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VOLTAGE INDICATOR AND TEST DEVICE

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10 Claims

ABSTRACT OF THE DISCLOSURE

A removable protective cover for a capacitance tap and lamp connected thereto on a power cable or cable termination housing, characterized by having means for short circuiting the capacitance tap and lamp when the cover is in place on the termination housing or cable.

This is a continuation application of an earlier application filed Dec. 21, 1965, Ser. No. 515,499, having the same title as designated above and filed by the same inventor identified herein.

This invention relates to improvements in voltage indicators and test devices therefor particularly as employed in electric power systems.

The trend toward underground electric power transmission and distribution systems has created a need for a highly reliable voltage indicator. This is because the normally current carrying conductors which are normally charged to a high potential relative to ground are entirely enclosed in insulation usually covered by an outer protective and conductive grounded sheath or shield. It is, therefore, difficult to gain access to such conductors to determine whether they are charged at times when trouble in the system, or any other reason, makes it necessary to change connections. If the conductor is charged at a time when an attempt is made to change connections, disastrous and hazardous power arcs may be drawn.

Such power systems may comprise various modules such as transformers, switches and multi-junctions all interconnected by insulated cable with standard detachable connectors between the cable terminations and the modules. A simple and fairly reliable device for indicating whether or not the current carrying parts are charged is a glow discharge lamp such as a neon glow lamp located at each connector and capacitively coupled through the insulation to the current carrying parts so that when they are charged the lamp will be lighted.

However, such lamps and connections, or both, may fail in which case a darkened lamp could provide a false indication of absence of voltage on the current carrying parts with the possibility of disastrous and even lethal results if an attempt is made to change connections.

In accordance with the present invention, there is provided a signal lamp arrangement for prolonging its useful life and a novel and simple device or system for testing the integrity of the signal element and its connections.

An object of the invention is to provide an improved voltage indicator means for cable terminations in electric power systems.

Another object of the invention is to provide an improved test device for a voltage indicator in electric cable terminations.

The invention will be better understood from the following description taken in connection with the accompanying drawing and its scope will be pointed out in the appended claims.

In the drawing,

FIG. 1 is a diagrammatic showing of an embodiment of the improved voltage indicator device, and

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FIG. 2 is a diagrammatic showing of an embodiment of the improved test device for the indicator of FIG. 1.

Referring now to the drawing and more particularly to FIG. 1, there is shown therein a portion of a cable termination which contains a voltage sampling electrode 1 which is capacitance coupled by capacitances indicated schematically by C_1 and C_2 to a high voltage cable conductor 2 and a conductive normally grounded shield 3, the latter two being separated by cable insulation 4. The capacitances C_1 and C_2 constitute a capacitive voltage divider and a small neon lamp 5 or equivalent signal is connected between electrode 1 and shield 3 so as to be energized in proportion to the voltage to ground of the conductor 2. As shown, the lamp 5 is mounted in a housing 16. A removable metal cover 7 which caps the housing 6 for the neon lamp is provided which, when in place, short circuits the lamp 5 through a spring connector 8 connected to the electrode 1 thus keeping the lamp 5 deenergized when the cover is in place. When the cover is removed, the short circuit on the lamp 5 is removed, and if there is voltage on the conductor 1, the lamp 5 will glow. If the lamp does not glow, the probability is that the voltage on the conductor 1 is zero. However, the possibility still exists that the neon lamp is defective or that the electrode 1 is short circuited to the shield 3.

By maintaining the cover 7 in place during normal operation, the life of the lamp 5 is prolonged as it need only be operated momentarily or at short intervals by removing the cover 7 at times when it is desired to determine whether or not the conductor 2 is energized.

The sixty cycle impedance of the capacitance C_2 should have a value which will provide approximately three microamperes average current for the lowest voltage on the conductor 2 for which an indication is desired. For sixty volt lamp breakdown, the reactance of C_2 should be about twenty megohms which would make it equal to about 120 micromicrofarads. The lower voltage limit desired, and the termination capacity, will then determine the specific electrode geometry and required material properties of the cable section.

FIG. 2 shows a test device to be used by a repair crew and consists essentially of a battery 9, a transistor oscillator or vibrator 10, a step-up transformer 11 and two neon lamps 12 and 13. This unit can be mounted in a housing 14 about the size of a flashlight having a normally open pushbutton switch 15 for connecting the battery 9 across the input terminals of the oscillator 10. The output terminals of the oscillator 10 are connected to the input winding of the step-up transformer 11 whose output winding is connected to the lamps 12 and 13 in series with each other and with a resistor 16. Probe electrodes 17 are connected across the lamp 12 and resistor 16 and have terminations BB for fitting over terminals AA in the housing 6 when the cover 7 of FIG. 1 is removed as shown in FIG. 2.

When the switch 15 on the tester is closed, voltage is applied to the lamps 12 and 13 causing them to glow. When the tester terminations BB are connected to pins AA of FIG. 1 after the cover 7 has been removed, lamp 5 should glow showing that the voltage indicator unit is sound. However, if lamp 5 does not glow it should be presumed to be defective. If neither lamp 5 nor lamp 12 glows, the indication is that the electrode 1 itself is faulty and shorted to the shield 3. In either of these two latter cases, the true state of the voltage on the conductor is unknown and the maintenance crew is thus alerted that proper action should be taken.

The oscillator 10 should preferably operate in the 2 to 5 kilocycle range and the step-up transformer 11 should have a ratio of approximately 60 to 1. The com-

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paratively high frequency will lead to a smaller step-up transformer and a more conveniently handled test unit.

While there has been shown and described a particular embodiment of the invention, it will be obvious to those skilled in the art that changes and modifications may be made without departing from the invention.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. In an electric cable system having a normally charged conductor in a sheath of insulation surrounded by a grounded conductive shield, an electrode in the electric field between said conductor and shield, an electric signal connected between said electrode and shield, and a removable protective cover for said signal having means for short circuiting said signal when said cover is in place.

2. A system as in claim 1 in which said signal is a lamp.

3. A system as in claim 1 in which said signal is a glow lamp.

4. In an electric cable system having a normally charged central conductor in a sheath of insulation surrounded by a grounded conductive shield, an electrode in the electric field between said conductor and shield, an electric signal connected between said electrode and shield, an auxiliary source of voltage, a pair of auxiliary electric signals and a resistor serially connected across said auxiliary source, and means for connecting said signal in parallel with said resistor and one of said auxiliary signals.

5. A system as in claim 4 in which at least one of said signals is a lamp.

6. A system as in claim 4 in which at least one of said signals is a glow lamp.

7. In an electric cable termination having a normally charged central conductor in a sheath of insulation surrounded by a grounded conductive shield, an electrode in the electric field between said conductor and shield, an electric signal connected between said electrode and shield, a removable protective cover for said signal having means for short circuiting said signal when said cover

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is in place, an auxiliary source of voltage, a pair of auxiliary electric signals and a resistor serially connected across said source, and means for connecting said signal in parallel with said resistor and one of said auxiliary signals when said cover is removed.

8. A system as in claim 7 in which said signals are lamps.

9. A system as in claim 7 in which said signals are glow lamps.

10. A test device for a glow lamp voltage indicator for an electric power distribution system cable termination comprising, in combination, a portable housing, a normally open switch mounted in said housing and manually closable from outside said housing, a transistor oscillator mounted in said housing and having a pair of input terminals and a pair of output terminals, a battery mounted in said housing, means including said switch for connecting said battery across said input terminals, a voltage step-up transformer having an input winding connected across the output terminals of said oscillator and having an output winding, a pair of glow lamps mounted in said housing, means including a resistor for serially connecting said lamps across said output winding, and a pair of conductive prongs extending through said housing and connected across one of said lamps and said resistor.

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