

Dec. 31, 1957

L. B. CAYOT
WALL FURNACE

2,818,059

Filed Dec. 31, 1954

5 Sheets-Sheet 1

Fig. 4.

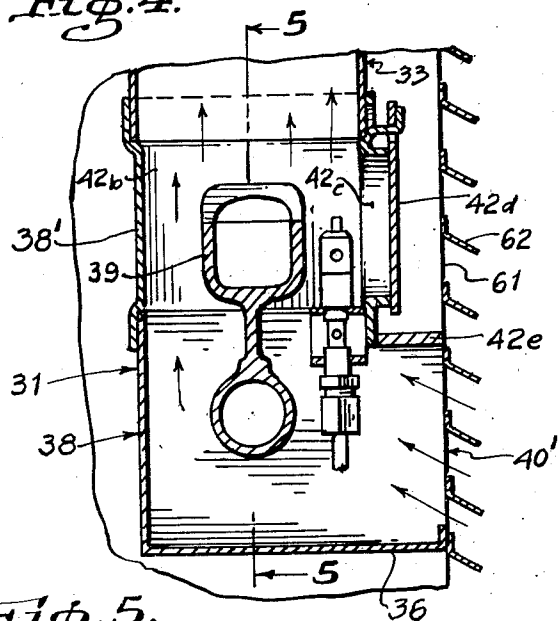


Fig. 1.

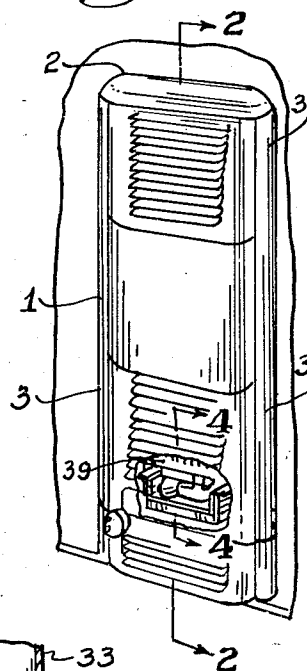
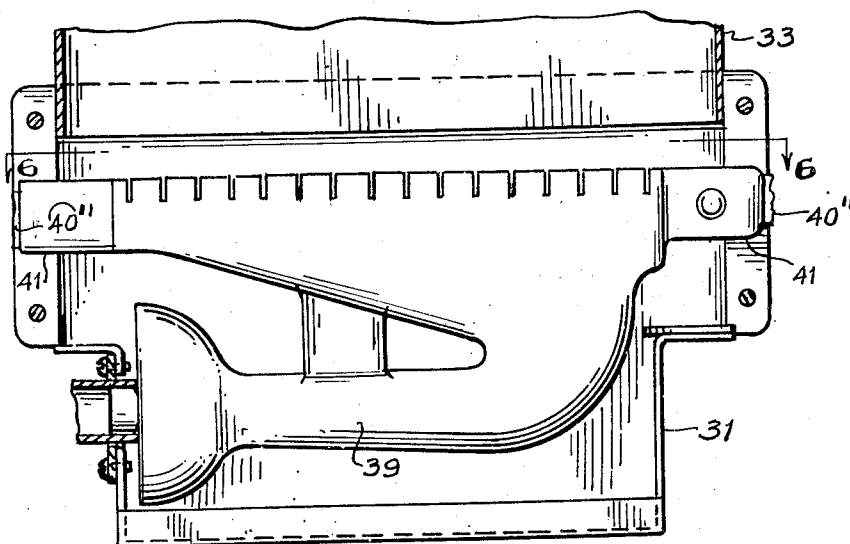


Fig. 5.



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Fig. 2.

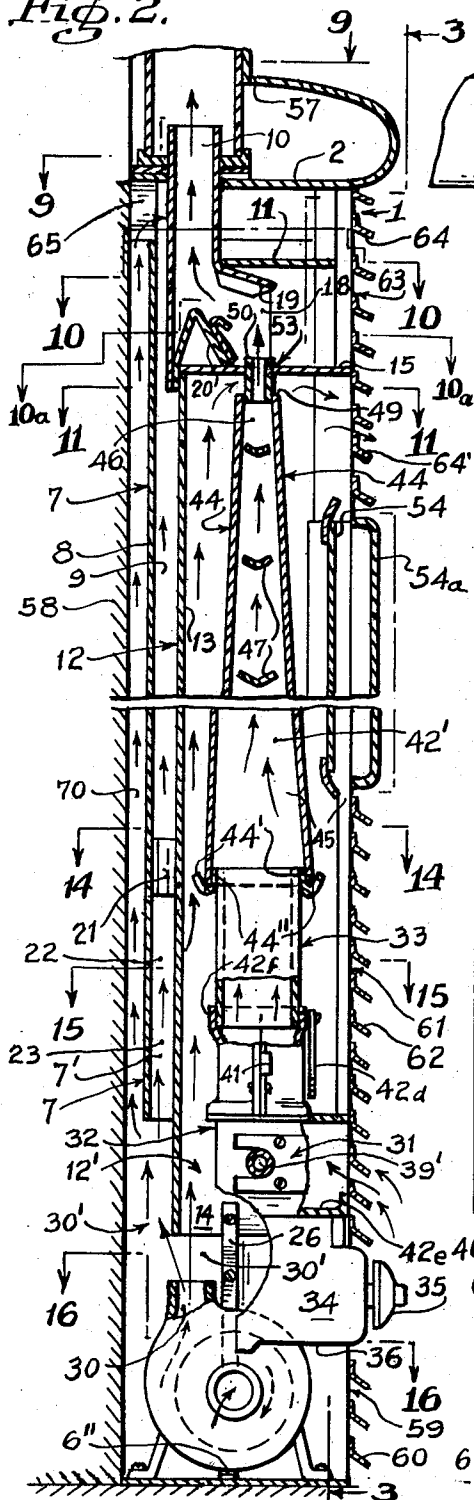
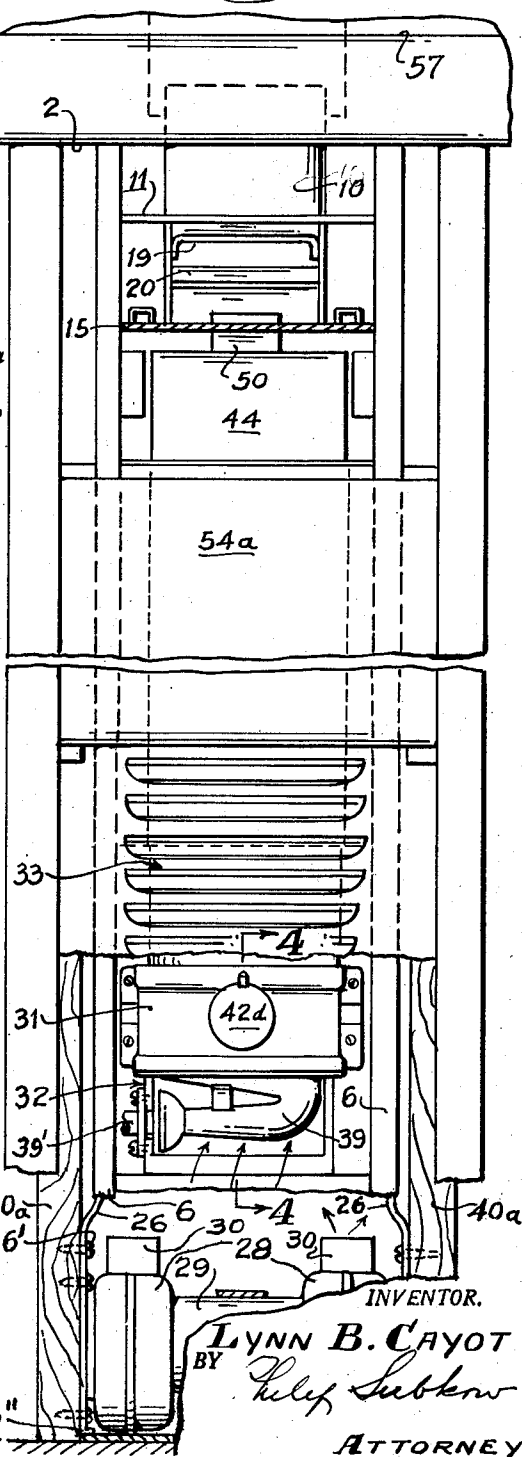


Fig. 3.



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Fig. 6.

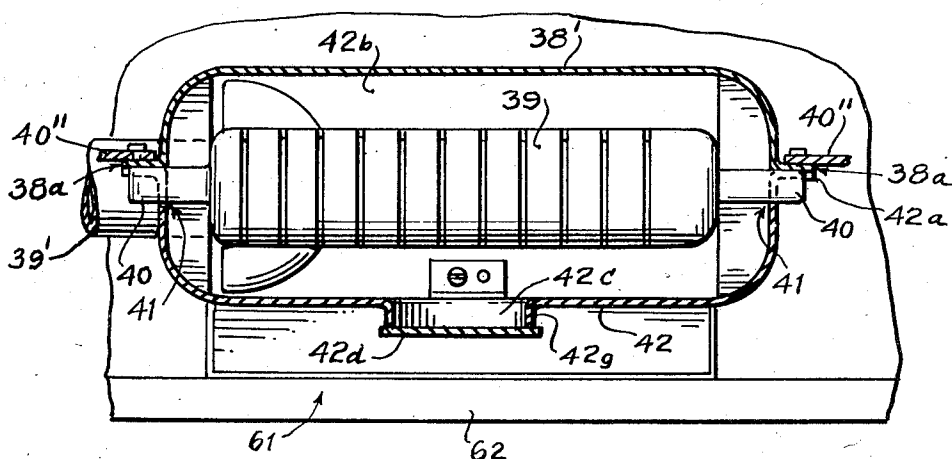
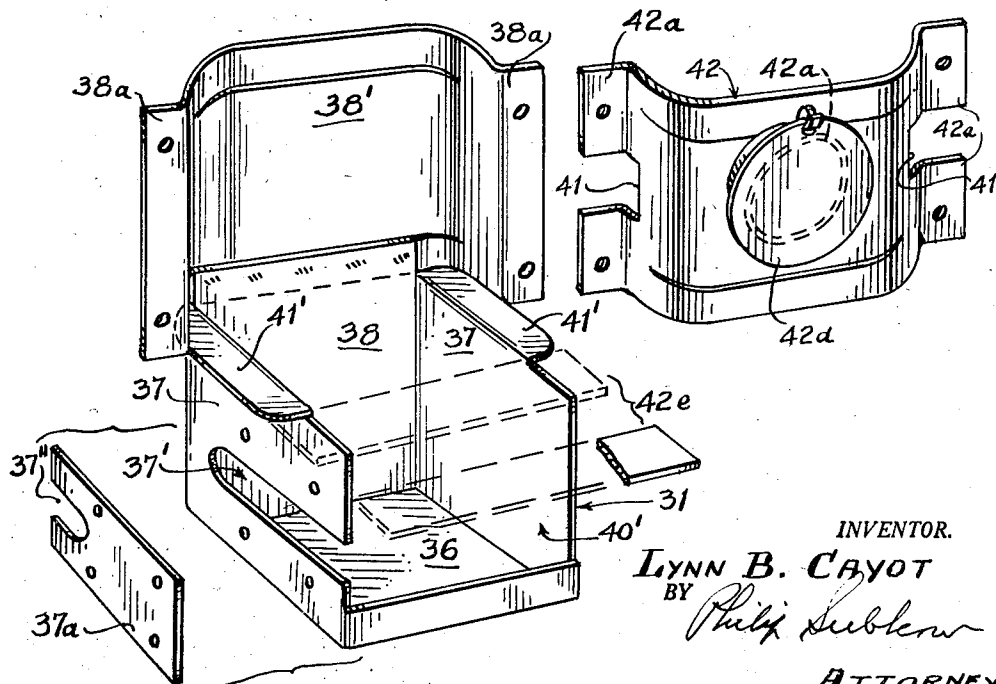


Fig. 7.

Fig. 8.



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Fig. 9.

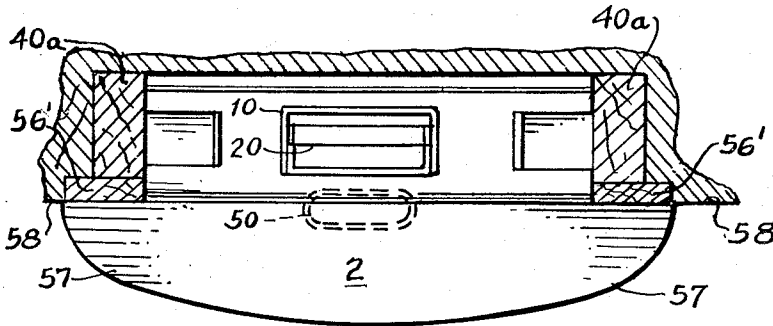


Fig. 10.

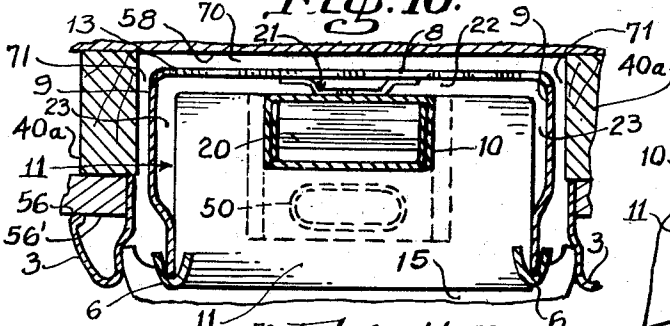


Fig. 11.

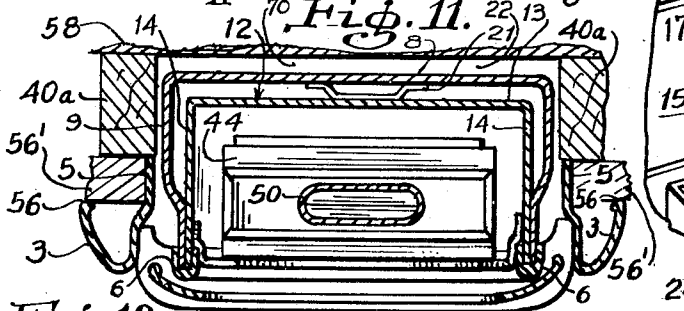


Fig. 10a.

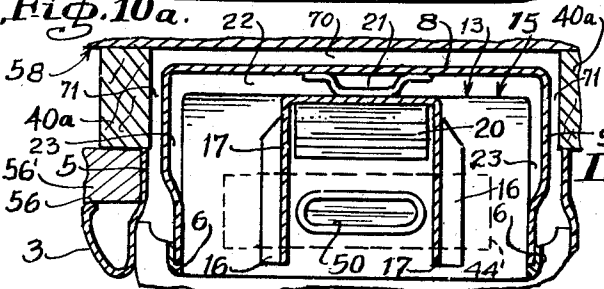


Fig. 12.

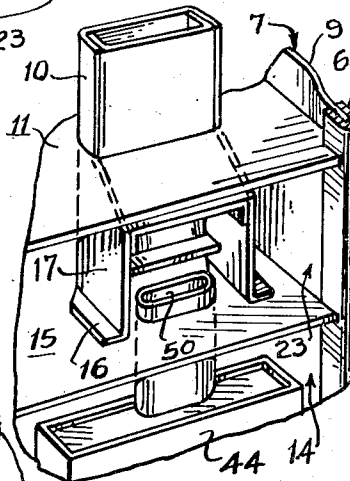
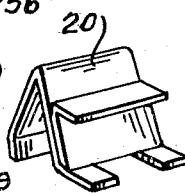


Fig. 13.



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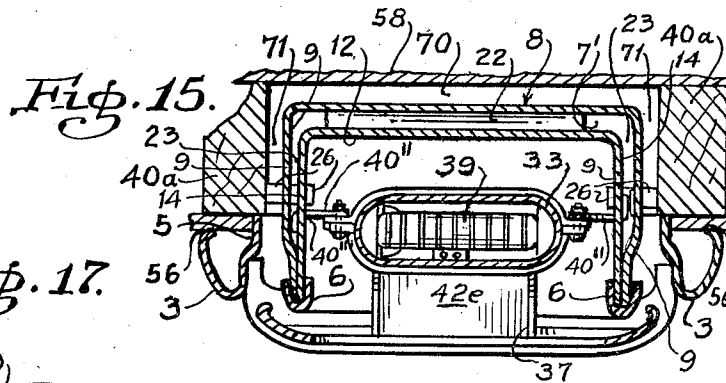
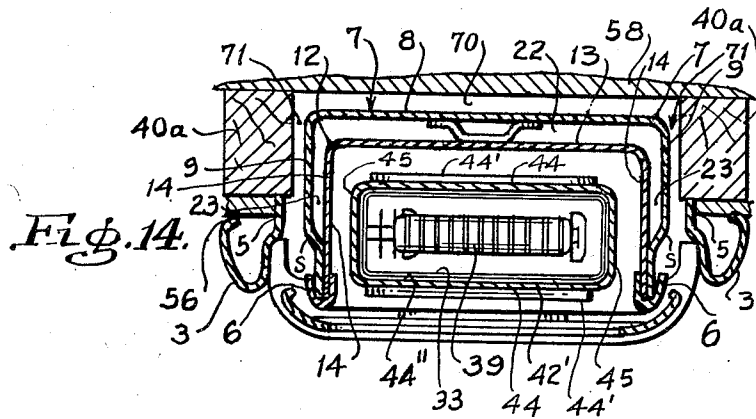


Fig. 17.

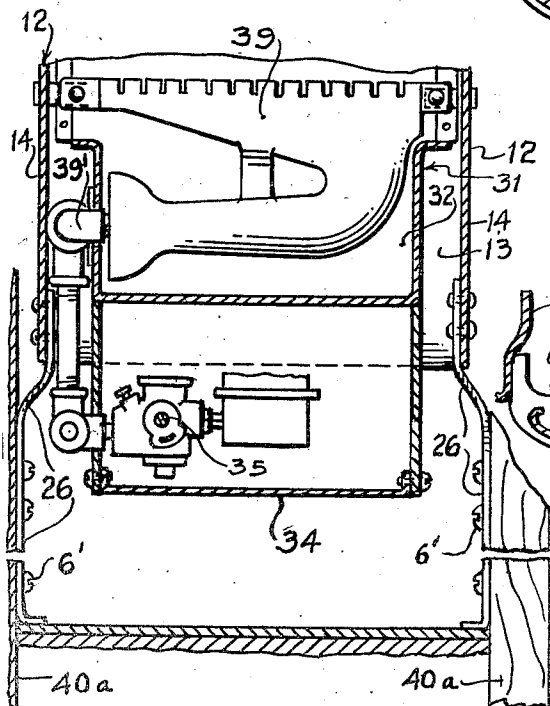
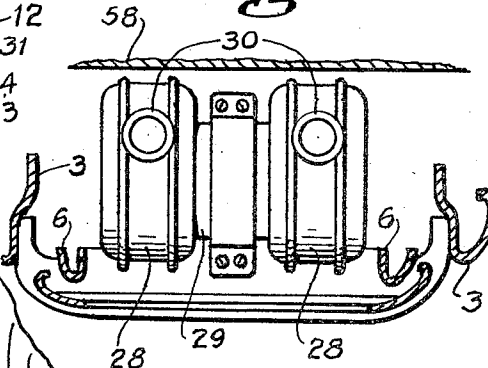


Fig. 16.



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2,818,059

WALL FURNACE

Lynn B. Cayot, Alhambra, Calif., assignor to Commonwealth Company, Alhambra, Calif., a copartnership

Application December 31, 1954, Serial No. 479,162

6 Claims. (Cl. 126—110)

This application is a continuation-in-part of my co-pending application Serial No. 196,554, filed November 20, 1950, now Patent No. 2,702,539, granted February 22, 1955.

This invention relates to furnace constructions adapted to be inserted into a wall. These furnaces belong to that general type known as hot-air furnaces wherein air circulates over flues inside of which combustion gases pass. Such furnaces are in one form so constructed that they may be inserted into a wall between studs and headers provided to receive the furnace structure. Usually a grille work is provided for circulation of air from the room around the flues and back to the room. Since circulation is thus a convection of the air it may occur by thermosyphonic circulation whereby the heated air rises around the flues to be discharged through an upper grille into the room and the relatively cool air near the floor of the room enters through a lower grille, due to the draft created by the rising hot air around the flue.

It will be seen that with a hot flue positioned inside a wall structure there is a fire hazard and therefore the authorities require that the wall portions adjacent the furnace show but a few degrees rise in temperature above room temperature. In order to attain this requirement elaborate baffle systems are built into such prior art furnaces to isolate the flue from the walls by means of stagnant layers of insulating air. The structure of the furnace is thus complicated and made more costly and also made bulky and requires larger openings.

This is further complicated and aggravated by the fact that the invention obtained in such prior art furnaces depends entirely on the temperature to which the circulating air is heated, and in order to obtain adequate heating the temperature to which the flue is heated must be raised. This further complicates the baffling problem and tends to increase the furnace size.

I have designed a furnace of the hot air type which obviates these difficulties. Instead of relying on thermosyphonic circulation of a relatively high temperature, low velocity stream of heated air over the heated flue, I employ force draft circulation. Since the total heat transferred to the circulating air per unit of time is proportional to the product of the mass of air circulated per unit of time and the temperature, I can transfer an equal or even greater amount of heat to the circulating air from the flue, which is maintained at a lower superficial temperature, by increasing the rate of circulation of the air at a lower circulating heated air temperature. By employing the circulating air as a blanket between the flue and the wall, I simplify the baffle system and reduce the number of baffles which I need and thus reduce the over-all dimensions of the furnace.

I have found it advantageous to vent the flue through which combustion gases pass to the discharge chimney by a vent into the room positioned near the top of the furnace. This, as I have found, will prevent any gust of wind passing down the chimney from blowing

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out the gas flame. This, however, presents the problem that the circulating hot air which also discharges into the room will by-pass into the flue through the vent. I have solved this problem by a unique and suitable baffle system which isolates the circulating stream of hot air from the hot combustion gases and prevents the by-passing of the circulating hot air into the flue.

I have also solved the problem of interference with the operation of the burner in the combustion chamber and the draft in the flue cavity by the suction created by the intake of the blower and the pressure of the air discharged from the blower and circulated in heat exchange with the combustion flue gases, by enclosing the flue and combustion chamber so that the said suction or discharge doesn't interfere with the said operation of the burner or circulation of the said combustion gases in the flue.

The effective isolation of the forced air circulation from the combustion chamber and combustion products flue permits of obtaining any desired air velocity and blower intake suction without influencing the character of the combustion or the composition of the combustion products. When the air stream in the hot air flue may be forced into the combustion chamber an excess of air may be found in the combustion chamber to deleteriously affect the character of the combustion. In like manner, any suction on the combustion space or combustion products flue created either by the intake of the blower or by the draft and the air stream in the hot air flue will in time reduce the efficiency of the combustion and deleteriously affect the combustion process.

Another feature of this invention is the protection of the encompassing wall, into which the furnace is set, from excessive temperature rise. I have provided for a protecting blanket of circulating relatively cool air between the exterior furnace wall and the circumambient wall into which the furnace is set. I also provide a space for circulation of another blanket of insulating air between the exterior wall of the furnace and the circulating hot air flue, and by these means effectively reduce the heat transfer from the furnace walls to the wall of the structure into which the furnace is set.

These and other objects of my invention will be further described in connection with the drawings.

Fig. 1 is a front view of a furnace of my invention as installed in a wall;

Fig. 2 is a section taken on line 2—2 of Fig. 1;

Fig. 3 is a section taken on line 3—3 of Fig. 2, with parts broken away for better illustration of the parts;

Fig. 4 is a section taken on line 4—4 of Fig. 3;

Fig. 5 is a section taken on line 5—5 of Fig. 4;

Fig. 6 is a section taken on line 6—6 of Fig. 5;

Fig. 7 is a perspective view of the combustion chamber housing;

Fig. 8 is a perspective view of the combustion chamber cover employed with the housing of Fig. 7;

Fig. 9 is a section taken on line 9—9 of Fig. 2;

Fig. 10 is a section taken on line 10—10 of Fig. 2;

Fig. 10a is a section taken on line 10a—10a of Fig. 2;

Fig. 11 is a section taken on line 11—11 of Fig. 2;

Fig. 12 is a perspective view of a detail of the flue gas discharge outlet;

Fig. 13 is a perspective view of a detail of a baffle for the flue gas discharge outlet;

Fig. 14 is a section taken on line 14—14 of Fig. 2;

Fig. 15 is a section taken on line 15—15 of Fig. 2;

Fig. 16 is a section taken on line 16—16 of Fig. 2; and

Fig. 17 is a section similar to Fig. 5 but showing additional details.

The furnace is formed of an outer frame 1 made up of a top header member 2 and side members 3 which are

welded or otherwise affixed to the header 2. The header and side members are curled so as to present an arcuate and artistic exterior form. The vertical members 3 are curled to form an interior longitudinal flange 5 on the longitudinal edge of the curled vertical frame member. Vertically disposed channel members 6 are connected at their upper end to the header 2 and extend parallel to the vertically disposed frame members 3 and spaced inwardly therefrom.

An external channel member or casing 7 depends from a horizontal baffle 11 near the top of the furnace. The channel 7 is formed of a back 8 and side walls 9 which fit into the vertical channel members 6. A chimney 10 is positioned in a suitably provided hole in the top 2. The horizontal baffle 11 extends forwardly from the chimney, parallel to the top 2 and spaced downwardly therefrom.

An internal channel member or casing 12, formed of a back 13, side walls 14, and top 15 depends from the chimney 10 to which it is connected at the flanges 16 turned outwardly from the side walls 17 of the chimney 10 (see Fig. 12). The front longitudinal edges of the walls 14 fit in the channel 6 inside of the front edges of the walls 9 of the exterior channel member 7. The lower ends of side walls 14 of the channel member 12 are supported on brackets 26 which extend downwardly to the floor along the studs or side members 40a, to which they are connected by screws 6', the lower extremities of the brackets resting on feet 6'' positioned on the floor adjacent the studs.

The chimney 10 between the baffle 11 and the top 15 has a combustion gas entrance 18 with a deflecting baffle 19 positioned at an acute angle to the top 11. A wedge-shaped member 20 (see Figs. 2 and 13) is positioned on the top 15 in alignment with the chimney 10 to form a restriction in the throat of the chimney and to provide additional baffling for the purposes described below. A spacer 21 is provided near the bottom of the back 8.

There is thus created a space 22 between the back walls and a space 23 between the side walls of the channel members 7 and 12.

At the bottom of the unit is positioned a blower or blowers 28, suitably driven by an electric motor 29. The discharge from the blowers terminate in nozzles 30, which discharge into the space 30' below channel members 7 and 12. The nozzles 30 are so positioned that the major portion of the discharged air is directed to the space 12' inside baffle 12 with only a minor portion directed into the space 7' between members 7 and 12. Nozzles 30 can be positioned to vary the relative proportion of air discharged from the blowers into spaces 12' and 7'.

A combustion chamber 32 is positioned in the furnace just above the blowers 28. The chamber 32 is completely enclosed and is composed of a lower burner box 31 and an upper chamber 33. Burner box or housing 31 has attached to the lower end thereof a case 34 which houses the burner mechanism, and a valve 35 is positioned in front of case 34 for adjusting the burner. The burner box 31 (see Figs. 7 and 8) is a substantially three sided housing having a bottom 36, side walls 37, and a back wall 38, one of the side walls 37 having an elongated slot 37' therein. A burner 39 is positioned inside the burner box with inlet pipe 39' thereof extending through slot 37' and an aligned slot 37'' formed in a plate 37a which is bolted to one side 37 of the burner box to retain pipe 39' in position.

The burner box 31 is open in the front 40' and at the top thereof, and has horizontal flanges 41' extending longitudinally along the upper edges of the side walls 37. Connected, as by welding, to the back wall 38 of the burner box is a vertical plate 38' having inwardly curved opposite ends which are bent back to form vertical flanges 38a, said flanges extending outwardly beyond flanges 41' and normal to the plane thereof. A vertical front plate 42 mating with plate 38' and having inwardly curved ends and vertical flanges 42a connected thereto is bolted

to plate 38' at the flanges 38a and 42a to form a chamber 42b in the burner box which houses the upper portion of burner 39. The ears 40 of the burner are supported in notches 41 in the opposite sides of plate 42 adjacent the flanges 42a thereof. The flanges 38a and 42a are connected to supporting plates 40'' in turn connected to the side walls 9 of channel 7 for supporting the burner and burner box.

A circular hole 42c is formed in plate 42 to provide access to the burner pilot light, and a cover 42d is positioned over a peripheral flange 42g formed about hole 42c and is arranged to be swung or rotated away from the hole for access to the pilot. The cover 42d, when in position over hole 42c, is in tight frictional engagement with the outer edge of flange 42g and does not permit any substantial amount of air to pass through hole 42c into the chamber 42b. A cover member 42e is adapted to cover the open portion of the top of the burner box 31 beyond flanges 41' thereof. Supported in an outwardly flared lip 42f formed in the upper end of plates 38' and 42 of the burner box is an elliptically shaped pipe 33 forming the upper portion of the combustion chamber 32 and communicating with chamber 42b.

The flue member 42' is made up of an enlarged lower section which fits over the combustion chamber with the side walls 45 of the flue and the back and front walls 44 thereof resting in hooks 44' positioned along the edges of a rectangular flange 44'' connected about the upper peripheral ends of pipe 33. The flue is thus in communication with pipe 33 and is located and supported on the combustion chamber so that no gas leakage can take place at the juncture of pipe 33 and flue 42'. The upper horizontal section 46 of the flue is constricted in length, but not in width, to form a flue of trapezoidal vertical section in which is positioned a plurality of spaced baffles 47 extending across the width of the flue. The top of the flue is covered by a cover 49 to which a nozzle 50 is attached. The nozzle extends by a sliding fit through a hole 53 in the top 15.

An internal front plate 54 is positioned at the front of the furnace and connected at its ends to the channel members 6 and thus acts also as a cross brace therefor. An external plate 54a is positioned in front of plate 54 and is attached at its ends to the frame member 3.

The furnace is installed between the studs 40a of a wall with a backwardly curled flange 56 flush against the members 56' disposed adjacent the outer faces of the studs, and the curled back flange 57 of the header 2 against the wall 58. The furnace may be secured to the studs by means of nails or screws passed through the members 3 into the studs. The front grille is then installed. This grille consists of a lower panel 59 carrying louvers 60 positioned near the floor adjacent the blowers 28. A panel 61 carrying louvers 62 is positioned between the plate 54a and the bottom of the open end 40' of the burner box 31. A third panel 63 carrying the louvers 64 fits on top of the panel 54a and underneath the header 2.

It will be observed that the external casing 7 is spaced from the wall at the back by means of a spacer 65 positioned at the upper end of the posterior surface of the back 8, and at the sides by the spacing provided by the relative position of the channel 6 and the frame members.

The air circulation by means of the blower discharges chiefly into the space between the flue and the interior casing 12 and circulates over the hot flue. It will be observed that the coldest air discharges adjacent the combustion chamber and thus the members 7 and 12 and the walls are shielded from the hot flame by a blanket of relatively cool moving air. As the heated air moves upward around the flue the temperature of the flue gases drops. The temperature of the hot air in the space around the flue depends on the mass velocity of the air movement, i. e., the output of the fan. I may thus trans-

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fer a large quantity of the B. t. u. content of the flue gas to the moving air but maintain the temperature of the moving air relatively low.

It is noted that a portion of the air discharged from the blower is directed into the spaces 22 and 23 between the interior casing 12 and the exterior casing 7, and some of the air will also pass into the spaces 70 and 71 between the member 7 and the wall 58 and wall members 40a. The air passing upwardly in spaces 22 and 23 is discharged over the upper end of the interior casing 12 and enters the space between the horizontal baffle 11 and the top 15 of member 12 (see Figs. 10a and 12) to proceed mainly into the chimney 10 via the gas entrance 18. The air passing upwardly in spaces 70 and 71 enters the upper space between the horizontal baffle 11 and the header 2. The movement of the air through spaces 22 and 23, and through spaces 70 and 71 enables the temperature of the walls to be maintained substantially at or but a few degrees above room temperature.

It is also seen that air for combustion passes through louvers 62, into the open end 40' of the burner box 31 and upwardly therein through the chamber 42b, and with the combustion products passes into pipe 33 and the flue 42'. Thus, the combustion air and combustion products are completely isolated from the air passing through grille 59 and the forced air circulation by the blowers, and it is possible to vary the air velocity and blower intake suction without affecting the nature of the combustion or of the combustion products. Hence, the air discharged from the blowers and moving upwardly about the flue does not interfere with the draft of air to the combustion chamber which enters through the louvers 62.

The circulating hot air is deflected by the top 15 through the lower portion 64' of grille 64 below said top. This completes the circuit of the circulating air which is thus completely isolated from the combustion gas circuit.

The combustion gases discharging from the nozzle 50 above the top 15 are deflected by the baffle 19 and the wedge 20 into the chimney 10, the draft being sufficient to maintain a sufficiently lower pressure in the chimney than is present in the room, the blowers 28 being positioned sufficiently far down from the louvers 64 to avoid any cycling of the combustion gases into the room during ordinary operations. However, if a gust of wind creates a momentary pressure wave down the chimney 10, it will be discharged into the room through louvers 64 between the baffles 15 and 11 rather than down the relatively narrow constricted nozzle 50, and thus the burner flame is protected against a wind which may blow it out.

By removing the backs 8 and 13 of channel members 7 and 12, and placing a second combustion chamber and flue and grille cover on the opposite side of the nozzles 30, the furnace may be employed as a double wall furnace, the air thus circulating through the nozzles 30 and between the flues and out under tops such as 15 through each of the grilles in each side of the wall, with the air for cooling the walls flowing in the spaces 23 and in the spaces 71 between the exterior baffle and the wall members, such air currents discharging into the spaces between top 15 and header 2 as described above.

While I have described a particular embodiment of my invention for the purpose of illustration, it should be understood that various modifications and adaptations thereof may be made within the spirit of the invention as set forth in the appended claims.

I claim:

1. A combination wall and hot air furnace structure comprising an elongated combustion gas flue extending through said furnace, a combustion chamber positioned near one end of said furnace and connected to one end of said combustion gas flue, an air heating conduit positioned in said furnace and surrounding said combustion gas flue and extending therealong in spaced relation-

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ship to said combustion gas flue, said air heating conduit comprising a channel member having back and sides and a front wall member connected to the sides of the said channel, a second channel member positioned in said furnace and extending along said first channel member, said second channel member comprising a back and two sides, said back and sides being positioned exteriorly of said air heating conduit and being spaced from the back and sides of the said air heating conduit, the space between said channel members defining a second conduit, means forming an air outlet from said last-named conduit, means forming an air inlet to said combustion chamber positioned at one end of said wall member adjacent said combustion chamber, means forming a heated air discharge outlet from said air heating conduit positioned near the other end of said wall member, a top to said heating conduit above said heated air outlet, an air blower positioned near the bottom of said furnace, said air blower having an intake and a discharge, means forming an air inlet in said furnace communicating with said blower intake, means spacing and isolating said last-named air inlet from said air inlet to said combustion chamber, means defining a passage about said second channel member, means forming an air outlet from said passage, said blower discharge communicating with said air heating conduit, said second conduit, and said passage, a flue gas discharge conduit connected to the other end of said flue and communicating with the space above said top, means forming a flue gas outlet for said flue gas discharge conduit and communicating with said space, and means forming a second air outlet positioned above said top and said heated air outlet, said second air outlet being separate and isolated from said heated air outlet, said air outlets from said passage and said second conduit communicating with said flue gas outlet and said space and said second air outlet, and means isolating said blower discharge from said combustion chamber.

2. A hot air furnace adapted to be set in a wall, comprising means defining an air heating chamber, said means including a back and sides and a front wall member connected to the said sides, a combustion chamber positioned near one end of said furnace within said air heating chamber, a combustion gas flue extending through said air heating chamber, one end of said flue being connected to said combustion chamber, said combustion chamber being provided with means forming an air inlet, said air inlet being positioned at one end of said wall member adjacent said combustion chamber, said air heating chamber having means forming an air inlet, the walls of said air heating chamber surrounding the walls of said combustion gas flue and extending therealong in spaced relation therefrom and having means forming a heated air outlet spaced from said heating chamber inlet and positioned near the other end of said wall member, a top to said heating chamber above said last-named outlet, a flue gas discharge conduit connected to the other end of said flue and communicating with the space above said top, means forming a flue gas outlet for said conduit and communicating with said space, means forming a second air outlet positioned above said top and said heated air outlet, and communicating with said space and said flue gas outlet, said second air outlet being separate and isolated from said heated air outlet, a blower near one end of said furnace having an intake and a discharge, means forming an air inlet in said furnace in communication with the air intake to said blower, means separating said last-mentioned air inlet from said inlet to said combustion chamber, means about said air heating chamber and forming an air passage externally of said heating chamber adjacent the walls thereof, means forming an air outlet from said passage communicating with the space above said top and with said flue gas outlet and said second air outlet, said blower discharge communicating with said air heating chamber and said passage and being

directed toward said air outlets, and means isolating said blower discharge from said combustion chamber.

3. A hot air furnace adapted to be set in a wall comprising an elongated combustion gas flue extending through said furnace, a combustion chamber positioned near one end of said furnace and connected to one end of said combustion gas flue, an air heating conduit positioned in said furnace and surrounding said combustion gas flue and extending therealong in spaced relationship to said combustion gas flue, said air heating conduit comprising back and sides and a front wall member connected to the said sides, means forming a heated air discharge outlet from said air heating conduit near one end of said air heating conduit, said combustion chamber having means forming an air inlet thereto, said air inlet being positioned at one end of said wall member adjacent said combustion chamber and said heated air outlet positioned near the other end of said wall member, a top to said heating conduit above said last-named outlet, a flue gas discharge conduit connected to the other end of said flue and communicating with the space above said top, means forming a flue gas outlet for said flue gas discharge conduit and communicating with said space, and means forming a second air outlet positioned above said top and said heated air outlet, said second air outlet communicating with said space and said flue gas outlet, and being separate and isolated from said heated air outlet, an air blower positioned near one end of said furnace, said air blower having an intake and a discharge, means forming an air inlet in said furnace communicating with said blower intake, means spacing and isolating said last-named air inlet from said air inlet to said combustion chamber, a second conduit positioned about said air heating conduit, and means forming an air outlet from said last-named conduit communicating with the space above said top and with said flue gas outlet and said second air outlet, said blower discharge communicating with said air heating conduit and said second conduit and being directed toward said air outlets.

4. A hot air furnace adapted to be set in a wall comprising an elongated combustion gas flue extending through said furnace, a combustion chamber positioned near one end of said furnace and connected to one end of said combustion gas flue, an air heating conduit positioned in said furnace and surrounding said combustion gas flue and extending therealong in spaced relationship to said combustion gas flue, said air heating conduit comprising a channel member having back and sides and a front wall member connected to the said sides, a second channel member positioned in said furnace and extending along said first channel member, said second channel member comprising a back and two sides, said back and sides being positioned exteriorly of said air heating conduit and being spaced from the back and sides of the said air heating conduit, the space between said channel members defining a second conduit, means forming a heated air discharge outlet from said air heating conduit near one end of said air heating conduit, said combustion chamber having means forming an air inlet thereto, said air inlet being positioned at one end of said wall member adjacent said combustion chamber and said heated air outlet positioned near the other end of said wall member, a top to said air heating conduit above said last-named outlet, a flue gas discharge conduit connected to the other end of said flue and communicating with the space above said top, means forming a flue gas outlet for said flue gas discharge conduit and communicating with said space, and means forming a second air outlet positioned above said top and said heated air outlet, said second air outlet communicating with said space and said flue gas outlet, and being separate and isolated from said heated air outlet, an air blower positioned near one end of said furnace, said air blower having an intake and a discharge, means forming an air inlet in said furnace communicating with said blower intake, means spacing and isolating said last-

named air inlet from said air inlet to said combustion chamber, means forming an air outlet from said second conduit communicating with the space above said top and with said flue gas outlet and said second air outlet, said blower discharge communicating with said air heating conduit and said second conduit and being directed toward said air outlets.

5. A combination wall and hot air furnace structure comprising an elongated combustion gas flue extending through said furnace, a combustion chamber positioned near one end of said furnace and connected to one end of said combustion gas flue, an air heating conduit positioned in said furnace and surrounding said combustion gas flue and extending therealong in spaced relationship to said combustion gas flue, said air heating conduit comprising back and sides and a front wall member connected to the said sides, means forming a heated air discharge outlet from said air heating conduit near one end of said air heating conduit, said combustion chamber having means forming an air inlet thereto, said air inlet being positioned at one end of said wall member adjacent said combustion chamber and said heated air outlet positioned near the other end of said wall member, a top to said air heating conduit above said last-named outlet, a flue gas discharge conduit connected to the other end of said flue and communicating with the space above said top, means forming a flue gas outlet for said flue gas discharge conduit and communicating with said space, and means forming a second air outlet positioned above said top and said heated air outlet, said second air outlet communicating with said space and said flue gas outlet, and being separate and isolated from said heated air outlet, an air blower positioned near one end of said furnace, said air blower having an intake and a discharge, means forming an air inlet in said furnace communicating with said blower intake, means spacing and isolating said last-named air inlet from said air inlet to said combustion chamber, a second conduit positioned about said air heating conduit, means forming an air outlet from said last-named conduit communicating with the space above said top and with said flue gas outlet and said second air outlet, means defining a passage about said second conduit, and means forming an air outlet from said passage, said last named outlet communicating with said space and said second air outlet, said blower discharge communicating with said air heating conduit and said second conduit and said passage, and being directed toward said air outlets.

6. A combination wall and hot air furnace structure, comprising means defining an air heating chamber, a combustion chamber positioned near one end of said furnace within said air heating chamber, a combustion gas flue extending through said air heating chamber, one end of said flue being connected to said combustion chamber, said combustion chamber being provided with means forming an air inlet, said air heating chamber having means forming an air inlet, the walls of said air heating chamber surrounding the walls of said combustion gas flue and extending therealong in spaced relation therefrom and having means forming a heated air outlet spaced from said heating chamber inlet, means forming a first passage extending outside and along the walls of said air heating chamber, means forming a second passage separate from and adjacent said first passage, means defining a space above and isolated from said air heating chamber and said heated air outlet, means forming an air outlet from said space, the other end of said flue communicating with said space, means forming a flue gas outlet from said space, means forming an outlet from each of said passages to said space, a blower near one end of said furnace having an intake and a discharge, said blower discharge communicating with said air heating chamber and said first and second passages, means isolating said blower discharge from said combustion chamber, means forming an air inlet in said furnace in communication with the air intake to said blower, and

means separating said last-mentioned air inlet from said inlet to said combustion chamber.

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