United States Patent [19]

Fisher

[11] **3,909,509**

[45] **Sept. 30, 1975**

[54] **BUSHING WELL ASSEMBLY**

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[22] Filed: **Apr. 1, 1974**

[21] Appl. No.: **456,611**

[52] **U.S. Cl.**..... **174/152 R;** 339/126 R; 339/157 R

[51] **Int. Cl.**[2]..... **H01B 17/26;** H01R 21/00

[58] **Field of Search**..... 174/11 BH, 18, 19, 74 R, 174/75 R, 75 D, 142, 152 R, 153 R, 167; 336/107; 339/94 A, 94 R, 126 R, 129, 130 R, 130 C, 156 R, 157 R, 158, 159 R, 160, 161, 162, 198 C, 198 E

[56] **References Cited**

UNITED STATES PATENTS

1,274,844	8/1918	Berg	339/159 R
3,150,230	9/1964	Goodman	339/198 E X
3,414,868	12/1968	Howe	174/18 X
3,422,392	1/1969	Woods	174/152 R X
3,469,223	9/1969	Leonard	174/152 R X

FOREIGN PATENTS OR APPLICATIONS

985,003	3/1965	United Kingdom	174/18

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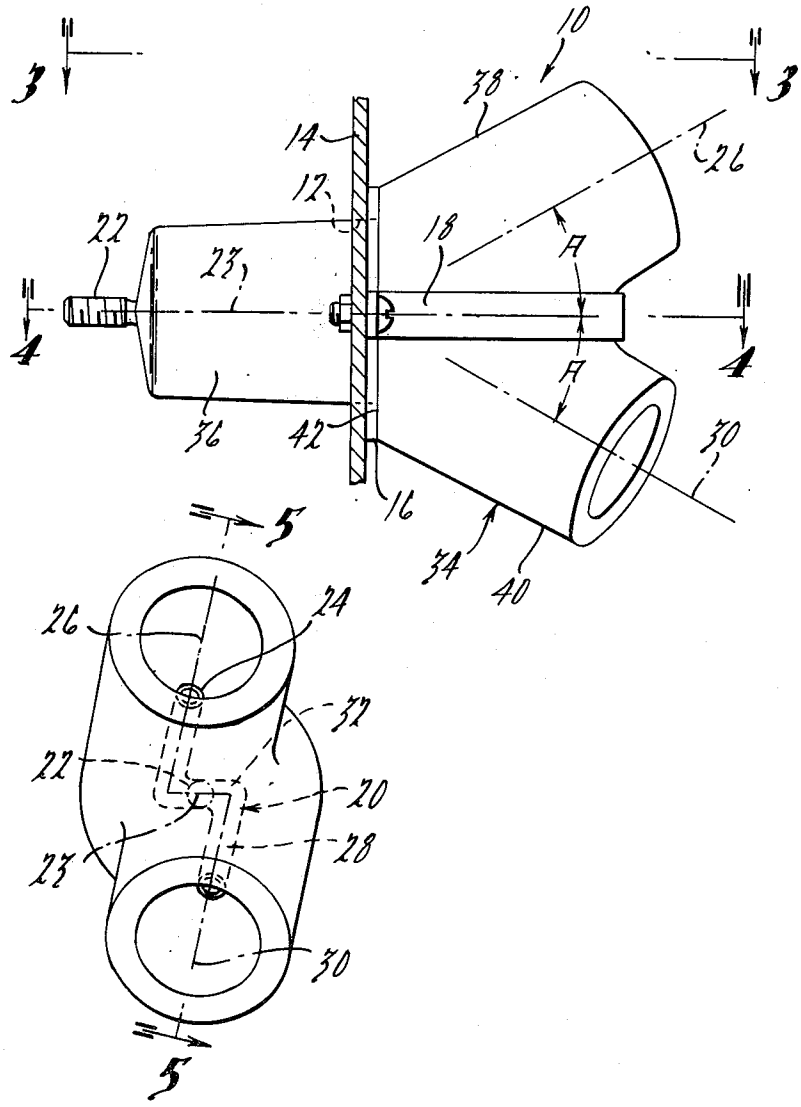
[57] **ABSTRACT**

An integrated bushing well assembly for a transformer enclosure having a first conductor portion disposed on a first axis and extending interiorly of the transformer enclosure for connection to the transformer coil, at least two other conductor portions disposed on respective second and third axes and extending exteriorly of the transformer enclosure for connection to respective separable terminators, and an insulating housing for supporting the conductor portions with respect to the enclosure.

5 Claims, 7 Drawing Figures



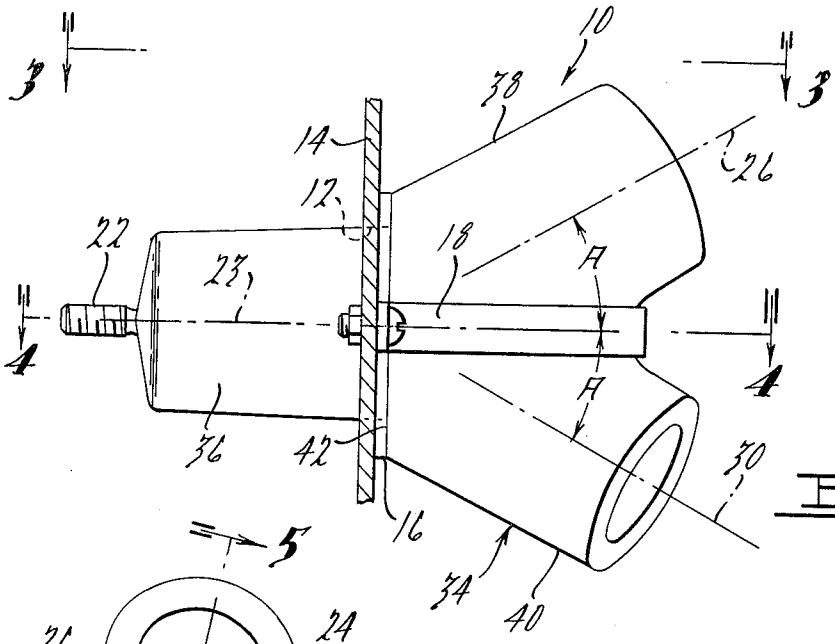


Fig. 1.

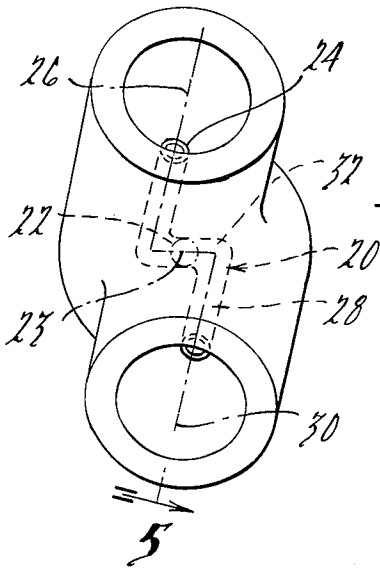


Fig. 2.

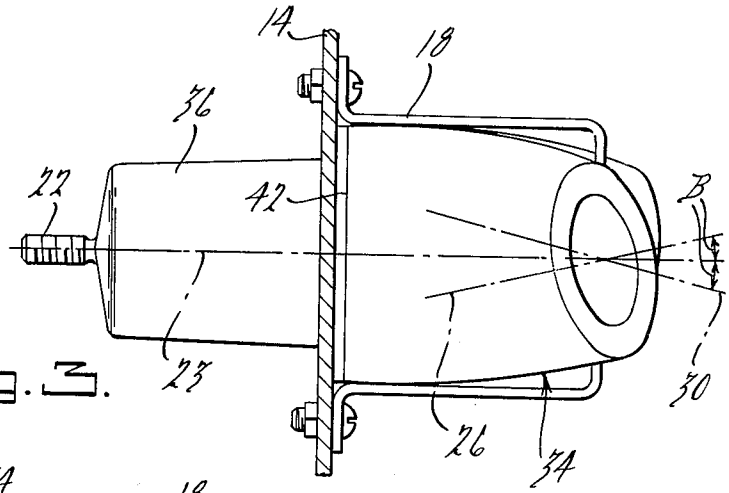


Fig. 3.

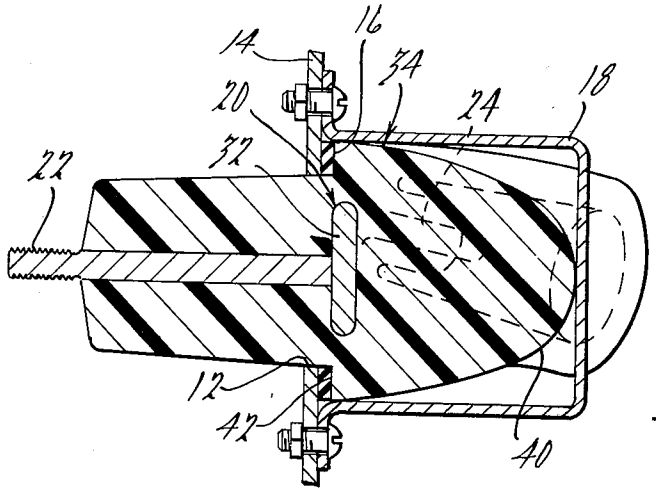


Fig. 4.

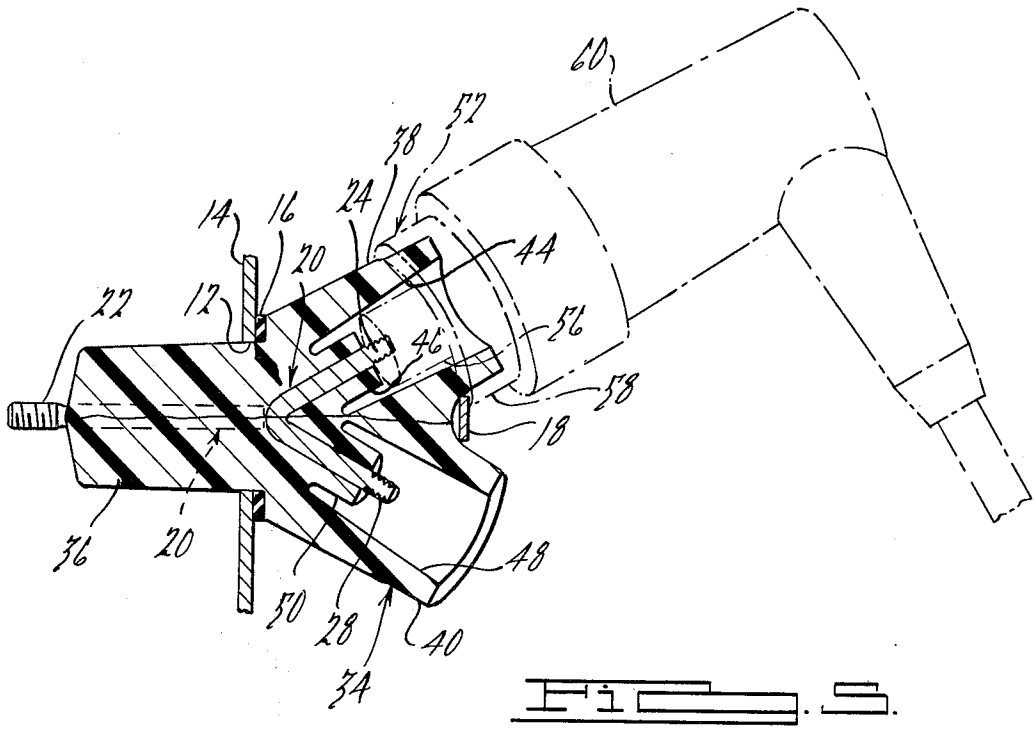


Fig. 5.

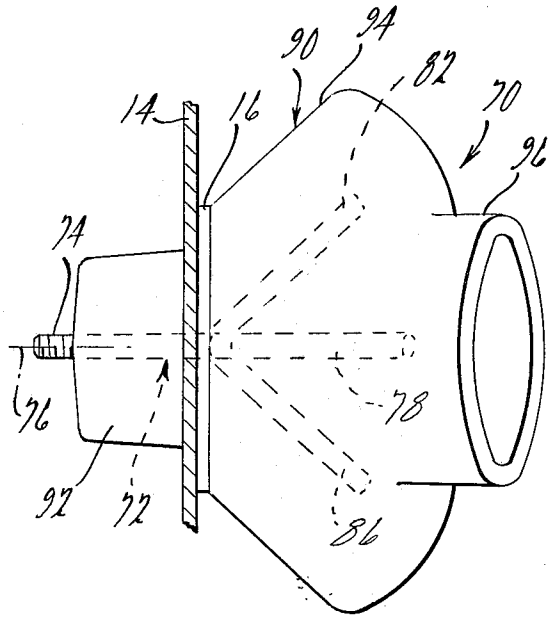


Fig. 6.

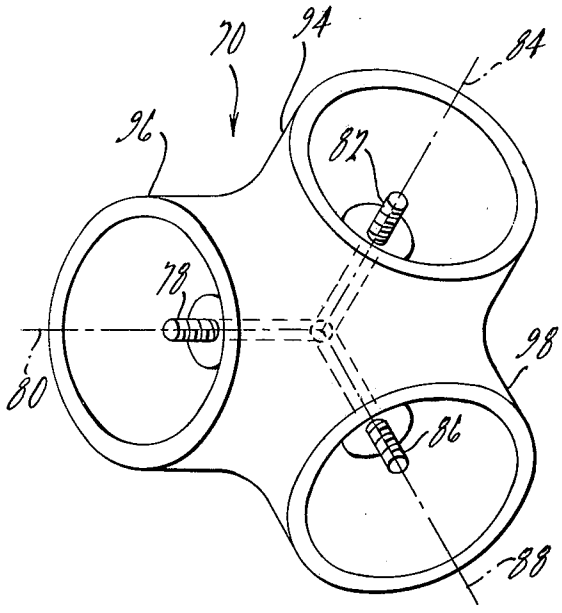


Fig. 7.

BUSHING WELL ASSEMBLY

BACKGROUND AND SUMMARY OF THE INVENTION

The present invention relates to new constructions of bushing wells for transformer enclosures, and particularly, constructions which provide for feedthrough capability from one separable terminator to a second separable terminator. The bushing well constructions of the present invention reduce the space requirements for the bushing well and the separable terminator and reduce cantilever loading of the bushing well. One embodiment of a bushing well of the present invention includes a conductor arrangement having a first conductor portion which is disposed on a first axis and which extends interiorly of the transformer enclosure for connection to the transformer coil, and second and third conductor portions which extend exteriorly of the transformer enclosure and which are disposed on respective second and third axes which are non-intersecting with said first axis so that they may be skewed at two angles with respect to the first conductor portion. The conductor portions are generally surrounded by an insulating housing having three housing portions which are generally coaxial with respective ones of the three conductor portions. The housing portion associated with the first conductor portion extends into the transformer enclosure generally in the manner of conventional bushing wells while the housing portions associated with the second and third conductor portions are exterior of the transformer enclosure. A suitable shoulder or the like is provided to seal the opening for the bushing in the housing cooperatively with a gasket for that purpose.

A second embodiment of the present invention includes a conductor arrangement having a first conductor portion which is disposed on a first axis and which extends interiorly of the transformer enclosure for connection with the transformer coil, and second, third and fourth conductor portions which extend exteriorly of the transformer enclosure and which are disposed on respective axes which intersect at the axis of the first conductor portion. The four conductor portions are generally surrounded by and supported on the enclosure by a housing portion as described above.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a first elevational view of a first embodiment of a loop-feed bushing well according to the present invention;

FIG. 2 is a top elevational view of the loop-feed bushing well of FIG. 1;

FIG. 3 is a second side elevational view of the loop-feed bushing well of FIG. 1 viewed in the direction of arrows 3—3;

FIG. 4 is a partially cross-sectioned view of the loop-feed bushing well of FIG. 1 viewed in the direction of arrows 4—4;

FIG. 5 is a cross-sectional view of the loop-feed bushing well of FIG. 1 viewed in the direction of the arrows 5—5 in FIG. 2, shown in combination with an elbow-type insulated insulated terminator;

FIG. 6 is a side elevational view of a second embodiment of a loop-feed bushing well according to this invention; and

FIG. 7 is a top elevational view of the loop-feed bushing well of FIG. 6.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

In FIGS. 1–5, a first embodiment of the bushing well 10 according to the present invention is illustrated. The bushing well 10 is mounted in an opening 12 in the wall 14 of a transformer enclosure. The bushing well 10 is clamped to the wall 14 by a U-shaped bracket 18 which straddles the bushing well 10. Ordinarily, the transformer enclosure 14 will contain oil so that a fluid-type seal between the bushing well 10 and the wall 14 is provided through the means of a gasket 16.

The bushing 10 has a conductor 20 with a first portion 22 which extends into the transformer enclosure along an axis 23 which is generally perpendicular to the plane of the wall 14. The first conductor portion 22 is provided with a threaded end inside of the enclosure for connection to a cable which in turn is connected to the transformer coil. The conductor 20 has a second conductor portion 24 which extends exteriorly of the transformer enclosure and which is generally aligned on an axis 26 which does not intersect the axis 23 of the first conductor portion 22. It should be noted that the axis 26, as shown in FIGS. 1 and 3, appears to intersect with the axis 23, but in actuality, axis 26 is offset from axis 23 as can be best seen in FIG. 2. In the projected view of axes 23 and 26 of FIG. 1, the axis 23 is seen to be disposed at an angle A, preferably 30°, with respect to the axis 26. In the orthogonal projected view of those axes of FIG. 3, the axis 23 is seen to be at an angle B, preferably 12½°, with respect to the axis 26.

The conductor 20 has a third conductor portion 28 which is exterior of the transformer enclosure and which is disposed on an axis 30 which is non-intersecting with the axis 23. The axis 30 is also disposed at an angle A, preferably 30°, with respect to the axis 23 in the projected view of FIG. 1 and at an angle B, preferably 12½°, in the orthogonal projected view of FIG. 3. The axes 26 and 30 are seen to be offset and parallel in the projected view of FIG. 2. A short fourth conductor portion 32 extends perpendicularly of the conductor portion 22 and connects the conductor portions 24 and 28.

In view of the above description of the conductor portions 22, 24 and 28, it will be appreciated that no two of the axes thereof lie in a common plane, and additionally, by means of the offset or non-intersecting nature of the second and third axes 26 and 30 relative to the first axis 23, the second and third axes 26 and 30 are definable by two angular measurements relative to the first axis 23. The above configuration may be contrasted with a planar "Y" configuration in which the axis of each leg of the Y lies in a common plane and in which each of the axes may be defined by a single angular measurement.

The loop-feed bushing assembly 10 has a housing 34 of insulating material which is preferably cast about the conductor 20. The housing 34 includes a generally circular first portion 36 which is slightly tapered toward the threaded end of the conductor portion 22 and is coaxial with the conductor portion 22, a second generally cylindrical portion 38 which is coaxial with respect to the conductor 24, and a third generally cylindrical portion 40 which is coaxial with respect to the third conductor portion 28. The second portion 38 and the third portion 40 smoothly merge each into the other as seen in the figures. The second housing portion 38 and the

third housing portion **40** provide an annular shoulder **42** which is perpendicular to the axis **23** and which sealingly abuts the gasket **16.**

As can be best seen in FIG. **5,** the housing portion **38** has an inwardly-tapering coaxial bore **44** which terminates at a coaxial cylindrical projection **46.** The conductor portion **24** has a threaded end which projects from the cylindrical projection **46** to permit its connection to an insulated separable connector insert to be described. The housing portion **40** has an inwardly tapering coaxial bore **48** which terminates at a coaxial cylindrical projection **50.** The conductor portion **28** has a threaded end which projects from the cylindrical projection **50** to permit its connection to an insulated separable connector insert as will also be described.

The exterior of the housing **34** is preferably coated with an electrical coating so as to carry the ground potential at the wall **14** to the separable terminators.

With particular reference now to FIG. **5,** the manner of connecting an insulated separable connector insert **52** to the exterior conductor portions **24, 28** is shown. The separable connector insert **52** has a central conductor with a threaded bore located in a coaxially extended cylindrical portion **56** which threads onto the threaded end of the conductor portion **24.** The separable connector insert **52** has a resilient annular collar **58** which sealingly grips the external cylindrical surface of the housing portion **38.** Insulated separable connector inserts, as shown at **52,** are known in the art, and therefore, a detailed description thereof will not be provided. A separable elbow-type terminator **60** is secured to the separable connector insert **52** and provides an electrical connection therewith. Elbow-type terminators, as shown at **60,** are also known in the art, and therefore, a detailed description thereof will not be provided.

In FIGS. **6** and **7** yet another embodiment of a bushing well assembly **70** according to the present invention is illustrated. The bushing well **70** of FIGS. **6** and **7** has three external taps to provide an accessory connection as well as a feedthrough connection. The bushing well **70** has a shoulder which is in sealed engagement with the wall **14** of a transformer enclosure through the means of the resilient gasket **16.** The bushing well **70** has a conductor assembly **72** including a first conductor portion **74** which extends into the transformer enclosure. The first conductor portion **74** is located on an axis **76** which extends perpendicularly with respect to the wall **14.** The conductor assembly **72** further includes a second conductor portion **78** located on an axis **80,** a third conductor portion **82** located on an axis **84,** and a fourth conductor portion **86** located on an axis **88.** Each of the conductor portions **78, 82** and **86** has threaded ends and extends exteriorly of the transformer enclosure for connection to separable terminators as described above. Each of the axes **80, 84** and **88** intersects with the axis **76** and is equidistantly disposed relative to each other, i.e., each being disposed at an angle of 120° relative to each other. Additionally, the axes **80, 84** and **88** are disposed at approximately 45° with respect to the axis **76.**

The bushing well **70** has a housing **90** with a first tapered portion **92** which is coaxial with the first conductor portion **74** and extends into the transformer enclosure. The housing **90** further includes a second generally cylindrical portion **94** which is coaxial with the conductor portion **82,** a third generally cylindrical portion **96** which is coaxial with the conductor portion **78,** and a fourth generally cylindrical portion **98** which is coaxial with the conductor portion **86.** Each of the housing portions **94, 96** and **98** has an inwardly tapering coaxial bore terminating in a cylindrical projection portion as described with respect to FIG. **5.**

In view of the above, it will be appreciated that new bushing well constructions are disclosed which allow for feedthrough capability of the incoming line, for example, to a second transformer or to a lightning arrestor device, or both. Moreover, it will be appreciated that these constructions minimize the overall projection of the bushing well, bushing insert, and separable terminator assembly so that these bushing wells may be used with existing transformer enclosures which may have limited space for such assemblies. Furthermore, it will be appreciated that the bushing well constructions of the present invention advantageously minimize the cantilever stresses on the bushing well.

It is to be understood that the foregoing description is that of preferred embodiments of the invention. Various changes and modifications may be made without departing from the spirit and scope of the invention as defined by the appended claims.

What is claimed is:

1. For a transformer having an enclosure, a bushing well comprising

a. conductor means having

1. a first conductor disposed on a first axis for connection to said transformer,
2. a second conductor disposed on a second axis for connection to a first terminator means and extending outwardly of said enclosure,
3. a third conductor disposed on a third axis for connection to a second terminator means and extending outwardly of said enclosure,
4. a fourth conductor attached to said first conductor and being disposed between and connected to said second and third conductors,
5. said three axes being disposed so that they are non-intersecting and so that no plane may be defined which contains any two of said axes,
6. at least one of said second and third axes being inclined at two angles with respect to said first axis with each of said two angles being defined in respective orthogonal projections, and

b. insulating means connected to said first, second, third and fourth conductors for supporting said conductor means relative to said enclosure and for insulating said conductor means therefrom.

2. A bushing well according to claim **1** wherein said insulating means has first, second and third insulating means portions with each of said portions surrounding a respective one of said first, second and third conductors.

3. A bushing well according to claim **2** wherein said insulating means has shoulder means for cooperation with said enclosure for providing a fluid seal with said enclosure.

4. A bushing well according to claim **1** wherein said insulating means has a first portion surrounding said first conductor and second and third portions surrounding said second and third conductors with said second and third portions joining said first portion so as to define a shoulder for cooperation with said enclosure to provide a fluid seal with said enclosure.

5. A bushing well according to claim **1** wherein both of said second and third axes are inclined at two angles with respect to said first axis with each of said two angles being defined in respective orthogonal projections.

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