United States Patent

[11] 3,601,117

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[21] Appl. No. **846,911**
[22] Filed **Aug. 1, 1969**
[45] Patented **Aug. 24, 1971**

[54] **COUNTERFLOW FIREPLACE**
7 Claims, 17 Drawing Figs.

[52] **U.S. Cl.** **126/121**
[51] **Int. Cl.** **F24b 7/04**
[50] **Field of Search** 126/120, 121, 307; 237/51, 55

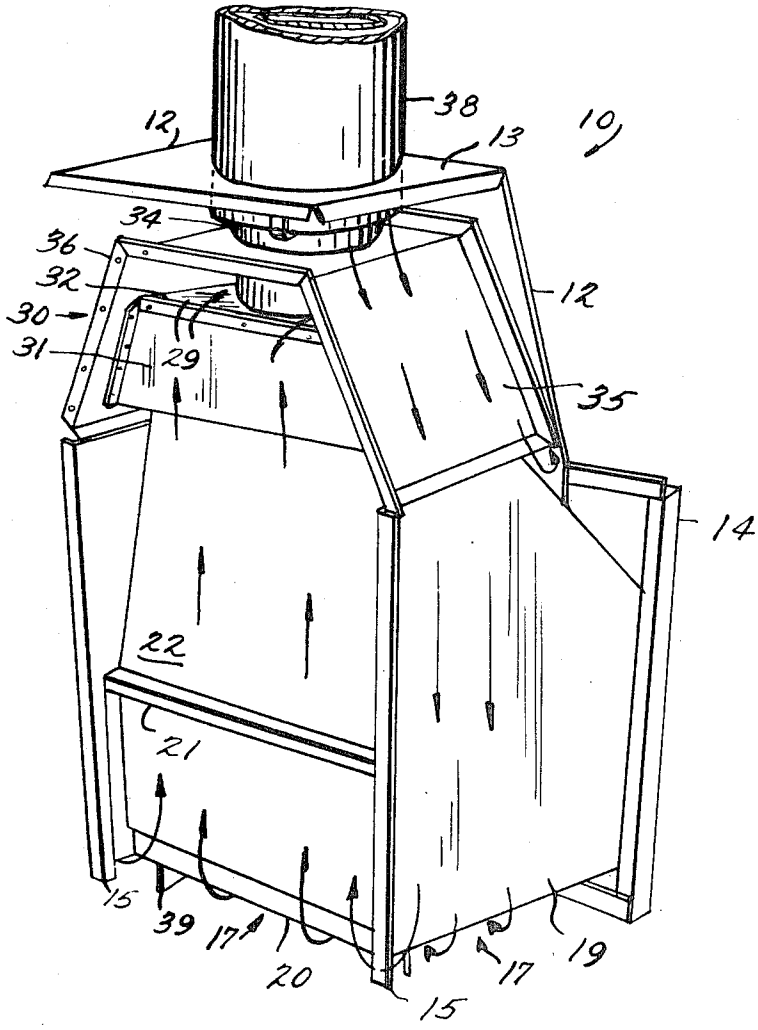
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Primary Examiner—Charles J. Myhre
Attorney—Cushman, Darby & Cushman

ABSTRACT: The double-walled fireplace is described which is adapted to be connected to a counterflow chimney arrangement designed to introduce cold air into the fireplace through an outer duct while the heated air is drawn out through an inner duct and discharged to the atmosphere simultaneously with flue gases from the firebox. At the point of attachment of the chimney to the firebox, a diaphragm or baffle assembly is provided which directs the cold air down the sides of the firebox. By providing suitable baffling on one side of the front and the opposite side at the rear, the air flowing down one side can be made to pass up the firebox, and the cold air from the other side can be made to pass up the rear wall of the firebox. In order to accommodate different fireplace configurations it is possible to modify the baffle structure so that different flow patterns will occur.



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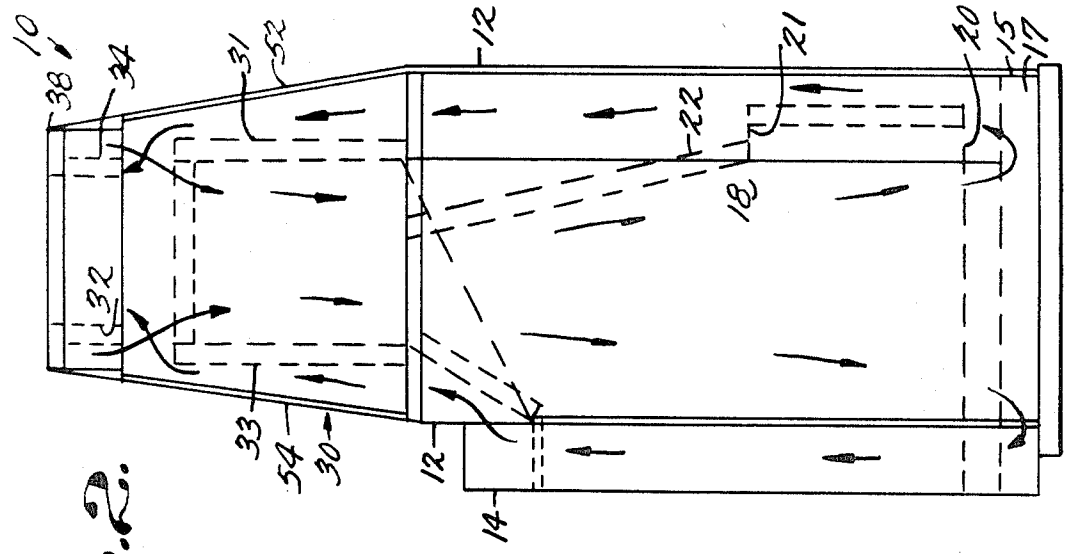


Fig. 2.

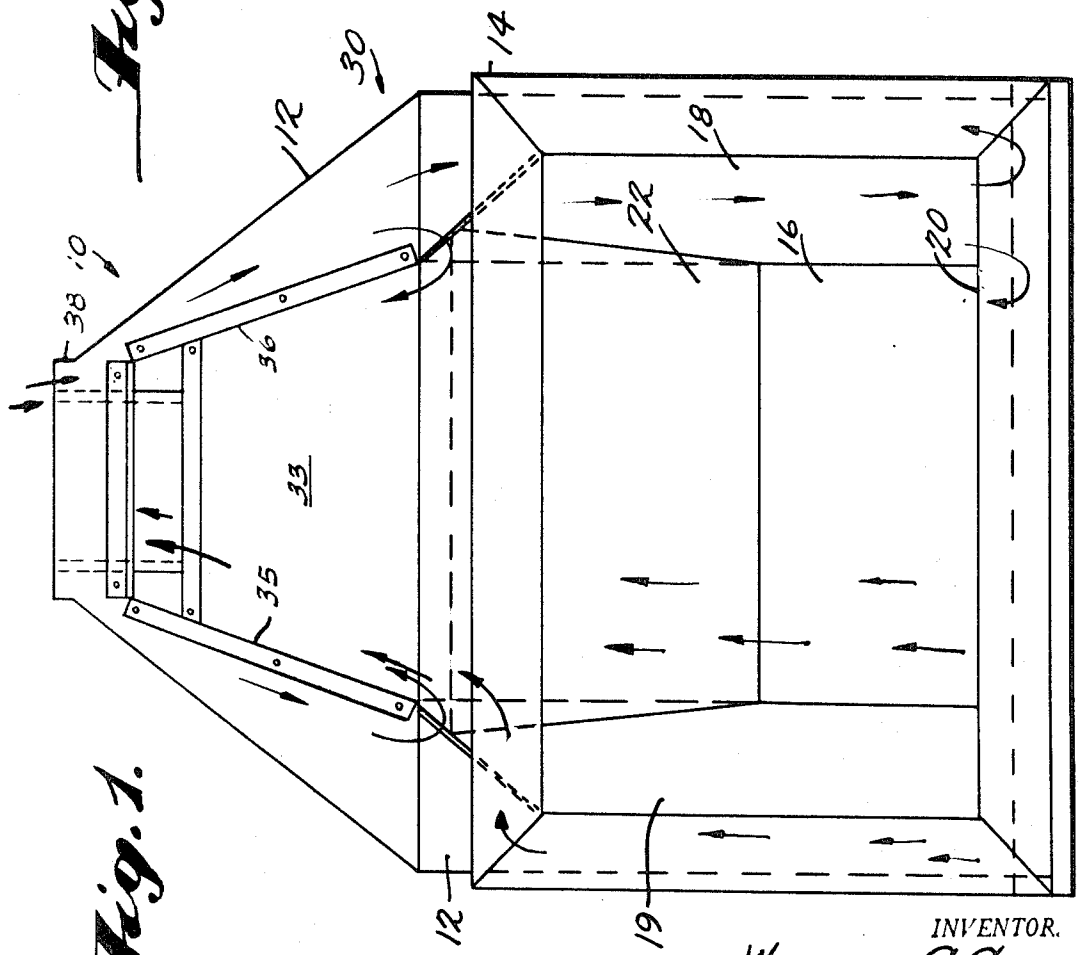


Fig. 1.

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Fig. 3.

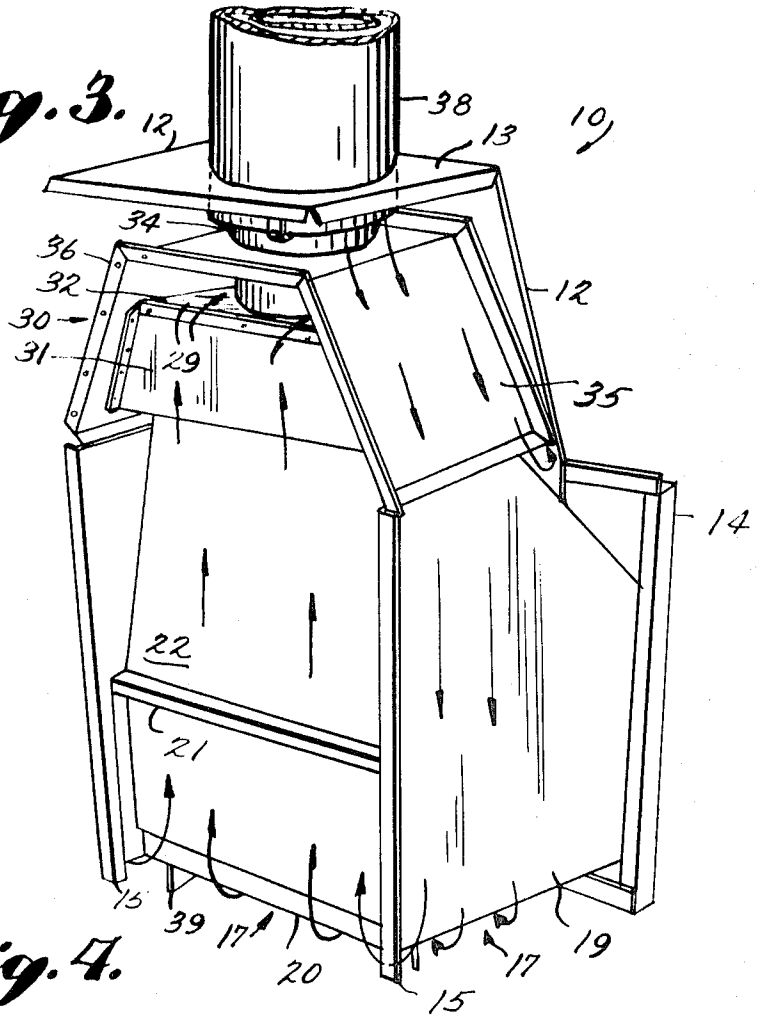
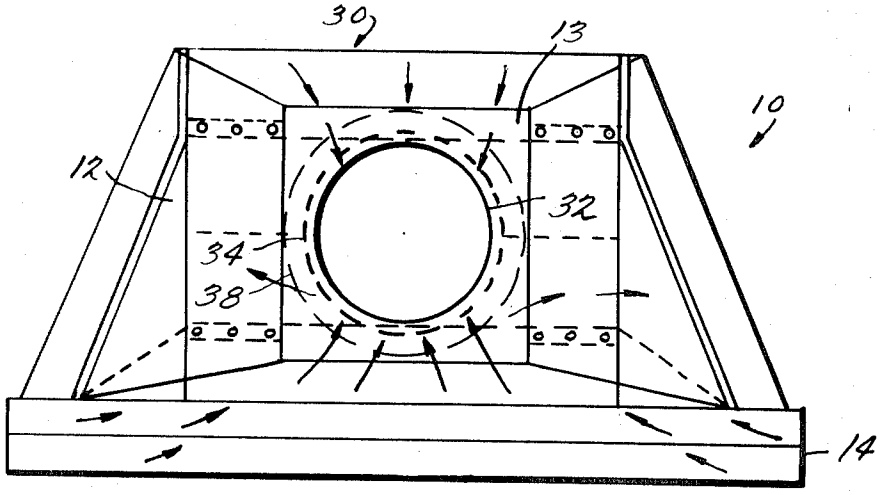


Fig. 4.



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Fig. 5.

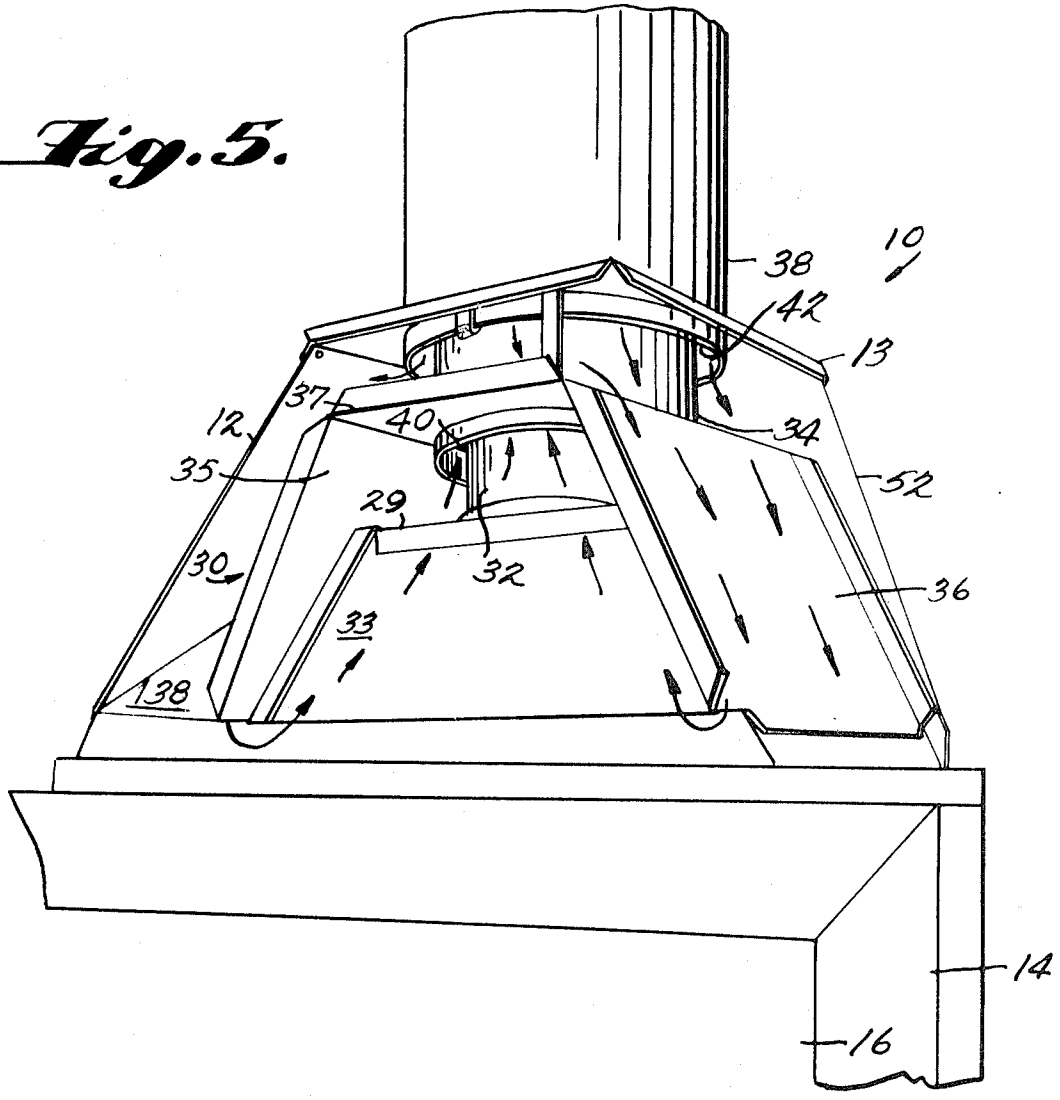


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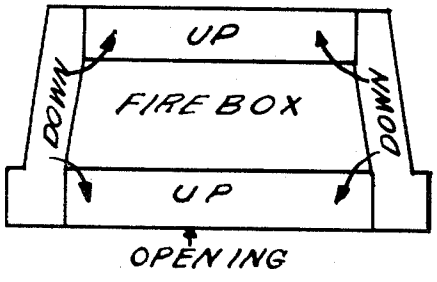
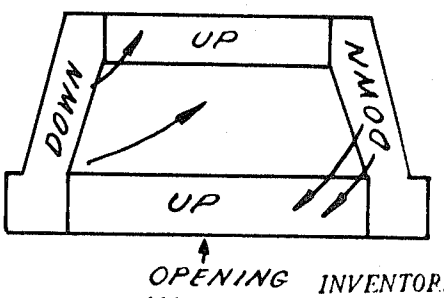


Fig. 7.



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Fig. 8.

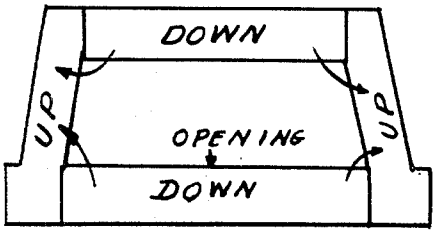


Fig. 9.

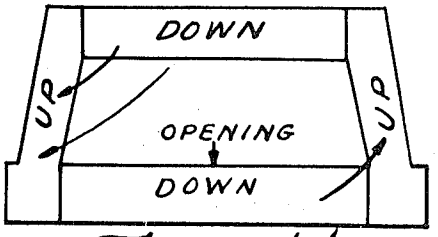


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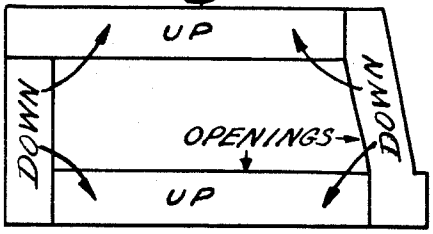


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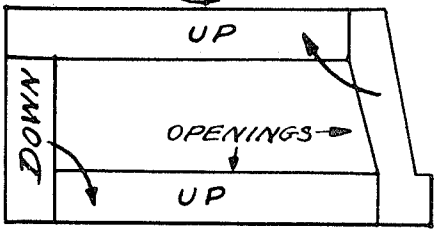


Fig. 12.

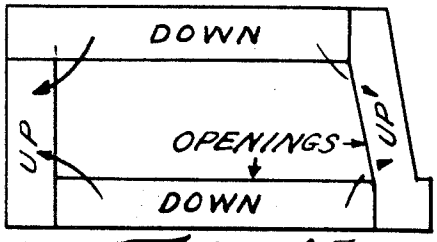


Fig. 13.

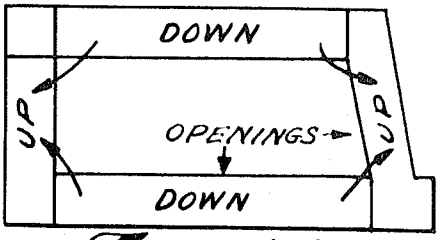


Fig. 14.

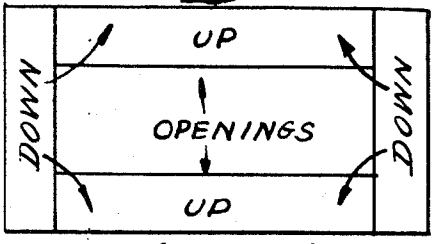


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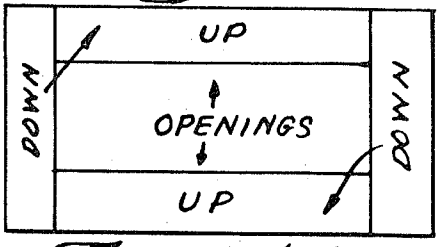


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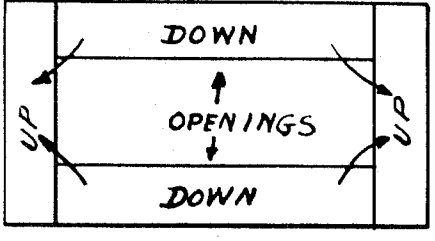
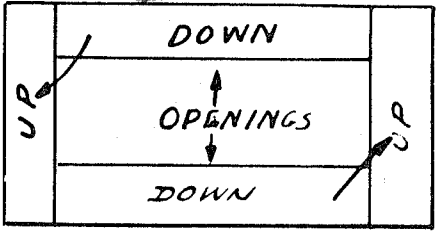


Fig. 17.



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COUNTERFLOW FIREPLACE

This invention relates to fireplace construction and in particular to a fireplace assembly which is prefabricated to be installed into the building of which it is to become a permanent part.

A major problem facing those designing fireplace assemblies of the above-mentioned type is to provide a fireplace in which the exterior surfaces are sufficiently cooled so that the temperature of the fireplace will not endanger the surrounding structure. Furthermore, the fireplace must be designed so that it will not direct a significant amount of heat into the room in which it has been placed so as not to be uncomfortable when used with a central heating system.

In U.S Pat. No. 2,821,975to Robert K. Thulman, a fireplace construction is described which circulates cool air around the firebox and draws off the heated air. This latter construction provides a plurality of thermosyphonic paths to maintain safe temperatures on the surface of the outer casing of the fireplace unit. This patented construction is, however, unduly complex in that at least two concentric casings must be provided around the firebox in order to provide the necessary paths for airflow. This results not only in a complex assembly, but one of extreme weight and bulk.

It is therefore an object of this invention to provide a fireplace assembly which is of simple construction and uses only a single housing around the firebox while providing the needed paths for cooling airflow.

It is another object of this invention to provide a baffle system for a fireplace construction having only a single housing around the firebox in which said baffles properly direct cool airflow from a cold air duct and in which others of said baffles direct the heated air into a hot air duct to be expelled.

The aforementioned and other objects may be obtained in a fireplace assembly constructed according to the principles of this invention in which a single housing surrounds the firebox and the dome structure extending from the firebox to the chimney. The double-walled fireplace assembly connects to a counterflow chimney having an annular cold air duct and an annular hot air duct coaxial therewith. The cold air is drawn down into the fireplace assembly, and the heated air is drawn up through an inner casing and discharged to the atmosphere simultaneously with flue gasses from the firebox. At the point of attachment of the chimney to the dome structure of the firebox, the cold air is directed by means of suitably constructed and placed baffles down the side walls of the firebox and up the rear wall of the firebox. A baffle is provided to direct the heated air from the rear wall into the heated air duct. Baffles are provided to direct a portion of the cool air to a front wall of the dome structure of the fireplace, and a baffle is provided for directing the heat from the front portion of the fireplace up into the heated air duct. This airflow pattern can be modified by altering the baffle structure around the dome of the firebox so that, for example, the airflow can be diverted making it flow down the front and back up the side. Therefore, the exterior temperature of the fireplace assembly constructed according to the principles of this invention is maintained at an acceptable level while obviating the need for a complex and bulky structure.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention may be best understood by reference to the specification hereinbelow and the drawings in which:

FIG. 1 is a front elevation of a preferred embodiment of the fireplace assembly constructed according to the principles of this invention;

FIG. 2 is a side elevational view of the preferred embodiment illustrated in FIG. 1;

FIG. 3 is a rear perspective view of the preferred embodiment illustrated in FIG. 1 with the sidewalls and the rear wall of the housing removed;

FIG. 4 is a top elevational view of the preferred embodiment illustrated in FIG. 1;

FIG. 5 is a fragmentary front perspective view of the preferred embodiment illustrated in FIG. 1 in which the front wall and a sidewall of the housing have been removed;

FIG. 6–9 are sectional plan views of an open front fireplace constructed according to the principles of this invention illustrating the various airflow patterns which may be realized in a fireplace construction utilizing this invention;

FIGS. 10–13 are sectional plan views of an open end fireplace, which is a fireplace open on two adjacent sides, constructed according to the principles of this invention illustrating the various airflow patterns which may be realized using this invention; and

FIGS. 14–17 are sectional plan views of a fireplace open on two opposite sides constructed according to the principles of this invention illustrating the various airflow patterns which may be realized utilizing this invention.

DETAILED DESCRIPTION OF THE DRAWINGS

FIGS. 1–5 in which like numerals refer to like elements illustrate the structural details and the airflow patterns of a fireplace constructed according to the principles of this invention of the type which has a single horizontal opening for receiving combustibles. The fireplace assembly is generally indicated by the numeral **10**. A firebox generally indicated as **16** is made up of a base member **20**, sidewalls **18** and **19** and a rear wall **22** which extends vertically upward from the base member **20** until a shoulder **21** is reached from whence the rear wall **22** tapers upwardly and inwardly. The firebox opening is surrounded by flat elongated frame members **14**.

The upper portion of the firebox **16** communicates with a dome structure generally indicated as **30** which in turn communicates with a chimney flue **32**. The dome structure **30** is formed from a rear wall **31**, a front wall **33**, and baffles **35** and **36**. The rear wall **31** of the dome structure **30**, as best shown in FIG. 3, extends upwardly from the upper end of rear wall **22** of the firebox **16** to a cover member **29** through which the chimney flue **32** is connected to the dome structure and thereby to the firebox by means of a circular opening centrally disposed therein. The front wall **33** of the dome structure **30** extends upwardly from the horizontal opening of the firebox to the cover member **29**. As will be described in greater detail hereinbelow, the walls **33** and **31** form baffles conducting the heated air upwardly and away from the fireplace assembly. Baffles **35** and **36** form the sidewalls of the dome structure **30**, but these walls or baffles extend upwardly beyond the cover member **29**, while tapering inwardly, to a cover member **37**. A circular opening is centrally disposed in cover member **37** to allow a cylindrical casing **34** which is concentric with but of a greater diameter than chimney flue **32**, to pass therethrough. The casing **34** extends downwardly only so far as to pass through cover **37**. The annular space between chimney flues **32** and cylindrical casing **34** forms an inner annular duct **40** through which the heated air is expelled to the atmosphere.

A housing **12** entirely surrounds the firebox **16** and the dome structure **30**. It will be noted that the portion of the housing **12** which surrounds firebox **16** is substantially rectangular while the walls of the housing **12** surrounding the dome structure **30** taper inwardly forming a wedge-shaped configuration. The housing **12** is spaced from the walls of the dome structure **30** and the firebox **16** forming therewith the passageways through which the cold air and the heated air circulate around the firebox and dome assembly. A cover member **13** forms the top of the housing **12**. Centrally disposed in cover member **13** is a circular opening of a diameter which will allow it to receive a cylindrical casing **38** which extends only so far as to go through cover **138** and which is concentric with flue **32**, but of a greater diameter than cylindrical casing **34**. Thus, an annular outer duct **42** is formed between the casing **34** and **38**. It is through this outer duct **42** that the cold air for cooling the fireplace assembly **10** is introduced therein.

The housing walls **52** and **54** which are adjacent the dome structure walls **31** and **33**, respectively, are inclined at an

angle which allow them to be joined with cover members **13** and **37** but not with cover member **29**, because walls **31** and **33** are inclined inwardly at a greater angle than the angle of incline of walls **52** and **54** and cover member **29** is narrower. Thus, passages extending from the sides of annular ducts **42** passing down baffles **35** and **36** to the sides of firebox **16** are formed. The rear wall **52** of housing **12** and baffle **31**, which is a rear wall of the dome structure **30**, form a passage extending downwardly from the annular ducts **40** to the area adjacent the rear wall **22**. Likewise, front baffle **33**, which forms the front wall of the dome structure **30** and which extends downwardly from the front portion of annular ducts **40** forms along with front wall **54** of the housing **12** a passageway from the upper front portion of the firebox **15** and the surfaces formed by the rear surfaces of vertical frame members **14** to the annular duct **40**. The base of member **20** of firebox **16** is mounted on legs **15** which extend from the base member **20** to the bottom of housing **12** forming therebetween a gap **17** which provides a passageway for air flow beneath the firebox. as shown in FIG. **5**, an upright baffle **138** is provided which extends downwardly from front to rear within the duct defined by the baffle **35** and the wall of housing **12** adjacent the baffle. Baffle **138** directs a portion of the cool air proceeding down baffle **35** to the front wall **33** of the fireplace dome structure **30**. A baffle similar to baffle **138** may be provided on the opposite side of the duct at baffle **36**. A baffle **39** extending beneath base member **20** directs a portion of the airflow thereunder to rear wall **22**.

DESCRIPTION OF OPERATION

After a fire has been built in firebox **16**, as is generally the case with fireplaces having a single horizontal opening, the sidewalls **18** and **19** of the firebox will be at a lower temperature than rear wall **22**, base plate **20** and the front wall **33** of the dome structure. With this temperature relationship of the firebox walls it is desirable to direct the incoming cold air downward along the lower temperature walls allowing the heated air to be drawn upwardly along the walls which are at a higher temperature. This is accomplished by utilizing the principles of this invention to construct a fireplace assembly of only double-walled construction and providing the appropriate baffles to properly direct the air to and from a counter flow chimney, thus, utilizing the counterflow principle for cooling the exterior surfaces of the fireplace. This should be contrasted with the prior art devices in which triple-walled construction was used to employ thermosyphonic movement of air around the exterior surfaces of the fireplace resulting in a complex, bulky structure.

In operation the cold air is drawn downwardly through outer annular duct **42** and directed by the side baffles **35** and **36** downwardly along the sidewalls **18** and **19** of the firebox. As mentioned above, baffle **138** shown mounted adjacent side baffle **35** directs a portion of the incoming cold air along the forward wall **33**. A portion of the airstream descending adjacent to baffle **36** is directed back up the front wall **33** in a similar manner, as shown by the arrow in FIG. **5**. The air directed down the sidewalls of the firebox will proceed underneath base plate **20** and will be drawn upwardly across rear wall **22** and the rear surfaces of vertical frame members **14**. The air directed to the front portion of the fireplace assembly will proceed upwardly along inclined forward wall **33** of the dome structure and enter inner annular duct **40**. The heated air from rear wall **22** is directed upwardly along the rear wall **31** of the dome structure into the inner annular duct **40**. Therefore, the flow pattern in this embodiment is basically one of having cold air directed down the sides of the fireplace and heated air up the front and back walls.

The fireplace assembly constructed as described hereinabove may be placed in a building wall which provides the necessary clearances. The firebox may be held in place by blocking with stud wallplates or moulding, or it can be nailed or screwed in place through the holes punched in either side of the fireplace frame. Any conventional wall-covering material may be applied to the studs providing it does not extend within approximately 2 inches of the sides of the fireplace opening, or within about 4inches from the top thereof. The chimney may be installed in the conventional manner making sure that the necessary clearances are provided between the chimney structure and the surrounding wall and floor material.

FIGS. **6–17** are sectional plan views of various fireplace configurations describing the various airflow patterns which may be caused to take place by constructing the particular fireplace according to the principles of this invention. That is, by providing the particular fireplace configuration with the proper baffles, and by properly placing and directing those baffles, the illustrated flow pattern will be the result. The choice of which baffle configuration to use will depend upon which walls are desired to be kept at a lower temperature with respect to the other walls.

FIGS. **6–9** illustrate the flow patterns which may be caused to occur in an open front fireplace like the one described hereinabove as a preferred embodiment of the invention. FIG. **6** is a diagram of the flow pattern taking place in the fireplace assembly described hereinabove with reference to FIGS. **1–5**. The baffles direct the cold air down the side of the fireplace and up both the front and the back. FIG. **7** demonstrates a variation of the flow pattern in the same type of fireplace wherein air is caused to move down the sides of the fireplace, but the air from one side moves only up the backwall while the air from the other side moves only up the front. FIG. **8** illustrates an open front fireplace in which the airflow pattern of FIG. **6** is just reversed. In this case the air is caused to move down the front and back and up the sidewalls. FIG. **9** is a flow pattern which is just the reverse of the flow pattern of FIG. **7**, and in this case the air moves down the front and back, but the air from the back moves only up one side and the air from the front moves up only the other side.

FIGS. **10–13** illustrates the flow patterns which may be caused to occur in the fireplace having two adjacent sides open, and indicated by the legend "openings " and the arrows. In these figures the same sequence of flow patterns as was illustrated in FIGS. **6–9** may be caused to take place.

FIGS. **14–17** illustrate the use of this invention in conjunction with a "see through " fireplace or one in which two opposite sides are open. The sequence of the flow pattern in these FIGS. is the same as the sequence illustrated in FIGS. **6–9**.

The embodiments described hereinabove are only exemplary, and it will be apparent to those skilled in the art that the construction and arrangement of the elements of the invention may be modified within the scope of the appended claims.

I claim:

1. A fireplace assembly comprising a firebox, a chimney means including a first duct for conducting cold air into said fireplace assembly and a second duct for exhausting heated air from said fireplace assembly, means for placing said firebox in communication with said chimney means, a single-walled housing means completely surrounding said firebox and said means for placing said firebox into communication with said chimney and spaced therefrom defining passageways therebetween, first baffle means for directing cold air from said first duct down a first pair of opposed sides of said firebox, second baffle means for directing heated air from a second pair of opposed sides of said firebox upwardly through said second duct, and third baffle means directing said air from each of said first pair opposed sides to each of said second pair of opposed sides.

2. The fireplace assembly defined in claim **1** wherein said third baffle means directs air from one of said first pair of opposed sides to one of said second pair of opposed sides and from the other of said first pair of opposed sides to the other of said second pair of opposed sides.

3. The fireplace assembly defined in claim **1** wherein said first pair of opposed sides are the front and back sides of said fireplace and said second pair of opposed sides are the right and left sides of said fireplace.

4. The fireplace assembly defined in claim 1 wherein said first pair of opposed sides are the right and left sides of the fireplace and said second pair of opposed side are the front and back sides of said fireplace.

5. The fireplace assembly defined in claim 2 wherein said said first pair of opposed sides are the front and back sides of said fireplace and said second pair of opposed sides are the right and left sides of said fireplace.

6. The fireplace assembly defined in claim 2 wherein said first pair of opposed sides are the right and left sides of said fireplace and said second pair of sides are the front and back sides of said fireplace.

7. A fireplace assembly adapted to cooperate with a chimney means having a flue, a first annular duct for conducting cold air into said fireplace assembly and a second annular duct coaxial with said first annular duct for exhausting heated air from said fireplace assembly, said fireplace assembly comprising

a firebox having a lateral opening in the front portion thereof to receive combustibles and comprising a base member supported on legs, opposed vertical sidewalls extending upwardly from the sides of said base member and rear vertical wall extending upwardly from the rear of said base member,

a dome assembly communicating said firebox with said flue, said dome assembly comprising an opposed pair of sidewalls inclined downwardly and outwardly from said first annular duct to the sidewalls of said firebox, a rear wall inclined downwardly and rearwardly from said second annular duct to said rear wall of firebox, and a front wall inclined downwardly and forwardly from said second annular duct to said lateral opening,

a single wall housing means completely surrounding said firebox and said dome assembly and spaced therefrom in such a manner that passageways are defined therebetween downwardly from said first annular duct across said sidewalls of said dome assembly, upwardly from said rear wall of said firebox across said rear wall of said dome assembly, into said second annular duct, upwardly from the front portion of said firebox across said front wall of said dome assembly into said second annular duct, and beneath said firebox, and

first baffle means for directing a portion of the air flowing down said sidewalls of said dome assembly to the front portion of said firebox and second baffle means for directing airflow from beneath said firebox to said rear wall of said firebox.