Nov. 16, 1948. F. R. HIGLEY 2,453,913

RADIAL FLOW FORCED-AIR HEATER

Filed Aug. 28, 1943 2 Sheets-Sheet 1

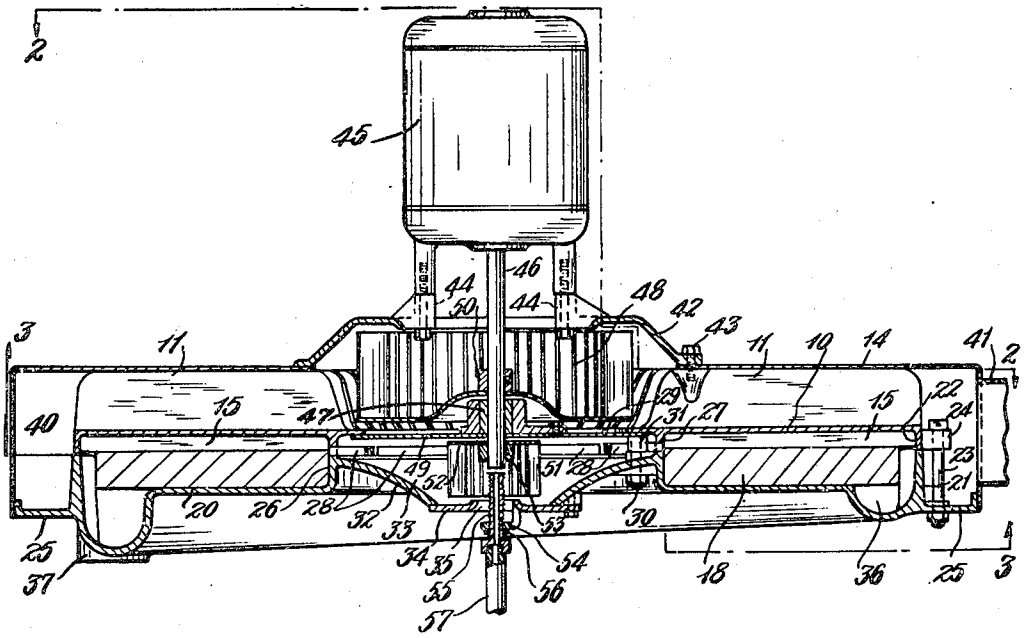


FIG. 1

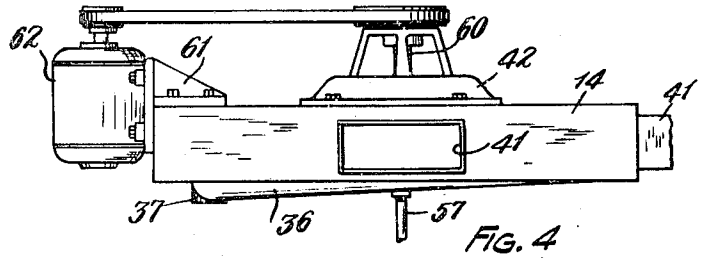


FIG. 4

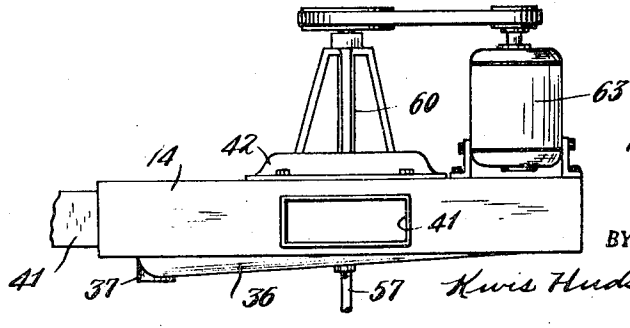


FIG. 5

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RADIAL FLOW FORCED-AIR HEATER

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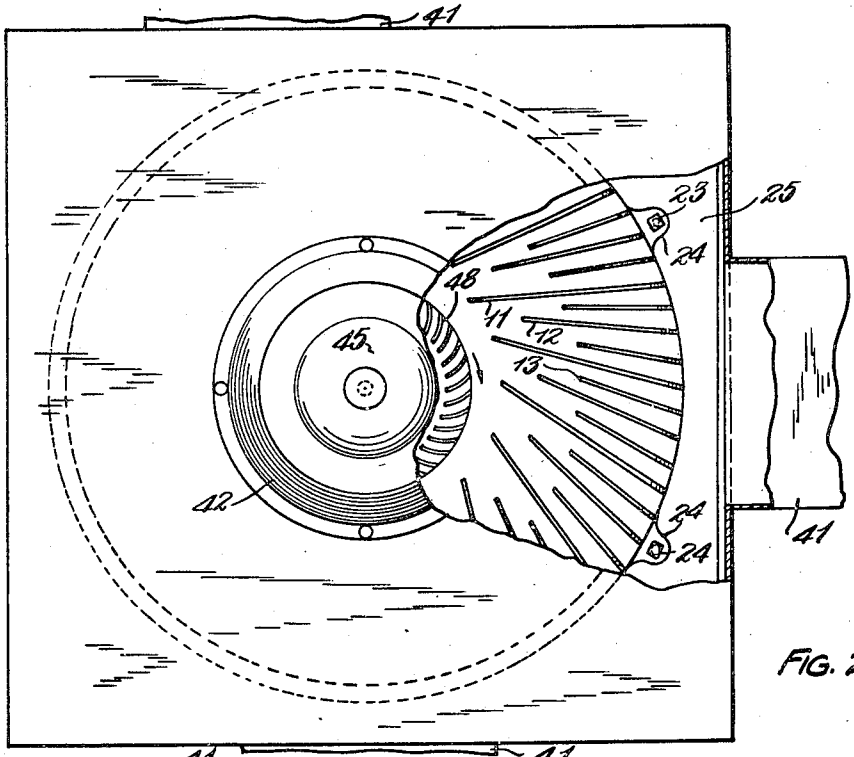


FIG. 2

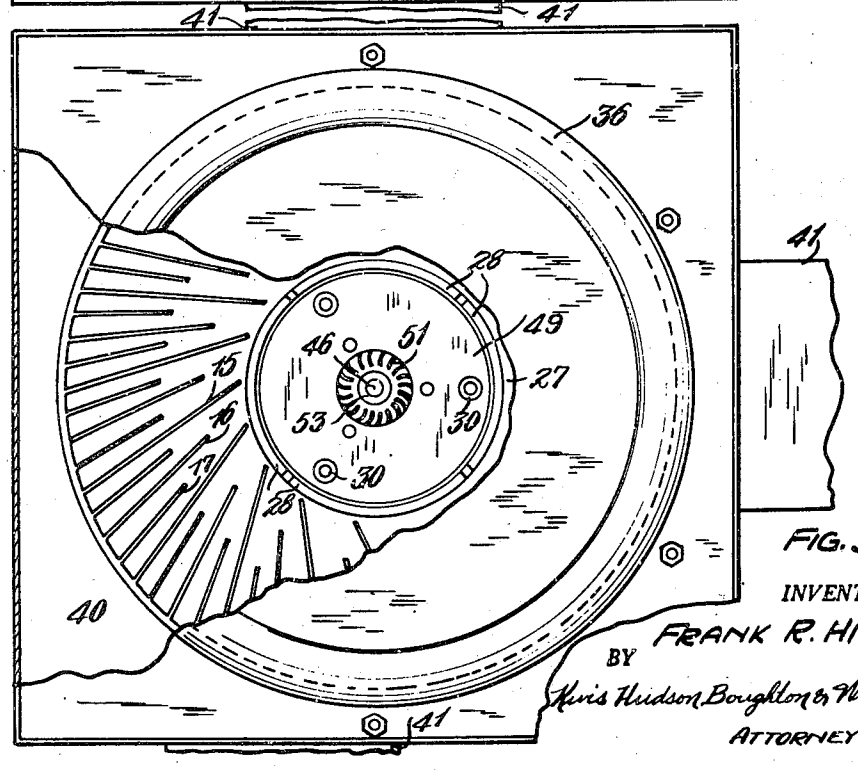


FIG. 3

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RADIAL FLOW FORCED-AIR HEATER

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Application August 28, 1943, Serial No. 500,387

6 Claims. (Cl. 126—110)

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This invention relates to improvements in forced air heaters in which the air to be heated is driven by a centrifugal blower through an annular diffuser, at least one wall of which is heated, the apparatus including preferably a power burner arranged to move products of combustion over an outer surface of the diffuser in parallel flow with the moving air, that is to say parallel flow as distinguished from counterflow.

One of the objects of the invention is the provision of a heater of relatively small size and weight with a minimum of moving parts.

Another object is the provision of a heater which is adaptable for installations of varying character in which the available vertical space is small.

Still another object is the provision of a power gas burner of novel construction.

Other objects and features of novelty will appear as I proceed with the description of those embodiments of the invention which, for the purpose of the present application, I have illustrated in the accompanying drawings, in which

Fig. 1 is a central vertical sectional view of a heater embodying the invention;

Fig. 2 is a plan view of the same partially in section along the line 2—2 of Fig. 1;

Fig. 3 is a bottom plan view partially in section along the line 3—3 of Fig. 1; and

Figs. 4 and 5 are small scale elevational views showing different dispositions of the driving motor.

The heater of the present invention is a compact apparatus with a relatively small axial dimension as compared with its lateral dimensions, and is particularly adapted for installation beneath the ceiling or beneath the floor of a room or rooms to be heated. The air to be heated and the gas and air mixture to be burned are both moved outwardly from the axis of the heater by the action of centrifugal blower wheels mounted on the same shaft in separate compartments. The flow of air and the flow of combustible mixture are therefore both divergent from the axis of the heater and in parallel with each other. The parts are also so arranged as to provide an annular flame pattern substantially opposite the zone of greatest air velocity and as the heat becomes less intense during the divergent outward flow of the products of combustion, the air velocity decreases in similar ratio, so that maximum heat transfer is effected. The heated air may be collected in a plenum chamber surrounding the diffuser, and the warm air ducts extend radially outward from the perimeter of the plenum chamber, so that maximum effect of the impelling force of the air blower is maintained.

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In the drawings the heater is shown as comprising two principal castings. The upper one includes an annular partition 10 upon the upper side of which there are a series of vanes 11, 12 and 13 of the same height but of different lengths, as illustrated in Fig. 2. A cover 14 rests upon the vanes 11, 12 and 13 and with the annular partition 10 constitutes a diffuser.

On the bottom side of partition 10 there are fins 15, 16 and 17 disposed opposite the fins 11, 12 and 13 respectively. These bottom fins are of less height than the fins 11, 12 and 13, and engage the upper surface of a heat insulating and reflecting annular body 18, which may be in a single piece or in a series of like sections. Member 18 rests in a concavity of a second casting 20 which has an outer annular wall 21 that meets a down turned flange 22 on the upper casting, the meeting surfaces being machined and the outer edge of the upper casting being secured to the lower one by a plurality of bolts 23 extending through perforated lugs 24 on the upper casting and through a flange 25 on the lower one. An annular wall 26 of the lower casting is machined to meet an annular flange 27 near the inner edge of the upper casting, the latter flange having a series of notches 28 formed therein constituting burner port means of circular form. The circular opening at the center of the annular partition 10 is closed by a disk 29 which bears against the undersurface of partition 10 inside the flange 27. Bolts 30 extend through the partition 10, the disk 29, separators 31 and bosses on the lower casting 20, whereby these parts are all secured together.

Casting 20 has a downwardly and inwardly flared wall 32 which with the disk 29 and the flange 27 forms a mixing chamber 33 that is closed at the bottom by a plate 34 except for a small central air intake opening 35 in the plate.

The products of combustion after leaving the burner ports 28 travel outwardly between the partition 10 and the insulating and heat reflecting body 18 and are collected in a conductor 36 which

increases in depth gradually toward an outlet 37 leading to a flue, not shown. Since the fins 15, 16, 17 impart a swirl to the emerging combustion products, the collecting conductor 36 is preferably given volute characteristics as indicated in Fig. 1.

The cover 14 extends down along the sides of the heater to meet the flange 25 of the lower casting, forming a plenum chamber 40, which is illustrated as having a square perimeter. The number of sides may be increased as desired however. Warm air conduits 41 extend outwardly at right angles from as many of these sides as the requirements of a particular installation dictate. The warm air leaving the diffuser can thus flow directly into these conduits without deflection and without giving up any of the impetus which it receives from the impelling force.

An upwardly dished ring 42 partially bridges the circular space at the center of the cover 14, being attached by means of studs 43 or the like extending through holes in the cover into bosses formed in certain of the vanes 11. This ring carries brackets 44 upon which is mounted an electric motor 45, the shaft 46 of which extends downwardly at the axis of the heater and through a hole in the disk 29. The latter disk supports a bearing 47 for the shaft. A centrifugal blower wheel 48 is secured to shaft 46 above bearing 47, the wheel being open at the top to correspond with the opening in ring 42, and being closed at the bottom by an end wall 49 which is welded or otherwise fastened to a collar 50 by means of which the wheel is secured to the shaft. The blades of the wheel and the vanes 11, 12 and 13 are so related angularly that the air impelled by the wheel tends to flow outwardly between the vanes with a minimum of friction.

On the shaft 46 below the disk 29 there is mounted a second centrifugal blower wheel 51 of comparatively small size, this wheel being open at the bottom and closed at the top by a circular plate 52, which is attached to a collar 53 that surrounds the shaft and is secured thereto.

Plate 34 at the bottom of the mixing chamber carries a downwardly offset central hub member 54 which is threaded to receive an externally threaded tube 55 that extends upwardly into close proximity with the end of shaft 46, thereby forming an annular gas port. The width of this port may be adjusted by threading the tube 55 upwardly or downwardly, and the parts may be held in adjusted position by means of a lock nut 56. A suitable gas conductor 57 connects with the lower end of tube 55. Gas entering through tube 55 and air entering through opening 35 are drawn to the center of wheel 51 and expelled centrifugally, being thoroughly mixed in the wheel and in the chamber 33. Flowing through the ports 28, the mixture burns in a circular flame pattern outside the ports. I thus provide a power burner of simple design and low cost, the flame of which is applied to the partition 10 beneath the entrance to the diffuser where the velocity of air travel is at its maximum. The cooling effect of the rapidly moving air thus prevents the temperature of the partition at this point from becoming excessively high.

In Figs. 4 and 5 I have illustrated two different motor mountings using flexible belt drive means to the shaft 60 for the blower wheels. In Fig. 4 I have shown a bracket 61 carried upon the heater, the motor 62 being bolted to the side of this bracket. By this means the motor is supported approximately in the plane of the heater, reducing the over all vertical dimension to a minimum.

In Fig. 5 the member 63 is supported upon the heater in a position offset from the axis. This arrangement is excellent where the heater is to be installed beneath a floor, for then the motor as well as the upper end of shaft 60 with its pulley and upper bearing may be accommodated between adjacent floor joists.

Having thus described my invention, I claim:

1. In a heater, a heat exchange partition, a centrifugal wheel for moving air divergently over one surface of said partition, means coaxial with said wheel for moving products of combustion divergently over the opposite surface of said partition, said partition having opposed fins on the two surfaces thereof, said fins being disposed in the direction of discharge from the wheel.

2. In a heater, a combustion chamber one wall of which constitutes a heat exchange partition and the opposite wall of which has heat reflecting and insulating properties, rotary means for moving products of combustion through said combustion chamber divergently along one surface of said partition, and coaxial rotary means for moving air divergently over the opposite surface of the partition.

3. In a heater, two coaxial centrifugal blower wheels means providing separate compartments therefor of substantially equal radial dimensions, one wheel being relatively large and the other relatively small, the compartment for said large wheel having a central air intake and the compartment for said small wheel having substantially central gas and air intakes, the space within the latter compartment outside of said small wheel constituting a mixing chamber, said small wheel compartment having burner ports opposite the discharge from the large wheel, and an annular heat exchange partition over the opposite surfaces of which air from the air blower and products of combustion from the flame at said ports flow divergently.

4. In a heater, a combustion chamber one wall of which constitutes a heat exchange partition, means for moving products of combustion through said combustion chamber divergently over one surface of said partition, means for moving air divergently over the opposite surface of the partition, said partition and said means for moving air and combustion products being distributed about a common axis, and means arranged peripherally of the combustion chamber for collecting the products of combustion and having a flue outlet.

5. In a heater, a combustion chamber one wall of which constitutes a heat exchange partition, means for moving products of combustion through said combustion chamber over one surface of said partition, means for moving air in parallel flow therewith over the opposite surface of the partition, said partition and said means for moving air and combustion products being distributed about a common axis from which divergent flow of air and combustion products takes place, and means of volute form arranged peripherally of the combustion chamber for collecting the products of combustion and conducting them to discharge outlet means.

6. In a heater, a combustion chamber one wall of which constitutes a heat exchange partition, means for moving products of combustion through said combustion chamber over one surface of said partition, means for moving air in parallel flow therewith over the opposite surface of the partition, said partition on the combustion chamber side having fins disposed in a non-radial direction

corresponding to the direction of discharge from the wheel, said partition and said means for moving air and combustion products being distributed about a common axis from which divergent flow of air and combustion products takes place, and means of volute form arranged peripherally of the combustion chamber for collecting the products of combustion and conducting them to discharge outlet means.

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