July 4, 1933. H. W. CRANE 1,916,360

MOTOR OPERATING SWITCH

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Fig. 1.

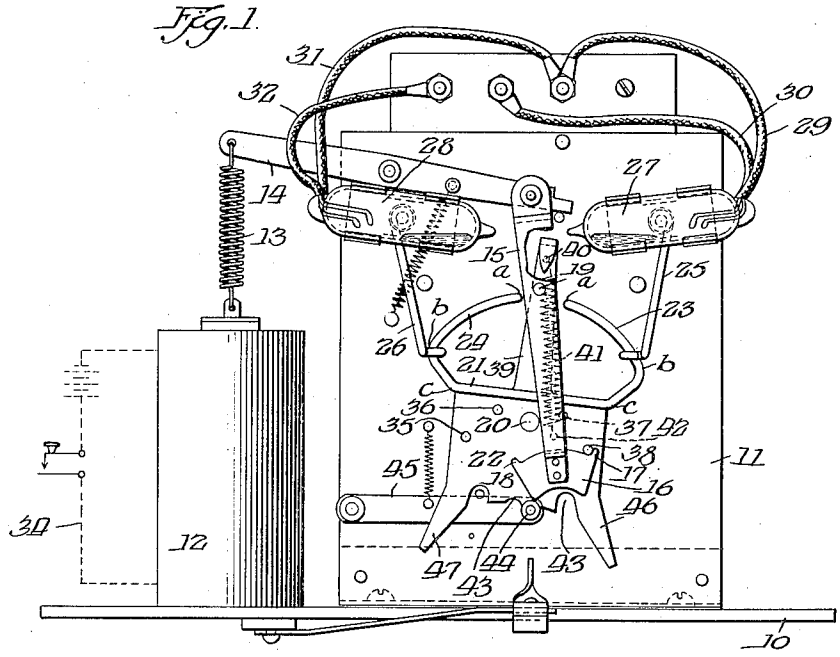
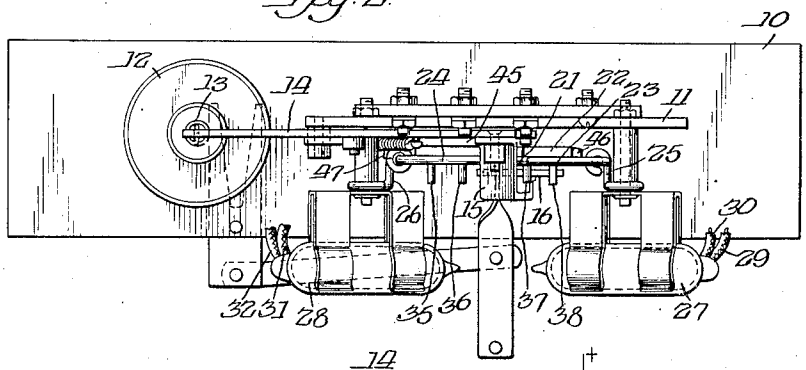


Fig. 2.



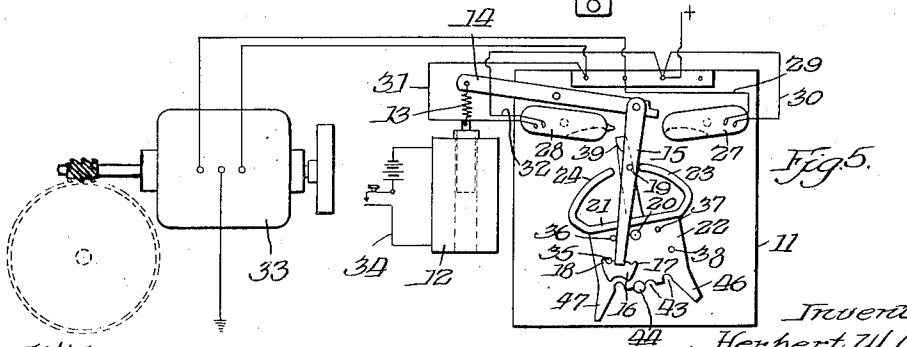


Fig. 5.

Witness:
R. B. Davison.

Inventor:
Herbert W. Crane.
By: Murray & Murray
Attys

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Fig. 3.

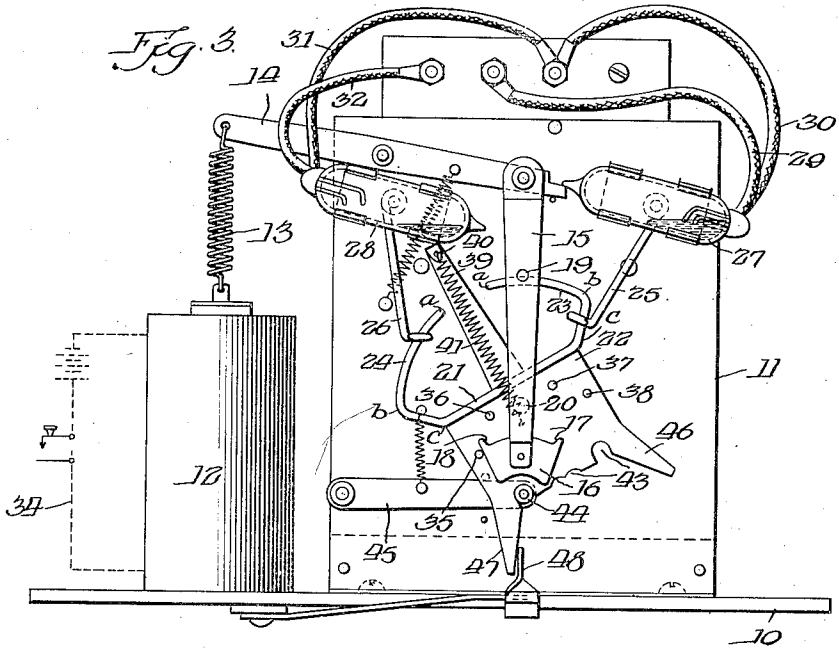
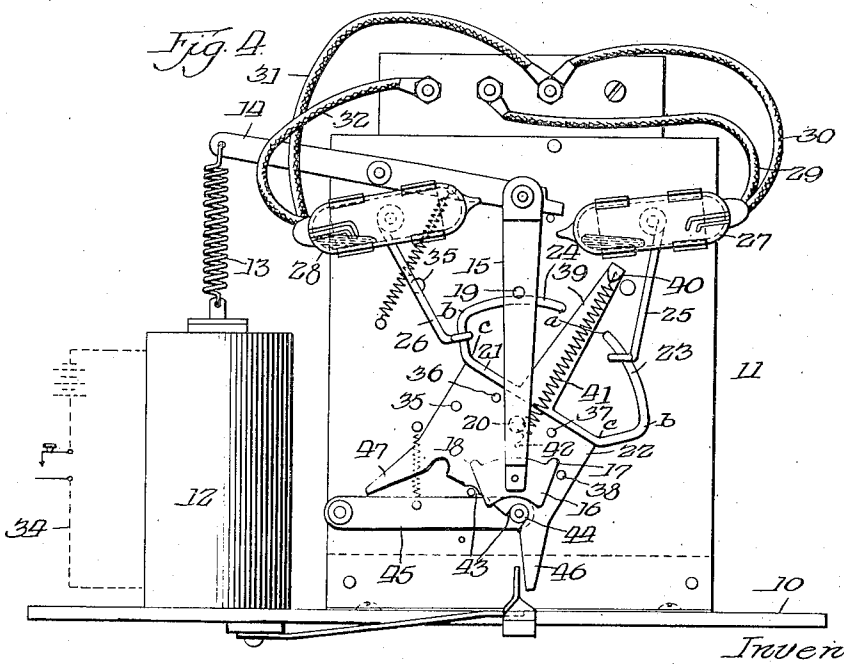


Fig. 4.



Witness:
R. B. Davison.

Inventor:
Herbert W. Crane
By Murray Murray
Attys

Patented July 4, 1933

1,916,360

UNITED STATES PATENT OFFICE

HERBERT W. CRANE, OF OAK PARK, ILLINOIS

MOTOR OPERATING SWITCH

Application filed August 6, 1931. Serial No. 555,523.

My invention relates to switches and particularly to a reversing switch adapted for use with door-operating motors.

An essential in successful operation of doors by motor control is a suitable reversing switch. Preferably the motor switch is operable by a low voltage relay, including a solenoid adapted to effect the necessary mechanical movement. In operations of this character in which the solenoid movement is always in the same direction and of the same extent, a switch should be provided in which the required positions are obtained with certainty and with a minimum number of parts.

I have found that successful operation is insured by the use of small mercury switches mounted for oscillation, the mechanism employed for effecting the required movement being very simple and designed for operation for an indefinitely long period without attention.

My invention will be more readily understood by reference to the accompanying drawings, in which:

Fig. 1 is a face view of switch mechanism constructed in accordance with my invention;

Fig. 2 is a plan view thereof;

Figs. 3 and 4 are views identical to that of Fig. 1 but with the parts in other operative positions, and

Fig. 5 is a wiring diagram.

Essentially the parts comprise a base 10, a support 11 mounted perpendicularly thereon and a solenoid 12. A spring 13 connects the solenoid core with the outer end of a rocker arm 14 pivoted to the support. A pendulous member 15 is pivoted to the inner end of the arm 14 and is provided at its lower extremity with a member 16 having hook elements 17, 18 on opposite sides of the central axis of the pendulous member. A pin 19 is located intermediate of the length of the pendulum and projects rearwardly for a purpose later to be explained.

A throw piece is pivoted for oscillation on an axis provided by the pin 20 fixed in the support 11, this piece having the function of moving the switch elements to the desired positions. The throw piece is provided with means forming a cam track, such means consisting of a length of wire, the middle portion 21 of which is welded to the body 22 of the throw piece, the two arms 23, 24 being bent into arcuate form. The two arms are of duplicate outline and perform identical functions. The portions of the wire arms from the points "*a*" to "*b*" are bent into an arc of a circle whose center is the pin 20; that is, the center of oscillation of the throw piece. However, the portions of the wire arms from "*b*" to "*c*" are either straight or bent on a very short arc, and arranged at an abrupt angle to the upper portions "*a*", "*b*" of the wire. These wire arms, constituting in effect a cam track, are engaged by eyes formed in the ends of arms 25, 26 rigidly connected to suitable frames and spring finger that carry the mercury switch tubes 27, 28 the tubes, which act as circuit closers being adapted for oscillation in order to throw the mercury into and out of circuit-making position. Flexible wires 29, 30, 31 and 32 lead from the ends of the mercury tubes to suitable binding posts from which wires are connected from a source of power and to the windings of the motor 33. The low voltage circuit for operation of the solenoid is indicated at 34.

Also provided on the body 22 of the throw piece are projections 35, 36, 37 and 38 arranged in arcuate outline; that is, they are laterally and vertically spaced relative to the center 20 of oscillation of the throw piece. These projections are in position to be engaged in proper sequence by the hooks 17, 18 on the pendulum.

Projecting vertically from the body 22 of the throw piece is an arm 39 having a stop 40 at its upper end, which stop, in certain positions of the parts will contact the pin 19 on the pendulum preventing overthrow. A spring 41 extends from the top of the arm 39 to the lower end of the pendulum being connected thereto at the point 42. The spring being under tension, its tendency is to swing the pendulous member according to the position of the throw piece.

The throw piece is maintained in adjusted position by means of the notches 43, in its

lower edge, engaged by the roller 44 on the spring pressed arm 45. The fingers 46, 47 on the lower end of the throw piece are adapted to be contacted by the arm 48, that is directly connected through suitable links to the door mechanism thus acting as an automatic switch-throw when the door reaches its respective limits of movement.

The operation is as follows: In Fig. 1 the parts are shown in a neutral position, that is, with neither of the switches in closed circuit condition. However, the pendulous member is so positioned that upon the next actuation of the solenoid, the arm 14 will raise the pendulum. Inasmuch as the hook 17 is positioned beneath the pin 38, the elevation of the pendulous member will result in the oscillation of the throw piece to the position shown in Fig. 3. This causes the eye on arm 25 to ride into the portion "*b*", "*c*" of the cam track and to result in quick throw of the mercury switch into the position shown in Fig. 3. However, the arm 26 will ride on the portion "*a*", "*b*" of the cam track which is in the arc of the center of oscillation of the throw piece and no movement whatever of the mercury tube 28 can occur. Upon the return of the solenoid to its starting position, the pendulous member will be lowered and the spring 41 will pull the pendulous member to the left into the position shown in Fig. 3 with the hook 18 beneath the projection. Upon the next actuation of the solenoid the pendulous member will be lifted and the parts swung into the neutral position of Fig. 5; that is, with the arm 39 to the left of the center of the pendulous member. The pull of the spring 41 will therefore place the pendulous member with its hook 18 beneath the pin or projection 35, and upon the next actuation of the solenoid, the parts will be thrown into the position of Fig. 4, that is with the contacts closed in the tube 28 and unchanged in the tube 27. This movement serves to cause pull of the spring to the right of the pendulous member and results in positioning the hook 17 underneath the pin 37. Therefore, upon the next actuation, the parts will be returned to the position of Fig. 1 with both circuits open and with the parts in position to effect the closing of the circuit of the tube 27. Thus with identical movements of the solenoid arm, the parts are sequentially moved into the respective closed circuit positions and to the intervening neutral positions. If movement of the throw piece is effected by the mechanically moving arm 48, the action is the same as that described.

It is obvious that the form of connection between the solenoid and the actuating pendulous member could be varied widely also that the form of connection between the mercury tubes and the switch piece could be varied considerably. These and other modifications are considered to be within the scope of my invention.

I claim:

1. In combination a support, a rocker arm thereon, means for actuating the rocker, a pendulous member connected to one end of the rocker said pendulous member having a hook at its extremity, a throw piece pivoted for oscillation on the support, said piece providing a cam track and having a series of spaced projections on its face, a pair of circuit closers mounted for oscillation on the support and having arms in engagement with said cam track, and spring means connected to the throw piece and the pendulous member acting to position the hook on the pendulous member relative to the projections on the throw piece.

2. In combination, a support, an arm pivoted for oscillation thereon, a pendulous member connected to one end of the arm, said member having a hook thereon, a throw piece pivoted for oscillation on the support, said piece providing a cam track and having a series of projections arranged in laterally and vertically spaced relation on the body of said piece, a pair of switch elements, arms connected to said cam track and adapted to effect movement of said switch elements, and means operated by the throw piece for positioning said pendulous member relative to the projections on said piece.

3. In combination, a support, an arm pivoted for oscillation thereon, a pendulous member connected to one end of the arm, said member having a hook thereon, a throw piece pivoted for oscillation on the support, said piece having an arcuate guide member thereon, and said piece also having a series of projections arranged in an arcuate line around the center of oscillation of the piece, a pair of switch elements, arms, means connecting the switch elements to the arcuate guide member, and means for positioning the pendulous member to effect engagement of the hook thereof with said projections in sequence.

4. In combination, a support, an arm pivoted for oscillation thereon, a pendulous member connected to one end of the arm, said member having a hook thereon a throw piece pivoted for oscillation on the support, a throw piece having a body portion and an arm and being pivoted for oscillation on the support, said throw piece having a guide member, one portion of which is formed in an arc whose center is the center of oscillation of the piece, switch elements, means connecting the switch elements to the guide member, projections on the throw piece, and a spring connecting the arm on the throw piece to the pendulous member for positioning the member for sequential engagement with said projections.

5. In combination, a support, a pendulous

member, means connected to the member for effecting reciprocation and permitting oscillation thereof, a throw piece pivoted for oscillation on the support, a cam track provided by the piece, a pair of mercury switches, arms for oscillating said switches, said arms being connected to said cam track, projections on said throw piece, and means operable by the throw piece for positioning the pendulous member to contact said projections in sequence whereby to effect oscillation of the throw piece.

6. In combination, a support, a pendulous member, means connected to the member for effecting reciprocation and permitting oscillation thereof, a throw piece pivoted for oscillation on the support, means providing a curved guide member on the piece, the arc of curvature of the guide member being varied within its operative length, a pair of switch elements, arms connecting the switch elements to the guide member, projections arranged in arcuate outline arranged on the face of said throw piece, and means for positioning the pendulous member for actuating contact with said projections in sequence, whereby to effect oscillation of the throw piece.

In testimony whereof I have affixed my signature.

HERBERT W. CRANE.