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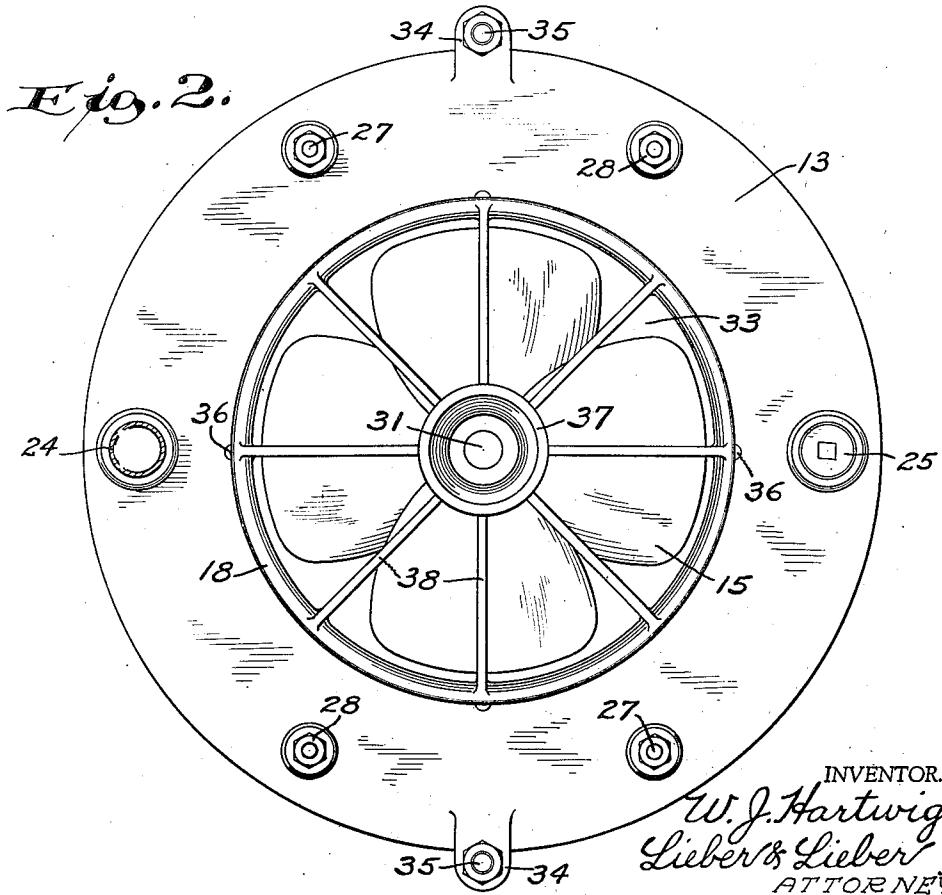
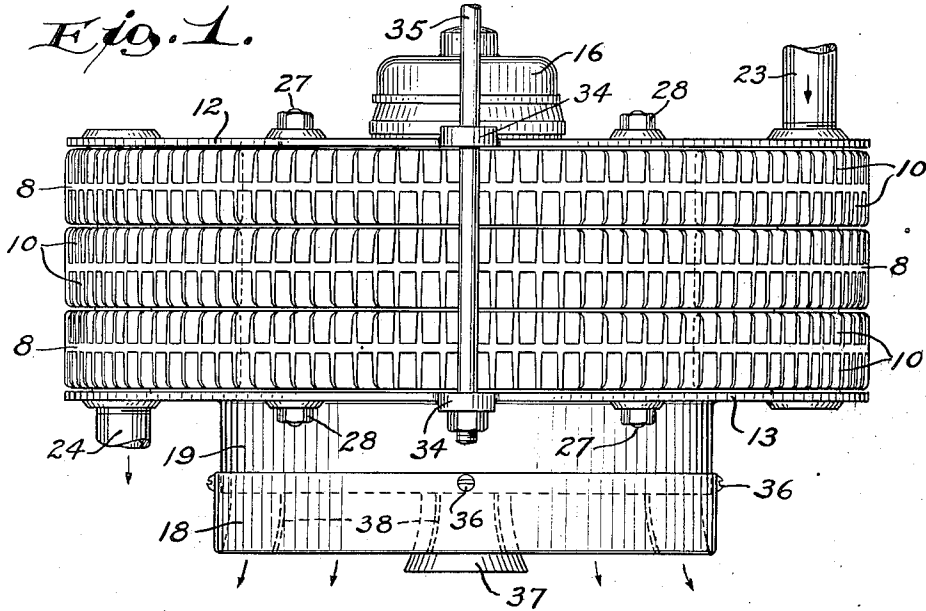
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2,370,309

CIRCULAR UNIT HEATER

Filed Dec. 26, 1942

3 Sheets-Sheet 1



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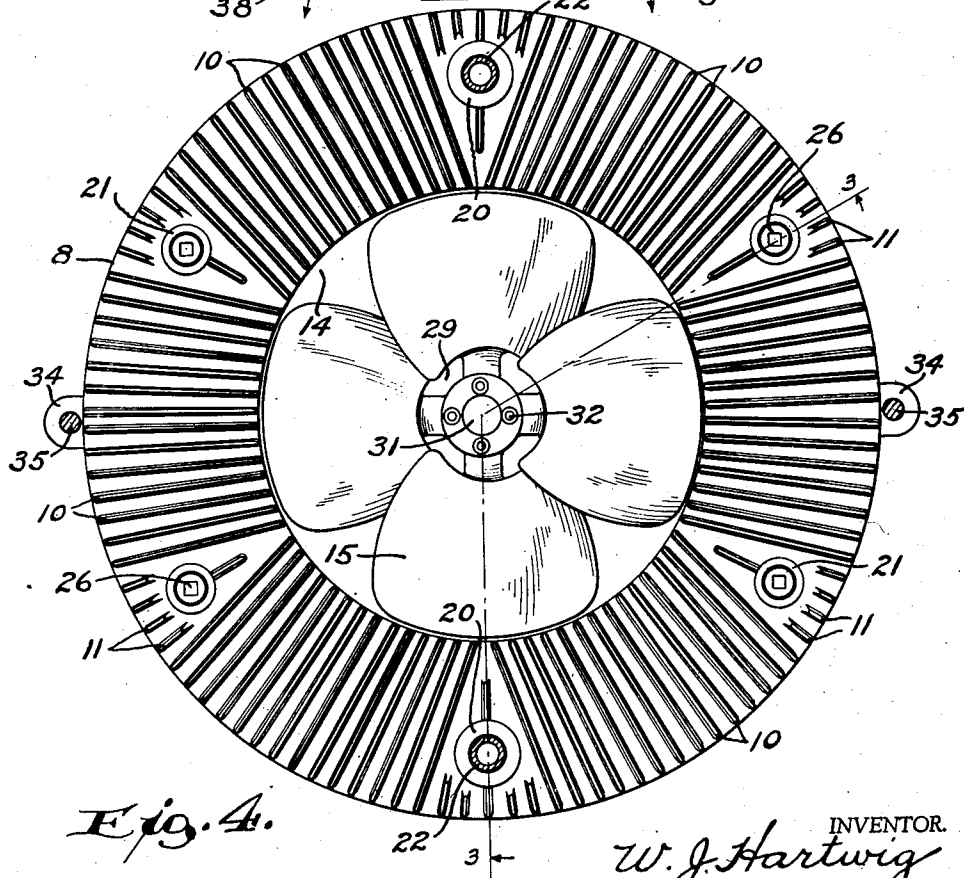
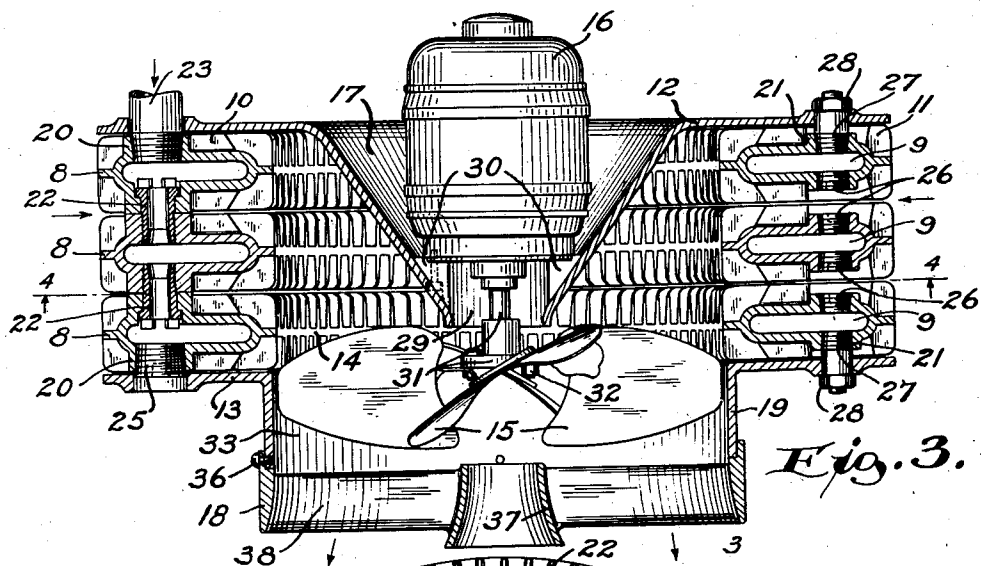
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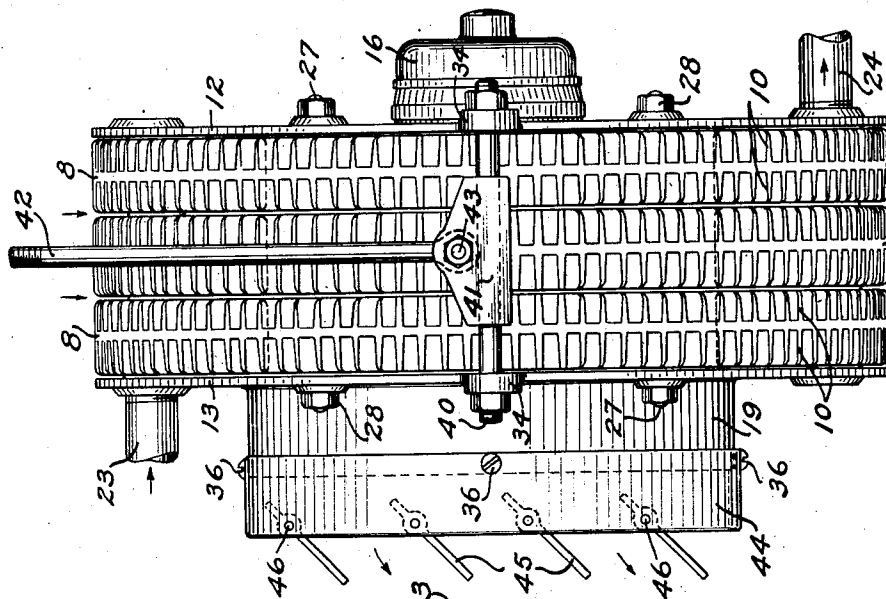


Fig. 5.

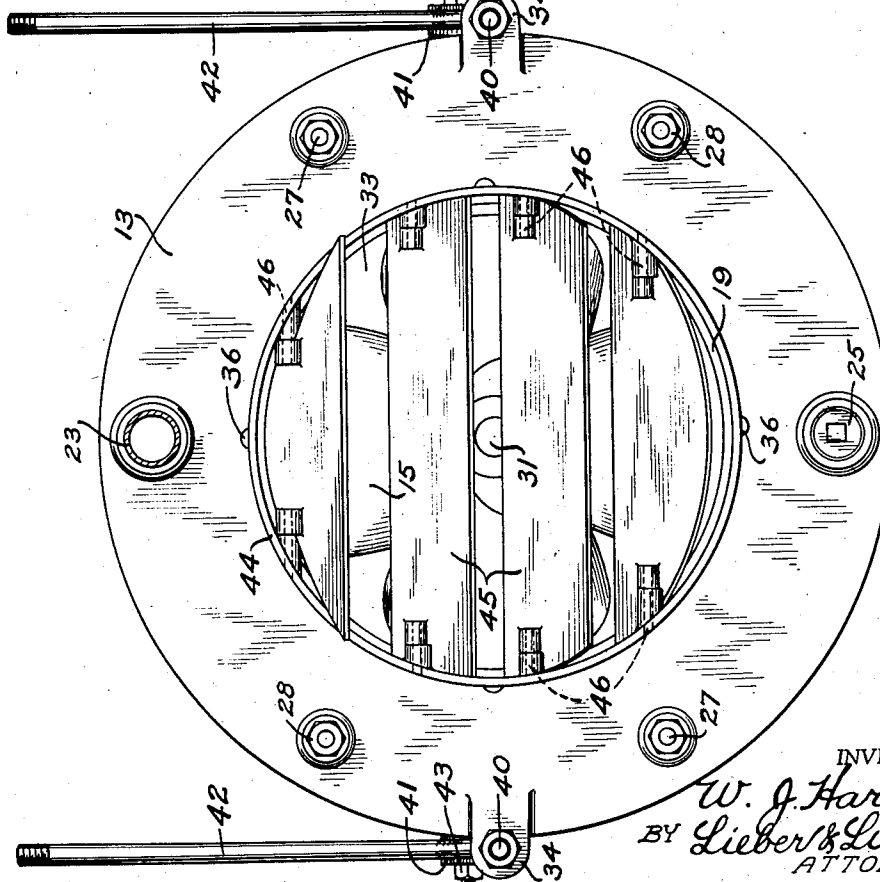


Fig. 6.

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UNITED STATES PATENT OFFICE

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CIRCULAR UNIT HEATER

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Application December 26, 1942, Serial No. 470,157

4 Claims. (Cl. 257—137)

The present invention relates generally to improvements in the art of conditioning and distributing air or other gases, and relates more especially to various improvements in the construction and operation of circular heat transfer devices of the type having one or more heat transfer coils and an air circulating fan or blower embodied in a single unit which is adapted for installation directly within or closely adjoining the space in which the air is to be conditioned.

The principal object of this invention is to provide a new and useful unit heater or cooler which is simple and compact in construction, and which is also highly efficient in operation and extremely flexible in its adaptations.

Some of the more important specific objects of the present invention are as follows:

To provide an improved air conditioner having one or more approximately circular heat transfer coils each provided with a multiplicity of heat radiating fins, and which may be readily assembled for most effective cooperation with an air circulating fan or blower.

To provide an improved heat transfer assembly for heating or cooling a continuous stream of air or other gas, which is adapted to most effectively distribute the treated gas throughout the zone of utilization thereof.

To provide an improved unit heater comprising annular heat transfer elements and an air circulating fan cooperating therewith, which is well adapted for overhead suspension with its central axis disposed either vertically, or horizontally, or in any intermediate angular position.

To provide a heating unit having one or more annular heat transfer coils provided with inwardly directed heat radiating fins formed to produce enlarged air entrance area and to thereby minimize the entry losses.

To provide a most efficient, compact and durable unit heater especially adapted for down-blow distribution of heated air, and having interchangeably similar heat transfer coils which may be readily assembled in different numbers so as to produce units of greater or lesser capacities.

To provide a heating assembly comprising relatively few simple parts which may be readily constructed and conveniently assembled, and in which the direction of flow of the air and of the heating medium through the unit may be reversed without materially affecting the operating efficiency of the assembly.

To provide an improved heat transfer structure adapted to interchangeably cooperate with

vortex breakers, diffusers and air distributors of different types, and having a motor driven air circulating fan the propelling motor of which is amply ventilated and protected against excessive heat at all times.

To provide an improved unit heater assembly which occupies minimum space, which is highly attractive in appearance, and which can be manufactured and sold at moderate cost for diverse uses.

These and other specific objects and advantages will be apparent from the subsequent description.

A clear conception of the various features constituting the present improvement, and of the construction and operation of a unit heater embodying the invention, may be had by referring to the drawings accompanying and forming a part of this specification wherein like reference characters designate the same or similar parts in the various views.

Fig. 1 is a side elevation of a vertically disposed down-below unit heater built in accordance with this invention;

Fig. 2 is a bottom view of the vertical unit heater of Fig. 1;

Fig. 3 is a rather irregular vertical section through the down-below unit heater, taken along the lines 3—3 of Fig. 4;

Fig. 4 is a transverse horizontal section through the unit heater taken along the line 4—4 of Fig. 3;

Fig. 5 is a side elevation of a horizontally disposed similar unit heater; and

Fig. 6 is a front view of the horizontally disposed unit heater.

While the invention has been shown and described herein as being especially applicable to circular unit heaters each embodying a series of annular finned heat transfer coils and a motor driven fan cooperating therewith, it is to be understood that it is not my desire or intent to unnecessarily restrict the scope or the utility of the improvement by virtue of this specific embodiment, since some of the improved features may also be advantageously applied to coolers for air or other gases.

Referring to the drawings, the improved circular heat transfer unit comprises in general several concentric annular heating sections or coils 8 of interchangeably similar construction each having an internal continuous chamber 9 for heating medium, and a multiplicity of external radiating fins 10, 11 directed inwardly toward the center of the annulus; opposite side sheets 12, 13

forming a passage 14 for normally initially directing a flow of air inwardly between the coils 8 and fins 10, 11, and finally along the axis of annularity of the heating sections; a rotary blower or fan 15 disposed within the axially directed portion of the passage 14, and being operable by means of an electric motor 16 mounted within a central depression 17 of the side sheet 12 to produce a continuous circulation of air through the passage 14; and a vortex breaker or diffuser 18 detachably secured to the tubular outlet portion 19 of the other side sheet 13, coaxially of the fan 15 and motor 16.

The improved annular heat transfer sections or coils 8 with the fins 10, 11 formed integral therewith, may be readily constructed by ordinary foundry methods, and each of these coils 8 is provided with a series of integral bosses 20, 21 which are tapped for the reception of piping, nipples, or pipe plugs, and some of which are adapted to coact with the corresponding bosses of adjacent coils. As shown, there are three similar annular coil sections 8 in the assemblage, but depending upon the heating capacity required, any desired number of coils 8 may be provided. These coil sections 8 are stacked or superimposed, one upon another, and are firmly interconnected by means of two sets of diametrically opposite special nipples 22 which coact with the adjoining larger bosses 20 of the adjacent tubular coils, and these hollow nipples 22 also serve to provide open passages connecting the several chambers 9, see Fig. 3. One of the outer bosses 20 is connected to a heating medium supply pipe 23, while the outer boss 20 on the opposite side of the coil assemblage and on the opposite side of the central axis, is connected to an exhaust pipe 24, as illustrated in Fig. 1, and the two remaining outer bosses 20 are closed by pipe plugs 25. The supply and exhaust pipes 23, 24 may communicate with either side of the unit, but when the assemblage is disposed vertically, the supply pipe 23 is preferably at the top while the exhaust pipe is at the bottom. All of the smaller inner bosses 21 are normally sealed by means of standard pipe plugs 26, but the outer-most bosses 21 are provided with special plugs 27 having threaded outer ends projecting through openings in the casing sheets 12, 13 and with which clamping bolts or nuts 28 coact. These special plugs 27 and nuts 28 cooperate with the special nipples 22 to retain the casing and coils firmly assembled, without necessitating the provision of additional clamping bolts.

The radiating fins 10, 11 which are formed integral with the coil bodies, are all directed inwardly toward the central axis of the unit heater, and these fins cooperate with the casing sheets 12, 13 to form passageways constituting a part of the passage 14 for conducting the air through the unit. The longer fins 10 are arranged in groups and the fins 10 of each group are disposed approximately parallel to each other, although they are in fact separated somewhat farther apart at their outer ends than at the inner ends thereof, in order to permit free entry of the incoming air and to reduce entry losses to a minimum. The shorter fins 11 are likewise arranged in groups adjacent to the bosses 20, 21 and are formed to permit free circulation of the air about these bosses; and all of the fins 10, 11 are so formed and disposed that they will provide maximum radiating surface without undesirably obstructing the free flow of air through the assemblage, and

that they may also be readily cast integral with the coils.

While the heat transfer coils 8 are preferably produced by casting, the opposite side sheets 12, 13 of the casing may either be cast or formed of sheet metal and by welding parts together. The central conical portion or depression 17 of the side sheet 12, is adapted to change the direction of the flow of air passing through the unit, from radial to axial, and has a central opening 29 at its smaller end directed away from the motor 16 and toward the fan 15. The depression 17 may also be provided with brackets 30 for supporting the fan motor 16, and the fan rotor 15 may either be removably attached to the motor shaft 31 by means of bolts 32, or the motor 16 may be reversible in operation, so that the fan action may be reversed. The casing sheet 13 is provided with the tubular portion 19 forming a duct 33 within which the fan rotor 15 is rotatable, and both of the housing sheets 12, 13 are provided with peripheral suspension lugs 34 with which vertical suspension rods 35 may be caused to cooperate as shown in Figs. 1 and 2, when the unit is disposed vertically.

The vortex breaker or diffuser 18 for the vertical unit heater, comprises an outer ring which is detachably secured to the tubular portion 19 of the casing sheet 13 by means of bolts or screws 36, a flaring central tube 37 disposed coaxially of the opening 29 and fan 15, and a series of radial vanes 38 connecting the outer ring with the tube 37 so as to prevent excessive swirling of the heated air delivered from the unit. While the diffuser 18 is shown as being formed of one piece of cast metal, it may be built up of sheet metal and the vanes 38 may be made adjustable.

While the diffuser 18 and the mode of suspension, is suitable for cooperation with most vertically disposed unit heaters of the improved type, it may also be desirable to suspend the unit from above with its axis horizontal, and to provide for changing the direction of the stream of heated air delivered from the unit heater. In such cases a suspension rig and diffuser such as shown in Figs. 5 and 6 may be provided, and the unit heater assembly remains unaltered except for these two parts.

The substitute suspension rig of Figs. 5 and 6 consists of a pair of through bolts 40 coacting with the ears 34 formed on the side plates 12, 13, and a U-shaped clamping member 41 embracing each of the bolts 40 and being adjustably attached to the lower ends of the adjacent suspension rods 42 by means of clamping bolts 43. As shown, the unit heater is suspended with its central axis horizontally disposed, but by releasing the bolts 43, this unit may be tilted in either direction so that its central axis will assume an oblique angle or even a vertical position. The bolts 43 may subsequently be tightened to firmly retain the heating unit in the desired position of adjustment.

The substitute diffuser 44 of Figs. 5 and 6 consists of an outer ring adapted for attachment to the tubular portion 19 of the casing plate or sheet 13 by means of the screws 36 and having a series of vanes or louvers 45 pivotally suspended therein by means of friction pins 46. The louvers 45 may be independently adjusted to any desired position so as to direct the warm air in the desired direction, and also serve as vortex breakers or diffusers for the hot air stream leaving the heater.

During normal operation of the improved unit heater assemblage, the annular chambers 9 of the finned coils 8 should be constantly supplied

with heating medium through the inlet pipe 23, and the spent heating fluid will be discharged through the exhaust pipe 24, and while the direction of flow of the heating medium may be reversed, the inlet should preferably be located well above the outlet so as to insure proper drainage. The motor 16 should be operated to rotate the fan 15, and this fan will normally be operating to cause fresh air to flow inwardly between the fins 10, 11 and to thereby become heated by virtue of its contact with the heated fins. The direction of flow of the heated air will be changed from radial to axial by the conical casing portion 17, and the axially advancing stream of warm air will then pass through the fan 15 and will be discharged at relatively high velocity from the duct 33 and through the diffuser. The axially advancing stream of air will also draw a limited quantity of fresh air through the depression 17 and central opening 29, and will thereby constantly ventilate the motor 16, and the diffuser will break up the vortex or swirling motion and will effect uniform distribution of the heated air. In this manner, the improved unit heater will continuously and effectively heat the air stream, and will deliver a uniformly heated flow of air to the space which is to be heated.

The improved unit is extremely simple and compact in construction and flexible in its adaptations, by virtue of the fact that either pipe 23, 24 may be used as an inlet for heating medium, the direction of flow of the air stream may be reversed either by reversing the motor or the fan, the diffusers 18, 44 may be interchanged, and the overhead suspensions may be interchanged. While the suspension rig of Figs. 1 and 2 is simple and suitable for vertical suspension of the unit, the rig of Figs. 5 and 6 will permit varied disposition of the heater; and the formation and disposition of the radiating fins 10, 11 improves the efficiency by minimizing the air entrance losses and shock, and also prevents overheating of the motor 16 when the unit is idle.

From the foregoing detailed description it will be apparent that my present invention provides a highly useful unit heater which is simple, durable, and compact in construction, and which is moreover efficient in operation and very flexible in its adaptations. While the assemblage is especially adapted for heating air, it may also be advantageously used for cooling purposes, and the circular or annular heat transfer coils can be readily manufactured and assembled in groups of any desired number. The formation and disposition of the radiating fins on the sections or coils 8, not only augments the operating efficiency,

but also facilitates construction and assembly of the improved unit heaters, and the fan 15 and its driving motor are both amply protected against damage by impact and heat. The improved heater assemblage obviously occupies very little space, has no unsightly projections, can be conveniently suspended from above and in any angular position, and can be manufactured and sold at moderate cost.

It should be understood that it is not desired to limit this invention to the exact details of construction or to the precise mode of operation, herein shown and described, for various modifications within the scope of the appended claims, may occur to persons skilled in the art.

I claim:

1. In combination, several similar annular coils concentrically stacked and each having diametrically opposite bosses coacting with corresponding bosses of the adjacent sections and all provided with alined threaded openings, hollow nipples rigidly connecting said coils at said openings, inlet and exhaust pipes connected to said coils at some of said openings, a casing coacting with said coils to provide an air passage therethrough, and attaching means for said casing providing closures for some of said threaded openings.

2. In combination, several similar coils each having alined bosses on the opposite sides thereof provided with threaded openings, hollow nipples connecting the adjoining openings of the adjacent coils, pipe plugs closing other of said openings, a casing coacting with said coils to provide an air passage surrounding the latter, and attaching means for said casing secured to some of said plugs.

3. In combination, several similar concentric annular coils each having alined bosses on the opposite sides thereof provided with threaded openings, hollow nipples connecting the adjoining openings of the adjacent coils, a casing coacting with said coils to provide an air passage within which said coils are disposed, and common means for attaching said casing to said coils and for sealing some of said threaded openings.

4. In combination, several similar concentric annular coils each having alined bosses on the opposite sides thereof provided with threaded openings, hollow nipples connecting the adjoining openings of the adjacent coils, a casing coacting with said coils to provide an air passage within which said coils are disposed, and pipe plugs closing some of said openings and having said casing detachably secured thereto.

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