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G. VAN DAAM

2,313,786

ELECTRIC HEATER

Filed May 28, 1941

2 Sheets-Sheet 1

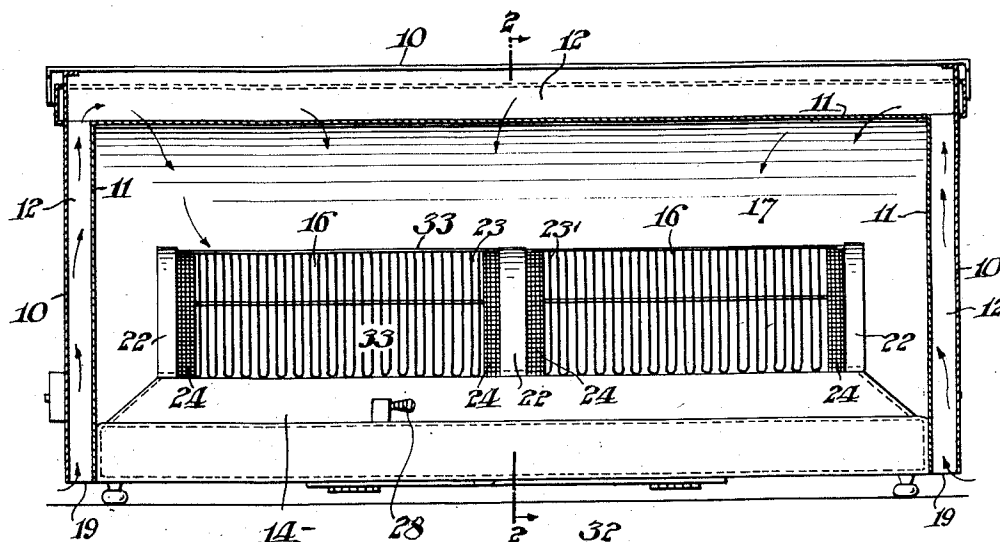


Fig. 1.

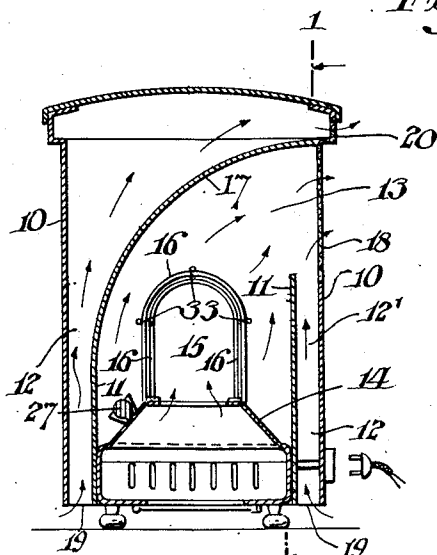


Fig. 2.

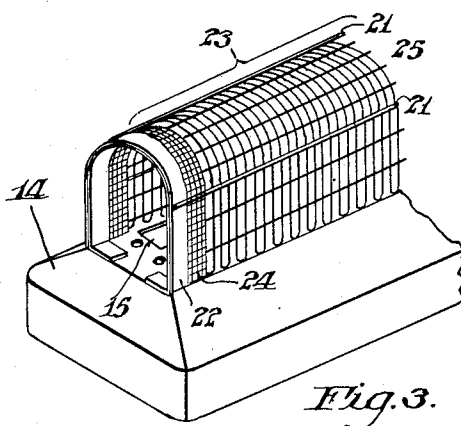


Fig. 3.

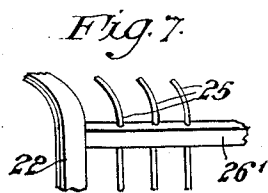


Fig. 7.

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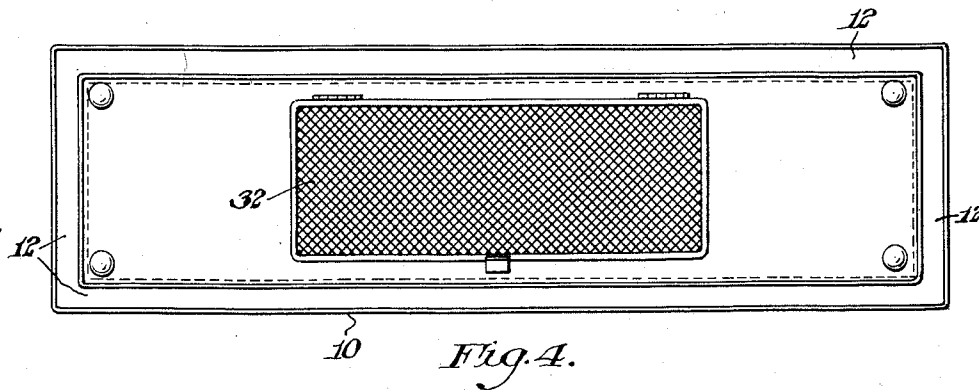
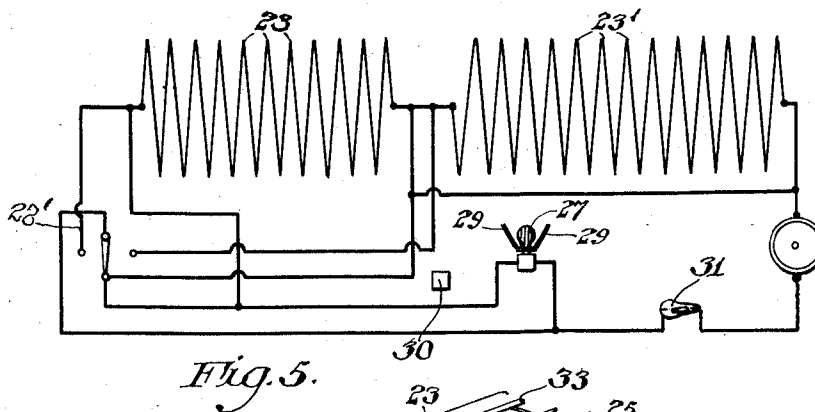
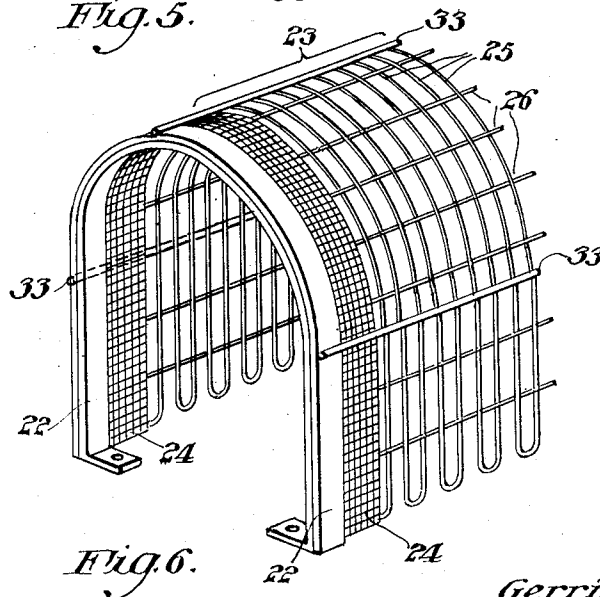
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2 Sheets-Sheet 2



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UNITED STATES PATENT OFFICE

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ELECTRIC HEATER

Gerrit Van Daam, Buffalo, N. Y.

Application May 28, 1941, Serial No. 395,585

3 Claims. (Cl. 219-38)

My invention relates to electric heaters. The object is to provide safe, compact and efficient means for delivering heated air to a required region and for maintaining the outer surfaces of the device at sufficiently low temperature to prevent injury or danger from contact therewith.

The invention comprises improvements in the construction, arrangement and support of the resistance or heating element within a suitable enclosure.

The invention also comprises improved means for assembling a plurality of resistance elements or units of the same or different capacities, and energizing the same, either singly or in different combinations.

The invention also comprises the formation of air passages for so conducting the air that some may be delivered directly to and from the heating element into the region to be heated, while some may be conducted between inner and outer walls of the enclosure or housing, to prevent undue heating of the outer walls of the housing and also to permit the heating of the air in said passages, by conduction, through the metal walls. This heating of secondary air will cause the same to travel upwardly in said passages and to deliver to or near the region of the primary air which is delivered directly from the space containing the resistance. This secondary heated air which is delivered through suitable ports or openings in the upper part of the front wall of the housing is utilized to merge with and supplement the heating effect of the primary air.

By the arrangement as above indicated, the primary heated air is delivered directly from the chamber in which the heating unit is enclosed, while the secondary heated air is delivered and partly heated as it travels upwardly through said air passages. Some secondary air also delivers into the chamber containing the heating unit and thereby merges with the primary air in and issuing from said chamber.

Referring to the drawings, which illustrate merely by way of example, suitable means for the embodiment of my invention;

Fig. 1 is a longitudinal vertical section on line 1-1 of Fig. 2.

Fig. 2 is a vertical cross-section on line 2-2 of Fig. 1, on a reduced scale.

Fig. 3 is a fragmentary perspective view of a heating element and its supporting base.

Fig. 4 is a plan view of the under side of the heater housing.

Fig. 5 is a diagrammatic view of the wiring.

Fig. 6 is an enlarged fragmentary view of the resistance body.

Fig. 7 is a fragmentary perspective view showing the supporting and spacing strips 26' of lava or the like.

Similar numerals refer to similar parts throughout the several views.

As shown in the drawings, the housing 10 is substantially rectangular, with inner walls 11 parallel with and spaced from the outer walls of said housing 10. This arrangement provides air passages 12 open at the bottom, as at 19, of the housing and discharging at the top of the housing, on three sides, while the passage along the front wall discharges into the main heating space 13.

Near the bottom of the housing 10 is a frame element 14 secured to or supported by the inner walls 11 near the bottom of the housing.

This frame element 14 has upwardly inclined, convergent walls which surround the opening or passage delivering to the space 15 within the heating or resistance body 16 which it supports. The rear inner wall 11 develops into an upwardly curved deflector 17, which engages with the side walls and with the upper front wall of the housing, thus forming a chamber 13 enclosing the heating element 16. This curved extension of the rear wall 11 is provided with a polished or reflector surface on the side toward the heating element for the purpose hereinafter described.

The front wall of the housing is provided with a discharge opening 18, which delivers the heated air directly from chamber 13. This may be called primary heated air.

The air passages 12 at each end or side, and at the back of the housing are provided with inlet openings 19 at the bottom of the housing and deliver secondary air through a suitable opening 20 in the upper part of the front wall of the housing.

The passage 12' at the front of the housing delivers secondary air into the main heating space 13, where it merges with the primary air which is heated directly by the resistance heater within chamber 13.

The secondary air, flowing upwardly through the passages, effectively protects the outer walls of the housing from excessive heat, without impairing the total heat delivered to the region intended. That is, the secondary heat becomes a supplement to the primary heated air.

It also follows that with the outer walls of housing thus protected, a more effective heating unit may be used without danger: That is, a

higher degree of temperature may be permitted without danger.

An especial feature of the present invention comprises the construction, arrangement and support of the resistance, or resistance heating elements.

This resistance element is fabricated or woven into a sheet 23 having preferably reinforced margins or selvages 24. The individual resistance strand extensions 25 are held in proper spaced relationship, by cross-strands 21 of insulating material, such for instance, as asbestos. In case of very high temperatures I have found it desirable to use supporting strips of lava, or the like. In which case the resistance strand may be baked in the strips. The resulting sheet is formed or bent into the shape of an arch, or tunnel, that is, the middle longitudinal part is arched, while the flanking sides are vertical and parallel. This arched formation contributes substantially to the stability of the complete element or unit, and requires a minimum of cross-weaving or other support. This serves an important purpose to be hereinafter described.

Corresponding in shape to the cross-section of the resistance element when bent into proper shape, are the supporting rigid end-pieces 22, to which are secured in any suitable way, the edges or margins of the resistance body 23, or the ends of the supporting strips. The end-pieces may rest upon, or be secured to the frame element 14.

In the construction of the resistance heating element the resistance strand 25 is arranged in continuous parallel zigzag extensions (see Fig. 6) and secured in spaced apart relationship by suitable strands 26 or strips 26' of insulating, heat resisting material.

The asbestos strands or lava strips extend longitudinally and horizontally, while the resistance strands are threaded transversely to the direction of the supporting strands or strips. In such way a flat sheet is formed, which is bent into arched formation as shown in Fig. 6 of the drawings. In accordance with such construction, each end extension of the resistance strand lies in a vertical plane, and is largely self-supporting and stable, due to said arch formation and vertical extensions, so that the insulating strands or strips may be extremely light, and widely separated, especially over the arched area. This provides an open mesh which permits free passage of air therethrough.

In some cases, depending upon size and material, reinforcing rods 33 may be connected to the end-pieces and in supporting relation to the heating elements, suitably insulated therefrom.

This arrangement has distinct advantages when compared with the usual way of supporting resistance strands, as for instance, by channeled fire-brick bodies, or excessive covering of insulating fibre. In accordance with the present example, the arched part of the strand, which is the most critical part, requires little, if any, insulating material. Hence a minimum of obstruction to the passage of air through this part of the resistance, and a greater heat transfer is secured.

It will be noted that the supporting frame 14 has an open middle part through which the air is delivered into the bottom of the heating unit, between the vertical extensions and beneath the arched portion. By such arrangement no appreciable part of the primary air escapes without passing through the resistance unit.

These resistance heating elements may be made in one, or a plurality of units, for example 23 and 23', which may be connected singly or in series, by suitable wiring and switch control, in order to vary the amount of heat delivered.

A red lamp 27 is so placed as to project its rays to the reflecting surface of the curved deflector 17. The shield 29 may be used for localizing and increasing the illuminating effect.

This lighting device is particularly significant in connection with what is known as "black heat" resistance. In the usual electric heating device a resistance is used which glows when energized, so that the user may know when the heat is "turned on." With "black heat" the conditions are different, and a separate special means is required for indicating the condition of the heater. By properly directing and concentrating the rays from a red lamp, or through a suitably colored screen, upon the curved and polished reflector the whole device is made to glow with extremely pleasant effects.

The thermostat 30 operates to break circuit when predetermined temperature is reached.

Thermostats may be arranged to act automatically for the independent control of each of several heating units. An arbitrary control is provided, as at 28', for energizing of the several heating singly or in combination units.

As these controls are common in many devices, such as the electric heating pad, a more detailed description would seem to be unnecessary.

The mercury switch 31 for automatically breaking circuit when the heater is overturned, adds to the convenience and safety of the device.

A screen door 32 is provided in the bottom of the housing, over the inlet for air to the element 15, provides convenient access to the interior of the housing.

What I claim is:

1. In an electric heater, the combination of means forming a housing having outer walls and inner walls spaced therefrom and providing air passages between said walls and leading upwardly from near the bottom of the housing and discharging near the top thereof, a heating element supported within the housing and evenly spaced from enclosing walls of the housing, said heating element consisting of a sheet-like body formed of a resistance strand having parallel strand-extensions and cross-extensions of insulating material for holding the resistance strand-extensions in spaced apart relationship, said fabricated sheet-like body then bent transversely of the resistance strand-extensions to form a tunnel-like structure open at the bottom, and a heating element supporting frame associated with the bottom of the housing and having a central opening for delivering air to the interior of the tunnel-like formation.

2. In an electric heater, the combination of means forming a housing having outer walls and inner walls spaced therefrom and providing air passages between said walls and leading upwardly from near the bottom of the housing and discharging near the top thereof, a heating element supported within the housing and evenly spaced from enclosing walls of the housing, said heating element consisting of a sheet-like body formed of a resistance strand having parallel strand-extensions and cross-extensions of insulating material for holding the resistance strand-extensions in spaced apart relationship, said fabricated sheet-like body then bent transversely of the resistance strand-extensions to

form a tunnel-like structure open at the bottom, and a heating element supporting frame associated with the bottom of the housing and having a central opening for delivering air to the interior of the tunnel-like formation, said tunnel-like formation having rigid reinforcing ends, cooperating with the housing walls to maintain the element in position.

3. In an electric heater, the combination of means forming a housing having outer walls and inner walls spaced therefrom and providing air passages between said walls and leading upwardly from near the bottom of the housing and discharging near the top thereof, a heating element supported within the housing and evenly spaced from enclosing walls of the housing, said

5 heating element consisting of a sheet-like body formed of a resistance strand having parallel strand-extensions and cross-extensions of insulating material for holding the resistance strand-extensions in spaced apart relationship, said fabricated sheet-like body then bent transversely of the resistance strand-extensions to form a tunnel-like structure open at the bottom, and a heating element supporting frame associated with the bottom of the housing and having a central opening for delivering air to the interior of the tunnel-like formation, a wall in said housing serving to separate the interior of the housing into two chambers, one of which contains the heating element.

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