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Scogin

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[54] **ROOM HEATER**

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[52] **U.S. Cl.**..... **126/110 R;** 126/99 C; 126/110 AA

[51] **Int. Cl.**..... **F24b 7/00**

[58] **Field of Search**..... 126/110 R, 110 A, 110 AA, 126/99 C

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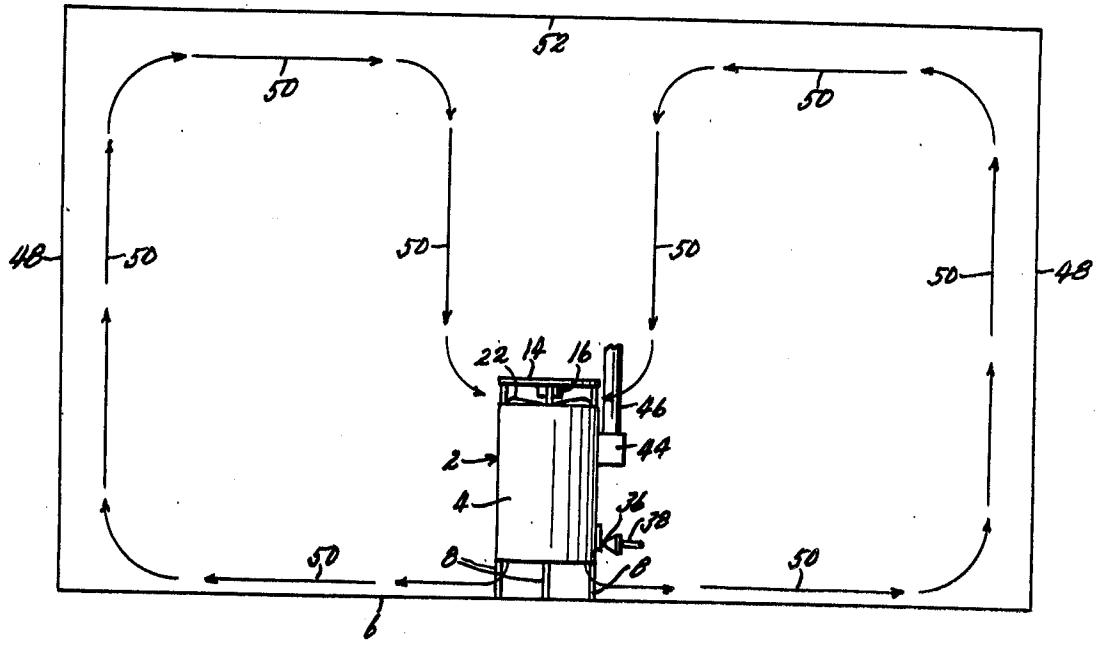
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[57] **ABSTRACT**

A room heater consisting of an air plenum chamber surrounding a combustion chamber, and a blower operable to direct room air admitted at the top downwardly through said plenum chamber, and then downwardly and outwardly against the room floor, whereby the normal gravity convection air currents in the room which would occur in a heater without a blower are reversed, so that the warmer air temperatures are concentrated at the floor level rather than at the ceiling level, resulting in more effective and efficient use of the heat and fuel. The blower and plenum chamber are specially constructed to provide a "nozzle" effect in order to obtain the air velocity necessary to maintain this "reverse" air flow.

2 Claims, 4 Drawing Figures



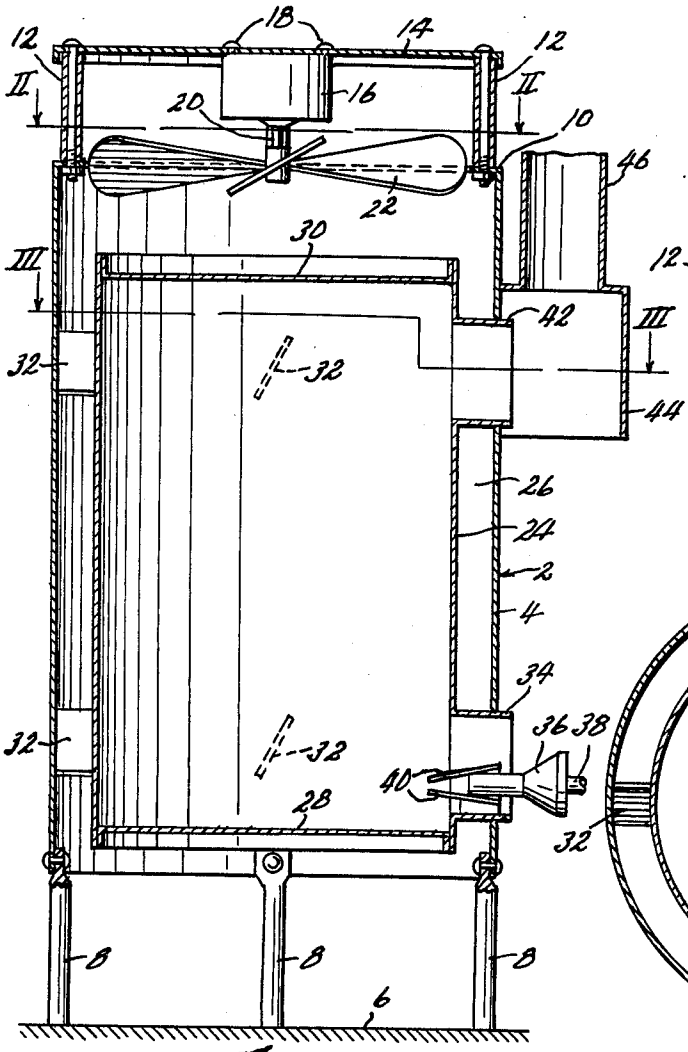


Fig. 1

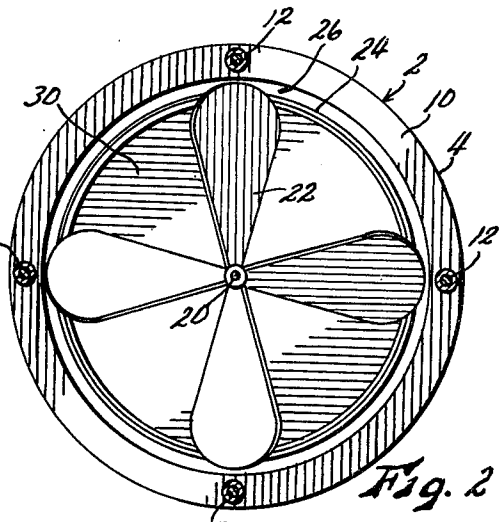


Fig. 2

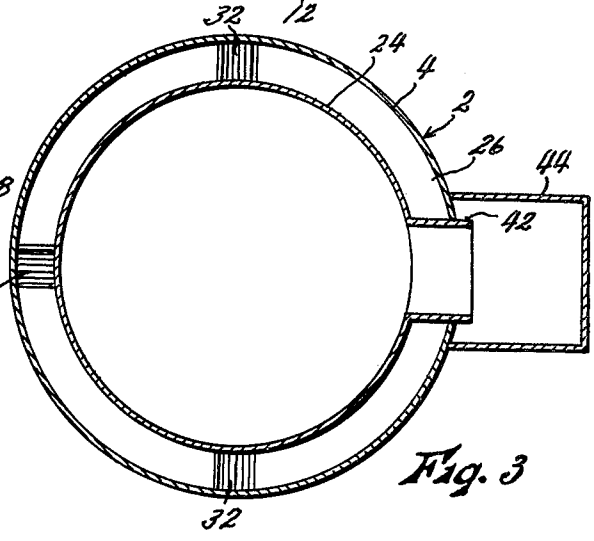


Fig. 3

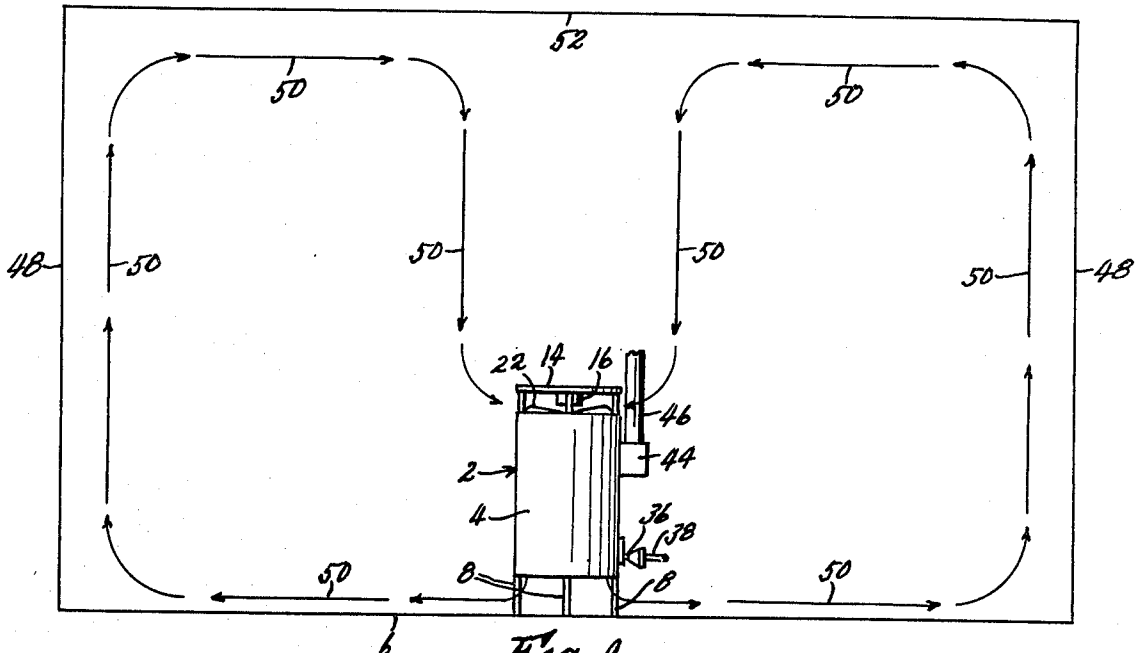


Fig. 4

ROOM HEATER

This invention relates to new and useful improvements in room heaters, and has as its principal object the provision of a room heater which makes more effective and efficient usage of fuel, in that it concentrates the warmer air delivered thereby at the floor level and at the "living" or "breathing" level of the room, rather than at the ceiling level.

In most room heaters, even those including a forced draft blower, the air heated thereby tends to rise directly therefrom to the ceiling level, where it spreads toward the room walls, then falls gradually to floor level as it cools, and finally moves horizontally at floor level to return to the air intake of the heater. This is a normal gravity or convection air flow, but it has the disadvantage of providing the highest air temperatures adjacent the ceiling, which is largely nonutilized space, and where it is of little use in contributing to the comfort of the occupants of the room, cooler temperatures at the "breathing" level, usually considered to be 4 or 5 feet above the floor, and the lowest temperatures at floor level. With room heaters of this type, it will therefore be apparent that if the lower levels of the room, this being the "living" space, are to be kept at a comfortable temperature, the ceiling levels must be heated to a still higher temperature, which inevitably results in wasted heat and fuel. It will also be apparent that if this stratification of temperature levels could be reversed, so that the warmer air could be concentrated at the lower levels and the cooler air at ceiling level, a corresponding saving of heat and fuel could be obtained. The heater contemplated by the present invention accomplishes this reversal.

Generally, this object is accomplished by the provision of a blower operable to deliver heated air downwardly and outwardly against the room floor, with sufficient velocity to reach the room walls before it rises materially due to its reduced density. The air then rises, displacing the cooler air at higher levels upwardly, in spite of its lower density, the higher air actually being cooled as it loses its heat and hence denser than the lower air, due to simple bulk displacement by the warmer air constantly being delivered thereunder by the blower. The air therefore rises as it cools, which is a reversal of a normal convection current, so that the floor and adjacent regions are maintained warmer than the ceiling region. The ceiling air tends to move to the area directly above the heater, where it then moves downwardly both by gravity and by the downdraft created by the blower to return to the heater for recirculation.

Since the described reverse air flow must combat the gravity forces tending to produce a normal convection flow, it will be apparent that a higher than normal velocity must be imparted to the air ejected by the heater, and it is another object of the present invention to provide this increased air velocity, without at the same time increasing the total volume of air flow, the desired air flow rate being largely dictated by the heat content of the fuel being consumed. Measures to provide this velocity increase include "sealing" of the blower as well as possible against reverse air flow, and the design of the air flow chamber within the heater to produce a "nozzle" in which the velocity of air flow is increased.

Other objects are simplicity and economy of construction, efficiency and dependability of operation, and adaptability for use either as a floor-supported unit, or as a ceiling unit suspended high above the floor.

With these objects in view, as well as other objects which will appear in the course of the specification, reference will be had to the accompanying drawing, wherein:

FIG. **1** is a vertical sectional view of a room heater embodying the present invention, with parts left in elevation,

FIG. **2** is a sectional view taken on line II—II of FIG. **1**,

FIG. **3** is a sectional view taken on line III—III of FIG. **1**, and

FIG. **4** is a schematic view of a room with the present room heater disposed therein, and with the flow pattern of the heated air in said room indicated generally by arrowed lines.

Like reference numerals apply to similar parts throughout the several views, wherein it will be seen that a room heater constructed according to the present invention, indicated generally by the numeral **2**, includes a main housing **4** formed of sheet metal, said housing being cylindrical with its axis disposed vertically. In the embodiment shown, said housing is supported in spaced apart relation above the room floor **6** by floor-engaging legs **8** affixed thereto. Said housing is open at both its upper and lower ends, and is provided at its upper end with an inturned peripheral flange **10.** Fixed in flange **10** are a plurality of angularly spaced upright posts **12** extending upwardly therefrom, said posts supporting at their upper ends a horizontally circular plate **14,** said plate being concentric with housing **4** and disposed in spaced apart relation above housing flange **10.** An electric motor **16** is fixed to the lower surface of plate **14** by screws **18,** the drive shaft **20** of which extends downwardly concentrically with the housing and has affixed on the extended end thereof an air impellor fan **22** operable by said motor to deliver air downwardly through the housing. Said fan is "sealed" as well as possible in the opening of housing flange **10,** in order to defeat to a large degree any tendency of heated air to rise through the housing and past the fan while said fan is operating. This "sealing" is accomplished by positioning the fan with its principal plane directly in the plane of housing flange **10,** and by making the fan diameter as large as possible, providing only a minimum operating clearance between the fan blade tips and the housing flange.

Disposed concentrically within housing **4** is a combustion chamber **24,** also cylindrical, and of smaller diameter than housing **4** to provide an annular air passage **26** therebetween. Said combustion chamber is closed at its lower end by an end wall **28** fixed therein just above the lower end of housing **4,** and is closed at its upper end by an end wall **30** fixed therein and disposed in spaced apart relation below fan **22.** The cross-sectional area of air passage **26** must be substantially less than the area of the opening of flange **10.** As shown, the area of passage **26** is about one-half that of the flange opening, but as will appear this proportion is a matter of proper selection and may be varied. The combustion chamber **24** is supported in housing **4** by radial vanes **32** disposed in air passage **26,** and welded or otherwise affixed at their respective ends to the combustion chamber and housing. These vanes are of sheet metal, and are all inclined from vertical in the same direction, whereby to impart a circular motion around passage **26** to air passing downwardly through said pas-

sage. As shown, this whirling or "vortex" action is counter-clockwise as viewed from above. The combustion chamber is provided adjacent its lower end with a combustion air inlet tube **34** which projects outwardly through the wall of housing **4.** A fuel burner **36** is also positioned in tube **34,** being supplied with fuel from a suitable source by supply pipe **38** and operable to inject fuel into chamber **24** for burning therein. It will be noted also in FIG. **1** that the burner nozzle is equipped with flame spreader plates **40** operable to spread the flame of the burner horizontally. When properly designed, these spreader plates prevent direct impingement of the flame against the combustion chamber walls, and thereby reduce burning or flame damage to said walls. The control systems of both the burner and also of fan **22** may be standard, and are not shown. The combustion chamber is provided adjacent is upper end with an outlet tube **42** for spent combustion gases, said tube extending outwardly through the wall of housing **4,** and opening into an open-bottomed downdraft preventer housing **44** affixed to the outer surface of the housing. The usual flue pipe **46** is connected into the top of housing **44.**

In operation, it will be seen that air delivered downwardly through air passage **26** by fan **22** will be heated by contact with the external surface of combustion chamber **24.** Since the flow area of passage **26** is less than the area of the opening of housing flange **10** in which fan **22** turns, the velocity of air flow in passage **26** will be substantially greater than that imparted to it directly by the fan. This "nozzle" effect of the housing design is necessary if the heated air discharged is to have sufficient velocity to overcome and reverse the normal convection air flow pattern in the room being heated, since the actual total volume of air delivered by the fan is more or less closely dictated by the heat content of the fuel being consumed by the burner. In a heater without the described "nozzle" design, the higher velocity required could not be supplied simply by the use of a fan having a greater air delivery rate, since this would result in inadequate heating of the air due to its shorter retention time adjacent the combustion chamber, and hence in wastage of fuel. The present design provides the required retention time, despite the greater velocity, by virtue of the fact that vanes **32** impart a helical travel to the air around the combustion chamber, so that the same retention time of the air adjacent the combustion chamber is maintained since the path of air travel is longer. The natural tendency of air heated in passage **26** to rise due to its reduced density, and also the tendency of the back pressure against the fan created by the area reduction of passage **26** to force air upwardly past the fan, are combated by the previously described "sealing" of fan **22** in the opening of flange **10.**

As the heated air emerges from the lower end of passage **26,** it moves outwardly along floor **6** of the room toward walls **48** of the room, the general path or pattern of air flow in the room being indicated by arrowed lines **50** in FIG. **4.** The air velocity at the heater outlet should be sufficient that at least a portion of it reaches the walls before it starts to rise due to its reduced density. Different heaters, having different B.t.u. ratings and different air descharge velocities, may be provided for rooms of different sizes. It will be understood also that the whirling motion imparted to the air by vanes **32** within the heater causes the discharged air to tend to move horizontally outwardly along the floor, by centrifugal force, rather than tending simply to "rebound" upwardly from the floor, as would be the tendency without said whirling motion. However, this whirling motion should not be extremely rapid, for reasons which will presently appear.

The heated air distributed over the floor as just described then rises gradually toward the room ceiling **52,** displacing the cooler air at higher levels upwardly, in spite of the fact that it is hotter than the air above it and hence less dense. The cooler air is displaced upwardly, in a reversal of the usual gravity convection flow, by the sheer bulk of the warmer air constantly supplied therebeneath by the fan. The room air therefore will be warmest at the floor and coolest in the ceiling region, which is the pattern generally most desirable in providing comfort for occupants of the room, and which saves fuel otherwise wasted in heating the largely unused ceiling region. The air currents eventually cause the ceiling air to move to a zone directly above the heater, where it is moved downwardly both by gravity and also by the downdraft created by the heater fan, for reheating and recirculation. It should further be understood that while a substantially increased air flow velocity at the heater outlet is required to overcome the usual gravity convection pattern of air flow to produce a rising flow of cooling air, nevertheless the gravity forces tending to produce the usual flow pattern are still at work, and the air velocity supplied by the fan need only be great enough to overcome the usual flow and to reverse it only to a slight degree. Therefore, if the air velocity is properly related to the size of the room, there will still be no excessive rate of general air movement in the room, and hence no feeling of unpleasant draftiness, with the possible exception of the floor area directly adjacent the heater. The air velocity drops rapidly as it moves farther from the heater.

The heater as described may also be used as an overhead heater as well as in the floor-supported position shown, simply by suspending it from the ceiling. Legs **8** could of course then be dispensed with. In this position, the heated air discharged from the lower end of passage **26** is directed downwardly to the floor in a rather acute conically divergent pattern, but still with enough radially outward component that it is directed radially outwardly when it does engage the floor. In other words, the whirling motion imparted to the air by vanes **32** in passage **26** is sufficiently slight to leave enough vertically downward component in the motion of the ejected air that said air reaches the floor by its own momentum, at least so long as the heater is disposed at only normal elevations above the floor. It is this feature that contributes most directly to the adaptability of the heater to either floor or overhead use. It will be seen that in a heater designed exclusively for floor use, better directionality of the air discharged could be obtained by so configurating the passage **26** as to discharge the air directly in a horizontal direction, but this would render the heater unsuitable for overhead use, since the heated air would not then pass directly to the floor. On the other hand, better directionality of the discharged air could be provided in a heater designed solely for overhead use by eliminating vanes **32** so that the air would be discharged vertically downwardly, but the heater would then be inefficient in floor use, due to the upward "rebounding" of air from the floor as discussed above. By using the vanes, but so pro-

portioning them that the ejected air has a motion with strong components both vertically downwardly and radially outwardly, efficient operation of the heater to produce the "inverted" flow of upward currents of cooling air in the room is maintained in either position.

While I have shown and described a specific embodiment of my invention, it will be readily apparent that many minor changes of structure and operation could be made without departing from the spirit of the invention.

What I claim as new and desire to protect by Letters Patent is:

1. A room heater adapted to be disposed in a free-standing position within the room space to be heated, and comprising:

a. a housing open at both top and bottom directly to the room space to be heated, and including means spacing the open lower end thereof above the floor of said room space,

b. a combustion chamber mounted within said housing, an air passage surrounding said combustion chamber and opening through the top and bottom of said housing being formed between said housing and said combustion chamber,

c. means operable to burn fuel within said combustion chamber,

d. means operable to direct air entering the top of said housing from said room space downwardly through said air passage to be discharged downwardly from the lower end of said housing to said room space, and

e. vane means disposed in said air passage and operable to impart a whirling motion to air moving downwardly through said passage around an axis parallel to said downward movement, whereby air is ejected from the lower end of said housing with a motion having both vertically downward and radially outward components.

2. A room heater as recited in claim **1** wherein said air passage is substantially smaller in cross-sectional flow area than the top opening of said housing; wherein said air directing means constitutes a blower fan operably mounted in said top opening and operating in a circular orbit concentric and coplanar with said opening, and having only a minimum operating clearance therein; and with the addition of vane vanes disposed in said air passage and operable to impart a whirling motion to air moving downwardly through said passage around an axis parallel to said downward movement, whereby said air is ejected from the lower end of said housing with a motion having both vertically downward and radially outward components.

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