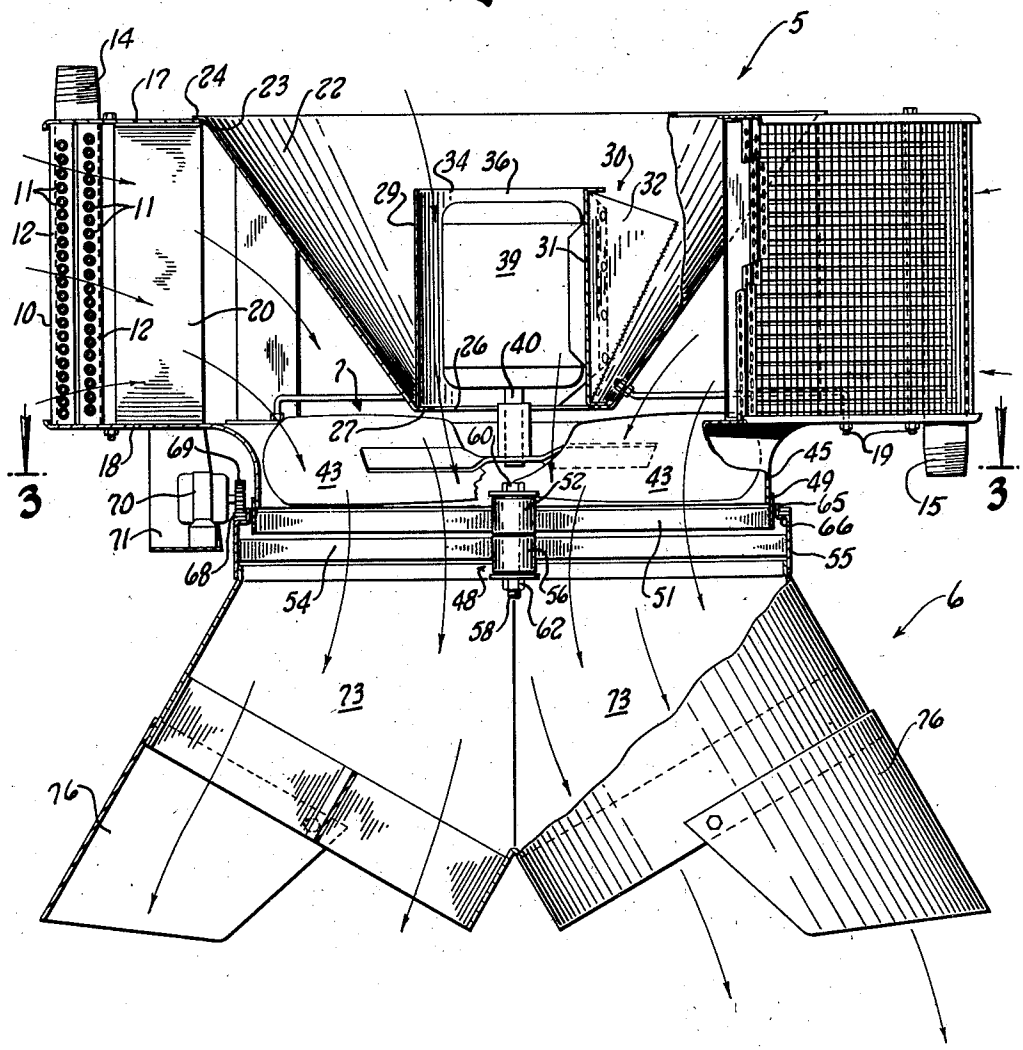
Nov. 12, 1957 F. M. YOUNG 2,812,925

OVERHEAD TYPE UNIT HEATER

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Fig. 1.



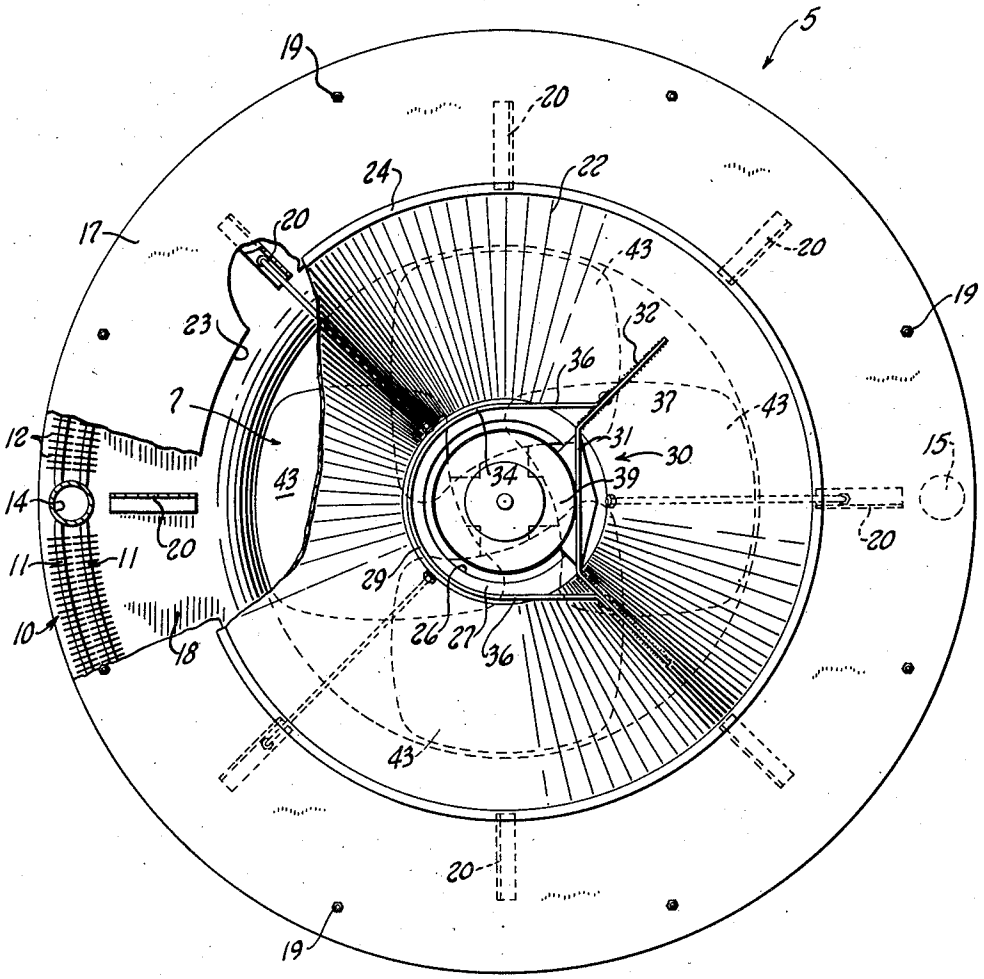
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OVERHEAD TYPE UNIT HEATER

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Fig. 2.



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Fig. 3.

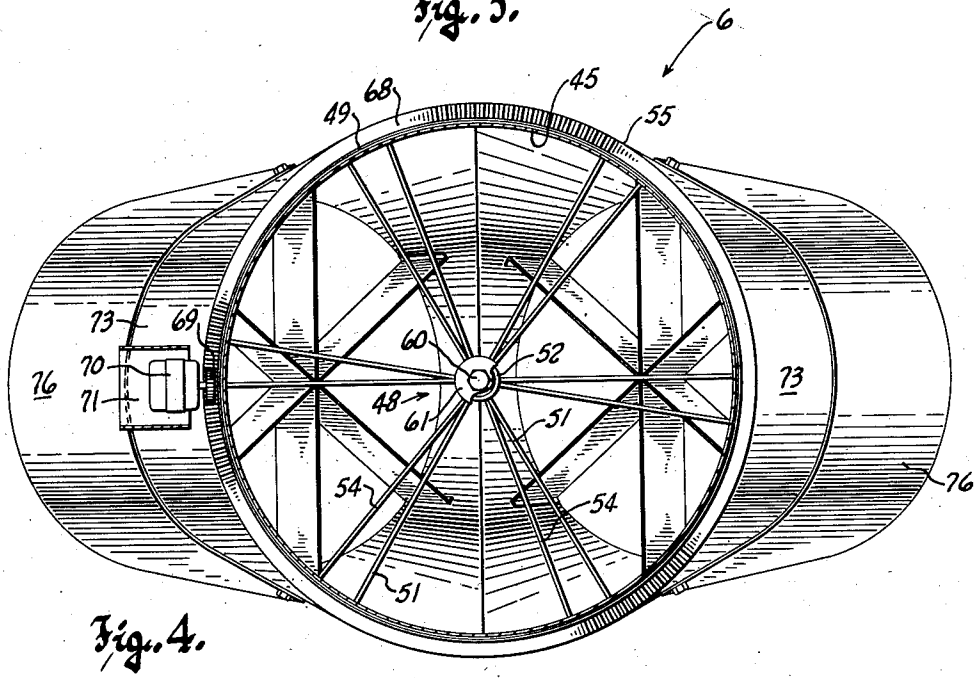
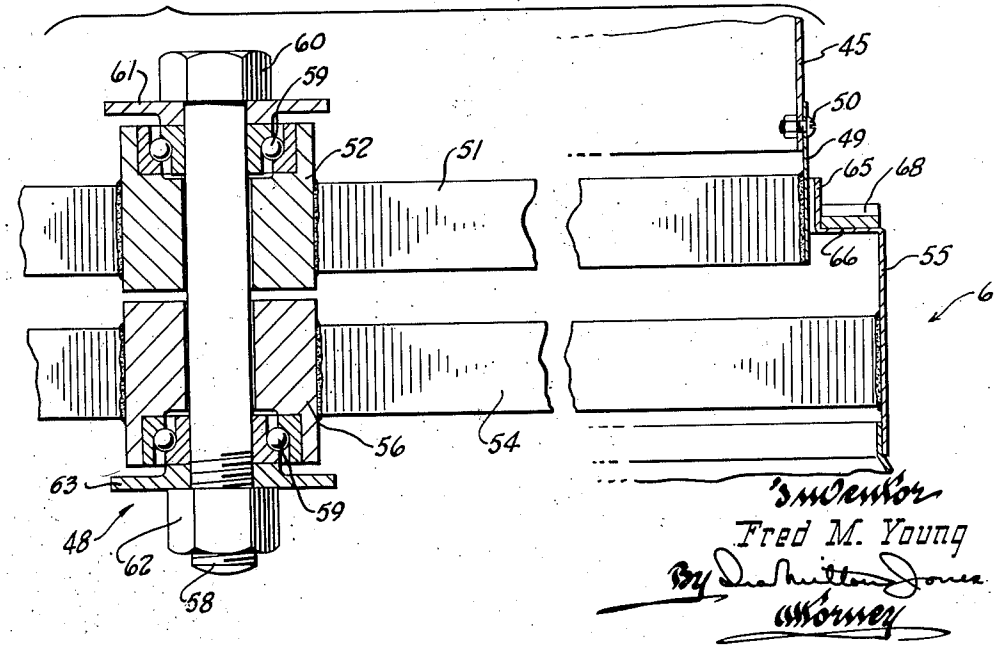


Fig. 4.



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United States Patent Office 2,812,925 Patented Nov. 12, 1957

2,812,925

OVERHEAD TYPE UNIT HEATER

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Application May 25, 1956, Serial No. 587,270

2 Claims. (Cl. 257—137)

This invention relates to unit heaters and has more particular reference to unit heaters of the overhead type which are adapted for mounting at high elevations in large buildings.

Unit heaters of this type usually comprise an annular heat exchanger core through which a heating medium such as steam is circulated. The core is ordinarily confined axially between top and bottom plates, and an electric motor driven fan having its blades operating within a shroud at the underside of the lower plate draws air to be heated radially inwardly through the core and blows the heated air downwardly into the space to be heated. In any unit heater designed to be mounted at a substantial elevation in a large building such as an airplane hangar, for instance, the radiator core must have a substantially large heating capacity, and as a consequence, the core has a correspondingly large diameter.

One of the most annoying problems encountered with unit heaters of this type is that of adequately protecting the electric fan motor against the high temperatures adjacent to the heat exchanger core, not only during times when the fan is in operation, but also at times when the fan is inoperative.

One of the principal objects of this invention, therefore, resides in the provision of an overhead type unit heater of the character described wherein the fan motor, though mounted entirely in the space defined by the heat exchanger core for compactness, is at all times protected against the heat of the core. More specifically, it is an object of this invention to provide a unit heater of the character described, wherein the fan motor is mounted in a duct located entirely inside the space defined by the annular heat exchanger core, to facilitate the circulation of cooling air over the motor, and wherein a heat insulating dead air space around the duct affords additional protection for the motor, especially during periods when the fan motor is inoperative.

A further object of this invention resides in the provision of an overhead type unit heater of the character described which incorporates a revoluble diffusing head supported by the lower plate of the heating unit in an exceptionally simple but sturdy manner, and which is adapted to be driven by an electric motor carried by the unit so as to effect rotation of the diffusing head at a slow speed and discharge of the heated air from the unit through a plurality of diverging discharge nozzles on the head.

Further objects of this invention reside in the provision of an overhead type unit heater which is exceptionally compact and sturdy and which features simplicity of construction to facilitate assembly and servicing of the unit.

With the above and other objects in view, which will appear as the description proceeds, this invention resides in the novel construction, combination and arrangement of parts substantially as hereinafter described and more particularly defined by the appended claims, it being

understood that such changes in the precise embodiment of the hereindisclosed invention may be made as come within the scope of the claims.

The accompanying drawings illustrate one complete example of the physical embodiment of the invention constructed according to the best mode so far devised for the practical application of the principles thereof, and in which:

Figure 1 is a view partly in side elevation and partly in longitudinal section of an overhead type unit heater constructed in accordance with this invention;

Figure 2 is a plan view of the unit shown in Figure 1, with portions broken away and shown in section;

Figure 3 is a cross sectional view taken through Figure 1 along the plane of the line 3—3; and

Figure 4 is an enlarged fragmentary longitudinal sectional view of the bearing structure by which the diffusing head is freely rotatably suspended from the underside of the unit.

Referring now more particularly to the accompanying drawings in which like numerals are applied to like parts through the several views, the numeral 5 generally designates the upper or heating section of an overhead type unit heater constructed in accordance with this invention. In addition to the heating section 5, the unit includes a diffusing head 6 on the underside of the heating section, and a fan 7 interposed between the heating and diffusing sections for drawing air inwardly through the heating section and blowing it downwardly through the diffusing head into the space to be heated.

The heating section 5 comprises a substantially large diameter annular heat exchanger core 10 made up of a series of tubes 11 arranged on concentric inner and outer circles and vertical, radially disposed plate fins 12 having holes into which the tubes are expanded. The fins 12, of course, are spaced circumferentially of the core so that the core may be said to have radial air passages therethrough. Steam may be supplied to the heating section by means of an inlet header 14 projecting into the top of the core to communicate with all of the tubes thereof at one side of the core, and the condensate is exhausted from the heating section through a header 15 likewise communicating with all of the tubes but located diametrically opposite the inlet header and projecting from the bottom of the core.

The heat exchanger core is confined axially between the parallel outer edge portions of horizontally disposed annular top and bottom plates 17 and 18, respectively, fixed with respect to the core as by means of a series of circumferentially spaced rod bolts 19 extending vertically between the inner and outer tube circles. Both the top and bottom plates extend a short distance inwardly from the annular heat exchanger core so as to accommodate vertical plate-like reinforcing members 20 therebetween, the opposite end portions of the reinforcing members being welded or otherwise secured to the opposing surfaces of the plates.

The heating section also includes a frustoconical shell 22 mounted inside the annular core inwardly of the upright reinforcing members 20, with its large diameter end portion uppermost and its lower small diameter end portion disposed adjacent to the plane of the bottom plate 18. The upper end portion of the frustoconical shell has a diameter such as to substantially fit the large circular opening 23 in the center of the upper plate 17, and it is supported therefrom by means of an annular flange 24 bent outwardly from the upper end of the shell and seating upon the inner edge portions of the plate adjacent to the opening 23 therein. In this manner, the shell is properly positioned coaxially within the core, with its wall spaced a substantial distance inwardly of the core and di-

verging therefrom toward the bottom of the shell. Preferably the annular flange **24** is welded to the upper plate **17** all around the edge of the opening **23** therein, so that the upper plate cooperates with the shell to close the top and inside of the core, except for the opening **26** in the smaller diameter lower end of the shell. The opening **26** in the lower end of the shell is coaxial with the annular heat exchanger core, and it is defined by the inner edge of a short inwardly directed annular flange **27** on the bottom of the shell.

Seating on and fixed to the upper surface of the flange **27** is an upright ventilating stack **29** having a height substantially less than that of the frustoconical shell so as to be located wholly within the interior thereof, or more particularly, in the lower end portion of the shell. One wall portion of the stack **29** is provided by a sheet metal motor mounting bracket **30** having a flat base wall **31** projecting vertically upwardly from the flange **27** and having outwardly diverging radial leg portions **32** edgewise seating on and secured to the outwardly sloping walls of the shell, as by welding. A U-shaped member **34** cooperates with the bracket to provide the remainder of the stack **29**. Its semi-circular bight portion is disposed at the side of the opening **26** in the shell remote from the flat wall portion **31** of the motor mounting bracket, and its opposite parallel legs **36**, which embrace the edge of the opening **26** in the shell, project toward the motor mounting bracket to be secured to the outwardly diverging arms **32** of the bracket, as at **37**.

A fan motor **39** is secured to the flat wall portion **31** of the motor mounting bracket, so as to be disposed wholly within the stack **29**, with its housing in spaced relation to the walls of the stack except directly adjacent to the upright base wall of the bracket. The shaft **40** of the fan motor projects coaxially downwardly through the opening **26** in the lower end of the shell a short distance beyond the plane of the lower plate **18**, and the fan **7** is fixed on its projecting end. The blades **43** of the fan project radially a distance outwardly beyond the adjacent small diameter end of the frustoconical shell, mainly beneath the plane of the lower plate **18**.

The blades **43** of the fan rotate within a cylindrical shroud **45** on the underside of the bottom plate and which, in the present case, is shown as an integral part thereof, being spun inwardly and downwardly therefrom coaxially of the heat exchanger core, to closely encircle the fan blades. As seen best in Figure 1, the wall of the shroud is located substantially midway between the periphery of the lower plate **18** and the small diameter lower end of the frustoconical shell so as to leave a generous annular opening around the latter communicating with the space inside the heat exchanger core.

When the fan motor is energized, it rotates the fan in the direction to draw air to be heated radially inwardly through the heat exchanger core toward the shell **22**, the wall of which deflects the air downwardly past the lower open end of the shell and into the shroud, to issue through the open bottom of the latter. The fan **7** thus establishes a substantially high velocity flow of heated air past the lower end of the frustoconical shell, in eductive relationship to the opening **26** therein, to also cause air from the space above the heating section to flow downwardly through the ventilating stack **29** in direct contact with the walls of the motor housing therein to cool the motor and protect it from the heat of the core. It should be noted that the duct or stack **29** also cooperates with the wall of the frustoconical shell which surrounds it to provide a highly effective heat insulating dead air space around the exterior of the stack to additionally protect the motor against the heat of the core. While this feature is highly important during periods when the fan is operating, it is equally as important at times when the fan motor, which is usually thermostatically controlled, is inoperative.

The diffusing head **6** is freely rotatably suspended from the lower end portion of the shroud **45** by means of a free running bearing structure **48** carried jointly by the shroud and the diffusing head. For this purpose, an adaptor ring or collar **49** is telescoped over and detachably secured by bolts **50** to the lower end of the shroud to provide a short downward extension thereof. A series of radial spokes **51** are joined to the ring **49** at their outer ends and project inwardly toward the axis of the shroud to have their inner ends fixed to a hub **52**, so as to support the hub from the shroud, at its center.

Similar radial spokes **54** having their outer ends joined to the cylindrical upper end portion **55** of the diffusing head and their inner ends fixed to a hub **56** support the latter in a position directly beneath the hub **52**, and with the bores of the hubs coaxial with the shoud. A spindle **58** passing through the aligned bores in the hubs to be received in combination radial and axial thrust bearings **59** therein, holds the diffusing head coaxial with the shroud and constrains the head to rotation on a vertical axis. The spindle **58** comprises a bolt having its head **60** bearing on a washer **61** which seats on the inner race of the upper bearing, and having a nut **62** threaded on its lower end and bearing against a washer **63** which, in turn seats upon the inner race of the lower bearing. The spindle, therefore, detachably holds the diffusing head assembled on the unit, and enables other types of heads or nozzles to be readily attached to the unit.

The cylindrical upper end portion **55** of the diffusing head, to which the radial spokes **54** are joined, has a diameter slightly larger than that of the ring or collar **49** on the lower end of the shroud, and its upper extremity is offset inwardly and upwardly to provide a short upstanding cylindrical flange **65** loosely embracing the ring **49** and an annular horizontal shoulder **66** connecting the flange **65** with the larger diameter upper end portion of the diffusing head. Supported on and secured to the shoulder **66** is a ring gear **68** having its teeth facing upwardly and meshing with a drive pinion **69** fixed to the shaft of an electric motor **70** mounted on a bracket **71** which is carried by the lower plate **18** of the heating section. The shaft of the motor **70**, of course, is disposed horizontally and radially of the axis of the ring gear **68**, and when it is in operation, the motor rotates the diffusing head at a substantially slow speed.

The diffusing head **6** is provided with two downwardly diverging boots or nozzles **73** having a series of radial vanes fixed therein to act as straighteners for the streams of heated air flowing downwardly and outwardly therefrom.

With this construction of the diffusing head, the heating unit is able to direct heated air both downwardly and outwardly over a substantially large circular area even though the unit is located at a substantial elevation above the floor level.

The desired directional control of heated air issuing from the diffusing head is further enhanced through the use of vizor-like shields **76** bolted to the nozzles or boots **73** at their outer sides.

From the foregoing description taken together with the accompanying drawings, it will be readily apparent to those skilled in the art that this invention provides an improved overhead type unit heater which features compactness and ease of assembly and servicing by reason of the fact that its various components are detachably secured together by a minimum number of bolts, and which further features exceptionally good protection against overheating of the electric motor by which the fan of the unit is driven.

What is claimed as my invention is:

1. A heating section for overhead type unit heaters, comprising: an annular heat exchanger core having radial air passages therethrough; upper and lower annular plates having parallel edge portions between which the core is coaxially confined; a frustoconical shell inside the core having its large diameter end uppermost and its small

diameter end terminating adjacent to the plane of the lower plate and defining an opening coaxial with but remote from the core; means mounting the shell on the heating section in fixed relation to the core, said means including an annular outwardly extending flange on the upper end of the shell resting on and secured to the upper plate around the inner diameter edge portions thereof so that said shell closes the heating section from the top thereof except for the opening in its lower end portion; and annular inwardly directed flange on the lower end of the shell, the inner edge of which flange defines the opening in the lower end of the shell; a stack mounted on said inwardly directed flange and located wholly within the shell, said stack having vertical walls which define a duct registering with the opening in the lower end of the shell and communicating with the space above the heating section through the large diameter upper end portion of the shell; an electric fan motor supported by said stack, in the interior thereof, with its housing walls in spaced relation to the walls of the stack and with its shaft projecting coaxially downwardly through said opening in the lower end of the shell; means on the underside of the lower plate defining an annular shroud coaxial with the opening in the lower end of the shell but spaced radially outwardly therefrom; and a fan fixed on the motor shaft with its blades encircled by the shroud, to draw air radially inwardly through the heat exchanger core and downwardly along the exterior surfaces of said shell for discharge through the shroud in eductive relationship to the opening in the lower end of the shell, whereby air is drawn downwardly through the stack from the space above the heating section to flow over the electric motor in the stack and thereby effect cooling of the motor, said stack cooperating with the lower wall portions of the shell which divergently encircle the stack to provide a heat insulating dead air space around the stack to protect the electric motor from the heat of the core.

2. In an overhead type unit heater: an annular heat exchanger core having radial air passages therethrough; upper and lower annular plates having the core confined coaxially between their outer edge portions; a frustoconical shell mounted coaxially inside the core with the small diameter end portion of the shell adjacent to the plane of the lower plate and with the large diameter end of the shell uppermost and engaging the upper plate all around the inner diameter edge portion of the latter, said shell cooperating with the upper plate to close off the top and inside of the core except for the opening in

the small diameter lower end of the shell; a shroud on the lower plate extending downwardly therefrom coaxial with the opening in the lower end of the shell; an electric fan motor mounted in the lower end portion of said shell, in spaced relation to the wall of the shell, with the shaft of the motor projecting coaxially downwardly through said opening and into the shroud; means fixed inside the lower portion of the shell defining a vertical stack surrounding the motor in spaced relation thereto and registering with said opening in the lower end of the shell, said stack seating against the lower end of the shell and its upright wall being spaced from the lower wall portions of the shell which divergently surround the same, whereby the stack cooperates with the shell to define an annular heat insulating dead air space around the exterior of the stack and also provides a duct extending centrally through said dead air space; a fan fixed to the motor shaft with its blades encircled by the shroud and operable to draw air radially inwardly through the heat exchanger core, along the downwardly convergent wall of said frustoconical shell, and through the shroud, in eductive relationship to the opening in the lower end of the shell, for discharge through the shroud together with air educted downwardly through said vertical stack and passing over the motor to cool the same; an adapter ring of a size to fit the lower end of the shroud; means detachably securing the adapter ring to the lower end of the shroud with a portion of the adapter ring projecting downwardly from the shroud; a diffusing head having a circular inlet portion at its top loosely encircling the downwardly projecting portion of the adapter ring; and a free running bearing structure carried by said downwardly projecting portion of the adapter ring and supporting the diffusing head from the shroud for rotation on the axis of the core, with the diffusing head forming a downwardly directed rotatable extension of the shroud, and with the diffusing head readily dismountable from the heating unit upon detachment of the adapter ring from the shroud.

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