S. T. HUTTON.

ELECTRIC SWITCHING APPARATUS.

APPLICATION FILED FEB. 13, 1909.

969,480.

Patented Sept. 6, 1910.

2 SHEETS—SHEET 1.

Fig. 2.

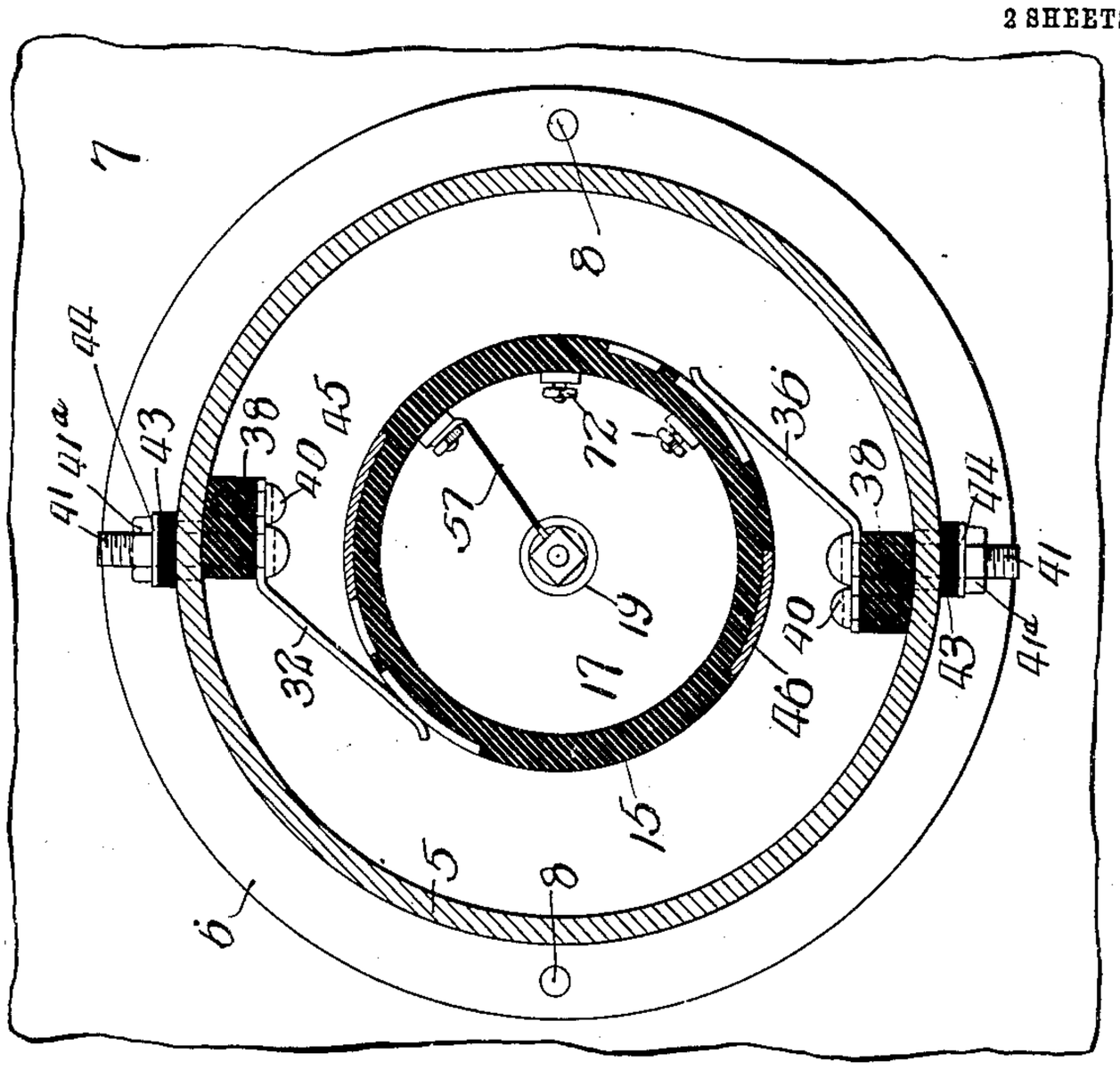

Fig. 1.

Witnesses:
F. H. Alfred
G. M. Campbell

Inventor:
Samuel T. Hutton
by Poole & Brown
Attys

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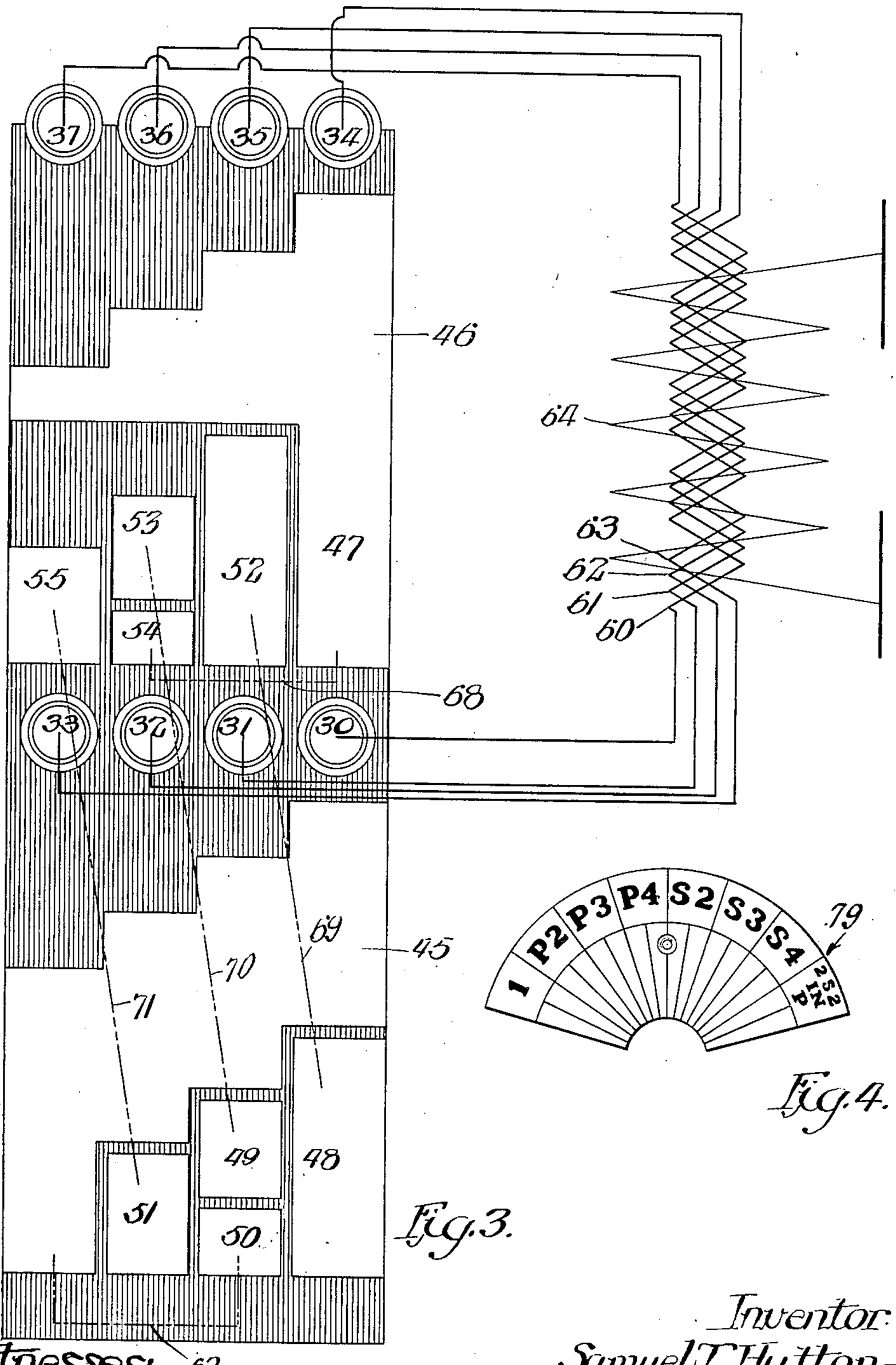

Fig. 3.

Fig. 4.

Witnesses:
F. H. Alfreds
S. M. Campbell

Inventor:
Samuel T. Hutton
by Poole & Brown
Attys

UNITED STATES PATENT OFFICE.

SAMUEL T. HUTTON, OF CHICAGO, ILLINOIS, ASSIGNOR TO SHEIDEL WESTERN X-RAY COIL COMPANY, OF CHICAGO, ILLINOIS, A CORPORATION OF ILLINOIS.

ELECTRIC SWITCHING APPARATUS.

969,480. Specification of Letters Patent. Patented Sept. 6, 1910.

Application filed February 13, 1909. Serial No. 477,576.

To all whom it may concern:

Be it known that I, SAMUEL T. HUTTON, a citizen of the United States, and a resident of Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Electric Switching Apparatus; and I do hereby declare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawings, and to the letters of reference marked thereon, which form a part of this specification.

This invention relates to an electric switch for connecting in various relations a number of conductors, such as heat or resistance coils, incandescent lamps, etc., and more particularly to a switch which is arranged to connect such conductors with a current supply source, in series, multiple or series multiple with each other.

A switch made in accordance with my invention embraces a rotating member carrying insulated contact members which are interconnected electrically and brushes adapted to separately or simultaneously engage with the various contact members to connect pairs of said brushes in various relations.

The invention consists in the matters hereinafter set forth and more particularly pointed out in the appended claims.

In the drawings illustrating this invention in which same is shown as applied to an induction coil the primary of which is composed of coil sections:—Figure 1 is a longitudinal cross sectional view of the device, with parts broken away. Fig. 2 is a transverse cross sectional view taken upon line 2—2 of Fig. 1. Fig. 3 is a view developed on a plane of the rotating member, showing diagrammatically the external and internal connections. Fig. 4 is a front view of a dial plate used in connection with my device.

In the said drawings 5 designates a metal casing having the form of a cylinder open at one end and having on the margin of its cylindric wall, at its open end, a flange 6 by means of which the said casing is secured to a panel 7 of insulating material, such as slate, marble or wood, the means of attachment consisting of screws or bolts 8, 8 which extend through the said panel and engage with screw threaded holes provided in the said flange. At its closed end the said casing is provided with a flat end wall 9, upon which is centrally located an outwardly projecting, centrally apertured hub 10, which forms a journal bearing for a stub shaft 19 as hereinafter described.

Within the metal casing 5 is located the rotative part of the switch, which comprises a hollow cylinder 15 of hard rubber, fiber or some other suitable insulating material. Closing the ends of this hollow cylinder are disks 16 and 17 of the same material as the cylinder, said disks being equal in diameter to the inside diameter of the said cylinder and secured in either end thereof by means of screw threaded studs 18, 18. To the outer face of the cylinder 15 are secured a plurality of metal contact plates which are preferably inlaid so that their outer faces are flush with the surface of the cylinder. The several contact segments are electrically connected with each other in the manner and for the purpose hereinafter set forth. The said drum or rotating member is rotatively supported at one end by means of the stub shaft 19 which is provided with a screw threaded stud 20 which engages with a screw threaded opening in the center of the disk 16. At its outwardly extending end the said shaft is rotatively supported in the hub 10 of the metal shell 5. At its end adjacent to the panel 7 the said drum is supported by a stub shaft 22 which is provided with a screw threaded stud 23 which is engaged with a central screw threaded opening in the end disk 17. The outwardly extending end of the said shaft 22 is supported in a metal bearing sleeve 24 which is inserted and secured in a cylindric aperture in the panel 7, said sleeve being provided with a collar 25 which bears against the inner face of the said panel. The inner ends of the said stub shafts 19 and 22 are reduced in diameter to form screw threaded studs 26 and 27, respectively, upon which are placed clamping or binding nuts 28, 28 between which and the adjacent shoulders on the shafts, the ends of conductors constituting parts of the internal electrical connections are clamped.

Located at diametrically opposite positions upon the periphery of the inner face of the metal casing 5 are two rows of spring metal brushes, the brushes of one row being designated by the reference numbers 30, 31, 32 and 33 and those of the other row by reference numbers 34, 35, 36 and 37. The brushes of both rows are insulated from each other and from the metal casing 5 by means

of brush blocks 38 and 39 of insulating material, the said brushes being secured thereto in rows of four each by means of screws 40, 40. The said brush blocks are secured to the inner surface of the metal casing 5 by means of a plurality of binding post screws 41, 41 which are inserted through the spring brush blocks and extend outwardly through the wall of the casing, the heads thereof being in contact with the said brushes. In the openings in the wall of the metal casing through which extend the screws 41, 41 are insulating bushings 42, 42 which surround the said screws and insulate them from the casing. At their outer ends the said screws 41, 41 are provided with fiber or hard rubber washers 43, 43 which rest upon, and insulate the screws from the surface of, the casing. Resting upon the insulating washers 43, 43 are metal washers 44, 44 adapted for contact with electrical conductors which are clamped to the binding post screws by means of clamping nuts 41[a] which serve also to retain the brush blocks against the inner surface of the wall of the casing.

Upon the outwardly projecting end of the stub shaft 22 and secured thereto by means of a screw-threaded pin 80 is a knob 81 of insulating material, said knob being adapted to be grasped for rotating the drum. For indicating the relations in which the windings are connected there is secured to the face of the panel 7 an indicating dial 79 over the face of which travels an indicating finger or pointer 82 which is attached to the knob 81.

The four sections or coils of wire constituting the primary windings of an induction coil are indicated by 60, 61, 62 and 63. Said coils are connected with the two rows of brushes 30, 31, 32, 33 and 34, 35, 36, 37 through the binding posts, preferably in the following order: The terminals of the windings constituting the section 60 are connected to brushes 30 and 34, the terminals of the second section 61 to brushes 31 and 35, the terminals of the third section 62 to brushes 32 and 36 and the terminals of the fourth section 63 to the brushes 33 and 37. 64 indicates the secondary winding of the induction coil. 65 and 66 (Fig. 1) indicate conductors leading from the opposite terminals of a primary battery or generator and connected one with the metal casing 5 and the other with the metal bearing sleeve 25.

As shown in Fig. 3, the cylinder 15 carries upon its face metal plates 45 and 46 which are adapted as the said cylinder rotates to connect the brushes with the current supply source. The plate 45 which is equal in width to that of the cylindric surface of the cylinder is connected with one side of the current supply source through the medium of a wire 57, the stub shaft 22 and the metal bearing 24. The plate 46, which is located diametrically opposite to the plate 45 is also equal in width to that of the cylindric surface of the cylinder and is connected with the opposite side of the current supply source through the medium of a conductor 56 and the stub shaft 19 and the metal casing 5. Upon each of its side margins the metal plate 45 is provided with a series of angular notches forming an obliquely disposed row of steps each of slightly greater width than one of the brushes; said steps being adapted to make or break the circuit through the separate brushes of either row of brushes at succeeding intervals of time as the drum is rotated. The steps on the advance edge of the cylinder (assuming said cylinder to be rotating in a counter clockwise direction) have their transverse edges separated by equal spaces circumferentially of the cylinder while three of the steps on the rear margins of the said strip are equally spaced circumferentially while the fourth is of greater length. The metal plate 46 is provided on its advance or forward margin with a similar obliquely arranged row of steps for the same purposes. On its other rear edge the said metal strip has a straight margin extending three-fourths of the distance across the face of the cylinder which is adapted to make or break contact with three brushes of one row simultaneously as the cylinder is rotated, and at one side of said face has a rearwardly extended portion 47 arranged circumferentially in line with the foremost step on the advance edge of the plate. Located upon the side of the cylinder 15 bearing the strip 45 and insulated therefrom and from each other are rectangular metal plates, one of which, 48, is located in the path of the brushes 30 and 34, two others of which, 49 and 50, are in line with the brushes 31 and 35, and the fourth, 51, is in the path of the brushes 32 and 36. Similarly upon the side of the cylinder 15 bearing the strip 46 and insulated therefrom and from each other are located rectangular metal plates, of which the plate 52 is in the path of the brushes 31 and 35, the plates 53 and 54 are in the path of the brushes 32 and 36 and the plate 55 is in the path of the brushes 33 and 37. At their forward ends the plates 52, 53 and 55 are progressively at greater distances circumferentially rearwardly from the rear straight transverse margin of the plate 46, and their rear ends are in alinement transversely with the rear end of the projection 47 of said plate 46. The forward ends of the plates 48, 49 and 51 are closely adjacent to the stepped rear edges of the plate 45, while the rear margins of the said plates 48 and 51, and that of the plate 50 are transversely in line with the rear margin of the rearmost step of the plate 45.

For connecting the coil sections 60, 61, 62

and 63 in various relations with each other the plates upon the cylinder are interconnected in the relations shown and hereinafter described by means of binding posts (Figs. 1 and 2) within the hollowed out portion of the cylinder 15, said binding posts being adapted at their outer ends for contact with the metal strips and provided at their inner ends with binding nuts and washers 72, 72 for clamping the connecting wires in place.

As indicated in the diagrammatic and developed view Fig. 3 of the drawings, the internal connections are as follows: The plate 45 which is connected with one side of the current supply source is connected by a conductor 67 with the plate 50. The plate 47 which is connected with the opposite side of the current supply source is connected by a conductor 68 with the plate 54. The plates 48, 49 and 51 are connected respectively with the plates 52, 53 and 55 by conductors 69, 70 and 71.

For delivering current from the supply source to the primary windings of the induction coil there is provided a binding post 73 which is attached to the metal shell 5 and a terminal 74 which is attached to the bearing 24. Through the binding post 73 current from one side of the source is delivered through the shell 5 and the stub shaft 19 to the plate 46, while current from the other side of the source is delivered through the terminal 74 and the stub shaft 22 to the metal plate 45.

With the connections made as hereinbefore described and with both sets of brushes resting upon the insulating portion of the drum face adjacent to the advance margins of the plates 45 and 46 the electrical path between the primary windings of the induction coil and the current supply source will be open and the operator desiring to close this circuit can do so by rotating the drum in a counter clockwise direction until the brushes 30 and 34 come into contact with the foremost ones of the obliquely disposed row of steps of the said plates 45 and 46. The remaining brushes still being upon the insulated portion, the circuit will be from the side of the battery connected with the plate 45 through the brush 30 and the winding 60 to the brush 34 and thence to the plate 46 and the other side of the battery, thus energizing with the entire battery current the section 60 of the primary winding. Further rotation of the drum in the same direction will move the succeeding steps of the plates 45 and 46 into contact with the brushes 31 and 35, providing two paths for the current; these being through the brushes 30 and 31, the windings 60 and 61 to the brushes 34 and 35 and the plate 46 to the opposite side of the current supply source, thus connecting the two windings in parallel with each other in the battery circuit. As the drum is rotated the windings 63 and 64 will be successively connected with the preceding winding and with the battery in a manner to provide a divided path for the battery current through each section of winding and the preceding ones until they are finally all connected in multiple. Further rotative movement of the cylinder after all of the windings have been connected in the multiple will disconnect the plate 46 from the brushes 35, 36 and 37, bringing the plate 52 into contact with the brush 35 and insulating the contact ends of the brushes 36 and 37. At the same time the plate 48 will be moved into contact with the brush 30 and the path of the current will now be from one side of the supply source connected with the plate 45 and brush 31, through the coil section 61 to the brush 35 and plate 52, thence through the conductor 69 to the plate 48 and the brush 30 through the coil section 60 to the brush 35 and the plate 46 to the opposite side of the battery, thus connecting the sections 60 and 61 in series with each other and with the battery. In a similar manner the winding 62 will be connected in series with the windings 60 and 61 and the winding 63 in series with the windings 60, 61 and 62 by means of the conductors 70 and 71 as the drum is rotated to move the plate connected by the said conductors into contact with the brushes connected with the terminals of the said windings. By still further rotation of the said drum the plates 50 and 54 will be brought into contact respectively with the brushes 31 and 36 providing a divided path for the current, part thereof passing from the plate 45 and the brush 35 through the winding 63 to the brush 37 and plate 55, thence through the conductor 71 to the plate 51 and brush 52, through the coil section 62 to the brush 36 and the plate 54 back through the conductor 68 to the plate 46 and the other side of the supply source. The other path for the current in this case will be through the plate 45, the conductor 67 to the plate 50 and brush 31 through the coil section 61 to the brush 35 and plate 52, thence through the conductor 69 to the plate 48 and brush 30 and through the coil section 60 to the brush 35 and plate 46 to the other side of the source, thus providing a path for the current through windings 63 and 62 which are in series with each other and through the windings 61 and 60 in series with each other, the two sets of series windings being connected in parallel with each other. Further rotation of the drum in the same direction will operate to connect the coil sections constituting the primary windings in their various relations except in a reverse order and with the current therethrough in a reverse direction to that above described. That is to say, there will first be two series of two layers

each, in parallel, succeeded by three in series, two in series, and so on until the drum has reached a position where the brushes are insulated from the windings and no current is flowing through the primary of the induction coil. In case that it is desired to use the switch in this latter manner, there may be employed an indicating dial similar to the dial shown except that the positions of the letters will be reversed to make them appear right side up.

Instead of arranging the sets of brushes in straight lines transversely of the cylinder, and making the forward edges of the plates 45 and 46 of stepped form, these parts may be arranged in other equivalent relation, adapted to secure the results in operation hereinbefore set forth, the other contact plates in the cylinder being disposed in any case circumferentially of the cylinder to accord with the positions of the several brushes.

I claim as my invention:—

1. In an electric switching apparatus in combination, two sets of brushes, and two sets of contact plates movable with respect to said brushes, each set of said contact plates embracing a plate connected with one terminal of a current supply source and adapted to coöperate through its relative movement with respect to said brushes to connect a desired number of said brushes with a current supply source, two other plates severally connected with the corresponding plates of the other set, each of said latter plates and its corresponding connected plate being adapted for simultaneous contact with a coöperating pair of brushes to connect two pairs of said brushes with the current supply source in series with each other, and a plate which is electrically connected with the first named plate, the last named plates being adapted to be brought simultaneously into contact with two of the said brushes to connect in parallel the pairs of brushes connected in series by the second named plates.

2. In an electric switching apparatus in combination, two rows of brushes, and two sets of contact plates movable with respect to the said brushes, said sets of plates embracing a pair of plates severally connected with the terminals of a current supply source, one plate of said pair being adapted to make or break contact at both side margins at succeeding intervals of time with the several brushes of one row and the other plate of said pair being adapted to make or break contact at one side margin at succeeding intervals of time and at the other side margin simultaneously with a plurality of the brushes of one row, a second pair of plates the plates of which are severally associated with the plates of the first named pair and are electrically connected with each other, the plates of the second pair of plates being so arranged that they coöperate with each other and with the first named pair to connect two or more pairs of brushes with the current supply source in series with each other, and a third pair of plates which are severally electrically connected with the plates of the first named pair and are adapted to be brought simultaneously into contact with one brush of each row while two other brushes of each row are severally in contact with the first and second pair of plates.

3. In an electric switching apparatus in combination, two rows of stationary brushes, two sets of movable contact members, each set consisting of a metal contact plate connected with one terminal of the current supply source, a second plate which is connected with the first named plate of the other set and a third plate which is electrically connected with the first named plate of the same set, and a rotatively mounted drum upon which said plates are carried, the corresponding plates of each set being located at diametrically opposite sides of said drum and so arranged with respect to each other that as said drum is rotated the contact plates will be brought into contact with the brushes to connect pairs of said brushes with the current supply source in various relations with each other.

4. In an electric switching apparatus in combination, a metal casing, two rows of brushes mounted in said casing and located at diametrically opposite sides thereof, said brushes being insulated from said casing and from each other, a rotatably mounted drum of insulating material located within said casing, metal contact plates inlaid in the cylindric surface of said drum and flush therewith, said metal plates comprising two sets, one plate of each set being connected with one terminal of a current supply source and plates of said sets of plates being adapted through the rotation of said drum to be brought separately or simultaneously into contact with said brushes to connect pairs thereof with the current supply source, in series, parallel or series parallel.

In testimony, that I claim the foregoing as my invention I affix my signature in the presence of two witnesses, this 6th day of February A. D. 1909.

SAMUEL T. HUTTON.

Witnesses:
G. M. CAMPBELL,
T. H. ALFREDS.