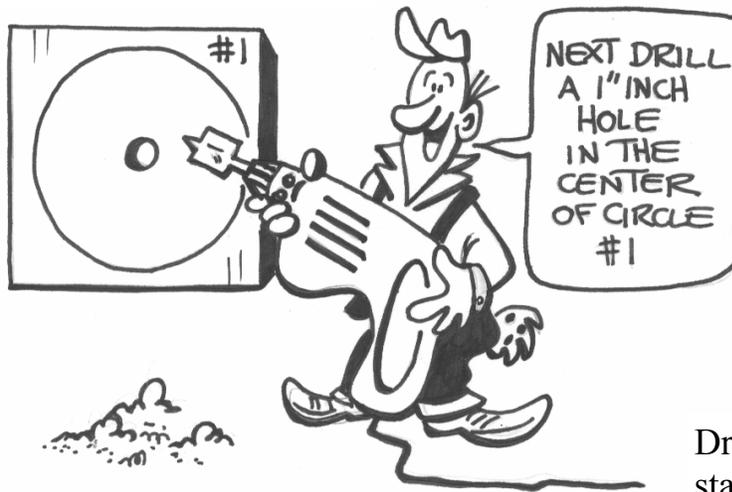
Cut the pieces out of 3/4 inch plywood and assemble as shown.



Mirror-o-Matic



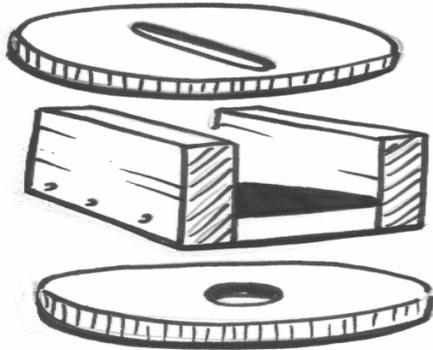
More 3/4 inch plywood pieces to cut out.



Drill a 3/8 inch starting hole in the center of the disk. This will make finding the zero eccentric location easier.

Saw or route the 3/8 inch slot. Sand or file the edges so that the shaft of a 3/8 inch bolt slides smoothly in the slot. Don't forget to allow for paint thickness.

Mirror-o-Matic



THIS BLOCK WILL FIT INSIDE! DRILL A HOLE IN IT SO A BOLT WILL FIT THROUGH!



Drill a hole as required in the center of the 3"x3" block. A 3/8" threaded insert (3 prong T-nut) needs to be pressed into it. This block will rest in the "tunnel" of the eccentric and catch the bolt that goes through the rod end bearing of the eccentric drive rod.



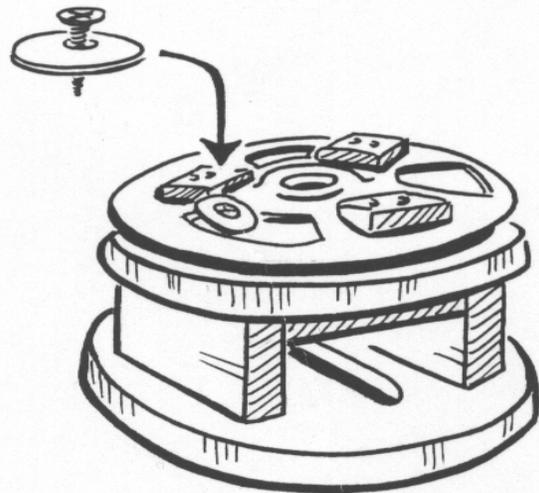
Mirror-o-Matic



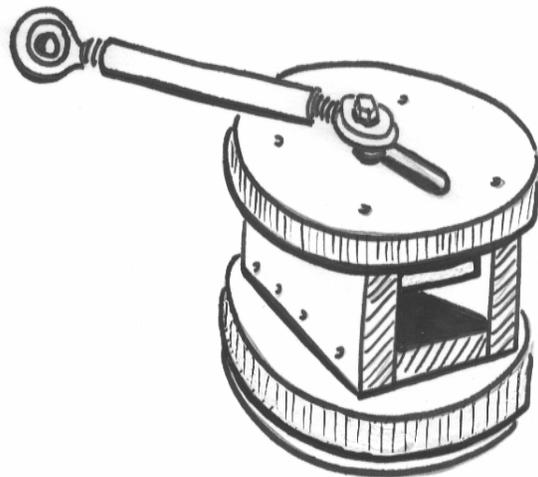
Lay the 8 inch eccentric pulley on a piece of plywood and layout three plywood driving dogs by tracing around the spokes.

Attack them to the bottom of the eccentric in the same method as the turntable. You can center the pulley and eccentric with a short piece of one inch shafting.

I also ran a short screw and washer into the dog next to one of the pulley webs to avoid rocking of the eccentric. It is under some stress when polishing.



Sandwich the eccentric push rod spherical bearing between two large washers and thread a $\frac{3}{8}$ " X $2\frac{1}{2}$ " UNC bolt through the slot into the 3"x3" piece with the 3-pronged tee nut. Set the assembly aside until final assembly.



Final Assembly Time

Install the one inch x 12 inch shafts into the bearing boxes with thrust bearings and collars. The shafts should stick up about 3 inches above the collars. They will be fine adjusted later.

If you wish, you can lightly grease or oil the bearings and shafts.

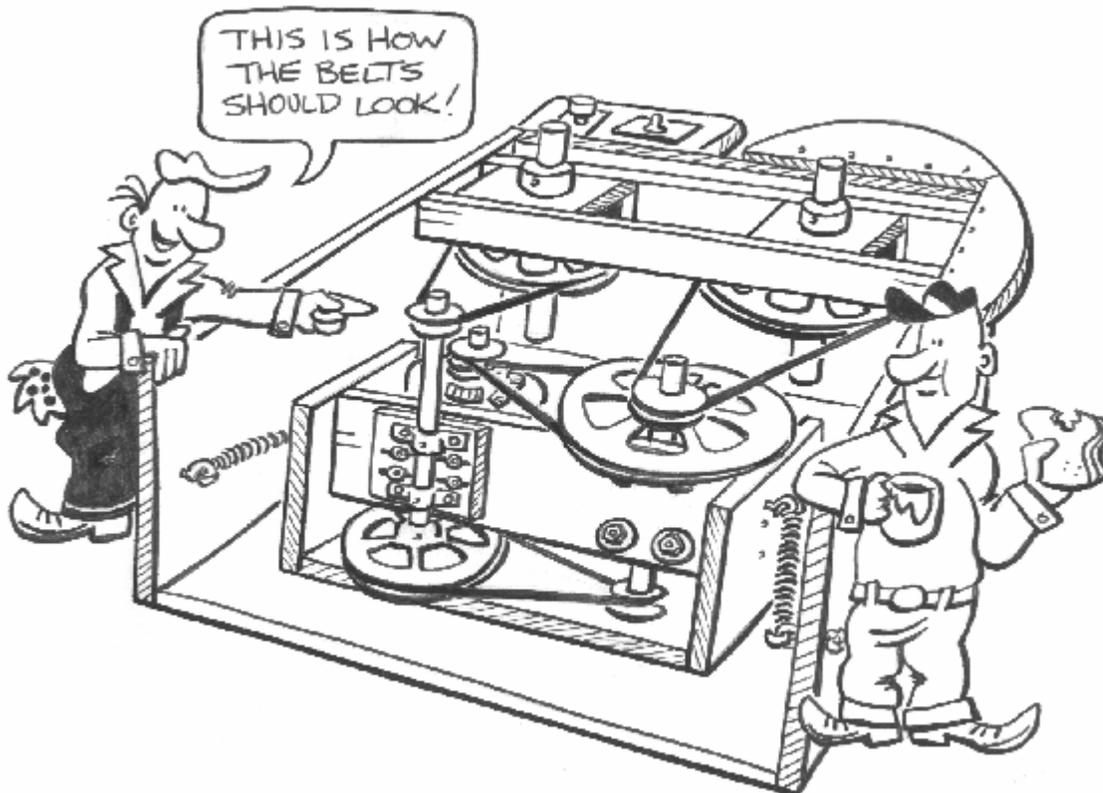
Install an eight inch pulley on the eccentric shaft and a twelve inch pulley on the turntable shaft. Tighten the set screws just enough to keep the pulleys from sliding off the shafts.

Set the power head assembly into the base box. Install the belts and adjust all of the pulley heights to make the belts run true.

Tighten all of the set screws.

Install the two tension springs.

Turn on the motor and make sure that everything is running smoothly.



Mirror-o-Matic

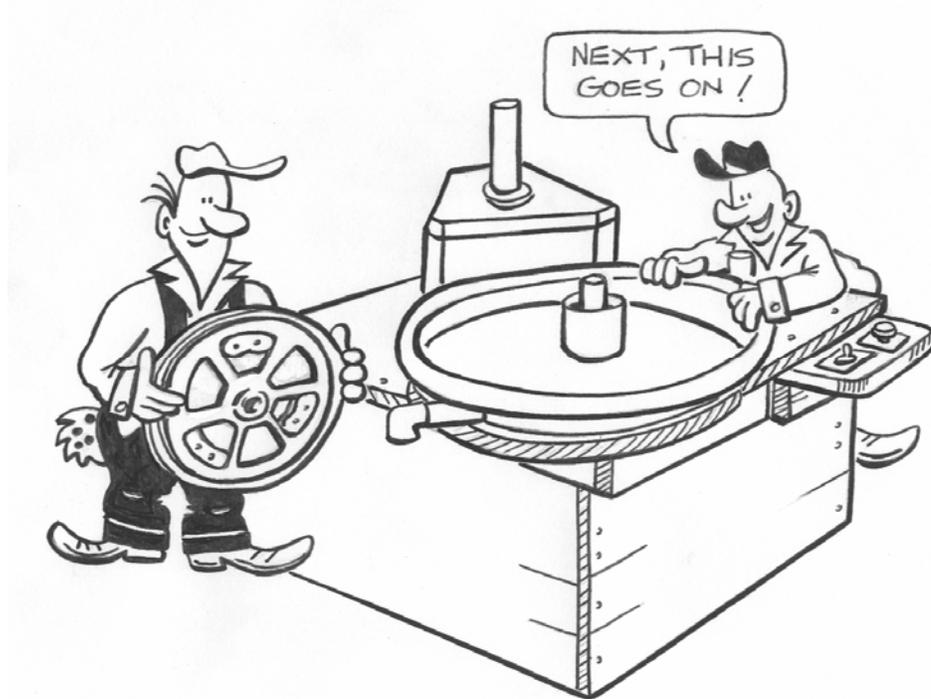
If you are happy with the way that the power system is working, you can complete the wiring to the control panel. I would advise using some sort of quick connector between the power head and the controls. It can be as simple as a wall plug. When adjusting belts and pulleys, it is nice to be able to remove the power head.

Install the over-arm platform. Countersink 1-1/2 wood screws about 8 inches on center around the perimeter. You may wish to install a couple of screws into the bearing box assemblies through the top of the platform to stiffen the bearing boxes.

If you have not yet painted the machine, now would be a good time to do so. I suggest a good porch and deck epoxy or other water proof finish. Mirror making can be a messy business.



Mirror-o-Matic



Install the drain pan by screwing it down to the table in several places using wood screws and rubber washers or calking. If you want to avoid holes in the bottom, you can use some sort of side clip.

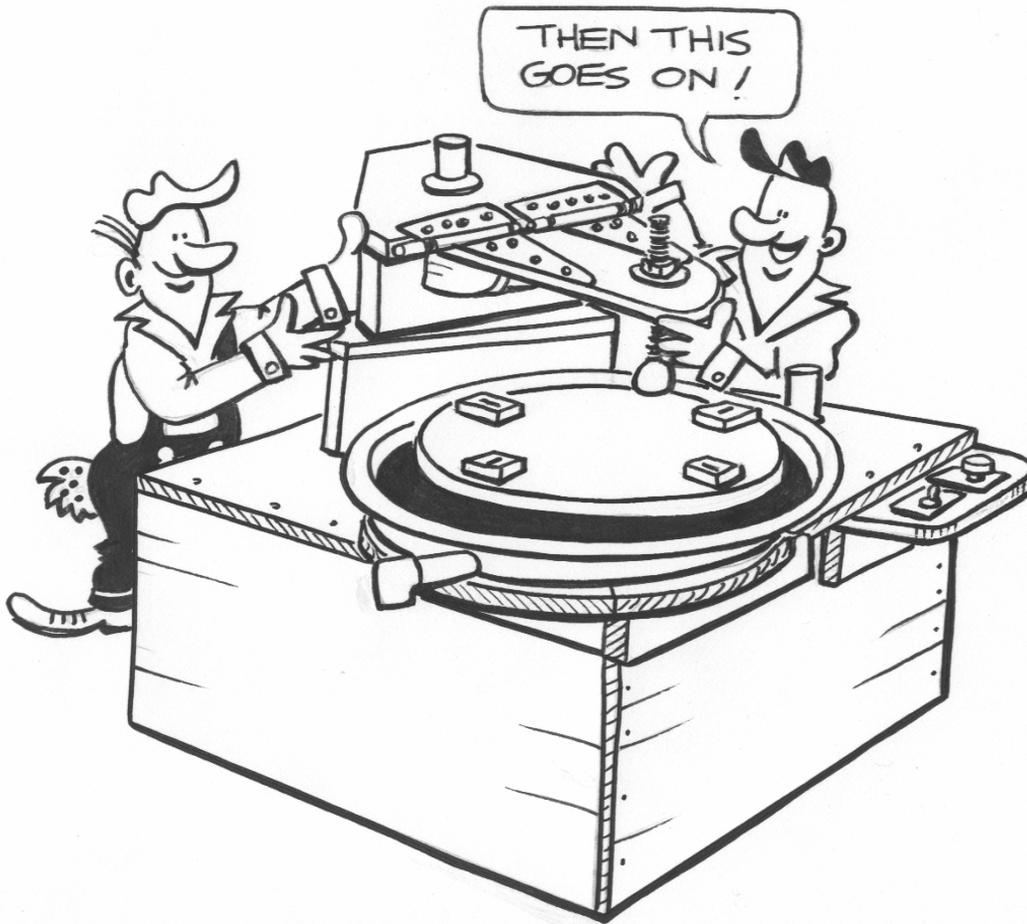
Next install a 12 inch pulley on the turntable shaft and tighten the set screw. Place the turntable on the pulley with the dogs engaged into the pulley spokes



Mirror-o-Matic

Place a one inch inside diameter x 1-1/2 inch outside diameter x 1/8" bronze thrust washer on the one inch over-arm tower shaft. Slide the over-arm assembly onto the shaft. Install another bronze thrust bearing and one inch shaft collar onto the shaft to keep the over-arm from lifting up.

Check the over-arm assembly for smooth side to side operation.



Mirror-o-Matic

Install the eight inch eccentric pulley and eccentric. Align the top of the eccentric with the top of the over-arm support curved slot.

Sandwich the rod end bearing on the over-arm side with large washers and install a 3/8 "X 2-1/2" bolt. Use a 3/8" nut with large washer or another 3 pronged t-nut and small piece of wood to tighten the bolt.

Set the eccentric end of the drive rod to zero throw by positioning it to the center of the eccentric. Position the swivel so that it rest over the center of the turntable. Tighten the bolts on each end of the eccentric rod.

Adjust the swivel height so that the swivel is several inches above the turntable.

Turn the machine on and make sure that there is no interference with moving parts. Turn the machine off and add about one inch of throw to the eccentric. Turn the machine on again. If all is working correctly, you are ready to start grinding.

Congratulations.

