Oct. 22, 1940. G. E. WHITE 2,218,999

ELECTRIC HEATER

Filed Sept. 7, 1937

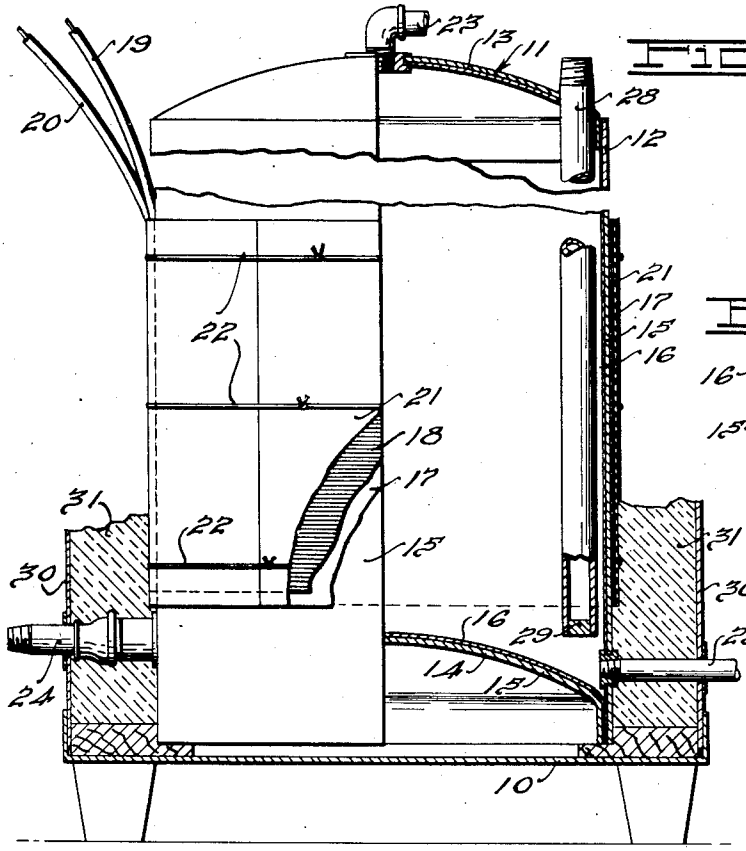


FIG. 1.

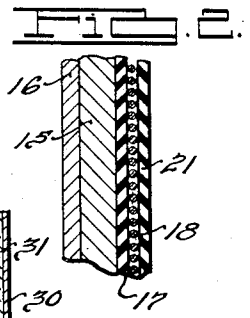


FIG. 2.

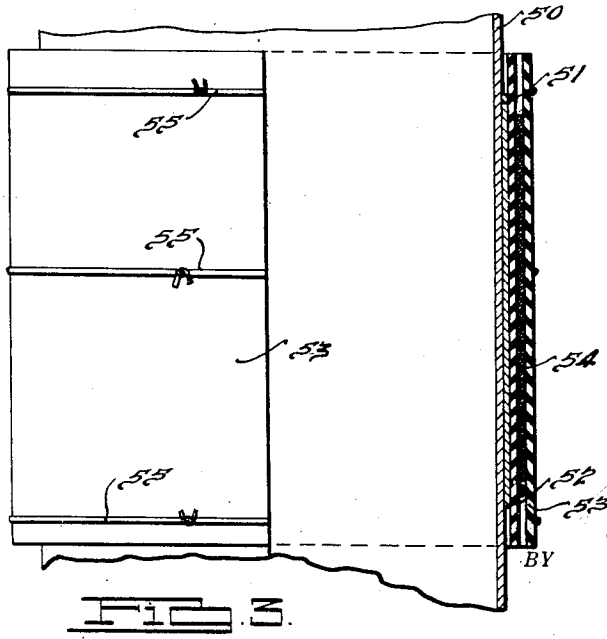


FIG. 3.

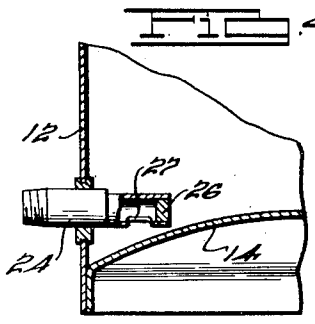


FIG. 4.

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ELECTRIC HEATER

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2 Claims. (Cl. 219—47)

This invention relates to electric heaters, and more particularly to heaters of the induction type. It is particularly applicable to water heaters, but it may be applied to space heaters as well.

Electric water heaters of the induction type have been known before my invention, but they were not efficient, their power factor being so low that their use under most conditions was impractical.

An object of my invention, therefore, is to provide a heater that remedies this condition and has a power factor of nearly unity.

A further object of my invention is to provide a heater which can be readily and economically constructed, using standard parts easily procured on the market.

A further object of my invention is to provide a water heater with sufficient capacity to allow enough water to be heated at one time to last the average family through the day.

A further object of my invention is to provide a heater with an improved cold water inlet such that the inflowing water does not mix with the hot water.

These and other objects ancillary thereto will appear in the following description, when read in connection with the attached drawing, wherein:

Figure 1 is a fragmentary elevational view, partly in section, of my complete heater;

Figure 2 is a fragmentary section on an enlarged scale of a portion of the wall of the storage tank and primary and secondary coils of the heater shown in Figure 1;

Figure 3 is a fragmentary elevational view, partly in section, of the tank and coils of a modified form of my invention; and

Figure 4 is a fragmentary sectional view of my heater showing an improved inlet pipe.

Referring now to the drawing, a base 10, which may be of any suitable construction, supports a tank 11 consisting of a cylindrical portion 12 and upper and lower heads 13 and 14 respectively.

The cylindrical portion 12 and the heads 13 and 14 are formed of some magnetic material 15, such as iron or steel, completely lined on their inner sides with sheets of a non-magnetic material 16, such as copper or brass.

In actual practice each copper or brass sheet is tinned on one surface and laid with the tinned side against the iron or steel sheet, after which the two sheets are put under heat and pressure whereby they are sweated together, forming an integral structure. The composite sheets are then formed by pressing or bending into the shapes required for the various walls of the tank, and the various parts joined together.

A layer of electrical insulation 17 is wrapped about the lower portion of the tank to form a support for the helical primary coil of wire 18. This coil consists of a plurality of turns of wire wound in a single layer, and the ends are taken out at 19 and 20 to be connected to the source of electrical supply. A second layer of electrical insulation 21 is wrapped about the coil 18, and is held in place by cords or wires 22.

The entire tank is encased in an outer shell 30. This shell is made of some inert non-magnetic material that is a non-conductor of both electricity and heat. It is preferred to make the shell 30 of a material made up of many layers of paper, cemented together and pressed into the form of fairly rigid sheets or cylinders.

Packed between the shell and the tank is any suitable heat insulating material 31, such as asbestos, spun glass wool, or the like.

The head 13 is provided with a hot water outlet pipe 23, and the cylindrical portion 12 is provided at its lower end with a cold water inlet pipe 24. An outlet 25 controlled by a suitable valve (not shown), for draining the tank or drawing off of any sediment, is also connected to the tank.

The cold water inlet 24 is of a peculiar construction in order that the incoming water will flow smoothly over the bottom of the tank and will not create turbulence. The water is thereby stratified, rather than churned up, whereby the cold water at the bottom of the tank and the hot water at the top of the tank are not mixed.

The inlet pipe 24 is closed at its inner end by a plug 26, and has an elongated narrow slot 27 in its lower surface. The water flowing into the tank through the slot spreads smoothly over the bottom of the tank, preventing any appreciable mixing of the hot and cold water. This feature is an essential part of my invention, particularly where used as an off-peak heater.

During certain periods of each day the electrical power load on the generating plant supplying the current is much lower than at other times. Many power companies, therefore, allow a lower rate for power used during these off-peak periods than for that furnished at other times. Hence, with a properly designed heater, enough water may be heated and stored during these periods to last throughout the day. As hot water is drawn off throughout the day it must be replaced in the tank with cold water, and if the incoming cold

water mixes with the hot water at the top, the advantages of this type of heater are lost.

Within the tank is a well 28 closed at its lower end with a plug 29. The well forms a chamber for an automatic thermostatic control for the source of electric current. The controls may be set to turn the heating current on and off automatically at any desired temperatures so that the tank can be kept filled with a constant supply of hot water.

It will be noted that the control chamber is located adjacent a side of the tank. This is so that if for any reason the tank should be emptied, and the current go on automatically, the heat generated will be radiated to the control which will cut the current off before a dangerous temperature can be reached. If the tank is full of water and the current is on, the heat is dissipated in the water until it reaches a temperature such that the current is cut off.

The modification of my invention shown in Figure 3 differs from that shown in Figures 1 and 2 primarily in the location of the secondary coil. In this structure a tank 50 of iron, steel or other magnetic material has a sheet of copper or brass or other non-magnetic material 51, wrapped about it in intimate contact therewith. The sheet 51 has its ends in contact with each other, thus forming a short circuited cylindrical secondary coil. Two layers of electrical insulation 52 and 53, with the helical primary coil 54 between them, surround the secondary coil and are tied in place with cords 55. The tank and heating element thus formed are encased in heat insulation and an outer shell and mounted on a base in the same manner as the tank shown in Figures 1 and 2. The inlet and outlet pipes are also the same as in Figures 1 and 2.

The advantage of the structure shown in Figure 3 over that of Figures 1 and 2 is primarily the lesser cost of manufacture. A standard galvanized iron storage tank may be used as the nucleus of the heating system, and in addition, less copper is required for the secondary coil.

The heater shown in Figures 1 and 2 has the advantage over that of Figure 3, however, in providing a rustproof tank.

In its operation, the apparatus shown in Figures 1 and 2 acts as a transformer consisting of primary coil 18, secondary coil 16, and armature 15. In the following description of the operation the iron walls 15 of the tank will be referred to as the armature.

When the ends 19 and 20 of primary coil 18 are connected to a source of alternating electric current, a magnetic field is created in the armature 15. The magnetic field induced therein changes in direction with each change in direction of the current, and the changing field induces an alternating electric current in secondary coil 16.

As the secondary coil is a relatively large metal mass and is short circuited, the current induced therein does not flow in straight lines but flows as eddy currents, which are dissipated in heat within the coil. This heat is transferred to the water in the tank by radiation and induction.

In addition to the heat generated in the secondary coil, some heat is generated in the primary coil due to its resistance (R I drop), but the amount is relatively small.

Some heat is also generated in the armature itself due to eddy current induced in it by self induction.

The use of the secondary coil increases the heating efficiency of the apparatus a substantial amount over prior heaters where only a primary coil and armature were used. Such an increase in efficiency is due to the decrease in leakage flux. In other words, practically all of the lines of force, or flux, of the magnetic field are used in inducing a current in the secondary coil.

The operation of the apparatus shown in Figure 3 is the same as that of Figures 1 and 2. It is immaterial whether the secondary coil is between the primary coil and armature, or the armature between the primary and secondary coils.

It will be readily seen from the foregoing that I have produced a highly efficient and very practical electric induction heater which can be economically manufactured. The particular devices described, however, are by way of illustration only, and my invention is to be limited in scope only by the appended claims.

I claim:

1. An electric heater comprising a storage tank of relatively large capacity, the walls of which include magnetic material, a secondary coil formed from a sheet of non-magnetic material arranged concentrically with respect to a wall of said tank and with the ends of the coil short circuited, a helical primary coil surrounding a portion of the wall of said tank and electrically insulated therefrom, a layer of heat insulating material surrounding said tank and coils, and an outer shell of non-conducting, non-magnetic material enclosing said tank and insulating material.

2. In combination, a cylindrical storage tank formed of magnetic material having an outlet at the upper end and an inlet at the lower end thereof, a secondary coil formed from a sheet of non-magnetic material arranged concentrically with respect to a portion of the side walls of said tank and with the ends of the coil short circuited, a helical primary coil surrounding said tank and electrically insulated therefrom, an outer shell of non-conducting non-magnetic material surrounding said tank, and a layer of heat insulating material between said shell and said tank.

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