# United States Patent [19]

**Fisher et al.**

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[54] **ELECTRICAL PENETRANT STRUCTURE**


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[52] **U.S. Cl.** ..... **174/151**, 174/11 R, 174/12 BH, 174/152 R

[51] **Int. Cl.** ..... **G21c 13/04**, H01b 17/30

[58] **Field of Search**..... 174/11 R, 11 BH, 12 R, 174/12 BH, 18, 151, 152 R, 152 E, 152 GM



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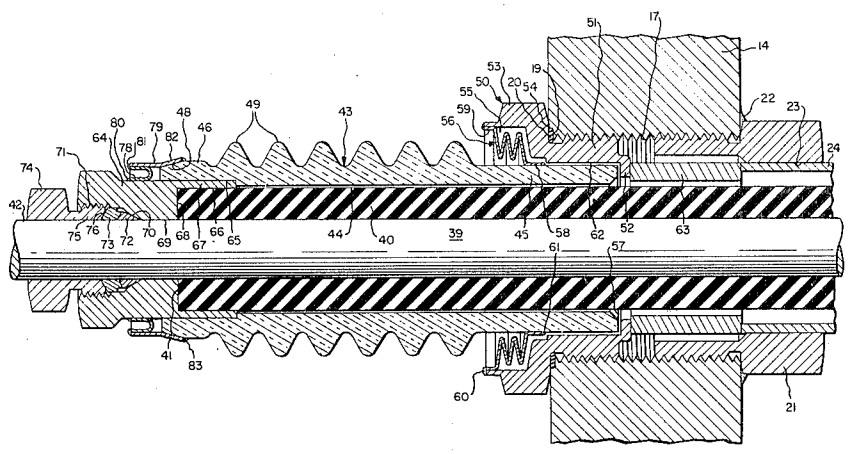
*Primary Examiner*—Laramie E. Askin
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[57] **ABSTRACT**

An electrical penetrant structure to provide medium voltage power penetration through a wall such as the concrete containment wall of a nuclear powered electrical generating facility and used typically to supply electrical power to electrical motor driven reactor coolant pumps. The electrical penetrant structure includes at least one conductor so mounted as to allow longitudinal and lateral movement thereof relative to its support, such longitudinal movement resulting from a thermal effect in the conductor as occurs during starting up of the pumps when the conductor handles a higher starting current than during normal pump-operating conditions, and such lateral movement being possible from a short circuit which produces high lateral forces between conductors where more than one conductor is included in the structure as is usually the case.


**13 Claims, 7 Drawing Figures**



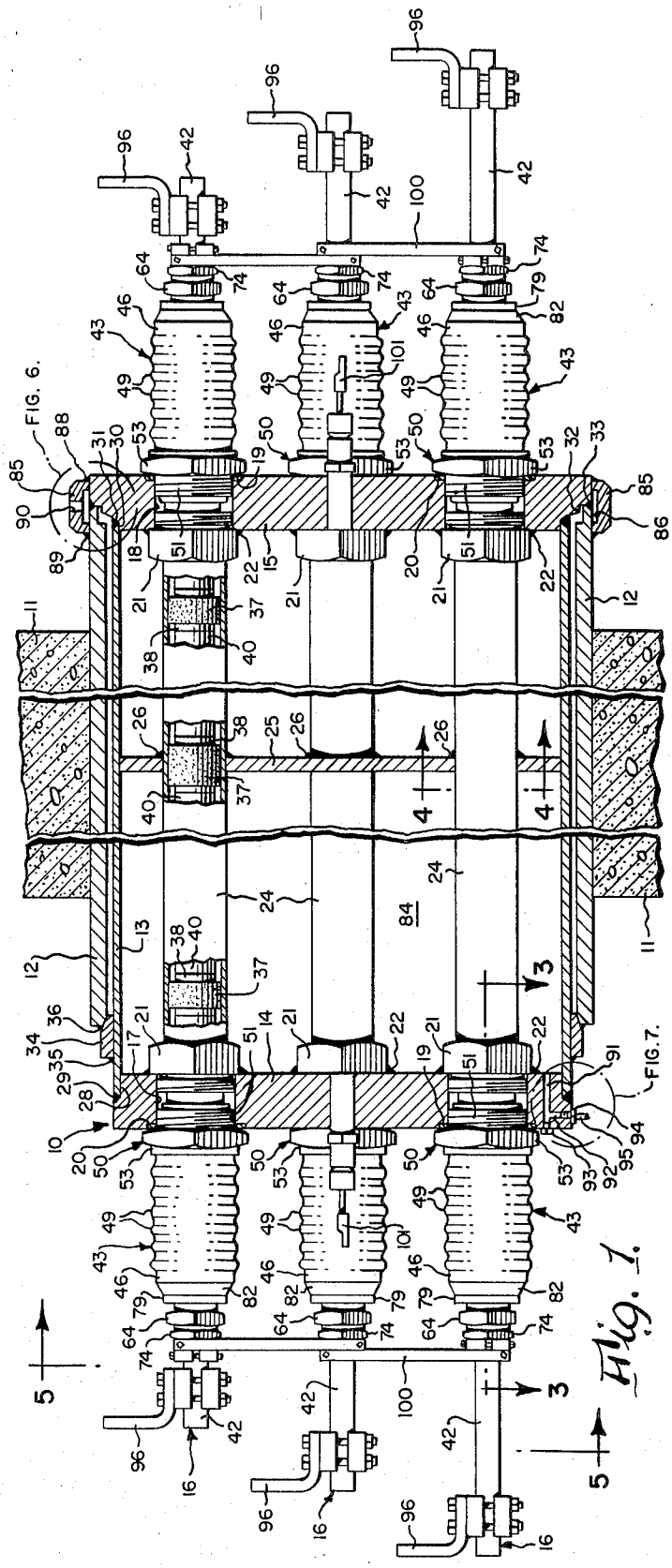


Fig. 1.

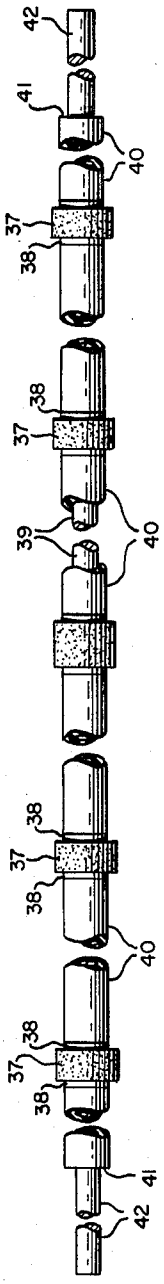


Fig. 2.

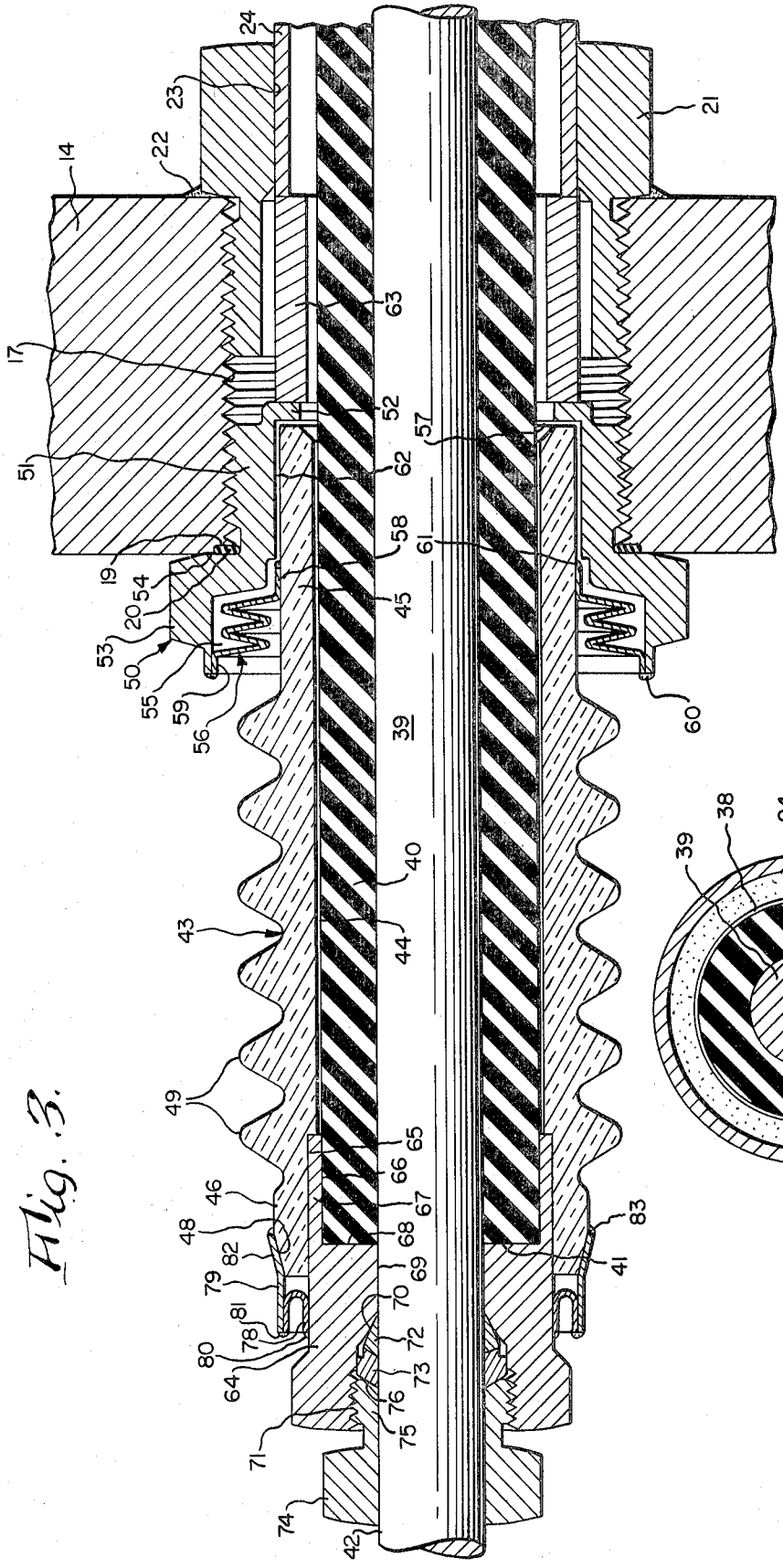

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Fig. 3.

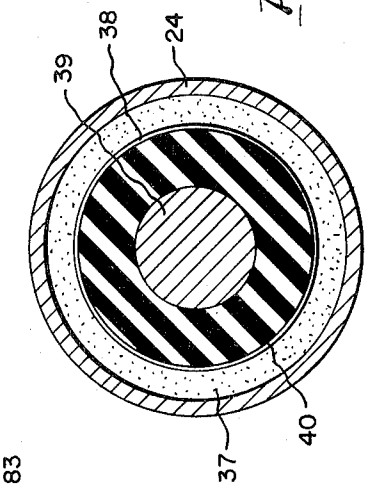

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Fig. 4.

Fig. 5.

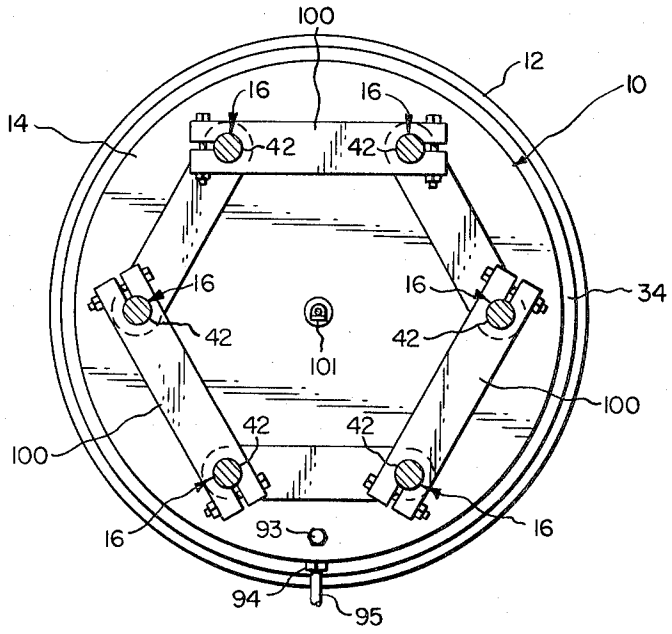



Fig. 6.

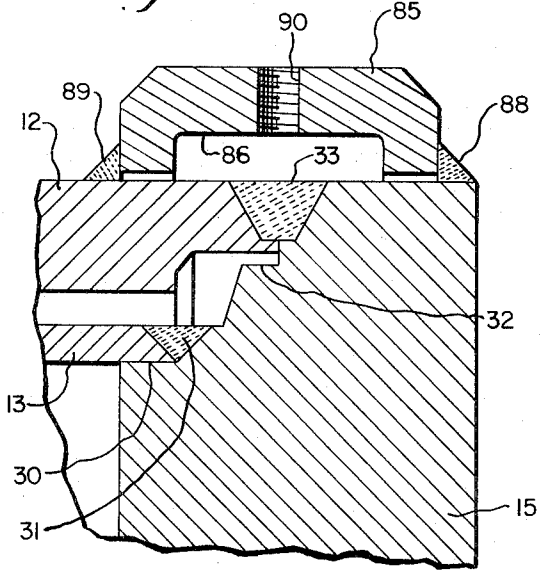
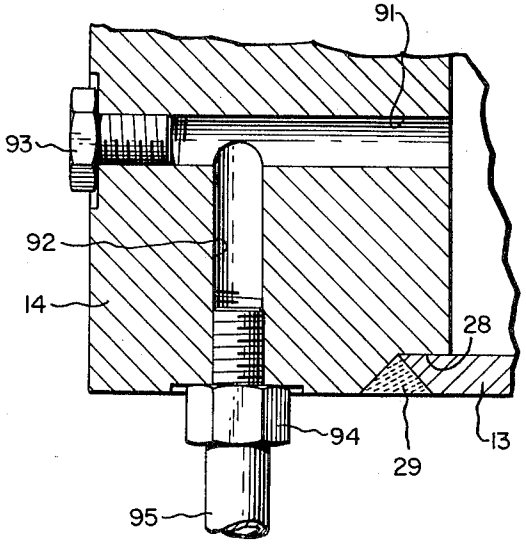



Fig. 7.



# ELECTRICAL PENETRANT STRUCTURE

## BACKGROUND OF THE INVENTION

In nuclear powered electrical generating facilities, pumps are provided for circulating reactor coolant. These pumps are driven by electrical motors of the induction type carrying normal loads of 300 to 700 amperes at approximately 5 to 10 kilovolts. Provision must be made in the electrical supply for such motors for the handling of a much higher current during start-up. It takes about 20 seconds for the motors to come up to speed, drawing initially a current as high as 10,000 amperes which gradually decreases to the aforementioned normal operating level of 300 to 700 amperes. The conductors handling such a range of current are made oversize, typically of copper rod having a one inch diameter, to reduce Joule or resistive heating which must be controlled within prescribed limits during normal running of the pump drive motors, such as a 25° F. differential from ambient at the interface between a concrete wall and a metal pipe extending therethrough on which the electrical penetrant structure is mounted. However, there is a substantial dimensional change or growth in the conductor during start-up conditions when handling the much higher current. This thermal change during motor start-up may typically cause a conductor longitudinal growth of one-eighth inch.

Where two or more such conductors are within reasonably close proximity of each other such as several inches and should a short circuit therebetween occur, high forces are developed which cause spreading of or tend to urge relative lateral movement between such conductors. A current as high as 70,000 r.m.s. amperes may be involved in such a short circuit.

The reactor coolant pumps and their motors are contained on one side of a concrete wall which is typically 4 feet thick. It is through this concrete wall that the electrical power supply for all conditions must pass. Moreover, the electrical penetrant structure must be constructed and mounted on the concrete wall so that no gas can leak through the wall as a result of the electrical supply structure penetrating the same and this is determined by using a monitoring gas.

## SUMMARY OF THE INVENTION

It is therefore the primary object of the present invention to provide an electrical penetrant structure, suitable for electrical power supply for the purposes described and in the environment mentioned hereinabove which allows for longitudinal movement of the conductor during thermally induced dimensional change, and also lateral movement of the conductor as may occur during a short circuit, while maintaining seal integrity against gas leakage.

Another object of the present invention is to provide such an electrical penetrant structure which permits replaceability in the field of an individual conductor, even though the whole structure is initially installed as a unit.

Yet another object of the present invention is to provide such an electrical penetrant structure in which lateral movement of conductors, where there are at least two, is restrained.

In accordance with the present invention, an electrical penetrant structure termination arrangement is provided comprising a wall member having an opening



therethrough, a conductor extending through said opening, and means mounting said conductor on said wall member so as to allow longitudinal and lateral movement of said conductor relative to said wall member including a tubular sleeve of electrical insulating material surrounding said conductor and having inner and outer end portions, said inner end portion being arranged adjacent said opening in spaced relation to said wall member to provide an annular space therebetween, first seal means sealingly connected to said wall member and sleeve and closing said space and allowing longitudinal and lateral movement of said sleeve relative to said wall member, and second seal means sealingly connecting said outer end portion to said conductor.

Other objects and advatages of the present invention will be apparent from the following detailed description of a preferred embodiment illustrated in the accompanying drawings.

## BRIEF DESCRIPTION OF DRAWINGS

FIG. 1 is a generally central longitudinal sectional view through an electrical penetrant structure embodying the present invention and showing the same mounted on a concrete wall, portions of the structure and wall being broken away to reduce the length of the figure.

FIG. 2 is a side elevational view of one of the conductor assemblies shown in FIG. 1, with portions of the assembly broken away, again to reduce the length of the figure.

FIG. 3 is an enlarged fragmentary central longitudinal sectional view through a portion of the structure illustrated in FIG. 1 and showing the means for mounting a conductor assembly on a wall member, this view being taken generally on line 3—3 of FIG. 1.

FIG. 4 is an enlarged vertical transverse sectional view of one of the conductor assemblies as arranged in the electrical penetrant structure, this view being taken on line 4—4 of FIG. 1.

FIG. 5 is a vertical transverse sectional view of the structure shown in FIG. 1, this view being taken generally on line 5—5 of FIG. 1.

FIG. 6 is an enlarged fragmentary view of the upper portion of the right end head shown in FIG. 1 and showing the mounting of a monitoring ring.

FIG. 7 is an enlarged fragmentary sectional view of the lower portion of the left end head shown in FIG. 1 and showing the passages provided in such end head for the introduction, removal and pressure sensing of a monitoring gas confined within the canister portion of the structure.

## DESCRIPTION OF THE PREFERRED EMBODIMENT

The electrical penetrant structure embodying the present invention is represented generally by the numeral 10 (FIG. 1), and is shown as mounted on a concrete wall 11 which forms part of a nuclear reactor facility. Wall 11 is shown as having an opening through which extends a length of cylindrical metal pipe 12, known as a nozzle, so as to be sealingly mounted on the wall and having portions extending outwardly from opposite vertical surfaces thereof.

Arranged within nozzle 12 and extending therethrough is the electrical penetrant structure 10. The same is shown as comprising a canister including a cy-

lindrical tubular body or shell **13** having at its left end a header plate or end head **14** and at its right end another header plate or end head **15.** Electrical conductor assemblies **16** extend through the canister so provided. While any suitable number of such assemblies may be provided, in the embodiment illustrated in the drawings six such conductor assemblies are shown as arranged in equidistant circumferentially spaced fashion. For this purpose, left end head **14** is provided with six similar horizontal through holes **17.** Similar and registering holes **18** are provided in right end head **15.**

The detailed description of a single conductor assembly **16** mounted in a pair of registered holes **17** and **18** will be given and is intended to apply to each of the other conductor assemblies shown in the embodiment illustrated. Also, inasmuch as the mounting of various elements is similar on each end head, the mounting of only one set of elements on one end head, specifically the left end head **14** will be given, with the intention that such description shall be applicable to the mounting at the other end of such conductor assembly **16** on end wall **15.**

Similar reference numerals indicate like parts in the several figures of the drawings.

Referring to FIG. **3,** the opening **17** in end head **14** is shown as being internally threaded and of uniform diameter throughout its length except for a slight counterbore **19** at its outer or left end in which an annular seal ring such as an elastomeric O-ring **20** is arranged for a purpose hereinafter explained.

Mounted on the inner or right end portion of internally threaded hole **17** is a tubular adapter **21** made of suitable conductive metal such as stainless steel. It has an enlarged head externally out of round to permit the application of a turning tool such as a wrench (not shown) to screw it into hole **17** after which it is welded in place by an annular weldment **22.** This adapter adjacent its inner or right end has a reduced cylindrical bore **23** adapted to receive and closely surround one end portion of a conduit pipe **24** also made of suitable conductive metal such as stainless steel. Pipe **24** extends from adapter **21** on end wall **14** to the similar adapter on the other end wall **15.** Intermediate its length, each pipe **24** is supported on a spacer plate **25** extending vertically transversely of the canister shell **13.** The various pipes **24** pass through individual holes provided in this plate **25** and are suitably welded thereto as indicated typically at **26.**

The parallel pipes **24** with their common transverse intermediate support plate **25** are fabricated as a subassembly. Each end head **14** and **15** with its adapters **21** mounted on the inside thereof and welded in place are also fabricated as separate sub-assemblies. The ends of pipes **24** slide into the bores **23** of the respective adapters **21.**

Left end head **14** is shown as having a shoulder **28** adapted to be overlapped by the left marginal end portion of canister shell **13.** This shell at its left end is then secured to end head **14** by an annular weldment indicated at **29.** Right end head **15** is shown as provided with an annular shoulder **30** adapted to receive the right marginal end portion of shell **13** and is suitably secured thereto as by an annular weldment indicated at **31.** The outer end portion of right end head **15** is shown as being larger in diameter than its inner end portion and has a second annular shoulder **32** adapted to be overlapped by the right marginal end portion of nozzle **12.** This nozzle and right end head **15** are secured together by an annular weldment indicated at **33.** This weldment is performed at the nuclear reactor facility.

At its front end canister shell **13** is supported in radially spaced relation to the surrounding nozzle **12** by a ring **34,** suitably secured to this shell by an annular weldment indicated at **35** and also suitably secured to this nozzle by an annular weldment indicated at **36.** Weldments **35** and **36** are also applied at the nuclear reactor facility when mounting the electrical penetrant structure on nozzle **12.**

Referring to FIG. **2,** the conductor assembly **16** includes a conductor **39** which is shown as being an elongated cylindrical rod of conductive metal such as copper and surrounded by a sheath or covering of insulating material **40** of suitable composition. The insulating sheath **40** is not as long as conductor **39** so as to provide an end face **41** for the insulation at each end from which a bare or uncovered portion **42** of the conductor extends axially. A conductor assembly **16** is arranged within and extends through each of the conduit pipes **24.** In order to support such assembly coaxially in its pipe in radially spaced relation thereto, the assembly is provided with a plurality of longitudinally spaced sleeves **37** made of suitable insulating material and arranged at intervals along the length of the conductor sheath **40.** These sleeves **37** internally closely fit sheath **40** and externally closely fit the corresponding pipe **24.** A wrapping of insulating tape **38** on opposite sides of each sleeve **37** secures the same to sheath **40** and holds the sleeve in the desired axial location on the sheath.

Referring to FIG. **3,** the means are illustrated therein for mounting a conductor assembly **16** on left end head **14,** which may be regarded as a wall member, so as to allow longitudinal and lateral movement of the conductor assembly relative to this end head. Such mounting means is shown as including a tubular bushing or sleeve, represented generally by numeral **43,** made of suitable electrical insulating material and surrounding the conductor assembly **16** with its insulating sheath **40** in slightly radially spaced relation thereto, such radial spacing being indicated at **44.** Bushing **43** has a cylindrical inner end portion **45,** and a cylindrical outer end portion **46** the outer corner of which is provided with an annular bevel indicated at **48.** Intermediate cylindrical portions **45** and **46,** bushing **43** is shown as provided with a series of longitudinally spaced outwardly extending annular ribs **49** so as to provide the bushing with an externally fluted configuration. Bushing **43** is preferably made of a ceramic material such as alumina formed into a rigid element. Also, the external surface of the fluted intermediate portion of bushing **43** is preferably glazed to provide a smooth, moisture-impervious, surface which also discourages the collection of dust thereon.

Inner end portion **45** of bushing **43** is surrounded by a tubular housing represented generally by the numeral **50.** This housing is shown as having an externally threaded neck portion **51** which screws into the outer portion of internally threaded hole **17** in left end head **14.** At its inner end this neck has an integral inturned annular flange part **52.** The outer end portion of housing **50** is shown as having an enlarged head part **53** having at one end a flat annular vertical surface **54** adapted to engage seal ring **20.** Externally head part **53** is out

of round to permit the application of a turning tool such as a wrench (not shown) to screw housing 50 into hole 17. Thus, when housing 50 is screwed tightly into opening 17, so as to compress seal ring 20, the external joint between housing 50 and end head 14 is effectively sealed.

Housing 50 adjacent its outer end is shown as provided with an enlarged recess portion indicated at 55 in which are arranged flexible imperforate seal means represented generally by the numeral 56. Such means 56 is sealingly interposed between housing 50 and inner end portion 45 of ceramic bushing 43 and is so constructed as to allow longitudinal and radial movement of this bushing relative to this housing. As shown, means 56 is a fexible imperforate corrugated metal tube of bellows-like construction housed within recess 55 and having a tubular annular flange 58 at its inner end and another tubular annular flange 59 of larger diameter at its outer end. Flange 59 is suitably sealingly secured to housing 50 as by an annular weldment indicated at 60. The portion 45 of bushing 43 surrounded by inner flange 58 is suitably metalized according to a known technique so as to permit this flange to be brazed to bushing 43, such brazing also providing a sealed joint and being suggested by the annular weldment indicated at 61.

It is pointed out that the bore of tubular housing 50 inwardly of weldment 61 is of such diameter as to leave an annular radial clearance indicated at 62. Flange 52 of housing 50 is shown as overlapping but slightly spaced from the inner end face of bushing 43 to provide an axial clearance 57. A tubular spacer 63 is shown as abuttingly interposed between housing flange 52 and the adjacent end face of conduit pipe 24. This spacer serves to position this conduit pipe relative to the adapted 21 insofar as its longitudinal position is concerned.

Means are provided for sealingly connecting the outer end portion 46 of ceramic bushing 43 to the conductor assembly 16. Such means is shown as including a metal gland body 64 having an externally cylindrical cup-shaped inner end portion 67 which is received in a counterbored portion 65 of bushing 43. Inner end portion 67 of gland body 64 is shown as having a cylindrical recess defined by a cylindrical inner wall 66 and a transverse bottom wall of annular configuration 68. The adjacent end portion of insulation sheath 40 is adapted to be received in this recess so that end face 41 of this sheath bears against the recess end face 68 and cylindrical surface 66 closely surrounds the external periphery of the sheath.

To the left or outwardly of the aforementioned recess in gland body 64, this body is provided with a cylindrical bore 69 through which the bared conductor end portion 42 extends. Outwardly of this bore 69 is an annular seat 70 of outwardly enlarging tapered configuration terminating at its outer end in an internally threaded bore portion 71. Arranged against annular seat 70 is a ferrule 72 backed up by an annular follower 73, the interface between these elements being preferably spherical. A tubular compression cap 74 surrounds conductor 39 and has an externally threaded neck 75 with an end face 76 at its inner end which bears against follower 73. By screwing cap 74 into recess 71, ferrule 72 is forced against seat 70 and compressed radially inwardly to provide a sealed joint with the external periphery of the bared conductor portion 42. In this manner a sealed joint between the bared or uncovered end portion 42 of conductor 39 and gland body 64 is provided.

The joint between the cylindrical inner part 67 of gland body 64 and outer end portion 46 of bushing 43 is provided by an annular U-shaped imperforate inner metal ring 78 and an annular substantially flat imperforate outer metal ring 79. Ring 78 is arranged on and surrounds the cylindrical periphery of gland body portion 67 so that the opening of this U-shaped ring faces to the left, leaving an exposed rim or edge on the inner leg of this ring. This inner leg is secured to gland body 64 by an annular weldment indicated at 80. The rim of the other leg of this U-shaped ring 78 is secured to the left end of ring 79 by an annular weldment indicated at 81. The inner end portion of ring 79 has a slightly radially outwardly flared portion 82 which overlies tapered portion 48 on ceramic bushing 43. This tapered portion 48 is metalized and the portion 82 of ring 79 is brazed thereto, such brazing being suggested by the annular weldment indicated at 83. Thus, the joint between bushing 43 and bland body 64 is effectively sealed, by rings 78 and 79 and weldments 80, 81 and 83.

From the foregoing, it will be seen that the outer seal means sealingly connects the outer end of ceramic bushing 43 to conductor 39 in such manner that this bushing is constrained to move with this conductor during any longitudinal movement thereof, and the inner seal means sealingly connects the inner end of this bushing to end head 14 in such manner that both longitudinal and lateral movement of this conductor relative to this end head is permitted. It is the bellows-like tube 56 which is so structured as to be expandable and contractible axially to permit such relative longitudinal movement, and also to be flexible laterally or radially so that one end thereof can move radially relative to the opposite end and thereby permit such lateral movement of the conductor relative to the end head. The clearance 62 allows relative radial movement between bushing 43 and housing 50. The clearance 44 allows some relative radial movement between insulation sheath 40 and bushing 43.

The canister provided by shell 13 and end heads 14 and 15 define a chamber 84 which is filled with a gas under pressure, such as nitrogen maintained at the pressure of about 15 pounds per square inch gauge. This gas is maintained within chamber 84 for the purpose of monitoring any leakage along any of the joints provided by the aforementioned inner and outer seal means involved with the mounting of conductor assemblies 16 on end heads 14 and 15, and also for the purpose of monitoring any leakage due to the mounting of the canister on nozzle 12.

As to the mounting of this canister on this nozzle, an annular monitoring ring 85 having an inner annular groove 86 is shown as surrounding weldment 33 between right end head 15 and nozzle 12. Ring 85 is shown as secured to end head 15 by an annular weldment 88 and to nozzle 12 by an annular weldment 89. This ring has a radial hole 90 to which a tube (not shown) can be suitably attached and associated with suitable apparatus (not shown) for monitoring gas that is collected in groove 86 as a result of any leakage outwardly through the joints provided by weldments 33 and 31.

Canister chamber 84 is filled, serviced and the pressure therein monitored by utilizing a passage 91 ex-

tending axially through left end wall **14** and the radial branch passage **92** leading from passage **91** to the periphery of this end head. The outer end of passage **91** is shown as being closed by a plug **93.** The outer end of branch passage **92** is shown as being connected to fitting **94** for a tubing **95** which leads to remote monitoring equipment (not shown). Suitable gauges, filling and drain valves, none of which is shown, can be connected to the outer ends of passages **91** and **92,** as desired in order to fill, maintain and measure the pressure of the monitoring gas confined within canister compartment **84.**

The exposed outer end portion **42** or conductor **39** of each assembly **16** at each end thereof is shown as provided with a suitable connector **96** to which a suitable conductive lead (not shown) in turn may be connected. These connectors **96** are shown as being of the clamp type so as to be capable of being mounted on and removed from the conductors. The exposed outer end portions **42** of the various conductors may have different lengths as shown to allow for mounting of the connectors thereon at different axial locations to avoid interference with one another.

At each end of the electrical penetrant structure, the leads (not shown) for connectors **96** severally have a shield. The ends of these shields adjacent each end of the electrical penetrant structure are joined together and electrically connected to an electrical connector **101** mounted on corresponding end head **14** or **15** so as to be insulated therefrom. These connectors **101** are electrically connected together internally of the canister so that such shields extend electrically therethrough. The conductor portion of connector **101** is normally a 600 volt capacity conductor.

As previously explained, in case of a short circuit, especially one between two adjacent conductors **39,** high level forces would be developed tending to move the conductors laterally relative to each other. This possibility is minimized in two ways. One way is to physically connect adjacent conductor bars **39** to restrain their relative movement. For this purpose, a strap such as indicated at **100** is suitably clamped at opposite ends to the exposed portions **42** of adjacent conductors. If these conductors are not to be connected in parallel, this strap is made of suitable insulating material. On the other hand, if the conductors are to be connected in parallel, this strap can be made of a conductive metal such as copper so as to provide a buss strap.

The second way of minimizing relative lateral movement between adjacent conductors **39** is by providing a short circuit path to ground rather than from one conductor to another. Accordingly, conductive pipe **24,** surrounding each conductor assembly **16,** at its opposite ends is electrically connected through adapters **21** to end walls **14** and **15** which are at ground potential. Inasmuch as these end walls are electrically connected to ground, in the event of a short circuit the path of the short circuit is likely to be from the affected conductor **39** to the surrounding pipe **24,** to end heads **14** and **15** and thence to ground. This will prevent a short-circuiting of one conductor to another conductor.

In the use for the invention as explained, the reactor coolant pumps operate on a resistive grounded system so that in the event of the short circuit of one of the conductors **39** to ground within the assembly the normal rating of the conductor will not be exceeded. As a consequence, the whole assembly is still protected.

Regarding strap **100** between adjacent conductors, regardless of whether such strap is made of a conductive or non-conductive material, it has the advantage of stabilizing the assembly of conductors **39** and restraining them from relative lateral movement. Apart from forces that might be generated during short circuits to cause lateral movement of a conductor relative to the end heads, the electrical penetrant structure is typically so dimensioned that there is more length of a conductor inside the canister than outside. Hence the conductor tends to fulcrum on the end heads. The tie straps **100** reduce this tendency and improve stability.

In the event a conductor **39** is desired to be replaced in the electrical penetrant structure after installation, this can be readily done in the field in the following manner. Connectors **96** and straps **100** on the conductor **39** to be replaced are removed. Next, compression cap **74** is unscrewed from the gland body **64** at each end of such conductor, thereby freeing up ferrule **72** for removal of it and its follower **73** at each end. Bushing **43** at each end is then removed from the corresponding end head **14** or **15** by unscrewing the corresponding housing **50,** being careful to turn the housing and bushing together so as not to break seal means **56.** This conductor is then pulled axially from the structure. A replacement conductor is inserted in the structure, the bushing **43** with attached housing **50** are mounted over each end of the replacement conductor and the housing screwed to the end head, and the ferrules **72,** followers **73** and caps **74** are then replaced and tightened. The connectors **96** and straps **100** can then be mounted on the exposed ends of replacement conductor. It is to be noted that none of the welded or brazed seal joints is disturbed.

It will thus be seen that the embodiment of the present invention illustrated and described accomplishes the various stated objects.

What is claimed is:

**1.** In an electrical penetrant structure, the combination comprising a wall member having an opening therethrough, a conductor extending through said opening, and means mounting said conductor on said wall member so as to allow longitudinal and lateral movement of said conductor relative to said wall member including a tubular sleeve of rigid electrical insulating material surrounding said conductor and having inner and outer end portions, said inner end portion being arranged adjacent said opening in spaced relation to said wall member to provide an annular space therebetween, first seal means sealingly connected to said wall member and sleeve and closing said space and allowing longitudinal and lateral movement of said sleeve relative to said wall member, and second seal means sealingly rigidly connecting said outer end portion to said conductor.

**2.** An electrical penetrant structure according to claim **1** wherein said first seal means includes a flexible imperforate corrugated tube one end of which is sealingly connected to said wall member and the other end of which is sealingly connected to said sleeve, and said second seal means removably connects said sleeve to said conductor.

**3.** An electrical penetrant structure according to claim **2** wherein said opening in said wall member is internally threaded, said first seal means includes a tubular housing surrounding said sleeve and externally threaded and removably screwed into said threaded

opening and having an enlarged head, a seal ring between said head and wall member and sealing the threaded joint between said wall member and housing, and said one end of said tube is sealingly connected to said housing.

4. An electrical penetrant structure according to claim 3 wherein said enlarged head is internally recessed, and said flexible corrugated tube is arranged in such housing recess.

5. An electrical penetrant structure according to claim 1 wherein said second seal means includes a gland body surrounding said conductor and arranged partially within said sleeve, ferrule means arranged within said gland body and surrounding said conductor, a compression cap connected to said gland body and arranged to compress said ferrule means, and an imperforate ring means sealing the joint between said sleeve and gland body.

6. An electrical penetrant structure according to claim 5 wherein said gland body is made of metal, said ring means is brazed to said gland body and to said sleeve.

7. An electrical penetrant structure according to claim 5 wherein said opening in said wall member is internally threaded, said first seal means includes a tubular housing surrounding said sleeve and externally threaded and removably screwed into said threaded opening and having an enlarged head internally recessed, a seal ring between said head and wall member and sealing the threaded joint between said wall member and housing, said first seal means also including a flexible imperforate corrugated tube arranged in such housing recess and having one end sealingly connected to said housing and its other end sealingly connected to said sleeve.

8. An electrical penetrant structure according to claim 7 wherein there is a second conductor extending through a second opening in said wall member and mounted thereon in the same manner as defined for the first mentioned conductor, that portion of each of said conductors arranged on the inside of said wall member being surrounded in spaced relation by an electrically conductive pipe electrically connected to said, and means mounted on said wall member for grounding said wall member.

9. An electrical penetrant structure according to claim 1 wherein there is a second conductor extending through a second opening in said wall member and mounted thereon in the same manner as defined for the first mentioned conductor, such conductors severally extending outwardly beyond their respective second seal means, and strap means interconnecting such extended portions of said conductors to restrain relative lateral movement between said conductors.

10. An electrical penetrant structure according to claim 9 wherein said strap means is made of a conductive material so as to provide a buss strap electrically connecting said conductors in parallel.

11. An electrical penetrant structure according to claim 9 wherein said strap means is made of an electrical insulating material.

12. An electrical penetrant structure providing electrical power transmission in the 5 to 10 kilovolt range through the containment wall of a nuclear powered electrical generating facility, comprising a canister extending through said wall and including spaced end heads having openings therethrough, an uninterrupted solid conductor extending through said openings, and means insulatively and sealingly mounting said conductor on said end heads so as to allow longitudinal and lateral movement of said conductor relative to said end heads.

13. An electrical penetrant structure according to claim 12 wherein such mounting means are removably connected to said conductor and also to said end heads thereby to allow replacement of said conductor as well as said means following permanent installation of said canister to said containment wall.

* * * * *

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# UNITED STATES PATENT OFFICE
# CERTIFICATE OF CORRECTION

Patent No. 3,856,983 Dated December 24, 1974

Inventor(s) Edward Fisher, Wilbur S. Ratio, Roman Jankowiak, et al.

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

| | |
|---|---|
| Col. 5, line 36: | "adapted" should be--adapter--; |
| Col. 6, line 22: | "bland" should be--gland--; |
| Col. 7, line 13: | "or" should be--of--; |
| Col. 8, line 32: | between "of" and "replacement",--the-- should be inserted; |
| Claim 8, line 8: | between "said" and ",and",--wall member-- should be inserted |

Signed and sealed this 6th day of May 1975.

(SEAL)
Attest:

RUTH C. MASON
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents
and Trademarks

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