

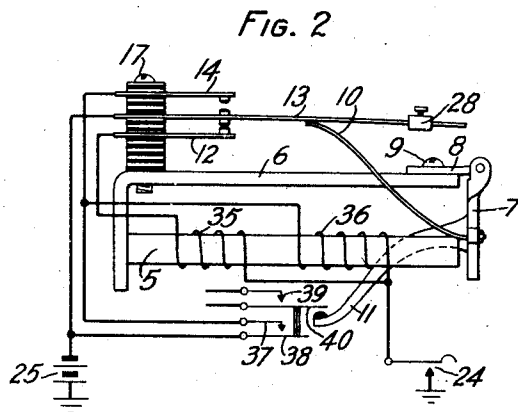
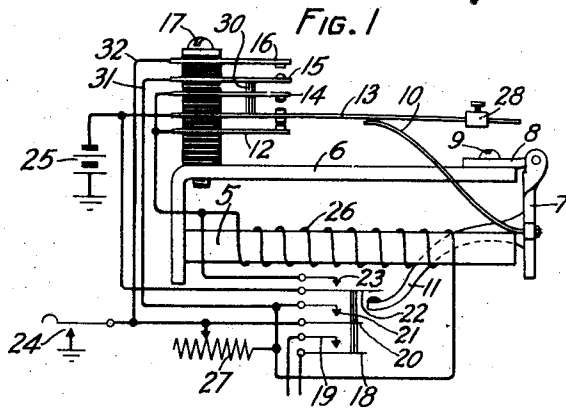
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SLOW ACTING RELAY

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SLOW ACTING RELAY

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This invention relates to electromagnetic devices and more particularly to improvements in the so-called slow to operate type relays.

5 It is the object of this invention to improve the electrical operating characteristics of electromagnetic devices of this type in which the actuation of a circuit controlling armature to its operated position lags appreciably behind the closure of the energizing circuit for the electromagnet.

10 This object is attained in accordance with a feature of the invention by the provision of an electromagnet and an armature controlled by a vibratory spring member, which so controls the completion of the energizing circuit and regulates the current therein as to materially delay the complete actuation of the circuit controlling armature.

15 Another feature of the invention resides in adjustable means associated with the vibratory spring member, by virtue of which the time interval elapsing between the initial closure of the energizing circuit and the complete actuation of the armature may be varied.

20 This invention will be readily understood from the following detailed description made with reference to the accompanying drawings which disclose two relays embodying the basic inventive idea and differing only in constructional details, the relay shown in Fig. 1 being a single winding relay and the one in Fig. 2 being a two-winding relay.

25 Like parts throughout the two figures are designated by like numerals.

30 A core 5 is secured to the magnetic yoke 6 in any suitable manner. At one end of the yoke 6 a mounting element 8 is secured by means of screw 9 and serves as a pivotal mounting for the armature 7. The armature 7 is provided with two contact spring actuators 10 and 11, the former being a relatively thin flexible member secured to the armature in any suitable manner, and the latter a rigid member formed integrally with the armature.

35 Referring to Fig. 1, the flexible member 10 is shown controlling the contact springs 12, 13, 14, 15 and 16 which are insulatively

mounted as a unit on the core 6 by means of the screw bolt 17 or in any other desirable manner. The actuator 11 controls the contact springs 18, 19, 20, 21, 22 and 23. This set of springs may also be mounted on the relay structure in any suitable manner, and has been shown schematically in order to simplify the drawings and clarify the description.

40 To operate the relay shown in Fig. 1, the key 24 is actuated. With key 24 closed a circuit is established which may be traced from grounded battery 25, normally closed spring contacts 13—12 winding 26 of the electromagnet, variable resistance element 27, to ground at key 24. The inclusion of resistance 27 in this circuit limits the current in winding 26 to such a value as to cause only a partial actuation of armature 7. This movement of the armature does not disturb the contact springs controlled by the actuator 11, but is sufficient to separate springs 12 and 13 through the medium of the member 10. The remaining contact springs controlled by actuator 10 are not effectively actuated at this time.

45 As contacts 13—12 are opened the electromagnet becomes deenergized and armature 7 restores until the vibratory spring member 13 returns to contact with member 12. With the mass 28 located as indicated, the flexibility of spring member 13 permits the contacts 13—12 to be opened without an appreciable motion of mass 28. The reclosure of contacts 13—12 again causes the electromagnet to be operated. This self-interrupting action of the armature will therefore continue for some time at a rate dependent principally upon the electrical constants of the electromagnet and its circuit. The vibration thus imparted to the spring member 13 at a point intermediate its mounting and the mass 28 gradually imparts motion to the mass 28, so that the member 13 and the mass 28 together forming an elastic system take up a vibration dependent upon the constants of the elastic system. With this vibration established, the member 13 acquires a sufficient amplitude to effect the closure of contacts 13—14.

It will be noticed that the stud 30 should be so designed as to render the closure of contacts 15—16 coincident with the closure of contacts 13—14.

5 The electromagnet is now energized in a circuit extending from grounded battery 25, spring contacts 13—14, winding 26, conductor 31, spring contacts 15—16, conductor 32, to ground at key 24. The closure of contacts
10 15—16, short-circuits the resistance 27, whereupon the ampere turns for the electromagnet are increased and are of sufficient value to effect the complete actuation of armature 7.

When armature 7 is fully actuated the contact springs controlled by actuator 11 are operated and their respective contacts closed.

The closure of contacts 22—23 and 20—21 cause the relay to lock in a circuit extending from grounded battery 25, contacts 22—23,
20 winding 26, contacts 21—20 to ground at key 24. It will be observed that contacts 20—21 short-circuit resistance 27, so that armature 7 remains fully actuated independently of contacts 15—16.

25 By the complete actuation of armature 7, contacts 18—19 which control the external circuit are closed.

It is apparent from the foregoing description that the closure of the external circuit
30 contacts 18—19 lags appreciably behind the closure of key 24 and depends upon the length of time consumed by the vibratory spring member 13, and its associated rider 28, to attain an effective amplitude of vibration.

35 Referring to Fig. 2, the actuation of key 24 causes the electromagnet to be energized in a circuit extending from grounded battery 25, normally closed contacts 13—12, winding 35 to ground at the key 24. The winding 25 has
40 only sufficient turns to effect a partial actuation of the armature 7 and, as in the description of Fig. 1, the contacts controlled by the actuator 11 are not disturbed. Contacts 12—13 are opened as in the previous description,
45 and the vibratory spring member 13 is set vibrating due to the self-interrupting action of the electromagnet.

When the vibrating element 13 attains a sufficiently large amplitude of vibration the
50 contacts 13—14 are closed causing an increased pull on the armature 7 by the substitution of winding 36 for winding 35, the former having a greater number of turns. With this resulting increase in ampere turns,
55 armature 7 is fully actuated causing actuator 11 to operate contacts 37—38 and 39—40. The closure of contacts 38—39 causes the relay to lock in a circuit which may be traced from grounded battery 25, contacts 38—37,
60 winding 36 to ground at key 24. Contacts 39—40 control an external circuit and correspond to contacts 19—18 of Fig. 1.

Restoration of key 24 to normal position causes the relay, in both cases, to be deenergized.

What is claimed is:

1. In combination, a relay, an energizing circuit for said relay, and means controlled by said relay for giving said relay a self interrupted action, said means effective a predetermined period of time after the closure of said energizing circuit, for halting said self interrupted action and maintaining said relay permanently actuated.

2. In combination, a relay, a plurality of energizing circuits for said relay, and a vibratory element controlled by said relay for maintaining one of said energizing circuits effective for a predetermined period of time and substituting another of said energizing circuits after the lapse of said predetermined period of time.

3. In combination, a relay, a plurality of energizing circuits for said relay each having different electrical characteristics and a vibratory element controlled by said relay for interchanging said circuits a predetermined period of time after the closure of one of said circuits.

4. In combination, a relay, an armature therefor, means for effecting a partial actuation of said armature, means for effecting the complete actuation of said armature and means controlled by said armature for rendering said first mentioned means successively effective for a predetermined period of time and said second mentioned means effective after the lapse of said predetermined period of time.

5. In combination, a relay, means for partially energizing said relay, means for completely energizing said relay and means set in motion upon a partial energization of said relay for effecting repeated partial energizations of said relay and causing said second mentioned means to function after a predetermined number of partial energizations of said relay.

6. In combination, a relay, means for partially energizing said relay, means for completely energizing said relay and a vibratory element set in motion upon a partial energization of said relay for effecting repeated partial energizations of said relay and causing said second mentioned means to function after a predetermined number of partial energizations of said relay.

In witness whereof, I hereunto subscribe my name this 16th day of April, 1929.

FRANK H. HIBBARD.