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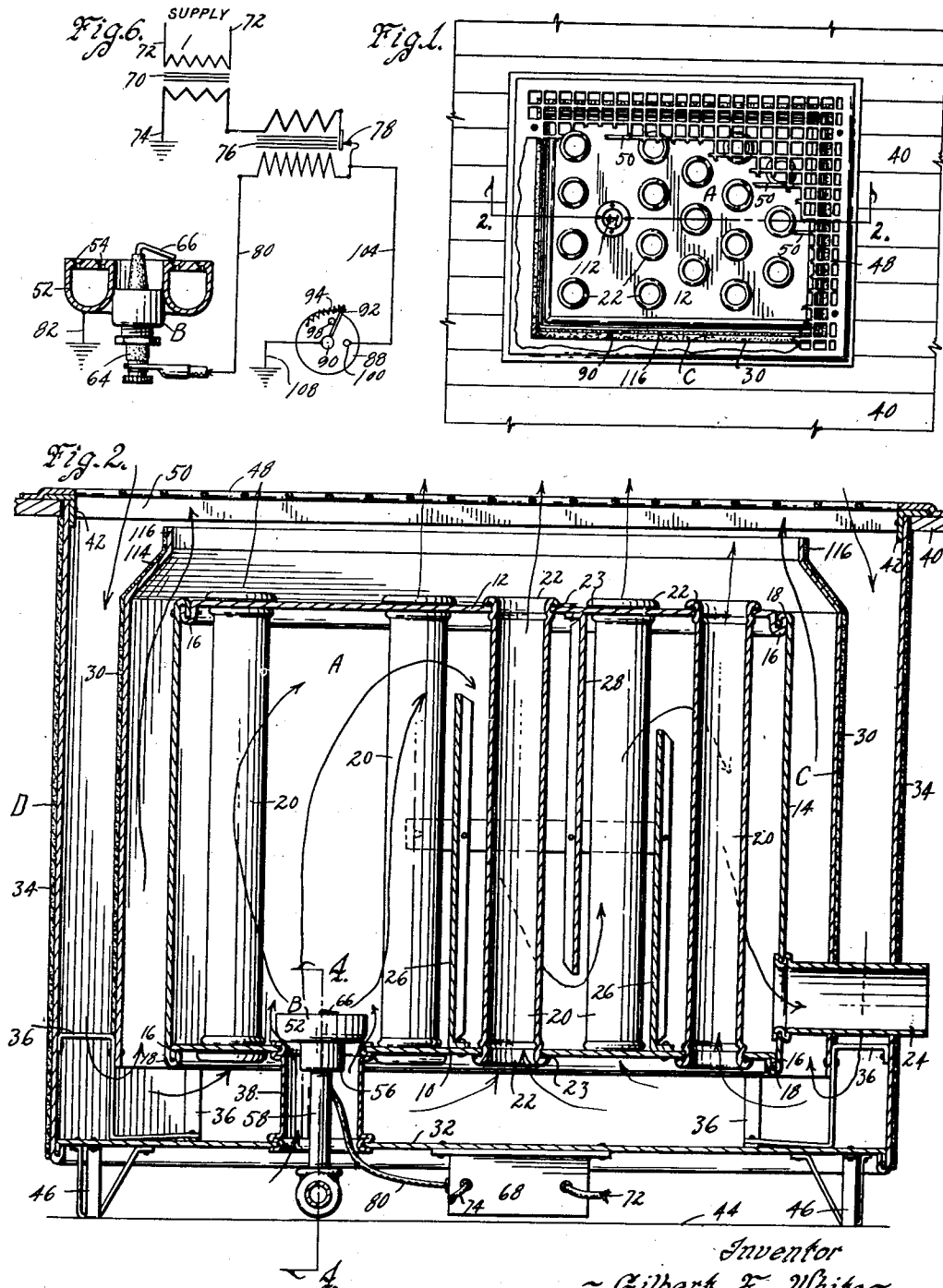
G. E. WHITE

1,936,003

GAS FURNACE

Filed Feb. 11, 1931

2 Sheets-Sheet 1



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2 Sheets-Sheet 2

Fig. 4.

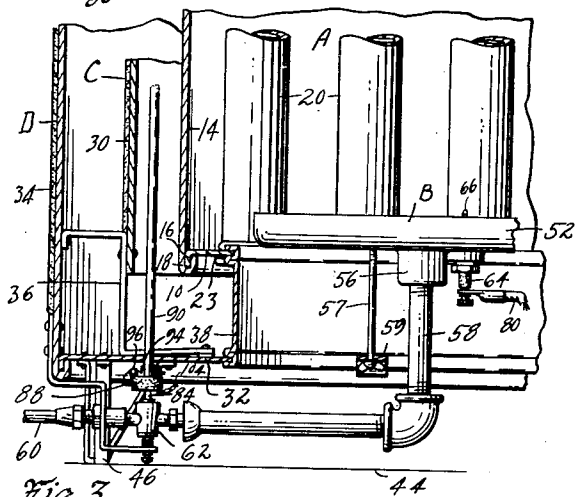


Fig. 5.

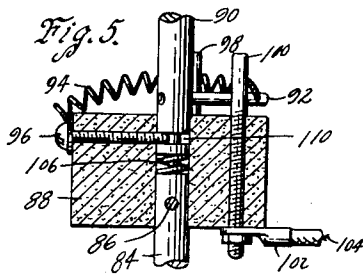
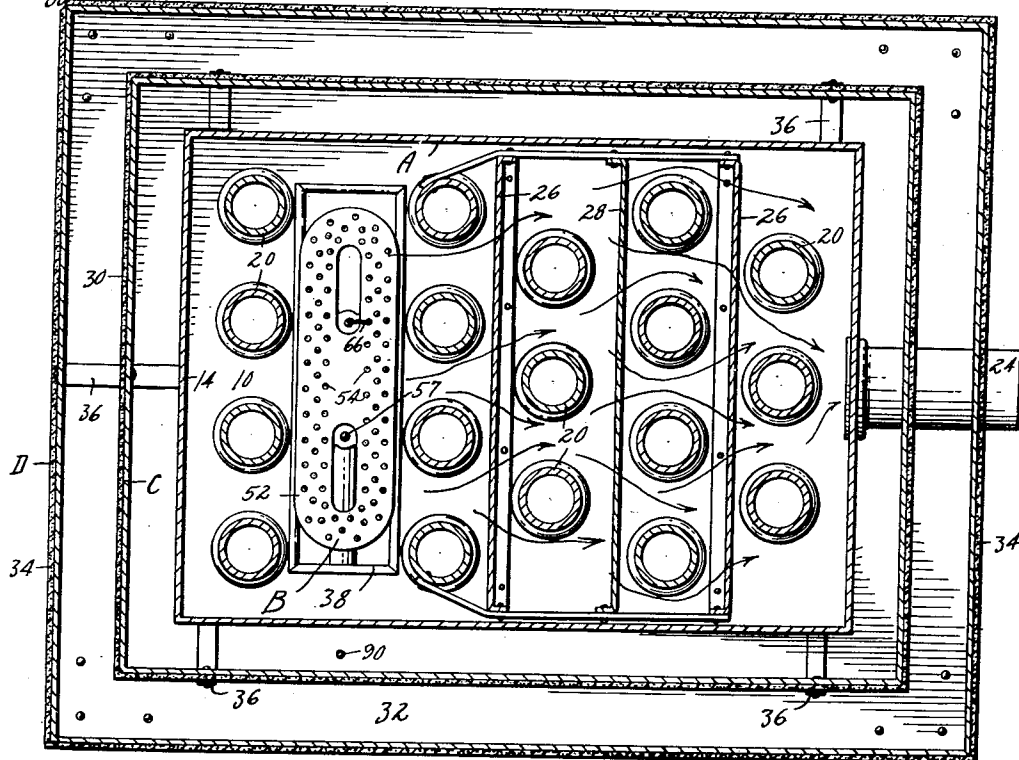


Fig. 3.



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UNITED STATES PATENT OFFICE

1,936,003

GAS FURNACE

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Application February 11, 1931. Serial No. 515,032

1 Claim. (Cl. 126—116)

The object of this invention is to provide an improved construction for a gas burning furnace capable of being located immediately beneath the floor of a room and so constructed as to be peculiarly efficient for heating the room with a minimum consumption of fuel.

A further object of the invention is to provide an improved gas burning furnace having a combustion chamber provided with a plurality of tubes extending vertically therethrough for the passage of air to be heated, the combustion chamber having a burner located near one end and a flue at the opposite end and also being provided with means for causing heated products of combustion to travel sinuous paths about the tubes for efficiently heating the air before being discharged from the combustion chamber.

Still another object is to provide a gas burning furnace having electric ignition means for initiating the combustion of the fuel.

Another and further object is to provide an electric lighted furnace characterized by a maximum degree of safety against leakage of unburned fuel or products of combustion to a space to be heated.

A further object of the invention is to provide an improved gas burning furnace having ample capacity for circulation of air and making it possible to obtain an even and uniform temperature throughout all portions of the space to be heated with a minimum amount of fuel consumption.

Still another object is to provide a gas burning furnace which is economical to manufacture and which occupies little floor space and is capable of being used for heating a house which has no basement, at the same time being placed in such a location that it is inconspicuous.

With these and other objects in view, my invention consists in the construction, arrangement and combination of the various parts of my gas furnace, whereby the objects contemplated are attained, as hereinafter more fully set forth, pointed out in my claim, and illustrated in the accompanying drawings, in which:—

Figure 1 is a plan view showing a portion of a floor with my improved furnace mounted therebeneath, a portion of the floor register being broken away in order to better show parts of the furnace itself.

Figure 2 is an enlarged vertical section through the furnace on the line 2—2 of Figure 1, the arrows indicating the travel of the cold and heated air and also the heated products of combustion in vertically sinuous paths.

Figure 3 is a horizontal sectional view through

the furnace, the arrows indicating the travel of heated products of combustion in horizontally sinuous paths.

Figure 4 is a vertical section on the line 4—4 of Figure 2, illustrating that portion of the furnace near the burner and the control means for the spark and fuel.

Figure 5 is a sectional elevation of a portion of the combination control means for the spark and fuel.

Figure 6 is a view including a transverse section through the burner and a diagram of the electrical wiring.

The furnace according to my invention includes a combustion chamber A which is made up in part of a base plate 10 and a head plate 12. The marginal portions of the base plate 10 and head plate 12 are connected by side walls 14 and the marginal portions of these members preferably are suitably connected by interengaging flanges 16 and 18.

A plurality of open ended tubes 20 extend vertically through the combustion chamber A and have their ends extended through the base plate 10 and head plate 12 respectively and crimped to form beads 22 at the outer surfaces of said plates. Asbestos packing members 23 preferably are located between the beads 22 and the plates 10 or 12 as the case may be, in order to render the joints perfectly gas tight.

At one end the combustion chamber A is provided with a laterally extending flue 24 which also has a gas tight connection with one of the walls 14. The flue 24 passes laterally through other members of the furnace to be described 90 later, and has a suitable connection, not shown, with a chimney.

Near the opposite end of the combustion chamber A is located a gas burner B. The burner B may be of any suitable construction, but preferably is of the type illustrated, described and claimed in my co-pending application, filed September 18, 1931, Serial No. 561,540.

It will be noted that the vertical tubes 20 are arranged in rows extending transversely of the combustion chamber A and that the tubes are staggered in adjacent rows so that heated products of combustion passing from the locality of the burner B to the flue 24 are required to travel horizontally sinuous paths as indicated by the arrows in Figure 3.

Furthermore, these heated products of combustion are required to travel in vertically sinuous paths as indicated by the arrows in Figure 2. This is accomplished by mounting baffle plates 26

- and 28 transversely of the chamber between adjacent rows of tubes. One or more of the baffle plates 26 are fixed to and rise from the bottom plate 10 and one or more baffle plates 28 are fixed to and extend downwardly from the head plate 12. The baffle plates 26 and 28 alternate with each other and extend considerable distances toward the opposite plate from that on which they are mounted.
- 10 The effect of causing the heated products of combustion to travel in horizontally and vertically sinuous paths is to lengthen their travel and to increase their contact with the tubes 20, thereby increasing the heating surfaces so that the air, flowing upward through tubes, extracts more heat for the amount of fuel consumed, over any other method owing to the longer travel of hot gases in the combustion chamber and the rapid extraction by the vertical tubes.
- 15 The combustion chamber A is surrounded by an intermediate shell C which is open both at its upper and lower ends. In other words, the shell C comprises primarily an annular side wall completely surrounding and spaced from the side walls 14 of the combustion chamber. The shell C preferably has an asbestos or other suitable insulating covering 30 on its outer surface.
- 20 The intermediate shell C is enclosed and surrounded by an outer shell D, which is substantially open at its upper end and closed at its lower end by a base plate 32. The shell D preferably is provided with an asbestos or other suitable insulating covering 34 on the outer surface of its side and bottom walls.
- 25 The outer shell D has its side walls spaced from the side walls of the intermediate shell C, and has its bottom wall 32 spaced below the bottom of the intermediate shell C and the combustion chamber A.
- 30 The intermediate shell C is supported from the bottom and side wall of the outer shell D by means of a plurality of substantially Z-shaped brackets 36.
- 35 The flue 24 extends through the intermediate shell C and outer shell D and has its inner end suitably connected to the wall 14 of the combustion chamber so that it assists in supporting said combustion chamber in place.
- 40 The combustion chamber A is further supported by an air tube 38 which has its lower end connected to the bottom plate 32 of the outer shell and its upper end connected rigidly to the bottom plate 10 of the combustion chamber. The air tube 38 is of considerable extent and it is located beneath and extends preferably substantially throughout the area of and in some instances beyond the burner B. The air tube 38 is open at both ends and it serves to supply air to the combustion chamber to furnish the necessary oxygen for combustion.
- 45 The furnace is designed to be mounted within and to extend downwardly from an opening in a floor 40 of a room to be heated. The outer shell D is provided at its upper margin with an angle iron frame 42 which is designed to engage the margins of the opening in the floor 40 and to assist in supporting the furnace in place. In some instances it may be desirable to support the furnace from below as by means of a supporting surface 44 engaging legs 46 on the bottom plate 32.
- 50 The opening in the floor at the upper end of the furnace may be covered by a suitable floor register including a reticulated structure 48 and transverse supporting bars 50 to strengthen the

reticulated structure and make it capable of supporting the weight of a person or article of furniture.

The burner B, as here shown, includes an elongated metallic shell 52 having a plurality of jet openings 54 in its upper surface for the passage of gaseous fuel.

The burner shell 52 is substantially enclosed and is formed on its bottom with a nipple or internally threaded boss 56 to which a fuel pipe 58 is attached.

The burner shell is supported by the pipe 58 and by a rod 57 engaging a bracket 59 extending transversely of the lower end of the air pipe 38. The pipe 58 extends downwardly through the air tube 38 and is suitably connected to a supply pipe 60.

A fuel valve casing 62 is interposed between the pipes 58 and 60 and communicates therewith. The valve casing is located beneath a portion of the annular space between the wall 14 of the combustion chamber A and the intermediate shell C.

An ignition spark plug 64 is carried by the shell 52 of the burner, and said spark plug includes an electrode 66 which has its point spaced from the upper surface of the shell at a point adjacent one of the fuel jet openings 54 for forming a spark gap.

Mounted on the bottom of the base plate 32 of the outer casing of the furnace is a housing 68 which contains certain elements connected with the ignition system for the burner. These elements are shown diagrammatically in Figure 6 and include a step-down transformer 70, having its primary winding connected through conductors 72 with a suitable source of current supply. One side of the secondary winding of the transformer 70 is connected to ground at 74 and the opposite side is connected to the primary winding of a spark coil 76 having make-and-break devices 78 of common form. One side of the secondary winding of the spark coil 76 is connected by a conductor 80 with the spark plug 64 and in this connection it may be stated that the circuit through the spark plug electrode 66 and the burner shell is completed by ground connection of the shell as indicated diagrammatically at 82 in Figure 6.

A combination control device for the electric current and for the fuel supply is provided and a portion thereof is shown in detail in Figure 5. This controlling device includes a valve stem 84 which enters the valve casing 62 and has a suitable connection with a valve, not shown, in said casing for controlling the flow of gaseous fuel therethrough.

Mounted on the upper end of the valve stem 84 and secured thereto as by a pin 86, is a block 88 of insulating material.

The insulating block 88 is formed with a vertical opening therethrough which receives the valve stem 84 and also receives the lower end of an operating shaft 90 which extends upwardly through the space between the combustion chamber A and the intermediate shell C to a point near the top of the furnace. The shaft 90 is adapted to be operated manually in any desired manner as by the use of a removable crank or key, not shown, and such actuation may be accomplished from a point above the furnace, or in other words, from the room which is to be heated thereby.

An arm 92 is fixed to and projects laterally from the operating shaft 90 at a point some-

what above the insulating block 88. A coil spring 94 is fixed at one end to the arm 92 and at its opposite end to a screw 96 carried by the block 88. It is the function of the spring 94 to yieldingly hold the shaft 90 in one direction and against a stop pin 98 projecting upwardly from the block 88.

It is purposely moved from such position by further movement of the shaft so that the supply of gas to the burner will continue until it is shut off by reverse operation of the shaft 90 through manual means which is effected by causing the arm 92 to forcibly engage the stop pin 98, thus turning the block 88 and valve stem 84 in a direction for closing the valve.

The insulating block 88 also carries a contact post 100 which projects upwardly from its upper surface at a point spaced from the stop pin 98 and on the opposite side of the arm 92 therefrom. The contact post 100 projects through the block 88 and is threaded so as to serve as a terminal for attachment of a clip 102 carried by one end of a conductor 104, which is connected with the other side of the secondary winding of the spark coil 76 as illustrated in Figure 6.

This combination control means for the ignition and fuel, whereby movement of the controlling shaft first causes an electrical contact for producing a spark at the burner and then produces an opening movement of the valve, insures that means will be at hand for igniting the fuel as soon as it begins to flow through the burner. In other words, there is little or no danger that the fuel will be turned on without being ignited, such a contingency only arising in case of a possible accident to the connections through the ignition system. However, it will be noted further that the burner is located in a gas-tight combustion chamber A and that in the event unburned gas does escape from the burner, it will pass to the flue 24 and thus out of the building by way of the chimney.

Between the adjacent ends of the valve stem 84 and the operating shaft 90 and within the recess in the insulating block 88 is an expansive coil spring 106 which serves to maintain an electrical connection between said members, whereby the current may be grounded through the valve casing 62 as indicated diagrammatically at the point 108 in Figure 6.

The operating shaft 90 is arranged for independent movement within the insulating block 88 and is held against removal therefrom by causing the inner end of the screw 96 to be fitted in a peripheral groove 110 in said shaft, as shown in Figure 5.

A transparent window 112 of mica or the like is provided in the head plate 12 of the combustion chamber at a point above the burner B for the purpose of enabling one to observe the condition of the flame and to make the necessary regulation thereof.

When it is desired to initiate combustion in the furnace, the operating shaft 90 is rotated manually in a direction to apply tension to the spring 94 and to cause the arm 92 on said shaft to be moved away from the stop pin 98 and into engagement with the contact post 100. It will be observed that this is a free movement of the shaft 90 and that the insulating block 88 and valve stem 84 are not affected thereby.

When the furnace is in operation, cold air from the room or rooms which are heated, and particularly from the neighborhood of the floor, will be drawn downwardly through the register and through the annular space between the intermediate shell C and outer shell D. When this air reaches the bottom of the intermediate shell it passes laterally and inwardly and portions of it travel upwardly through the tubes 20, while other portions travel upwardly through the annular space between the intermediate shell C and the walls 14 of the combustion chamber.

As soon as the arm 92 comes into engagement with the contact post 100, a circuit is completed through the electrical parts of the device and the spark coil 76 creates an impulse which results in the passage of a spark between the electrode 66 of the spark plug and the metallic shell 54 of the burner. This is accomplished in a common and well known manner and the spark will travel the gap intermittently so long as the circuit is completed through the contact of the arm 92 with the post 100.

I prefer to restrict the top portion of the intermediate shell C as shown in Figure 2 by forming it with an inwardly sloping portion 114 which starts at about the horizontal level of the top of the combustion chamber and which terminates in a neck 116 located at a slight distance below the reticulated register 48, the neck 116 being of substantially the same area as the top of the combustion chamber. This arrangement of the parts serves to provide an enlarged portion at the upper end of the annular space between the intermediate shell C and outer shell D to facilitate the entrance of unheated air thereto, as well as to prevent interference between the upwardly and downwardly traveling currents of air.

Further rotary movement of the shaft 90 in the direction indicated will cause the insulating block 88 to be rotated because of the engagement of the arm 90 with the post 100. This rotation of the block 88 causes the valve stem 84 also to be rotated, which results in opening the valve in the valve casing 62 and permitting the flow of gas through the pipe 58 to the burner. The gas will then be ignited by the spark at the spark gap, and in this manner combustion is initiated in the combustion chamber A at the surface of the burner and will continue under normal conditions so long as fuel and oxygen are supplied.

Those portions of the upwardly traveling currents of air which pass through the tubes 20 are heated by direct contact of products of combustion within the combustion chamber A with the surface of the tubes. As before stated, the travel of the products of combustion is lengthened by the staggered arrangement of the tubes and by the staggered baffle plates and intimate contact of the heated products with the walls of all the tubes is afforded. This makes for very effective and economical heating of the air passing upwardly through the tubes.

As soon as combustion has started the operating shaft 90 may be released, whereupon the spring 94 will cause the shaft to be rotated reversely until the arm 92 engages the stop pin 98. It will be understood that such reverse movement will break the circuit through the ignition system and the spark at the spark gap of the burner will close.

It will also be understood that the valve device will remain in any position in which it is placed manually through operation of the shaft 90, until

Those portions of the air which travel upwardly between the walls of the combustion chamber and the intermediate shell C are heated by radiation from the walls 14 of the combustion cham-

ber so that a maximum degree of heating efficiency is secured for the amount of fuel consumed.

Because of the arrangement of the several parts of the furnace, there is a very rapid circulation of air through the device, which not only provides for comfortable conditions within the rooms to be heated, but also results in economy of fuel consumption and eliminates the necessity of heating the tubes and walls of the combustion chamber excessively. This rapid circulation is, of course, beneficial as the air, when warmed, flows to the ceiling, spreads out and down over the windows and doors and, being cooler, drops to the bottom of the furnace, thence out through the tubes with great rapidity. All the air circulates through the furnace four or five times per hour. Owing to the great rapidity of this circulation, the air rarely gets over 135 to 140 degrees Fahrenheit as it leaves the furnace, and at this temperature, it readily absorbs and carries all the humidity required from any suitable source (not shown). The floors, wood-work and furniture do not dry out, crack and check, nor is there any moisture on windows, walls, doors or furniture, as is found with all other different methods of gas heating. It eliminates all sweating and produces a healthful atmosphere.

I claim as my invention:—

A gas burning furnace comprising an outer shell open at its top and substantially closed at its bottom and supported beneath an opening in a floor, a combustion chamber within and

spaced from the walls of said shell, an air pipe affording communication means through the bottoms of the shell and combustion chamber for admitting air to the latter, a gas burner located in the combustion chamber adjacent the mouth of said air pipe, a flue leading from said chamber at a point spaced from the burner, a plurality of separate spaced tubes leading vertically through said combustion chamber whereby air entering the top of the outer shell will be caused to pass upwardly through said tubes and be heated by products of combustion within the chamber, said combustion chamber being provided with a plurality of staggered baffle plates arranged alternately in projecting relation from the bottom and top walls thereof, and said tubes being staggered, whereby products of combustion are required to travel in sinuous paths both horizontally and vertically in passing through said chamber, and an intermediate shell spaced between the outer shell and the walls of said combustion chamber, said intermediate shell being open at its bottom and top to permit upward travel between it and the chamber of some of the air which travels downwardly within the outer shell, whereby the last named portions of upwardly traveling air will be warmed by radiation from the chamber, said intermediate shell extending above the level of the chamber and having its upper end restricted to an area corresponding substantially to that of the top of said chamber.

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