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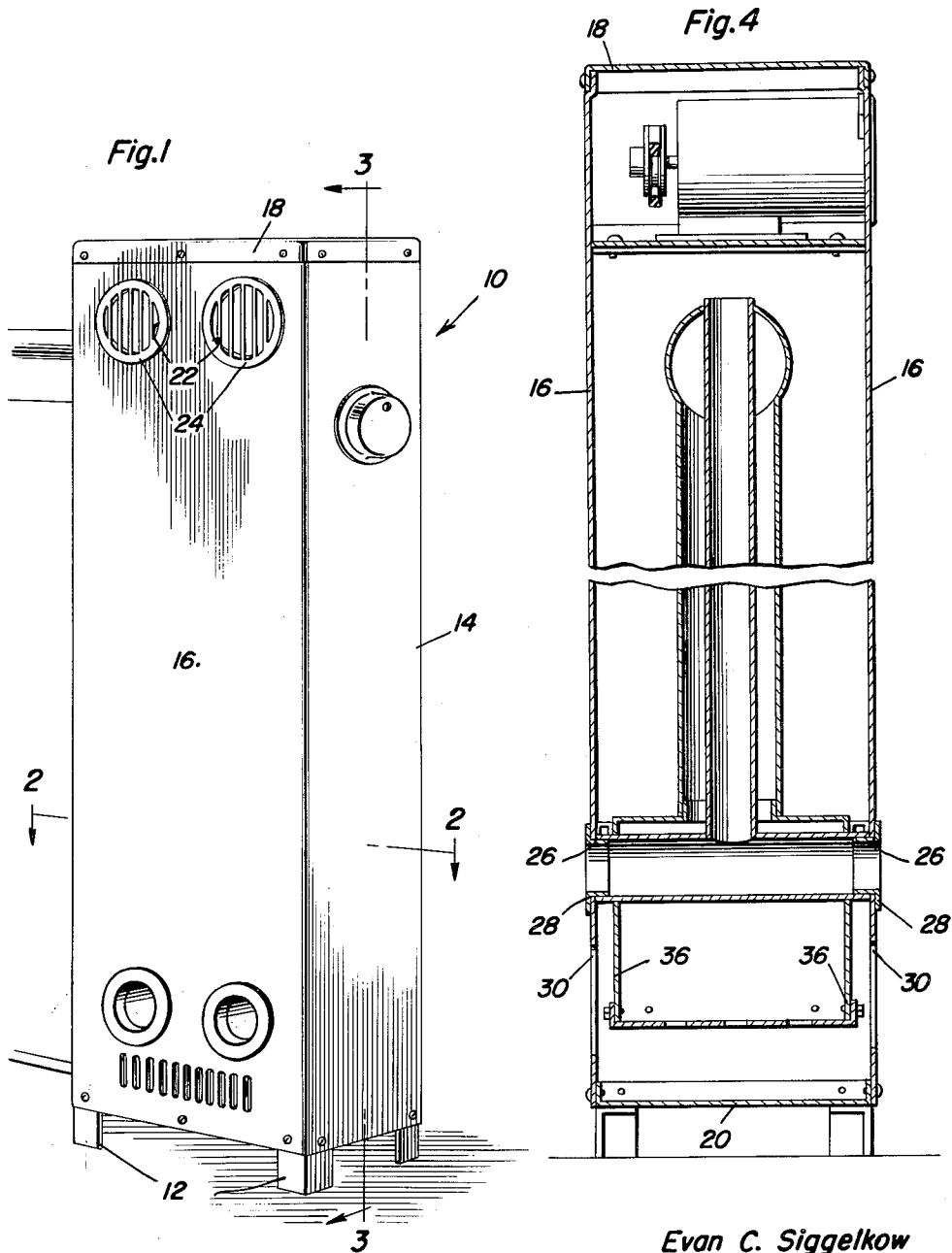
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3,027,890

HOT AIR HEATER

Filed June 25, 1958

2 Sheets-Sheet 1



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Fig. 2

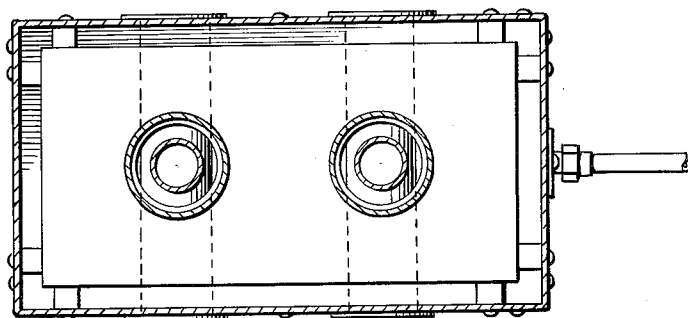
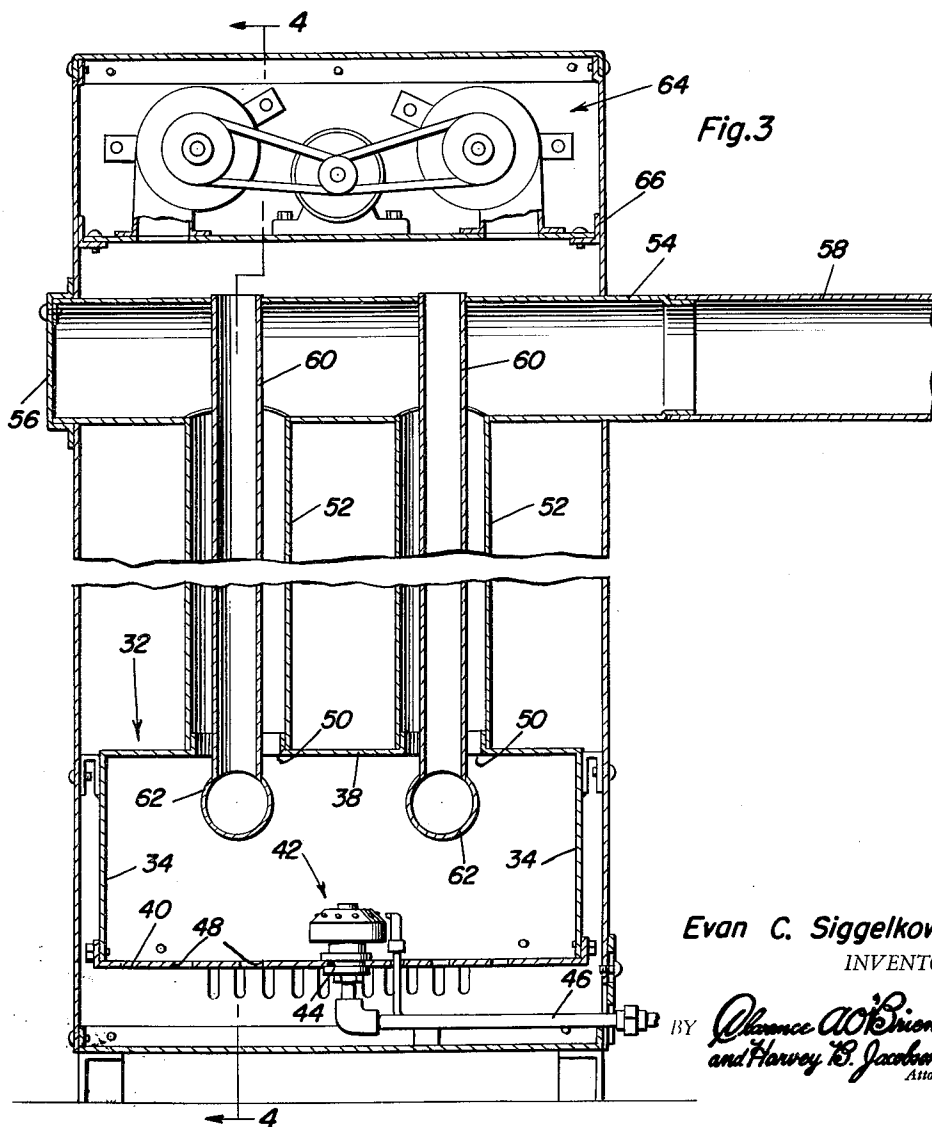


Fig. 3



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HOT AIR HEATER

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3 Claims. (Cl. 126-110)

This invention relates generally to hot air heaters, and more particularly to a heat exchange unit employed in a forced down flow hot air space heater or in a space heater without forced air circulation.

The primary object of this invention is to provide a space heater which is of relatively small size and yet capable of supplying as much heat, or B.t.u.'s as much larger units.

Another object of this invention is to provide a device of the character described whereby efficient use will be made of the hot products of combustion for heating the air in a room very efficiently, since the air to be heated flows both internally and externally of the hot flue pipes.

Still a further object of this invention is to provide a device of the character described which may, because of its versatility, be placed in almost any position in a home so that it will be enabled to be installed where floor space is at a minimum.

Still a further object of this invention is to provide a device of the character described wherein any air that flows externally of the hot flue pipes also flows over the external surface of the combustion chamber and is heated further thereby.

Yet another important object of the present invention resides in the provision of a heat exchange unit for a forced downflow hot air space heater in which a horizontal combustion chamber and a horizontal exhaust header are interconnected by vertically extending flue pipes over which air is forced with each of the flue pipes having an air pipe concentric therewith and extending vertically through the exhaust header for receiving a portion of the downflowing air with the lower end of the air pipes extending through a portion of the interior of the combustion chamber and terminating exteriorly thereof with the entire unit being enclosed in a casing concentrically spaced therefrom for guiding and retaining the downflowing air in heat exchange relation with the heat exchange unit.

Still a further object of this invention is to provide a simple and inexpensive device yet one which is exceedingly effective for the purpose for which it is designed.

This invention contemplates the use of a rectangular casing within which all of the heater components are installed. In the lower portion of this casing is a small housing which acts as the combustion chamber and into which a gas, or other type of burner is installed. Air holes are provided at the bottom of this housing for supplying combustion supporting air. The flue pipes are connected to the upper portion of the combustion chamber and extend vertically in the casing into a horizontal exhaust header which is communicated with the atmosphere. A plurality of smaller air pipes extend vertically through the horizontal header and internally of the vertical flue pipes in concentric spaced relation and pass into the combustion chamber, where they communicate with horizontal pipes extending horizontally through the walls of the combustion chamber so as to communicate with the interior of the casing. The combustion chamber or housing is of slightly smaller dimensions than the casing so that air may flow over the outer surfaces. A fan is provided at the upper portion of the casing to force air downwardly through the casing with inlet ports being provided at the top of the casing and outlet ports being provided in the bottom thereof.

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Thus, when the fan is forcing air downwardly in the casing, the air will pass between the inside of the casing and externally of the exhaust header and flue pipes so that a large amount of air may be heated at one time.

The air passing externally of the flue pipes then flows over the outer surface of the combustion chamber for further heating and flows outwardly through the outlet ports adjacent the bottom of the casing. A portion of the downflowing air is also forced down through the smaller vertical air pipes, and outwardly through the horizontal pipes in the combustion chamber for discharge into an area to be heated with this portion of the air being quite hot when discharged. When the heat exchange unit is employed in a heater without forced downflow, natural air convection circulation causes cool air to pass inwardly through the horizontal air pipe and upwardly through the vertical air pipes while the exterior surfaces of the combustion chamber, flue pipes and exhaust header are heating air and radiating heat to space adjacent thereto.

These together with other objects and advantages which will become subsequently apparent reside in the details of construction and operation as more fully hereinafter described and claimed, reference being had to the accompanying drawing forming a part hereof, wherein like numerals refer to like parts throughout, and in which:

FIGURE 1 is a perspective view of the forced downflow hot air space heater in which the heat exchange unit comprising the present invention is installed;

FIGURE 2 is a horizontal sectional view taken substantially upon the plane defined by reference line 2-2 of FIGURE 1 illustrating details of construction thereof;

FIGURE 3 is a vertical sectional view taken substantially along the plane defined by reference line 3-3 of FIGURE 1; and

FIGURE 4 is a vertical sectional view taken substantially along the plane defined by reference line 4-4 of FIGURE 3 illustrating further details of construction thereof.

Referring now more specifically to the drawings, it may be seen that the numeral 10 generally designates the external casing of the space heater. This casing has a plurality of legs 12 connected to the bottom end thereof so that the casing may be stood on its end when desired. The casing 10 includes end walls 14, side walls 16, a detachable top 18 and detachable bottom plate 20. A plurality of inlet ports 22 are formed in the upper portion of one of the side walls 16, and a plurality of grills 24 cover the ports so as to make for a more pleasing appearance. In the lower end of both of the side walls 16, are formed outlet ports 26 which are framed by collar members 28 so as to give a more pleasing appearance thereto. Below the outlet ports 26, a plurality of vertical slots 30 are formed so as to provide outlets for the heated air from the casing 10.

A combustion chamber or housing 32 is disposed in the lower portion of the casing 10, and this chamber 32 is defined by end walls 34, side walls 36, and top and bottom walls 38 and 40 respectively. A gas burner 42 is disposed internally of the combustion chamber and projects through an opening 44 formed in the bottom wall 40 thereof. A gas supply conduit 46 enters the casing and supplies the burner 42 with fuel. A plurality of openings 48 are formed in the bottom wall 40 of the combustion chamber so that sufficient oxygen will be supplied for supporting combustion. It is pointed out that other types of burners and fuel may be employed with the same results.

In the top wall 38, openings 50 are formed to which vertical flue pipes 52 are connected so as to carry away the hot products of combustion. The vertical flue pipes 52 connect to and communicate with a horizontal exhaust

header 54 extending through both end walls 14 with one end being closed by a removable and recessed cap 56. Any other type of conduit 58 desired is connected with the other end of header 54 to convey the products of combustion to a chimney or the like for discharge. The combustion chamber 32 is concentrically spaced from the casing 10 as shown in FIGURE 2 and the spacing of the casing 10 from the flue pipes 52 and header 54 is shown in FIGURES 2-4 whereby the casing forms a guide for air flow over the surfaces of the combustion chamber 32, flue pipes 52 and header 54 for picking up heat therefrom. Vertically extending air conducting pipes 60 are disposed internally of flue pipes 52 and project upwardly through horizontal header 54 and downwardly into combustion chamber 32. Connected to the lower end of each pipe 60 is a horizontal air pipe 62 located within the combustion chamber 32. The pipes 62 extend through side walls 36 of chamber 32 and communicate with outlet ports 26 as clearly shown in FIGURE 4.

With the hot combustion products passing around the horizontal air pipes 62 and upwardly from the combustion chamber 32 between the inner surface of the flue pipes 52 and air pipes 60, the air passing through the air pipes 60 and 62 will be heated thus lowering the temperature of the combustion products discharged by the conduit 58. At the same time air is being heated by heat exchange contact with the external surfaces of the combustion chamber 32, flue pipes 52 and exhaust header 54. Thus, a greater area of heat exchange surface is provided with there being no increase in size of the casing 10. Also, the cap 56 may be placed on either end of the exhaust header 54 thus permitting the conduit or stove pipe 58 to extend from either side of the casing for versatility in installation. Also, the heat exchange unit including the combustion chamber 32, flue pipes or tubes 52, exhaust header 54, air pipes or tubes 62 and 64 and the burner 42 may be installed in a forced air heater or furnace or in a heater or furnace using natural air convection for air circulation with the same advantageous results.

In the form of the invention specifically disclosed, an air impelling means 64 including a motor and fans is mounted upon brackets 66 in the upper portion of the casing, so that a forced downflow of air will be drawn through inlet ports 22 and discharged into the casing 10 above the header 54.

Thus, as fuel is supplied to burner 42 within the combustion chamber 32, the air impelling means will force air downwardly with a portion of the air passing through vertical pipes 60, where it will be heated by the upflowing hot combustion products, and thence into horizontal pipes 62 where it will be further heated since it is disposed within the combustion chamber. The air is then forced outwardly through port 26 and into the room to be heated. The remainder of the air is forced downwardly about horizontal exhaust header 54, and over the external surface of flue pipes 52 within the confines of casing 10, so that this air will be heated by contact with the outer surface of flue pipes 52 and header 54. This air also passes over the outer surface of the major portion of the combustion chamber 32 so that it will be heated even further, and is then expelled through ports 30 disposed at the bottom of the casing for that purpose. In this manner, an efficient heat exchange relationship between the air and combustion products is obtained. The air impelling means draws the air from an elevated area and discharges the heated air just above the floor level thus eliminating stratification of the air in a room. After the force of discharge of the heated air out of the bottom has been expended, the hot air will naturally rise for providing an even temperature throughout the room. The air returning to the fan is already warm thereby requiring less fuel to reheat it. A portion of the air flowing downwardly in the casing may pass in through openings

48 in the combustion chamber 32 for supporting combustion with heated air.

The pipes 60 located concentrically in the flue pipes 52 will effectively utilize heat of the combustion products that would be normally lost by passage through the stove pipe or conduit 58 since the column of combustion products in the center of a conventional fire tube or flue pipe has very little heat exchange contact with the inner surface of the flue pipe since it is normally spaced therefrom with very little moving contact which is necessary for the heat exchange.

This heat exchange unit may be employed in conjunction with other types of forced hot air furnaces or heaters and may be used with a gravity air heater or furnace in which natural air convection currents are employed for air circulation. In this type of use, air would enter from the bottom ports and pass in through pipes 62 and up through pipes 60 with the external surfaces of the combustion chamber 32, flue pipes 52 and exhaust header 54 also heating other air with convection currents causing movement of the air.

The foregoing is considered as illustrative only of the principles of the invention. Further, since numerous modifications and changes will readily occur to those skilled in the art, it is not desired to limit the invention to the exact construction and operation shown and described, and accordingly, all suitable modifications and equivalents may be resorted to, falling within the scope of the invention as claimed.

What is claimed as new is as follows:

1. In combination with a heating device including a vertically elongated casing having air ports adjacent the upper and lower ends thereof, and a heat exchange unit disposed within the casing and comprising a combustion chamber, a plurality of spaced and parallel tubular flue pipes connected to and communicated with the combustion chamber for receiving combustion products therefrom, an exhaust header connected to and communicated with the flue pipes for receiving combustion products therefrom, said header having an end vented to the atmosphere for discharge of combustion products, said combustion chamber and exhaust header being horizontally disposed and spaced vertically, a burner within the combustion chamber for burning fuel and producing hot combustion products, an air pipe extending vertically within each flue pipe in concentrically spaced relation, said air pipe extending vertically through the horizontal exhaust header thereby communicating the area above the exhaust header with the air pipes, the lower ends of the air pipes extending vertically through the top of the combustion chamber, a plurality of horizontal air pipes disposed in the combustion chamber above the burner and connected to and communicated with the vertical air pipes, said horizontal air pipes extending through the combustion chamber and out through the casing for communication with the atmosphere exteriorly of the combustion chamber whereby air in the air pipes will be heated simultaneously with air being heated by heat exchange contact with the external surface of the exhaust header, flue pipes, and combustion chamber, said casing being disposed in spaced enclosing relation to the heat exchange unit thereby providing space for circulation of air over the combustion chamber, flue pipes and exhaust header, said horizontal air pipes providing for circulation of air through the air pipes, said header extending horizontally through the casing for venting the combustion products.

2. The combination of claim 1 wherein air impelling means is mounted in the upper end of the casing for forcing air downwardly in the casing with a portion of the air passing downwardly through the air pipes and the remainder of the air passing downwardly over the exhaust header, flue pipes and combustion chamber for discharge of the heated air adjacent the bottom of the casing.

3. The combination of claim 2 wherein said combustion chamber is provided with an apertured bottom spaced

from the bottom of the casing whereby a portion of the heated downflowing air will enter the combustion chamber for supporting combustion.

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