Oct. 20, 1931. P. B. MURPHY 1,828,507

CIRCUIT CONTROLLING DEVICE

Filed June 14, 1927

FIG. 2

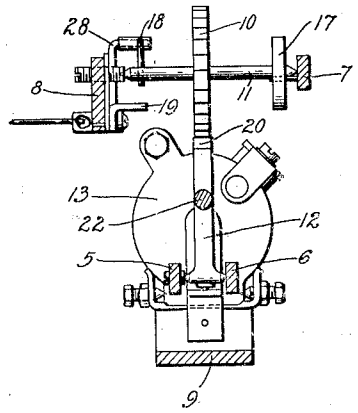


FIG. 1

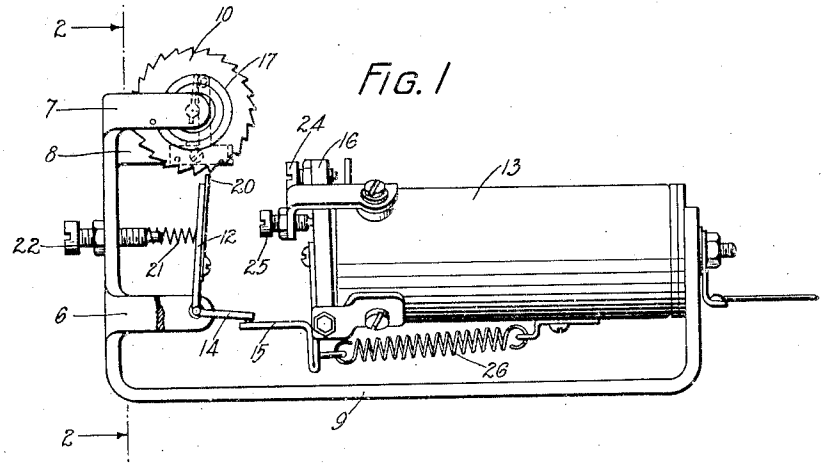


FIG. 3

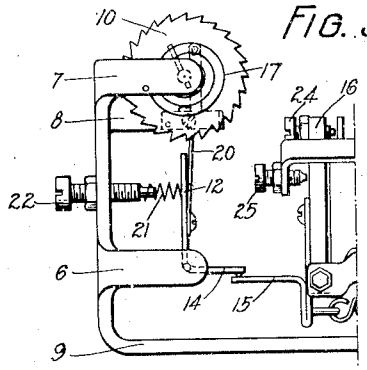
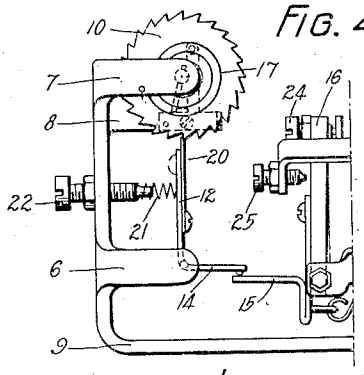


FIG. 4



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UNITED STATES PATENT OFFICE

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CIRCUIT CONTROLLING DEVICE

Application filed June 14, 1927. Serial No. 198,786.

This invention relates to circuit controlling devices and more particularly to selectively operated electromagnetic relays of the slow acting type.

The object of this invention is to provide a slow acting relay, tuned to respond to periodically recurring current impulses of a predetermined frequency.

To attain this object there is provided a time consuming mechanism which comprises a circuit controlling toothed wheel, adapted to be stepped around under the influence of a vibrating armature, and retarded in its advancement by the action of an adjustable spiral spring, the vibrations of the armature being transmitted to the wheel by an intermediate, spring controlled lever. By a proper adjustment of the two springs the relay is rendered selectively responsive to a current of predetermined frequency.

The invention will be readily understood from the following detailed description made with reference to the accompanying drawings in which:

Fig. 1 is a front view of the time consuming mechanism and the controlling electromagnetic device.

Fig. 2 is a sectional view taken along the line A—B of Fig. 1 and looking in the direction of the arrows.

Fig. 3 is a partial view of the relay structure showing the relative positions of the various elements of the time consuming mechanism when the armature is partially actuated.

Fig. 4 is similar to Fig. 3 except that the armature is fully actuated.

The following is a detailed description of the mechanism and its operation.

Mounted between the projections 7 and 8 of the mounting frame 9 is a shaft 11 upon which is permanently mounted the ratchet wheel 10. The spiral spring 17 has one end secured to the shaft 11 and the other end adjustably mounted on the projection 7 so that when the wheel 10 is stepped around in effecting the closure of the contacts 18 and 19, of an external circuit, the spring 17 is tensioned, and has a tendency to return the wheel to its normal position. Normally the contact 18, which is permanently secured to shaft 11, rests against the stop 28 holding the ratchet wheel in its normal position.

Pivotally mounted between the projections 5 and 6 of the frame 9 is a lever 12 provided with an arm 14. The arm 14 normally rests upon the extension 15 which is secured to armature 16 of electromagnet 13. Secured to lever 12 is a spring member 20 which is adapted to engage the teeth of wheel 10 when armature 16 is vibrated, and advance the wheel, tooth by tooth, until the contacts 18 and 19 are closed. A spring member 20 is so mounted on lever 12 as to permit it to slide over the teeth in wheel 10 as is shown in Fig. 3. A spring 21 has one end secured to lever 12 and the other end secured to the adjusting screw 22, by means of which the tension of spring 21 may be varied and the natural frequency of vibration of lever 12 changed accordingly.

Armature 16 of electromagnet 13 is provided with stops 24 and 25 and a restoring spring 26, the functions of which are obvious and well known in the art.

The operation of the device is as follows:

Upon the energization of electromagnet 13 by a low frequency alternating or pulsating current, armature 16 is attracted on the first impulse, causing the lever 12 to assume a position as shown in Fig. 4, with the spring member 20 flush with a tooth in wheel 10. In this position the spring 21 is compressed. Upon the cessation of the first impulse armature 16 restores under the action of spring 26, whereupon lever 12 is forced outwardly when spring 21 releases. At the beginning of the outward movement of lever 12, spring 20 being in engagement with a tooth of wheel 10 as shown in Fig. 4, the wheel is advanced one tooth, against the action of spiral spring 17. The inertia of wheel 10 causes the wheel to continue to advance on the first impulse, so that when the wheel has reached its limit of advancement due to the first impulse, a second impulse will have placed the spring 20 in a position to actively engage the next succeeding tooth in wheel 10. Spring 21 again recoils upon the release of armature 16 and the wheel is advanced another tooth.

On repeated impulses armature 16 vibrates. These vibrations are transmitted to the lever 12 which in turn causes the wheel 10 to rotate until the contacts 18 and 19 are closed, provided the energizing current is maintained sufficiently long.

It will be noted that the ratchet wheel 10 is not provided with a stopping pawl so that the wheel depends upon its own inertia to carry it around from tooth to tooth. Upon the cessation of current through the magnet 13 the wheel 10 returns to normal position under the restoring action of spring 17. By the proper adjustment of springs 17 and 21 the wheel 10 may be caused to step around when current of any predetermined frequency is impressed on the windings of magnet 13 as will hereinafter appear.

Assume the springs 17 and 21 to be adjusted so that the time consuming mechanism functions properly to close the external circuit when a 20 cycle frequency current is applied to magnet 13, and a current of a higher frequency is impressed on the magnet windings. The armature 16 would then tend to vibrate in accordance with the impressed frequency, but due to the tension of spring 21 the lever 12 would not follow these vibrations truly. That is, the armature 16 would vibrate at such a rapid rate that the lever 12 would follow the first impulse and assume the position shown in Fig. 4, but spring 21 not having been adjusted to meet this condition would not repel the lever 12 soon enough. Lever 12 therefore would not reach its normal position, but while returning to normal under the action of spring 21, would meet the extension 15 of armature 16, coming up again due to the second impulse, with the result that lever 12 would not vibrate with sufficient amplitude to cause the ratchet wheel 10 to rotate. Under this condition the spring 8 would vibrate between two teeth of the wheel 10.

In like manner should a current of a frequency lower than 20 cycles be supplied to electromagnet 13 armature 16 would vibrate at a slower rate and lever 12 would tend to follow these vibrations. The spring 17, having been adjusted for a 20 cycle frequency current, would cause the wheel 10, which may have advanced one tooth due to the first impulse, to return to normal before the second impulse reactuates lever 12, so that the wheel would not be rotated sufficiently to close the contacts 18 and 19. It is therefore evident that this invention provides a slow acting relay which may be tuned to respond to periodically recurring impulses of different predetermined frequencies.

It will be noted that the movement of the ratchet wheel 10 is effected upon the release of lever 12 under the action of spring 21 and not upon the advance of lever 12. This arrangement provides for a more constant force acting on the teeth of the ratchet wheel, since the electromagnet may be associated with telephone lines of various lengths and the pull on armature 16 would vary in strength accordingly, resulting in varying forces being applied to the wheel 10.

What is claimed is:

1. In a relay, an electromagnet, an armature actuated thereby, and a time consuming mechanism actuated by said armature embodying means for rendering said relay selectively responsive to currents of predetermined frequencies.

2. In a relay, an electromagnet, an armature therefor responsive to alternating current impulses through said electro-magnet, a time consuming mechanism actuated by said armature, and switch contacts controlled thereby, said mechanism embodying means for rendering it selectively operative upon the application of current of a predetermined frequency to said electromagnet to effect the closure of said switch contacts.

3. In a relay, an electromagnet, an armature and an energizing circuit therefor, a ratchet wheel, switch contacts controlled thereby, means intermediate said armature and said ratchet wheel for translating vibrations of said armature into a rotary movement of said ratchet wheel to effect the closure of said switch contacts, and adustable means for rendering said intermediate means ineffective when said armature is vibrated at any but a certain predetermined frequency.

4. In a relay, an electromagnet, an armature and an energizing circuit therefor, a ratchet wheel, switch contacts controlled thereby, a lever intermediate said armature and said ratchet wheel for translating vibrations of said armature into a rotary movement of said ratchet wheel to effect the closure of said switch contacts when alternating current is impressed on the energizing circuit of said electromagnet, and a spring for controlling the action of said lever to render said relay selectively responsive to currents of predetermined frequencies.

5. In a relay, an electromagnet, an armature and an energizing circuit therefor, a ratchet wheel, switch contacts controlled thereby, means normally engaging said armature and disengaging said ratchet wheel for translating vibrations of said armature into a rotary stepping movement of said ratchet wheel to effect the closure of said switch contacts when alternating current is impressed on the energizing circuit of said electromagnet, and a plurality of spring members cooperating with said ratchet wheel and said means to render said relay selectively responsive to currents of predetermined frequencies.

6. In a relay, an electromagnet responsive to currents of different frequencies, an arma-

ture and an energizing winding therefor, a ratchet wheel, means intermediate said ratchet wheel and said armature for translating vibrations of said armature into a rotary movement of said ratchet wheel when current of a predetermined frequency is impressed on said winding, and means associated with said intermediate means for rendering said ratchet wheel inoperative when said armature is vibrated at a frequency higher than the predetermined frequency.

7. In a relay, an electromagnet responsive to currents of different frequencies, an armature and an energizing winding therefor, a ratchet wheel, means intermediate said ratchet wheel and said armature for translating vibrations of said armature into a rotary movement of said ratchet wheel when current of a predetermined frequency is impressed on said winding, and means associated with said ratchet wheel for rendering it inoperative when said armature is vibrated at a frequency lower than the predetermined frequency.

8. In a relay, an electromagnet, an armature therefor actuated by current of different frequencies applied to said electromagnet, a ratchet wheel, switch contacts controlled thereby, a lever intermediate said ratchet wheel and said armature adapted to translate vibrations of said armature into a rotary movement of said ratchet wheel to effect the closure of said switch contacts, a spring for said lever, a spring for said ratchet wheel, and adjusting means for said springs to adjust the tensions thereof so that said ratchet wheel is actuated to close said circuit only upon the application of current of a predetermined frequency to said electromagnet.

In witness whereof, I hereunto subscribe my name this 13th day of June, A. D. 1927.

PAUL B. MURPHY.