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H. E. WALKER

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CONVECTION HEATING APPARATUS

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FIG. 1.

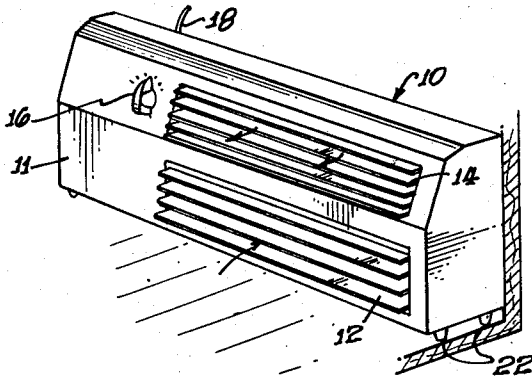


FIG. 5.

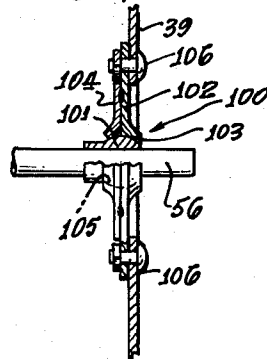


FIG. 2.

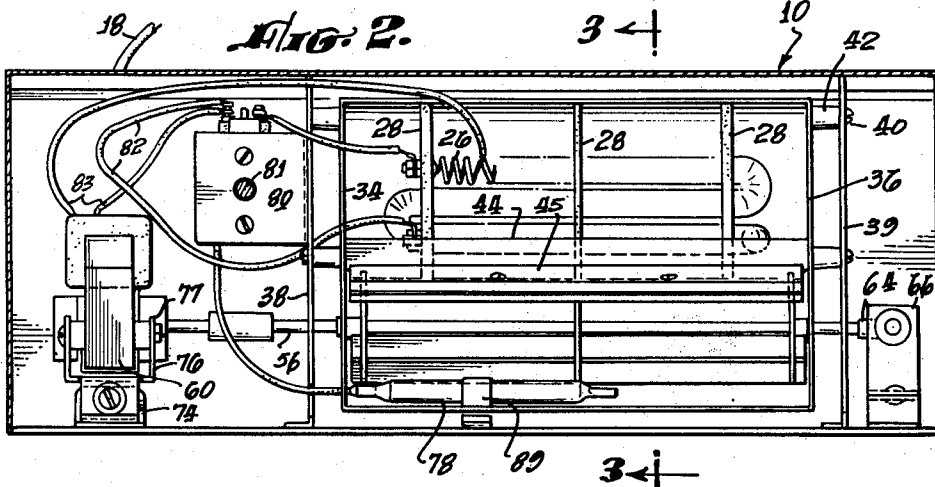


FIG. 3.

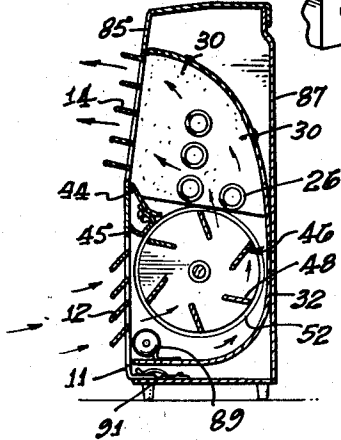
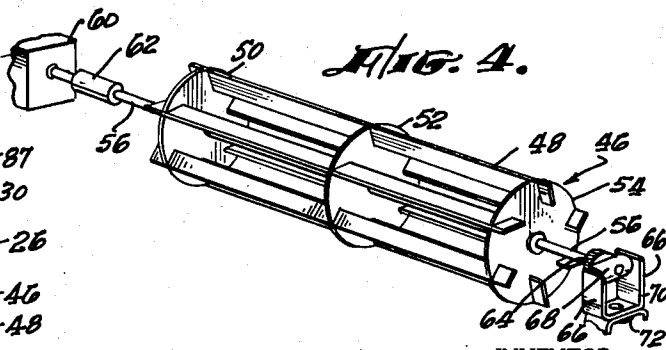


FIG. 4.



INVENTOR.

HENRY E. WALKER,

BY

Nilsson & Robbins
ATTORNEYS.

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CONVECTION HEATING APPARATUS

Henry E. Walker, 17041 Burton St., Van Nuys, Calif.

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5 Claims. (Cl. 219—370)

The present invention relates to a heating apparatus and particularly to an electrically-controlled hot-air heater.

Baseboard heaters to be installed in a wall adjacent the floor are widely employed in homes and business establishments. Often, these units consist simply of an electrical resistance element mounted in a compact low-height or low-profile natural convection housing. In operation, the heating element attains a high temperature and produces considerable heat which passes from the unit by radiation and natural convection. Generally, in order to get the required amount of heat for a given room, and in order to keep the wattage and temperature per lineal foot of baseboard within safe limits requires a great length of baseboard, often more than is available. Such "natural convection" baseboard heaters have an indifferent circulation. That is, the heated air for the most part "drizzles" straight up the walls above the heaters soiling the walls, and increasing radiation losses.

One manner of avoiding these problems in a heater is to alter the principle of operation to forced convection. In such an altered unit, the air is moved over the heating element, then forced into the room or confined space in which the unit is operated. The heated air is directed away from the walls eliminating the soiling of the walls; and by directing the heat into the room, the high radiation losses which occur when the heated air drizzles straight up along the walls as in natural convection heaters are avoided. The forced air picks up the heat from the heating element much more efficiently than do natural convection currents of air. Hence the heating element does not attain as high a temperature for a given wattage. The heating element in an apparatus of this type operates more effectively and at a lower temperature resulting in longer heating element life.

However, a forced-air convection heater would normally be quite expensive to manufacture in view of the cost and usual size of apparatus to move the air over the heating element without vibration or noise. Specifically, such an apparatus would require a blower to move air over substantially the entire heating element, a motor to drive the blower, and mounting fixtures for both of these devices. Additionally, forced-air systems often suffer deleterious vibration and stresses. Therefore, prior forced-air systems have often required a very rigid structure to minimize vibration and noise. Furthermore, some form of apparatus to control or regulate the operation of the motor and the heating element would also be necessary.

In general, an example of the present invention comprises a forced-air convection baseboard type heater wherein air is circulated through a housing over a heating element and exhausted to warm a room or other confined space. The air is circulated over the elongate heating element by an elongate impeller positioned generally parallel to the heating element. The impeller is driven by a motor; and the combination of the motor and the impeller is mounted in a floating arrangement to avoid the necessity of precise alignment during installation and to permit the impeller and motor constantly to accommodate themselves to substantially perfect alignment during operation increasing efficiency and decreasing mechanical vibrations thereby decreasing the noise of operation. The operation of the motor and the heating element is controlled by an electrical thermostat which is placed in the path of air entering the unit from several intake vents

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which may draw air from various locations in the room. The apparatus also incorporates structure tending to balance air pressures developed therein to avoid vibration and noise.

5 An object of the present invention is to provide an improved baseboard heater.

Another object of the present invention is to provide a baseboard heater utilizing an improved method of transferring heat from the heating element to the air thereby making it possible to have a much shorter baseboard heater than heretofore possible with a baseboard heater of the same capacity.

15 Still another object of the present invention is to provide such a forced-air convection heating unit which incorporates temperature-sensitive means to control the operation of the unit.

A further object of the present invention is to provide an improved, substantially, noiseless convection heating apparatus which may be economically manufactured and easily installed.

One further object of the present invention is to provide an economical electrical convection heater wherein an air stream is directed over the entire length of an electrical heating element which is safely shielded.

25 Still one further object of the present invention is to provide an economical convection heater incorporating an elongate blower which moves a stream of air over substantially the entire length of a parallel-mounted heating element, which blower incorporates an advantageous mounting apparatus.

These and other objects of the present invention will become apparent from a consideration of the following, taken in conjunction with the drawings, wherein:

FIG. 1 is a perspective view of an apparatus constructed in accordance with the present invention;

FIG. 2 is a front elevational view of the apparatus of FIG. 1 with the front cover removed;

FIG. 3 is a vertical sectional view taken along line 3—3 of FIG. 2;

FIG. 4 is a perspective view of a portion of the apparatus shown in FIG. 3; and

FIG. 5 is a fractional vertical sectional view of an alternative form of a portion of an apparatus similar to that of FIG. 1.

Referring initially to FIG. 1, the heater is shown in a housing 10 having a front panel 11 containing intake louvers 12 and exhaust louvers 14, which constitute intake and exhaust ports respectively. Of course, various other intake and exhaust structures may be employed. The front panel 11 also supports a control knob 16 to turn the heater on and off and regulates the amount of heat provided through the louvers 14.

The unit is energized through an electrical conductor 18 which may be variously connected to a source of electrical power convenient the operating location of the unit. The unit is normally affixed on the floor adjacent the wall supported by legs 22 formed of heat-insulating material. However, it may also be used as a wall-insert heater or as a portable unit, and moved to various locations as needed.

60 Considering the internal components of the apparatus, reference will now be made to FIG. 2. The heating element 26, in this example, comprises a coiled length of resistance wire which may extend in four lengths across the unit and be supported by fibre insulation boards 28 to form an elongate structure. The boards may comprise asbestos solidified in a binder material or various other heat-resistant insulating materials. The boards 28 are held in position by brads 30 (FIG. 3) received through a duct member 32. The duct member 32 includes end sections 34 and 36 (FIG. 2) by which it is affixed to verti-

cal spaced-apart brackets 38 and 39 with screws 40 carrying spacers 42.

The duct member 32 is formed into a closed air passage by a horizontal vane 44 and a skirt 45 (FIG. 3) which are affixed between the vertical brackets 38 and 39 for peeling air from the periphery of the impeller, see below. Therefore, these elements and the duct member 32 define an air passage between the intake louvers 12 and the exhaust louvers 14.

An elongate rotative impeller 46 (FIG. 4), substantially the length of the heating element 26, is mounted in the air passage defined by the duct 32 so as to be adjacent the intake louvers 12 and parallel to the elongate heating element 26.

The impeller (FIG. 4) includes elongate angularly-offset blades 48 supported in parallel relationship on space-apart disks 50, 52 and 54. The disks 50, 52 and 54 concentrically receive a mounting shaft 56 which is affixed thereto. One end of the shaft 56 is coupled to a motor 60 by a coupling 62 while the other end is journaled into a bearing 64 mounted in a support structure 66. The bearing 64 is supported on a stub shaft 68 which is in turn held in a yoke 70, that is pivotally affixed to a bracket 72. Therefore, the bearing 64 is essentially floating and may be variously aligned to accommodate angular deviations by the shaft 56.

The mounting of the motor 60 is similarly flexible to accommodate the self-alignment of the impeller 46. Specifically, the motor 60 (FIG. 2) is pivotally-mounted on a bracket 74 which supports a yoke 76 carrying the motor in a pivotal mounting 77.

The motor 60 and the resistance element 26 are energized under control of a thermostat 78 and a thermostat control unit 80 which may comprise a potentiometer with a rotative shaft 81 including an on-off switch. The two conductors 82 carried in the electrical cord 18 are joined through a series circuit including the resistance element 26 and the control unit 80. The motor 60 is then connected across a portion of the resistance element 26 by conductors 83. Thus, the current flow through the resistance element 26 is controlled by the control unit 80 in accordance with the temperature sensed by the thermostat 78, and the setting of the shaft 81. The motor 60 is similarly energized, however a reduced potential may be applied to the motor 60 by varying the portion of the resistance element across which the motor is connected. Therefore, the motor 60 need not be highly standardized and an inexpensive motor can be utilized with the proper operating voltage provided simply and easily by selectively connecting the motor across a proper portion of the resistance element 26.

In the assembly of the illustrative embodiment of the invention, the housing may be stamped or otherwise formed of two separate sheet metal members 85 and 87 (FIG. 3) with the louvers formed in the front panel 11. Next, the brackets 38 and 39 (FIG. 2) may be affixed to the back housing member 87 as by spot welding or riveting to provide the support for affixing the duct member 32, the vane 44 and the skirt 45. The impeller and the resistance element may now be placed in parallel position and the impeller connected to the motor 60 and journaled into the bearings 64. It is to be noted, that by reason of the mounting for the motor 60 and the support structure 66, the impeller is self-aligning and precise alignment procedures are avoided.

Next, the control unit 80 may be affixed to the bracket 38 and the thermostat 78 positioned at the intake of the apparatus and supported by a clamp 89. The electrical connections are then made between the control unit 80 and the resistance element 26. Thereafter, the connection of the motor 60 across a portion of the resistance element is made, after determining the best operating voltage for the motor, as by variously contacting the resistance element 26. The front housing member 85 may now be placed on the unit, and fitted into clips 91 (FIG. 3).

In the operation of the heater as disclosed, the impeller 48 forces air over the thermostat 80, then around the heating element 26 to be heated and expelled through the exhaust louvers 14. As the air is forced through the passage by the blade 48, pressure fluctuations tend to build up at the back of the heater between the impeller 46 and the heating element 26 (FIG. 3). Normally, this would tend to extend undesired forces in the apparatus, producing vibration and noise. However, in the present system, a pressure variation is also developed on the skirt 45 which tends to balance the pressure at the back of the heater. As a result, unbalanced pressures do not develop and the apparatus operation is smooth and noiseless.

As air passes through the heater, the thermostat 78 receives it at an average temperature resulting from a combination of air from the several louvers 12. As a result, the control unit 80 operates to regulate the current flow through the resistance element 26 in accordance with the composite temperature sensed by the thermostat 78 and the setting of the rotative shaft 81 of the control unit 80 to which the knob 16 is affixed. In general, this control by the thermostat means is exercised to regulate the temperature in the room or restricted space. However, in addition, the operation of the control unit provides considerable safety in the operation of the heater. For example, if an obstacle, as a window drape, should restrict the air flow through the heater, the temperature therein would rise radically to cut off the electrical current flow through the resistance element 26 and thereby prevent the temperature from becoming adequate to ignite the obstructing article. This safety feature in conjunction with the rather complete shielding provided the resistance element 28, and the lower operating temperature of the resistance element 28, results in a heater which is considerably safer than prior similar devices.

Another important feature of the present invention resides in the manner of mounting the impeller 46 to permit economical assembly and alignment, thereby avoiding expensive construction.

One other important feature of the present invention resides in the parallel-mounted blower and heating elements which enable a structure that is simply and easily installed without removing sections of baseboard, yet capable of effectively converting electrical energy to heat at power rates of up to 1500 watts per lineal foot of heater.

Of course, other forms of various aspects of the present invention include the structure shown in FIG. 5 which discloses a bearing assembly 100 attached to the bracket 39. The bearing assembly includes a ball 101 seated in a half bearing plate 102 fastened to the bracket 39. An opening in the plate 102 receives the other plate 104 which is spot welded to the plate 102. Thus the plates are held in the opening 105 by bolts 106 to provide a flexible self aligning support for the shaft.

It should be noted that although particular embodiments of the invention herein described are fully capable of providing the features and achieving the objects set forth, such embodiments are merely illustrative and this invention is not to be limited to the details of construction illustrated and described herein, except as defined by the appended claims.

What is claimed is:

1. A baseboard type circulating air heater to be operated from a source of electrical power comprising: an elongate housing defining an air passage having air inlet and air outlet means; an elongate electrical resistance heating element positioned in said air passage; thermostat means for providing electrical control of said heating element, said element being connected with said thermostat means and adapted to be connected to said source of electrical power whereby said thermostat means controls the power received by said heating element; an elongate impeller positioned in said air passage parallel to said heating element and for forcing air through said passage; a motor rigidly affixed to said impeller and being

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electrically connected to said heating element whereby said motor is energized in coincidence with said heating element; and angularly flexible motor mounting means for supporting said motor in said housing.

2. Apparatus according to claim 1 wherein said motor is connected across a portion of said heating element whereby to be energized by a voltage reduced from the voltage of said power source.

3. A horizontally elongated, low-profile, forced air, electrical space heater comprising: an elongated thin-wall heater housing having a frontal face portion, and a horizontal length which is long compared to its height and horizontal depth; continuous air passage means in said housing including elongated intake and exhaust ports disposed in said frontal face portion for taking in and exhausting air of said space in generally the same direction, said ports being separated by not more than a few inches; an electric motor-impeller unitary assembly horizontally mounted in said air passage means, said motor-impeller assembly including a motor, an elongated rotary impeller fixedly connected at one end to said motor and having an axis of rotation, a pivotal, self aligning bearing means for rotatably supporting the other end of said impeller, and self aligning pivotal means for pivotally supporting said motor; and an electric heating means having an elongate configuration and being supported in said air passage means substantially parallel to said axis, said heating means being characterized in that it is capable of dissipating not less than approximately one thousand watts per lineal foot of said configuration.

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4. The invention according to claim 3 in which said impeller includes: approximately six elongated impelling blades each disposed parallel to said axis and each being disposed substantially in a plane which is angularly offset from radial; and a plurality of light-weight, spaced-apart supporting disks connected to said blades in a supporting relationship.

5. The invention according to claim 3 in which said air passage means includes a horizontally elongated, vertically short exhaust duct interconnecting said impeller and said exhaust port within which are disposed said elongate heating means, said duct including a rear radiation reflective wall and a forward air peeling skirt having an elongate edge disposed contiguously along the length of said impeller.

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