

Nov. 12, 1940.

J. V. FALCO

2,221,703

ELECTRIC UNIT HEATER

Filed July 25, 1939

3 Sheets-Sheet 1

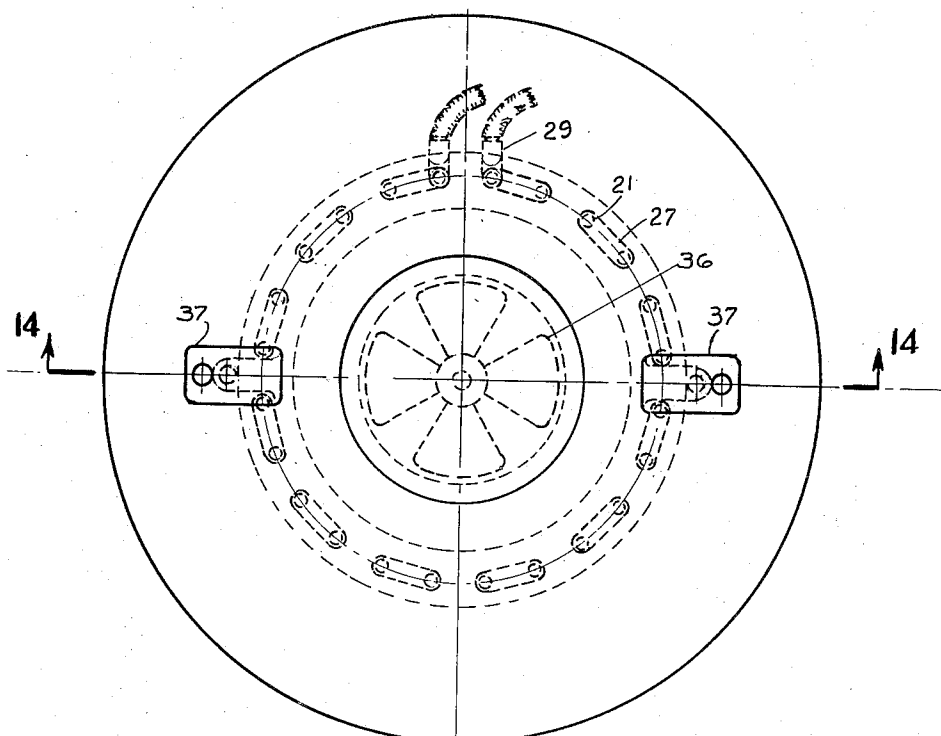


FIG. 1

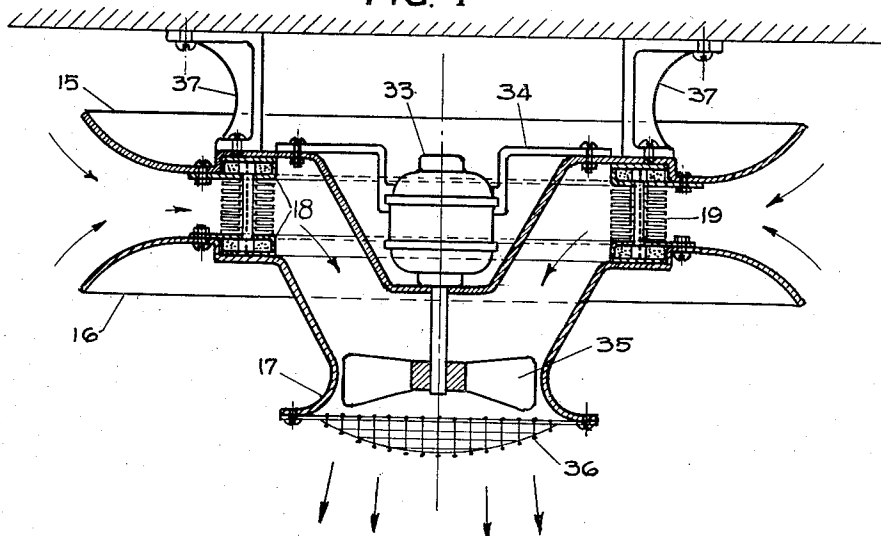


FIG. 2

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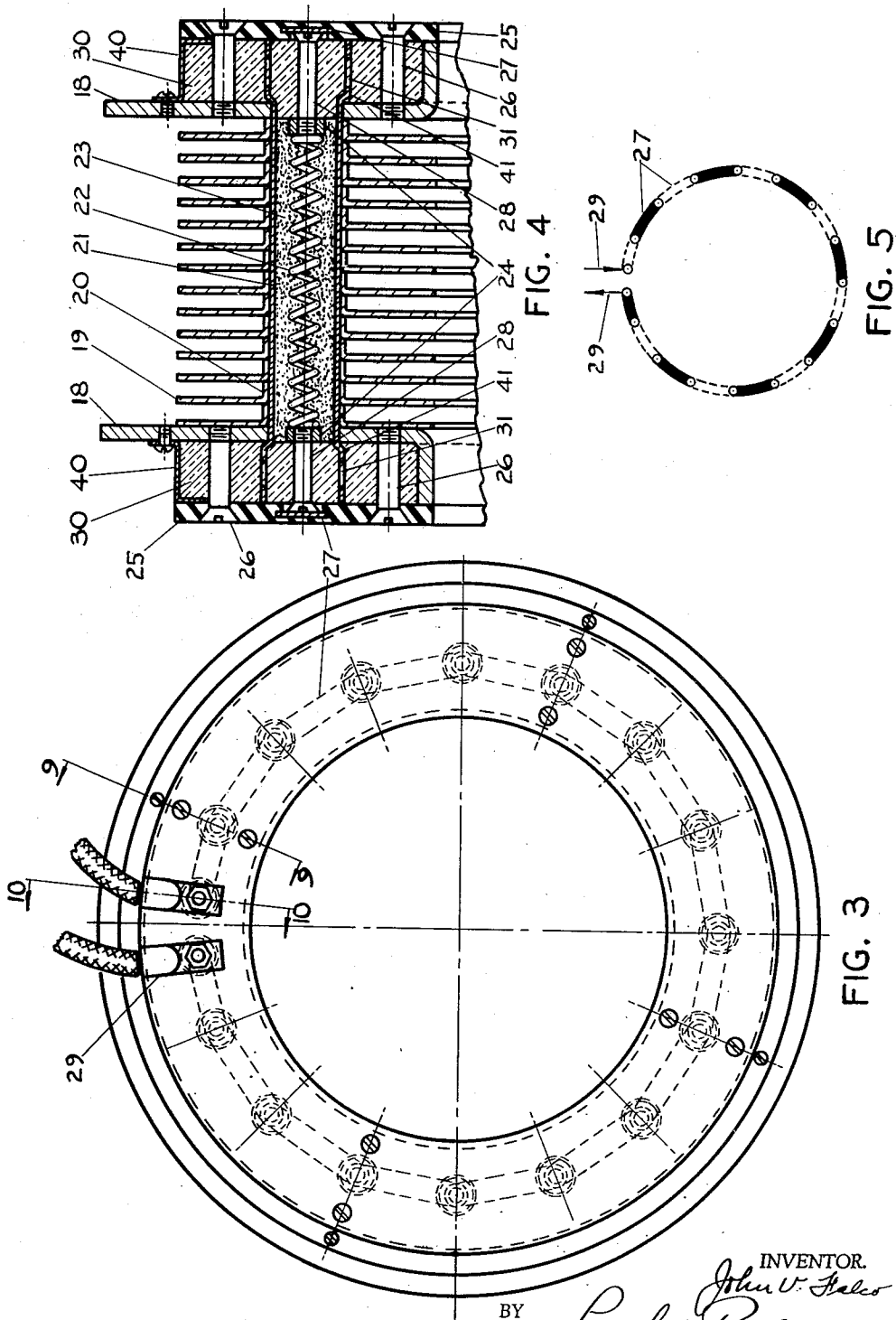
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3 Sheets-Sheet 3

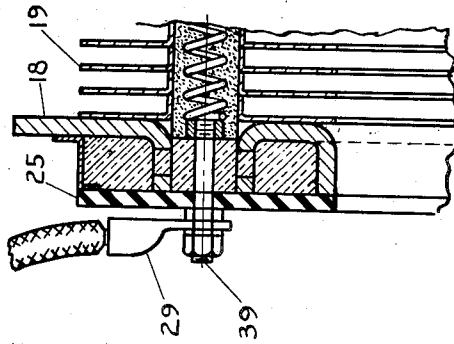


FIG. 7

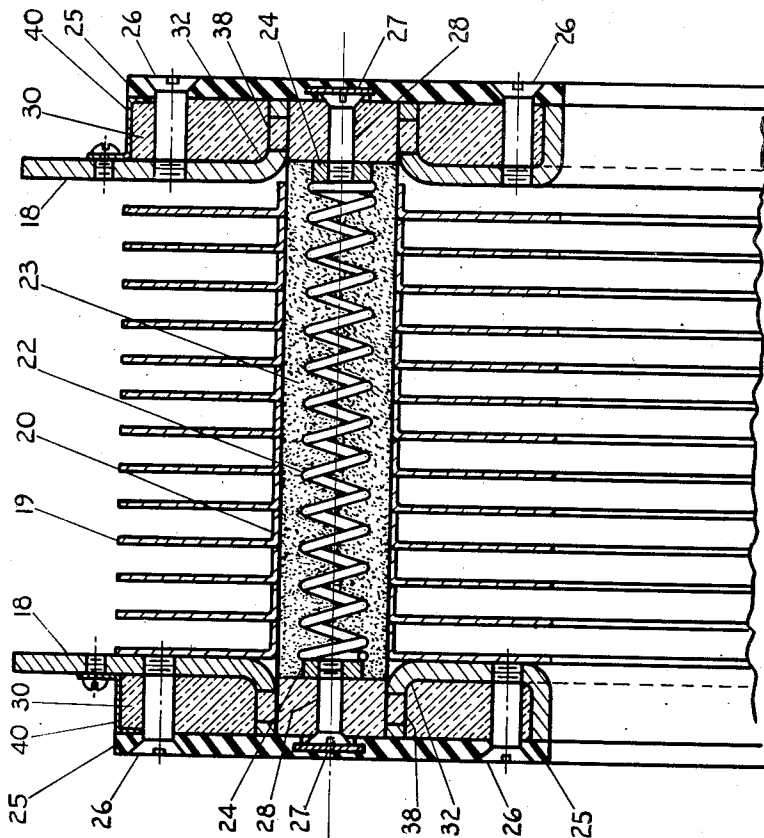


FIG. 6

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ELECTRIC UNIT HEATER

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Application July 25, 1939, Serial No. 286,453

10 Claims. (Cl. 219—39)

This invention relates to electric air radiators and, more particularly, to an electric heater wherein air is heated by being either drawn in or forced out between a plurality of spaced electrically heated fins.

One of the objects of the invention is the development of an improved type electric space radiator for use with spaced discs or rings in which the heat transfer surfaces are thin bare metal fins independent of the electric heating resistors. As now constructed, electric air heaters are large cumbersome mechanisms wherein tremendous quantities of current are used for heating comparatively small volumes of air.

The present invention includes two forms of electric resistor elements formed independently of the fin surface area and thereby permit a light and compact construction to be utilized having great thermal capacity with the expenditure of comparatively small amounts of electric current.

Another object is to construct an electric air radiator of annular construction having an inner void space so that air may be flowed from the inner space outwardly and radially in parallel layers through the spaced fins or vice versa; the flow of air being created by an electric motor and fan.

A further object is the development of an electric radiator having extended fin surface areas which are continuous throughout their whole circumference whereby each fin is capable of absorbing and dissipating the heat of the entire series of radially displaced resistor elements.

A still further object is the formation of the terminal connectors for the resistor elements and the efficient sealing and insulating of these connectors both thermally and electrically.

Referring to the drawings,

Fig. 1 represents a top plan view of my proposed electric heater shown partly in dotted lines;

Fig. 2 is a section elevation partly in cross section taken on line 14—14 of Fig. 1;

Fig. 3 is an elevation of the complete electric radiator unit;

Fig. 4 is a cross sectional view taken on line 9—9 of Fig. 3;

Fig. 5 is a diagrammatic showing of the resistor connecting plates;

Fig. 6 is a cross sectional view of a modified form of heating unit showing the resistor and radiating fins and end connections; and

Fig. 7 is a fragmental sectional view of the modified form of unit illustrating one of the end electric terminals.

Referring now to the form of heater illustrated

in Figs. 1 to 4, inclusive, it will be seen that between the pair of spaced metal plates 18 there are positioned a series of annular shaped continuous metal fins 19. These fins are concentric with the heater plates 18 and thus a void space is formed in the inner or central portion of the radiator. Each fin 19 is provided with a series of spaced concentrically displaced flared openings or flanges 20 through which metal tubes 21 are positioned. The tubes 21 extend beyond the outer surfaces of each heater plate 18 and are expanded to a larger diameter than the central portions thereof, as indicated by numeral 41. The enlarged ends 41 of the tubes serve to bind against openings in the plates 18 to hold the parts in proper relation.

The resistors 22 preferably take the form of a coil of resistance wire positioned within each of the tubes 21 surrounded by a compact mass of dielectric material 23. This material may be of any suitable commercial ceramic cement which is both dielectric and heat conducting.

To the ends of each resistor wire 22, there is welded or otherwise secured nuts 24 having screws 25 threaded into the nuts and extending outwardly therefrom. Spaced end insulating plates 26 composed of Bakelite or other electrically insulating material are joined to the heater plates 18 by means of bolts 26 with the intervening space filled with insulating cement 30. It will be observed that this cement is also placed in the holes 31 of the flared portions 41 of the tubes 21. The proper spacing of the outer insulating plates 26 to the heater plates 18 is secured by flaring or bending the inner edges of the plates in an outwardly manner to contact with the plates 18.

An annular sheet metal band 39 is placed around the outer periphery of the heat insulating cement 30 to prevent its chipping or dropping away.

A series of thin metal connector plates 27 are embedded in the end insulating plates 26 and joined mechanically and electrically to each resistor by means of the screws 25, thus forming an electrical connection between the several resistors 22. The connector plates 27 are of sufficient length to overlap one another between adjacent resistors and are alternately spaced on the plates 26 with respect to the connector plates at the opposite end. The relationship of the plates is clearly shown in the circuit diagram illustrated in Fig. 5 where the heavy shaded portions indicate the connector plates at one end, while the dotted lines indicate the connector plates at the opposite end. Thus the resistors are connected

in electric series with the series adapted to be energized through connection with end terminals 29.

It will be understood that the invention is not limited to the use of a series circuit and a parallel circuit may be used if desired. It is obvious to those skilled in the art that when a parallel circuit is desired the ends of the resistors will be joined by a continuous connector plate embedded in each of the end plates.

From this description of the unit, it will be observed that the heat radiating fins 19 with their radial flanges 20 are in perfect thermal contact with the tubes 21 and consequently the vast majority of the heat generated by the resistor elements in each section is transmitted to the fins in an efficient manner.

By isolating the resistors from the end plates 25 so that they are more or less independent results in a vastly increased efficiency of operation, since all of the heat generated by the resistors is utilized and blown out by the fan 35 instead of being transmitted to adjacent parts which in the prior constructions are not resistant to the exceedingly high temperatures generated by the resistors.

Referring now to Figs. 6 and 7 which show a modified form of electrical heating unit, it will be seen that here the tubes 21 utilized in the first form are omitted and the resistor elements 22 are compacted or fabricated within a cylindrical body of dielectric heat conducting material 23. The annular heat radiating fins 19 are formed with tubular projections or flanges 20, as before stated, and when assembled the ends of the flared or flange portions contact the next adjacent fin so that a continuous hollow tubular section is formed.

While it is preferable to place the resistors in a preformed cylindrical body, it is practical to place the resistors in the tubular sections and compact the dielectric material around the resistors. The resistor elements terminate in the flared openings 32 pressed outwardly from the inner peripheries of the annular end plates 18 while the end terminals 29 are made as before described. In this connection the nuts 24 attached to the ends of the resistors are screw-threaded in engagement with bolts 28 affixed in end plates 25.

The details of the modified form of heater end connections are shown in detail in Fig. 7. This showing is of the resistors connected in electrical circuit wherein adjacent end resistors have elongated bolts 39 in place of the screws 28 so that terminal lugs 29 may be connected to them for making the final connection to the source of electric current.

The connector plates or bars 27 are similar to the plates heretofore described and the space between the insulating plates 25 and end plates 18 is filled with insulating cement 30 with the outer periphery of the material retained within band 40.

Both types of heater unit are adapted to be secured between upper and lower flared plates 15 and 16, see Fig. 1, and suspended by ceiling brackets 37. A flared funnel-like member or venturi 17 is formed to the lower deflector plate 16 with its mouth covered by a screen mesh 36. An impeller or fan 35 is mounted in the restricted throat of the venturi 17 and rotated by means of a centrally held motor 33 suspended by radial arms 34.

In the drawings the arrows indicate the flow of air between the deflector plates 15 and 16, thence between the heat radiating fins 19 where the air

is heated or tempered. The impeller 35 draws air between the plates and into the depending funnel or venturi 17 where it is discharged in a downward direction. It will be understood that the operation may be reversed by changing the direction of rotation of the impeller or shape thereof to draw the air in through the bottom screen and discharge it outwardly and radially through the spaced heat transmitting fins.

The present device is capable of heating or tempering large quantities of air at a low consumption of electrical current due to the improved characteristics of the resistors and associated heat transmitting fins.

What I claim is:

1. An electrical air heater including a plurality of spaced vertical electrical resistors mounted in a circular arrangement between a pair of spaced ring-like plates, and an electrical motor and fan centrally suspended from the upper of said plates adapted to axially move air between said spaced vertical resistors.

2. In an electric air heater a pair of spaced apart outwardly flared ring-like plates, an outwardly flared depending funnel-like member secured to the lower of said plates, a motor suspended from the center portion of the upper plate, and having a depending shaft and fan secured thereto, said fan being mounted for rotation in the constricted portion of said depending flared funnel-like member, and a plurality of spaced vertical electrical resistors mounted between said pair of ring-like plates.

3. An electrical air heater including a plurality of spaced vertical electrical resistors connected in electrical circuit, and positioned in circular arrangement, outwardly flared discs mounted above and below said resistors, a centrally located discharge funnel secured to the lower of said discs and a motor driven fan secured to the central portion of said upper disc and extending into said discharge funnel adapted to circulate air between said discs and through the said funnel.

4. An electrical heating unit for use with air heaters of the character described comprising a pair of spaced parallel supporting rings, a plurality of spaced tubular heating elements joining said rings, each of said elements consisting of metallic tubes passing through openings formed in said rings, the end portions of said tubes being flared, a pair of insulating rings covering the ends of said tubes, electrical conductors embedded in said second pair of rings, electrical resistors mounted in said tubes but insulated therefrom and electrical connectors affixed to the opposite ends of said resistors and to said electrical conductors.

5. An electrical heating unit for use with air heaters of the character described comprising a pair of spaced parallel supporting rings, a plurality of spaced tubular heating elements joining said rings, each of said elements consisting of metallic tubes passing through openings formed in said rings, a plurality of spaced parallel continuous heat conducting annular members joining the exteriors of said tubes, the end portions of said tubes being flared, a second pair of rings covering the ends of said tubes, electrical conductors embedded in said second pair of rings, electrical resistors mounted in said tubes but insulated therefrom and electrical connectors affixed to the opposite ends of said resistors and to said electrical conductors.

6. An electrical heating unit for use with air heaters of the character described comprising a

pair of spaced parallel supporting rings, a plurality of spaced tubular heating elements joining said rings, each of said elements consisting of metallic tubes passing through openings formed in said rings, a plurality of spaced parallel continuous heat conducting annular members joining the exteriors of said tubes, the end portions of said tubes being flared, a second pair of rings covering the ends of said tubes, heat resistant cementitious material filling the space between the pairs of rings around the said tubes, electrical conductors embedded in said second pair of rings, electrical resistors mounted in said tubes but insulated therefrom and electrical connectors affixed to the opposite ends of said resistors and to said electrical conductors.

7. An electrical heating unit for use with air heaters consisting of a plurality of spaced vertical electrical heating elements arranged in the form of a circle and having their ends attached to insulating rings, each of said units comprising an electrical resistor embedded in a cylinder of dielectric, heat conducting ceramic material and electrical conductors carried by said insulating rings and joining said resistors.

8. An electrical heating unit for use with air heaters consisting of a plurality of spaced vertical electrical heating elements arranged in the form of a circle and having their ends attached to insulating rings, each of said units comprising an electrical resistor embedded in a cylinder of dielectric heat conducting ceramic material, a plurality of spaced parallel continuous heat conducting annular members in close contact with the said ceramic material, and electrical conductors carried by said insulating rings and joining said resistors.

9. An electric heating element for use with air heaters of the character described comprising a pair of spaced parallel supporting members, a plurality of continuous spaced parallel fins located

between said members, each fin having a series of openings carrying tubes transversely connecting said fins and supporting members, electric resistor elements encased in said tubes and embedded in a mass of dielectric heat conducting material for insulating the resistors from the said tubes, an insulating plate spaced apart from said supporting members for insulating the interior working parts from external contact, electric connector elements embedded in said insulating plates adapted to connect said resistors in electric circuit, and a cementitious heat resisting mass filling the space between the said insulating plates and the said supporting members for isolating the high temperature elements from adjacent parts.

10. An electric heating element for use with air heaters of the character described comprising a pair of spaced parallel supporting members, a plurality of continuous spaced parallel fins positioned between said members, each of said fins having a series of flared openings, the said flared openings abutting against the openings of adjacent fins to thereby produce a plurality of continuous hollow tubular sections, electric heating elements mounted in the tubular sections, the said electric heating elements consisting of an electric resistor compacted in a mass of dielectric heat conducting material thereby electrically insulating said resistors from the said fins, an electric insulating plate spaced apart from said supporting members for insulating the resistors from external contact, electrical connector plates embedded in said spaced insulating plates and arranged to connect said resistors in electric circuit and a cementitious heat resisting material compacted in the space between the said insulating plates and the said supporting members for isolating the high temperatures generated from transmission to adjacent portions of the heater.

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