Nov. 24, 1970 R. K. BUSTAD 3,543,014

BURIED PANEL-ILLUMINATING INSTALLATION

Filed May 6, 1968 2 Sheets-Sheet 1

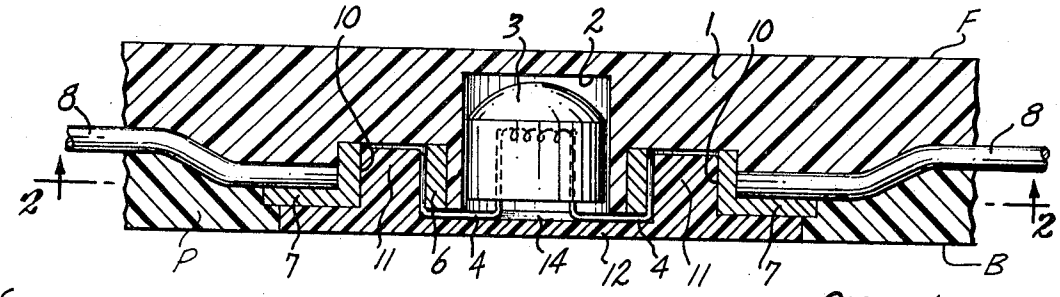

Fig. 1.

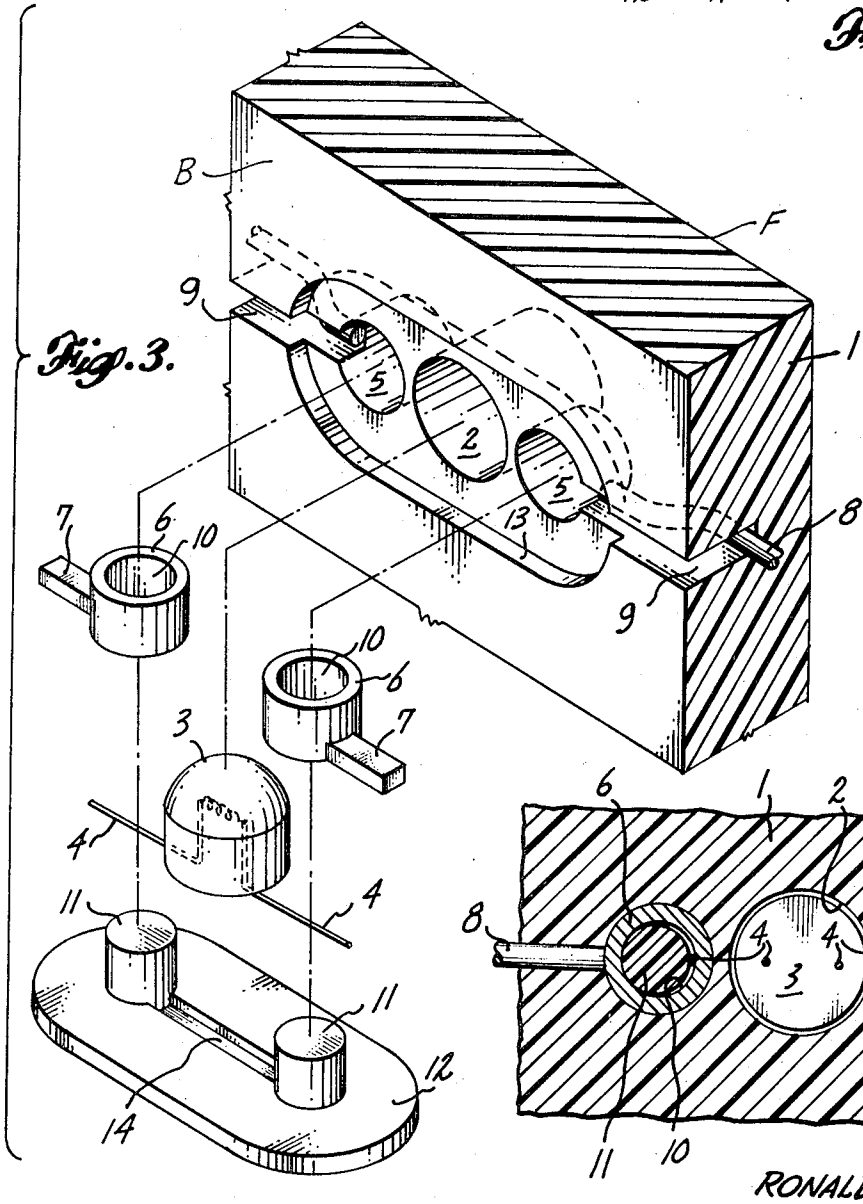

Fig. 3.

Fig. 2.

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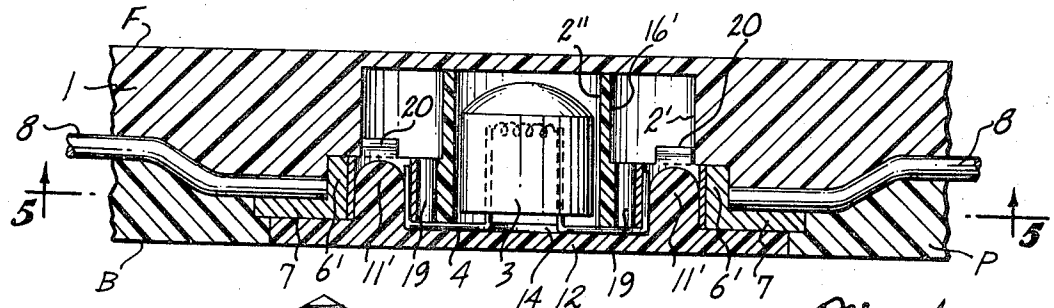


Fig. 4.

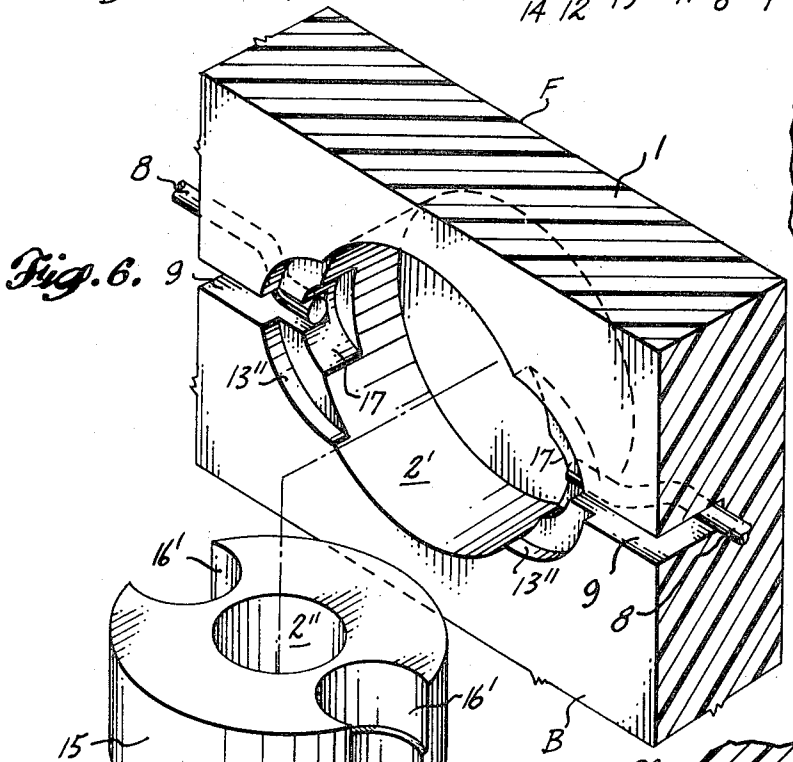


Fig. 6.

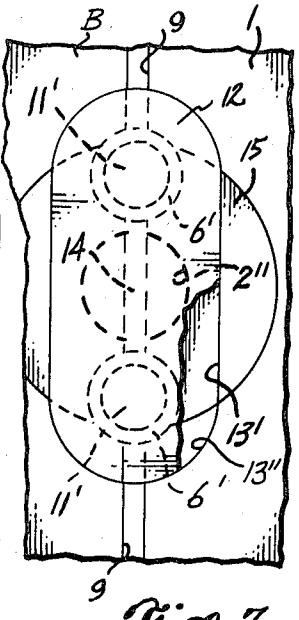
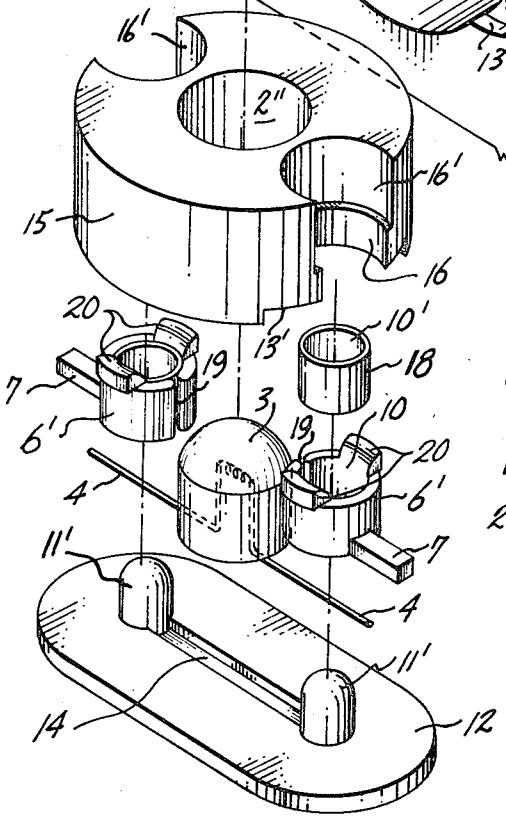


Fig. 7.



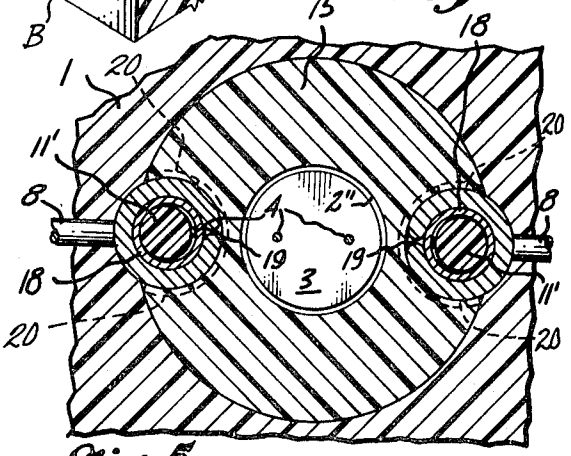


Fig. 5.

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BURIED PANEL-ILLUMINATING INSTALLATION

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ABSTRACT OF THE DISCLOSURE

In a panel cavity, a miniature light bulb is received having leads projecting from such cavity into sockets at opposite sides of the cavity, respectively. Apertured terminals of supply wires are fitted in such sockets and the light bulb leads extend into the terminal apertures. The panel surface toward which the cavity and sockets open in recessed to receive a closure flush with such panel surface which has projections that enter the apertures of the respective terminals and bind the light bulb leads in such apertures.

For various purposes, it is desirable to illuminate a transparent panel between its surfaces. Such a panel may, for example, be an instrument panel such as used in an airplane. Customarily, such internal illumination of a panel has been accomplished by shining light into the edge of such a panel or by mounting light units at various locations on a large panel in registry with apertures through the panel.

It is a principal object of the invention to provide an installation for illuminating the interior of a transparent panel which is sufficiently compact to be buried in the panel between its principal surfaces. A companion object, therefore, is to provide such a panel-illuminating installation which will not require any projections beyond either surface of the panel.

Another object is to provide such a panel-illuminating installation which is composed of few parts that can be assembled quickly and easily.

A further object is to provide such a panel-illuminating structure, the parts of which can be manufactured economically in quantity, such as by casting and/or extruding the metal parts and molding plastic parts.

FIG. 1 is a transverse section through a panel at the location of a panel-illuminating installation and FIG. 2 is a section through a portion of a panel parallel to its principal faces taken on line 2—2 of FIG. 1 through a panel-illuminating installation.

FIG. 3 is a top perspective of such a panel-illuminating installation showing parts in exploded relationship.

FIG. 4 is a tranverse section through a portion of a panel similar to FIG. 1, but showing a modified type of panel-illuminating installation, and FIG. 5 is a section parallel to the principal surfaces of the panel taken on line 5—5 of FIG. 4.

FIG. 6 is a top perspective of a panel-illuminating installation of the type shown in FIGS. 4 and 5 with parts in exploded relationship.

FIG. 7 is a back face view of a portion of a panel in which a panel-illuminating installation such as shown in FIGS. 4, 5 and 6 has been made, parts being broken away.

While it may be desirable to illuminate transparent panels internally for uses of various types, such as for an airplane instrument panel, for an electric power station instrument panel, or for an advertising display, a representative use is for an airplane instrument panel. In such an installation, the transparent panel 1 may be made of acrylic resin and have a thickness between its front principal surface F and its back principal surface B within the range of one-quarter of an inch to a half of an inch. Light projected into an edge of such a panel, whether that edge be at the margin of the panel or at an internal location, travels through the panel confined between surface portions of the panel which are polished or made opaque. Light will be emitted from any portion of a panel surface which is roughened, such as by being sandblasted, or will be emitted from edge portions of the panel, such as panel edges forming an aperture in the panel. Emission of light from the panel can thereby be controlled to illuminate only desired portions of the panel or instruments mounted in registry with apertures extending through the panel.

If a light unit which is thicker than the panel is mounted in registry with an aperture in the panel, such light unit must project beyond the front face F of the panel, which forms an unsightly projection, or a portion of such light unit must project beyond the back surface B of the panel, which may interfere with mounting the panel. Also, in either of such instances, the problem of sealing the light unit to the panel so as to prevent escape of stray light may be encountered. Such disadvantages are eliminated by the buried illuminating installation of the present invention. In addition, the entire amount of light generated by the light source is utilized directly and effectively.

As shown best in FIGS. 1 and 3, a cavity 2 is provided in the panel 1 which opens toward the back B of the panel and is of a size to receive within it a miniature light bulb 3. It is preferred that the envelope of such light bulb be substantially cylindrical to fit closely within the panel cavity 2 which, as shown in FIGS. 2 and 3, is of circular cross section. One end of the light bulb envelope may be of dome shape and be disposed adjacent to the bottom of the cavity 2. Such cylindrical wall and domed end of the light bulb are transparent or at least translucent. The end of the light bulb element opposite its domed end preferably is flat and may or may not be transparent or translucent. Leads 4 connected to the light filament project through such flat end of the light bulb element.

Two sockets 5 of circular cross section are located respectively adjacent to opposite sides of the cavity 2, and the leads 4 extend from the light bulb 3 and the cavity 2 into such sockets, respectively. Such sockets, like cavity 2, are blind and open toward the back B of the panel 1. Such sockets are of a cross-sectional size and shape and of a depth to receive in them supply wire terminals 6. Such terminals are hollow or tubular, preferably having a cylindrical exterior from one end of which projects a radial lug 7 shown best in FIG. 3. Such lugs are connected to the supply wires 8 received in slots 9 opening in the back surface of the panel, as shown in FIG. 3.

The supply wire terminals 6 are made of metal such as copper or brass, and conveniently may be cast parts. The hollow 10 is of cylindrical shape and the leads 4 from the light bulb 3 can extend into the hollows of these lugs and be bent alongside their inner walls, as shown in FIGS. 1 and 2. Such leads can be secured in the terminal bores and clamped against the internal surfaces of such bores with sufficient force to make a good electrical contact by unthreaded projections 11 integral with projecting inwardly from a plate 12. The projections 11 have a snug push fit in the terminal bores and plate 12 form a closure for the open ends of the light bulb cavity 2 and the terminal sockets 5. The plate element is received in a recess 13 in the back B of the panel 1 shown in FIG. 3. Such recess and plate are elongated so that the plate will span the length of the row of indentations formed by the bulb cavity 2 and the terminal sockets 5. Preferably the op-

posite ends of such plate are of semicircular shape and such ends are connected by straight sides.

The panel recess **13** is of a depth corresponding to the thickness of the closure plate element **12** so that when the closure has been placed in indentation-closing position, the outer surface of the closure will be flush with the back B of the panel **1**. The depth of the slots **9** adjacent to the terminal sockets **5** will be such as to accommodate the supply wire **8** and the lug **7** for each terminal, but when the closure is pressed into place, the inner surface of the plate element **12** will press against each lug **7** and press the inner surface of the lug into electrical contact with the supply wire **8** if such lug and supply wire have not previously been secured together, such as by soldering. Since the depth of the recess **13** corresponds to the thickness of the closure plate element **12**, it is necessary to provide a passage for the leads **4** from the light bulb cavity **2** to the hollows of lugs **6**. Such a passage can be provided by a groove **14** in the inner side of the closure plate element **12** extending between the projections **11**, as shown in FIGS. 1 and 3.

In assembling the components of the panel-illuminating installation, the supply wires **8** are inserted in their slots **9**. Simultaneously, or subsequently, the terminals **6** are inserted into their respective sockets **5**. Next, the light bulb **3** is inserted into its cavity **2** and its leads **4** are bent to extend between such cavity and the interiors of terminals **6** and the end portions of such leads are bent to lie alongside the inner walls of the terminals **6** in the positions shown in FIG. 1. Finally the closure **11, 12** is put in place so that its projections **11** clamp the light bulb leads **4** against the inner surfaces **10** of the terminals and the plate element **12** of the closure is pressed into the recess **13**. As the closure is pressed into place, the groove **14** in the inner side of its plate element **12** will fit over the leads **4**. Sliding of the projections **11** into the apertures of terminals **6** will cause the projections to bear against the leads **4** and pull their end portions so as to straighten their portions extending between the light bulb and the terminals.

When the closure is to be applied over the panel indentations, suitable adhesive can be placed in the bottom of the recess **13**, or on the inner surface of the closure plate element **12**, or both to effect a permanent bond between the closure and the panel to seal the installation in place permanently. Alternatively, the closure may be removable and its removal can be facilitated by providing one or more indentations in the rim of the closure plate element **12** into which an implement can be inserted to pry out the closure. Alternatively, threaded sockets can be provided in the closure in registry with the projections **11** into which bolts can be screwed to provide elements to which a force for withdrawing the closure can be applied. Also, liquid or soft plastic P can be placed in the slots **9** over the supply wires **8** to fill such slots flush with the back B of the panel.

The panel-illuminating installation shown in FIGS. 4 to 7 is generally similar to the installation of FIGS. 1 to 3 inclusive described above, but the light globe-receiving cavity and the sockets for the supply wire terminals are formed in a somewhat different manner. In this instance, a blind bore **2'** over a cross-sectional area much larger than the light bulb-receiving cavity is formed in the panel opening through the back B as shown best in FIG. 6. Into this blind bore is pressed a plug **15** shown best in FIG. 6, which is of transparent plastic material. This plug has a central aperture **2''** extending through it, which, when the plug has been inserted in the blind bore **2'**, serves as the cavity to receive the light bulb **3**, as shown in FIG. 4. Stepped notches **16, 16'** of arcuate contour are provided in diametrically opposite sides of the plug **15**, as shown in FIG. 6, to cooperate with complemental notches **17** in the opposite sides of the blind bore **2'**.

In this type of installation, the supply wire terminals **6'** are of two-part construction. Tubular thimbles **18** are

inserted into the apertures of the terminals **6'** to form liners and the terminals have splits **19** in their sides opposite their lugs **7** so that the annular terminals will be somewhat resilient to clamp the thimbles **18** tightly when they have been fitted within the terminal hollows having cylindrical walls **10**. The projections **11'** of the closure are then formed of a size to fit inside the internal wall **10'** of the respective thimbles **18**.

In the type of construction shown in FIGS. 4 to 7, the terminals **6'** must be assembled with the plug **15** before such plug is fitted into the blind bore **2'** of the panel. Such preliminary assembly is necessary because the inner edge of each lug **6'** has ears **20** projecting from its opposite sides outward to engage behind the shoulder formed by the step between the smaller portion **16** and the larger portion **16'** of the notch in one edge of the plug **15**. Engagement of such ears with such shoulder will prevent the terminal **6'** from being withdrawn from its socket when the plug **15** has been inserted into the blind bore in the manner shown in FIG. 4. The outer end of the plug **15** has a recess **13'** in it which cooperates with recesses **13''** in the back of the panel to provide an elongated recess for receiving the plate portion **12** of the closure. The plug is wider than such plate portion so that the recess forms a band across the plug's outer end.

The components of the panel-illuminating installation shown in FIGS. 4 to 7 is generally the same as that described in connection with the installation shown in FIGS. 1 to 3. Instead of the lugs **6'** being inserted directly into sockets in the panel, however, such lugs are assembled in the notches of the plug **15** and then such plug and the terminals are inserted together into the indentations of the panel. The thimbles **18** can be inserted into the apertures of the terminals before or after the plug **15** is placed in the panel. Next, the light bulb **3** is inserted into its cavity **2''** and its leads **4** are extended to the apertures of the terminals and the end portions bent down into such apertures. Finally, the projections **11'** of the closure are pushed into the bores **10'** of thimbles **18** and the plate portion **12** of the closure is pressed into the recess **13', 13''** so that the light bulb leads fit into the groove **14** of the closure plate portion **12**. The slots **9** are then filled with plastic P to complete the installation.

Alternatively, the supply wire terminals **6'**, light bulb **3** and closure can be assembled with the plug **15** before that plug is inserted into the blind bore **2'** of the panel. In this assembly operation, the terminals **6'** are assembled in their respective notches **16** with the lugs **20** lodged in the notches **16'**. Next, the light bulb **3** is inserted in the cavity **2'**, the thimbles **18** are inserted in their terminals **6'**, and the leads **4** are bent into the thimbles in the positions shown in FIG. 4. The projections **11'** of the closure are then pressed into the thimbles and the plate portion **12** of the closure is fitted into the recess **13'** of the plug **15**.

With the several components thus assembled with the plug **15**, such plug can be pressed into the panel blind bore **2'** with the supply wire **8** placed in the slots **9** so that again the parts are disposed in the relationship assembled in the panel indentations, as shown in FIG. 4. The slots **9** can then be filled with plastic P as mentioned above.

I claim:

1. A buried panel-illuminating installation comprising a panel having therein a cavity opening at one surface of said panel and terminal sockets adjacent to said cavity and opening at the same side of said panel, supply wire terminals received in said respective sockets, a replaceable miniature light bulb removably received in said cavity and having leads integral with said light bulb extending to said respective terminals, and closure means closing said cavity over said light bulb and being separable from said light bulb for removal from cavity-closing position independently of said light blub.

2. The installation defined in claim 1, in which the supply wire terminals are separate from the closure means and have apertures therein, the light bulb leads are disconnected from the terminals but extend into such apertures, and binding means received in such terminal apertures and clamping the light bulb leads therein against the walls of such apertuers in electricity-conducting contact therewith.

3. The installation defined in claim 2, in which the binding means received in the terminal apertures are unthreaded projections of a size to fit snugly in such apertures with a push fit.

4. The installation defined in claim 3, in which the binding means projections are both integral with the closure means.

5. The installation defined in claim 1, in which the panel has a recess, the cavity and the socket rims are in the bottom of such recess and the closure means includes plate means separate and separable from the light bulb and fitting in such recess in covering relationship to the light bulb.

6. The installation defined in claim 5, in which the terminals have apertures therein, the light bulb leads are disconnected from the terminals but extend into said apertures, and projections integral with and projecting from the plate means into said apertures for clamping such leads against the walls of such terminal apertures in electricity-conducting contact therewith.

7. The installation defined in claim 1, in which each terminal includes a split collar and a tubular thimble fitted into said collar.

8. The installation defined in claim 1, in which the panel includes a plug having therein the light bulb cavity and at least a portion of each of the terminal sockets, and the panel has in it a blind bore in which said plug fits.

9. The installation defined in claim 8, in which the

cavity and the sockets have openings recessed from the surface of the panel at which the cavity and sockets open, including a band recess across the plug, and the closure includes elongated plate means having a width less than the corresponding width of the plug, which plate means fit in such recess.

10. The installation defined in claim 8, in which each terminal has a projection extending outwardly from its inner side and the socket has an undercut shoulder engageable by said projection requiring each terminal to be assembled into the inner end of such socket.

11. The installation defined in claim 8, in which the terminal sockets are arcuate notches in the side of the plug, each of which notches is of an angular extent exceeding 180 degrees.

12. The installation defined in claim 11, in which the panel blind bore has notches in its edge complemental to the notches in the plug, so that in each instance the complemental notches cooperatively form a terminal socket of circular cross section.

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U.S. Cl. X.R.

240—8.16; 339—176