

# QUICK BOILING BOILER

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The principles of increasing the area of heating surface in model boilers may be applied very practically to the common kettle.

The quick-boiling kettle is useful for camping out, for heating the morning tea water of the very early riser, and for the study "brew," which sometimes has to be made in a hurry; and, on occasion, it will be so welcome in the kitchen as to constitute a very useful present to the mistress of the house.

As the putting in of the tubes entails some trouble, it is worth while to select a *good* kettle for treatment. Get one that is made of *thick* tinned sheet iron (cast-iron articles are unsuitable), or even of copper, if you are intent on making a handsome gift which will last indefinitely. The broad shallow kettle is best suited for tubing, as it naturally has a fair heating surface, and its bottom area gives room for inserting plenty of tubes. Also, the tubes can be of good length. Let us, therefore, assume that the kettle will be of at least 8 inches diameter.

In Figs. 96 (a) and 96 (b) are shown two forms of *fire-tube* kettles (a and b) and two of *water-tube* (c and d). For use over a spirit or Swedish petroleum stove the first two types are most convenient; the third will work well on a stove or an open fire; and the last proves very efficient on an open fire. One may take it that, as a general rule, areas of heating surface being equal, the water-tube kettle will boil more quickly than the fire-tube.

## Fire-tube Kettles

The tubing of Figs. 96 (a) and 96 (b) presents a little difficulty in each case. The straight tube is the more difficult to insert, owing to the elliptical shape of the ends; whereas the bent tube requires only circular holes, but must be shaped on a template.

The tubing used for (a) should have at least 5/8-inch internal diameter, for (b) 1/2 inch, and be of thin copper. Hot gases will not pass

willingly through tubes much smaller than this, in the absence of induced or forced draft.

For convenience in fitting, the tubes should run at an angle of 45 degrees to the bottom and side of the kettle, as this gives the same bevel at each end. Find the center of the bottom, and through it scratch plainly four diameters 45 degrees apart. From their ends draw perpendiculars up the side of the kettle.

Now draw on a piece of paper a section of the kettle, and from what is selected as a convenient water-level run a line obliquely, at an angle of 45 degrees, from the side to the bottom. Measuring off from this diagram, you can establish the points in the side and bottom at which the upper and longer side of the tubes should emerge. Mark these off.

Next bevel off a piece of tubing to an angle of 45 degrees, cutting off roughly in the first instance and finishing up carefully with a file till the angle is exact. Solder to the end a piece of tin, and cut and file this to the precise shape of the elliptical end. Detach by heating, scribe a line along its longest axis, and attach it by a small countersunk screw to the end of a convenient handle.

Place this template in turn on each of the eight radii, its long axis in line with it, being careful that the plate is brought up to the marks mentioned above, and is on the bottom corner side of it. Scratch round plainly with a fine steel point.

To remove the metal for a tube hole, it is necessary to drill a succession of almost contiguous holes as near the scratch as possible without actually cutting it. When the ring is completed, join the holes with a cold chisel held obliquely. Then file carefully with a round file, just not cutting the scratch. As the side of the hole nearest to the bottom corner should run obliquely to enable the tube to pass, work this out with the file held at an angle.

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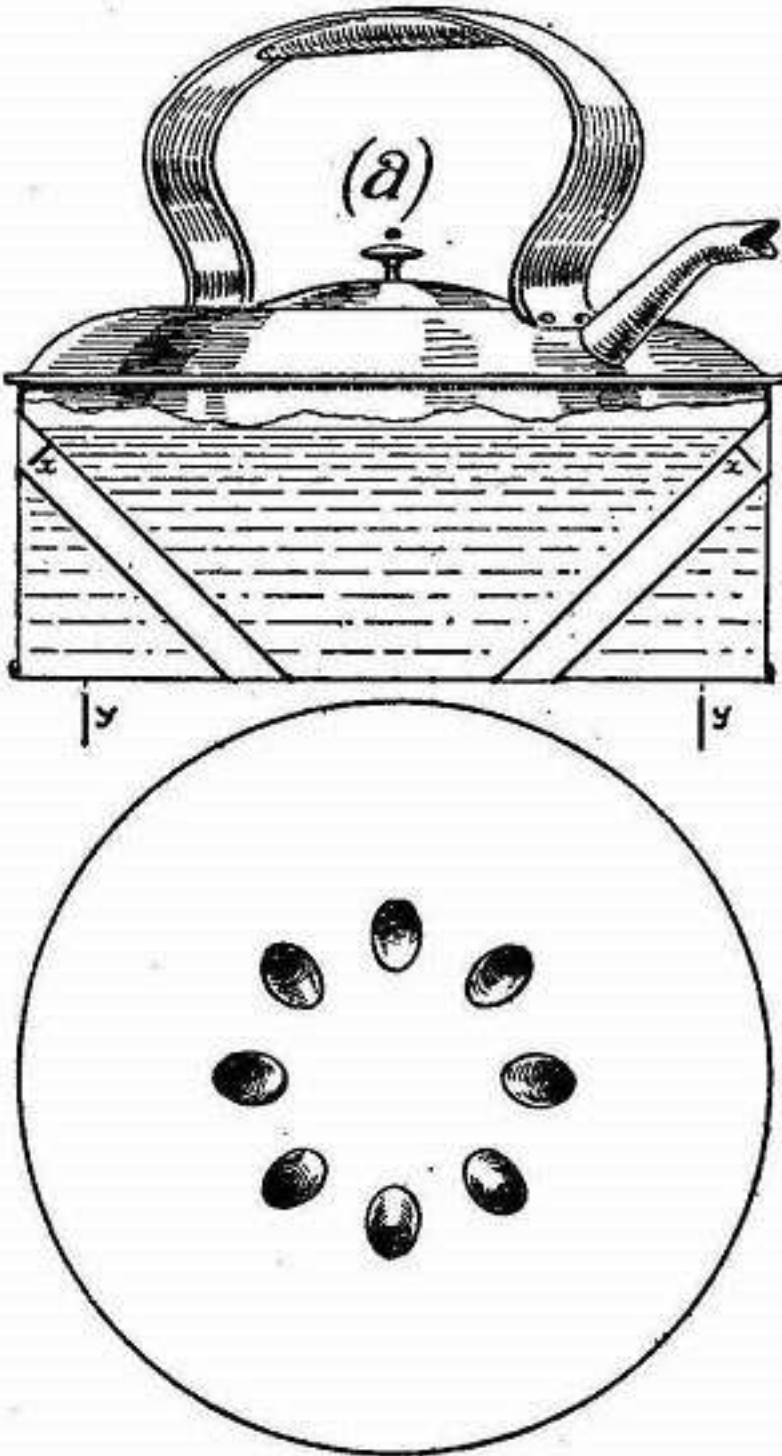


FIG. 96 (a).

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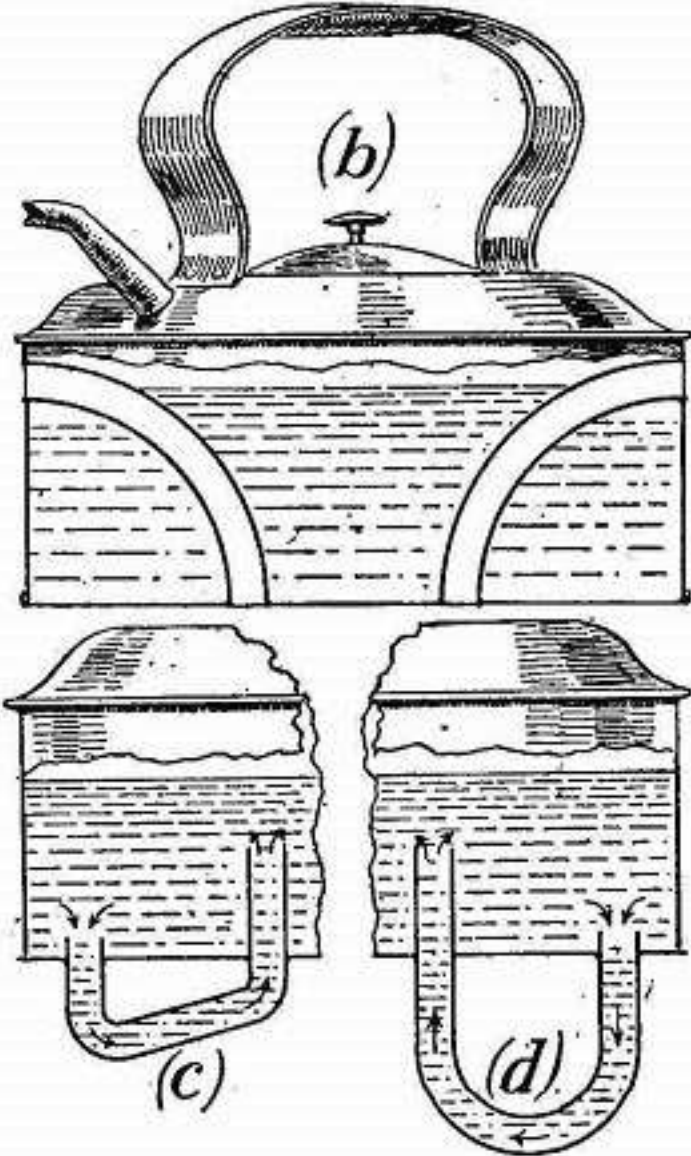


FIG. 96—(b), (c), and (d).

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As soon as a pair of holes (one in the bottom, the other in the side) have been made, true up the side hole until a piece of tubing will run through it at the correct angle. Then bevel off the end to 45 degrees and pass the tube through again, bringing the bevel up against the bottom hole from the inside. If it is a trifle difficult to pass, bevel off the edge slightly on the inside to make a fairly easy driving fit. (Take care not to bulge the bottom of the kettle.) Mark off the tube beyond the side hole, allowing an eighth of an inch extra. Cut at the mark, and number tube and hole, so that they may be paired correctly later on.

When all the tubes are fitted, "tin" the ends with a wash of solder before returning them to their holes. If there is a gap at any point wide enough to let the solder run through, either beat out the tube from the inside into contact, or, if this is impracticable, place a bit of brass wire in the gap. Use powdered resin by preference as flux for an iron kettle, as it does not cause the rusting produced by spirit of salt. If the latter is used, wipe over the solder with a strong ammonia or soda solution, in order to neutralize the acid.

As the hot gases may tend to escape too quickly through large tubes, it is well to insert in the upper end of each a small "stop,"  $x$  -- a circle of tin with an arc cut away on the bottom side. To encourage the gases to pass up the tubes instead of along the bottom, a ring of metal,  $y$ , may be soldered beyond the bottom holes, if an oil or spirit stove is to be used. This ring should have notches cut along the kettle edge, so as not to throttle the flame too much.

As the tubes for these require bending to shape in each case, the three types may be

grouped together. The tubes of  $c$  and  $d$ , which require bending to somewhat sharp curves, may be of 3/8-inch internal diameter. In the last two cases the direction of the water travel is shown. The up-flow end, which projects farther through the bottom than the down-flow, is nearer the center, where, if a gas stove is used, the heat is more intense than at the circumference of the bottom. (*Note.*-If type  $c$  is for use on a three-support stove, increase the number of tubes to 9, equally spaced, 40 degrees apart, so that the kettle may be adjusted easily.)

The copper tubing should be annealed or softened by heating to a dull red and plunging in cold water. Cut a wooden template of the exact outline of the *inside* line of the shape that the tube is to assume, and secure this firmly to a board. Fill the tube with melted resin, to prevent, as much as possible, "buckling" or flattening on the curves. The tube must be kept up to the template by a stop of hard wood, at the end at which bending commences. Don't cut the tube into lengths before bending, as short pieces are more difficult to handle. When a piece sufficient for a tube has been bent, cut it off, and remove the resin by heating.

The fitting of the tubes is an easy matter, as the holes are circular. Pair off a tube with its holes and number it. A fluted reamer will be found invaluable for enlarging them to the correct size. Tin all tubes at points where they are to be attached to the kettle.

In Figure 96 ( $c$ ) and ( $d$ ) care should be taken to make all the tubes project the same distance, so that the kettle may be level when resting on them.

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Transcribed by David Lee ([dslee@together.net](mailto:dslee@together.net)) and Ben Conway ([nhengineer@tds.net](mailto:nhengineer@tds.net))

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