

Sept. 30, 1941.

W. LINTERN

2,257,342

HEATING AND AIR CIRCULATING UNIT

Filed Nov. 28, 1938

2 Sheets-Sheet 1

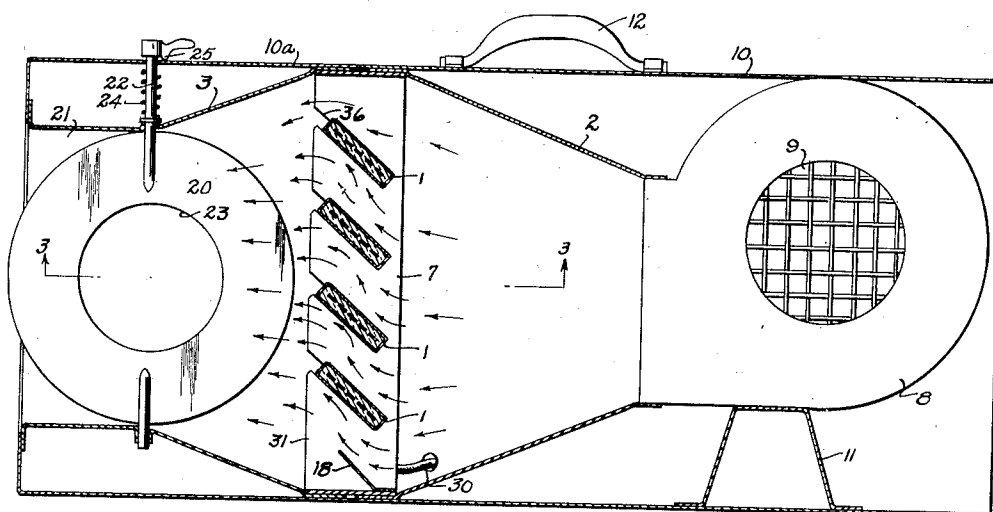


Fig. 1

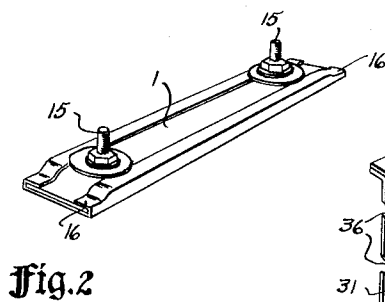


Fig. 2

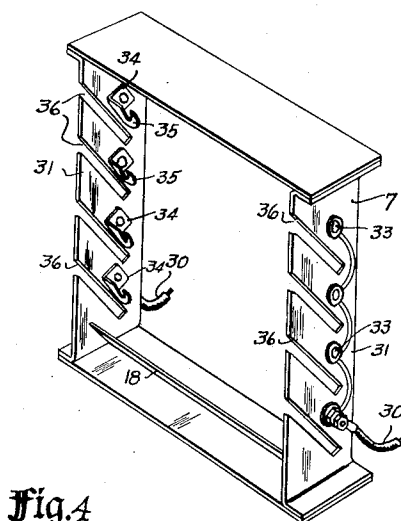


Fig. 4

INVENTOR.
WILLIAM LINTERN

BY

John H. Lawrence
ATTORNEY.

Sept. 30, 1941.

W. LINTERN

2,257,342

HEATING AND AIR CIRCULATING UNIT

Filed Nov. 28, 1938

2 Sheets-Sheet 2

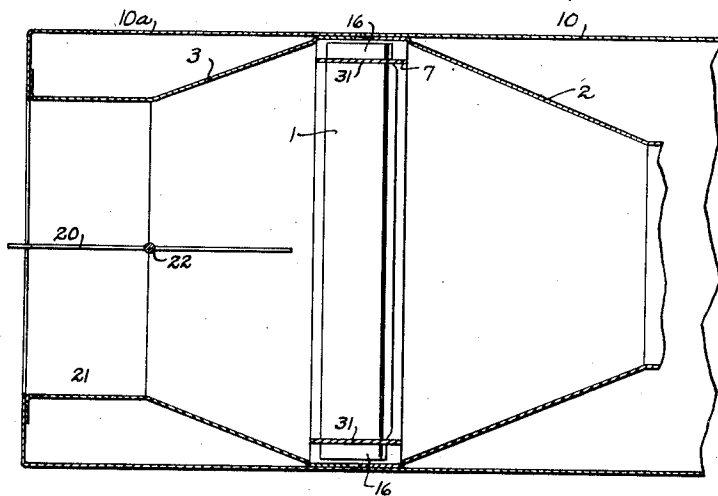


Fig. 3

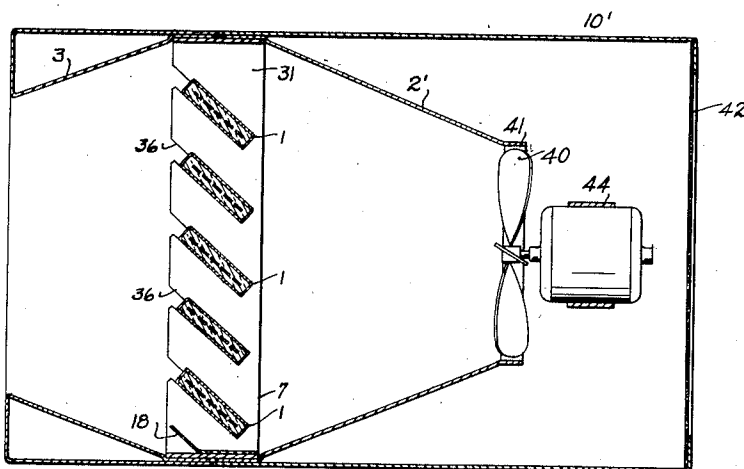


Fig. 5

INVENTOR.
WILLIAM LINTERN

BY

John H. Bennett,
his ATTORNEY.

UNITED STATES PATENT OFFICE

2,257,342

HEATING AND AIR CIRCULATING UNIT

William Lintern, Cleveland, Ohio

Application November 28, 1938, Serial No. 242,647

6 Claims. (Cl. 219—39)

This invention relates to an electrically operable air-tempering unit useful, for example, in isolated spaces in factory buildings, homes, and the like, and to an economical portable unit which can be used effectively for both heating and cooling.

An object is to provide a heater and air circulating unit in which a known type of electrical resistance heating element in the form of an elongated strip is used to greater advantage than heretofore, and with a maximum of safety, as well as in a manner which will tend to prolong the life of the individual strips although used at maximum capacity in respect to current input.

Another object is to provide an electrically operable air heating and circulating apparatus in which maximum flexibility of control is possible so as to obtain the desired degrees of heat and/or volumes of air for a variety of specific uses.

Further objects include the provision of an improved manner of mounting a plurality of so-called "strip" heating elements and supplying current thereto such as will enable exposure of all surfaces of the elements uniformly to air supplied to them as a forced stream, and in a manner that will offer a minimum of impedance to the air of such forced streams.

Other objects and features of the invention and the principal advantages of the constructions herein shown will become apparent from the following description relating to the accompanying drawings showing exemplary forms. The essential characteristics are summarized in the claims.

Referring briefly to the drawings, Fig. 1 is a longitudinal sectional view through a portable unit of one form embodying the invention. Fig. 2 is a perspective view of a conventional strip heater of one form. Fig. 3 is a fragmentary sectional plan view taken substantially along the line 3—3 on Fig. 1. Fig. 4 is a perspective view of a suitable mounting device for strip heaters for use in a unit such as shown herein, and Fig. 5 is a view similar to Fig. 1 and showing a modified form of apparatus.

The type of strip-heater element shown herein is well known; see, for instance, U. S. Patent 1,614,330. Such elements are marketed with alloy conductor cores or filaments embedded in highly compacted refractory material, and covered by a relatively heavy metal sheath of generally rectangular elongated section. These elements can be obtained in a variety of sizes and capacities. A characteristic of the alloy

used for the filament is that the amount of heat obtainable from an element of a given capacity at rated voltage is predetermined, and the current such element consumes does not vary with the manner of use of the heat, whether effectively or ineffectively. The present invention is concerned in part with utilizing to best advantage, all the heat available from a battery of such strip elements and with the distribution of such heat at maximum efficiency.

The invention is further concerned with making certain that all areas of the strips will be subjected substantially uniformly to moving air used as the distributing medium for the heat, so that no part of any one of the elements will be subjected to overheating (hot spots). The above objectives can be attained in a relatively inexpensive way while using standard strip heating elements now available.

In the matter of variation of the intensity of heat of the distributing medium, I have found that this can be accomplished with almost negligible expense. The preferred air-forcing means is a sirocco blower, and by controlling the volume of air which can be operated upon by the blower (for example, by restricting or enlarging the outlet or inlet to the entire unit), the available heat can be regulated as to intensity without recourse to rheostats, change speed devices, electrical cut-outs for certain of the elements, etc., such as ordinarily used when control of heat intensity is a factor or necessity. The same principle of control could be used with a propeller-type blower, and appropriate modifications made in such event to allow emergency slippage in order to prevent overloading of the motor which drives the fan. Various sizes or models of units in keeping herewith can be made to supply the market with relatively inexpensive space heaters for a wide variety of requirements. So far as I know, no previous proposal or arrangement has utilized strip heaters in providing a simple and efficient space heating unit which can be easily serviced and controlled, and which can be used effectively both for heating and circulating of air for cooling. The present invention affords the above advantages.

Referring further to the drawings, and first to the form shown in Figs. 1 to 4, a suitable casing for the strip heaters, five of which are shown at 1, may comprise a sheet metal duct having members or sections 2 and 3. These members are relatively enlarged at the central portion of the duct, and each may overlap a

hollow frame member 7 which supports the strip heaters 1, and be detachably secured to the frame. The end of the member 2 which is remote from the region of the strip heaters is shown in telescoping relation to the outlet of a sirocco blower of conventional form having a housing 8. The air inlet opening is indicated at 9. The usual squirrel-cage type of blower fan connected to an electrical motor, not shown, is disposed coaxially with the air inlet.

The duct and the blower housing can be supported in an outer housing member of box-like hollow form shown at 10. As illustrated, the blower housing is supported on the bottom wall of the outer housing 10 on a U-shaped bracket 11. The upper wall of the housing 10 may be provided with a handle 12.

The central enlargement of the air duct provided by the members 2 and 3 can extend both vertically and horizontally, as shown by Figs. 1 and 3. The enlargement is only to compensate for the restrictive effect of the heater strips 1 on the column of air passed through the duct. The discharge end of the member 3 may be open to the outside air, or be adapted for connection to pipe of any sort to carry the heated air away from the unit.

As shown in Fig. 1, the heater strips 1, one being more fully illustrated in Fig. 2, are so placed that air from the blower will pass substantially uniformly into contact with all surfaces of the strips exclusive of their end portions which are utilized for attachment to the frame 7.

The strip heaters, as commonly made, are of rectangular section (about $\frac{5}{16}$ " x $1\frac{1}{2}$ ", usual size), and with binding posts for current as at 15 which may be near the two ends of the main heating portion, and with tabs 16 beyond the binding posts for attachment to various supports or members to be heated. The relatively thin edges of the strips are comparatively blunt, and if the strips are placed with their main surfaces parallel to each other, and air blown across the strips from front edge to rear edge, the leading edge in the direction of encountering such air deflects the air upwardly and downwardly so that hot spots occur on the strips. Such parallel placement of the strips would, of course, result in minimum impedance to air passage thereover. If the strips are set vertically and crosswise of the duct, then, of course, the impedance to air passage is greater, even though the strips are staggered and lie in different transverse planes. I have found that when the strips are placed obliquely with reference to the path of air travel through the duct, no hot spots occur, and nevertheless there is very little impedance to air flow. Where the strips extend horizontally across the duct in the manner shown, and the upper and lower ones are fairly close to the top and bottom wall surfaces of the duct, then the strip which is inclined toward the center of the duct from its leading to its trailing edge, in reference to air travel, requires a deflector such as shown at 18, to divert air passed as under the lowermost element 1 against the downwardly exposed face of this element. The other elements act successively as deflectors on elements thereabove. For instance, the lowermost element 1 causes air to be deflected upwardly and against the downwardly exposed face of the element next to the lowermost, as indicated by the arrows on Fig. 1. The relative inclination of the various strips may be reversed so that the leading edges relative to the direction of air travel are above the trailing

edges, in which event the deflector 18 would be positioned at the top of the duct. Also, the strips can be disposed with their largest dimensions vertically.

Assuming proper electrical connections for the elements 1 (in parallel) and the same for the motor of the blower, the concurrent operation of the blower and heating elements will result in the discharge of warmed air from the duct member 3. The member 3 can be removable with an end part 10a of the casing 10, and if it is not desired to localize the heat discharged from the unit, or to vary the intensity of heat of the air discharged, then the members 3 and 10a can be left off for operation.

The discharge end of the member 3 is preferably brought to circular form as at 21, and the outlet passage can be controlled by a suitable damper 20. The damper, as shown in Fig. 3, may comprise a centrally apertured disc on an adjusting shaft 22. The size of the opening 23 in the damper limits the amount of restriction of the discharge outlet by the damper to a safe point. When the damper disc is at right angles to the outlet passage, the heat of the air discharged is more intense, because there is less air per minute flowing over the heater strips. As the damper is opened, more air is discharged, but the amount of heat made available remains the same as before. A position retaining spring 24 may operate through the damper shaft to hold the damper in adjusted positions. As shown, the spring forces a damper adjusting handle on the shaft downwardly toward the upper wall of the casing member 10a, and the latter may have a series of retaining sockets indented therein to receive a projection 25 on the handle. Suitable damper means could be provided at the air inlet end of the unit as across the opening 9 of the blower housing which communicates with the open rear end of the outer casing 10.

Assuming the unit has a series of strip heaters properly proportioned to the intended use as to wattage and size, all these strips can be energized to the fullest extent, that is, with no resistance in the service line leading thereto, and the rate of heating of the space in which the unit operates then governed solely by controlling the supply of air to the strip heaters, and likewise the intensity of heat of the air controlled. When the damper 20, for instance, is operated to restrict the discharge of air, the latter issues with considerable more heat per cubic foot, but there will be less heated air discharged into the space to be heated.

The back pressure on the sirocco blower does not cause this to operate at a disadvantage, since, if the discharge of this type of blower is restricted, the blower merely takes in less air at the inlet. If it is desired to use the unit for cooling, as by circulating air in the space in which the unit operates, then the strip heaters are de-energized and the blower alone is operated.

The strips 1 can be connected with the electrical supply lines, one of which is shown at 30, Fig. 1, and supported in operating position by the arrangement shown particularly in Figs. 1 and 4. The ends of the strips slide into slots 36 in the side frame members 31 of the frame 7. These side members may be spaced from the adjacent walls of the air duct so as to provide room for making electrical attachments as at 33 with metal clips 34 having open-ended slots in thin free end portions 35, which portions lie

parallel to the receiving slots 36 for the strips. When the strips are placed in the slots 36, the terminal posts 15 of the strips are received easily into the open-ended slots of the clip portions 35 to which the posts can then be secured by appropriate binding nuts not shown. This makes it an easy matter to remove a strip that has been burned out and replace it by another strip at any time. The frame 7 can be made of any suitable material and in order to reduce expense in making and insulating the electrical connections, at least the side members 31 of the frame can be made of electrically insulative and heat resisting material such as hard asbestos board.

Any suitable safety device such as thermally operable cut-out switches, can be used in the service line leading to the heating elements and/or the blower motor. Since the motor for the blower is usually positioned at one side of the blower casing, as in line with the inlet opening 9, the duct portion 2 can have its entrance offset horizontally from the center of the unit so that a motor and blower of adequate size can be accommodated in a simple rectangular housing 10 without waste of space.

As shown in Fig. 5, the blower comprises a propeller-type fan 40 operating in a restricted inlet 41 of a duct member 2'. The motor for driving the fan may be suspended on cross members 44 connected to the sides of the outer housing 10', and the rear open end of the housing can be covered by any suitable screen as of wire mesh shown at 42. The heating elements in this type can be arranged and supported as shown in Figs. 1 and 4. The electrical connections to the strips are not shown. When a propeller-type fan is used, it is preferable not to have any damper, because excessive restriction can overload the motor.

I claim:

1. A unit of the class described comprising means forming an air duct which is open at both ends, air forcing means operatively adjacent one end of the duct, a mounting for elongated heater strips which are of elongated, substantially rectangular cross section, said mounting being disposed between the ends of the duct and being constructed and arranged to hold the strips in substantially parallel relation to each other with their longer dimensions transversely of the duct and with their principal planes disposed obliquely to the longitudinal axis of the duct, whereby one side face of each strip is exposed directly to air forced through the duct and the same sides of

some of the strips deflect the air against the opposite faces of other strips.

2. A portable unit of the class described comprising means forming an air duct, motor driven air-forcing means arranged to blow air through the duct, a plurality of sheathed electrical resistance heater strips mounted in a common plane transversely to the axis of the duct and positioned with their principal planes obliquely to the longitudinal axis of the duct and in mutually parallel relationship, the duct being widened materially in the region of said plane so that the passage for air through the duct is as large in cross section in the region of the strips as at any other portion of the duct.

3. A portable heater having a blower and a duct for air moved by the blower, and wherein a plurality of sheathed electrical resistance heater strips of flat elongated cross-section are arranged crosswise of the duct in the same transverse plane, the strips being individually disposed with their principal planes extending obliquely to the duct axis, and uniformly spaced apart distances no greater than the longest transverse cross-sectional dimension of the strips so that the rearward faces of individual strips direct air against the forward faces of respective other strips.

4. A heater having a blower and a duct for air moved by the blower, a series of electrical resistance heater strips disposed intermediate the ends of the blower and in parallel relationship with their principal planes oblique to the longitudinal axis of the duct, the strips being in a common plane extending transversely of the duct so that faces of some of the strips act as deflectors to direct air against relatively opposite faces of other strips, and a deflector member positioned adjacent one of the strips so as to function in the manner of the first mentioned faces of certain of the strips.

5. A heater according to claim 3, wherein the strips have their principal planes disposed at approximately 45° relative to the axis of the duct.

6. A portable heater having a sirocco blower, and an air duct communicating with the outlet of the blower, a plurality of elongated electrical resistance heater strips arranged side by side and extending crosswise of the duct with their principal planes substantially parallel to each other and extending obliquely to the axis of the duct, and means beyond the strips arranged variably to restrict the outlet of the duct.

WILLIAM LINTERN.