

Oct. 31, 1944.

F. R. HIGLEY ET AL

2,361,545

FORCED AIR FURNACE

Filed May 13, 1941

3 Sheets-Sheet 1

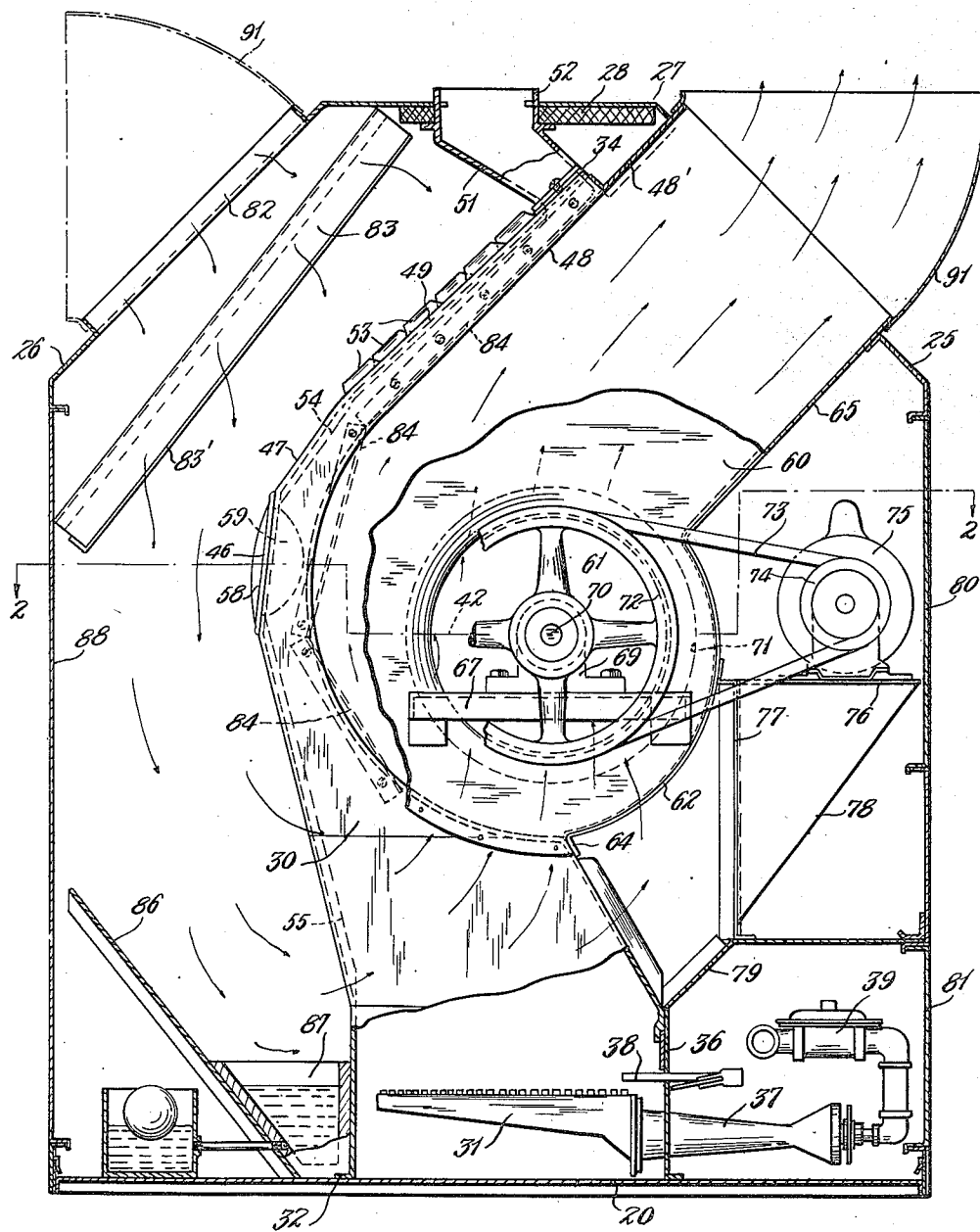


FIG. 1

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3 Sheets-Sheet 2

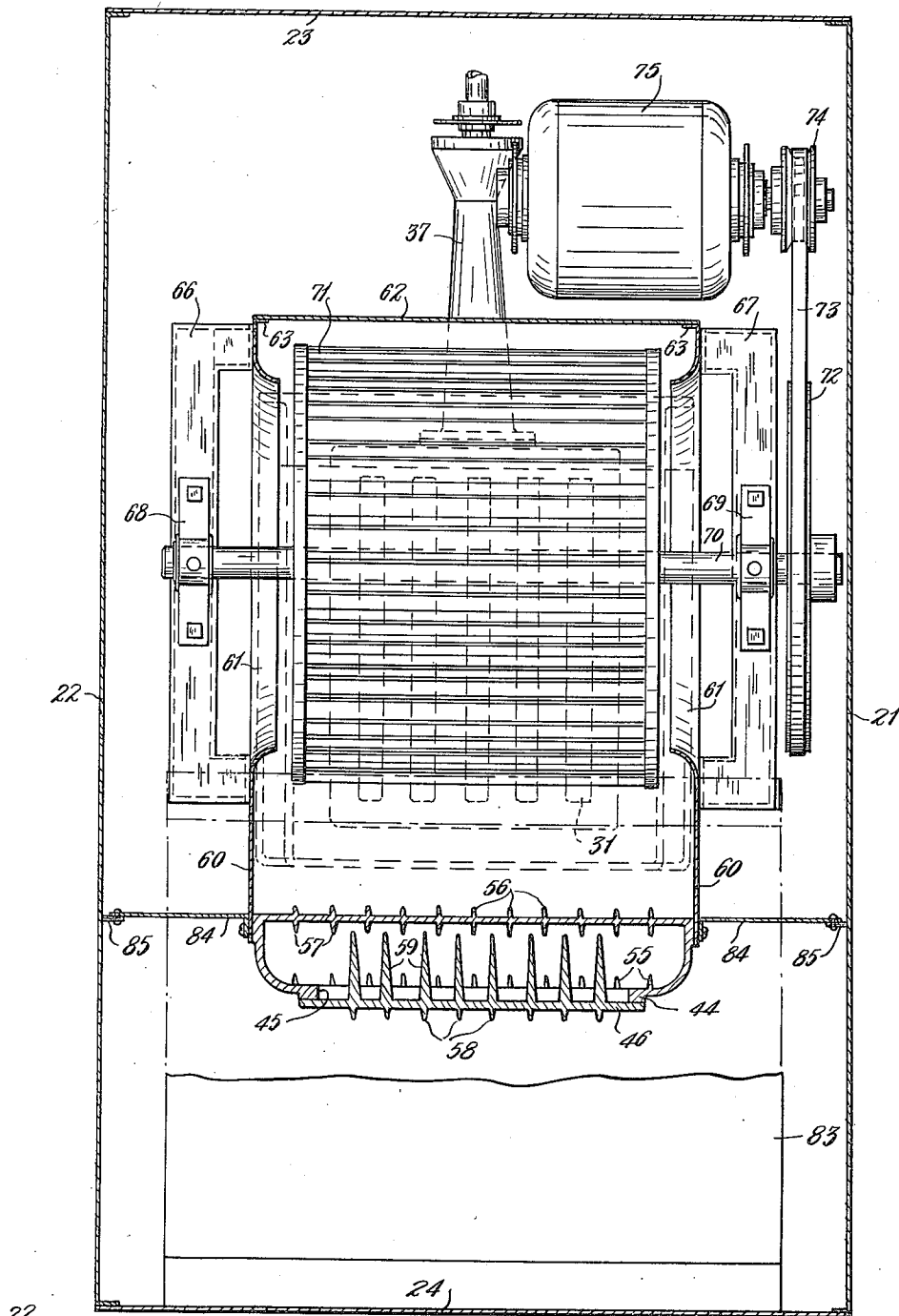


FIG. 2

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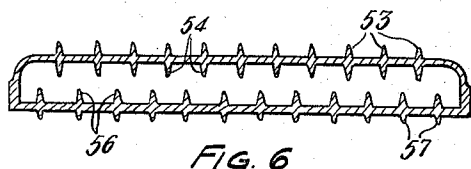
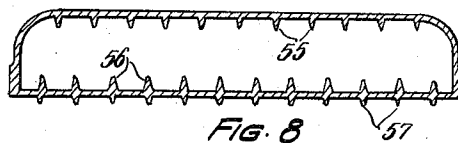
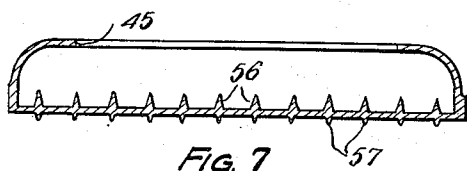
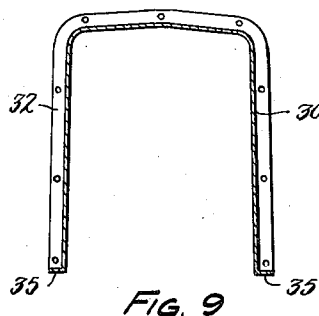
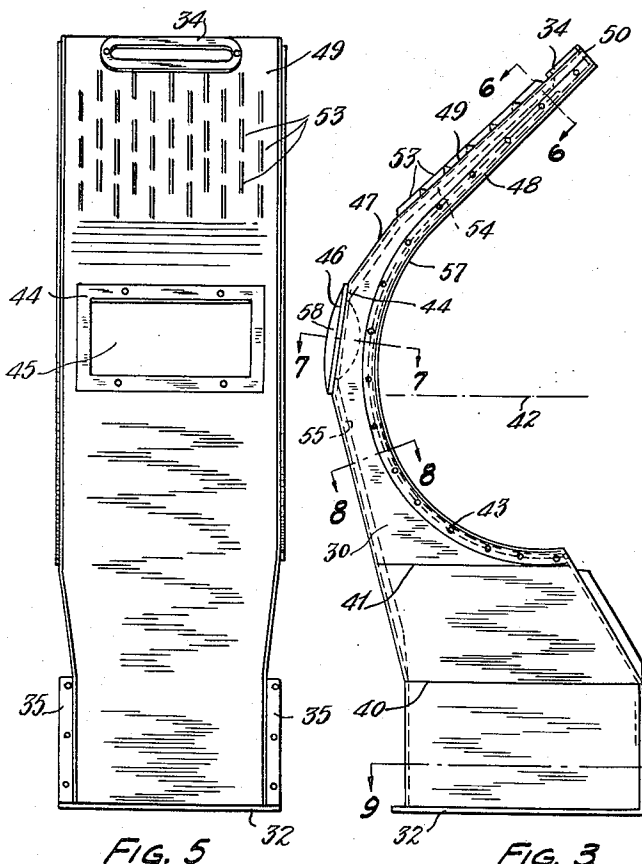
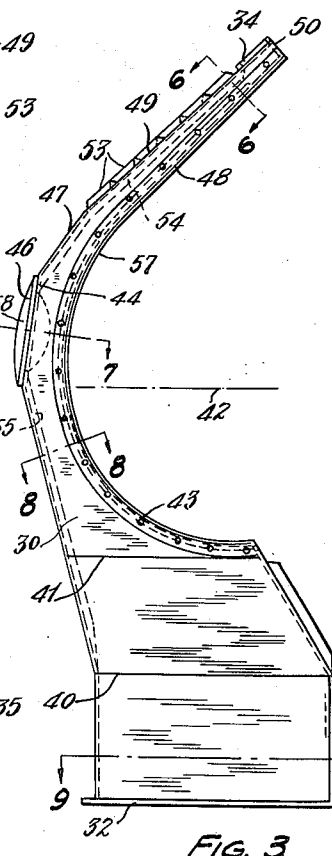
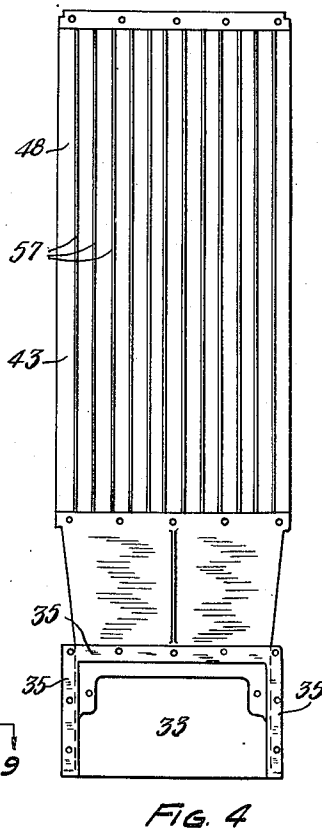
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3 Sheets-Sheet 3



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2,361,545

FORCED AIR FURNACE

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Application May 13, 1941, Serial No. 393,302

13 Claims. (Cl. 126—110)

This invention relates to improvements in forced air furnaces, and has reference particularly to what may be termed scroll type heaters wherein the scroll of a centrifugal blower is utilized as a heat transfer element. The invention in certain respects is an improvement upon the construction disclosed in the copending application of Frank R. Higley, Serial No. 318,147, filed February 9, 1940, now Patent No. 2,330,122, September 21, 1943.

An object of the present invention is the arrangement of a blower scroll within an enclosing casing in such manner and in such relation to the intake and discharge openings of the casing as to most efficiently heat the air being circulated by the blower.

Another object is the provision of a scroll of the character indicated wherein that portion of the scroll which constitutes the heat transfer element consists of a hollow casting while the remaining portions are constructed of sheet metal to conserve weight and save expense.

Another object is to so construct and arrange the hollow casting that it may carry or support all other stator and rotor parts of the blower.

Still another object of the invention is to so arrange the blower and the other apparatus of the heater in the enclosing casing that access may be had to the various parts of the heater without disassembling other parts.

Other objects and features of novelty will appear as we proceed with the description of that embodiment of the invention which, for the purposes of the present application, we have illustrated in the accompanying drawings, in which

Fig. 1 is an elevational view of heating apparatus embodying the invention, one side wall of the casing being removed and certain parts being broken away and others shown in section in order to more clearly illustrate the invention.

Fig. 2 is a plan view, partly in horizontal section on the line 2—2 of Fig. 1.

Fig. 3 is a side view of a hollow casting forming an important part of the invention.

Figs. 4 and 5 are front and rear elevational views of the casting.

Figs. 6, 7 and 8 are cross-sectional detail views taken substantially on the lines 6—6, 7—7 and 8—8 of Fig. 3.

Fig. 9 is a cross-sectional view of the casting base, taken substantially on the line 9—9 of Fig. 3, and

Fig. 10 is a detail view of a modified form of joint.

In the drawings we have illustrated a heating

apparatus embodying a casing having a base member 20 of sheet metal, sidewalls 21 and 22 and end walls 23 and 24. The top of the furnace comprises two inclined walls 25 and 26 and a connecting horizontal portion 27, preferably lined with insulation 28. The various parts of the apparatus are mounted within this casing.

An important part of the heater is a hollow casting 30, illustrated more or less in detail in Figs. 3 to 9, inclusive. This casting stands in a generally upright position and is formed preferably of ferrous metal. For most of the upper two-thirds of its height it constitutes a part of the scroll of a centrifugal blower. Throughout the lower third of its height approximately it is enlarged or expanded horizontally for a two-fold purpose; first, to provide a suitable base upon which it may rest firmly, and secondly, to provide a combustion space for a burner indicated at 31 in the drawings. The lower end of the casting is open and is bounded on three sides by a bottom flange 32 with openings therethrough for the reception of fastenings by means of which the casting is attached to the base 20 of the casing.

In the front wall of this enlarged base portion the casting is provided with an opening 33 with an outwardly extending flange 35, this flange being adapted to receive a closure member 36 provided with openings for the reception of a fuel conductor 37 and pilot apparatus 38. Valve mechanism, such as a suitable snap valve, is indicated at 39. This mechanism may or may not include pressure regulating means.

Up to the level of the horizontal line 40, Fig. 3, the walls of the casting, as preferably constructed, are vertical. From this line the side walls slope outwardly somewhat and the front and back walls slope rearwardly. From a line 41 the back wall continues its rearward slope up to the level 42 of the axis of the rotor, presently to be described. From the level 41 the front wall of the casting begins its cochleate form and constitutes a part of the scroll of the blower. This cochleate wall, marked 43 in the drawings, continues through an angle of approximately 150°. The outer wall of the casting has a straight portion 44 in which is formed a clean-out opening 45 that is normally covered by a closure plate 46. Extending upwardly a short distance from the straight portion 44 the outer wall has another portion 47 which is inclined forwardly more sharply than the portion 44 and extends upwardly to a point opposite the upper end of the cochleate portion of the front wall of the cast-

ing. From the latter point both walls are straight and extend upwardly at an angle preferably of about 45°, the thickness of the space between walls diminishing slightly, however, in the upward direction. This part of the casting is not, properly speaking, a part of the scroll, but constitutes an extension of a scroll wall. The front and back walls of this part of the casting are marked 48 and 49 respectively. They are joined by a narrow cross-wall 50, but the interior of the casting is in communication through a rearwardly extending neck 51 with a circular open-ended collar 52 for the reception of a flue pipe, not shown. This collar, it will be noted, is symmetrically arranged in the central longitudinal plane of the casing.

While it would be possible to cast the parts 51, 52 integral with the main casting 30, we have found it convenient to form these parts as a separate casting which is bolted to a machined boss around an elongated hole 34 through the rear wall of casting 30. A sheet metal plate 48' fastened to the casting 30 forms a continuation of wall 48 to complete that side of the blower delivery passage.

On the rear surface of the wall 49 we form heat transfer fins 53, and on the forward surface of this same wall we provide fins 54 which extend down preferably to the straight portion 44 of this wall. Below this there are other fins 55 which extend down approximately to the level indicated by line 40. The forward wall 43, 48 of the casting is provided with fins 56 on its rear surface and fins 57 on its forward surface. The removable closure 46 is preferably finned on its rear surface as at 58 and on its forward surface is provided with baffle means, illustrated herein as fins 59. This baffle means is employed for cutting down the cross-sectional area of the path for hot gases at this point. By varying the height or the number of fins the rate of flow of the hot gases may be altered to some extent.

The casting comprising the combustion space with its burner 31 and the heat exchanger portion or hot gas conductor constitutes the furnace structure of the apparatus, although the inner wall of the conductor and the top wall of the combustion space function additionally as part of the scroll of the blower.

The side walls 60 of the blower, formed of sheet steel, are screwed or bolted at their rear edges to the casting 30 and are thus supported thereupon. Each of them has a circular opening 61, concentric with the axis of the rotor. The forward wall of the blower housing has a cochleate portion 62 which is bolted to flanges 63 on the side members and is itself flanged at 64 for attachment to the forward wall of the casting. The forward straight portion 65 of the housing, constituting one wall of the air outlet, is likewise bolted to the side walls 60.

Flanged braces 66 and 67 are attached to the side plates 60 adjacent the openings 61 therethrough, and on these braces are mounted bearings 68 and 69 for the shaft 70 of a centrifugal rotor 71. Beyond bearing 69 this shaft carries a pulley 72 over which runs a belt 73 that is driven by a pulley 74 on the shaft of a motor 75 which is supported on a shelf 76 attached at its rear edge to a transverse partition plate 77 which is secured at its upper edge to the scroll wall 62 and at its side edges to the side walls 21 and 22 of the casing. 78 is a triangular bracket plate for shelf 76 attached at its rear edge to partition plate 77. A second partition plate 79 extending

entirely across the casing meets the lower edge of plate 77, and at its own lower edge merges with the plate 36, previously referred to, which also extends entirely across the casing. The plates 36, 79 and 77 together provide a barrier limiting the forward flow of air and directing it into the openings 61 of the blower.

In the front wall of the casing there are two removable panels 80 and 81, the former providing access to the motor 75 and around the ends of the blower to the bearings 68 and 69 for the rotor shaft 70, while the latter panel provides access to the burner controls.

The air inlet to the casing is located at 82 in the inclined wall 26, which is substantially parallel to the straight upper part 48, 49 of the casting. The entering air therefore flows in a direction substantially normal to the rear surface of the casting. Preferably it is caused to pass first through a filter 83 of conventional character, which rests in a frame 83'.

An important feature of the invention is that the construction is such as to cause the air after striking the casting to be deflected and moved longitudinally along the surface of the casting for a considerable distance before it is permitted to enter the blower. For this purpose we provide sheet metal baffles 84 which are screwed or otherwise secured at their inner edges to the casting, and terminate adjacent the side walls 21 and 22 of the casing. The joints with the casing walls are sealed by means of asbestos strips 85 which are fastened to the baffles but merely engage or wipe against the casing walls, thereby affording flexibility in assembly. The baffles 84 follow the general course of the front wall of the casting, but inasmuch as it is convenient to make them in straight sections, they do not conform closely to the curvature of the cochleate forward wall of the casting. These baffles at their lowest point are preferably well below the level of the axis of the rotor. Hence, as indicated by the arrows in Fig. 1, the air must travel over the surface of the hot rear wall of the casting before it can flow forwardly over the hot side walls of the combustion chamber and upwardly and into the ends of the blower.

86 is a fixed baffle extending across the casing and cutting off the lower rear corner thereof. In front of this baffle and behind the rear wall of the casting we mount a pan 87 in which water is maintained by suitable known means at a fixed level. The partially heated air flowing down and over the water in the pan 87 is thus humidified before it enters the blower.

The rear wall of the casing is provided with a removable panel 88 which affords access to the humidifying apparatus and to the air filter as well as to the clean-out closure 46 and the opening covered thereby. By virtue of the facilities described each part requiring servicing may be reached for this purpose after removal of a front or rear panel of the casing without disassembling any other part.

It will be observed that the lower part of the volute wall 48 is exposed to radiant heat from the burner 31 as well as to heat by convection from the products of combustion. The flow of air over this part of the volute is rapid owing to the action of the blower, and therefore this intense heat is removed at a rate fast enough to prevent this section of the volute from becoming excessively heated. The balance of the wall 48 is heated by convection from the flue gases, all of which are carried up along one side only of the blower. The rear or outer wall 47 of the casting

is, of course, also heated by convection from the hot gases, and in order to take advantage of this fact we cause the entering air to first wipe the wall 47 before it enters the blower, the air progressing in a direction opposite to that of the heat application and its flow over the less intensely heated wall 47 being less rapid than its flow over the wall 48, and particularly the lower part thereof which is heated to an especially high temperature partly by convection and partly by radiation.

In Fig. 10 we have shown a modification of the joint between the baffles 84 and the side walls of the casing, wherein the baffles are provided with flanges 89 that are riveted or bolted to the casing walls. The use of one or the other of these joints is dependent upon the method of shipping the furnace, that is to say if the furnace is shipped knocked down it is advisable to employ the flexible joint of Fig. 2, whereas if the entire furnace is to be assembled and crated as a unit it is then advisable to employ the joint illustrated in Fig. 10, as the casting is thereby tied to the casing and relative movement between these parts during transit is prevented.

The casting 30 is rather large and is somewhat difficult to make on account of the core which is required. It will be observed, however, that both ends of the casting are open, so that core supports may be there provided, and also that the clean-out opening 45 is located approximately at the middle of the casting, affording an opportunity for support of the core at that intermediate point. The production of the casting in one piece is thereby made feasible. Also, since the cochleate part of the forward wall of the casting extends through considerably less than 180° no difficulty in parting the mold is encountered.

By inclining the air inlet and outlet at 45° as shown, uniform elbows 91 may be employed for both connections. If mounted as at the outlet in Fig. 1 the discharge is vertical. If the elbow is removed, turned through 180° and replaced the discharge will be horizontal. Hence the discharge may be at 45° without an elbow or vertical or horizontal with an elbow. The same is true of the air inlet.

Having thus described our invention, we claim:

1. In apparatus of the class described, a casing, a centrifugal blower of the volute type, a hollow member disposed at an angle to the vertical forming one part of the blower scroll, said casing having an air inlet at one side arranged to direct air on a downward slope towards the back of the scroll, the scroll being disposed to discharge air from the opposite side of the casing in a direction sloping upwardly at right angles to the incoming air, and means for causing tempering fluid to flow upwardly through the hollow member.

2. In heating apparatus, a casing, a centrifugal blower therein, a scroll therefor one wall of which contains a flue passage, said casing having an air intake and an air outlet spaced apart and arranged at an angle with respect to each other, means for causing air from the intake to flow over the outer wall of said scroll and to enter the blower and be discharged through the outlet, said flue having an exit portion intermediate said intake and outlet surrounded within the casing by air admitted through said intake.

3. In apparatus of the class described comprising a centrifugal blower of the volute type, a casing having an air intake and an air outlet on

opposite sides sloping outwardly and upwardly at 45° angles, a hollow member forming one part of the blower scroll and providing a passage for tempering fluid, said member being disposed at a 45° angle to the vertical to receive air from said intake for tempering the same before it enters the blower and for tempering it further as it is forced by the blower against and along the opposite side of said hollow member and is discharged through said outlet, and movable 45° elbow connections for said intake and outlet whereby vertical, horizontal, or 45° air conductors may be accommodated.

4. In apparatus of the class described, comprising a centrifugal blower of the volute type, a casing having at the junction of its top and one side an air intake sloping downwardly and outwardly at a 45° angle, a conductor for tempering fluid disposed within the casing opposite said intake and at substantially the same angle for tempering the air before it enters the blower, and a filter disposed between the intake and conductor at approximately the same angle.

5. In heating apparatus, a casing, a scroll having a centrifugal blower mounted in said casing extending crosswise throughout a major portion of the casing width and having a portion inclined to the vertical, an air inlet in the upper rear corner of the casing substantially parallel to said inclined portion of the scroll, a removable air filter mounted in the casing between said inlet and said scroll, said filter being approximately parallel to said inlet and inclined scroll portion and being inclined downwardly and rearwardly, and a removable panel in the rear wall of the casing arranged to expose the lower edge of said filter, whereby the latter may be readily removed for servicing purposes.

6. In heating apparatus, a centrifugal blower rotor, a scroll therefor comprising an inner wall of a hollow casting constituting a flue for hot gases, the inner wall of said casting being cochleate for a portion of its length to constitute a heat transfer element for the air moving through the blower, the outer wall of the casting having an opening therethrough, and a removable closure for said opening provided with a baffle means extending into said flue passage, whereby the cross-sectional area of the flue passage at that point may be reduced.

7. In heating apparatus, a centrifugal blower, a gas conductor forming a portion of the scroll of said blower, said conductor having an inner wall of volute curvature constituting means for transferring heat to the air moved by said blower, means for causing hot gases to flow through said conductor, and a clean-out door in the outer wall of the conductor at an intermediate point, whereby a cleaning brush may be inserted into the conductor in either of two directions.

8. In heating apparatus, a scroll for a centrifugal blower, comprising a generally upright hollow casting open at both ends, one wall of the casting having a cochleate portion adjacent the blower rotor, means at the upper end of the casting for connection with a flue pipe, the lower portion of the casting being enlarged to form a combustion chamber, the outer wall of the casting having a clean-out opening therein about midway of the height of the casting, and a closure for said opening.

9. In heating apparatus, a centrifugal blower, a gas conductor forming a portion of the scroll of said blower, said conductor having an inner wall of volute curvature constituting means for

transferring heat to the air moved by said blower, and an outer wall with a bend therein at an intermediate point, means for causing hot gases to flow through said conductor, and a clean-out door in the outer wall at said bend whereby a cleaner brush inserted into the conductor in either of two directions will clean the entire conductor.

10. In heating apparatus, a casing, a centrifugal blower therein, a conductor for hot gases mounted in the casing extending from top to bottom thereof and crosswise throughout a major portion of the casing width, said conductor constituting part of the scroll for said blower, an air inlet at the upper rear portion of the casing, baffles to cause the entering air to flow downwardly over the rear surface of said conductor before entering the blower, and a humidifier mounted at the bottom of the casing behind said conductor.

11. In heating apparatus, a casing, a centrifugal blower therein, a conductor for hot gases mounted in the casing extending from top to bottom thereof and crosswise throughout a major portion of the casing width, said conductor constituting part of the scroll for said blower, and having a clean-out door in its rear wall at an intermediate point, an inclined air inlet at the upper rear corner of the casing, a similarly inclined air filter mounted in front of said inlet, baffles to cause the filtered entering air to flow downwardly over the rear surface of said conductor before entering the blower, a humidifier

mounted at the bottom of the casing behind said conductor, and a removable panel in the rear wall of the casing adapted to expose for servicing the filter, the clean-out door and the humidifier.

12. In heating apparatus, a casing, a centrifugal blower therein comprising a scroll and a rotor, means for heating externally a portion only of the scroll spaced from the radially innermost portion, and an electric motor operatively connected with said rotor and positioned in the casing adjacent said unheated and radially innermost portion of the scroll.

13. In heating apparatus of the character described, a casing, a centrifugal blower of the volute type mounted therein, an upright hollow member the upper portion of which forms a hot gas conductor with opposed inner and outer walls, said inner wall forming that portion only of the blower scroll which is remote from the radially innermost portion, said member having a combustion chamber at its lower end, said casing having an air inlet opposite the upper portion of the outer wall of said member, and baffles bridging the space between the scroll and the casing following approximately the curved line of the scroll downwardly to the upper end of the combustion chamber where the air is permitted to flow radially upward toward the blower intake, whereby the entering air is caused to wipe completely the outer walls of said member including the combustion chamber.

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