Nov. 19, 1968 R. P. JOHNSTON 3,412,353

SHIELDED HIGH VOLTAGE ELECTRICAL APPARATUS PERMITTING POTENTIAL TEST

Filed May 9, 1966

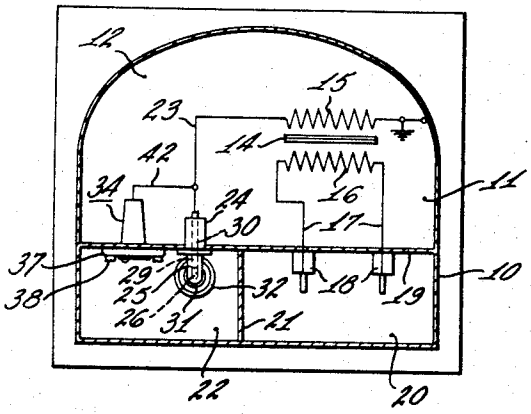


Fig. 1

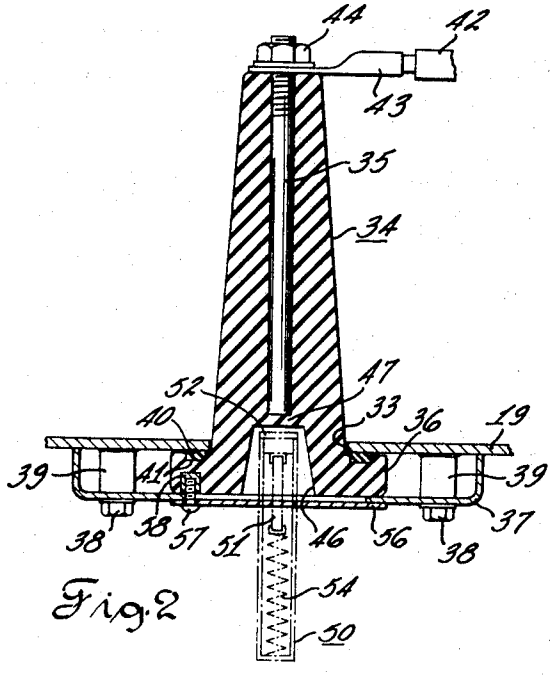


Fig. 2

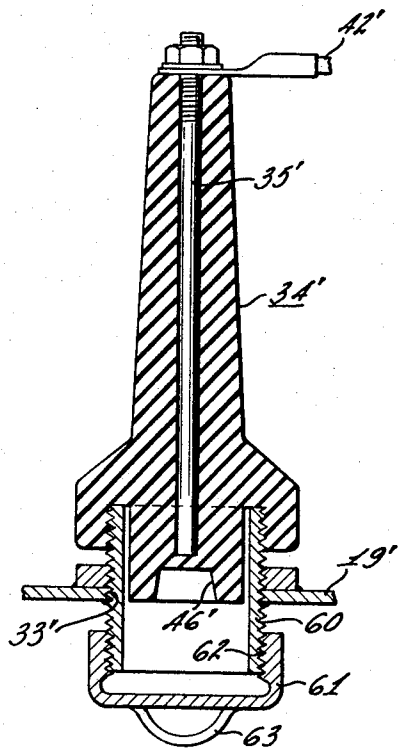


Fig. 3

Inventor,
Richmond P. Johnston
By Lee W. Kaiser
Attorney

United States Patent Office 3,412,353 Patented Nov. 19, 1968

3,412,353

SHIELDED HIGH VOLTAGE ELECTRICAL APPARATUS PERMITTING POTENTIAL TEST

Richmond P. Johnston, Glenshaw, Pa., assignor to Allis-Chalmers Manufacturing Company, Milwaukee, Wis.

Filed May 9, 1966, Ser. No. 548,621
13 Claims. (Cl. 336—105)

ABSTRACT OF THE DISCLOSURE

A ground level distribution transformer has a grounded metallic housing enclosing a core and coil assembly and provided with an aperture completely closed by an insulating member having a conductive electrode embedded therein opposite the aperture and connected to the transformer primary winding. The insulating member prevents accidental contact with the electrode and has an instrument receiving recess opposite the aperture in which an instrument can be inserted to detect if the electrode is generating an electrostatic field, which would indicate that the transformer is energized.

This invention relates to high potential electrical apparatus and in particular to shielded high potential electrical apparatus having means permitting a lineman to detect whether the apparatus is energized.

High voltage electrical apparatus such as power distribution system cables, transformers and voltage regulators are a source of danger to linemen performing installation, maintenance or repair work thereon. Electrical transformers for residential underground distribution systems are often installed in metallic ground level housings or in metallic tanks positioned in underground vaults, and shielded primary underground cables may be connected to the transformers through disconnectable plug-in connectors which are not load-break devices. Great hazards would exist for the operator and the apparatus might be heavily damaged if the separable connector was inadvertently disconnected while magnetizing or load current was flowing therethrough to the transformer. The lineman must be certain that the transformer is not hot, i.e., energized, before he opens the connector or enters the vault or housing to perform work thereon, and he must also be certain that both the cable and transformer are deenergized before he mates the male and female portions of the connector. When the male and female connector elements are separated, the lineman can attempt to draw a fuzzing arc with a Hotstick to determine if the elements of the power system are hot. However, when the male and female connector elements are mated, the metallic tank of the transformer and the conductive shield on the cable and the disconnectable connector form a continuous outer sheath which is usually grounded and prevents determination of whether potential exists in the electrical apparatus.

It is an object of the invention to provide a shielded high voltage electrical apparatus which readily permits the lineman to determine whether the apparatus is energized.

This and other objects and advantages of the invention will be more readily apparent from the following detailed description when considered in conjunction with the accompanying drawing wherein:

FIG. 1 is a schematic plan view of a ground level distribution transformer embodying the invention;

FIG. 2 is a sectional view through the means which permit a lineman to determine if the apparatus of FIG. 1 is energized; and

FIG. 3 is a sectional view through an alternative embodiment of the means shown in FIG 2.

The invention may be incorporated in any element of a shielded underground power distribution system such as the transformer, the disconnectable connector of the primary underground cable, but the invention will be described with reference to a distribution transformer.

Referring to FIG. 1 of the drawing, a ground level distribution transformer shown schematically in plan view comprises a grounded metallic housing **10** having a sealed compartment **11** filled with insulating dielectric such as transformer oil **12**. A transformer core and coil assembly immersed in oil **12** includes a magnetic core **14** linked by a primary winding **15** and a secondary winding **16**. The ends of secondary winding **16** may be connected by leads **17** to axial conductor studs on secondary insulating bushings **18** which are mounted on a vertical panel **19** of metallic housing **10** and extend into the low voltage compartment **20** of the housing **10**. A barrier **21** divides the low voltage compartment **20** from the high voltage compartment **22**. One end of the primary winding **15** may be connected to the grounded metallic housing **10**, and the other end of primary winding **15** may be connected by a lead **23** to the axially extending conductor stud of a primary insulating bushing **24** that mates with a disconnectable connector **25** which is shown as being of the elbow type. The connector **25** is well known and commercially available and may include an axial conductor **26** surrounded by insulation and an outer conductive sheath and having a female terminal **29** one end of which releasably engages a complementary male terminal **30** member of insulating bushing **24**. The other end of axial conductor **26** may be connected through stress grading means (not shown) to the axial conductor of an underground cable **31** which extends through a conduit **32** in the concrete pad on which the housing **10** is supported. The outer sheaths on cable **31** and connector **24** may be grounded and connected to grounded metallic housing **10** and form a continuous conductive shield which prevents a lineman from using a Hotstick to attempt to draw a fuzzing arc to determine if the electrical apparatus is energized.

As shown in FIG. 2, an aperture **33** in panel **19** of metallic housing **10** may receive an elongated cylindrical insulating member **34** having a conductive electrode **35** embedded therein and an outwardly extending circumferential flange **36** disposed against the portion of panel **19** defining aperture **33**. A metallic clamping plate **37** extending above circumferential flange **36** may be affixed by bolts **38** to metallic studs **39** welded to panel **19** to secure insulating member **34** to metallic housing **10**. A continuous resilient gasket **40** is compressed within a circumferential groove **41** in flange **36** to hermetically seal metallic housing **10** at aperture **33**. Electrode **35** may be connected by a conductor **42** to one end of primary winding **15**, and as shown in FIG. 2, electrode **35** is threaded and conductor **43** is crimped to an eye terminal **43** secured to electrode **35** by a nut **44**.

An axial instrument receiving recess, or well **46**, provided in insulating member **34** is accessible from the exterior of metallic housing **10**, and electrode **35** extends to adjacent the bottom of recess **46** so that a relatively thin wall **47** of insulating material exists between the bottom of recess **46** and electrode **35** which is of sufficient thickness to assure safety of the lineman when an electrostatic field detecting instrument is inserted into recess **46**. Metallic housing **10** forms an outer conductive shield which normally prevents detection of the electrostatic field generated by the transformer, but electrode **35** is connected to the transformer primary winding **15** and is disposed opposite aperture **33**, thus permitting the electrostatic field generated by electrode **33** to be detected by any suitable electrostatic field detecting instrument **50** held opposite aperture **33**. The electrostatic field detecting instrument may be of the type commercially available under

the trademark Statiscope which is approximately the size of a fountain pen and includes an insulating casing enclosing a neon bulb **51** and having a metallic probe **52** at one end electrically connected to one terminal of neon light **51** and a metallic spring **44** engaging the other terminal of the neon light and urging it toward the probe **52** and wherein the electrical current for lighting the neon light **51** flows to earth through the capacitance of the lineman holding the detecting instrument.

A metallic cover **56** normally closes the instrument receiving well **46** and is releasably secured by screws **57** engaged in tapped inserts **58** molded within flange **36** of insulating member **34**. Cover **56** engages clamping plate **37** and thus is normally grounded to assure safety of a lineman coming into contact therewith. Removal of cover **56** exposes instrument receiving well **46** and permits the lineman to determine if the electrical apparatus is energized.

The circumferential flange of the FIG. 2 embodiment is omitted from the insulating member **34'** of the embodiment of FIG. 3, and a metallic tubular support member **60** having external threads thereon is embedded in the material of insulating member **34'** and is welded to the margin of panel **19'** defining aperture **33'**. A cup shaped metallic cover **61**, which may be a standard pipe cap, has internal threads **62** which releasably engage the external threads on tubular support member **60** to normally prevent access to instrument receiving well **46'** and is thus electrically connected to the metallic housing and grounded. Cover **61** may have an eye **63** affixed thereto to facilitate removal with a Hotstick.

The preferred embodiment has been described with reference to a transformer, but the invention is not so limited and also may be embodied in other shielded high voltage apparatus such as cables, disconnectable connectors, voltage regulators or separately housed sectionalizing switches. Many modifications and variations of the invention will be apparent to those skilled in the art, and consequently it is intended in the appended claims to cover all such modifications and variations which are within the true spirit and scope of the invention.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. In combination, high potential electrical apparatus having an outer conducting sheath provided with an aperture therein,

an insulating member closing said aperture,

and a conductive electrode electrically connected to and positioned within said high potential electrical apparatus opposite said aperture and being covered by said insulating member,

said insulating member completely closing said aperture so that said electrode is not exposed at the exterior of said apparatus and cannot be accidentally contacted and said insulating member being penetrable by the electrostatic field generated by said electrode when said apparatus is energized whereby said electrostatic field penetrates said aperture and said insulating member and can be detected from the exterior of said apparatus by an electrostatic field detecting instrument to determine if said apparatus is energized.

2. In the combination defined by claim **1**, wherein said sheath is grounded.

3. In the combination defined by claim **2** wherein said electrode is embedded within said insulating member and extends adjacent to the surface of said insulating member.

4. In the combination defined by claim **3** wherein said insulating member has an instrument guiding recess therein opposite said aperture and said electrode and accessible from the exterior of said apparatus.

5. In the combination defined by claim **4** and including a protective conductive cover, and means releasably securing said cover in a position wherein it closes said instrument guiding recess and electrically engages said sheath.

6. In the combination defined by claim **2** wherein said conducting sheath is a metallic casing.

7. In the combination defined by claim **6** wherein said electrical apparatus is an electrical transformer within said casing having primary and secondary windings and said electrode is connected to said primary winding.

8. In the combination defined by claim **6** wherein said insulating member is an elongated cylinder extending through said aperture and having an axial instrument guiding recess therein accessible from the exterior of said casing and a wall of insulating material separating said electrode from the bottom of said recess.

9. In the combination defined by claim **8** and including a metallic cover, and means releasably securing said cover in a position wherein it closes said recess and electrically connects said cover to said metallic casing.

10. In the combination defined by claim **8** and including a tubular metallic member coaxial with and embedded in said insulating member in surrounding relation to said recess and having the outer periphery thereof secured to the portion of said casing defining said aperture.

11. In the combination defined by claim **10** wherein said tubular member is threaded and including a cup shaped metallic cover having threads in the sidewall portion thereof releasably engaging said threads on said tubular member and normally preventing access to said instrument receiving recess.

12. In the combination defined by claim **6** wherein said insulating member is an elongated cylinder and extends through said aperture and has a circumferential flange disposed against the portion of said casing defining said aperture and said electrode extends axially of said cylindrical member.

13. In the combination defined by claim **12** wherein said circumferential flange has a circumferential groove therein opposite said metallic casing and including means for clamping said flange against said casing and a continuous resilient gasket within said groove compressed between said casing and said flange and hermetically sealing said casing at said aperture.

References Cited

UNITED STATES PATENTS

1,706,140	3/1929	Brand	174—152 X
1,902,617	3/1933	Burr	174—143 X
3,377,487	4/1968	McNulty	174—18

LARAMIE E. ASKIN, *Primary Examiner.*