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2,603,208

DOWNDRAFT HOT-AIR FURNACE

Filed Nov. 5, 1948

2 SHEETS—SHEET 1

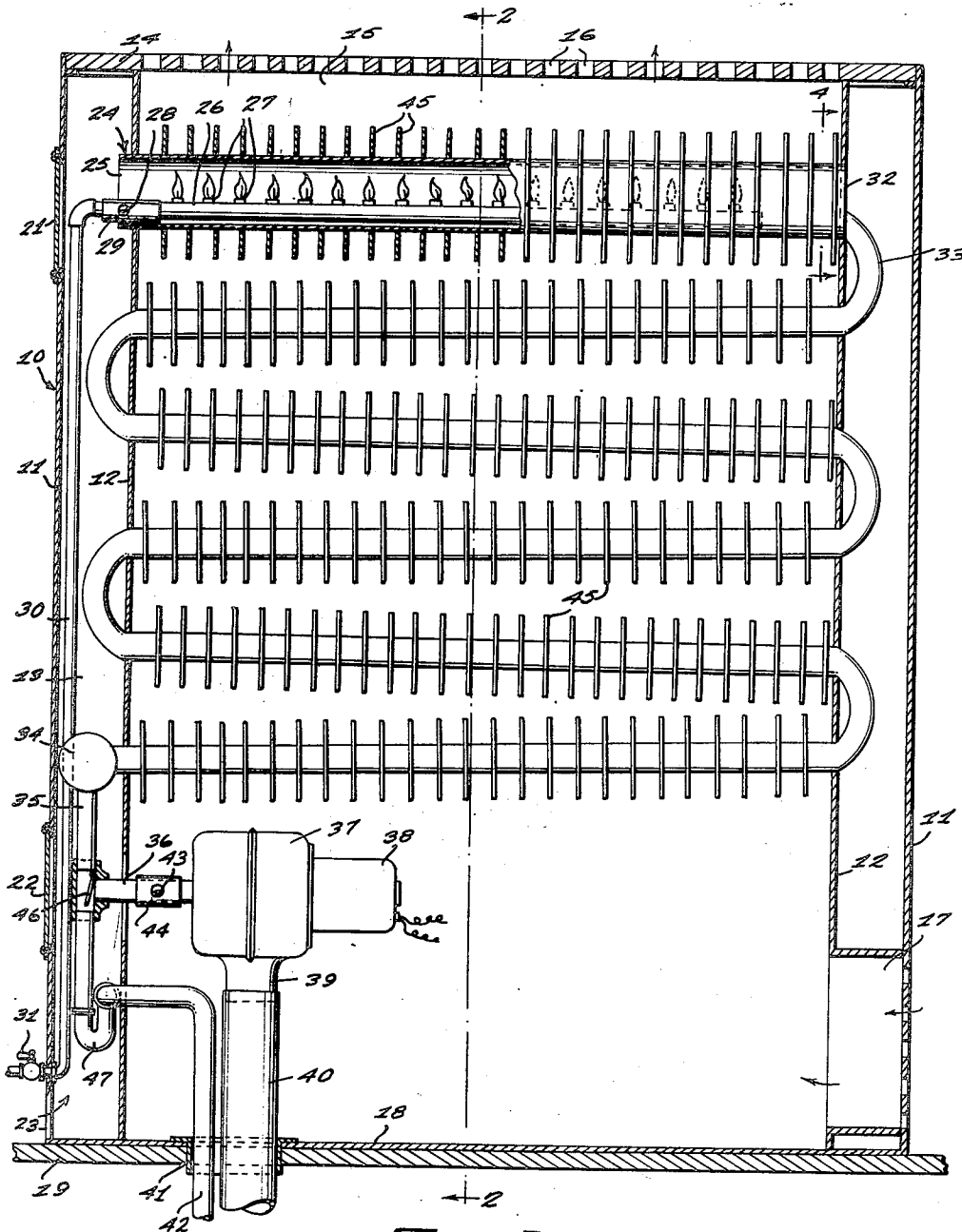


FIG 1

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2 SHEETS—SHEET 2

FIG. 2

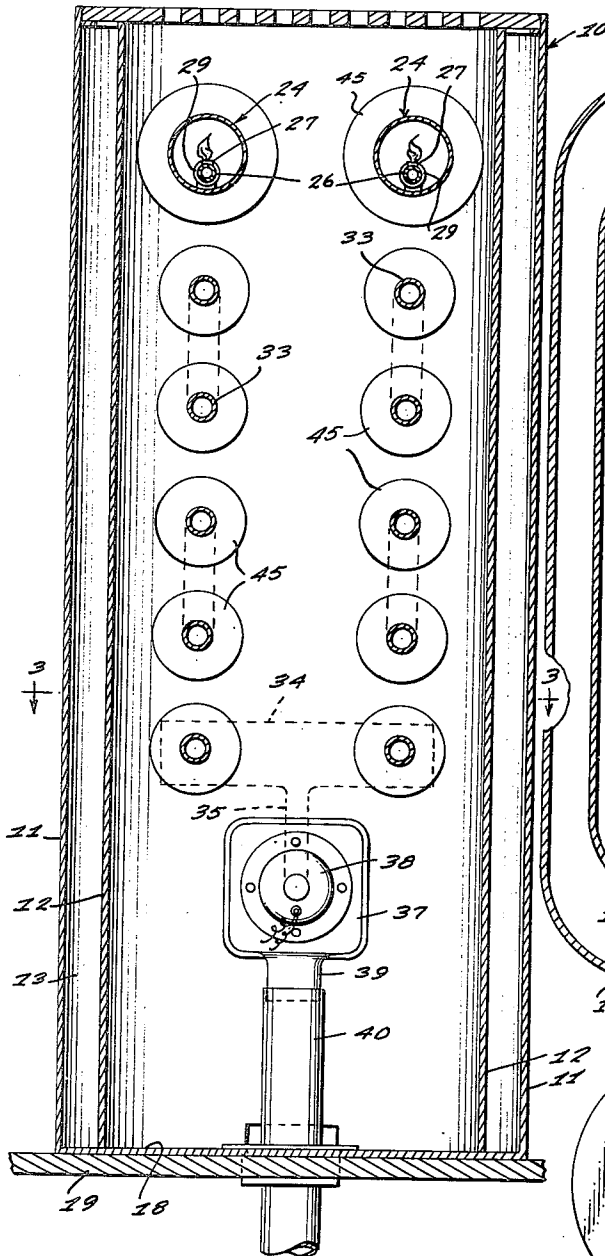


FIG. 3

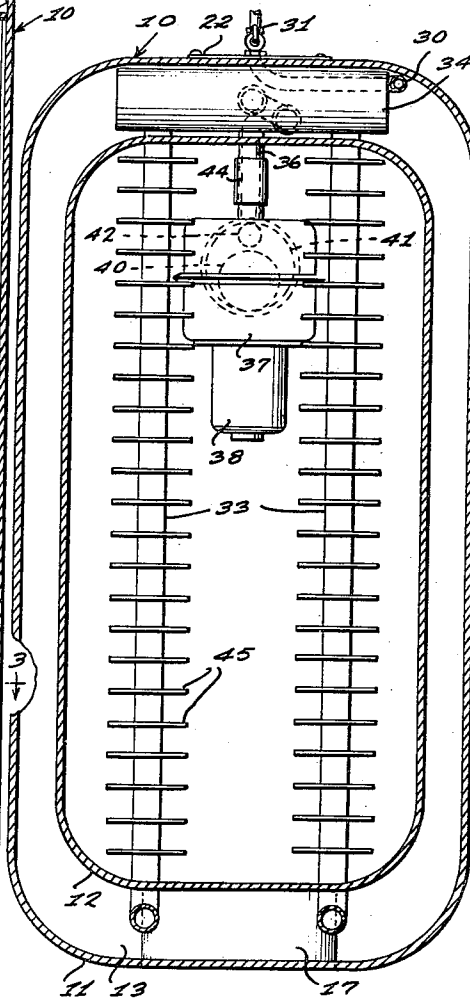
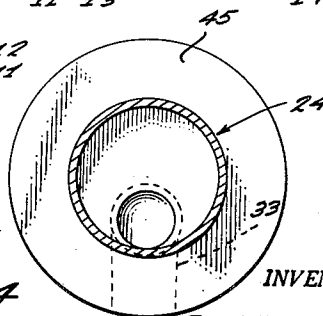


FIG. 4



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DOWNDRAFT HOT-AIR FURNACE

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Application November 5, 1948, Serial No. 58,477

1 Claim. (Cl. 126—116)

1

My invention relates to furnaces, and more particularly to furnaces for heating air or fluid.

An object of my invention is to provide an improved furnace which includes a vertically-disposed tortuous flue for the products of combustion, the heating chamber operatively connected to the upper end of the flue, and means operatively associated with the flue for drawing the products of combustion downwardly through the flue and discharging the same from the lower end thereof.

A further object is to provide an improved furnace such as that last described, which includes means for separating condensate from the gaseous products of combustion.

Other objects and advantages reside in the particular structure of the invention, combination and arrangement of the several parts thereof, and will be readily understood by those skilled in the art upon reference to the attached drawings in connection with the following specification, wherein the invention is shown, described and claimed.

In the drawings:

Figure 1 is a longitudinal vertical sectional view through the furnace according to the invention;

Figure 2 is a transverse vertical sectional view taken substantially on the plane of the line 2—2 of Figure 1;

Figure 3 is a horizontal sectional view taken substantially on the plane of the line 3—3 of Figure 2;

Figure 4 is an enlarged fragmentary vertical sectional view taken substantially on the plane of the line 4—4 of Figure 1.

Referring specifically to the drawings, wherein like reference characters have been used throughout the several views to designate like parts, the form of furnace illustrated herein by way of an example comprises a housing 10 of any suitable material, but which preferably includes outer and inner walls 11 and 12, respectively, providing an air space 13 therebetween. The housing 10 may be partially closed at the top by a top wall 14. That portion of the top wall 14 overlying the interior chamber 15 defined by the inner walls 12 is perforated, as at 16, for the passage of heated air upwardly out of the furnace. A cold air intake 17 opens through the walls 11 and 12 adjacent the lower edges thereof. The housing 10 may be closed at the bottom by a single bottom wall or floor 18, and the furnace itself is adapted to rest upon the floor 19 of a room or the like. Suitable access doors 21 and 22

2

may be provided as necessary in the outer wall 12 of the housing. Also, an opening 23 may be formed in a lower portion of the outer wall 11 for the entrance of air for supporting combustion in a combustion chamber now to be described.

In the embodiment illustrated, there has been provided a pair of combustion chambers 24, but it is to be understood that but a single combustion chamber can be used, or that more than two combustion chambers may be used, if desired. As the combustion chambers 24 are substantially identical, it will suffice to describe but a single one of them. Thus, each combustion chamber 24 comprises a tubular body extending longitudinally of the housing 10 and supported at each end by opposite inner walls 12. The front ends 25 of the chambers 24 open into the space 13 between the walls 11 and 12. An elongated gaseous fuel burner 26 extends longitudinally of each combustion chamber 24 interiorly thereof. Each burner 26 includes a plurality of upwardly-directed gas jets 27. The burner 26 in the region of the front end 25 of the combustion chamber is provided with laterally-directed apertures 28, Figure 1. An apertured sleeve 29 encircles a burner 26 in the region of the apertures 28 whereby to control the mixture of air supplied to the jets 27 in a well known manner. Access to the sleeve 29 may be had through the uppermost access door 21. Gaseous fuel is supplied to the burners 26 by any suitable pipe 30 which may include a cut-off valve 31. Moreover, it is to be understood that suitable well known automatic controls, not shown, may be operatively coupled to thermostats or the like, not shown, whereby to automatically control the supply of gas to the burners 26.

The rear end 32 of each combustion chamber 24 opens into a vertically-disposed flue 33 which is of zig-zag configuration to provide a tortuous flue. The lower ends of the flues 33 are connected together by any suitable header 34 which in turn opens into a downwardly-directed conduit 35. A laterally-directed conduit 36 opens into the downwardly-directed conduit 35 intermediate the ends of the latter. The conduit 36 is connected to the intake side of any suitable suction-generating device, such as the blower 37 which may be driven in any suitable manner, as by the electric motor 38. The outlet port 39 for the blower 37 discharges into any suitable stack or exhaust conduit 40 which leads from the housing 10 through an opening 41 formed in the floor 18 thereof and the floor 19 of the room. The

opening 41 is oversized so as to permit the passage through the same of a condensate discharge pipe 42.

The suction of the blower 37 may be varied in any suitable manner, as my means of automatic controls, not shown, for the motor 38. However, in the embodiment illustrated, the laterally-directed conduit 36 is provided with one or more apertures 43. Also, the conduit 36 has an apertured sleeve 44 rotatable therearound whereby to regulate the size of the openings 43 and thereby lessen or increase the suction of the blower 37. Thus, with the sleeve 44 so positioned as to completely uncover the apertures 43, a minimum suction will be created in the conduit 35 and flue 33. On the other hand, when the sleeve 44 is rotated as to completely cover the apertures 43, the maximum suction is created in the conduit 35 and flue 33.

As best seen in Figure 1, each substantially horizontal run of the flue 33 is slightly downwardly sloped so that any condensate formed in the flue will run downwardly into the header 34, and eventually into the downwardly-directed conduit 35. To prevent such condensate from entering the laterally-directed conduit 36, there has been provided a downwardly-directed baffle 45 which overlies the entrance to the laterally-directed conduit 36 whereby to permit the entrance of gaseous products of combustion, but prevent the entrance of condensate. Such condensate continues down a downwardly-directed conduit 35 to a trap 47 formed at the lower end thereof. The discharge end of the trap 47 is connected to the discharge pipe 42 for the condensate. The trap 47 provides a seal to prevent air from being sucked into the blower 37 through the pipe 42. At the same time, the trap 47 permits a constant flow of condensate outwardly into the pipe 42.

Each combustion chamber 24 and each horizontal run of the flue 33 is surrounded by a plurality of spaced fins 45 which may be circular and comprise means for rapidly dissipating the heat formed in the flues by the products of combustion. Likewise, these fins 45 provide an increased surface area for contacting air entering the furnace from the inlet 17 whereby to heat such air prior to its passage outwardly of the furnace through the outlets 16.

By providing a forced down draft, not only are the products of combustion substantially entirely cooled by their passage through the tortuous flue, but virtually all of the condensable products of combustion have condensed into condensate and been separated from the purely gaseous products. Likewise, the tortuous flue contains hot products of combustion which are flowing in substantially the opposite direction as the flow of the air passing through the furnace and heated by the flue. Moreover, virtually no heat is wasted and substantially all of it is utilized in heating the air passing through the furnace whereby to provide a highly efficient and economical furnace.

While I have shown and described what is now thought to be a preferred embodiment of the invention, it is to be understood that the same is susceptible of other forms and expressions. Consequently, I do not limit myself to the precise structure shown and described hereinabove except as hereinafter claimed.

I claim:

An air heating furnace, comprising an outer casing having a bottom wall, upstanding side walls and a top wall, an inner casing having side walls spaced from the side walls of the outer casing, the inner casing having an open top and and the top wall of the outer casing overlying the open top of the inner casing and being perforated to constitute an outlet, said inner casing having an air inlet duct adjacent the bottom wall, said duct being in communication with the space exterior of the outer casing and with the space within the inner casing through one of the spaced side walls thereof, a combustion tube transversely mounted at its ends in opposing side walls of the inner casing and disposed horizontally below the top of the outer casing, said tube having an open end communicating with the space between the side walls of the casings, the side wall of the outer casing having a combustion air supply opening, said opening being in communication with the space exterior of the outer casing and with the space between the casings, a burner mounted in the tube and disposed substantially coextensive therewith, adjustable primary air inlet means for the burner communicating through the open end of the combustion tube with the space between the casings and adapted to receive combustion air admitted to the space between the casings through said combustion air supply opening, fuel supply means connected to said burner and mounted within said space between the casings, an elongated continuous serpentine flue vertically arranged in the inner casing and including a plurality of communicated horizontal sections mounted in vertically spaced superposed relation below the combustion tube and affixed at their ends to the opposing side walls of the inner casing, heat exchange fins on said flue sections, the uppermost flue section being connected to the end of the combustion tube opposed to said open end thereof, the lowermost section being disposed adjacent to the air inlet duct, and an adjustable suction means mounted within the inner casing and operatively connected to said lowermost flue section for creating a downdraft in the flue in opposition to the upward travel of the air heated by the heat exchange fins.

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