The disclosure comprises an electric relay switching device having a solenoid coil; a magnetically responsive armature adapted for reciprocal movement; a pair of electrical switching contacts; a cam device rotatably secured to said reciprocating armature and adapted for reciprocation therewith, said cam device being formed with a plurality of recesses; stationary detent means adapted to cause said cam to rotate upon reciprocation thereof, said switching means being responsive to the rotation of said cam device.
ELECTROMAGNETIC SWITCHING DEVICE WITH MOVABLE RATCHET

My invention relates to a stepping relay having a reciprocating cam member adapted to rotate and upon rotation to cause electrical switching means to alternate between open and closed position.

One of the objects of my invention is to provide a ratchet device for a solenoid switching device which is adapted to cause rotation of a cam means upon both forward and reverse stroke of the solenoid armature to thereby permit the housing and operation of the mechanism in a relatively shorter space.

A further object of my invention is to produce a relay type switching mechanism that is inexpensive to produce and positive and reliable in its action.

Further advantages will become apparent from the drawings and specifications descriptive thereof.

In the drawings:

FIG. 1 is a top plan view of a preferred embodiment of my invention;

FIG. 2 is a side elevation of the relay shown in FIG. 1;

FIG. 3 is an end elevation of the relay shown in FIG. 1;

FIG. 4 is a top plan view of a modified form of relay embodying my invention;

FIG. 5 is a side elevation of the modification shown in FIG. 4;

FIG. 6 is a bottom plan view of the ratchet mechanism as embodied in the modified form shown in FIG. 4;

FIGS. 7, 8 and 9 are top and side views respectively of the detent or pawl used in the modification shown in FIG. 4;

FIG. 10 is a sectional view as taken on line 10-10 of FIG. 6.

Referred to FIGS. 1 and 2, I have provided a base plate 15 upon which is mounted an electromagnetic coil 16. It will be understood that the coil 16 is formed with an axial bore adapted to receive in telescopic relation an armature 18.

Armature 18 is formed with an annular collar 19. A compression spring 20 is disposed over the armature 18 between the collar 19 and the end of the coil 16 whereby the spring 20 is biased to return the armature to its outer or extended position when no electric current is flowing through the coil 16.

The armature 18 is also formed with a diametrically disposed slot 22 at its outer end. A combination ratchet-cam wheel 23 is disposed for free rotation in said slot 22. The cam 23 is formed with a plurality of notches 25 and 26 in spaced relation around the periphery. It will be noted that alternate notches 25 and 26 are different in depth, the purpose of which will become readily apparent later.

Oppositely acting detents 27 and 28 are secured to the base 15 and are adapted to engage the notches 25 and 26. The detent 28 extends beyond the notch 25 and carries an electrical contact means 30 which alternately closes and opens with respect to contact 31.

When detent 28 is resting in notch 25, the contact points 30 and 31 are open. When detent 28 is resting in notch 26 the contacts 30 and 31 are closed.

A guide member 33 extends upwardly from the base 15 and is formed with an upwardly extending section 34. The purpose of the guide member 33 is to prevent the armature 18 from rotating about its axis and from being displaced out of the bore of the armature 16.

In the operation of the device, electrical energy is applied to the coil 16 creating a magnetic field which draws the armature 18 into the bore of the coil (to the right in FIG. 1). Since the detent 27 engages the notch 25, the the ratchet wheel 23 is forced to rotate clockwise (FIG. 1) to thereby advance the next successive notch 25 or 26 into registry with detent 28. Upon the coil 16 being deenergized, the spring 20 causes the armature to move to the left.

Since detent 28 engages one of the notches 25 or 26, the ratchet wheel is again forced to rotate clockwise to thereby advance the cam-ratchet wheel to position detent 27 in the corresponding notch 25 or 26 for; the next on or off positioning.

Referring now to FIGS. 4 to 10 inclusive, I have illustrated a modified form of the ratchet wheel. In the modified form all parts and elements which are the same as the form illustrated in FIGS. 1 to 3 inclusive have the same reference numbers.

The principal modification rests in the configuration of the ratchet wheel, cam and detent mechanisms. In the modified form, as illustrated in FIGS. 4 to 10 inclusive, I have provided a ratchet wheel 35 having radially disposed ratchet teeth 36 depending from the under surface of the wheel 35. It will be noted that the wheel 35 is hexagonal in plan configuration to thereby act as a cam upon rotation.

The detent means comprises a base 37 having upwardly extending segments 38, 39 and 40. The segments 38 and 40 engage the ratchet teeth 36 so that upon inward movement of the armature 18 segment 38 causes the ratchet wheel 35 to rotate clockwise (in FIG. 4) sufficiently to cause segment 40 to engage a ratchet tooth. Upon return of the armature to its extended position by reason of the compression spring 20, the segment 40 causes the ratchet wheel 35 to rotate further in a clockwise direction to thereby cause the cam to close or open the contacts 30 and 31.

Segment 39 of base 37 performs the same function of retention as the guide member 33 as illustrated in FIG. 2.

I have illustrated my invention in what I consider its most practical embodiments. The drawings are for illustrative purposes only and are not intended as limitations. The only limitation intended and the true scope of my invention is set forth in the appended claims.

I claim:

1. A switching device comprising: an electromagnetic coil having an axial bore; an armature disposed in said bore for reciprocation on energization of said coil and having one end extending beyond one end of said coil; cam means rotatably disposed on said extending armature end and being formed with a plurality of circumferentially spaced alternately relatively shallow and relatively deep ratchet teeth; detent means engageable with said cam means to cause said cam means to rotate in only one direction upon reciprocal movement of said armature; electrical contact members movably alternately to on or off position; and actuator means engageable with said ratchet teeth to move said contact members alternately to on position and off position on successive reciprocations of said armature.
3. A switching device as characterized in claim 1 wherein said armature is normally biased in extended position.

4. A switching device as characterized in claim 3 wherein said cam means is mounted for rotation through a slot in said end of the armature.

2. A switching device as characterized in claim 1 wherein said armature is normally biased in extended position.