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APPARATUS FOR MAKING ELECTRICAL CONNECTIONS TO ARTICLES IN TRANSIT

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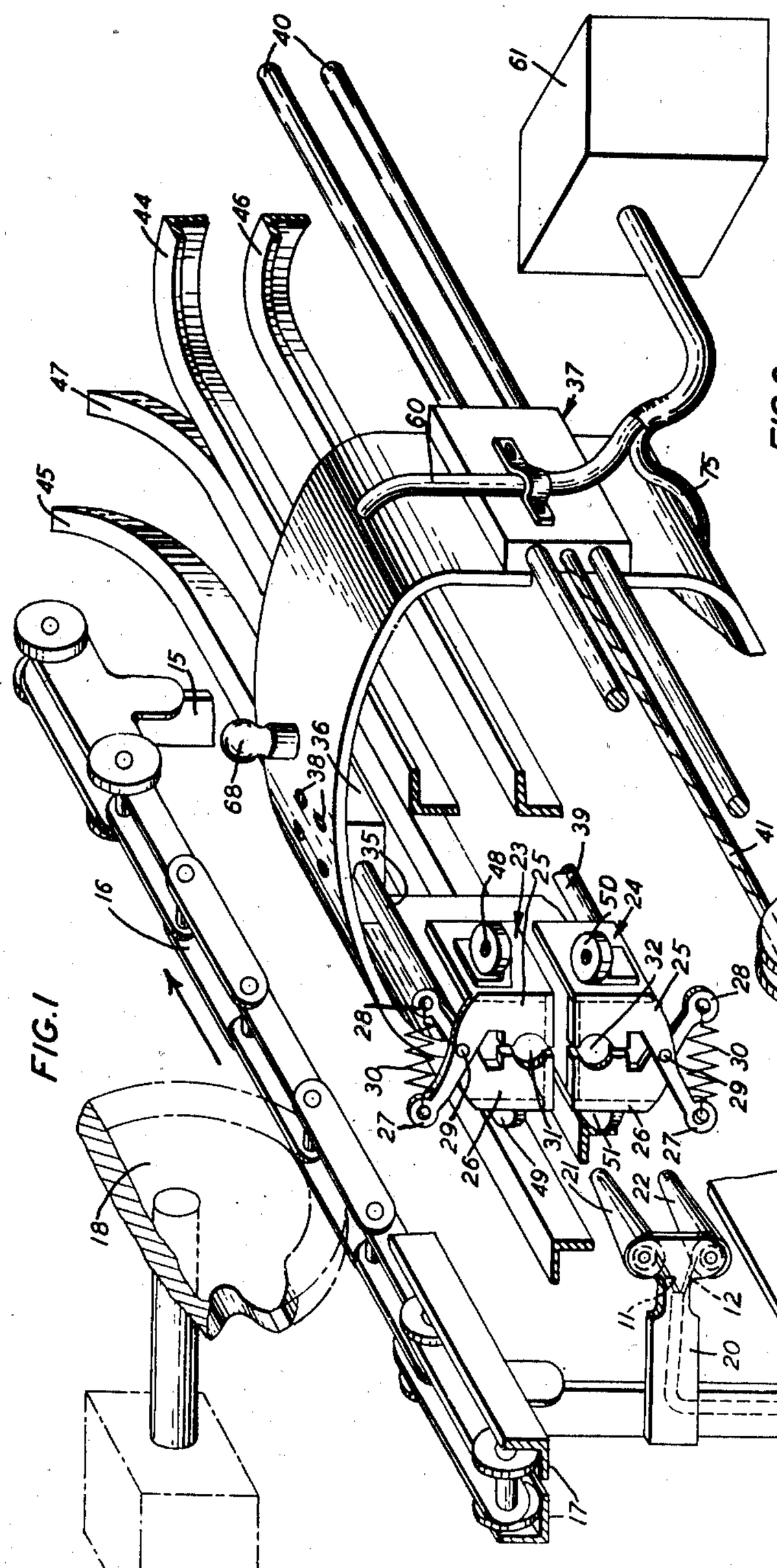

FIG. 1

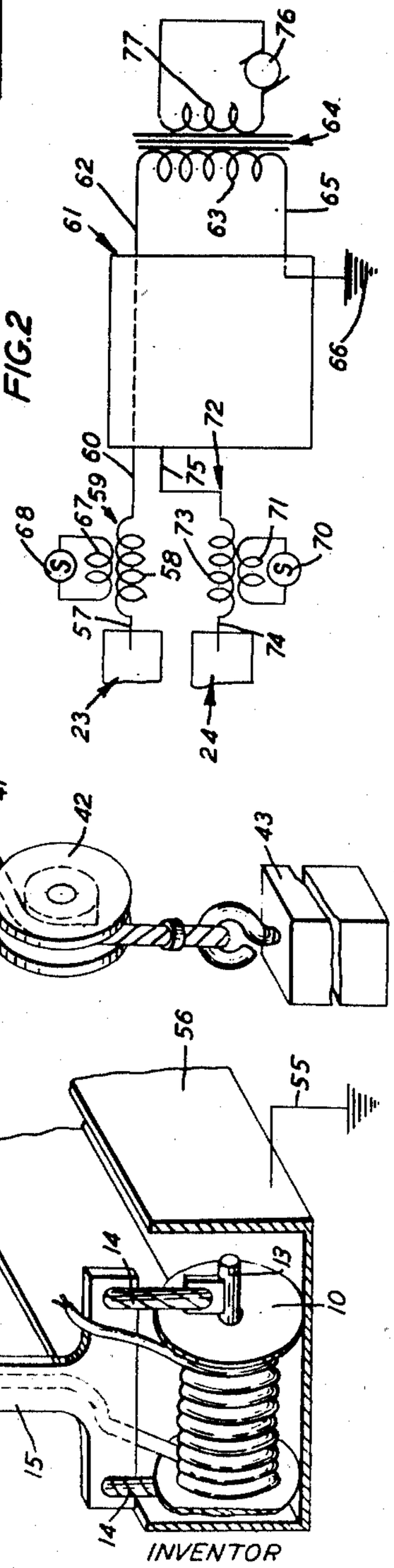

FIG. 2

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APPARATUS FOR MAKING ELECTRICAL CONNECTIONS TO ARTICLES IN TRANSIT

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1

This invention relates to apparatus for making electrical connections to articles with a minimum contact resistance variation while in transit and more particularly to apparatus for making electrical tests on insulated conductors stored on spools while they are being transported on a moving conveyor.

In the manufacture of electrically insulated wire and cable it is necessary to make a multiplicity of electrical tests such as dielectric strength, insulation resistance, mutual capacitance, capacitance unbalance to ground, etc. To obtain uniform and continuous speed of operation with efficiency in a wire working plant, it is requisite that apparatus be provided for automatically making such electrical tests while the insulated wire is in transit on a conveying means.

Accordingly, one of the principal objects of the invention is to provide a simple and dependable apparatus for automatically connecting in sequence to a stationary test set coils of insulated wire while they are being carried along on a traveling conveyor.

Other objects and advantages will be apparent from the following detailed description when taken in conjunction with the accompanying drawing in which:

Fig. 1 is a fragmentary perspective view of an apparatus embodying the invention wherein coils of insulated wire are subjected to various electrical tests while being moved along by a conveyor; and

Fig. 2 is a schematic diagram of the electrical circuits involved in Fig. 1 associated with a testing equipment.

As shown in Fig. 1 a metal spool 10, carrying a pair of insulated e'ectrical conductors 11, 12 to be tested, is supported by two bars 13 which extend a short distance into each end opening in the spool. Each of the bars 13 is secured to a rope 14 which is fastened to an inverted T shape member 15. A plurality of these members 15 for carrying spools of insulated wire are secured at spaced distances to a link conveyor 16 traveling in an overhead trackway 17 in a direction indicated by the arrow in Fig. 1. The conveyor 16 which may be of the endless type is operated by a sprocket wheel 18 driven by an electric motor 19. Midway of each moving member 15 and secured at right angles thereto is an insulator 20 which has mounted thereon two tapered metal plugs 21, 22. The insulated conductor 11 to be tested is electrically connected to a terminal or plug 21 and insulated conductor 12 is connected to plug or terminal 22.

2

The plurality of spaced sets of plugs 21 and 22 carried by the members 15 moving with the conveyor 16 are adapted to enter and engage upper and lower split jacks 23 and 24. Each of these split jacks comprises a right jaw 25 and left jaw 26 having crossed arms 27, 28 pivoted at 29 and interconnected at their ends by a coil spring 30 under tension. The contours of the faces of the two jaws 25, 26 are such as to provide in their closed positions a circular opening 31 in the upper split jack 23 and a similar opening 32 in the lower split jack 24 into which the plugs 21, 22 fit and make electrical contact.

The upper split jack 23 is secured through insulation to a pipe 35 carried by a conduit box 36 which is fastened to a hollow carriage 37 by machine screws 38. Likewise lower split jack 24 is insulatively secured by a pipe 39 through a conduit box to the carriage 37 which is slidably mounted on a plurality of horizontal guide rods 40 supported by any suitable framework (not shown).

The carriage 37 and split jacks 23, 24 carried thereby are normally retained in their foremost position to the left as viewed in Fig. 1 by a weighted rope 41 secured to the carriage. This rope 41 passes over a pulley 42 supported by the stationary framework of the apparatus and has attached to its free end a heavy counterweight 43.

Associated with the carriage 37 for cooperation with the jacks 23, 24 are a plurality of cam tracks 44, 45, 46 and 47 which are supported by any suitable framework (not shown). Upper split jack 23 has a roller 48 secured to the outside of right jaw 25 and a second roller 49 secured to the outside of left jaw 26. These rollers 48—49 engage cam tracks 44 and 45, respectively, to hold the jaws 25, 26 of jack 23 closed against the pull of spring 30 as shown in Fig. 1. However, when the carriage 37 is moved rearwardly the rollers 48, 49 follow the outward flare of the cam tracks 44 and 45 thereby permitting spring 30 to move the jaws 25, 26 apart to allow tapered plug 21 to pass therebetween. Lower split jack 24 also has a roller 50 secured to its right jaw 25 and a second roller 51 secured to its left jaw 26 so that these rollers 50, 51 engage cam tracks 46, 47, respectively, to hold these jaws together in clamping position as shown in Fig. 1 against the pull of its spring 30. Jaws 25, 26 of lower jack 24 are also moved apart by spring 30 to permit the passage of lower tapered plug 22 when the carriage 37 is moved rearwardly whereby rollers 50, 51 follow the outwardly flared ends of cam tracks 46, 47.

The electrical connections shown in Figs. 1 and 2 consist of a grounded conductor 55 (Fig. 1), connected to a long metal tank or trough 56 extending below the conveyor which is filled with water and in which the insulated wires 11, 12 on spools 10 are submerged while in transit. The ends of the conductors 11 and 12 on the spool 10, which are not connected to the terminals 21, 22, are insulated to prevent a short circuit through the water or are pulled up and positioned above the level of the tank 56 as shown in Fig. 1 so as not to be submerged. The spools 10 and the insulated wires stored thereon are pulled along under the water in the tank 56 and if a break or defect occurs in the insulation on conductor 11 under test then electrical current passes through conductor 55, metal tank 56, through the water in the tank into the defect in the insulation to the wire 11, then through tapered plug 21 into split jack 23 in contact therewith, through conductor 57 (Fig. 2), the primary winding 58 of a transformer 59, conductor 60, through predetermined electrical circuits in the test set 61, a conductor 62 therefrom, the secondary winding 63 of a step-up transformer 64 through conductor 65 back to ground at 66 to complete the circuit. Connected in the secondary winding 67 of the transformer 59 is a signal lamp 68 mounted on the top of carriage 37, which lamp lights up to indicate to the operator that a defect occurs in insulated wire 11 under test when current passes through the primary winding 58 to induce a current in the secondary winding 67.

Similarly a lamp 70 (Fig. 2) mounted on the lower part of carriage 37 is connected to the secondary winding 71 of a transformer 72 which has its primary winding 73 connected by conductor 74 to split jack 24 and by a conductor 75 into the test set 61 to give a visual indication to the operator when a defect occurs in the insulation of wire 12 under test. Electric power for the testing is supplied by an electric generator 76 connected in circuit to the primary winding 77 of the transformer 64.

The conductors 60 and 75 (Fig. 1) extending from the split jacks 23, 24 are formed into a flexible cable which connects into the testing equipment 61 (Fig. 2).

With the foregoing detailed description in mind it is believed that the general operation of the apparatus will now be understood. For this purpose it will be assumed that the conveyor 16 has been set in motion by the motor 19 and sprocket wheel 18 and that it is carrying along with it a plurality of spaced spools 10 suspended from spaced members 15; said spools carrying a plurality of conductors 11, 12 connected to the plurality of individual pairs of tapered plugs 21, 22 mounted on the arms 20 secured to the members 15, secured at spaced intervals along the conveyor. The spools with the insulated wires stored thereon to be tested are thus carried along under the water in the tank 56 and as a spool of wire comes into position to be tested as indicated in Fig. 1 the associated tapered plugs 21 and 22 enter into the openings 31, 32 of the upper and lower split jacks 23, 24, respectively, to push these jacks and the carriage 37 back along the guide rods 40 against the pull of the counterweight 43 attached to the rope 41.

During this movement, the insulated wires 11, 12 under test are connected to the test equipment 61 through tapered plugs 21, 22, split jacks 23, 24, conductors 57, 74, primary windings 58, 73, conductors 60, 75, respectively, into the test set

whereby various desired electrical tests are made while the wire is in transit without variation in contact resistance. If a defect occurs in the insulation of wire 11, the signal lamp 68 is operated and if a defect occurs in wire 12, signal lamp 70 is operated in the manner previously described.

After a predetermined movement of the carriage 37, split jacks 23, 24 and tapered plugs 21, 22 in the direction indicated by the arrow in Fig. 1, the rollers 48, 49, 50, 51 follow the outwardly flared tracks 44, 45, 46, 47 whereupon the springs 30 pull the jaws 25, 26 of the split jacks 23, 24 apart to allow the tapered plugs 21, 22 to pass on through the opened split jacks. When the plugs 21, 22 pass through the jacks 23, 24 the counterweight 43 attached to the rope 41 returns the carriage 37 and the jacks back to normal position so that the jacks are in position to meet and make contact with the next set of plugs 21, 22 carried by the moving conveyor and connected to another pair of insulated wires, such as 11, 12, stored on another spool 10. Thus the apparatus makes possible the automatic electrical testing of insulated wire or other electrical equipment while in transit from one location to another.

Although the present invention has been described in terms of the preferred illustrative embodiment disclosed herein it will be understood that it is susceptible of many different forms and that various changes and modifications may be made without departing from the spirit and scope of the invention as defined by the appended claims.

What is claimed is:

1. Apparatus for making electrical connections to articles while in transit comprising a conveying means, means attached to the conveying means for supporting an article, an electrical terminal carried by the conveyor, a carriage positioned in the path of travel of the terminal on the conveyor, a second terminal carried by the carriage, and driving means for moving the conveying means to engage the electrical terminal thereon with the terminal on the carriage to move the carriage with the conveyor.

2. Apparatus for making electrical connections to articles while in transit comprising a conveyor, means attached to the conveyor for supporting an article, an electrical plug carried by the conveyor, a carriage positioned in the path of travel of the plug, a split jack carried by the carriage, driving means for advancing the conveyor to bring the plug into engagement with the jack and move the carriage, and means for opening the split jack after a predetermined movement of the carriage to permit the plug to be disengaged from the jack.

3. Apparatus for making electrical connections to articles while in transit comprising a conveyor, means attached to the conveyor for supporting an article, an electrical plug carried by the conveyor, a carriage positioned in the path of travel of the plug, a counterweight attached to the carriage for normally keeping it in a predetermined position, a split jack carried by the carriage, driving means for moving the conveyor to engage the plug with the jack to move the carriage, and means for opening the split jack after a predetermined movement of the carriage to permit the plug to be disengaged from the jack and to permit the counterweight to return the carriage to normal position.

4. Apparatus for making electrical connections to articles while in transit comprising a conveyor, means attached to the conveyor for supporting

an article, an electrical plug carried by the conveyor, a carriage positioned in the path of travel of the plug, a split jack carried by the carriage, driving means for moving the conveyor to engage the plug with the jack and move the carriage, and cam tracks engaging the split jack to keep it closed for a predetermined time and then for permitting it to open so that the plug can pass therethrough.

5. Apparatus for making electrical connections to articles while in transit comprising a conveyor, means attached to the conveyor for supporting an article, an electrical plug carried by the conveyor, a reciprocable jack positioned in the path of travel of the plug, driving means for actuating the conveyor to engage the plug with and move the jack, means for opening the jack and disengaging the plug after predetermined travel of the jack, and means for returning the jack to its normal position after such disengagement.

6. In an apparatus for making electrical connections to articles while in transit, a conveyor, an article holder secured to the conveyor, an electrical plug carried by the conveyor, a movable split jack for engaging the plug comprising two pivoted members and a spring for forcing the two pivoted members apart, means for holding the pivoted members together, and driving means for advancing the conveyor to carry the plug into engagement with the jack and to advance the jack to a predetermined position whereupon the spring opens the jack.

7. Apparatus for making electrical connections to articles while in transit comprising an endless conveyor, article holders fixed to the conveyor at spaced distances, a plurality of electrical plugs secured to the conveyor at the same spaced distances as the article holders, a plurality of reciprocable split jacks positioned in the path of travel of the electrical plugs, driving means for advancing the conveyor to sequentially engage the plugs with the jacks and move them along therewith, means for sequentially opening the split jacks after a predetermined travel to permit the plugs to pass therethrough, and means for returning the disengaged jacks to normal position to be engaged by the next set of plugs connected to other articles.

8. Apparatus for electrically connecting articles while in transit comprising a conveyor, supporting means secured to the conveyor for supporting an article to be electrically connected, an electrical terminal secured to the said supporting means, a reciprocable carriage positioned in the path of travel of the electrical terminal, indicating means secured to the carriage and adapted to be electrically connected to a test set, a second terminal carried by the carriage and electrically connected to the indicating means, and means for actuating the conveyor to cause engagement of the terminals to move the carriage and operate the indicating means upon a predetermined condition.

9. Apparatus for electrically connecting articles while in transit to testing equipment comprising a conveyor, a tank filled with liquid and positioned below the conveyor, means secured to the conveyor and extending into the tank to support an article submerged therein, an electrical connector carried by the conveyor and electrically connected to the submerged article in the tank, a movable connecting means adapted to be electrically connected to the testing equipment, said movable connecting means positioned

in the path of travel of the electrical connector, and driving means for moving the conveyor to carry the submerged article along through the tank and carry the electrical connector into engagement with the movable connecting means whereby the article is adapted to be electrically connected to the testing equipment, said movable connecting means being advanced by continued movement of the electrical connector during the course of a test.

10. Apparatus for electrically connecting coils of insulated wires to make tests thereon while in transit comprising a conveyor, an elongated tank filled with a fluid and positioned below the conveyor, a plurality of means secured at spaced distances to the conveyor for supporting the coils of insulated wires in a submerged condition in the tank, a plurality of sets of electrical plugs carried by the conveyor at the same spaced distances and electrically connected to individual wires in said coils, a reciprocable carriage, means for guiding and supporting the carriage, a plurality of split jacks secured to the carriage and positioned in the path of travel of the plugs, a plurality of indicating means secured to the carriage and individually electrically connected to predetermined plugs, said tank being adapted to be electrically connected to testing equipment, driving means for moving the conveyor to move the submerged coils of wires through the tank and to bring a set of plugs into electrical engagement with and to move the plurality of split jacks and carriage to permit electrical tests to be made and to operate an indicating means when a predetermined condition exists in one of the wires under test, a spring normally tending to spread the jacks apart, camming means for holding the jacks closed in engagement with its cooperating plug and for opening the set of split jacks after moving a predetermined distance to permit the plugs to move therethrough, and means for returning the carriage and split jacks to normal position so as to be engaged by another set of electrical plugs connected to coils of other insulated wires to be tested as they are in transit through the tank.

11. In an apparatus for making electrical connections to a moving article, a conveyor, means on the conveyor for carrying the article, a first set of electrical contacts carried by the conveyor and electrically connected to the article, a second set of electrical contacts arranged to engage the first set of contacts and to be moved thereby, a plurality of indicating means connected to the second set of electrical contacts, driving means to move the conveyor to engage the first set of contacts with the second set of contacts, means coacting with the second set of contacts to allow the first set of contacts to disengage from the second set of contacts after moving through a predetermined distance, means to return the second set of contacts and the indicating means to their original position, and electrical conductors interconnecting the second set of contacts with the plurality of indicating means.

12. In an apparatus for making electrical connections from a testing means to a moving article under test, a conveyor, means carried by the conveyor for supporting the article under test, a first set of electrical contacts carried by the conveyor and electrically connected to the article under test, driving means for advancing the conveyor to move the first set of contacts, a second set of electrical contacts positioned in the

path of movement of the first set of contacts and movable upon engagement with the first set of contacts for a predetermined distance, said second set of contacts being adapted to be connected to said testing means.

13. In an apparatus for electrically connecting a moving article to a movable indicating means, a first group of contacts movable with and electrically connected to the article, a second group of contacts positioned in the path of travel of the first group of contacts, said indicating means being connected to the second group of contacts, means for moving the first group of contacts into engagement with the second group of contacts, to move the second group of contacts and the indicating means therewith, means to return the second group of contacts and the indicating means to their original position after they have moved through a predetermined distance, and means electrically connecting the second group of contacts to the movable indicating means.

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