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APPARATUS FOR TESTING CABLE ELEMENTS

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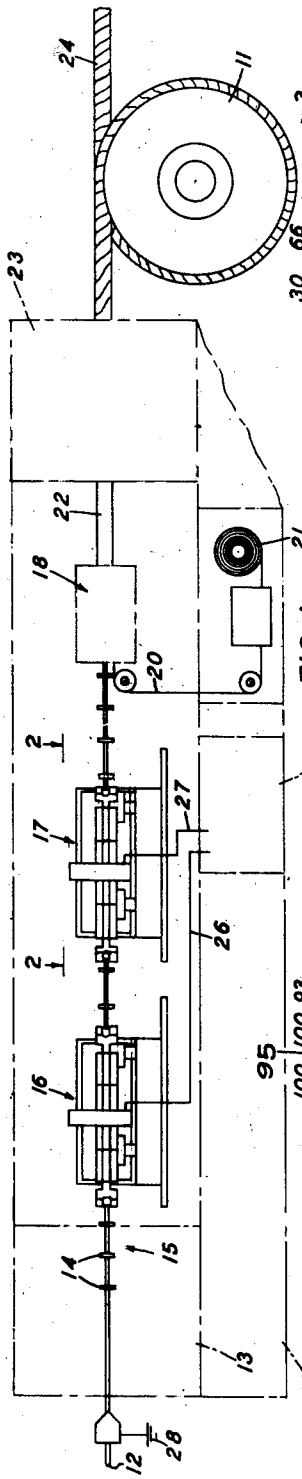


FIG. 1

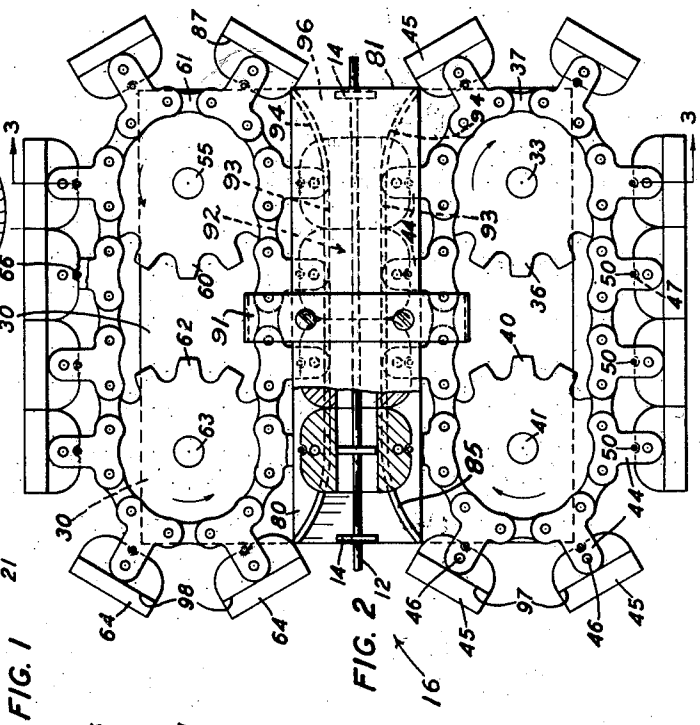


FIG. 2

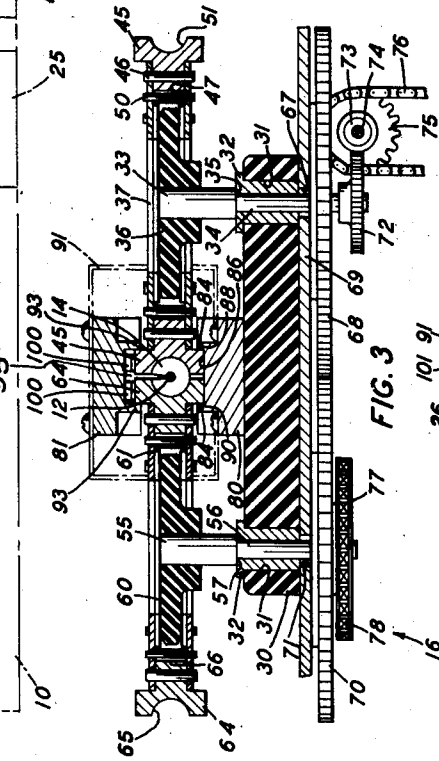


FIG. 3

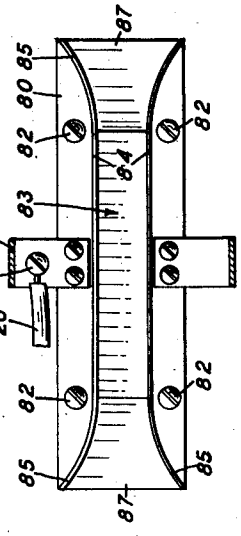


FIG. 4

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APPARATUS FOR TESTING CABLE ELEMENTS

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3 Claims. (Cl. 219—11)

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This invention relates to apparatus for testing cable elements, and more particularly to apparatus for testing elements forming parts of coaxial cable units.

Coaxial cables are widely used in long distance telephone transmission lines and usually consist of a plurality of individual coaxial units twisted together to form a composite core which is enclosed in a lead sheath. Each of the coaxial units consists of a solid central conductor, an outer tubular conductor formed therearound and spaced concentric therewith by disc-shaped insulators spacedly positioned on the central conductor and a steel tape spirally wrapped around the outer conductor.

It was found that the transmission characteristics of the coaxial units are vitally affected by the presence of conductive faults within the coaxial unit which provides a path of reduced dielectric strength between the central and outer conductors. These faults may take many forms, the more common being a microscopic conductive film of dirt on the insulating discs, bits of metal embedded in the discs, or very fine metallic slivers or splinters attached to the central conductor.

In the manufacture of such coaxial units, a solid conductor is continuously advanced through a coaxial unit forming machine, which first applies the insulator discs thereon in uniform spaced relation to form a coaxial unit core. The central conductor with the discs attached is advanced through a high potential electrode for the purpose of electrically burning away any conductive faults that may be present in the conductor and disc assembly and then through a high potential testing electrode to ascertain whether or not any faults remain. If no faults are detected by the testing electrode the outer tubular conductor is formed over the discs by a subsequent operation of the forming machine.

The types of electrodes used heretofore for burning out faults in and testing the conditions of such a conductor and disc assemblage are provided with a substantially circular passage designed to slidably engage the peripheries of the discs positioned on the advancing conductor. It was discovered that the central conductor and disc assembly did not travel in a fixed path between the disc applying apparatus and the outer conductor forming apparatus of the coaxial forming machine, but varied slightly in all directions. This variation in the travel of the conductor caused the discs to engage portions of the circular passage through which they were

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advanced with such force that sometimes the discs were displaced on the central conductor.

In addition, the passage through this type of electrode must be elliptical in cross section in order that slightly oversize insulating discs may be advanced therethrough without being displaced on the central conductor. Consequently, the average insulating disc contacts the elliptical passage at the top and bottom only, which means that any fault which happens to be located outside of the direct line between the point of contact between the disc and the electrode and the grounded central conductor may not be removed by the burn-out electrode.

In order to overcome the disadvantages present in the types of electrodes known heretofore, it is desirable that an electrode be provided in which no relative movement occurs between the contacting members and the insulating discs of the core, and the contactiing members engage the entire periphery of the discs.

An object of the invention is to provide new and improved apparatus for testing cable elements, and more particularly to provide simple and effective apparatus for testing elements of coaxial units.

In accordance with a specific embodiment of the invention, there is provided an electrode for impressing a high potential across a continuously advancing coaxial unit core which comprises a pair of endless chains driven in timed relation with the advancing core unit and arranged to carry a plurality of disc contacting members. The chains are synchronized with each other so that their respective electrodes come together at a predetermined point and completely engage a disc on the advancing core and move in unison with the advancing core so that no relative movement occurs between the contacting members and the discs of the core unit.

A clear understanding of the invention may be had from the following detailed description of a specific embodiment thereof, when read in conjunction with the appended drawing, in which:

Fig. 1 is a diagrammatic side view of a coaxial unit forming machine showing testing electrodes embodying the invention;

Fig. 2 is an enlarged, plan view of one of the electrodes shown in Fig. 1;

Fig. 3 is a vertical, sectional view taken along line 3—3 of Fig. 2, and

Fig. 4 is an enlarged, plan view of a portion of the apparatus shown in Figs. 2 and 3.

Referring now to the drawing and more particularly to Fig. 1, a coaxial unit forming machine, indicated generally by the numeral 10, has a capstan 11 associated therewith which serves to advance a conductor 12 from a suitable supply source (not shown) through a disc applying apparatus 13, of a suitable design, by the aid of which insulating discs 14—14 are positioned on the conductor 12 at uniformly spaced intervals to form a coaxial unit core 15. As the core 15 is continuously advanced from the disc applying apparatus 13, it is engaged by a burn-out electrode 16, a testing electrode 17 and then passes through a tube forming die 18 which forms a copper tape 20 drawn from a supply pad 21 longitudinally around the discs 14—14 of the core 15 for form a tubular conductor 22. The partially formed coaxial unit advances through a taping head 23, of known design, by means of which a plurality of steel tapes are served spirally around the conductor 22 to form a completed coaxial unit 24, which, after passing around the capstan 11 several times, is directed to suitable takeup means (not shown).

The burn-out electrode 16 is connected to one side of a high potential burn-out circuit energized and controlled by suitable electrical apparatus indicated generally at 25 by a conductor 26. The testing electrode 17 is connected to one side of a high potential testing circuit also energized and controlled by the electrical apparatus indicated generally at 25 by a conductor 27 (Fig. 1). The opposite side of the burn-out circuit and the testing circuit are connected to ground, and the conductor 12 is connected to ground at 28 which arrangement serves to apply a high burn-out or testing potential across the portion of the core 15 engaged by the electrodes 16 and 17, respectively. The purpose of the burn-out electrode 16 is to electrically burn away or vaporize any conductive fault which might be present in the core 15, and the purpose of the testing electrode 17 is to test the core 15 after it has been treated by the testing electrode 16 to ascertain whether any conductive faults remain in the core. The electrical apparatus indicated generally at 25 is associated with the testing electrode 17 in such a manner that, should any fault be present in the portion of the core 15 being engaged by the testing electrode 17, the driving means (not shown) for the entire coaxial forming machine 10 is deenergized thereby preventing the tubular conductor 22 from being formed around a defective core.

It is believed to be apparent that the capstan 11, the disc applying apparatus 13 and the taping head 23 must be driven in timed relation with respect to each other in order to form a uniform coaxial unit 24. Therefore, when a defect in the core 15 is not eliminated by the testing electrode 16, an electrical circuit is formed therethrough by means of the testing electrode 17 which serves to deenergize all the driven elements of the coaxial unit machine 10 simultaneously. For a complete description and disclosure of the electrical circuit and apparatus associated with the burn-out and testing electrodes 16 and 17, respectively, attention is directed to copending application Serial No. 566,910, filed December 6, 1944, by E. Bertalan and E. U. Rice, said application now being Patent No. 2,494,029, dated January 10, 1950.

The burn-out and testing electrodes 16 and 17, respectively, are identical in construction and operation and for that reason only the burn-out electrode 16 will be described in detail hereinbelow.

Referring now to Fig. 3, it will be noted that the electrode 16 comprises a rectangular base 30 of suitable electrical insulating material and having a bore 31 provided adjacent to each corner thereof for receiving a self-lubricating bushing 32. Each of the bushings 32—32 is provided with a flanged head which serves to maintain the bushings in proper position in the bore 31 provided in the base 30. A shaft 33 is provided with a reduced body portion 34, which is rotatably positioned in the bushing 32 positioned in the bore 31 provided in the lower right hand corner of the base 30 (Fig. 2), and is provided with a shoulder 35 which slidably engages the head of the respective bushing 32. A sprocket 36, made of insulating material, such as "Micarta," or the like, is secured on the upper end of the shaft 33 and engages a roller chain belt 37 which in turn meshes with a sprocket 40 also made of suitable insulating material. The sprocket 40 is secured on the upper end of a shaft 41 rotatably mounted in the bushing 32 positioned in the bore 31 provided in the lower left hand corner of the base 30 (Fig. 2). The shaft 41 is mounted in its respective bushing 32 substantially in the same manner as is illustrated in Fig. 2 for the shaft 33 and is provided with a shoulder which serves to maintain the sprocket 40 horizontally aligned with the sprocket 36 so that the chain 37 connecting the two sprockets travels in a horizontal path with respect to the base 30.

Alternate links of the chain 37 have arms 44—44 formed integrally therewith which serve to form a plurality of vertically aligned spaced supports on alternate links throughout the entire length of the chain. A contact member 45 is pivotally mounted between each pair of vertically aligned arms 44—44 by means of a pin 46 positioned in vertically aligned bores provided in the arms 44—44. Each contact member 45 is provided with a semicircular groove 47 (Figs. 2 and 3) which loosely engages a pin 50 positioned in another pair of vertically aligned bores provided in the arms 44—44. Pins 50—50 are designed to engage the semicircular groove 47 of the members 45—45 and prevent the members from turning haphazardly about the pin 46 and thereby maintain the members in a substantially parallel position with respect to the particular link on which the member is mounted. At the same time, the pins 50—50 are undersize with respect to the size of the groove 47 so that slight movement of the member 45 about its respective pin 46 is permitted in either direction.

Each of the members 45—45 is provided with a longitudinal semicircular groove 51 in its outer face, the diameter of which is substantially the same as the diameter of the average insulating disc 14 positioned on the conductor 12. The members 45—45 are designed so that the semicircular grooves 51—51 will engage substantially one-half of the peripheries of the discs 14—14 positioned on the central conductor 12.

A shaft 55 is provided with a reduced body portion 56 which is rotatably positioned in the bushing 32 positioned in the bore 31 provided in the upper right hand corner of the base 30 (Fig. 2), and is provided with a shoulder 57 which slidably engages the flanged head of the bushing. A sprocket 60, made of suitable electrical insulating material, is secured on the upper end of the shaft 55 and engages a roller chain belt 61 which meshes with a sprocket 62, likewise made

of suitable insulating material. The sprocket 62 is secured on the end of a shaft 63 which has its reduced body portion (not shown) rotatably positioned in the bushing 32 positioned in the bore 31 provided in the upper left hand corner of the base 30 (Fig. 2). The shaft 63 is provided with a reduced body portion and a shoulder substantially the same as that illustrated for the shaft 33, which shoulder serves to maintain the sprocket 62 in horizontal alignment with the sprocket 60 mounted on the shaft 55. It will be noted from Fig. 3 that the sprockets 60 and 62 which carry the chain 61 are maintained in the same horizontal plane as the sprockets 36 and 40 which carry the chain 37, whereby the chains 37 and 61 travel in the same horizontal plane.

The chain 61 is identical in construction with the chain 37 and has contact members 64—64 mounted on alternate links in the same manner as that described for the contact members 45—45 mounted on the chain 37. The members 64—64 are identical in construction with the members 45—45, having a longitudinal semicircular groove 65 in the outer face thereof which is designed to engage substantially one-half the periphery of the insulating discs 14—14, and a vertical semicircular groove 66 which loosely engages a pin positioned on the chain 61 in the same manner as described for the chain 37.

The reduced body portion 34 of the shaft 33 extends beyond the bushing 32 and through a bore 67 provided in a partition 69 of the coaxial forming machine 10, so as to receive a gear 68 (Fig. 3). The gear 68 meshes with a gear 70 secured on the end of the reduced body portion 56 of the shaft 55 which extends through a bore 71 provided in the partition 69 and aligned with the bore 31 provided in the base 30. The gears 68 and 70 are positioned on the shaft portions 34 and 56 of the shafts 33 and 55, respectively, so that the electrodes 45—45 and 64—64 positioned on the adjacent portions of the chains 37 and 61 will line up juxtaposed with each other in the manner shown in Fig. 2. This gear drive between the shaft 33 and the shaft 55 will maintain the chains 37 and 61 and the electrodes 45—45 and 64—64, respectively, positively synchronized with each other when the electrode 16 is driven in a manner presently to be described.

A worm gear 72 is secured on the extreme end of the body portion 34 of the shaft 33 and engages a worm 73 secured on a shaft 74 which is rotatably supported in a suitable manner on the partition 69. A sprocket 75 is secured on the shaft 74 and meshes with a roller chain belt 76 which in turn engages a sprocket (not shown) driven in timed relation with the disc applying apparatus 13 and the capstan 11 of the coaxial forming machine 10. The chain 76 and the sprocket 75 are arranged to drive the shaft 74 in a given direction so that the worm 73 and the worm gear 72 will drive the shaft 33 and its respective sprocket 36 in a clockwise direction as indicated by the arrow positioned thereon (Fig. 2).

This direction of rotation of the sprocket 36 serves to advance the inner leg of the chain 37 and the members 45—45 carried thereby from left to right, which is the same direction of travel as that in which the core 15 is being advanced from the disc applying apparatus 13 by the capstan 11. The speed ratio between the driven sprocket 75 and its driving sprocket (not shown) provided on the coaxial forming machine 10 and the speed ratio between the worm 73 and

the worm gear 72 is arranged to rotate the shaft 33 and the sprocket 36 at a speed which will advance the inner leg of the chain 37 and the members 45—45 from left to right at the same rate of speed as that travelled by the core 15.

The gear 68 drives the gear 70 (Fig. 3), the shaft 55 and the sprocket 60 secured thereon in a counterclockwise direction which advances the inner leg of the chain 61 and its associated contact members 64—64 from left to right in unison with the members 45—45 and the advancing core 15. A sprocket 77 is provided on the extreme end of the body portion 56 of the shaft 55 and meshes with a chain 78, which in turn is connected to a similar sprocket (not shown) mounted on the testing electrode 17 and arranged to drive the testing electrode 17 in the same manner as that described hereinabove for the testing electrode 16.

In order to maintain the grooves 51 and 65 of the contact members 45—45 and 64—64, respectively, tightly against the periphery of the discs 14—14 positioned on the advancing conductor 12, there is provided a pair of vertically aligned guides 80 and 81 (Figs. 2 and 3). The guide 80 (shown in detail in Fig. 4) is secured to the base 30 by screws 82—82 and is provided with a longitudinal groove 83 forming side walls 84—84 whose ends 85—85 curve outwardly and join the sides of the guide 80. The bottom surface 86 of the groove 83 has its end portions 87—87 adjacent to the curved walls 85—85 tapered downwardly toward the base of the guide 80. The guide 80 is positioned on the base 30 so that the longitudinal axis of the groove 83 is aligned with the central axis of the electrode 16. The width of the groove 83 is such that the inner surface of the walls 84—84 thereof slidably engage an elongated shoulder 88 and an elongated shoulder 90 provided on the lower portion of the contact members 45—45 and 64—64, respectively, while the depth of the groove 83 is such that the bottom surface 86 thereof is slidably engaged by the bottom face of the contact members.

The guide 81 is identical in size and shape with the guide 80 but it is secured in an inverted menner above the chains 37 and 61 on a U-shaped support 91 (Figs. 2 and 4) which is mounted on the flanged portions of the guide 80. The guide 81 also is provided with a longitudinal groove 92 having side walls 93—93 whose end portions 94—94 curve outwardly to join the sides of the guide 81. The bottom surface 95 of the groove 92 has is end portions, one of which is indicated by the numeral 96, adjacent to the curved walls 94—94 tapered upwardly toward the top of the guide 81. The guide 81 is positioned on the support 91 so that its longitudinal groove 92 is vertically aligned with the groove 83 of the guide 80. The width of the groove 92 is equal to the width of the groove 83, consequently, the inner surface of the side walls 93—93 thereof slidably engage elongated shoulders 97 and 98 provided on the upper portion of the contact members 45 and 64, respectively.

The depth of the groove 92 is substantially greater than the depth of the groove 83 in order that a pair of elongated leaf springs 100—100 may be secured to the bottom surface 95 (Fig. 3) of the groove 92. Each of the leaf springs 100—100 has only one end thereof firmly secured to the bottom 95 at the leading end of the groove 92, and is offset at each end thereof which causes a substantial portion of the spring to project downwardly from the bottom of the groove in the

path of the contact members advancing through the guides 80 and 81. The leaf springs 100—100 are of such length that they cover substantially the entire bottom surface 95 of the groove 92 and since they have only one end secured to the surface 95 the opposite end of each spring is free to slide on the bottom surface as the spring is urged upwardly by engagement with the upper face of the contact members 45 and 64.

When the chains 37 and 61 are being driven in a manner described hereinabove, each synchronized pair of contact members 45 and 64 enter the grooves 83 and 92 of the guides 80 and 81, respectively, whereupon portions of their respective shoulders 88, 97, 90 and 98 slidably engage the inner side of the adjacent curved walls 85—85 and 93—93 of the grooves. As each pair of members 45 and 64 advance further into the grooves, the entire length of their respective shoulders slidably engage the adjacent side walls of the grooves 83 and 92, respectively, in which position the walls serve to hold the semicircular grooves 51 and 65 of the members 45 and 64, respectively, tightly against the periphery of a disc 14 engaged thereby. The leaf springs 100—100 resiliently urge the contact members 45 and 64 engaged thereby downwardly in the groove 83 of the guide 80 so that the bottoms of the contact members make a good physical contact with the bottom surface 86 thereof as the contact members are advanced through the guides 80 and 81. The ends 85—85 and 96—96 of the grooves 83 and 92, respectively, are tapered as described so as to prevent the ends of the contact members 45 and 64 from striking the end of the guide and thereby damaging the contact members or the chains carrying the contact members.

Since the discs 14—14 are positioned on the conductor 12 at uniformly spaced intervals by the disc applying apparatus 13, the chains 37 and 61 are selected to have a pitch equal to one-half the distance between the discs 14—14 positioned on the conductor 12. By positioning the contact members 45—45 and 64—64 on alternate links of the chains 37 and 61, respectively, having such a pitch it is possible to obtain such a spacing of the members that each pair of contact members consisting of one member 45 and one member 64 will engage a single disc of the advancing core 15. Since the pitch of the chains 37 and 61 is equal to one-half the spacing of the discs on the conductor and since the chains are driven in timed relation with the advancing conductor, no relative movement occurs between the disc and the contact members as successive pairs of contact members come together and engage the discs on the conductor. The contact members are centrally mounted on their respective chain belts and are of such length that the ends thereof butt against the ends of adjacent members. When a pair of contact members come together in the grooves 83 and 92 of the guides 80 and 81, respectively, the semicircular grooves 51 and 65 provided in the contact members form a complete circular channel with the exception of a very slight clearance provided between oppositely disposed contact members.

Therefore, when two members come together on the disc 14 of the core 15, practically the entire periphery of the disc is engaged thereby. The normal amount of play which exists between the contact members and their respective supporting links, and between the individual links of the chains makes the contact members somewhat self-adjustable, thereby enabling the testing electrode 16 to engage a substantial portion of the periphery of each disc of the coaxial unit core 15, irrespective of the fact that the diameter of the discs may vary slightly. Obviously, the chains 37 and 61 could be selected to have a pitch equal to the spacing of the discs on the conductor or any sub-multiple of the spacing and still be operated so that no relative movement occurs between the contact members and the discs engaged thereby.

The bared end of the conductor 26 is secured to the support 91 by a screw 101 and thereby serves to connect the guides 80 and 81 directly to one side of the high potential burn-out circuit energized and controlled by the electrical apparatus indicated generally at 25. By virtue of the fact that each pair of juxtaposed contact members 45 and 64 slidably engage the guides 80 and 81 as they are advanced by their respective chains 37 and 61 from left to right with the advancing core 15, they are in turn charged with the high burn-out potential, in which case the entire portion of the core 15 engaged by each pair of juxtaposed contact members is thereby subjected to the burn-out potential. The high potential burn-out circuit is connected directly to the guides 80 and 81 so that if a breakdown should occur at a fault present in that portion of the core 15 engaged by the several pairs of contact members positioned in the groove 82 of the guide 80, the high current flowing in the circuit as a result of the breakdown is confined to the guide 80 and the particular pair of electrodes enclosing the fault and therefore is not permitted to travel through any portion of the chains 37 and 61. The four sprockets 36, 40, 60 and 62 are made of suitable insulating material in order to completely insulate the contact members and their respective chains from the coaxial forming machine because the forming machine and the central conductor 12 are grounded at 28, as is the opposite side of the high potential circuits connected to the electrodes 16 and 17.

Operation

In the operation of the device, the burn-out electrode 16 is positioned on a coaxial forming machine of known design, such as the coaxial forming machine indicated generally at 10, so as to engage the discs 14—14 of the core 15 immediately after the insulating discs have been placed on the central conductor 12 by the disc applying apparatus 13. The chains 37 and 61 are being driven at the proper rate of speed so as to advance their respective contact members from left to right at the same rate of speed as that at which the core 15 is being advanced by the capstan 11. The chains are synchronized with the movement of the core 15 and with each other so that each oppositely disposed pair of contact members consisting of a contact member 45 and a contact member 64 come completely together and surround a portion of the advancing core 15 including a portion of the conductor 12 and an individual disc 14 positioned thereon as the disc reaches the transverse center line of the sprockets 40 and 62. Thereafter, the members 45 and 64, which have been brought together and now enclose a portion of the core 15, travel with the conductor and the disc from left to right until the disc and the contact members reach the transverse centerline of the sprockets 36 and 60.

During this portion of travel of the conductor and disc, the contact members slidably engage the walls 84—84 and bottom 86 of the groove 82

provided in the guide 80 and the walls 93—93 and leaf springs 100—100 of the guide 81. Since the guide 80 is connected by the conductor 26 to one side of a high potential burn-out circuit energized and controlled by the electrical apparatus indicated generally at 25, the conductor 12 and the disc 14, being surrounded by the contact members, has the high potential applied around their respective peripheries, there being an air dielectric surrounding the central conductor 12 (Figs. 2 and 3). The springs 100—100 engage the upper surface of the contact members and resiliently urge the bottom surfaces against the bottom 86 of the groove 83 thereby providing a good electrical contact between the contact members and the guide and preventing any arcing which may occur from a loose contact between the guide and the members.

Should there be a fault in the engaged portion of the core 15, such as conductive foreign matter embedded in the disc or metallic slivers attached to the surface of the conductor 12, a path of reduced dielectric strength occurs between the members 45 and 64 and the grounded central conductor 12. Since the opposite side of the burn-out circuit is grounded, the burn-out potential breaks down the fault and a high current flows therethrough causing the fault to be burned out or vaporized.

It should be noted that the high current caused to flow in the high potential circuit due to a breakdown of the fault in the core 15 is not allowed to flow through the links of the chain or through the pins which pivotally support the contact members 45—45 and 64—64 on their respective chains. The current flowing through the fault is confined between the members 45 and 64 and the guide 80, thereby preventing any arcing or pitting to occur between the various moving elements of the electrode 16.

As the core 15 and the discs are advanced further toward the right, the members separate and leave the disc and are carried around by their respective chains until they are again in position to engage another portion of the advancing core. It is obvious that no relative movement occurs between the contact members and the discs engaged thereby, in which case the discs cannot in any way be displaced on the central conductor by engagement with the burn-out electrode 16.

Since the discs 14—14 positioned on the central conductor 12 are not advanced through the circular passage formed by the grooves 51 and 65 provided on the contact members 45—45 and 64—64, respectively, the shape of the grooves can be made to conform exactly to the peripheries of the discs and thereby engage substantially the entire periphery thereof except for the very small clearance provided between a pair of oppositely disposed members. Because of this fact, a good mechanical contact between the contact members 45—45 and 64—64 and the peripheries of the discs is obtained, thereby eliminating the possibility of an air gap being present between contacting surfaces of the grooves 51 and 65 of the contact members and portions of the peripheries of the discs, which air gap may prevent the contact members from burning out a fault present in the advancing core 15. It should also be noted that the members 45—45 and 64—64 are so designed that when several oppositely disposed pairs are aligned against the walls 84—84 of the guide 80 and the walls 93—93 of the guide 81, the individual contact members of each chain butt against each other. This arrangement of the contact members makes certain that the entire length of the core 15 is thoroughly tested by the burn-out electrode 16 before the core 15 is engaged by the testing electrode 17.

After being engaged by the burn-out electrode 16 the advancing core 15 is engaged by the testing electrode 17 before being advanced through the tube forming die 18. The mechanical construction and operation of the testing electrode 17 is identical with that of the burn-out electrode 16 described hereinabove. However, in its electrical operation the testing electrode 17 varies from that of the burn-out electrode, in that the electrode 17 serves to arrest the operation of the coaxial forming machine when a fault is present in the core 15. The electrode 17 is connected to one side of a high potential testing circuit energized and controlled by the electrical apparatus 25, and thereby applies a high potential around the peripheries of the insulating discs and the grounded central conductor. If any faults remain in the core 15 after being engaged by the electrode 16, the high testing potential breaks down the fault and a high current flows in the circuit. This breakdown current operates current responsive apparatus included in the electrical apparatus 25 to arrest the driving means of the forming machine thereby preventing the defective core 15 from having the tubular conductor 22 formed thereover by the tube forming die 18.

While the above-described electrodes are particularly well adapted to test coaxial unit cores and prevent the machine from forming a defective coaxial unit, they may be modified to test various types of conductors without departing from the invention, as defined in the annexed claims.

What is claimed is:

1. In an apparatus for electrically testing a continuously advancing coaxial unit core consisting of a filamentary central conductor having insulating discs spacedly positioned thereon including means for grounding the central conductor and a source of high voltage, an improved electrode for applying a high potential around the advancing core, which comprises a chain belt having a pair of spaced supports provided on alternate links thereof, said chain belt being positioned to one side of the advancing core and having the axis of its path of travel in the same plane with the longitudinal axis of the advancing core, a contact member pivotally mounted between each pair of spaced supports and having a semicircular groove along the face thereof, a second chain belt having a pair of spaced supports provided on alternate links thereof, said second chain being positioned on the opposite side of the advancing core and having the axis of its path of travel in the same plane with that of the first-mentioned chain belt, a contact member pivotally mounted between each pair of spaced supports of said second chain belt and having a semicircular groove along the face thereof, means for driving said first and second chain belts in unison so as to advance the contact members on the adjacent legs thereof in the same direction and at the same rate of speed as that travelled by the advancing core for a predetermined portion of their travel, said chain belts being synchronized so that the contact members on the adjacent legs of the chain belts are juxtaposed during their period of travel with

the core unit and so spaced that the contact members on the adjacent legs thereof enclose a portion of the core advancing therebetween, and upper and lower guides for holding each pair of advancing juxtaposed contact members together during their travel with the core so that their respective semicircular grooves engage the periphery of the discs of the core unit.

2. In an apparatus for electrically testing a continuously advancing coaxial unit core consisting of a filamentary central conductor having insulating discs spacedly positioned thereon including means for grounding the central conductors and a source of high voltage, an improved electrode for applying a high potential around the advancing core, which comprises a chain belt having a pair of spaced supports provided on alternate links thereof, said chain belt being positioned to one side of the advancing core and the axis of its path of travel in the same plane with the longitudinal axis of the core, a contact member pivotally mounted between each pair of spaced supports and having a semicircular groove along the face thereof, a second chain belt having a pair of spaced supports provided on alternate links thereof, said second chain being positioned on the opposite side of the advancing core and having the axis of its path of travel in the same plane with that of the first-mentioned chain belt, an elongated contact member pivotally mounted between each pair of spaced supports of said second chain belt and having a semicircular groove along the face thereof adjacent to the core unit, means for driving said first and second chain belts so as to advance their respective contact members in the same direction as and at the same linear speed as that travelled by the advancing core for a predetermined portion of their travel, means for synchronizing the movement of the chain belts so that the contact members of each chain are juxtaposed during their travel with the core, upper and lower guides for holding each pair of juxtaposed contact members together during their travel with the core so that their respective semicircular grooves enclose the portion of the advancing core, and means provided on the chain belts for maintaining the contact members in a substantially parallel position with respect to their respective supporting links when the contact members are not engaged by the said guides.

3. In an apparatus for electrically testing a continuously advancing coaxial unit core consisting of a filamentary central conductor having insulating discs spacedly positioned thereon including a high voltage testing circuit and means for connecting the central conductor to one side thereof, an improved electrode for applying a high potential around the advancing core, which comprises a pair of endless chain belts spaced equidistantly astride the path of travel of the advancing core and having the axis of their respective paths of travel aligned with the longitudinal axis of the core, a plurality of contact members mounted on each chain belt and having a semicircular groove therein for engaging the peripheries of the discs positioned on said advancing core, means for driving the chain belts so that the adjacent legs travel in the same direction and at the same linear speed as that of the advancing core, means for synchronizing the movement of said chain belts with respect to each other so that the contact members on the adjacent legs of the chain belts are juxtaposed during their period of travel with the advancing core, said chain belts being so spaced with respect to the core advancing between said adjacent legs, upper and lower guides arranged to hold the contact members against the discs on the advancing conductor for a predetermined length of travel of the contact members, resilient means provided on the upper guide member for urging the contact members downwardly so that they make a good sliding contact with the lower guide therewith, and means for electrically insulating the chain belt synchronizing means and driving means from the track members, whereby when one side of a source of potential is connected to the lower track member the contact members engaged thereby are raised to a value of potential substantially above that of the central conductor of the advancing core.

DAWSON M. TAGGART.

REFERENCES CITED

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

UNITED STATES PATENTS

Number	Name	Date
1,247,501	Butcher	Nov. 20, 1917
1,288,866	Friel	Dec. 28, 1918
1,361,970	Dickey	Dec. 14, 1920
2,092,487	Weston	Sept. 7, 1937
2,386,127	Longfellow	Oct. 2, 1945