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[54] **CHIMNEYLESS FIREPLACE STRUCTURE**
13 Claims, 3 Drawing Figs.

[52] **U.S. Cl.** **126/121,** 126/127
[51] **Int. Cl.** **F24b 1/18**
[50] **Field of Search** 126/120, 121, 127, 128, 129

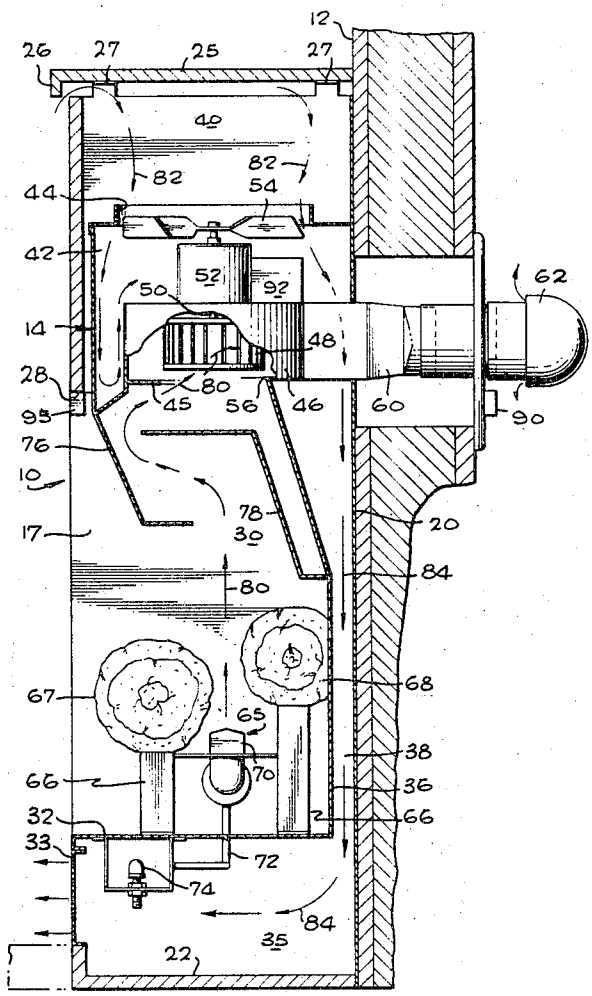
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ABSTRACT: A gas fireplace structure including a multispeed motor, used to provide forces to exhaust combustion products, produced in the structure's firebox by the combustion of gas fuel, through an exhaust pipe extending to a room's exterior through other than the room's ceiling is disclosed. The structure includes an air pressure sensor located near the exhaust end of the exhaust pipe to sense the exterior air pressure and control the motor speed as a function of the air pressure to insure the provision of sufficient exhausting forces against increased air pressure. The motor is also used to rotate a fan to force heated air to exit near the structure's base to produce efficient heating and control temperatures within the structure.



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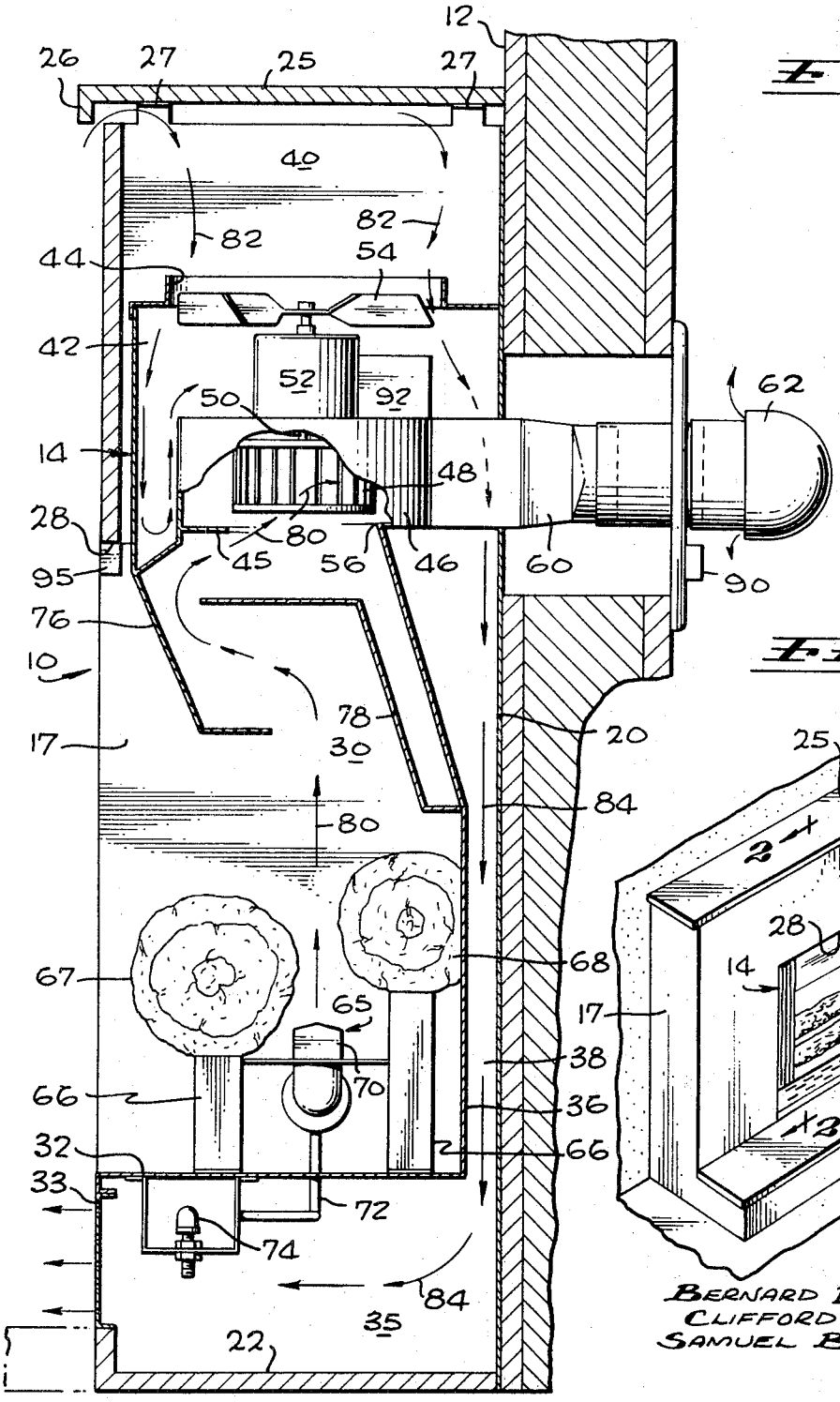


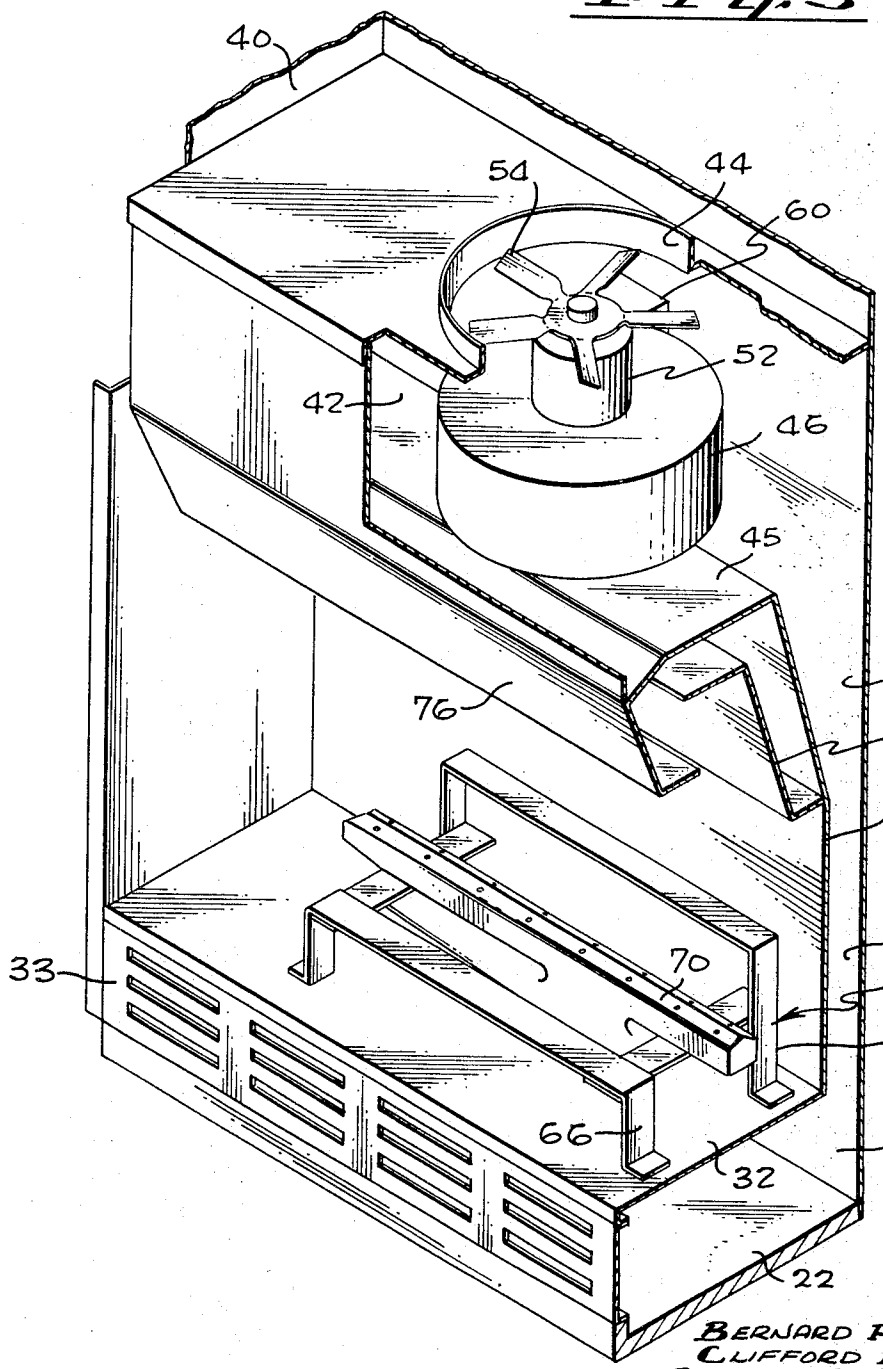
Fig. 2

Fig. 1

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Fig. 3



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CHIMNEYLESS FIREPLACE STRUCTURE

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to fireplaces, and, more particularly, to an improved gas air-heating fireplace structure.

2. Description of the Prior Art

Herebefore, several different types of natural gas air-heating fireplace structures, hereafter simply referred to as gas fireplaces, have been proposed and actually constructed. The basic functions of such gas fireplaces is to simulate functionally, as well as in appearance, a wood-burning fireplace by enabling the occupants of a room in which the gas fireplace is installed to view the gas, burning in a log unit, but without the attendant disadvantages occasioned in the operation of a wood-burning fireplace. The gas fireplace also heats cool air which is permitted to circulate and heat the room, thereby perform a heating function. Another advantage of such gas fireplaces is the ability of installing them in an already built room without major constructural changes.

Most of the prior art fireplaces require the incorporation and the use of a chimney pipe, whose function is to remove or exhaust products of combustion, such as smoke and noxious gasses, which are produced by the burning natural gas fuel. The need for such chimney pipes is most undesirable, since it results in a relatively large size fireplace and, more particularly, since it limits the use of fireplaces only in places, such as for example, rooms with ceilings, through which the chimney pipes can extend upwardly to exhaust the undesired combustion products. Clearly, such chimney-incorporating fireplaces cannot be used in rooms in multistory buildings, except for those of the top floor. Even where ceiling venting is possible, the need for such venting is undesirable, since it complicates and increases the cost of fireplace installation. Such a marked disadvantage can only be overcome by providing a chimneyless gas fireplace, from which combustion products are exhaustable through other than the ceiling of the room in which the fireplace is to be installed.

Another significant disadvantage of prior art fireplaces is the inability to properly exhaust combustion products, irrespective of sudden and significant changes in the wind velocity outside the room or house. These wind velocity changes are reflected by sudden changes in the back pressure, experienced by the gas fireplaces' exhaust pipes, thereby greatly affecting the proper exhaustion of the combustion products. Yet another undesired feature of prior art fireplaces is the direction of flow of the heated air therefrom. Typically, the air, heated in such gas fireplaces, exits them by convection through appropriate openings at the tops thereof, rather than at or near their bases. The exiting of heated air near the base of a fireplace optimizes air flow in the room for most efficient heating.

OBJECTS AND SUMMARY OF THE INVENTION

It is a primary object of the present invention to provide a new improved chimneyless gas fireplace.

Another object of the present invention is to provide a new chimneyless gas fireplace with a capability of exhausting combustion products despite large changes in outside wind pressure against the gas fireplace's exhaust pipe.

A further object is to provide a new improved chimneyless gas fireplace with improved heated air flow direction, whereby heated air exits into a room, which is heated by the fireplace, near the fireplace's base to produce desirable air circulation.

Still further object of the present invention is the provision of a relatively simple, yet highly advantageous gas fireplace, characterized by the absence of a chimney the ability to exhaust combustion products, with relatively inexpensive means, despite significant changes in the outside air pressure due to large wind velocity changes.

These and other objects of the present invention are achieved by providing a gas fireplace housing comprising front, rear and side walls, with the front wall defining a screenable front fireplace opening. The gas fireplace housing fixedly supports, about its front opening, a firebox containing a gas log unit which is actuatable by the operation of an appropriate switch to light natural gas fuel, supplied thereto. The firebox has solid bottom, top and rear walls. Preferably, the bottom, top and rear walls of the firebox are spaced apart from the housing's bottom, top and rear walls thereof, thereby forming bottom and top air cavities or chambers, which are in communication with the room, in which the fireplace is installed, as well as a rear air duct which communicates with the bottom and top air chambers. The firebox is in communication with an air exhaust duct or pipe through an opening of a suitable location such as the top side thereof. The exhaust pipe extends through the housing's rear wall to the exterior of the room through one of the room's walls, against which the housing is installed.

A multi or variable speed motor, which is actuatable or energized when the log units is energized is also included. One end of the motor's shaft which extends into the air exhaust pipe supports a blower wheel, which rotates when the motor is energized to forcibly exhaust air, including the combustion products which enter the exhaust pipe, to the room's exterior. At the same time, the other end of the rotating shaft, which extends into the top air chamber supports a multiblade fan, which when being rotated, forces the air in the top chamber through the air duct, defined by the rear walls of the firebox and housing, to the bottom air chamber and therefrom through its appropriate openings into the room. Thus, the heated air exits the fireplace near its base, rather than at the top as is the case in prior art gas fireplace structures.

The novel features of the invention are set forth with particularity in the appended claims. The invention will best be understood from the following description when read in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a simple isometric view of the gas fireplace structure of the present invention;

FIG. 2 is a side cross-sectional view along lines 2–2 in FIG. 1; and

FIG. 3 is an isometric view of the interior of the gas fireplace housing of the present invention, with portions removed to reveal the internal structure.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Reference is now made to FIG. 1, wherein reference numeral 10 designates a gas fireplace structure, in accordance with the teachings of the present invention, shown installed against a wall 12 of a room or any other appropriate structure in which gas fireplace 10 is to be installed. As seen from FIG. 1 and FIG. 2 which is a cross-sectional view along lines 2–2 in FIG. 1, the gas fireplace 10 comprises a fireplace housing 14 which includes a front wall 16, a pair of side walls 17 and 18, and a rear wall 20 which abuts against the room wall 12. If desired, the housing 14 may include a bottom side 22.

As shown in FIG. 2, the housing 14 which has an open top may be coverable by a mantel 25, defining a peripheral downward pointing lip or flange 26. Preferably, the mantel 25 is supported by the rear wall 20 and on extensions 27 of the side walls, in order to define an air path between the room and the housing interior, while at the same time covering the open top of the housing, with lip or flange 26 extending downwardly, to conceal the opening between the housing and the mantel.

The front wall 16 defines a front gas fireplace opening 28, which serves as the front open wall of a firebox 30, securely supported in the housing 14. The special relationships between the sides or walls of the firebox 30 and the various walls of housing 14, as well as the various elements supported in each may be explained in greater detail and clarity in conjunction with FIGS. 2 and 3, the latter being an isometric view, with various side walls removed, to reveal the interior of hous-

ing 14 and the firebox 30 supported therein. As seen from FIGS. 2 and 3, the firebox 30 includes a bottom side 32, spaced apart and above bottom side 22 with the front space therebetween occupied by an air grill 33. The space between bottom sides 22 and 32 may be thought of as comprising a bottom air cavity or chamber 35, with the apertures in air grill 33 providing an air flow path between chamber 35 and the room in which the housing is installed.

As seen from the figures, the firebox 30 further includes a rear wall 36 which is spaced apart from the housing's rear wall 20 to define an air duct 38, which is in communication with the bottom air chamber 35. The top of duct 38 is in communication with a top air chamber 40 through a motor-housing chamber 42. An aperture 44 at the top side of chamber 42 provides an air flow path therebetween.

Spaced between chamber 42 and a top side 45 of firebox 30 is a circular housing compartment 46 which houses a blower wheel 48, supported at one end of a shaft 50 of a variable or multispeed motor 52, which is mounted on top of housing 46 in chamber 42. A portion of the motor's shaft extending in said chamber is used to fixedly support a multiblade fan 54. Briefly, the function of fan 54 is to force air entering chamber 42 through aperture 44 from the top air chamber 40, down air duct 38 into the bottom air chamber 35, with the air forced therein exiting into the room through the aperture in air grill 33.

An air flow path is provided between the blower wheel housing 46 and firebox 30 by means of an aperture 56 in the top side or wall 45 of firebox 30, while an air flow path between housing 46 and the exterior of the room is provided by an exhaust duct or pipe 60 which extends from housing 46 through the rear wall 20 of the housing 14 and the room wall 12 to the room's exterior. The exterior end of pipe 60 may be partially covered by an exhaust pipe cover unit 62. Pipe 60 may be of the telescopic type to accomodate room walls of different thicknesses.

The firebox 30 fixedly supports a gas fireplace log unit 65, which is preferably, though not limited to, the type of log unit described in U.S. Pat. No. 3,277,882. Such a unit comprises a bracket 66 which supports a pair of noncombustible logs 67 and 68, between which a gas burner 70 is fixedly mounted. The burner is connected by means of a gas pipe 72 to the building's gas supply lines through a gas control unit 74. As is appreciated by those familiar with the art, such gas log units 65 are controllable by a switch (not shown) such as a pushbutton, which, when actuated automatically lights the gas which is permitted to flow out of burner 70 to produce a gas flame. The flame projecting through and between logs 67 and 68 simulate the flame produced by burning wood.

As is appreciated by those familiar with the art, the burning of natural gas fuel produces combustion products, such as smoke and noxious gasses which must be exhausted to prevent their escape into the room through the fireplace front opening 28. In the prior art, such exhausting has been achieved by the use of chimneys, the undesirability of which has been previously explained. In the novel gas fireplace structure of the present invention, however, the need of a chimney is eliminated by the use of motor 52 which is energizable, simultaneously with the actuation of the log unit 65. As soon as motor 52 is energized, its rotating shaft rotates the blower wheel 48 to force the air and the hot combustion products produced by the burning natural fuel gas which enter housing 46 through an aperture 56 through the exhaust pipe 60 to the exterior of the room. Thus, the need for a chimney is completely eliminated.

To prevent the hot combustion products, which rise from unit 65 to the top of firebox 30, from accidently exiting the housing 14 into the room through opening 28, a downward projecting baffle 76 extends downwardly and inwardly into the firebox 30. A complimentary baffle 78 extending from rear wall 36 upwardly, towards the top side 45 may be employed to guide the rising hot combustion products, represented in FIG. 2 by arrows 80 to flow between the two baffles toward the top of the firebox and through aperture 56 into the housing 46, from which they are exhausted by the rotating blower wheel 48.

The shaft 50 of motor 52, which rotates when the log unit 65 is actuated and the natural gas fuel is burning, in addition to causing the rotation of blower wheel 48 to forcibly exhaust the hot combustion products, reaching it from firebox 30, through the exhaust pipe 60, is also used to rotate the multiblade fan 54 which is supported thereon. As shown in FIG. 3 the blades of the fan 54 are sloped so as to force the air entering chamber 42 from the top air chamber 40 toward air duct 38. The air, forced thereinto, is heated due to the high temperatures of the various walls of the firebox, and in particular, the rear wall 36. However, unlike prior art gas fireplace structures in which the heated air flows freely upwardly, in the present invention, due to the force applied by the fan 54 the heated air is forced down air duct 38 into the bottom air chamber 35, eventually exiting into the room through the apertures in air grill 33. Thus, in the gas fireplace of the present invention, hot air exits the fireplace structure near its base, which is usually close to the room's floor, which from an air circulation and heating efficiency point of view is the preferred location. Such advantages are not realizable with prior art gas fireplaces in which the heated air is permitted to exit the fireplaces near their topsides, which are closer to the room's ceilings.

In FIG. 2, the cool air, entering the top air chamber 40, is designated by arrows 82, while the air heated in the air duct 38, which is forced into the room through the bottom air chamber 35, is designated by arrows 84.

In order to provide the novel gas fireplace structure of the present invention with the capability of exhausting the combustion products to the room's exterior, irrespective of changes in the air velocity or air pressure conditions near the exhaust end of pipe 60, an arrangement is provided whereby the speed of rotation of motor 50 is made a function of the exterior air pressure, thereby controlling the force which the rotating blower wheel 48 applies to exhaust the combustion products. Such an arrangement includes a transducer 90 which is mounted outside the room, preferably, near the exhaust end of pipe 60. Any known air pressure or air velocity sensing device which provides signals, indicative of the phenomenon sensed thereby, may be used as transducer 90. The signals produced thereby are supplied by means of leads (not shown) to a motor speed control unit, which in FIG. 2 is represented by block 92, and is shown coupled to motor 52 in chamber 42. The function of unit 92 is to control the speed of motor 52, thereby controlling the exhausting force, as a function of the signals from transducer 90 which in turn represents the exterior air pressure. As the exterior air pressure increases, the speed of motor 52 increases thereby increasing the force used to exhaust the combustion products, to insure proper exhausting of such products against an increased air pressure.

If desired, motor 52 may be of the variable speed type, in which case, its speed is continuously varied as a function of variation in the air pressure. On the other hand, motor 52 may be of the dual speed type, in which case, motor speed control unit 92 is used to control the motor to rotate at its lower speed when the air pressure is below a preselected level, while causing the motor to rotate at the higher of the two speeds when the air pressure exceeds the particular level. Such an arrangement is particularly significant in minimizing the manufacturing cost of the fireplace, since it enables the use of a relatively inexpensive motor which produces a minimum of disturbing noise when operated at its lower speed, when the exterior air pressure or wind velocity is low. However, when the wind velocity is quite high, even though the motor is operated at its higher speed, and it may produce significant noise, such nois will not be disturbing to one sitting in the room, since the noi produced by the motor will be less than the noise in the roo due to the exterior high winds.

From the foregoing it should thus be appreciated, that in accordance with the teachings of the present invention a novel chimneyless gas fireplace structure is provided, characterized by the capability of exhausting undesired combustion products to the exterior of the room through one of the walls thereof, rather than its ceiling. The exhausting is facilitated by the use of a rotatable blower wheel, to which the heated combustion products are directed for exhausting, through an exhaust pipe to the room's exterior. The exhausting force which the blower wheel provides, as a result of being rotated by a motor **52** is controlled to be a function of the exterior air pressure. This insures the provision of increased exhausting forces when the exterior air pressure increases, thereby insuring proper exhausting of combustion products under variable air pressure conditions. It should be appreciated, that even though in the foregoing, the exhausting of the combustion products is shown occuring through the housing's rear wall, when the housing is positioned at a corner of a room, such exhausting may be accomplished through one of the side walls.

In addition to providing a chimneyless gas fireplace structure, with the capability of exhausting combustion products under variable outside pressure conditions, the novel fireplace structure of the present invention is designed so that the air heated therein enters the room to be heated near the structure's base, rather than near its top as is the case in the prior art, thereby providing improved air circulation and increased heating efficiency. Although herebefore, the heated air has been assumed to enter the room through the apertures in the front air grill **33**, it should be apparent that, if desired, air grills which are in communication with the bottom air chamber **35** may be provided on one or both side walls **17** and **18** to enable the heated air to enter the room through other than the front wall of the housing **14**.

The novel gas fireplace structure of the present invention may preferably include a limit control unit **95** to automatically extinguish the burning gas, *i.e.*, deenergize the log unit **65** whenever the unit is activated but motor **52** is not energized. This is desirable to prevent the burning of gas fuel without providing the necessary combustion products exhausting forces. Limit control unit **95** is shown in FIG. **2** in block form, since units or devices which are capable of deenergizing a circuit, such as the log unit **65**, when a motor, such as motor **52**, stops are within the present state of the art of circuit control.

Although particular embodiments of the invention have been described and illustrated herein, it is recognized that modifications and variations may readily occur to those skilled in the art and, consequently, it is intended that the claims be interpreted to cover such modifications and equivalents.

We claim:

1. The fireplace structure comprising:
- a housing having a plurality of walls;
- a firebox;
- means for supporting said firebox in said housing so as to define at least first and second air chambers which are substantially above and below said firebox, with air flow communication therebetween, said housing defining openings for providing air flow path between each of said first and second chambers and the exterior of said housing;
- exhaust means extending from a first end thereof, which is in communication with said firebox, to a second end thereof through one of the walls of said housing;
- activatable power means for forcibly exhausting air in said firebox through said exhaust means to the exterior of said housing; and
- means coupled to said activatable power means for forcing air to flow from said first to said second chamber.

2. A fireplace structure comprising:
- a housing having a plurality of walls;
- a firebox supported in said housing;
- exhaust means extending from a first end thereof, which is in communication with said firebox, through one of the walls of said housing to a second end thereof;
- activatable power means for forcibly exhausting air in said firebox through said exhaust means to the exterior of said housing; and
- power control means including pressure sensing means for sensing the air pressure at the exterior of said housing, substantially at the second end of said exhaust means, and for controlling the power used to force the exhausting of air through said exhaust means as a function of the air pressure sensed by said sensing means.

3. The fireplace structure as recited in claim **2** further including means supporting said firebox in said housing for defining at least first and second air chambers with air flow communication therebetween, said housing defining openings for providing an air flow path between each of said first and second chambers and the exterior of said housing; and means coupled to said activatable power means for forcing air to flow from said first to said second chamber.

4. The fireplace structure as recited in claim **3** wherein said first and second chambers are substantially at the top and bottom of said housing, respectively.

5. A fireplace structure, comprising:
- a housing having a plurality of walls including a front wall, defining a fireplace opening therein;
- a firebox supported in said housing and in communication with said fireplace opening, said firebox having a plurality of walls including one wall spaced from one of the housing's walls to form an air duct therebetween, said firebox being adapted to support heat-generating means for heating the air therein and the walls thereof, said housing supporting said firebox therein to define top and bottom air chambers in communication with said air duct, said housing further defining openings in the top and bottom thereof for providing air flow paths between the housing exterior and said top and bottom air chambers;
- exhaust means including an exhaust duct extending from the exterior of said housing through one of the housing's walls, and in communication with said firebox; and
- actuatable power means for forcing air in said firebox to the exterior of said housing through said exhaust duct, said power means further including means for forcing air in said top chamber, down said air duct and therefrom to the exterior of said housing, through said bottom air chamber.

6. The structure defined in claim **5** wherein said actuatable power means include an energizable motor having a rotatable shaft, said exhaust means including first means supported at one end of said shaft for forcing air in said fire box through said exhaust duct to the exterior of said housing, and air forcing means supported at the other end of said shaft for forcing the air in said top air chamber down through said air duct to said bottom air chamber and therefrom to the exterior of said housing.

7. The structure as defined in claim **6** further including motor control means including pressure sensing means for sensing the air pressure at the exterior of said housing from which said exhaust duct extends into said housing to control the rate of rotation of said shaft as a function of the air pressure sensed thereby, so as to vary the force with which air is forced out of said firebox to the exterior of said housing as a function of the sensed air pressure.

8. The structure as recited in claim **7** wherein said motor is energizable to rotate the shaft at at least two different speeds of rotation, the speed of rotation being directly related to the sensed air pressure.

9. A fireplace structure, comprising:
- a housing having at least rear and side walls, and a front wall defining a fireplace opening;
- a mantel positionable on top of said housing at a spaced relationship therefrom to provide a free air flow path therebetween;
- a firebox in communication with said fireplace opening having at least a rear wall spaced from the housing's rear wall to form an air duct therebetween, said firebox being

adapted to support an energizable gas fuel burning means for burning when energized said gas fuel to heat the air in said firebox and the walls thereof while producing combustion products;

exhaust means including an exhaust duct extending from the exterior of said housing through one of the housing's walls, said exhaust duct being in communication with the top of said firebox; and

actuatable power means for forcing the air and combustion products at the top of said firebox to the exterior of said housing through said exhaust duct, said power means further including means for forcing air, flowing into said housing through the space between the mantel and said housing top, down said air duct and therefrom to the exterior of said housing.

10. The structure defined in claim **9** wherein said actuatable power means include an energizable motor having a rotatable shaft, said exhaust means including first means supported at one end of said shaft for forcing the air at the top of said firebox through said exhaust duct, and air forcing means supported on the other end of said shaft for forcing the air, entering said housing through the top thereof, down through said air duct.

11. The structure defined in claim **10** further including motor control means including pressure sensing means for sensing the air pressure at the exterior of said housing from which said exhaust duct extends inwardly into said housing to control the rate of rotation of said shaft as a function of the sensed air pressure.

12. The structure as recited in claim **11** wherein said motor is energizable to rotate the shaft at at least two different speeds of rotation, the speed of rotation being directly related to the sensed air pressure.

13. The structure as recited in claim **9** further including control means for automatically deenergizing said gas fuel burning means upon the sensing of a malfunction in said actuatable power means.