CHAPTER

25 Wobbler

A wobbler is usually the first type of engine made by the beginner. The wobbler takes care of the valving without any additional tiny parts. The Frame, Foot and Flywheel are aluminum on the model shown and described here.

Start by making the **FRAME** from an accurate 1/4" x 1" x 2-1/4" piece of metal. Lay out and machine the **FOOT**,Pivot and Crank holes.

Make a jig and **LOCATING PIN** as shown. Run a close-fitting pin through the pivot hole and jig. Drill the 1/16" port opening while holding the side X of the jig against the 3/16" Locating Pin. Turn the jig over to drill the other port. Note — the lower hole goes all the way through. The upper hole is 3/16" deep. Transfer the upper hole centerline around to the end and drill and tap the 5-40 steam connection. Now is the time to check smoothness and flatness where the Cylinder rubs against the Frame. Make the bearing and set with "Loctite". Drill a small oil hole.

The **CYLINDER** is the next part to make. On an accurate and square brass block 1/2" x 5/8" x 1-1/8", lay out and center punch the centers for the 3/8" bore and 1/8" pivot. Chuck in the 4-jaw and center with a center test indicator. Turn and bore and ream 3/8". Before reaming, make an undercut at the bottom for reamer runout. This is done to avoid a shoulder that the Piston would strike. Chuck the Cylinder in the 4-jaw, using a protector over the bore end, centering on the pivot with a center test indicator. Check for squareness in the jaws. Face and undercut as shown and drill for the 1/8" pivot pin.

Make a brass **PIVOT PIN** 11/16" long and thread the end 5-40. In the 3/8" Cylinder bore, insert a close-fitting aluminum pin. Solder the Pivot Pin into the Cylinder using only a tiny bit of low-temperature silver solder. The solder will not stick to the aluminum Pin. Heat is applied to the Cylinder with a propane torch.

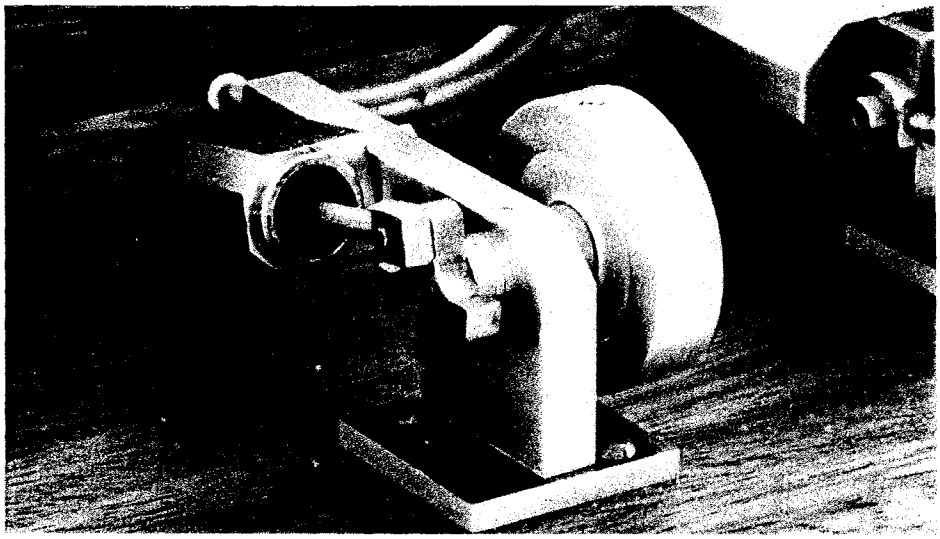
Make the **PISTON** of brass as shown. For the **ROD**, chuck a 1/4" brass rod in the 3-jaw with about 2" projecting. Drill a center hole with a tiny 3/64" center drill and bring the tail center up to support while turning the 1/8" diameter. Turn this long enough to cut away the center hole later. Thread 5-40 using a tailstock die holder. Use parting cuts to bring to final dimensions. Hold the 1/8" diameter in a V-slot in the milling vise and mill to 1/8" thickness. Drill and ream for the **CRANK PIN**. Place the drill jig over thePivotPin. Run a close-fitting 3/32" pin through the jig and the Crank Pin hole after inserting the Piston in the Cylinder. Drill the 1/16" port in the Cylinder.

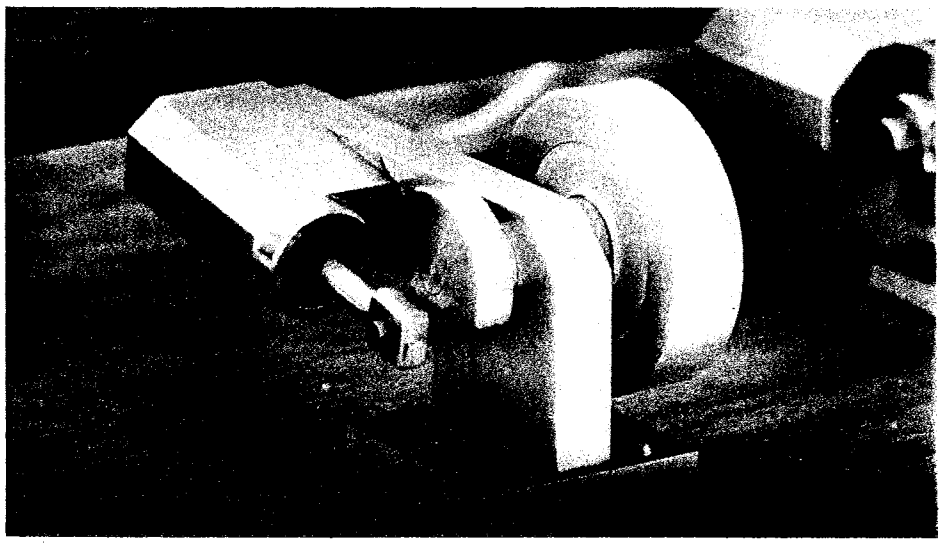
The **CRANKSHAFT**, **FOOT** and **STEAM CONNECTION** don't require much explanation. The CrankShaft is steel. The shoulder on the Shaft helps square up the Crank Disk at assembly. The "steam" connection is made to take 3/16" plastic aquarium tubing on compressed air.

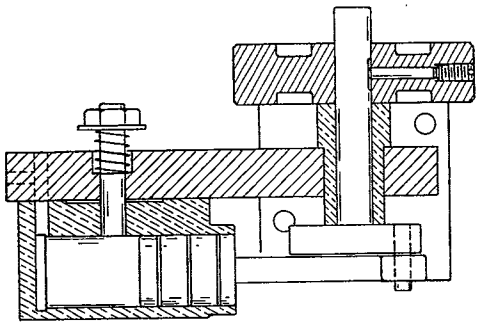
SPRING proportions shown are those of a spring found in the odds-and-ends department.

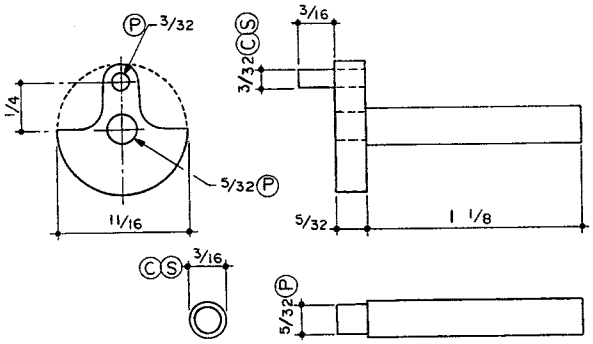
The **FLYWHEEL** is 1-1/4" diameter x 5/16" wide with a set screw. In this case, a set screw is near the surface and a free-fitting pin in the tap drill hole applies the pressure to the Shaft.

It's all done, now so you can ssemble, lubricate and give a test run on 5 to 10 pounds of air.

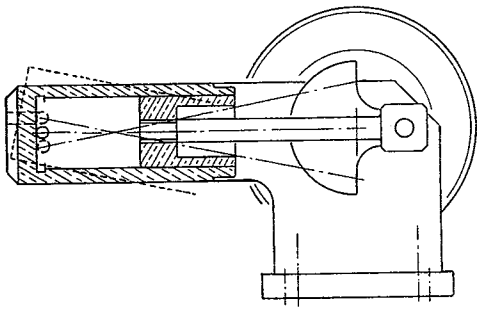


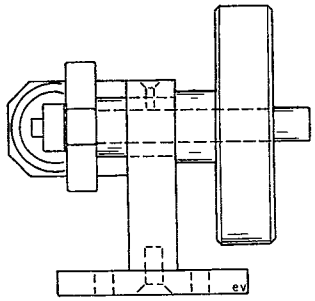




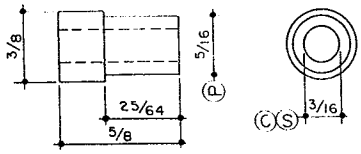


CRANKSHAFT
Steel

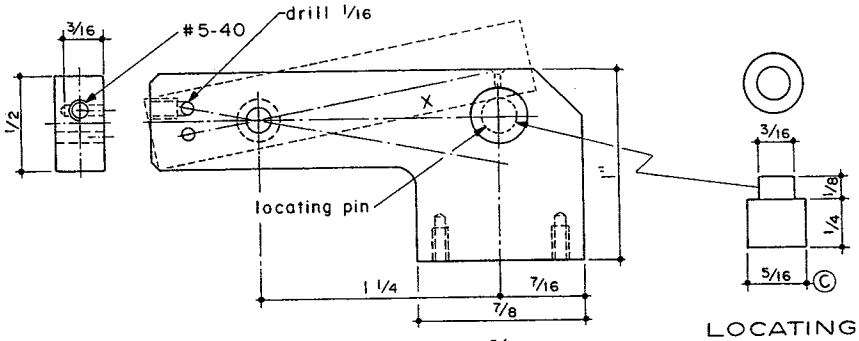




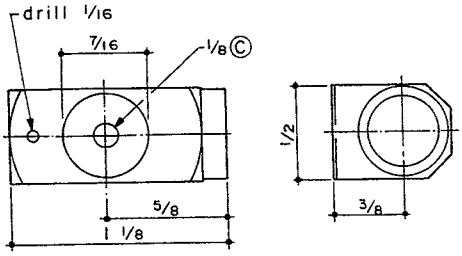
WOBBLER

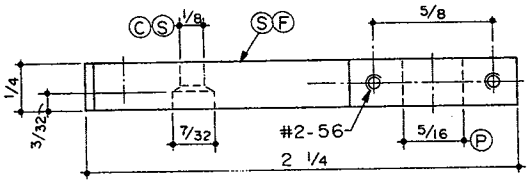


BEARING
Brass

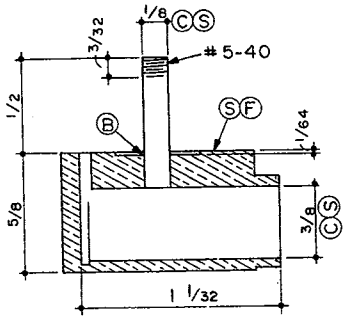


LOCATING
PIN
Steel

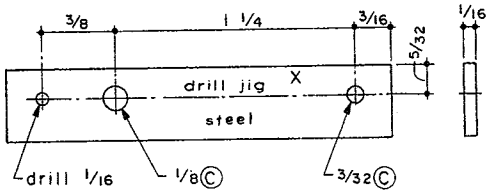


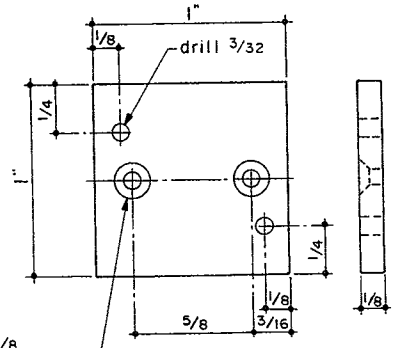


FRAME
Aluminum

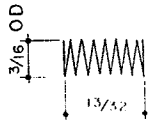


CYLINDER
Brass

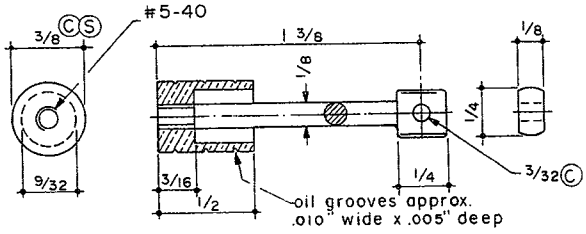




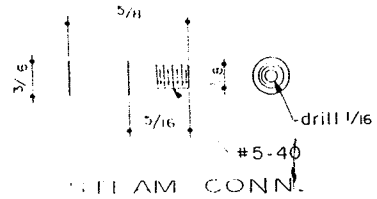
FOOT
Aluminum



SPRING
.022" Steel Wire



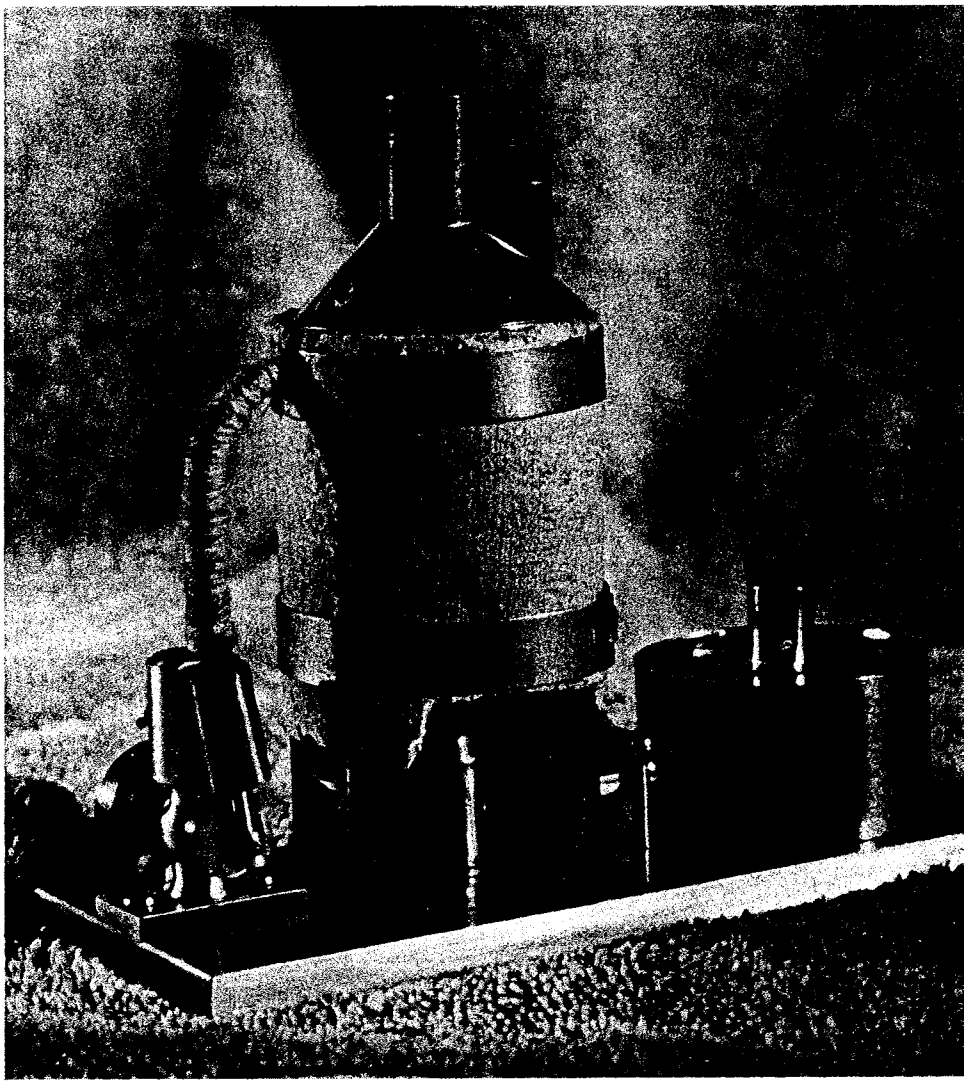
PISTON AND ROD
Brass



...TEAM CONN.
Brass

CHAPTER

26 Live Steam Boiler and Engine



It is fun to complete an engine and see it run on compressed air, but it is more fun to run it on steam. The engine and boiler described here are good starters on your Live Steam projects. They are within the capacity of a model lathe and made of quite common materials.

The **BOILER** and **BURNER** are of copper and brass construction for easy soldering. The model shown was soldered with 430° solder. After firing up a half-dozen or so times, there is no sign of failure. The 1-1/2" tubing is common sink drain pipe. The **FLUE** is 1/2" O.D. copper. The two **FILL TUBES** are 5/16" I.D. x 11/32" O.D. brass sold as telescoping tubing. An assortment package of corks from the corner hardware store had four corks that fit the 5/16" tubing.

The **LAGGING** here is sheet asbestos. It is really needed. The brass carries away the heat so fast the burner can barely keep up. Optional Lagging could be 1/28" wood veneer stock of your choice. Run the grain vertical and moisten the outside so it will bend easily and wrap around the Boiler.

While making the parts for the Boiler and Burner, try for a push fit at all solder points. The assembly will hold its shape better while soldering. The cone-shaped **TOP** makes a dead air space for insulation and makes the Boiler appear slightly more authentic. Use an escutchen pin for a rivet in this cone. Try for a lose free fit on the Boiler. It is not soldered to the Boiler.

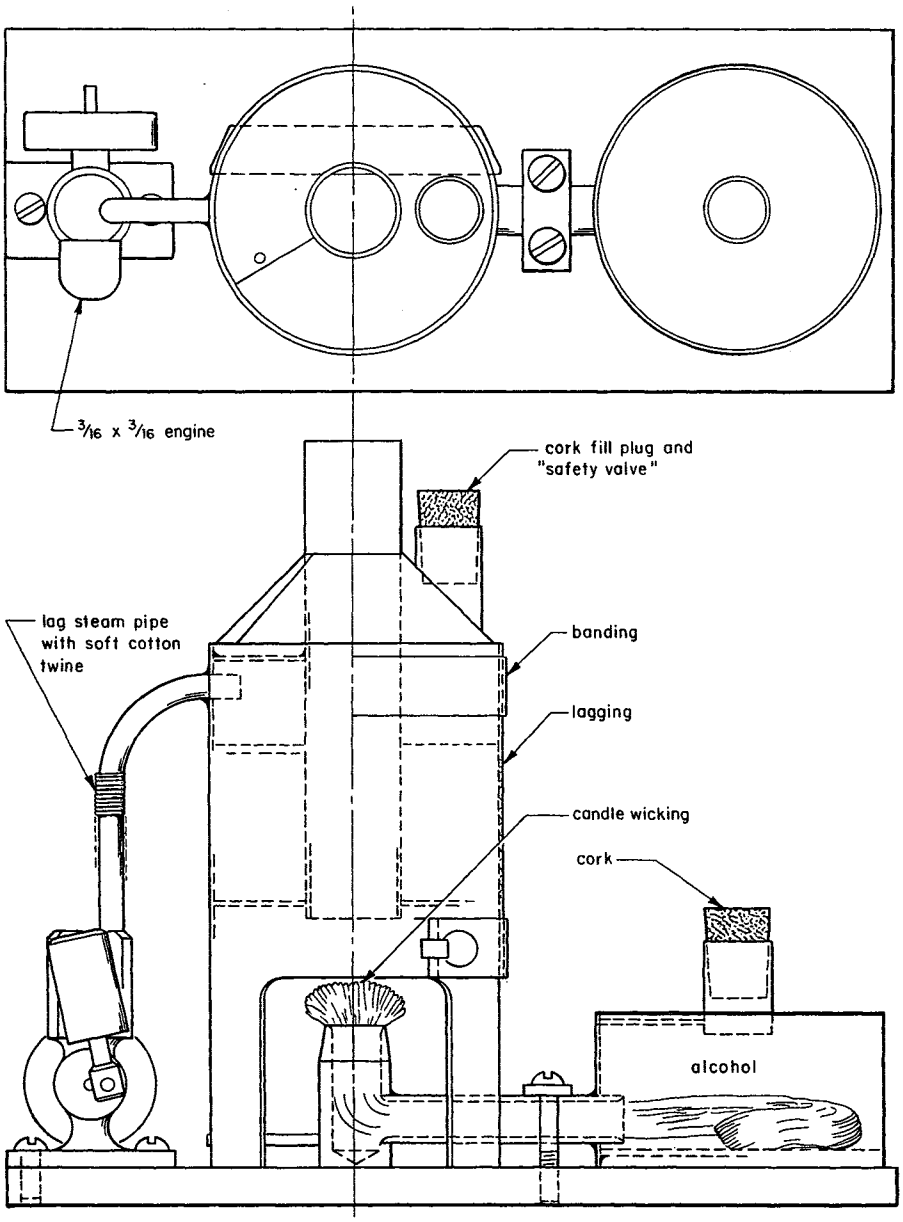
About 12" of fine wire was folded in the center and started in the Wick end of the Burner. With a bit of patience, it can be worked through until it shows under the fill tube. Hook it up out of the fill tube and thread the candle wicking through the wire loop. Draw it back through the tube until 3/8" of Wick is showing above the Burner. The size of this Wick bouquet determines the size of the flame.

The **ENGINE** is fairly simple and not too much will be said about the construction. The rubbing face of the **CYLINDER** must be flat and smooth. Make the 1/16 Shaft a close fit so it will be sqaure with the face when soldered. Chamfer the Cylinder slightly for the solder. Apply flux and a very tiny chip of solder and heat the Cylinder with a propane torch. By inserting a close-fitting aluminum rod in the bore, the Shaft and solder will not enter the bore or stick to the aluminum.

Try various **SPRINGS** from your collection. The one used here had the dimensions shown.

Do not run the **STEAM PIPE** in so far that it shuts off the steam passage. Thread the end #5-40 while the metal is rigid or "half hard". Mount the threaded end in a small vise and place a piece of larger tubing over the projecting end. Play the propane torch flame on one side of the tube and slowly apply pressure, bending away from the torch. You can feel the moment the heat has removed the work-hardened condition of the tube. Take it easy and bend at a right angle. If the heat is spread evenly on the stretch side of the bend, it will hardly collapse the tube at all. At final assembly, the bent end must aim at the Boiler when it runs tight in the thread. Apply pipe joint compound to the thread. Assemble the Engine and Boiler on the Base and solder the pipe into the Boiler.

The ports in the column are made with a jig as shown. Use the shoul-



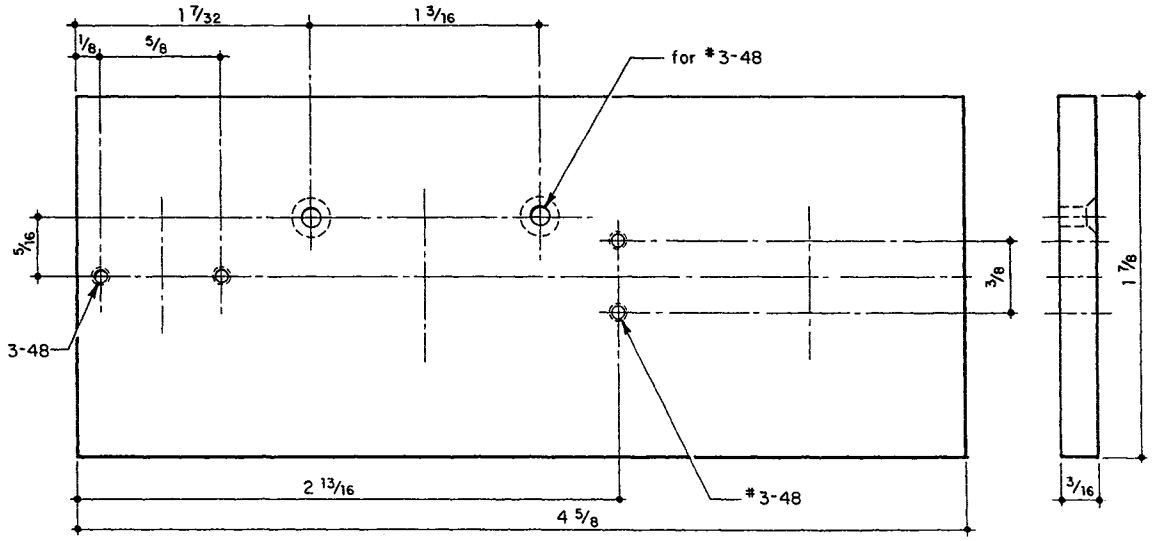
dered locating pin and a 1/16" straight pin in the column. Hold the jig against the locating pin while drilling. Turn the jig over the second hole.

Use the same jig to drill the port in the Cylinder. Insert the Piston in the Cylinder. Place jig over the shaft and a 1/16" pin through the jig and Connecting Rod.

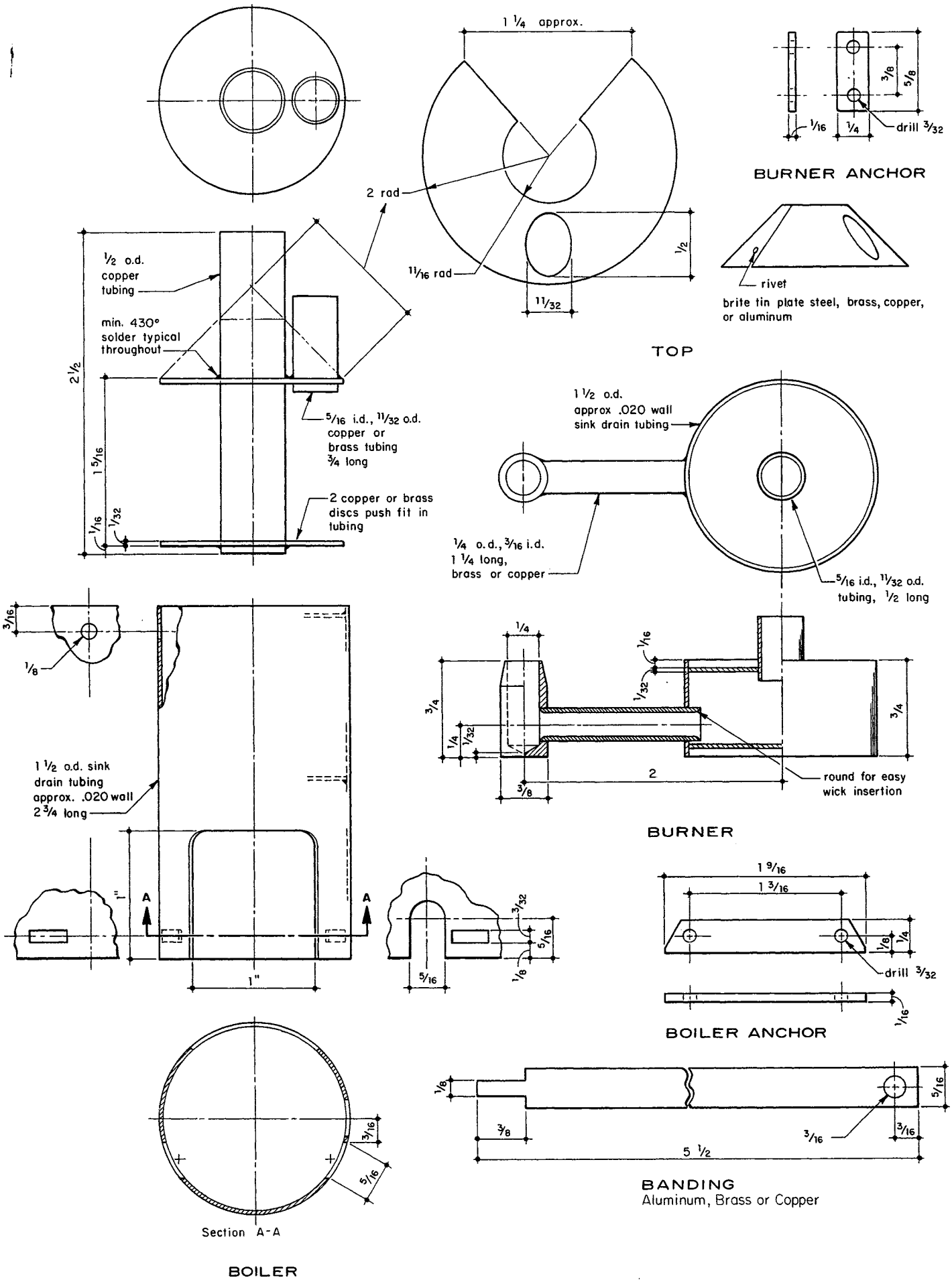
Do not seal this Boiler any tighter than provided by the cork. It will hold the 5 to 10 pounds of pressure needed and easily blow out if higher pressure develops. Do not have your face above the Boiler when operating. **Remember, you are dealing with flammable liquid, fire, hot water and steam. If you made this for your grandson, supervise his operation of this model.**

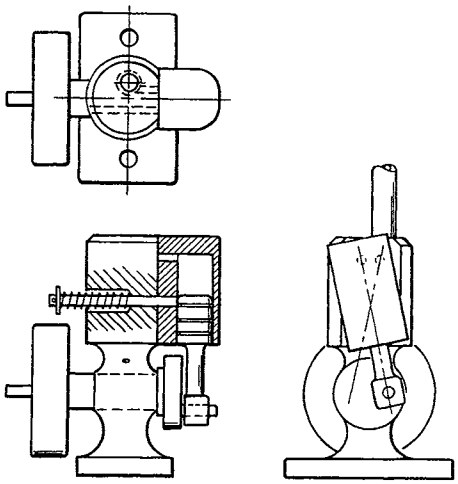
A hypodermic syringe is great for measuring the water and alcohol. The Boiler should be only about 2/3 full of water. If the Boiler runs out of water (the engine stops) blow out the flame immediately

This is a good educational project with lots of operational action.

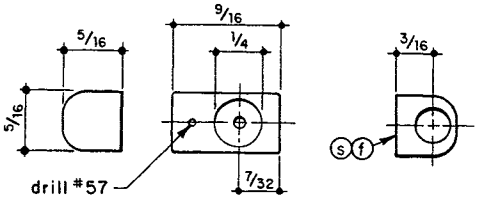


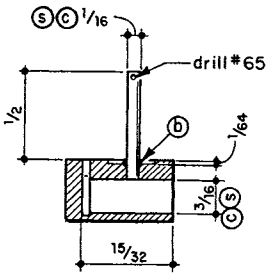
BASE


1 1/4 approx.
2 rad
11/16 rad
1/2
11/32
TOP
1/2 o.d. copper tubing
min. 430° solder typical throughout
2 1/2
1 5/16
1/16
1/32
5/16 i.d., 11/32 o.d. copper or brass tubing 3/4 long
2 copper or brass discs push fit in tubing
3/16
1/8
1 1/2 o.d. sink drain tubing approx. .020 wall 2 3/4 long
A
A
1"
1"
5/16
3/32
5/16
1/8
1 1/2 o.d. approx .020 wall sink drain tubing
1/4 o.d., 3/16 i.d. 1 1/4 long, brass or copper
5/16 i.d., 11/32 o.d. tubing, 1/2 long
1/4
1/16
1/32
3/4
1/4
1/32
3/4
2
3/8
round for easy wick insertion
BURNER
3/8
5/8
1/16
1/4
drill 3/32
BURNER ANCHOR
rivet
brite tin plate steel, brass, copper, or aluminum
1 9/16
1 3/16
1/8
1/4
drill 3/32
1/16
BOILER ANCHOR
1/8
5/16
3/8
3/16
3/16
5 1/2
BANDING
Aluminum, Brass or Copper
3/16
5/16
Section A-A
BOILER

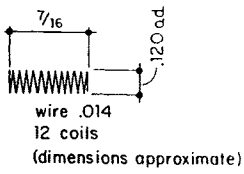


3/16 x 3/16 WOBBLER ENGINE

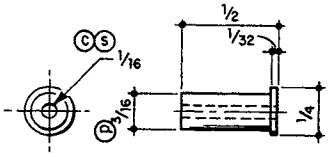




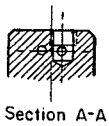
CYLINDER
Brass

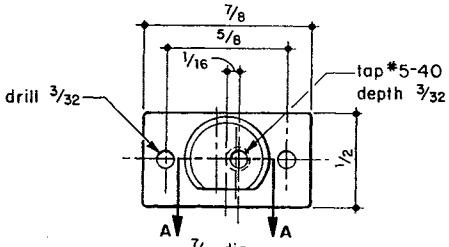


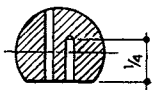
SPRING
Bronze or Stainless Steel



BEARING
Brass or Bronze


Section A-A





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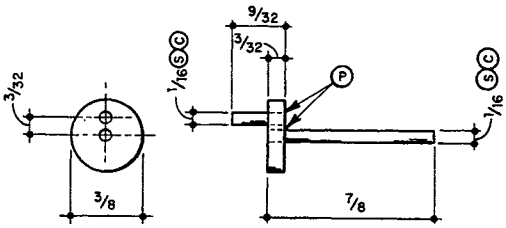
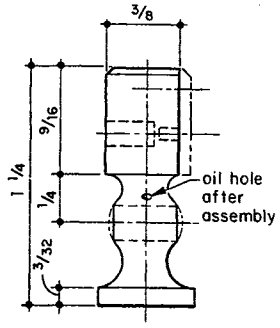
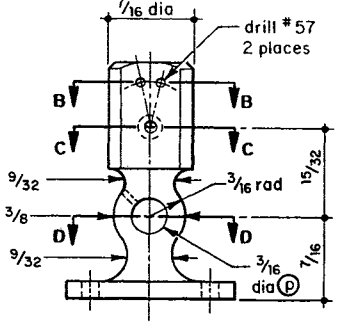
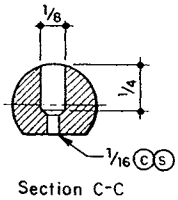


CRANKSHAFT
Brass

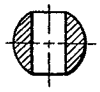


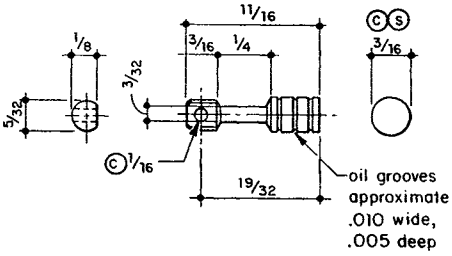


COLUMN
Aluminum or Brass

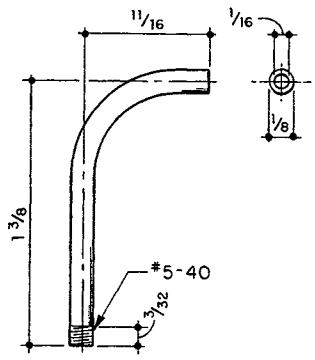


Section C-C

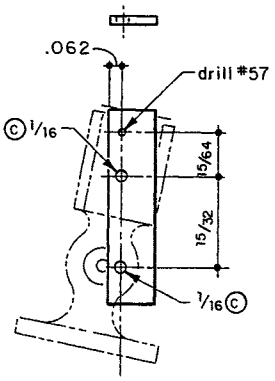

Section D-D



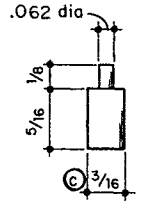
PISTON AND ROD
Aluminum



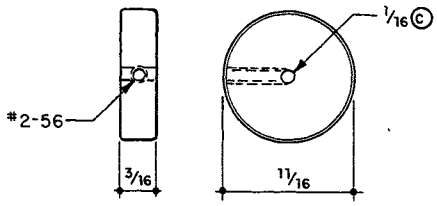
STEAM PIPE
Copper or Brass
(Half Hard)



DRILL JIG



LOCATING PIN



FLYWHEEL
Brass

C close fit	P press fit or loctite
S smooth	b braze or solder
f flat	