

Oct. 26, 1971

J. C. GOODGION

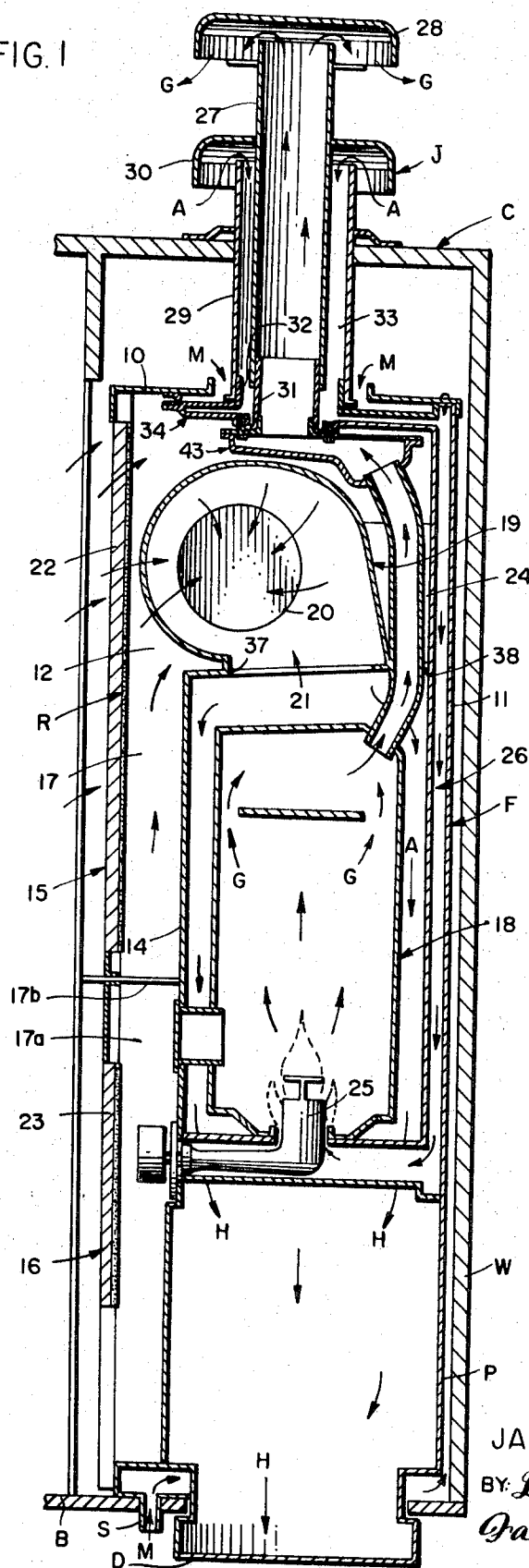
3,614,949

MOBILE HOME FURNACE WITH MAKE-UP AIR SUPPLY MEANS

Filed Feb. 6, 1970

2 Sheets-Sheet 1

FIG. 1



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2 Sheets-Sheet 2

FIG. 2

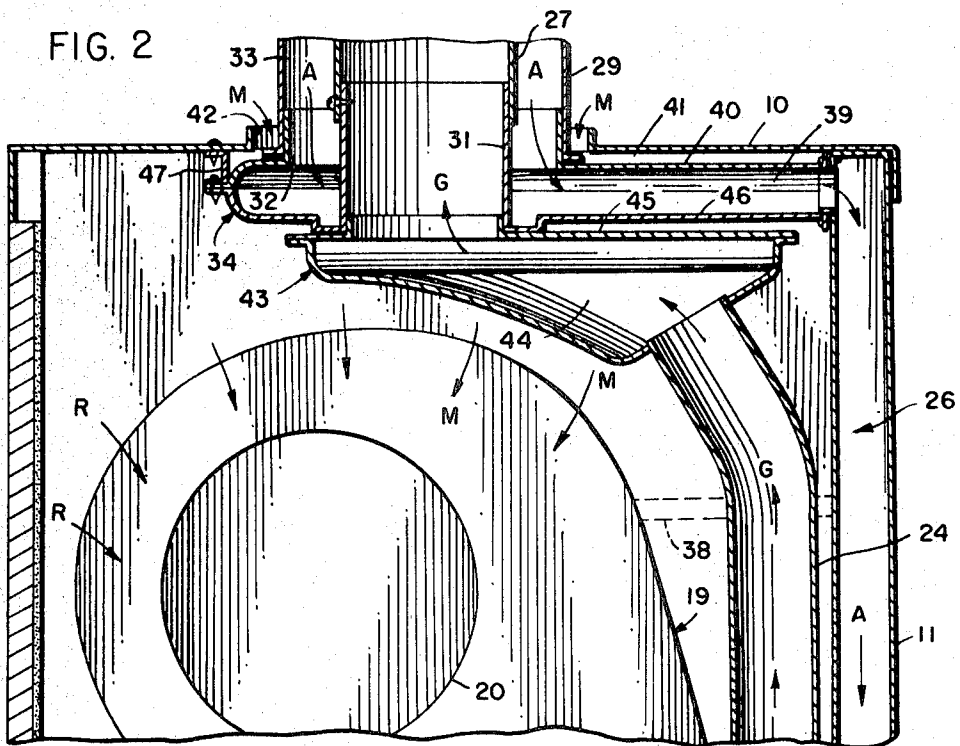


FIG. 4

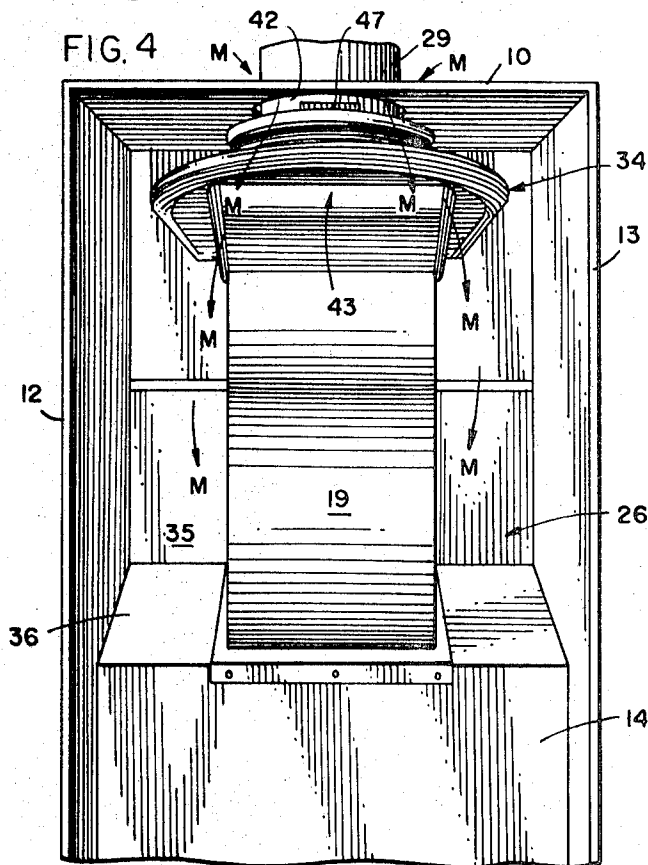
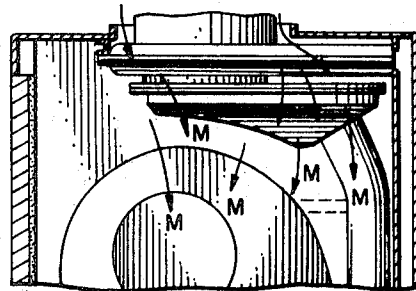


FIG. 3



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MOBILE HOME FURNITURE WITH MAKE-UP AIR SUPPLY MEANS

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5 Claims

ABSTRACT OF THE DISCLOSURE

A compact sealed combustion furnace adapted to be mounted within a closet or alcove of a mobile home, including a downflow air circulator mounted above a combustion chamber casing within an exterior casing, is provided with a make-up air supply means. More specifically, an air box is mounted above the blower and beneath the top wall of the exterior casing, the air box providing a connecting passage between an annular combustion air intake of a roof jack and a combustion air passage extending downwardly along the rear wall of the exterior casing. The top wall of the air box is spaced downwardly and separated from the exterior casing top wall and the sides of the box are spaced inwardly and separated from the exterior casing side walls. The make-up air intake means extends through the top wall of the exterior casing outwardly of the base of the roof jack to communicate with the space between the air box top and the casing top wall. The blower draws make-up fresh air over and around the air box and into the rearward portion of the blower inlets. The incoming make-up air also scrubs a flue box which is positioned below and separated from the air box.

BACKGROUND AND SUMMARY

Gas and oil fired furnaces for use in mobile homes are required to be of the sealed combustion type, that is, the combustion air-flue gas circuit must be separated from and hermetically sealed in relation to the circuit of the air to be heated, including the inside room air and the outside make-up air. As is well known in the art, the combustion air can be supplied through a duct extending to a point beneath the floor of the mobile home, or a concentric roof jack can be employed, the inner pipe of the roof jack serving as a flue and the outer pipe defining an annular chamber for the introduction of combustion air. Both systems have been in widespread use in the United States for many years. This invention is concerned with improvements in the design of top air intake of sealed combustion mobile home furnaces.

More particularly, this invention is directed to certain design problems, which heretofore have not been satisfactorily solved. Where the combustion air is drawn in through an annular passage concentric to the flue pipe, the combustion air may be heated to a temperature requiring objectionably large passages to provide the optimum number of pounds of air per pound of fuel for complete combustion under all fuel input conditions from low to high fire. The enlargement of air intake passage size, however, not only adds to manufacturing cost, but also is limited by installation space requirements. Mobile home furnaces must be very compact since they are required to fit into small closets or alcove spaces of the mobile homes. Accordingly, it is desirable to maintain the incoming combustion air as cool as possible without at the same time increasing unit size or manufacturing cost.

With downflow furnaces the air circulator or blower is mounted in a blower space or compartment above the combustion chamber and radiator casing. Ordinarily,

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this blower is of the squirrel-cage type having intakes on each side. Air is supplied to these intakes through slots or louvers in the front or door side of the furnace, the air being drawn in from the room space adjoining the front of the furnace. The air supplied to the blower therefore tends to be somewhat unbalanced, the rearward of the portion of the blower's intake receiving less of the recirculated air.

Still another related design problem is that the make-up fresh air temperature varies with the outdoor temperature. The make-up air may be cooler than the room air, and can thereby benefit by preheating. Even during maximum outdoor temperatures, however, the make-up air is capable of being preheated, and can thereby be utilized to recover additional heat from the flue gases. The overall heating efficiency can be increased if the make-up air is preheated by heat exchange contact with the exiting flue gases while at the same time avoiding objectionable preheating of the incoming combustion air.

The design features of the present invention substantially overcome the above described problems, and provide the desired operating advantages. Specifically the preheating of the incoming combustion air is minimized while at the same time employing a top air intake, the supply of air to the blower is improved, and at the same time the incoming make-up air is preheated without correspondingly preheating the combustion air. The resulting composite design is therefore adapted for use in a compact sealed combustion top air intake mobile home furnace and which can be manufactured at minimum cost and installed in restricted closet or alcove spaces of mobile homes.

THE DRAWINGS

This invention is shown in an illustrative embodiment in the accompanying drawings wherein:

FIG. 1 is a side sectional elevational view of a mobile home furnace incorporating the design features of the present invention;

FIG. 2 is a fragmentary enlarged sectional view of the upper portion of the furnace of FIG. 1;

FIG. 3 is a fragmentary sectional view similar to FIG. 2, except that the flue tube, flue box, flue jack and combustion air box are shown in elevation rather than section for greater clarity of illustration of the make-up air flow over and around the combustion air and flue boxes; and

FIG. 4 is a fragmentary front perspective view of the upper portion of the furnace.

DETAILED DESCRIPTION

Looking first at FIG. 1, there is shown a compact sealed combustion furnace F which is mounted within a closet or alcove, such as would be provided by a mobile home manufacturer for housing the furnace. As shown, the closet has a wall W, a base or floor B and a ceiling C. The atmosphere exterior to the trailer is accessible through the base B or the ceiling C.

For installation and use of the furnace F, there is provided a concentric roof jack J which extends through the ceiling C, and a heated air distribution duct D which extends through and runs below the floor B. There is also provided a make-up air intake chute S.

In FIG. 1, the air and flue gas flows are indicated by arrows and letters. The arrows R represent the room air which is supplied to the heater and returned to the interior space of the mobile home as heated air H through the duct D.

The hot combustion or flue gases are indicated by the arrows G, and are shown as exiting to the atmosphere at the top of the flue jack J. The combustion air A is shown

entering the flue jack at an intermediate level and passing downwardly for combustion of the oil or gas.

The furnace F has an exterior casing including a top wall 10 a rear wall 11 and side walls 12 and 13 (FIG. 4). The front of the casing is closed by a wall 14 including 5 louvered doors or panels 15 and 16, the space between wall 14 and the door panel 15 comprising a vestibule 17, separated from the lower vestibule space 17 or by a partition 17b.

Within the exterior casing as enclosed by the walls 10, 11, 12, 13 and 14, there is mounted a combustion chamber providing casing 18. As shown, the walls of casing 18 are in spaced relation to the walls of the exterior casing.

An air circulating blower 19 is mounted above the top of the combustion chamber casing 18. Preferably, as shown, air circulator 19 is a squirrel-cage blower having 15 side air intakes 20 and bottom air outlet 21. The inlets 20 communicate with the air space in the upper portion of the exterior casing, and outlet 21 is arranged to direct the air to be heated over and around the combustion chamber 20. Room air inlet means, comprising the louvers 22, admits the room air to be heated through the vestibule 17 and the space surrounding the blower 19 for introduction into the blower intakes 20. As previously explained, the louvers 22 are in the front side of the exterior casing, 25 and communicate with the air within the mobile home. The louvers 23 admit room air to lower vestibule space 17a to prevent overheating of this space.

The furnace also includes flue gas exhaust passage means extending upwardly from the combustion chamber. In the illustration given, this means comprises the flue tube 24 which extends from the rear top portion of the combustion chamber casing 18 along the rear of the air circulator 19. As an alternative to the single combustion chamber 18 and the single flue tube 25, multiple combustion chambers and flue tubes can be employed. As shown, combustion chamber 18 is equipped with a gas burner 25, of a conventional type, but an oil burner can also be used, or an oil or gas gun-type burner. Whatever the fuel source or burner, it is necessary to supply combustion air to the burner through 40 a hermetically sealed combustion air intake passage.

In the illustration shown, the combustion air is supplied to burner 25 through a downwardly extending duct 26, which runs along casing rear wall 11. As shown, the flue tube 24 extends upwardly between the front of duct 45 26 and the rear of blower 19.

The concentric pipe means or flue "jack" J includes an inner flue pipe 27 terminating in a cover or cap 28 and an outer pipe or jacket 29 terminating in an intermediate cover or cap 30. As shown, the base of roof jack J extends through wall 10 to the air box 34, the flue pipe 27 and the outer pipe 29 respectively connecting with collars 31 and 32. The flue pipe 27 communicates with the flue tube 24 for exhausting the flue gases beneath the cover 28, and the annular space 33 defined by outer pipe 29 55 communicates with the combustion air intake duct 26.

The novel features of the present invention will now be described with particular reference to the second sheet of drawings, comprising FIGS. 2, 3 and 4.

In accordance with the present invention, a horizontally-extending air box 34 is mounted in the upper portion of the exterior casing, which in effect provides a blower compartment 35. The blower 19 is removably mounted on a transverse wall 36 which has a central opening 37 therethrough aligned with the blower outlet 21. Toward 65 the rear, the wall 36 can be extended to chute 26 to partially or completely close the space around the flue tube 25 by partition strip or baffle 38. If desired, the seal or baffle 38 can be located at a higher level, as indicated by the dotted lines 38.

The air box 34 provides the collar 32 which connects with the outer pipe 29 of the roof jack. It also provides a horizontally extending passage 39 which connects with the upper end portion of the combustion air intake duct 26. For the purpose of the present invention, it is essential

that the top wall 40 of the air box 34 be spaced downwardly and separated from the top wall 10 at the exterior casing. Also, as shown more clearly in FIG. 4, the sides of the air box 34 are spaced inwardly and separated from the side walls 12, 13 of the exterior casing. This construction provides an air flow space 41 above the flue box 34 which communicates around the sides of the flue box with the blower compartment 35 and the blower air intakes 20.

For cooperation with the air space 41, there is provided a make-up fresh air intake 42 extending through the top wall 10 outwardly of the base of the roof jack J. The intake 42 communicates with the space 41 between the air box top 40 and the casing top wall 10. With this construction, the blower 19 draws the make-up fresh air (indicated by the arrows M) over and around the air box 34 and into the rearward portion of the blower side inlets 20. In other words, the incoming make-up or fresh air scrubs the top and sides of the air box and thereby assists in maintaining the incoming combustion air at a minimum temperature.

In the preferred embodiment shown, the air intake 42 is in the form of an annular slot extending substantially entirely around the outer pipe 29. It will be apparent therefore, that this construction requires only that the opening through the top wall 10 for the roof jack J be made oversize, an annular clearance being provided around the outside of the roof jack, when it is installed, as shown in the drawings. By utilizing the annular slot opening, the incoming make-up air is distributed uniformly, flowing over and around the air box 34 to achieve a uniform flow of air to both sides of the blower 19.

In accordance with the present invention, there is also preferably provided a horizontally-extending flue box 43. As shown, the flue box 43 is mounted beneath the air box 34 and above the blower 19. The flue box provides a connecting passage 44 between the flue 27 and the flue tube 24. Preferably, the top wall 45 of the flue box is spaced downwardly, and at least along most of its length, is separated from the bottom wall 46 of the air box. As shown more clearly in FIG. 4, the sides of flue box 43 are spaced inwardly and separated from the sides 12, 13 of the exterior casing. With this arrangement, conductive transfer of heat between the flue box 43 and the air box 34 are minimized, and the incoming make-up air after scrubbing the air box, flows over the flue box and also over the upper portion of the flue tube 24, thereby recovering additional heat from the flue gases.

Various means can be employed for mounting and supporting the air box and flue box. In the illustration given, the rear end of the flue box is supported at its juncture with the duct 26, while its forward end is supported by a bracket 47. The flue box 43 can be supported by rigid mounting on the upper end of flue tube 24. For example, the combustion chamber casing 18, the flue tube 24, and the flue box 43 can be assembled by welding, permitting installation and removal as a unitary assembly.

The operation of the furnace will be largely apparent from the foregoing disclosure. The make-up air M can be drawn in through the floor B by means of chute S, passing around the sides of the deck into the closet space P which forms a passage around the sides and rear of the exterior casing of the heater. The make-up air flows upwardly being warmed as it rises, and is drawn in through the annular inlet 42, scrubbing the air box 34 and the flue box 43, as previously described before entering the rearward portions of the blower inlets 20. The rest of the operation of the heater takes place as already described.

I claim:

1. A compact sealed combustion furnace adapted to be 70 mounted within a closet or alcove space of a mobile home, said furnace having an exterior casing including top, rear and side walls, combustion chamber providing casing means mounted within said exterior casing in spaced relation to said walls, an air circulating blower mounted in the upper portion of said exterior casing above the top

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of said combustion chamber providing means, said blower having inlet means on the sides thereof communicating with said upper portion and an outlet directing the air to be heated over and around said combustion chamber providing means, room air inlet means communicating with said upper portion through the front of said exterior casing, combustion air intake passage providing means extending downwardly along said rear wall, flue gas exhaust passages providing means extending upwardly from said combustion chamber providing means between the rear of said air circulating means and the front of said combustion air passage providing means, and concentric pipe means having a base portion extending through said top wall, said pipe means providing an inner flue communicating with said flue gas passage means and an outer annular air intake communicating with combustion air passage means, wherein the improvement comprises:

- (a) a horizontally-extending air box mounted in said upper portion above said blower and beneath said top wall, said air box providing a connecting passage between said annular air intake and said combustion air passage, the top wall of said box being spaced downwardly and separated from said exterior casing top wall and the sides of said box being spaced inwardly and separated from said exterior casing side walls; and
- (b) make-up fresh air intake means extending through said top wall outwardly of the said base of said pipe means and communicating with the space between said air box top and said casing top wall;

whereby said blower draws make-up fresh air over and around said air box into the rearward portion of said blower side inlet means.

2. The furnace of claim 1 in which said fresh air intake means is in the form of an annular opening extending substantially entirely around said pipe means base.

3. The furnace of claim 1 in which a horizontally-extending flue box is provided beneath said air box and above said blower, said flue box providing a connecting passage between said flue and said flue gas passage means, the top wall of said flue box being spaced downwardly and separated from the bottom wall of said air box and the sides of said flue box being spaced inwardly and separated from the sides of said exterior casing, whereby said make-up air also flows over and around said flue box.

4. A compact sealed combustion furnace adapted to be mounted within a closet or alcove space of a mobile home, said furnace having an exterior casing including top, rear and side walls, combustion chamber providing casing means mounted within said exterior casing in spaced relation to said walls, an air circulating blower mounted in the upper portion of said exterior casing above the top of said combustion chamber providing means, said blower having inlet means on the sides thereof communicating with said upper portion and an outlet directing the air to be heated over and around said combustion chamber providing means, room air inlet means communicating with

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said upper portion through the front of said exterior casing, combustion air intake passage providing means extending downwardly along said rear wall, flue gas exhaust passage providing means extending upwardly from said combustion chamber providing means between the rear of said air circulating means and the front of said combustion air passage providing means, and concentric pipe means having a base portion extending through said top wall, said pipe means providing an inner flue communicating with said flue gas passage means and an outer annular air intake communicating with combustion air passage means, wherein the improvement comprises:

- (a) a horizontally-extending air box mounted in said upper portion above said blower and beneath said top wall, said air box providing a connecting passage between said annular air intake and said combustion air passage, the top wall of said box being spaced downwardly and separated from said exterior casing top wall and the sides of said box being spaced inwardly and separated from said exterior casing side walls;
- (b) an annular opening extending substantially around said pipe base means communicating with the space between said air box and said casing top wall for the admission of make-up fresh air, and
- (c) a horizontally extending flue box mounted beneath said air box and above said blower, said flue box providing a connecting passage between said flue and said flue gas passage means, the top wall of said flue box being spaced downwardly and separated from the bottom wall of said air box and the sides of said flue box being spaced inwardly and being separated from the side of said exterior casing;

whereby the air drawn inwardly through said annular opening by said blower scrubs said air box and said flue box.

5. The furnace of claim 4 in which room air inlet means extends substantially the full height of the front of said exterior casing, and vertically-extending vestibule means provides a connecting passage to the forward portions of said blower inlet means.

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CHARLES J. MYHRE, Primary Examiner

U.S. Cl. X.R.

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