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INSULATOR FOR HIGH VOLTAGE CABLE TERMINATOR OR BUSHING

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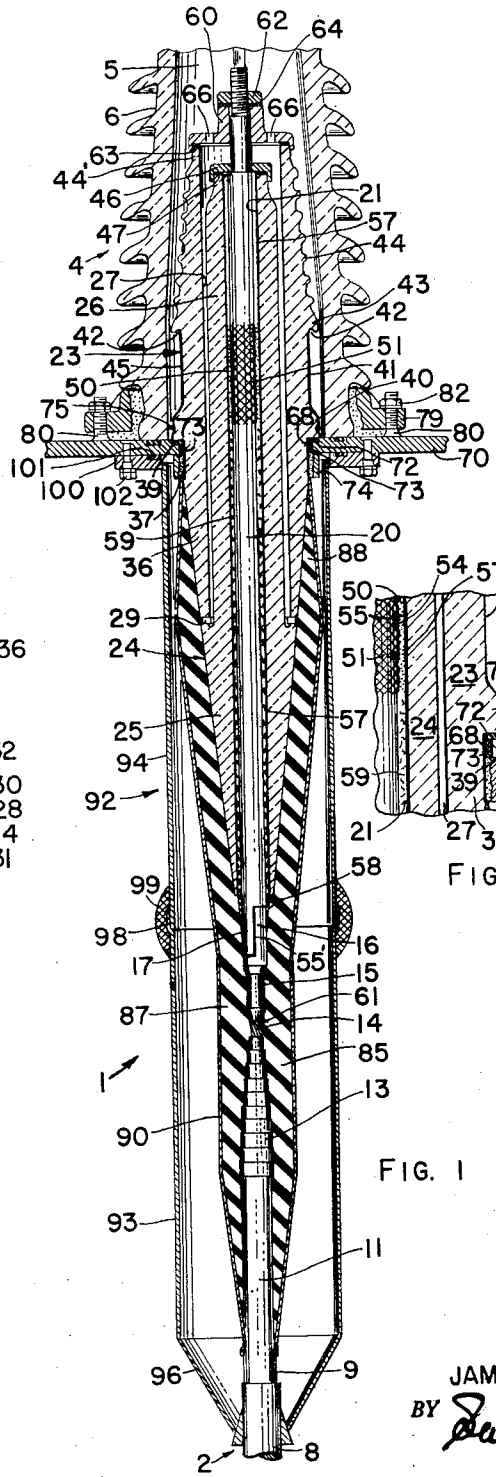


FIG. 1

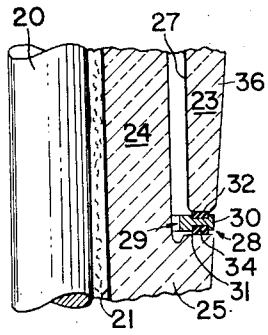


FIG. 3

FIG. 2

INVENTOR.
JAMES H. NICHOLAS
BY
Attorney

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INSULATOR FOR HIGH VOLTAGE CABLE TERMINATOR OR BUSHING

James H. Nicholas, Chicago, Ill., assignor to G & W Electric Specialty Company, Chicago, Ill., a corporation of Illinois

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4 Claims. (Cl. 174—20)

This invention relates to stop joints for interconnecting an insulating-fluid-filled high voltage cable with a terminator, switch, transformer or the like.

In high voltage cable joints, it is often desirable to utilize a porcelain insulator as part of the joint insulation. In such case, a metal connector usually extends through the insulator.

The radial wall thickness of the porcelain insulator is determined by the operating voltage involved. At very high voltages the thickness requirements of the insulator make it desirable to fabricate the insulator in sections, one telescoping within the other. Where the composite insulator is utilized in a stop joint, the problem of providing a reliable long lasting, fluid-tight joint between the separate parts of the insulator arises as does the additional problem of preventing voltage breakdown in the gaps or spaces between the parts thereof.

This invention relates to a stop joint including a composite insulator which is constructed and arranged to provide an effective and long lasting fluid-tight joint between the insulator parts and also to prevent voltage breakdown in the spaces between the parts of the insulator.

It is a still further object of the invention to provide a stop joint as above described wherein the fluid tightness between the parts of the composite insulator are maintained by a gasketing means compressed between a shoulder on one of the parts of the insulator and another part thereof. It is a still further object of this invention to provide means for maintaining said gasketing means under compression through the use of a nut threaded around the connector which passes through the insulator.

It is a still further object of this invention to provide a stop joint as above described wherein the insulator, the connector and the cable end are suitably wrapped with insulation taping and are shielded and confined within a fluid-tight casing.

These and other objects, advantages and features of the invention will become apparent upon making reference to the specification to follow, taken in conjunction with the drawings showing an exemplary embodiment of the invention.

In the drawings:

Fig. 1 is a longitudinal section through a stop joint constructed in accordance with the invention;

Fig. 2 is a fragmentary enlarged sectional view through a part of the stop joint of Fig. 1; and

Fig. 3 is an enlarged fragmentary view of still another portion of the stop joint of Fig. 1.

Reference should now be made to the drawings where like reference characters indicate like parts throughout.

The stop joint structure of the invention illustrated in the drawings is generally indicated by the reference numeral **1**, and it electrically and mechanically interconnects a gas or oil-filled cable **2** and a terminator or pothead insulator structure **4**. The stop joint of the invention, however, is useful in other high voltage connections, as between a cable and transformer, switch, and the like. The terminator structure has an oil filled compartment **5** and the stop joint isolates the fluid therein from the insulating fluid in the cable **2**.

In preparing the cable **2** for jointing, the outer sheathing **8** and the shielding braid **9** of the cable **2** are removed from the cable end exposing the machine-applied insulation **11** of the cable, as is the usual practice in forming high voltage cable joints. The bared end of the cable conductor **14** is connected with a metal connector ferrule **15** having a semi-cylindrical portion **16** which interfits with a like semi-cylindrical portion **17** of a connector rod **20**. The connector rod **20** extends axially through an oversized axial through-bore **21** formed in the innermost of a pair of telescoping porcelain insulator parts **23** and **24**.

The inner insulator part **24** has a tapered bottom end **25** and a reduced cylindrical upper portion **26** which telescopes within the somewhat larger cylindrical bore **27** of the outer insulator part **23**. At the junction between the cylindrical upper portion **26** and the tapered lower end **25** of the inner insulator part is formed an annular shoulder **31**. Resting on the shoulder **31** is a gasket assembly **29** comprising an annular ring **28** having grooves in the opposite axial faces thereof which grooves receive, respectively, resilient ring gaskets **32** and **34**. The bottom of the outer insulator part bears against the top of the gasket assembly to compress the gaskets against the shoulder **31** of the inner insulator part **24**.

Proceeding upward from the bottom of the outer insulator part **23**, the outer surface thereof is tapered to form a continuation of the tapered end **25** of the other insulator part **24** and this tapered portion merges with a cylindrical neck portion **37**. At the top of the neck portion, the outer surface of the insulator part suddenly increases in diameter at an axially facing annular shoulder **39** to provide a narrow collar or flanged portion **40**. Above the flanged portion **40** is a reduced cylindrical portion **41** which terminates in an annular recess **42** within the insulator part. The recess is formed by a downwardly inclined annular skirt **43**. A conductive glaze **45** is applied around the outer insulator part from the extremities of the annular recess **42** thereof down to a point a small distance below the insulator neck portion **37**. The insulator part above the skirt has a number of peripheral insulating skirts **44**, and this portion of the insulator generally tapers to a cylindrical neck **44'** at the top of the insulator part.

The connector rod **20** together with the inner and outer insulator parts form an integral fluid-tight assembly. To this end, the connector rod **20** is provided with a metal cap **46** which fits over a reduced neck at the upper end of the inner insulator part. The cap compresses a basket **47** against the upper part thereof to provide a fluid-tight seal between the connector rod and the inner insulator part. The compression of the gasket **47** is maintained by securing the connector rod to the inner insulator part under tension by a cementitious bond **50**. The cementitious bond **50** extends between a knurled portion **51** spaced from the upper end of the inner insulator part and the defining walls of the bore **21** thereof. The cementitious bond includes a coating of a resilient compressible material, such as Glyptol, applied to the knurling **51**, and a relatively rigid adhesive material, such as poreclain or lumnite cement **55** which fills the rest of the space between the connector knurling and the inner insulator part. The cement bond is, of course, applied while the connector rod is held under tension with the connector cap **46** bearing against the gasket **47** to place it under sufficient compression that a seal will be maintained under the limits of expected relative thermal expansion and contraction of the connector rod and inner insulator part.

To prevent insulation breakdown in the region between

the connector rod and the inner insulator part, the defining walls of the bore **21** are initially coated with a conductive glaze **57** which maintains the walls of this bore at the same potential as the connector rod **20**.

Below the knurling **51**, the space between the connector rod and inner insulator part is packed with lead wool 59 down to the bottom of the inner insulator part.

The gap between the ferrule **15** and the bottom end of the connector rod **20** is filled with lead wool packing 55'. Also, lead foil is applied to the sharp corners 53 between the bottom of the inner insulator part **24** and the projecting portion of the connector rod **20**, and at **61** between the ferrule **15** and the cable conductor **14**, to form tapered fairings at these locations to insure a gradually sloping contour along the conducting surfaces of the stop joint.

The outer insulator part **23** is held securely around the reduced upper portion **26** of the inner insulator part by an assembly of a metal cap **60** fitting over the cylindrical upper neck **44'** of the outer insulator part and a nut 62 threaded around the connector rod **20** and bearing downward upon the top of the cap **60**. A cushioning ring 63 is interposed between the cap **60** and the top of the porcelain insulator part **23** to prevent damage to the latter by the pressure of the cap thereagainst. Also, a lock washer **64** is interposed between the nut **62** and the top of the cap **60** to eliminate play between the nut **62** and the connector threading.

It should be appreciated that threading of the nut **62** upon the connector rod draws the inner insulator part **24** connected thereto upward while pushing the outer insulator part downward to thereby compress the gasket rings **32** and **34** between the bottom of the outer insulator part and the shoulder **31** of the inner insulator part.

The cap **60** is provided with holes **66** permitting passage of the insulating fluid, usually oil, from inside the terminator insulator **6** into the space between the inner and outer insulator parts to prevent insulation breakdown therein.

The insulator bushing assembly just described is mounted within an opening **68** formed in a grounded mounting plate **70**. The outer insulator part **23** below the flanged portion **40** thereof is sized to fit through the opening **68**.

To insure grounding of the glazing **45** around the outer surface of the outer insulator part **23**, lead wool **73** is packed in the space between the insulator neck **37** and the mounting plate. A fluid-tight seal is provided between the insulator bushing and the defining walls of the hole **68** by a gasket **72** located within a groove formed in the upper surface of the mounting plate **70** and compressed between the shoulder **39** of the outer insulator part and the bottom of the aforementioned groove. Compression is maintained by a stainless steel ring **74** cemented to the neck **37** of the outer insulator part immediately below the mounting plate **70** while the outer insulator part is held against the gasket **72**.

Due to the fact that it is often necessary to grind flat the shoulder **39** on the outer insulator part after the outer surface thereof is glazed, removal of the glazing at the shoulder **39** during the grinding operation requires the provision of some means to insure the grounding of the glazing **45** above the shoulder **39**. This means preferably includes a conductive wire **75** wound about the glazing surrounding the flanged portion **40** of the outer insulator part. The wire **75** is connected to the mounting plate 70 by a lug **77** threading thereinto.

The terminator insulator **6** surrounds the upper portion of the composite insulator bushing assembly and is secured to the mounting plate **70** by means including a metal collar **79** cemented to the bottom of the terminator insulator **6**, threaded studs **80** which are anchored to the mounting plate **70** and extend upward through holes in the collar **79**, and nuts **82** threaded around the top of the mounting plate studs **80**.

After the insulator bushing assembly has been secured to the mounting plate **70**, hand wrapped insulation **85** is applied around the cable covering insulation from a point immediately above the shielding braid **9** thereof, and around the ferrule **15**, the projecting bottom end of the connector rod **20**, the tapered bottom portion **25** of the inner insulator part, and the tapered bottom portion of the outer insulator part up to a point immediately below the bottom of the stainless steel ring **74**. The taping is preferably an oil-packed crepe paper material. The contour of the taping is generally conical and, proceeding upward from the end of the cable shielding braid **9**, initially tapers outward a small amount reaching a cylindrical contour at 87 around the tapered portion of the covering insulation and the bottom portion of the ferrule **15**. Then the taping gradually flares outward to follow the general contour of the bottom end **25** of the inner insulator part **24** which the latter portion surrounds. At approximately the junction between the inner and outer insulator parts, the taper of the taping reverses and merges with the tapered bottom end **36** of the outer insulator part **23**.

Metal tinsel braid **90** is then applied over the wrapped insulation **85** along its entire length. The bottom end of the tinsel braiding overlaps the grounded shielding braid **9** of the cable **2** and at the other end overlaps the glazing **45** of the outer insulator bushing to ground the latter.

The stop joint between the cable **2** and the bottom of the mounting plate **70** is surrounded by a casing assembly **92**. The casing assembly comprises a bottom cylindrical casing part **93** and an upper cylindrical casing part **94**. The bottom casing part **93** has an inturned bottom end **96** which is sealed around the cable sheathing **8** in any suitable manner. The upper end of the sleeve part **93** is slightly enlarged at **98** and the enlarged upper end thereof receives the bottom of the upper casing part **94**. The two casing parts **93** and **94** are secured together by a wiped solder joint **99**.

Secured to the upper end of the upper casing part **94** is a mounting flange **100** which is sealed to the bottom of the mounting plate **70** by a gasket **101** maintained under compression by screws **102** passing through the mounting flange and threading into the mounting plate **70**.

It should be understood that numerous modifications may be made of the preferred embodiment of the invention above described without deviating from the broader aspects of the invention.

I claim:

1. A high voltage cable joint interconnecting an insulating-fluid-containing high voltage cable with an insulating-fluid-filled high voltage apparatus, comprising an insulator formed of at least two separate insulator parts, one telescoped within the other, a connector extending through the inner of said insulator parts, a shoulder formed on one of said insulator parts, gasket means compressed between said shoulder and the other insulator part and providing a fluid-tight seal extending completely around the innermost of said insulator parts, the space between said insulator parts on one side of said gasket means communicating with the insulating fluid of one of said apparatus and cable and the other side of said gasket means communicating with the insulating fluid of the other of same, means fixedly securing said connector to the shouldered one of said insulator parts, means carried by said connector bearing against the other insulator part to force the same toward said shoulder to compress said gasket means, and means forming a fluid-tight seal between said connector and the innermost of said insulator parts.

2. A high voltage cable joint comprising an insulator formed of at least two separate insulator parts, one telescoped within the other, a connector extending through the inner of said insulator parts, a shoulder formed on one of said insulator parts, gasket means compressed between said shoulder and the other insulator part and providing a fluid-tight seal extending completely around

the innermost of said insulator parts, means fixedly securing said connector to the shouldered one of said insulator parts, means carried by said connector bearing against the other insulator part to force the same toward said shoulder to compress said gasket means, and means forming a fluid-tight seal between said connector and the innermost of said insulator parts.

3. A high voltage cable joint comprising an insulator formed of at least two separate insulator parts, one telescoped within the other, a connector extending through the inner of said insulator parts, a shoulder formed on the innermost of said insulator parts, gasketing means compressed between said shoulder and the outer insulator part to provide a fluid-tight seal extending completely around the innermost of said insulator parts, means fixedly securing said connector to the inner of said insulator parts, and means carried by said connector bearing against the outer insulator part to force the same toward said shoulder, and means forming a fluid-tight seal between said connector and the inner insulator parts.

4. A high voltage cable joint comprising an insulator assembly formed of at least two separate insulator parts, one part having a reduced end portion telescoping within

the other part and also having a portion located outside of said other part which portion tapers from the end of said other part to a minimum thickness at the end of said one part, gasket means compressed between said parts to provide a fluid-tight seal therebetween, a connector extending through said one insulator part, a cap fixedly secured to said connector, gasket means held under compression between said cap and an end of said one insulator part to provide a fluid-tight seal between the connector and the latter insulator part, said latter gasket means being held under compression by a cementitious bond between the connector and said one insulator part which bond holds the connector under tension, and a nut threaded about said connector and forcing said other insulator part toward said one insulator part to compress said former gasket means therebetween.

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