No. 819,821. PATENTED MAY 8, 1906.

A. A. TIRRILL.

ELECTRIC SWITCH.

APPLICATION FILED DEC. 11, 1902.

2 SHEETS—SHEET 1.

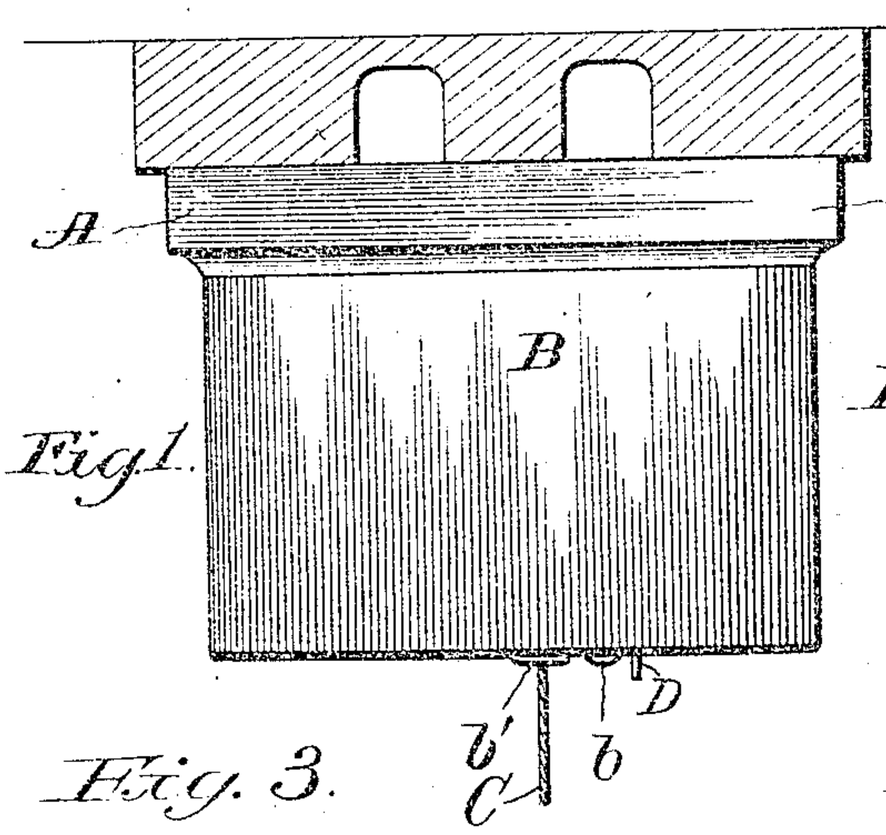


Fig. 1.

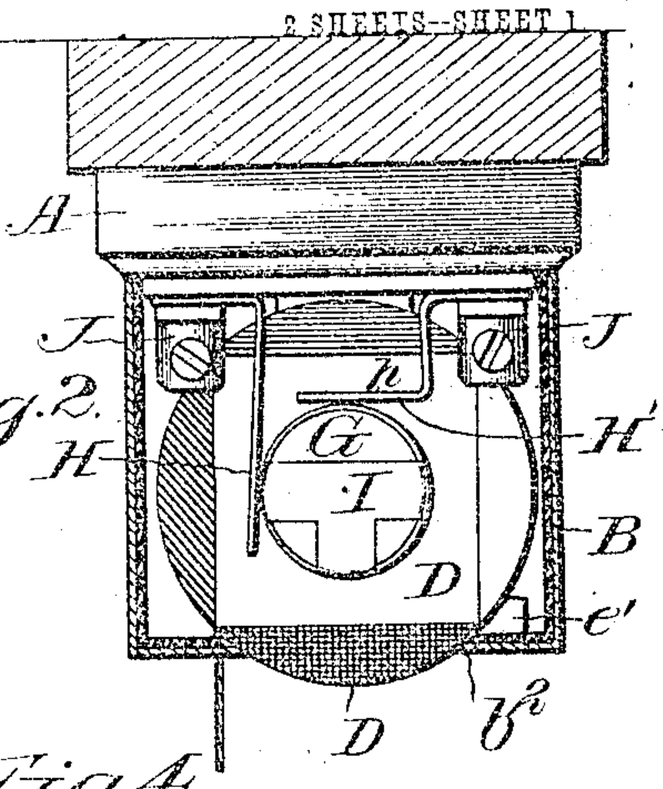


Fig. 2.

Fig. 3.

Fig. 4.

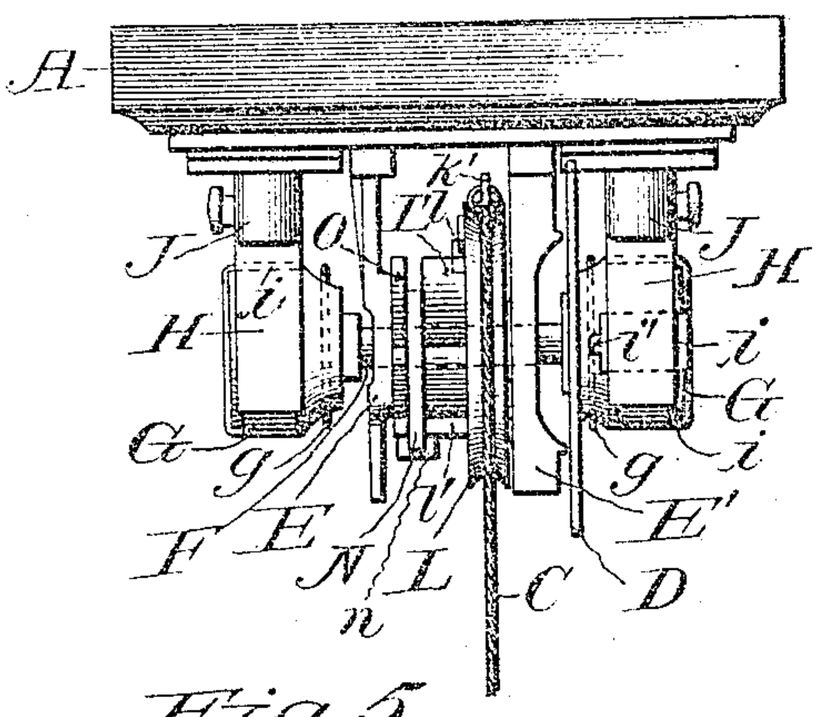


Fig. 5.

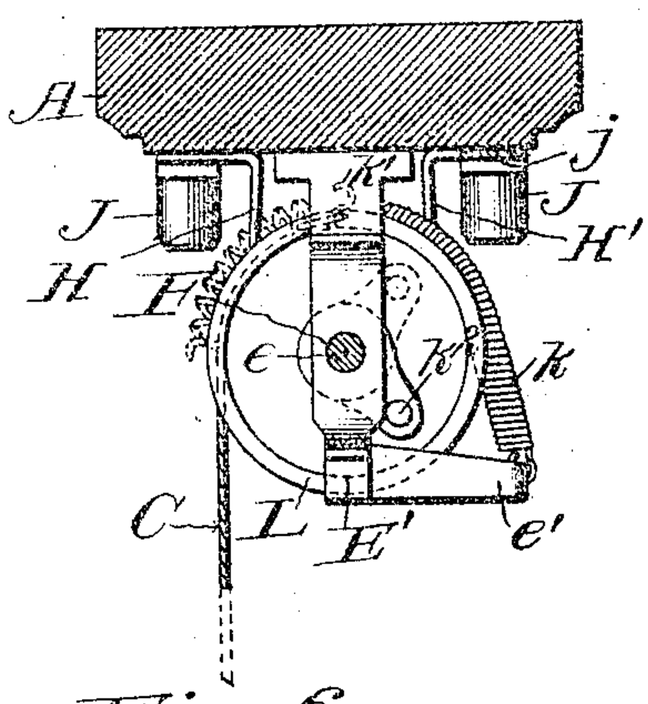
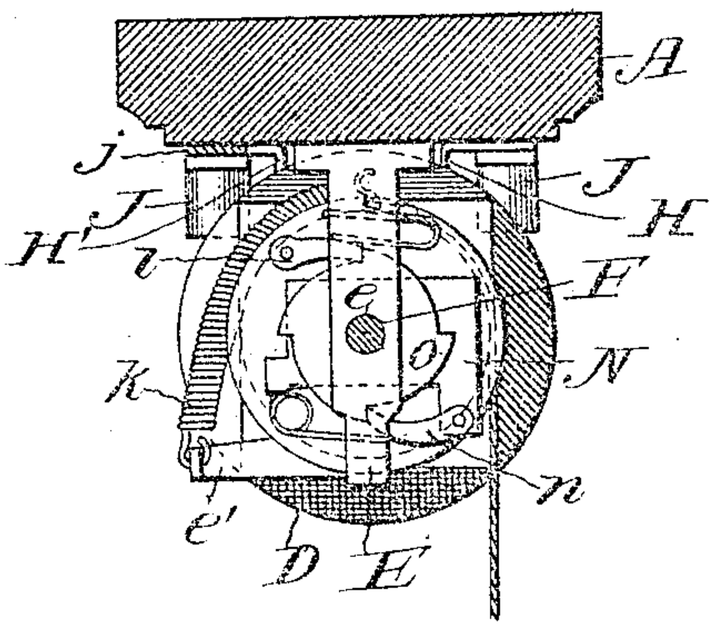
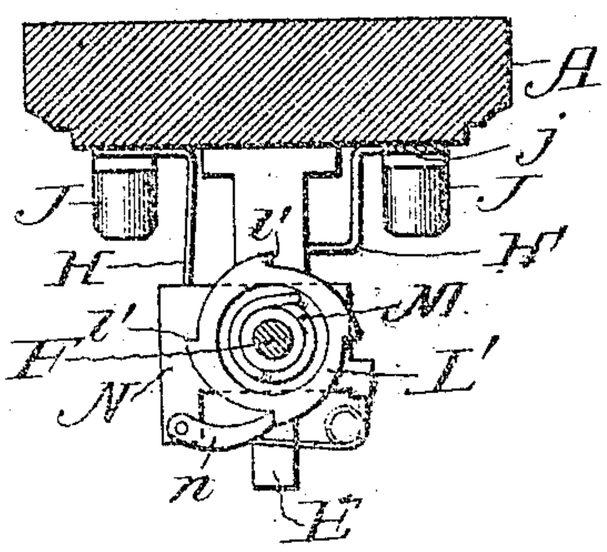


Fig. 6.





Inventor:
Allen A. Tirrill
By Arthur O. Brown
Attorney

Witnesses:
C. H. Wacker.
Fabius T. Milans

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2 SHEETS—SHEET 2.

Fig. 7.

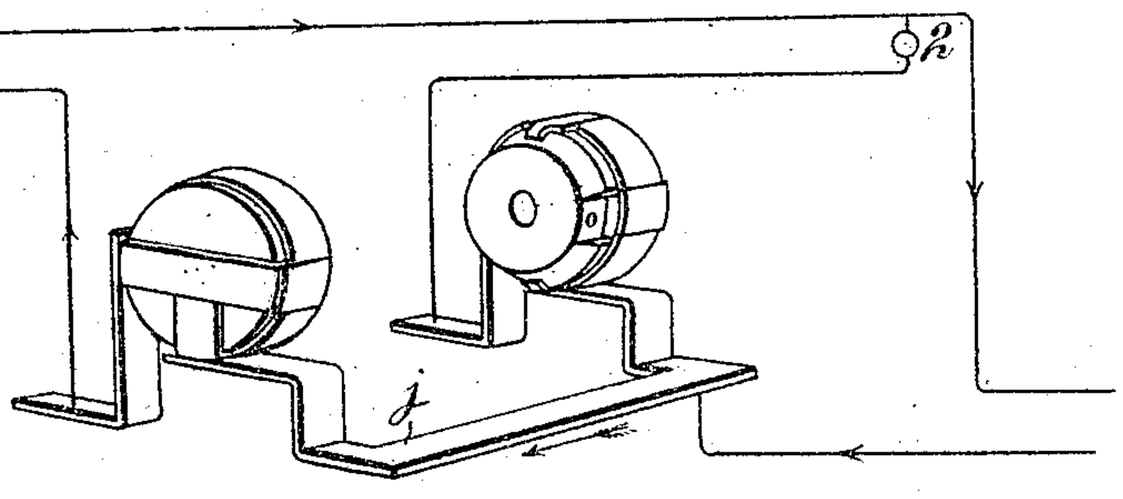


Fig. 8.

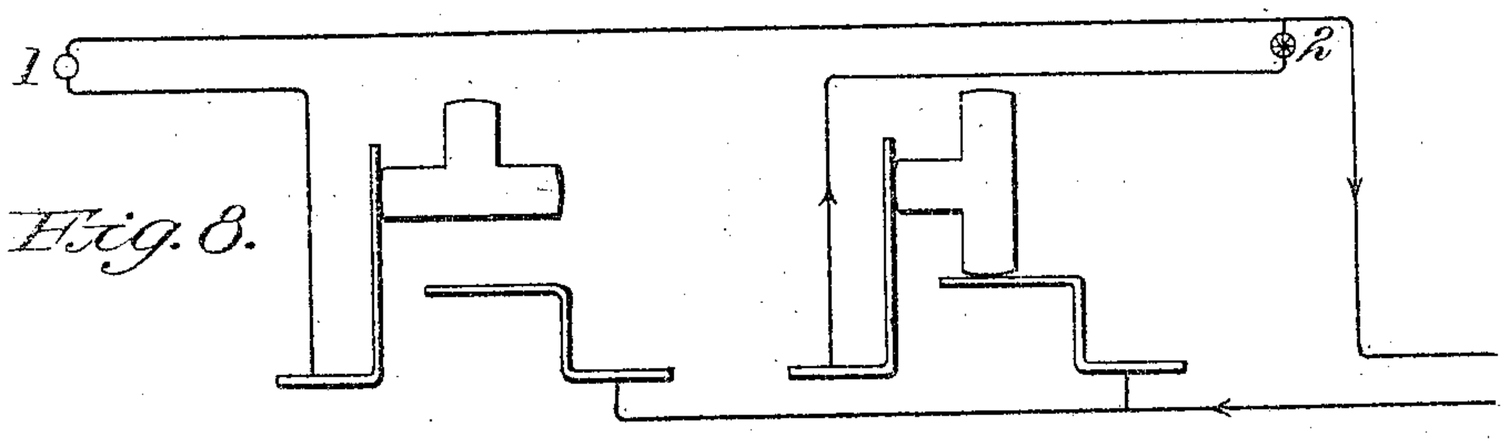


Fig. 9.

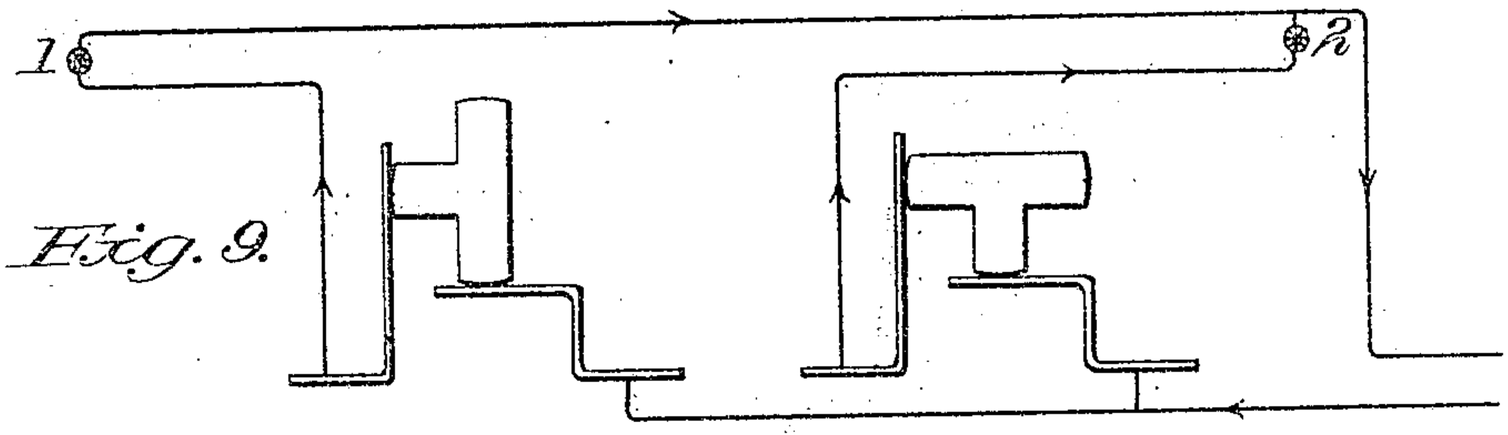
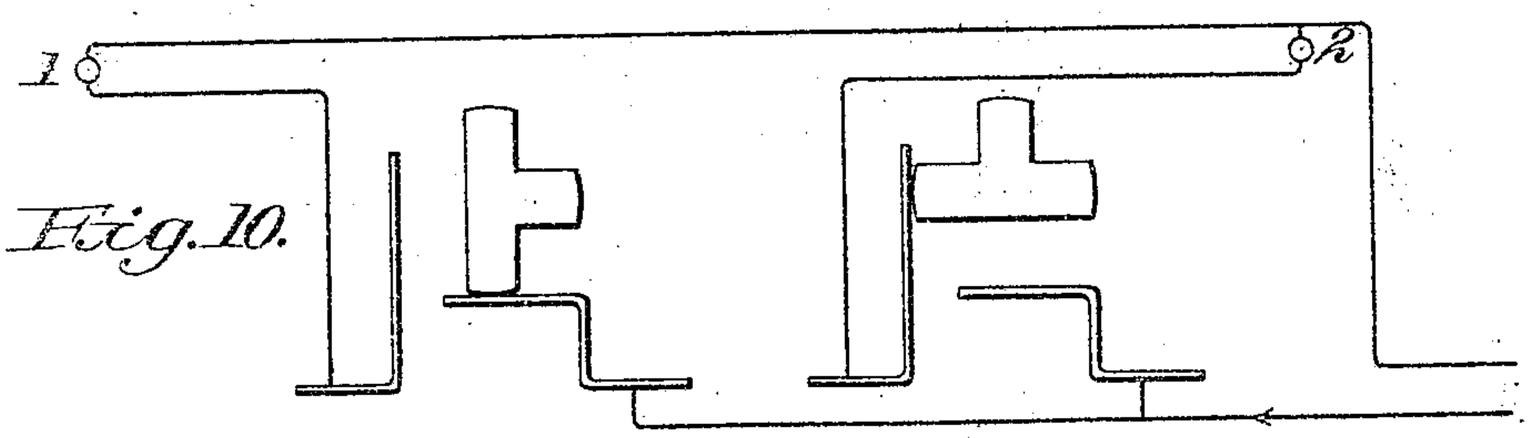


Fig. 10.



Witnesses:
C. H. Walker.
Calvin P. Milans.

Inventor:
Allen A. Tirrill,
By Arthur J. Brown
Attorney.

UNITED STATES PATENT OFFICE.

ALLEN AUGUSTUS TIRRILL, OF SCHENECTADY, NEW YORK.

ELECTRIC SWITCH.

No. 819,821. Specification of Letters Patent. Patented May 8, 1906.

Application filed December 11, 1902. Serial No. 134,850.

To all whom it may concern:

Be it known that I, ALLEN AUGUSTUS TIRRILL, a citizen of the United States, residing in Schenectady, in the county of Schenectady and State of New York, have invented certain new and useful Improvements in Electric Switches, of which the following is a specification.

This invention is designed to contribute to the convenience and efficiency of operation of that type of electric switch wherein hand-controlled means effect the making and breaking of the circuit substantially instantaneously.

An object of the invention is to supply to a switch-indicator instrumentalities operated automatically by the actuation of the switch which shall indicate the condition of the switch relative to the respective circuits.

Herein the invention will be described in connection with an improved snap-switch intended to be placed on a ceiling and to be operated through a depending cord or chain, successive pulls on which alternately make and break the circuit.

All discussion of possible modifications will be omitted until the specific mechanism has been described.

In the drawings, Figure 1 is an elevation of an open cleat or molding work type of switch inclosed in its cover and secured to a subbase. Fig. 2 is an end elevation of the switch, the cover being shown in section. Fig. 3 is a side elevation of the switch mechanism. Figs. 4, 5, and 6 are sectional views in various vertical transverse planes of the switch mechanism. Figs. 7, 8, 9, and 10 are diagrammatic views illustrating the mode of operation of the switch.

For convenience the mechanism of this switch may be described in four divisions: First, the driven parts, comprising the contacting agencies and their carriers; second, the driving mechanism, consisting of the parts which operate upon the contacting agencies to accomplish immediately the making and breaking of the circuit; third, the actuating instrumentalities controlled by the operator, which compel the operation of the driving mechanism, said driving mechanism in turn communicating its action to the driven parts; fourth, the indicator and the means whereby it is operated.

The object of the driving mechanism intermediate between the actuating instrumentalities and the driven contacting agencies is to translate the necessarily variant action of the former (it being controlled by hand) to quick decisive action on the part of the latter in order that the make and break of the circuit may be as nearly as practicable instantaneous.

The driven parts comprise contactors G, a shaft F, a shaft-locking pawl *n*, and its carrier N. The contactors G consist of cylindrical pulleys fixed, as by means of cotter-pins *g*, upon the extremities of the shaft F. Each contactor carries a contact-plate I upon its outer face, portions of said contact-plates being bent over onto the peripheries of the contactors so as to constitute metallic connection between different areas of said periphery. As shown herewith, each contact-plate I has three arms, two of which establish metallic communication between diametrically-opposite areas of the periphery of the contactor, the third arm establishing metallic communication between the other two and an area of said periphery lying at a quadrant's distance from the areas connected by the first two arms. The contact-plates I are suitably associated with spring-brushes H and H′ in a manner presently to be explained. The pawl-carrier N, rigid with the shaft F, carries the shaft-locking pawl *n*, which is pivoted to permit its point to rock toward and away from the shaft. This pawl *n* is equipped with a spring which tends to depress the point of the pawl inwardly toward the shaft. The point of the pawl is sufficiently broad to oppose the teeth both of a ratchet L′ and of a stop-plate O. The shaft F, having the contactors G and the pawl-carrier N rigid upon it, is journaled in the brackets E and E′, which are conveniently positioned between the contactors to secure compactness in the arrangement of the mechanism.

The above-described driven parts being collectively rigid are rotated concurrently by the driving mechanism. It is important that their rotation be divided into successive steps which shall effect alternately the making and breaking of the circuit. To this end the rotation of the driven parts is subjected to a series of arrests resulting from the cooperation of the shaft-locking pawl *n* with successive fixed shaft-stops arranged conveniently on a stationary stop-plate O. As shown herewith, there are four such shaft-stops so disposed as to arrest the rotation of

the driven parts at successive intervals when the contact-plates I are in certain predetermined positions relative to spring-brushes H and H′. The stop-plate O is conveniently rigid with the bracket E. The shaft-stops are given conveniently the form of ratchet-teeth which engage the point of the shaft-locking pawl. When properly assembled, the stop-plate O and the pawl-carrier N are positioned close together, so that the shaft-locking pawl will play against the shaft-stops, being retained thereagainst by the spring on the pawl-carrier. The pawl coöperates with these shaft-stops to arrest the rotation of the driven parts in the forward operative movement of the switch, which for convenience will be styled "positive rotation." The period of inaction succeeding each arrest continues until the pawl is released from its engagement with a shaft-stop, permitting the driven parts to be rotated another step by the driving mechanism.

A principal element of the driving mechanism is a spiral shaft-motor spring M, attached at one end to said driving mechanism, the other end being operatively connected with the shaft. When wound up, this shaft-motor spring tends to impart rotary motion to the shaft through said pawl-carrier. Besides supplying the immediate motive power which rotates the shaft the driving mechanism also releases the shaft-locking pawl from its detaining shaft-stop at appropriate times in the operation of the switch and also receives from the actuating instrumentalities the action which is transmitted to the driven parts.

The shaft-locking pawl is released from its detaining shaft-stop by the ratchet L′, which is loose upon the shaft E. In the normal condition of the switch when it is at rest the point of the shaft-locking pawl opposes one of the shaft-stops and is also seated in one of the teeth of the ratchet L′. When said ratchet is given positive rotation, the rear face of the tooth next succeeding the one in which the pawl was seated acts as a pawl-lifter to lift the point of the pawl outwardly away from the shaft. The crest of the next-succeeding tooth is at such a distance from the shaft that when said crest has arrived beneath the point of the pawl in the rotation of the ratchet said point of the shaft-locking pawl will be lifted clear of its shaft-stop, whereupon the rotation of the shaft will be for the moment unobstructed. The spiral shaft-motor spring is wound around the shaft, one end being operatively connected to said shaft, the other end being connected to the ratchet L′. Consequently when the ratchet L′ is given positive rotation the motor-spring is wound up to an increasing tension, which tends to impart positive rotation to the shaft.

The actuating instrumentalities act upon the driving mechanism through the ratchet L′. The principal actuating instrumentality is the reciprocating sheave L, which is mounted loosely upon the shaft adjacent to the bracket E′. The travel of this reciprocating sheave is limited by a projecting lug k^2 rigid therewith, which abuts upon the edge of said bracket E′ at each limit of the sheave's reciprocation. This lug is conveniently given the form of a pin rigid with the sheave which projects beyond the extreme lateral plane of said sheave upon the side nearest to the said bracket E′. The sheave is maintained in its normal position, with the lug k^2 abutting against the lower part of the bracket E′, by the tension of a retracting coil-spring k, attached at one end to the bracket and at its other end to the sheave. The concave periphery of the sheave receives said coil-spring, which is held in place by its own tension. The sheave is removed from its normal position to its opposite limit of motion by means of a cord or chain attached thereto. When a pull is exerted through said cord or chain, the sheave is rotated about the shaft, the cord being tangent to the circumference of the sheave. It is evident that the pull on the cord opposes the tension of the retracting-spring k, whence the sheave will return to its initial normal position when the pull on the cord is relaxed. Upon the face of the sheave farthest from the bracket E′ there is pivoted an actuating spring-pawl l. When the parts are properly assembled, the inner face of the sheave is positioned close to a face of the ratchet L′, so that the actuating-pawl l is in a position to engage the teeth of said ratchet. The actuating-pawl l is so disposed that a positive movement of the sheave (*i. e.*, the movement imparted by pulling the cord) drives the point of the pawl against one of the teeth of the ratchet L′ and gives thereto a rotary motion. The reciprocation of the sheave, as shown herewith, is limited, by the lug k^2, to occur through substantially the space of a quadrant. Hence a single positive movement of said sheave gives to the ratchet rotary movement through a quarter-revolution.

The switch illustrated in the accompanying drawings is a double-pole switch having a pair of spring-brushes H H′, associated with each of the contactors G. Each brush H extends in a vertical direction from its point of attachment to the base A of the switch to contact at its free end with the periphery of the contactor, while each brush H′ has an arm h at its free end arranged to contact with the periphery of the contactor at a point ninety degrees removed from the point of contact of the brush H. These brushes are supplied with binding-posts J of any convenient sort. For the purposes of the present specific construction it is desirable that two of the brushes at opposite ends of the shaft be

in direct electrical communication, for which reason there is supplied a band or wire *j* of any suitable conductor.

The brushes H H′, the brackets E E′, and the binding-posts J are secured to a base A in any convenient manner, said base being supplied, preferably, with suitable apertures for the reception of wires leading to the binding-posts and for the passage of screws which attach the switch to the ceiling or elsewhere. The mechanism of the switch may be incased in a dome-like cover B, which may be held in place by a screw *b* passing through its top into a threaded hole in the top of one of the brackets. An aperture *b′* is provided in the top of the cover B to permit the actuating-cord to pass through.

The operation of the switch is as follows: As already explained, a pull on the actuating-cord rotates the sheave through a quarter-revolution, thereby rotating the ratchet L′ through the agency of the pawl *l*. When this occurs, the shaft-locking pawl *n* is in engagement with a shaft-stop which maintains the shaft stationary. One end of the spiral motor-spring being operatively connected to the shaft, said end is also stationary. The other end of the spring being attached to the ratchet L′, the spring is wound up to an increasing tension as ratchet is rotated. While the motor-spring is being wound up one of the pawl-lifters of the ratchet L′ is gradually lifting the shaft-locking pawl *n* from its engagement with a shaft-stop, so that when the said spring has reached a certain maximum tension the pawl is released, leaving the shaft free to rotate under the impulse of the motor-spring. When the shaft-locking pawl has been released and the shaft rotated by the motor-spring, the ratchet L′ will be brought to a standstill by reason of the limited movement of the sheave L′, which can actuate the movement of the driving mechanism through a limited rotation only. The limit of this rotation is reached just after the shaft-locking pawl has been released from its detaining shaft-stop. Consequently during the positive rotation of the shaft and the pawl-carrier the ratchet L′ remains stationary. The rotation of the shaft will continue until the shaft-locking pawl *n* is engaged anew by the next succeeding shaft-stop, the pawl being depressed into engagement therewith by its spring. The rotation of the shaft between the release of the shaft-locking pawl and its subsequent reëngagement effects the make or break of the circuit or otherwise changes the same in a manner hereinafter to be described. When this has been accomplished, the actuating-cord may be relaxed, whereupon the reciprocating sheave will return to its initial normal position. The spring-actuating pawl *l* will be carried to its former position and will there be in a position to engage another tooth on the ratchet L′. Another pull on the cord will initiate a repetition of the above-described operation, the effect upon the circuit varying according to the previous relative positions of the brushes and the contact-plates. It is evident that each pull on the actuating-cord will rotate the contact-plates through the distance of a quadrant.

The effects of the different positions of the contact-points relative to the brushes are well illustrated in diagram in Figs. 7, 8, 9, and 10. In these views the numerals 1 and 2 indicate incandescent lamps. When the contact-plates occupy the positions shown in Fig. 7, the electric current will follow the course indicated by the arrows, lamp No. 1 being lighted thereby, lamp No. 2 being out. When the contact-plates occupy the positions shown in Fig. 8, the current will follow the course indicated by the arrows, lighting lamp No. 2, lamp No. 1 being out. When the contact-plates occupy the positions in Fig. 9, the current will follow the course indicated by the arrows, lighting both lamps 1 and 2. When the contact-plates occupy the positions shown in Fig. 10, the circuit will be broken, and neither lamp will be lighted.

It is highly desirable to employ in connection with the above-described switch some means controlled by the operating mechanism for indicating the condition of the switch at any particular time. For example, a disk D may be supplied mounted rigidly on the shaft, a portion of its periphery protruding through a slot b^2 in the cover B of the switch. Those portions of the disk disclosed to the eye of the operator at various periods of the operation of the switch may be appropriately colored or lettered to indicate the pending condition of the current. (See Fig. 1.)

As is apparent, changes entirely within the scope of my invention may be made in the particular structure or embodiment of the invention herein shown and described.

I claim as my invention—

1. A snap-switch having, in combination, a shaft carrying the contact making and breaking devices; a shaft-motor spring operatively connected with the shaft; a series of stationary shaft-stops arranged peripherally around the shaft; a pawl-carrier fixed to the shaft having a shaft-locking spring-pawl cooperating in succession with said shaft-stops; a step-by-step moving ratchet-wheel loose on the shaft and connected with said shaft-motor spring to wind up the same, said ratchet-wheel having a series of pawl-lifters adapted to disengage said shaft-locking pawl from said shaft-stops respectively, each pawl-lifter acting to lift the pawl as the ratchet-wheel completes one of its steps in advance and after the shaft-motor spring has been wound up; a reciprocating actuator having a spring-pawl coöperating with said ratchet-wheel to advance the same, thereby

winding up the shaft-motor spring; hand-controlled means for advancing said actuator; a spring to return the actuator, and stops to limit the movement of the actuator in both directions.

2. A snap-switch having, in combination, a shaft carrying the contact making and breaking devices; a shaft-motor spring operatively connected with the shaft; a series of stationary shaft-stops arranged peripherally around the shaft; a pawl-carrier fixed to the shaft having a shaft-locking spring-pawl coöperating in succession with said shaft-stops; a step-by-step moving ratchet-wheel loose on the shaft and connected with said shaft-motor spring to wind up the same, said ratchet-wheel having a series of pawl-lifters adapted to disengage said shaft-locking pawl from said shaft-stops respectively, each pawl-lifter acting to lift the pawl as the ratchet-wheel completes one of its steps in advance and after the shaft-motor spring has been wound up; and means for giving said ratchet advance movement.

3. A snap-switch having, in combination, a shaft carrying the contact making and breaking devices; a shaft-motor spring operatively connected with the shaft; a series of stationary shaft-stops arranged peripherally around the shaft; a pawl-carrier fixed to the shaft having a shaft-locking spring-pawl coöperating in succession with said shaft-stops; a step-by-step moving ratchet-wheel loose on the shaft and connected with said shaft-motor spring to wind up the same; means for rotating said ratchet; and means for releasing said pawl when said shaft-motor spring has been wound up.

4. A snap-switch having, in combination, a shaft cafrying the contact making and breaking devices; a shaft-motor spring operatively connected with the shaft to rotate the same; a shaft-stop to arrest the rotation of the shaft; a shaft-locking pawl attached to the shaft and coöperating with said shaft-stop; means for rotating said shaft through the agency of said spring; and means for releasing said pawl from the shaft-stop.

5. A snap-switch having, in combination, a shaft carrying the contact making and breaking devices; means for rotating said shaft; a series of stationary shaft-stops arranged peripherally around the shaft; a pawl-carrier fixed to the shaft having a shaft-locking spring-pawl coöperating in succession with said shaft-stops; a step-by-step moving ratchet-wheel loose on the shaft, said ratchet-wheel having a series of pawl-lifters adapted to disengage said shaft-locking pawl from said shaft-stops respectively, each pawl-lifter acting to lift the pawl as the ratchet-wheel completes one of its steps in advance when the shaft is under a rotary impulse; a reciprocating actuator having a spring-pawl coöperating with said ratchet-wheel to advance the same; and means for reciprocating the actuator.

6. A snap-switch having, in combination, a shaft carrying the contact making and breaking devices; means for rotating said shaft; a series of stationary shaft-stops to arrest the rotation of the shaft; a pawl operatively connected to said shaft to coöperate in succession with said shaft-stops; a series of pawl-lifters adapted to disengage said pawl from said shaft-stops respectively, each pawl-lifter acting to lift the pawl when the shaft is about to be rotated; a reciprocating actuator which effects the rotation of said shaft and also operates said pawl-lifters; and means for reciprocating said actuator.

7. A snap-switch having, in combination, a contact making and breaking device comprising oppositely-disposed cylindrical contactors of insulating material; contact-plates of conducting material disposed on the peripheries of said contactors, the contact-plates being in relatively different positions on their respective contactors; spaced brushes for each carrier, one brush being at an angle to the plane of the other; a conductor between two homologous brushes of the two carriers; and means for rotating the carriers.

8. A snap-switch having, in combination, a contact making and breaking device comprising oppositely-disposed contactors of insulating material; contact-plates of conducting material on said contactors; spaced brushes for each contactor; a conductor between two homologous brushes of the two contactors, and means for rotating said contactors.

9. A snap-switch having, in combination, a contact making and breaking device, operating mechanism therefor, and an indicator, separate from and controlled by the operating mechanism, projecting through the cover to show at any time the pending condition of the switch.

10. A snap-switch having, in combination, a contact making and breaking device, operating mechanism therefor, a slotted cover for the switch, and a disk, associated with said operating mechanism, adapted to project through a slot in the cover and to indicate at any time the pending condition of the switch.

11. A snap-switch having, in combination, a shaft carrying the contact making and breaking devices, means for rotating said shaft, a cover inclosing said shaft, and an indicator upon said shaft which projects through an aperture in said cover and which is adapted to show at any time the pending condition of the switch.

12. A snap-switch having, in combination, a contact making and breaking device, a cover and operating mechanism for said device, and means separate from the operating mechanism, mounted within said cover and projecting without the same, controlled by

said operating mechanism to indicate at any time the pending condition of the switch.

13. A snap-switch having, in combination, a shaft carrying contact making and breaking means, tensional driving means for said shaft; a rigid, stationary shaft-stop; yielding means mounted upon the shaft to coact with said stop to prevent rotation of the shaft in response to the action of the tensional driving means; means for actuating said stop-engaging means to cause the same to yield in its engagement with the stop, and thereby to allow rotation of the shaft in response to the action of said tensional driving means, one-way clutch mechanism mounted loosely upon the shaft for storing power in the tensional driving means and for operating the stop-engaging actuating means aforesaid.

14. A snap-switch having, in combination, a shaft carrying contact making and breaking device; tensional driving means for said shaft; a stationary shaft-stop; a resilient means mounted upon the shaft to coact with said stop to prevent rotation of the shaft in response to the action of the tensional driving means; means for actuating said resilient means to cause the same to yield in its engagement with the stop, and thereby to deliver said shaft to the action of the tensional driving means, one-way clutch mechanism mounted loosely upon the shaft for storing power in the tensional driving means and for operating the stop-engaging actuating means aforesaid.

In witness whereof I have hereunto signed my name in the presence of two subscribing witnesses.

ALLEN AUGUSTUS TIRRILL.

Witnesses:
CHARLES F. REYNOLDS,
HOBE MATTICE.