A. F. BERRY.

AIR CONDITIONING APPARATUS.

APPLICATION FILED AUG. 10, 1916.

1,295,416.

Patented Feb. 25, 1919.

2 SHEETS—SHEET 1.

Fig. 1.

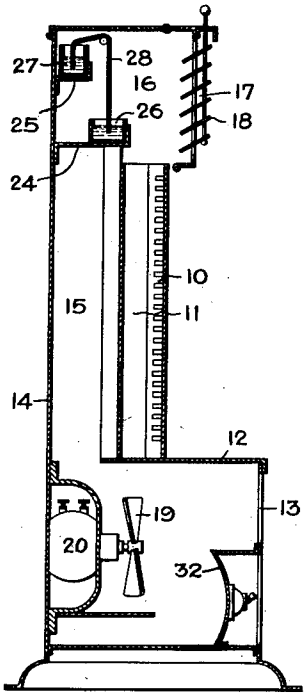


Fig. 2.

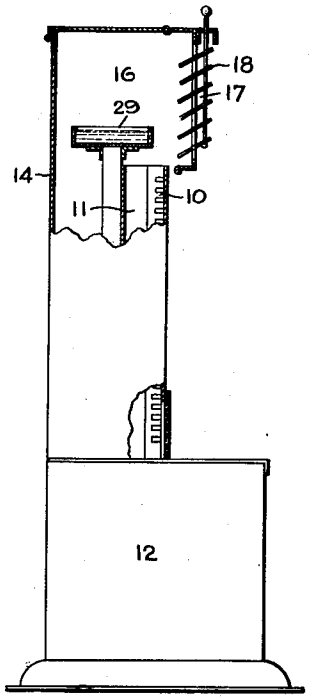


Fig. 5.

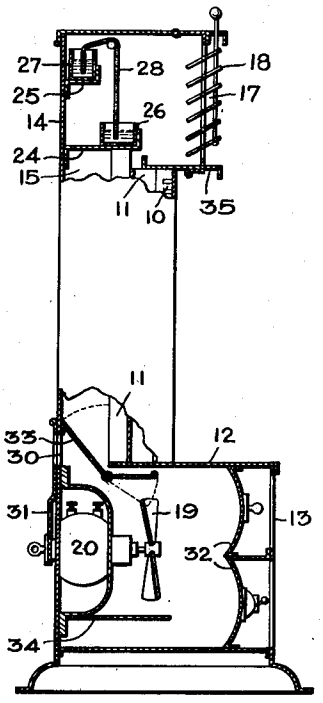


Fig. 3.

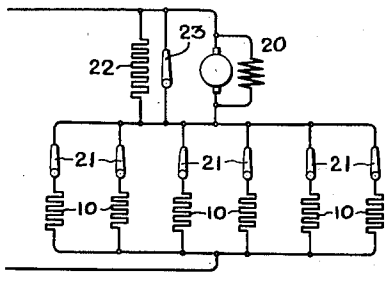
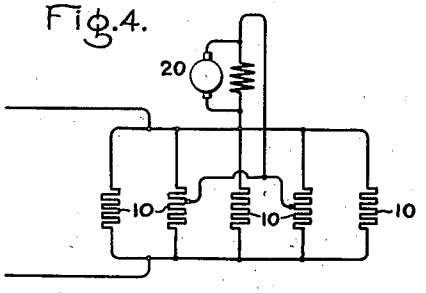


Fig. 4.



Inventor:
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2 SHEETS—SHEET 2.

Fig. 6.

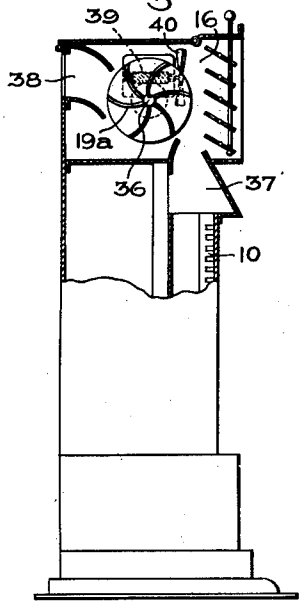


Fig. 7.

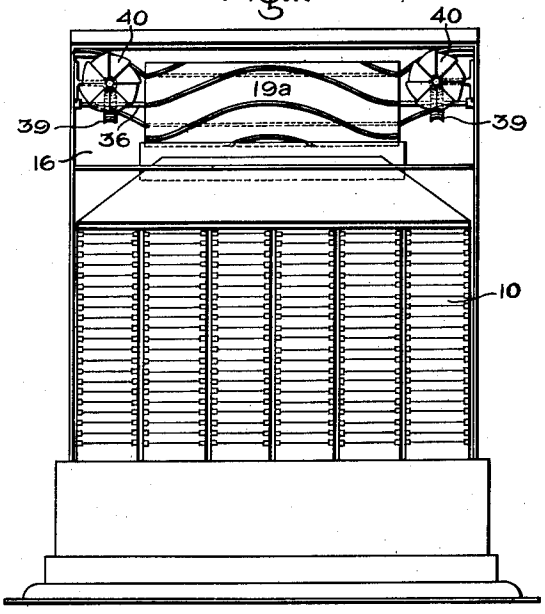


Fig. 9.

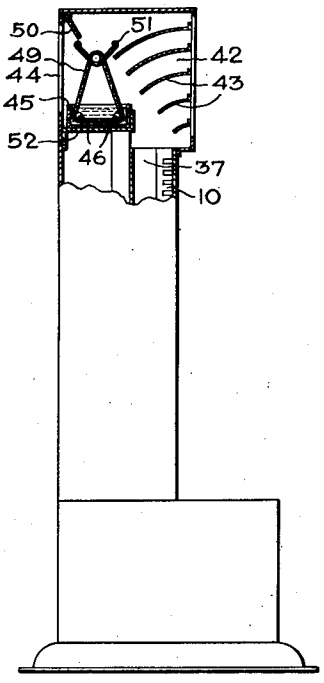
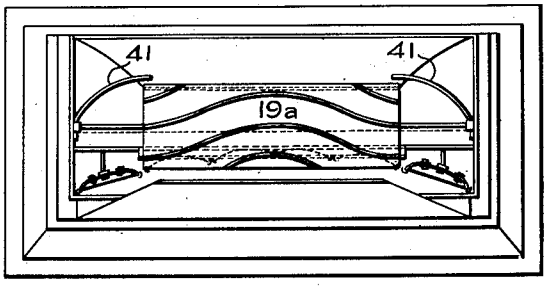


Fig. 8.



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UNITED STATES PATENT OFFICE.

ARTHUR FRANCIS BERRY, OF LONDON, ENGLAND, ASSIGNOR TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

AIR-CONDITIONING APPARATUS.

1,295,416. Specification of Letters Patent. Patented Feb. 25, 1919.

Application filed August 10, 1916. Serial No. 114,208.

To all whom it may concern:

Be it known that I, ARTHUR FRANCIS BERRY, a subject of the King of Great Britain, residing at London, England, have invented certain new and useful Improvements in Air-Conditioning Apparatus, of which the following is a specification.

In electric heat radiators and like heating apparatus as heretofore usually constructed, air heated thereby and rising therefrom by convection, flows rapidly upward to the top of the room or other space in which the radiator or heater is placed where its heat is either wasted by escape of the air from the room or other space, or where it cannot be utilized in so beneficial a manner as is usually desired.

My present invention has for its object to provide electric heating apparatus whereby air heated thereby can be conditioned as by lowering its temperature, and delivered into a room, apartment or other space in a more or less horizontal or downward direction and therefore into the lower part of the room, whence it can slowly rise and warm the room in a better manner than has heretofore usually been the case when the heated air has been allowed to flow directly and rapidly from the apparatus to the top of the room. In one form of my invention, a casing is provided through which extend one or more passages, and in the upper portion of each is located a chamber. In one form of my invention, air is passed over an electric heater from which the same is discharged into the upper chamber of the apparatus where the cooler air of the room is mixed with the same. The cooled air is then forced through the passage or passages to the lower portion of the apparatus, where it is discharged into the lower part of the room, from which the same will gradually ascend.

For a full understanding of my invention reference may be had to the accompanying drawings in which Figure 1 shows in vertical section, one construction of heating apparatus embodying my invention; Fig. 2 shows partly in side elevation and partly in vertical transverse section a modification; Figs. 3 and 4 are diagrams showing the electrical connections of the heating elements and an electrically driven fan; Fig. 5 shows the apparatus illustrated in Fig. 1 adapted for supplying cool air to a room; Fig. 6 shows partly in side elevation and partly in vertical section another construction of heating apparatus embodying my invention and Fig. 7 is a front elevation thereof with parts removed; Fig. 8 shows in horizontal section a modification of the arrangement shown in Figs. 6 and 7, and Fig. 9 is a view similar to Fig. 6 showing a further modification.

The heating apparatus shown in Fig. 1 comprises a number of vertical electrical heating devices 10 arranged side by side in a straight row, or they may be in a curved row, in front of a suitable backing 11, conveniently comprising a similar number of vertical concave surfaces, and above a hollow stand or support 12 formed with one or more air exit openings 13 in its front or sides, or both, the apparatus being adapted to produce radiant and convected heat. A construction suitable for this purpose is disclosed in a prior application, Serial No. 66,435, which was filed by me December 13, 1915, and to which reference may be made for details of structure. Combined with the backing 11 and stand or support 12 is a rear casing 14 arranged to form therewith an air chamber or passage 15 surmounted by a hood or air-mixing chamber 16 extending over the heating devices 10 and into which air heated by these devices and adjacent parts of the apparatus and rising by convection will pass. The chamber 16 is provided with an air inlet 17 controlled by a valve, or by a regulator 18 that may, as shown, conveniently consist of a Venetian blind, the vanes of which are so connected that they will all move together. Near the bottom of the air chamber of passage 15 is a fan 19 driven by an electric motor 20, the winding of which is arranged to be placed in series with the heating device or devices 10, or parts thereof; it may be by switches when such devices are switched into circuit. The motor may, as shown in Fig. 3, be arranged to be connected between one of the electric supply leads and the electric heating element or elements 10 when such element or any of them are switched on by switches 21. A resistance 22 is arranged in shunt to the motor. Or, where a number of electric heating elements 10 are used, the motor winding may be arranged in parallel with parts thereof that will be in circuit whenever the apparatus is being used. The

arrangement is such that when the apparatus is in use, air heated by convection will rise and flow into the chamber 16 into which cooler air will simultaneously flow through the regulator 18 from the room, the heated and cooler air mixing in the chamber and being drawn therefrom downward through the passage 15 by the fan 19 and delivered through the exit opening or openings 13 in the base or stand 12 near to the floor of the room upon which the base or stand rests. By suitably adjusting the air inlet valve or regulator 18, any desired amount of cooler air can be drawn into the air chamber 16 by the fan 19 from the room or other space and mixed with the heated air so as to condition the temperature of the air delivered through the bottom of the apparatus into the room to suit various requirements. At the same time the apparatus will heat the room by radiant heat. A switch 23 may be provided for putting the blower out of action when desired as by short circuiting it.

The apparatus may be provided with means for humidifying the air passing therethrough. For this purpose there may be provided within the casing 14 above the backing 11, supports 24 and 25 for two vessels 26 and 27 at different levels and from one to the other of which extends a screen 28 comprising one or more layers of fabric, textile yarn or like absorbent material dipping into water in the lower vessel 26 and into the upper vessel 27, the arrangement being such that the mixed air on its way from the chamber 16 to the blower 19 must pass through the wetted screen and become moistened. Or, in lieu of this humidifying arrangement, the apparatus may, as shown in Fig. 2, be provided with a water receptacle 29 over which the warm mixed air will pass, or the water in which will be vaporized by heat derived from the heating device or devices and become mixed with the air.

Apparatus such as described may be adapted for supplying cool air to a room in warm weather. For this purpose the base or support 12 may, as shown in Fig. 5, be provided at the rear of the blower 19 and its motor 20 with an air inlet 30 controlled by a suitable valve device 31, for example a hit and miss arrangement, and in front of the fan 19 with air-guiding means, as for example horizontally arranged curved surfaces 32 arranged one above the other and adapted to close the air outlet 13 in the lower front portion of the base or support 12 and deflect the air to the lower part of the air chamber or passage 15 through which it will be caused to flow and also through the moistened screen 28, if used, and escape through the opening or openings 17, in the upper part of chamber 16 into the room. To facilitate the flow of air in the required direction there may be provided in the base or support, below the air chamber, a movable air controlled device comprising an upwardly extending sheet metal plate 33 pivoted at its lower edge to a sheet metal guide 34 surrounding or partly surrounding the fan motor 20. The arrangement is such that when the apparatus is to be used to supply cool air, the air-guiding device 33 can be moved into the position shown in full lines in which it bears against the back of the casing 14 so as to close direct communication between the air chamber or passage 15 and the cool air inlet 30 to the base or support 12 while leaving open a way to the said passage 15 around the front of the guide 34 for the cool air drawn in through the said inlet and delivered by the fan. When the apparatus is to be used to supply warm air, the said air-controlling device 33 is moved into the position shown in dotted lines in which it bears against the backing 11 so as to place the lower end of the passage 15 in direct communication with the air space around the motor 20 and behind the fan, the air inlet 30 to the base or stand being then closed and the upper concave air-guiding device 32 removed. To facilitate cool air being directed through the air controller 18 of the chamber 16, the upper part of the space between the backing 11 and the heating devices 10 and chamber 16 may, at this time, be closed by a removable plate 35 of sheet material.

When the warm conditioned air is to be delivered in a more or less horizontal or downward direction from the upper part of the apparatus, the arrangement is such that when the apparatus is in use and the fan in motion, cool air will enter the air chamber at the upper part of the apparatus and become mixed with the heated air rising from the heating element or elements so as to reduce its temperature, the conditioned air thus produced then flowing direct from the chamber into the room for the purpose set forth.

One arrangement of this kind is shown in Figs. 6 and 7 wherein the upper part of the heating apparatus is provided with a chamber 16 containing an elongated fan 19^a comprising a number of concave blades carried by a boss fixed upon a freely movable horizontal spindle 36. The fan is arranged above an exit passage 37 for hot air adapted to direct the heated air rising from the electric heating elements 10 from below against the blades that are for the time being, extending downwardly and forwardly, and also below an air inlet passage 38 arranged at the back upper part of the apparatus and adapted to direct cool or relatively cool air descending therethrough against the blades

that are for the time being, extending upwardly and rearwardly. The arrangement is such that when the apparatus is in action the fan 19ª will be rotated by the conjoint action of heated and cool air acting in opposite directions against blades at opposite sides of the axis. One-half of the axially extending blades have a right-hand helical twist and the other half a left-hand helical twist (see Fig. 7) so that the conditioned air produced by the mixture of heated and cool air will be discharged endwise by the fan in opposite directions into the end portions of the chamber 16 where it can issue in a horizontal or downward direction through slits or other suitably shaped openings in the front wall of the chamber. The fan spindle 36 may be arranged to rotate rapidly through suitable gearing, as for example worm gear 39, light fans 40 having their spindles at right angles to the front of the apparatus so that they will discharge the conditioned air entering the end portions of the chamber through the openings in the front wall thereof.

Or, as shown in Fig. 8, the conditioned air may be directed forwardly and downwardly by the fan 19ª, acting as a motor blower, by providing the end portions of the chamber 16 with suitably shaped curved surfaces 41 that will deflect the conditioned air outward.

When a fan or equivalent is not used, the air exit from the said chamber 16 may be in the form of a number of passages so shaped and arranged that air escaping therethrough will induce cool air to flow into the chamber and become mixed with the heated air. Fig. 9 shows an example of this kind wherein the air exit comprises a number of superposed curved passages 42 formed between suitable curved metal plates 43 and arranged above the passage 37 through which the heated air rises from the heating elements 10 and having their outer ends extending horizontally or downwardly. The cool air inlet 44 may, as shown, be arranged in the upper rear portion of the heating apparatus. Between the air exit passages 42 and cool air inlet 44 may be arranged means for humidifying the entering cool air. Such means may comprise, as shown, a water receptacle 45 in which is supported a triangular frame or equivalent structure 46 around which is wrapped absorbent material 49, for example textile fabric or yarn, that will become moistened by the water in the receptacle and through which the entering cool air, guided by a plate 50, will be caused to flow and become humidified. The upper part of the said frame may carry a trough 51 into which water can be poured and thence fall into the receptacle 45 which can be made removable from its support 52 through the air inlet 44.

In accordance with the provisions of the patent statutes, I have described the principle of operation of my invention, together with the apparatus which I now consider to represent the best embodiment thereof; but I desire to have it understood that the apparatus shown is only illustrative, and that the invention can be carried out by other means.

What I claim as new and desire to secure by Letters Patent of the United States, is:—

1. An apparatus for conditioning an air supply comprising an air heater, means for mixing cool air with the heated air, and means for discharging the mixed air in a more or less horizontal direction into the room or space to be heated.

2. An apparatus for conditioning an air supply comprising an air heater, means for mixing cool air with the heated air, and means comprising a fan or blower for discharging the mixed air in a more or less horizontal direction into the room or space to be heated.

3. An apparatus for conditioning an air supply comprising an air heater, means for mixing cool air with the heated air, means comprising a fan or blower for discharging the mixed air in a more or less horizontal direction in the room or space to be heated, and means for regulating the admission of the cool air.

4. An apparatus for conditioning an air supply comprising a mixing chamber located at the top of the apparatus, means for heating air and discharging the same into said chamber, means for admitting cool air to said mixing chamber, means for forcing the mixed air to the bottom of the apparatus and discharging the same into the space to be heated.

5. An apparatus for conditioning an air supply comprising a mixing chamber located at the top of the apparatus, means for heating air and discharging the same into said chamber, means for admitting cool air to said chamber, and means for forcing the mixed air to the bottom of the apparatus and discharging the same into the space to be heated and comprising a fan or blower located in the bottom of the apparatus.

6. An air heater comprising an upright casing with a passage extending therethrough, and with a chamber located at the upper portion, an electrical heating element for heating the air and discharging the same into said chamber, means for mixing cool air of the room with the heated air, and means for forcing the air thus mixed through said passage to the bottom of the casing from which it is discharged into the bottom of the room or space within which the device is located.

7. An air heater comprising an upright casing provided with a passage extending upwardly therethrough and with a chamber located at the upper portion thereof, an

electrical heater for heating the air and discharging the same into said chamber, means for admitting cool air to said chamber and for regulating the amount that may be so admitted, and means for forcing the air downwardly through said passage into the bottom of the device from which the same is discharged into the bottom of the room or space within which the device is located.

8. An air heater comprising an upright casing provided with a substantially vertical passage and a chamber located at the upper portion thereof, a vertically arranged heating element located beneath said chamber for heating the air and discharging the same into said chamber, means for admitting air from the room or space within which the device is located to said chamber, and means for forcing the mixture of heated and cold air to the bottom of the device and for discharging the same into the bottom of the space within which the device is located.

9. In a device for conditioning an air supply, means for heating the air, a cold air inlet, and means for rendering either the heating means or the cold air inlet operative and the other inoperative whereby either hot or cold air may be introduced into the space surrounding the device.

10. In a device for conditioning an air supply, means for heating the air, means for mixing cool air with the heated air, a cold air inlet, and means for rendering either the heating means or the cold air inlet operative and the other inoperative whereby either hot or cold air may be introduced into the space surrounding the device.

In witness whereof I have hereunto set my hand this 22d day of July, 1916.

ARTHUR FRANCIS BERRY.