July 5, 1927. 1,634,704

H. BRAND

WATER HEATER

Filed Dec. 20, 1926

Fig. 1.

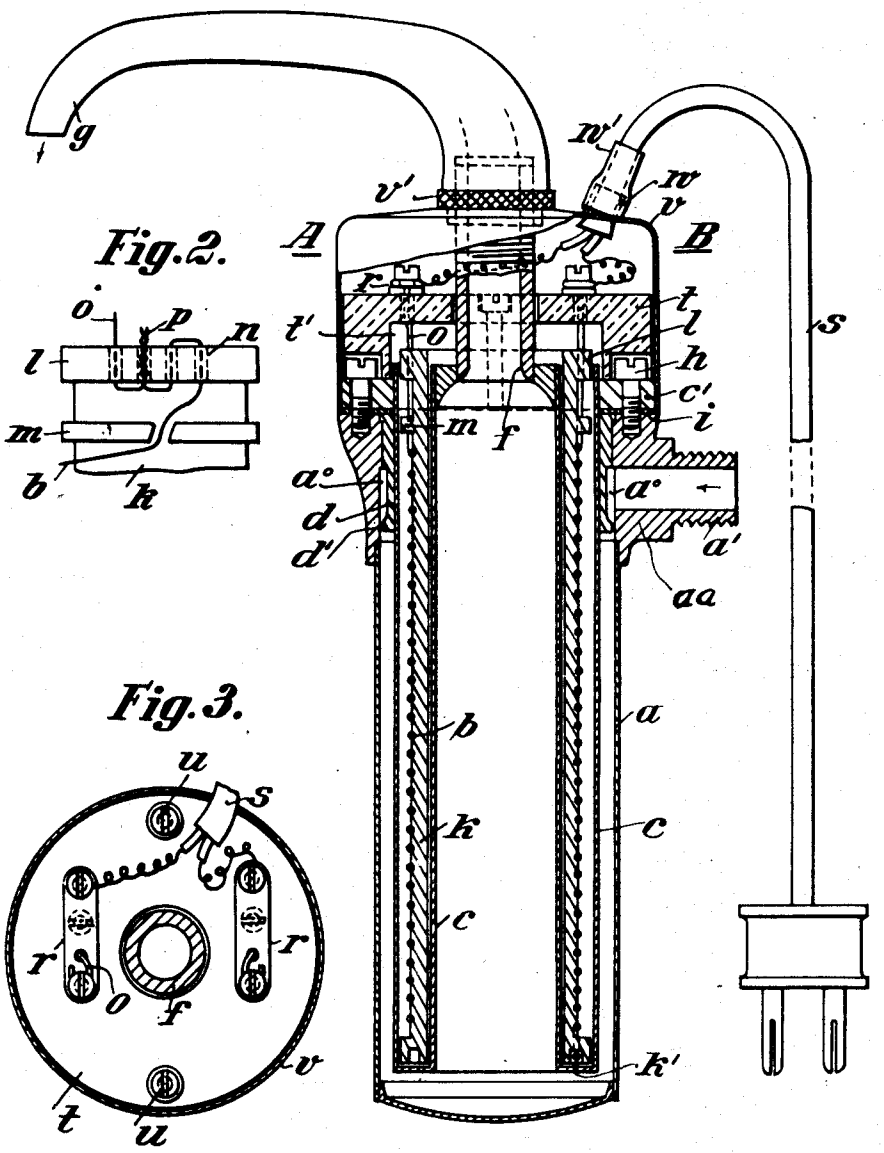


Fig. 2.

Fig. 3.

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Patented July 5, 1927. 1,634,704

UNITED STATES PATENT OFFICE.

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WATER HEATER.

Application filed December 20, 1926, Serial No. 156,041, and in Germany December 22, 1925.

My invention relates to electric water heaters in which a coil wound on an insulating body and through which the current passes is mounted in a double walled hollow cylinder of thin sheet metal which is in contact on both sides with the water to be heated.

In the known water heaters of this type a series of disadvantages have been found. The heat produced in the heating coil was not transferred to the water and carried away thereby sufficiently rapidly, so that over-heating easily occurred. Further I have observed that also in the interior of the hollow metal cylinder containing the heating coil, in spite of the fact that this is closed on all sides, a water deposit is formed, apparently because under certain temperature conditions the metal is porous. The penetration of water drops into the interior of the cylinder soon leads to disturbances (short circuits and the like).

By means of numerous and thorough researches I have ascertained that all these disadvantage are eliminated and a water heater, operating continuously with the highest efficiency, is obtained by the combination of the following features which are partly known:

1. The water to be heated is first passed along the outside of the double walled hollow cylinder containing the heating coil, hereinafter referred to as the heating element, and then flows into the inner cylinder. It is conducted away at the upper end and heated in the middle of the heating element.

2. The cold water is supplied to the uppermost end of the outer cylinder surface which comes in contact with the water.

3. A direct contact of the cold water with the thin outer wall of the heating element is avoided as it has been found that opposite the inlet point a deposit of water would be effected in the interior of the heating element, particularly during the heating period. The water flows towards a narrow annular space at the upper end of the outer side of the heating element and is diverted outwardly and downwardly by a nozzle-like annular slot in such a manner that it does not come directly into contact with the wall of the heating element.

4. On the upper end of the heating element, which is placed by means of a flange on the container for the water supply, there is fitted with a tight fit a bell-shaped cap of thin sheet metal, into which the current conducting wires are passed in a fluid tight manner and from the centre of which, also with the use of packing devices, the hot water outlet pipe passes.

A preferred form of construction of the invention is illustrated in the accompanying drawings, wherein

Figure 1 is a vertical section of my improved water heater, partly in elevation.

Figure 2 is a view of a detail.

Figure 3 is a horizontal section on the line A—B of Figure 1.

According to Figure 1 the water heater consists of a container a, for example of cylindrical shape having an enlarged end wall or extension member $a\ a$ provided with a threaded nipple a' adapting the device to connection with a suitable water tap or supply pipe.

Into the cylindrical container a is fitted the heating element, which more particularly consists of a heating wire b wound around a body k composed of chamotte, to which current is supplied in the manner hereinafter described and which is surrounded by a double walled hollow cylinder c of thin good heat conducting metal, more particularly of copper. At the upper end, this cylinder is pressed with the annular ring or flange c' against the upper edge of the container a or extension $a\ a$ thereof, by means of headed bolts h, a packing disc i being interposed between said flange and the upper end or extension member of said container.

The container a and double walled hollow cylinder c are of relative sizes such that when the latter is fitted within the former, an annular space is provided between the opposing walls thereof, at the upper end of which the water inlet or nipple a' is located. At the upper end of the container a, there is fitted a sleeve d which closely surrounds the outer wall of the cylinder c within said annular space. Said sleeve prevents the cold water from coming directly into contact with the thin outer wall of the cylinder c. Registering with the water inlet to the heater, an annular channel a^0 is formed by an annular recess in said sleeve into which the cold water is first introduced and distributed, and from the lower end of which the water then passes through a narrow nozzle-like slot d' downwardly and outwardly in such manner that it will move as much as possible along the inner wall of the vessel a. In this manner the inflowing cold water will

tend to film against the outer wall of the conductor *a* and the losses due to heat radiation will be greatly reduced. The water in flowing around the lower end of the heater-element housing cylinder *c* and into the inner cylindrical hollow space of the latter, will become gradually heated by the double walls of said cylinder *c* during its passage upwardly to the outflow pipe *f* on the upper end of which is fitted an oscillatory outflow pipe *g*. The flow of the water to the outlet opening is favoured by the upward drive or impulse resulting upon its becoming heated or by the steam which is generated when considerable heating takes place.

By guiding the water in the manner described, the danger of deposits of water being formed within the heating element is considerably restricted. The last possibility of damage by the formation of water is prevented by constructing the upper closure of the device in the manner hereinafter described.

The heating wire *b* is arranged as a closed double pitch screw around the body *k* and at the lower end the passage from one spiral winding to the other is effected in a groove *k'* provided at the bottom of the body *k*. At the upper end the chamotte body *k* is provided with two annular ribs *l* and *m* which fit easily within the space between inner and outer walls of the cylinder *c*. The wire *b* is bent backwards and forwards as shown in Figure 2 and passes through holes *n* provided in the rib or flange *l* parallel to the axis of said body so that the wire is firmly secured in place. If desired, the connecting wire *o* may be twisted together with the resistance wire *b* in the manner indicated at *p* and the twisted portions then passed through an additional hole *n* as illustrated.

The connecting wire *o* leads to one of the terminals *r* (Figure 3) of the usual type for the wires of a supply cable *s*. Said terminals are secured to an insulating body *t* of fibre or the like, provided with recesses for the heads of the screws *k* and with a recess *t'* which overextends the upper open end of the heating element *c*. The outlet pipe passes through a central hole in the body *t*. Two screws *u* serve to secure the body *t* to the flange *c'* of the heating element.

Over the insulating body *t* with the terminals *r* is fitted a thin walled metal closing cap *v* which is snugly fitted over the cylindrical outer edge of the flange *c'*. The flange, as illustrated, is made comparatively thick so that at this point a joint is formed which entirely prevents the admission of atmospheric air and moisture of the air. The cap *v* is provided with a guide sleeve *w* for the rubber cable *s* conducting the current to the terminals *r* and which is fitted as tightly as possible into said sleeve *w*. A completely fluid-tight closure is obtained by means of a short rubber tube *w'* which is drawn over the whole. The cap *v* is pressed firmly against the upper edge of the container *a* by a nut *v'* which is screwed on the exterior of the pipe *f*. A fluid-tight joint may be formed at this point if desired by the insertion of packing means not illustrated.

If for any cause, moisture should pass into the interior of the heating element *c*, it will pass in the form of steam into the chamber of the cap *v* during operation. The lower edge of the cap which is seated on the flange *c'* then enables the moisture to escape as the connection at this point acts somewhat in the manner of a valve. Admission of moisture from the outside however is prevented as already stated above.

For the production of large quantities of heat a number of apparatus can be arranged in parallel so as to form a battery, in which case a single outer container could be used in place of a plurality of outer containers *a*.

Although I have described my invention with reference to a preferred form of construction, it will be understood that modifications may be made in the details described without departing from the spirit and scope of my invention as set out in the following claims.

Having now particularly described and ascertained the nature of my said invention and in what manner the same is to be performed, I declare that what I claim is:—

1. A water heater comprising in combination, an outer cylindrical container having an enlarged extension member adapted to connection with a source of water supply, a double-walled hollow cylinder fitted within said outer container and forming therewith an annular water space between opposing walls thereof, said double-walled cylinder being secured upon the extension member of the outer container in a fluid tight connection therewith, a heating element protectively fitted between the walls of said double-walled cylinder in fluid tight segregation from the water space of the heater, means for heating said heating element and means for discharging heated fluid from said container centrally of said double-walled cylinder and heating element.

2. A heating device according to claim 4, characterized by the fact that the double-walled heating element housing cylinder is capped at its open end by an insulating body carrying connections for the heating element while leaving a narrow passage for air therethrough and that the water discharge means passes through said insulating body.

3. A heating device according to claim 4, characterized by the fact that the double-walled heating element housing cylinder is enclosed at its open end by an insulating body carrying connections for the heating

element while leaving a narrow passage for air therethrough and that said insulating body carrying said connections for the heating element is in turn enclosed by a metal cap fitted tightly thereon, the discharge means for the heated water being passed therethrough and centrally connected with said hollow cylinder.

4. A water heater comprising in combination, an outer cylindrical container having an enlarged extension member adapted to connection with a source of water supply a double-walled hollow cylinder fitted within said outer container and providing therewith an annular water space between opposing walls thereof, said double-walled hollow cylinder being secured upon the extension member of the outer container in a fluid tight connection therewith, means located within the space between the walls of the outer container and said double-walled hollow cylinder for distributing and restricting the water supply to the heater at the point of introduction thereinto, a heating element fitted between the double walls of said hollow cylinder in fluid tight segregation from the water space of the heater, means for heating said heating element and means for discharging heated fluid from said container centrally of said hollow cylinder and heating element.

In testimony whereof I have affixed my signature.

HERMANN BRAND.

CERTIFICATE OF CORRECTION.

Patent No. 1,634,704. **Granted July 5, 1927, to**

HERMANN BRAND.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 2, line 118, claim 2, and line 126, claim 3, for the numeral "4" read "1"; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 2nd day of August, A. D. 1927.

M. J. Moore,
Acting Commissioner of Patents.

Seal.