

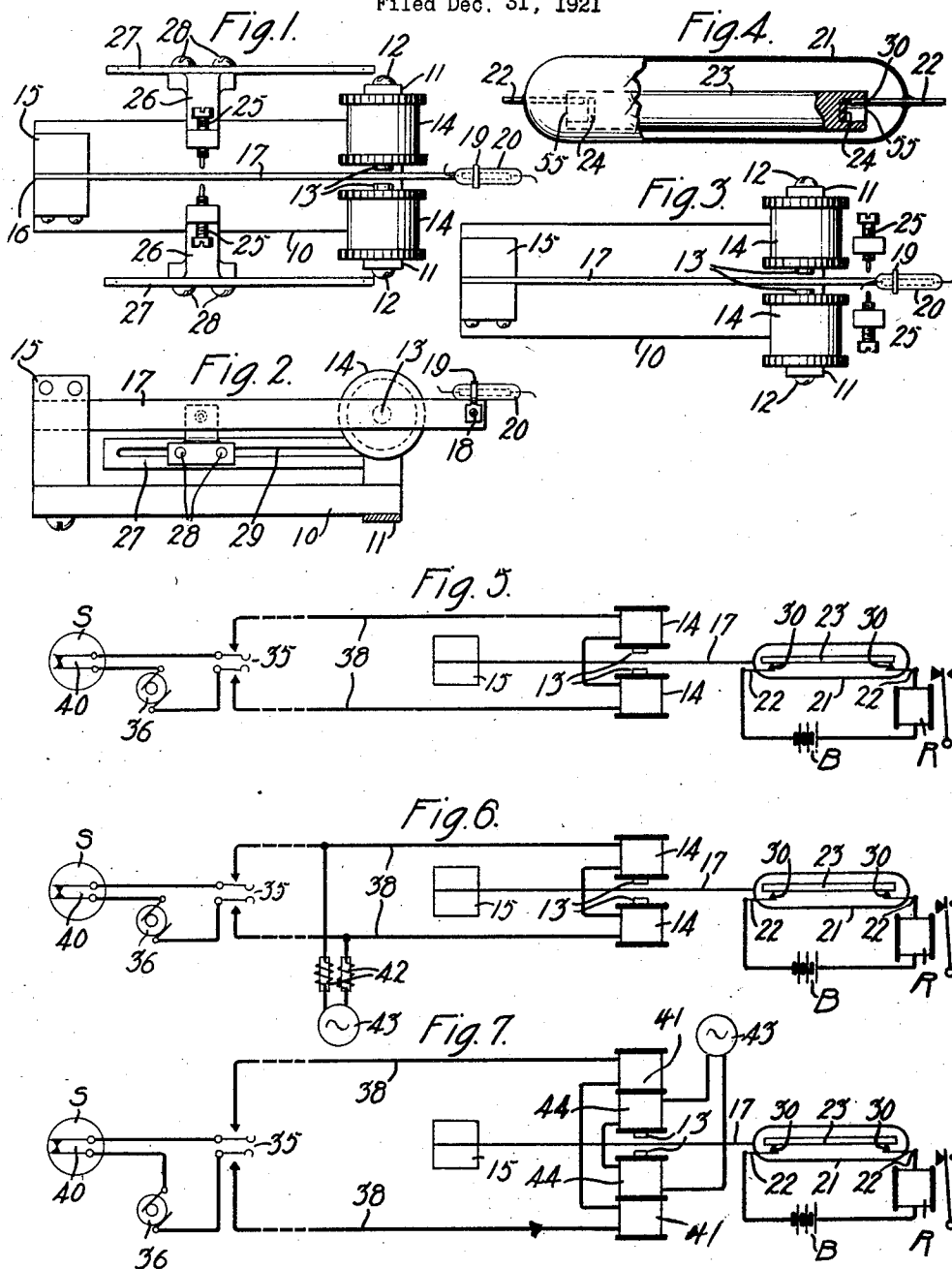
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SWITCHING DEVICE

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UNITED STATES PATENT OFFICE.

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SWITCHING DEVICE.

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This invention relates to switching devices and more particularly to such devices for controlling electrical circuits.

The object of the invention is to improve devices of this character which, when associated with a first and second circuit, operate in response to alternating current in the first circuit to control the second circuit.

To attain one object of the invention, a reed armature of an electromagnet has associated therewith a loose metallic vibratory switch member which, when the reed is vibrated at a certain rate, is agitated to alter the relationship of the terminals of the switch member.

To attain another and more specific object of the invention, the above loose metallic vibratory switch member is enclosed in a sealed receptacle carried by the said armature.

Other features of the invention will be apparent from the following description when considered in connection with the accompanying drawing.

The invention is illustrated in the accompanying drawing in which Fig. 1 shows a plan view of the preferred form of the switching device; Fig. 2 is a side elevation thereof, also partly in section; Fig. 3 shows a modification of Fig. 1, the modification consisting of differently locating the stops for the reed; Fig. 4 shows an enlarged side view, also partly in section, of the circuit controller fixed to the reed; Fig. 5 shows a circuit arrangement in which the switching device of the invention is useful; Fig. 6 shows a modified circuit arrangement embodying the switching device wherein the reed is constantly vibrated by a source of alternating current and the contacts of the circuit controller are actuated only when a second source of a different frequency is superimposed upon the current from the first source; Fig. 7 shows a modification of the arrangement shown in Fig. 6 wherein the source for constantly vibrating the reed is connected to a different winding than the source which actuates contacts of the circuit controller. In the arrangement shown in this figure the frequencies are not superimposed.

Referring now to Figs. 1 and 2 which illustrate the preferred form of the switching device, 10 shows a permanent magnet having at one end flat bar polar extensions

11, 11 of soft iron suitably fixed thereto. Fixed by means of screws 12, 12 to the flat polar extensions are cores 13, 13 to which electromagnetic coils 14, 14 are fitted. To the opposite end of the permanent magnet a soft iron block 16 is suitably fixed, which block forms a support for the vibratory reed 17. The reed 17 is clamped or held at this end and the free end thereof extends between and beyond the pole faces of the cores 13, 13. In the drawing the reed 17 is shown as tightly fitting into a slot 16 of the block 15, although any other suitable means may be employed. The free portion of the reed 17 may be tuned by so adjusting its dimensions as to give it any natural period desired in order that it will have the greatest response at some predetermined frequency of the driving source. Fixed to the reed by means of a screw 18 is a socket 19 which holds the circuit controlling device to the reed. Associated with the reed are adjustable stops 25, 25, the tips of which may be either of non-yielding or resilient material. These stops 25, 25 are held by the arms 26, 26 and are adjustable at right angles to the reed 17. For certain frequencies either one or both the stops may be adjusted so as to be normally in engagement with the reed. Although shown opposite each other in the drawing, it is to be understood that their relative positions may be varied. The arms 26, 26 are screwed to the supports 27, 27, each of which contains a slot 29 for lengthwise adjustment of the stops for the reed. The stops 25, 25, the arms 26, 26, and the supports 27, 27 are preferably of non-magnetic material and may be supported on a suitable base (not shown) upon which the magnet 10 may also be mounted.

A preferred form of the circuit controller 20, carried by the reed 17, is illustrated in Fig. 4. The circuit controller comprises a sealed tubular-shaped receptacle 21, preferably of glass, having leading-in terminals 22, 22, to which a local circuit may be connected. For contacting with these terminals there is contained in the receptacle a loose metallic member 23. The member 23 is preferably a rod provided with bored out cavities 55, 55 at each end to provide contacting surfaces 30, 30 and a support for the member. At the bottom of the cavities 55, 55 insu-

lating discs 24, 24 tightly fit so as to prevent contacting of the inner end of the terminals 22, 22 with the bottom of the cavities.

When the reed is at rest the action of gravity holds the member 23 in the position shown in Fig. 4 and since the contacts 30, 30 are closed, the terminals 22, 22 are electrically continuous. When the reed is vibrated at a certain predetermined rate and the stops 25, 25 are set so as to destroy the free movement of the reed, the contacts will be violently agitated and the electrical continuity of the terminals 22, 22 will be broken. The stops 25, 25 insure jostling of the loose contact member 23 and therefore insure opening of the circuit including the terminals 22, 22.

The stops 25, 25 also perform an important function in providing mechanical damping means for the reed. It has been found that by having the tips of the stops 25, 25 of resilient material, good damping results are obtained by adjusting the stops to engage the reed at certain points during its vibration. By this means a plurality of coexistent vibrations are set up relative to the free vibration rate of the reed. If an unyielding tip, as a pointed metal screw, is employed as a stop, and is adjusted to lightly touch the reed, or to make engagement with it when the reed is moved from its normal position of rest in response to the driving current, the stop would have the effect of imparting short, staccatic blows to the reed. These sharp blows on the reed will tend to set up harmonic vibrations of maximum amplitude which will substantially predominate the vibrations corresponding with the free period of the reed.

Fig. 3 shows a device similar to the one in Fig. 1 except that the stops 25, 25 are located near the end of the reed.

Fig. 5 shows schematically an arrangement in which the device of the invention is useful. By means of a switch 35 and impulse sender or dial S, interrupted alternating current from a source 36 may be applied to the windings 14, 14 of the switching device. Connected to the leading-in terminals of the receptacle 21 there is a battery B and a relay R so that current normally flows through the contacts 30, 30 and the relay R is normally energized. When the sender S and the switch 35 are actuated to transmit a number of impulses of alternating current over the conductors 38 of the first circuit, the reed 17 will be vibrated during the closure of contacts 40 of the sender S causing the loose contact member 23 to be agitated, the contacts 30, 30 to be opened, and relay R to be deenergized. Each time the contacts 40 of the sender S are opened during a series of impulses the reed and consequently the loose member 23 will come to rest resulting in the closure of the local circuit and the

energization of relay R. The relay R may control any suitable device and will be energized and deenergized in accordance with the number and duration of the impulses transmitted by the sender S.

In Fig. 6 a modification of Fig. 5 is shown, the modification consisting of having a source of alternating current 43 normally connected to the conductors 38 so that the reed 17 is constantly vibrating. It has been found that by choosing a certain frequency for the source 43, the contacts 30, 30 will not be opened during the vibration of the reed in response to the application of such frequency to the coils 14, 14. For the purpose of actuating the contact's circuit controller the sender S and a switch 35 are employed to superimpose current from a second source 36 having a frequency differing from that of the source 43. By superimposing the current from the source 36 upon the current from the source 43, it has been found that the contacts 30, 30 of the circuit controller will be actuated in accordance with the impulses transmitted by the sender S. Ordinarily the frequency of the source 43 would be lower than the frequency of the source 36. Choke coils 42 are therefore employed to direct the current from the source 36 through the coils 14, 14.

Fig. 7 shows a modification of the arrangement in Fig. 6, the modification consisting of providing separate windings for the two frequencies. Current from the source 43 is normally connected to the inner windings 44, 44 on the cores 13, 13 and current from the source 36 may be interruptedly applied to the outer windings 41, 41 of the cores 13 by means of the sender S and the switch 35.

With the arrangement shown in Fig. 5 it is to be understood that mechanical stops as shown in Figs. 1 or 3 may be employed for certain frequencies and may be dispensed with for other frequencies. With the arrangements shown in Figs. 6 and 7 effects similar to the effects produced by the mechanical stops shown in Figs. 1 and 3 are produced electrically. In Figs. 6 and 7 the continuous vibration of the reed by current from the local source 43 renders the contacts 30, 30 more readily responsive to smaller or more attenuated current from the distant source 36.

The glass receptacle which contains the loose contact member may be simply sealed or it may be evacuated or it may contain a gas as desired. In either case oxidation of the contacts is prevented by enclosing them in the receptacle.

What is claimed is:

1. In an alternating current relay, in combination, a tuned reed armature, a fixed circuit terminal mounted on and movable with the free end of said armature, a second fixed circuit terminal and an elongated loose me-

tallic member normally supported at each of its ends by one of said terminals and providing an electrical connection between said terminals, and electromagnetic means for vibrating said armature to agitate said loose member.

2. In an alternating current circuit, in combination, a tuned reed armature, a light weight vibrating switch mechanism mounted on and movable with said armature, said mechanism comprising a pair of fixed contact points and a loose member having a pair of electrically connected contacts at each end thereof so arranged as to normally engage and electrically connect said fixed contact points when said armature is at rest, and means for vibrating said armature through an amplitude sufficient to open said connection between the fixed contact points.

3. In an alternating current relay, in combination, a tuned reed armature, a sealed receptacle mounted on, and movable with, said member, a loose vibrating switch contained in said receptacle comprising a pair of fixed circuit terminals and a loose contact member normally resting on and electrically connecting said terminals when said armature is at rest, and an electromagnet for vibrating said armature, whereby said electrical connection between the fixed terminals is rendered discontinuous.

4. In an alternating current relay, in combination, a reed armature tuned to vibrate at

a desired frequency, a metallic fixed circuit terminal mounted on and movable with the free end of said armature, a second metallic fixed circuit terminal, a loose contact member normally resting on and electrically connecting said fixed terminals when said armature is at rest, said loose member having metallic contact surfaces where it engages said fixed terminals, and electromagnetic means for driving said armature to cause said loose member to break its contact with said fixed terminals while said armature is vibrating.

5. In an alternating current relay, in combination, a reed armature fixed at one end and tuned to a particular frequency, the free end of said armature being positioned between opposing pole pieces of a polarized electromagnet effective to vibrate said armature in response to electrical energy of a frequency corresponding to the particular period of said armature, a fixed circuit terminal mounted on and movable with the free end of said armature, a second fixed circuit terminal, a loose contact member normally resting on and electrically connecting said circuit terminals when said armature is at rest and out of contact with said terminals when said armature is vibrating.

In witness whereof, I hereunto subscribe my name this 30th day of December A. D., 1921.

HENRY W. O'NEILL.