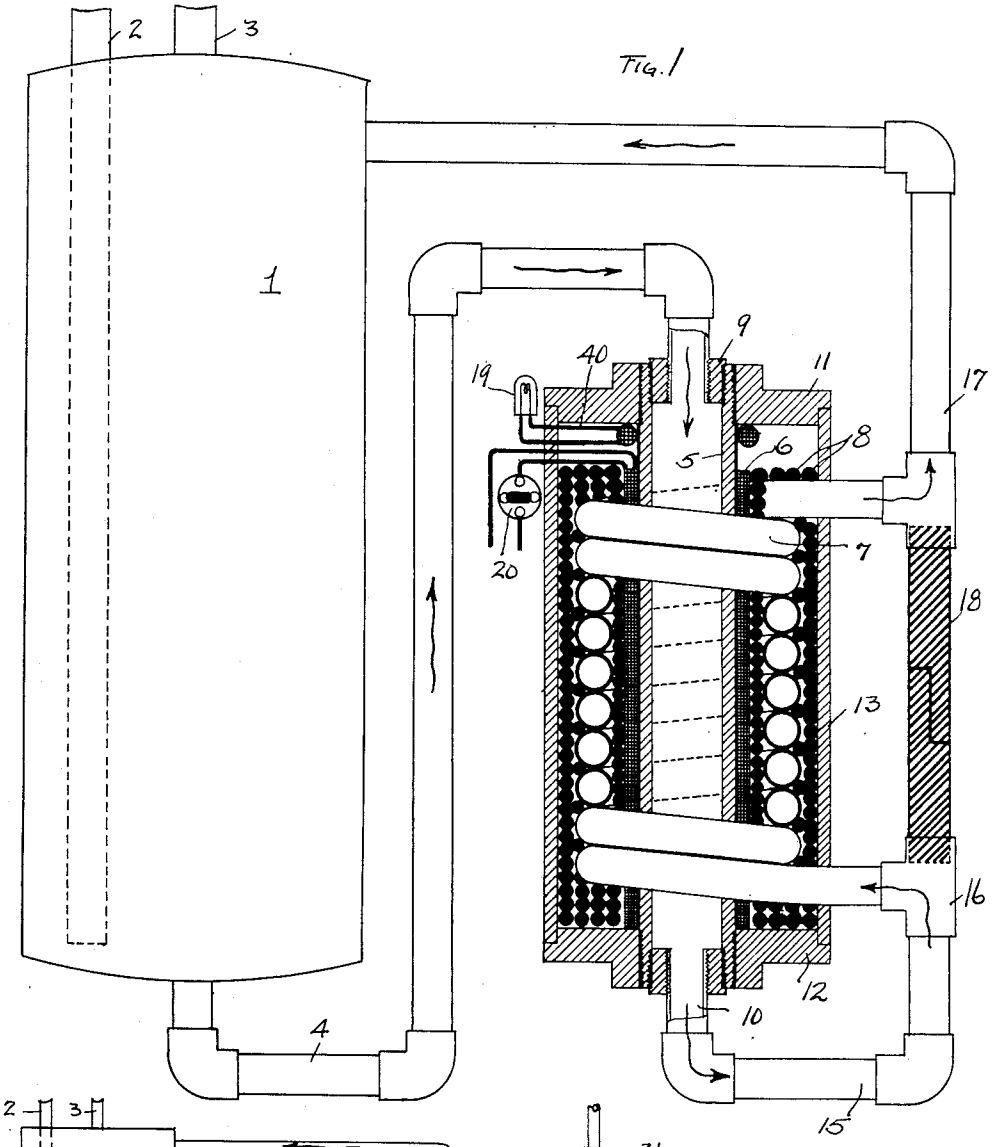
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ELECTRIC HEATER

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FIG. 1



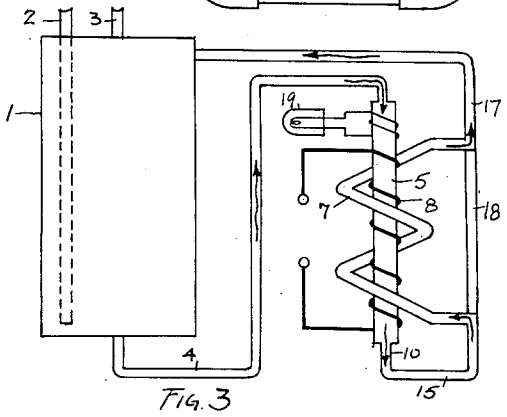


FIG. 3

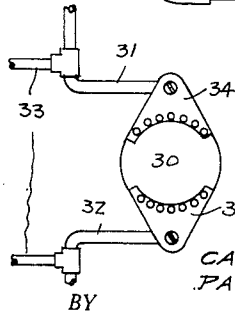


FIG. 5

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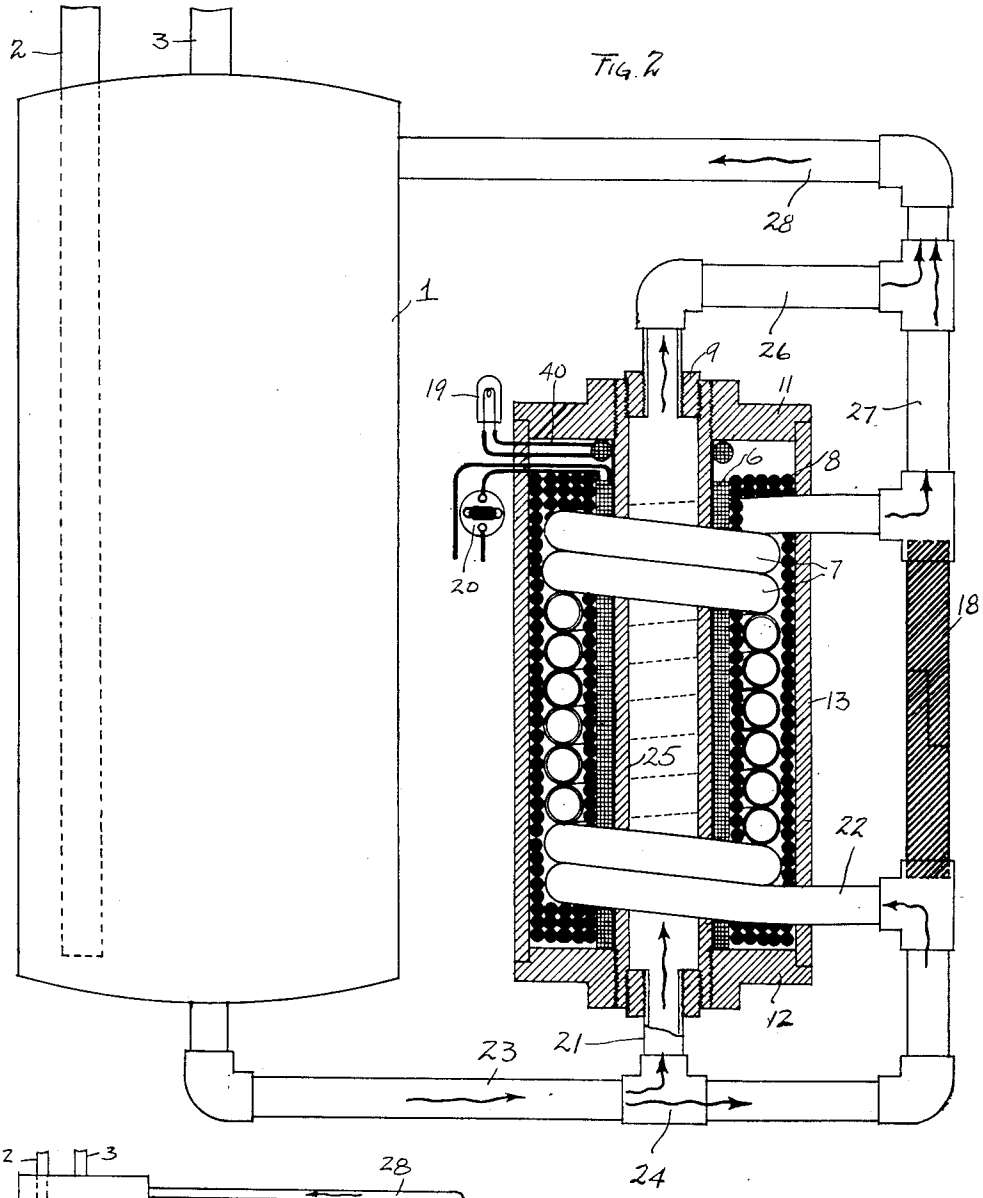


FIG. 2

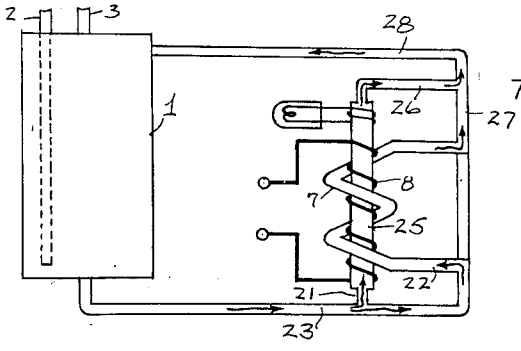


FIG. 4

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Patented Oct. 28, 1924. 1,513,087

UNITED STATES PATENT OFFICE.

CARL H. BUHL AND PAUL GILBERT, OF CLEVELAND, OHIO, ASSIGNORS TO THE NATIONAL ELECTRIC WATER HEATER COMPANY, OF CLEVELAND, OHIO, A CORPORATION OF OHIO.

ELECTRIC HEATER.

Application filed March 29, 1922. Serial No. 547,661.

To all whom it may concern:

Be it known that we, CARL H. BUHL and PAUL GILBERT, both citizens of the United States, and residents of Cleveland, county of Cuyahoga and State of Ohio, respectively, have jointly invented a new and useful Improvement in Electric Heaters, of which the following is a specification, the principle of the invention being herein explained and the best mode in which we have contemplated applying that principle, so as to distinguish it from other inventions.

The present invention relating, as indicated, to water heaters is particularly directed to a new and improved apparatus for heating-fluids electrically with considerably increased efficiency over that obtained in any of the present heating mechanisms.

To the accomplishment of the foregoing and related ends, said invention, then, consists of the means hereinafter fully described and particularly pointed out in the claims.

The annexed drawing and the following description set forth in detail certain mechanism embodying the invention, such disclosed means constituting, however, but one of various mechanical forms in which the principle of the invention may be used.

In said annexed drawing:—

Fig. 1 is a side elevation partially in section of my improved heating apparatus as applied to a water heater for household use; Fig. 2 is a similar view showing a modification of the construction of Fig. 1; Fig. 3 is a diagrammatic view showing the wiring connections for the apparatus of Fig. 1; Fig. 4 is a similar view showing the connections for the apparatus of Fig. 2; and Fig. 5 is a partial plan view showing the connection to my heating apparatus of a grid or other heating element.

In Figure 1 there is shown a water containing tank 1 which may be of usual construction with inlet pipe 2 and discharge pipe 3. A pipe 4 leads from the bottom of this tank 1 to a hollow tubular core 5 which forms a core of a transformer in which there is provided a primary coil 6 wound concentrically about the hollow core 5, and a secondary coil 7 which is wound concentrically about the primary coil 6. These two coils are separated and covered by insulating material 8. The core 5 is threaded internally and externally at either end and receives connecting sleeves 9 heating the end of the pipe 4 and the end of the second discharge pipe 10, which carries the fluid from the other end of the core. Mounted on the external threading of core 5 are plates 11 and 12 between which is held a tubular casing 13. This casing with the head plates 11 and 12 encloses the primary and secondary coils and also the core of the transformer and constitutes a closed magnetic core for the transformer.

The water or fluid which is being heated is let through the pipe 4 to the interior of the core 5 where it is of course heated by the current passing through the primary coil 6. The fluid is then let through the connection 10 to a conduit 15 which is connected by means of a T connection 16 to one end of the secondary coil 7, this secondary coil being formed from a tube of electrically conductive material. The fluid after passing through the core has been heated to a certain extent and is now reheated to a higher degree by its passage through the secondary coil through which the induced current is flowing. After passing through this coil the fluid is returned to a conduit 17 which extends back to the tank 1. In order to form a closed circuit through it, the secondary coil connector of high capacity, in the form of a bar 18, is connected between the conduits 16 and 17. This bar 18 is of course solid and is not a part of the water conducting circuit but is a part of the secondary electrical circuit.

Wound on the core is a second separate secondary circuit 40 constructed to reduce the voltage considerably, probably to six volts, and this circuit operates a lamp 19 to indicate the operation of the heater. Obviously a thermostatic switch may be used if desired for automatically connecting or disconnecting the heating apparatus in order to maintain water at the desired temperature in the tank 1.

In Fig. 2 we have shown the same heating apparatus modified to bring the fluid to be heated in parallel through the hollow core 21 and the secondary coil 22. In order to do this the supply conduit 23 on the tank is branched at the connection 24, part of the fluid being sent through the hollow core 25 and the remainder through the secondary

coil 22. The fluid after passing through the core is carried in conduit 26 which is adjoined to a conduit 27 connected to the discharge end of the secondary coil, the fluids then being again brought together in a single conduit 28 which leads back to the tank 1. Otherwise the construction of the apparatus shown in this figure may be the same as that previously described. The electrical and fluid connections are diagrammatically shown for each form of apparatus in Figs. 3 and 4. The present heating apparatus may be readily adapted for other uses, in which case a grid 30, shown in Fig. 5, may be connected in the secondary circuit between the leads 31 and 32, which closes the circuit through the secondary coil 33. These leads 31 and 32 constitute the same connection in this apparatus that the bar 18 does in the apparatus of Figs. 1 and 2. In this modification the grid 30 may be formed of cast iron with integrally connected copper lugs 34 and 35. These lugs 34 and 35 are connected to the leads 31 and 32, and the cast iron which is a very much poorer conductor than the copper leads and lugs, and therefore offers a much greater resistance to the passage of current, is very quickly heated to a high temperature, although the use of this heating element in the secondary circuit will of course, to some extent, cut down the efficiency of the secondary coil in heating the fluid which is passed through it.

The present apparatus offers a method of increasing to a marked extent the heating efficiency of an electrical apparatus, while at the same time the construction is simple and inexpensive to manufacture and affords a high degree of protection for the coils against the temperature, which would otherwise quickly destroy the coils or at least impair their efficiency very considerably.

Other modes of applying the principle of our invention may be employed instead of the one explained, change being made as regards the mechanism herein disclosed, provided the means stated by any of the following claims or the equivalent of such stated means be employed.

We therefore particularly point out and distinctly claim as our invention:—

1. In a device of the character described, the combination of a transformer having a hollow core, a primary coil wound thereon and a hollow secondary coil wound concentrically about said primary coil, and means adapted to supply a fluid to be heated to the interior of said hollow core and said secondary coil.

2. In a device of the character described, the combination of a transformer having a hollow core, a primary coil wound thereon and a hollow secondary coil wound concentrically about said primary coil, and means adapted to supply a fluid to be heated to said hollow core and said secondary coil in parallel.

3. In a device of the character described, the combination of a transformer having a hollow core, a primary coil wound thereon, a coiled conduit of conducting material disposed about said core, said conduit constituting a secondary coil, and means adapted to supply a fluid to be heated to said core and said conduit.

4. In a device of the character described, the combination of a transformer having a hollow core, a primary coil wound thereon, a coiled conduit of conducting material disposed about said core, said conduit constituting a secondary coil, a liquid supply conduit, and connections between the same and said core and conduit, said connections being adapted to cause such liquid to pass through said core and then through said coiled conduit.

5. In a device of the character described, the combination of a transformer having a hollow core, a primary coil wound thereon, a coiled conduit of conducting material disposed about said core, said conduit constituting a secondary coil, a liquid supply conduit, connections between said supply conduit, said core and said coiled conduit, said connections being adapted to cause liquid from said supply conduit to pass through said core and said coiled conduit in parallel.

6. In a device of the character described, the combination of a core consisting of a tubular shell, a second shell disposed concentrically within the same, and end plates connecting the respective ends of said shells, said shells and end plates being of magnetic material, a primary coil wound upon said inner shell, a secondary coil wound upon said primary coil within said outer shell, said secondary coil being hollow and having its ends extending through said outer shell, liquid supplying connections for the ends of said hollow coil, and an electrical conductor connected across the ends of said secondary coil.

7. In a device of the character described, the combination of a core consisting of a tubular shell, a second shell disposed concentrically within the same, and end plates closing the space between the ends of said shells, a primary coil wound upon said inner shell, a hollow secondary coil also wound upon said inner shell and having its ends extending exteriorly of said outer shell, a liquid conveying connection between one end of said inner shell and one end of said secondary hollow coil, and a liquid supply conduit connected to the other end of said coil.

8. In a device of the character described, the combination of a core consisting of a tubular shell, a second shell disposed con-

centrically within the same, and end plates closing the space between the ends of said shells, a primary coil wound upon said inner shell, a hollow secondary coil also wound upon said inner shell and having its ends extending exteriorly of said outer shell, a liquid conveying connection between one end of said inner shell and one end of said secondary hollow coil, a liquid supply conduit connected to the other end of said coil, and an electrical conducting member connected to the ends of said secondary coil.

9. In a device of the character described, the combination of a transformer having primary and secondary coils, said secondary coil being hollow, means adapted to supply a fluid to be heated to the interior of said secondary coil, and a second secondary coil operated by said primary coil, said second secondary coil operating a signal upon closure of said primary coil.

Signed by us this 22nd day of November, 1921.

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PAUL GILBERT.