Sept. 14, 1937. C. C. CARSON 2,093,349

HEATING APPARATUS

Original Filed Sept. 27, 1928 2 Sheets-Sheet 1

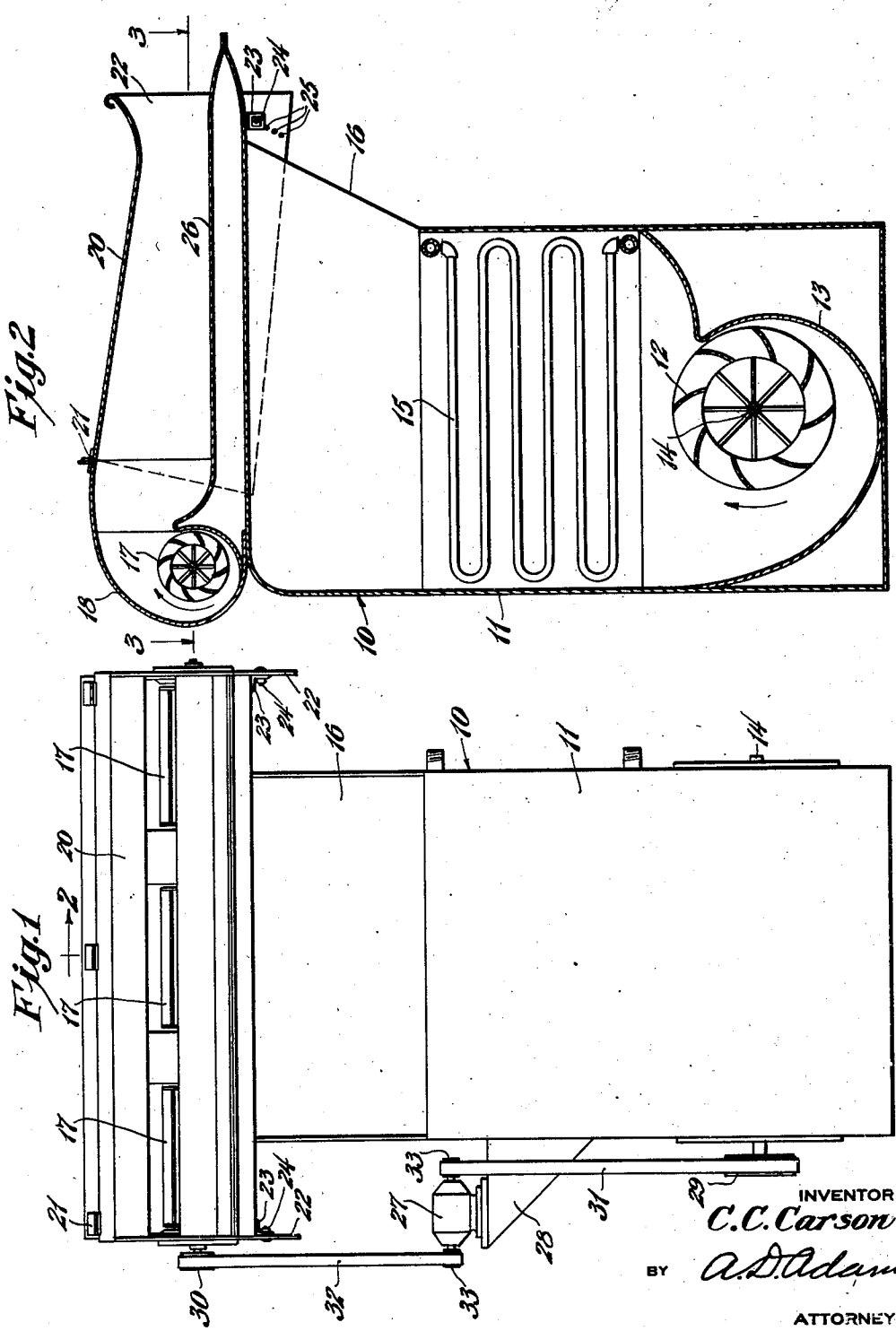

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Fig. 3

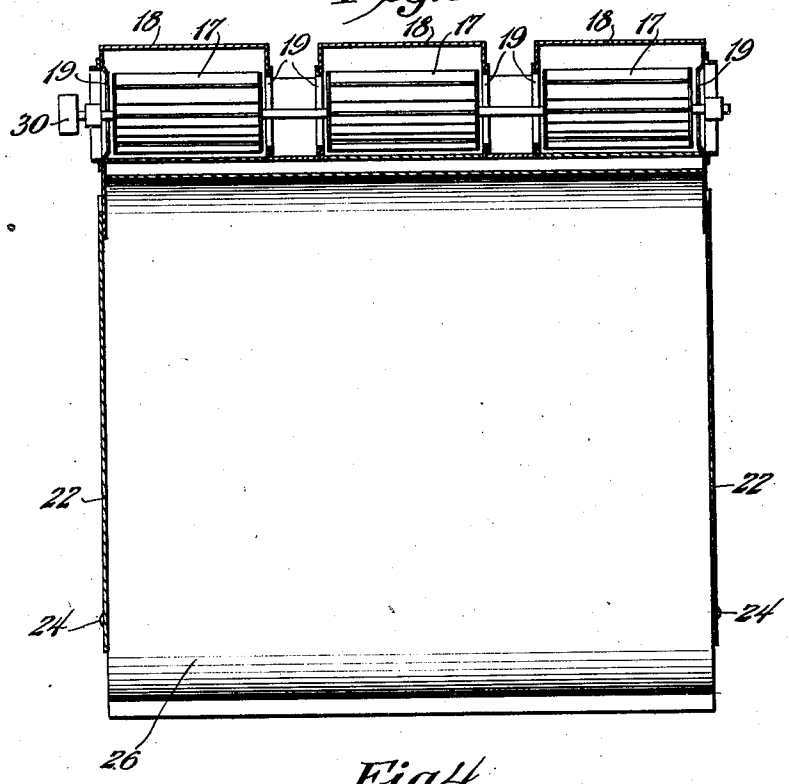
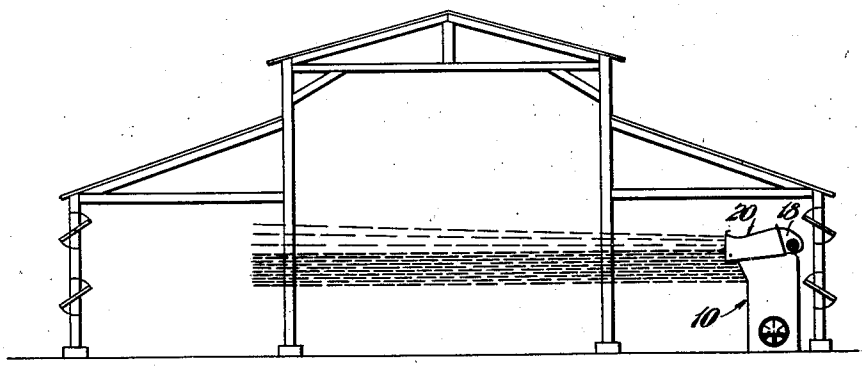


Fig. 4



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Patented Sept. 14, 1937 2,093,349

UNITED STATES PATENT OFFICE

2,093,349

HEATING APPARATUS

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Original application September 27, 1928, Serial No. 308,681. Divided and this application August 24, 1931, Serial No. 559,090

13 Claims. (Cl. 98—39)

This invention relates to apparatus for heating rooms or buildings, such as factories, theaters and the like, and aims, among other objects, to provide an improved heater installation having means to discharge a curtain or stream of air at relatively high velocity above a stream of heated air and thereby confine the heated air below the breathing line until a substantial portion of the heat is given up. The main idea is to increase the efficiency of ordinary unit heaters or indirect air heaters by confining the discharged heated air to circulate in the inhabited portion of a building or room to reduce the heat losses by maintaining a minimum difference between the temperature of the air at the roof or ceiling and that of the outside air.

This application is a division of my copending application, Serial No. 308,681, filed September 27, 1928, entitled "Method of heating", maturing into Patent 1,820,893, issued August 25, 1931.

In the accompanying drawings,

Fig. 1 is a front elevation of a unit heater embodying the invention;

Fig. 2 is a sectional view taken on the line 2—2 of Fig. 1;

Fig. 3 is a sectional view taken on the line 3—3 of Fig. 2; and

Fig. 4 is a diagrammatic view showing a heater in an ordinary shop or factory building.

Referring particularly to the drawings, the improvements are shown embodied in a well known type of unit heater 10 having a sheet metal casing 11 at the bottom of which is arranged a centrifugal fan 12 within a scroll 13. The fan is mounted on a shaft 14 and is adapted to recirculate room air through the casing 11 in heat exchanging contact with heating coils or heat exchanging elements 15 and out through a horizontal outlet or nozzle 16. The coils 15 are usually heated by steam. However, the source of heat is immaterial.

In this example, the confining curtain or stratum of relatively cold air is discharged substantially horizontally above the issuing stream or stratum of hot air. While the curtain may be created in a great variety of ways, a series of centrifugal fans 17 are shown as being mounted within housings 18 in the form of separate scrolls secured to the top of the casing 11. These fan housings are conveniently made of sheet metal and have intake openings 19 at their opposite ends. Each of the fans discharges through a flat nozzle provided by a sheet metal hood 20, preferably hinged at 21 to the upper walls of the fan housings, as clearly shown in Fig. 2. The hoods are shown as having vertical side walls 22, the rear ends of which overlap the side walls of the fan housings and the arrangement is such that the hoods may be adjusted to vary the width of the nozzles and the thickness of the air curtains issuing therefrom. In this instance, the upper wall of the casing 11 is extended forwardly and has lugs or brackets 23 carrying bolts 24 adapted to be secured in any one of a series of holes 25 through the vertical side walls 22 of the hoods. However, the mode of adjustment may be widely varied.

To prevent the cold air curtain from creating eddy currents and commingling with the hot air, the hoods are bent upwardly at their forward ends and the forward ends of the scroll extensions 26 forming the bottom walls of the hoods are bent downwardly so that the nozzles are Venturi-shaped in cross section as viewed in Fig. 2. By lowering the hoods to create relatively thin air curtains, the volume of the cold air may be raising the hoods and vice versa. Thus, the relative volumes of air in the hot and cold streams may be varied. It has been found in practice that the cold air stream or streams should be discharged at about twice the velocity of the hot air stream. For heating large plants, the velocity of the hot air should be about 1500 feet per minute and that of the cold air curtain or stream should be about 3000 feet per minute. Of course, these velocities may be widely varied, depending upon the design of the heater, the size of the building or room, the heating demands and other factors.

While the fans may be separately driven, they are shown as being driven by a single motor 27 supported upon a bracket 28 on one side wall of the heater casing 11. The fan shafts are extended through the side wall of the casing and of the fan housings and have pulleys 29 and 30 driven by belts 31 and 32 on pulleys 33, at the opposite ends of the motor shaft. The speed ratio of the fans is determined by the sizes of the pulleys and may be changed to vary the velocity ratio of the hot and cold air streams or strata.

In Fig. 4, a unit heater of the type described is shown in a factory building of ordinary design. One or more units may be arranged within the building depending upon their capacity and the heating requirements. In this figure, the separate strata of air are indicated by dotted lines to convey a general idea of the operation, no attempt being made to show how the air is deflected or any eddy currents that may be created

because the paths of the streams where they are somewhat dissipated cannot be clearly shown.

Inasmuch as the method of heating by projecting separate strata or streams of air at different temperatures and velocities is described in more or less detail in my aforesaid co-pending application, it is unnecessary to point out the advantages in this application. It is sufficient to state that the high velocity cold air curtain serves to confine the hot air to circulate below the breathing line (five feet) until a substantial portion of the heat is given up in the inhabited portion of the building. The cold air is of greater density than the warm air and will tend to overcome the tendency of the warm air to rise to the ceiling. Practical demonstrations have proved that heaters of the general type shown will reduce the temperature rise per foot of height above the breathing line to less than 1 per cent of the temperature at the breathing line, thus materially reducing the heat loss at the roof or ceiling of the enclosure. In buildings having monitor roofs or high ceilings, the cost of heating is materially reduced.

Obviously, the present invention is not restricted to the particular embodiment thereof herein shown and described. Moreover, it is not indispensable that all the features of the invention be used conjointly, since they may be employed advantageously in various combinations and sub-combinations.

Furthermore, it is to be understood that the invention is not limited to the particular use herein disclosed.

What I claim is:—

1. A device of the character described comprising, in combination, a casing; air heating means within the casing; a fan arranged to create a current of air through the casing; an outlet for discharging heated air substantially horizontally near the top of the casing; means associated with the casing above the heated air outlet for creating a blast of air at a lower temperature than the air from the heater and at a greater velocity; and a wide nozzle communicating with said means and arranged to discharge said relatively low temperature air in a relatively thin substantially horizontal stratum above the heated discharging air.

2. A device of the character described comprising, in combination, a casing; air heating means within the casing; a fan arranged to create a current of air through the casing; an outlet nozzle for discharging heated air substantially horizontally near the top of the casing; a fan housing associated with the casing; a fan within the housing arranged to create a blast of relatively low temperature air at a greater velocity than the heated air; a wide nozzle above the heater casing connected to discharge a thin stratum of the relatively low temperature air in a substantially horizontal stratum above the discharging hot air; and means to vary the thickness of said stratum discharged from said nozzle.

3. Apparatus for heating buildings or enclosures, comprising, in combination, a unit heater including a casing having a substantially horizontal discharge outlet; means to create and discharge a heated air stream horizontally from the heater through the space to be heated near the floor level; and separate means associated with the casing connected to create and discharge a substantially horizontal curtain of relatively cold air above and adjacent to the discharged heated air to confine the heated air near the floor level.

4. Apparatus for heating buildings or enclosures, comprising, in combination, a unit heater having a plurality of heating coils therein; a substantially horizontal discharge outlet; a fan arranged to blow air around the coils and discharge it horizontally through said outlet into the space to be heated; a plurality of fans above the heater; an adjustable hood having a nozzle-shaped discharge opening above the discharge opening for the heater and connected to discharge air from said fans above the heater in the form of a substantially horizontal curtain above the discharging heated air; and driving means connected to said fans.

5. Apparatus for heating a room or enclosure comprising, in combination, a casing; air heating means in the casing; means to create a draft of air through the heating means; a substantially horizontal outlet for directing the heated air into the lower portion of the room or enclosure; and means including a wide nozzle supported on said casing above the heated air outlet for discharging a confining stream of relatively cold air substantially horizontally above and adjacent to the issuing stream of heated air.

6. Apparatus for heating a room or enclosure comprising, in combination, air heating means; means to create a draft of air through the heating means; means for directing the heated air substantially horizontally into the lower portion of the room or enclosure; and a fan having a wide discharge nozzle above and adjacent to the outlet for the heated air and arranged to discharge a stratum of relatively cold air at a high velocity above and approximately parallel with the stream of heated air to confine the heated air so that it will circulate in the lower portion of the room or enclosure until a substantial portion of its heat is given up.

7. Apparatus of the class described comprising, in combination, a unit heater including a casing having a discharge nozzle arranged to direct heated air into the lower portion of a room or enclosure; a fan within the casing; a plurality of centrifugal fans having housings mounted on the casing; adjustable hoods connected to the housings and providing nozzles for directing a substantially horizontal stratum of relatively cold air immediately above the discharging heated air; and means to drive the fans at such speeds as to discharge the streams of air at such velocities that the cold air stratum effectively confines the heated air so that it will circulate in the lower portion of the room or enclosure until a substantial portion of its heat is given up therein.

8. Heat exchanging and air distributing apparatus for rooms or enclosures comprising, in combination, a casing having a wide, horizontal outlet to discharge air into the space to be heated; a heat exchanger in the casing; an air conduit having a wide horizontal outlet immediately above the outlet from and mounted on the casing; and means to create and discharge streams of air at different velocities through both outlets, the upper stream traveling at a greater velocity than the lower stream and the lower stream being heated by said heat exchanger.

9. In an air heater for rooms or enclosures, a casing having a wide, horizontal outlet to discharge air into the space to be heated; a heat exchanger in the casing; an air conduit having a wide horizontal outlet immediately above the outlet from and supported by the casing; means to create and discharge streams of air through both outlets, the lower stream passing through the

heat exchanger and being heated thereby; and means to vary the relative discharge velocities of the two streams.

10. Heat exchanging and distributing apparatus for rooms or enclosures comprising, in combination, a heat exchanger; a fan for delivering air through the heat exchanger; an outlet leading from the heat exchanger and arranged to discharge a substantially horizontal stratum of conditioned air into the enclosure; a separate conduit having a discharge outlet adjacent to said outlet from the heat exchanger to discharge a second stratum of air substantially parallel with and adjacent to the first stratum and at a different temperature and different velocity; and a fan connected to deliver air through said conduit.

11. Heat exchanging and air distributing apparatus for large rooms or enclosures comprising, in combination, means for creating separate streams of air; means for discharging said streams substantially horizontally into the room or enclosure, one adjacent to and above the other whereby one stream tends to maintain the direction of flow of the other and tends to cause the air to be distributed uniformly within the habitable portion of the enclosure; and a heat exchanger connected in the path of one of said streams whereby the lower stream is always maintained warmer than the upper stream.

12. Heat exchanging and air distributing apparatus for large rooms or enclosures comprising, in combination, an air conduit having an outlet arranged to discharge a stream of air into said room above the normal breathing line; a fan for creating said air stream; a second air conduit having an outlet immediately below the first mentioned outlet; a second fan connected to recirculate room air through said second conduit and create a separate air stream of different velocity discharging substantially horizontally into the room through said second mentioned outlet so that one stream aids in distributing the other throughout the room; and heat exchanging means for the air forming one of said streams whereby the upper stream is always cooler than the lower stream to make the habitable portion of the room comfortable.

13. In an air conditioner and ventilating device of the character described, a heater casing having a fan connected to discharge a warm stream of air substantially horizontally into a room or enclosure; means mounted on the casing to discharge a wide, relatively cold stream of air above and approximately parallel with the warm stream including an independent outlet adjacent to the discharging warm air stream, whereby one stream retards the vertical movement of the other; and means to vary the relative thicknesses of said streams.

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