Sept. 28, 1965 W. C. KLAMMER 3,209,103

RELAY APPARATUS WITH HERMETIC SEAL CONSTRUCTION

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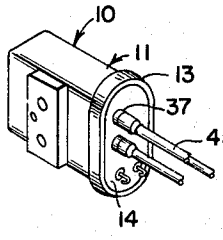

FIG. 1

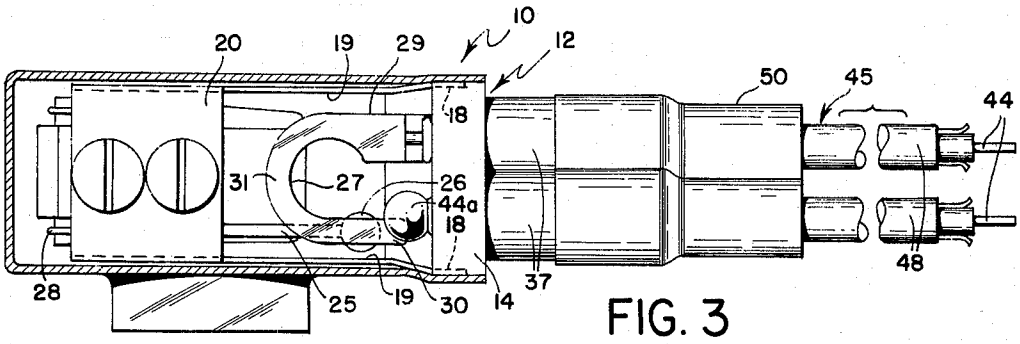

FIG. 3

FIG. 2

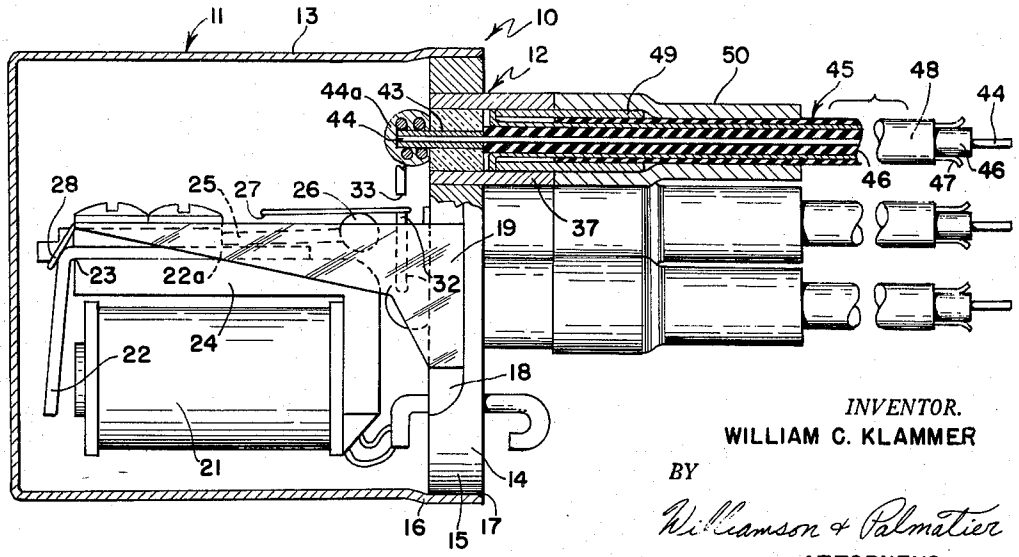

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FIG. 5

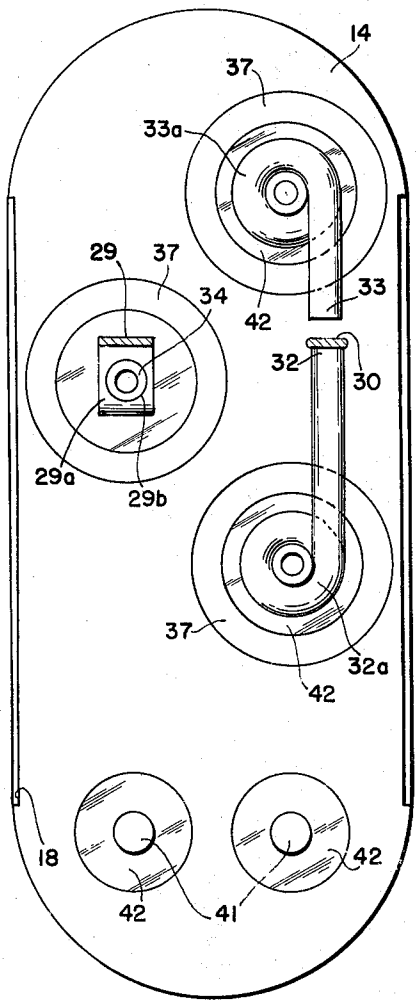
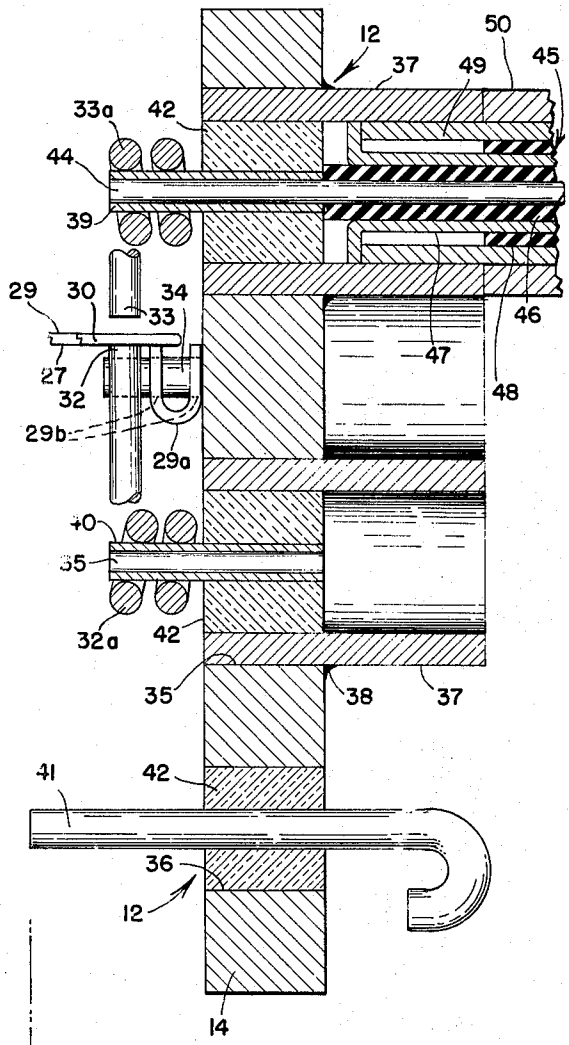


FIG. 4



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RELAY APPARATUS WITH HERMETIC SEAL CONSTRUCTION

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3 Claims. (Cl. 200—168)

This invention relates to a relay and more particularly to a relay assembly adapted for use with coaxial cables to produce switching in a desired atmosphere.

In many phases of modern technology there is a need for relays which are extremely small or adapted for miniaturization and which may be used with coaxial cables. It is frequently desirable to maintain a predetermined atmosphere at the contacts of the relay and around the coil and moving armature so as to assure proper operation. Such relays must be confined within a true hermetically sealed enclosure.

An object of the invention is to provide a new and improved relay of simple and inexpensive construction and operation.

Another object of the invention is the provision of a novel relay construction wherein the operating mechanism of the relay is confined within a hermetically sealed enclosure.

A further object of the invention is the provision of an improved miniature relay construction adapted for attachment to a coaxial cable and maintained in hermetically sealed condition.

A still further object of the invention is the provision of a new and novel header construction for transmitting electrical signals therethrough while maintaining the opposite sides of the header in electrically sealed relation with respect to each other.

These and other objects of the invention will more fully appear from the following description made in connection with the accompanying drawings wherein like reference characters refer to similar parts throughout the several views and in which:

FIG. 1 is a perspective substantially full sized view of the invention;

FIG. 2 is an enlarged side elevation view with a portion of the case being broken away and certain of the parts being shown in section for clarity of detail;

FIG. 3 is an enlarged top plan view with portions of the casing being broken away for clarity of detail;

FIG. 4 is an enlarged detail section of the header shown detached from the remainder of the case and with the solder eliminated and with certain of the portions of the relay eliminated for clarity of detail; and

FIG. 5 is an elevation view of the apparatus shown in FIG. 4 and viewed along a line as indicated at 5—5 in FIG. 4.

One form of the invention is shown in the drawings and is described herein.

The relay construction is indicated in general by numeral **10** and includes a rigid metal case indicated in general by numeral **11**, which includes a header **12** and a cover **13**. The header **12** includes a steel panel **14** having an outer periphery **15** identical in shape to the open end **16** of the cover **13** and fitted therein in tight-fitting relation. A soldered seal **17** is provided between the plate **14** and cover **13** around the entire periphery of the plate so as to provide a hermetic sealing relation between the plate and cover. In the form shown, the cover **13** is formed of a nickel-silver alloy, but could as well be constructed of some other material such as brass.

The opposite sides of the header plate **14** have shallow recesses **18** in which the ends of relay mounting brackets **19** lie. The mounting brackets **19** are fixed to the header plate **14** as by spot welding. The brackets **19** include a

bridging portion **20** formed integrally thereof and spaced from the header **12** for mounting the relay coil **21** and the movable armature **22** which pivots about a knife edge **23** of frame member **24**. The inner portion **22***a* of the armature has an extension rod **25** affixed thereto which carries an insulating glass ball or bead **26** on the end thereof for operating the movable contact **27**. The relay includes spring wires **28** which continuously urge the armature against the knife edge **23**.

The movable relay contact **27** will be seen to be substantially U-shaped and has opposite leg portions **29** and **30** which extend toward the header **12** and also has an intermediate portion **31** interconnecting said legs. The movable contact **27** is substantially flat and planar in shape and oriented substantially normal to the header plate **14** so as to permit the leg **30** to move freely between stationary contacts or obstructions **32** and **33**, hereinafter more fully described. The leg **29** has a substantially U-shaped offset portion **29***a* which is apertured at **29***b* and is mounted on a pin-like conductor member **34** which is affixed to the header plate **14**. The leg **29** as hereinafter more fully described, is soldered to the pin-like conductor member **34**, and is twisted slightly out of the plane of the movable contact **27** about the axis of the pin-like conductor member **34** so as to normally bias the leg **30** against the stationary contact **32**. It will be noted that the contact member **27** is constructed of a resiliently flexible and highly conductive material such as noble metal alloy.

The header **12** also includes a plurality of rigid sleeves **37** which are constructed of a steel alloy which in the present instance is a nickel-steel alloy, very similar or identical to the header plate **14**. The sleeves **37** have inner ends which extend into apertures **35** of the header plate and have outer ends which extend from the outer side of the header plate **14**. The header plate **14** also has apertures **36** therein.

The sleeves **37** are brazed around their outer peripheries at **38** to the header plate **14**. It is important to note that the brazing of sleeves **37** produces a true hermetic seal to prevent passage of gas therebetween and also produces a sound electrical connection. Conductor members **34**, **39**, **40** and **41** extend through the openings of sleeves **37** and through the apertures **36** in substantially concentric relation with the openings and apertures. The conductor members **34**, **39**, **40** and **41** are secured to and insulated from the sleeves and header plate by a plurality of glass annuli **42**, the inner and outer peripheries of which are fused to and integral with the adjoining metal components including the conductor members **34**, **39**, **40** and **41**, sleeves **37**, and the header panel **14**. At this point it will be noted that it is essential that the header panel **14** and sleeves **37** be of such a material as to be compatible to the glass in the annuli **42** so that metal and glass may be fused together in an integral one-piece structure. The fused relationship between the glass annuli and the adjoining metal parts produces a true hermetic seal between these several parts so as to prevent passage of gas through the header **12**.

The conductor members **41** are identical with each other and are solid conductors of a nickel-iron or nickel-steel alloy which is similar or identical to the alloy used in sleeves **37** and plate **14** so as to have a compatible coefficient of expansion with the glass in the annuli **42** and thereby permit the proper fusing between the glass and conductor members **41**.

All of the conductor members **34**, **39** and **40** are substantially identical with each other and an understanding of one of these conductor members will suffice for an understanding of all of the conductor members. The conductor member **39** includes a tube **43** and a stranded central conductor **44** within the tube **43** in snug-fitting relation and soldered thereto to fill the spaces between the

strands of conductor **44** and produce a hermetic seal between the conductor **44** and tube **43** and thereby prevent passage of gas centrally through the tube **43**. The tube **43** essentially comprises the outer periphery of conductor member **39** and is constructed of a metal suitable for fusing to the glass annulus **42** and in the form shown, the tube **43** is of a nickel-iron or nickel-steel alloy similar to that of sleeves **37** and plate **14**.

The central conductor **44** constitutes a portion of a coaxial cable indicated in general by numeral **45**. The coaxial cable includes the central conductor **44**, an inner insulation **46** surrounding the central conductor, a braided conductor **47** surrounding the inner insulation **46** and an outer insulation **48** surrounding the braid **47**.

The cable **45** is permanently attached to the header **12** and has the inner insulation disposed in abutting end-to-end relation with the tube **43** and with a portion of the inner periphery of the glass annulus **42**. A rigid conductor sleeve **49** is applied on the end of cable **45** in tight-fitting relation around the outer insulator **48** which is preferably constructed of Teflon or nylon. The sleeve **49** is constructed of brass in the present disclosure and is fitted into the outer end of sleeve **37** in tight-fitting relation. The entire outer periphery of sleeve **49** is soldered to the inner periphery of sleeve **37** to produce a hermetic sealed relation and to physically retain the sleeve **49** in the sleeve **37**. The metallic braid **47** is flared and soldered to the inner end of sleeve **49** so as to produce a sound electrical connection therebetween. An insulating outer sleeve **50** is applied over the inner portion of cable **45** and is telescoped over the brass sleeve **49** to minimize the bending of the cable in immediate proximity with the header.

It will be recognized that the conductor members **34**, **39** and **40** appear at the inner side of the header as rigid pins.

The leg **29** is applied to the conductor member **34** as previously denoted and is soldered thereto to be physically held in the desired position and to produce a sound electrical connection between the contact member **27** and the conductor member **34** and particularly the central conductor **44** thereof.

The stationary contacts **33** and **32** are formed of substantially rigid wire having the contact-forming outer ends thereof disposed on opposite sides of the plane of the moving contact member **27** and in confronting relation with the movable leg **30** for engaging the leg **30** when the leg is moved transversely of its plane. The inner ends **32***a* and **33***a* of the stationary contact wires **32** and **33** are wrapped around the tubes **43** of conductor members **40** and **39** respectively and have solder applied thereto in the form of an enclosing bead **44***a* to be retained in stationary position and to provide a sound electrical connection to the central conductors **44**. It will be noted in the drawings that the solder beads **44***a* are eliminated in FIGS. 4 and 5 for clarity of detail but are shown in FIGS. 2 and 3. It will be seen that the stationary contact wire **32** is slightly longer than the wire **33**.

It is important to note that the space within the case **11** is completely hermetically sealed from the atmosphere at the exterior of the case. Plate **14** is soldered at the outer periphery to the cover **13** and is brazed at the apertures **35** to the sleeves **37**. The glass annuli are fused to and integral with the plate **14** at apertures **36** and are fused to and integral with the sleeves **37**; and the glass annuli are fused to and integral with the outer peripheries of each of the conductor members **34**, **39**, **40** and **41**. The conductor members **41** are of solid construction and are connected at their inner ends to the operating coil **21** of the relay. The conductor members **34**, **39** and **40** have the tubes **43** soldered to the stranded conductors **44** with the solder filling the spaces between the strands so as to produce a hermetic seal against longitudinal passage of gas.

It is also important to note that the tight-fitting relation between brass sleeve **49** and the outer insulation **48** produces a moisture seal so as to exclude moisture from the area adjacent the inner end of sleeve **49**.

In operation, a control signal may be applied through the conductor members **41** to the operating coil **21** which causes shifting of the armature, whereupon the glass ball **26** moves the leg **30** of movable contact **27** away from stationary contact **32** and into engagement with contact **33**. When the control signal is terminated, the resiliency of the contact member **27** returns the leg **30** thereof into engagement with stationary contact **32** and also returns the armature to the position shown.

It is of particular importance to note that the present relay **10** is well adapted for miniaturization and has actually been produced with the length of the case **11**, to the front face of header **12** equalling thirteen sixteenths of an inch with the width equalling twenty-five thirty-seconds of an inch. The header **12** and case **11** continue the electro static shielding effect of the braid **47** of the cable and interconnect all of the braids of the several cables together. The stationary and movable contacts of the relay produce no material change in the impedance of the cables **45**. In the form shown, the stationary contact wires **32** and **33** are constructed of a gold-platinum-silver alloy.

It will, of course, be understood that various changes may be made in the form, details, arrangement and proportions of the parts without departing from the scope of the invention which consists of the matter shown and described herein and set forth in the appended claims.

What I claim is:

1. A relay assembly comprising a hermetically sealed case including a metal header wall having inner sides and also having a pair of apertures therein, a pair of electrical cables each having a central conductor and an inner insulation surrounding said conductor and a conductive braid surrounding said inner insulation and an outer insulation surrounding said braid, a pair of first metal sleeves with inner ends affixed in respective apertures of the header wall and brazed to the wall in hermetically sealing relation with the wall around the entire periphery of the aperture, said first sleeves having outer ends protruding from the outer side of the header wall, a plurality of metal tubes each disposed within a respective first sleeve in spaced relation therewith and projecting from the inner side of the header wall, a pair of glass annuli each disposed within a respective first sleeve and in surrounding relation with the corresponding tube, the inner and outer peripheries of said glass annuli being fused to and integral with the tubes and sleeves in hermetically sealed relation, said central conductors projecting through said tubes and being soldered thereto in hermetically sealing relation to prevent passage of gas endwise through the tube, a pair of second metal sleeves each in tight fitting relation around the outer insulation of a respective cable and each being received in snug-fitting relation within a respective first metal sleeve, said second metal sleeves being soldered to the braids for providing electrical connection between the braid and the first metal sleeves and the header wall, a relay within the case and having movable and stationary contacts respectively connected with said tubes for producing electrical switching in relation to said central conductors of the cables and under a known atmosphere of desired pressure.

2. A relay assembly comprising a hermetically sealed case including a conductive header wall having inner and outer sides, a relay mounted within the case and having a coil and also having stationary and movable contacts, a pair of coaxial cables each having a central conductor with an inner insulation thereon and each also having a braided conductor encompassing said insulation and further having an outer insulating sheath encompassing the braided conductor, said header wall having a pair of apertures therein, a pair of sleeves each having an outer end projecting outwardly from the header wall and each

having an inner end inserted into a respective aperture in close-fitting relation, means hermetically sealing each of the sleeves to the header wall and around the entire periphery of the corresponding aperture, a pair of metal tubes substantially smaller than said sleeves, each of said tubes having a first end projecting into the inner end of a respective sleeve and having a second end projecting inwardly from said wall, a pair of glass annuli each disposed within the inner end of a respective sleeve and encompassing the first end of the corresponding tube, the inner and outer peripheries of said annuli being integral in welded relation with said tubes and sleeves respectively and thereby creating a hermetic seal between the tubes and sleeves, said central conductors projecting through respective tubes in snug fitting relation and being soldered to said tubes around the entire inner peripheries thereof in hermetically sealed relation, and means within the outer end of the sleeves confining and securing the cables thereto and electrically connecting the braided conductors to the sleeves, means electrically connecting the contacts to the second ends of the tubes and mounting the contacts on the tubes, and conductors extending through, insulated from and hermetically sealed in the case and connected with the relay coil to supply energy thereto.

3. A header wall assembly for use with electrical apparatus to maintain different atmospheres on opposite sides thereof in isolation from each other, comprising a metal panel with front and rear sides and having an aperture therethrough, a steel alloy sleeve having an inner end in said aperture and being brazed around the entire periphery thereof to the panel in hermetically sealing relation, said sleeve also having an outer end projecting from the front side of the panel, a steel alloy tube having a first

end disposed concentrically within said sleeve and spaced therefrom and having a second end projecting from the rear side of the panel, a glass annulus within said sleeve and surrounding said tube and having inner and outer peripheries fused to and integral with the tube and sleeve respectively, a conductor element extending inwardly through the tube and being soldered to the tube in hermetically sealing relation to prevent passage of gas endwise through the tube, an inner insulation on the conductor element, a metallic braid surrounding said inner insulation, an outer insulation surrounding the braid, the insulations and braid projecting into the sleeve, a second rigid metallic sleeve in tight-fitting relation on the outer insulation and being soldered to the braid and interfitted with said first mentioned sleeve and welded thereto in stationary and electrically conducting relation.

References Cited by the Examiner

UNITED STATES PATENTS

2,401,213	5/46	Wood	200—166
2,636,072	4/53	Lamoureux	174—50 X
2,769,881	11/56	Hailes	200—166
2,868,925	1/59	Grotelueschen	200—168
2,916,584	12/59	Molyneux	200—166 X
2,926,318	2/60	Lanctot	200—104 X
2,938,067	5/60	Werner	174—50.61 X
2,951,135	8/60	Lazich	200—104
3,033,956	5/62	Juptner	200—87 X
3,100,813	8/63	Rice et al.	174—50.56

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