Jan. 10, 1950 E. BERTALAN ET AL 2,494,029

METHOD OF AND APPARATUS FOR TREATING AND TESTING CORES USED IN COAXIAL CABLE UNITS

Filed Dec. 6, 1944

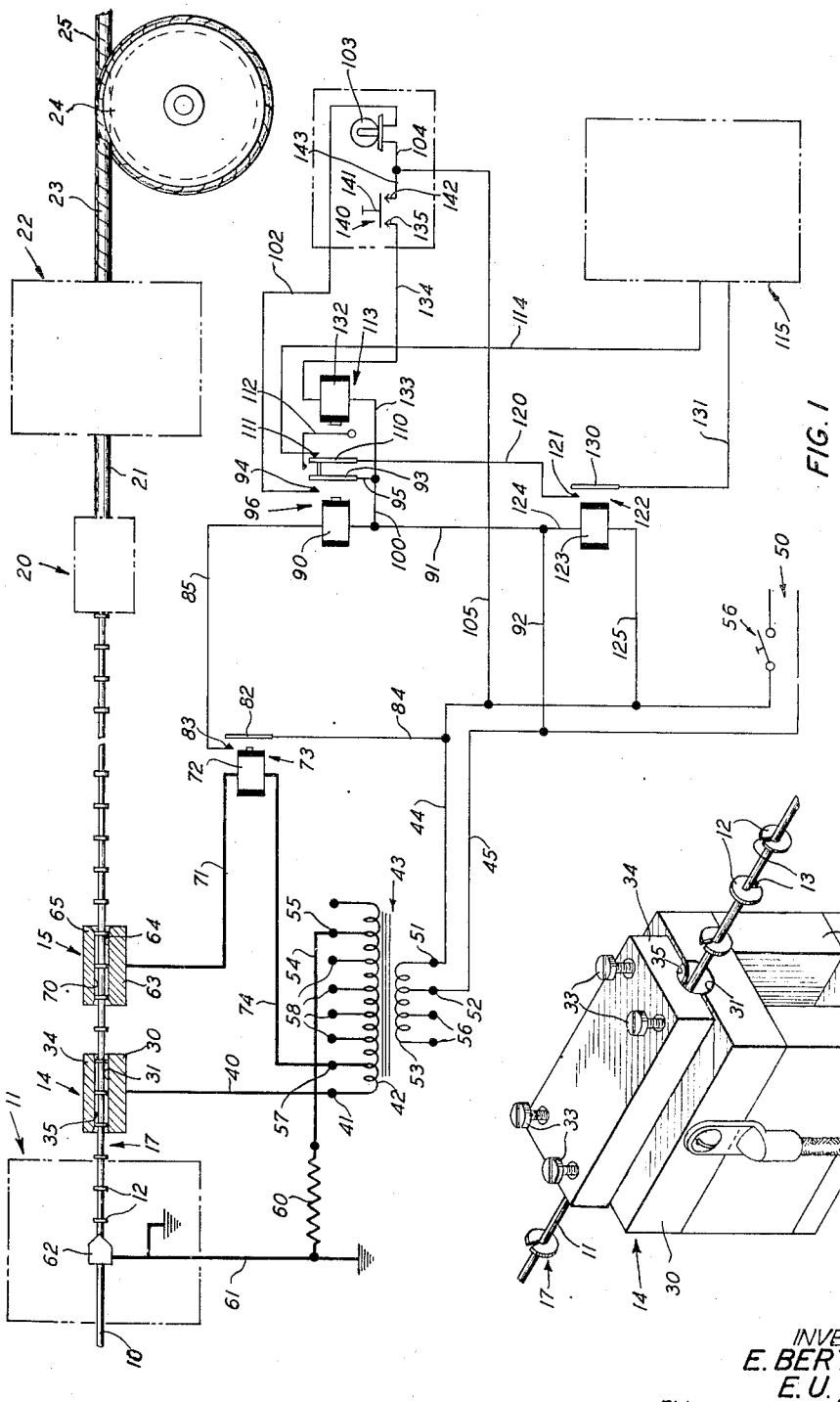


FIG. 1

FIG. 2

INVENTORS
E. BERTALAN
E. U. RICE

BY

ATTORNEY

Patented Jan. 10, 1950

2,494,029

UNITED STATES PATENT OFFICE

2,494,029

METHOD OF AND APPARATUS FOR TREATING AND TESTING CORES USED IN COAXIAL CABLE UNITS

Edward Bertalan, Glen Arm, and Edgar U. Rice, Towson, Md., assignors to Western Electric Company, Incorporated, New York, N. Y., a corporation of New York

Application December 6, 1944, Serial No. 566,910

9 Claims. (Cl. 219—29)

1

This invention relates to methods of and apparatus for treating and testing articles and more particularly to methods of and apparatus for treating and testing insulating discs used in coaxial cables.

In the manufacture of coaxial cables, discs of insulating material are formed and are applied to central conductors of such cables, after which operations, outer conductors are applied over the insulating discs. Occasionally, electrically conductive impurities are present in the blanks from which the discs are formed, conductive impurities may be applied to the discs by the applying operations and conductive impurities may be gathered by the discs after they are applied to the central conductors. Some of such impurities cause the insulating discs to have an insulating value below a required minimum value and such discs must be removed from central conductors and replaced before the outer conductors can be applied thereto. Another type of defect of coaxial cables is that of conductive slivers positioned on the central conductors. Some of such slivers, when present in a coaxial cable, bridge the gap between the central conductor of the cable and the outer conductor thereof, thereby forming a low resistance path between the central and the outer conductors. However, many such defects, which word is used hereinafter to designate either or both slivers and other conductive impurities, may be removed by passing a high amperage current through the defects, which current burns away the defects and makes them less conductive, thereby eliminating the necessity of further treatment thereof.

An object of the invention is to provide new and improved methods of and apparatus for treating and testing articles.

One apparatus for practicing a method embodying the invention comprises means for applying a high potential to the outer periphery of a plurality of the insulated discs positioned on a central conductor to burn out defects therein, means for contacting the outer peripheries of a plurality of discs which have had a high potential applied thereto by the potential applying means, and means associated with the contacting means for indicating the presence of a defect which has not been burned away.

A complete understanding of the invention may

2

be obtained from the following detailed description of an apparatus forming a specific embodiment thereof, when read in conjunction with the appended drawings, in which:

Fig. 1 is a partially diagrammatic, partially sectional view of an apparatus embodying the invention, and

Fig. 2 is an enlarged perspective view of a portion of the apparatus.

Referring now in detail to the drawings, a filamentary conductor 10 (Fig. 1) is drawn through a disc applicator 11 of suitable construction, which applies insulating discs 12—12, which have slits 13—13 therein, upon the conductor 10 at regularly spaced intervals, whereby a core 17 is formed. The discs 12—12 are formed of an electrical insulating material, such as a rubber or a rubber-like compound, or other suitable electrical insulating materials such as polyethylene (polymerized ethylene). After the discs have been applied, the core is advanced through a burnout electrode 14, a detecting electrode 15, a tube former 20 of suitable design, which applies an outer tubular conductor 21 over the discs, and a taping head 22, which applies a tape 23 over the outer conductor 21 to form a coaxial cable unit 25. The coaxial cable unit passes around a capstan 24, which serves to advance the elements of the coaxial cable unit through the elements of the apparatus just described at a constant rate of speed.

The burnout electrode 14 (Fig. 2) includes a stationary plate 30 having a groove 31 formed therein, which is flared at the ends thereof. The plate 30 rests upon supports 32—32 formed of an insulating material and has a plurality of bolts 33—33 projecting from the upper surface thereof. The bolts serve to mount a plate 34 on the plate 30 in such a manner that the plate 34 may be moved freely toward or away from the plate 30. The plate 34 is provided with a groove 35, which is complementary to the groove 31 and is flared at the ends thereof. When the core unit 17 is advanced through the grooves 31 and 35, the plates 30 and 34 contact substantially the entire peripheries of the discs 12—12 and the plate 34 rests upon the discs.

A conductor 40 (Fig. 1) connects the electrode 14 to a tap 41 of a secondary winding 42 of a high potential transformer 43, while conductors 44

and 45 of a power line 50 are connected to taps 51 and 52, respectively, of a primary winding 53 of the transformer. A conductor 54 connects a tap 55 of the secondary winding to a current limiting resistance 60 connected to a grounded conductor 61. The conductor 61 is connected to a grounding electrode 62, which contacts and grounds the central conductor 10.

The primary winding 53 also is provided with taps 56—56 to which the conductor 45 may be secured to vary the output potential of the transformer 43. The secondary winding 42 has, in addition to the taps 41 and 55, a tap 57, which connects a conductor 74 to the secondary winding, and taps 58—58. The conductors 40, 54 and 74 may be connected to others of the taps of the secondary winding to obtain different potential differences therefrom.

When the transformer 43 is energized, a high potential is applied to the burnout electrode 14, and if defects of a type which may be burned away are present in the portion of the core passing through the burnout electrode, current will flow through such defects from the burnout electrode 14 to the grounded conductor 10 and the defects will be burned away. The transformer 43 is designed to apply a potential as high as 4000 or more volts to the electrode 14. Consequently, any defects susceptible of being burned away by such a potential are destroyed.

The detecting electrode 15 is identical in construction with the burnout electrode 14 and includes a stationary plate 63 having a groove 64 provided therein and a movable plate 65 having a groove 70 formed therein. A conductor 71 serves to connect the electrode 15 to a winding 72 of a high-sensitivity relay 73, and the winding 72 is connected by the conductor 74 to the tap 57 of the secondary winding 42 of the transformer 43.

When the transformer 43 is energized, a high potential is applied to the electrode 15. However, this potential is not so high as the potential applied to the burnout electrode 14 since the tap 57 is at a lower potential then the tap 41. The potential applied to the detecting electrode 15 is high enough to cause current to pass through a portion of the core 17 having a defect therein, but is low enough that no current flows through satisfactory portions of the core.

When a portion of the core 17 having a defect therein which has not been burned away is advanced through the detecting electrode 15, current flows from the electrode 15 through the defect and the conductor 10. This causes current to flow through the winding 72 of the relay 73, whereby a contactor 82 of the relay is drawn into engagement with a contact 83. A conductor 84 connects the contactor 82 to the conductor 44 of the power line 50, and a conductor 85 connects the contact 83 to a winding 90 of a relay 96. A conductor 91 connects the winding 90 to a conductor 92 connected to the conductor 45 of the power line. Thus, when the contactor 82 is in engagement with the contact 83, the winding 90 is supplied with current from the power line 50, whereby the relay 96 is energized and causes a contactor 93 to be drawn into engagement with a contact 94 of the relay 96. When the relay 96 is actuated and the contactor 93 is in engagement with the contact 94, a lamp 103 is lighted by current passing thereto through conductors 44, 105 and 104, and through conductors 45, 92, 91, 100 and 95, the contactor 93, the contact 94 and a conductor 102. When the incandescent lamp 103 is lighted, it indicates to an operator of the apparatus that the detecting electrode 15 has contacted a defect in the core 17 which was not destroyed by the burnout electrode 14.

The relay 96 includes a contactor 110, which is normally in engagement with a contact 111. When the relay 96 is operated, the contactor 93 is moved into engagement with the contact 94, the engagement between contactor 110 and the contact 111 is broken and a latching armature 112 of a relay 113 latches the contactors 93 and 110 in such positions. The contact 111 is connected by a conductor 114 to a motor controller 115 of standard construction, and a conductor 120 connects the contactor 110 to a contact 121 of a relay 122.

A winding 123 of the relay 122 is connected by a conductor 124 to the conductor 92 and by a conductor 125 to the conductor 44 so that, whenever the switch 56 is closed, the winding 123 will be energized, whereby a contactor 130 of the relay 122 is held in engagement with the contact 121. Whenever the switch 56 is open, the winding 123 is de-energized and the engagement between the contact 121 and the contactor 130 is broken. The contactor 130 is connected by a conductor 131 to the motor controller 115, and, whenever the engagement between the contactor 130 and the contact 121 is broken, the motor controller 115 cannot be actuated and the driving motor (not shown) controlled thereby cannot be operated, whereby the capstan 24, the taping head 22, the tube former 20 and the disc applicator 11, all of which are driven by the driving motor, will not be driven.

The relay 113 includes a winding 132, which is connected to the conductor 100 by a conductor 133, and is connected by a conductor 134 to a contact 135 of a manually operable, reset switch 140. The switch 140 includes a contactor 141 and a contact 142, which is connected by a conductor 143 to the conductor 105. Thus, when the switch 140 is closed, the winding 132 is energized.

In the operation of the apparatus described hereinabove, an operator closes the switch 56, whereby high potentials are applied to the electrodes 14 and 15 and the relay 122 is operated to cause engagement between the contactor 130 and the contact 121, which closes a control circuit to the motor controller 115. Since this circuit is closed the motor controller 115 can be actuated to start the driving motor (not shown), which is done, and the driving motor drives the capstan 24, the taping head 22, the tube former 20 and the disc applicator 11.

The capstan 24 then advances the central conductor 10 through the disc applicator 11, which applies the discs 12—12 to the central conductor at spaced points thereon, and the grounding electrode 62 grounds the central conductor as the central conductor is advanced to the disc applicator. The core 17 consisting of the central conductor 10 and the discs 12—12 thereon then is drawn through the burnout electrode 14, where the peripheries of the discs 12—12 are closely contacted by the plates 30 and 34. If defects are present in the portion of the core in the burnout electrode, current is passed through the defects, which, if they are susceptible of being burned away by the high current, will be burned away as the defective portion of the core 17 is advanced through the electrode 14.

The core 17 then is drawn through the detecting electrode 15, which is at a potential somewhat lower than that of the burnout electrode 14. If

the portion of the core passing through the detecting electrode 15 has an insulating value above a predetermined value and no defects are present therein, no current flows from the electrode 15 to the grounded conductor 10. However, if any undestroyed defects are present in the portion of the core in the detecting electrode and form a path of low resistance in that portion, current flows from the electrode 15 through the defect to the grounded conductor 10, and the high-sensitivity relay 73 is operated, whereby the contactor 82 and the contact 83 are brought into engagement and the relay 96 (Fig. 1) is operated.

When the relay 96 is operated, the contactor 93 is brought into engagement with the contact 94, the engagement between the contactor 110 and the contact 111 is broken and the latch 112 latches the contactor 93 and 110 in such positions. When the engagement between the contactor 110 and the contact 111 is broken, the circuit to the motor controller 115 is broken, which causes the driving motor (not shown) to be de-energized, whereby the operations of the capstan 24, the taping head 22, the tube former 20 and the disc applicator 11 are stopped.

When the contactor 93 is brought into engagement with the contact 94, the incandescent lamp 103 is lighted, which indicates to an operator of the apparatus that the detecting electrode 15 has contacted a defect. The switch 56 then is opened and the defect is removed from the core 17.

The re-start the apparatus after the defect has been removed, the switch 56 is closed, whereby the winding 123 of the relay 122 is energized, the contactor 130 is brought into engagement with the contact 121 and the electrodes 14 and 15 are energized. However, the motor controller 115 cannot be actuated to start the motor at this time because the latching armature 112 holds the contactor 110 out of engagement with the contact 111 and the circuit to the motor controller is open. The latching armature 112 then is caused to release the contactors 93 and 110 by operating the reset switch 140.

After the winding 132 of the relay 113 draws the latching armature 112 out of engagement with the contactor 110, if the portion of the core 117 contacted by the detecting electrode 15 is free from defects, the contactor 110 moves into engagement with the contact 111 and the contactor 93 moves out of engagement with the contact 94. The breaking of the engagement between the contactor 93 and the contact 94 breaks the circuit to the lamp 103, which is darkened, thereby indicating that the portion of the core contacted by the electrode 15 has no defects and that the motor controller 115 may be actuated to start the apparatus. The switch 140 then is opened, whereby the winding 132 of the relay 113 is de-energized, and the motor controller is actuated to start the driving motor to start the operation of the apparatus.

The burnout electrode 14 destroys many defects of the core 17 so that the apparatus need not be stopped to repair the defective portions of the core, and the testing electrode 15 detects any undestroyed defects of the core before the outer conductor is applied thereover. As a result, while most defects are burned away by the burnout electrode, any defects which cannot be burned away are located by the testing electrode. If desired, one or more additional testing electrodes may be inserted into the apparatus, together with circuits similar to the above-described circuit, for further testing operations.

What is claimed is:

1. An apparatus for testing a continuously advancing core of a coaxial cable unit having insulating discs spacedly positioned along a filamentary central conductor, which comprises a plurality of electrodes spacedly positioned along the path of travel of the core and adapted to successively engage the peripheries of the discs as the core passes through the said electrodes, means for continuously applying an electrical potential across the central conductor of the core and at least the first of said electrodes having an intensity sufficient to cause a current to flow through and burn away defects providing paths of reduced dielectric strength between the electrode and the central conductor in the portion of the core advancing therethrough, and means for continuously applying an electrical potential across the remaining electrodes and the central conductor having an intensity sufficient to cause a current to flow across any defects in the portion of the core passing therethrough which were not burned away by the first mentioned electrode, whereby any defects encountered by the last mentioned electrodes may be detected.

2. An apparatus for testing a continuously advancing core of a coaxial cable unit having insulating discs spacedly positioned along a filamentary central conductor, which comprises an electrode having a bore adapted to engage the peripheries of a plurality of the discs as the core advances therethrough, a second electrode having a bore adapted to engage the peripheries of a plurality of the discs as the core passes therethrough upon emerging from the first mentioned electrode, means for continuously applying an electrical potential across the central conductor and the first mentioned electrode having an intensity sufficient to cause a current to flow through and burn away defects which provide paths of reduced dielectric strength between the electrode and the central conductor in the portion of the core passing through said electrode, and means for continuously applying an electrical potential across the second electrode and the central conductor having an intensity sufficient to cause a current to flow through any defects in the portion of the core passing therethrough which were not burned away by the first mentioned electrode, whereby any defects encountered by the second electrode may be detected.

3. An apparatus for testing a continously advancing core of a coaxial cable unit having insulating discs spacedly positioned along a filamentary central conductor, which comprises an electrode having a bore adapted to engage the peripheries of a plurality of the discs as the core advances therethrough, a second electrode having a bore adapted to engage the peripheries of a plurality of the discs as the core passes therethrough upon leaving the first mentioned electrode, means for continuously applying an electrical potential across the central conductor and the first mentioned electrode having an intensity sufficient to burn away defects which provide paths of reduced dielectric strength between the electrode and the central conductor in the portion of the core passing through said electrode, means for continuously applying an electrical potential across the second electrode and the central conductor of the core having an intensity sufficient to cause a current to flow through any defects in the portion of the core unit passing therethrough which were not burned away by the first electrode, and means electrically asso-

ciated with the second electrode for indicating when current is flowing through a defect in the portion of the core encountered by the second electrode.

4. An apparatus for testing a core of a coaxial cable unit having insulating discs spacedly positioned along a filamentary central conductor, which comprises means for continuously advancing such a core along a predetermined path, an elongated electrode adapted to engage the periphery of a plurality of discs of the core advanced by the advancing means, a second electrode adapted to engage the periphery of a plurality of the discs of the core after the core unit emerges from the first electrode, a transformer energizable to continuously impress across the first mentioned electrode and the central conductor of the core unit an electrical potential having an intensity sufficient to cause a current to flow through and burn away defects providing paths of reduced dielectric strength between the electrode and the central conductor in the portion of the core passing therethrough, said transformer being arranged to continuously impress across the second electrode and the central conductor of the core an electrical potential having an intensity sufficient to cause only a current to flow through defects in the portion of the core passing therethrough which were not burned away by the first mentioned electrode, an electric circuit for selectively controlling the operation of the advancing means, and means electrically associated with the second electrode for causing the control circuit to stop the advancing means when a defect which was not burned away by the first electrode is encountered by the second electrode.

5. An apparatus for testing a continuously advancing core of a coaxial cable unit having insulating discs spacedly positioned along a filamentary central conductor, which comprises means for continuously advancing a core having insulating discs spacedly positioned thereon along a predetermined path of travel, means for substantially enclosing successive portions of the advancing core, a second means for enclosing successive portions of the advancing core after it leaves the first enclosing means, means for continuously applying across the first enclosing means and the central conductor of the advancing core a potential having intensity sufficient to cause a current to flow through defects providing paths of reduced dielectric strength in portions of the core encountered by the first enclosing means sufficient to burn away such defects, said potential applying means being arranged to simultaneously apply across the second core enclosing means and the central conductor of the advancing core a potential having an intensity sufficient to cause a current to flow through defects which were not burned away as the core advanced through the first core enclosing means which will not burn away the defects, and means associated with the second enclosing means for indicating when said defects are encountered by the second core enclosing means.

6. The method of testing a continuously advancing core of a coaxial cable unit having insulating discs spacedly positioned along a filamentary central conductor, which comprises passing such a core continuously through an elongated electrode adapted to engage the discs of the conductor of the advancing core, constantly applying a potential across the electrode and the central conductor of the core having an intensity sufficient to cause a current to flow through and burn away any defects providing paths of reduced dielectric strength in the portion of the core passing through said electrode, passing said core continuously and directly from said electrode through a second electrode, constantly applying a potential across the central conductor and the second electrode sufficient to cause a current flow through any defects in the portion of the core passing therethrough which were not burned away as the core passed through the first mentioned electrode, and utilizing the current flowing through defects encountered by said second electrode to indicate the presence of such defects in the advancing core.

7. The method of testing a core of a coaxial cable unit having insulating discs spacedly positioned along a filamentary central conductor, which comprises passing such a core continuously through an elongated burn-out zone adapted to surround the discs of the advancing core, creating a potential difference between the burn-out zone and the central conductor of the core of such intensity as to cause a current to flow through and burn away defects providing paths of reduced dielectric strength in the portion of the core unit passing through said burn-out zone, passing said core from said burn-out zone through a testing zone adapted to surround the discs of the advancing core, creating a lower potential difference between the central conductor and the testing zone of such intensity as to cause only a current flow through defects in the portion of the core passing therethrough which were not burned away as the core passed through the burn-out zone, and utilizing the current flowing through defects encountered by the testing zone for stopping the advancement of the core.

8. The method of testing a continuously advancing core of a coaxial cable unit having insulated discs spacedly positioned along the filamentary central conductor, which comprises advancing a core along the predetermined path of travel, grounding the central conductor of the core, continuously applying a potential around the periphery of each of the insulating discs of the advancing core to cause a current to flow through any defects providing paths of reduced dielectric strength between the periphery of the discs of the central conductor sufficient to burn away such defects, and subsequently applying a potential around the periphery of each of the discs of the advancing core to cause a current to flow through defects which were not burned away by the prior application of potential, whereby the defects which were not burned away by the first application of the potential may be detected by the application of said second potential.

9. The method of testing a continuously advancing core of a coaxial cable unit having insulating discs spacedly positioned along a filamentary central conductor, which comprises continuously advancing a core having discs positioned thereon along a predetermined path of travel, continuously creating a potential difference between the periphery of the insulating discs and the central conductor of successive portions of the advancing core having an intensity sufficient to cause a current to flow through any defects providing paths of reduced dielectric strength between the periphery of the discs and the central conductor that will burn away such defects, continuously creating a potential difference between the periphery of the discs and the

central conductor of successive portions of the advancing core having an intensity sufficient to cause a current to flow through any defects which were not burned away by the prior application of potential which will not burn away such defects, and utilizing the current flowing through the defects as a result of the second application of the potential to indicate the presence of defects in the core which were not burned away by said first potential difference.

EDWARD BERTALAN.
EDGAR U. RICE.

REFERENCES CITED

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

UNITED STATES PATENTS

Number	Name	Date
920,970	Mansbridge	May 11, 1909
1,782,403	Bouvier	Nov. 25, 1930
2,043,528	Davis	June 9, 1936
2,060,162	Boe	Nov. 10, 1936
2,087,783	Savage	July 20, 1937
2,099,112	Hill	Nov. 16, 1937
2,108,637	Bartgis	Feb. 15, 1938