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Burns

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[54] **ARC-OUT SHUT OFF VALVE ASSEMBLY FOR A HIGH VOLTAGE BUSHING**

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[52] **U.S. Cl.**..... **339/111;** 200/144 C; 339/143 R

[51] **Int. Cl.**[2]..... **H01R 13/52**

[58] **Field of Search**..... 200/144 C, 147 R, 149 A; 339/111, 143 R, 60 R

[56] **References Cited**

UNITED STATES PATENTS

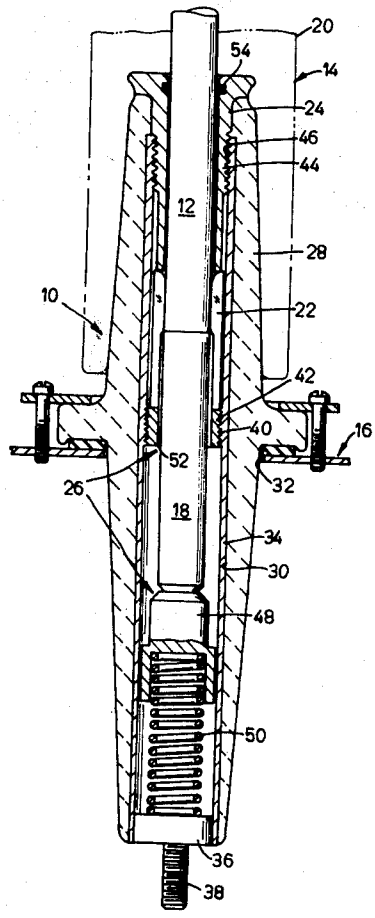
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Primary Examiner—Roy Lake
Assistant Examiner—DeWalden W. Jones
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[57] **ABSTRACT**

A high voltage cable termination bushing for terminating a high voltage cable and including a housing having an axial passage, an electrically conductive receptacle within the passage and supported intermediate the ends thereof, the passage being closed at the inner end, and a gas trap valve provided between the inner end of the passage and the receptacle, the valve being biased into engagement with the receptacle that traps gases within the passage. The gas trap valve is opened by the arc-extinguishing rod provided on the conductive probe of the cable connector and having a length sufficient to allow the valve to close at the anticipated position of the probe, with respect to the receptacle where the arc will be extinguished.

12 Claims, 3 Drawing Figures



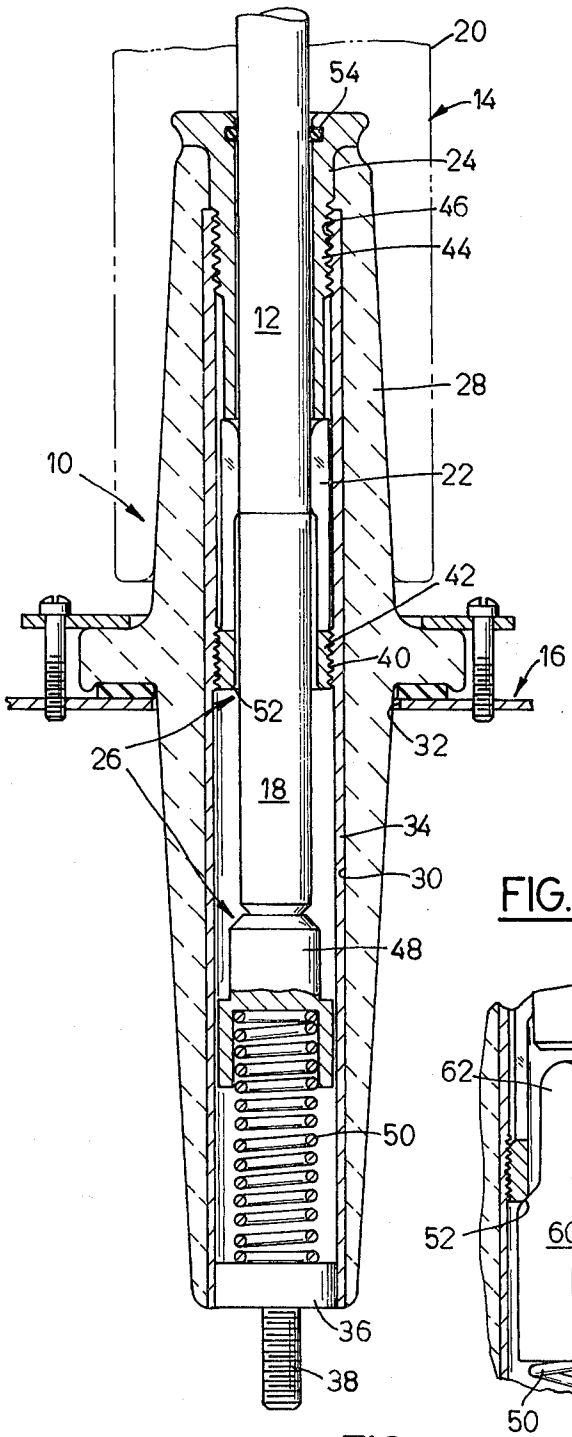


FIG. 1

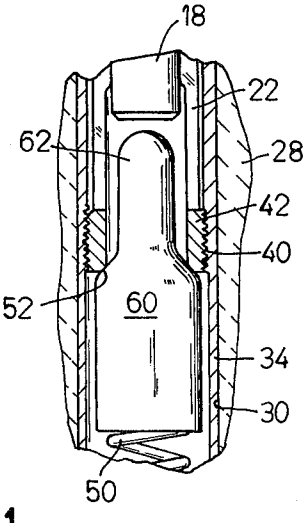


FIG. 3

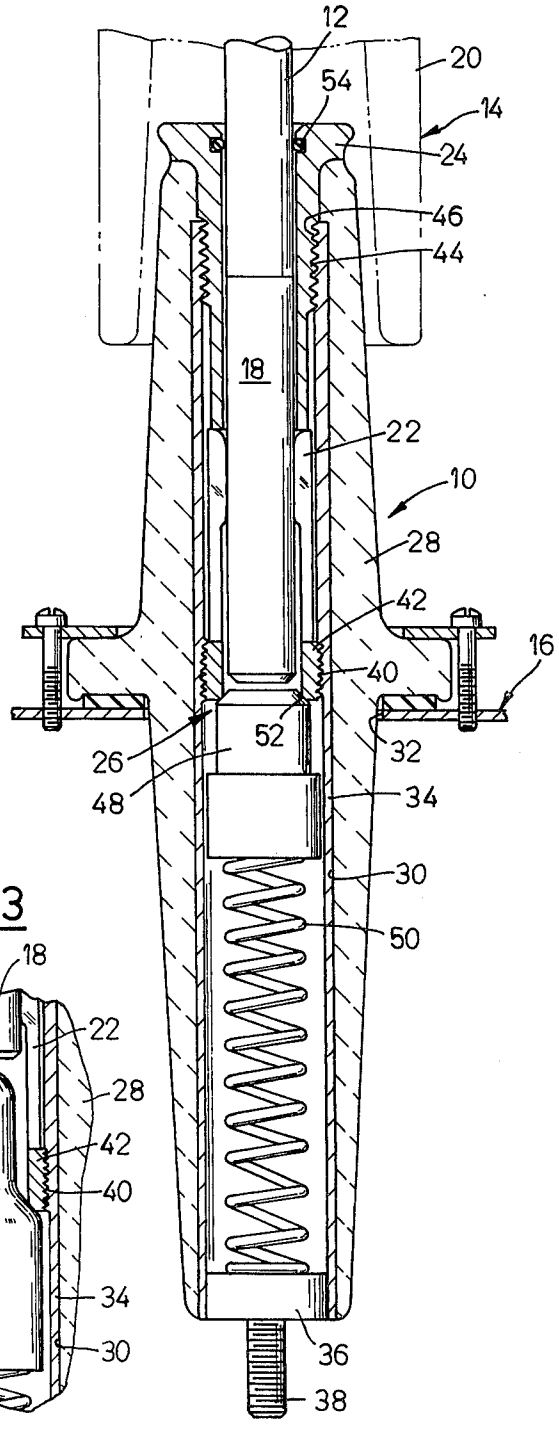


FIG. 2

ARC-OUT SHUT OFF VALVE ASSEMBLY FOR A HIGH VOLTAGE BUSHING

BACKGROUND OF THE INVENTION

In U.S. Pat. No. 3,763,461 entitled "Electric Cable Termination Module Having a Gas-Trap Valve" issued on Oct. 2, 1973, a gas trap valve is shown at the inlet to a bushing which is used to trap gases after a load break operation has been completed and as the probe is withdrawn from the entrance of the bushing. The valve prevents ionized gases from being expelled from the bushing into the atmosphere on separation. Prevention of the expulsion of the gases reduces the possibility of restrike either internally or externally from the probe to the female contact or to the ground shield after the probe has been completely withdrawn from the bushing.

SUMMARY OF THE INVENTION

In the present invention the valve is located internally of the arc chamber so that the valve does not utilize arc extinguishing space. With the internal valve the arc has no chance of playing on the surface of the gas sealing surfaces, thus giving a more reliable seal.

DRAWINGS

FIG. 1 is a side view in section of the bushing of the present invention with the conductive probe of the electrical connector in electrical contact with the bushing and the gas trap valve fully open;

FIG. 2 is a view similar to FIG. 1 showing the conductive probe partially withdrawn from the bushing far enough to interrupt the arc and allow the gas trap valve to close; and

FIG. 3 is a view of an alternate embodiment of the valve.

DESCRIPTION OF THE INVENTION

The bushing **10** of the present invention is used to electrically connect the conductive probe or contact **12** of an electrical connector **14** to an electrical apparatus mounted within a housing **16.** A high voltage electrical connector of this type is shown in U.S. Pat. No. 3,474,386 of Edwin A. Link entitled "Electrical Connector" and issued on Oct. 21, 1969. In this type of an electrical connector, a gas evolving, arc-quenching extension or rod **18** is provided on the end of the probe **12.** The probe **12** and rod **18** are supported within a housing **20** that is designed to matingly engage the bushing **10.** The bushing **10** is provided with an electrically conductive receptacle **22** which is designed to electrically engage the probe **12** and an arc-quenching sleeve **24** which cooperates with the rod **18** to produce an arc-quenching gas on close-in or interruption. The arc-quenching materials can be any of the well-known materials used for this purpose such as hard vulcanized fiber, the acrylics or polytetrafluoroethylene.

In a high voltage terminator of this type, the gas evolving materials respond to the heat of the arc to produce large volumes of gas that operate to quickly snuff the arc. It is generally agreed that the arc snuffing materials produce the intended result. However, as a result of the confinement of these gases within the bushing, the large volumes of hot ionized gases will be expelled from the bushing on withdrawal of the rod from the bushing forming a low resistance electrical path between the ground shield and one of the energized contacts of the separated electrically conductive members. This condition can be extremely dangerous under fault current conditions increasing the risk of injury to the operator and creating a destructive condition.

In accordance with the invention, the bushing **10** is provided with a gas trap valve assembly **26** which is located in a position to minimize the amount of gases expelled on withdrawal of the probe from the bushing. More particularly, the bushing **10** includes a housing **28** formed or molded from a dielectric material and having an axially extending passage **30.** The housing **28** is adapted to be mounted in an opening **32** in the enclosure or housing **16** to provide an electrical connection between a high voltage cable and electrical apparatus within the housing.

The electrically conductive receptacle **22** is supported within the passage **30** intermediate the ends thereof by means of a hollow tube or conductive member **34.** In this re regard, the conductive member **34** is closed at the inner end by means of an electrically conductive plug **36** having a threaded member **38** extending into the housing **16** for connection to the electrical apparatus. A reduced diameter threaded section **40** is provided intermediate the ends of the member **34** for threadedly receiving the threaded end **42** of the conductive receptacle **22.**

The entrance to the passage **30** is lined by means of the arc-extinguishing sleeve **24** and extends inwardly into the tubular member **34** far enough to engage the end of the conductive receptacle **22.** The sleeve **24** is supported within the tubular member **34** by means of a threaded section **44** provided on the sleeve **24** which is threadedly received on the threaded end **46** of the tubular member **34.**

Means are provided at the end of the sleeve **24** for sealingly engaging the probe **12** and rod **18.** Such means is in the form of an O-ring seal **54** provided in a groove at the end of the sleeve **24.**

The gas produced by the arc on interruption is trapped within the tube or member **34** by means of the valve assembly **26.** The valve assembly **26** includes a valve member or element **48** which is biased by means of a spring **50** into engagement with a valve seat **52** provided on the end of the conductive receptacle **22.** It should be noted that the valve assembly **26** is located approximately midway between the ends of the passage **30** so that any gas under pressure trapped between the valve means **26** and the end plug **36** will be prevented from being expelled from the bushing on withdrawal of the connector from the bushing.

In operation, and referring to FIG. **1,** the connector **14** is shown mounted on the bushing **10** with the conductive probe **12** in electrical engagement with the conductive receptacle **22.** The rod **18** extends through the receptacle **22** forcing the valve member **48** into the tubular member **34** and against the bias of the spring **50.** The tubular member **34** will then be open throughout its full length.

On withdrawal of the connector **14** from the bushing **10,** as seen in FIG. **2,** the probe **12** and rod **18** will be pulled outwardly from the receptacle **22.** In the position shown in FIG. **2,** the arc length between the probe **12** and the receptacle **22** will be at approximately the length at which the arc will be extinguished by the gases produced by the heat of the arc. It should also be noted that at this point, the valve member **48** will be simultaneously seated on the valve seat **52** trapping the gases

within the member **34.** At the instant just prior to seating the valve member **48** on the valve seat **52,** gas pressure within the tubular member **34** will be equal throughout the length of the bushing. On arc interruption the gases produced by the heat of the arc will be trapped within the passage in the sleeve **34** by the seal **54.** The only gases that can escape from the bushing are those gases trapped between the O-ring seal **54** located at the end of the sleeve **24** and the gas trap valve **26.** The majority of the high pressure gases are therefore trapped within the sleeve **34** by the valve **26.** This reduction in the volume of gases expelled from the bushing reduces the danger of strike over between the live contacts on circuit disconnection.

FIG. 3

The valve member or element **60** shown in FIG. **3** provides a means for delaying closing of the tube **34** for different voltage ratings. In this regard, it should be noted that as the arc length or distance increases at higher voltages, the time for closing of the tube **34** is delayed in order to trap a greater amount of the gases in the tube **34.** Such means is in the form of the valve member which is normally biased by the spring **50** into engagement with the valve seat **52** to close the tube **34.** The valve member **60** is provided with an extension **62** that is axially aligned with the rod **18.** The combined length of the extension **62** and the length of the rod **18** are selected to correspond to the arc distance for each voltage rating in accordance with the arcing distance. If the lengths are properly selected, the valve member will close the passage **34** at arc-out.

I claim:

1. A high voltage cable termination bushing for connecting an electrical apparatus to an electrically conductive probe having an arc extinguishing rod on the end, said bushing comprising: a housing formed from an insulating material and having a passage, said housing being adapted to be mounted in the entrance to a housing for an electrical apparatus, an electrically conductive member supported within said passage intermediate the ends thereof, electrically conductive means closing one end of said passage, said conductive means being electrically connected to said conductive member for connecting said bushing to the apparatus within the housing, valve means positioned within said passage between said conductive member and said conductive means for trapping gases between said member and said conductive means, said valve means being normally in a closed position and opened by the arc extinguishing rod on the end of the probe on cable termination, on withdrawal of the probe the valve means will close to prevent the escape of gases trapped in the passage.

2. The bushing according to claim **1** wherein said valve means includes a valve member and a spring positioned to bias said valve member into engagement with said conductive member to close the passage.

3. The bushing according to claim **2** wherein said valve member includes an extension positioned to engage the rod, said extension and rod having a combined length established by the voltage rating for the bushing to close the passage at arc-out.

4. The bushing according to claim **1** including an arc extinguishing sleeve positioned at the open end of said passage and an O-ring seal in the sleeve to sealingly engage the probe.

5. The combination of an electrical connector having an electrically conductive probe and an arc extinguishing rod on the end of said probe and a high voltage cable termination bushing having a housing formed from an insulating material and a passage extending through the length of the housing, said passage being closed at one end, an electrically conductive receptacle mounted in said passage intermediate to the ends thereof and being adapted to be electrically connected to an electrical apparatus, said receptacle including a valve seat at the inner end, valve means positioned within said passage between the receptacle and said closed end of said passage for movement into engagement with said valve seat to trap gases within said passage, said rod having a length sufficient to provide for the extinction of the arc produced on withdrawal of the probe from the receptacle and to substantially simultaneously close said valve means at arc out.

6. The combination according to claim **5** wherein said valve means includes a valve member positioned for movement into engagement with said valve seat and a spring biasing said valve member into engagement with said valve seat.

7. The combination according to claim **5** including means at the other end of said passage for sealingly engaging said probe and rod.

8. The combination according to claim **5** including means on said valve member for delaying closing of the passage.

9. A high voltage cable termination bushing for connecting an electrical apparatus to an electrically conductive probe having an arc extinguishing rod on the end, said bushing comprising: a housing formed from a dielectric insulating material and adapted to be mounted in the opening of an enclosure for an electrical apparatus, a passage in said housing, a hollow cylindrical electrically conductive tube in said passage, a conductive plug closing one end of said tube and being adapted to be connected to an electrical device apparatus within the enclosure, an electrically conductive receptacle supported in said tube intermediate the ends of said housing, normally closed valve means mounted in said tube for movement into engagement with said receptacle to define a gas trap chamber in said tube, said valve means being opened by the rod on said probe on cable termination, the rod being of sufficient length to allow the valve means to close on withdrawal of the probe from the receptacle a sufficient distance to extinguish the arc.

10. The bushing according to claim **9** including an arc extinguishing sleeve supported at the entrance to said tube and means at the entrance to said sleeve for sealingly engaging said probe and rod.

11. The bushing according to claim **9** wherein said valve means includes a valve element and a spring positioned in said tube to bias said element into engagement with said receptacle.

12. The bushing according to claim **1** wherein said valve means includes means for delaying the closing of said valve means to correspond with arc out.

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