

Plans for The Siamese Twins

Requests have been pouring in for plans for the Siamese Twins. In fact, another one poured in just last week! So I've spent the past several days drawing them up. I think it took almost as long to draw the plans as it did to build the engine!

The drawings are shown in the next 10 pages. Where possible, I've included a picture of the part of interest alongside the drawing. Final Assembly notes are on the last two pages.

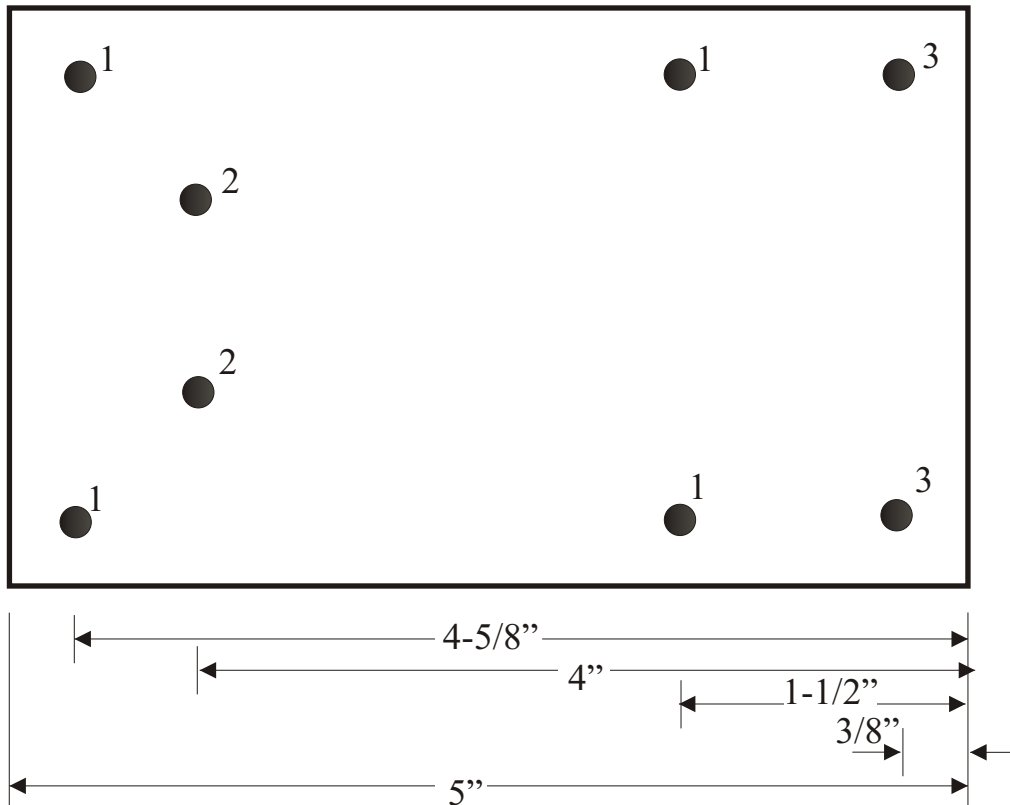
Note that the drawings do not include the holes that mount the part to the frame. The omission is deliberate, based on the fact that I am seldom successful in locating holes precisely where they need to be. I get around this by mounting the part with adhesive, clamping it to the frame, and then drilling through the frame and into the part. That way I know the threaded hole is going to be there when I drop a screw through the hole in the frame. Not very professional, but it works for me!

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Northridge, CA
5/5/01

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Base

1/4" x 3" x 5" Aluminum

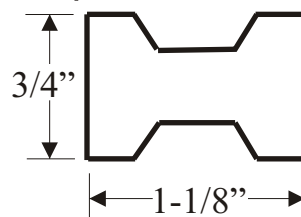


Notes:

1. Holes "1" (4 each) are for the legs.
2. Holes "2" (2 each) are for the cylinder block.
3. Holes "3" (2 each) are for the bearing blocks.
4. Drill all holes 9/64", to provide clearance for 6-32" screws.
5. Overall length of 5" is the minimum required.. I built mine on a 12" piece, to allow room for a boiler or some driven device, such as a tiny generator.

Legs (Make 4)

Brass, 3/4" Hex x 1-1/8"

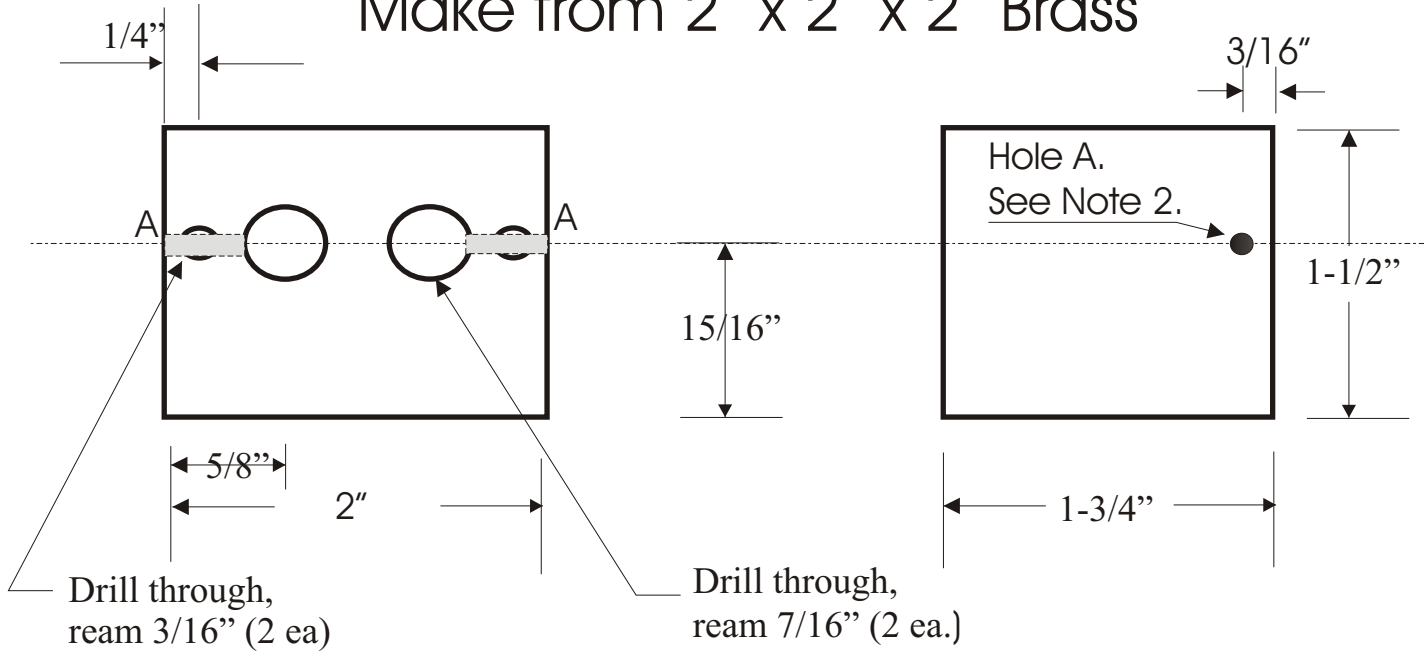


Note::

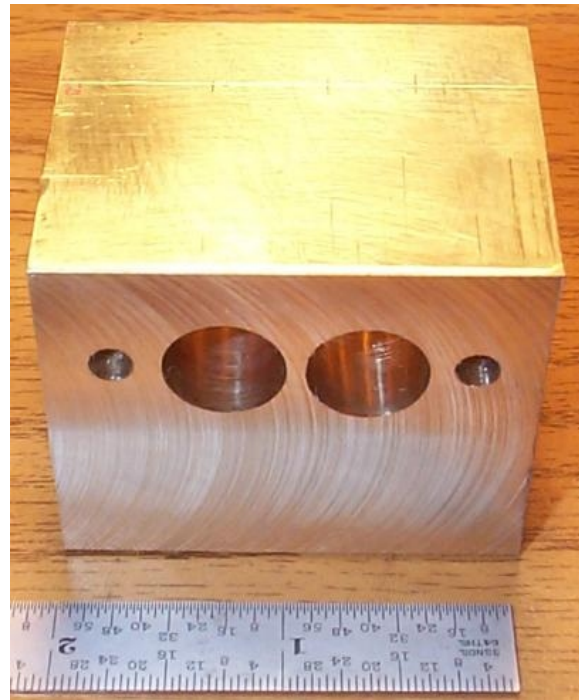
Make to suit, of whatever material and dimensions you wish. The base is drilled to allow 3/4" hex to fit flush with the sides.

Cylinder Block

Make from 2" x 2" x 2" Brass



- Notes:**
1. Hole placement for right bank same as that for left bank. Measure from right edge.
 2. Drill hole "A" on both sides of the block into each piston cylinder. Tap 10-32 to just short of the valve cylinder, so that the nipple will jam before it enters the cylinder.



Nipple (Make 2)

1/4" dia. X 3/8" Brass

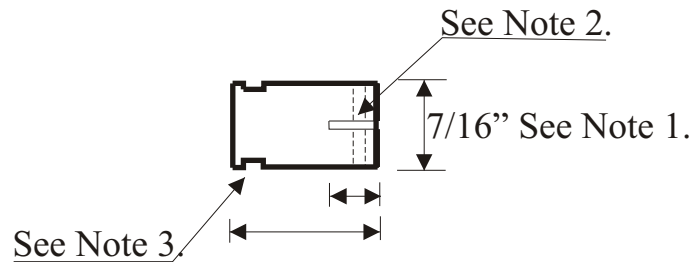


Drill through 1/8"
Thread 10-32 for 1/4"

Note: These 2 nipples screw into Hole "A," above.

Piston (Make 2)

7/16" dia. x 3/4" Aluminum

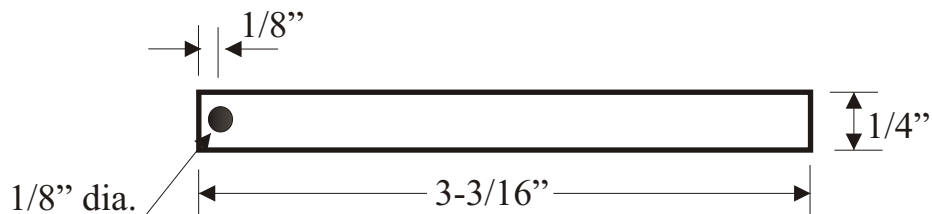


Notes:

1. Turn for slip fit into cylinder.
2. Drill and ream through 1/8" hole centered 1/8" from end. With workpiece still in vise, slot 1/16" x 5/16" perpendicular to the hole.
3. Oil groove. Place as desired, .005" deep and width of cutoff tool (approx. 3/16").

Piston Rod (Make 2)

1/16" x 1/4" x 3-3/16" Brass



Note:

Round the corners of the end with the hole, so that end will have free movement within the piston.

Wrist Pin (Make 2)

1/8" dia. X 3/8" Steel

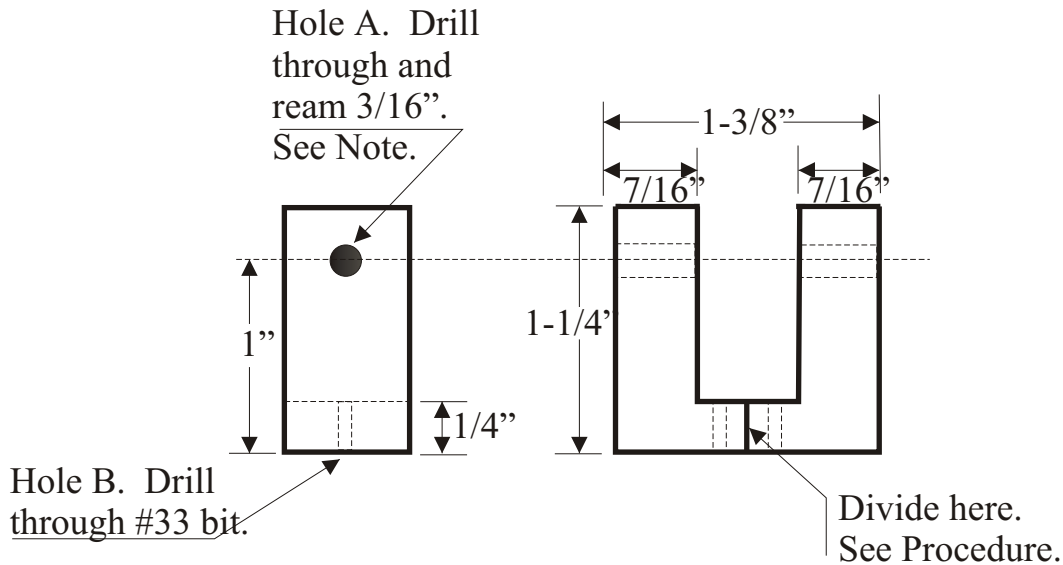


Note:

Round off and smooth ends so that they will not scour the cylinders in operation.

Bearing Block (2)

Make 1, Cut in Half for 2
1-1/4" x 1-1/4" x 5/8" Brass

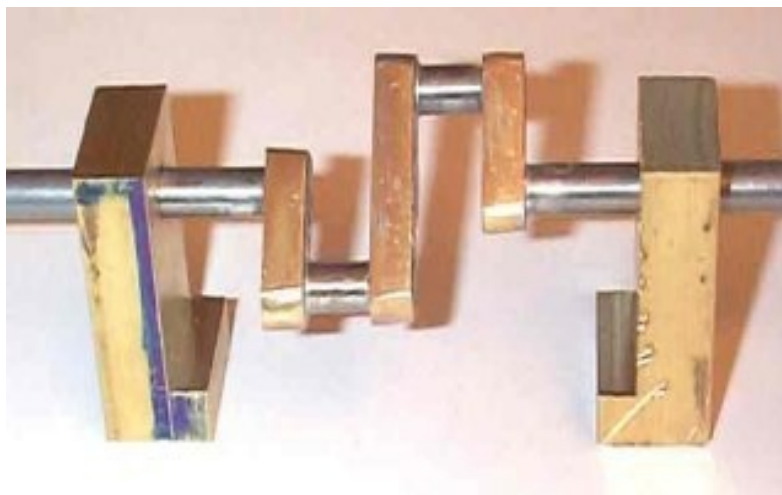


Procedure:

1. Cut brass block to 1-1/4" x 1-1/4" x 5/8".
2. Drill hole "A."
3. Mill center as shown in right-hand drawing.
4. Drill Hole "B" (2 places).
5. Divide block as shown in right-hand drawing.

Notes:

1. For longer life and smoother running, drill for 3/16" bronze bearings.
2. Blocks are milled and drilled as one piece to assure alignment of drive shaft hole during final assembly.



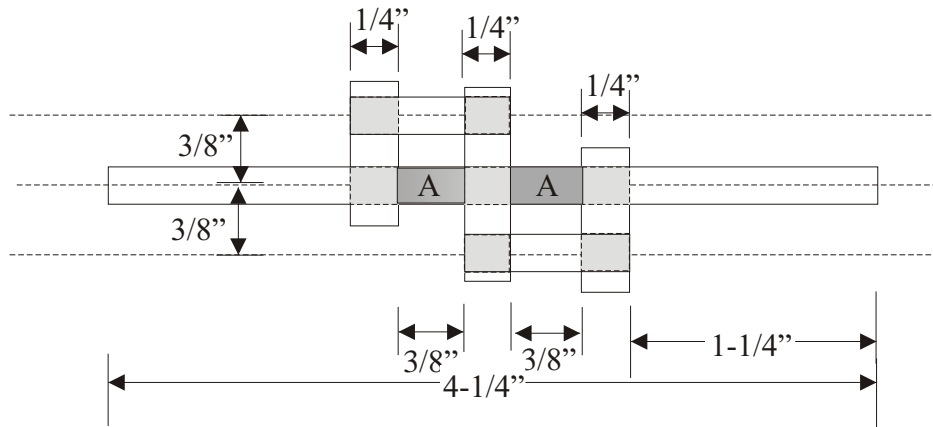
Crankshaft

3/16" x 4-1/4" Steel (1)

3/16" x 7/8" Steel (2)

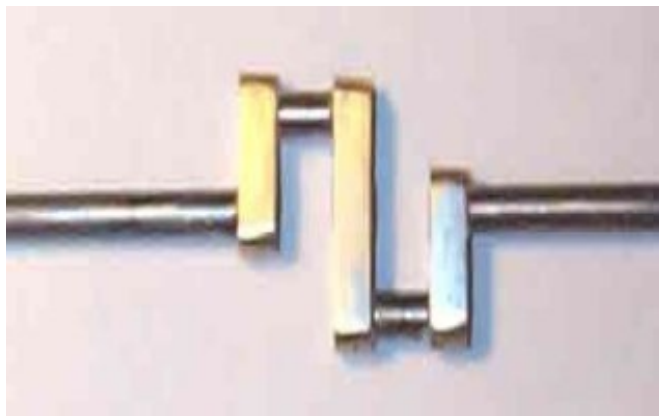
1/4" x 1/4" x 1" Brass (1)

1/4" x 1/4" x 5/8" Brass (2)



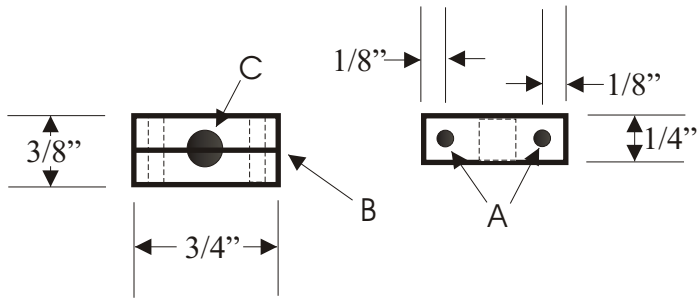
Procedure:

1. Cut the 3 brass parts to size.
2. Drill and ream the 3/16" holes (7)
3. Assemble the parts as shown. Solder all joints.
4. Cut away the "A" part of the 4-1/4" shaft (2 places)



Crank Coupling (Make 2)

Make from 1/4" x 3/8" x 1/4" Brass



Procedure:

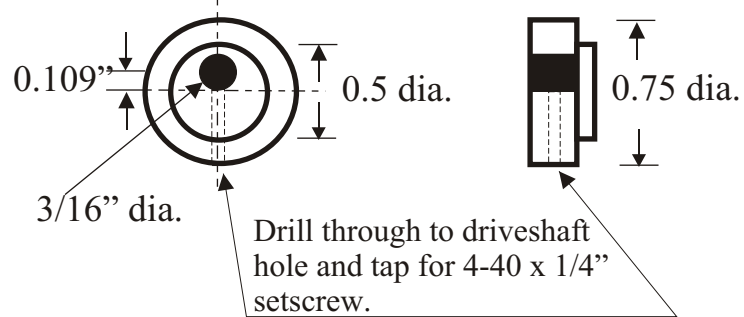
1. Mill piece to outside dimensions
2. Drill the 2 holes (A) through and tap 2-56
3. Cut the piece in half (B)
4. Rejoin the two pieces with 2-56 x 3/8" screws
5. Drill and ream hole C to 3/16"

Note that step 5 must be the last operation, to maintain specified diameter.



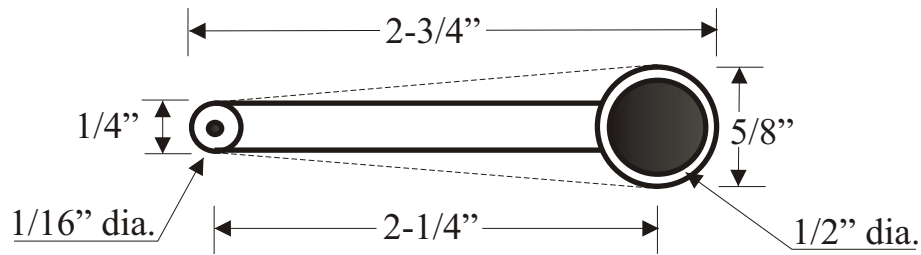
Use a slitting saw to notch the end of the assembled coupling. This notch will be used during final assembly to solder the piston rod to the lower half of the coupling. The upper half is also notched to provide clearance.

Eccentric (Make 2) Make from Steel Round



Valve Rod (Make 2)

1/16" x 5/8" x 2-3/4" Brass

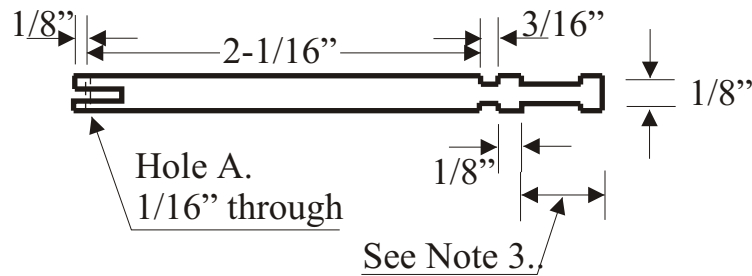


Notes:

1. Profile is cosmetic only. Dotted lines show an optional profile.
2. 1/2" hole is most easily drilled with a stepping drill.

Valve (Make 2)

3/16" dia. X 2-3/4" Brass Round

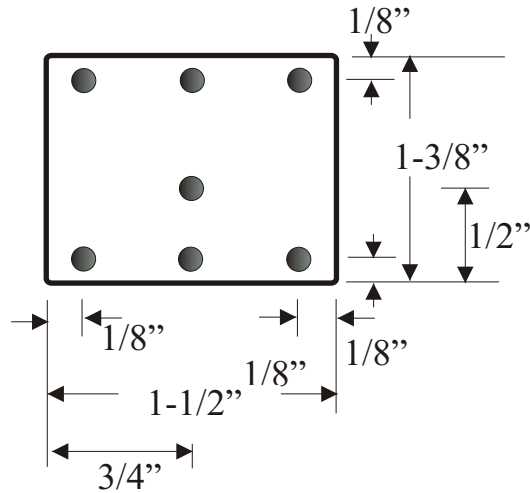


Notes:

1. After trimming to length, drill hole "A."
2. With the workpiece still in the vise, cut 1/16" x 1/4" slit. This will ensure that the slit is perpendicular to the hole.
3. This segment is purely cosmetic. It is not needed for operation.

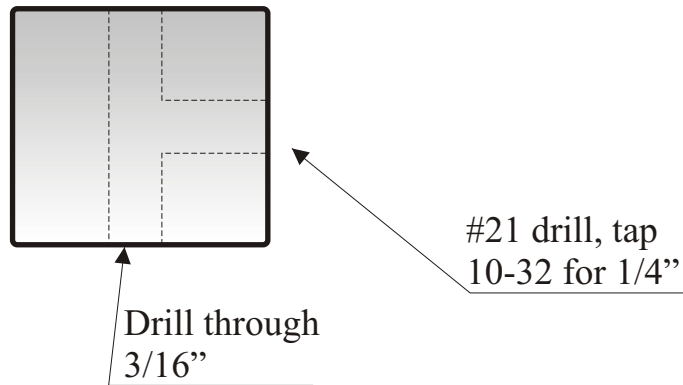
Backplate

1/16" x 1-1/2" x 1-3/8" Brass



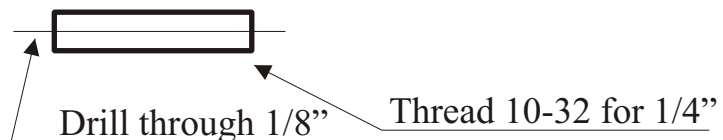
Manifold

5/8" dia. X 5/8" Brass



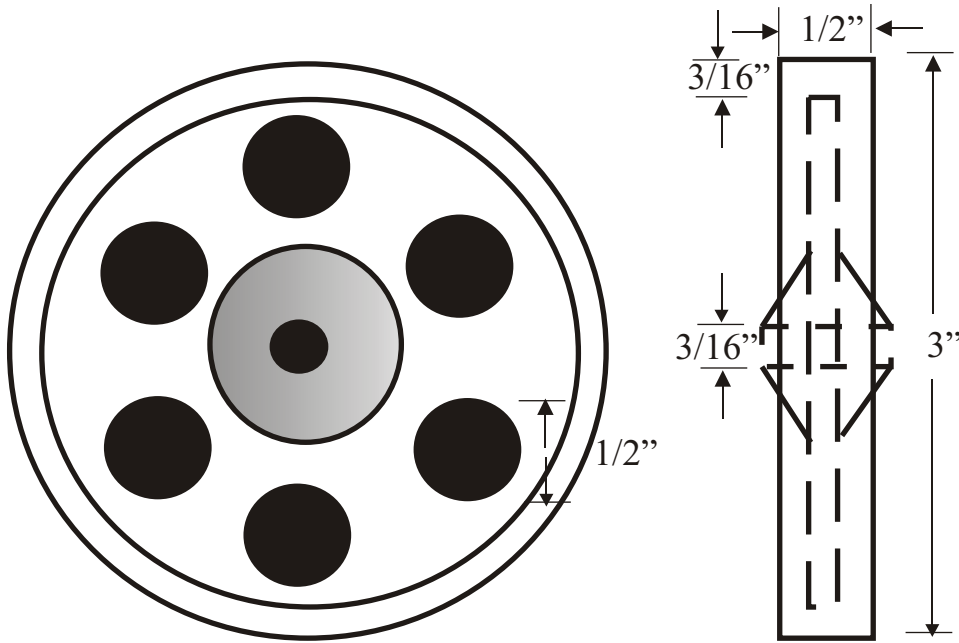
Nipple

1/4" dia. X 1" Brass



Flywheel (Make 2)

Make from Aluminum Round, 3" x 5/8"



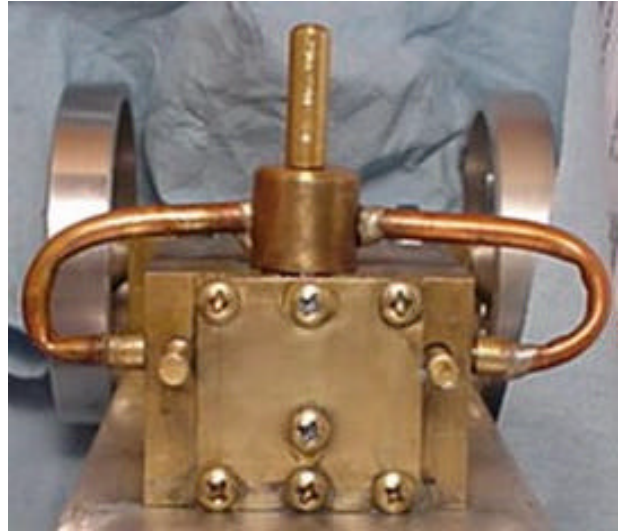
Assembly Notes

1. Solder the “no-hole” ends of the piston rods to the lower halves of the couplings.

I used a low-temperature plumber’s solder. Note in the picture that the end of the rod is wider than the depth of the coupling half. That is the reason the upper coupling half is notched as well. That upper notch provides clearance for reassembly. Another way to go would be to notch the rod instead. This would remove the need to notch the upper half of the coupling.



2. Glue the backplate onto the cylinder block as shown, making sure it covers the piston cylinders but leaves the valve cylinders open. You may wish to make a thin cardboard gasket to place between the backplate and cylinder block. I used liquid gasket material from an auto parts store. It served as both a gasket and adhesive. Drill through the backplate mounting holes into the cylinder block to a depth of about 1/2". Depth is not critical as long as the holes are deep enough to accept whatever screws you plan to use. I used 6-32 x 1/2" brass screws.



3. Glue the cylinder block assembly to the frame, with its “open” end 3-1/4" from the end of the frame. Clamp the pieces together, and drill through holes “2” on the frame into the cylinder block assembly to a depth of about 1/2" with a #36 drill. Tap 6-32. Screw the two pieces together with 6-32 x 1/2 brass screws.

4. Assemble the crankshaft, eccentrics, valve connecting rods and bearing blocks as shown. Glue the bearing blocks to the frame over holes “3”. Drill through holes “3” into the bearing blocks to a depth of about 1/2" with a #36 drill. Tap 6-32, and screw the bearing blocks to the frame.

5. Insert the valves into the cylinder block, with the slotted end toward the crankshaft. Use brass brads to connect the valves to the connecting rods.

6. Attach the pistons to the piston connecting rods with the wrist pins. Insert the pistons into the cylinder block and attach the other end of the piston connecting rods to the throws on the crankshaft.



7. Attach the legs to the frame, in the same manner as was done with the cylinder block in step 3.

8. Secure the flywheels to the crankshaft. I used Loctite, taking great care to avoid getting it into the bearing blocks. Loctite likes bearing blocks, and wants to flow into them. Use a small amount, and only on 1/8" or so of the end of the crankshaft.
9. Time the engine. This is done one cylinder at a time. Look through hole "A" on the cylinder block to observe valve operation. Rotate the flywheel in the direction you want the engine to operate, until the piston is at bottom dead center. (The throw on the crankshaft is at its closest to the cylinder.) Hold the flywheel in that position, and turn the eccentric until you can see the narrow part of the valve just coming into view in hole "A". Tighten the eccentric on the flywheel.

Screw the 3/8" nipple into hole "A".

Pump some air into hole "A" while spinning the flywheel in its operating direction. The engine should run on that one cylinder.

(**Note:** I used compressed air from a can sold for blowing out computer keyboards; got it from Home Depot.) When you have the engine running off the one cylinder, repeat the operation on the other cylinder.

It's a good idea to scratch a witness mark on the eccentrics once the engine is in tune, as final assembly will hide hole "A" from view.

Final Assembly

10. Attach the manifold to the top of the cylinder block. I glued it in place with Loctite. This is strong enough, for installing the copper tubing will further strengthen the assembly.
11. Cut and bend 1/4" copper tubing as shown, and solder to the manifold and cylinder block nipples. I used a low-heat plumber's solder. Even under steam, the engine has not gotten hot enough to weaken the connection.

Lubrication

12. Lube all moving parts sparingly with light machine oil. Be sure to add a little oil in the cylinders for both pistons and valves. The groove in the piston will capture oil and greatly improve operation if the fit between piston and cylinder happens to be a little loose.

Operation

The engine ran smoothly on 5-10 psi compressed air, and super-fast on up to 40 psi. But it would not run on lung power. Then I ran it on steam one day, and much to my surprise it ran on lung power after that. The steam cleaned it out.