Jan. 26, 1932. R. C. WHELCHEL 1,842,810

COMMUTATOR TESTING DEVICE

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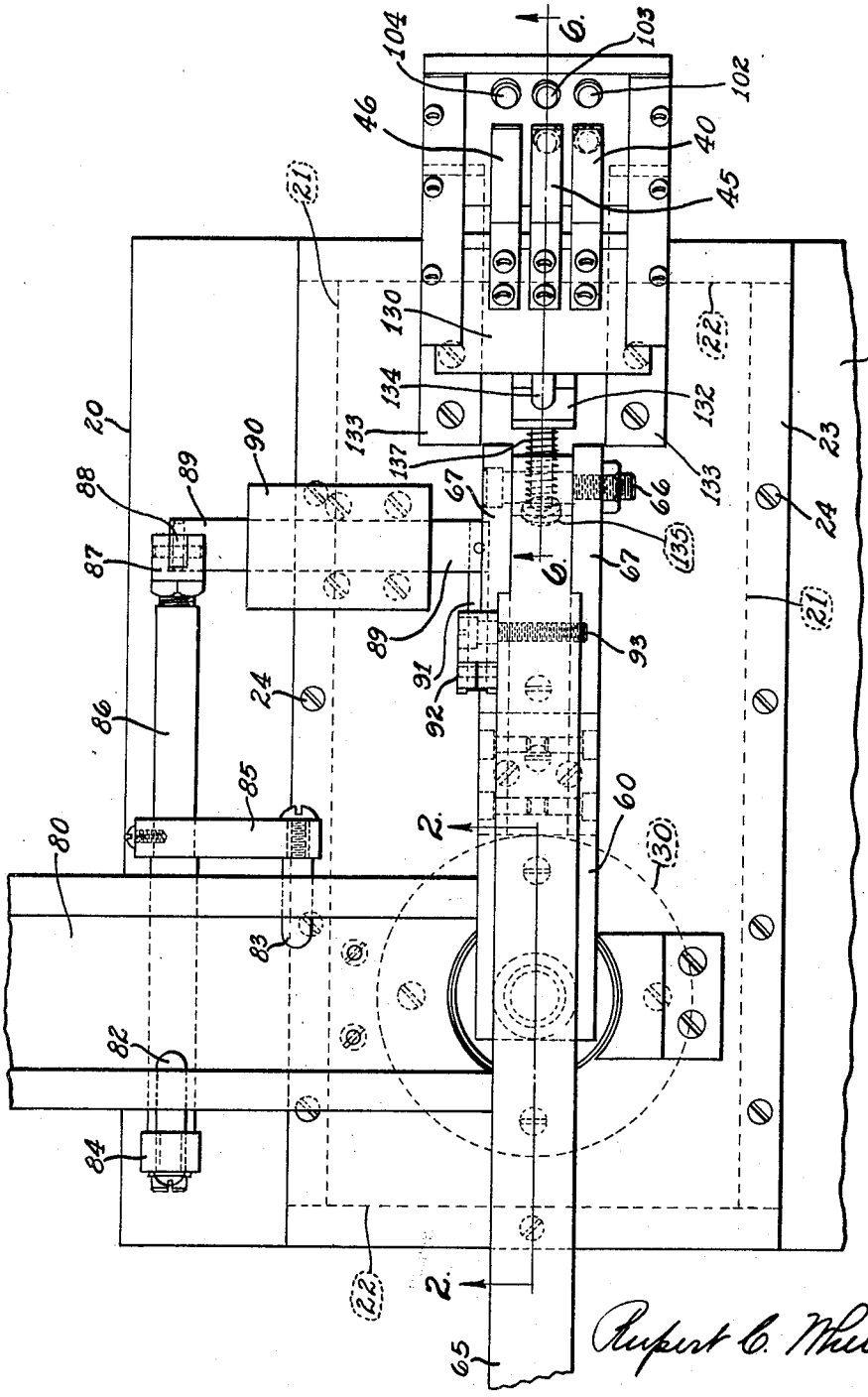


Fig. 1.

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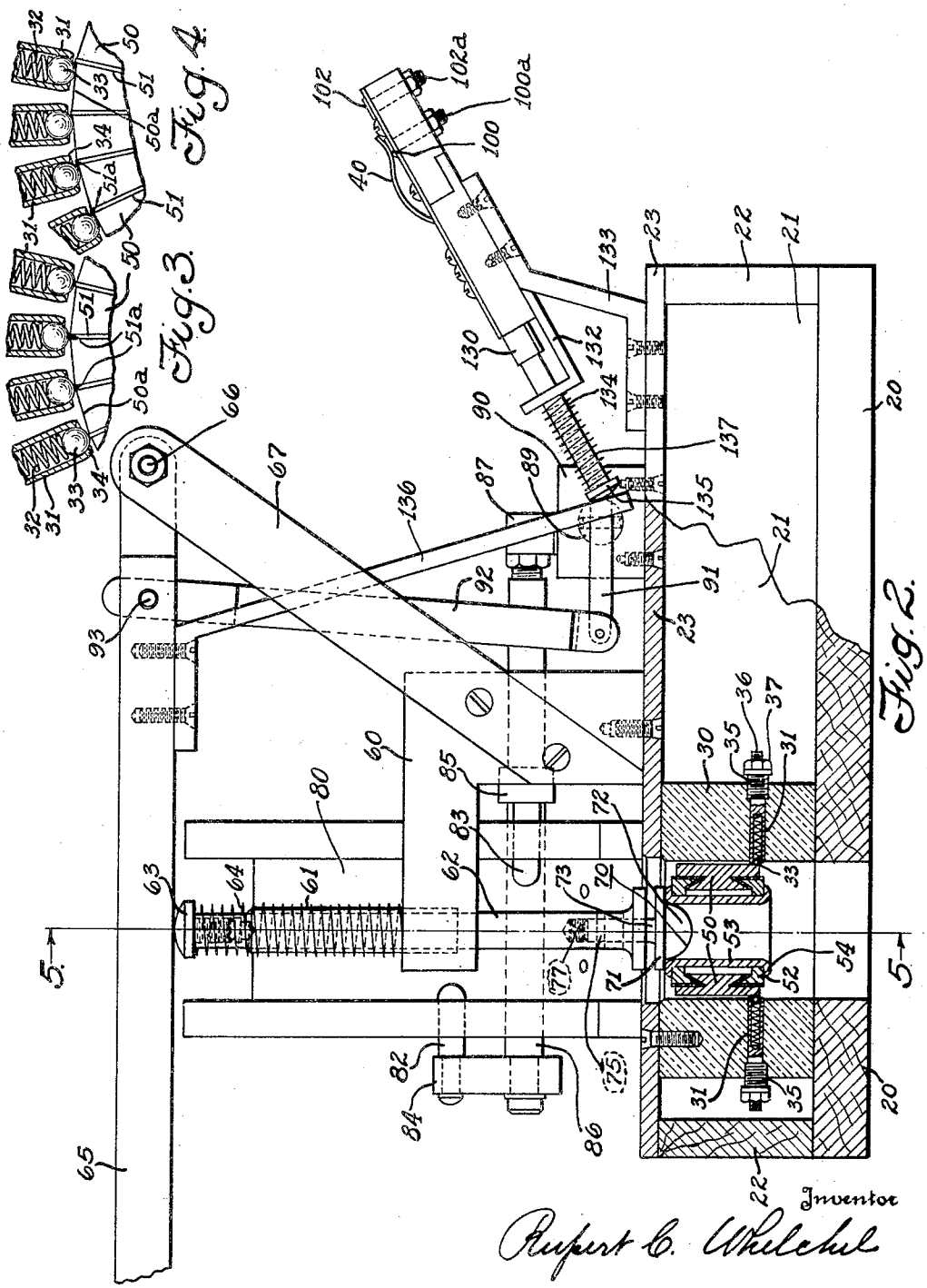


Fig. 2.

Fig. 3.

Fig. 4.

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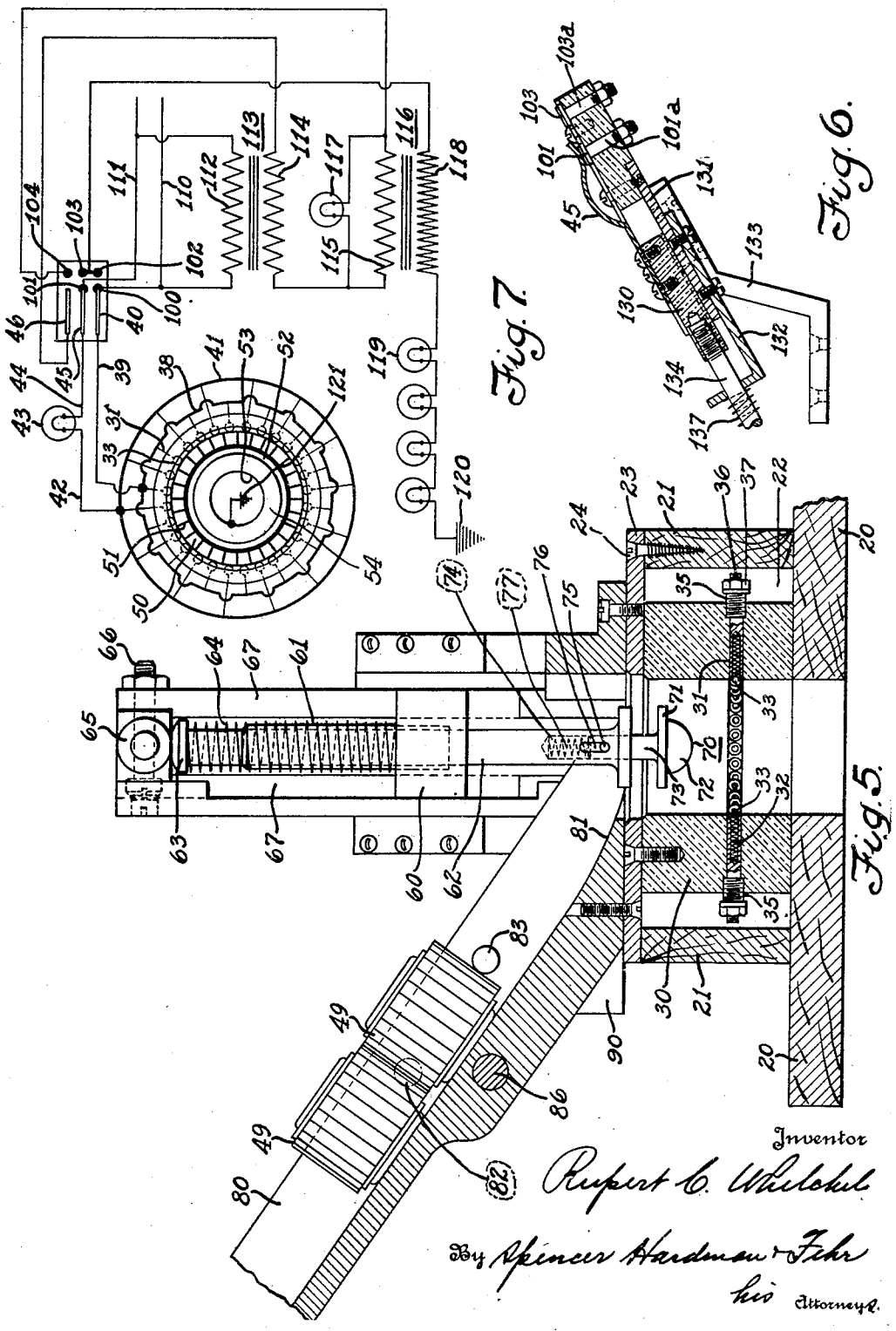


Fig. 7.

Fig. 6.

Fig. 5.

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UNITED STATES PATENT OFFICE

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COMMUTATOR TESTING DEVICE

Application filed November 19, 1930. Serial No. 496,645.

This invention relates to apparatus for testing the commutators of dynamo electric machines prior to its assembling the commutators upon armature shafts.

It is an object of the present invention to provide a durable and efficient commutator testing machine which can be manufactured at relatively low cost.

Carrying out this object of the invention means are provided for pushing commutators successively through a work holder, the walls of which support an annular row of contacts each adapted to bear against a commutator segment. The means for pushing the commutators through the work holder is associated with electrical switching means for connecting up the commutator segment contacts of the work holder in a manner such that the commutator will be tested for short circuits between adjacent segments and also for short circuits between any of its segments and its metallic core by which the commutator is mounted upon a shaft.

Further objects and advantages of the present invention will be apparent from the following description, reference being had to the accompanying drawings wherein a preferred embodiment of one form of the present invention is clearly shown.

In the drawings:

Fig. 1 is a plan view of an embodiment of the present invention.

Fig. 2 is a side elevation partly in section, the section being taken on the line 2—2 of Fig. 1.

Figs. 3 and 4 are diagrammatic views showing on an enlarged scale a fragment of a commutator engaged by commutator contact members which are shown in section.

Fig. 3 shows the contact members engaging the insulation between the commutator segments, and Fig. 4 shows a commutator segment engaged by the contact members.

Fig. 5 is a sectional view on the line 5—5 of Fig. 2.

Fig. 6 is a sectional view on the line 6—6 of Fig. 1.

Fig. 7 is a wiring diagram illustrating the use of the present invention.

The apparatus comprises a base 20 of wood or other suitable nonconducting material supporting side plates 21 and end plates 22 thus providing a box like structure which receives a metallic cover plate 23 secured by screws 24 to the side and end plates. This box-like structure houses a nonconducting work holder 30 having a central passage therethrough through which commutators to be tested are pushed one at a time. The work holder 30 supports an annular row of conducting tubular members 31 each providing a guide for receiving a spring 32 bearing against a ball 33. The inner end of the tube 31 is swedged inwardly to provide a flange 34 (see Figs. 3 and 4) for retaining the ball 33 in the tube. Each tube 31 is provided with a threaded portion 35 which screws into a tapped hole in the work holder 30, and is provided with a threaded outer end 36 for receiving a nut 37 by which a wire is secured to the tube 31. Referring to Fig. 7 the ball contacts 33 are represented diagrammatically by the small circles 33 and the tubes 31 are represented by the radial lines 31 extending from the circles. Alternate tubes 31 are connected together by a wire 38 connected by a wire 39 with a switch contact 40. The remaining tubes 31 are connected by a wire 41 connected with a wire 42 connected with an indicating lamp 43 connected by wire 44 with a switch contact 45. These wires have been omitted in Figs. 1, 2 and 5 for sake of clearness.

The commutator 49 to be tested comprises an annular row of segments 50 alternating with insulation pieces 51 and insulatingly supported upon V-clamping rings 52 mounted upon a central core 53 having its ends swedged over at 54 against the outer faces of the clamping rings 52. As the commutator is forced through the work holder 30 by a mechanism to be described each of its segments 50 will be engaged by a contact ball 33 as shown in Fig. 4. In case the commutator should start to move through the work holder 30 in a manner such that the insulating pieces 51 are each engaged by a contact ball 33, it has been found that the insulation pieces 51 will not remain in engagement with the balls 33 during any sub-

stantial portion of movement of the commutator through the work holder but that the commutator will automatically turn from the position shown in Fig. 3 to that shown in Fig. 4 when pressure is applied to force the commutators downwardly through the work holder from the position shown in Fig. 2. The testing of the commutator is done before it is assembled upon an armature shaft and hence before the outer surface of the commutator is machined concentric with the axis of the shaft. Before machining the commutator the outer surface 51*a* of each insulation piece 51 extends slightly beyond the outer surfaces 50*a* of the segments 50. The slightest tendency for the commutator to turn as it is pushed through the work holder will immediately be assisted by the springs 32 tending to push the balls 33 as close in toward the commutator as it is possible for them to move. Since the commutator passes very loosely through the work holder, it is certain that the commutator will not move through the work holder without even the slightest turning. Therefore, if the commutator starts down through the work holder with its insulation pieces 51 engaged by the balls 33, the commutator will very soon turn slightly so that the balls 33 will engage the segments 50. Hence, it is apparent that the segments 50 of the commutator will be automatically brought into engagement with the contact balls 33 without requiring any means for guiding the commutator through the work holder in a precise manner. It is also evident that none of the balls 33 can provide an electrically conducting path from one segment 50 to an adjacent segment since the insulation pieces 51 extend beyond the surfaces 50*a* of the segments 50 before the commutator is machined.

Before completing the description of the wiring diagram in Fig. 7, the mechanism for pushing the commutator through the work holder and for controlling the circuits leading to the contact balls 33 will be described.

The plate 23 carries an L-shaped metal bracket 60 which supports a metal guide tube 61 located vertically above the passage through the work holder 30. The tube 61 guides a metal rod 62 which receives at its upper end a screw 63, the head of which retains a spring 64 bearing at its lower end upon the bracket 60. Thus the spring 61 normally maintains the rod 62 in an uppermost position permitting movement of commutators to the upper end of the work holder passage and resisting movement of the rod 62 downwardly into the positions shown in Figs. 2 and 5. The rod 62 is moved downwardly by a lever 65 made preferably of non-conducting material and pivoted upon a screw 66 attached to brackets 67 which are attached to the bracket 60. In order to insure making a good electrical contact between the metal rod 62 and the commutator core 53, the rod carries at its lower end a contact member 70 having a flange 71 adapted to rest upon the upper end of the core 53 and having a semi-spherical projection 72 adapted to fit within the core 53. The contact 70 has a stem 73 which is slidable somewhat loosely into a recess 74 provided by the rod 62. The stem 73 carries a pin 75 the ends of which extend in opposite directions into elongated slots 76 provided by the rod 62. In this way relative axial movement may take place to a limited extent between the rod 62 and the contact 70. A spring 77 located in the recess which receives the stem 73 urges the contact 70 downwardly so that the pin 75 normally is located at the lower ends of the slot 76.

The commutators 49 descend through a chute 80 and are permitted to pass from the chute one at a time to the central passage through the work holder 30. The bottom surface 81 of the chute is curved adjacent the upper end of the work holder 30 so that the commutators 49 will descend endwise from the chute into the work holder passage. The mechanism which feeds the commutators one at a time from the chute to the work holders comprises pegs 82 and 83 carried respectively by arms 84 and 85 attached to a rod 86 guided for horizontal sliding movement by the chute 80 and attached to a forked block 87 which is pivotally connected with a lever 88 carried by a shaft 89 journalled in a block 90 attached to the plate 23. The shaft 89 carries an arm 91 connected with a link 92 which is pivotally attached at 93 to the lever 65. When the lever 65 moves upwardly from the positions shown in Figs 2 and 5, the shaft 89 will be turned clockwise as viewed in Fig. 2 thus causing the peg 83 to be retracted from the chute to permit the lowermost commutator 49 shown in Fig. 5 to pass from the chute into the work holder while at the same time causing the peg 82 (represented by the dot-and-dash line circle 82 in Fig. 5) to move under or against the lowermost side surface of the commutator 49 which is then the lowermost commutator remaining in the chute. During the downward movement of the lever 65 for the purpose of forcing the commutator in the work holder through the work holder to cause the commutator to be tested, the peg 82 will be retracted from the chute to permit the lowermost commutator in the chute to descend upon the peg 83 which was inserted into the chute while the peg 82 was being retracted.

During the downward movement of the rod 62 the switch contacts 40 and 45 are moved from an off position to the left of the position shown in Fig. 7 first into engagement with contacts 100 and 101 respectively, and then out of engagement with contacts 100 and 101 into engagement with contacts 102

and 103 respectively. At the same time another switch contact 46 is moved from a normal off position into a second off position shown in Fig. 7 when the contacts 40 and 45 are moved into engagement with contacts 100 and 101 respectively. When the contacts 40 and 45 are moved into engagement with contacts 102 and 103 respectively the contact 46 is moved into engagement with the contact 104. The contacts 100 and 101 are connected respectively with wires 110 and 111 connected with preferably a 110-volt lighting circuit. The wires 110 and 111 are connected with the primary 112 of a 1-to-1 ratio transformer 113 whose secondary 114 is connected in series with the primary winding 115 of a step-up transformer 116 and with contacts 104 and 46. A signal lamp 117 is connected across the terminals of the transformer primary 115. The secondary 118 of the step-up transformer 116 is connected with one or more indicating lamps 119 grounded at 120 and with both contacts 102 and 103. The ground connection 121 with the core 53 shown in Fig. 7 is made when the contact 70 engages the core 53 as shown in Fig. 2, the plate 23 which has an electrical connection with the contact 70 being grounded.

The contacts 40, 45 and 46 are mounted on a non-conducting block 130 guided for sliding movement by a switch frame 131 carrying a bracket 132 and attached to a bracket 133 mounted on the plate 23. The bracket 132 provides a guide for a switch rod 134 threadedly connected with the block 130 and carrying at its lower end a head 135 which bears against an arm 136 attached to the lever 65. A spring 137 surrounding the rod 134 and located between the head 135 and the bracket 132 tends to maintain the block 130 in lowermost position against the stop bracket 132 and resists movement into the contact making position shown in Figs. 1, 2, 6 and 7. The stationary contacts of the switch are provided by the heads of bolts to which corresponding reference numerals are applied with the affix "*a*".

The testing apparatus is used in the following manner: The lever 65 normally stands in such position due to the action of the spring 64 that the peg 83 is retracted from the chute to permit a commutator to pass from the chute and to descend vertically into the passage of the work holder 30 until the lower end edges of its commutator segments rest against the balls 33 which project into the central passage in the work holder. The commutator is pushed through the work holder by pushing the lever 65 downwardly. This downward movement of the lever causes the switch contacts 40, 45 and 46 to move from the normal off position into the position shown in Figs. 1, 2, 6 and 7 thereby connecting the contacts 40 and 45 with a 110-volt circuit while the contact 46 remains unconnected with any circuit. If a short circuit should exist between any two adjacent commutator segments an electrical circuit to the signal lamp 43 will be established. By the burning of this lamp this short circuit between adjacent commutator bars will be detected and the commutator will be rejected by the operator. As the operator continues the downward movement of the lever to force the commutator below the contact balls 33 so that the commutator may drop from the apparatus, the contacts 40, 45 and 46 are finally brought into engagement with the contacts 102, 103 and 104 respectively. When this occurs, the contacts 46 and 104 being closed, the series connection between the transformer secondary 114 of the 1-to-1 transformer 113 and the transformer primary 115 of the step-up transformer 116 will be established and the establishment of this connection is indicated by the burning of the lamp 117. The engagment of the contacts 100, 101, 102 and 103 will cause all of the commutator segments to be connected with one end of the secondary 118 of the step-up transformer 116. Should there be a ground between any commutator segment and the core 53 a circuit will be completed between the core and the other end of the step-up transformer secondary 118 through the signal lamps 119. Hence the burning of the signal lamps 119 will indicate the presence of a short circuit between any commutator segment and the commutator core 53.

From the foregoing description of the construction and mode of operation of this testing device it is apparent that the testing of commutators can be effected very rapidly since all that the operator is required to do is push the lever 65 downwardly to force a commutator through the work holder while the operator watches the signal lamps 43 and 119 which are preferably red lamps and also watches the lamp 117 which is preferably a clear lamp which will burn each time the lever 65 is pushed downwardly in order to indicate the operativeness of the high voltage transformer circuit. The burning of the lamps 43 and 119 will indicate to the operator that the commutator has not passed the tests and hence must be rejected.

While the form of embodiment of the present invention as herein disclosed, constitutes a preferred form, it is to be understood that other forms might be adopted, all coming within the scope of the claims which follow.

What is claimed is as follows:

1. A commutator testing device comprising, in combination, a block for receiving a commutator having an annulus of insulated segments, an annular row of contacts insulatingly supported by the block each adapted to engage a segment of the commutator when it

is moved through the block, means for moving a commutator through said block, and an electric circuit including a signalling device controlled by said commutator moving means for indicating a short circuit between adjacent commutator segments.

2. A commutator testing device comprising, in combination, a block for receiving a commutator comprising an annular row of insulated segments insulatingly attached to a central metallic core, an annular row of contacts insulatingly supported by the block each adapted to engage a segment of the commutator, means for moving the commutator through said block, and an electric circuit including a signalling device controlled by said commutator moving means for indicating a short circuit between any segment and the core.

3. A commutator testing device comprising, in combination, a block for receiving a commutator comprising an annular row of insulated segments insulatingly attached to a central metallic core, an annular row of contacts insulatingly supported by the block each adapted to engage a segment of the commutator, means for moving the commutator through said block, electric signalling means, a circuit established by a first movement of the commutator moving means for connecting alternate segments with a current source and an electric signal whereby the circuit may be completed between the signal and current source by a short circuit between adjacent segments, and another circuit established by a further movement of the commutator moving means for connecting the segments and the core with a current source and an electric signal whereby a circuit may be completed between a signal and the current source by a short circuit between any segment and the core.

4. A commutator testing device comprising, in combination, a block for receiving a commutator comprising an annular row of insulated segments insulatingly attached to a central metallic core, an annular row of contacts insulatingly supported by the block each adapted to engage a segment of the commutator, means for moving the commutator through said block, means operated by the commutaor moving means for feeding comuators singly from a chute to the block, electrical signalling means, and electric circuits rendered operative successively by operation of the commutator moving means for causing the signalling means to indicate a short circuit between adjacent commutator segments or between any segment and the core.

5. A commutator testing device comprising, in combination, a block for receiving a commutator comprising an annular row of insulated segments insulatingly attached to a central metallic core, an annular row of contacts insulatingly supported by the block each adapted to engage a segment of the commutator, means for moving the commutator through said block, electrical signalling means, a switch having a contact connected with alternate segments and another contact connected with the remaining alternate segments, said switch being operated by the commutator moving into one of its positions, means to connect the segment contacts separately in series with a current source and an electric signal in order to indicate a short circuit between adjacent segments, and operated by the commutator moving means into another of its positions to connect both segment contacts together in series with an electric signal, a current source and the core.

In testimony whereof I hereto affix my signature.

RUPERT C. WHELCHEL.