ELECTRIC HEATER.

SPECIFICATION forming part of Letters Patent No. 427,574, dated May 13, 1890.

Application filed December 28, 1889. Serial No. 335,213. (No model.)

To all whom it may concern:

Be it known that I, BENJAMIN CHEW HOWARD, a citizen of the United States, residing at Baltimore, in the State of Maryland, have invented certain new and useful Improvements in Electric Heaters; and I do declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to the letters and figures of reference marked thereon, which form a part of this specification.

My invention relates to devices for heating air for warming dwelling-houses, stores, public buildings, railroad-cars, steamboats, and other habitations.

The object of the invention is to accomplish this result in a safer and more economical mode than has been done heretofore and place the heating appliances under complete control of the attendant. I attain these results by employing electricity as the heating agent, causing it to pass through suitable resistance-coils, through which the air to be warmed is drawn, preferably by a fan driven by an electric motor.

In the accompanying drawings, which represent one mode of carrying out my invention, Figure 1 is a longitudinal section of the heating apparatus. Fig. 2 is an enlarged view of one of the screens incomplete. Fig. 3 is a diagram of the electrical circuits and connections. Figs. 4 and 5 are views of the switch, and Figs. 6 and 7 illustrate in diagram two arrangements of the winding of the screens.

The same letters and numerals refer to the same parts in all the figures.

Within an inclosing-jacket A, preferably of sheet metal, is arranged a tube B, preferably of non-conducting material, such as earthenware. It may be of any desirable cross-section and of a length and diameter proportionate to the service it is to perform. The outer end of the tube B is united air tight to the jacket A; but elsewhere it is preferably somewhat smaller than the jacket in order to provide an air-space *a* around it, suitable supports *b* being provided to retain the tube in place. The air-space is not, however, an essential feature and the jacket may be omitted. At or near the mouth of the tube there may be a netting *b'*, to prevent the entrance of anything but air. The inner end of the jacket or of the tube communicates with a delivery-flue C, by which the air passing through the apparatus is conveyed to the desired place. A netting *c'* may be arranged at the entrance of the flue.

Within the tube B, I place a set of resistance-coils D. I have shown six coils in the drawings, but any number may be used that experience and the exigencies of the service may demand. The coils may consist of flat screens composed of flat or round uninsulated wire wound in parallel lines back and forth across an open frame *d*, each frame holding, preferably, three layers d' d^2 d^3, the wires in one layer running in a different direction from those in the other layers, as clearly shown in Fig. 2. The several layers may be connected in series, as indicated in Fig. 6, or two of them may be in parallel circuit with each other and the pair in series with the third layer, as in Fig. 7.

The frames *d* are fitted into the tube B at suitable distances apart, and the coils are connected up to a switch-board E, preferably in the manner shown in Fig. 3. Screens 1 and 4 are here shown in series, and also screens 2 and 3, while screens 5 and 6 have independent connections and may be wound with finer wire to give a higher heating effect than the first four. These last two are intended to be used only in case of extremely cold weather or when the apartment is to be quickly heated.

Any suitable switch-board may be used and the connection may be made otherwise than as specified above, if desired. A convenient form of switch is shown in Figs. 4 and 5. Fastened upon an insulating-base F are pairs of spring-clips f f' f^2 f^3, &c., which are connected, respectively, with the wires e e' e^2 e^3, &c. Mounted on a shaft is a segment G, composed of metallic faces g g', suitably insulated from each other. The main conductors X Y are connected, respectively, with the upper and lower clips f by means of the wires *e*. When the segment G is turned to enter between and form contact with the two pairs of clips f f', the current will flow through the coils 1 4. If the segment G is turned to engage the next pair of clips f^2, the coils 2 and

3 will be thrown into circuit, and so on. The coils will be cut out in reverse order upon turning the segment backward. A handle G′ outside of the box E affords a ready means of manipulating the segment.

The draft of air through the tube B may depend upon the natural tendency of heated air to rise; but I prefer to render its movement positive by means of a fan H, driven by an electric motor, which is connected with the main conductors independently of the coils.

A switch *h* gives the attendant control of the fan-motor, which is located at any convenient point in the line of the air-current.

It is obvious that the screens D can be heated to a greater or less degree by a proper system of resistances R in their respective circuits, and that the speed of the motor can be similarly governed. This gives the attendant complete control of the apparatus, and he can regulate the heating effect with great nicety. In summer the fan alone can be run to send a current of cool fresh air through the flue C.

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

1. An electrical apparatus for heating air, consisting of a tube containing a series of resistance-coils, and means for causing the air to pass through said coils, substantially as described.

2. An electrical apparatus for heating air, consisting of a tube containing a series of wire screens, means for causing an electric current to traverse one or more of said screens, and a flue for conveying away the heated air, substantially as described.

3. An electrical apparatus for heating air, consisting of a series of wire screens, suitable connections for conveying a current of electricity to each of them, and means for regulating the intensity of the several currents, substantially as described.

4. An electrical apparatus for heating air, consisting of a tube containing a series of resistance-coils, each composed of a frame having a fine uninsulated wire wound back and forth across it in parallel lines, and means for varying the number of coils in circuit, substantially as described.

5. An electrical apparatus for heating air, consisting of a tube containing a series of resistance-coils composed of frames, each having a fine wire wound back and forth across it in two or more layers, the wires in one layer running in a different direction from those in the next, and a switch adapted to vary the number of coils in circuit, substantially as described.

6. In an electrical apparatus for heating air, the screen D, consisting of an open frame *d*, having a fine wire wound upon it in layers *d′* *d²* *d³*, two of which are in parallel circuit, the other being in series with them, substantially as described.

7. An electrical apparatus for heating air, consisting of a jacket inclosing a tube, with an air-space between them, a series of resistance-coils in the tube, and a fan for drawing a current of air through the coils, substantially as described.

8. In an electrical apparatus for heating air, a tube B, containing a series of screens D, some of which are wound with finer wire than the rest, substantially as described.

9. In an electrical apparatus for heating air, a tube B, containing a series of screens D, connected with a switch-board, whereby the number of screens in circuit can be varied, substantially as described.

10. In an electrical apparatus for heating air, the combination, with the mains X Y, of the screens D and the fan-motor H, and means for controlling them independently, substantially as described.

In testimony whereof I affix my signature in presence of two witnesses.

BENJAMIN CHEW HOWARD.

Witnesses:
ALVIN BELT,
GEO. P. WHITTLESEY.

(No Model.)

B. C. HOWARD.

ELECTRIC HEATER.

No. 427,674. Patented May 13, 1890.

FIG. 1.

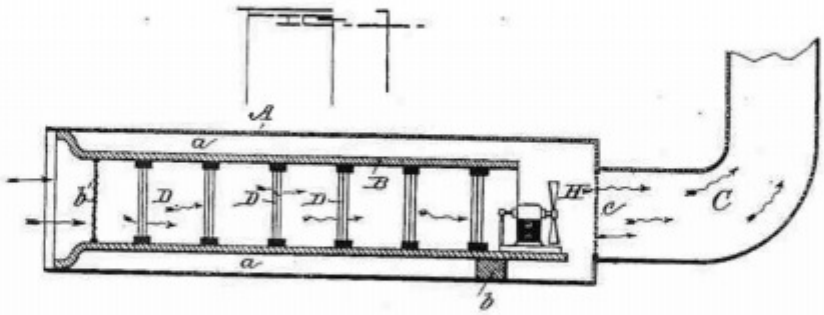


FIG. 2.

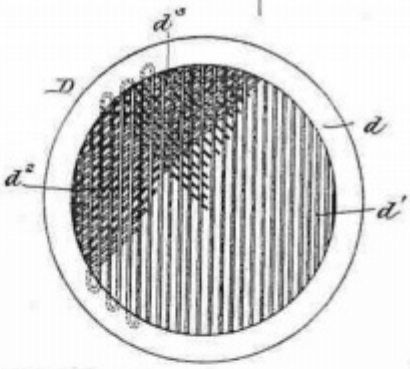


FIG. 3.

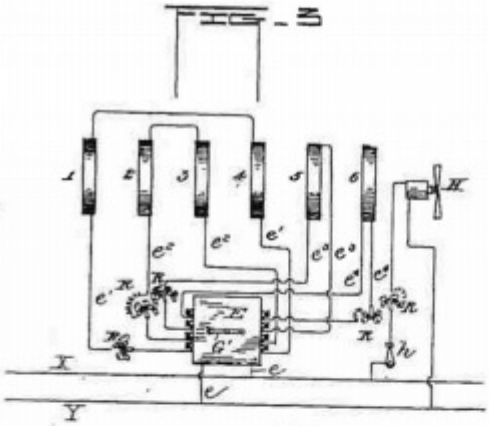


FIG. 4.

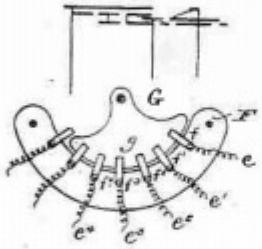


FIG. 6.

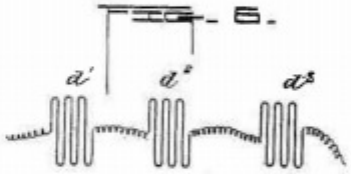


FIG. 5.

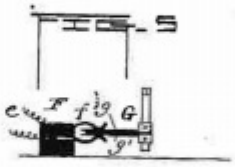
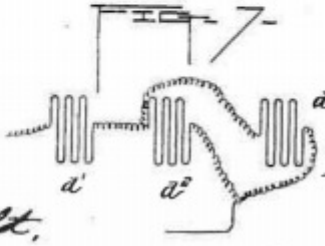


FIG. 7.



WITNESSES

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