

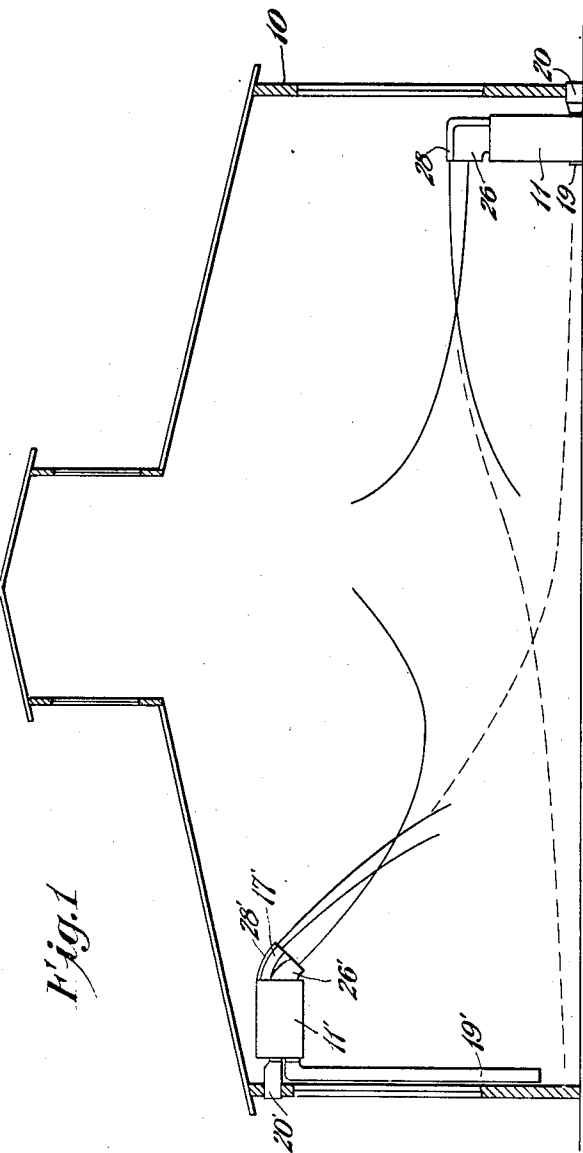
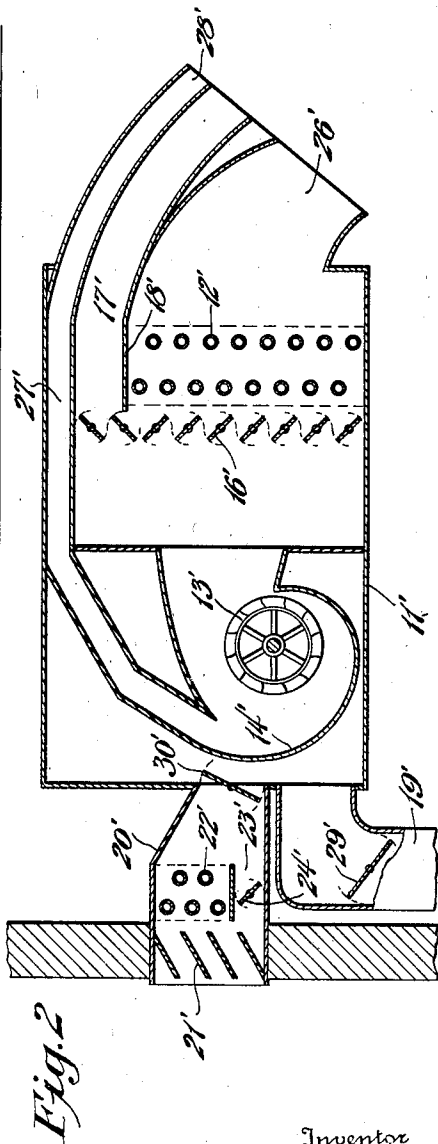
July 1, 1941.

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2,247,987

APPARATUS FOR HEATING AND VENTILATING

Original Filed May 21, 1931 2 Sheets-Sheet 1



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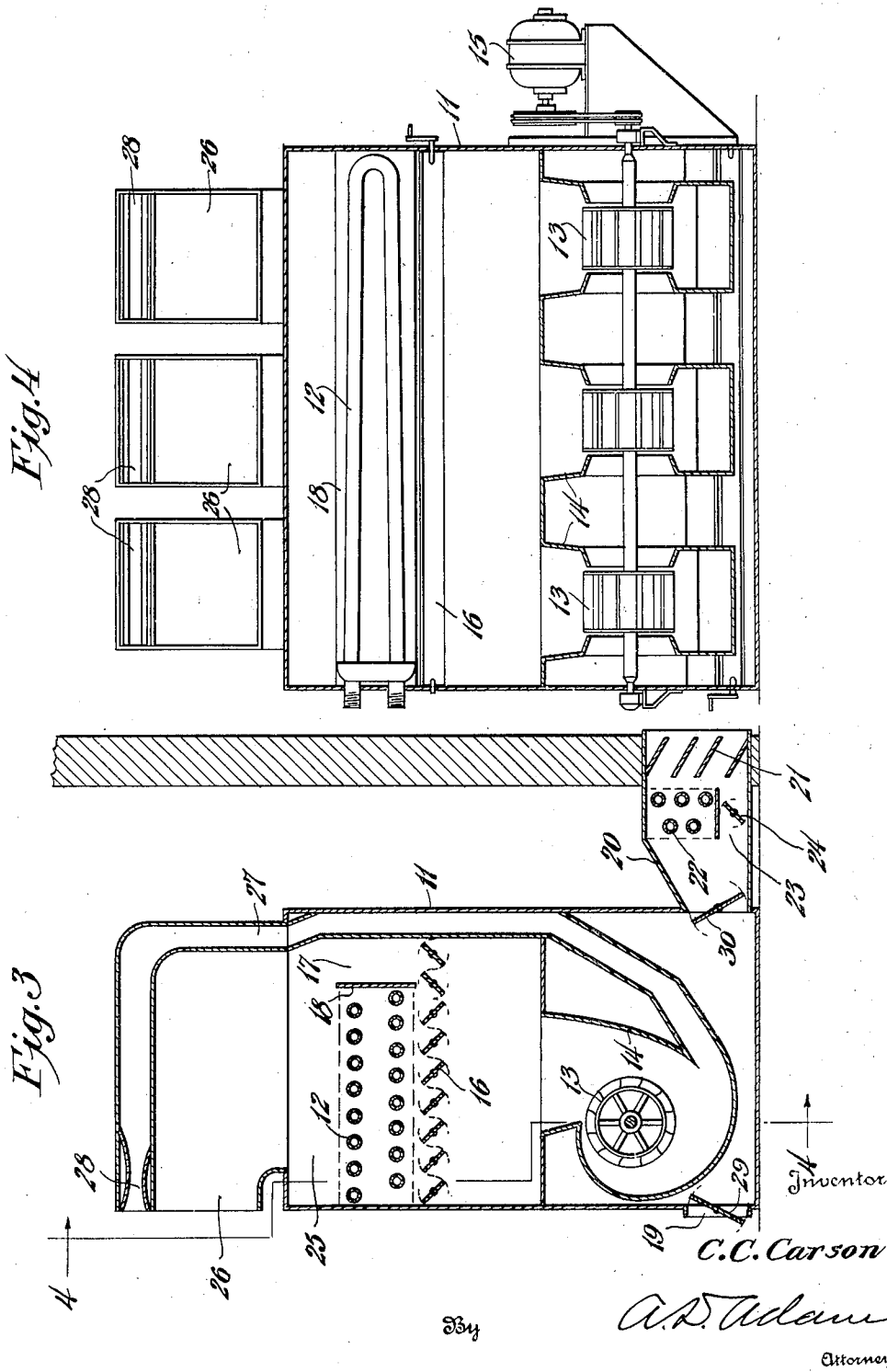
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UNITED STATES PATENT OFFICE

2,247,987

APPARATUS FOR HEATING AND VENTILATING

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Original application May 21, 1931, Serial No. 539,062. Divided and this application March 12, 1937, Serial No. 130,575

5 Claims. (Cl. 257—137)

This invention relates to combined heating and ventilating systems for rooms or enclosures such as factory buildings and aims to provide an improved, efficient and economical apparatus for heating and ventilating the working area so as to insure a practically uniform, comfortable distribution of heated air and ventilating air, while the upper portion of the room or enclosure is maintained at a lower temperature than usual, so as to reduce the heat loss. This application is a division of my application Ser. No. 539,062, filed May 21, 1931, now Patent 2,076,399.

Other aims and advantages of the invention will appear in the specification, when considered in connection with the accompanying drawings, wherein:

Fig. 1 is a diagrammatic sectional view of a monitor type building showing two unit heaters embodying the invention;

Fig. 2 is a vertical sectional view on an enlarged scale of one of the unit heaters in Fig. 1;

Fig. 3 is a vertical sectional view of the other heater; and

Fig. 4 is a sectional view taken on the line 4—4 of Fig. 3.

Heretofore, considerable difficulty has been experienced in obtaining the proper distribution of heating and ventilating air in large rooms or buildings. Ordinary unit heaters and ventilators, now in general use, do not distribute the air properly. One of the reasons is due to the fact that heated air projected into a room tends to rise because its density is less than that of the relatively cold room air through which it passes. Further, when the warm air in a room or building comes in contact with the relatively cold walls or surfaces, it is cooled and its volume is decreased due to the lower density. As a result, the constantly cooled or chilled air which comes in contact with the building surfaces exposed to the outside elements produces a tendency to maintain a zone of low pressure compared with the mean room pressure in the regions adjacent to such exposed surfaces.

In most industrial or factory buildings, it is frequently necessary to use materials which permit the concentration of loss of heat to the outside air near those portions of the room or building composing the upper glass sash, walls, the roof, monitor sash, etc. Large areas of glass in the roof monitors of such buildings, and the great height of this roof from the floor, concentrate a great proportion of the total heat losses in the building to these surfaces. The natural tendency of warm air is to rise and this

tendency is often increased very materially by the low pressure zones against such upper surfaces of a room due to the chilling of the room air lying against the upper surfaces. The chilling of the air, in effect, produces a pull of room air toward the exposed surfaces.

In practice, the air in a room being heated and/or ventilated by unit heaters or unit ventilators, tends to stratify the warm air concentrating under the upper surfaces of the room. Hence, great difficulty is experienced in producing a condition of comfort both as to temperature and as to fresh air in that portion of the room near the floor, which, in most cases, is the only space in the room which is inhabited. It is apparent that the building up of high temperatures under the exposed upper surfaces of the room or building, increases the loss of heat through such surfaces and increases the tendency to decreasing room pressure adjacent to such surfaces. It is the main purpose of this invention to heat and ventilate a room by the use of unit heater ventilators of improved design, which, in their operation, prevent an accumulation or stratification of high temperature air in the upper portions of a room, as is obtained by the present methods. The invention also proposes to utilize improved means for projecting a larger proportion of fresh air into the space near the floor level than is obtained by the apparatus now used. It is also a further aim to obtain a more even distribution of the heated and ventilating air and more comfortable working conditions in all inhabited parts of a room.

In accordance with this invention, I propose to utilize a portion of fresh, outside air which is introduced for the purpose of ventilation in producing a stream or streams of moving air at a temperature below the mean room temperature above a projected stream of warm air from a heating unit. The idea is to partially isolate the upper space of the room from those spaces near the floor and decrease the tendency of the warm stream to rise and stratify in the upper spaces of the room. The idea is to partially offset the tendency of the heated air to produce reduced pressures adjacent to the exposed building surfaces which cause an increase in the leakage or infiltration of outside air through cracks and openings in that portion of the building.

Referring particularly to the accompanying drawings, there is shown an installation applied to an ordinary monitor type building 10 outlined in Fig. 1. In this instance, two heater-ventilator units are shown as being arranged at opposite

sides of the building. One of them is of the floor type which is somewhat similar to that shown in my copending application, Ser. No. 398,443, filed October 9, 1929, while the other is of the suspension type somewhat similar to that shown in my copending application, Ser. No. 409,657 filed November 25, 1929, now Patent No. 1,820,779. The unit shown at the right hand side of Fig. 1 and in Figs. 3 and 4 comprises a casing 11 in which is arranged heat transfer elements 12 and a series of centrifugal fans 13 of conventional design enclosed by scrolls 14. The construction is such that the fans deliver air through the heater elements into the space to be heated. The fans are conveniently arranged on a common shaft and are driven by a motor 15 suitably supported on the casing. Between the fans and the heater elements there is shown a plurality of dampers or valves 16 for regulating the flow of air through or around the heating elements, so as to control the volume of heated air according to the room requirements.

In this instance, there is shown a by-pass 17 behind the heater elements and separated therefrom by means of a partition 18. The air is admitted to the housing through an intake opening 19 near the base and an intake conduit 20 leading through the wall of the building to the outside, the mouth of the intake conduit having a series of weather louvres 21 to prevent rain from beating in. In the intake conduit 20 there is preferably arranged a pre-heater in the form of heating elements 22 near the top of the conduit and a by-pass 23 through which a portion of the air may be admitted without passing through the pre-heater. The by-pass 23 is preferably controlled by a damper 24 which may be either manually or automatically controlled in accordance with the temperature. The air is first mixed in the chamber around the fan scrolls and, then, admitted to the fans to be discharged through the passages in the casing into a mixing chamber 25 above the heater elements 12. From the mixing chamber, the air is adapted to be discharged through large horizontal nozzles 26 into the room or space to be heated.

A confining curtain of relatively cold, fresh air is discharged above each hot air stream through ducts 27 and nozzles 28. These air curtains are preferably created by each of the centrifugal fans 13, being discharged tangentially into the ducts 27 from the scrolls 14. The arrangement is such that the relatively cold curtains or curtains counteract the tendency of the hot air to rise before it has given up a substantial portion of its heat. The velocities of the two streams or strata are so regulated that the mean direction of travel of the currents is represented by the dotted line, Fig. 1. Thus, the heated air may be confined to travel across the building before it circulates above the breathing line.

To control or regulate the admission of air to the unit and also to enable it to be used either as a ventilator or a heater to recirculate room air, there is shown a damper 29 in the opening or duct 19 and a damper 30 in the intake conduit 20. Thus, the proportion of fresh, outdoor air and recirculating room air can be varied at will. Moreover, either inlet can be closed entirely while the other is open to convert the unit into a recirculating heater, or a fresh air heater and ventilator. Further, by closing the damper 29 and all of the dampers 16, the unit can be used to introduce ventilating air into the room through duct 27 without heating any part of it.

The suspended heater 11' shown in Figs. 1 and 2 is similar in most respects to the floor type of heater just described. In this instance, the casing is horizontal and the cold air intake duct 20' is connected to its rear end, extending through the wall of the building above the windows. The intake duct 19' for the room air extends downwardly to a point near the floor level. Furthermore, the outlet nozzles are curved to direct the air downwardly at an angle of thirty degrees or more to the horizontal into the space to be heated. The partition 18' within the heater casing extends forwardly to provide a separate conduit 17' for the by-passed air within the heater casing. Thus, three separate superposed streams or strata are discharged and the intermediate, relatively cold air stream travels at a lower velocity than the upper curtain or confining stream. The hot air nozzle or discharge duct 26' is shown as being directed downwardly at an angle to the upper nozzles to prevent eddy currents from being set up at the mouth. The middle stratum of relatively cold air not only acts as a confining curtain tending to overcome the buoyancy of the hot air, but also, separates the hot air from the upper cold air curtain until the air is dissipated and begins to mix.

In this example, the velocities and temperatures of the different strata of air are so controlled or regulated that the mean direction of travel is substantially along the dotted line in Fig. 1. In both diagrams the dotted lines represent the ideal direction of intermingled air and this circulation insures a maximum heat distribution in the lower portion of the space to be heated and ventilated thereby greatly reducing the temperature and heat losses in the upper part of the space.

While both types of unit heaters are shown in a building, it will be understood that a single unit may be used very effectively in relatively small buildings or spaces. When two or more units are used it is sometimes desirable to arrange them in staggered or offset relation on opposite sides of the room or space.

Obviously, the invention is not restricted to the particular embodiments thereof herein shown and described.

What is claimed is:

1. A combined unit heater and ventilator comprising, in combination, a casing; a fan within the casing; a heat exchange element in the casing; an air intake duct leading outside of the enclosure to be heated and ventilated; a heat transfer element in said duct; a second air intake opening adapted to admit room air to the casing; a discharge duct for the heated air; a wide nozzle above said discharge duct; a conduit leading from the fan to the nozzle so arranged as to discharge cold air at a high velocity above the heated air; and a damper-controlled by-pass in said casing around said heat transfer element connected to direct a wide stream of by-passed air between the relatively heated air stream and the air stream issuing from said nozzle.
2. A unit heater-ventilator comprising, in combination, a casing; a fan within the casing; a conduit for admitting air into the casing; a heat transfer element in a portion of the casing; a discharge outlet leading from the heat transfer element; a by-pass channel around said heat transfer element arranged to discharge air above the heated air stream; means to regulate the flow of air through said discharge outlet and said by-pass; and a separate channel connected

to the fan and having a discharge nozzle above said by-passed air stream arranged to project a confining stream of relatively cold air above the discharging lower streams.

3. A unit heater-ventilator comprising, in combination, a casing; a fan within the casing; a conduit for introducing fresh air into the casing; an air preheater in said conduit; a conduit for admitting room air into the casing; an air mixing chamber adjacent to the fan; a heat transfer element in a portion of the casing; a discharge outlet leading from the heat transfer element; a by-pass channel around said heat transfer element having a discharge outlet above the heated air outlet; means to regulate the flow of air through the passages; and a separate channel connected to the fan and having a discharge nozzle above both of said outlets arranged to project a confining stream of cold air above the discharging lower streams.

4. A unit heater of the class described comprising, in combination, a casing; a heat exchanger in a portion of the casing; an outlet leading from the casing to discharge heated air into the space to be heated; a by-pass within the casing around the heat exchanger connected to

5 deliver a separated stream of relatively cold air above the hot air stream; means to deliver air through the casing; means to vary the relative volumes of air passing through the heat exchanger and said by-pass to control the temperature of the heated air; and a separate air conduit connected to said air delivering means having an outlet above and adjacent to the discharging stream of by-passed air and arranged to deliver a confining stream of cold air substantially parallel with the air streams discharging from the casing.

5. A unit heater of the class described comprising, in combination, a casing; a heat exchanger in a portion of the casing; a by-pass within the casing to deliver air around the exchanger; means for directing the resulting streams in separate strata into the space to be heated above the breathing line; dampers connected to control the volume of air passing through the heat exchanger and by-pass; and a separate conduit connected to said air delivering means to discharge a cold air curtain parallel with the air discharged from said casing.

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