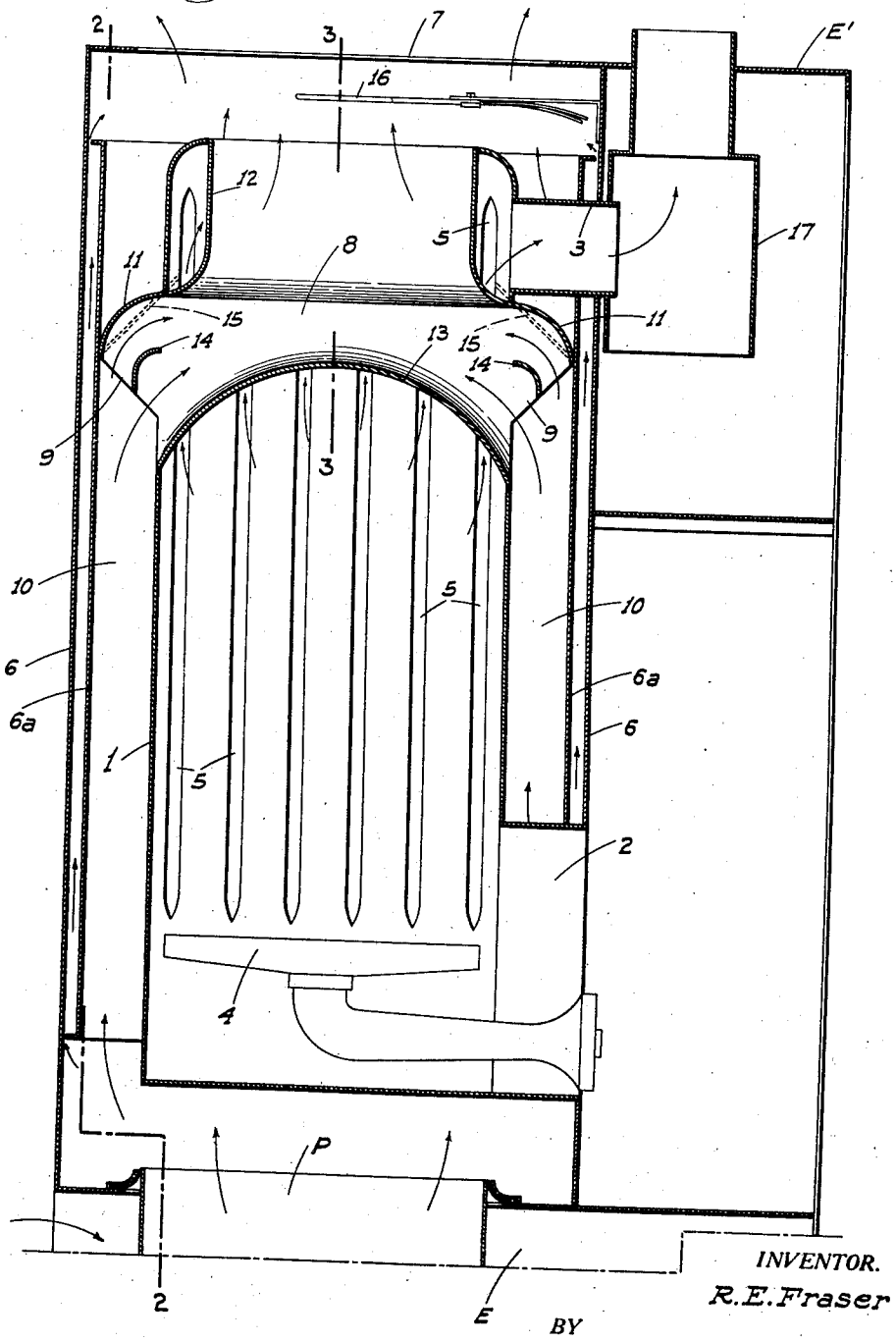
April 4, 1944. R. E. FRASER 2,345,559

AIR HEATING FURNACE

Filed July 5, 1941 2 Sheets-Sheet 1

Fig. 1



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Fig. 2

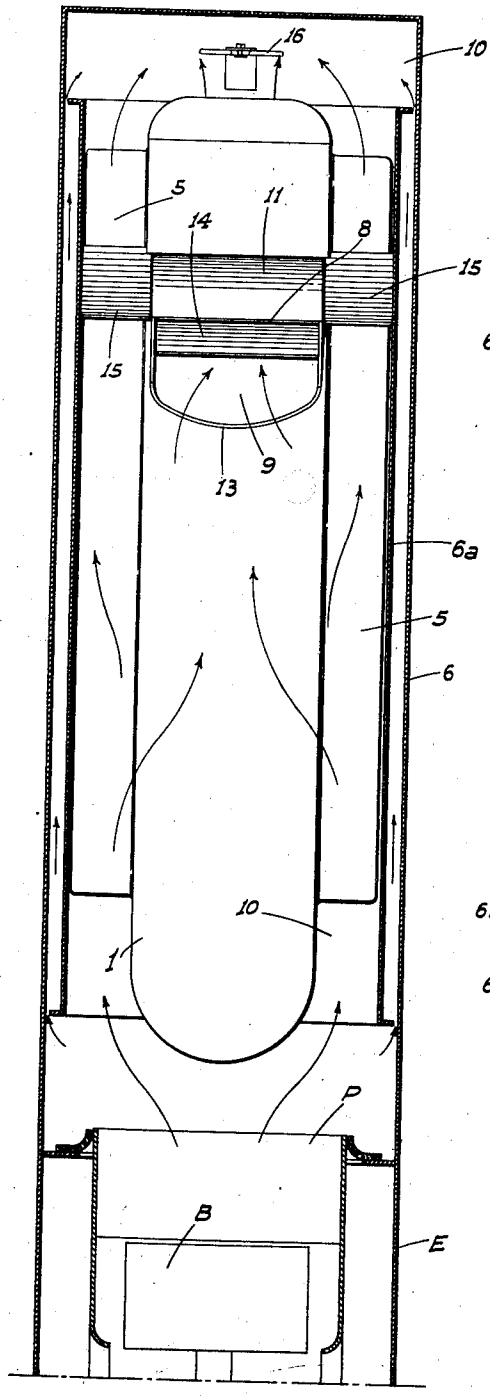


Fig. 3

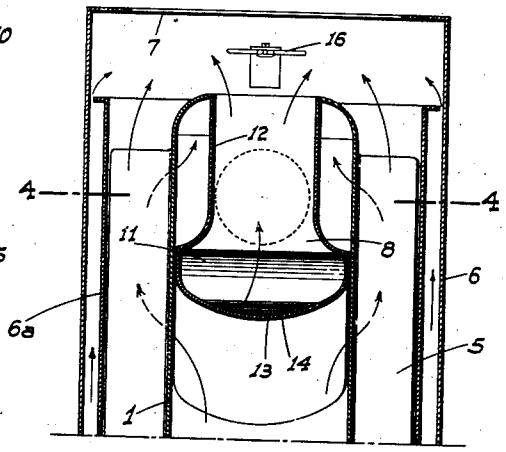
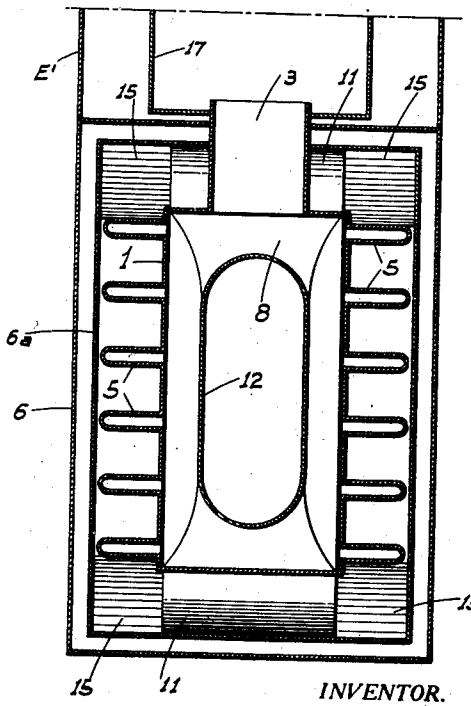


Fig. 4



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UNITED STATES PATENT OFFICE

2,345,559

AIR HEATING FURNACE

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Application July 5, 1941, Serial No. 401,149

8 Claims. (Cl. 126—99)

This invention relates to an air heating furnace for use in room heating by forced warm air circulating through the rooms, and particularly to a furnace of this type especially designed as a small unit for heating small residences and the like and in which the area available for mounting the furnace is apt to be somewhat limited, particularly as to floor space and height. However, multiple-unit furnaces can be erected for larger houses.

The principal objects of my invention are to provide a furnace which will give very high efficiency with a low operating cost; one which may be made relatively short without sacrifice of efficiency; one so constructed that a control device such as an automatic fan and air temperature control thermostat may be applied thereto at the factory so that no electrician's charges or similar expenses are involved when installing the furnace in place; and one in which the thermostat control member may be located in such relation to the heated air stream as to give extremely accurate results and a corresponding close control of the air temperatures in the areas being heated.

A further object of the invention is to produce a simple and inexpensive device and yet one which will be exceedingly effective for the purpose for which it is designed.

These objects I accomplish by means of such structure and relative arrangement of parts as will fully appear by a perusal of the following specification and claims.

In the drawings similar characters of reference indicate corresponding parts in the several views:

Figure 1 is a sectional elevation of my improved furnace.

Figure 2 is a transverse vertical section on the line 2—2 of Fig. 1.

Figure 3 is a fragmentary transverse vertical section on the line 3—3 of Fig. 1.

Figure 4 is a sectional plan on the line 4—4 of Fig. 3.

Referring now more particularly to the characters of reference on the drawings, the furnace comprises a substantially rectangular upstanding firebox 1, having an air intake opening 2 on one side at the bottom and an outlet conduit 3 on the same side at the top. A gas or similar burner 4 of standard type is mounted in the firebox at the bottom so as to direct its flame upwardly. The firebox is also formed with a plurality of spaced upstanding hollow fins 5 on opposite sides which extend from above the burner to adjacent the top of the firebox and are open to the interior thereof.

The firebox is surrounded by an outer casing 6 mainly open at its lower end, below but adjacent the bottom of the firebox, for connection with the discharge passage P of a motor driven blower B, which takes its air through an opening in the back of the casing-extension E depending from casing 6. The upper end of the casing is a short distance above the top of the firebox and is provided with an air outlet 7 or otherwise arranged for connection with conduits leading to the different areas to be heated, as is standard practice. The bottom of the firebox is transversely rounded as shown in Fig. 2 so as not to restrict the flow of air from the blower. The casing walls are spaced somewhat widely from the firebox both at front and back, but along the sides the corresponding walls extend close to the outer edges of the fins as shown in Fig. 4.

The casing 6 is heat insulated for the greater portion of its height by an inner casing 6a arranged to leave only restricted air entry and escape passages at the top and bottom, below outlet 7 and above the blower passage member P respectively. In this manner, a flow of air is forced up between the outer and inner casings which is sufficient in volume to keep the outer casing cool but insufficient in volume to materially affect the temperature of the main body of heated air passing through outlet 7.

Mounted in the firebox below the outlet 3 is a transverse air conduit or duct 8. This conduit extends from front to back of the firebox and for substantially the full width thereof. At its ends the conduit terminates in downwardly facing intakes 9 which project into the vertical air passages 10 formed between the casing and the firebox 1. The top walls 11 of the intakes are disposed outside the firebox and curve down and abut against the adjacent inner casing walls 6a so that the air cannot pass upwardly beyond the intakes but is deflected into the conduit 8. Above the intakes the conduit inside the firebox is formed with a relatively large vertical outlet passage 12 substantially symmetrical to but smaller than the firebox, and terminating at the top thereof in sealed relation therewith, and so that the air discharged from said passage will blow toward the outlets 7.

The bottom wall 13 of the conduit 8 is arched lengthwise thereof or from front to back of the firebox, as shown in Fig. 1, and is convexly curved relative to the firebox transversely of the conduit

as shown in Fig. 3. The intakes 9 have their inception at the low edges of the bottom wall 13, so that the entering air tends to contact the arching surface of said wall as the air travels toward the outlet 12. Air deflecting baffles 14 are mounted in and extend across the intakes intermediate their top and bottom in position to cause a large percentage of the entering air to be directed downwardly against said bottom wall 13, so that it will be brought into contact with the highly heated surface thereof.

The air blown into the casing 6 at the bottom of course moves upwardly therein all around the firebox, and in order to cause the greater portion of the air in the front and back passages 10 to be positively deflected into the intakes 9, vertical sloping baffle plates 15 are mounted in said passages 10 and substantially fill the corners therein between the endmost fins and the exposed projecting side and top portions of the transverse conduit, as shown in Figs. 2 and 4.

With the above described arrangement, therefore, it will be seen that the highly heated products of combustion not only heat the firebox walls and fins throughout their entire area, especially toward the top of the firebox, but are restricted in their outflow by reason of the air conduit 8 which is interposed between the burner and the gas outlet 3 and which is substantially the same horizontal area as the cross sectional area of the firebox. This restriction greatly increases the heat radiating value, since it causes not only the bottom wall of the conduit to be highly heated, but the side walls thereof and the adjacent portion of the fins 5 as well, inasmuch as all products of combustion to reach the outlet 3 must pass either through said portion of the fins or through the very small spaces left between the walls of the firebox and those of the conduit. As a result the air as it reaches the outlet openings 7, either directly up the casing at the sides or which has been deflected into the conduit 8 from the front and back, is in the desired highly heated condition.

Due to the arrangement of the air passages in the furnace relative to the terminal air outlets, the control tubes 16 of a thermostat device to control the blower may be placed in the air stream at its hottest point, as shown, so as to be very accurate in operation.

The main casing is also formed with a front extension E', shut off from the chamber 10, in which the draft hood 17 for the flue 3 is located, and providing ample space, below the hood, for the mounting of the thermostatically controlled switch box for the blower motor and burner valve, as well as the pilot and adjacent main piping, etc., used in connection with the operation of the burner as usual. While the casing 6, and extensions E and E' have been described as being separate parts, they actually present a continuous unbroken appearance from the outside, the interior of extension E' communicating freely with the interior of extension E, in which the blower and its motor are located.

The above described structure has many advantages over the present form of air heating furnaces of the same general character, as will now be enumerated:

(1) With the design of the fins and center duct or conduit in the top of the firebox as described, I am able to condense the overall size of the furnace in width, depth and height; and due to this decreased size, it is possible to provide a forced air furnace at a very low cost and still maintain one having very high efficiency.

(2) The duct or flue opening being in the center of the top of the firebox, it is possible to place the automatic fan and air temperature control thermostat tube close to the top of the firebox. This is because the flow of forced air from this opening which enters the duct from opposite sides of the firebox gives an equalized air temperature over the center of the firebox as well as at the sides. With this construction, a desired temperature of air can thus be maintained which cannot be had with a flat top furnace. A flat top prevents circulation of air to the controls, and also the controls are subject to a radiant heat from the top of the firebox. This combination of radiant heat and lack of circulation to the controls, which my furnace construction overcomes, make it impossible to accurately regulate the operation of the fan and the temperature of the air leaving the furnace.

(3) Another objection which this construction overcomes is a common one in forced air furnaces—that of cold air being blown into the house after the room thermostat has been satisfied and has turned off the gas burner. With a large volume of either heated or cooled air being directed to the control device at the top of the furnace (the temperature of the air being governed by the gas burner), the control will respond instantly to the temperature change and will govern the off and on period of the fan or blower as well as the air temperature leaving the furnace, and thus prevent the circulation of cold air in the heated rooms.

(4) The flame on a gas burner has a tendency to taper toward the center of the firebox, thus causing the side walls of the furnace to be the hottest. The use of the hollow fins on the sides of the firebox enables me to absorb this excessive heat at this point; but due to the character of the burner flame, the radiating surfaces on the ends of the firebox are at a much lower temperature than the sides; and the corresponding portions of the air passages or chambers on the outside of the firebox are used as conduits for this relatively cool air to reach the cross conduit at the top of the firebox. The volume of air passing between the hollow fins on the sides of the firebox, and the air passing through this cross duct from the front and back of the firebox are thus utilized so as to give a uniform temperature of the air leaving the top of the firebox from both sides as well as from the top of the central cross duct. The bottom of this duct being arched, it naturally provides a greater distance between the center of the flame and the duct, while the ends of the duct are closer to the burner, where the heat is less intense.

This arrangement provides a very uniform temperature over the entire bottom surface of this cross duct adjacent the top of the furnace. The cool air entering the duct is deflected against the bottom of the same by the curved baffles 14 at each end. The bottom of the duct becomes very hot and a great deal of heat is absorbed at this point. Also at this point said cross duct restricts the flow of the gases and forces the hot gases to enter the top of the furnace through the hollow fins. The velocity of the burned gases in this top portion of the furnace is therefore reduced, and with the combination of the central cross duct and the outer heat radiation at this point through the fins, sufficient heat units are extracted to give a very low stack temperature.

(5) Another advantage of this type of construction is that a unit sufficiently small in size may be built to go through any standard width door. The construction also permits of complete assembly of the furnace, including all necessary electrical connections and installing of all automatic controls, at the factory. This obviously saves considerable time and expense to the installer on the job.

From the foregoing description it will be readily seen that I have produced such a device as substantially fulfills the objects of the invention as set forth herein.

While this specification sets forth in detail the present and preferred construction of the device, still in practice such deviations from such detail may be resorted to as do not form a departure from the spirit of the invention, as defined by the appended claims.

Having thus described my invention, what I claim as new and useful and desire to secure by Letters Patent is:

1. An air heating furnace comprising a vertical firebox having a burner in its lower end and a side outlet for gases of combustion adjacent its upper end, a casing surrounding the firebox on its sides in clearance relation thereto to provide air passages all around the same, said casing at its lower end being open for the entry of air to be heated and having an outlet above the upper end of the firebox, an air conduit in the firebox extending between opposite sides thereof adjacent and below the firebox outlet, said conduit at both ends having intakes communicating with the corresponding casing packages, an upstanding air outlet member formed with the conduit intermediate its ends and terminating in upwardly facing relation at the top of the firebox, and means to deflect the majority of the air moving up said casing passages into the ends of the conduit, the bottom wall of the conduit being convexly curved on the inside lengthwise of the conduit, and baffles in the intakes deflecting the entering air toward said curved bottom.

2. An air heating furnace comprising an upstanding firebox having a burner in its lower end and a flue gas outlet adjacent its upper end, an upstanding casing surrounding the firebox, the firebox and casing being disposed in clearance relation to each other, whereby to form air-flow passages between corresponding walls thereof, said casing having an air inlet adjacent its lower end and an air outlet at its upper end, vertically elongated, horizontally spaced hollow fins formed on opposed walls of and open to the interior of the firebox, said fins projecting laterally outwardly across adjacent air-flow passages to a termination close to the corresponding wall of the casing, a substantially horizontal air conduit extending across the firebox intermediate the ends of said fins, said conduit projecting at its ends through other opposed walls of the firebox into communication with adjacent air-flow passages, said conduit being of a size and configuration in plan to substantially block the firebox whereby to deflect the gases of combustion below said conduit into said fins for passage about the conduit, and a top outlet on the conduit intermediate its ends extending upwardly through and out of the firebox into the casing.

3. An air heating furnace comprising an upstanding firebox having a burner in its lower end and a flue gas outlet adjacent its upper end, an upstanding casing surrounding the firebox, the firebox and casing being disposed in clearance relation to each other, whereby to form air-flow passages between corresponding walls thereof, said casing having an air inlet adjacent its lower end and an air outlet at its upper end, vertically elongated, horizontally spaced hollow fins formed on opposed walls of and open to the interior of the firebox, said fins projecting laterally outwardly across adjacent air-flow passages to a termination close to the corresponding wall of the casing, a substantially horizontal air conduit extending across the firebox intermediate the ends of said fins, said conduit projecting at its ends through other opposed walls of the firebox into communication with adjacent air-flow passages, said conduit being of a size and configuration in plan to substantially block the firebox whereby to deflect the gases of combustion below said conduit into said fins for passage about the conduit, and a top outlet on the conduit intermediate its ends extending upwardly through and out of the firebox into the casing; said projecting portions of the conduit extending into engagement with the casing walls corresponding to said other opposed walls and opening downwardly only into communication with said last named air-flow passages.

4. An air heating furnace comprising an upstanding firebox having a burner in its lower end and a flue gas outlet adjacent its upper end, an upstanding casing surrounding the firebox, the firebox and casing being disposed in clearance relation to each other, whereby to form air-flow passages between corresponding walls thereof, said casing having an air inlet adjacent its lower end and an air outlet at its upper end, vertically elongated, horizontally spaced hollow fins formed on opposed walls of and open to the interior of the firebox, said fins projecting laterally outwardly across adjacent air-flow passages to a termination close to the corresponding walls of the casing, a substantially horizontal air conduit extending across the firebox intermediate the ends of said fins, said conduit projecting at its ends through other opposed walls of the firebox to the adjacent casing walls and opening downwardly into adjacent air-flow passages, said conduit being of a size and configuration in plan to substantially block the firebox whereby to deflect the gases of combustion below said conduit into said fins for passage about the conduit, and a top outlet on the conduit intermediate its ends extending upwardly through and out of the firebox into the casing; and baffles mounted in said adjacent air flow passages and extending between the sides of the projecting portions of the conduit and said corresponding walls of the casing and between the endmost fins and said adjacent casing walls with a downward slope from the fins whereby to prevent air flow upwardly in said airflow passages except into said projecting portions of the conduit or between said fins.

5. A structure as in claim 4 in which the firebox and casing are rectangular, said projecting portions of the conduit being disposed at right angles to adjacent fins; said baffle means comprising corner baffle plates.

6. An air heating furnace comprising an upstanding firebox having a burner in its lower end and a flue gas outlet adjacent its upper end, an upstanding casing surrounding the firebox, the firebox and casing being disposed in clearance relation to each other, whereby to form air-flow passages between corresponding walls thereof, said casing having an air inlet adjacent

its lower end and an air outlet at its upper end, vertically elongated, horizontally spaced hollow fins formed on opposed walls of and open to the interior of the firebox, said fins projecting laterally outwardly across adjacent air-flow passages to a termination close to the corresponding wall of the casing, a substantially horizontal air conduit extending across the firebox intermediate the ends of said fins, said conduit projecting at its ends through other opposed walls of the firebox into communication with adjacent air-flow passages, said conduit being of a size and configuration in plan to substantially block the firebox whereby to deflect the gases of combustion below said conduit into said fins for passage about the conduit, and a top outlet on the conduit intermediate its ends extending upwardly through and out of the firebox into the casing; the bottom wall of the conduit being convexly curved on the inside lengthwise thereof, and baffles in said projecting portions of the conduit arranged to deflect entering air toward said curved bottom.

7. A structure as in claim 6 in which said conduit is convexly curved on the inside transversely thereof.

8. A structure as in claim 2 in which the top outlet on the conduit is adjacent to but spaced from the corresponding portion of the firebox whereby to form a restricted flue gas passage therebetween; said flue gas outlet leading from one side of said corresponding portion of the firebox.

RICHARD E. FRASER.