April 11, 1944. C. M. ASHLEY ET AL 2,346,410

UNIT HEATER

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FIG. 1.

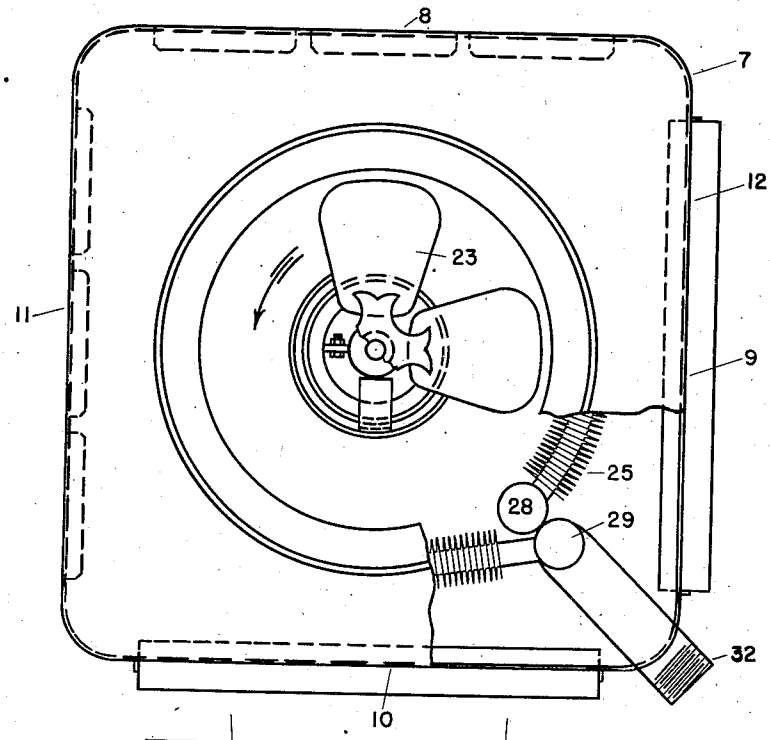
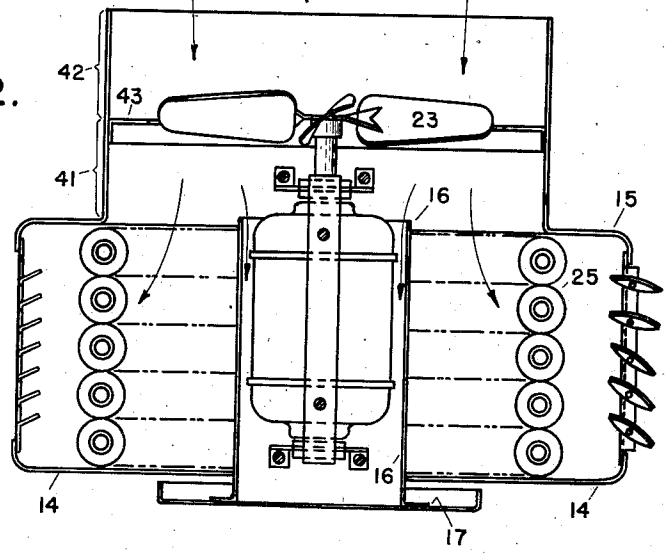



FIG. 2.




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FIG. 3.

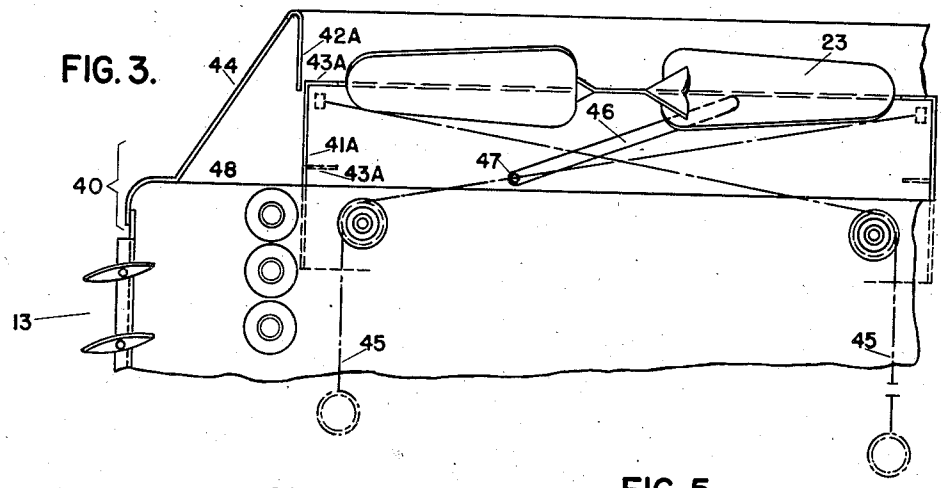



FIG. 4.

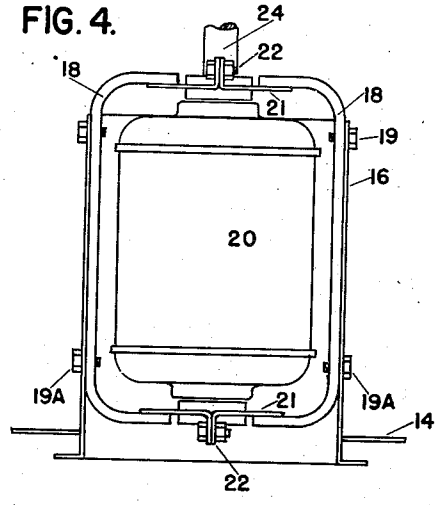
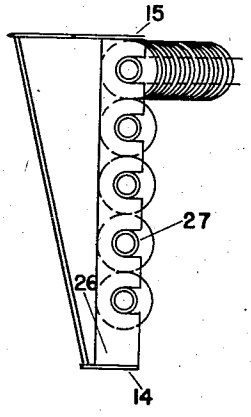



FIG. 5.



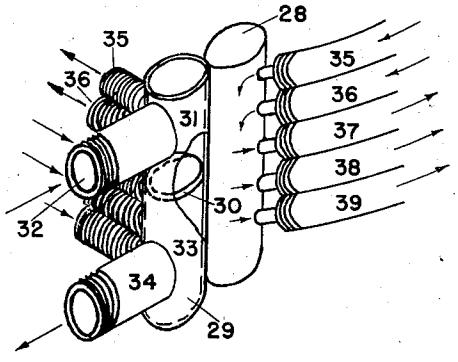




FIG. 6.

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Patented Apr. 11, 1944 2,346,410

# UNITED STATES PATENT OFFICE

2,346,410

## UNIT HEATER

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Application August 21, 1941, Serial No. 407,820

4 Claims. (Cl. 257—137)

This invention relates to air handling units and more particularly to unit heaters having vertically mounted fans adapted to blow air through tempering coils for discharge in desired volume in one or more directions.

The principal objects and features are:

(*a*) The provision of a "blow-through" unit, with the fan handling untempered or relatively cool air, thus enabling more pounds of air per unit of time per horse power to be propelled than in existing units where the air is tempered before being drawn into the fan.

(*b*) The use of a "blow-through" arrangement whereby a considerable amount of turbulence is created at the tempering coil thus increasing heat transfer.

(*c*) The use of a round or curved coil within a square or other multi-sided surrounding casing, with the space between the coil and casing serving as a plenum area, so that if one or more outlets in the sides of the casing are closed off, the total coil area will still be substantially effectively employed to temper the air discharged through the open outlets.

(*d*) The use of removable sides in the casing which may accommodate confining panels or directional type outlets or scoop type outlets to provide means for discharging varying volumes of air at desired velocities adjustably directed, as may be required in different areas or under different conditions.

(*e*) The use of a novel mounting arrangement for a motor and fan assembly positioned within and surrounded by the coil, said arrangement including a cylindrical shield for protecting the motor from the coil and for providing an air passage through which cool air is blown for cooling the motor when the fan operates, and through which a stack effect is produced to cause a circulation of air for cooling the motor when the fan is inoperative.

(*f*) The provision of a novel method of supporting a motor assembly by the use of a notched sleeve, whereby the motor assembly is secured to the sleeve by removable means fitted within the notches, the motor being adapted to be placed in position through the top or bottom of the sleeve, both ends of the sleeve being open, the sleeve being supported by a simple bottom pan.

(*g*) The use of a spiral coil if desired; or, preferably a series of coils in parallel whereby the tempering medium, (hot water for example) may be circulated at high velocity, the use of a plurality of passes enabling uniform temperatures to be obtained throughout the coil, because air binding of a portion thereof is eliminated.

(*h*) The use of a novel spacing arrangement for positioning accurately and uniformly the tubes making up the coil, whereby they fit snugly within a series of notches spaced one above the other in a fixed mounting bracket.

(*i*) The use of a pair of headers positioned one behind the other in the direction of air flow instead of one alongside the other, whereby substantially the same amount of coil surface is presented to all the air blown through the unit except for the width of one of the headers (or less) at their point of positioning.

(*j*) The use of a partition in one of two headers whereby the tempering medium will flow in one direction through a series of passes and in the opposite direction through the remaining passes, the supply and return connections being made on the same header, this assuring equal tempering of air regardless of the points of contact of any portion of the air stream in its passage through the passes comprising the coil.

(*k*) The use of a ring in combination with the fan whereby the ring may be lowered to cut off part of the coil surface and at the same time enable part of the air to recirculate to the fan inlet and part to bypass around the coil, so that there will result a decreased volume of air at a decreased velocity discharged from the unit at a decreased temperature (assuming the coil is used for heating) and at a reduced power cost.

These and other features will be apparent from the following detailed description of the invention to be read in connection with the accompanying drawings in which

Fig. 1 diagrammatically illustrates, in fragmentary form, a plan view of a vertical unit showing applicant's arrangement of parts;

Fig. 2 diagrammatically illustrates in section the structure of Fig. 1;

Fig. 3 diagrammatically illustrates the bypassing arrangement adapted to be applied to the unit of Figs. 1 and 2;

Fig. 4 shows the manner of motor mounting and the sleeve shield arrangement for segregating the motor from the surrounding coil;

Fig. 5 illustrates the method of supporting the coils used in the unit, and;

Fig. 6 illustrates diagrammatically, in fragmentary form, the header and steam or other tempering fluid distribution arrangement.

Considering the drawings, similar designations referring to similar parts, numeral 7 designates a unit heater casing generally square in conforma-

tion, having sides 8, 9, 10, and 11. The casing is provided with rounded corners, as shown, and may be finished as desired, to provide a pleasing appearance. Each of the sides is provided with a plurality of openings 12, which may be equipped with outlets 13. Although the outlets 13 are shown provided with horizontal louvres, it is apparent that a combination of horizontal and vertical louvres may be employed at each opening 12, in order to control the direction of discharge from the opening. The louvres are adjustable and if desired, may be completely closed. Also, although the unit is shown with openings in all four sides of the casing, the coil arrangement within the casing is designed to function efficiently if it should be desired to provide openings only in some of the sides and have the remaining sides equipped with solid partitions.

The sides of the casing are positioned within bottom member 14 and top member 15. Cylindrical sleeve or shield member 16 is suitably secured to bottom member 14 which may be flat or which may have recessed annular portion 17. Motor brackets 18 are secured to clamping members 21 which are drawn as by confining bolts and nuts 22 about resilient mounting collars surrounding the shaft of motor 20. The brackets 18 have bolts 19 projecting therethrough and adapted to be slid and rest within notches or recesses at the upper edge of member 16. Additional bolts 19a may be provided to secure together the brackets and member 16 at other points. Fan 23 is mounted upon vertical shaft 24 extending upwardly from the motor.

The coils 25 are held at a plurality of support points by mounting brackets 26. These brackets extend between top and bottom casing members 14 and 15 and comprise metal hangers having a series of recesses 27 within which the tubes of the coils may snugly be positioned. The recesses are uniformly spaced so that when the tubes repose therein, each of the passes of the coil will be spaced precisely in position and at the same time be securely held in place.

The coils are preferably substantially circular, as shown in Figs. 1 and 2, and a minimum of space is utilized for positioning of headers 28 and 29, since these are placed one behind the other, as shown in Fig. 1, so that in effect no more useful space is utilized for positioning the two headers than that required for positioning one of them. The coils are provided with extended surfaces to promote rapid dissipation of heat. These extended surfaces may be in the form of plate fins or may be spirally wound fins attached to the coils.

Header 29 has an internal partition 30. Steam or other heating fluid is delivered to portion 31 of header 29 through inlet line 32, and leaves from portion 33 of the header through discharge line 34. As is indicated by the arrows in Fig. 6, steam, or other fluid, enters portion 31 of the header then flows through passes 35 and 36 to header 28 where it enters passes 37, 38, 39, flowing in the opposite direction back to header 29 where it enters portion 33 and then leaves through line 34.

Steam or other fluid lines may readily be connected to lines 32 and 34 in the usual manner, and with the power lines constitute the only connections required for the unit.

Bypassing arrangement 40 is generally illustrated in Fig. 3 which is a modification of the structure of Fig. 2. In Fig. 2 a collar 41, integral with or attached to top casing member 15 surrounds fan 23 and has an extension 42 extending above the center line of the fan blades to a desired distance. A confining ring 43 leaves a slight clearance between itself and the blades of the fan. While the arrangement in Fig. 2 shows collar 41 as stationary, the modified arrangement of Fig. 3 illustrates how a bypass may be incorporated with the collar 41*a*, in this instance, being movable. The ring 43*a* is integral with collar 41*a* and moves with it. Annular surrounding housing 44 has an extension 42*a* which corresponds to 42 of Fig. 2. When collar 41*a* is in solid line position, the action will be the same as in Fig. 2. However, if lowering device 45 is actuated to move the collar downwardly to the dotted line position because of the movement of the slot 46 with respect to pin 47, then a space will be opened up below extension 42*a* to the lowered position of 43*a*, and part of the coils will be blanked off by 41*a* in its lowered position. As a result, the suction above fan 23 will cause part of the air discharged from the fan to be short-circuited in a path from the fan discharge, through the space between extension 42*a* and lowered ring 43*a*, through the space between the fan blades and extension 42*a* and back to the fan intake. Another part of the air will go through the reduced effective coil surface not blanked off by ring 43*a*; and the remainder of the air will bypass the coils by going through passage 48 directly to the outlets 13. With the bypass passage open, the heated and by-passed air will be mixed and the resultant temperature of the mixture will be less than the temperature of the heated air alone. The reverse will be true when the coils are used for cooling. The velocity and volume of the mixture will be less than if the bypass were closed and the power consumption reduced due to the short-circuiting of a portion of the air.

Since many changes may be made in the invention without departing from its scope, it is intended that all matter set forth in the above description or shown in the accompanying drawings be regarded as illustrative and not in a limiting sense.

We claim:

1. A unit of the character described including an outer casing, a coil positioned within the casing, a fan for delivering air to and in contact with the coil for discharge from the casing, a first header for delivering conditioning medium to the coil, a second header for discharging conditioning medium from the coil, said headers being positioned substantially one behind the other with respect to the center of the unit whereby substantially the same amount of coil surface is exposed to the passage of air through all parts of the unit except for the width of one of said headers at a point in the unit.

2. A unit heater of the character described comprising an outer casing substantially square in form, outlets in the casing, a coil substantially round in conformation positioned within and spaced from the sides of said casing, said casing substantially completely surrounding said coil, a motor assembly positioned within and substantially surrounded by the coil, a shield surrounding said motor to form a barrier between the motor and the coil and a passage for the flow of air over the motor, a fan mounted on the shaft of the motor, said fan being formed to draw air from above the unit and discharge it through and in contact with said coil and into the area between the coil and the surrounding casing, said area

forming a plenum in which an outward pressure is built up so that the total coil area is effectively employed for heat exchange between the coil and the air passing therethrough regardless of the extent to which the outlets are opened.

3. A unit according to claim 2 including a stationary collar positioned above the casing and substantially surrounding said fan, said fan being of the propeller type, said stationary collar having an annular portion spaced from the periphery of the outermost course of rotation of the fan and extending upwardly from the center line of the blades of the fan, a movable collar positioned above the casing, means for moving said movable collar from a position where it contacts said annular portion to a position where it slides within and adjacent to a desired portion of the coil leaving a space between the top of the movable collar and said annular portion, and a flanged portion at the top of the movable collar for confining the fan within an opening substantially the same as the diameter of the fan when said stationary and movable collars are in contact with each other.

4. A unit according to claim 2 including a stationary collar positioned above the coils, said collar having an annular portion, said fan being of a propeller type positioned to rotate in a plane adjacent the lower edge of and within said annular portion, a movable collar positioned above the coils and having an annular portion substantially in contact with the lower edge of the annular portion of the stationary collar, a flange on the movable collar for confining the blades of said fan, and means for moving the movable collar away from the stationary collar for causing some of the air delivered by the fan to be recirculated to the intake side of the fan, a second portion to bypass the coil and a third portion to pass through and in contact with a desired portion of the coil.

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