

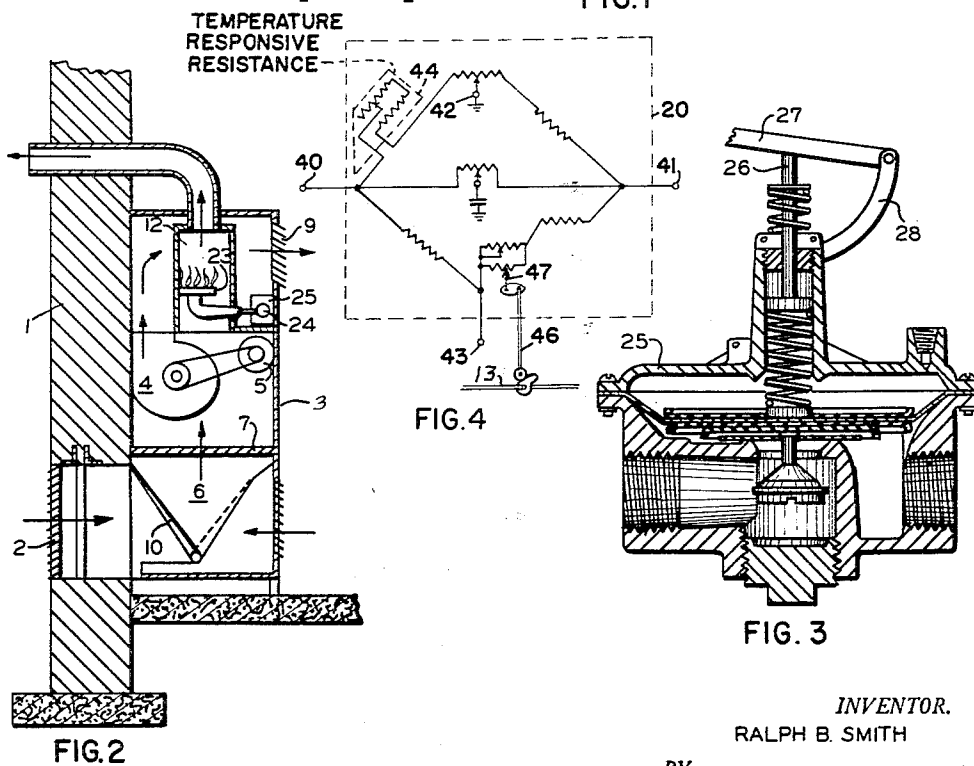
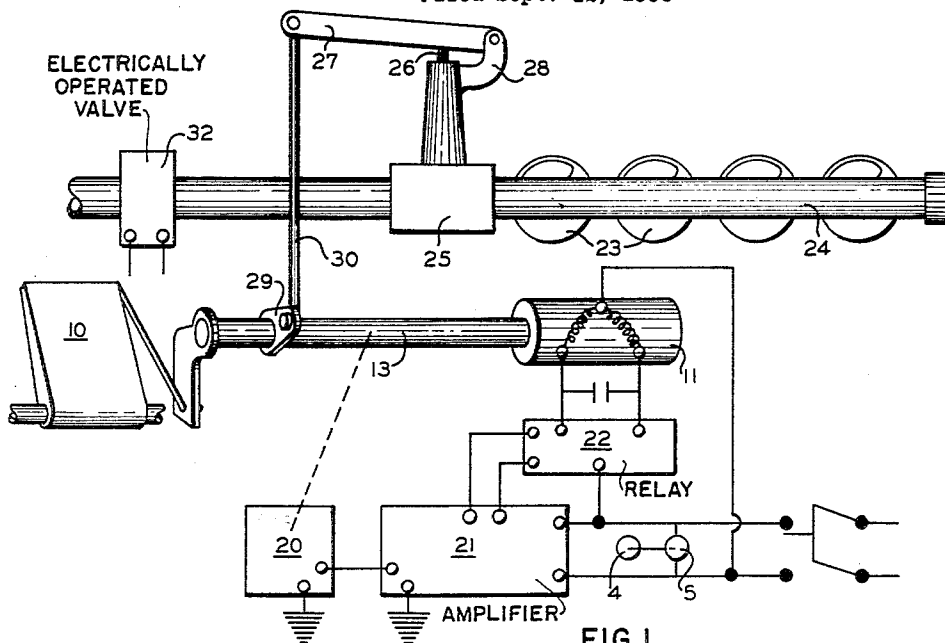
May 3, 1960

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2,935,262

DAMPER OPERATED GAS VALVE FOR UNIT VENTILATOR

Filed Sept. 12, 1956



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2,935,262

DAMPER OPERATED GAS VALVE FOR UNIT VENTILATOR

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Application September 12, 1956, Serial No. 609,411

2 Claims. (Cl. 236—11)

Gas fired unit ventilators conventionally comprise: a cabinet having one air inlet for outside air, another air inlet for room air and an outlet for discharging air from either or both inlets into the room; a blower within the cabinet between said inlets and said outlet; a gas burning heater within the cabinet between the said inlets and said outlet; a movable damper for opening and closing the outside air inlet; a reversible motor operable in one direction to progressively open the damper and in the opposite direction to progressively close it; and control means normally set for a predetermined room temperature condition and normally operative in response to a room temperature condition which rises above or falls below said predetermined temperature condition, to progressively operate the motor in the damper opening or closing direction as required.

With the room temperature at a desired value and with the damper wide open, the gas flow to the heating element should be at a minimum or entirely cut off. However, as the room temperature drops and the damper progressively closes, the gas flow should be progressively increased. Various controls have been proposed to accomplish this control of the gas flow.

The principal object of the present invention is to provide a simple and inexpensive control for the gas flow, one which will progressively increase the gas flow as the damper progressively closes and progressively decrease it as the damper progressively opens.

In accordance with my invention, the principal object may be achieved simply and inexpensively, by providing the fuel line with a gas flow control valve and by connecting that valve to the damper operating means in a manner such as to cause said means to open and close the valve in the progressive manner that it closes and opens the damper.

The present invention is illustrated in the accompanying drawing wherein:

Fig. 1 is a diagrammatic view showing the mechanical and electrical relationship between the operating elements of the invention;

Fig. 2 is a vertical section of the unit ventilator and an adjacent building wall;

Fig. 3 is an enlarged vertical section of the gas control valve of Fig. 1; and

Figure 4 is a schematic circuit diagram of the circuit elements forming the Wheatstone bridge.

The structure illustrated in the drawing conventionally comprises: an outside building wall 1 having an air inlet opening 2; and a ventilating unit 3 having a blower 4 operated by a motor 5 for drawing air from its inlet chamber 6 through an air filter 7 so as to discharge that air into the room through air outlet 9. The inlet chamber 6 of the unit contains a damper 10 mounted for movement by a damper operating motor 11 from one extreme damper-closed position to another extreme damper-open position, i.e., the dotted line position illustrated in Fig. 2. A gas fired heater is mounted in the cabinet 3 between the blower 4 and the outlet 9. With the damper 10 closed,

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the blower 4 operates to recirculate room air into the inlet chamber 6 through the recirculating room air inlet, the heater 12, and discharges that air through outlet 9 into the room. With the damper fully open, the blower 4 operates to draw only outside air through the outside inlet opening 2. When the damper 10 is in an intermediate position, it will draw both room and outside air in quantities depending upon the position it occupies in relation to the outside air inlet and the recirculating room air inlet.

The damper 10 is connected by a suitable linkage to a shaft 13 of the reversible damper operating motor 11 which is energized by a suitable control system.

The control system preferably is of the character described and illustrated in the copending application of Forrest G. Baker, Ser. No. 426,770, now U.S. Patent No. 2,843,324. This system may be energized from a suitable electrical energy source and includes a Wheatstone bridge having temperature responsive resistances and a variable resistance controlled by the movement of the damper operating motor 11. The bridge 20, when energized, operates in response to varying room temperature conditions to feed varying currents to an amplifier 21 controlling the flow of current through a relay 22. When the control system is in a balanced condition, the bridge 20 causes the amplifier to feed an intermediate current to the relay 22 which balances the mechanical pull of a spring against the magnetic pull of a coil, energized by the intermediate current, to maintain the damper motor 11 de-energized. As the room temperature drops, the current through relay 22 decreases whereby the mechanical pull of the spring overcomes the magnetic pull of the coil to energize the damper closing circuit of motor 11 causing it to move the damper 10 in the damper closing direction until the control system is again in balance. Conversely, when the temperature rises, the relay 22 energizes a damper opening circuit of motor 11 causing it to move the damper 10 in the damper opening direction until the system is again in balance.

The gas fired heater 12 includes a plurality of burners 23 (Fig. 1) connected by a gas line 24 containing a variable control valve 25 to a suitable source of gas supply. The control valve 25 has a plunger 26 biased in a closing direction by a spring and actuated in an opening direction by a lever arm 27 pivoted at one end to a suitable bracket 28. The free end of the arm 27 is interconnected by a suitable mechanical linkage to the shaft 13 of the damper operating motor 11. This linkage may comprise a link 30 joined to the outer end of a crank 29 mounted on the shaft 13.

The gas line 24 also contains an electrically operated valve 32 which is operated by a suitable switch means connected to the damper 10 to completely stop the gas flow to the burners.

This is a safety measure as the design of the progressively operated valve 25 is such that, in some instances, it will allow a slight amount of leakage even though it is in its maximum closed position. The valve 32 will be closed after the valve 25 is in its maximum closed position.

The valve 32 can also be connected with other suitable switches which will cause it to close in the event of hazardous operation of the heater 12.

Figure 4 illustrates the essentials of the circuit elements included in a suitable Wheatstone bridge as represented by the box 20 in Figure 1. As indicated earlier, Baker U.S. Patent 2,843,324 discloses the illustrated structure and explains the operation thereof. In general, the Wheatstone bridge 20 is provided with a pair of power receiving terminals 40 and 41 and a pair of energy delivering terminals 42 and 43. The power receiving

terminals 40 and 41 are connected to a suitable power supply. The energy delivering terminals 42 and 43 are suitably connected to the amplifier 21 as illustrated in Figure 1. One leg of the illustrated bridge contains a temperature responsive resistance such as a room thermostat 44. As indicated, the rotative displacement of the damper shaft 13 is transmitted through a suitable linkage schematically shown and designated by the reference numeral 46 into concomitant displacement of a potentiometer arm 47 which serves to re-balance the bridge and bring the system again into balance.

Operation

Assuming the damper 10 to be in extreme damper open position, i.e., the dotted line position of Fig. 2, the valve 25 will be completely closed. The room temperature falls and the control system energizes the motor 11 to start moving the damper 10 in the damper closing direction. The movement of the shaft 13 by motor 11 will also produce a corresponding movement of the lever arm 27 to open the valve 25 progressively. This movement of the motor 11 will continue until either the control system is balanced by the room temperature which de-energizes the motor 11 or the damper is completely closed and the valve 25 is wide open. At such time, the heater 12 will be operating at maximum heat output and the blower 4 will be drawing all of its air through the recirculating room air inlet.

Next, assuming that the damper 10 is in extreme damper closed position and the room temperature is rising, the damper operating motor 11 will be energized to move the damper 10 in damper opening direction and the valve 25 in a valve closing direction to progressively reduce the heat output of the heater 12.

The movement of the damper 10 in either damper open or closing direction and the corresponding closing or opening of the valve 25 will continue until either the damper 10 is in one of its extreme positions or the room temperature balances the control system causing the relay 22 to de-energize the motor 11.

An example of how the automatic control system of the unit ventilator could be adjusted to perform is given in the following table.

Room Temperature Normal 72°	Damper Position	Gas Valve Position
72°	50% open	50% open.
73°	75% open	25% open.
74°	100% open	0% open.
75°	75% open	25% open.
76°	50% open	50% open.
77°	25% open	75% open.
78°	0% open	100% open.
79°	25% open	75% open.
80°	50% open	50% open.

Having described my invention, I claim:

1. In a combination room heater and ventilator conventionally comprising a cabinet having an inlet for outside air, an inlet for room air, an outlet for discharging air from either or both inlets into the room, a blower, a

gas fired heater, and a damper movable between minimum and maximum positions for opening and closing said outside inlet, an automatic control system comprising: a reversible motor connected to said damper for displacing the same intermediate said minimum and maximum positions; a temperature responsive circuit to energize said motor to move said damper to a normal intermediate position between said minimum and maximum positions in response to a predetermined temperature condition, said circuit energizing said motor to move said damper progressively toward inlet closing position in response to a temperature condition falling below said predetermined temperature condition, and to energize said motor to move said damper progressively toward inlet opening position in response to a temperature condition rising above said predetermined temperature condition; a variable gas flow control valve for controlling the admission of gas to said heater; and valve operating means connected intermediate said damper and control valve and directly responsive to damper displacement for opening said valve progressively as said damper is progressively closed and for closing said valve progressively as said damper is progressively opened.

2. In a gas fired unit room ventilator having a fresh air inlet, and a gas fired heater for warming air introduced through said inlet, an automatic temperature responsive control system comprising a damper for controlling the amount of air introduced through said inlet displaceable from one limiting position closing said air inlet to a second limiting position remote therefrom, an adjustable gas valve variably controlling the flow of gas to said heater, means for sensing departures from a predetermined desired room temperature, means controlled by said sensing means and operative in response to sensed departures of room temperature from said predetermined desired value for selectively displacing said damper in a direction to reduce the differential intermediate the sensed temperature and the desired room temperature and linkage means connecting said damper and said gas valve and continually responsive to the positional disposition of said damper over its entire range of displacement relative to said air inlet for selectively adjusting said gas valve in accordance therewith to maintain a predetermined inverse relationship between the amount of gas flowing to said heater and the amount of air introduced through said air inlet.

References Cited in the file of this patent

UNITED STATES PATENTS

Re. 18,109	Otis	June 23, 1931
1,288,516	Cole	Dec. 24, 1918
2,212,285	Ayers	Aug. 20, 1940
2,235,150	Gibbs et al.	Mar. 18, 1941
2,275,317	Ryder	Mar. 3, 1942

OTHER REFERENCES

Control Manual for Heating Ventilating and Air Conditioning, copyright 1940 by the Minneapolis-Honeywell Reg. Co., pages 149 and 153.