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METAL-ENVELOPE TRANSLATOR

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Fig. 1

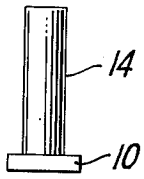


Fig. 2

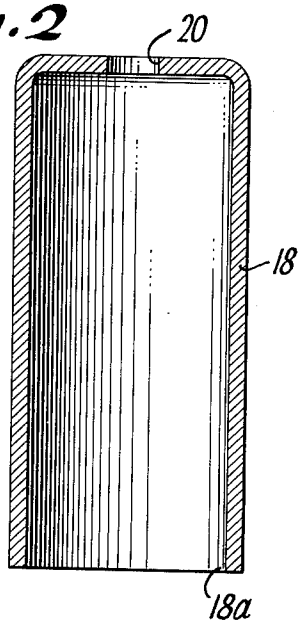


Fig. 3

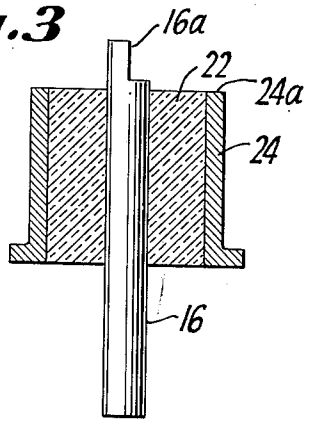
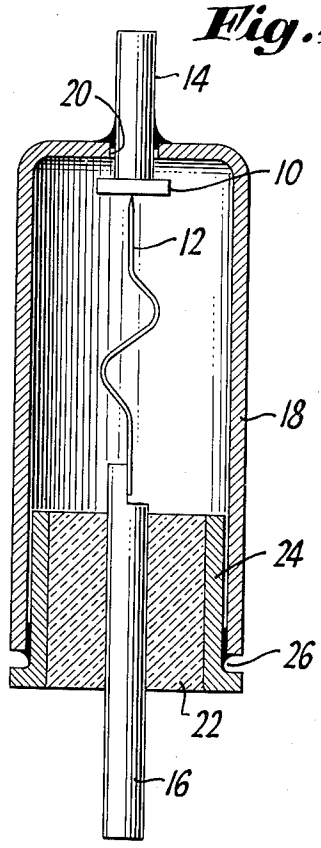


Fig. 4



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METAL-ENVELOPE TRANSLATOR

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4 Claims. (Cl. 317—236)

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The present invention relates to electrical translators employing a semi-conductive element, more particularly to so-called crystal diodes, and to methods of assembling such devices.

It has been realized that germanium diodes can be made of stable characteristics in which a small volume of air is allowed to remain in a sealed envelope. These diodes have a germanium chip (or like semi-conductor) and a point-contact element resiliently in engagement with the chip. The semi-conductor and the resilient contact element are, however, often subject to destruction by excessive heat when the envelope is being sealed and this problem is especially difficult with metal envelopes.

The present invention is concerned with a novel method and construction for semi-conductor translators having a largely metallic envelope. In the illustrative embodiment of the invention described below, a short metal sleeve and an inner conductor are hermetically sealed together by a spacer of vitreous material that is ordinarily glass having virtually the same thermal coefficient as that of the sleeve and the inner conductor. The latter is arranged to project (at least at one end) beyond the end of the sleeve to be accessible, so that one of the translator elements, either the chip or the point-contact element, can be attached after the glass and metal sub-assembly is completed. In this way the translator element is not subjected to the heat of forming the glass-to-metal seals and is not likely to be otherwise damaged or deformed in the process. A tubular metal member, either a cup or a tube, can then be soldered or otherwise united hermetically to the short sleeve previously mentioned, this tubular member constituting most of the desired metal envelope. In the illustrative embodiment described below the other translator element is mounted inside the tubular metal member in a preliminary operation so that proper engagement of the two translator elements can be effected while the long tube and the sleeve are being hermetically united.

The nature of the invention and further features of novelty will be more apparent from the following detailed disclosure of an illustrative embodiment shown in the accompanying drawings, wherein:

Fig. 1 is a lateral view of a crystal and lead sub-assembly;

Fig. 2 is a tubular metal member to constitute most of the envelope of the translator;

Fig. 3 is a coaxial metal and glass sub-assembly; and

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Fig. 4 is a longitudinal cross-section of the illustrative crystal diode embodying various features of the invention and showing the parts in Figs. 1–3 in assembly.

In Fig. 4 a chip or small body of semi-conductive material 10 as tin-doped germanium is shown engaged by a resilient point-contact element 12 and these translator elements 10 and 12 are supported in proper mutual contact by leads 14 and 16 that also constitute external terminals. Tubular metal member 18 that may be considered the envelope is formed as a drawn cup having an aperture 20 formed in one end. The apertured end of the cup is soldered to lead 14 so as to have a hermetic seal. At the open end of member 18, lead 16 is supported and sealed by a quantity of glass or other vitreous insulating material 22 within metal sleeve 24 that is soldered at 26 to the open end of member 18.

Chip 10 in this embodiment is a small piece of highly purified germanium with a trace of alloying tin, having a carefully ground flat and etched surface. In Fig. 1, chip 10 is secured to lead 14 in a preliminary operation, suitably by a quick soldering operation to limit the degree of damage to the semi-conductor by excessive heating. This sub-assembly is next inserted into aperture 20 of cupped tubular member 18 through the open end 18*a* thereof, and soldered in place hermetically.

Lead 16 is supported by a body 22 of glass or the like that is molded within sleeve 24 in a preliminary operation to form the sub-assembly of Fig. 3, which constitutes a closure for open end 18*a* of tubular metal envelope member 18. A portion 16*a* of lead 16 projects beyond the end 24*a* of sleeve 24 so as to be readily accessible for securing contact element 12 in place as by welding. By forming the sub-assembly of Fig. 3 in an operation before element 12 is attached, that element need not be exposed to the hazards of molding heat and handling that might change its shape or physical properties. Ordinarily, it is of fine gauge tungsten wire that is secured by heat and pressure applied to lead portion 16*a*.

The end closure and resilient contact assembly are next slipped into place within envelope 18 so that element 12 contacts element 10 properly as indicated by concurrent assembly and electrical test, and portion 18*a* and sleeve 24 are soldered together hermetically to seal translator elements 10 and 12 within an essentially metal envelope.

It is notable that sleeve 24 and tubular member 18 are of two separate pieces which are soldered together rather than being formed of a single

piece; for were the latter construction used, portion 16a of lead 16 would not be accessible for securing a translator element in place, and the entire metal envelope would then be of the same relatively costly alloy as that required for sleeve 24. In the present construction the only critical materials in contact with glass 22, which hence are required to have virtually the same thermal coefficient of expansion as that of the glass, are lead 16 and sleeve 24.

Certain modifications in the foregoing construction and procedure will naturally be suggested by this illustrative embodiment. Thus, the transverse dimensions of lead 14 and chip 10 may be made alike (or chip 10 may be smaller than the end of lead 14) so that it can be inserted from the end of envelope 18 opposite 18a; and in this event it might be inserted as the final step in the assembling procedure. Were this procedure used, certain care would be required in maintaining lead 14 properly oriented so that the end face of chip 10 would be truly perpendicular to contact element 12, this function being accomplished by the snug fit of sleeve 24 in member 18. In another construction aperture 20 might be omitted and the semi-conductor element soldered to the bottom of cupped metal member 18 as a preliminary assembling operation. This variation would eliminate lead 14 that is sometimes required for circuit connection, although envelope 18 itself could then be used as a solderless terminal of the diode. Various other modifications will undoubtedly occur to those skilled in the art and therefore the appended claims should be allowed that latitude of interpretation that is consistent with the spirit and scope of the invention.

What I claim is:

1. An electrical translator including an integral unitary tubular metal envelope member, a piece of semi-conductor and a point-contact element contained in said member, a metallic support carrying said semi-conductor and closing one end of said tubular member and hermetically sealing off said one end, and a coaxial assembly supporting said point-contact element in proper contact with said semi-conductor, said coaxial assembly including a metal sleeve, an inner conductor projecting into the tubular member beyond the axial end of the sleeve, and a vitreous insulator sealed between said sleeve and said inner conductor and having fused hermetic seals to said sleeve and to said inner conductor, said sleeve being sealed hermetically to said tubular metal member.

2. An electrical translator including an integral tubular metal envelope member, a pair of mutually engaging translator elements contained in said member, a metallic support carrying a first one of said elements and closing one end of said tubular member and hermetically sealing off said one end, and a coaxial assembly closing the other end of said tubular member and supporting the other of said elements in proper contact with said first element, said coaxial assembly including a metal sleeve, an inner conductor projecting into the tubular member beyond the axial end of the sleeve, and a vitreous insulator closing off the space between said sleeve and said inner conductor and having fused hermetic seals to said sleeve and to said inner conductor, said sleeve being sealed hermetically to said metal envelope member.

3. An electrical translator including a hollow metal envelope member containing a pair of mutually engaging translating elements, said envelope member having an opening at one end, a lead supporting one of said translating elements, an insulator surrounding and having a fused seal to said lead, and a sleeve having a fused hermetic seal to and encasing said insulator and sealed to the open end of said metal envelope member, said lead projecting into said metal envelope beyond the end of the sleeve and electrically conductive means supporting the other of said pair of translating elements fixedly within said hollow metal envelope member.

4. An electrical translator including a tubular metal envelope member, a piece of semi-conductor and a point-contact element contained in said member, a metallic support carrying said semi-conductor and closing one end of said tubular member, and a coaxial assembly supporting said point-contact element in proper contact with said semi-conductor, said coaxial assembly including a sleeve, an inner conductor projecting into the tubular member beyond the axial end of the sleeve, and a vitreous insulator sealed between said sleeve and said inner conductor, said sleeve being sealed hermetically to said tubular metal member, and said sleeve and said inner conductor being of an alloy having a thermal coefficient equal to that of the vitreous insulator.

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