March 28, 1967 D. A. MELNICK 3,311,696

ELECTRICALLY AND THERMALLY CONDUCTIVE SHIELD

Filed June 18, 1965 2 Sheets-Sheet 1

FIG. 1.

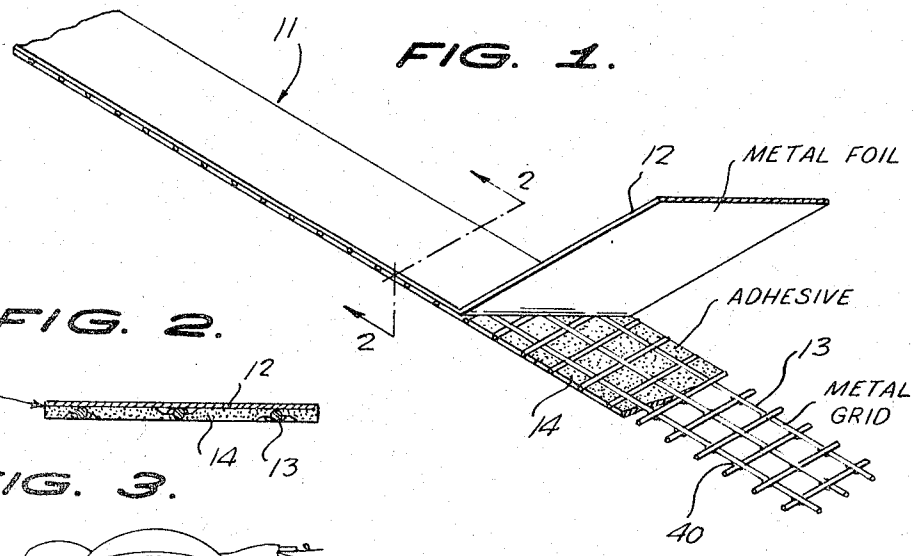
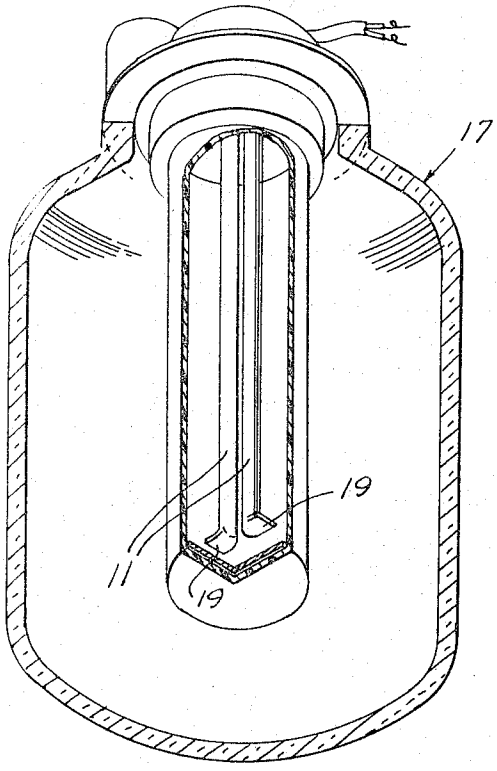


FIG. 2.

FIG. 3.



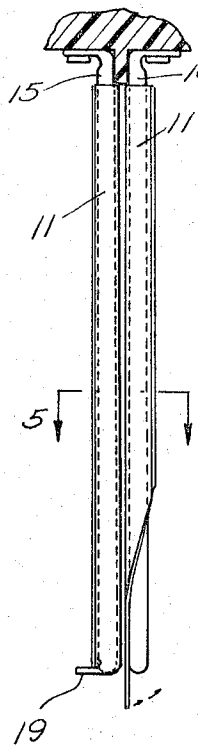
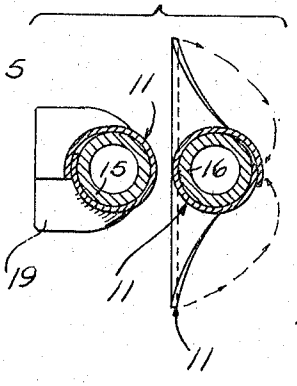


FIG. 4.

FIG. 5.



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FIG. 6.

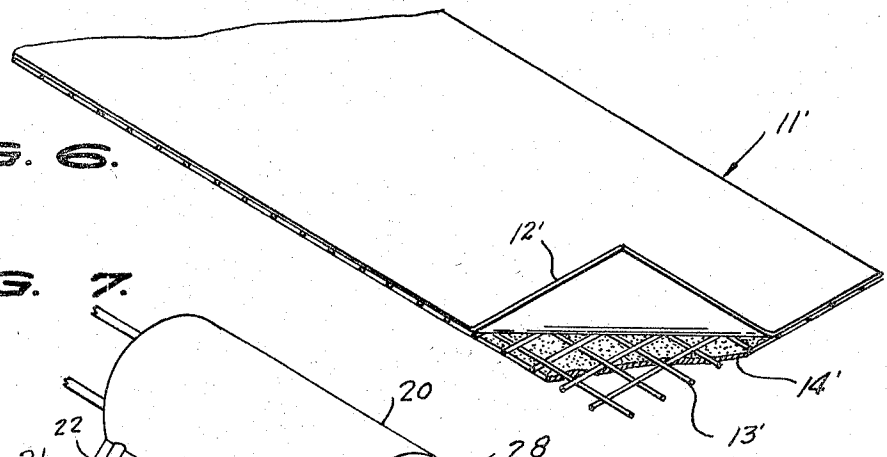
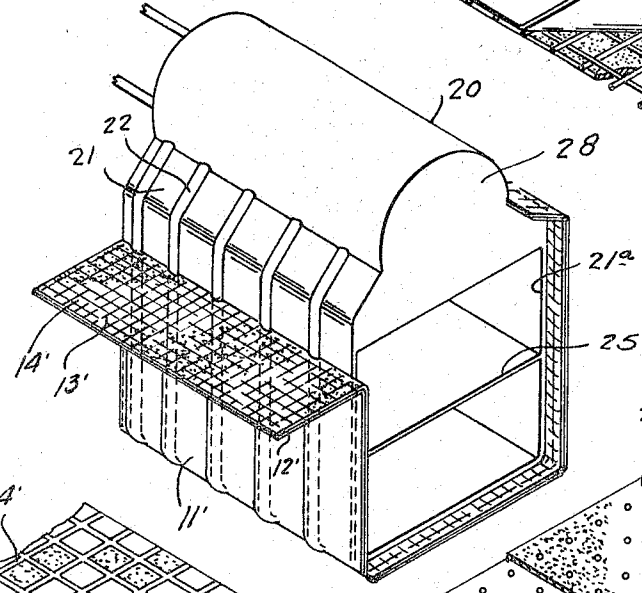


FIG. 7.



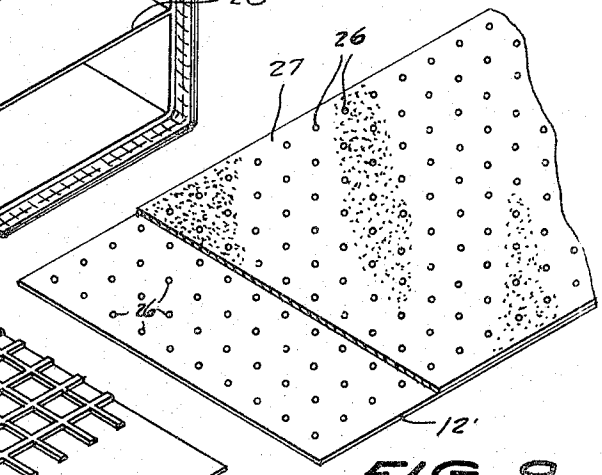


FIG. 9.

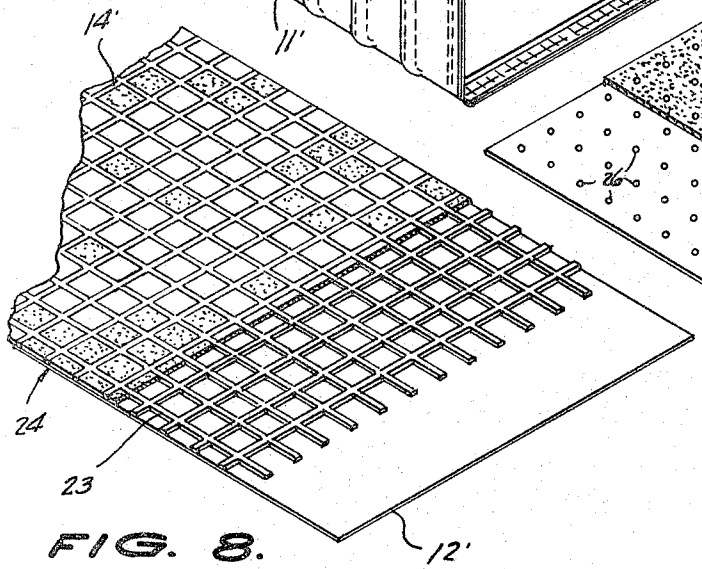


FIG. 8.

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3,311,696

ELECTRICALLY AND THERMALLY CONDUCTIVE SHIELD

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Filed June 18, 1965, Ser. No. 465,043
11 Claims. (Cl. 174—18)

This invention relates to electrically or thermally conductive web or sheet material, and more particularly to conductive tape or sheet material for use in covering immersion heating electrodes, freezer units, or similar elements employed for conduction of electrical current or heat to or from a contiguous adjacent medium, wherein it is desirable to protect the electrodes or corresponding unit from undesired deposits from said medium.

A main object of the invention is to provide a novel and improved expendable covering material for electrodes, freezer units, or the like, the covering material being of simple construction, providing highly efficient conduction, and being easy to install and remove.

A further object of the invention is to provide an improved web or sheet material for use in covering electrodes, freezer units, or similar elements wherein electrical current or heat is to be conducted to or collected from a surrounding medium, the web or sheet covering material serving as a means for collecting sediment, frost, or other undesired deposits from the surrounding medium, the material being inexpensive to fabricate, being rugged in construction, being sufficiently pliable to accurately conform with the surfaces to which it is to be applied, and being easy to strip off for unloading or replacement.

A still further object of the invention is to provide an improved expendable tape or sheet material for use as a protective conducting cover for electrodes, freezer units, and similar elements exposed in a medium, primarily fluid mediums, either liquid or gaseous, wherein there is a tendency for material to be deposited on the elements being protected, the covering material serving to receive such deposits and to eliminate the necessity of cleaning the elements, the material being relatively thin and pliable as well as being highly conductive, and being constructed so that it does not in any way interfere with the normal operation of the elements covered thereby.

Further objects and advantages of the invention will become apparent from the following description and claims, and from the accompanying drawings, wherein:

FIGURE 1 is a perspective view of a length of adhesive tape material constructed in accordance with the present invention and shown with a portion of the outer metal foil layer thereof separated from the remainder thereof to clarify structural details.

FIGURE 2 is an enlarged transverse vertical cross sectional view taken substantially on the line **2—2** of FIGURE 1.

FIGURE 3 is a perspective view, partly in cross section, taken through an electrical vaporizer assembly whose electrodes are covered with conductive tape material such as that shown in FIGURES 1 and 2.

FIGURE 4 is an enlarged elevational view of the electrodes of the vaporizer of FIGURE 3, one of the protective tape elements being shown partly detached from its associated electrode so as to illustrate the manner in which the tape elements are applied to the electrodes.

FIGURE 5 is an enlarged horizontal cross sectional view taken substantially on the line **5—5** of FIGURE 4.

FIGURE 6 is a perspective view of a piece of wide covering material in the form of a relatively wide web for use in covering refrigerator freezer units, or similar large freezing or other thermal-active surfaces, a corner portion of the mateial being opened up to reveal the internal construction of the material.

FIGURE 7 is a perspective view of a typical refrigerator freezer unit and illustrating the manner in which a sheet of the material shown in FIGURE 6 is applied thereto for the purpose of acting as a frost collector.

FIGURE 8 is a perspective view showing a fragmentary portion of an alternative form of conductive sheet material which may be employed in the same manner as the material shown in FIGURE 6.

FIGURE 9 is a perspective view showing still another alternative form of conductive material which may be employed in the same manner as the material shown in FIGURES 6 and 8.

Referring to the drawings, and more particularly to FIGURES 1 to 5, **11** generally designates a typical form of expendable pliable tape material which may be employed in accordance with the present invention to cover electrode elements for the purpose of protecting said electrode elements against direct accumulation thereon of sediment or scale material, since such deposits ordinarily require considerable effort and time in scraping off and removing the deposits. The protective tape material **11** therefore is employed to cover such electrodes and to collect the undesirable deposits, the tape material being easy to apply to the electrodes and being similarly easy to strip off the electrodes after a considerable amount of scale or other deposits have accumulated thereon. After removal, the tape material may be merely discarded or, if so desired, may be suitably laundered or cleansed and reused.

The tape material **11** comprises an outside layer **12**, which may consist of pliable metal foil, such as aluminum foil, or the like. Secured in any suitable manner to the bottom surface of the outer conductive metallic layer **12** is a relatively wide mesh metallic screen or grid **13** of fine wire material coextensive in width with the outer metal foil strip **12** and conductively integral therewith. The spaces in the wire mesh material **13** are filled with adhesive material **14** of any conventional composition, for example, of the same composition as is employed in ordinary pressure-sensitive adhesive tape, the material being preferably of a type having stability over a wide temperature range, including the boiling point temperature of water or of other liquids which may be employed in the devices with which the tape is intended to be used. There are many commercial adhesive materials which are suitable for this purpose and which are capable of adhering to both the metallic portions of the tape **11** and to the metal electrode surfaces with which the tape is employed at the operating temperatures of the electrodes. The thickness of the layer of adhesive material **14** is substantially identical with the thickness of the wire mesh screen **13** so that when the tape is installed on a stationary electrode the wire mesh screen **13** makes electrical contact with the electrode as well as being electrically connected with the outer metallic foil strip **12**, whereby said outer metallic strip **12** becomes electrically connected to the electrode so that there is no electric field between the tape and the electrode and hence there is no heating, bubbling or deposit of sediment in this region.

In using the covering tape **11**, suitable lengths thereof are cut off and are respectively installed on the electrodes to be protected, for example, the pair of electrodes **15** and **16** of a conventional water vaporizer **17** shown in FIGURE 3. The strips of tape **11** are of sufficient length to cover the major portions of the surfaces of the electrodes **15** and **16** and to extend a short distance below the electrodes. The strips of tape **11** are placed lengthwise on the electrodes and tightly wrapped around same in the manner illustrated in FIGURE 4, forming a lengthwise overlapping seam at their meeting vertical margins, with the bottom portion of the strip bent horizontally and outwardly, as shown at **19** in FIGURES

4 and 5. The outwardly projecting tab elements **19** provide a means for grasping and manipulating the lower portion of the tape when it is to be unwrapped and stripped off the electrodes after a considerable period of use during which substantial deposits of sediment have collected on the exposed outer metallic foil elements **12**.

As will be readily apparent from FIGURE 2, the grid wires **13** are located so as to make good electrical contact with the surfaces of the electrodes **15** and **16**, so that the covering strips of tape **11** act as electrical extensions of the electrodes and provide efficient conduction of electric current to the liquid in which the electrodes are immersed.

To remove the covering strips of conductive tape **11**, the tabs **19** are merely bent downwardly to vertical positions, providing access to the bottom corners of the overlapping margins of the strips, whereby said margins may be disengaged from each other and whereby the strips may be easily detached from the electrodes.

The wire elements of the wire mesh layers **13** are preferably flattened at their points of transverse crossing, as shown at **40**, so as to maintain the thickness of the wire mesh layers **13** substantially uniform throughout.

Although the electrodes **15** and **16**, illustrated in FIGURES 4 and 5 are generally cylindrical in shape, the conductive tape material **11** may be also employed with equal efficiency with electrodes of other cross sectional shape.

As will be presently described, the screen material **13** may be formed integrally with the outer covering layer **12**, and does not necessarily have to be in the form of a two-dimensional grid. It may be in the form of a one-dimensional array of linear elements which protrude through the adhesive layer **14**, or it may simply be an array of spaced dot elements which similarly protrude through the adhesive.

Referring now to FIGURES 6 and 7, **11'** designates a web of material similar in construction to the relatively narrow tape material **11** shown in FIGURE 1, and comprising an outer layer of pliable metal foil **12'**, a grid of pliable thin wide-mesh pliable wire material **13'**, and a layer of adhesive material **14'** similar to that employed in the embodiment of FIGURE 1 and filling the spaces of the wire mesh material **13'** while allowing the wire mesh to be exposed at the bottom of the sheet **11'**. The material **11'** may be employed as a protective cover to facilitate defrosting of the freezer units of refrigerators, deep freeze equipment, or the like. Thus, the web material **11'** is preferably of at least sufficient width to span the depth of a conventional refrigerator freezer unit **20**, shown in FIGURE 7. A suitable length of the web material **11'** is cut off, preferably sufficient to completely cover the thermally conductive wall surface **21** of the freezer unit **20** which contains the evaporation coil channels **22**. Where possible, the web material **11'** is also applied to the inside wall surface **21***a* and shelf **25**. As shown in FIGURE 7, the web material is applied so as to project beyond the end **28** of the freezer unit **20** to prevent the accumulation of frost around the edge of the open end and to facilitate the removal of the web material with the accumulated frost thereon.

The length of conductive web material **11'** is applied to the wall surface of the freezer unit **20**, and is sufficiently pliable so that it closely conforms to the contour of said wall surface and adheres thereto by the adhesive action of the material **14'** incorporated in the cover element **11'**. The wire mesh elements **13'** are in thermally conductive contact with the surface of the freezer unit wall **21** substantially over the entire area of the covering material, so that heat is conducted to the foil outer layer **12'** from the interior of the associated refrigerator and then to the wall surface **21** and freezer unit coil channels **22** through the conductive wire mesh layer **13'**. Therefore, the thermal efficiency of the freezer unit **20** is in no way impaired, while at the same time accumulations of frost occur on the protective covering member **11'** rather than directly on the wall surface **21** of the freezer unit. After a substantial amount of frost has accumulated on the cover sheet, the sheet is merely stripped off the freezer unit, and may be replaced by another protective sheet **11'**. The previously used protective cover sheet may be allowed to thaw out in a sink or bucket, whereby the cover sheet may be reused, if so desired.

In order to decrease the amount of chopping of ice required to remove the sheet adjacent the edges thereof, the sheet is preferably somewhat greater in width than the depth of the freezer unit **20**, so that the edges of the protective cover sheet **11'** protrude beyond the edges of the wall of the freezer unit. It is preferable to employ a somewhat denser conductive grid in the modification shown in FIGURES 6 and 7 than was employed in the form of the invention illustrated in FIGURES 1 to 5 so as to avoid presenting too high a thermal resistance through the grid **13'**. The metal of the grid **13'** preferably should cover at least an area of the order of ten percent of the area of the conductive outer metallic foil layer **12'** in order to prevent too high a thermal resistance through the grid. It is also preferable to employ an outer foil layer **12'** of substantial thickness, whereby to assist, by lateral conduction, in bridging any areas of imperfect contact between the grid **13'** and the adjacent surfaces of the freezer wall **21**.

FIGURE 8 illustrates a modification of the webbing material **11'** wherein the pliable grid, designated at **23**, is formed integrally with the pliable main foil element **12** of the cover sheet, shown at **24**. The spaces in the integral pliable grid **23** are filled with the adhesive material **14'** in the same manner as illustrated in FIGURE 6. As previously mentioned, instead of employing a two-dimensional grid arrangement, a one-dimensional array of parallel ribs or line elements may be used, formed intergally with the pliable conductive foil member **12'** and exposed through the adhesive material **14'**. As a further alternative, the conductive intervening screen employed with the foil sheet **12'** may comprise an array of dot-like projections **26**, as shown in FIGURE 9, said projections being formed integrally with the foil sheet **12'** and exposed through the layer of adhesive material, shown at **27** in FIGURE 9.

While certain specific embodiments of an improved conducting covering member for use with electrical or thermal-active elements have been disclosed in the foregoing description, it will be understood that various modifications within the spirit of the invention may occur to those skilled in the art. Therefore, it is intended that no limitations be placed on the invention except as defined by the scope of the appended claims.

What is claimed is:

1. A pliable conductive shield comprising a body of thin malleable sheet metal, uniformly distributed substantially uni-planar conductive projection means secured to the bottom surface of said body in conductive contact therewith, and a layer of adhesive material on said bottom surface and being substantially flush with said projection means for securing the shield to a metal surface with said projection means in conductive engagement with the metal surface.

2. A pliable conductive shield comprising a body of thin malleable sheet metal, a conductive grid secured to the bottom surface of said body in conductive contact therewith, and a layer of adhesive material on said bottom surface with the bottom surface of said adhesive layer substantially flush with the bottom plane of said grid for securing the shield to a metal surface with said grid in conductive engagement with the metal surface.

3. A pliable conductive shield device comprising a web of malleable metal foil, substantially uniformly distributed uni-planar malleable metal spaced projection means conductively secured to the bottom surface of said

web, and adhesive material on said bottom surface filling the spaces defined by said projection means but being substantially flush with the bottom surface of the projection means for securing the device in covering relation to a conductive metal surface with the projection means held in conductive contact with said metal surface.

4. A pliable conductive shield comprising a web of malleable metal foil, a malleable wire mesh grid conductively secured to the bottom surface of said web and extending substantially over the area defined by said bottom surface, and adhesive material on said bottom surface in the meshes of said grid and being substantially flush with the bottom plane of the grid for securing the shield in covering relation to a metal surface with the grid in conductive contact with said metal surface.

5. An electrode shield comprising a web of malleable metal foil, a malleable wire mesh grid conductively secured to the bottom surface of said web and being distributed over the area of said bottom surface, and adhesive material in the meshes of said grid and being substantially flush with the bottom plane of the grid for securing the shield around an electrode with the grid in conductive contact therewith.

6. In combination, a metal body exposed in a fluid medium, a conductive metal foil member covering said body, a wire mesh intermediate member secured conductively to the inner surface of said foil member and conductively engaging said body, and adhesive material carried in the meshes of said intermediate member and adhesively securing the foil member to the body, whereby said foil member is a conductive extension of said body in said medium.

7. In combination, an electrode, a web of malleable metal foil wrapped around said electrode, and a malleable electrically conductive grid interposed between the web and the electrode in conductive contact with said web and electrode, and means securing said foil to said electrode.

8. In combination, an electrode, a web of malleable metal foil wrapped around said electrode, a malleable electrically conductive grid interposed between the web and the electrode in conductive contact with said web and electrode and adhesive material in the meshes of said grid securing the web to the electrode.

9. In combination, an electrode, a web of malleable metal foil wrapped around the electrode, a layer of malleable wire screen material interposed between the web and

the electrode, said layer being conductively secured to the web and being in conductive contact with the electrode, and adhesive material disposed in the meshes of said wire screen material and being in adhesive contact with the electrode, whereby to secure the web to the electrode with the web forming a conductive extension of the electrode.

10. In an enclosure containing a fluid medium, a metal body projecting into the enclosure and being normally subjected to depositions of material from the medium, and detachable shield means on the body to receive such depositions of material, said shield means comprising a conductive malleable metal foil member covering a substantial portion of the surface area of said body, malleable metal grid means interposed between the foil member and the surface area covered thereby and being in conductive relationship between the foil member and said surface area, and adhesive material carried in the spaces defined by said grid means and adhesively securing the foil member to said surface area, whereby said foil member defines a conductive extension of said metal body in said fluid medium.

11. In an enclosure containing a fluid medium, a metal body projecting into the enclosure and being normally subjected to depositions of material from the medium, and detachable shield means on the body to receive such depositions of material, said shield means comprising a conductive malleable metal foil member covering a substantial portion of the surface area of said body, malleable metal grid means interposed between the foil member and the surface area covered thereby and being in conductive contact with said member and said surface area, and adhesive material carried in the spaces defined by said grid means and adhesively securing the foil member to said surface area, whereby said foil member defines a conductive extension of said metal body in said fluid medium, said foil member having a free portion extending outwardly from the metal body and serving as a tab means for stripping the shield member from the body.

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LARAMIE E. ASKIN, *Primary Examiner.*