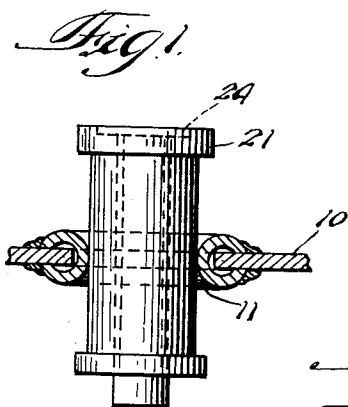
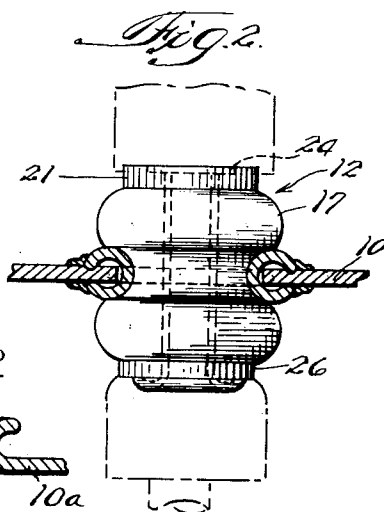
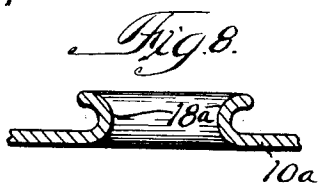
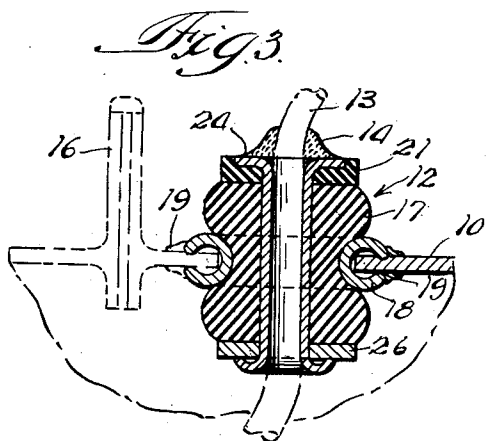
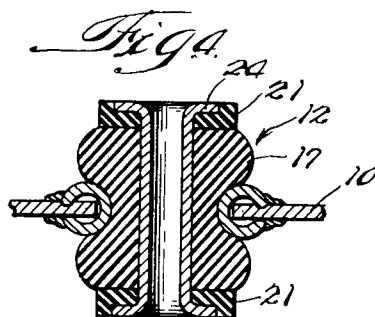
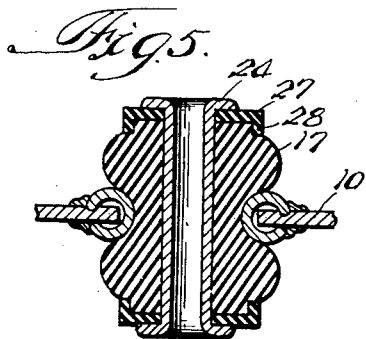
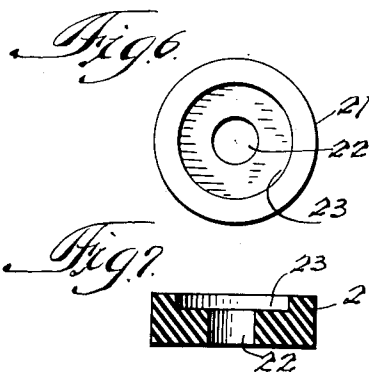


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S. A. KRUSS ET AL
LEAD-THROUGH TERMINALS

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2,816,950

LEAD-THROUGH TERMINALS

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Application May 15, 1952, Serial No. 287,924

1 Claim. (Cl. 174—153)

Our invention relates to improvements in lead-through terminals for establishing electrical contact through metallic housings which are required to be hermetically sealed.

The present invention is an improvement over our co-pending application Serial No. 228,918, filed May 29, 1951. In the said application, there is disclosed a structure embodying metallic washers on opposite ends of a silicone rubber sleeve for confining the said sleeve in compressed condition. In electrical devices of the type requiring hermetic sealing and the use of lead-through terminals in the metallic housing containing the apparatus, a flash-over of electrical current through the air between the metallic housing and the exposed portion of the terminal frequently occurs, particularly when the ambient conditions of pressure and moisture are conducive to such occurrence. This results in failure or breakdown of the apparatus and in order to avoid the liability of such a condition occurring, the terminal is so designed that the exposed portion thereof is located at a sufficient height above the surface of the housing through which the terminal passes so that the liability of flash-over occurring is greatly minimized.

We have found that through the use of a compressing washer formed of a resin known in the trade as polytetrafluorethylene, in a lead-through terminal of our invention particularly desirable electrical qualities are obtained, namely, high resistance to the passage of electrical current through the terminal and additionally high resistance to the passage of electricity over its surface, as for example, when the surface is exposed to a gaseous atmosphere. Accordingly, as a result of the use of such a washer in combination with a silicone rubber body, as will be presently described, it is now possible to reduce the height of the terminals by as much as two-thirds of the height of conventional terminals heretofore used and yet obtain very satisfactory results.

Accordingly, it is an object of our invention to provide a lead-through terminal of the type described which is more efficient in service operation than terminals of similar types heretofore used.

Another object of our invention is the provision of a lead-through terminal which has high resistance to the passage of electricity thereby permitting the use of terminal structures of reduced height so as to effect a saving of space occupied by the apparatus and in addition a saving of material.

Other and further objects and advantages of our invention will become apparent from the following description when considered in connection with the accompanying drawings in which:

Fig. 1 is an elevational view of one embodiment of a lead-through terminal and illustrating the first step in assembling the same in a panel of a receptacle or housing, the panel being shown in cross-section.

Fig. 2 is a similar view showing the second step in assembling the lead-through terminal.

Fig. 3 is a cross-sectional view through the lead-through terminal and panel and showing the same in fully assem-

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bled condition with an electrical conductor passing through the terminal.

Fig. 4 is a vertical cross-sectional view showing a modified embodiment of the invention.

Fig. 5 is a similar view showing another modified embodiment of the invention.

Figs. 6 and 7 are respectively plan and cross-sectional views of a detail of construction.

Fig. 8 is a cross-sectional view of a modified panel structure which may be utilized with our invention.

Referring to the drawings, the numeral 10 indicates a metallic panel of a receptacle intended for housing an electrical apparatus of the type required to be hermetically sealed in a receptacle. The metallic panel is provided with a plurality of apertures 11 in each of which is received a lead-through terminal indicated generally by the numeral 12 and hereafter to be described. An electrical conductor 13 is passed through the lead-through terminal and soldered thereto, as at 14, as illustrated in Fig. 3, so as to effect hermetic sealing engagement therewith. In the panel 10 is sealed a conventional tubular tip 16 communicating with the interior of the receptacle and adapted to be connected to a suitable vacuum pump whereby the receptacle may be evacuated, the said tip being sealed off in a well known manner after evacuation of the receptacle has been completed.

The lead-through terminal 12 of our invention includes a bushing of silicone rubber 17 which is inserted in an aperture 11 of the panel 10 of the receptacle, the aperture first having been prepared by inserting an eyelet 18 therein flaring out one end thereof and bonding the eyelet to the panel with molten metal as at 19 in the manner described in our co-pending application for patent. This construction provides a smoothly rounded annular wall surface of relatively short radius against which the silicone rubber bushing 17 will seal. The modified form of panel 10a illustrated in Fig. 8 is formed by spinning or otherwise forming the marginal edges of an aperture in the panel to provide a rounded annular wall 18a of relatively short radius.

Superposed on top of the silicone bushing 17 is a washer 21 which is preferably formed like that illustrated in Figs. 6 and 7, the said washer being in the form of a flat annular body having a central aperture 22 and a concentric annular recess 23 in one face thereof. A metallic conductor or terminal 24 of a headed tubular type is inserted through the washer 21 and bushing 17 and through a second washer 26 adjacent the bottom end of the bushing 17 with the flanged end of the conductor 24 preferably engaging the upper washer 21. The second or lower washer may be of metal as is illustrated in Figs. 1, 2 and 3 or may be like washer 21 as illustrated in Fig. 4. The lower end of the conductor 24 is spun outwardly as described in our co-pending application so as to compress the silicone bushing 17 between the washers 21 and 26 thereby to effect sealing engagement of the bushing 17 with the wall of the aperture and the conductor 24.

The washer 21 is formed of a resin known chemically as polytetrafluorethylene. We have found this material to have, in addition to a high dielectric strength, the quality of resisting the passage of electricity through its surface, as for example, when the surface is exposed to a gaseous atmosphere. Silicone rubber and polytetrafluorethylene each individually have relatively high ratings insofar as high dielectric strength and resistance to the passage of electricity over their surfaces are concerned, and it might be expected that the structure comprising the combination of these two materials would have a rating equal to or at least no greater than the higher rating of the two. However, in fact, the combination of the silicone rubber bushing and the polytetrafluorethylene washer compression members disposed at the ends thereof, as em-

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bodied in our invention, affords a structure having a total rating which is substantially higher than the ratings of the separate materials. Thus, the combinational structure of the invention breaks down at a voltage which is much larger than the sum of the voltages required to break down each of the component elements of the structure. As a result, we have found that lead-through terminals according to our invention may be reduced in size under conventional terminals by as much as 35% to 65%. In conventional practice, the minimum height of an insulated terminal which may be employed for a given service requirement is governed by the liability of flash-over of electrical current through the air from the metallic panel to the lowest point of the terminal having an exposed metallic surface. Thus, the distance separating the panel from the metallic surface of the terminal must always be sufficient to prevent flash-over occurring. Consequently, with our invention, an electrical apparatus may be made more compact, resulting in a substantial saving in space occupied by the apparatus as well as a saving in materials.

In the modified embodiment illustrated in Fig. 5, the polytetrafluorethylene washer 27 is formed with an annular flange 28 providing a cap structure for the silicone rubber bushing 17.

While the lower washer may be metallic such as washer 26, under certain conditions of service it is desirable that the said lower washer be made of polytetrafluorethylene and formed either like washer 21 or washer 27.

We claim:

In combination with a panel having an aperture there-

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in and an eyelet passed therethrough and metallicity bonded to said panel, the said eyelet being flanged on opposite sides of said panel, a hermetically sealed bushing of silicone rubber received in said eyelet, an apertured disc insulating compression member formed of polytetrafluorethylene seated on the upper end of said bushing, and a conductor member extending through said bushing and said compression member and maintaining the said bushing in compressed condition and in sealing engagement to said conductor member and said eyelet, said apertured disk insulating compression member being formed with an annular recessed portion on one side thereof and said conductor member having a flange at an end thereof of no greater radial dimension than said recessed portion whereby said flange is adapted to be seated within said recessed portion to thereby minimize the over-all height of said conductor member.

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