July 5, 1955 M. EPSTEIN 2,712,588

ELECTRICAL HEATING APPARATUS

Filed Sept. 30, 1953 2 Sheets-Sheet 1

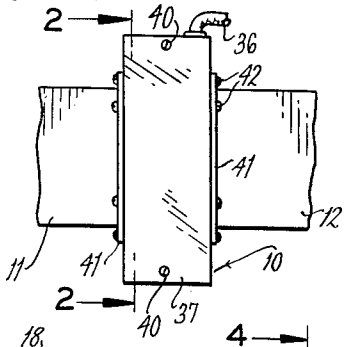


FIG. 1.

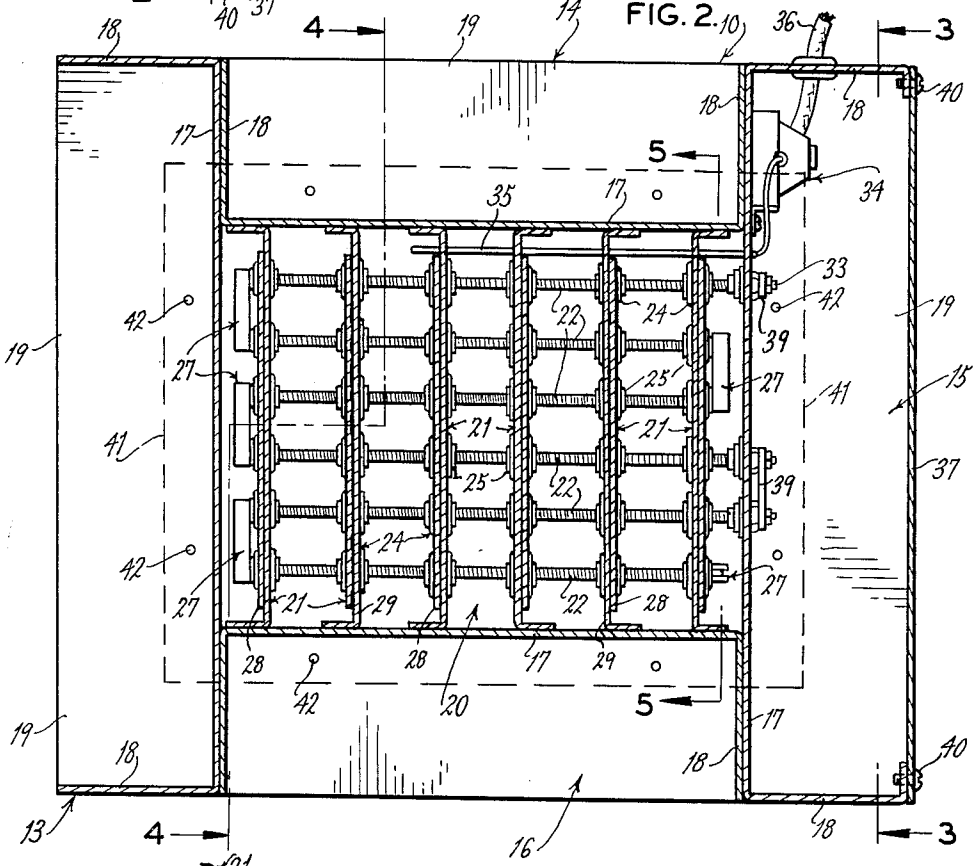


FIG. 2.

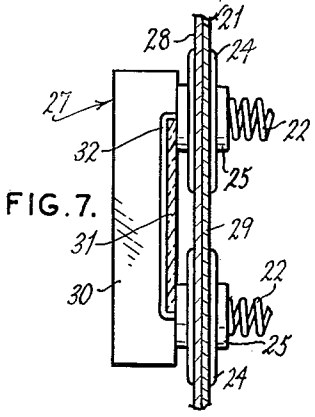


FIG. 7.

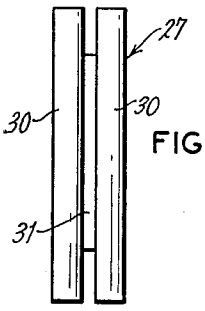


FIG. 8.

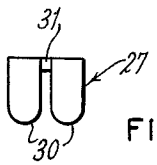


FIG. 9.

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ELECTRICAL HEATING APPARATUS

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2 Sheets-Sheet 2

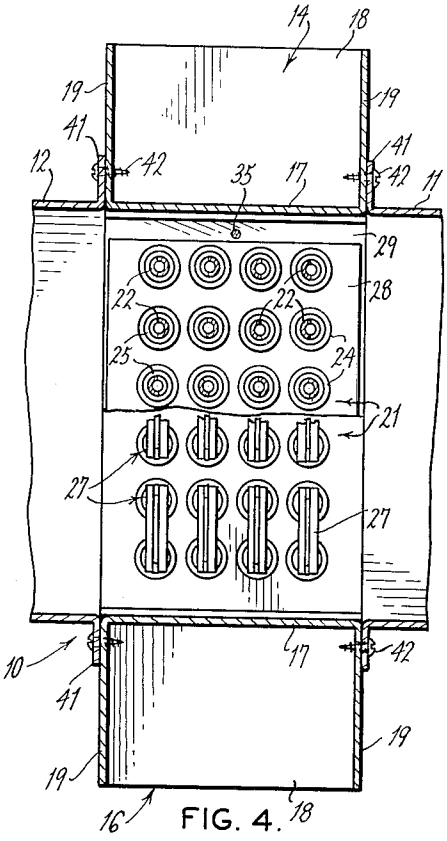


FIG. 4.

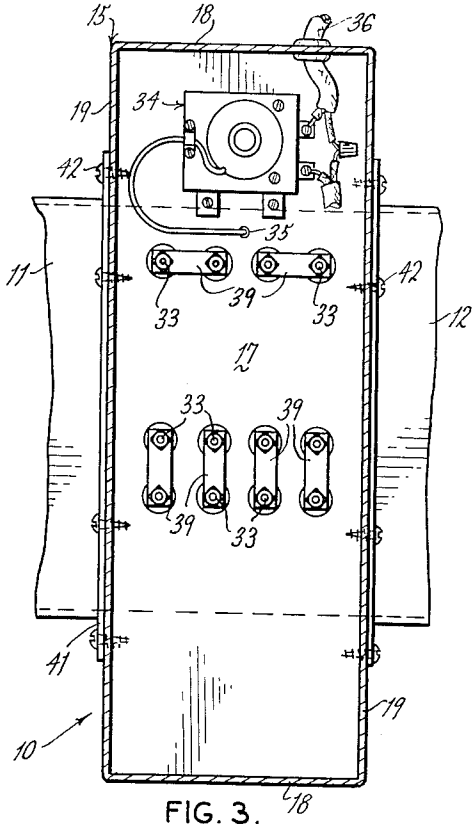


FIG. 3.

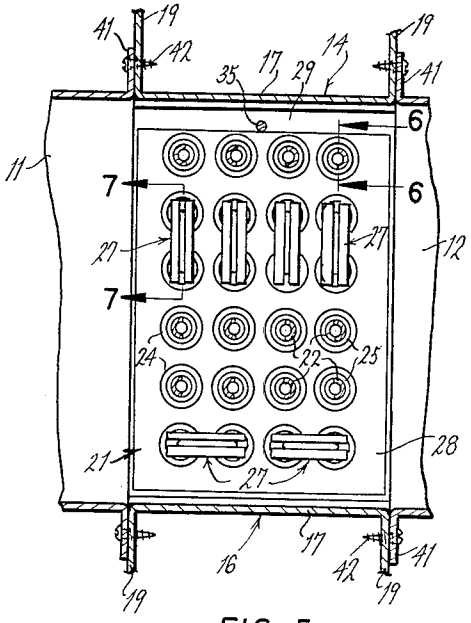


FIG. 5.

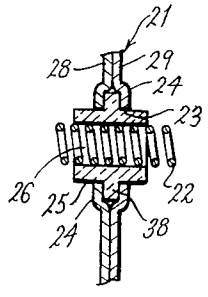


FIG. 6.

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ELECTRICAL HEATING APPARATUS

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Application September 30, 1953, Serial No. 383,326

7 Claims. (Cl. 219—34)

My invention relates to improvements in electrical heating apparatus, and has particular reference to improvements in so-called blast coil heaters which are installed in and form a part of forced air space heating systems.

The principal object of the present invention is to provide an improved heating unit of the character described which can be manufactured and installed more economically than comparable units of prevailing type. Among the various constructional improvements are the use of open coil resistance elements in place of the refractory embedded coils heretofore customarily employed, and the special provisions by which such open coils are insulatingly mounted in the frame or casing of the unit.

A further important object of the present improvements is realized in a compact arrangement and construction of a frame of the heater device, the frame affording a heating compartment adapted normally to be interposed and mounted to duct sections of a duct work system, and affording a distinctly separate, yet immediately adjacent, terminal and control compartment that is conveniently accessible for connections and service attention.

Yet another object of importance is realized in the provision of mounting flanges extending outwardly of a housing structure that defines a heating compartment, the flanges adapting the housing structure for mounting in and between duct sections of a duct system. The flanges, in part, define with the housing structure a separate terminal compartment.

Additional and important objectives and advantages include the provision of an improved compact arrangement of control devices and terminals, and the location of such elements in a separate, easily accessible terminal compartment, the terminal compartment being distinct from a heating compartment disposed in duct sections.

The foregoing and numerous other objectives and advantages will more clearly appear from the following detailed description of a presently preferred embodiment of the improvements, particularly when considered in connection with the accompanying drawings, in which:

Fig. 1 is a side elevational view of an electric space heating device, the device being shown as connected between and to fragmentary duct sections of a duct work system;

Fig. 2 is an enlarged cross sectional view of the space heating device as taken along line 2—2 of Fig. 1;

Fig. 3 is a fragmentary view in cross section as taken along line 3—3 of Fig. 2;

Fig. 4 is a fragmentary view in cross section as taken along staggered line 4—4 of Fig. 2;

Fig. 5 is a cross sectional, fragmentary view as taken along line 5—5 of Fig. 2;

Fig. 6 is an enlarged cross sectional view as taken along line 6—6 of Fig. 5;

Fig. 7 is an enlarged, fragmentary view as seen along line 7—7 of Fig. 5;

Fig. 8 is a side elevational view of the insulating block clearly shown in Fig. 7, and

Fig. 9 is a top plan view of the insulating block shown in Fig. 8.

Referring now by characters of reference to the drawings, and first to Fig. 1, it is seen that an electric space heating device, generally indicated at 10, is particularly adapted to be mounted on and carried by duct sections 11 and 12 of a duct work system.

The space heating device assembly consists of four box members referred to at 13, 14, 15 and 16. Each of the box members includes a bottom wall 17, opposed end walls 18 as best shown in Fig. 2, and side walls 19. The box members are arranged so that the bottom walls 17 define a substantially rectangular heating compartment generally designated at 20. In the preferred arrangement of box members, the lateral box members 13 and 15 are arranged in a spaced, parallel relation with the openings of the box members facing outwardly. Located between the lateral box members 13 and 15 are the upper and lower box members 14 and 16, the box members 14 and 16 having their end walls 18 abutting the outer end portions of bottom walls 17 of box members 13 and 15. The upper and lower box members 14 and 16 are arranged similarly to lateral box members 13 and 15 in having their openings facing outwardly.

It will be noted that bottom walls 17 of the box members constitute a housing structure for heating compartment 20. Disposed in the heating compartment, and more particularly, secured to the opposite bottom walls 17 of spaced upper and lower box members 14 and 16, are several panels 21. The panels 21 are normally arranged in a regularly spaced relation, and are retained in a vertical position as best viewed in Fig. 2. A right angularly related foot flange is provided at opposite ends of each panel 21, the foot flanges being adapted to facilitate connection of the panels 21 to walls 17 defining heating compartment 20.

These panels 21 are adapted to support and carry one or more heating coils 22. Each of panels 21 consists of two connected plate members 28 and 29 (Fig. 6) having embossed portions 24. Formed medially through the mating embossed portions 24 are a plurality of apertures 23, the apertures 23 of each panel 21 providing a regular pattern, and being in register with corresponding apertures of adjacent panels. The apertures 23 realize a series of vertically spaced rows, and hence afford an arrangement whereby the heating coils 22 may be received through and carried by apertures 23 of one row, and thence reversed and extended through the apertures 23 of an adjacent row. Of course, the heating coils may be disposed in several banks, or combination of banks, as disclosed in the instant heater assembly.

An insulating bushing 25, preferably constructed of lava, includes a flange 38 that is received and retained by embossed portions 24 of plate members 28 and 29. Each of the insulating bushings 25 is provided with a central opening 26 that is adapted to receive exposed heating coil 22. It will be apparent from the above described structure that heating coils 22 are electrically insulated from panels 21, and hence from the box members forming the housing structure by bushings 25. In assembling bushings 25 to panels 21, plate members 28 and 29 are initially separate. Bushings 25 are inserted through apertures 23 of plate member 29 so that flanges 38 abut embossed portions 24. Then, plate members 28 are arranged so that bushings 25 extend through their apertures 23. The contiguous, flat portions of plates 28 and 29 are then welded together.

There is an additional insulatory feature provided where the heating coil 22 is reversed or turned from one row of apertures 23 to an adjacent row of apertures in panels 21. This latter structure is clearly shown in Fig. 7. At this particular location, an insulating block 27 is pro-

vided. Block 27 consists of spaced side flanges 30 (Figs. 7–9) connected by an intermediate piece 31. It will be noted that intermediate piece 31 is spaced from the outermost ends of block 27.

The wire portion 32 of heating coil 22 extends from one row of apertures 23 into the enclosure provided by spaced side flanges 30 to overlie intermediate piece 31, and thence extends into the insulating bushing 25 of the adjacent row. The insulating block 27 is of a length as to bridge the insulating bushings 25 of adjacent rows. Further, it will be noted that intermediate piece 31 is of such length as to extend substantially from the axis of one row of apertures 23 to the axis of the adjacent row of apertures. The intermediate piece 31, in other words, bridges the insulating bushings 25 of adjacent rows. Very importantly, the space between the side flanges 30 of block 27 is of a width to form a narrow slot only slightly larger than the diameter of wire portion 32 of coil 22. Thus, it is seen that wire portion 32 is completely shrouded or shielded at all times by the enclosure provided by insulating block 27.

Each of the heating coils 22 is connected to connection means, later fully described, in a manner so as to maintain the coils under a tension force in its course through adjacent rows of apertures 23 of panels 21. Perhaps as best illustrated in Fig. 7, it is seen that if heating coil 22 is under a tension, the wire portion 32 extending over intermediate piece 31 of block 27 will exert a retaining force against the intermediate piece 31, thus holding intermediate piece 31 and flanges 30 of block 27 tightly against insulating bushings 25 of adjacent rows. No other retaining provision is needed to hold block 27 securely in position.

Lateral box member 15 is utilized as a terminal and jumper assembly compartment that is adjacent to, but entirely separate from, the heating compartment 20 occupied by heating coils 22. Extended through bottom wall 17 of box member 15, and insulated therefrom, are a plurality of terminals referred to at 33, the outer ends of terminals 33 being located internally of the terminal compartment realized by box member 15. The heating coils 22 are connected to the inner ends of terminals 33 on the other side of wall 17. A plurality of straps or jumper elements 39 are used to connect various terminals in the terminal compartment.

Also mounted on bottom wall 17, and located internally of the terminal compartment defined by box member 15 is a thermal cutoff device generally indicated at 34. A thermal responsive sensing bulb 35 is mounted in panels 21, and is extended through bottom wall 17 for connection to the cutoff device 34. For completeness of disclosure, it will be noted that a power lead wire 36 is extended through wall 18 of the terminal compartment, and is connected to the thermal cutoff device.

A removable panel 37 is secured to the outermost side of the terminal compartment, the panel 37 being secured by screws 40 to downturned flanges formed on walls 18. At any time, incident to connection or service attention, the removable panel 37 may be detached for convenient access to the terminal compartment without requiring entry into heating compartment 20 or causing any disturbance of the heating and insulating parts contained therein.

To facilitate mounting and fastening the heating device 10 to and between duct sections 11 and 12 of a duct work system, a plurality of apertures are provided in side walls 19 of each of box members 13, 14, 15 and 16. These side walls 19 constitute connecting or mounting flanges that are adapted to abut adjacent flanges 41 formed on duct sections 11 and 12. Threaded screw elements 42 extend through flanges 41 and through mounting flanges or side walls 19 to secure the heater 10 to the ducts.

The housing structure defined by bottom walls 17 of the box members is open at the front and at the rear to expose the heating coils 22 to a flow of air from one adjacent duct section 12, through the heating compartment 20, and thence into the other connected duct section 11. The terminal compartment is distinctly separate from the heating compartment 20, and affords access to terminals 33 and cutoff device 34 for connections, and for adjustment of connections, or for other service attention to the control elements, without disturbing the mounting of the heater 10 to the duct sections.

Several distinct advantages result from the utilization of open coils in the heating compartment 20. It will be readily apparent that there is an immediate release of the heat as the coil itself is exposed to the air stream, the coil not being embedded in any refractory materials which would retard heat flow. This method of exposing heating coils 22 directly to the air stream also results in lower coil temperatures and consequently longer life, and importantly results in obtaining an even temperature curve.

In the event of air failure, the sensing bulb 35 disposed in heating compartment 20 will cause actuation of thermal cutoff device 34 to open the circuit, the sensing bulb 35 being responsive to thermal conditions in the heating compartment.

The space heating assembly described above provides two distinct and separate compartments, each of which serves an entirely different purpose. The heating compartment 20 is located internally of the duct work, and is adapted to receive the heating coils 22 and essential insulated mounting structure. The terminal compartment receives the terminals 33 and the control mechanism represented by cutoff device 34, and provides access to these control elements for adjustment and connection without requiring any dismantling of the heater 10 from the duct system, or requiring access to the heating compartment 20.

Although the invention has been described by making detailed reference to a currently preferred embodiment, this detail of disclosure should be understood solely in an instructive, rather than in any limiting sense, numerous variants being contemplated as within the scope of the claims hereunto appended.

I claim as my invention:

1. In a space heater adapted for use in a duct work system, a housing structure having spaced top, bottom and side walls, said walls defining a heating compartment, a heating coil disposed internally of the housing structure between said walls, means located between the walls for carrying the coil, spaced mounting flanges extending outwardly from the walls, said flanges being adapted to mount the housing structure in the duct work system, terminals carried by and located externally of the wall of said housing structure, said mounting flanges and the wall carrying said terminals defining a terminal compartment adjacent to and separate from the heating compartment, said heating coil being electrically connected to said terminals, and a removable panel on the outermost side of the terminal compartment affording access to said compartment and to said terminals for connection and service attention.

2. In a space heater, adapted for use in a duct work system, a housing structure having spaced top, bottom and side walls, peripheral mounting flanges extending outwardly from said walls, said flanges being spaced and adapted to mount the housing structure to the ducts of the duct work system, a heating coil disposed between said walls and located internally of the housing structure, the housing structure being open at the front and at the rear to expose the heating coil to a flow of air from the ducts through a heating compartment defined by said walls, the heating compartment being occupied by the heating coil, a series of spaced panels carried by said walls of the housing structure, said panels being adapted to support the heating coil, means on said panels for electrically insulating the coil from the housing structure, one of said walls and the spaced flanges immediately adjacent thereto defining a terminal compartment, terminals carried externally on the last said wall of the housing structure and located

within the terminal compartment, the heating coil being connected to said terminals, said terminal compartment being adjacent to and separate from the heating compartment, whereby to afford access to the terminals independent of entry into said heating compartment and any dismantling of the heater from the duct work system.

3. In a space heater adapted for use in a duct work system, a plurality of box members, each of which includes a bottom, opposed end and side walls, the box members being arranged so that the bottom walls define a heating compartment, the side walls of said box members extending outwardly from said bottom walls, the side walls being adapted to mount the heater in a duct work system, the heating compartment being open at the front and at the back to permit a flow of air from a duct section immediately adjacent the heater through the heating compartment, and thence into the duct section connected on the opposite side of the heater, a heating coil disposed in the heating compartment between the bottom walls of said box members, means located in the heating compartment for supporting the heating coil and for insulating the coil from the box members, terminals carried by the bottom wall of one of said box members, said terminals being located externally of the heating compartment, the box member carrying said terminals constituting a terminal compartment immediately adjacent to and separate from said heating compartment, the heating coil being connected to said terminals, and a removable panel on the outermost side of the terminal compartment affording access to the terminals for connection and service attention.

4. In a space heater adapted for use in a duct work system, four box members, each of which includes a bottom, opposed end and side walls, the box members being arranged so that the bottom walls define a heating compartment, exposed heating coils located in said heating compartment between said bottom walls, the heating compartment being open at the front and at the rear to expose the heating coils to a flow of air from the connected ducts through the heating compartment, the front and rear openings of the heating compartment being substantially the dimension of the internal dimension of connected duct work, the side walls of said box members extending outwardly from the bottom walls and away from the heating compartment, said side walls being adapted to mount the heater in the duct work system, spaced panels secured to opposed bottom walls and extended across the heating compartment, the heating coils being carried by said panels, means for insulating the coils from the box members and said panels, one of said box members constituting a terminal compartment located immediately adjacent the heating compartment and separate therefrom, a thermal cutoff device and terminals located in said terminal compartment, a thermal sensing bulb located in the heating compartment, said bulb being connected to the cutoff device and carried by said panels, the heating coils being connected to said terminals, and a removable panel on the outermost side of the terminal compartment affording access to said terminals and to said cutoff device for connection and for service attention.

5. In a space heater adapted for use in a duct work system, a plurality of box members, each of which includes a bottom, end and side walls, the box members being arranged so that the bottom walls define a heating

compartment, spaced panels extending between opposed bottom walls of said box members, said panels being provided with a plurality of apertures, said apertures of adjacent panels being arranged and aligned in rows, an insulating bushing carried in each of said apertures, a heating coil carried by and received in said bushings, the heating coil being extended transversely through one row of bushings and being reversed to extend through an adjacent row of said bushings, an insulating block disposed to support the heating coil portion that is reversed from one row of apertures to an adjacent row, said block being arranged in bridging relation to the bushings of adjacent rows said block being provided with a narrow slot adapted to receive said heating coil portion, the block shielding said heating coil portion at all times, the heating coil being retained under tension to position and secure the insulating block, one of said box members constituting a terminal compartment, terminals located in said terminal compartment, the heating coil being connected to said terminals, said terminal compartment being adjacent to and separate from the heating compartment.

6. In a space heater, a housing structure having spaced top, bottom and side walls, said walls defining a heating compartment, spaced panels extending between said walls, said panels being provided with a plurality of apertures, apertures of adjacent panels being arranged and aligned in rows, an insulating bushing carried in each of said apertures, a heating coil carried by and received in said bushings, the heating coil extending transversely through one row of bushings, and being reversed to extend through an adjacent row of bushings, and an insulating block arranged in bridging relation to a pair of bushings in said adjacent rows, the block being provided with a narrow slot adapted to receive the heating coil portion that is reversed from one row of apertures to an adjacent row, the block shielding the heating coil portion at all times.

7. In a space heater, a housing structure having spaced top, bottom and side walls, said walls defining a heating compartment, spaced panels extending between said walls, said panels being provided with a plurality of apertures, apertures of adjacent panels being arranged and aligned in rows, an insulating bushing carried in each of said apertures, a heating coil carried by and received in said bushings, the heating coil extending transversely through one row of bushings, and being reversed to extend through an adjacent row of bushings, and an insulating block including spaced side flanges connected by an intermediate piece, said intermediate piece being spaced from the outermost ends of said block, said intermediate piece bridging the bushings of adjacent rows, and adapted to support the heating coil portion that is reversed from one row of apertures to an adjacent row, said side flanges shrouding said heating coil portion at all times.

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