United States Patent

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[73] Assignee **Rave Industries Incorporated**

[54] **ELECTRICAL CONNECTOR AND ASSEMBLY**
6 Claims, 5 Drawing Figs.

[52] U.S. Cl. ..... **339/60 M,** 339/94 A, 339/128
[51] **Int. Cl.** **H01r 13/52**
[50] **Field of Search** 339/60, 93, 94, 126, 128; 174/152, 153

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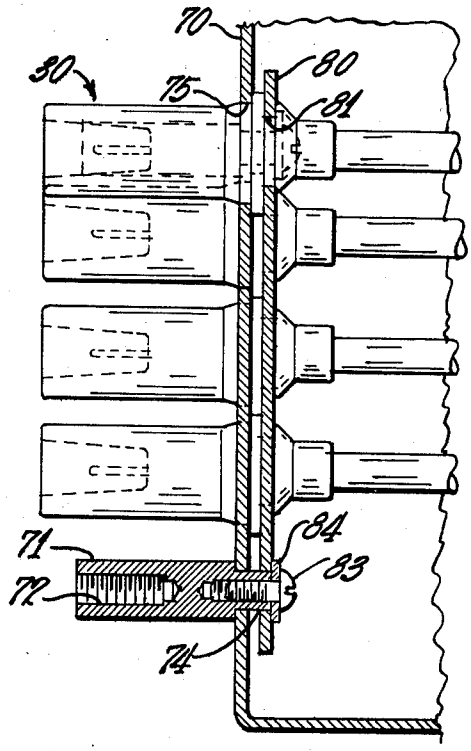
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ABSTRACT: A connector for disconnectable joinder of electrical terminals adapted to establishment of a sealed relation with the container wall of fluid encased circuitry wherein at least one terminal has an elastomeric body with an integral sealing gasket and either or both terminals have resilient shoulder configurations for accommodating the terminal bodies for snap-in mounted relation on their respective support panels.



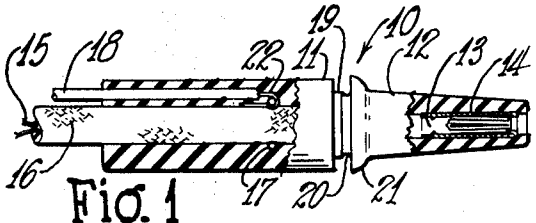


Fig. 1

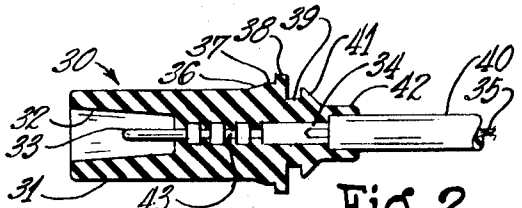


Fig. 2

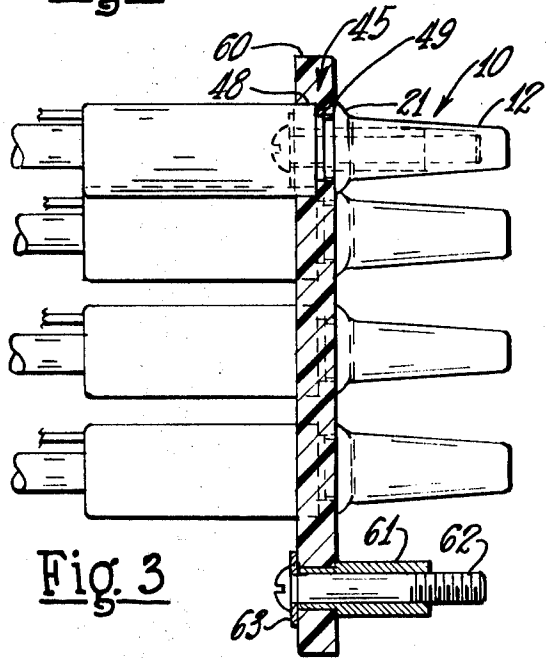


Fig. 3

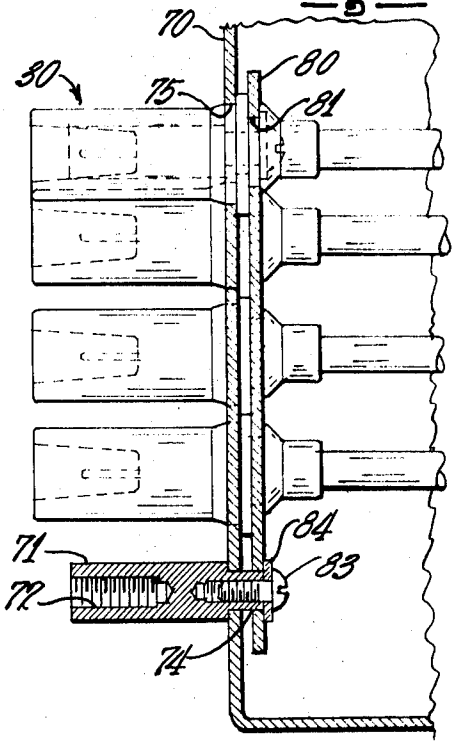


Fig. 4

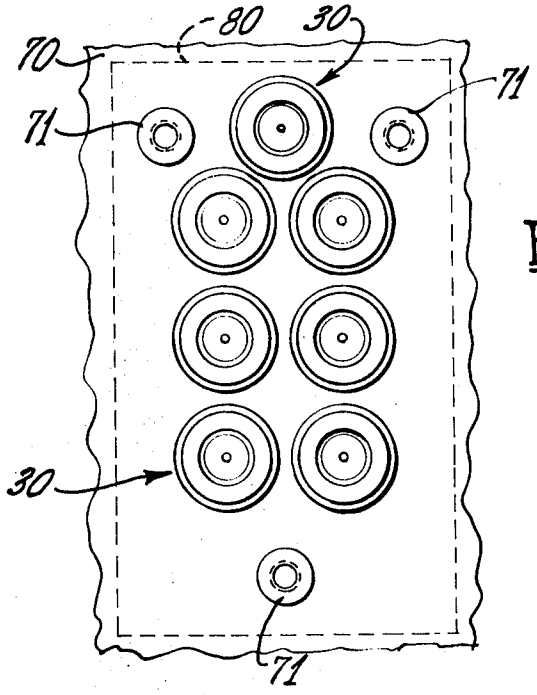


Fig. 5

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ELECTRICAL CONNECTOR AND ASSEMBLY

This invention relates to connectors for electrically joining conductors particularly, but not exclusively, of high voltage electrical circuits.

Although electrical connectors for high-voltage circuits are known in the art, few lend themselves to association in multiple as units of an assembly for joinder of groups of connectors. Further, difficulty exists in utilizing prior connectors in association with circuit conductors encased in fluid dielectric media, because of the need for separate and often complex sealing means usually required to make them accessible for connection in such arrangements.

It is therefore an object of the present invention to provide a socket and plug-type electrical connector which readily lends itself to electrical connection of individual pairs of high-voltage circuit conductors as well as to connection of pairs of conductors as part of an assembly of groups of pairs of conductors to be joined.

In addition, and no less important, it is an object of this invention to provide an electrical connector readily adapted to providing easy electrical connection to conductors within a fluid dielectric media.

In brief the novel concepts of the present invention lie particularly in the provision of a connector with a built-in, or integral, self-sealing gasket for fluid dielectrics and a snap-in resilient shoulder configuration adaptable to either or both plug or socket portions of the connector, facilitating ready and efficient assembly as part of either a multiple terminal connector for circuitry protected in a dielectric fluid or as part of an external connector panel. In this regard, the configurations of the connector members herein presented lend themselves to ready use in either dry or wet panel assemblies.

Features of the structural arrangement of the invention, beside providing efficient and safe waterproof electrical connection of conductors under field conditions, lie in the adaptability of the connectors to group assemblage and, as such, enabling connection of a plurality of pairs of conductors.

Still further a more particular feature of the invention is the incorporation in the connector structure of an integral fluid seal, or what might be termed a self-sealing gasket permitting efficient adaption of the connector to electrical connection of external conductors to conductors encased in a fluid dielectric medium without fear of leakage of the dielectric fluid. Such features indicated above have proven particularly desirable in high-voltage circuitry, such as are associated with cathode-ray tube equipment and the like.

These and additional novel features of the invention will be more apparent and better understood upon review of the following description when read in connection with the accompanying drawings in which:

FIGS. 1 and 2 are side elevational views, partly in cross section of a plug or male portion, and a socket or female portion, respectively, of an electrical connector embodying features of the present invention.

FIG. 3 is a side elevational view, partly in cross section, of an external portable panel assembly of a plurality of plug portions of connectors of the present invention while;

FIG. 4 is a side elevational view, partly in cross section, of an assembly of sockets of the present invention in self-sealing relation with the wall of a container encasing a plurality of conductors of high-voltage circuitry surrounded in a fluid dielectric medium.

FIG. 5 is a front elevational view of the socket assembly of FIG. 4.

Referring to the drawings in greater detail, FIG. 1 shows a plug **10** while FIG. 2 shows a socket **30** of an electrical connector for effecting high-voltage circuit connections. FIG. 3 shows an assembly of the plugs **10** of FIG. 1 in an external portable panel **60** arranged to effect connection with a corresponding plurality of sockets **30** of FIGS. 4 and 5 assembled as terminals for a plurality of circuit wires **35** insulatedly protected in a liquid dielectric within a container **70**.

The plug **10** as shown in FIG. 1 has a body **11** having a tapered forward insert portion **12** incorporating a cylindrical

interior **14** containing a connection terminal or sleeve **13**. A wire **15** terminating at the plug is suitably electrically connected to the terminal or sleeve **13** at the rear end of the sleeve within the plug (not shown) and the wire is suitably insulated and covered by a braided shield covering **16** which is terminated at a connection ferrule **17** of conducting material such as brass shown in the cross-sectional rear portion at which the wire **22** of a ground lead **18** is also terminated.

Referring now to a snap-in feature of the plug permitting its assembly into an external multiple plug panel **60**, it will be seen as shown in FIG. 3, that the plug has a snap-in rounded shoulder **21** behind which resides a double diameter or double ridged recess having a greater depth or smaller diameter ridge **20** immediately behind the shoulder **21** and the slightly larger diameter ridge **19** immediately adjacent the body portion **11**. By this arrangement, the annular plug shoulder **21** can be folded more tightly into a smaller diameter within the recess than might otherwise be accomplished with a single larger diameter recess. Thus the shoulder **21** can be made somewhat larger than might otherwise be expected to assure a more secure or solid positioning of the plug when snapped into a matching recess in the panel **60**. It will be noted that the panel recess **45** for acceptance of the plug **10** is provided with a generally mating single ridge configuration as well as a slightly larger body receiving portion **48** for the plug. Thus upon insertion of the longitudinal tapered portion **12** of the plug **10** into its panel aperture **45**, the plug shoulder **21** is caused to fold over into the combined double ridge recess **19** and **20**, and with a forceful twist the shoulder is conveyed through its matching aperture until the end of the body **11** of the plug is mated with body receiving portion **48** of the panel recess **45**, while the aperture step **49** of the panel extends across the width of the combined recess ridges **19** and **20** and to the level of ridge **20** of the plug. As indicated above, by reason of the fold over of the shoulder **21** to a small diameter within the double ridged recess, the shoulder can be specially built up, or in other terms, "beefed up" so that upon passage through the corresponding aperture in the panel **60**, the shoulder **21** can act to solidly hold the plug in position on the panel **60** without need for extra bracing means.

The socket **30** has a body portion **31** with a flared forward opening **32** into which the insert portion of the plug can be matedly inserted. A center contact or terminal **33** is molded in the body **31** and projects into the flared opening **32** of the socket for connection within the sleeve **13** of the plug when inserted in the socket. The lead wire **35** is electrically connected to the center contact **33** by suitable means such as by being soldered to the contact end **34**.

A tapered insert portion **36** leading to a support shoulder **37** is provided near the rear of the body portion **31**. The shoulder **37** is of diameter such that it mates snugly with the opening **75** in the container **70**. An integral radially outward projecting flange or self-sealing gasket **38** is provided immediately behind the shoulder **37** followed by a smaller diameter recess **39** and a flared snap-in shoulder **41**. The insulating covering **40** of the wire **35** extends into the socket body through the rear stub portion **42**.

In constructing the socket, the center terminal contact **33** is first soldered in to the wire **35** at the region **34** and the entire socket body is then molded about the end of the wire insulation **40** and over the connection **34** and knurled or annular ridge portions **43** of the terminal contact **33**. Both the plug and the socket are molded of resilient elastomeric material such as rubber or neoprene.

To assemble the sockets in multiple as connection members for a series of wires protectively encased in a fluid dielectric such as oil, the plurality of sockets are first snapped in place on a retainer panel **80**. This may be done conveniently in a position outside the container **70**, similar to the manner in which the plugs are inserted in the dry panel **60**. The sockets **30** are snapped in place on the retainer panel by pulling the wire leads **40** through the respective panel apertures **81** which are of shape and dimension to mate with the corresponding

recesses 39 of the plugs 30. Since in its final mounting on the container wall, the sockets 30 are held both by the retainer panel 80 and the snap-in shoulder 41 of the socket, the shoulder 41 need not be as large as the shoulder 21 of the plug, the main means holding the plug in place. Thus a single ridge recess 39 rather than a double ridge recess is used for holding the socket in the retainer panel and proves quite adequate for holding the sockets in place in the retainer panel 80 until finally mounted in the container wall 70.

Once all the sockets are mounted in the retainer panel 80, the assembly can be readily inserted from within the casing 70 into corresponding apertures in the container wall. The insertion process is facilitated by the fact that the external diameter of the body portion 31 of each of the sockets is smaller than the corresponding openings in which the sockets are inserted. In addition, the insert shoulder 37 is flared to guide the plug into place, with the tapered insert portion 36 acting as the guide and the insert shoulder 37 finally mating with the opening.

The external panel 60 is provided with three spacers 61 arranged in distributed relation as shown in FIG. 5, on the front of the panel for mated relation with corresponding spacers 71 projecting from the face of the container 70. The spacers 61 and 71 are arranged to have a length such that upon abutting each other in end-to-end mated relation, a predetermined distance between the panels 60 and 70 is established such that full insertion of the plugs 10 is established with the sockets 30 and solid electrical connection is established between the center contacts 33 of the sockets and the connection sleeve 13 of the plugs 10. The spacers 61 are fixedly secured to the panel 60 by brazing, swagging or other suitable joining means, and a threaded screw 62 extended therethrough projects beyond the spacer for threaded engagement with the corresponding threaded section 72 of a spacer 71.

Spacers 71 are fixedly secured in sealed relation with the socket wall of the container 70 also by swagging, brazing or other suitable means. The sealed relation between the spacers 71 and the container wall is established to prevent leakage of any fluid from within the container in the spacer zone. The spacers 71 each have a rear projection 74 extending into the container a predetermined distance for establishment of the desired sealed relation between the gaskets 38 of the sockets 30 and the interior surface of the container wall 70 as determined by the location of the retainer panel 80 held at the end of the projection portion 74 by threaded screws 83 threaded into a blind threaded aperture at the rear of the spacers 71. In this regard both threaded apertures 72 and 74 are blind or in other words, terminate within the body of the sleeve to prevent the possibility of fluid escaping therethrough from within the container.

The retaining panel 80 is drawn against the rear of the integral socket gaskets 38 to a degree such that the gasket is at least slightly under compression to assure a fluidtight seal over the apertures 75 in which each of the sockets 30 is inserted. As indicated, the diameter of the shoulder portion 37 of each of the sockets is matched in size for snug fit association of the socket within the opening 75, and the sizes of the gaskets 38 are somewhat larger than the apertures 75 so that under compression, the gaskets 38 positively seal the apertures 75 against any leakage of fluid, such as liquid dielectric, from within the container.

Thus, it will be seen, that the sockets 31, once snapped into the retainer panel 80, are held in snug fit association on their recess shoulder 39 by their respective snap-in shoulders 41 and can be readily guided into the aperture 75 by the small diameter body portions 31 over the flared shoulders 36 and fixed in position on their snug fit insert shoulder 37. Thus, a proper positioning of the integral gaskets 38 is automatically effected over their respective apertures 75 for a sealed relation. The extent of projection of spacers 74 into the container 70 fixes the location of the retainer panel 80 to hold the resilient gaskets 38 in their sealed association over the panel container aperture 75. The threaded screws 83 may have integral or separate washers 84 to fix the retainer panel in position on the end of the spacer projection 74 to assure that all the gaskets 38 are held in such sealed relation.

In view of the foregoing, although features of each of the plugs 10 lie in the manner in which they might be snapped into the panel 60 to effect a ready assembly of a plurality of the plugs for connection with the sockets of the mating assembly, as well as the manner in which the sockets 30 can be held in snapped-in relation in a retaining panel 80 within a container, it will be recognized that the snap-in and sealing configurations illustrated for the plug and for the socket members respectively might be interchanged if desired to permit the sockets instead to be assembled into an external dry panel arrangement while the plugs can be provided the configuration permitting their incorporation in a wet panel arrangement.

I claim:

1. A connector for disconnectable joinder of a pair of electrical terminals at least one of which is associated with fluid encased circuitry comprising a body of dielectric material having an electrical terminal encased therein partially exposed for an electrical connection with a mating terminal, a self-sealing resilient gasket integral with and projecting outwardly from said body in fully surrounding relationship therewith, fluid containing means having a wall with an aperture for snug fit receipt of said body in mounted projected relation from said wall with one side of the resilient gasket fixed in abutting relation against a surface of said wall at the margin of said aperture, a retaining panel having a corresponding aperture for snug fit receipt of said body disposed interiorly of said fluid containing means in abutting relation with the opposite side of said resilient gasket, and means adjustable externally of said fluid containing means for securing said retaining panel in sufficiently close relation with said container wall to hold said connector gasket in compressed fluid sealed relation with said container wall in the marginal region of said container aperture from which said connector projects.

2. A connector for disconnectable joinder of a pair of electrical terminals at least one of which is associated with fluid encased circuitry comprising a body of dielectric material having an electrical terminal encased therein partially exposed for an electrical connection with a mating terminal, a self-sealing resilient gasket integral with and projecting outwardly from said body in fully surrounding relationship therewith, fluid containing means having a wall with an aperture for snug fit receipt of said body in mounted projected relation from said wall with one side of the resilient gasket fixed in abutting relation against a surface of said wall at the margin of said aperture, a retaining panel having a corresponding aperture for snug fit receipt of said body disposed in abutting relation with the opposite side of said resilient gasket, said body having a resilient shoulder larger than said retainer panel aperture and surrounding the body in spaced relation from said gasket a distance substantially equal to the thickness of said retaining panel, and means for securing said retaining panel in sufficiently close relation with said container wall to hold said connector gasket in compressed fluid sealed relation with said container wall in the marginal region of said container aperture from which said connector projects.

3. An electrical connector according to claim 2 wherein said resilient shoulder is sufficiently small to permit compressed passage through said retainer panel aperture thereby permitting establishment of the fixed mounted relation on said retainer panel.

4. A connector for effecting a disconnectable joinder of a pair of electrical terminals comprising a terminal of dielectric material having an electric terminal encased therein but partially exposed for electrical connection with a mating terminal, a mounting panel having an aperture for snug fit projection of one end of said connector body therethrough in a position of abutment of a larger dimension portion of said body against said mounting panel, said body having a resilient shoulder larger than said panel aperture surrounding the body spaced from said gasket a distance substantially equal to the

thickness of said panel, the body portion between said larger dimension portion and said resilient shoulder having a portion adjacent said shoulder of slightly smaller dimension than the remaining in-between portion to provide additional space for fold-over of said resilient shoulder upon passage of said shoulder through said panel aperture, whereby said shoulder is substantially larger than might otherwise be passed through said aperture.

5. An electrical connector according to claim 4 wherein the cross-sectional configuration of said panel at the edge of said aperture is substantially matched to the connector body configuration between said larger dimension portion and shoulder.

6. A connector for disconnectable joinder of electrical terminals comprising a body of dielectric material containing an electrical terminal, said body having an opening to said electrical terminal permitting electrical connection with a mating terminal, said body having a pair of spaced projections at least one of which is resilient extending outwardly from said body and each surrounding the body, the body portion between said projections being shaped for snug-fit accommodation in an aperture of a support panel, said resilient projection being larger than the panel aperture and spaced from the other projection a distance substantially equal to the thickness of the panel, said body portion between the two projections having a portion adjacent said resilient projection of sufficiently smaller cross-sectional dimension than the remaining between portion providing additional space for fold over and compression of said resilient projection therein upon passage of said shoulder through the panel aperture, whereby said resilient projection is substantially larger than might otherwise be passed through the aperture.

UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 3,611,256 Dated October 5, 1971

Inventor Raumond L. Abair

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Cover page, after Assignee, cancel

"Rave" and insert --Rowe--

Signed and sealed this 21st day of March 1972.

(SEAL)
Attest:

EDWARD M.FLETCHER,JR.
Attesting Officer

ROBERT GOTTSCHALK
Commissioner of Patents