

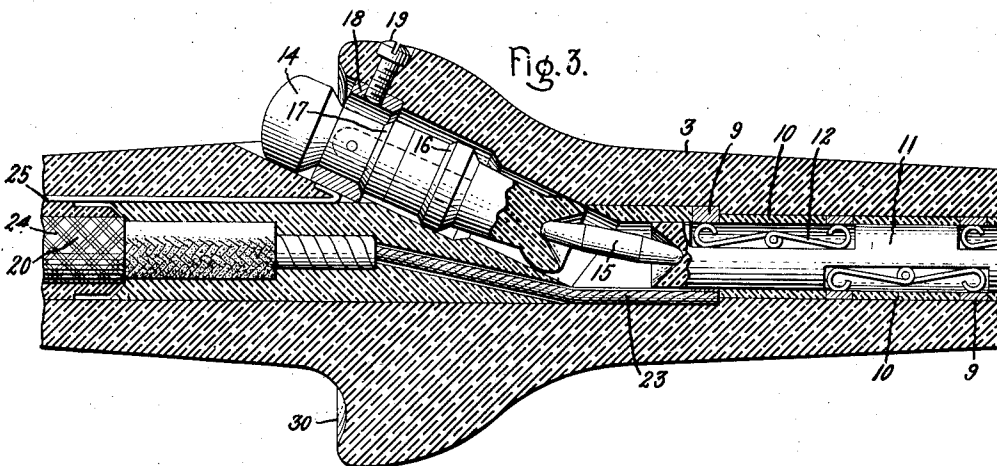
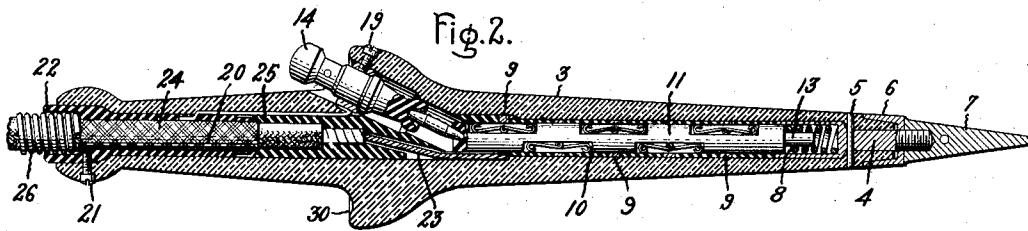
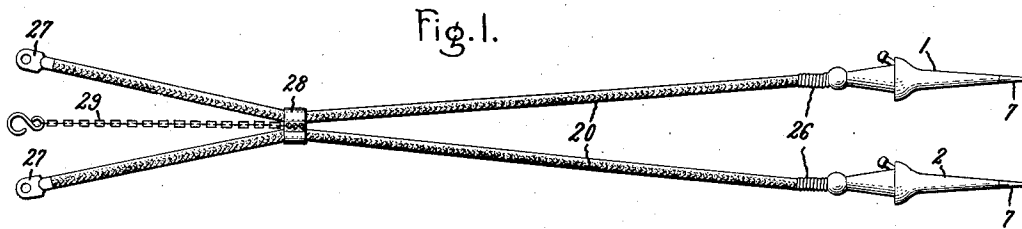
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A. B. HENDRICKS, JR

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ELECTRICAL TESTING APPARATUS

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Inventor:
Allan B. Hendricks, Jr.,
by *Albert B. Davis*
His Attorney.

UNITED STATES PATENT OFFICE.

ALLAN B. HENDRICKS, JR., OF PITTSFIELD, MASSACHUSETTS, ASSIGNOR TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

ELECTRICAL TESTING APPARATUS.

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My invention relates to electrical testing apparatus and more particularly to testing apparatus adapted for use in applying a source of high potential current for test purposes to parts of electrical devices such as across the terminals of transformer coils, across the insulation between conductors, and so forth.

The general object of the invention is to provide a portable testing device of the nature mentioned above which shall be efficient and convenient to use. Another object of the invention is to provide a portable high potential testing device which may be safely taken directly in the hands and applied to the apparatus to be tested without the necessity of making permanent connections. A further object of the invention is to provide a portable testing device so constructed that all exposed conducting surfaces are automatically disconnected from the source of current except during such times as they are deliberately connected therewith by pressure upon a contact actuating portion of the device. By reason of this latter feature of the invention, the device cannot be left inadvertently with any portion of its exposed surface connected with the source of current so as to be dangerous to handle.

One embodiment of the invention is illustrated in the accompanying drawing in which Fig. 1 is a view of a pair of high potential test handles or electrodes equipped with insulated conductors adapted to connect them with a suitable source of high potential current, Fig. 2 is a sectional view of one of the handles and Fig. 3 is an enlarged sectional view of a portion of one of the handles.

In the form of invention shown in the drawing, a pair of test handles 1 and 2 are adapted to be connected with the two terminals of the source of current, although it is obvious that cases may arise where only one terminal of the source of current need be used, in which case the use of a single handle will be sufficient.

As shown in the section views of the drawing, the handle includes an insulating sleeve 3 which may be turned to the desired size and

shape from a piece of hard wood. Fitted into one end of this insulating sleeve is a stud 4 secured in position by the pin 5. A ferrule 6 is placed over the outer end of the stud 4 and a contact point 7 is threaded to the stud 4 outside the ferrule 6. The inner or rear end of the stud 4 is recessed to surround a spiral spring 8. Fitting the opening in the handle is a series of conducting contact rings 9 which are secured in definitely spaced relation by insulating spacers 10, these rings 9 and spacers 10 forming a lining for the handle and providing a central space in which a contact carrier 11 of insulating material may slide. Along the contact carrier 11 is a series of recesses, each recess accommodating a contact spring 12 formed and arranged to present two outwardly pressed contact surfaces, one at each end of the spring. The length of each spring 12 is such that the distance between its two contact surfaces corresponds with the spacing of the contact rings 9. Each spring 12 is thus adapted to be moved by the carrier 11 to bridge and conductively connect two successive contact rings 9 as shown in Fig. 3. The recesses for the contact springs 12 are relatively so disposed that successive springs are angularly displaced, preferably 180 degrees apart, about the carrier 11 and also overlap a short distance longitudinally of the carrier. This arrangement permits the adjacent ends of two successive contact springs 12 to make simultaneous contact with one of the contact rings 9, the two springs extending in opposite directions to make contact also with two other rings disposed on opposite sides of the first ring. The first or forward spring 12 is arranged to bridge the space between and to connect the recessed inner end of the stud 4 and the first or forward one of the contact rings 9. In the handle shown in the drawing, the contact carrier 11 is provided with five contact springs, but the handle may be designed with fewer or more than this number of springs if desired. The forward end of the contact carrier 11 is provided with a stop 13 extending inside the spiral spring 8 and adapted to strike the bottom of the recess in

the stud 4 to arrest forward motion of the contact carrier when the contact springs 12 have been moved into position to connect together the rings 9 and stud 4.

5 From near the rear end of the contact carrier 11, an opening or passage extends rearwardly and outwardly at an acute angle to the axis of the handle and a plunger 14 slides in this opening. The adjacent ends of the
10 plunger 14 and the contact carrier 11 are formed with opposing recesses between which is fitted a pin 15, there being thus formed between the plunger and carrier a flexible compression joint. The plunger 14 is formed
15 with an inner beveled shoulder 16 and an outer beveled shoulder 17, these beveled shoulders being arranged to engage a stop 18 in the form of a ring surrounding the plunger and secured in place by a screw 19.
20 Pressure upon the plunger 14 will be communicated through the pin 15 to the contact carrier 11 and move this carrier forward against the spiral spring 8 until the stop
25 13 strikes the bottom of the recess in the stud 4, the spring contacts 12 being moved by the carrier into position to connect together in series the rings 9 and the stud 4 as shown in Fig. 3. Just beyond the outer shoulder
30 17, the plunger is smaller than the opening in the stop 18 so that in the contact making position of the plunger it may be moved laterally to bring one side of the shoulder
35 17 into engagement with the stop 18, a very slight lateral pressure on the plunger being then sufficient to maintain this engagement and keep the contacts between the contact
40 springs 12 and the rings 9 and stud 4 closed against the pressure of the spiral spring 8. Upon removing this lateral pressure from the plunger 14, however, the pressure of the
45 spiral spring 8 will cause the beveled shoulder 17 of the plunger to become disengaged from the stop 18, the parts then moving under the pressure of the spring into the position
50 shown in Fig. 2 with the inner beveled shoulder 16 in engagement with the stop 18. The distance between the two beveled shoulders 16 and 17 of the plunger is preferably one half of the distance between the two contact
55 surfaces at the opposite ends of one of the contact springs. Consequently, while the spring 8 is holding the contact parts away from the stud 4 with the shoulder 16 in engagement with the stop 18, the contact surfaces of the contact springs 12 are midway between and out of engagement with the contact
60 rings 9. As the trailing contact surface of each contact spring 12 leaves the contact ring 9, it is immediately followed by a portion of the insulating contact carrier 11 which covers the portion of the contact ring where contact was broken and which also serves as an insulating body interposed between the
65 contact spring and the contact ring while the contacts are broken. Thus, by pressing

and releasing the contact making plunger 14, the contact point 7 of the test handle is connected with and disconnected from the rear contact ring 9, there being twice as many
70 make and break series contacts in this path as there are contact springs, the handle shown in Fig. 2 having five contact springs and therefore ten make and break contacts. The number of springs and contacts may be more
75 or less if desired depending on the characteristics of the current which is to be interrupted when the contacts are broken. The mechanism which has been described for making and breaking the circuit in the test handle constitutes a multiple break plunger switch
80 adapted for use in high potential circuits.

The end of the test handle just behind the plunger 14 forms a grip so as to be conveniently held in the hand with the thumb in position to operate the plunger 14. This
85 rear portion of the handle surrounds one end of the insulated cable 20. A set screw 21 secures in place a tube 22 of any suitable material which surrounds and retains the end of the cable inside the handle. The cable
90 includes a central conductor 23 of fine copper strands covered by suitable layers of insulation. The outside layer is preferably of heavy cotton covering a layer of fine copper wire braid 24. Inside the handle, this outer
95 cotton braid is removed to expose the copper braid 24 which is connected by a link 25 with the ring or stop 18. A stiff helical spring 26 protects the cable at the point where it enters the handle. The conductor 23 is extended inside the handle and connected to
100 the rear contact ring 9 so as to furnish testing current for the contact point 7 at such times as the contacts of the switch are closed by depressing the plunger 14.

105 These test handles are preferably used in pairs as indicated in Fig. 1, the ends of the cables opposite the two handles of a pair being provided with lugs 27 for attachment to the source of high potential current such as a transformer. The wire braid covering 24
110 and any coverings outside this one are removed from each cable for a sufficient distance from the lugs 27 to prevent short circuiting them. The outer covering above is then removed from each cable to expose the wire
115 braid covering 24 for a short distance and the two cables secured together at this point by a metal clamp 28 provided with a chain 29 which may be attached by a hook at its free end to some suitable ground, the length of the chain being adjusted to relieve the cables of strain. It will be seen that ground connection is furnished through the chain 29 to the clamp 28, the braided copper covering 24 of
120 the cables, and through the links 25 to the plunger 14. Grounded protection is therefore provided for the operator against shock under normal conditions attending the use of the handle and also in the event of failure of
125 130

the insulation at any point as it lies between the operator and the live conductors practically throughout the circuit. Just in front of the plunger 14, the test handle is abruptly enlarged to form a protecting collar or guard 30 which prevents the operator's hand from sliding forward on the handle toward the contact point 7.

The switch contacts are held normally open by the spiral spring 8. In testing a piece of electrical apparatus, such as a high tension winding of a transformer, the handles are connected by means of the cables 20 with a source of current of the proper potential for testing and the chain 29 is properly grounded. The contact points 7 are then touched to the terminals of the device under test, the sharp ends of these contact points assuring good electrical connection. The plungers 14 are then depressed to close the switch contacts, thus connecting the high potential source of current to the device under test. Slight lateral pressure on the plungers 14 holds the beveled shoulders 17 in engagement with the stops 18 to keep the contacts of the switch closed as long as it is desired to subject the transformer or other device to test. At the end of the test, the lateral pressure on the plungers is removed and the spiral springs 8 cause the beveled shoulders 17 to disengage from the stops 18 and the movable switch parts to disconnect the switch contacts, the shoulders 16 coming into engagement with the stops 18 to cooperate with the spiral springs 8 in maintaining the switches in normal open condition. The opening of the switch is entirely automatic so that it is impossible to leave the switch contacts closed and the exposed points 7 of the handles alive while the plungers 14 are not being deliberately and wilfully depressed by the operator. When the high tension circuit is opened by a pair of handles constructed in accordance with the showing in Fig. 2 of the drawing, the switch in each handle makes ten breaks in the circuit and insulating material is immediately interposed between the separated contacts of half of these breaks. The precaution of using a circuit breaker in the low voltage side of the transformer which furnishes the high potential testing current is of course advisable.

What I claim as new and desire to secure by Letters Patent of the United States, is—

1. In electrical apparatus, an insulating sleeve surrounding an elongated space having a section of uniform diameter, a conducting member at one end of said sleeve, a contact carrier having slidable fit in the uniform section of said elongated space, a series of conducting contacts on said contact carrier, a second series of contacts secured to said sleeve along the uniform section of said elongated space, an operating member beyond the end of said contact carrier opposite said con-

ducting member, said operating member extending through one side of said sleeve at an acute angle to the direction of motion of said contact carrier, and a flexible joint between the inner end of said operating member and the adjacent end of said contact carrier, whereby said contact carrier may be moved toward said conducting member to connect said contacts in series.

2. In electrical apparatus, a switch including a movable contact operating member, a member for moving said contact operating member in one direction to complete a circuit between contacts, said latter member being movable in a direction at an acute angle to the direction of movement of said contact operating member, said two members having opposed recesses formed in adjacent portions thereof, a compression member held between said two recesses to form a universal joint, and means for moving said contact operating member in the other direction to break said circuit.

3. In electrical apparatus, a switch including a movable contact operating member, a member for moving said contact operating member in one direction to complete a circuit between contacts, said latter member being movable in a direction at an acute angle to the direction of movement of said contact operating member, said two members having opposed recesses formed in adjacent portions thereof, a compression member held between said two recesses to form a universal joint, and means for automatically moving said contact operating member in the other direction to break said circuit.

4. In electrical apparatus, a switch including a movable contact operating member, a member for moving said contact operating member in one direction to complete a circuit between contacts, said latter member being movable in a direction at an acute angle to the direction of movement of said contact operating member, a compression member held between adjacent portions of said two members to form a universal joint, and means for moving said contact operating member in the other direction to break said circuit.

5. In electrical apparatus, a switch including a contact operating member, a plunger for moving said member in one direction to complete a circuit between contacts, means for automatically moving said member in the other direction to break said circuit, said plunger having a shoulder, and a shoulder engaging stop, said plunger being movable laterally to cause its shoulder to engage said stop when said circuit has been completed, said plunger having a second shoulder engageable by said stop after said circuit has been broken.

6. In electrical apparatus, a switch including a hollow insulating member with a plurality of contacts on its inner surface, an in-

insulating carrier slidable within said member, and having a plurality of contacts displaced longitudinally thereof, and means for moving said carrier to connect and disconnect its contacts and those of said insulating member, said insulating carrier fitting the space within said hollow insulating member,

whereby the path between contacts is closed by insulation to prevent arcing when the contacts are separated.

In witness whereof, I have hereunto set my hand this 4th day of Nov., 1921.

ALLAN B. HENDRICKS, JR.