Nov. 14, 1944. R. P. SKERRITT 2,362,940

CONTROL FOR FUEL ECONOMIZERS

Filed April 8, 1942 2 Sheets-Sheet 1

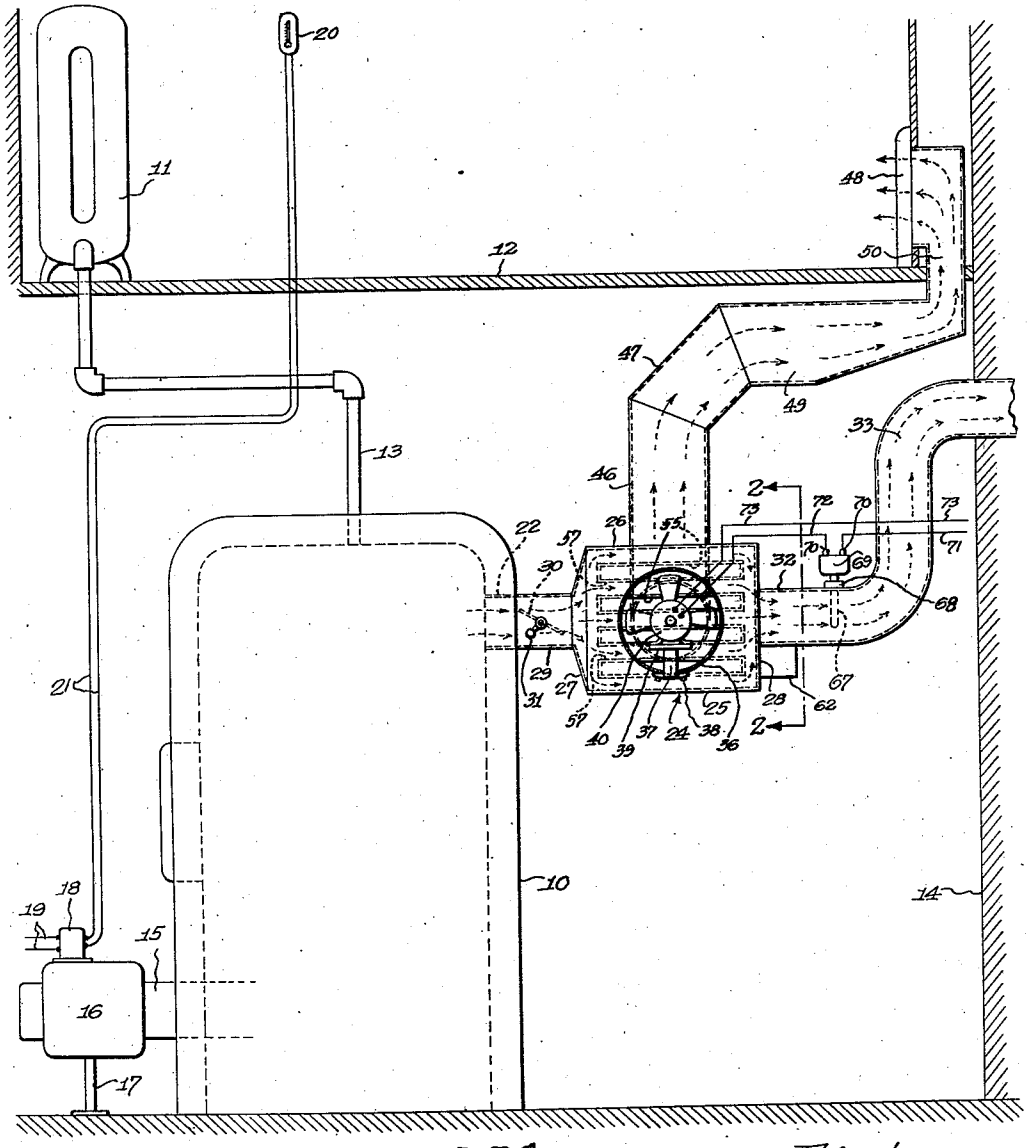

Fig. 1.

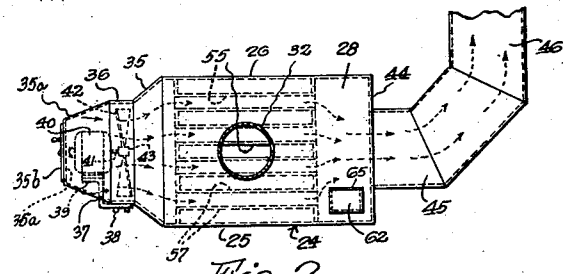

Fig. 2.

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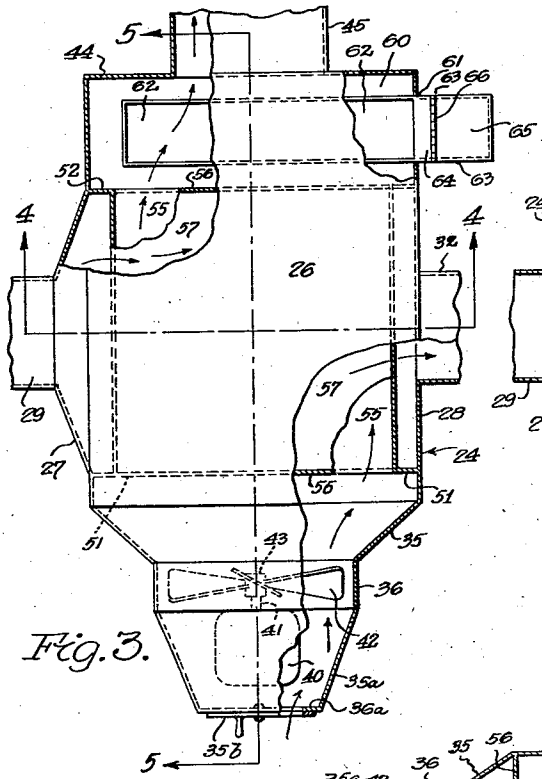

Fig. 3.

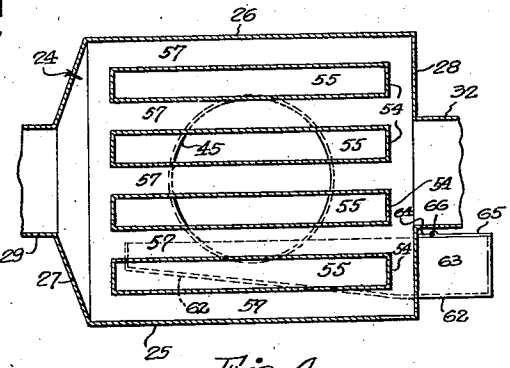

Fig. 4.

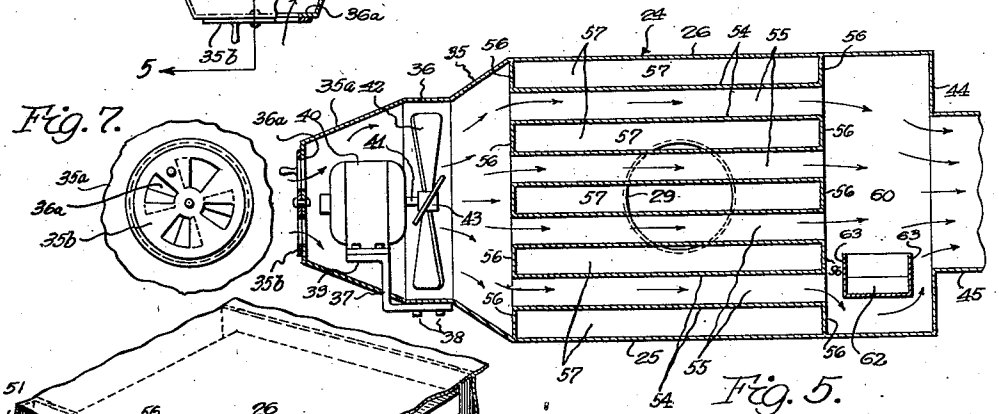

Fig. 5.

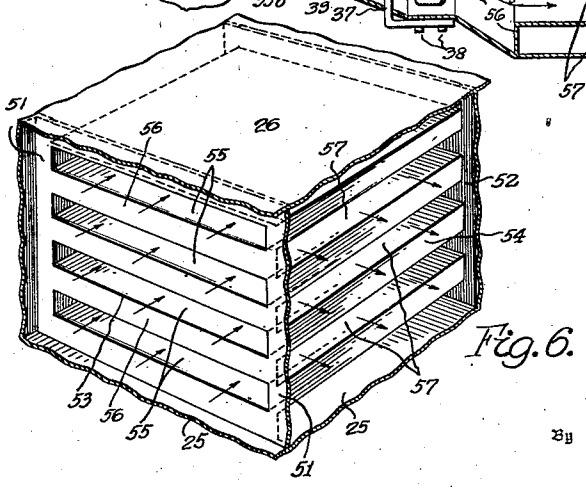

Fig. 6.

Fig. 7.

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UNITED STATES PATENT OFFICE

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CONTROL FOR FUEL ECONOMIZERS

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Application April 8, 1942, Serial No. 438,148

4 Claims. (Cl. 257—2)

The present invention relates to heat economizers, and more particularly to a control therefor.

The primary object of the invention is to provide a device for utilizing the heat carried off in gaseous form from a furnace or heater by passing said gases of combustion through a heat exchanger having means for conveying heated air to desired locations in a house or building.

Another object of the invention, is to provide a device as set forth in the preceding object which is particularly applicable to furnace structures which have been converted from a coal fired boiler to a gas or oil type burner so that the heat from the gaseous products of combustion passing through the furnace will be utilized instead of being conducted to the atmosphere through the flue and stack.

Another object of the invention is to provide a heat exchanger of unique construction having a passageway communicable with the furnace flue and passages extending transversely thereof for conducting air through said exchanger so that the air exhausting therefrom may be used for heating rooms in addition to the conventional house heating system.

Another object of the invention, is to provide a heat exchanger of the above mentioned type having a force feed fan which is adapted to be controlled by a thermostat in the flue pipe on the outlet side of the heat exchanger so that in the absence of heat in said flue, the operation of the fan or other air force feed means will be discontinued to prevent the feeding of cold air to the room or rooms coupled to the heat exchanger.

Another object of the invention, is to provide a heat economizer which is adapted to be employed for supplying heated air to a room of a building in which the furnace control thermostat is placed so that said room will receive additional heat and the furnace control thermostat will govern the furnace heater in accordance with said heat, whereupon an ideal heating condition will exist in which one of the rooms will be maintained at a higher temperature, such as the living room so that the bedrooms of the building will not be overheated and will be properly conditioned for healthful sleeping.

Other objects and advantages of the invention will become apparent during the course of the following description of the accompanying drawings wherein:

Figure 1 is a side elevation of the device embodying the invention illustrating the same coupled with a conventional hot water heating system and showing diagrammatically the manner of supplying additional heat to one of the rooms in a building;

Figure 2 is a vertical cross sectional view taken on line 2—2 of Figure 1 looking in the direction of the arrows illustrating the transverse air passage through the heat exchanger and the manner of creating a forced draft therethrough;

Figure 3 is a top plan view of the heat exchanger partly broken away and greatly enlarged to further illustrate details thereof.

Figure 4 is a vertical cross sectional view taken on line 4—4 of Figure 3 looking in the direction of the arrows showing the structure of the heat exchanger per se;

Figure 5 is a longitudinal cross sectional view taken on line 5—5 of Figure 3 looking in the direction of the arrows illustrating the forced draft means and showing a humidifier on the outlet side of the heat exchanger, and;

Figure 6 is a perspective view of the heat exchanger illustrating portions of the casing broken away to clearly show the construction thereof.

Figure 7 is a side elevation of the air supply valve.

General arrangement

The invention comprises a rectangular casing adapted to be interposed in the flue pipe of a furnace, which furnace has been converted to a gas or oil type heater so that the furnace gases will travel through said rectangular casing and cause heat to be transferred by induction to transversely extending passageways through which air is conducted by means of a blower or other force feed means. The heated air from the rectangular casing is then conducted to one of the rooms of a building for supplying additional heat thereto, which additional heat will raise the temperature of the room and allow the burner control or thermostat therein to be more easily satisfied, thus resulting in a further saving of fuel and the prevention of house overheating. Further, the invention consists of providing thermostatic means in the furnace flue on the outlet side of the heat exchanger for controlling the force draft means so that said forced draft means will cease operation in the absence of heat in the flue pipe below a predetermined degree. It is contemplated that the thermostat operate to cut off the force feed means when the temperature in the flue drops to a predetermined degree dependent upon the operation of the furnace heater so that cold air will be prevented from being forced through the exchanger

and into the room, and the gases will be prevented from being condensed which condensation if allowed would result in deleterious effects and damage to the casing structure through corrosion.

Detailed description

In the drawings, wherein for the purpose of illustrating the invention and wherein like reference characters will be employed to designate like parts throughout the same, the reference character 10 will generally be employed to designate a conventional furnace having a boiler structure coupled to a radiator 11 in a room 12 by means of a pipe 13. The room 12 may constitute a living room of a building above the cellar foundation 14 in which the furnace 10 is usually placed.

The invention is adapted to be applied to heating systems in which the furnace 10 has been converted to a gas or oil fired type and for the purpose of illustration, an oil burner type heater 15 is shown in Figure 1 having a blower 16 supported by a suitable pedestal 17. The blower 16 of the oil burner is controlled by means of a switch mechanism 18 mounted thereon in the form of a relay so that closing of said switch will establish electrical contact with the supply lines 19. A thermostat 20 is located in the room 12 adjacent the radiator 11 and is coupled to the relay switch 18 by line wires 21 so that said thermostat may operate the relay 18 and thereby control the motor blower 16.

In converted furnaces of the above type, the outlet for the burned gases is placed adjacent the top of the furnace and as indicated in Figure 1, includes a flue pipe opening 22 for receiving a flue pipe adapted to be coupled to the stack extending through the foundation wall 14.

The invention includes a heat exchanger generally designated by the reference character 24 and said heat exchanger is shown in detail in Figures 2 to 6 inclusive. The heat exchanger comprises a casing having a bottom wall 25 and a top wall 26 connected by end walls 27 and 28. The end wall 27 is provided with converging portions connecting a circular flue pipe section 29 which is adapted to be inserted in the flue pipe opening 22 of the furnace 10. A damper 30 is interposed in the flue pipe section 29 and is provided with an operating handle 31 so that the damper may be swung on its pivot to control the flow of hot gases to the casing 24. The opposite wall 28 is provided with a tubular section 32 centrally mounted thereon which has its end as at 33 extending into the chimney or smokestack of the building, having communication therewith through the foundation wall 14.

Convergent side walls 35 connect the end walls 27 and 28 as well as the bottom and top walls 25 and 26, and said convergent walls terminate in a circular flange portion 36, further tapered at 35*a*, closed by a perforated end wall 36*a*, providing an opening in the casing for the passage of air currents therethrough. A disk valve 36*b* is rotatably secured to the perforate end wall 36*a* so that the perforation in said walls may be brought into registry to control the volume of air through the air passageway and thereby prevent the flue gases from being cooled to such an extent as to cause damage to the casing structure from the condensation of said flue gases. Monuted on the circular flange 36 is a motor supporting bracket 37 secured in place by means of bolts or the like as at 38 and the upper end of the bracket 37 as at 39 is adapted to support a motor 40 having an armature shaft 41 provided with a fan 42 the hub of which as at 43 is rigidly secured to the armature shaft to rotate therewith. The opposite side wall of the casing as at 44 is provided with a centrally disposed tubular section 45 for connection with a vertical air pipe 46 having an elbow 47 for connection with a hot air register 48 by means of an L-shaped connector 49, the foot portion of which as at 50 extends through the floor 12 of the room so that hot air may be conducted to said room under forced draft from the fan 42.

Mounted within the heat exchanger casing 24 is a pair of oppositely disposed header plates 51 and 52 which are identical in structure and are provided with openings 53 for receiving the ends of flat heat exchanger tubes 54. The tubes 54 are formed from thin sheet metal and provide transverse passageways 55 for conducting air currents through the casing in the direction of the arrows indicated in Figures 5 and 6. The openings 53 provide relatively long spaced header strips 56 for connecting the ends of adjacent tubes to provide hot gas passageways 57 arranged alternately on opposite sides of the passageways 55 and relatively flat plate-like tubes 54. This structure provides for the allowance of heat induction between the passageways 57 and the passageways 55 extending at right angles thereto so that heat exchange will occur and the air forced through the passageways 55 will reach a relatively high temperature upon the outlet side 45. Since the heat conduction surfaces are equal, the air on the exhaust side 45 of the casing will reach a temperature equal to half the temperature of the hot gases combined with the temperature of the air on the inlet side 36 of the casing.

The outlet side 45 of the casing is formed with a humidifier chamber 60 by spacing the header plate 52 from the side wall 54 a sufficient distance as is shown clearly in Figure 3. An opening 61 is formed to one side of the end wall 26 and said opening is preferably formed rectangular in shape for receiving a humidifier trough 62 extending the full width of the humidifier chamber 60. The trough 62 is provided with a marginal upstanding side wall 63 and connecting the upstanding side wall 63 is a ledge portion 64 to which is hinged a cover 65 as at 66. The trough 62 may be inserted in the rectangular opening 61 so that the ledge 64 projects therein to prevent the escape of hot air from finding its way through the trough and to the atmosphere. The humidifier trough may be filled with water by raising the cover 65 and filling the trough to the desired level.

Mounted in the tubular flue section 32 is a thermostatic control member 67 which projects into the casing into the path of the hot gases passing therethrough as indicated in Figure 1. A bushing 68 is formed on the thermostatic member 67 and is provided with a casing 69 in which is located a switch element having contacts 70 which are in series with a source of current supplied through a lead line 71 and connecting the motor 40 by a lead line 72. A lead line 73 is connected to the motor 40 to the opposite side of the power source to complete the circuit.

Mode of operation

For consideration of the operation of the invention, it will be first assumed that the furnace 10 and the burner 16 are inoperative by reason

of the heat in the room 12 satisfying the thermostat 20. Under these conditions, the thermostat 67 will be in a position to maintain the normally open switch 69 in its open position wherein the motor will be at rest as will also be the fan 42. Next, it will be assumed that the temperature in the room 12 drops so that the thermostat 20 will close the circuit through the relay 18 and start the burner 16, whereupon heat will be created in the furnace 10 and the hot products of combustion will pass through the flue section 29 and heat exchanger 24 to the stack 33. When this condition exists, the thermostat 67 will cause the switch in the casing 69 to be closed, thereby energizing the motor 40 and causing a forced draft to be created through the passageways 55 so that heat conducted thereto from the flue gases traversing the passageways 57 will cause said air to be heated and conducted to the humidifier chamber 60 where it is passed over the humidifier tray 62 and thence to the register 48 in the room 12.

In this manner, additional heat is supplied to the room 12 whereby the temperature therein will be raised by the heat from the radiator 11 and also by the heat entering the room through the register 48. Obviously, the room temperature will reach the desired degree more quickly so that the thermostat 20 will be satisfied and cause the relay 18 to cut the burner blower 16 out of the supply line 19 and thereby stop the operation of the furnace and burner 15. When this condition exists, heat from the products of combustion is likewise ended and the temperature in the circular flue section 32 will start to fall so that the switch within the casing 69 will open and cut off the motor 40 and the forced draft operation of the fan 42. The cycle of operation above described will continue to maintain the room 12 at a proper temperature with a smaller consumption of fuel in the burner 15 resulting in a considerable saving of maintenance cost.

It is to be understood that the form of the invention herewith shown and described is taken as a preferred embodiment of the same and that various changes in the shape, size and arrangement of parts may be resorted to without departing from the spirit of the invention or the scope of the subjoined claims.

What I claim is:

1. A heat exchanger comprising a rectangular casing, a plurality of relatively flat air tubes extending transversely through said casing, a plurality of contiguous flue gas passageways formed at right angles to said air tubes, means within said casing on the inlet side of said relatively flat air tubes for creating a forced draft of air therethrough and a humidifier within said casing on the outlet side of said relatively flat air tubes for humidifying the heated air passing from the heat exchanger through said contiguous flue gas passageways.

2. A heat exchanger comprising a rectangular casing having a series of spaced relatively flat passageways for flue gases, a series of relatively flat transversely extending tubes mounted in said heat exchanger forming air passageways therethrough and between said series of spaced relatively flat flue passageways, a blower on one side of the heat exchanger within the casing for creating a forced draft of air through said tubes and a humidifier on the outlet side of said transversely extending air tubes within the casing for humidifying the heated air, said humidifier being located beneath the outlets of the major portion of said air tubes in air contact relation thereto.

3. A heat exchanger comprising a cruciform casing having aligned flue passageways, a series of spaced relatively flat transversely extending tubes mounted in said casing, header plates for the ends of said tubes, the spaces between said tubes being in communication with said flue passageways in the casing and providing flue gas conduits, a blower supported in the casing at the air inlet side of said tubes for creating a forced draft of air through said tubes, a humidifier mounted within said casing at the outlet side of the transversely extending tubes and heat responsive means in the outlet side of the flue passageway responsive to temperature changes within said flue passageway for controlling the blower.

4. A heat exchanger comprising a cruciform casing having aligned flue inlet and outlet pipes, a series of relatively flat transversely extending tubes mounted in the casing between said flue inlet and outlet, header plates having openings for receiving said tubes, a blower within the casing and one of said header plates on the inlet side of the relatively flat transversely extending tubes for creating a forced draft of air through said tubes, a humidifier located within the casing between the other header plate and the outlet side of the relatively flat transversely extending tubes and a thermostatic switch mounted in the direct path of gases in the outlet flue passageway responsive to temperature changes therein for controlling said blower.

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