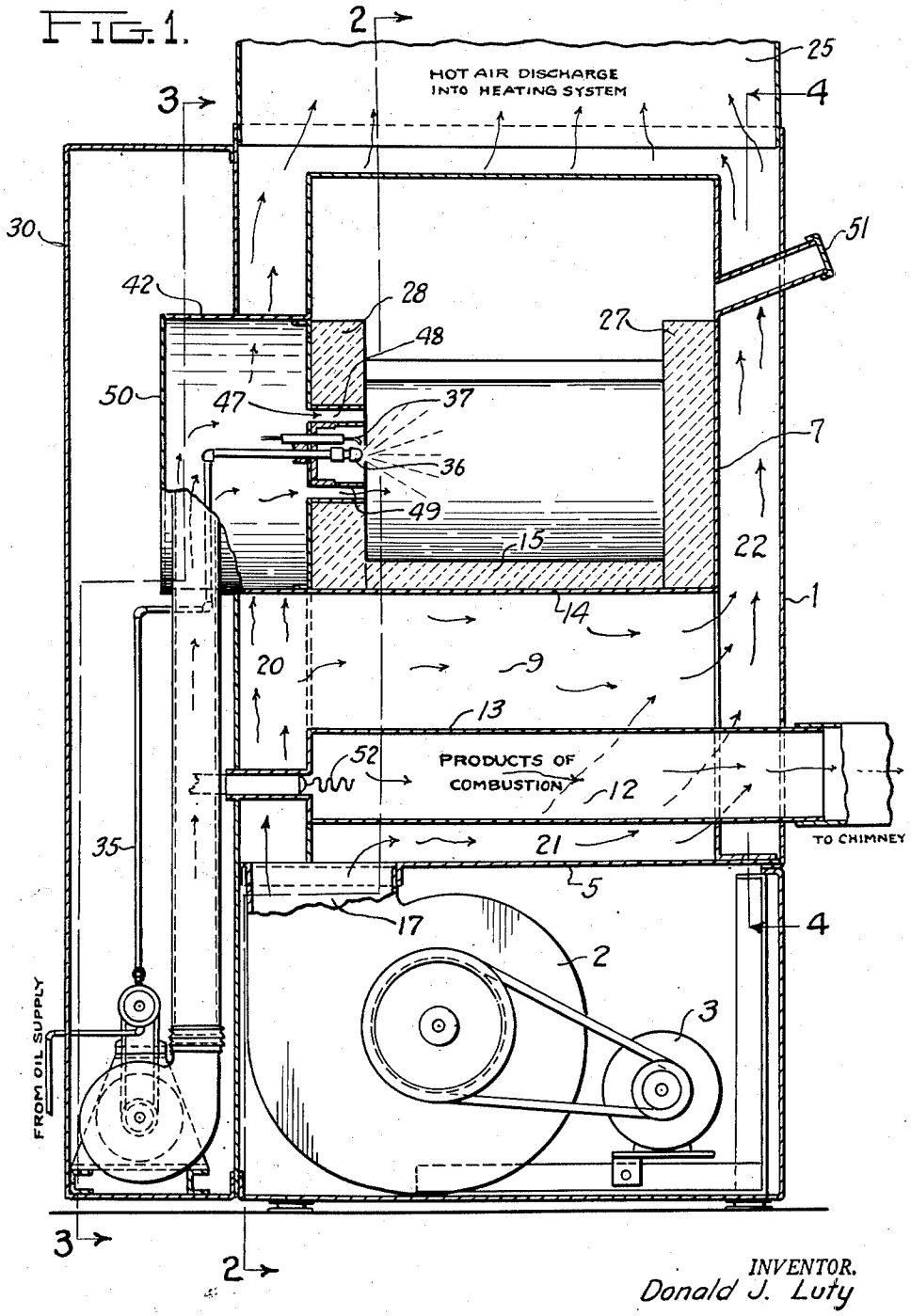
Dec. 18, 1951 D. J. LUTY 2,579,047

FORCED AIR FLOW AIR HEATING FURNACE

Filed March 31, 1947 4 Sheets-Sheet 1

FIG. 1.




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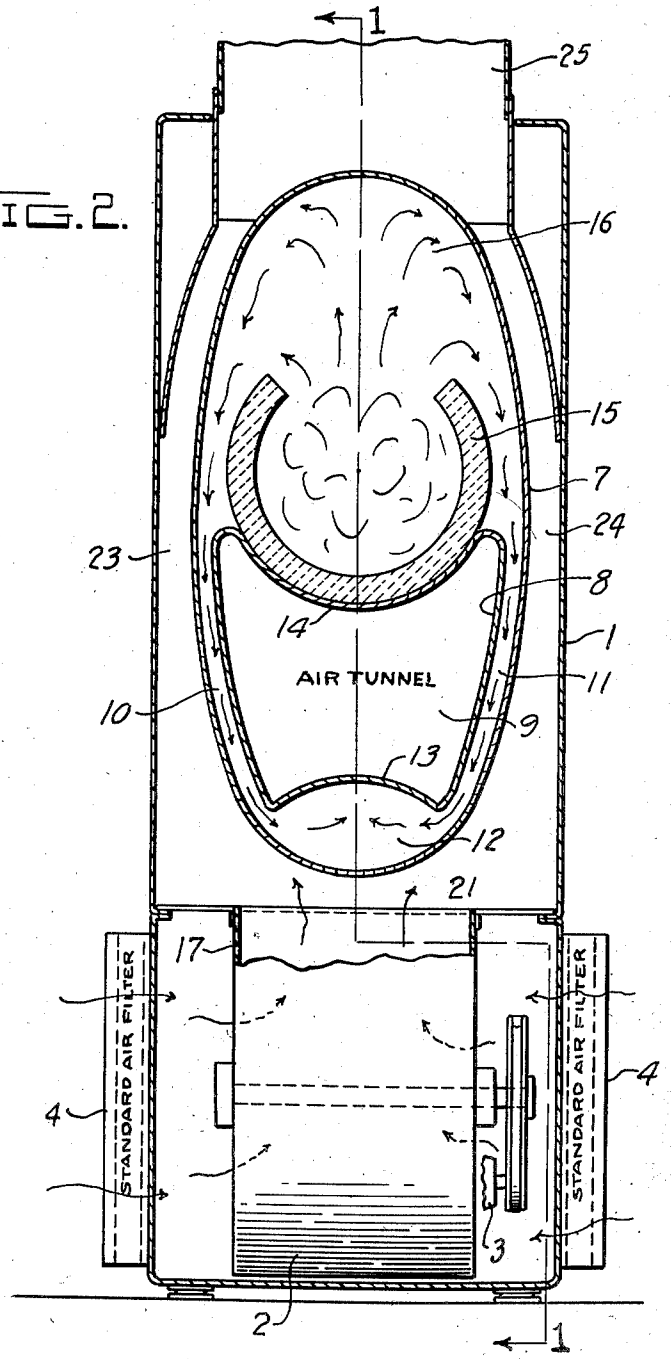
Barnes, Kisselle, Laughlin & Raisch
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FORCED AIR FLOW AIR HEATING FURNACE

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FIG. 2.




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FIG. 3.

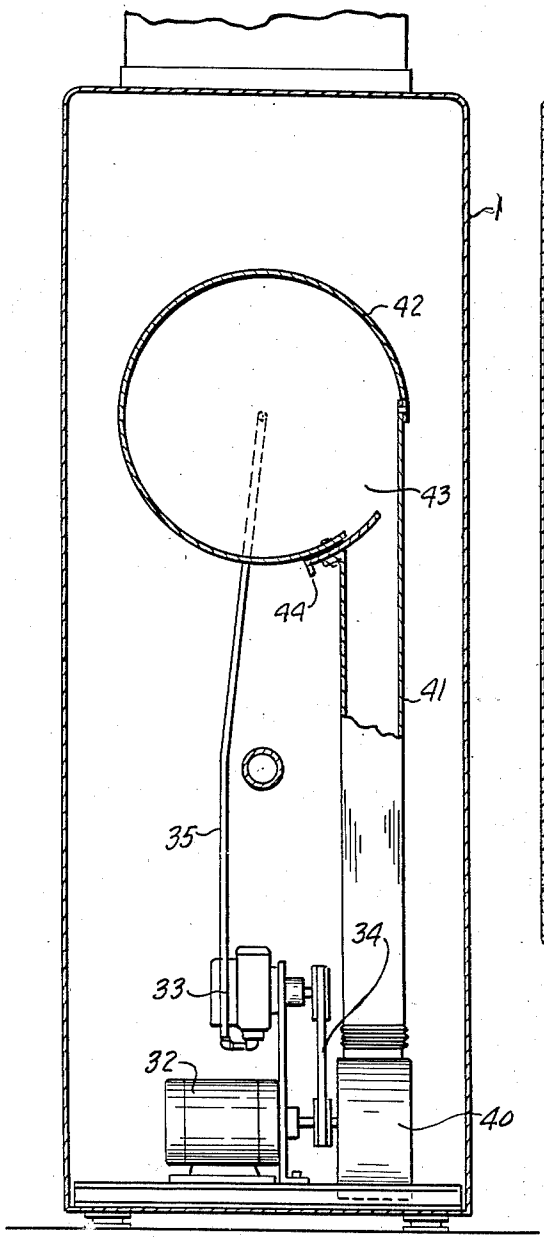
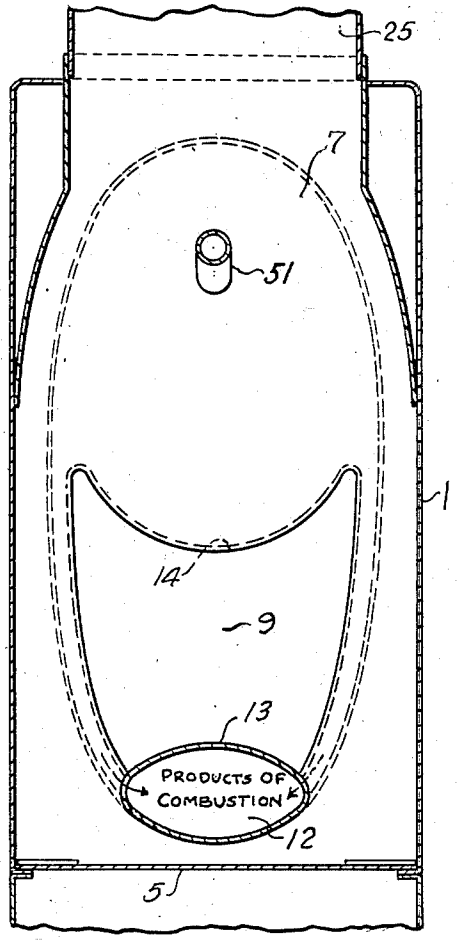



FIG. 4.




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FIG. 5.

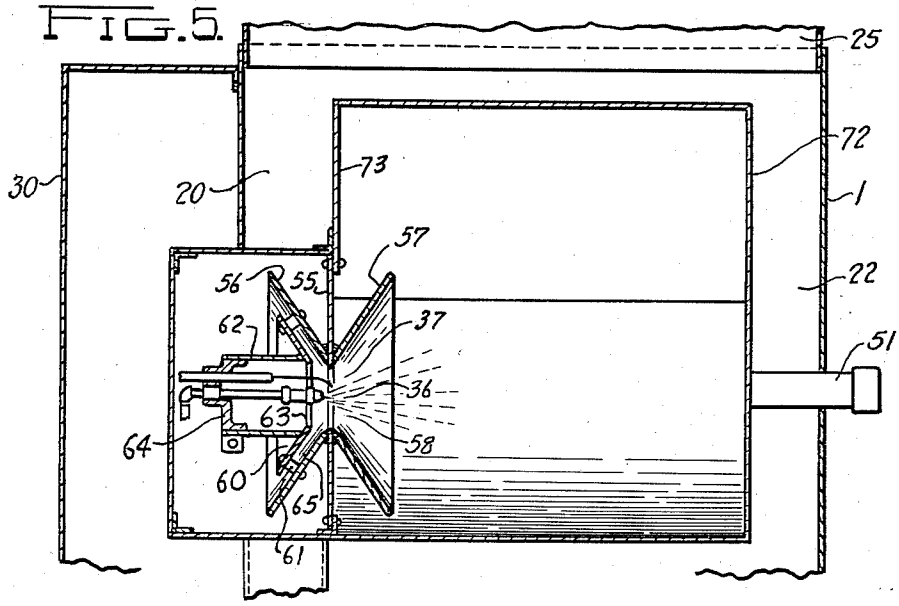
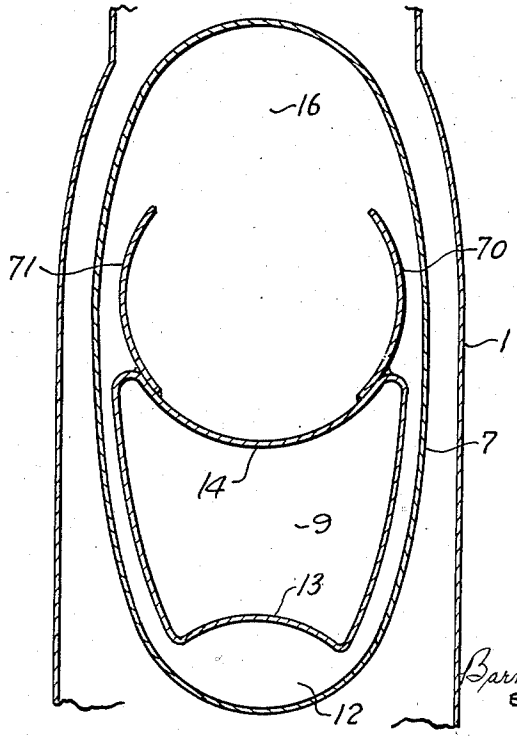



FIG. 6.




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Patented Dec. 18, 1951 2,579,047

# UNITED STATES PATENT OFFICE

2,579,047

## FORCED AIR FLOW AIR-HEATING FURNACE

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Application March 31, 1947, Serial No. 738,458

2 Claims. (Cl. 126—110)

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This invention relates to a heating furnace and burner structure for liquid fuel, such as oil. The invention has to do with a furnace structure for facilitating efficient transfer of heat from the fire box to air and with the provision of an improved arrangement for the combustion of oil.

One object of the invention is to provide for a large area of heat transfer in the furnace, accomplishing the same with a simple and efficient construction. Other objects of the invention are to provide an improved arrangement for supplying air to the flame of the burning fuel. In this connection, the invention is adapted to commonly used devices for atomizing the fuel such for example as the high or low pressure nozzle type of oil burner where the oil is sprayed therefrom in the form of a cone-shaped jet, and the invention aims to supply or project air to the burning fuel, also in a cone-shaped form. For this latter purpose, the air which is supplied to the flame for supporting the combustion is given a rotary movement and this is accomplished without the use of guiding vanes to thus simplify the construction and thus minimize interference with the flow of the air. With regard to this latter point, a novel wind box is provided wherein the air is introduced therein under pressure so that it is subjected to and given a rotary action. There is a relatively clear and unobstructed passage between the wind box and the fire box.

The invention is demonstrated in the accompanying drawings wherein:

Fig. 1 is a view generally as a vertical cross section showing a furnace constructed in accordance with the invention.

Fig. 2 is a view taken substantially on section line 2—2 of Fig. 1 showing some of the interior construction.

Fig. 3 is a view taken substantially on line 3—3 of Fig. 1 showing the oil pump unit and the wind box construction.

Fig. 4 is a view taken substantially on line 4—4 of Fig. 1 showing some of the interior fire box construction.

Fig. 5 is a sectional view showing another form of construction at the juncture between the wind box and the fire box.

Fig. 6 is a view similar to Fig. 2 showing a modified form of fire box.

The furnace structure, as indicated in Figs. 1 and 2, has an outer casing 1 in the lower portion of which is a suitable air fan 2 driven by an electric motor 3. The air fan may be of double inlet construction so that air is drawn in

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from each side through suitable filters 4. A partition 5 is disposed above the fan and the fire box is disposed above the partition 5 and it comprises an inner shell 7. This inner shell 7 may be made of sheet metal, and may be formed after the manner shown in Fig. 2. It is provided with a hollow air tunnel or air passage member 8, which provides an air passage 9, and which defines opposite passages 10 and 11 for products of combustion, which passages connect to a flue structure or passage 12. The lower end of the air tunnel 8 is shaped, as at 13, to facilitate the formation of the passage 12, and the upper end is curved or recessed as at 14, to receive a suitable ceramic fire box member 15. This member, as shown in Fig. 2, may be partially circular in formation and resting in the recess 14, and it is open at the top where the products of combustion pass into the area 16 which communicates with the passages 10 and 11.

The outlet of the fan casing, as shown at 17, communicates with an opening in the partition 5 so that the air is pumped upwardly through a passage 20 at the front of the furnace structure. Some of the air moves laterally in a direction from the front to the rear of the furnace in the space 21 below the inner wrapper 7 and through the air tunnel 9 which connects the passage 20 with the passage 22 at the rear of the furnace. Also, at the sides of the furnace are passages 23 and 24. These various passages all communicate into a common outlet 25 and the air thus heated is suitably conducted to the space or spaces to be heated.

It will be noted by reference to Figs. 1 and 2 that the air passes upwardly on all sides of the inner wrapper 7; through the air tunnel where heat is transmitted thereto from the fire box, the passages 10 and 11, and from the flue 12. The passage 20, as will be appreciated by reference to Fig. 1, is partially obstructed by the wind box structure, later to be described, so that some of the air is forced laterally through the tunnel 9. The fire box comprising the ceramic line 15 may have end pieces of ceramic, as at 27 and 28.

The means for supplying fuel and air to the burner may be at the front of the furnace as indicated in Fig. 1, and it may be enclosed by an enclosing structure having a removable panel indicated at 30. For supplying oil there may be an electric motor 32 for driving an oil pump unit 33 in any suitable manner, such, for example, as a belt 34 and leading from the pump is an oil line

35, which has a suitable gun or nozzle 36 on its end for spraying the oil into the fire box. As indicated by the broken lines, the oil is sprayed into the fire box generally in the shape of a cone. In other words, the sprayed oil spreads outwardly. A suitable ignition element, such as electrodes, is illustrated at 37.

The motor 32 also drives a fan 40 to force air through a duct 41 and thence into a wind box 42. This wind box is circular in form, as shown in Fig. 3, and the duct 41 enters the wind box tangentially as at 43. For the purpose of controlling the volume of air, there is a slide valve 44 which is adjustable to vary the size of the throat between the duct and the wind box. Accordingly, it will be appreciated in considering Fig. 3 that the air which is forcibly blown into the wind box tangentially has imparted thereto a rotary motion in the wind box. The valve 44 is preferably mounted to throttle the inner edge portion of the duct so that whatever throat size is employed, the air passing therethrough has direct passage into a region adjacent the peripheral wall of the circular wind box.

The wind box 42 extends through the outer casing 1 and abuts or may be attached to the inner shell 7. The wind box has an opening of circular form, as shown at 47, which registers with a similar opening 48 in the ceramic liner 28 for the passage of the air into the fire chamber. The opening 48 is defined by an inner member 49 which provides a space for the reception of the nozzle 36 and the ignition element 37. The wind box is, of course, closed at its outer side as shown at 50.

The furnace is provided with a suitable opening covered by a sight glass, as shown at 51, for inspection of the fire and a suitable control sensitive to the products of combustion as indicated at 52.

In a modified form of device, as shown in Fig. 5, there is a subassembly which comprises a central plate 55 with a cone-shaped element 56 on one side thereof and a cone-shaped element on the other side thereof, this element being mounted in the inner shell, as indicated. The nozzle and ignition device are mounted in the usual manner substantially in the central opening 58 of the plate 55.

A second cone-shaped element 60 is mounted in spaced relationship to the cone 56 as by means of spacing studs 61 while a central tubular element 62 is secured to the cone element 60. The tubular element 62 is closed by an electrode holder 64. The cone element 60 has a central opening 63 substantially in alignment with the opening 58. As illustrated, the plate 55, is mounted in the shell of the fire box and serves as a closure. The two cone elements 56 and 60 provide a tapering or cone-shaped passage 65 through which the air passes with the air moving laterally inwardly therethrough and then passing through the opening 58 and into the fire box. The cone member 57 lies in the fire box to control, to some extent, the expansion and spreading of the air and fuel ejected by the element 36 and the air entering through the opening 58 and to reflect heat to facilitate vaporization and combustion of the oil fuel.

The form of structure shown in Fig. 5 is illustrated as being used with a fire box structure of modified form as shown in Fig. 6. In this form the ceramic liner is dispensed with and chrome steel plates 70 and 71 are used in place thereof. These plates are welded or otherwise secured to the portion 14 of the fire box structure. It will be observed also that the end ceramic members 27 and 28 may be dispensed with in the modified form, as shown in Fig. 5, and in place thereof, chrome steel plates or other heat resisting metal are used as at 72 and 73.

In the operation of the apparatus, it will be observed that the air which is supplied to the fire chamber is forcibly pumped tangentially into the wind box and thereby given a rotary action. This air passes through the opening 48 and enters the fire box with a rotating motion and thereby expands more or less in the fashion of a cone with the spreading or cone-shaped action of the fuel thus providing an efficient and, in fact, near perfect fuel mixture. The rotary motion of the air is thus accomplished without the use of vanes or other motion directing surfaces. The air to be heated, which is pumped by the fan 2, passes upwardly on all sides of the fire box wrapper, through the tunnel 9 and around the duct 12 carrying the products of combustion. As above stated, the products of combustion rise from the fire into the space 16 and then pass downwardly through passages 10 and 11 thence into the duct 12 and out of the furnace. The above is true of both the modified form shown in Fig. 5 and with the metallic plate arrangement shown in Fig. 6. The air passing through the passage 65 is swirling with a rotary motion, and as it passes through the opening 58, it expands somewhat in the nature of a cone corresponding to the projection of the fuel from the nozzle 36. Due to the fact that there is a clear passageway between the fire box and the wind box, there is a free breathing action which smooths out the operation and eliminates pulsations in the fire box.

I claim:

1. In a furnace structure of the type for heating air, an outer casing, an inner casing in the form of a wrapper sheet fashioned into tubular form which is horizontally disposed and vertically elongated, the inner casing being spaced from the outer casing to provide air passages, a fire box structure within the inner casing, a hollow tunnel formation extending through the inner casing below the fire box, said tunnel communicating with the air passages at both ends and arranged to support the fire box structure, said tunnel formation having opposite side walls cooperating with and spaced from the walls of the inner casing to provide downwardly extending ducts for conducting products of combustion from the upper portion of the inner casing to the lower portion thereof, the lower wall of said tunnel cooperating with the lower wall portion of the inner casing to provide a duct for the products of combustion, the last named duct having an outlet extension passing through an air passage and through the outer casing, air pump means for pumping air through said air passages and a wind box for passing air to the fire box disposed above the tunnel formation and partially blocking one of the passages to divert some of the air into and through said tunnel, said tunnel being in heat transferring relationship with the fire box and the several ducts.

2. In a furnace structure of the type for heating air, an outer casing, an inner casing in the form of a wrapper sheet fashioned into tubular form which is horizontally disposed and vertically elongated and spaced from the walls of the outer casing to provide air passages, a fire box in an intermediate portion of the elongated inner

casing, a tunnel structure extending through the inner casing below the fire box, which tunnel structure communicates with passages at opposite ends of the furnace for the passage of air therethrough, said tunnel structure having walls spaced from the wrapper sheet of the inner casing to provide ducts for carrying the products of combustion from one end of the inner casing to the other end thereof past said tunnel structure, the lower wall of the tunnel structure and the lower end of the inner casing cooperating to form a duct adjacent the air tunnel for receiving the products of combustion from the first mentioned ducts, the last named duct having an outlet extension passing through an air passage and through the outer casing, means for pumping air into a passage adjacent one end of the furnace, and means for partially obstructing said last



named passage so as to divert some of the air through said tunnel structure.

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