

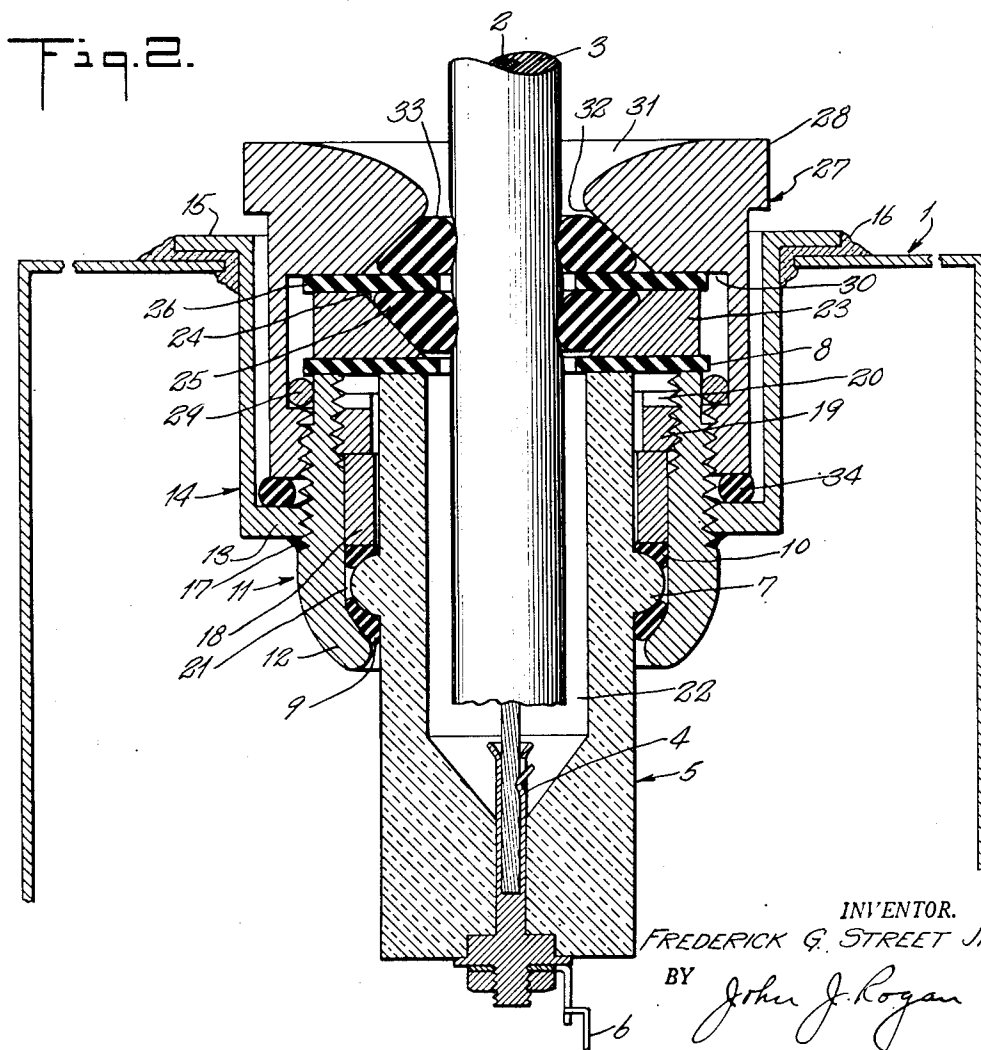
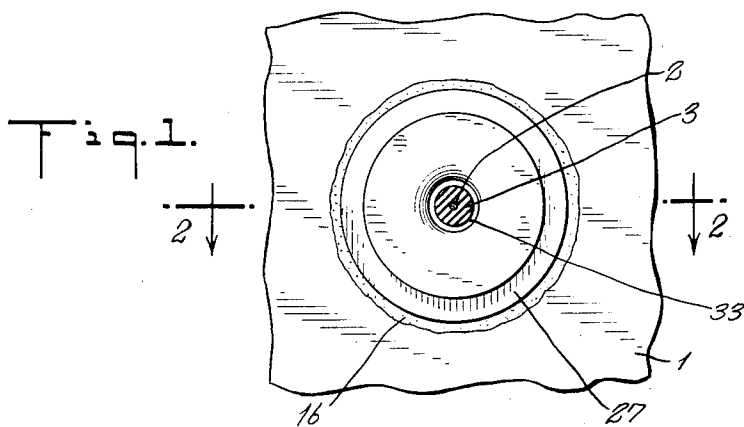
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HIGH-VOLTAGE TERMINAL CONNECTOR

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HIGH-VOLTAGE TERMINAL CONNECTOR

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5 Claims. (Cl. 174-152)

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This invention relates to high voltage devices and more particularly it relates to sealed connector terminals.

A principal object of the invention is to provide an improved sealed but detachable terminal connector for electrical devices, whereby the likelihood of voltage breakdown at the region of the terminal connection is greatly reduced.

Another principal object is to increase the safety factor of high voltage apparatus by employing a sealed-in joint between a circuit lead-in or supply wire and a corresponding connection joint within the apparatus; the joint not only being sealed against physical contact but also being protected against mechanical injury and against voltage breakdown by moisture absorption.

One of the features of the invention is a connection joint for electrical apparatus wherein the overall length of the apparatus and its terminals is greatly reduced since the usual long stand-off insulators are completely avoided.

Another feature relates to a connection joint of the kind wherein the actual connection between the lead-in or cable wire and the contact point or lug which forms part of the apparatus, is located within a sealed chamber which is recessed, at least in part, below the wall of the casing which houses the apparatus, and wherein a novel arrangement of deformable sealing rings is provided.

Another feature relates to an improved detachable connector for high voltage devices, wherein the actual connection joint is sealed within an individual chamber by special removable sealing means to render the said chamber immune to voltage breakdown in the presence of high humidity or ambient moisture conditions.

A further feature relates to an improved detachable connector for high voltage devices, wherein the actual connection joint is immersed in an individual chamber arranged to be assembled through the wall of the metal enclosing housing of the device, in conjunction with a novel sealing arrangement and assembly which also protects the said chamber from mechanical injury.

A further feature relates to a novel arrangement of rubber-like or plastic sealing rings which are arranged in spaced pairs to reduce the likelihood of excessive moisture absorption at the critical voltage breakdown points.

A still further feature relates to the novel organization, arrangement and relative location and interconnection of parts which cooperate to provide an improved and safe terminal connector for high voltage electric apparatus generally.

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Other features and advantages not particularly enumerated, will be apparent after a consideration of the following detailed descriptions and the appended claims.

The invention is in the nature of an improvement on the kind of sealed-in connector terminal disclosed in my prior application Serial No. 84,301, filed March 30, 1949, now abandoned.

In the drawing which shows, by way of example, one preferred manner of practicing the invention,

Fig. 1 is a top-plan view of my improved sealed connector joint.

Fig. 2 is a section taken along the line 2-2 of Fig. 1 but in magnified form.

Referring to the drawing, the numeral 1 represents the metallic enclosing casing of any well-known electrical device such for example as a high voltage transformer. The numeral 2 represents one of the insulated lead-in wires or circuit conductors having any known electrical insulating sheath 3, the wire being arranged for electrical connection to an appropriate point within the device. Heretofore, in order to reduce the chances of voltage breakdown between the wire 2 and casing 1, it has been the customary practice to employ stand-off insulators of porcelain or the like. These stand-off insulators greatly increase the over-all height or length of the apparatus, and the actual connection joint is external to the apparatus and is usually open to the air. Because of this external projection, these prior joints are liable to mechanical breakage. In my prior application Serial No. 84,301, now abandoned, I have devised an arrangement wherein the connector joint is located within a sealed glass or vitreous chamber which is supported from the casing wall, and which is located partly or entirely within said casing. However, I have found that while this prior joint is satisfactory under many conditions of use, it is subject to the breakage of the glass or ceramic housing when the projecting portion or its fastening nut is subjected to mechanical shock. Furthermore, the sealing of the said glass or ceramic chamber is effected by a single deformable rubber or rubber-like ring such neoprene. I have found that under excessive humidity or ambient moisture conditions, this rubber or rubber-like sealing ring, over an extended period of time, soaks up enough moisture to lower the voltage breakdown limit for the joint. The present invention overcomes these and other difficulties of the said prior sealed joint.

The actual joint between the supply or circuit wire 2 and the contact lug or terminal 4 is located

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within a member 5 which may be of insulating plastic, glass or ceramic having the connector lug or terminal 4 permanently sealed through the bottom end thereof. The lug 4 is connected to the appropriate conductor 6 of the device, for example a transformer winding (not shown) housed within the casing 1. It will be understood of course that while one particular kind of connector lug is shown, any other well-known form of connector lug may be employed. Member 5 is formed with an integral sealing shoulder 7 which extends completely around the external periphery thereof, and the upper end of member 5 has a smooth flat face arranged to seat against an annular ring 8 of a moisture-proof or non-moisture absorbent plastic. I have found that the best results are obtained when this plastic is of the types known in the trade as "Kel-F" (polytrifluorochloroethylene) or "nylon." It will be observed that the annular opening of ring 8 is of larger diameter than the diameter of the insulating sheath 3.

Surrounding the member 5, and arranged to be clamped or squeezed against the lower and upper sides of shoulder 7, are a pair of deformable sealing rings 9, 10, of rubber or rubber-like material such as neoprene. The sealing pressure between ring 9 and shoulder 7 is effected by a brass or other metal sleeve 11 whose lower end has an inwardly curved lip or flange 12. Member 11 is externally threaded into the internally threaded bottom 13 of a metal member 14. Member 14 passes through the corresponding circular opening in the top wall of casing 1 and has a flat annular flange 15 which is to be brazed, soldered or otherwise permanently sealed or integrally united to the casing top, as indicated by the numeral 16. Likewise the threaded joint between members 11 and 14 is permanently sealed by a brazed, sweated or silver-soldered joint 17. In effect therefore, member 11 is rigidly attached to casing 1. The sealing ring 10 is clamped against shoulder 7 by a metal sleeve or collar 18 which is of slightly larger internal diameter than the outside diameter of member 5. The upper end of member 11 is internally threaded to receive a lock nut or bushing 19 having a slot 20 to receive a suitable fastening tool. Thus by turning the member 19, the rings 9 and 10 are deformed to completely seal the space between shoulder 7 and member 11. It will be observed however, that an annular gap 21 is left between the rings 9 and 10. I have found that this gap is of the greatest importance in protecting the space within casing 1 sealed against moisture. Furthermore, the use of two separate and spaced rubber rings located as shown, protects the member 5 from mechanical shock and breakage as will be described hereinbelow.

In order to permit conductor 2 to be detachably secured to lug 4 while at the same time completely sealing the chamber 22, a second sealing and fastening assembly is provided. This latter assembly comprises a metal or insulating washer 23 having an inclined inner wall 24. The lower flat face of washer 23 seats against the above-mentioned special plastic washer 8. Located in the space between washer 23 and the sheath 3 of the supply wire is a sealing ring 25 which may be of the same material as rings 9 and 10. The cross-section of ring 25 may be circular so that when it is subjected to clamping pressure, as will be described, it is annularly deformed to substantially the shape shown in Fig. 2, so as to form a moisture-proof seal and at the same time to form

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a rigid grip between the inclined face 24 and the sheath 3. In fact by increasing the clamping pressure, ring 25 can somewhat bite into or inwardly deform the surface of the sheath 3 as shown.

Seated against the upper flat face of washer 23 is another plastic washer 26 having an annular opening of about the same size as the opening in washer 8 so as to completely clear the sheath 3. Threaded on to the external face of member 11 is a metal bushing cap 27 having a projecting head 28. The internal wall of bushing 27 is undercut or recessed to accommodate the parts 8, 23, 26, and also to accommodate the retaining metal spring ring 29 whose purpose will be described hereinbelow. The flat underface 30 of head 28 is arranged to seat against the sealing washer 26 so as to transmit clamping or sealing pressure to the parts located between the flat upper end of member 5 and the said flat face 30.

The bushing 27 has an enlarged central opening 31, the inner wall of which is of somewhat rounded V-shape cross-section to provide an inclined clamping surface 32, and located between the surface 32, the sheath 3 and the washer 26 is another sealing ring 33 preferably, although not necessarily, of the same material as ring 25. It will be seen, therefore, that as the bushing 27 is turned to tighten it, the ring 25 is clamped against the sheath 3, and because of the inclined clamping face 24, this ring is spread out somewhat horizontally to increase the sealing surface between the washer 26 and the said inclined surface 24. Likewise, the ring 33 is subjected to clamping pressure between the inclined face 32 and the washer 26.

I have found that by using two separate deformable sealing rings 25 and 33 with an intervening non-absorbent and non-porous washer 26, the chances of moisture entering the chamber 22 are greatly reduced. The washer 26 acts as a barrier against the sponge-like transmission of moisture between the ring 33 and the ring 25 into chamber 22, which would otherwise take place if the two sealing rings were in actual contact, or if only a single ring were used. Likewise, by providing the gap 21 above described between the rings 9 and 10, the chances of moisture absorbed by one ring and being transmitted or conducted to the other ring, is substantially eliminated. If desired, an additional sealing gasket 34 may be located between the flat lower lip of bushing 27 and the inner flat face of flange 13. As above-mentioned, a spring retaining ring 29 is provided. The purpose of this ring is merely to retain the parts 8, 23, 25, 26, 33, in their assembled position in the bushing 27 before the latter is threaded on to the member 11.

It is believed that the manner of assembly of the parts will be clear from the foregoing description. However, the following is a resume of the steps in the assembly. The member 14 is threaded and brazed or silver-soldered to the member 11. The sealing ring 9 is then dropped into place resting against the shoulder 12. The member 5 carrying the terminal 4 is then dropped into place so that the shoulder 7 engages the ring 9. Next the ring 10 is dropped into place against shoulder 7. The metal collar 18 is then dropped on top of the ring 10 and the threaded fastening ring 19 is tightened to clamp the member 5 centrally in position while at the same time deforming the sealing rings 9 and 10 as above described. If the optional sealing gasket 34 is to be used, it is then dropped into place resting on the

flange 13. The next step is to invert the bushing 21 from the position shown in Fig. 2, then to drop the sealing ring 33, washer 26, sealing ring 25, clamping washer 23, and washer 8, in superposed relation. These parts can then be held in their inverted assembled position by a suitable split retainer ring 29. This assembly can then be inverted to the vertical position shown in Fig. 2, and it can be threaded on to the member 11 as above described. After soldering parts 11 and 15, and before tightening up the bushing 27, the conductor 2 with its sheath 3, is passed through the assembly and the conductor 2 is plugged into or otherwise united to the lug 4. When the parts have been thus assembled, the bushing 27 is tightened until the required clamping pressure is transmitted to the various sealing rings and washers.

It has been found that by using the duplex spaced sealing rings either with an intervening gap such as gap 21, or with a non-porous plastic washer 26, the desired clamping pressure can be transmitted so as to effectively grip the sheathed conductor 2 while at the same time effectively hermetically sealing the contents of casing 1 and the chamber 22 against ingress of moisture. It will be understood of course, that the casing 1, if desired, can be provided with a filling of a high voltage oil or jelly, and likewise the chamber 22 may, if desired, be filled with such a high voltage oil or jelly as is well-known in the high voltage transformer art.

It will be observed from the foregoing disclosure that by reason of the improved sealing arrangements described, should for any reason the sealing assembly comprising the elements 8, 23, 25, 26, 33, be removed or become loose, that would not result in any deterioration of the hermetic sealing of the contents of casing 1.

While in the foregoing description the various sealing rings or washers have been referred to as of rubber-like characteristic, it will be understood that this is done in a generic sense to cover any deformable sealing material which has the characteristic of being deformable under pressure so as to spread out radially to effect the desired hermetic sealing contact with the adjacent parts, for example as illustrations of such materials may be mentioned, "Kel-F=polytrifluorochloroethylene," "nylon," "neoprene," or even a deformable soft metal or alloy, the essential features being that the sealing material has the desired deformability as well as the characteristic of withstanding the various conditions including the temperature conditions and moisture conditions under which the device is to be used.

While one particular embodiment has been described herein, it will be understood that various changes and modifications may be made therein without departing from the spirit and scope of the invention. Thus, if desired, the parts 11 and 14 can be made as a single piece, and the member 14 can be internally threaded to receive a corresponding external thread on member 27 instead of threading member 27 on to member 11 as shown.

What is claimed is:

1. In combination, a metal housing for a high voltage electrical device, an opening in a wall of said housing through which an insulation-sheathed conductor is to pass, metallic means rigidly united to said wall around said opening and extending interiorly of said casing and having a circular opening with a shouldered flange, a cup-like insulating member having an integral

peripheral shoulder, said member being closed at one end and being supported within said casing and with its other end open and facing the exterior of said casing, a first sealing ring located between said flange and said shoulder, another sealing ring also engaging said shoulder but out of moisture conducting contact with the first ring, means to clamp said flange said shoulder and said rings together as a unit, separately removable means for sealing the open end of said cup-like member and for gripping said sheathed conductor, said removable means comprising an annular bushing in threaded engagement with said first-mentioned metallic means, said bushing having a clamping surface inclined downwardly and outwardly from said sheathed conductor, a non-porous washer, a first sealing ring located between the inclined surface of said bushing and said non-porous washer, a clamping washer having an inner surface inclined downwardly towards said sheathed conductor, a second sealing ring located between said non-porous washer and the inclined rim of said sealing washer, and a sealing gasket located between said clamping washer and the rim of said cup-like member.

2. An electric connection joint between an electrical apparatus housed within a casing and an insulation-sheathed lead-in wire, comprising a cavity-defining member registering with an opening in said casing and extending therein, said member having an open end facing the exterior of the casing, a connector device carried by a wall of said member and extending inwardly of the cavity therein to connect with said wire, means to seal said open end of said member, the last-mentioned means comprising in superposed clamping relation a first non-porous plastic washer, a clamping washer having an inclined clamping surface, a first deformable sealing ring in engagement with said inclined surface, a second non-porous plastic washer in engagement with said clamping washer and said first sealing ring, a second deformable sealing ring in engagement with said second plastic washer, a clamping ring having an inclined surface in engagement with said second sealing ring, means to tighten said clamping ring to clamp said first non-porous washer against the open end of said member and to clamp said sealing rings in gripping relation with the sheathed conductor, and a tubular metal support fastened to said casing and passing through said opening in said casing for supporting said cavity-defining member within said casing, said member and said tubular support having cooperating spaced shoulders, a third deformable sealing ring located between said cooperating spaced shoulders, and means to clamp said third sealing ring between said cooperating shoulders to seal said opening in said casing.

3. An electric connection joint between an electrical apparatus housed within a casing and an insulation-sheathed lead-in wire, comprising a cavity-defining member registering with an opening in said casing, said member having an open end facing the exterior of said casing, a connector device carried by the bottom of said member to make connection to said wire, means for hermetically sealing the said open end of said member the last-mentioned means including a first non-porous sealing washer removably seated against the rim at the open end of said member, a first metal clamping washer with an inclined inner rim, a first deformable sealing ring sur-

rounding said sheathed conductor between said conductor and said inclined rim, another metal clamping washer having an inclined inner rim and surrounding said sheathed conductor, a second deformable sealing ring located between the inclined rim on said other metal washer and the sheath of said conductor, a non-porous plastic washer sandwiched between said sealing rings, means to clamp said rings and washers together to deform said sealing rings into hermetic gripping relation with said inclined rims and with the sheath on said conductor, and a tubular metal support passing through said opening in said casing and extending interiorly thereof to support said cavity-defining member within the casing, said tubular support and said cavity-defining member having cooperating shoulders, a third deformable sealing ring located between said cooperating shoulders, and means to clamp said third sealing ring between said cooperating shoulders to hermetically seal said opening in said casing.

4. An electric connection joint for an electrical apparatus housed within a conductive casing which casing has an opening through which is to pass an insulation-sheathed lead-in conductor, comprising an insulating member constituting a joint-enclosing cavity of moisture-proof insulation, said insulating member being closed at one end and the opposite end being open and facing the exterior of said casing, a peripheral shoulder on said insulating member, a pair of deformable sealing rings surrounding said insulating member on opposite sides of said shoulder, said shoulder serving to hold said sealing rings out of moisture conducting contact with each other, a pair of clamping elements to clamp said sealing rings against said shoulder, means including a tubular metal member fastened to said casing and extending through the casing opening to support one of said clamping elements and said insulating member interiorly of the casing, means including said sealing rings to hermetically seal said casing opening, and means to separately seal the said open end of said insulating member, the last-mentioned means including at least one deformable ring and a pair of cooperating clamping washers for causing said last-mentioned deformable ring to hermetically grip said sheathed conductor, one of the last-mentioned clamping washers being

threaded on to a corresponding threaded extension on the said one of the first-mentioned clamping elements.

5. An electric connection joint for an electrical apparatus housed within a conductive casing which casing has an opening through which is to pass an insulation-sheathed lead-in conductor, comprising an insulating member constituting a joint-enclosing cavity of moisture-proof insulation, said insulating member being closed at one end and the opposite end being open and facing the exterior of said casing, a peripheral shoulder on said insulating member, a pair of deformable sealing rings surrounding said insulating member on opposite sides of said shoulder, said shoulder serving to hold said sealing rings out of moisture conducting contact with each other, a pair of clamping elements to clamp said sealing rings against said shoulder, means including a tubular metal member fastened to said casing and extending through the casing opening to support one of said clamping elements and said insulating member interiorly of the casing, means including said sealing rings to hermetically seal said casing opening, and means to separately seal the said open end of said insulating member, the last-mentioned means including a pair of deformable sealing rings and cooperating inclined surface clamping washers for deforming said rings into gripping relation with said sheathed conductor, a non-porous plastic washer sandwiched between the last-mentioned pair of sealing rings, one of the last-mentioned clamping washers being threaded on to a corresponding threaded extension on the said one of the first mentioned clamping elements.

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