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(54) IMPROVEMENTS IN OR RELATING TO A BLOWING ELECTRIC RADIATOR

(71) We, CALOR, a Body Corporate organized under the laws of France, of Place Ambroise-Courtois, Lyon 8° (Rhône) France, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The present invention relates to a blowing electric radiator of the forced-convection type.

Up to the present, most of the blowing electric radiators worked by directing pulsed air directly onto heating resistors.

The invention concerns a blowing electric radiator, the structure of which is such that the air is not blown directly onto a heating resistor element, but is intimately mixed with the hot air produced in proximity to the resistor element proper.

The present invention provides an electric blowing radiator of the forced-convection type including a rectangular housing supporting a reflector assembly therein and provided with a grille for the escape of hot air, the reflector assembly forming a partition separating the space in the housing into a front section opening towards the front grille and including a heating resistor unit, and a rear section closed by the back wall, the two side walls, and the top and bottom wall of said housing, a blowing device in the rear section enabling external cool air to be sucked in through openings in the housing back wall and to be directed into the front section through slots provided in the upper portion of the reflector assembly, the reflector assembly being a channel-shaped member having one flat vertical wall forming the partition and two lateral flanges extending therefrom and being constituted by resilient laminae integral with said flat wall and adapted to support the heating resistor unit therebetween.

The path followed by the air flow in the radiator housing is thus readily understood: the cool air is blown from the base of the housing up to its top where it is guided through

slots provided in the upper portion of the reflector, in order to be stirred with the hot air resulting from the heating unit in the front portion of the apparatus. The cool air and the hot air thus stirred constitute a homogeneous mixture which escapes through the grille and especially through the upper portion of the apparatus.

The resistor element may be a tape or strip having very low thermal inertia mounted in staggered arrangement on the insulating support members on either side of the lateral flanges of the channel-shaped reflector.

The heating tape thus mounted in the reflector is constantly maintained at a suitable mechanical tension, without however undergoing permanent elongation. Moreover, the heating of this tape associated with the reflector enables good heating to be obtained by way of radiation on the front portion of the radiator.

A particular embodiment of the invention will now be described by way of example with reference to the accompanying drawings, showing an exploded perspective view of a blowing electric radiator within the invention, wherein

Fig. 1 shows part of the housing, the blowing unit and thermostat,

Fig. 2 shows the reflector unit, and

Fig. 3 shows the grille, of the radiator.

The radiator illustrated in the drawing includes a rectangular case or housing 10 made for instance from painted and ornamented sheet-metal; a blowing unit 20 and a reflector assembly 30 mounted, as will be described subsequently, in the housing 10; a front grille 50 secured to the walls of the housing 10; and a thermostatic unit 60 with a safety device controlled by means of a control knob 61 also mounted in the housing 10.

The housing 10 has a rear or back wall 1, upper wall 2, a lower wall 5, two side walls 3 and 4, and a front wall 6. As clearly shown, the grille 50 partially completes the upper wall 2 and the front wall 6 by being

secured to them. A handle 7 enables the housing 10 to be moved and is secured to the back wall 1. The various walls of the housing 10 are assembled in a suitable manner, for instance by means of attachments or lugs 8. Legs 9, made for instance from rubber, are secured to the base of the side walls 3 and 4 and impart good stability to the radiator. Lastly, a supply cord 10a and a terminal member 11 for the electric circuit of the apparatus are provided in the lower portion of the housing 10 and are for instance mounted on the lower wall 5. It should be noted that both side walls 3 and 4 are preferably made from suitable plastics material.

A blowing unit 20 is also mounted on the lower wall 5 by means of tongues 21 provided respectively with outer catches 22 and engaging into apertures 12 provided in the said lower wall 5. A metal lug 23 screwed to the lower wall 5 firmly maintains the blowing unit 20 in the housing 10. The blowing unit has two walls 24 and 25 forming, as it were, a guiding passageway for the air flow produced by a centrifugal impeller 26, of a type known *per se*, actuated by a motor 27, for instance of the single-phase asynchronous type provided with phase shift rings. The wall 24 is provided with a series of deflectors 28 enabling the air flow proceeding from the opening 29 to be driven towards the upper portion of the housing 10. Orifices 13 through which the external air is sucked form a substantially circular pattern located opposite the impeller 26 in the rear wall 1 of the housing 10.

The air flow is channeled in a rear section of the housing 10, which section is constituted essentially by the side walls 3 and 4, the rear wall 1 and a flat vertical wall 31 of a reflector assembly 30 mounted in the case 10. More specifically, the channel-shaped reflector 30 is mounted by its two portions 32 and 33 forming flanges respectively on the front wall 6 and the upper wall 2 of the case 10. To this end, the front wall 6 of the case 10 may be provided with lugs 14 penetrating into apertures 34 of the flange 32 and enabling the reflector 30 to be suitably positioned before being screwed onto the front wall 6 and the upper wall 2. It thus clearly appears that the reflector 30 is fitted in the case 10, while the blowing unit 20 is housed in the space comprised between the vertical wall 31 of the reflector and the rear wall 1 of the case 10.

The upper portion of the vertical wall 31 of the reflector 30 is provided with vent slots 35 provided respectively with ribs, strips or the like 36 enabling the cool air emanating from the blowing unit 20 to penetrate the vents. As shown clearly in the Fig. 2 of the drawing illustrating the reflector assembly 30, the latter is substantially channel-shaped the two lateral flanges 37 and 38 of which are com-

posed respectively of a series of resilient laminae 37a and 38a which are integral with the vertical wall 31. The resilient laminae 37a and 38a are each provided with an insulating support member 39. The insulating support members which in this embodiment are substantially identical and are made from a fire-proof material, have substantially the shape of a triangle, the apex of which is secured in the said resilient laminae by means of a clip 40 and the base of which is provided with a groove 41 in which may be retained, loop-wise, a heating resistor tape 42. As appears clearly from the drawing, the tape 42 is mounted in staggered arrangement on either side of the walls 37 and 38 of the reflector 30, through the medium of the insulating support members 39. The resistor tape 42 is of a type having very low thermal inertia and therefore reaches its maximum temperature very soon after the apparatus is switched on. The two ends 43 and 44 of the tape 42 are respectively mounted, for example by welding, on terminals 43a and 44a which pass through suitable insulators 43b and 44b thus enabling connection to the electric supply circuit.

A certain number of rotatable points appear from the structure of the reflector 30 just described: the structure of the reflector enables each strand of the resistor tape to acquire a tension which is independent from that of the other strands. Moreover, the temperature reached by the resistor tape being of the order of 800° C, the resilience of the laminae of the walls 37 and 38 enable the various strands to expand, while at the same time ensuring a suitable mechanical tension of the tape. Otherwise stated, this mechanical tension remains strong enough to prevent the tape strands from coming into contact with one another, either naturally or under the action of external impacts or vibrations. On the other hand, this mechanical tension remains weak enough to avoid permanent elongation of the resistor tape 42, it being understood that the said tape must return to its initial length when the current ceases to flow therethrough and the tape cools. It therefore appears that the structure of the reflector 30 is particularly advantageous in that it imparts permanently to the resistor tape 42 a suitable mechanical tension while at the same time making allowance for its resiliency, thus ensuring excellent life. Lastly, the mechanical properties of the alloy used to make the reflector, as well as the reflecting properties of its surface, are particularly adapted to meet the requirements of its function.

As described previously, a grille 50 for the discharge of the hot air completes the external structure of the case 10. The grille 50, as shown in Fig. 3 is preferably constituted by two separate elements 51 and 52 respectively screwed to the walls 2 and 6 of the case 10, for instance by means of

lugs 51a corresponding to orifices 2a of the wall 2. The grille 50 may be made for instance from stamped and formed aluminium alloy, and the substantially reversed and slightly inclined L-shape of the ribs, strips, bars or slats constituting the grille is particularly advantageous as it enables an effective discharge of the hot air circulating in the apparatus while at the same time ensuring effective protection against direct radiation from the heating tape onto the portion of the ground situated right in front of the radiator.

The control and regulation of the heating of the radiator is ensured by a thermostatic unit 60 mounted in the case 10 and, more specifically, secured to the upper wall 2 of the case: as appears from the drawings, the fastening and anchoring lugs 62 and 63 correspond respectively to the orifices 15 and 16 of the upper wall 2 of the case 10, while the actuating spindle or pin 64 of the thermostatic unit 60 passes through the opening 17 of the upper wall 2 to receive at its end a graduated actuating knob 61.

The thermostatic unit 60 is mounted on an insulating plate 65 which is itself supported by a mounting plate or the like 66 made for instance from metal, the aforesaid fastening and anchoring lugs, respectively 62 and 63, being integral with the mounting plate 66. This unit comprises a thermostatic assembly with blade contacts, of a type known *per se*, a safety device for the apparatus in case of tipping or turning upside down, and supply means for a signal lamp made up as follows:—

a) the thermostatic assembly is constituted by an upper contact 87, a lower contact 67 and a bimetallic element 68, all of which are mounted on an insulator fast with the metal plate 66. The bimetallic element 68 is adapted to actuate the upper contact 87 by acting upon an insulating stud 69 fast with the contact 87. Furthermore, the spindle 64, which is advantageously provided with a spring 70 for taking up play in order to ensure its positioning in the plate 65, is prolonged by an insulating stud 71 passing through the upper contact 87 and abutting against the lower contact 67. Of course, by unscrewing or unscrewing the regulating pin or screw 64, the lower contact 67 is made to move towards or away from the upper contact 87.

b) The safety device for the apparatus in case of accidental forward or backward tipping or turning upside down is an inertia-block 72 mounted freely and hinged at 73 on the metal plate 66. The inertia-block 72 comprises a metal core 74 on which is slipped, shrunk or moulded an insulating portion 75, made for instance from plastics, which insulating portion comprises at its end two cams

76 adapted to come into abutment against the upper contact 87 during the rotation of the inertia-block 72. In case the apparatus should accidentally fall down, the inertia block 72 turns freely about its axis pin 73 under the action of gravity and automatically breaks the heating circuit of the said radiator, owing to the fact that one or the other of the cams 76 swinging together with the inertia-block causes the upper contact 87 and the lower contact 67 to move apart.

c) A cam 77 made from insulating material and fast with the regulating screw 64 actuates the two blade contacts 78 and 79. When the contacts 78 and 79 are closed, the signal lamp 80 is lit to show that the radiator is switched on. The lamp 80 is visible by means of a transparent sighting aperture 18 provided in the upper wall 2 of the case 10. The cam 77 is fitted or mounted on the regulating or control screw 64, so that the two contacts 78 and 79 are open when the actuating knob 61 indicates the position O; otherwise stated, as soon as the user sets the control knob 61 in a position other than that of the O, the signal lamp 80 is lit to indicate that the apparatus is in operation, and this is not systematically visible (or the apparatus audible) when the thermostat has produced a period of rest for the radiator, i.e. when the premises or room to be heated is momentarily at the desired temperature.

Although the operation of the above-described radiator can be inferred from the description just made, the principle thereof will now be briefly described. The apparatus is put into operation in the premises or room which it is desired to heat by turning the control knob 61 of the thermostatic unit 60, so as to obtain the desired temperature in the said premises or room. The blowing unit 20 and the heating resistor tape 42 are of course supplied with current simultaneously. Cool air is blown into the rear section of the apparatus and the upper portion of the latter, while a natural convection radiation takes place towards the front portion of the apparatus owing to the reflector 30. The heated air emanating from the reflector 30 tending to move up towards the upper section of the case 10 mixes up homogeneously with the blown air flowing out through the vents 35 provided at the upper portion of the reflector. As a result and subsequent to this mixing, the air escapes through the grille 50, in particular through the upper grille element 51. It is obvious that the radiator will alternatively have periods of operation and of rest which will be controlled by the thermostatic unit 60.

Of course, the present invention is by no means limited to the form of embodiment

described and illustrated which has been given by way of example only. Thus, the materials used to make the case 10 may be chosen at will. Also, the fastening of the various elements constituting the radiator may be achieved by any appropriate means.

WHAT WE CLAIM IS:—

1. An electric blowing radiator of the forced-convection type including a rectangular housing supporting a reflector assembly therein and provided with a grille for the escape of hot air, the reflector assembly forming a partition separating the space in the housing into a front section opening towards the front and including a heating resistor unit, and a rear section closed by the back wall, the two side walls, and the top and bottom wall of said housing, a blowing device in the rear section enabling external cool air to be sucked in through openings in the housing back wall and to be directed into the front section through slots provided in the upper portion of the reflector assembly, the reflector assembly being a channel-shaped member having one flat vertical wall forming the partition and two lateral flanges extending therefrom and being constituted by resilient laminae integral with said flat wall and adapted to support the heating resistor unit therebetween.
2. A radiator according to claim 1 wherein an insulating support member is secured to each resilient lamina and the resistor unit is a tape having very low thermal inertia mounted in staggered arrangement on the insulating members on either side of the lateral flanges of the channel-shaped reflector.
3. A radiator according to claim 2, wherein each insulating member has substantially the shape of a triangle, the base of which is provided with a groove in which the tape is wound loop-wise, and the apex of which is secured to its associated lamina by means of a clip, so as to provide a suitable interval between the various tape strands while both ends of the tape are respectively and electrically connected to the current supply circuit.
4. A radiator according to any one of the preceding claims wherein an electric control unit including a thermostat is mounted on the top wall of the housing, which unit includes a safety device enabling the heating circuit to

be automatically opened in case the apparatus is accidentally tipped over.

5. A radiator according to claim 4, wherein the safety device is of the gravity-swing type and includes an inertia-block suspended and hinged on the electric control unit, the inertia-block comprising at least one cam acting upon one of the two contacts of the thermostat during the swinging of the radiator, so as to lift up said one contact in a position definitely spaced apart from the other contact.

6. A radiator according to claim 4, wherein the electric control unit together with its thermostat includes a plate on which are mounted: the thermostat provided with an upper blade-contact and a lower blade-contact and with a bimetallic member; a regulating screw actuated by means of a knob located on the outside of the top wall of the housing and prolonged by an insulating stud coming into abutment against the lower contact; and an insulating stud mounted on the upper contact and actuated by the bimetallic element; and a spring for taking up play and ensuring the positioning of the regulating screw in the plate.

7. A radiator according to claim 6, wherein a cam fast with the screw controls the putting into operation of the radiator by actuating one of the two contacts of a switch in the supply circuit, while a signal lamp supported by the plate is controlled by the switch.

8. A radiator according to any one of the preceding claims wherein the blowing device is mounted on the bottom wall of the housing and includes a centrifugal impeller actuated by an electric motor, the impeller and the motor being mounted in a blowing unit provided with deflectors for directing the air flow towards the upper portion of the rear section.

9. A radiator according to any one of the preceding claims wherein the grille constitutes the front of the housing and a portion of the housing top wall.

10. A radiator substantially as described with reference to and as illustrated in the accompanying drawings.

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2. A radiator according to claim 1 wherein an insulating support member is secured to each resilient lamina and the resistor unit is a tape having very low thermal inertia mounted in staggered arrangement on the insulating members on either side of the lateral flanges of the channel-shaped reflector.

3. A radiator according to claim 2, wherein each insulating member has substantially the shape of a triangle, the base of which is provided with a groove in which the tape is wound loop-wise, and the apex of which is secured to its associated lamina by means of a clip, so as to provide a suitable interval between the various tape strands while both ends of the tape are respectively and electrically connected to the current supply circuit.

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5. A radiator according to claim 4, wherein the safety device is of the gravity-swing type and includes an inertia-block suspended and hinged on the electric control unit, the inertia-block comprising at least one cam acting upon one of the two contacts of the thermostat during the swinging of the radiator, so as to lift up said one contact in a position definitely spaced apart from the other contact.

6. A radiator according to claim 4, wherein the electric control unit together with its thermostat includes a plate on which are mounted: the thermostat provided with an upper blade-contact and a lower blade-contact and with a bimetallic member; a regulating screw actuated by means of a knob located on the outside of the top wall of the housing and prolonged by an insulating stud coming into abutment against the lower contact; and an insulating stud mounted on the upper contact and actuated by the bimetallic element; and a spring for taking up play and ensuring the positioning of the regulating screw in the plate.

7. A radiator according to claim 6, wherein a cam fast with the screw controls the putting into operation of the radiator by actuating one of the two contacts of a switch in the supply circuit, while a signal lamp supported by the plate is controlled by the switch.

8. A radiator according to any one of the preceding claims wherein the blowing device is mounted on the bottom wall of the housing and includes a centrifugal impeller actuated by an electric motor, the impeller and the motor being mounted in a blowing unit provided with deflectors for directing the air flow towards the upper portion of the rear section.

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10. A radiator substantially as described with reference to and as illustrated in the accompanying drawings.

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