March 22, 1932. W. RICHARDSON 1,850,156

ELECTRIC FLUID HEATER

Filed April 9, 1929

Fig. 1.

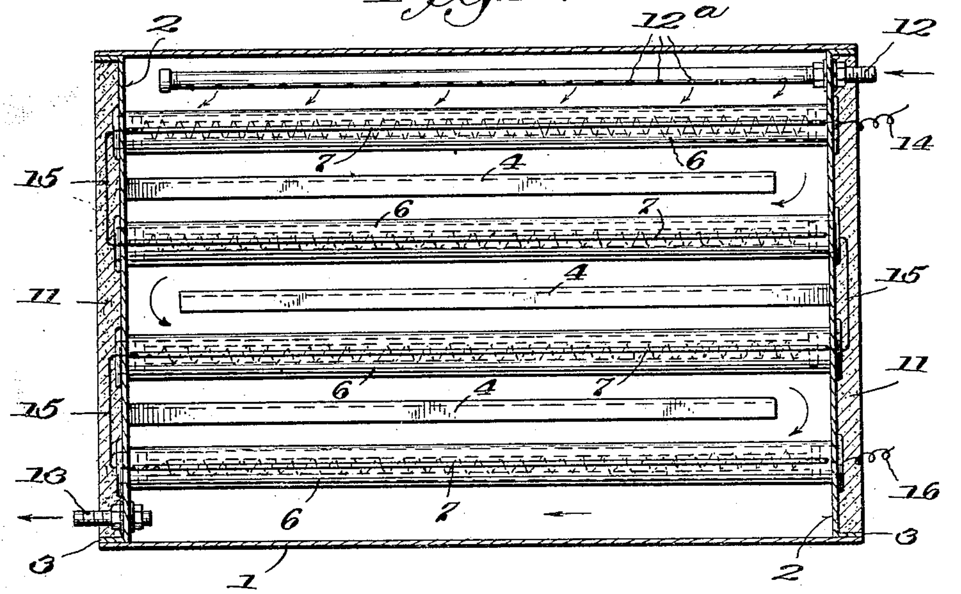


Fig. 2.

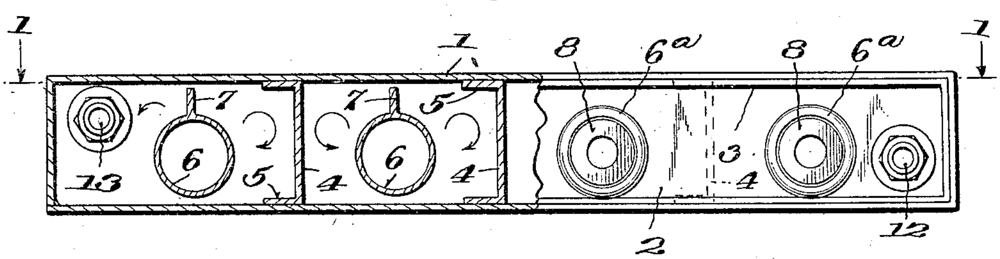


Fig. 3.

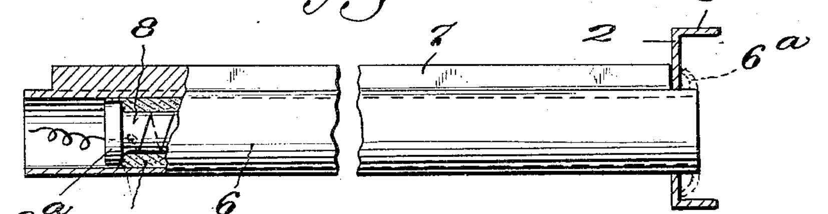
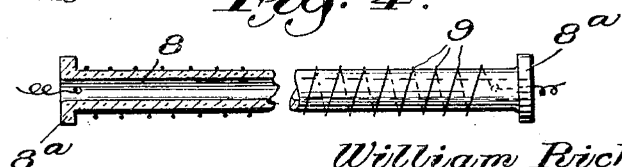


Fig. 4.



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UNITED STATES PATENT OFFICE

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ELECTRIC FLUID HEATER

Application filed April 9, 1929. Serial No. 353,718.

This invention relates to electric fluid heaters, and more particularly to heaters adapted for supplying hot water for domestic purposes.

While my invention is capable of use in many different relations, it is especially designed as an attachment for electric cooking ranges, and is intended to be connected to a water system in the manner shown in the copending application Serial No. 353,719, now Patent Number 1,813,124 of George Steingruber and myself, filed of even date herewith.

The objects of the invention are to provide a water heater which shall be cheap in construction and efficient in operation, and which may serve either as a circulation heater for a stand boiler or as a semi-instantaneous heater for quickly supplying relatively small quantities of hot water.

In order that the invention may be readily understood, reference is had to the accompanying drawings, forming part of this specification, and in which:—

Figure 1 is a sectional plan view of my improved heater;

Figure 2 is an end view thereof, partly in section, and partly in elevation;

Figure 3 is a side elevation of one of the heating elements, parts being broken away, and one of the end walls of the casing being shown in section; and

Figure 4 is a view partially in side elevation and partially in section of the heating coil itself, and the support therefor.

Referring to the drawings in detail, my improved heater is preferably formed of sheet metal and is of relatively shallow rectangular shape. It comprises a sheet 1 bent around, as shown in Figure 2, to form top, bottom and side walls, the top and bottom walls preferably being flat, as shown. Into each end of this body structure is inserted a flanged end plate 2, having flanges 3 welded or otherwise secured to the edges of the body portion 1. Thus, a completely closed casing or box is formed.

The top and bottom walls of the casing are stayed or tied together and thus prevented from bulging by means of partition strips 4, each preferably of channel shape and provided with flanges 5 welded or otherwise secured to the top and bottom walls. These partition strips also serve as baffle plates to direct the flow of fluid, as hereinafter explained, and to this end, they are arranged in parallel relation with their ends alternately spaced from the opposite end walls of the casing so as to provide a zig-zag passage.

In order to heat the fluid in its passage through the casing and around the baffle plates 4, I provide a plurality of heating units, each of which comprises a tube 6, preferably formed of copper or other good conducting material. These tubes are arranged in spaced parallel relation and are interposed between the baffle plates 4, as clearly shown in Figure 1. The tubes extend through openings in the end plates 2 of the casing and have their ends rolled over or expanded into these end plates, as indicated at 6^a, in the same manner as boiler tubes are set into tube sheets. Other methods of securing the tubes, as, for example, by soldering or brazing, can be employed, if desired. In order to assist in the circulation of the fluid and also to aid in imparting heat thereto, each of the tubes 6 is preferably provided on its upper side with a longitudinal rib or fin 7. As clearly shown in Figure 2, the tubes 6 are set relatively near the bottom of the casing, but out of contact therewith, and the fins 7 extend almost, but not entirely, to the top wall of the casing. Thus, when these tubes are heated, as hereinafter described, there is a tendency for the liquid adjacent thereto to move or circulate locally and laterally, in planes transverse to the direction of flow, as indicated by the arrows in Figure 2. At the same time, the liquid may pass between the tubes 6 and the bottom of the casing, and between the fins 7 and the top of the casing.

The tubes are heated by means of electric heating elements, each of which consists of a tube or spool 8 made of porcelain or other insulating refractory material and preferably provided with enlarged ends or heads 8^a of a size to snugly fit within the tubes. Wound on this spool is a heating coil 9 of suitable material, and the ends of this coil are brought out through the hollow center of the spool, as clearly shown in Figure 4, so that the coils of the several heaters may be properly connected. As clearly shown in Figure 1, these coils are preferably connected in series, the current entering, say, through the terminal 14 and passing successively through the coils of the several heating units through the end connections 15 and thence out through the terminal 16.

The heating elements comprising the spools 8 and coils 9 are inserted in the interior of the tubes, as clearly shown in Figure 3, the coils having first been embedded and covered with a coating 10 of refractory cement of any suitable character, this cement being applied to the body of the spool until it is flush with the heads 8^a thereof. In other words, the cement fills the space between the body of the spool and the interior of the tube, thus excluding air and thoroughly insulating the heating coil and preventing grounding, should it become broken.

By reference to Figure 1, it will be observed that the ends 2 of the casing are set back a slight distance from the edges of the body portion, so as to form recesses, and these recesses are preferably filled with a heat insulating cement, as indicated at 11. This not only covers and protects the connecting wires 15, but also seals the open ends of the tubes and prevents the access of air thereto.

Liquid enters the heater through a pipe 12, adapted to be connected to any suitable source. This pipe 12 is preferably located near the bottom of the casing, and at one side thereof, and, as shown in Figure 1, is extended inwardly for nearly the length of the casing, and provided with a plurality of small discharge holes or openings 12^a, so as to distribute the incoming liquid along the length of the first heating unit.

The liquid leaves the heater through an outlet pipe 13, and this, as clearly shown in Figure 2, is set at the opposite side of the casing and at a point near the top thereof.

From the foregoing, it will be seen that liquid entering the casing through the orifice 12^a of the inlet pipe 12 is delivered against the first heating unit and flows thence around the baffle plates 4 and along and around the successive heating units until it is finally discharged through the pipe 13. It is obvious that the liquid in its travel is brought into contact with a very large heating surface and this, combined with the local circulation which is set up adjacent the tubes, as hereinbefore described, results in an extremely rapid heating of the liquid. Thus, a few minutes after current is turned on, hot water may be drawn from the pipe 13. Otherwise, the pipes 12 and 13 may be connected to a stand boiler and will heat the same by circulation in the usual manner.

What I claim is:—

1. An electric fluid heater comprising a closed sheet metal casing having flat top, bottom and end walls, a plurality of heating elements extending through said casing and supported by said end walls, and combined stay and baffle plates parallel with and interposed between said heating elements and secured to said top and bottom walls.

2. An electric fluid heater comprising a closed casing having top, bottom and end walls, a plurality of heating elements extending through said casing and supported by said end walls, baffle plates parallel with and interposed between said heating elements, said baffle plates being spaced alternately from opposite end walls, inlet and outlet pipes arranged to cause fluid to flow in a zig-zag course around said baffle plates and in contact with said heating elements, and means for creating, adjacent each heating element, a local circulation in planes transverse to the direction of flow.

3. An electric fluid heater comprising a closed casing having flat opposed walls and end walls, a plurality of tubular heating elements extending through said casing and supported by said end walls out of contact with said flat opposed walls, and combined stay and baffle plates parallel with and interposed between said heating elements, and secured to said flat opposed walls to tie the same together.

4. An electric fluid heater comprising a closed casing adapted to contain the fluid to be heated and having opposite end walls, conducting tubes disposed within said casing, with their open ends extending through and set into said end walls, and insulating tubes having heating coils thereon fitting inside of said conducting tubes, said insulating tubes being of no greater length than said conducting tubes, and having unobstructed open ends.

5. An electric fluid heater comprising a closed casing divided into a plurality of compartments, an electric heating element in each compartment, means for causing the fluid to be heated to flow in series through said compartments, and means for causing a local circulation in each compartment in planes transverse to the direction of flow.

6. An electric fluid heater comprising a closed casing having flat opposed walls, a plurality of electric heating elements in said casing, inlet and outlet pipes tapping said casing, and a plurality of parallel baffle plates arranged to cause fluid to flow in series past all of said heating elements, the edges of said baffle plates being secured to said flat, opposed walls to brace the latter.

In testimony whereof I affix my signature.

WILLIAM RICHARDSON.