Nov. 25, 1947. R. A. L. COLE 2,431,308

ARRANGEMENTS FOR INSULATINGLY LEADING ELECTRIC CONDUCTORS THROUGH METAL CASINGS

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FIG. 1.

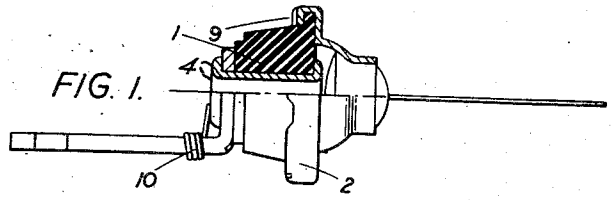


FIG. 2A.

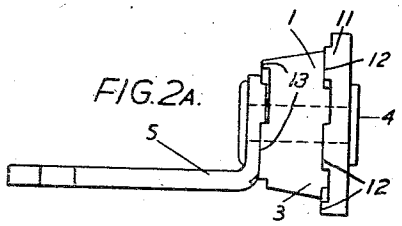


FIG. 2B.

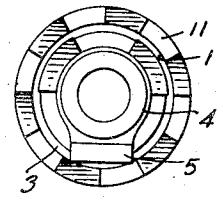


FIG. 3.

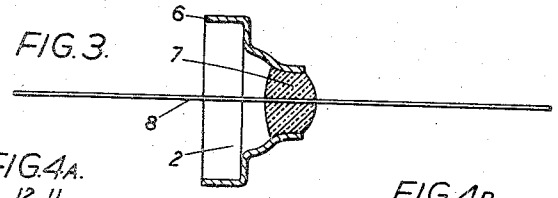


FIG. 4A.

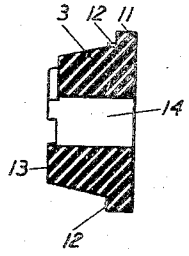


FIG. 4B.

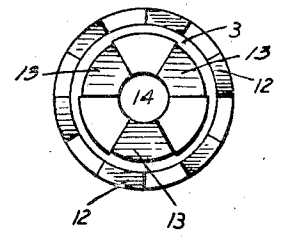
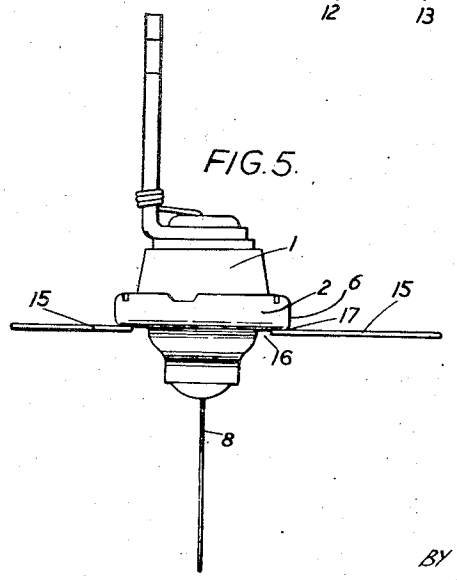


FIG. 5.



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ARRANGEMENTS FOR INSULATINGLY LEADING ELECTRIC CONDUCTORS THROUGH METAL CASINGS

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3 Claims. (Cl. 174—152)

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This invention relates to insulated terminals for electrical circuit elements enclosed in cases, and in particular to cases which are to be hermetically sealed.

In the electrical communication art, it is very commonly required to provide electrical circuit elements such as resistances, inductances, condensers, transformers, and the like, in a form in which they will not be appreciably affected by atmospheric conditions. It is very generally found, for example, that such elements must be protected from moisture, and this has been frequently done in the past by covering the dried element with some kind of sealing compound and enclosing it in a case which is not usually airtight. For example, a mica condenser, after drying out, may be assembled in a metal case which is filled up with paraffin wax, the leads being brought out through the wax and soldered to terminals mounted on an insulating strip closing the mouth of the can, no attempt being made to keep out the air, the wax being relied upon to keep the element permanently dry.

This method of sealing is found to have various objections. The sealing compound may undesirably affect the properties of the element; cracks may subsequently appear in the sealing compound resulting in introduction of moisture: the compound may melt in hot countries or when soldering: and in the manufacturing process it is often difficult to keep the element dry in the interval between drying and introducing the sealing compound.

Accordingly it has sometimes been found convenient to place the element in a case which is hermetically sealed, and which may be exhausted, or filled with dried gas at a suitable pressure, thus avoiding the use of sealing compound with its attendant objections as already described. In order that this may be done, suitable hermetically sealed terminals must be provided for bringing the leads of the element outside the case. The present invention provides such a terminal in which the hermetic seal is made by a metal-to-glass seal according to well known technique. While insulated terminals using this technique are already known, the present invention provides an arrangement whereby the glass seal does not take any part in supporting the actual outside terminal to which the external connecting wires are soldered, and is therefore not subjected to any mechanical stresses by which it might be broken, nor is it liable to be much heated when the wires are soldered.

According to the invention, there is provided a

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hermetically healed insulated terminal comprising a conducting wire sealed to a thin metal cup by means of a metal-to-glass seal in a manner substantially as described, and a circular bush of insulating material having a disc-like base portion provided with castellations, the said bush being assembled to the said cup by inserting the said base into the mouth of the cup, the lip of the cup being then crimped over the edge of the said base into the said castellations whereby relative rotation of the two parts is prevented.

The invention will be more clearly understood by reference to the following detailed description of an embodiment and to the accompanying drawing in which:

Fig. 1 is a side elevational view, partly in section, of one form of a hermetically sealed terminal constructed according to this invention.

Fig. 2A is a side elevational view of one of the two unitary assemblies, which together form the completed terminal shown in Fig. 1.

Fig. 2B is an end elevational view of the structure shown in Fig. 2A, as seen looking from the left side of Fig. 2A.

Fig. 3 is a sectional view, taken in a vertical plane, of the other unitary assembly used in forming the complete terminal shown in Fig. 1.

Fig. 4A is a sectional lateral elevational view of the bush 3 of Figs. 2A and 2B.

Fig. 4B is an end elevational view looking from the left end of the element shown in Fig. 4A.

Fig. 5 shows the completely assembled device of Fig. 1, as applied to a case for an electrical circuit element, and especially illustrating the manner of fixing the terminal to such a case.

Fig. 1 shows a general view (partly in section to show the construction) of an insulated terminal according to the invention. It consists of two partial assemblies 1, shown in Figs. 2A and 2B and 2 shown in Fig. 3. Referring to Figs. 2A and 2B, the partial assembly 1 comprises a conical bush 3 of insulating material, of a ceramic nature for example, to which is fixed a metal terminal lug 5 by means of a rivet 4 passing through an axial hole in the bush 3.

Fig. 4A shows a section of the bush 3 and Fig. 4B shows the corresponding plan view. It will be seen to be in the form of a frustrum of a cone, the larger end of which spreads out into a flat circular disc 11; and the bush is provided with an axial cylindrical hole 14. The disc portion 11 is provided with castellations 12, the raised portions of which are shaded in the end elevational view, Fig. 4B. The smaller end of the frustrum is likewise castellated as indicated at 13.

The terminal lug 5 (Figs. 2A and 2B) is provided with depressions corresponding to the castellations 13 so that when the rivet 4 is spun over or otherwise assembled so as to hold the bush 3 and lug 5 together, the depressions engage with the castellations so that the lug 5 is held rigidly and is prevented from rotating with respect to the bush 3.

Referring now to Fig. 3, the partial assembly 2 comprises a metallic cup 6 which may be of copper, for example, sealed to a conducting wire 8 by means of a glass bead 7 in the well known manner. In order to obtain satisfactory sealing the cup 6 should preferably be thin, for example less than 0.01 inch thick, or if thicker should be tapered off at the sealing edge, and the wire 8 should preferably have about the same coefficient of expansion as the glass: for example, the wire 8 could be a composite wire consisting of a copper clad nickel-iron wire the thickness of copper being chosen to give the desired coefficient of expansion radially.

Referring again to Fig. 1, the partial assemblies 1 and 2 are brought together, the wire 8 being threaded through the rivet 4. The disc portion 11 is fitted into the open end of the cup 6 and pushed home, after which the edge of the cup is crimped over the edge of the disc 11 into the castellations at 9 (Fig. 1) thus fixing the two partial assemblies together in a manner which prevents the possibility of any relative rotation. The wire 8 is finally soldered or brazed to the lug 5 as indicated at 10 in Fig. 1.

In an actual practical case, an insulated terminal of the type shown in Fig. 1 was made up for a wire 8 of diameter 0.014 inch, and a convenient size was found to be such that the diameter of the larger end of the cup 6 in Fig. 3 was about 3/8 inch, the other dimensions being substantially as indicated by the various sketches, which are approximately to the same scale. These particular dimensions are of course not essential to the invention, and the actual sizes and shapes of the various parts will be determined in accordance with the particular purpose to which the insulated terminal is to be applied.

Fig. 5 shows how the insulated terminal of Fig. 1 may be fixed to a metal containing can for an electrical circuit element of any type, for example such elements as those enumerated in the second paragraph of this specification, providing at the same time a hermetic seal to enable the can to be exhausted, or filled with a gas at any desired pressure. In this figure, 15 presents a portion of the lid or a side of such a can, which may for example be made of sheet copper, or brass, or tinned iron, or other sheet metal as desired. A circular hole 16 is punched in the lid 15, the diameter being intermediate between that of the larger end of the cup 6, and that of the base of the domed portion of the cup, so that the insulated terminal 1, 2 will seat upon the lid 15, closing the hole, with the wire 8 extending inside the can. The insulated terminal may then be sealed to the can by soldering, or brazing, or otherwise, round the edge at 17, making a gas-tight joint.

It will be understood that while in Fig. 5 only one insulated terminal is shown fixed to the lid or side of a containing can or case, any desired number of such terminals may be fixed to the same can in the manner described.

It will be noted that in the insulated terminal which has been described, the terminal lug 5 is

firmly supported by the bush 3, which also supports independently the cup assembly 2, and relative rotation of the parts is prevented by the castellations. Thus the metal-to-glass seal is effectively protected against mechanical stresses produced when soldering external connecting wires to the lug, and also against being unduly heated, the only direct connection between the lug and seal being the relatively flexible portion of the wire 8.

While the invention has been described in terms of a particular embodiment, it is not intended to be limited thereto, and various modifications to suit the conditions of any specified case are possible in accordance with the principles of the invention, which are, briefly, that the terminal lug for the external wires and the assembly carrying the metal-to-glass seal should be independently and rigidly supported by a separate detail and that they should key together in such a way that rotation is prevented. In the embodiment described this detail is a circular bush with castellations. Other arrangements fulfilling the requirements will occur to those skilled in the art.

What is claimed is:

1. Electrical terminal device for forming a substantially hermetical seal, including a conducting wire, a cup of relatively thin metal having a flange on one side and an opening on the other side smaller than the opening defined by said flange, a glass-like bead insulatingly sealing said conducting wire so as to extend through said opening on the other side of said cup and so as to close said opening, said wire and cup together forming a unitary assembly structure, and a second unitary assembly structure including a tapered bush of insulating material having two unequally sized ends and provided with an axial aperture and having a disc-like base portion provided with castellations, said bush being partially positioned within said cup with said base of said bush held within the mouth of said cup, the lip of said cup being provided with a crimped edge overlapped to said base and extended into said castellations, whereby relative rotation of the two parts is prevented, and whereby said conducting wire is maintained in a position longitudinally extending through said complete assembly.

2. Device according to claim 1, additionally including a terminal lug having a collar abutting the smaller end of said tapered bush and connections between said wire and said lug.

3. Device according to claim 1, additionally including a terminal lug having a collar abutting the smaller end of said tapered bush and connections between said wire and said lug, and also including a hollow rivet passing through the central hole of said bush, and through the collar of said lug.

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