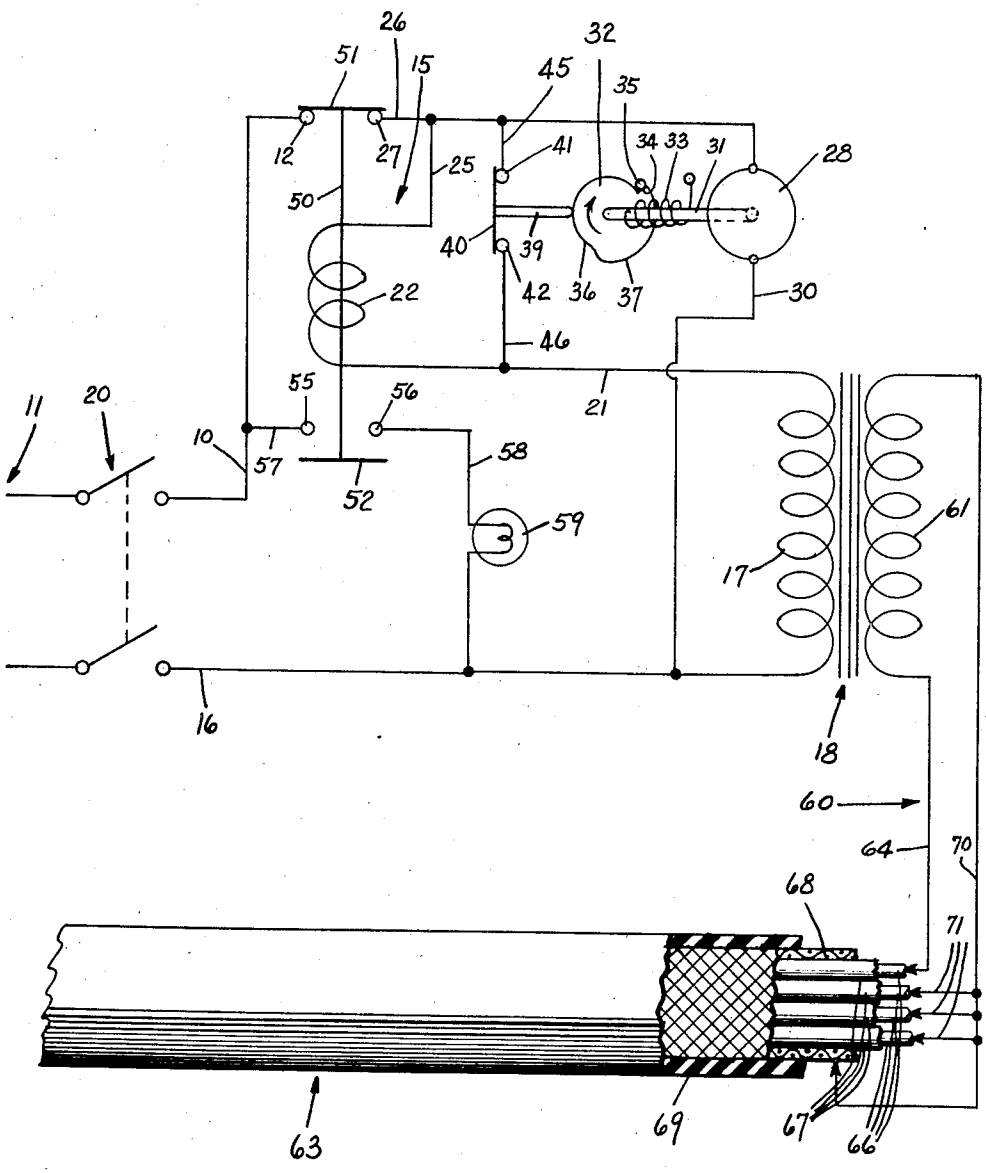
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ELECTRICAL INSULATION TESTING APPARATUS

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INVENTOR
C. E. LEWIS
BY
ATTORNEY

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ELECTRICAL INSULATION TESTING APPARATUS

Clay E. Lewis, Baltimore, Md., assignor to Western Electric Company, Incorporated, New York, N. Y., a corporation of New York

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This invention relates to electrical insulation testing apparatus, and more particularly to apparatus for determining the presence of faults in insulating covers of insulated conductors, and has for its object the provision of new and improved electrical insulation testing apparatus.

One apparatus embodying the invention includes a source of alternating current potential, means energizable by the potential, means operable to control the energization of the energizable means, means actuated by a surge of current through the energizable means, and means for preventing the operation of the last-mentioned means by a surge of current immediately after the switch is closed.

A complete understanding of the invention may be obtained from the following detailed description of a specific embodiment thereof, when read in conjunction with the appended drawing, in which the single figure is a schematic view of one embodiment of the invention.

Referring more specifically to the drawing, a conductor 10 of a power line 11, which is connected to a source of alternating current potential (not shown), is connected to a contact 12 of a current-responsive latch-in relay 15. The second conductor 16 of the power line 11 is connected to one end of a primary winding 17 of a transformer 18. The conductors 10 and 16 have a manually operable, normally open, single throw switch 20 provided therein.

A conductor 21 serves to connect a coil 22 of the relay 15 with the primary winding 17 and a conductor 25 connects the other end of the coil 22 to a conductor 26. The conductor 26 is connected to a contact 27 of the relay 15 and to a synchronous electric motor 28. The motor 28 is also connected to the conductor 16 by a conductor 30.

A shaft 31 connected to the armature (not shown) of the motor 28 has a cam 32 secured thereon and is biased in a counterclockwise direction, as viewed in the drawing, by a torsion spring 33 to urge a shoulder 34 formed on the cam 32 against a stop 35. The cam 32 has a dwell 36 and a lobe 37 formed on the periphery thereof. A button 39 of a contactor 40 bears against the dwell 36 of the cam 32 when the cam is in the position shown in the drawing, which is the starting position.

When the contactor 40 is in the starting position, it is in engagement with a pair of contacts 41 and 42. The contact 41 is connected by a conductor 45 to the conductor 26 and the contact 42 is connected by a conductor 46 to the conductor 21. When the motor 28 is energized, it serves to

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turn the shaft 31 and the cam 32 slowly and at a uniform rate in a clockwise direction, as viewed in the drawing, against the action of the spring 33, and when the lobe 37 is forced into engagement with the button 39, the contactor 40 is forced out of engagement with the contacts 41 and 42.

The relay 15 includes an armature 50 having contactors 51 and 52 secured to the respective ends thereof. When the armature 50 is in the position shown in the drawing, the contactor 51 is in engagement with the contacts 12 and 27. When a current of large magnitude flows through the coil 22, the armature 50 is forced upwardly, whereby the contactor 52 engages contacts 55 and 56 positioned adjacent thereto. The contact 55 is connected by a conductor 57 to the conductor 10 and the contactor 56 is connected by a conductor 58 to the conductor 16 with an indicating lamp 59 in series therewith. Thus, if the contactor 52 is in engagement with the contacts 55 and 56 when the switch 20 is closed, the lamp 59 will be connected to the conductor 16 by the conductor 58, and to the conductor 10 through the conductor 58, the contact 56, the contactor 52, the contact 55 and the conductor 57, whereby the lamp 59 will be lighted to indicate that a surge of current is flowing through the coil 22.

A testing circuit 60 is provided to test the insulation on the individual conductors of a cable 63. The cable 63 includes a plurality of conductors 66—66 having insulating covers 67—67 formed thereover. A metallic sheath 68 surrounds the insulating covers 67—67, and an insulating and weatherproofing jacket 69 encloses the sheath 68.

The circuit 60 includes a secondary winding 61 of the transformer 18, to one end of which one of the conductors 66—66 of the cable 63 to be tested is connected by a conductor 64. The sheath 68 is connected by a conductor 70 to the upper end of the secondary winding 61, as viewed in the drawing, and the conductors 66—66 that are not being tested are connected by conductors 71—71 to the conductor 70.

In the operation of the above described apparatus to determine the presence of a fault in the insulating cover 67 on one of the conductors 66—66, the elements of the cable 63 are connected to the conductors 64, 70 and 71—71 as described hereinabove. The switch 20 is then closed to supply current to the primary winding 17 of the transformer 18. At this time the contactor 40 is in engagement with the contacts 41 and 42 and any initial surge of magnetizing cur-

rent flowing to the conductors 21 and 26 from the conductor 16 and the primary winding 17, and from the conductor 10, the contact 12, the contactor 51 and the contact 27, respectively, will be shunted by the conductor 45, the contact 41, the contactor 40, the contact 42 and the conductor 46. This shunts enough current from the coil 22 of the relay 15 to prevent the relay from operating. Thus, the relay 15 will not be actuated to cause the lamp 59 to be lighted by the initial surge of magnetizing current caused by closing switch 20.

As soon as the switch 20 is closed, current flows to the motor 28 from the conductors 26 and 30 to energize the motor, whereby the cam 32 is rotated at an even speed in a clockwise direction, as viewed in the drawing. The motor 28 is so timed that a few seconds after the switch 20 has been closed, the lobe 37 of the cam 32 is forced into engagement with the button 39 of the contactor 40, whereby the contactor 40 is moved out of engagement with the contacts 41 and 42. By this time the initial surge of magnetizing current caused by the closing of the switch 20 has subsided and, if there are no defects in the cover 67 being tested, the no-load current of the transformer which flows through the coil 22 from the conductors 21 and 26 is not sufficient to actuate the relay 15.

This current which flows through the circuit including the primary winding 17 at this time is small if the conductor being tested is completely insulated from the sheath 68 and the other conductors, since no current flows in the testing circuit 60. However, if a conductive fault is present in the insulating cover 67, a current induced in the secondary winding 61 of the transformer 18 by the energization of the primary winding 17 will flow through the fault to the insulating cover 67 from that one of the conductors 66—66 being tested to the metallic sheath 68 or to the conductors 66—66 that are not being tested.

The presence of such a fault in the insulating cover 67 being tested will thus cause a flow of current through the secondary winding 61 of the transformer 18, which flow of current will be reflected as a magnified flow of current through the circuit including the primary winding 17 of the transformer 18. The magnified flow of current will flow through the coil 22 of the relay 15 and, since the current then flowing is sufficient to actuate the relay, the coil 22 will force the armature 50 upwardly and will bring the contactor 52 into engagement with the contacts 55 and 56, whereby the light 59 will be illuminated to indicate that a fault is present in the insulating cover 67 being tested.

The switch 20 is then opened, whereupon the elements of the apparatus return to the positions shown in the drawing. The cable 63 is removed from the testing circuit 60, and the faulty conductor then is tagged to indicate that a fault is present in the cover 67 thereof. One of the insulating covers 67—67 of the same or of another cable then may be tested by connecting another one of the conductors 66—66 thereof in the testing circuit in the manner described.

The above described apparatus serves to determine quickly and accurately the presence of faults in insulating covers of conductors and prevents any false indications of such faults by initial surges of magnetizing current from the power line 11.

If it is desired to test for faults in insulating covers of a conductor having no metallic sheath

similar to the sheath 68, such a conductor may be inserted in a grounded tank of water or other suitable conductive medium with the ends of the conductor out of contact with the water. The conductor 64 is connected to one end of the conductor to be tested and the conductor 70 is grounded. The apparatus then is operated in a manner similar to that described hereinabove. By immersing all of the conductor except the ends thereof in water, the presence of voids or cuts in an insulating cover formed thereon may be determined as well as the presence of conducting faults.

What is claimed is:

1. An apparatus for testing the insulation on an insulated conductor forming part of an electric cable, which comprises a transformer having an insulated conductor to be tested connected in the secondary circuit thereof, means for energizing the primary side of said transformer to impress a high potential across its secondary side and across the insulation of a conductor connected thereto to break down any faults in the insulation of said conductor, manually operable means for controlling the energization of the transformer, current responsive means connected in series with the primary side of the transformer to automatically deenergize said transformer when an increased current flows therein due to a breakdown in the insulation of the conductor connected thereto, and means including a timing device energized simultaneously with the transformer for shunting the current responsive means for a predetermined period of time thereby preventing the operation of the current responsive means by transient magnetizing inrush currents occurring upon the energization of the transformer.

2. An apparatus for electrically testing an insulated conductor, which comprises a transformer energizable to impress a high potential across an insulated conductor connected in the secondary circuit thereof, means for energizing the transformer, said transformer being subject to transient magnetizing inrush currents when energized, manually operable means for controlling the energization of the transformer, means connected to be responsive to the current flowing through the primary side of said transformer for deenergizing the transformer when a high current flows in the secondary side of the transformer due to faulty insulation in a conductor connected in the secondary circuit, means for indicating the operation of said current responsive means, and means including a timing device energized simultaneously with the transformer for shunting the current responsive means for a predetermined period of time after said transformer is energized to prevent the transient magnetizing inrush currents of said transformer from operating the current responsive means, whereby false interruption of the testing circuit by such transient inrush currents is prevented.

3. An electrical testing apparatus which comprises a transformer energizable to impress a high testing potential across an insulated conductor connected in the secondary circuit thereof, said transformer being subject to transient magnetizing inrush currents when energized, manually operable means for controlling the energization of the transformer, a current responsive relay for automatically deenergizing said transformer upon an increased current flow in the primary circuit of said transformer due to a breakdown in the insulation of the conductor con-

nected in the secondary circuit, said current responsive relay being unresponsive to the normal magnetizing current of the transformer, means for indicating when said current responsive relay is operated, and means including a timing device connected to be energized upon the energization of said transformer by said manually operable means for rendering said current responsive relay inoperative for a predetermined period of time to permit the subsidence of the transient magnetizing inrush currents, whereby energization of said current responsive relay by the transient magnetizing inrush currents is prevented.

CLAY E. LEWIS.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
1,525,282	Entwistle	Feb. 3, 1925
1,787,181	Traver	Dec. 30, 1930
1,919,802	Pfeiffer	July 25, 1933
1,922,792	Cain	Aug. 15, 1933
1,927,794	Fallou	Sept. 19, 1933
2,310,335	Wolfson	Feb. 9, 1943