No. 861,004. PATENTED JULY 23, 1907.

H. I. WASHBURN.

DIAL SWITCH FOR REGULATING TRANSFORMERS.

APPLICATION FILED NOV. 14, 1905.

2 SHEETS—SHEET 1.

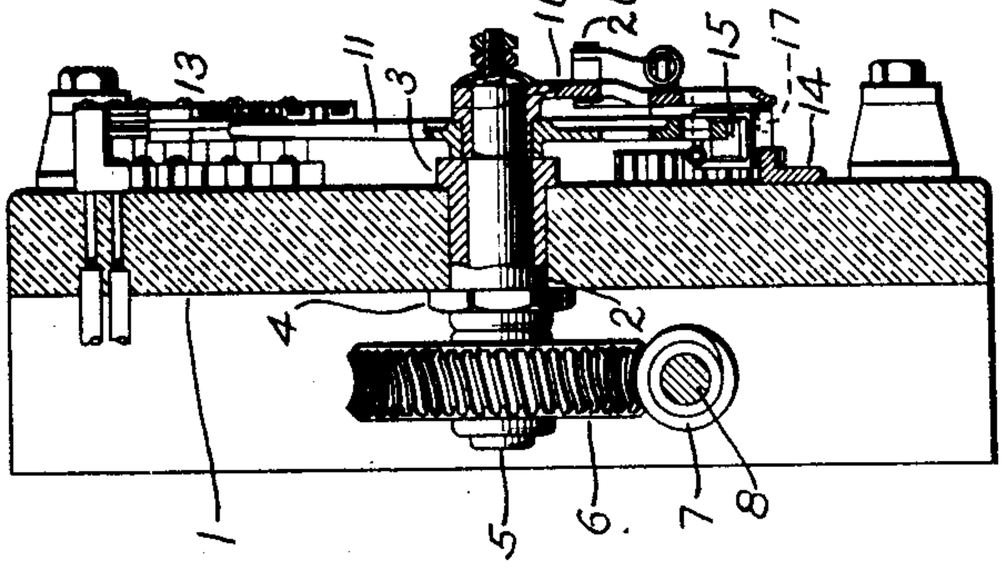
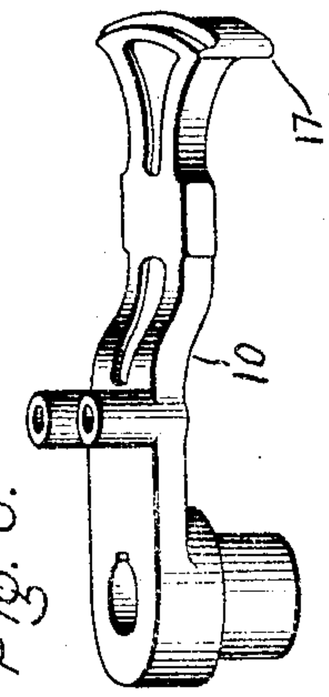


Fig. 2.



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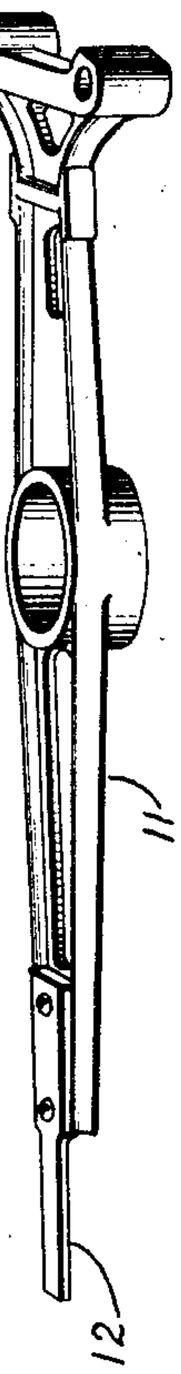


Fig. 4.

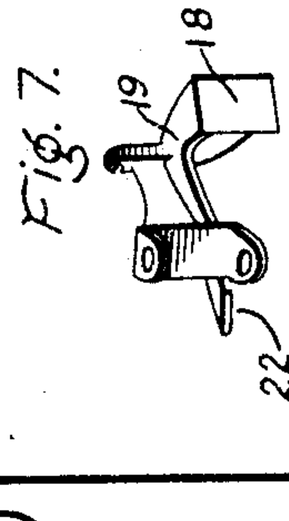
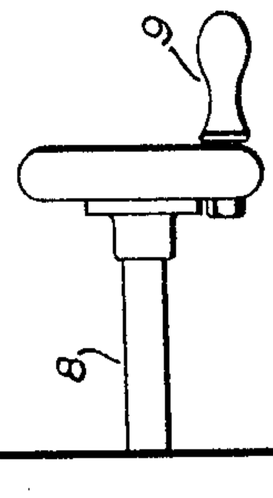


Fig. 7.



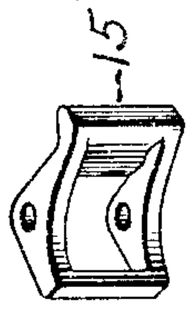


Fig. 5.

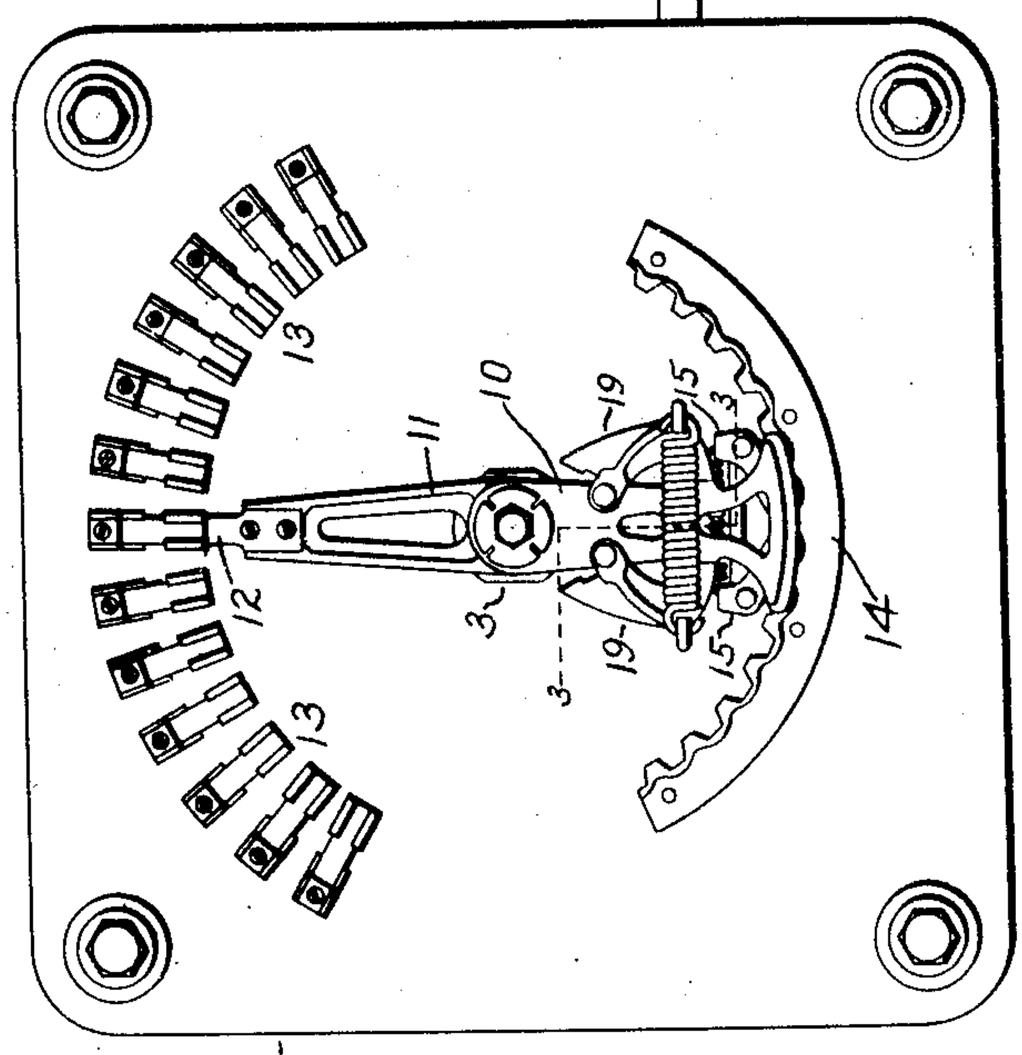


Fig. 1.

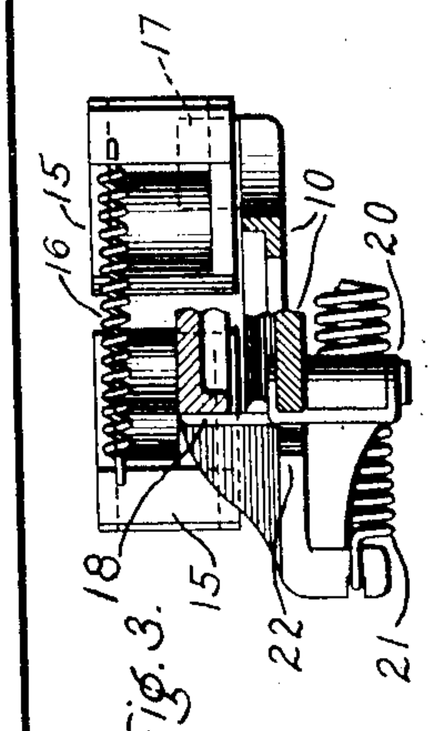


Fig. 3.

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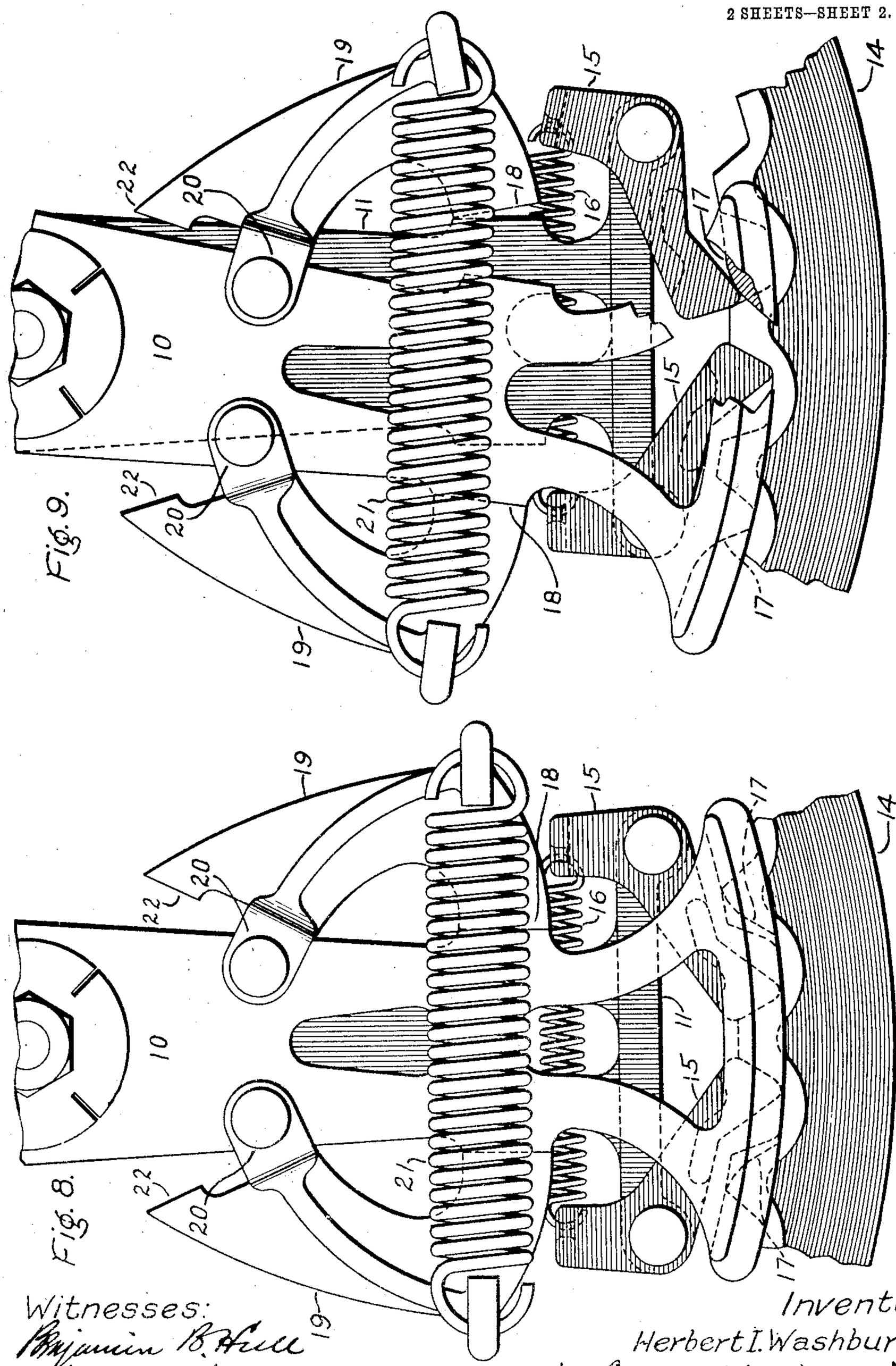

Fig. 9.

Fig. 8.

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UNITED STATES PATENT OFFICE.

HERBERT I. WASHBURN, OF OVERBROOK, NEW JERSEY, ASSIGNOR TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

DIAL-SWITCH FOR REGULATING TRANSFORMERS.

No. 861,004. Specification of Letters Patent. Patented July 23, 1907.

Application filed November 14, 1906. Serial No. 287,375

To all whom it may concern:

Be it known that I, HERBERT I. WASHBURN, a citizen of the United States, residing at Overbrook, county of Camden, State of New Jersey, have invented certain new and useful Improvements in Dial-Switches for Regulating Transformers, of which the following is a specification.

This invention relates to electric switches, and especially to those which control a plurality of contacts. It has been especially designed for use in connection with transformers in alternating current systems where it is necessary or desirable to vary widely the voltage supplied to the distributing mains. This is usually accomplished by providing the transformer with a plurality of taps leading out from different points on the winding, and a dial switch having a blade movable to and fro from tap to tap to cut in or cut out more or less of the transformer winding. As the drop in voltage from one tap to another is frequently considerable, it is desirable to have a switch which operates with a snap action in order to lessen the danger of arcing between the successive contacts. Moreover, the switch must be so constructed as not to skip a contact, but stop positively at each step. Furthermore, there must be means to positively actuate the switch-blade in case it sticks.

My invention relates to switches of this type, and its object is to provide an improved construction comprising certain novel and advantageous features, which will be specifically pointed out in the appended claims.

In the accompanying drawings, Figure 1 is a front elevation of a dial switch embodying my invention; Fig. 2 is a vertical section of the same; Fig. 3 is a sectional plan view on the line 3—3, Fig. 1; Fig. 4 is a perspective view of the switch lever; Fig. 5 is a perspective view of a dog; Fig. 6 is a perspective view of the driving-arm; Fig. 7 is a perspective view of a wing; Fig. 8 is an elevation on a large scale of the operating parts which produce the snap action; and Fig. 9 is a similar view showing another position of the same.

The various parts of the switch are mounted on a panel 1 of slate or the like. A bushing 2 is secured by a head 3 and a nut 4 in a central hole through said panel, and serves as a bearing for a shaft 5. At the back of the panel is arranged suitable mechanism for rotating the shaft in either direction; such as a worm-gear 6 secured to the shaft and meshing with a worm 7 on a shaft 8 which runs to one side of the panel and has a crank-handle 9, or other suitable means for turning it.

On the other end of the shaft in front of the panel is secured the driving arm 10, and loosely pivoted on the hub of said arm is the switch-lever 11 carrying at its upper end the switch-blade 12, which coöperates with a plurality of contact clips 13 secured to the panel in a curved row concentric with the shaft. The lower end of the switch-lever sweeps over a curved series of stops, such as a toothed rack 14 concentric with the shaft. One or more locking devices, carried by the lever, coöperate with said stops to hold the lever at any one of its several positions, in which the switch-blade makes contact with the several contact-clips.

The preferred form of locking device is a dog 15 pivoted to the lever, and inasmuch as the lever is to be shifted step by step in both directions, two dogs are provided facing towards each other, one operating when the lever moves to the right, and the other when it moves to the left. The dogs are urged into engagement with the rack by spring-pressure; preferably a single helical spring 16 is used, being attached at each end to a portion of a dog extending above its pivot.

The driving-arm, which moves in a plane parallel with the lever, carries cams for unlocking the dogs from the rack. These are preferably in the shape of laterally-projecting fingers 17 having beveled edges. The dogs are wider than the rack, and the cams lie under the projecting portions of the dogs, but out of contact therewith when the lever and the arm are in alinement. To maintain this alinement, the arm carries two alining devices, one on each side, each comprising a bar 18 extending across both the arm and the lever. A spring or springs causes these bars to press against the arm and lever, so that if one is moved out of alinement with the other, the spring-actuated bars will restore them to their normal positions. The bars are preferably pivotally supported on the driving-arm, and constitute the wide tips of wings 19 pivoted at 20, and connected below said pivots by a strong helical spring 21 connected to both wings, and urging them against the opposite sides of the lever and arm. On each wing is an upwardly-projecting shoulder 22 adapted to strike the lever at a certain point in the movement of the arm.

The operation is as follows: Upon steadily turning the shaft 8, either by hand or by power, the driving-arm 10 is swung in one direction or the other at a uniform speed. If moved to the left, as shown in Fig. 8, the right-hand finger 17 slides along under the right-hand dog 15 and lifts it. At the same time, a tension is put on the spring 21, owing to the fact that the lever 11 remains stationary and prevents the tip of the right-hand wing from following the arm 10, so that the wing swings on its pivot, as shown. But the instant the dog is lifted clear of the tooth of the rack, there is nothing to hold the lever 11, and the spring 21 at once snaps it over to the left. The right-hand dog, being no longer held up by the finger 17, and urged downward by the spring 16, drops into the space behind the next tooth and arrests the movement of the lever, just at the instant the switch-blade makes contact with the next clip. This operation is repeated for each tooth in the

rack, so long as the driving-arm is actuated; the lever snapping from step to step irrespective of the speed of the arm. A reverse motion of the arm causes a reverse snapping movement, step by step, of the lever; the left-hand dog, finger and wing being the active elements. It is of course understood that in each of its positions of rest, the switch-blade is in contact with a clip.

If the switch-blade sticks in a contact-clip, the movement of the driving-arm eventually brings the shoulder 22 of the rear wing into abutment with the arm 10, so that the wing can no longer swing, but exerts a direct pull on the lever 11.

What I claim as new and desire to secure by Letters Patent of the United States, is,—

1. In a switch, the combination with a plurality of contacts, of a movable contact member, an actuating member therefor, a plurality of stops corresponding with said contacts, a locking device on the contact member adapted to engage said stops successively, an unlocking device carried by the actuating member, and spring-actuated wings pivoted on one of said members and bearing against opposite sides of both members.

2. In a switch, the combination with a plurality of contacts, of a movable contact member, an actuating member therefor, a plurality of stops corresponding with said contacts, a locking device on the contact member adapted to engage said stops successively, an unlocking device carried by the actuating member, and spring-actuated wings pivoted on one of said members and bearing against opposite sides of both members, said wings being arranged to have a positive limit to their movement upon their pivots.

3. In a switch, the combination with a plurality of contacts, a movable contact member, an actuating member therefor, a spring connection between said members, a rack having teeth corresponding in position with said contacts, two spring-actuated pawls or dogs pivoted on the contact member and facing in opposite directions and engaging the teeth of said rack, and means carried by the actuating member for lifting one of said pawls out of engagement with said rack when said actuating member is moved a predetermined distance in either direction.

4. In a switch, the combination with a plurality of contacts, of a pivot concentric therewith, a driving-arm rotatable on said pivot, a switch-lever mounted on said pivot, a rack concentric with said pivot, two dogs pivoted on said lever and engaging with said rack, two fingers projecting from the arm and lying under said dogs, and two alining devices mounted on opposite sides of the arm and bearing against both the arm and the lever.

5. In a switch, the combination with a plurality of contacts, of a pivot concentric therewith, a switch-lever and a driving-arm on said pivot, a rack concentric with said pivot, locking devices on said lever, cams on the arm to unlock said devices, movable alining members mounted on each side of the arm, and a spring connecting said alining members.

6. In a switch, the combination with a plurality of contacts, of a shaft concentric therewith, a driving-arm secured to said shaft, a switch-lever pivotally mounted on said shaft, a rack concentric with said shaft, dogs pivoted on said lever and engaging with said rack, cams on said arm for disengaging said dogs, and spring-actuated alining members pivoted to said arm.

7. In a switch, the combination with a plurality of contacts, of a shaft concentric therewith, a driving-arm secured to said shaft, a switch-lever pivotally mounted on said shaft, a rack concentric with said shaft, dogs pivoted on the arm and engaging with said rack, cams on said arm lying under said dogs, and wings pivoted to said arm and bearing against opposite sides of both the arm and the lever.

8. In a switch, the combination with a plurality of contacts, of a shaft concentric therewith, a driving-arm secured to said shaft, a switch-lever pivotally mounted on said shaft, a rack concentric with said shaft, dogs pivoted on the arm and engaging with said rack, cams on said arm lying under said dogs, wings pivoted to said arm and bearing against opposite sides of both the arm and the lever, and a spring connecting said wings.

9. In a switch, the combination with a plurality of contacts, of a shaft concentric therewith, a driving-arm secured to said shaft, a switch-lever pivotally mounted on said shaft, a rack concentric with said shaft, dogs pivoted on the arm and engaging with said rack, cams on said arm lying under said dogs, and wings pivoted to said arm and bearing against opposite sides of both the arm and the lever, said wings having shoulders adapted to abut against said lever.

In witness whereof, I have hereunto set my hand this ninth day of November, 1905.

HERBERT I. WASHBURN.

Witnesses:

EDWARD WILLIAMS, Jr.,

EDMUND W. KIRBY.