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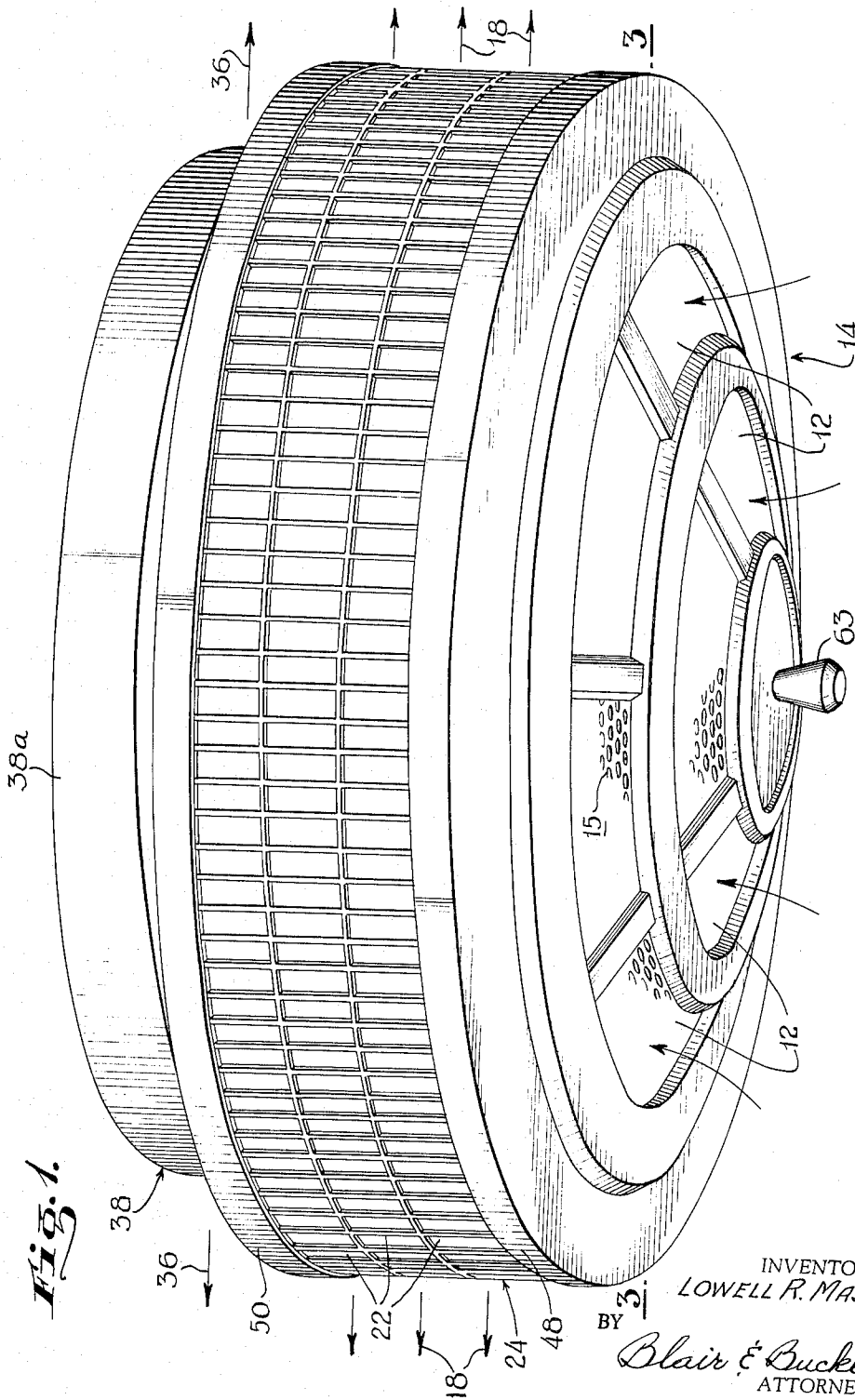
L. R. MAST

3,223,828

CEILING MOUNTED ELECTRIC SPACE HEATER

Filed May 7, 1963

3 Sheets-Sheet 1



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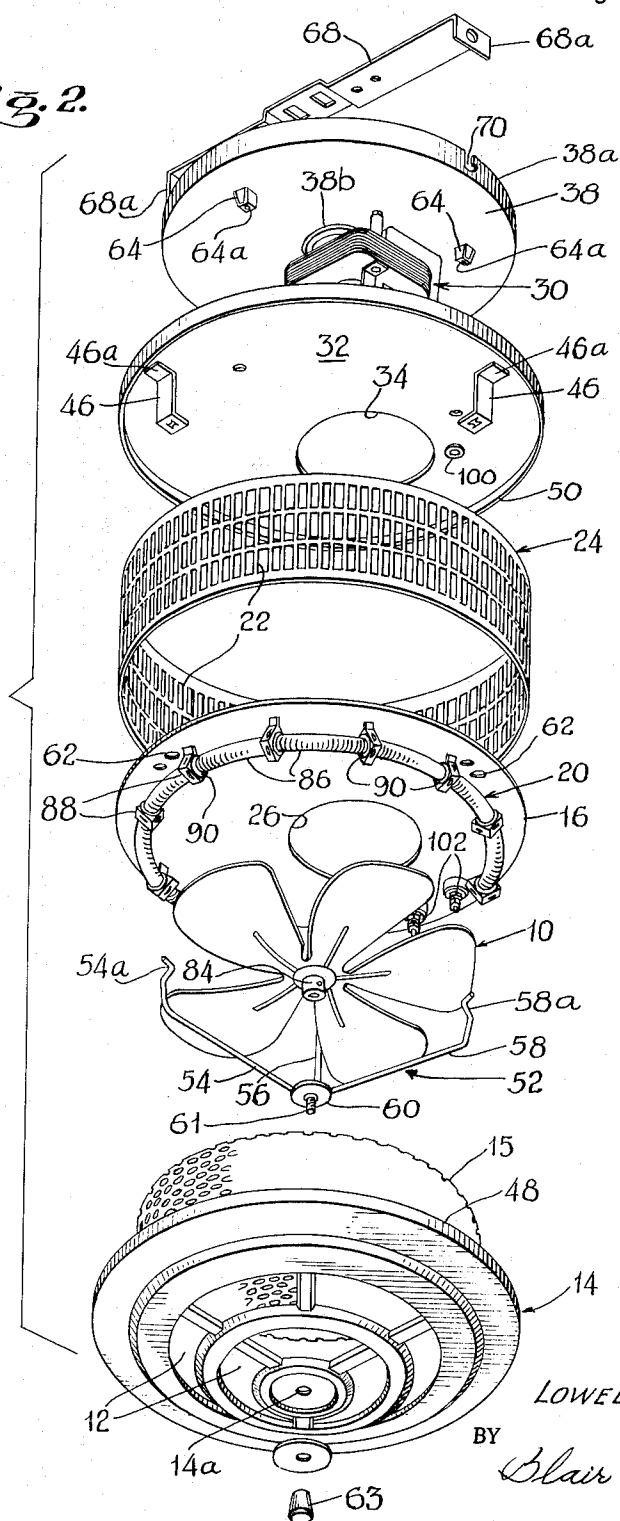
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Fig. 2.



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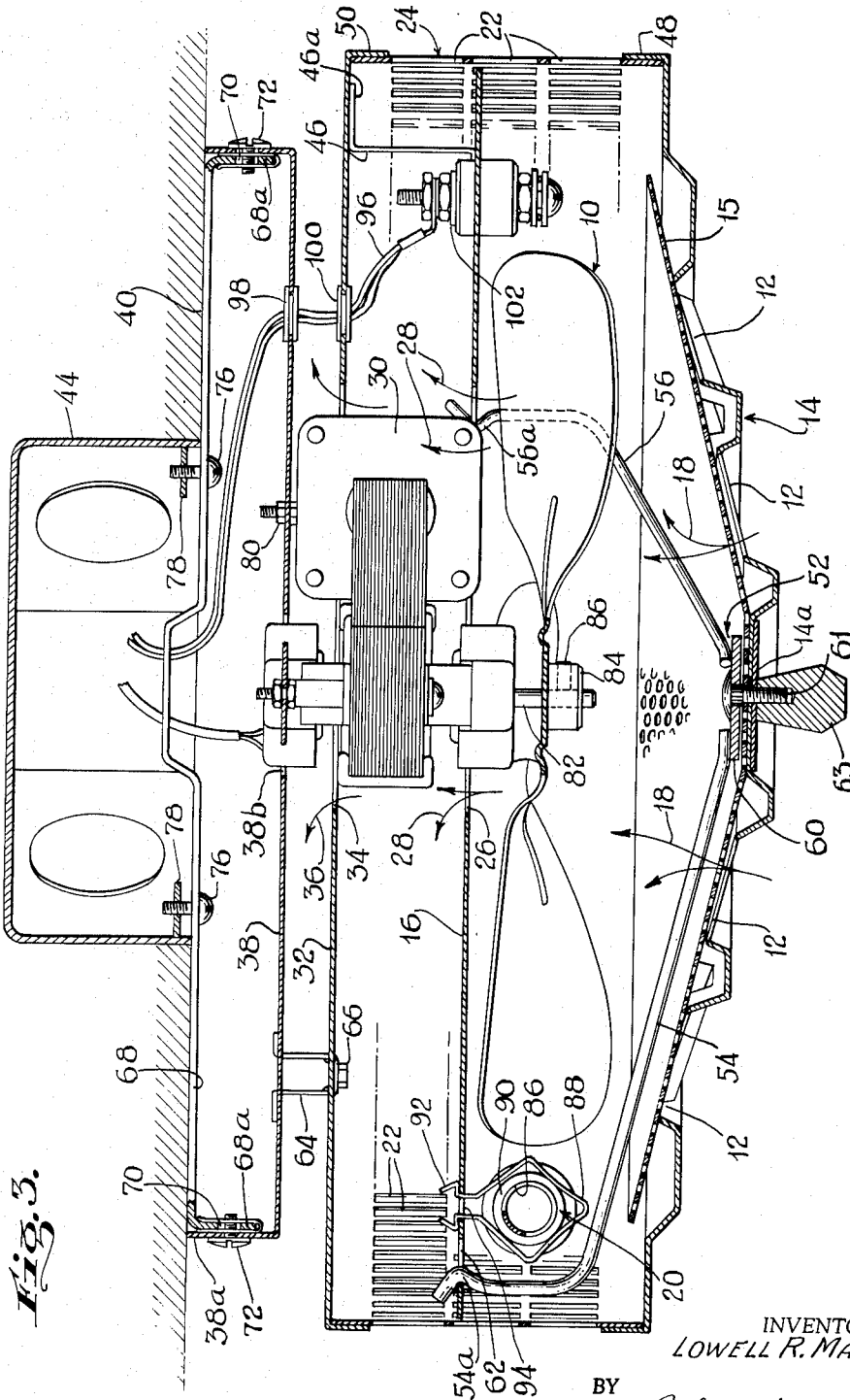


Fig. 3.

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3,223,828 CEILING MOUNTED ELECTRIC SPACE HEATER

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8 Claims. (Cl. 219—370)

This invention relates to electrical heaters of the type installed on ceilings. More particularly, it relates to a novel ceiling heater having multiple air paths for cooling the fan motor and for heat insulating the fan motor, ceiling and associated wiring from the heating element thereof.

This application is a continuation-in-part of an application filed in the name of Lowell R. Mast, Serial No. 8,055, filed February 11, 1960, and assigned to the assignee of the present application, now abandoned in favor of the instant application.

There have been a number of attempts in the past to make an efficient, safe electrical ceiling heater. The prior art heaters, however, have a number of shortcomings, both in efficiency and safety of operation.

Safety in operation is a prime factor in electric heater construction. Prior art heaters are generally spaced some distance from the ceiling to provide a large insulating air space between the heater and the ceiling. Such heaters are not only ungainly in appearance, but the resulting poor circulation to and from the dead air space causes a loss in efficiency.

A principal problem in prior art electrical heaters concerns the safe dissipation of radiant and conducted heat from the heating element. There is considerable heating of the housing of prior art heaters adjacent the ceiling, thereby increasing the danger of fire during prolonged periods of operation.

The heater wiring must also be protected to prevent destruction of the insulation. High temperature insulation is used in the heater itself but wiring in the connecting junction box generally will be subject to destruction at lower temperatures. Special provisions to protect the already existing wiring from overheating have been required in prior art electric ceiling heaters. Many prior art heaters have their air intake adjacent their heated air outlet. Hot air blown from the heater is pulled back into the cool air intake to be heated again. This "short circuiting" of the air flow results in decreased efficiency.

Another objectionable feature of prior ceiling heaters has been that the heated air outlet is directed downwardly and the area directly below the heater is uncomfortably warm, as a hot air blast is concentrated downwardly below the heater. Additionally the air drawn into the heater from the proximity of the ceiling is the hottest air in the zone being heated.

Another problem in prior art electric heaters is that they often produce noise, especially after being in service for an extended period of time. This is because the alternate expansion and contraction of the various parts of the heater due to heating and cooling thereof eventually loosens ordinary threaded fasteners, heretofore used in prior art heaters. Thus, it has been necessary in prior art heaters to use many locking fasteners to hold the various elements of the heater together. This has increased the cost of assembly of such heaters. Yet after heat cycling, rattles and other undesirable noises still appear.

Therefore, it is a primary object of this invention to provide a heater for ceiling installation that has increased efficiency and safety by providing multiple air paths through the heater.

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Another object of the invention is to provide a heater of the above character wherein the junction box wiring for the heater is protected against disintegration by heat.

It is a further object of the invention to provide a heater of the above character wherein the fan motor is cooled by circulating air that is also utilized to insulate and cool the ceiling above the heater.

Another object of the invention is to provide a heater of the above character wherein the baffles providing multiple air paths through the heater are also utilized to support heater components while keeping heat conducted to the ceiling and associated wiring at a minimum.

It is a further object of the invention to provide a heater of the above character that has a pleasing appearance and minimum dimensions for a given heating capacity.

Another object of the invention is to provide a heater of the above character with the air intake located on its bottom and the heated air outlets located on the heater sides, for better distribution of heat and more efficient circulation.

A further object of the invention is to provide an electric heater of the above character that will not produce excessive noise after extended use.

Another object of the invention is to provide a heater of the above character that is inexpensive to manufacture and durable in use.

Other objects of the invention will in part be obvious and will in part appear hereinafter.

The invention accordingly comprises the features of construction, combination of elements, and arrangement of parts which will be exemplified in the construction hereinafter set forth, and the scope of the invention will be indicated in the claims.

For a fuller understanding of the nature and objects of the invention, reference should be had to the following detailed description taken in connection with the accompanying drawings in which:

FIGURE 1 is a perspective view of the heater of my invention;

FIGURE 2 is an exploded perspective view of the heater of my invention; and

FIGURE 3 is a side sectional view taken along lines 3—3 of FIGURE 1.

Similar reference characters refer to similar parts through the several views of the drawings.

Electrical heaters adapted to be installed on room ceilings have a great variety of applications and may be used to supplement the built-in heating system of a home or other building. Such heaters have found extensive use in bathrooms, garages, sheds and similar outbuildings that require heating only occasionally. These ceiling heaters also are utilized to a great extent in tropical or semitropical climates when unseasonably low temperatures occur.

Electric heaters heretofore provided for the above described uses generally have a single air path through the heater. By providing only a single air path, radiated and conducted heat is permitted to be transmitted to the housing panel adjacent the ceiling, resulting in a dangerous fire hazard. In order to counteract this danger, many of the prior art ceiling heaters have to be spaced a considerable distance from the ceiling. Such construction results in an unpleasant appearance of the heater and in inefficient utilization of the radiant heat that is transmitted to the upper panel of the heater air path.

Such heaters are generally installed to utilize existing building wiring and are connected to a standard junction box on a ceiling. Since high temperature insulation is not generally provided in common household wiring the junction box must be protected against overheating.

The present invention obviates a number of the prob-

lems found in prior art heaters while maintaining low cost of production and attractive appearance of the heater. The present heater provides for multiple air paths through the heater structure to cool the heater motor and to efficiently remove heat from the heater baffles directing airflow therethrough. The baffling arrangement of the heater prevents transfer of radiated and conducted heat to the ceiling of the room and to the junction box wiring.

The ceiling heater of the present invention employs a novel balanced stress arrangement for holding the enclosure thereof together. In this arrangement some parts are under bending stress, others under tensional stress, and yet others under compressive stress, all balanced such that heat cycling of the unit cannot open up clearances to allow any of the members to rattle. Furthermore, a single accessible fastener is provided so that working elements of the heater may be conveniently installed on a ceiling and the heater housing then installed around them. The housing furthermore may be easily removed for cleaning and servicing of the heater.

As shown in FIGURES 1 and 3, air is drawn upwardly into the heater through openings 12 in the bottom 14 by a fan 10 and then divides into several paths. Openings 12 allow the passage of air through an area in bottom 14 substantially co-extensive with the air moving portions of the fan 10. The imperforate outer portion of bottom 14 prevents recirculation of air at the periphery of fan 10. A perforated decorative screen 15 is fitted just above bottom 14. A main partition 16 directs the majority of the air in a primary path as indicated by the arrows 18 past heating elements generally indicated at 20 and outwardly in all directions through openings 22 in a grill generally indicated at 24. A secondary air path passes through opening 26 in partition 16 and past the fan motor 30 as indicated by arrows 28 to cool the heat producing elements thereof. This secondary air flow is divided, most of it flowing between partition 16 and a top plate 32 and radially therefrom. Some air may flow through opening 34 in top plate 32 and thence outwardly beneath a top panel 38 indicated by arrows 36.

Thus, as shown in FIGURE 3, partition 16, top plate 32 and top panel 38 are parallel and spaced from one another to provide the various air paths through the heater. Motor 30 is located in the upper air paths of the heater to be cooled thereby while the ceiling 40 and wiring in junction box 44 are cooled by the air stream between top plate 32 and top panel 38.

Turning now to a more detailed description of the construction shown in FIGURES 2 and 3, partition 16 is supported in its intermediate position between top plate 32 and bottom 14 by a plurality of brackets 46 whose horizontal portions 46a may be spot-welded to top plate 32. Grill 24 is formed from a flat sheet of metal. Bottom 14 has an upstanding flange 48 while top plate 32 has a depending flange 50 so that grill 24, which is interposed therebetween, is resiliently bent into a circle to press radially outwardly against flanges 48 and 50. Grill 24 is fitted tightly between bottom 14 and top plate 32 to avoid rattling during operation of the fan. This tight fit is accomplished by a spring-type bracket, generally indicated at 52 in FIGURES 2 and 3. As can be seen from a study of this figure, this bracket includes three resilient prongs 54, 56 and 58 which extend radially from and are secured to a central disc 60, thence substantially upwardly to terminate in hook-like portions 54a, 56a and 58a. These hook-like portions extend through suitably positioned openings 62 in partition 16 and resiliently press outwardly against the outer edges of openings 62. A threaded stud 61 extends through the central portion 14a of bottom 14 and nut 63 is threaded thereon. By taking up firmly on nut 63 bottom 14 is pulled up to the position shown in FIGURE 3 to resiliently hold grill 24 in position between bottom 14 and top plate 32. When nut 63 is tightened, screen 15 is resiliently deformed by disc 60 to fit tightly against bottom 14. Thus when the

heater is turned on and the parts of the heater expand, the bracket 52, bottom 14, screen 15, and grill 24 all resiliently deform to maintain tight fit therebetween and thus prevent rattles.

As can be seen in FIGURES 2 and 3, a plurality of collars 64 depend from the bottom of top panel 38 with holes 64a formed therein to accommodate screws 66 which thus support top plate 32 so that it and all inner connected heater parts are thus suspended from top panel 38. As will be apparent from viewing FIGURES 2 and 3, top panel 38 may be conveniently secured to the ceiling of the room by way of a bracket member 68 having right angle flanges 68a interfitting with upstanding flange 38a on top panel 38, these flanges being provided with suitable holes 70, the parts being held together by screws 72. As can be seen in FIGURES 2 and 3, bracket 68 is shaped to be secured to a junction box, generally indicated at 44, of standard and well known construction and containing the usual electric wiring for various types of electric fixtures. Bracket 68 is held in this position to support the entire heater assembly by screws 76 secured in the flanges 78.

Motor 30 is preferably a standard A.C. motor which fits within openings 26 and 34 in partition 16 and top plate 32, as can be seen in FIGURE 3 with its upper portion extending through an opening 38b in top panel 38. It is held in this position by suitable bolts and nuts, generally indicated at 80, which securely fasten the motor to the top panel 38. Still referring to FIGURE 3, the motor shaft 82 extends downwardly and the fan 10 is secured thereto by a collar 84 and a set screw 86.

As can be seen in FIGURES 2 and 3, the heating element 20 comprises a series of sections 86 preferably curved in shape and held in position by spring clips, generally indicated at 88, which in turn support ceramic collars 90. As can be seen in FIGURE 3, these spring clips include angle-shaped legs 92 which extend through suitable holes 94 in partition 16 to rest upon the top side thereof. These clips 88 are designed to spring outwardly so that the angle-shaped legs press against the edges of holes 94 to thereby hold the heater assembly 20 firmly in the position shown and to avoid rattling during operation of the fan.

Suitable wiring, generally indicated at 96, extends from the junction box, through insulators 98 and 100 in top panel 38 and top plate 32 respectively, to be connected to binding posts or the like, generally indicated at 102, which are preferably mounted in the position shown on partition 16. Suitable electrical connections (not shown) are made between the motor 30 and the heating elements 20 to provide the necessary electric power, and this wiring will, of course, include proper switch connections for controlling the heater assembly from a wall switch (not shown) or the like.

The heater is turned on by a remote switch (not shown) to supply current to the heating elements 20 and fan motor 30. Intake air is drawn upwardly and the major portion thereof is directed as shown by arrows 18, beneath partition 16 past the heating element 20 and then through the grill 24 to be circulated through the room. A minor portion of the air goes through opening 26 in partition 16 and around the motor for cooling purposes.

Air also flows through opening 34 and out between top plate 32 and top panel 38 thus coacting with top panel 38 to prevent overheating the ceiling. The dead air space between the top panel 38 and the ceiling provides added protection against overheating of the ceiling and junction box wiring.

The heater of the present invention is thus extremely efficient and same in operation. The directing of multiple air paths through the heater results in rapid removal of heat and distribution throughout the room. The heater of my invention is inexpensive to manufacture since the great majority of parts can be easily stamped

from sheet metal and assembled with a minimum of labor. Further there is a minimum of short circuiting of heated air back into the heater, and there is no direct hot air blast below the heater since heated air is circulated outwardly from all sides of the heater.

The heater of the present invention is extremely easy to install, clean, and service, merely requiring the removal of the single nut 63. A balanced stress arrangement is inherent in the structure preventing rattling of the various parts during heater operation.

It will thus be seen that the objects set forth above, among those made apparent from the preceding description, are efficiently attained and, since certain changes may be made in the above construction without departing from the scope of the invention, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

It is also to be understood that the following claims are intended to cover all of the generic and specific features of the invention which, as a matter of language, might be said to fall therebetween.

Having described my invention, what I claim as new and desire to secure by Letters Patent is:

1. An electric heater for installation on a ceiling comprising in combination:

- (A) an upper horizontal panel;
- (B) means for attaching said upper panel to a ceiling to form a dead-air space between the ceiling and said panel;
- (C) a main partition suspended and spaced from said upper panel and having an aperture therethrough, said main partition and said upper panel defining a radial air flow passage therebetween;
- (D) an electric motor having its heat producing element mounted between said upper panel and said main partition above said aperture and its shaft extending through said main partition, said aperture permitting air movement therethrough and around said motor;
- (E) a fan mounted on said shaft below said main partition having blades pitched to move air axially upward;
- (F) an electric heating element spaced below said main partition adjacent the periphery of said fan in the plane of rotation of said fan; and
- (G) a housing for the electric heater comprising
 - (1) a perforated grill extending around the periphery of the heater, including at least a portion of the peripheral areas above and below said main partition to provide an air outlet around said housing, and
 - (2) a bottom panel supported below said fan and spaced from said main partition to define a peripheral radial air flow passage therebetween,
 - (a) said bottom panel having means forming an air intake opening therein

2. The combination defined in claim 1 wherein said fan blades are pitched so as to direct air upwardly through said air intake orifice and against said main partition and said aperture is of smaller diameter than said fan but large enough to permit a small portion of the upwardly directed unheated air to pass over the heat producing portions of said motor.

3. An electric heater comprising in combination:

- (A) a generally planar top plate
 - (1) flanged about the periphery thereof and suspendable from a ceiling with the flange thereof disposed downwardly;
- (B) a generally planar main partition suspended and spaced from said top plate to form a radial air flow passage therebetween;
- (C) a motor driven fan having blades pitched to move air axially upwardly;

(1) the motor of said fan being disposed above said main partition;

(2) the fan thereof being disposed below said main partition;

(D) an electric heating element disposed below said main partition near the periphery of said fan;

(E) a bottom plate spaced from said bottom plate and below said fan and having means forming an air inlet therethrough, said bottom plate being

(1) flanged about the periphery thereof

(a) said flange enclosing an area congruent with the area enclosed by the flange of said top plate, and

(b) said flange being disposed upwardly;

(F) a perforated grill

(1) disposed about the periphery of said heater within and against said flanges to provide a radial air outlet;

(2) said grill being spaced from the peripheral edge of said main partition; and

(G) a bracket under tension

(1) connecting said bottom plate to said top plate and main partition and causing said top plate and bottom plate to be urged together against said perforated grill.

4. The combination defined in claim 3 wherein said bracket comprises

(1) at least three resiliently bendable wire prongs connected together at a fastener attached to said bottom plate, and wherein

(2) said three wire prongs are engageable in openings in said main partition and when so engaged are urged against the edges of said openings.

5. The combination defined in claim 3 wherein said perforated grill is formed from a sheet of flat material and is resiliently bent to fit within the flanges of said top and bottom plates.

6. An electric heater comprising in combination:

(A) a generally planar top plate;

(B) means for attaching said top plate to a ceiling;

(C) a generally planar main partition suspended and spaced from said top plate to form a radial air flow passage therebetween;

(D) a motor driven fan having blades pitched to move air axially upwardly,

(1) the motor of said fan being disposed above said main partition,

(2) the fan thereof being disposed below said main partition;

(E) an electric heating element disposed below said main partition near the periphery of said fan;

(F) a bottom plate spaced from said main partition below said fan and having means forming an air inlet therethrough,

(1) the peripheral edge of said bottom plate being congruent with the peripheral edge of said top plate;

(G) a perforated grill

(1) disposed about the periphery of said heater to provide a radial air outlet

(2) within the periphery of said top and bottom plates; and

(H) a bracket under tension

(1) connecting said bottom plate to said top plate and main partition and

(2) causing said top plate and said bottom plate to be urged together against said perforated grill.

7. The combination defined in claim 6, wherein

(A) said main partition has an opening therein disposed below the heat producing elements of the motor of said fan and above an air-moving portion of said fan; and

(B) said bottom plate air inlet is opened to the pas-

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sage of air over an area substantially coextensive
with the air moving portions of said fan.

8. The electric heater defined in claim 7, and:

(A) a perforated screen

(1) of resilient bendable material

(2) disposed under bending stress over the open
area of said bottom plate air inlet.

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