

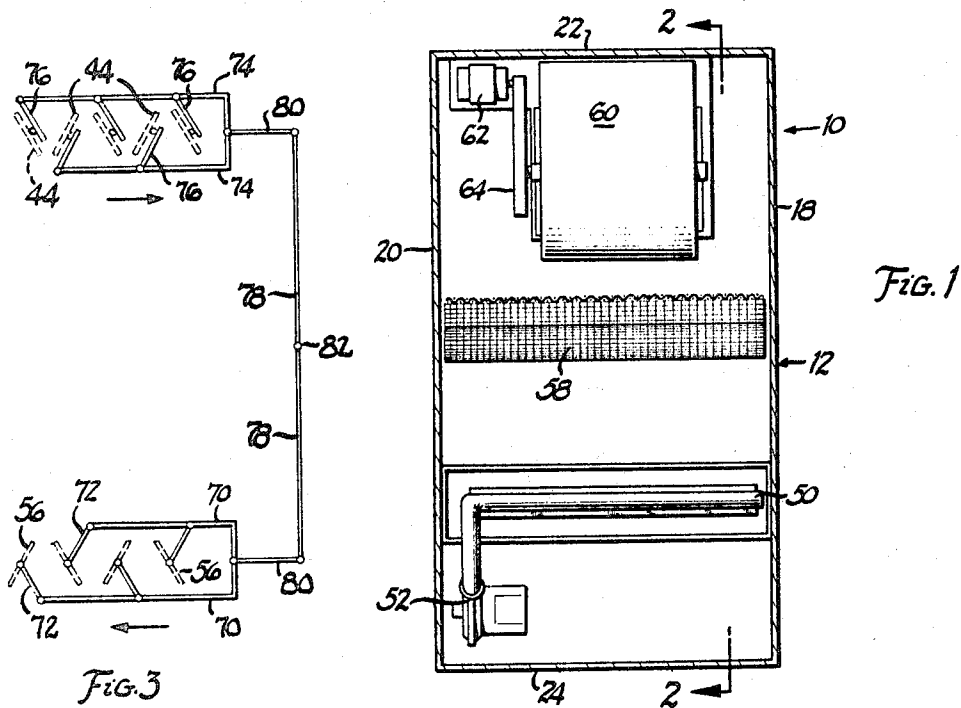
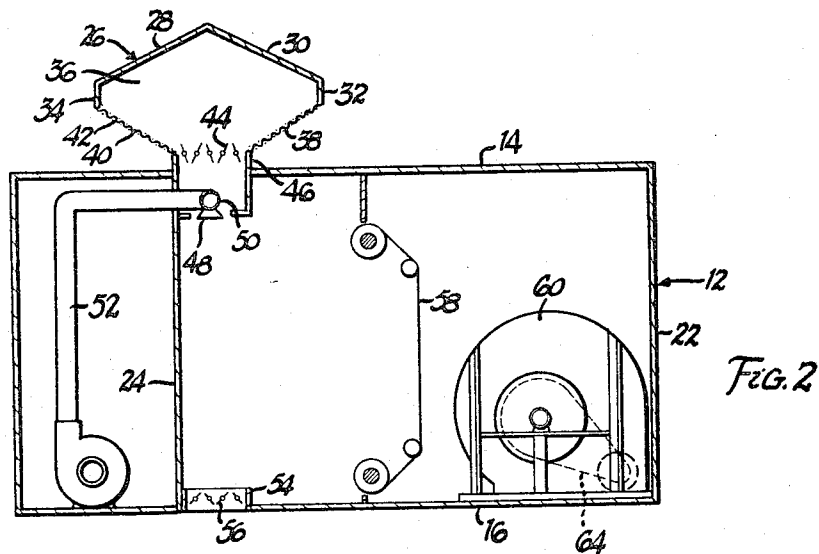
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3,398,940

AIR HEATING APPARATUS

Filed June 13, 1966



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3,398,940

AIR HEATING APPARATUS

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ABSTRACT OF THE DISCLOSURE

A make-up air heater particularly adapted for use in relatively large industrial buildings such as factories, warehouses, etc. in which heated building air may be recirculated through the heater without exposing the building air directly to combustion gases of the heater burner to thereby prevent the building up of undesirable quantities of carbon dioxide or carbon monoxide.

Heating apparatus embodying the present invention is intended for roof top installation on large industrial buildings to supply heated make-up air to the building interior. Heretofore conventional make-up air heaters have utilized gas burners which use relatively cold fresh outside air as the secondary air, the combustion gases and excess air then being fed into the building. While it would be economical to recirculate air drawn from the building through the hot combustion gases, most safety regulations prohibit such recirculation of the building air because of the danger of carbon dioxide build-up and the possibility that dangerous quantities of carbon monoxide could be formed.

An object of the present invention is to overcome disadvantages in prior heating apparatus of the indicated character and to provide improved heating apparatus incorporating improved means for supplying heated make-up air to the building interior.

Another object of the invention is to provide improved heating apparatus intended for roof top installation on relatively large industrial buildings such as factories, warehouses and the like to supply heated make-up air to the building interior.

Another object of the invention is to provide improved make-up air heating apparatus which provides significant fuel gas economies without carbon dioxide build-up.

Another object of the invention is to provide improved make-up air heating apparatus which has substantially constant volume air flow characteristics.

Another object of the invention is to provide improved make-up air heating apparatus incorporating improved means for increasing the efficiency of blower means incorporated therein.

Another object of the invention is to provide improved make-up air heating apparatus which is economical to manufacture, durable, efficient and reliable in operation.

The above as well as other objects and advantages of the present invention will become apparent from the following description, the appended claims and the accompanying drawing wherein:

FIGURE 1 is a sectional plan view of apparatus embodying the present invention, taken on the line 1-1 of FIGURE 2.

FIGURE 2 is a sectional, elevational view of the apparatus illustrated in FIGURE 1, taken on a line 2-2 thereof.

FIGURE 3 is a schematic view of mechanism for operating certain dampers used in the device of FIGURES 1 and 2.

Referring to the drawing, heating apparatus generally designated 10 embodying the present invention is il-

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lustrated therein and is comprised of a rectangular housing, generally designated 12, having top and bottom walls 14 and 16, side walls 18 and 20, and end walls 22 and 24, the apparatus 10 being intended for roof top installation on relatively large industrial buildings to supply heated make-up air to the building interior.

A fresh air weather shielded intake hood 26 is provided having inclined top walls 28 and 30, side walls 32 and 34 and end walls 36. The bottom walls 38 and 40 are provided with openings 42 through which fresh air is drawn into the apparatus 10.

Opposed fresh air inlet damper vanes 44 of the butterfly type are provided in a rectangular inlet channel 46 which connects the intake hood with an inlet opening 48 provided in the top wall 14 of the housing 12. A gas burner 50 is provided in the inlet channel 46, the gas burner being connected to a conventional primary air-fuel gas mixer 52 and discharging hot combustion gases directly into the air stream flowing downwardly through the dampers 44. The air stream contributes secondary air to the combustion process.

A return air inlet 54 having a set of butterfly damper vanes 56 is provided in the bottom wall 16 of the housing, the return air inlet communicating with the interior of the building and admitting a stream of building air into the housing down stream of the burner 50.

The heated fresh air, the combustion gases and the building air drawn into the housing through the inlet 54 pass through a conventional roll type filter 58 into a conventional centrifugal blower 60 which discharges the heated gases downwardly into the building, the blower 60 being driven by an electric motor 62 through conventional belt means 64.

With the above described construction the apparatus 10 recirculates building air from interior roof areas but the recirculated building air does not flow past the burner 50 where it could accumulate carbon dioxide. The return air stream is drawn into the housing 12 through the inlet 54 by the blower 60 at a point where the return air does not supply secondary combustion air to the burner 50. The return air thus does not have any carbon dioxide build up over and above the carbon dioxide which might be in the fresh air stream after its passage over the burner.

For added safety against carbon dioxide build up, the amount of return air is preferably limited by limiting the opening movement of the damper vanes 56 to a 50% open position and the closing movement of the fresh air damper vanes 44 to a 50% open position. With such a construction the percentage of return air issuing from the blower 60 is limited as added insurance against carbon dioxide build up.

The damper vanes 44 and 56 are preferably moved in synchronism to provide a substantially constant total flow of air through the blower 60. Thus, for example, the vanes 44 move from the 100% open position to the 50% open position at the same time that the vanes 56 are being moved from the 0% open position to the 50% open position. Assuming the inlet 48 has the same air flow capacity as the inlet 54, there is a substantially constant flow through the blower 60 thereby enabling the blower to operate at the peak efficiency of the blower operating curve.

Vanes 44 and 56 may be moved by any suitable drive or linkage mechanisms, as for example those shown in U.S. Patents 2,040,893 or 3,049,985. As shown schematically in FIGURE 3, the shaft for each vane 56 is connected to a frame mechanism 70 by a link 72. The shaft for each vane 44 is connected to a frame mechanism 74 by a link 76. Each frame mechanism 70 or 74 is linked to a lever 78 by a link 80. The arrangement is such that

pivotal movement of lever 78 about its fulcrum axis 82 causes mechanism 70 to shift leftwardly and mechanism 74 to shift rightwardly. In the FIGURE 3 position each damper vane 44 or 56 is in the 50% open position. The linkage system is such that movement of frame mechanisms 70 and 74 in the arrow indicated directions causes vanes 56 to move toward the fully closed position and vanes 44 to move toward the fully open position. The objective is to attain a substantially constant total air flow in all damper positions.

The desired constant total air flow is advantageous in that all system components, including distribution ductwork, registers, grilles, etc., operate at their design efficiencies. Distribution of air at varying total flow rates would introduce system inefficiencies. It will be understood that during different periods the proportion of outside air to return air is varied in accordance with the conditioning demand.

The damper linkage mechanisms may be driven from a suitable motor (not shown) controlled by thermostat devices sensing the temperatures of outside air and return air or responsive to the demand for heat in the space to which the blower 60 delivers the air. The idea is to control the temperature of the make-up air in accordance with heat demand by varying the relative proportions of heated air through vanes 44 and return air through vanes 56, and by means of varying fuel input, depending on ventilation requirements. FIGURE 3 is of course schematic, and various structural variations in the damper actuators can be resorted to while still achieving the proportioning objective. The gas fuel input may be controlled by one of several means. Typically, such means includes a modulating ductstat sensing the blower discharge temperature and varying the fuel input to maintain constant discharge temperatures as outside and recirculated temperatures vary. Such means could also include a modulating thermostat to vary fuel input to maintain area comfort standards, or a reset system that resets the discharge temperature inversely to the outside temperature, or various combinations of the above. Accessories can be added to the illustrated unit to incorporate further automatic control of conditioning air, such as air washers, evaporative coolers, and direct expansion coolers.

While a preferred embodiment of the invention has been shown and described it will be understood that various changes and modifications may be made without departing from the spirit of the invention.

What is claimed is:

1. Heating apparatus for supplying make-up air to a building and comprising, in combination, a housing defining a chamber, first air inlet means communicating with the ambient atmosphere and with the chamber defined by said housing, second air inlet means at a location remote from said first air inlet means and connecting the chamber defined by said housing with the interior of a building, burner means disposed within said first air inlet means at a location such that all air entering said first inlet means flows past said burner, air outlet means spaced from both said inlet means and communicating with said building interior, blower means for exhausting air from the chamber defined by said housing through said outlet means, said second air inlet means being so located that air flowing through the second inlet means is precluded from passing over the burner means, and means for regulating the flow of air through said first and second air inlet means to achieve a constant flow at said outlet means by increasing the flow through one of said inlet means upon the decreasing the flow through the other of said inlet means.

2. The combination of claim 1 wherein each inlet means includes a damper for varying the air flow there-through; the combination further comprising means for operating the dampers so that any flow through the second inlet means is always diluted by a substantial flow through the first inlet means.

3. The combination of claim 1 wherein each inlet means includes a damper for varying the air flow there-through; the damper for the first inlet means being restricted to movement between a partially open position and a fully open position, the damper for the second inlet means being restricted to movement between an open position and a fully closed position; and means for operating said dampers in synchronism so that the total air flow is substantially constant in all damper positions.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,398,940

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Basil A. Kosarin

It is certified that error appears in the above identified patent and that said Letters Patent are hereby corrected as shown below:

Column 3, line 21, "temperatures" should read -- temperature --. Column 4, line 21, after "decreasing" insert -- of --.

Signed and sealed this 24th day of February 1970.

(SEAL)

Attest:

Edward M. Fletcher, Jr.

Attesting Officer

WILLIAM E. SCHUYLER, JR.

Commissioner of Patents