

(No Model.)

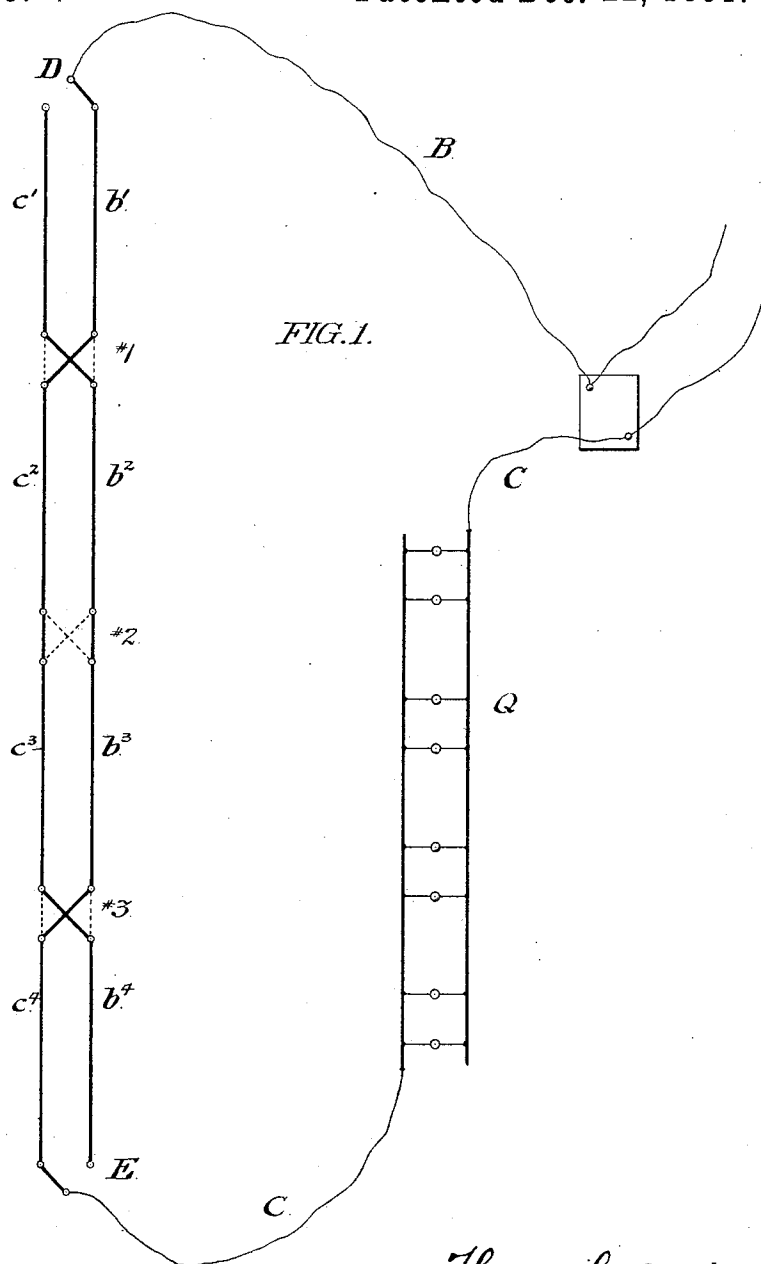
3 Sheets—Sheet 1.

T. C. SMITH & B. D. ACKER.

MEANS FOR TURNING ON AND OFF ELECTRIC CURRENTS.

No. 465,805.

Patented Dec. 22, 1891.



WITNESSES:

F. Norman Dixon
Lewis Altmaier

Thomas C. Smith
Benj. D. Ackers

INVENTORS:

By Their Attorneys,
Wm. C. Strawbridge
J. B. Sauer Taylor

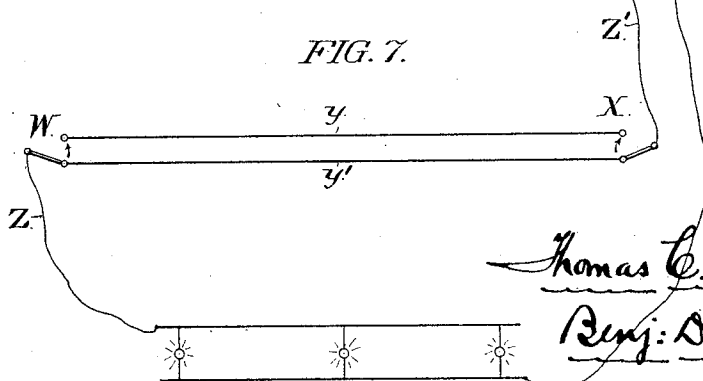
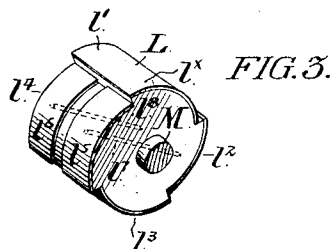
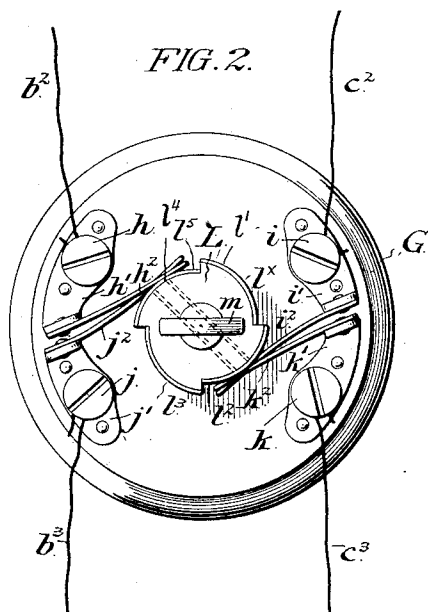
(No Model.)

3 Sheets—Sheet 2.

T. C. SMITH & B. D. ACKER.
MEANS FOR TURNING ON AND OFF ELECTRIC CURRENTS.

No. 465,805.

Patented Dec. 22, 1891.



WITNESSES:

J. Norman Dixon
Lewis Altmaier

INVENTORS:

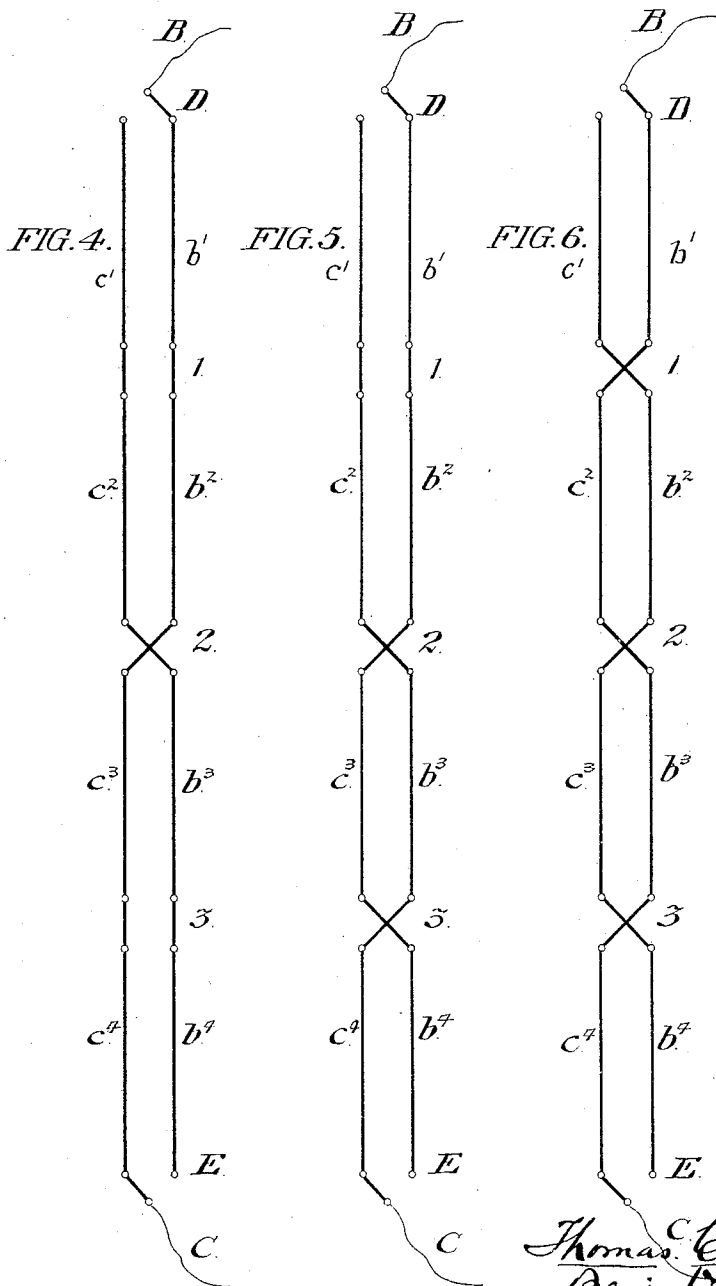
Thomas C. Smith,
Benj. D. Ackers,
By their Attorneys
Wm C. Strawbridge
Bmsaw Taylor

T. C. SMITH & B. D. ACKER.

MEANS FOR TURNING ON AND OFF ELECTRIC CURRENTS.

No. 465,805.

Patented Dec. 22, 1891.



WITNESSES:

J. Norman Dixon,
Lewis Altmaier.

Thomas C. Smith
Benj. D. Ackers
INVENTORS:

By Their Attorneys
Wm. C. Strawbridge
J. Benson Taylor -

UNITED STATES PATENT OFFICE.

THOMAS CARPENTER SMITH AND BENJAMIN D. ACKER, OF PHILADELPHIA, PENNSYLVANIA, ASSIGNORS TO ISAAC C. WALKER AND HENRY G. KEP-
LER, OF SAME PLACE.

MEANS FOR TURNING ON AND OFF ELECTRIC CURRENTS.

SPECIFICATION forming part of Letters Patent No. 465,805, dated December 22, 1891.

Application filed October 1, 1890. Serial No. 366,749. (No model.)

To all whom it may concern:

Be it known that we, THOMAS CARPENTER SMITH, a subject of the Queen of Great Britain, residing in the city and county of Philadelphia, in the State of Pennsylvania, and BENJAMIN D. ACKER, a citizen of the United States, and likewise a resident of the city and county of Philadelphia, in the State of Pennsylvania, have jointly invented certain new and useful Improvements in Means for Turning On and Off Electric Currents, of which the following is a specification.

Our invention relates to the means for locally controlling or turning on or off an electric current set up in a circuit utilized for any desired purpose, and relates especially to such currents as are employed to energize a series of electric lights.

Heretofore when a series of electric lights have been established upon a common circuit difficulty in their manipulation has been experienced in that while any number of points along the line might be provided at which the circuit could be opened, it has been necessary that the operator or user should, in turning the current on again, return to the place at which it was turned off, instead of being able to turn said current on or close the circuit from other points in the vicinity of which he might be along the line. Heretofore however a system has been devised of providing a pair of companion switch wires, which are both at one end connected respectively with two of the respective points of a three point switch, and are at the other end connected respectively with two of the respective points of a second three point switch, situated at a point more or less remote from the switch first named. Such an arrangement is shown in Fig. 7 of the drawings, in which W is one and X the other three point switch, and y y' the two companion switch wires. To the third point of the switch W the extremity of a line wire z is connected, and to the third point of the switch X the extremity of a line wire z' is connected. The line wires are always each in circuit with one or the other of the switch wires, and when both line wires are connected to the same switch wire, as for example, y , the circuit is

closed. When this is the case it is evident that the rotation of either switch so as to throw the extremity of the line wire connected with it into contact with the switch wire y' , will open the circuit, and when the current is so opened, it is apparent that the circuit can be closed at the point occupied by either switch, for the reason that one line wire being in circuit with one switch wire, and the other line wire in circuit with the other switch wire, rotation of either switch will necessarily place its main wire in circuit with the same switch wire which is in circuit with the other line wire. This system however cannot from the nature of its organization, provide more than the two points of control indicated, and therefore does not remove the difficulty mentioned. Thus for instance when it has been resorted to in connection with the wiring of residences lighted by electricity, one switch has been placed at the top and the other at the bottom of the house, manipulation of the switches necessitating a visit to either of these points, a consideration which diminishes the convenience and therefore the desirability of electric lighting systems for multi-storied buildings.

It is the object of our invention to provide an inexpensive, economical, and convenient, means by which an electric current can be opened or closed at will from any convenient one of any desired predetermined number of points of control along a circuit, with equal facility.

In the drawings we illustrate and herein we describe a preferred form of a convenient embodiment of our invention, the particular subject matter claimed as novel being hereinafter definitely specified.

In the drawings, Figure 1 is a diagrammatic view of a series of electric lights, the circuit in which the same are established being provided with a preferred embodiment of our invention. Fig. 2 is a front elevational view of one of the switches resorted to in connection with the practice of our invention, the cover being supposed removed to exhibit its construction. Fig. 3 is a detail view in perspective of the drum of said switch. Figs. 4, 5, and 6, are diagrammatic views illustrative

of different positions of the switches employed in the practice of our invention. Fig. 7 is as stated a diagrammatic view of a form of circuit opening and closing arrangement heretofore in use.

Generally stated, our invention comprehends the provision and employment at any preferred part of an electric circuit, of a double series of conducting sections, united by associated switches into a continuous system, the individual members of which double series, under the government of the switches, are thrown variously into circuit with either the one or the other or both of the main wires, or constitute temporarily with others a dead circuit.

In Fig. 1 of the drawings, A is the cut out or starting point of a circuit, and B C are the respective wires leading therefrom to form a circuit for the energizing of a series of lamps Q supposed located upon the different floors of a multi-storied residence. $b' b^2 b^3 b^4$ are a series of conductor sections and $c' c^2 c^3 c^4$ are a corresponding series of conductor sections. D is a three point switch at the extremity of the wire B, and E is a three point switch at the end of the wire C. The wires or conductor sections $b' c'$ are each as to one extremity connected with one of the points of the switch D, and the wires or conductor sections b^4 and c^4 are each as to one extremity connected with one of the points of the switch E. The wires $b' c'$ and the wires $b^2 c^2$ are connected by a device by which said wire b' is adapted to be placed and held in circuit with either the wire b^2 or c^2 ,—and by which said wire c' is adapted to be placed and held in circuit with either the wire b^2 or c^2 ,—the arrangement being such that when the wire b' is in circuit with the wire b^2 , the wire c' is necessarily in circuit with the wire c^2 ,—while on the other hand if the wire b' is in circuit with the wire c^2 , the wire c' is necessarily in circuit with the wire b^2 . This connection is effected by a form of switch contrivance of our invention, whereof hereinafter. A similar switch arrangement is made with regard to the contiguous ends of the wires $b^2 c^2$ and $b^3 c^3$,—and with regard to the contiguous ends of the wires $b^3 c^3$ and $b^4 c^4$,—and so on for as many conductor sections as may be employed.

In this specification when we speak in referring to the conductor sections, of a "straight" connection we refer to one in which the switch is set to make such a connection as that between and uniting the sections b' and b^2 or b^3 and b^4 , while when we speak of a "cross" connection we refer to such a connection as one between and uniting the sections b' and c^2 or b^3 and c^4 .

The operation of the apparatus so far described will be understood from the following description: Assume the switches all so set that a straight connection exists between the sections $b' b^2 b^3 b^4$ and a similar straight connection exists between the sections $c' c^2 c^3 c^4$,—and assume the wire B connected with the

section b' and the wire C connected with the section c' ,—in which arrangement the circuit is open,—it will be apparent that if any one of the switches, say for example the switch between the sections $b^2 c^2$ and $b^3 c^3$ (Fig. 4) be so set as to effect a cross connection between the sections b^2 and c^3 and $c^2 b^3$,—the sections $b' b^2 c^3$ and c^4 will place the wires B and C in circuit, while the sections $c' c^2 b^3$ and b^4 will form a dead circuit. The circuit being thus set up it is apparent that if said switch be restored to its set first described, the circuit will be again thrown open, and it will also be understood that if instead of restoring said switch to its first position, it be left in the position shown in Fig. 4, and any one of the other switches, as for instance the switch No. 3 connecting the sections $b^3 c^3$ with the sections $b^4 c^4$, be set to effect the cross connection of said sections, as shown in Fig. 5, said circuit will be thrown open for the reason that the current of the wire B will travel along the wires $b' b^2 c^3$ and b^4 ,—which latter is free or open, while the current of the wire C will travel along the sections $c^1 b^3 c^2 c'$, which is also free or open, said currents while so to speak overlapping each other, not being brought together, as shown in Fig. 5. If the switch No. 3 last referred to be returned to its straight position it will close the circuit again,—or if said switch be left in its cross position and the switch No. 2 be set in its straight position, it will close the circuit. If, again, said switches 2 and 3 be left in their cross position as shown in said Fig. 5, and any other of the switches be set to a cross position, the circuit will be closed. Thus for example if the switch No. 1 be as shown in Fig. 6 rotated to a cross position, the current of the wire B will pass along the sections $b' c^2 b^3 c^4$ to the wire C while the sections $c' b^2 c^3 b^4$ will form a dead circuit as we term it. The switches being now supposed all set in their cross positions, if any one of them be set in a straight position, it will open the circuit, or the alteration of the set of either of the three point switches will similarly open said circuit.

It will from the foregoing be understood that regardless of the various adjustments or positions in which the different switches may be set, if the circuit is closed the movement of any one of the switches will open it, while if the circuit is open the movement of any one of the switches will close it.

In practice in the application of the invention to the wiring of buildings it is contemplated to make each pair of companion conductor sections of such length as to extend from each floor to that above or below it, so that one of the switches may be located upon each floor, by which arrangement it is obvious that regardless of the floor from which the circuit is closed it may be opened from any, and on the other hand regardless of the floor from which the circuit is opened it may be closed from any. It is obvious that the arrangement is of utility in connection with

circuits utilized for other purposes than lighting, and also obvious that any desired number of conductor sections made in any desired lengths may be employed.

5 While a variety of switches to effect the straight and cross connections between the sections described may be resorted to, we prefer to employ a switch of the following character, viz:

10 G, Fig. 2, is the base plate of the switch, for instance No. 1, upon the face of which are located four binding posts, *h*, *i*, *j*, and *k*, to which binding posts are respectively secured the four conductor or switch sections *b*² *c*² *b*³ *c*³. Each of the posts conveniently supports
15 or is provided with a bracket or arm, respectively designated *h'* *i'* *j'* and *k'*, and upon each arm is mounted a brush which latter are respectively designated *h*² *i*² *j*² *k*². In the construction shown the brushes are secured at
20 their outer ends upon their respective brackets while their bodies and free extremities extend inwardly to the drum or commutator, the arrangement being such that the brushes *h*² *j*² are contiguous to each other but not
25 in contact, on one side of the commutator, so as to both tread on a common face of said commutator,—while the brushes *i*² *k*² are similarly contiguous to each other but not in contact,
30 on the opposite side of the commutator, so as to both similarly tread upon a common face thereof.

L is the drum or commutator, mounted conveniently upon so as to be rotated with a
35 spindle M, provided with a key *m* at its outer end and entered in the plate G. The periphery of said commutator embodies four segmental eccentric faces *l'* *l*² *l*³ *l*⁴ the point of greatest projection or crest of each being circumferentially succeeded by the place of least
40 projection of its neighbor, whereby shoulders are formed which prevent a brush from making contact with two faces at once. Each of the faces *l'* and *l*² is covered by a plate of conducting material *l*^x, and the faces *l*³ and *l*⁴
45 each bear a pair of strips, one, *l*⁵, at the outer end, and the other, *l*⁶, at the inner end, of the commutator. The plates *l*^x are insulated from each other and from the strips, but the two
50 strips *l*⁵ are connected by a conductor *l*⁷, and the two strips *l*⁶ are connected by a conductor *l*⁸, both which conductors conveniently extend through the body of the commutator.

Referring to Fig. 2 of the drawings it will
55 be understood from the foregoing description that the section *b*² is through the binding post *h*, bracket *h'*, brush *h*², plates *l*⁵, connection *l*⁷, brush *k*², bracket *k'*, and binding post *k*,—in circuit with the wire *c*³,—and that the wire *c*²
60 is through the binding post *i*, bracket *i'*, brush *i*², plates *l*⁶, connection *l*⁸, brush *j*², bracket *j'*, and binding post *j*, in circuit with the wire *b*³,—said switch being shown as set to effect the cross connection hereinbefore referred to.
65 It will also be understood that upon the quarter rotation to the right of the commutator, the brushes *h*² *j*² will both tread upon a com-

mon metal plate, *l*^x, and the wires *b*² and *b*³ therefore be in circuit with each other; and that the brushes *i*² *k*² will similarly both tread
70 upon a common metal plate *l*^x, and the wires *c*² *c*³ therefore be in circuit with each other, said switch being when in such position set to effect the straight connection hereinbefore referred to. A further quarter rotation to
75 the right of said commutator will bring the switch again into the position shown in Fig. 2.

The commutator shown is designed to be turned only to the right, as rotation in the other direction would be prevented by the
80 contact of its projections with the abutting extremities of the brushes.

Examination of the operation of the form of apparatus hereinbefore described will show that regardless of the various combinations
85 or alterations of adjustment to which the different switches may be successively shifted, the sections always constitute two equal groups, the individual sections of each group being electrically connected. Thus in Fig. 4
90 the sections *c'* *c*² *l*³ *b*⁴ form one group,—and the sections *b'* *b*² *c*³ *c*⁴ form the other group. Thus again in Fig. 5, and also in Fig. 6, the sections constitute two equal groups. These groups existing in substantial parallelism, or
95 overlapping so to speak, and the contiguous extremity of one line wire being necessarily in contact with either of the end sections, and the contiguous extremity of the other line wire being necessarily in contact
100 with either of the other end sections, it will be understood that, the two groups being necessarily continuous from end to end an opening or closing of the circuit may be made at
105 any point within the area covered by said sections and provided with a switch.

While we have mentioned the employment of three point switches at the respective ends of the series, it is obvious that switches of the character shown in Fig. 2 might be employed in their stead, as for example by attaching the extremity of the line wire B to the binding post *h*, attaching the wires *c'* *b'* to the binding posts *j* *k* respectively, and making no use of the binding post *i*,—the
115 result of which arrangement would be, as will be understood, that in the rotation of the drum or commutator the wire B would make connection alternately with the sections *c'* *b'*.

Having thus described our invention, we
120 claim:

1. In combination with the permanent terminals of two line wires of opposite polarity, companion conductors located between said terminals and embodying a series of interruptions,—movable conductors at each interruption which maintain two conductors on one side of a given interruption in connection alternately straight and cross with the two conductors on the other side of said interruption,
125 each permanent terminal being in circuit with one and out of circuit with the other of the adjacent pairs of conductor sections of the series, substantially as set forth.

2. In combination with line conductors, a pair of companion conductors embodying a series of interruptions by which they are divided into a succession of pairs of conductor sections, through a series of which sections, consisting of one member of each of said pairs electrically connected, the circuit of the line conductors is completed and closed, while the remaining member of each pair is out of circuit,—movable conductors located at the interruptions, which maintain the two conductor sections on one side of each interruption in connection, alternately straight and cross, with the two conductors on the other side of said interruption, substantially as set forth.

3. In combination with an electric circuit comprising companion conductors embodying a series of interruptions by which they are divided into a succession of pairs of conductor sections,—through a series of which sections consisting of one member of each of said pairs electrically connected the circuit is closed while the remaining member of each pair is out of circuit,—four terminals for the respective conductor sections at each interruption arranged around a common point, conductors capable of connecting the conductor sections straightwise and conductors capable of connecting the conductor sections cross-wise, with the result that the conductor sections not included in the closed circuit are electrically connected together, substantially as set forth.

4. In combination with an electric circuit comprising companion conductors embodying a series of interruptions, movable conductors capable of connecting the conductor sections straightwise, movable conductors capable of connecting the conductor sections cross-wise, and a common operating means for both sets of conductors, the conductor sections being by the movable conductors connected into two groups, the members of each pair of sections being distributed one in each of said groups, and said groups being distinct so that when one is in the closed circuit the other is out of circuit, substantially as set forth.

5. In combination with an electric circuit, comprising companion conductors embodying a series of interruptions which divide the conductors into a series of pairs of conductor sections, movable conductors capable of connecting the sections straightwise, movable conductors capable of connecting the conductor sections cross-wise, both mounted on a common structure, the conductor sections being by the movable conductors connected into two groups the members of each pair being distributed one in each of said groups, said groups being distinct so that when one is in the closed circuit the other is out of circuit, substantially as set forth.

6. In an electric circuit, in combination with the line wires, a series of conductor sections arranged in pairs, one line wire being

connected to a switch by which it may be placed alternately in circuit with the sections of the pair at one end, the other line wire being similarly connected to a switch by which it may be alternately placed in circuit with the sections of the pair at the other end of the series, and each section making contact with a switch by which it may be placed at will in circuit with either the longitudinally adjacent section in its own aligned series or the longitudinally adjacent section in the other series, the arrangement being such that when the circuit is closed part of said sections are included in it while the remainder of said sections, connected together, are out of said circuit, substantially as set forth.

7. In an electric circuit, in combination with conductor sections, a switch, two binding posts upon which four sections are respectively connected, brushes supported by said binding posts, a rotatable drum with which said brushes are by pairs in contact, which drum embodies independent segmental faces alternately composed of single plates of conducting material adapted to place the brushes of one pair in circuit with each other,—and of double independent plates of conducting material respectively connected with corresponding plates on another face of the drum and adapted to place brushes of one pair in circuit with brushes of an opposite pair, substantially as set forth.

8. In an electric circuit, in combination with pairs of conductor sections, a switch provided with a rotatable drum and with binding posts to which the sections are respectively connected, brushes supported by said binding posts, which brushes are by pairs in tread upon different peripheral portions of said drum, said drum being formed with faces, which are successively or alternately provided with insulated plates of metal, and with pairs of strips which are in connection with pairs of strips upon the opposite face of the drum or commutator, substantially as set forth.

9. In an electric circuit, a switch composed of a rotatable drum or commutator, embodying peripheral faces, half of which faces are provided with insulated plates of conducting material, and the others of which are each provided with two strips of conducting material, each of said last named strips being in circuit with corresponding strips on the other face or faces of the drum,—two pairs of conductor sections, brushes with which said sections are connected, the brushes to which the first section of each respective pair of sections are connected lying close together and in tread upon one face of the drum at a time,—and the brushes to which the second section of each respective pair of sections are connected, lying close together and in contact or tread upon one face of the drum at a time, all the brushes being always contemporaneously in tread upon faces of like character, substantially as set forth.

10. In an electric circuit, in combination with two pairs of conductor sections, brushes in circuit with said sections, a rotatable drum provided with plates l^x , and with strips l^5 l^6 5 connected by conductors l^7 l^8 the brushes in circuit with the first section of both pairs of conductor sections being both adapted to make contact with a common plate l^x or both with respective strips l^5 l^6 , and the brushes in 10 circuit with the second sections of each pair of conductor sections being both similarly adapted to make contact with the common plate l^x or with both respective strips l^5 and l^6 , all the brushes being contemporaneously in tread upon drum faces of similar arrangement, substantially as set forth. 15

In testimony that we claim the foregoing as our invention, we have hereunto signed our names this 25th day of August, A. D. 1890.

THOMAS CARPENTER SMITH.

BENJAMIN D. ACKER.

In presence of—

F. NORMAN DIXON,

LEWIS ALTMATER.