Jan. 23, 1962 L. B. CAYOT 3,017,878

WALL HEATER

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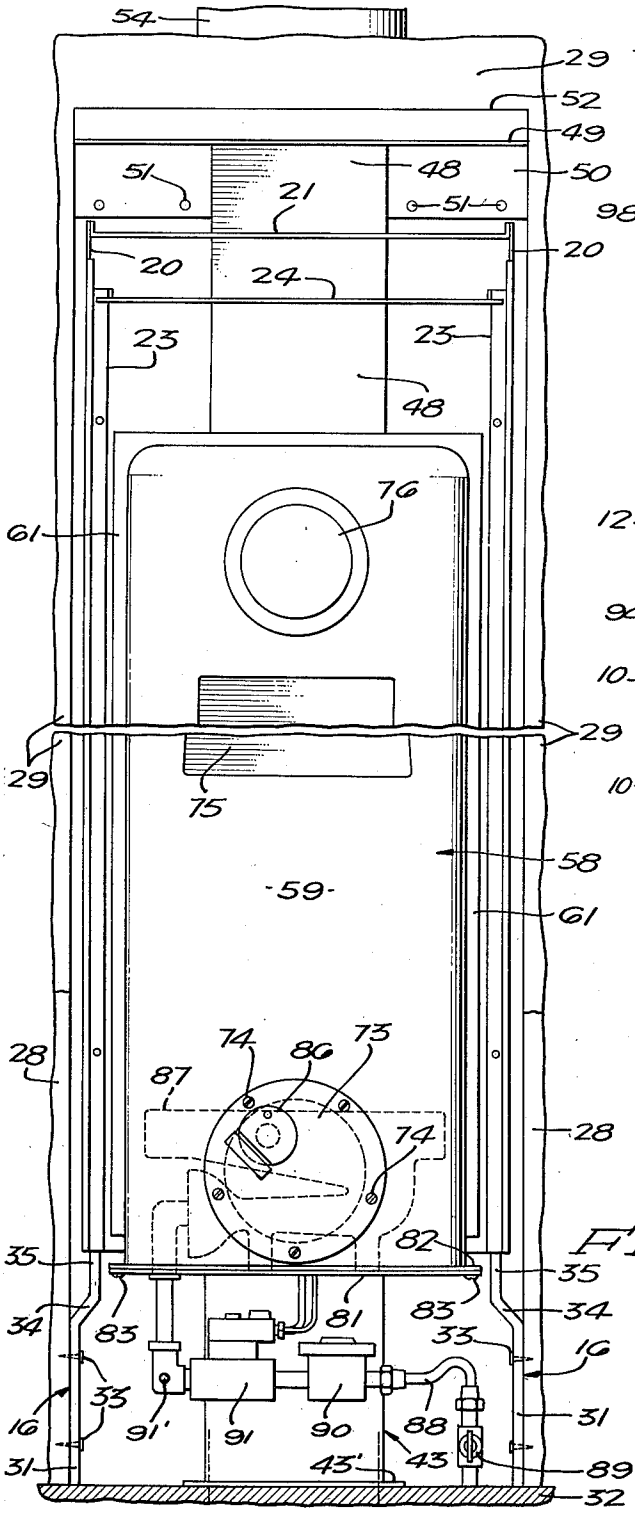


FIG. 1.

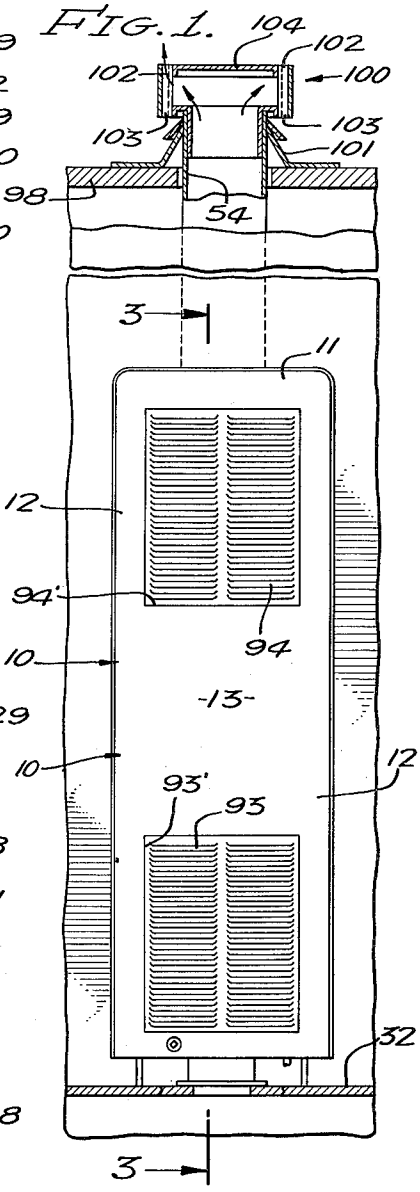


FIG. 2.

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WALL HEATER

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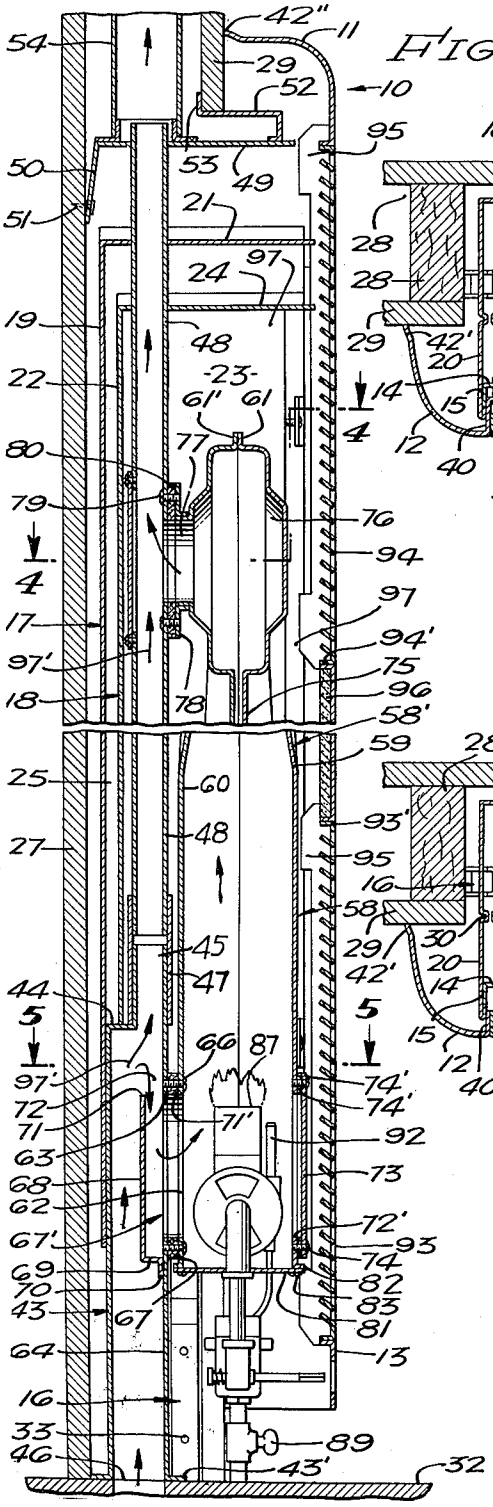


FIG. 3.

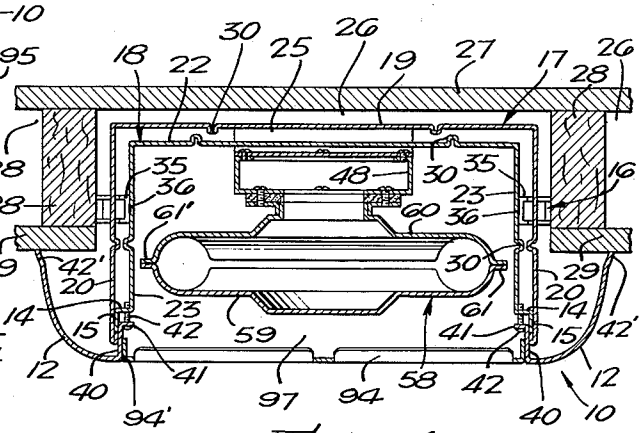


FIG. 4.

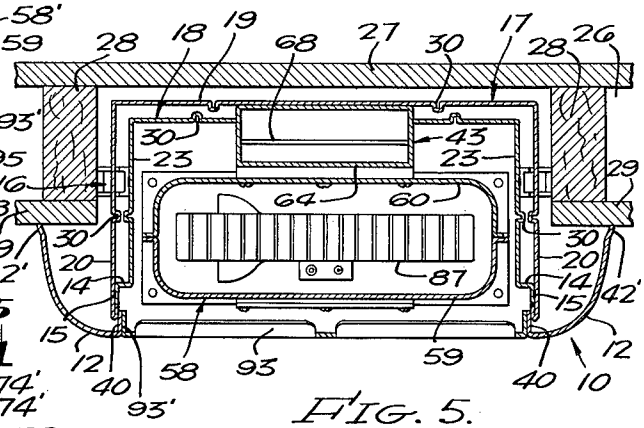


FIG. 5.

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3,017,878
WALL HEATER

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5 Claims. (Cl. 126—116)

This invention relates to a furnace construction adapted to be inserted into a wall, and is particularly concerned with a wall heater particularly adapted for use in auto trailers.

The furnaces concerned with herein belong to the general class of hot air furnaces wherein air to be heated circulates over flues inside 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 grillwork 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 and is 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.

Where wall heaters of this type are employed in automobile trailers, it is particularly desirable that air used for combustion in the gas furnace be obtained from the atmosphere externally of the trailer rather than from the interior thereof. If such combustion air is obtained from the interior of the trailer it seriously reduces the amount of fresh air available to persons occupying the trailer.

It is an object of the invention to design a heater or furnace of the above noted type which draws fresh air for combustion from the external atmosphere.

Another object is to provide a gas furnace having means to automatically take in the proper amount of air for efficient combustion, without drawing in an excess of air, and wherein sufficient air is by-passed to aid in keeping the walls cool and in cooling down the exiting flue gas.

Still another object is to afford a wall furnace which can be readily installed in a wall of a trailer, and which is simple in structure, yet durable and dependable in operation.

The above and other objects and advantages are accomplished according to a preferred embodiment of the invention by designing a wall furnace which is provided with means to draw in combustion air from below the floor A passageway is formed to carry this air upwardly toward an inlet to the combustion chamber. In said inlet is positioned a baffle or plate which is so located with respect to the top of said inlet that the amount of air introduced into the combustion chamber is restricted, and the combustion chamber only takes in sufficient air to produce complete burning, and permits a substantial portion of the air drawn in from below the floor to pass upwardly through channels along the rear of the furnace adjacent the walls, for cooling said walls and the exiting combustion gases. The result is that air in proper amount for combustion is drawn in from outside the trailer, and the combustion gases which are vented through a pipe in the roof are cooled by the substantial volume of air which is by-passed upwardly along the rear of the furnace. Sufficient combustion air is drawn into the combustion chamber to produce efficient combustion without formation of dangerous gases such as carbon monoxide.

The invention will be more clearly understood by reference to the following description of a preferred embodiment taken in connection with the accompanying drawings, wherein:

FIG. 1 is a front elevational view of the furnace;

FIG. 2 is an elevational view of the furnace of FIG. 1 with the front panel removed;

FIG. 3 is a vertical section taken on line 3—3 of FIG. 1;

FIG. 4 is a horizontal section taken on line 4—4 of FIG. 3; and

FIG. 5 is a horizontal section taken on line 5—5 of FIG. 3.

Referring to the drawings, the furnace is formed of an outer frame 10 made up of a top header member 11, side members 12 and a front panel 13. Members 11, 12 and 13 are welded or otherwise connected together, or they may be in the form of a single integral unit. The header 11 and side members 12 are curved so as to present an artistic exterior form.

The interior structure of the furnace, including the air heating chamber and the combustion chamber, to be described below, is supported on a pair of legs 16 of channel-shaped cross-section. These legs extend upwardly and are connected to a unit comprising an outer channel member 17 and an inner channel member 18. The channel members 17 and 18 are spaced from each other. The outer channel 17 has a back wall 19, side walls 20 and a horizontal top member 21, and the inner channel 18 has a back wall 22, side walls 23 and a horizontal top member 24 which is spaced downwardly from and parallel to member 21. The ends of the side walls 23 of the inner channel member 18 carry flanges 14 which are welded at 15 to the ends of side walls 20 of the outer channel. The two channel members 17 and 18 form a space 25, for a purpose described hereinafter, and the outer channel member 17 is spaced from the back wall 27, the studs 28 and the inner wall 29 in which the furnace is positioned, to provide an air space 26. The channel members 17 and 18 have a plurality of bent portions 30 to provide for expansion and contraction of these members.

The lower ends of legs 16 rest on the floor 32 and are connected to the studs 28 (see FIG. 2) by means of screws 33. The legs 16 are bent inwardly at 34 and the upwardly extending portions 35 of legs 16 are connected as by welding at 36 (see FIG. 3) to the inner channel member 18.

The side members 12 are bent inwardly at 40 (see FIG. 4) and carry flanges 41 which are connected to the flanges 14 of the inner channel member 18 by means of screws 42. By adjustment of the screws 42 the outer edges 42' of the side members 12 can be positioned in tight frictional engagement against the inner wall 29. This also places the upper end 42'' of the header 11 in tight frictional engagement with the inner wall 29.

A rectangular pipe 43 has flanges 43' which rest on the floor 32. The rear portion of the pipe 43 is bent inwardly at 44 forming an upper exit portion 45 of pipe 43, which is restricted in cross-sectional area as compared to the lower portion of the pipe, as seen in FIG. 3. The lower end of pipe 43 communicates with a hole 46 in the floor. About the upper portion 45 of the pipe 43 is placed a tightly fitting sleeve 47 into the upper end of which is placed a rectangular upwardly extending pipe 48. Pipe 48 passes upwardly through shelves 24 and 21 and the upper end of pipe 48 passes through an upper plate 49, having a downwardly bent rear portion 50 which is connected to the outer wall 27 by means of screws 51. The plate 49 has connected near its forward end a support member 52 which extends rearwardly and carries at the rear portion thereof a tongue 53 which abuts the back surface of the front wall 29. Pipe 48 can be adjusted vertically by slidable movement of the lower end thereof within sleeve 47. Mounted on the plate 49

directly above the upper end of pipe 48 is a flue discharge stack 54.

A combustion chamber 58 is positioned within the space provided by the inner channel member 18, said combustion chamber including an upwardly extending combustion gas flue 58'. Chamber 58 is formed of a front half portion 59 and a rear half portion 60 having peripheral flanges 61 and 61', respectively, which are connected together as by welding to form an enclosed chamber, as seen in FIGS. 3, 4 and 5. The lower rear portion of the combustion chamber has a circular opening 62 which communicates with a circular opening 63 of substantially the same diameter in the front plate 64 of pipe 43. Said rear portion 60 of the combustion chamber is connected to the adjacent front plate 64 of pipe 43 by means of screws 66 disposed about the periphery of openings 62 and 63, an insulation ring 67 being positioned between the rear portion of the combustion chamber and plate 64. It will thus be seen that the combustion chamber communicates with the pipe 43 via the entrance port 67' formed by openings 62 and 63 and the ring 67 positioned therebetween.

A rectangular baffle plate 68 is positioned in pipe 43 directly in front of the openings 63 and 62. Baffle plate 68 has a horizontally extending flange 69 at its lower end carrying a lip 70 which is welded to the front portion 64 of the pipe 43, as seen in FIG. 3. It will be noted that in preferred practice the upper edge 71 of the baffle 68 is about level with the upper extremity 71' of the combustion air inlet port 67'. It will thus be seen that the upper end 71 of the baffle plate 68 and the adjacent front portion 64 of pipe 43 form a passage 72 having a restricted cross-sectional area. On the lower front portion 59 of the combustion chamber is another circular opening 72', over which is mounted a plate 73 connected to the front plate 59 by means of screws 74, an insulation gasket 74' being provided between the plate 73 and member 59. Plate 73 provides access to the burner in the combustion chamber.

The combustion gas flue 58' tapers upwardly, as indicated at 75 in FIG. 3, and the upper portion of flue 58' connects with a header 76 carrying a short discharge pipe 77. The header 76 is held in position by a flange 78 disposed about the discharge pipe 77, and the flange 78 is connected to the pipe 48 by means of screws 79, with an insulation ring 80 disposed between the flange and pipe 48. A burner support plate 81 is connected to a flange 82 mounted on the lower end of the front and rear half portions 59 and 60 forming the combustion chamber, by means of the screws 83. A conventional gas burner 87 rests on the support plate 81, a gas line 88 introducing gas via a valve 89, pressure regulator 90, pilot control valve 91 and a shutoff valve 91' into the burner. A small door 86 in the front plate 73 provides access to the pilot 92 (see FIG. 3) of the burner.

A lower louver 93 is positioned in an aperture 93' of the front panel 13 of the furnace, and an upper louver 94 is also positioned in a suitable aperture 94' in the upper portion of the panel 13, the intermediate portion of the panel between the upper and lower louvers being provided with insulation as indicated at 96 in FIG. 3. There is thus provided within the inner channel member 18 about the combustion chamber 58 and pipe 48 an air heating space 97 which extends upwardly to the top member 24 of the inner channel 18.

In operation fresh air is drawn through the opening 46 in the floor 32 and passes upwardly through the pipe 43, since the pressure at the upper end of pipe 48 adjacent flue discharge stack 54 is less than the pressure at the lower end of pipe 43 adjacent inlet 46. At the inwardly bent portion 44 of pipe 43 the air is diverted somewhat to the right, as indicated in FIG. 3, toward and over the top edge 71 of the baffle plate 68. The upper edge 71 of the baffle plate is so positioned with respect to the upper edge of the air inlet port 67' to the combustion chamber that only that portion of the air passing through pipe 43 which is required to produce complete combustion within the combustion chamber is drawn into the restricted space 72 and thence via the air inlet port 67' into the combustion chamber, without drawing any significant excess of air into the combustion chamber. While experience has shown that the upper edge 71 of the baffle member should be about level with the top of the air entrance port 67' to the combustion chamber, it has been found that the upper edge of said baffle plate can be positioned a short distance above or below the top of the combustion air entrance port. Thus, for example, where the diameter of the apertures 62 and 63 forming the entrance port 67' is about 4½ inches, the upper edge 71 of the baffle plate can be located, say, about ½ inch above the upper edge of the entrance port or about ½ inch below it while still only permitting the required amount of air to be drawn into the combustion chamber according to the invention. The restricted passage 72 preferably has a cross-sectional area substantially smaller than the cross-sectional area of port 67'. Thus, for example, the area of passage 72 can be on the order of 4 square inches, whereas the area of port 67' can be about 16 square inches, so that the ratio of the cross-sectional area of passage 72 to port 67' can be about 1:4. But this ratio may be larger or smaller than 1:4, depending on various factors such as the amount of gas being consumed per unit of time by the burner, while still producing the invention results. It will be understood that the above noted dimensions and ratios are given as illustrative only and the invention is not to be taken as limited thereby. The heat of the combustion gases in the combustion chamber 58 is transferred to the air which has been drawn from the room into the lower louvers 93 and which passes upwardly through the space 97 around the combustion chamber and the combustion gas flue to the top member 24, and the thus heated air then passes outwardly through the upper louvers 94 into the room.

The combustion gases pass into the header 76 and through the outlet pipe 77 into the flue pipe 48, wherein the hot combustion gases intermix with the excess air in 48, which has by-passed the baffle member 71 in pipe 43 and proceeded upwardly through pipes 45 and 48, as indicated by the arrows 97' in FIG. 3. Such excess air passing through pipe 48 cools the combustion products down and the cooled mixed gases then pass through the upper portion of pipe 48 into the stack 54 which passes through the roof 98, and then through a cap 100 which is positioned at the top of the flue (see FIG. 1). This cap has a top member 104 and a plurality of peripheral openings 102 in the upper end thereof so that the flue gases are diverted outwardly and through said openings 102, as indicated by the arrows in FIG. 1. The cap 100 also has a plurality of peripheral openings 103 distributed in the lower portion thereof, said openings 103 being in communication and in alignment with the openings 102, so that in the event that a downward draft or gust is directed through the upper apertures 102 such gust of air will pass downwardly through the openings 103 without being conducted into the pipe 54, where they might tend to blow out the burner. A support 101 is positioned on the roof about the upper end of pipe 54 to maintain it in position. The cap 100 is of a type known in the art.

Where a baffle plate such as 68 is not employed adjacent the combustion air inlet according to the invention, it has been found that a large excess of combustion air will be drawn from pipe 43 through port 67' into the combustion chamber 58, substantially cooling down the combustion gases therein and reducing the heat transferred from the combustion chamber to the air being heated in the space 97. Further, under these conditions the amount of air passing upwardly through pipe 48 and intermixing wtih the combustion gases is substantially reduced and the combustion gases passing through the

pipe 77 into 48 accordingly are not sufficiently cooled down, resulting in the discharge of hot flue gases through pipe 48 and a loss of heat out of the stack, thereby reducing the efficiency of the system. These disadvantages are avoided by the provision of the baffle plate 68 and the positioning of said baffle plate with respect to the air entrance port to the combustion chamber so that essentially only the amount of air required to provide complete combustion, and little if any excess air, is drawn into the combustion chamber. In this manner there is no material amount of excess air present in the combustion chamber to dilute the combustion gases and reduce the temperature thereof, and greater heat transfer is thereby realized between the hot gases in the combustion chamber 58 and flue 58', and the ascending air being heated in the space 97 around the combustion chamber and flue 58'. Also, the mixing of the flue gases with the relatively large amount of by-passed cool air passing upwardly in pipe 48 substantially reduces the temperature of the gases being discharged.

The spaces formed between the members 24, 21 and 49 at the top of the furnace, the space 25 between the channel members 17 and 18, and the space 26 between channel member 17 and the surrounding walls and studs provide for the introduction of a blanket of air into the upper and rear portions of the furnace, to thus insulate the walls and studs from the furnace and reduce the temperature of the surrounding walls.

The furnace of the instant invention is particularly adapted for use in automobile trailers, since it provides for introduction of combustion air from the exterior atmosphere below the floor of the trailer and for discharging the combustion gases to the atmosphere above the roof of the trailer. In this manner the combustion air is drawn entirely from outside the trailer and is not taken from within the trailer, where the air supply is limited and it is highly desirable that there always be a sufficient supply of fresh air available to the occupants, and the products of combustion are sealed off from the interior of the trailer. However, it will be understood that the wall furnace of the invention can be employed other than in trailers, for example, in rooms of conventional dwellings or commercial buildings.

While I have shown in the preferred embodiment that the air inlet entrance for the combustion air is located in the floor and is adapted to receive air from below the floor, such air inlet can be located in the wall above the floor, e.g. in the wall 27, preferably below the level of the upper edge 71 of the baffle plate 68. Further, instead of discharging the flue gases through the roof, a discharge outlet can be connected to pipe 48 and pass through the wall 27 at a point above the air inlet. According to these modifications, inlet air for combustion is taken from the exterior atmosphere and the flue gas is discharged to the exterior atmosphere, in each case without disturbing the air in the room being heated.

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 hte appended claims.

I claim:

1. A hot air furnace comprising means defining an air heating chamber, a combustion chamber positioned near the lower end of said furnace within said air heating chamber, a combustion gas flue extending upwardly in said air heating chamber, one end of said flue being connected to said combustion chamber, means defining an air inlet at the bottom of said furnace below said air heating chamber, means forming a first air passageway communicating with said air inlet and extending upwardly alongside and separately from said air heating chamber, means forming an inlet for combustion air to said combustion chamber, last named inlet communicating with said passageway and being positioned above said first named inlet, baffle means mounted adjacent said air inlet to said combustion chamber, said baffle means providing a restricted air passage from said passageway to said last named inlet, and permitting only a portion of the air in said passageway to be introduced into said combustion chamber, sufficient only to produce substantially complete combustion of the fuel in said combustion chamber without any substantial amount of excess air, means forming a second passageway at the upper end and forming an extension of said first passageway and extending upwardly from said last named inlet along said air heating chamber separately therefrom, the other end of said flue being connected to said second passageway, a gas discharge conduit connected to said second passageway, means forming an air inlet in communication with said air heating chamber, and means forming a heated air outlet from said air heating chamber, said outlet being spaced from said last named air inlet.

2. A hot air furnace comprising means defining an air heating chamber, a combustion chamber positioned near the lower end of said furnace within said air heating chamber, a combustion gas flue extending upwardly in said air heating chamber, one end of said flue being connected to said combustion chamber, a pipe positioned adjacent and separate from said air heating chamber, said combustion chamber, said pipe extending below said combustion chamber and having an air inlet at the lower end thereof, means forming an air inlet for combustion air to said combustion chamber, said last named air inlet being positioned above said first mentioned air inlet, said pipe communicating with said air inlet to said combuston chamber, a baffle plate positioned in said pipe adjacent to said air inlet to said combustion chamber, said baffle plate being mounted in front of and spaced from said last named air inlet, the upper edge of said plate being disposed at approximately the same level as the upper edge of said air inlet to said combustion chamber and providing an restricted air passage between said pipe and said last named air inlet, to permit only a portion of the air in said pipe to be introduced into said combustion chamber, sufficient only to produce substantially complete combustion of the fuel in said combustion chamber without any substantial amount of excess air, a conduit communicating at its lower end with said pipe and forming an extension thereof, said conduit extending upwardly along and separately from said air heating chamber to the upper end thereof, the other end of said flue being connected to said conduit, a flue gas discharge outlet at the upper end of said conduit, means forming an air inlet in communication with said air heating chamber, and means forming a heated air outlet from said air heating chamber, said outlet being spaced from said last named air inlet.

3. A hot air furnace comprising means defining an air heating chamber, a combustion chamber positioned near the lower end of said furnace within said air heating chamber, a combustion gas flue extending upwardly in said air heating chamber, the lower end of said flue being connected to said combustion chamber, means defining an air inlet at the bottom of said furnace below said air heating chamber, means forming a first air passageway communicating with said air inlet and extending upwardly partially into said air heating chamber along the rear side thereof, means forming an inlet for combustion air to said combustion chamber, said last named inlet communicating with said passageway and being positioned above said first mentioned air inlet, a vertical baffle plate mounted at one side of said air passageway adjacent the air inlet to said combustion chamber, said plate permitting free passage of air in said passageway but forming a restricted air passage from said passageway adjacent the upper end of said plate to said air inlet to said combustion chamber, and permitting only a portion of the air in said passageway to be introduced into said combustion chamber, sufficient only to produce substantially

complete combustion of the fuel in said combustion chamber without any substantial amount of excess air, means forming a second passageway communicating with said first passageway and extending upwardly from said last named inlet along said air heating chamber, the upper end of said flue being connected to said second passageway, a gas discharge conduit connected to said second passageway, means forming an air inlet in communication with said air heating chamber, and means forming a heated air outlet from said air heating chamber, said outlet being spaced from said last mentioned air inlet.

4. A hot air furnace comprising means defining an air heating chamber, a combustion chamber positioned near the lower end of said furnace within said air heating chamber, a combustion gas flue extending upwardly in said air heating chamber, the lower end of said flue being connected to said combustion chamber, a pipe positioned adjacent said combustion chamber and extending upwardly partially into said air heating chamber along the rear side thereof, said pipe extending below said combustion chamber and having an air inlet at the lower end thereof, means forming an air inlet for combustion air to said combustion chamber, said last named air inlet being positioned above said first mentioned air inlet, said pipe communicating with said air inlet to said combustion chamber, a vertical baffle plate mounted in said pipe adjacent the air inlet to said combustion chamber, said plate substantially spanning said pipe and being of an area substantially equal to the area of said air inlet to said combustion chamber, said baffle plate being positioned in front of and spaced from said last named air inlet, the upper edge of said plate being disposed at approximately the same level as the upper edge of said air inlet to said combustion chamber, and providing a restricted air passageway from said pipe adjacent the upper end of said plate to said air inlet to said combustion chamber, to permit only a portion of the air in said pipe to be introduced into said combustion chamber, sufficient only to produce substantially complete combustion of the fuel in said combustion chamber without any substantial amount of excess air, a conduit communicating at its lower end with said pipe, said conduit extending upwardly along and exteriorly of said air heatng chamber, the upper end of sad flue being connected to said conduit, a flue gas discharge outlet at the upper end of said conduit, means forming an air inlet in communication with said air heating chamber, and means forming a heated air outlet from said air heating chamber, said outlet being spaced from said last named air inlet.

5. A hot air furnace comprising means defining an air heating chamber, a combustion chamber positioned near the lower end of said furnace within said air heating chamber, a combustion gas flue extending upwardly in said air heating chamber, the lower end of said flue being connected to said combustion chamber, means defining an air inlet at the bottom of said furnace below said air heating chamber, means forming a first air passageway communicating with said air inlet and extending upwardly along the rear side of said air heating chamber and separate therefrom, means forming an inlet for combustion air to said combustion chamber, said last named inlet communicating with said passageway and being positioned above said first mentioned air inlet, a substantially vertical baffle plate mounted at one side of said air passageway adjacent the air inlet to said combustion chamber, said plate permitting free passage of air in said passageway but forming a restricted air passage from said passageway adjacent the upper end of said plate to said air inlet to said combustion chamber, and permitting only a portion of the air in said passageway to be introduced into said combustion chamber, means forming a second passageway communicaitng with said first passageway and extending upwardly from said last named inlet along said air heating chamber, the upper end of said flue being connected to said second passageway, a gas discharge conduit connected to said second passageway, means forming an air inlet in communication with said air heating chamber, and means forming a heated air outlet from said air heating chamber, said outlet being spaced from said last mentioned air inlet.

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