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M. E. STROMQUIST ET AL

3,524,920

CIRCUIT BREAKER FOR CONDUCTIVE-COATED GLASS

Filed Feb. 16, 1968

Fig. 1

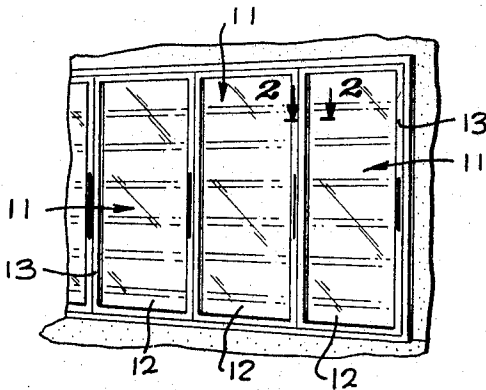


Fig. 2

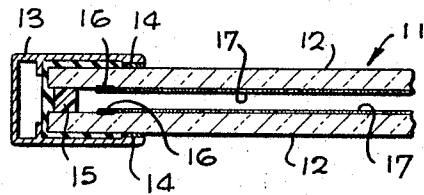


Fig. 3

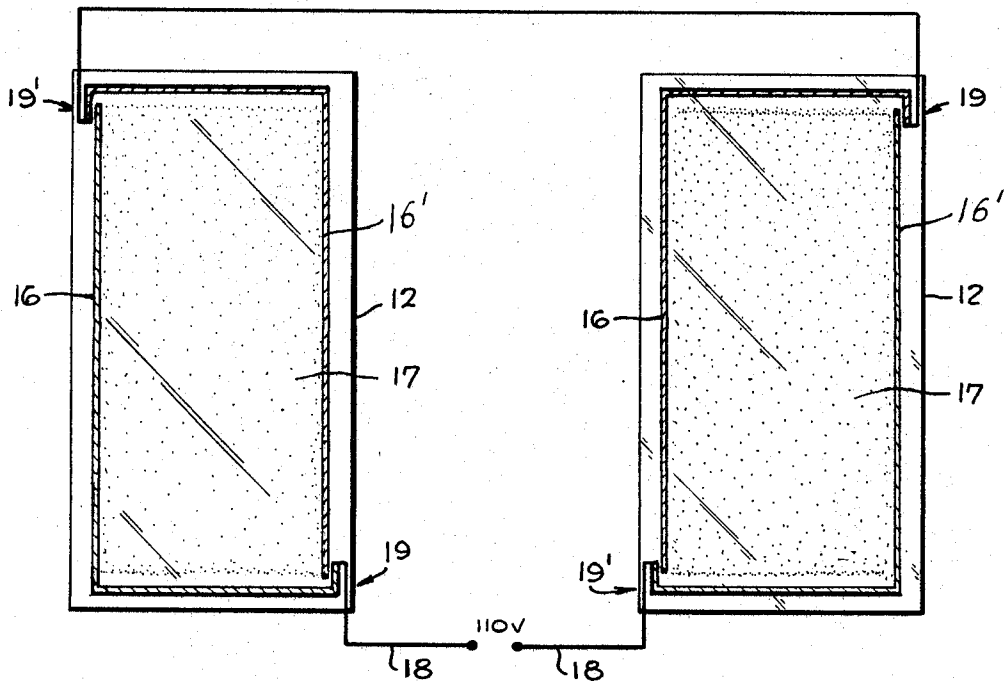
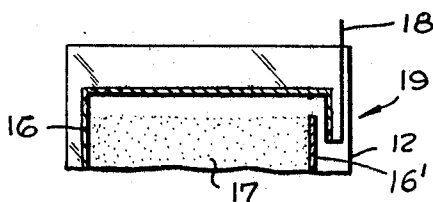


Fig. 4



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CIRCUIT BREAKER FOR CONDUCTIVE-COATED GLASS

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3 Claims

ABSTRACT OF THE DISCLOSURE

A safety device for a refrigerator door containing a conductive-coated tempered glass panel, in which the bus bar used to supply current to the conductive coating is frangibly bonded to the glass and arranged to surround the edges of the glass completely to form a continuous breakable current carrying barrier between the coating and the edges of the glass.

This invention relates in general to conductive-coated glass, and in particular to safety devices for use with refrigerator doors employing such glass.

It has become common in modern day merchandizing to display foods which normally must be kept refrigerated, such as dairy products and meats. One preferred way of accomplishing such display is to place a product in a refrigerated compartment provided with a transparent door for removal of the product. Such a door usually consists of a metal frame enclosing two pieces of glass bonded together at their edges and separated by an insulating air space.

Experience has shown, however, that even in most arid regions the glass in this type of door is susceptible to being fogged up because of the differential cooling on the inside and outside of the door. One method which has been used with considerable success to prevent this occurrence is to coat the surface of the glass with a transparent conductive coating and to pass electrical current through the coating to heat the surface of the glass which is exposed to condensation. While this method has been generally satisfactory for the prevention of moisture formation on the glass surfaces, the conductive coatings themselves have posed a potentially serious safety hazard. Any separation in the conductive coating, such as might be caused by thermal stresses within the glass or by percussive contact of the glass or the coating with an object, would result in a high electric potential existing across the break and would present a danger of shock to anyone coming in contact therewith. This danger can be minimized by utilizing low voltages rather than standard house current for heating the glass, but the expense of adapting these installations to such voltages and installing the necessary transformers is prohibitive.

The present invention overcomes these disadvantages by providing a conductive-coated glass door having the bus bar supplying current to the conductive coating completely encircling the surfaces of the glass and adapted to be fractured in the event the glass is broken. In case of such a break the electrical voltage drop is across the break in the bus bar and not in the region of the conductive coating. Since the bus bar is covered by the frame holding the glass in the door, there is little if any chance of a shopper coming in contact with the break. This chance may be reduced still further by providing electrical insulation between the frame and the glass and by sealing the frame to the glass so as to prevent moisture from seeping under the frame and contacting the break.

It is therefore the primary object of the present inven-

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tion to provide a new and improved safety device for refrigerated glass doors.

It is another object of the present invention to provide a safety device for glass doors having a conductive coating thereon.

It is a further object of the present invention to provide a safety device for conductive-coated glass surfaces to eliminate potential shock hazards therein.

It is still another object of the present invention to provide a new and improved bus bar configuration for a conductive-coated glass door.

It is yet another object of the present invention to provide a new and improved bus bar configuration for a conductive-coated glass door in which the bus bar shears upon any fracture of the glass door.

These and other objects of the present invention will become more apparent from the following detailed specification taken in conjunction with the accompanying drawings. It is to be understood however, that the specification and drawings are for purposes of illustration only and are not intended to be construed as a limitation upon the scope of the invention. In the figures which follow, corresponding reference numerals are carried forward wherever applicable.

FIG. 1 illustrates a typical conductively heated glass door installation for a refrigerated storage and display case;

FIG. 2 illustrates a cross-section of FIG. 1 along 2—2;

FIG. 3 illustrates a bus bar layout according to the present invention with the two glass panels shown in FIG. 2 placed side-by-side for diagrammatic purposes; and

FIG. 4 illustrates in greater detail the overlapping feature of the bus bar arrangement of FIG. 3.

In FIG. 1, a portion of the front face of a refrigerated compartment is shown. This front face comprises a series of glass doors 11 comprising glass panels 12 mounted in frames 13. The glass doors 11 are adapted to be swung open to enable a purchaser to avail himself on the contents of the refrigerated compartment.

In FIG. 2, a section of one such door and its glass panels 12 and framing 13 is shown in more detail. As is illustrated, the framing 13 is adapted to receive therein a plurality of the glass panels 12 which are sealed thereto by means of sealant 14 and separated from one another by means of a spacer 15 which may be composed of an insulating substance such as polyurethane. In this configuration, the edges of glass panels 12 are hermetically sealed with an air space between them to provide a highly thermally insulated closure for the front of the refrigerated compartment.

As also shown in FIG. 2, a series of bus bars 16, 16' are fused to the inside surfaces of the glass panels 12 and serve to carry current to the conductive coating 17 formed on the inside surfaces of the glass panels 12. The conductive coating 17 may be formed by the process of chemical or vacuum deposition and the thickness thereof is controlled so as to be substantially transparent to light. In the forming process the coating 17, like the bus bars 16, 16' actually becomes bonded to the glass. As explained previously, when electrical current is passed through the bus bars 16, 16' and the conductive coating 17 the surfaces of the glass panels 12 are heated sufficiently to prevent the condensation of moisture thereon.

FIG. 3 illustrates one embodiment of the unique bus bar configuration of the present invention which serves to prevent the creation of an electrical shock hazard when the conductive coating 17 is fractured due to breakage of the glass panels 12 or either of them. As is seen in FIG. 3, the glass panel 12 has the conductive coating 17 deposited thereon and in electrical contact with bus bars 16,

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16'. Electrical current is fed by means of leads 18 to the bus bars 16, 16' and across the conductive coating 17. Since the conductive coating 17 has a resistivity of the order of from 1 to 1000 ohms per square, heat is generated uniformly across the entire coated surface of the glass panel 12.

As is illustrated in FIGS. 3 and 4, the bus bars of the present invention are fused to the glass panel 12 in a geometric configuration completely surrounding the panel 12. A critical feature of the subject invention resides in the laying out of the bus bars 16, 16' in a pattern in which it is virtually impossible for any break in the glass panel to occur extending to the perimeter of the glass panel 12 which would not also result in a fracture through some portion of one or both of the bus bars 16, 16'. At each position 19, 19' on the glass panel 12 where one of bus bars 16, 16' ends, a portion of the other bus bar 16, 16' is found to overlap the ended portion of the first bus bar 16, 16' so that substantially no discontinuity of the bus bars 16, 16' exists with respect to the outside perimeter of the glass panel 12. Thus since the heat tempered glass used in all present day glass refrigerated storage and display container doors always breaks to the outside perimeter of such glass whenever any fracture of the glass occurs, and since the bus bars 16, 16' of the present invention are fused to the surface of the glass panel 12, shearing of the one or both of the bus bars 16, 16' upon any fracture of the glass panel 12 is assured.

From this brief description it will be apparent that numerous modifications may be made thereto without departing from the spirit and scope of the invention. For example, the subject invention readily may be employed with a heated door in which the conductive coating is applied to the surface of only one of the glass panels 12. In addition, the configuration of the bus bars 16, 16' shown in the regions 19 of FIGS. 3 and 4 may be varied

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as desired or required for any given installation. The only requirement is that a portion one of the bus bars 16, 16' must overlap the other bus bar's free ends to form a continuous breakable physical barrier between the central enclosed area of the panel 12 covered by the conductive coating 17 and the panel's edges.

What is claimed is:

1. In a conductively coated glass window unit, the combination comprising:

a film of electrically conductive material bonded to the surface of said glass so as to fracture therewith and spaced from the edges thereof; and

a pair of spaced bus bars bonded to said surface so as to fracture therewith, one of said bus bars being in electrical contact with one of the edges of said film, the other of said bus bars being in electrical contact with the opposite edge of said film, and each of said bus bars having its ends overlapping and electrically insulated from the ends of the other of said bus bars.

2. The combination of claim 1, wherein said glass is heat tempered.

3. The combination of claim 1, wherein said glass unit is surrounded by a frame electrically insulated from, and completely covering said bus bars.

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DARRELL L. CLAY, Primary Examiner

U.S. Cl. X.R.

219—203, 543; 338—309

07/1970
16/1970

UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,524,920 Dated August 18, 1970

Inventor(s) M.E. STROMQUIST et al.

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

In the specification, in column 1, line 6, that portion of assignee's address reading "San Francisco, Calif." should read --San Fernando, Calif.--.

SIGNED AND
SEALED

OCT 27 1970

(SEAL)

Attest:

Edward M. Fletcher, Jr.

Attesting Officer

WILLIAM E. SCHUYLER, JR.
Commissioner of Patents