

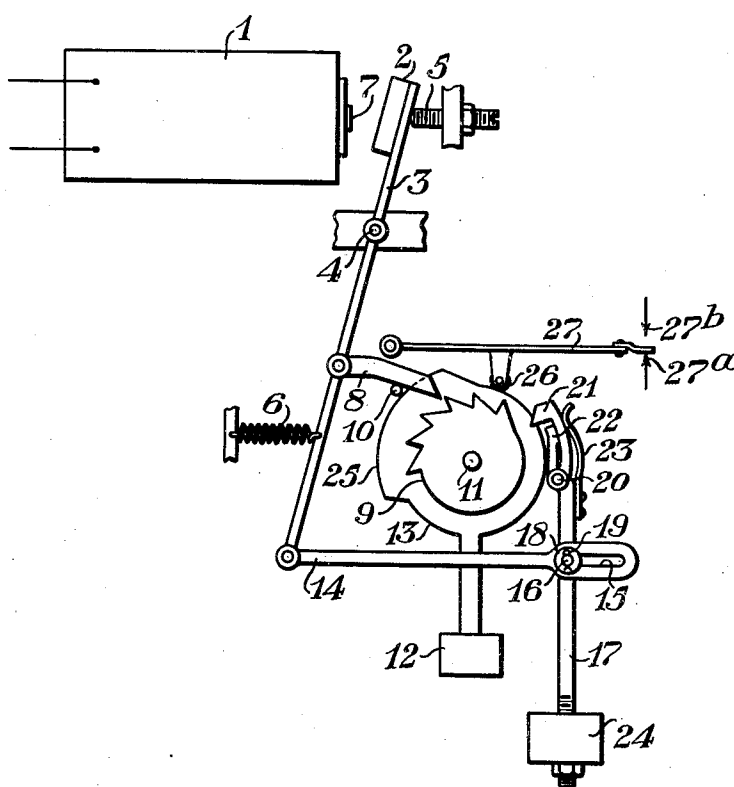
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ELECTRICAL RELAY

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ELECTRICAL RELAY

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My invention relates to electrical relays, and particularly to electrical relays of the type comprising a winding and a contact which is operated if and only if the winding is energized a plurality of times in such manner that the length of the time interval which elapses between successive energizations is less than a predetermined value.

I will describe one form of relay embodying my invention, and will then point out the novel features thereof in claims.

The accompanying drawing is a view, partly in elevation, and partly diagrammatic, showing one form of relay embodying my invention.

Referring to the drawing, the relay in the form here shown comprises an electromagnet 1, and an armature 2 which is controlled by the electromagnet 1. The armature 2 is fastened to the upper end of a substantially vertical arm 3, which arm is mounted to oscillate about a horizontal axis, indicated at 4 in the drawing. When electromagnet 1 is deenergized, the arm 3 is held against an adjustable stop screw 5 by means of a spring 6, but when electromagnet 1 becomes energized, this arm is rotated in a counterclockwise direction, to a position in which the armature 2 engages a core pin 7 attached to the core of electromagnet 1.

Pivoted to the arm 2 is a propelling pawl 8 which is adapted to engage one of the teeth of a ratchet wheel 9 each time magnet 1 becomes energized. The pawl 8 is guided into engagement with the teeth of the wheel 9 in the desired manner by means of a fixed pin 10 against which the underside of the pawl rests. The ratchet wheel 9 is fixed to a rotatable shaft 11, and is biased to the position shown by means of a counter-weight 12 formed integral with a cam 13 which is also fixed to the shaft 11. It will be noted that the ratchet wheel is provided with teeth on only a portion of its circumference, the reason for this being explained more fully hereinafter.

Also pivoted to the arm 3 at the lower end of the arm is a link 14, the free end of which is provided with an elongated slot 15. A horizontal pin 16 attached to the side

of a pendulum 17 extends with some clearance through the slot 15, and is held in place in the slot by means of a washer 18 and cotter key 19. The pendulum 17 is mounted for oscillation about an axis indicated at 20, and controls a detent 21 which is adapted to at times engage the teeth of the ratchet wheel, as will be explained hereinafter. The detent 21 is also mounted to oscillate about the axis 20, and is normally held against an offset portion 22 formed on the upper end of the pendulum 17, by means of a suitable spring 23 which is secured to the pendulum. The bob 24 of the pendulum is adjustably secured to the pendulum in such manner that it may be raised or lowered, so that the period of the pendulum can be regulated within certain limits.

The cam 13 is provided with a cam swell 25 which cooperates with a cam follower 26 attached to a contact finger 27. When the parts are in their normal positions, in which they are illustrated in the drawing, the cam follower 26 is out of engagement with the cam swell 25, and the contact finger 27 then engages a fixed contact 27^a to close a contact 27—27^a. If, however, the ratchet wheel is rotated through a sufficient angle in a clockwise direction, the cam follower 26 rides up on top of the cam swell 25, and the finger 27 then engages a fixed contact 27^b to close a contact 27—27^b.

The operation of the relay as a whole is as follows: When electromagnet 1 becomes energized, arm 3 is rotated to the position in which armature 2 engages core pin 7 as previously described. This rotation of the arm causes pawl 8 to rotate the ratchet wheel 9 one tooth in a clockwise direction, and also causes pendulum 17 to swing in a counterclockwise direction about axis 20, to a position in which detent 21 engages an adjacent tooth of the ratchet wheel 9, the detent subsequently being held in engagement with the tooth by means of the spring 23. When electromagnet 1 next becomes deenergized, arm 3 is returned to the position shown due to the bias of spring 6, thereby withdrawing pawl 8 from engagement with the ratchet wheel 9 and, at the same time, releasing the

pendulum 17, so that the pendulum is now free to swing back to its normal position under the influence of gravity. The detent 21 is so arranged that it will remain in engagement with the ratchet wheel until the pendulum has returned substantially to its normal position, at which time the offset portion 22 engages the pawl and automatically withdraws it from engagement with the ratchet wheel. It will be apparent, therefore, that if ratchet wheel 9 has been advanced due to the energization of electromagnet 1, this wheel will subsequently remain in its advanced position until electromagnet 1 has again become deenergized, and an interval of time has elapsed thereafter which is long enough for pendulum 17 to swing back to its normal position. As soon as the pendulum has returned to its normal position, the subsequent withdrawal of detent 21 just described releases the ratchet wheel 9, and counter-weight 12 then rotates the ratchet wheel in a clockwise direction to bring the ratchet wheel back to its original position.

It follows from the foregoing that if electromagnet 1 is energized a plurality of times in such manner that the time interval which elapses between successive energizations is less than the time interval required for pendulum 17 to return to its normal position after each impulse, the ratchet wheel 9 will be rotated with a step by step movement until the pawl 8 engages the last tooth, after which further rotation of the wheel is prevented. When ratchet wheel 9 has been rotated to this position, which position I will term the "operated" position of the wheel, the swell 25 on cam 13 engages the cam follower 26, thereby opening contact 27—27^a and closing contact 27—27^b as previously described. The ratchet wheel will subsequently remain in its operated position until electromagnet 1 becomes deenergized for a time interval which is long enough for pendulum 17 to swing back to its normal position from the position to which it was moved by the last impulse, whereupon the withdrawal of the detent 21 will release the ratchet wheel and permit the counter-weight 12 to return it to its normal position, thereby opening contact 27—27^b and closing contact 27—27^a.

It will be noted that as shown in the drawing, it is necessary to step the ratchet wheel 9 four successive times in order to move it to its operated position. This number of times is not essential to my invention, however, and may be varied as conditions require by varying the relative position of the cam and ratchet wheel and by increasing or decreasing the number of teeth on the ratchet wheel to correspond.

It will be apparent from the foregoing that I have provided a relay which will operate its contacts when and only when the electromagnet 1 is energized in such manner that the

time which elapses between successive energizations is less than a time interval which depends upon the period of the pendulum 17. Inasmuch as the period of the pendulum 17 is adjustable, it follows that the length of the critical interval which may elapse between successive energizations of the electromagnet may be varied for a given proportioning of the parts within limits which depend upon the limits of adjustment of the pendulum.

Although I have herein shown and described only one form of electrical relay embodying my invention, it is understood that various changes and modifications may be made therein within the scope of the appended claims without departing from the spirit and scope of my invention.

Having thus described my invention, what I claim is:

1. In combination, a member biased to one position, means for moving said member from said one position in a step by step movement, a pendulum, means for imparting movement to said pendulum each time said member is stepped, and means for preventing said member from returning to said one position between successive movements unless the time interval which elapses between successive movements exceeds a time interval which depends upon the period of said pendulum.

2. In combination, a member biased to one position, means for moving said member from said one position in a step by step movement, a pendulum, means controlled by said pendulum and effective when said pendulum is swung from its normal position in one direction for holding said wheel in its stepped position until said pendulum has returned to its normal position, and means for swinging said pendulum in said one direction each time said member is stepped.

3. In combination, a member biased to one position, means for moving said member from said one position in a step by step movement, a pendulum, means for swinging said pendulum from its normal position each time said member is moved, and means controlled by said pendulum and effective for preventing said member from returning to said one position between successive movements if and only if the time which elapses between successive movements is less than the time required for said pendulum to return to its normal position.

4. In combination, a toothed member biased to one position and adapted to be stepped in opposition to said bias, means for stepping said member, a pendulum, a detent controlled by said pendulum in such manner that if said pendulum is swung from its normal position in one direction said detent will engage one of the teeth of said member and subsequently remain in engagement with such tooth until said pendulum has returned to its normal position, and means for swinging said

pendulum from its normal position in one direction each time said member is stepped.

5 5. In combination, a toothed member biased to one position and adapted to be stepped in opposition to said bias, means for stepping
10 said member, a pendulum, a detent controlled by said pendulum in such manner that if said pendulum is swung from its normal position in one direction said detent will at times en-
15 gage one of the teeth of said member and subsequently remain in engagement with such tooth until said pendulum has returned to its normal position, means for swinging said
20 pendulum from its normal position in one direction each time said member is stepped, a contact, and means controlled by said member for operating said contact when said member has been stepped to a predetermined position.

25 6. In combination, a toothed member biased to one position and adapted to be stepped in opposition to said bias, means including an electromagnet for stepping said member, a pendulum, a detent controlled by said pen-
30 dulum in such manner that if said pendulum is swung from its normal position in one direction said detent will engage one of the teeth of said members and subsequently remain in engagement with such tooth until
35 said pendulum has returned to its normal position, and means for swinging said pendulum from its normal position in one direction each time said member is stepped.

40 7. In combination, a first member adapted to be oscillated, means for oscillating said first member, a toothed member biased to one position, a propelling pawl actuated by said first member and arranged to move said
45 toothed member one tooth each time said first member is oscillated, a detent adapted when moved into engagement with said toothed member to retain said toothed member in its stepped position for a predetermined time interval, and means for moving said detent
50 into engagement with said toothed member each time said first member is oscillated.

55 8. In combination, a first member adapted to be oscillated, means for oscillating said first member, a toothed member biased to one position, a propelling pawl actuated by said first member and arranged to move said
60 toothed member one tooth each time said first member is oscillated, a detent cooperating with said toothed member, and means actuated by said first member for moving said detent into engagement with said first member each time said first member is stepped and for subsequently maintaining said detent in engagement with said toothed member until
65 a predetermined time interval has elapsed.

9. In combination, a pivoted arm biased to one position, an armature attached to said arm, an electromagnet cooperating with said armature for oscillating said arm, a wheel
70 provided with teeth on a portion of its cir-

cumference and biased to one position, a propelling pawl pivoted to said arm and arranged to advance said wheel one tooth each time said arm is oscillated, a pendulum, a detent attached to the upper end of said pen-
75 dulum in such manner that if said pendulum is swung from its normal position in one direction said pawl will engage one of the teeth of said wheel and remain in engagement with such tooth thereafter until said pendulum has returned to its normal position, means attached to said arm for swinging
80 said pendulum from its normal position in said one direction each time said arm is oscillated, a contact, and means controlled by said toothed wheel for operating said contact when said toothed wheel has been moved from said one position through a predetermined angular distance.

In testimony whereof I affix my signature. 85
JOHN W. LIVINGSTON.

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