July 15, 1958 N. G. CAMPBELL ET AL 2,843,108

FORCED-DRAFT UNIT HEATER HAVING OUTSIDE COMBUSTION AIR SOURCE

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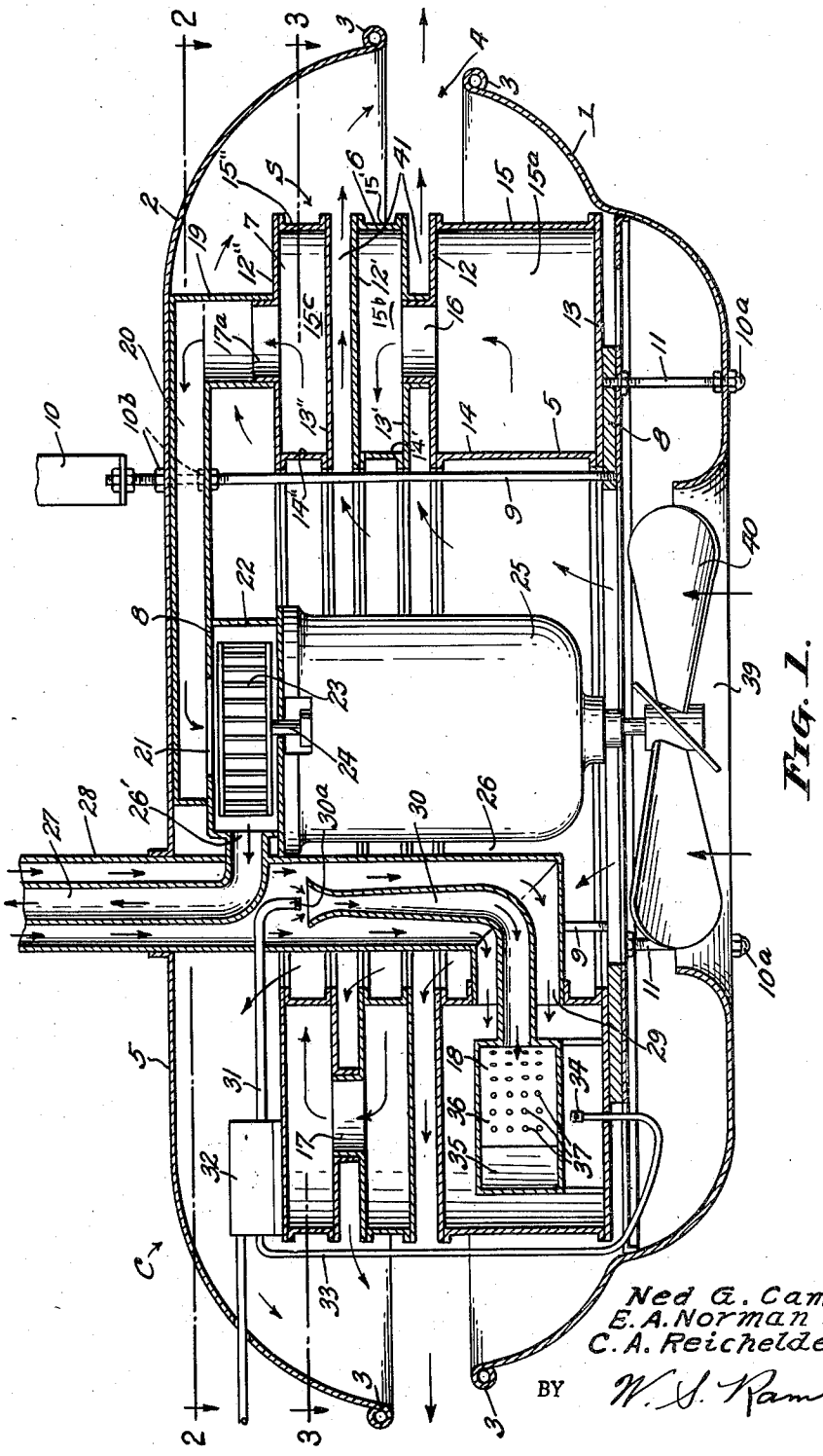


FIG. 1.

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FIG. 2.

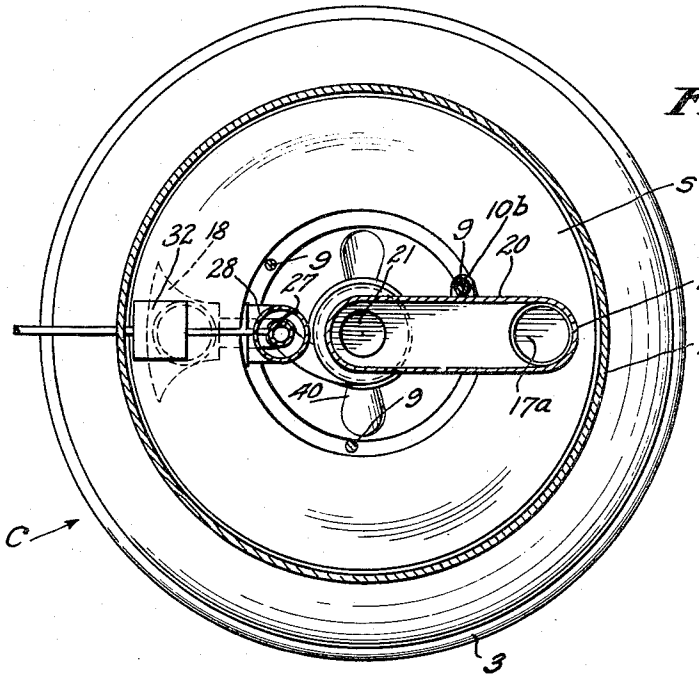
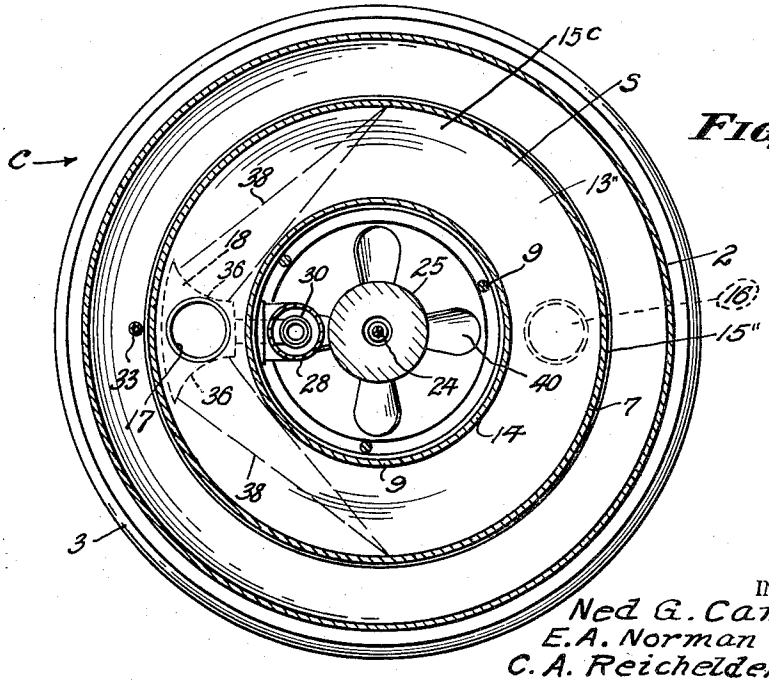


FIG. 3.



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FORCED-DRAFT UNIT HEATER HAVING OUTSIDE COMBUSTION AIR SOURCE

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Application December 27, 1955, Serial No. 555,514

1 Claim. (Cl. 126—110)

This invention relates to room or unit heaters, and has particular reference to ceiling-suspended unit heaters of the gas-fired, forced-air and draft type.

It is an object of this invention to provide a compact and efficient heater of this kind wherein a burner-containing heat exchanger is mounted in a circular outer casing and wherein motor-driven air-displacing means are employed to advance positively room air over the heated exterior surfaces of the heat exchanger to increase the temperature of the air and, also, to supply a fluid fuel burner, arranged within the interior of the heat exchanger, with combustion-supporting air.

Another object of the invention is to provide such an air heater with improved conduit means by which spent burner gases are conducted to an atmosphere removed from that of a room in which the heater is mounted; said conduit means, also, serving to supply air to an exchanger-mounted fuel burner from a source of supply extraneous to the room atmosphere, whereby to maintain the latter uncontaminated by the presence therein of spent combustion gases, and to avoid depriving the room atmosphere of its normal oxygen content by employing the same for sustaining burner fuel combustion.

A further object is to provide a unitary room heater wherein a novel circular or ring-type heat exchanger and burner construction is provided, and wherein heat generated through fuel combustion, produced by a burner mounted in a burner chamber of the apparatus, is caused to travel through said chamber, and thence through communicating heating chambers in a manner producing uniform wall temperatures on the part of the heat exchanger construction, whereby room air, forced by motor-driven fan operation across the exterior surfaces of the heat exchanger, will be heated uniformly to desired temperatures by the time the same is passed through an outlet for such heated air, the outlet being disposed peripherally of a casing in which the heat-exchanging and burner construction is mounted.

An additional object is to provide a unitary. ceiling-mounted heater of this character which, while relatively small and compact in size, possesses a high output capacity for large volumes of uniformly heated room air.

This application is a continuation in part of an earlier application, Ser. No. 374,544 filed August 17, 1953, now U. S. Patent No. 2,809,627 issued October 15, 1957.

A further understanding of the invention may be obtained by referring to the following detailed description of an exemplary form of the apparatus of the present invention and to the accompanying drawings illustrating the same, and wherein:

Fig. 1 is a vertical sectional view taken through a circular, ceiling-mounted, unitary room heater formed in accordance with the present invention;

Fig. 2 is a horizontal sectional view taken on the line 2—2 of Fig. 1;

Fig. 3 is a similar view on the line 3—3 of Fig. 1.

In accordance with the present invention, a unit heater of the ceiling-mounted type is provided. In this instance,

the heater includes an outer circular casing C, having a bowl-shaped bottom member 1 and a similarly formed but downwardly facing and axially displaced top member 2. The adjacent but relatively spaced circumferential edges 3 of these members form between them an annular slot 4 for the discharge of heated room air from the casing. It will be noted that the top member 2 possesses in the construction illustrated a somewhat greater diameter than does the lower member. This difference in diameter enables the upper member to act as a deflector in causing the heated outflowing air to travel in a generally downwardly directed pattern concentric to the heater.

The casing members 1 and 2 are carried by and enclose a combined burner and heat exchanger structure S. This structure, in the specific form thereof depicted by the drawings, possesses a ring-like formation and includes in aligned, vertically superposed order a lower burner-containing section 5, and intermediate and upper heat-exchanger sections 6 and 7. These sections rest on a base ring 8 and to suspend the structure from an overhead support, there arises from the ring a plurality of spaced, vertical, suspension bolts or rods 9. These rods include threaded upper ends which are suitably joined with stationary, ceiling-carried, suspension brackets 10, or their equivalents. In this instance, the ring 8 is provided with depending threaded stems 11, carrying nuts 10*a*, for the retention and support of the lower member of the casing thereon, while the upper member 2 of the casing rests on the top of the structure S and is held in place by nuts 10*b*.

The sections 5, 6 and 7 of the heat exchanger structure are each formed to provide flat, horizontally disposed, top and bottom walls 12, 12′ and 12″ and 13, 13′ and 13″ and relatively spaced concentrically disposed, vertical, inner and outer, side-forming walls 14, 14′ and 14″ and 15, 15′ and 15″, respectively. These walls define a series of circular or ring-like chambers 15*a*, 15*b* and 15*c*. In this instance, the chambers 15*a* and 15*b* of the lower and intermediate sections 5 and 6 are joined for gas flow communication by the vertical throat passage 16 arranged at one side of the structure and formed by interfitting boss extensions provided on the top wall 12 of the lower section 5 and the bottom wall 13′ of the intermediate section 6. Similarly, another throat passage 17 joins the intermediate section 6 of the heat exchanger with the top section 7 thereof, the passage 17 being disposed on the opposite side of the exchanger with respect to the side occupied by the passage 16.

Highly heated burner gases, developed by the operation of a gas-fired burner 18, are drawn in oppositely moving streams around the opposite sides of the chamber 15*a* of the lower section 5 and merge in the lower throat passage 16 for upward travel and delivery to the chamber 15*b* of the intermediate exchanger section 6. The burner 18 is disposed in the chamber 15*a* of the lower section 5 on the side of the latter diametrically opposite the throat passage 16 thereof. Within the chamber 15*b* of the intermediate section, which is of a substantially reduced cross-sectional area compared with the corresponding chamber of the lower section 5, the hot burner gases again divide and sweep at increased velocity, with respect to that attained in the lower section, around the opposite sides of the ring-like chamber 15*b* of said intermediate section, heating the walls of the latter substantially uniformly around their entire circumference. When an upper section is used in the construction of the heat exchanger S, the burner gases are delivered thereto by the use of the upper throat passage, as indicated at 17.

An outlet 17*a* projects inwardly from the upper section 7 and enters the lower end of a down-turned extension

19 of a horizontally disposed burner gas-discharging conduit 20. The bottom of this conduit at the end thereof opposite to the extension 19 is formed with an opening 21 for delivering the burner gases to a blower chamber 22 in which is mounted a rotatable air-displacing rotor 23. The latter is fixed to the upper end of the armature shaft 24 of an electric motor 25 which is stationarily mounted in a well 26 formed by the hollow interiors of the aligned sections 5, 6 and 7 of the exchanger structure S. The operation of the blower serves to withdraw spent burner gases from the exchanger sections by maintaining negative pressure in the chambers 15*a*, 15*b* and 15*c* thereof. Also, as will be presently explained, the blower effects a positive delivery of combustion air, drawn from an outside source, to the burner 18 for admixture with fuel gas supplied thereto, thus forming a gaseous combustible mixture which is ignited in the chamber 15*a* in producing the highly heated burner gases adapted for advance through the successive chambers 15*a*, 15*b*, and 15*c* of the exchanger S under the action of the blower rotor 23.

The chamber 22 includes an outlet opening 26' which communicates openly with the lower end of a vertically extending combustion gas outlet pipe 27, the latter leading from the heater and the building in which the heater proper is mounted to the atmosphere exterior thereto. Advantageously, the pipe 27 may be disposed within and coaxially of a vertical combustion air-supplying conduit 28. The latter extends through an opening in the upper casing member 5 and, in common with the pipe 27, leads to the atmosphere exteriorly of the building, so that combustion air may be supplied to the burner 18 without affecting the room atmosphere. The inner or lower end of the air-supplying conduit 28 communicates at 29 with the chamber 15 of the lower exchanger section 5. By this arrangement heat conducted and radiated from the walls of the pipe 27 is used to preheat incoming air.

Also, mounted in the lower part of the air pipe 28 is a Venturi type of a primary air admitting and mixing tube 30. The open upper end of this tube is disposed in registry with the adjoining but spaced orifice-containing discharge end 30*a* of a gaseous fuel delivery pipe 31. This pipe leads from any suitable source of fuel supply to customary automatic controls 32 common to gas-burning heaters of this category. From the controls a short branch line 33 extends to a pilot burner 34 which is employed, as usual, in igniting combustible fuel mixtures discharged from the burner.

Primary air for combustion, drawn from the atmosphere by the action of the blower 23, is admitted into the open upper end of the Venturi or mixing tube 30 with regulated volumes of fuel gas discharged for the orificed end of the fuel pipe 31. The mingled air and fuel gas pass from the lower end of the tube 30 into a mixing chamber 35 formed in the casing of the burner 18. The latter, as shown in Figs. 1 to 3 of the drawings, preferably is formed to provide spaced arcuate side walls 36 in which are formed a plurality of outlet ports or openings 37. The curvature of the opposite walls 36 is such that the gas fuel mixture drawn therethrough and introduced into the chamber 15*a* of the burner-containing section 5 is projected toward opposite sides of the chamber in the converging streams indicated at 38 in Fig. 3 and admixed with secondary combustion air contained in the chamber 15*a* of the lower exchanger section.

It will be noted that the angular projection of these streams is such as to produce maximum linear projection thereof before the streams impinge or are deflected by the circular side walls 14 of the burner section 5. Such prolongation provides for effective combustion of the components of the projected fuel streams 38 to produce efficient and thorough combustion of the carburetted or admixed fuels and to heat uniformly the walls of the exchanger sections without developing localized hot spots. The burning fuels are positively advanced in series flow through the chambers of the successive sections of the exchanger structure S, heating the walls of the latter to transfer heat to air to be used for room-heating purposes.

Room air is drawn upwardly into the casing through an opening 39 formed axially in the lower casing member 1. In this opening there is positioned a motor-driven fan or propeller 40. In this instance the fan 40 is shown as being carried by the lower end of the armature shaft 24 of the motor 25. However, it will be understood that a separate motor may be used to drive the fan 40 if desired. Room air drawn upwardly into the confines of the casing by the action of the fan 40 passes into the center well of the structure S and is positively forced over the exterior surfaces of the exchanger structure to increase the temperature thereof, the air so heated and displaced travelling in part through horizontal passages 41 formed between adjoining sections of the heat exchanger and radially outwardly of the casing through the annular peripheral slot 4.

As a result of the novel arrangement and construction of the heater elements as herein set forth a relatively small and compact unit heater is provided capable of handling and effectively heating relatively large volumes of air. Further, the construction of the heater makes the same safe to operate, since the air needed in effecting fuel combustion is drawn from an atmosphere remote to the room or building in which the heater is disposed for operation. Likewise, vitiated burner gases are discharged into such a remote atmosphere so that they cannot contaminate the room atmosphere. The burner construction is such that, together with the arrangement and formation of the burner gas chambers, a uniform heating of the walls of the exchanger sections is produced and localized overheating avoided, thus contributing to the long operating life of the apparatus and with uniform temperature of the circularly expanding warm air released from the outer circumference of the casing of the heater.

While a single preferred form of a unit heater incorporating the features of the present invention has been shown and described in detail, nevertheless, it will be understood that said form is exemplary rather than definitive in character and, therefore, modifications are contemplated in the construction of the heater within the scope of the following claim.

We claim:

In a forced-draft unit heater; an outer casing structure extending circumferentially about a vertical axis, said casing structure defining an internal heat exchanger-receiving compartment and having a first room air circulating opening disposed axially thereof and a second room air-circulating opening extending peripherally thereof; a plurality of relatively vertically spaced, horizontally disposed, annular and tubular heat exchanger sections positioned in the compartment of said casing between the air-circulating openings thereof, each of said heat exchanger sections being formed with closed internal chambers for the circulation of gaseous products of combustion; diametrically opposed passage means establishing serial communication between the internal chambers of each successive pair of heat exchanger sections; burner means positioned within the lowermost of said heat exchanger sections in diametrically opposed relation to the passage means communicating therewith; a remotely extending combustion air inlet conduit having one end portion extending through said casing and communicating with the chamber of the lowermost heat exchanger section adjacent said burner means, said combustion air inlet conduit having an opposite end portion adapted to extend to an atmosphere exterior of the zone to be heated by said unit heater; combustion gas passage-forming means mounted in said casing above the uppermost of said heat exchanger sections and communicating with the latter; a remotely extending flue pipe having one end communicating with said passage-forming means and extending coaxially through said combustion air inlet conduit and terminating in an opposite end portion adapted to extend to an atmosphere exterior of the zone to be heated by said unit heater, said combustion air inlet conduit, said heat

exchanger sections, said passage-forming means and said flue pipe being all disposed in serial communication; blower means positioned in said passage-forming means operable to create a forced circulation of gases through said combustion air inlet conduit, through said heat exchanger sections, said passage-forming means and outwardly through said flue pipe; and air-displacing means in said casing operable to circulate room air between the air-circulating openings of said casing and across and around said heat exchanger sections.

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