United States Patent

[11] 3,601,116

[72] Inventors **Richard L. Davis;**
James C. Goodgion, both of Wichita, Kans.

[21] Appl. No. **9,264**
[22] Filed **Feb. 6, 1970**
[45] Patented **Aug. 24, 1971**
[73] Assignee **The Coleman Company, Inc.**
Wichita, Kans.

[54] **MOBILE HOME FURNACE WITH AIR CIRCULATOR OUTLET MEANS**
10 Claims, 7 Drawing Figs.

[52] **U.S. Cl.** ..... **126/110 AA, 126/85 B, 126/116 B**
[51] **Int. Cl.** **F24h 3/02**
[50] **Field of Search** ..... 126/85 B, 90, 91, 110, 110 AA, 110 B, 116, 116 B, 307

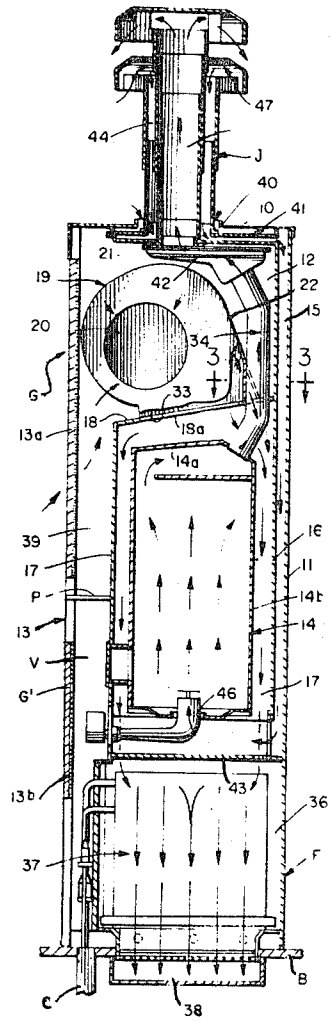
[56] **References Cited**

UNITED STATES PATENTS

2,942,600	6/1960	Heiman	126/110 AA
3,171,400	3/1965	Heiman	126/116 X
3,359,966	12/1967	Thomas	126/110 AA

Primary Examiner—Charles J. Myhre
Attorney—Dawson, Tilton, Fallon & Lungmus

ABSTRACT: A compact sealed combustion furnace adapted to be mounted within a closet or alcove of a mobile home is equipped with a downflow air circulator or blower characterized by auxiliary air outlet means oriented to direct the air discharged therefrom, first against one or more flue connection tubes, and then downwardly into the space between the combustion chamber casing and the rear wall of the exterior casing. The auxiliary air means may include passage-defining extensions on each side of the rear wall of the blower scroll, which are arranged to at least partially straddle the flue connection tube means. One or more slots can also be provided in the rear wall of the blower scroll in combination with or instead of the passage-defining extensions. In one preferred embodiment, a plurality of flue connection tubes are employed in combination with a plurality of transversely aligned slots in the rear wall of the blower scroll, the slots being oriented to direct air against and around the flue tubes.



PATENTED AUG 24 1971

3,601,116

SHEET 1 OF 2

FIG. 1

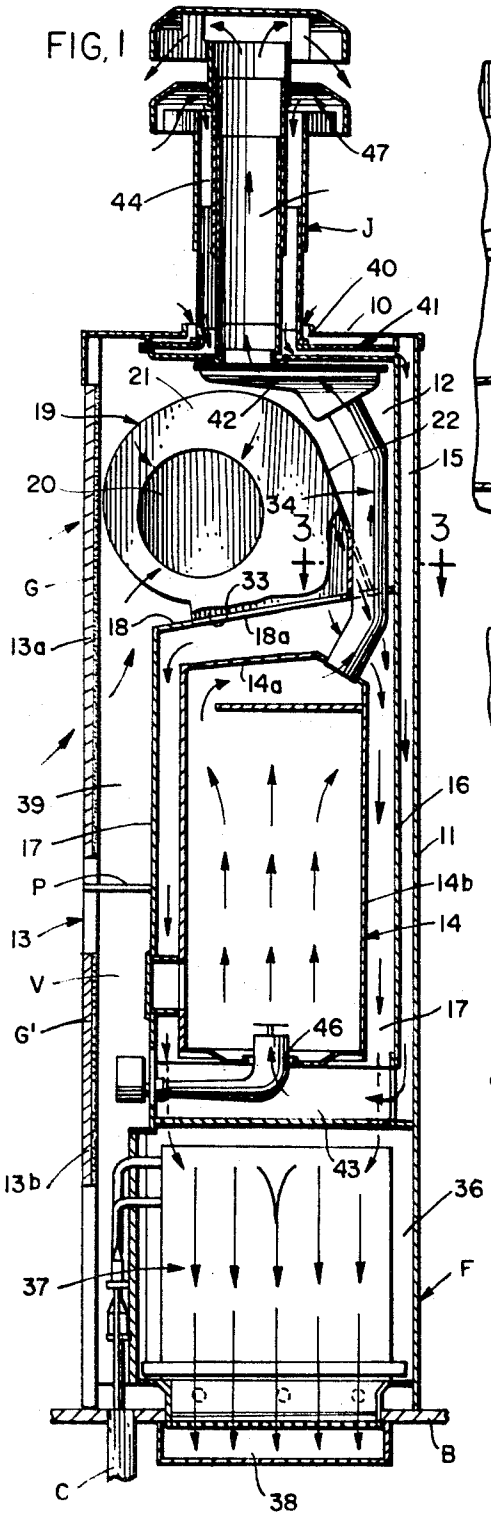


FIG. 2

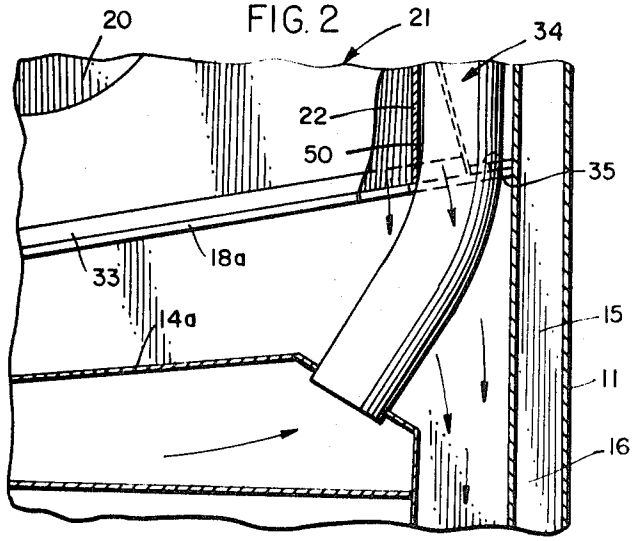


FIG. 3

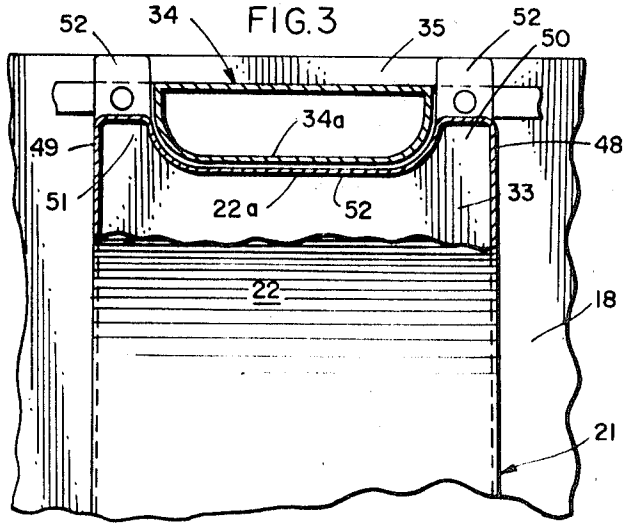
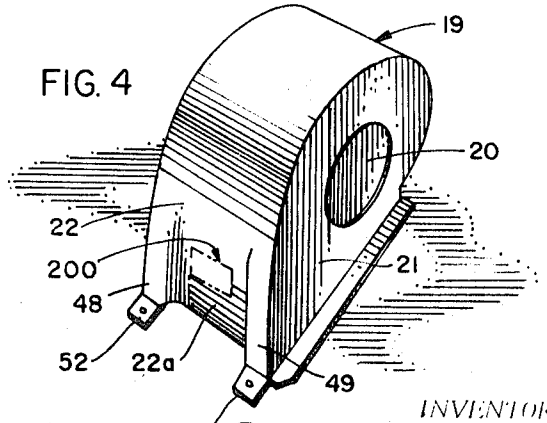


FIG. 4



INVENTORS:
RICHARD L. DAVIS
JAMES C. GOODGION

BY: Dawson, Tilton, Fallon & Lungren
ATT'YS

FIG. 5

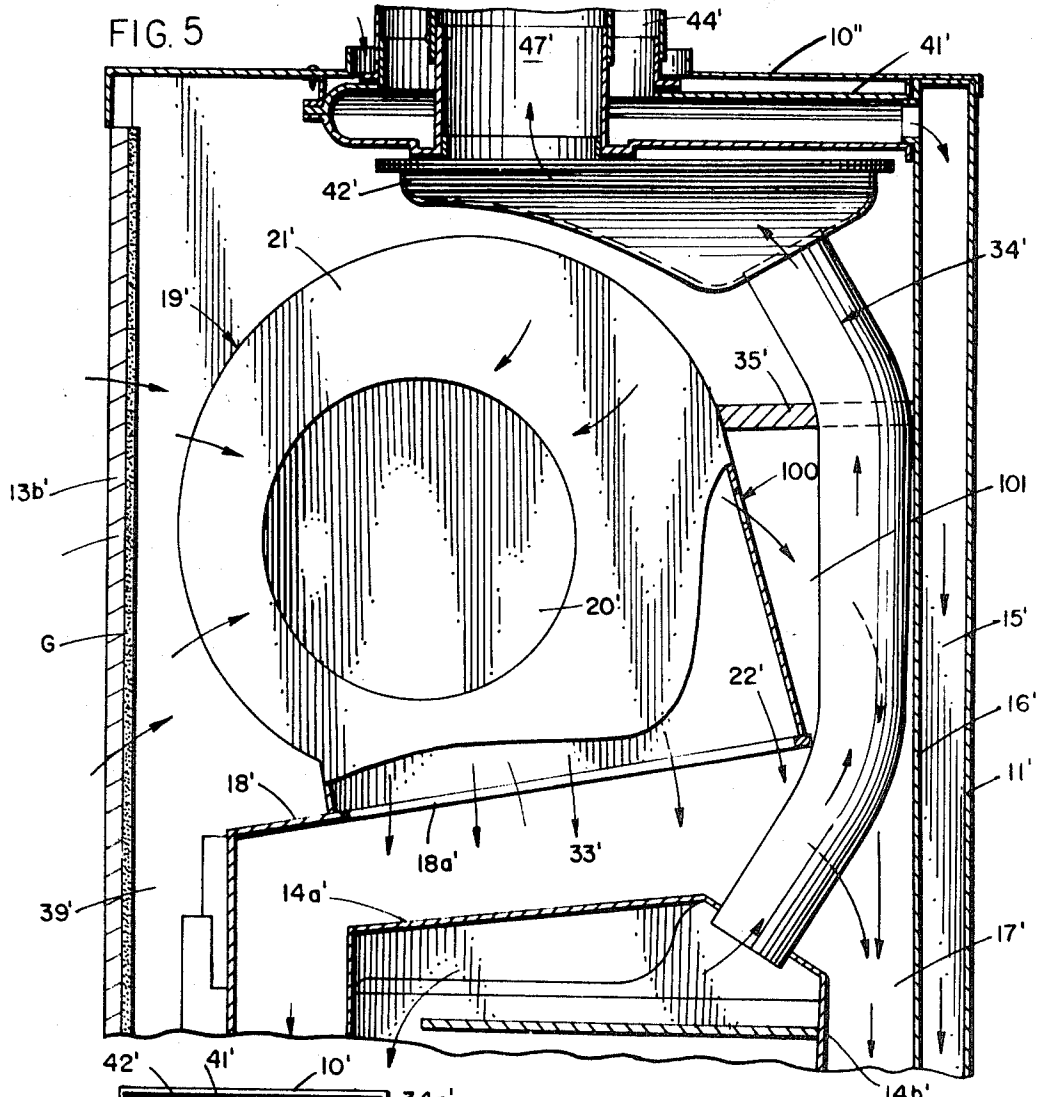


FIG. 6

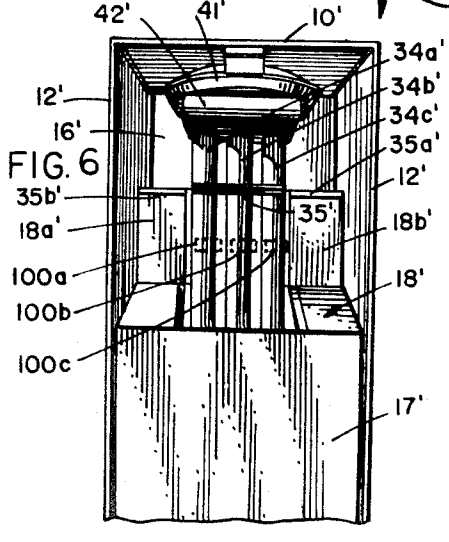
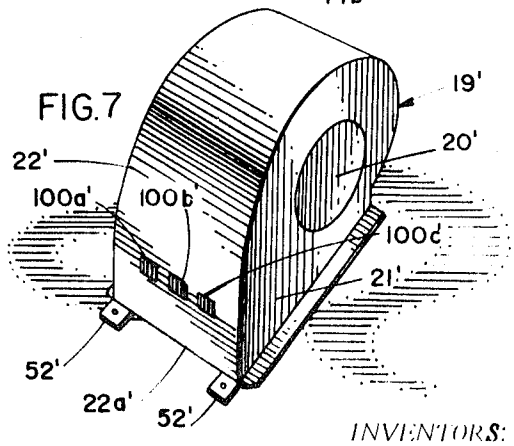


FIG. 7



INVENTORS:
RICHARD L. DAVIS
JAMES C. GOODGION

BY: Dawson, Tilton, Fallon & Lungren
ATT'YS

MOBILE HOME FURNACE WITH AIR CIRCULATOR OUTLET MEANS

BACKGROUND AND SUMMARY

Forced draft, downflow, sealed combustion furnaces for mobile homes are in widespread use in the United States. Usually, the exterior casing in its upper portion provides a blower compartment which receives a squirrel cage blower, having a bottom outlet directing air downwardly over a combustion chamber and radiator casing. The combustion chamber casing is spaced from the walls of the exterior casing to provide downflow air passages at the sides, rear, and front. The heated air is removed through a duct connected to the bottom of the exterior casing for supply to the room space of the mobile home. The air to the blower is primarily recirculated room air, but may also include makeup fresh air from outside the mobile home. The circuit for the combustion air intake and the flue gas exhaust is hermetically sealed from the circuit of the air to be heated. The combustion air can be taken in from beneath the floor and supplied to the burner through a sealed duct; or a concentric-type roof jack can be used, the combustion air being admitted through an annular space around the flue and passed downwardly through a sealed duct to the burner.

With such downflow mobile home furnaces, design problems are encountered because of the desire to obtain maximum heating efficiency while minimizing manufacturing costs. These design problems are further complicated by the necessity of limiting the exterior dimensions of the furnaces, which must fit into small closet or alcove spaces of mobile homes. Where the air circulator or blower is located above the combustion chamber casing, it is necessary to provide flue extension or connection tubes from the top of the combustion chamber casing to the flue. Since the flue connection tubes, which may be in the form of a single pipe or of a plurality of pipes, must extend through the blower compartment, they may cause objectionable heating of the interior of the blower compartment. While some preheating of the air supplied to the blower is desirable, excessive heating of the blower compartment can cause overheating of the door side of the furnace, which will usually include air filter elements, that must be kept below a certain maximum temperature. It is common to equip such furnaces with thermoswitches which shut off the burner of the furnace before the air intake filters exceed a maximum temperature. A related design problem which must be considered is the need to maximize the heating efficiency. It is desirable to recover additional heat from the flue gases after they leave the combustion chamber, providing this can be accomplished without overheating the blower compartment.

Because of installation space limitations, the maximum permissible depth of the exterior heater casing may require a relatively narrow or constricted airflow passage between the rear wall of the combustion chamber casing and the rear wall of the heater. This space can be even more constricted where a combustion air intake duct is provided along the rear wall of the heater, as may be desirable when the combustion air is supplied from a concentric-type roof jack. Consequently, this is another design consideration which relates to the maximizing of furnace efficiency.

The foregoing problems are substantially overcome, and the desired advantages are obtained by the present invention. More specifically, the blower is provided with an auxiliary air outlet which directs the air discharged therefrom first against the flue connection tubes and then downwardly into the space between the combustion chamber casing and the rear wall of the exterior casing. The auxiliary air in one embodiment is directed around the base of the flue tube (or tubes), and in another embodiment the auxiliary air is directed against the flue tubes at a higher level. The higher level outlet has the advantage of providing a greater limitation on the air temperature within the blower compartment, and it also provides for a longer heat exchange contact between the auxiliary air and the flue tubes. However, the lower position auxiliary air outlet, as will subsequently be described in detail herein, not only removes additional heat from the flue gas, but also greatly increases the velocity and volume of airflow through the rear air heating space. Where needed, therefore, both the intermediate and lower level auxiliary air outlets can be employed together.

THE DRAWINGS

The present invention is shown in illustrative embodiments in the accompanying drawings in which

FIG. **1** is a sectional elevational view of a mobile home furnace incorporating the blower auxiliary air outlet means of the present invention in one of its embodiments;

FIG. **2** is an enlarged fragmentary sectional view illustrating the auxiliary air outlet means of the heater of FIG. **1**;

FIG. **3** is an enlarged fragmentary sectional plan view taken on line **3**—**3** of FIG. **1**;

FIG. **4** is a perspective view of the blower casing or scroll, showing the modified rear wall construction as employed in the embodiment of the preceding figures;

FIG. **5** is an enlarged fragmentary sectional elevational view, showing a modification of the auxiliary air outlet means;

FIG. **6** is a front elevational view of the heater of FIG. **5** illustrating the relation of the auxiliary air outlet slots to the flue connection tubes; and

FIG. **7** is a perspective view of the blower casing or scroll of FIGS. **5** and **6**.

DETAILED DESCRIPTION

Looking first at FIG. **1**, there is shown a mobile home furnace F, which is mounted on a floor or base B, and which is utilized with a through-the-floor makeup air intake chute C and a through-the-roof concentric flue jack J. The ceiling and walls providing the alcove or closet space of the mobile home are not shown, but it will be understood that they will be utilized.

In general, the furnace includes an exterior casing having a top wall **10**, a rear an **11**, sidewalls **12**, and a front which is closed by a door assembly **13**, providing louver panels **13***a* and **13***b*. Lower panels **13***a* may include a filter element G. Within the heater is a combustion chamber and radiator casing **14** having a top wall **14***a* and a rear wall **14***b*. A combustion air intake duct **15** extends downwardly along rear wall **11**, being closed at its front by wall **16**. A downflow passage **17** for the air to be heated is provided between the walls **14***b* and **16** in the embodiment shown. However, it will be understood that if the combustion air is supplied from beneath the floor, the downflow air passage **17** will be provided between walls **14***b* and **11**. The front downflow air passage is provided between the front of the combustion chamber **14** and the closure wall **17**. At the sides, the downflow air passages are provided between the sidewalls of combustion chamber **14** and the walls **12** of the exterior casing. The top of the compartment enclosing the combustion chamber is provided by the inclined transversely extending wall **18**. Above the wall **18** within the upper portion of the exterior casing is provided a compartment for receiving the air circulator or blower **19**. Blower **19** is of the squirrel cage type having side air intakes **20** which extend through the outer casing or scroll **21**. The blower **19** provides a rear wall **22** against which air is directed by the action of the squirrel cage, and a bottom outlet **23** which is positioned on wall **18** in line with an opening **18***a* therein. As shown in FIGS. **1**–**3**, the wall **18** extends to the wall **16** around the flue tube **34**. To the rear of the flue tube, an extension of the wall **18** can be provided in the form of a filler or closure plate **35**. In the base of the exterior casing there is provided a compartment **36** for optionally receiving an air cooling unit **37**, which is positioned in the path of airflow to the distribution duct **38**.

In the operation of the furnace, room air to be heated is drawn in through the upper louver panels **13***a*, passing through the vestibule space **39** to the blower intakes **20**. Partition P separates the lower vestibule space V, which is ventilated by lower panel **13***b*. Makeup fresh air can also be supplied through the chute C passing upwardly within the closet space outwardly of the rear wall **11** and the sidewalls to an annular air intake **40** around the base of the flue jack J, the incoming makeup air flowing over and around the combustion air box **41** and the flue box **42**, as it flows to the rearward sides of the blower intakes **20**. The combined room air and makeup air is discharged from the blower through the bottom outlet **33**, and flows downwardly over and around the combustion casing **14**, including the rear space **17**. The heated air then flows around the sides of the cross duct **43**, and then through the compartment **36** to the distribution duct **38**.

The combustion air is taken in through the annular passage **44** of the roof jack, is passed through the interior of the air box **41** to the duct **15**, which communicates at its lower end with the cross duct **43**. From duct **43**, the air is supplied to the burner **46**. Burner **46** is illustrated as a gas burner, but it will be understood that other types of burners can be utilized, including oil burners. The hot flue gases pass upwardly within the combustion chamber casing **14**, and enter the flue connection tube **34**. As shown, the tube **34** is connected to the upper rear portion of the combustion chamber casing **14**, extends upwardly between casing rear wall **11** and the rear wall **22** of the blower casing to a point at which it connects with the flue box **42**. At its forward end, the box **42** connects with the flue passage **47**.

It will be understood that the cooling unit **37** can be operated alternatively to the burner **46**, that is, when the burner **46** is not in operation, the blower **19** will still direct air downwardly through the airflow passages around the casing **14** and into the compartment **36** for flow over the cooling coils of the cooling unit **37**. Cooled air will thereby be delivered to the duct **38**. While the use of a cooling unit is optional, the construction of the present invention has the advantage of increasing the overall velocity and volume of air delivered to the compartment **36**, thereby the heating features of the present invention also cooperate to provide the desired airflow during the cooling cycle of the furnace unit.

The distinctive features of the present invention will now be described with respect to each of the three embodiments shown in the drawing; namely, the embodiment of FIGS. **1–4**, the combination embodiment indicated by dotted lines in FIG. **4**, and the alternate embodiment of FIGS. **5** to **7**.

As shown more clearly in FIGS. **2–4**, the auxiliary air outlet means can be provided by shaping the rear wall **22** of the blower scroll **21** to provide passage-defining extensions **48** and **49**. As shown in FIG. **3**, the extensions **48** and **49** partially straddle the flue tube **34**, and interiorly, respectively, provide the auxiliary air passages **50** and **51** which directs air against and around the flue tube **34**. In the embodiment of FIGS. **1–4**, the flue connection means **34** comprises a single flattened flue pipe which extends between the extensions **48** and **49**. If desired, the front wall **34***a* of the flue tube can be curved to correspond with the curvature of the lower concave portion **22***a* of the scroll front wall, but preferably a clearance or space **52** is provided between the walls **22***a* and **34***a*, as shown in FIG. **3**. In this construction, the single flue tube **34** functions as a full-width heat saver. Air is directed against the front **34***a* of the flue tube through the regular blower outlet **34**, and against the outer corners and sides of the flue tube by the auxiliary passages **50** and **51** (FIG. **3**).

The blower **19** can be removably mounted on the wall **18** by means of suitable mounting tabs **52**, which as indicated in FIGS. **3** and **4**, can be located at each of the lower four corners of the blower scroll **21**.

In the alternate embodiment of FIG. **5** to **7**, corresponding parts are given the same numbers except that the numbers are primed.

Instead of being shaped to provide the passage-defining extensions **48** and **49**, as described with respect to the embodiments of FIGS. **2–4**, the rear wall **22'** has its intermediate portion provided with air outlet slot means designated generally by the number **100**. As indicated by the flow arrows in FIG. **5**, part of the air flowing downwardly along the inside of wall **22'** is diverted through the slot means **100**, flowing outwardly at high velocity against and around the flue tube means **34'**, and then downwardly into the airflow space **17'**. As indicated in FIG. **6**, the slot means **100** can be provided in the form of a plurality of slots in generally transverse alignment across the rear wall of the scroll at a spaced distance above the bottom thereof. For example, as indicated in FIGS. **6** and **7**, the slot means can comprise slots **100***a*, **100***b* and **100***c*. It will be understood that the dotted lines of FIG. **6** merely indicate the relative positions of the slots, which are horizontally aligned at the level indicated in FIG. **5**. While flue tube means **34'** can comprise a single flue tube, as described with respect to the embodiments of FIGS. **1–4**, a plurality of flue tubes is preferred. As shown in FIG. **6**, flue tube means **34'** can comprise the separate flue tubes **34***a'*, **34***b'* and **34***c'*. With this construction, it is desirable to arrange the slots **100***a*, **100***b* and **100***c* to direct the auxiliary air against and around all of the flue tubes.

With the embodiment of FIGS. **5** to **7**, the blower mounting wall **18'** at its rear is provided with upward extensions **18***a'* and **18***b'*, and the filler or closure plate **35'** is moved to a higher level, as shown in FIG. **5**. Filler plate **35'** can be designed to fit snugly around the flue tubes **34***a'*, **34***b'* and **34***c'*. On each side of filler plate **35'** there can be provided rearwardly extending wall portions **35***a'* and **35***b'*, as indicated in FIG. **6**. This construction provides a passage **101** surrounding the intermediate portions of the flue tubes **34'** through which air can flow from the slot means **100**. As indicated in FIG. **5**, after flowing in heat exchange relation with the tubes **34'**, the auxiliary air flows downwardly into the passage **17'** between the rear wall **14***b'* of the combustion chamber casing and the wall **16'**. As indicated, air also enters this space from the regular blower outlet opening **33'**.

Looking now at FIG. **4**, there is indicated in dotted lines a further modification of the blower scroll to provide combination auxiliary air outlet means; namely a slot means **200** in combination with the passage means **48** and **49**. In other words, the blower **19** has its rear wall **22** modified to incorporate both the previously described passage defining extensions and the slot means. This combination construction can be most advantageously employed with the single flue tube configuration of FIGS. **1–4**. Alternatively, however, the single flue tube **34** can be replaced by multiple flue tubes, such as two separate flue tubes, providing the tubes can be fitted into the space between extensions **48** and **49**.

With this combination, auxiliary air will be directed out of the slot means **200** below a filler plate, such as the plate **35'** of FIG. **5**, against the intermediate portion of the flue tube means, and will flow downwardly around the flue tube means. At the level of the passage-defining extensions **48** and **49**, additional auxiliary air will be directed against and around the flue tube means, the passage extensions **48** and **49** being arranged to partially straddle the flue tube means, as previously described with respect to the single flue tube embodiment of FIGS. **1–4**. The combined auxiliary air streams will then be directed downwardly into the airflow space **17**.

With the combination embodiments of FIG. **4** as well as the embodiment of FIGS. **5** to **7**, there is a further advantage in maintaining the blower compartment at a lower temperature than where the flue tubes extend through the compartment for a greater portion of their length. By maintaining the blower compartment at a lower temperature, heating of the air intake filters can be minimized. As is well known in the art, replaceable filter means can be mounted immediately inwardly of the louver openings for the room air, such as the louver panel **13***a*. As indicated in FIG. **1** and also in FIG. **5**, the filters G are positioned so that the incoming air flows through the filters, as it

enters the vestibule 39 or 39' on its way to the blower intakes 20'.

We claim:

1. A compact sealed combustion furnace adapted to be mounted within a closet or alcove of a mobile home, said furnace having an exterior casing including top, rear and sidewalls, flue means extending through said top wall, combustion chamber providing casing means mounted within said exterior casing in spaced relation to said walls, the upper portion of said exterior casing above the top of said combustion chamber casing means providing a blower compartment, room air inlet means communicating with said blower compartment through the front of said exterior casing, flue connection tube means communicating with said combustion casing means and extending upwardly from the top rear portion thereof through the rearward portion of said blower compartment, passage providing means extending between the upper portion of said flue tube and said flue means, a squirrel cage blower mounted in said blower compartment including a scroll casing having air intake means on its sides communicating with said blower compartment and a bottom air outlet for directing air over and around said combustion chamber casing, wherein the improvement comprises providing auxiliary air outlet means for said blower, said auxiliary air outlet means being associated with the rear wall of said blower and being oriented to direct the air discharged therefrom first against said flue tube means and then downwardly into the space between said combustion chamber casing means and the rear wall of said exterior casing.

2. The furnace of claim 1 in which said auxiliary air means includes shaping said scroll rear wall to provide passage defining extensions on each side thereof which at least partially straddle said flue tube means.

3. The furnace of claim 1 in which said auxiliary air means includes providing said scroll rear wall with at least one slot therethrough.

4. The furnace of claim 3 in which a plurality of said slots are provided in generally transverse alignment across said scroll rear wall at a spaced distance above the bottom thereof.

5. The furnace of claim 1 in which a plurality of said flue connection tubes are provided.

6. The furnace of claim 1 in which said auxiliary air means includes scroll passage defining extensions on each side of said scroll rear wall which at least partially straddle said flue tube means, and at least one slot through said rear wall at a spaced distance above said passage defining extensions.

7. The furnace of claim 6 in which said flue tube means comprises a plurality of flue connection tubes.

8. A compact sealed combustion furnace adapted to be mounted within a closet or alcove of a mobile home, said furnace having an exterior casing including top, rear and sidewalls, flue means extending through said top wall, combustion chamber providing casing means mounted within said exterior casing in spaced relation to said walls, the upper portion of said exterior casing above the top of said combustion chamber casing means providing a blower compartment, room air inlet means communicating with said blower compartment through the front of said exterior casing, a plurality of flue connection tubes communicating with said combustion casing means and extending upwardly from the top rear portion thereof through the rearward portion of said blower compartment, passage providing means extending between the upper portions of said flue tubes and said flue means, a squirrel cage blower mounted in said blower compartment including a scroll casing having air intake means on its sides communicating with said blower compartment and a bottom air outlet for directing air over and around said combustion chamber casing, wherein the improvement comprises providing auxiliary air outlet means for said blower, said auxiliary outlet means including at least one slot extending through the rear wall of said scroll at a distance above the bottom thereof, said slot being oriented to direct the air discharge therefrom towards flue tubes and then downwardly into the space between said combustion chamber casing means and the rear wall of said exterior casing.

9. The furnace of claim 8 in which a plurality of said slots are provided in generally transverse alignment across said scroll rear wall in opposing relation to said flue tubes for directing air against and around all of said flue tubes.

10. A compact sealed combustion furnace adapted to be mounted within a closet or alcove of a mobile home, said furnace having an exterior casing including top, rear and sidewalls, flue means extending through said top wall, combustion chamber providing casing means mounted within said exterior casing in spaced relation to said walls, the upper portion of said exterior casing above the top of said combustion chamber casing means providing a blower compartment, room air inlet means communicating with said blower compartment through the front of said exterior casing, a flue connection tube communicating with said combustion casing means and extending upwardly from the top rear portion thereof through the rearward portion of said blower compartment, passage providing means extending between the upper portion of said flue tube and said flue means, a squirrel cage blower mounted in said blower compartment including a scroll casing having air intake means on its sides communicating with said blower compartment and a bottom air outlet for directing air over and around said combustion chamber casing, wherein the improvement consists essentially of: said scroll casing providing a rear wall wider than said flue connection tube and being shaped to provide passage defining extensions on each side of said connection tube which at least partially straddle it, said passage extensions terminating above said combustion casing means with a portion of said connection tube therebelow and said extensions being oriented to direct the air discharged therefrom around the portion of said connection tube therebelow and downwardly into the space between said combustion chamber casing means and the rear wall of said exterior casing.