Apr. 17, 1923.

1,452,333

C. N. ALTER

ELECTRIC SWITCH

Filed June 21, 1919

3 Sheets-Sheet 1

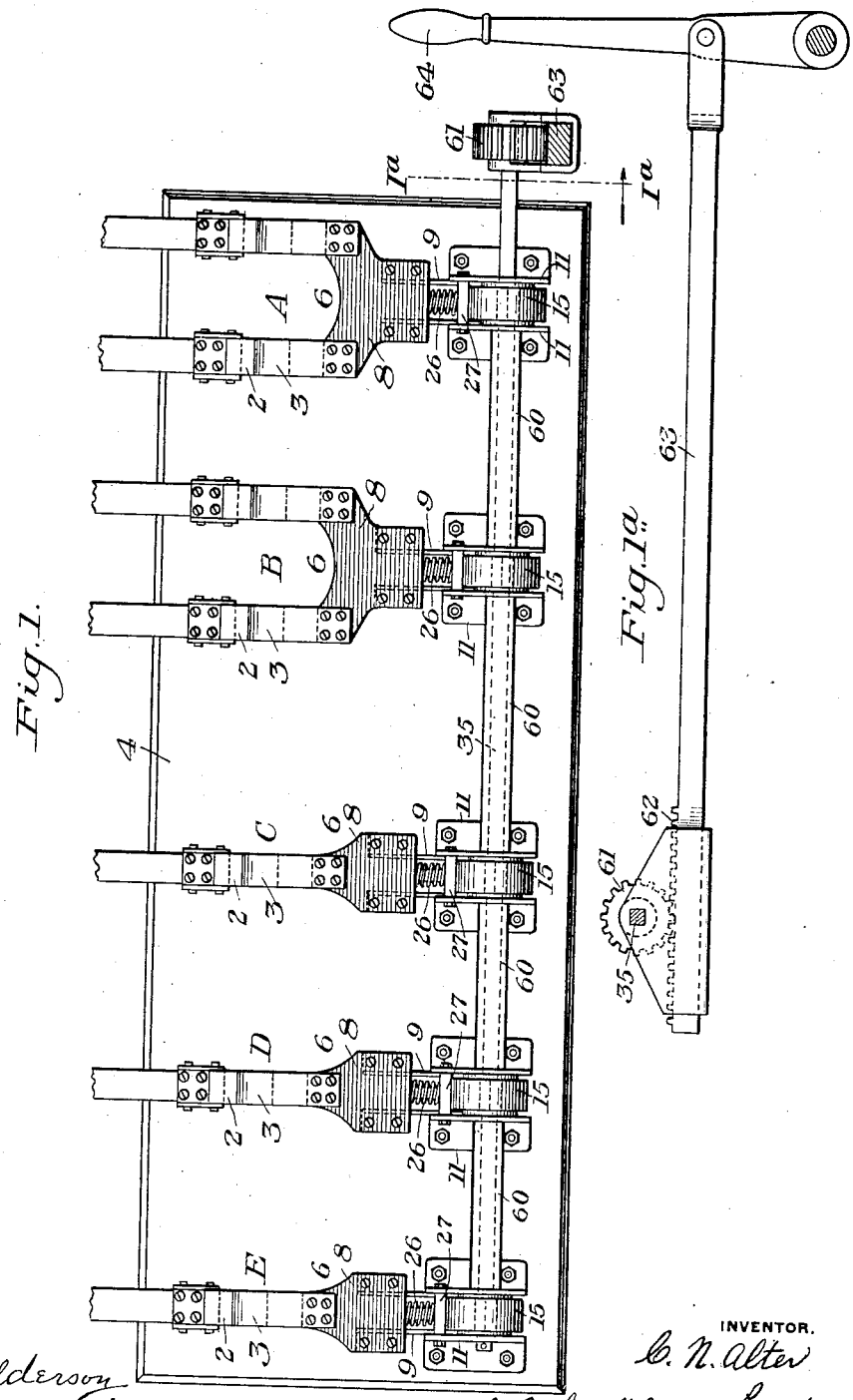


Fig. 1.

Fig. 1a.

WITNESS

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Apr. 17, 1923.

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1,452,333

ELECTRIC SWITCH

Filed June 21, 1919

3 Sheets-Sheet 2

Fig. 3.

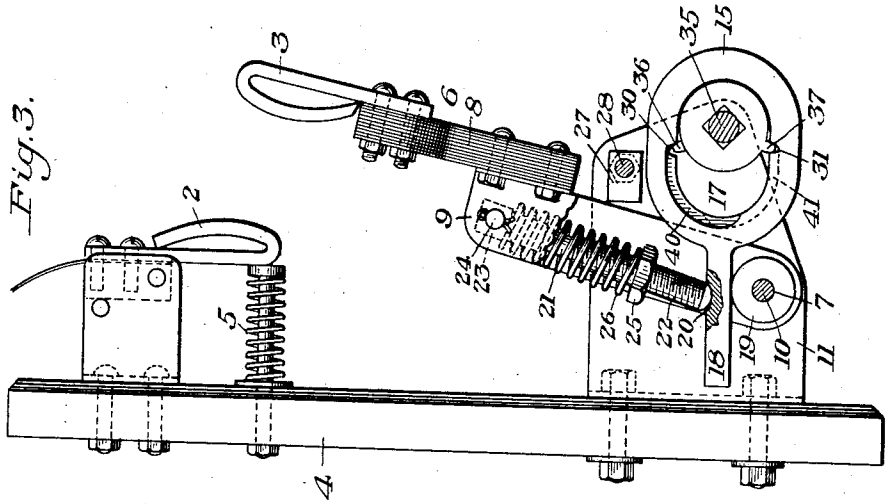


Fig. 4.

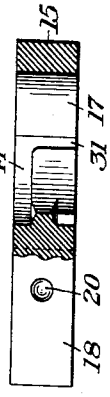


Fig. 5.

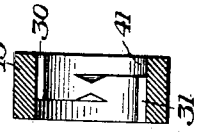
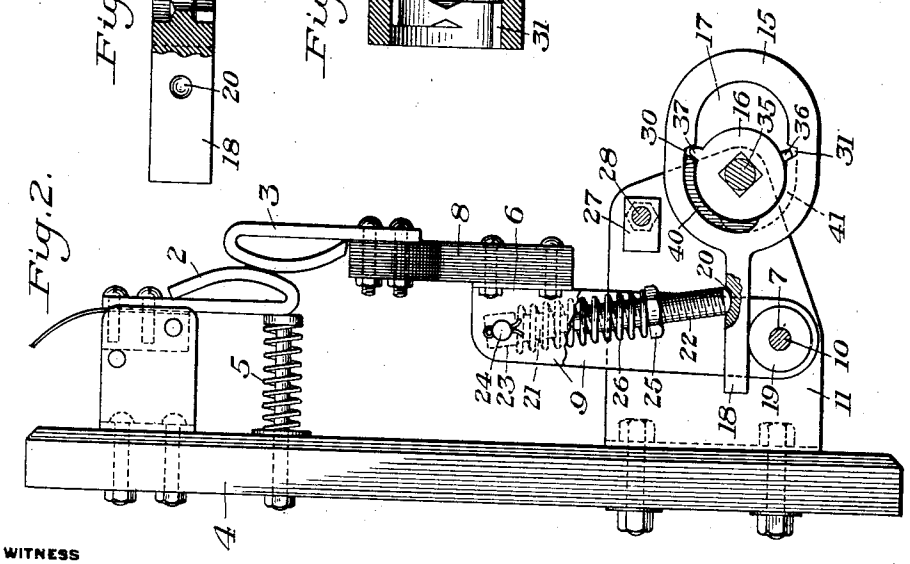


Fig. 2.



WITNESS

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ELECTRIC SWITCH

Filed June 21, 1919

3 Sheets-Sheet 3

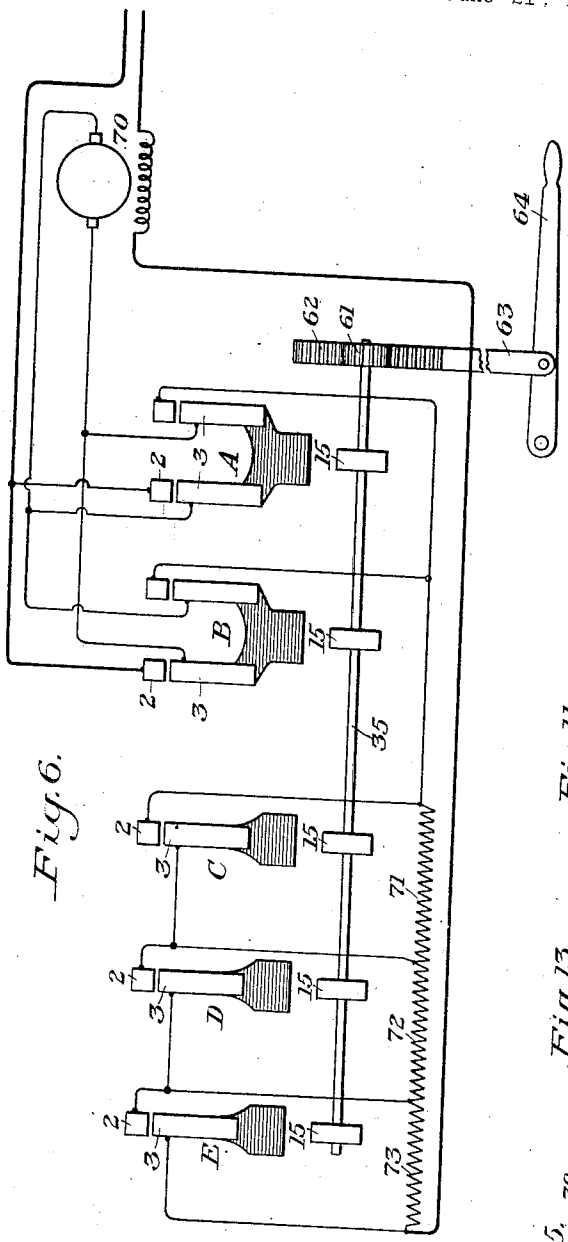


Fig. 6.

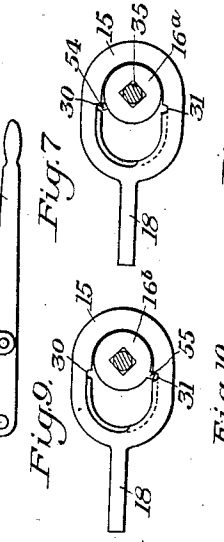


Fig. 7.

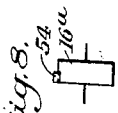


Fig. 8.

Fig. 9.



Fig. 10.

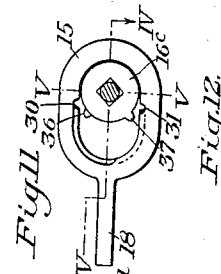


Fig. 11.

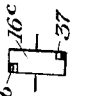


Fig. 12.

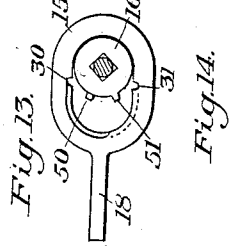


Fig. 13.

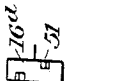


Fig. 14.

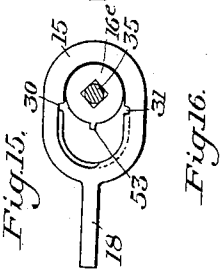


Fig. 15.



Fig. 16.

WITNESS

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Patented Apr. 17, 1923. 1,452,333

UNITED STATES PATENT OFFICE.

CHARLES N. ALTER, OF ALLIANCE, OHIO.

ELECTRIC SWITCH.

Application filed June 21, 1919. Serial No. 305,837.

To all whom it may concern:

Be it known that I, CHARLES N. ALTER, a citizen of the United States, residing at Alliance, in the county of Stark and State of Ohio, have invented a new and useful Improvement in Electric Switches, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, forming part of this specification, in which—

Figure 1 is an elevation of a panel showing assembly of five switches embodying the present invention.

Figure 1ª is a vertical section along the line Iª—Iª of Figure 1, showing the operating lever.

Figures 2 and 3 are side elevations of one of the switches showing the switch in its closed and open positions, respectively.

Figure 4 is a horizontal section through the shiftable yoke member along the line IV—IV of Figure 11.

Figure 5 is a vertical section through the shiftable yoke member along the line V—V of Figure 11.

Figure 6 is a diagrammatic view of the switch panel shown in Figure 1, together with the wiring connections to the motor.

Figures 7 and 8, Figures 9 and 10 Figures 11 and 12, Figures 13 and 14 and Figures 15 and 16, are side elevations and end elevations, respectively, showing the positions of the teeth for the rockers of the several switches shown in Figure 1.

The present invention relates to electric switches, and more particularly to the actuating mechanism therefor. In one of its narrower aspects, the invention relates especially to the combination of a plurality of switches and the herein described means for actuating them in succession. The object of the invention is to produce a simple reliable switch actuating mechanism and particularly a switch actuating mechanism by means of which a plurality of switches may be successively actuated. With this object in view, the present invention consists in an electric switch hereinafter described and particularly pointed out in the claims.

Referring to the embodiment of the invention illustrated in the drawings:—The invention is shown as embodied in an electric motor switch. Five of such switches, A, B, C, D and E, are shown mounted to be actuated by a common actuating handle, as shown in Figure 1. Each switch comprises a fixed contact member 2 and a movable contact member 3 (Figures 2 and 3). The fixed contact 2 is shown mounted at the upper part of the panel or board 4, and is provided with a spring 5 which permits it to yield when the movable contact 3 is brought against it. The movable contact 3 is mounted on an arm 6 which is pivoted at 7. The arm 6 consists of an insulating member 8 which is bolted to two metal arms 9. The metal arms 9 have holes at their lower ends which fit over the pin 10, which extends through side plates 11, which are bolted to the switch panel 4.

The switch is opened and closed by means of a shiftable yoke member 15, which is thrown back and forth by means of a toothed rocker wheel 16. The yoke 15 has an arm 18 which rests against an antifriction roller 19 which is carried on the pin 10. The upper part of the arm 18 has a recess 20 in which fits the lower end of a snap-spring connection between the shiftable yoke 15 and the switch arm 6. This snap switch connection consists of two telescoping rods 21 and 22. The upper rod 21 has a head 23 which is provided with a hole through which is passed a pin 24 which extends through the metal arms 9 of the switch arm 6. The upper rod 21 has a reduced portion which telescopes in the lower rod 22. The lower rod 22 fits against the recess 20 of the shiftable yoke. A helical spring 26 surrounds the telescoping rods 21 and 22, being compressed between the adjusting nut 25 and the head 23 and tending to push the rods 21 and 22 apart. As can readily be seen, when the recessed portion 20 of the shiftable yoke 15 passes over the pivot point 7 of the switch arm 6, the switch will be snapped either open or closed and held in such open or closed position by the spring 26. For example, starting with the parts in the position shown in Figure 2, if the shiftable yoke 15 is moved to the left, the switch will be held closed under the tension of the spring 26 until the recess 20 has passed to the left beyond the pivot point 7 of the arm 6, whereupon having passed this dead center, the switch will be suddenly snapped open by the spring 26.

The opening movement of the switch arm 6 is limited by a buffer block 27 carried on a pin 28 extending between the side plates 11.

The shiftable yoke members 15 have the

same form for each of the five switches. The yoke member 15 may be made of any suitable material, although I prefer to use a block of indurated fibre from which such yoke member is machined. The elongated opening 17 is of a general elliptical form, having circular ends and with horizontal parallel intermediate surfaces between the ends. Extending across the inner faces of the opening 17 about midway at the top and bottom are recesses 30 and 31, respectively. These recesses extend across the entire inner face of the yoke. These recesses are formed for the engagement with the tooth or teeth on the rocker wheel 16.

The rocker wheel 16 is mounted on the squared portion of a rock shaft 35 which extends across the panel 4. The rocker wheel 16 is preferably made from a block of indurated fibre like the shiftable yoke 15. In order to operate the switches successively, a different rocker wheel is provided for each of the five switches. These switches are indicated by reference numerals A, B, C, D and E, respectively. The rocker wheels for the several switches are shown in Figures 7 to 16, respectively, and are indicated by reference numerals 16^a, 16^b, 16^c, 16^d and 16^e, respectively.

Referring first to the rocker wheel 16^c (Figure 11), which is the one illustrated in Figures 2 and 3. This rocker wheel has two teeth, 36 and 37, which are arranged to engage the recesses 30 and 31. The position of the parts when the switches A, B, C, D and E are all open is shown in Figure 3. To close the switches, the rock shaft 35 is rotated in a clockwise direction as viewed in Figure 3. The rock shaft will turn a certain amount before the tooth 36 engages the recess 30, the purpose of this lost motion being hereinafter explained. When the tooth 36 engages the recess 30, the continued movement of the rock shaft 35 and rocker wheel 16 causes the shiftable member or yoke 15 to be moved to the right, thus snapping the switch closed and bringing the parts into the position shown in Figure 2. The switch is opened by the reverse movement of the rock shaft 35, the tooth 36 being brought with a considerable idle movement into engagement with the recess 30 to shift the yoke 15 to the left from the position shown in Figure 2 to that shown in Figure 3, thereby opening the switch.

The switch may also be closed from the position shown in Figure 3 to that shown in Figure 2, by the counter-clockwise movement of the rock shaft 35. The tooth 37 engages the recess 31 to move the yoke 15 to the right from the position shown in Figure 3. In this case the switch is closed by the reverse movement of the rock shaft in the clockwise direction.

The end wall of the opening 17, which is adjacent the arm or tongue 16, has formed therein slots 40 and 41. The slot 40 is formed on the near side of the yoke 15 as viewed in Figure 2. This forms a clearance space in which the tooth 37 may move idly when the end of the opening 17 in the yoke 15 is against the wheel 16, as shown in Figure 2. Similarly, the slot 41 forms a clearance space for the idle movement of the tooth 30 when the parts are in the position shown in Figure 2. The provision of these cut-away portions 40 and 41 permits the semi-circular end of the hole 17 in the yoke 15 to be brought up snug against the wheel 16 as shown in Figure 2.

The rocker wheel 16^d (Figs. 13 and 14) is similar to the rocker wheel 16^c, except that its upper and lower teeth 50 and 51 are spaced nearer together.

The rocker wheel 16^e (Figs. 15 and 16) instead of having two teeth spaced apart, has a single tooth 53 which extends across the entire length of the wheel.

The rocker wheel 16^a (Figs. 7 and 8) has a single tooth 54 which extends only part way across the wheel and which engages the recess 30. The rocker wheel 16^a has no tooth which engages the recess 31, the recess 31 being, however, present in its yoke member, because all the yoke members are made standard and the same.

The rocker wheel 16^b (Figs. 9 and 10) has a single tooth 55 which engages the recess 31, but has no tooth engaging the recess 30.

As shown in Figure 1, the common rock shaft 35 extends across the panel 4 to operate all five of the switches A, B, C, D, and E. This rock shaft has sleeves 60 which extend between the various switches. The rock shaft 35 is round and turns in the sleeves 60. The portions of the rock shaft which extend through the toothed rocker wheels 16^a. 16^b, 16^c, 16^d and 16^e are squared.

The end of the rock shaft 35 has a pinion 61 which meshes with the rack 62 carried on the end of the rod 63. The other end of the rod 63 is provided with a handle 64 for reciprocating it, this being provided to permit the operator's station to be at a distance in front of the panel 4. If desired, the handle may be applied directly to the rock shaft 35. The parts are so arranged that when the handle 64 is in its upright position, the several switches A, B, C, D and E are all open. Suitable stops (not shown) are provided which limit the movement of the handle 64 so that the rock shaft 35 has a movement of 180 degrees either clockwise or counter-clockwise from the position shown in Figure 3.

The switches A, B, C, D, and E are illustrated as the starting switches for an electric motor 70. The wiring connections to the switches are illustrated diagrammatically in Figure 6. The switch A is a double pole

switch and is closed when the motor is driven in one direction, say the forward direction. The switch B is likewise a double pole switch and serves as a reversing swtich. This switch is to be closed when the motor is to be driven in the reverse or backward direction. The switches C, D and E are single pole switches and serve to short circuit the starting resistance of the motor. To start the motor, either the switch A or B should be first closed and then the switches C, D and E closed in succession to successively cut out the sections of the starting resistance as the motor is brought up to speed.

With the position of the parts as shown in Figure 6, the switches are shown as all open. To start the motor in its forward direction, the switch A is first closed completing the circuit through the motor field and armature and through the resistance which is shown in three sections, 71, 72 and 73. Thereafter the switch C is closed, short-circuiting the resistance 71. Then the switch D is closed, short-circuiting the resistance 72. Thereafter the switch E is closed short-circuiting the resistance 73 and applying full line voltage to the motor. As shown in the diagram in Figure 6, the motor is illustrated as a series wound motor. When the motor is to be stopped, the switches are opened in reverse sequence. If the motor is to be run in the other direction, the switch B is closed and this is followed by the closing of the switches C, D and E in sequence.

The closing of the switches A or B, as desired, and the timed sequence of the closing of the resistance short-circuiting switches C, D and E, is accomplished by properly positioning the teeth on the rocker wheels 16^a, 16^b, 16^c, 16^d and 16^e. Suppose that all of the five switches are open and it is desired to start the motor in its forward direction. The operator draws the handle 64 forward (or to the right as shown in Figure 1^a), thus turning the rock shaft 35 in clockwise direction as viewed in Figures 2 and 3 and in Figures 7, 9, 11, 13 and 15. The tooth 54 of the rocker wheel 16^a immediately engages, without lost motion, the recess 54, shifting the yoke of the switch A and closing such switch. The tooth 55 of the rocker wheel 16^b of switch B, moves idly so that this switch is not closed. The continued movement of the rock shaft 35 next brings the tooth 36 of the rocker wheel 16^c into engagement with the recess 30, closing the switch C. Thereafter, the further movement of the rock shaft brings the tooth 50 of the rocker wheel 16^d into engagement with the recess 30 of its shiftable yoke member closing the switch D. Finally the movement of the rock shaft brings the tooth 53 of the rocker wheel 16^e into engagement with the recess 30, closing the switch E and cutting out all of the starting resistance. The lost motion which the rock shaft has before bringing the teeth 36, 50 and 53 into engagement with the recesses of the yoke members of the switches C, D and E, causes the timed sequence of the operation of such switches. All the operator has to do is to draw the handle 64 in the proper direction, and the motor is started and the starting resistance automatically cut out. The sequence in the operation of the switches is automatically predetermined and the operator, by moving the handle fast or slow, may determine the time intervals between the operation of the successive switches.

If the motor is to be stopped, the operator moves the handle 64 back to its upright or neutral position thereby opening the switches E, D, C and A.

If the motor is to be started in the reverse direction, the operator pushes the handle to the left, as viewed in Figure 1^a, thereby turning the rock shaft 35 in a counter-clockwise direction as viewed in Figures 2, 3, 7, 9, 11, 13 and 15. This causes the successive closing of the switches B, C, D and E, the switch A remaining open, because its rocker wheel 16^a has no tooth to engage the recess 31.

While I have described and illustrated the preferred form of my invention, it is to be understood that the invention is not limited to its preferred embodiment but may be embodied in other structures within the scope of the invention as defined in the following claims.

I claim:

1. In an electrical switching device, the combination of a contact, a pivoted contact member, a reciprocable yoke, yieldable means operatively connecting said yoke and said contact member, and eccentric means operating said yoke to impart a snap action to said contact member through said yieldable means, substantially as described.

2. In an electrical switching device, the combination of a contact, a pivoted contact member, a reciprocable yoke, yieldable means operatively connecting said yoke and said contact member and permitting relative independent movement therebetween, an eccentric member for operating said yoke and means for operating said eccentric member, substantially as described.

3. In an electrical switching device, the combination of a plurality of switches, each comprising a contact, a pivoted contact member, a reciprocable yoke, yieldable means operatively connecting said yoke and said contact member and permitting relative independent movement therebetween, means for operating each of said yokes, each of said operating means being normally at a different operative distance from its yoke with

respect to the other and means for operating all of said operating means, substantially as described.

4. In an electrical switching device, the combination of a plurality of switches, each comprising a contact, a pivoted contact member, a reciprocable yoke and yielding means operatively connecting said yoke and said contact member and permitting relative independent movement therebetween, an operating member for said switches, means on said member adapted to engage said yokes, said means being at different operative distances from the respective yokes, and means for moving said operating member to operate said contact members in a predetermined sequence, substantially as described.

5. In an electrical switching device, the combination of a plurality of switches, each comprising a contact, a pivoted contact member, a reciprocable yoke and yieldable means operatively connecting each yoke and contact member and permitting relative independent movement therebetween, and means operating said yokes in a predetermined sequence, substantially as described.

6. In an electrical switching device, the combination of a plurality of switches, each comprising a contact, a pivoted contact member, a reciprocable yoke and yieldable means operatively connecting each yoke and contact member and permitting relative independent movement therebetween, and means operating said yokes in both directions in a predetermined sequence, substantially as described.

7. An electric switch having a movable contact member and an actuating mechanism therefor comprising a rocker, a shiftable yoke member, the rocker and shiftable yoke member having a tooth and recess engagement, and a resilient connection between the shiftable yoke member and the switch contact member, substantially as described.

8. The combination of a plurality of electric switches and means for actuating them in succession, comprising a common connection having a plurality of eccentric members, one for each switch, and a shiftable yoke member for each switch having a recess engaged by one of said eccentrics, the eccentrics and recesses of the several switches being so positioned relatively as to actuate the several switches in a predetermined manner upon the movement of the common connection, substantially as described.

9. In an electrical switch, the combination of a contact, a pivoted contact member, anti-friction means, a reciprocable yoke member engaging said anti-friction means, a resilient member pivotally engaging said contact member and said yoke member, and means for reciprocating said yoke, substantially as described.

10. In an electric switch, the combination of a contact, a pivoted contact member, a reciprocable yoke in proximity to the pivotal point of said contact member, resilient means connecting said contact member and the said yoke whereby said contacts are separated and brought into engagement with each other dependent upon the position of the point of engagement between said yieldable member and said yoke with respect to a line passing through said contact and the pivotal point of said contact member, and eccentric means for reciprocating said yoke, substantially as described.

11. In an electrical switching device, the combination of a plurality of switches, each comprising a contact, a pivoted contact member, a reciprocable yoke and a yieldable member at one end operatively engaging said contact member and at its other end operatively engaging said yoke, operating means for said switches comprising a horizontal member, a plurality of eccentrics mounted thereon and each adapted to engage one of said reciprocable yokes and each being at a different angle with respect to the other, and means for rotating said operating member whereby said switches are operated in a predetermined sequence, substantially as described.

12. In an electrical switching device, the combination of a plurality of switches, each comprising a contact, a pivoted contact arm, means for operating said pivoted contact arms comprising a shiftable member near the pivotal point of said contact arm, a resilient member at one end pivotally engaging said contact arm and at its other end engaging said reciprocable member at a point on one side of a line joining the pivotal point of said arm and said yieldable contact, and means for moving said shiftable members in a predetermined order to move the point of engagement thereof with said resilient member to the other side of said line to operate said switches, substantially as described.

13. In an electrical switching device, the combination of a plurality of switches, each comprising a contact, a pivoted contact arm, a reciprocable member near the pivotal point of said contact arm, a member at one end operatively engaging said arm and at its other end operatively engaging said reciprocable member at one side of a line passing through said contact and the pivotal point of said arm, and means for moving in a predetermined sequence the point of engagement between each of said resilient and reciprocable members to the other side of said line to open or close the switch, substantially as described.

In testimony whereof, I have hereunto set my hand.

CHARLES N. ALTER.