Nov. 26, 1935. J. F. BALL 2,022,453

ELECTRIC HEATER

Filed Sept. 18, 1929

Fig. 1.

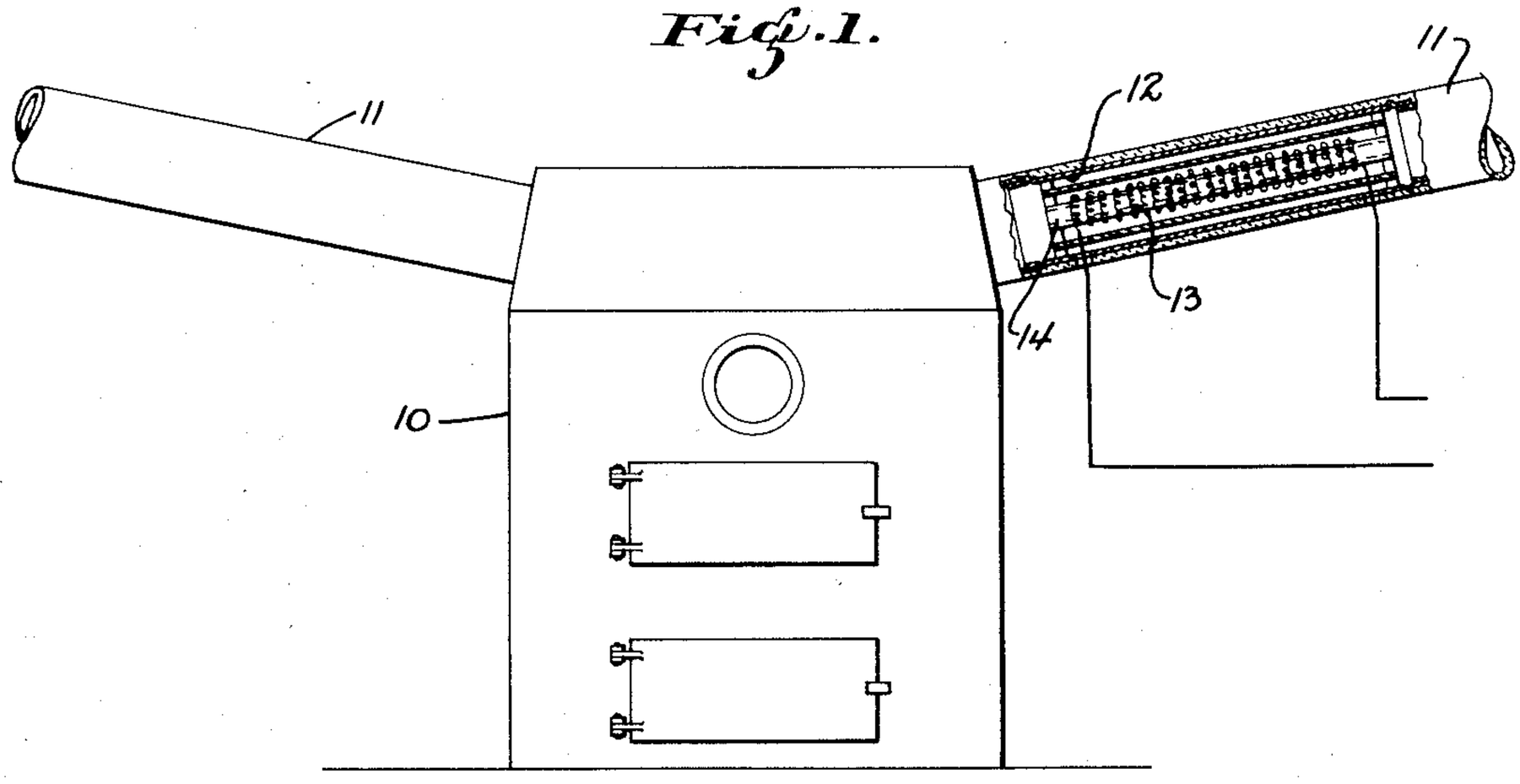


Fig. 2

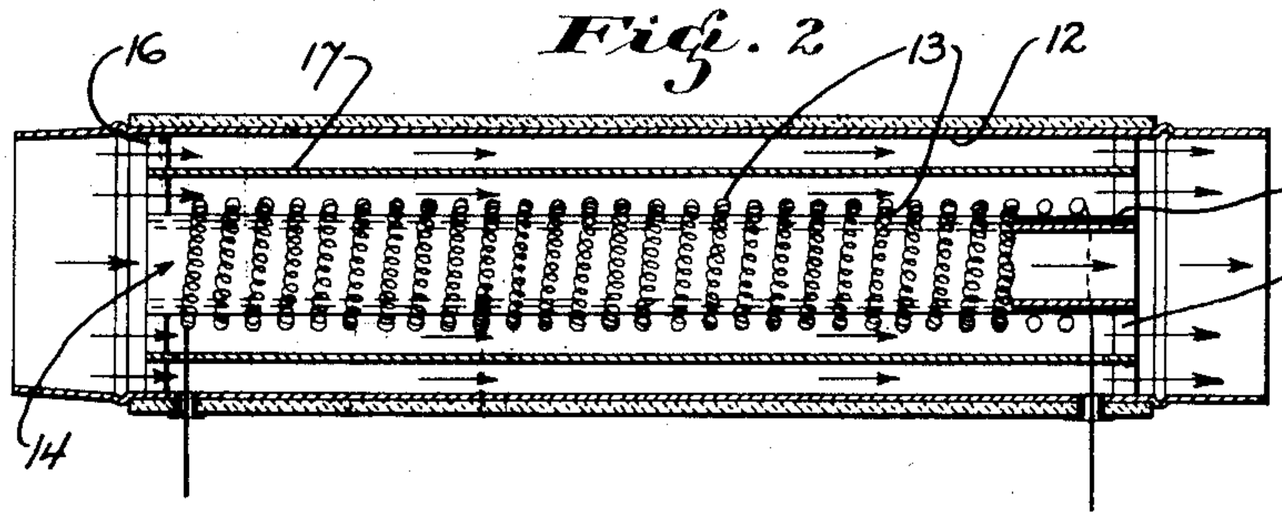


Fig. 3

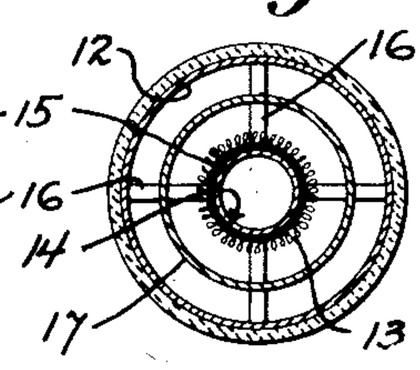


Fig. 4

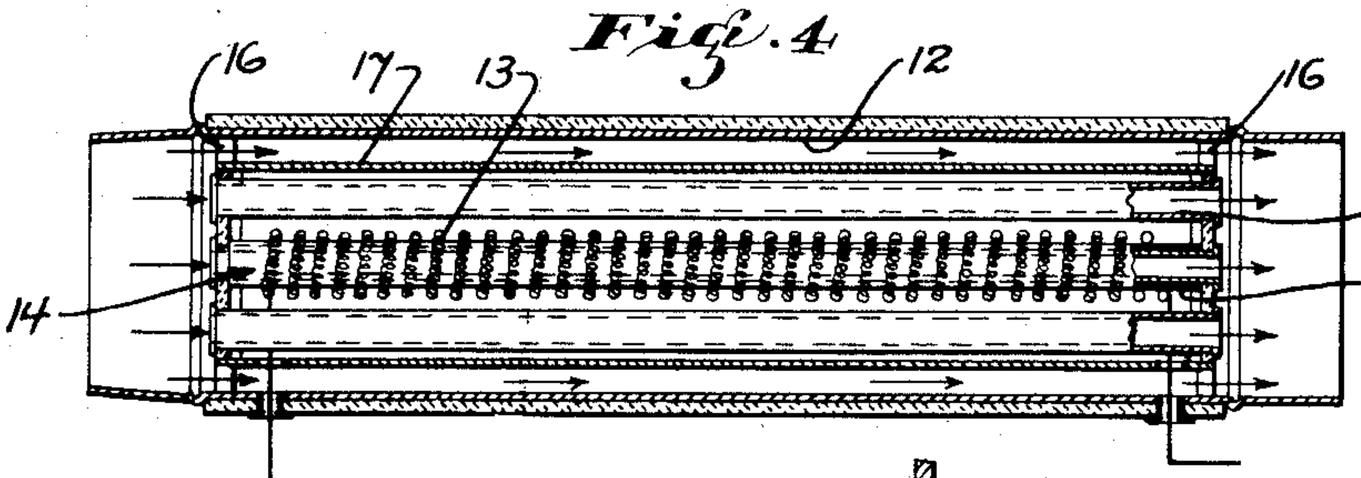


Fig. 5.

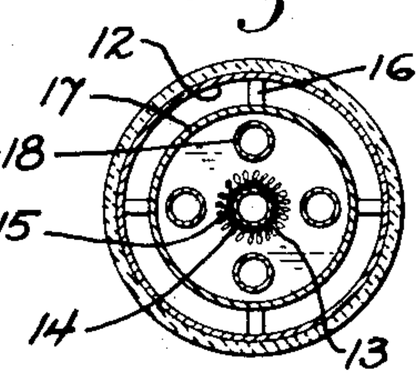
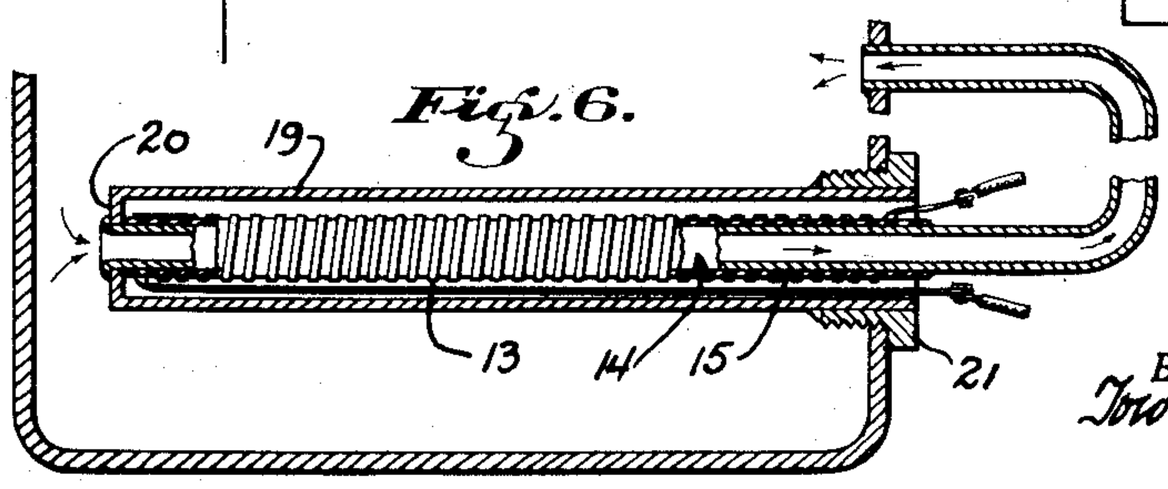


Fig. 6.



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Patented Nov. 26, 1935 2,022,453

UNITED STATES PATENT OFFICE

2,022,453

ELECTRIC HEATER

Joseph Franklin Ball, San Francisco, Calif.

Application September 18, 1929, Serial No. 393,466

3 Claims. (Cl. 219—38)

My present invention relates to electric heaters and more particularly to a new and novel type of heater by means of which the combined effect of current flowing through the resistance and current induced in adjacent conducting members is applied to the heating or a circulating medium.

One object of my invention is to provide a new, novel and effective type of heater unit for use in heating a circulating medium.

Another object of my invention is to provide in an electric heater unit a new and novel arrangement, whereby when alternating currents are available to energize the resistance element of my improved heater, adjacent parts thereof will be in inductive relation therewith and, as a result, afford a path for induced currents which will co-operate with the resistance winding to facilitate a rapid heating of the medium being circulated through the heater.

My invention also possesses other advantageous features, some of which, with the foregoing, will be set forth at length in the following description, where I shall outline in full that form of my invention which I have selected for illustration in the drawing accompanying and forming a part of this specification. In the drawing, I have shown three forms of heaters embodying my invention, but it is to be understood that I do not limit myself to such forms, since the invention, as set forth in the claims, may be embodied in a plurality of other forms.

In the drawing:—

Fig. 1 is a vertical elevation showing my improved heater inserted in the flue of an ordinary hot air furnace,

Fig. 2 is a sectional view of one form of my invention,

Fig. 3 is a sectional view projected from the unit illustrated in Fig. 2.

Fig. 4 is a sectional view of a modified form of my invention,

Fig. 5 is a sectional view projected from the unit illustrated in Fig. 4, and

Fig. 6 is a sectional view showing an embodiment of my invention which is particularly adapted to the heating of water and other fluids.

In Fig. 1 of the drawing, 10 designates an ordinary hot air furnace having the usual outlet flues 11. Inserted in the flues 11, I show a length of pipe 12 in which there is disposed a resistance heater unit 13. This heater unit 13 is wound upon a metallic cylindrical core 14 and in inductive relation therewith, so that, when energized, currents will be induced into the cylindrical member 14 and thus effect a more rapid heating of the air circulating therethrough than would be the case were the heater unit 13 alone relied upon.

By referring now to Fig. 2, it will be seen that the length of pipe 12 is flanged at the ends so that it may be inserted in any standard flue and that the cylindrical support 14 is mounted centrally thereof. Surrounding the cylindrical member 14, I show a suitable insulation 15, upon which the resistance winding 13 is wound. The cylindrical support 14 is shown as held in position upon suitable radially extending stays 16. Interposed between the winding 13 and the pipe 12, I show a second cylindrical member 17. This cylindrical member 17 completely surrounds the resistance unit 13 and is spaced a distance therefrom so that air may freely circulate over the resistance unit 13 along the interior thereof and also around its outer surface. With this arrangement it will be seen that there is provided a restricted passageway for the air over the resistance unit. It will also be understood that because of the inductive relation of this cylindrical member 17 it will prevent any magnetic lines cutting the outer pipe 12 and, as a result, prevent the induction of currents in the latter. With this arrangement, it will be seen that the air has three possible paths through the section of pipe 12, one path being through the center of the cylindrical pipe 14; another path immediately outside thereof and inside of the cylindrical member 17; and a third path outside of the cylindrical member 17.

In Figs. 4 and 5 it will be noted that, instead of permitting the air to flow freely over the resistance unit 13, I have provided a plurality of radially disposed paths for the medium to be heated, these paths being formed by suitable conduits 18 which are arranged in spaced relation about the heater unit 13 and within the cylindrical shell 17. With this arrangement, it will be seen that the heater unit 13 will first heat up the stationary air immediately surrounding it and that this heat so accumulated will then be transferred to the air which circulates through the conduits 18 and through the center of the support 14 upon which the resistance unit 13 is wound. With this unit it will be seen that the flow of the medium to be heated is somewhat restricted and, as a result, a greater degree of heat will be possible of attainment with this type of heater, this being particularly true where a lesser circulation of air is required.

The embodiments of my invention above described, it will be understood, will have their

most frequent application in connection with the so-called hot air systems of heating, but it should be understood that they may be equally applicable to the heating of mediums other than air.

For the purpose of applying the principles of my invention to the heating of water or the generation of steam, I propose to embody my invention in the form illustrated in Fig. 6 of the drawing. In this embodiment, the cylindrical supporting member **14** is shown as a length of pipe through which the fluid to be heated may freely circulate. This pipe, it will be understood, is in inductive relation with the resistance unit **13** so that currents will be induced therein when the winding **13** is energized by alternating current. Immediately surrounding the resistance winding **13**, I show a cylindrical housing **19** which is closed at one end, as by the member **20**, so that when the member is screwed into a liquid container, as by the plug or pipe fitting **21**, it will prevent the escape of any fluid into which the heater unit is submerged.

In operation, it is contemplated that a unit of this character will be mounted in the lower portion of a container and below the level of the liquid therein and that the liquid will be free to enter the inner end of the cylindrical support **14** and flow outwardly therethrough and up to a point where it will return to the container.

While I have, for the sake of clearness and in order to disclose my invention so that the same can be readily understood, described and illustrated specific devices and arrangements, I desire to have it understood that this invention is not limited to the specific means disclosed but may be embodied in other ways that will suggest themselves, in view of this broad disclosure, to persons skilled in the art. It is believed that this invention is broadly new and it is desired to claim it as such so that all such changes as come within the scope of the appended claims are to be considered as part of this invention.

Having thus described my invention, what I claim and desire to secure by Letters Patent is—

1. In an electric heater, the combination of a metallic cylindrical housing through which a medium to be heated may pass, a cylindrical support having a passageway therethrough disposed axially in said housing, an alternating current resistance winding wound upon said cylindrical support, and a plurality of tubes adjacent said winding and said first cylindrical housing adapted to define restricted passageways for the medium to be heated.

2. A heater of the character described which comprises in combination, a cylindrical housing, a helically wound heating unit arranged concentrically of the housing, a tubular passage arranged concentrically of said heating unit, a plurality of tubular passages arranged parallel to and closely adjacent said heating unit, and means for directing fluid flowing through said housing to said tubular passages whereby said fluid will be in close proximity to said heating unit.

3. In a heater of the character described, a section of pipe of relatively small diameter, a heating element wound on and insulated from said section of pipe, a second section of pipe of slightly larger diameter than the first named section concentrically surrounding the same and having its inner wall spaced from said heating element, means closing one end of the larger section and sealing it to the outer periphery of the smaller section adjacent an end thereof, the other end of the larger section being open for the passage of current conductors to the heating element, a threaded fitting surrounding and secured to the larger section at its open end whereby it may be inserted into and connected with a container for liquid to be heated, the corresponding end of the smaller section being adapted for communication with said container whereby liquid in the container will be caused to circulate through the smaller section and around the exterior of the larger section.

JOSEPH FRANKLIN BALL.