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2,529,227

APPARATUS FOR WIRE CODING

Filed Dec. 30, 1943

3 Sheets-Sheet 1

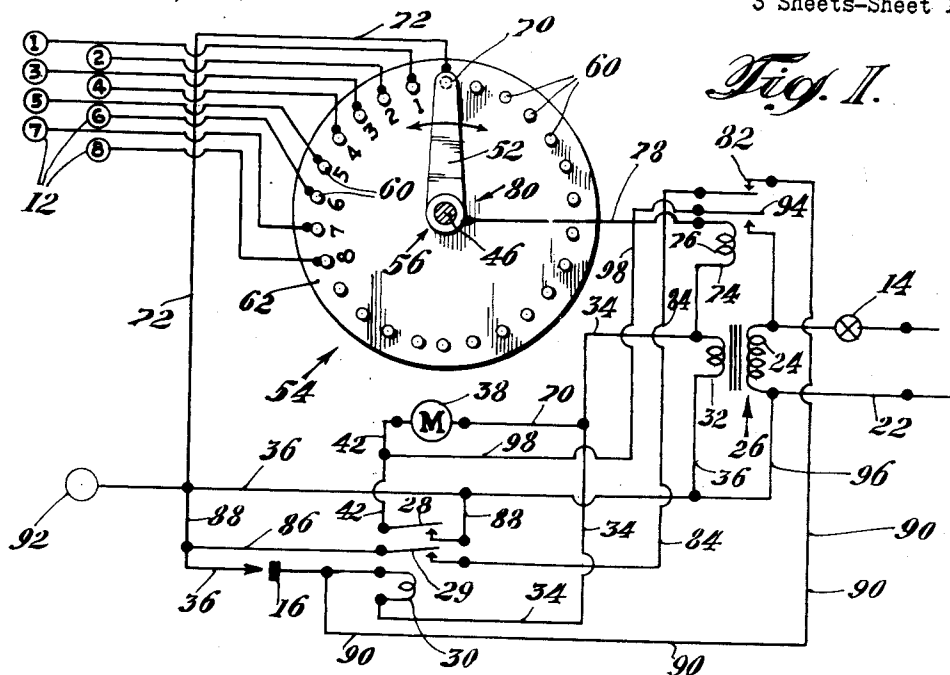


Fig. 1.

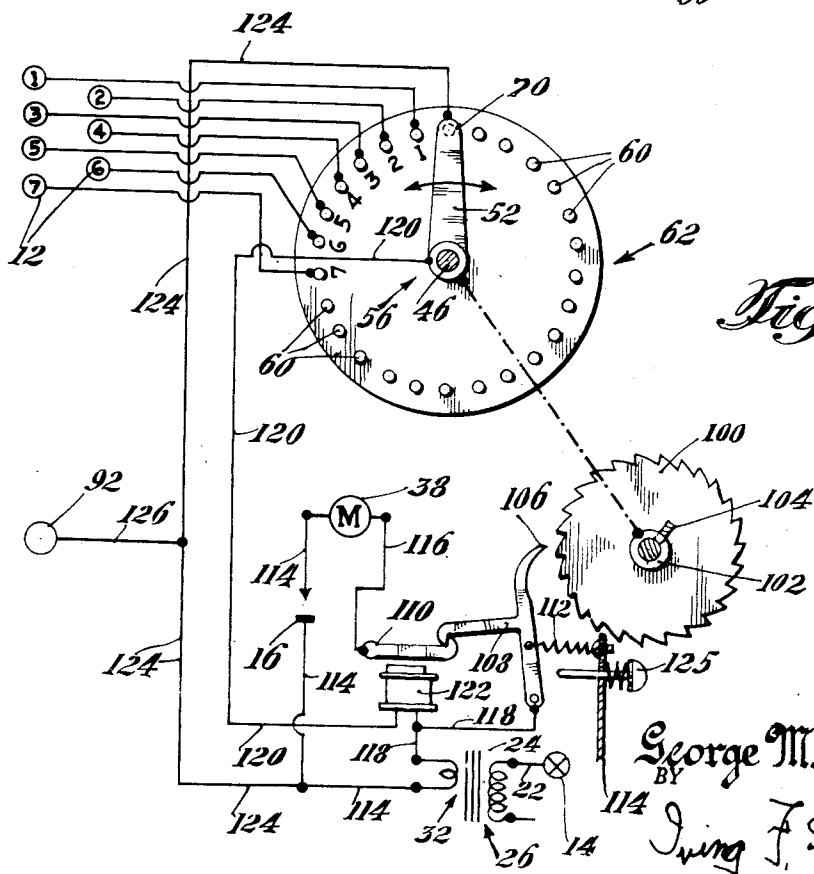


Fig. 2.

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3 Sheets-Sheet 2

Fig. 3.

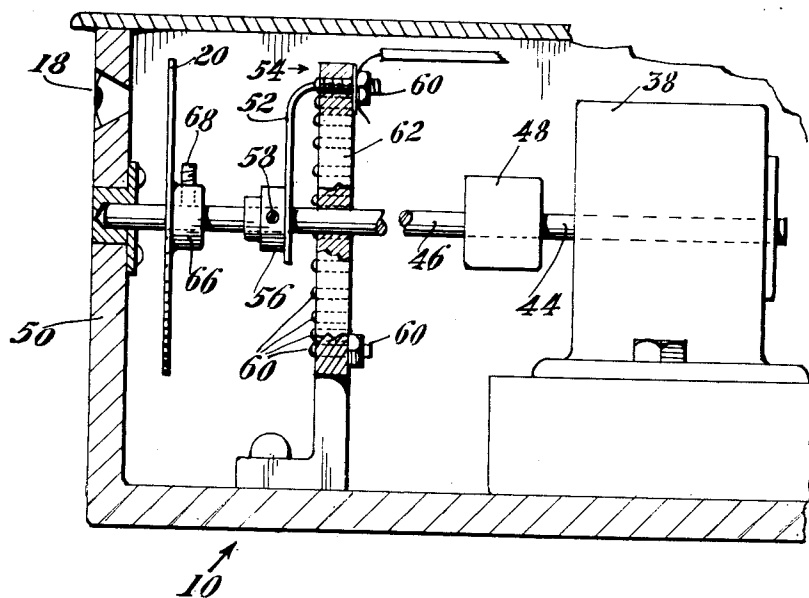
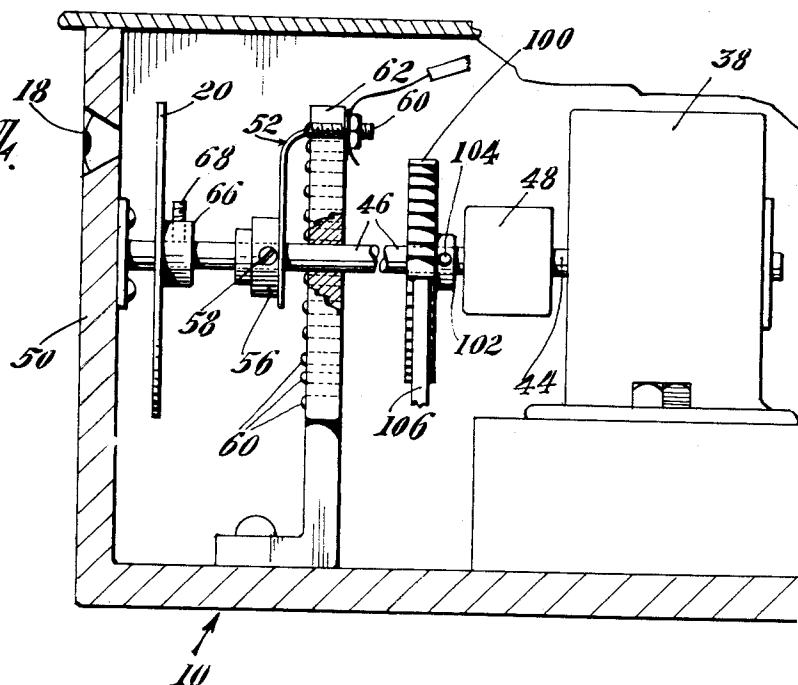


Fig. 4.



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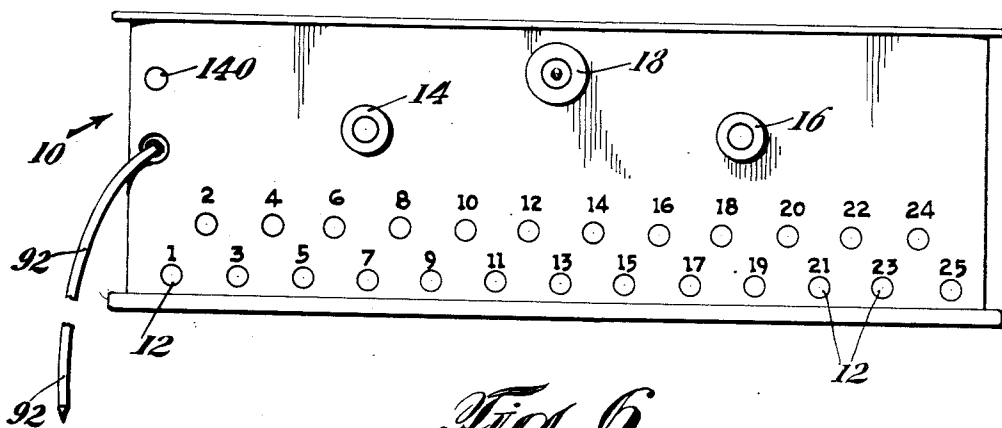
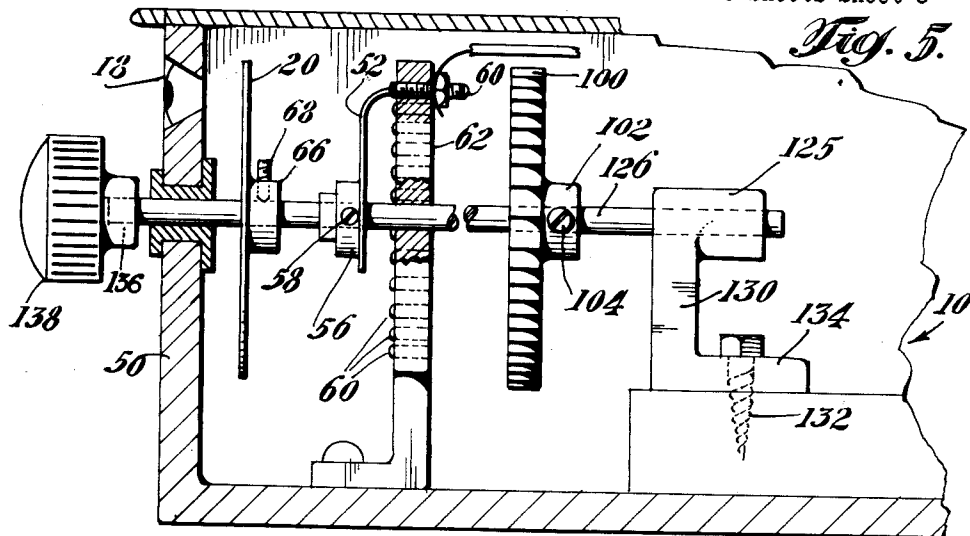
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3 Sheets-Sheet 3



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APPARATUS FOR WIRE CODING

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5 Claims. (Cl. 175—183)

1

This invention relates to apparatus for ascertaining and coding each wire in a plurality thereof and locating short circuits therein.

Cables having a plurality of wires, sometimes as many as several hundred individual wires are used in the electrical systems of ships, airplanes, telephone communications and various other electrical systems. In use it is necessary to select or code each individual wire so that it may be properly used in the electrical system.

Heretofore, this has been a time consuming operation and relatively complex and difficult operation, particularly where the number of individual wires or pairs exceeds the range of color coding.

Oftentimes, in use, the individual wires may become grounded or short circuited to another wire or wires in the cable or the sheath itself. Heretofore, this also has required a comparatively large time consuming, complex and difficult operation to determine such grounding or short circuit.

The present invention, therefore, contemplates the provision of an apparatus that will enable a user, thereof, to rapidly, visually and in a comparatively simple manner identify each wire in a system having a great number of individual wires so that each wire can be quickly coded for use in the electrical system.

The present invention further contemplates the provision of an apparatus by means of which it may be quickly and easily determined which wire of a plurality thereof may be short circuited to another wire of that plurality of wires.

Other objects, advantages and uses of the present invention will become apparent from the description which follows and the drawings appended thereto in which like reference characters identify like elements and wherein

Fig. 1 is a schematic wiring diagram of one form of a testing and coding apparatus according to my invention

Fig. 2 is a schematic wiring diagram of another form or modification of my invention

Fig. 3 is a partial cross-section showing the mechanical elements used in the device employing the wiring diagram illustrated in Fig. 1

Fig. 4 is a partial cross-section showing the mechanical elements used in the device employing the wiring diagram illustrated in Fig. 2

Fig. 5 is a partial cross-section of a manually operated device according to my invention

Fig. 6 is a plan view of the housing or casing of a device according to my invention.

Referring now to Fig. 6, each form or modification of my invention is housed in a casing 10,

2

which is provided on the outside thereof with a plurality of binding posts 12, to each of which an individual wire of the cable or group thereof to be coded and tested is secured.

While I have shown twenty-five binding posts in the drawing, it will be understood that this is only for purposes of illustration, since a greater or lesser number may be used in the practice of my invention.

Arranged on the outside of the casing or housing 10 is the power circuit switch 14 and the push button switch 16, the function of which will be hereinbelow explained.

In order to ascertain the individual wire which has been probed or identified with the apparatus, I provide the window 18 through which the indicating dial 20 may be seen.

Referring now to Fig. 1 current for operating the apparatus is supplied through the line 22, which is secured to the primary 24 of the conventional transformer 26. In operation, the switch contacts 28 and 29 of the conventional locking relay 30, which are normally open, are closed upon closing the push button switch 16 which completes the circuit from the secondary 32 of the transformer 26 so that the relay 30 is energized to close the contacts 28 and 29. This circuit is from the secondary 32 through the lead 34 to one end of the locking relay 30 and from the other end thereof through the push button 16, and the lead 36 to the other end of the transformer secondary 32. Push button switch 16 need only be momentarily depressed in order to lock relay 30. This locking effectively taking the place of manual depression of switch 16. The circuit for locking the relay 30 is as follows—from contacts 29, through lead 36, lead 38 to secondary 32 and from secondary 32 through lead 34 to relay 30, then through lead 30, through contacts 32 of unlocking relay 76, through lead 34 and back to contacts 29 which keeps relay 30 locked.

Upon release of the push button switch 16, the contacts 28 remain closed to complete the circuit through the motor 38, which circuit is from one end of the secondary through the lead 34, lead 40, motor 38, lead 42 through the upper switch contact 28 and back through the lead 36 to the other end of the secondary 32.

Referring now to Fig. 3, the shaft 44 of the motor 38 is preferably connected to the carrying shaft 46 by any suitable means such as the clutch or coupling 48. The front end of the carrying shaft 46 is preferably journaled in the front wall 50 of the housing or casing 10. Secured on the carrying shaft 46, I provide a wiper-arm 52 of a

3

rotary switch, generally indicated by the reference character 54, as by the collar 56 and set screw 58. Operation of the motor 38 rotates the wiper-arm 52 successively across the terminal contacts 60 of the stationary commutator 62 of the rotary switch, which is secured to the housing 10 by any suitable means. Each terminal contact 60 is electrically connected to a binding post 12 so that the individual wire of the cable secured to that binding post 12 is in the electric circuit that is completed through the wiper-arm 52, for the coding function that will be described.

The indicator dial 20 is secured on the shaft 46 as by means of the collar 66 and set screw 68 and positioned thereon so that the number thereon corresponding to the binding post 12 terminal contact and corresponding terminal 60 and which is electrically engaged by the wiper-arm 52 will appear in the window 18.

As will become apparent from the further description, the corresponding number on the indicating dial 20 is brought into registration with the window 18, and remains stationary when the probing circuit is completed through the identified wire in the cable and the binding post to which that wire is secured.

The neutral or zero position 70 of the commutator terminal (see Fig. 1) and wiper-arm is connected in the operative electrical circuit by means of the lead 72, lead 36, secondary 32, lead 74, the unlocking relay 76 (the function of which will be described), lead 78 and wiper-arm 52 so that operation of the apparatus can be commenced from zero position.

The wiper-arm 52 at its pivot 80 at the center of the commutator 62 about which it is rotated is electrically connected at one end thereof to the unlocking relay 76, the switch contacts 82 of which, are normally closed to permit operation of the motor 38 through the closed contact 32, lead 84, switch contact 29, lead 86, lead 36, lead 88, contact 28, lead 42, motor 38, lead 34, locking relay 30, lead 90 to switch contact 82.

In order to identify an individual wire of a group of wires, I provide on the exterior of the apparatus housing 10 a probe 92, which is placed in contact with a wire to be coded and which probe is electrically connected to one terminal of the unlocking relay 76 by means of the lead 36, the transformer secondary 32 and lead 74. The other terminal of the unlocking relay 76 is electrically connected to the wiper-arm 52 by means of the lead 78.

In operation, the individual wires of the cable are each connected to a binding post and each wire tagged or labeled with a number that corresponds to the binding post to which it is secured.

As each wire is identified in the manner to be described at the remote end of the cable, that wire is also tagged or labeled with a number that corresponds to the number of the binding post to which it has been secured to at the other end of the cable. In this manner each individual wire is coded at each end of the cable.

To operate the device the probe 92, which may be a comparatively long insulated wire having a contact at its free end, is placed in contact with one of the wires of the cable which is thereby to be identified whereupon the push button 16 of the conventional type is momentarily closed to lock the relay 30 in switch closing position which commences operation of the motor 38, thereby rotating the wiper-arm 52.

Since the switch contacts 29 have been closed

4

the motor 38 will continue to operate although the push button 16 has been released.

For illustration, assume that the probe 92 has been secured to a wire that is connected to number 5 binding post, then the wiper-arm 52 will rotate until it contacts that terminal 60 on the commutator 62 which is connected to the binding post number 5.

When this is accomplished the circuit through the unlocking relay 76 will be completed through the probe 92 the wire which is secured to the number 5 binding post, the corresponding terminal 60, the wiper-arm 52, the lead 78, the relay 76, lead 74, secondary 32, lead 36, to the probe 92, whereupon the unlocking relay is energized to open the contact 82, which breaks the motor circuit through the contacts 28 to stop operation of the motor by unlocking relay 30.

Since the unlocking circuit has been energized and the basic motor circuit thereby opened unless a means is provided whereby the motor 38 will nevertheless rotate the wiper-arm 52 off the number 5 commutator terminal; closing of the push button 16 can not again, as long as the wiper-arm completes the unlocking circuit, commence operation of the motor to return the wiper-arm 52 to neutral or zero position 70.

This is accomplished by means of the unlocking relay switch contact 94, which is normally open but is closed when the relay 76 is energized.

Closing contact 94 completes a secondary circuit through the motor from contact 94, lead 96, lead 36, transformer secondary 32, leads 34, motor 38, leads 42 and 98 back to contact 94. Thus the motor 38 will continue to operate until the wiper-arm moves off the number 5 binding post commutator terminal, whereupon the unlocking relay circuit is broken, thereby returning the contact 82 to normally closed position. At the same time, contact 94 is returned to normal open position to break the secondary motor circuit and stop rotation thereof to enable use of the apparatus for the succeeding tests.

At this time the synchronized indicator dial 20 concurrently stops to show the number 5 through the window 18.

The wire which has been engaged by the probe is thereby identified as the wire to which the number 5 binding post has been connected and this wire may then be tagged with its proper number and so identified in the cable.

In order to commence operation of the motor 38, again the push button 16 is closed, which again locks the relay 30 and closes the contacts 28 and 29.

The wiper-arm 52 will then continue to rotate back to normal or zero position unless a wire in the group is grounded across the number 5 wire, it being understood, of course, that the probe 92 remains in contact with the number 5 wire until the wiper-arm is returned to its neutral or zero position.

Should a wire be grounded across the number 5 wire, for example the wire that is secured to number 7 binding post, then when the wiper-arm 52 engages the corresponding commutator terminal contact 60, the unlocking relay 76 will again be energized through the number 5 wire (with which the probe remains in contact) so that operation of the rotary switch will stop by reason of opening switch contacts 82 and closing contact 94, as described.

Since the number 7 on the indicator dial 20 will appear in the window 18, it is indicated

5

that the number 7 wire is grounded across the number 5 wire.

The motor 38 will be stopped and the wiper-arm 52 carried off the terminal contact which is secured to number 7 wire as described above, whereupon the push button 16 is again closed so that the wiper-arm may be returned to neutral or zero position.

The probe is then placed in contact with another wire in the cable and the operation repeated until that wire is identified and determination of grounded wires thereacross similarly made until the entire complement is scanned, coded and tested.

Referring now to Figs. 2 and 4, wherein like reference characters are used to identify like elements, illustrated in Figs. 1 and 3, I illustrate a modification of my invention wherein a mechanical means is used in place of an electrical unlocking means, such as the relay 76.

In this modification the ratchet wheel 100 is secured to the shaft 46 by any suitable means such as the collar 102 and set screw 104 to be rotated by the motor 38 operating through the clutch or coupling 48.

Pivoted to the housing in any suitable manner, I provide the pawl 106, from which the hook-locking finger 108 extends to engage the pivoted second hook locking finger 110 to normally lock the pawl out of engagement with the ratchet, against the tension of the spring 112.

The Spring 112 is secured at one end to the panel 114 and at the other end to the pawl 106. The motor circuit is completed from one end of the transformer secondary 32 through the lead 114, switch 16 to the motor 38 and from the motor through the lead 116 to the locking fingers 110 and 108 and the lead 118 to the other end of the transformer secondary 32.

The rotating wiper-arm 52 at its inner pivoted end is connected by means of the lead 120 to one end of the relay magnet 122.

The other end of the relay magnet 122 is connected to one end of the transformer secondary 32 by means of the lead 118 and the other end of the secondary to the probe 92 by means of the lead 114, lead 124 and lead 126.

The transformer secondary 32 is also connected by means of the lead 124 to the neutral or zero terminal contact 70 of the commutator 62.

In operation, the motor 38 is started by closing the motor circuit by means of the switch 16, the pawl being in locked position to release the ratchet 100 to permit rotation of the motor 38 and provide an unbroken motor circuit.

The probe is placed in contact with a wire of the group to be scanned and tested, for example, that one which has been secured on the binding post number 5, the other wires of the group or cable having each been connected to a binding post as previously described.

When in its rotation, the wiper-arm 52 engages the terminal contact corresponding to the binding post number 5, a circuit will be completed through the probe 92, binding post and terminal contact number 5, wiper-arm 52, lead 120, relay magnet 122, lead 118, the secondary 32 of the transformer 26, leads 124 and 126 back to the probe 92, thereby energizing the relay 122.

The relay attracts the locking finger 110 to release the pawl 106 which is pulled back into engagement with the ratchet 100 to stop its further rotation and open the motor circuit.

The ratchet 100 is so indexed on the drive

6

shaft as to stop the wiper-arm 52 just after it contacted the terminal 60 corresponding to the #5 binding post, so that operation of the motor can again be commenced.

The wire secured to number 5 binding post is thus identified, the indicator dial 20 disclosing through the window 18 the number corresponding to the terminal contact 60 which leads to the binding post number 5.

In order to release the ratchet 100 and close the motor circuit, the pawl 106 is returned into locking engagement with the finger 110 by means of the push rod 125.

In order to return the wiper-arm 52 to neutral position to ascertain a short circuit and again perform the identifying function of the apparatus in the same manner as described with reference to the device illustrated in Figs. 1 and 3, the switch 16 is closed whereupon the wiper-arm 52 returns to neutral position, whereat the circuit through the relay 122 is again completed thereby opening the motor circuit so that the coding operation may be repeated for another identifying operation. It will, of course, be understood that during the return of the wiper-arm to neutral position, shorts, if any, will be disclosed as described with reference to Figs. 1 and 2.

Referring now to Fig. 5, I have therein illustrated a modification of the apparatus illustrated in Figs. 2 and 4, wherein the motor 38 is replaced by a manually operated means for rotating the wiper-arm 52 across the commutator 62 the elements otherwise being the same. In this modification the operative shaft 126 is journaled at its inner end in the bearing 128 of the support 130, which latter is secured to the housing or casing 10, as by means of the screw 132 and platform 134.

The other end of the shaft 126 extends through the front wall or panel 50 in which it is journaled.

Secured to the shaft 126, on the exterior of the housing as by means of a conventional frictional coupling 136, I provide the preferably knurled knob 138, by means of which the shaft and wiper-arm are rotated to identify each wire and test for shorts.

The shaft 126 has secured on it the indicator dial 20, a wiper-arm 52 and a ratchet 100. A pawl and locking fingers, a relay arranged to move one of the fingers, a probe and binding posts such as are illustrated in Fig. 2 are provided, though they need not be illustrated again in Fig. 5.

The wiper-arm 52 is rotated by the knob 138, so that when a circuit is completed through the probe, the identified wire, the rotary switch and the relay, one of the locking fingers is thereby attracted and moved to disengage the other finger so that the pawl engages the ratchet wheel 100 and prevents further manual rotation of the shaft.

The wire having been identified in this manner, the locking fingers are brought back into engagement, as by means of a push rod such as that illustrated in Fig. 2. The pawl is thus disengaged from the ratchet 100 to permit further rotation of the knob and the return of the wiper arm to neutral or zero position to thereby ascertain whether there are any short circuits across the wire just identified and to repeat the identifying operation with the probe in contact with another wire of the cable.

In order to determine whether a wire is grounded or shorted across the sheath of the

cable, I provide a binding post 140 (see Fig. 6) to which the cable sheath may be connected. This binding post is connected to a terminal contact on the commutator 62 and the indicator dial 20 has arranged thereon an idicia corresponding in position thereon to this terminal. It will be understood that determination of a short circuit to the sheath is made in the manner described for an individual wire.

It will now be recognized that I have provided a simple and relatively inexpensive apparatus by means of which the individual wires comprising a cable or group thereof may be very quickly identified and coded and tested for short circuits by a single operator.

While I have described in detail certain embodiments of my invention, it will be understood that such embodiments are merely for illustration and that many changes and modifications may be made therein without departing from the spirit and scope of the invention.

I claim:

1. In an apparatus for determining each wire in a group of wires, a testing circuit, a plurality of means for detachably securing one of said means to a wire of said group of wires, each said securing means having an identifying indicia, an indicator circuit, a locking relay having a switch arranged in the indicator circuit for closing said indicator circuit, an unlocking relay controlling switch arranged in the testing circuit for opening the indicator circuit upon closing the testing circuit and a visual means movable into and out of visible position in the apparatus and having indicia thereon corresponding to the said identifying indicia on each securing means, said visual means moved into position whereby an identifying indicia corresponding to a securing means becomes visible upon closing the testing circuit through the wire of said group connected to the said securing means having the indicia thereon corresponding to the indicia on the visible means.

2. In an apparatus for determining each wire in a group of wires, a motor, a motor circuit, a testing circuit, a rotary switch in said testing circuit and having a wiper arm driven by the motor and a stationary commutator, a plurality of terminals on the commutator for closing the rotary switch upon engagement of a terminal by said wiper arm, means for connecting each wire of the group of unknown wires to one of the terminals on the commutator and an indicator dial driven by the motor in synchronism with the wiper arm, said indicator dial having indicia thereon corresponding to each means for connecting each wire to one of the terminals, a locking relay having a normally open switch controlled thereby, said switch arranged in the motor circuit for closing said motor circuit upon energizing said locking relay and an unlocking relay in the testing circuit, said unlocking relay having means for opening the locking relay circuit to thereby deenergize said locking relay and opening the motor circuit upon closing the testing circuit through the rotary switch.

3. The apparatus of claim 2, said unlocking relay having a normally open switch in the motor circuit for closing said circuit upon completing the testing circuit there through the rotary switch and opening the motor circuit upon opening the rotary switch to open the testing circuit.

4. In an apparatus for determining each wire in a group of wires, an indicator circuit having a rotary switch arranged therein, said rotary switch

having a plurality of contacts, means for detachably connecting each wire of the group to one of the contacts of the rotary switch and having identifying indicia thereon for each wire, means for operating said rotary switch, a visual indicator having indicia corresponding to the identifying indicia and driven by said switch operating means in synchronism with said rotary switch, a locking relay having two normally open switches arranged in the indicator circuit, said switches closed upon completing a circuit through the locking relay and an unlocking relay in the testing circuit and having two switches, one of said switches of the unlocking relay normally closed and arranged in the circuit of the locking relay in which said circuit one of the normally open switches of the locking relay is arranged and the other of the said switches of the unlocking relay being normally open and in the circuit of the means for operating the rotary switch.

5. In a device for determining each wire in a group of wires, a rotary switch comprising a stationary commutator having a plurality of contacts thereon and a rotatable wiper arm, a motor for driving the arm continuously in one direction of rotation, an indicator viewable from the exterior of the device and driven by the motor in synchronism with the wiper arm, a plurality of binding posts, each binding post connected to one of the contacts on the commutator and for detachably securing thereto one of the wires in the group of wires, a locking relay coupled to a switch in the motor circuit, said locking relay normally open, an unlocking relay controlling a first switch and a second switch to respectively open and close said switches upon completing a circuit through the unlocking relay, said first switch coupled in the motor circuit for momentarily closing said circuit, a probe connected to one end of the unlocking relay, said arm connected to the other end of the unlocking relay whereby a circuit through the relay may be completed through the arm and the probe, said second switch connected in the motor circuit and closed upon opening the first switch, said second switch opened upon completing a circuit through the probe and the unlocking relay, and closed switches controlled by the locking relay.

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