March 30, 1965 S. LIGHTER 3,176,116

HEATING PANEL

Filed Feb. 26, 1962

FIG. 1

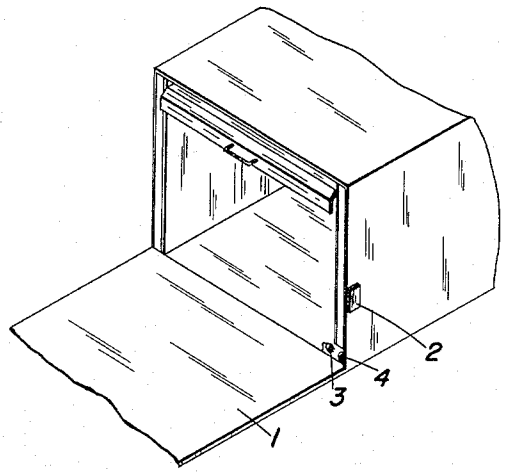


FIG. 2

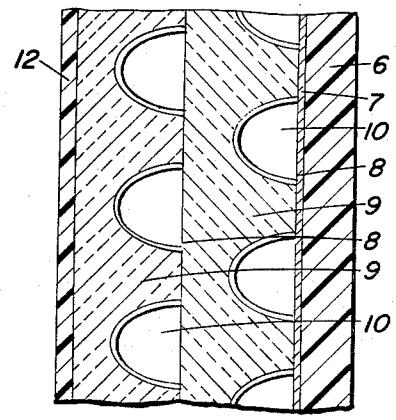


FIG. 3

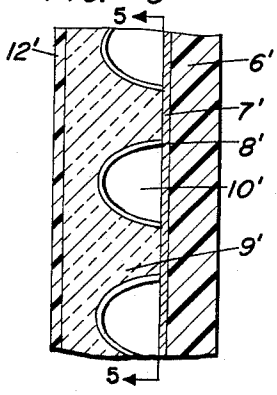


FIG. 4

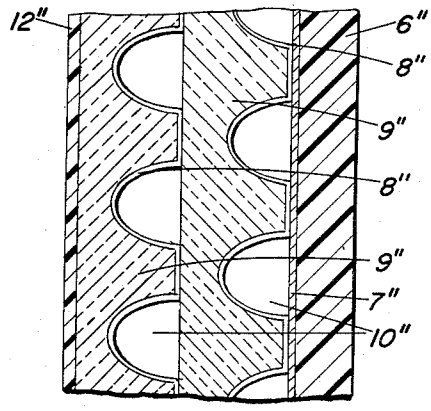
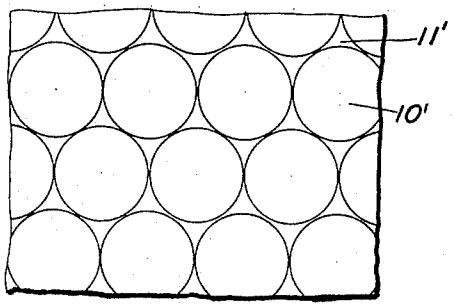


FIG. 5



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United States Patent Office 3,176,116 Patented Mar. 30, 1965

3,176,116

HEATING PANEL

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Filed Feb. 26, 1962, Ser. No. 179,269
2 Claims. (Cl. 219—345)

This invention relates to a method for providing heated sidewalks and driveways and other heated outdoor surfaces and relates to a heating and heat-retaining device for food and in particular to a food heater for use in aircraft and other related fields.

At present large heated areas are often used as sidewalks and driveways. There are several advantages to heating such areas. Snow removal is greatly facilitated, as one merely has to turn on the heat and watch the snow disappear. The danger to passers-by of slipping on packed snow or ice is completely eliminated; and with it the property owner's fear of liability for such injuries. Many stores, filling stations, airports, and other businesses have been using heated driveways, sidewalks, runways, etc. with marked success.

It is a purpose of this invention to provide heated structures exposed outdoors for supporting people and automobiles and the like and especially sidewalks and driveways which may be operated at lower cost and greater efficiency than heretofore possible.

Other purposes will become apparent from the drawings and from the following detailed description in which it is intended to illustrate the applicability of the invention without thereby limiting it to a scope less than that of all equivalents which will be apparent to one skilled in the art.

This application is a continuation-in-part of my copending applications having Serial Numbers 772,205 and 772,293, both filed November 6, 1958, now, respectively, abandoned and issued as Patent No. 3,026,399.

This invention is a unique improvement upon my earlier invention entitled "Method of Making Building Insulation and Products," U.S. Patent #2,747,651, filed December 1, 1954, in which I disclosed the use of small, substantially spherical concavities located throughout the surface of an insulating panel and provided with heat reflecting surfaces to materially decrease the flow of heat through said insulating panel. By including a unique additional member, a layer of heat-producing material disposed adjacent to said concavities, a heating panel may be constructed as is herein disclosed.

A preferred embodiment of the invention consists of a protective surfacing layer, backed by a layer of some material of moderate to high electrical resistivity, backed by one or more sheets of relatively thick, inexpensive insulating material which has the surface facing the electrical conductor intended with a plurality of local concavities, each having a substantially parabolic zone surface and completely covered with a thin, reflective, electrically non-conductive coating. When an electric current is passed through the layer of moderate to high electrical resistivity heat is produced. This heat is contained by the insulating sheets and directed back towards the surface of the paneling by the highly reflective surface coating and focused on the heating layer by the geometrical shape of the substantially parabolic concavities. The paneling may be used throughout the area to be heated and may be connected to an electrical source through a transformer, or through a rectifier, or through both; or directly to a source of low-voltage current.

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insulating material which has the surface facing the electrical conductor indented with a plurality of local concavities, each having a substantially parabolic zone surface and completely covered with a thin, reflective, electrically non-conductive coating. When an electric current is passed through the layer of moderate to high electrical resistivity heat is produced. This heat is contained by the insulating sheets and directed back towards the surface of the paneling by the highly reflective surface coating and focused on the heating layer by the geometrical shape of the substantially parabolic concavities. The paneling may be used throughout the area to be heated and may be connected to an electrical source through a transformer, or through a rectifier, or through both; or directly to a source of low-voltage current.

It is important to note that my earlier invention mentioned above refers, in its claims, to the concavities as bounded by "an approximately spherical zone surface." No such implied limitation is intended in this invention, and while the concavities are generally referred to as "substantially parabolic," the intent is broad enough including any concave, substantially continuous, internally curved surface.

The diameter of the opening of the concavities, at the surface of the sheet is preferably 1½" or more, because it has been found that optimum efficiency in reflecting infra-red waves is obtained only if the distance between the reflecting surface and the source of waves is at least ¾".

FIGURE 1 is a perspective view of a portion of an area to be heated. The area may conceivably be of any size.

FIGURE 2 is an enlarged cross-sectional view of a portion of one embodiment of the paneling herein disclosed in FIGURE 1.

FIGURES 3 and 4 are cross-sectional views similar to that of FIGURE 2, showing other possible embodiments.

FIGURE 5 is a cross-section of the embodiment of FIGURE 3 taken on line 5—5, showing the relative spacing of the concavities in surface 11.

The conductive layer 1 (FIGURE 1) completely underlies the heated area, and may be connected to a source of current by plug 3 and receptacle 4. A rheostat 2 may be used to control the current and therefore the temperature of the surface. This rheostat may be thermostatically actuated, allowing the owner to select the desired temperature and set it directly on a dial.

As shown in FIGURE 2, the heating and insulating panel of the invention may comprise any common exterior finishing surface 6 which is electrically non-conductive, such as asphalt, concrete, tile, etc.; a conductive layer 7 constructed of a medium to high electrical resistance material such as a metal layer, or a non-conductive material either coated with a conductive material, such as polyester film (sold by DuPont as "Mylar") with a metal vacuum deposited upon one or both surfaces, or with a conductor impregnated or formed within it, such as two layers of the polyester film with conductive wires between them; a sheet of relatively thick insulating material 9 such as foamed metal, foamed plastic, magnesia board, or a similar insulator, being provided throughout its entire area with relatively small local concavities 10 having substantially continuous internally curved surfaces; a coating of highly reflective electrically non-conductive material 8 covering the entire area of each concavity; backed by another of the insulating sheets described above and disposed in substantially the same manner; and backed by any number of similar insulating sheets. The conductive layer may be substantially thicker near the terminals in order to facilitate even current distribution throughout the layer. A structural base layer 12 may be added as shown.

This invention utilizes all of the insulating properties described in my earlier invention heretofore referred to, such as the retardation of heat by the main fibrous sheet and the reflection of heat waves by the geometrical shape of the concavities and the highly reflective coating applied thereto, to provide an effective and economical heating panel when used in conjunction with an electrically conductive layer disposed adjacent to the reflective surface as herein disclosed.

Another embodiment (FIGURE 3) may include the surfacing material 6', conductor 7', and a single insulating sheet 9' containing depressions 10' and coated as described with a non-conductive material 8'. Structural base layer 12' may be added as shown.

Still another embodiment (FIGURE 4) may have the entire surface of the insulating sheets 9'' coated with the highly reflective, electrically non-conductive material 8''. Layers 6'', 7'' and 12'' may be provided in a manner similar to FIGURE 2 with concavities 10'' being provided as shown.

It is important to provide that the material immediately adjacent to the conductive layer be themselves non-conductive, to prevent wasteful current leakages. Current values are not sufficiently high to produce danger to human beings, because of the extremely low voltage required to drive the current across a conductor with a substantially large cross-sectional area.

The improved heating and insulating qualities of such a panel used in connection with large surface areas such as driveways or sidewalks are obvious. The conductor distributes the heat evenly over the entire area to be heated. The concave depressions coated with reflective, electrically non-conductive material augment the insulating properties of the thick sheet of insulating material by reflecting heat rays towards the exterior of the heated area and focusing them on the heating layer of conductive material. There can be any number of these concavities, stamped, cut or otherwise formed in the surface of the insulating sheets, and by properly orienting said concavities the structural properties and insulating properties of the panel may be materially increased. The exterior temperature of the surface is easily controlled by the amount of current allowed to flow through the conductive layer, and the current may be thermostatically regulated from any convenient location.

To illustrate one embodiment of the invention, I may provide an asphalt surface 1'' thick and 10' square, backed by a conductive layer of aluminum vacuum deposited on a sheet of polyester resin .005'' thick (such as polyethylene terephalate sold commercially by DuPont as "Mylar") and having a resistance of .24 ohm/ft.^{2}, backed by two sheets of foamed polystyrene 1½'' thick and containing parabolic concavities about 1½'' in diameter coated with white epoxy-base resin .006'' thick, the assembly having a total thickness of about 4¼''. It would take a current of on the order of 160 amps at 40 volts flowing for 60 minutes to melt 3'' of snow uniformly distributed over the surface.

While certain modifications and embodiments of the invention have been described, it is of course to be understood that there are a great number of variations which will suggest themselves to anyone familiar with the subject matter thereof and it is to be distinctly understood that this invention should not be limited except by such limitations as are clearly imposed in the appended claims.

I claim:

1. In a structure exposed outdoors for supporting people: a panel comprising; a sheet of insulating material having a plurality of local substantially parabolic concavities throughout a major portion of a side thereof each bounded on one side by a substantially continuous internally curved surface, a continuous coating of highly reflective electrically non-conductive material completely covering the said surface of each concavity and each of said concavities being bounded on the side opposite said curved surface with a layer of electrically conductive material in direct contact with said side of said sheet.

2. In a structure exposed outdoors for supporting people: a panel comprising; a sheet of insulating material having a plurality of local substantially parabolic concavities throughout a major portion of a side thereof each bounded on one side by a substantially continuous internally curved surface, a continuous coating of highly reflective, electrically non-conductive material completely covering the said surface, each of said concavities being bounded on the side opposite said curved surface with a layer of electrically conductive material in direct contact with said side of said sheet, and a layer of decorative material adjacent to said electrically conductive material.

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