Aug. 29, 1944. C. HUETTEN 2,356,791

RELAY

Filed March 19, 1942

Fig. 1

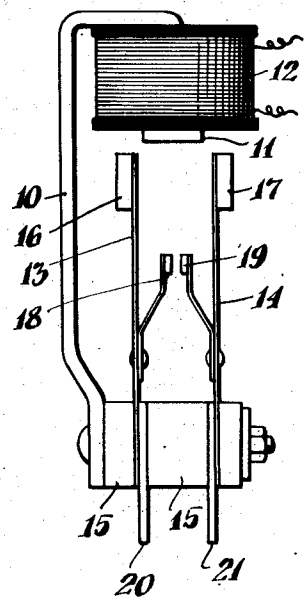


Fig. 3

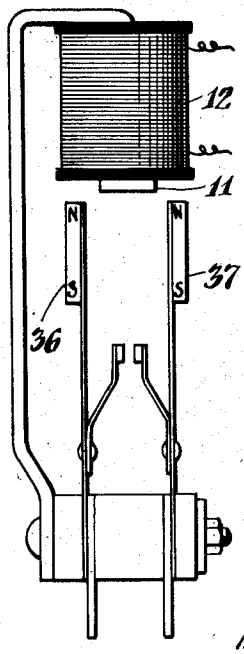


Fig. 4

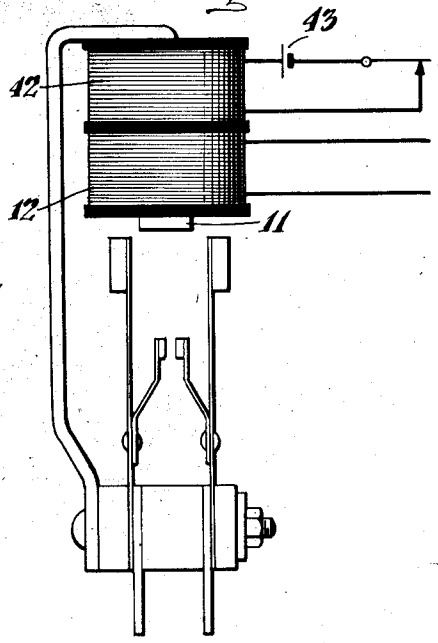
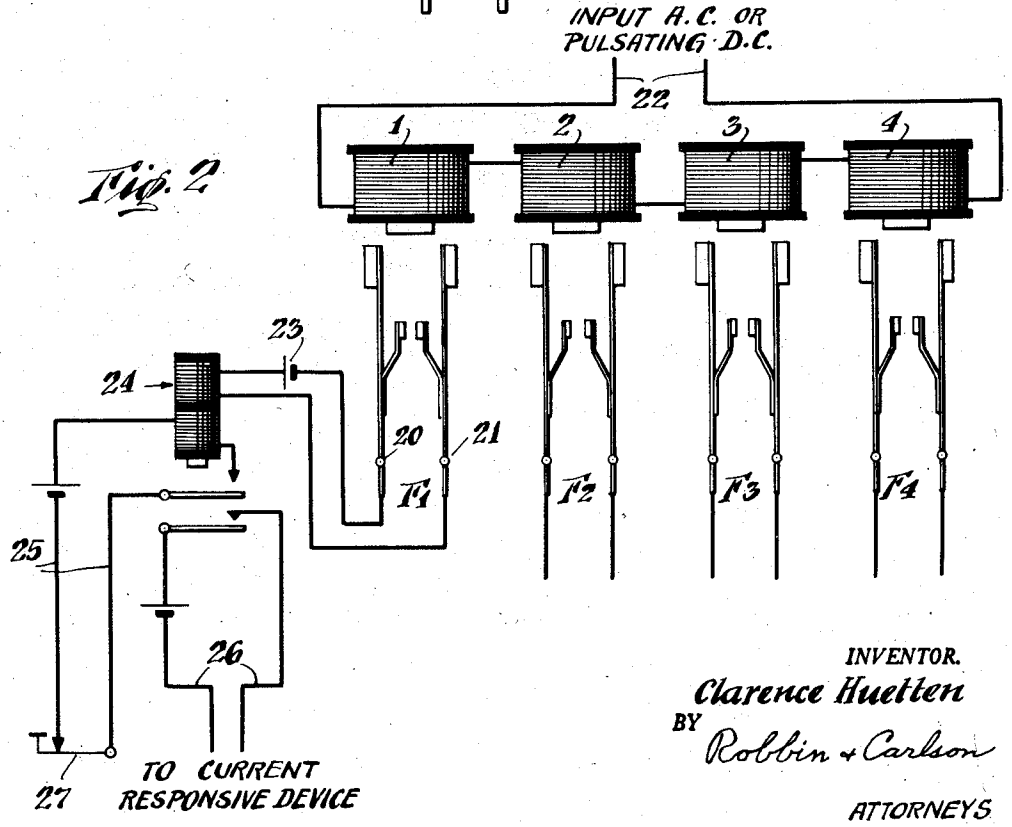


Fig. 2



INVENTOR.
Clarence Huetten
BY Robbin & Carlson
ATTORNEYS

Patented Aug. 29, 1944

2,356,791

UNITED STATES PATENT OFFICE

2,356,791

RELAY

Clarence Huetten, Indianapolis, Ind., assignor to P. R. Mallory & Co., Inc., Indianapolis, Ind., a corporation of Delaware

Application March 19, 1942, Serial No. 435,337

4 Claims. (Cl. 200—103)

This invention relates to frequency selective relays.

An object of the invention is to improve frequency selective relays.

Other objects of the invention will be apparent from the following description and accompanying drawing taken in connection with the appended claims.

The invention comprises the features of construction, combination of elements, arrangement of parts, and methods of manufacture and operation referred to above or which will be brought out and exemplified in the disclosure hereinafter set forth, including the illustrations in the drawing.

In the drawing:

Figure 1 is a side view of a relay embodying features of the present invention;

Figure 2 is a diagram of a circuit utilizing relays of the type shown in Figure 1;

Figure 3 is a detail of a modification of the relay; and

Figure 4 is a detail of a further modification.

In its preferred embodiment the present invention contemplates a frequency selective relay which operates to close a circuit, at least momentarily, in response to pulsating or alternating electric current of a predetermined frequency. The relay may be made unresponsive to electric currents which are not of the frequency to which it is tuned.

The general construction of the relay may be generally similar to the vibrator shown and described in Ira M. Slater Patent 2,190,685 of February 20, 1940. The relay of the present invention differs, however, in having mounted thereon a pair of tuned reeds which cooperate to close a circuit responsive to a predetermined frequency.

While a preferred embodiment of the invention is described herein, it is contemplated that considerable variation may be made in the method of procedure and the construction of parts without departing from the spirit of the invention. In the following description and in the claims, parts will be identified by specific names for convenience, but they are intended to be as generic in their application to similar parts as the art will permit.

Referring to Figure 1 the relay comprises a frame 10 of iron or other paramagnetic material bent to provide a body portion and a reverse pole piece 11 on which is mounted an electromagnet winding 12. A pair of carefully tuned reeds 13 and 14 are clamped at their base at the opposite end of frame 10 from the electromagnet and separated from the frame and from each other by insulating blocks 15. The reeds 13 and 14 carry pole pieces 16 and 17, respectively, of iron or similar material at their free ends. The free ends of the reeds are symmetrically disposed on opposite sides of the axis of electromagnet pole 11 with both reed armatures 16 and 17 within the sphere of effective magnetic influence of the electromagnet.

Reed 13 carries a spring arm riveted thereto at an intermediate point, the spring arm carrying an electric contact 18. Reed 14 similarly carries an electric contact 19 on a spring arm in opposed spaced relation to contact 18. The contacts are thereby enabled to come together and make contact responsive to the swing of reeds 13 and 14 toward each other.

Terminals 20 and 21 are provided at the base of reeds 13 and 14, respectively, to enable connection of the reeds to an outside circuit. The relay may be provided with any suitable supporting base or casing, such as that illustrated in Slater Patent 2,190,685, for example.

Both reeds 13 and 14 are tuned to the same frequency F. It will be apparent, therefore, that if electromagnet 12 is energized with a pulsating current of frequency F, reeds 13 and 14 will start vibrating in such a manner that their armatures swing first toward each other, then away from each other at the frequency F to which they are tuned. As soon as sufficient vibratory energy has been stored in the reeds, their amplitude will reach a point where contacts 18, 19 will periodically close, thus periodically closing the circuit connected to terminals 20, 21. It will be evident that even with a very small input to electromagnet 12, the reeds will eventually vibrate at sufficient amplitude providing they are in resonance with the frequency of the input current. However, if the input current is at a substantially different frequency from the natural mechanical vibratory frequency of the reeds, the influence of the electromagnet upon the reeds will be very slight and, no matter how long the pulsating current is applied to the electromagnet, it will have no cumulative effect upon the reeds and hence will never build up sufficient amplitude of vibration therein to close the contacts.

Since the two reeds 13 and 14 vibrate 180° out of phase a balanced vibratory action is obtained. This mode of vibration also reduces the effect of external damping which would be present to some extent in a single reed relay. Moreover, due to the fact that both reeds move together simultaneously, contacts 18 and 19 may be spaced

comparatively far apart and will still be closed by the joint operation of both reeds during their vibration.

Accidental shocks or jars applied to the relay will not cause closure of the contacts inasmuch as both reeds will swing simultaneously in the same direction, thus maintaining the contact spacing. For a similar reason the relay can be used or mounted in any position since the deflection caused by gravity deflects both reeds equally in the same direction.

The relay can readily be constructed to have a sharp frequency response at the desired frequency and be extremely insensitive at all other frequencies.

Figure 2 illustrates a frequency selective circuit using four frequency selective relays, 1, 2, 3 and 4 of the type illustrated in Figure 1. These relays may be tuned to four separate frequencies F_1, F_2, F_3, and F_4 respectively.

The electromagnets of relays 1, 2, 3 and 4 are all connected in series with a circuit 22 carrying signal or other pulsating currents. Terminals 20 and 21 of relay 1 are connected in series with a battery 23 and the operating winding of a lockup relay 24. Selective relays 2, 3 and 4 may be similarly connected to suitable control circuits.

Should a signal be received over circuit 22 having a frequency F_1, relay 1 will resonate to close its contacts, at least momentarily, to actuate relay 24. On operating, relay 24 will lock up over its lockup circuit 25 and at the same time will also close an energizing circuit 26 for energizing any suitable current responsive or signal device. Should an operator desire to reset the circuit, this can be done by momentarily actuating key 27 to open the lockup circuit 25 of relay 24 permitting it to release.

The relay described above is not polarized and it will be evident, therefore, that the reeds will respond to pulsating current of either polarity applied to the electromagnet. If relay 1 is tuned to a frequency F_1 of 60 cycles per second, for example, the relay will respond to a pulsating direct current of 60 pulses per second flowing in either direction in the circuit. If alternating current is used, however, both halves of the A. C. cycle will produce an impulse in the relay and hence a relay tuned to 60 cycles will respond to an alternating current of 30 cycles. The same relay may be made to respond to 60 cycles however, by connecting a half wave rectifier in series with the input circuit. The same relay can also be made to respond to 60 cycle alternating current by imposing a direct current component on the alternating current signal.

Figure 3 illustrates a modification of the relay of Figure 1 wherein the reed armatures 36 and 37 comprise permanent magnets having corresponding poles (north poles, for example) adjacent the pole piece 11 of the relay electromagnet. The relay is thereby polarized so that the reed armatures will be alternately attracted and repelled by the electromagnet when it is energized by an A. C. input signal. This relay will, therefore, vibrate in response to an A. C. frequency equal to the frequency to which the relay is tuned rather than to an A. C. frequency of half the reed frequency.

Figure 4 shows a further modification in which the relay pole 11 carries a polarized electromagnet 42 energized by a battery 43 in addition to the signal winding 12. The relay will thereby respond to an A. C. frequency equal to the natural frequency of the reeds since the electromagnet will produce a pulsating uni-directional flux responsive to the combined energization of windings 12 and 42.

It will also be evident that the relay of Figure 4 may be adapted to operate on a D. C. signal current pulsating at half the natural frequency of the relay by connecting winding 42 in opposition to the winding 12, so as to cancel the D. C. component, thereby creating an alternating flux in the electromagnet core.

It is also contemplated that one frequency selective relay may be made to perform two functions, such as connecting and disconnecting a circuit alternately by supplying input frequencies F and 2F respectively. For example, one frequency selective relay may be actuated first at frequency F. The associated relay circuit may then render the same relay selective to 2F frequency by introducing one of the frequency response doubling methods described above. The device may then be returned to normal by an input frequency of 2F. Similarly frequencies ½F and F may be used.

A circuit may likewise be made responsive to a combination of frequencies by use of two relays selective at F1 and F2 respectively where 2F1 is not equal to F2 and 2F2 is not equal to F1. Suppose we should close a circuit by successively receiving input frequencies f_1, f_2 and f_3 where no two adjacent frequencies may be alike. The associated relay circuits, in view of the preceding paragraph may then enable the circuit to be closed with any of the following combinations of frequencies:

f_1	f_2	f_3
F_1	F_2	F_1
F_1	F_2	$2F_1$
F_1	F_2	$2F_2$
F_1	$2F_1$	F_1
F_1	$2F_1$	F_2
F_1	$2F_1$	$2F_2$

While the present invention, as to its objects and advantages, has been described herein as carried out in specific embodiments thereof, it is not desired to be limited thereby but it is intended to cover the invention broadly within the spirit and scope of the appended claims.

What is claimed is:

1. A frequency selective relay comprising a frame, an electromagnet mounted at one end of said frame, a pair of tuned reeds of the same natural period mounted at the opposite end thereof and extending in spaced parallel relation to points adjacent a pole of said electromagnet, armatures on the free ends of said reeds symmetrically disposed on opposite sides of the axis of said pole, and a pair of spring arms mounted respectively on said reeds and cooperating contacts at the face ends of said arms.

2. A frequency selective relay comprising a frame, an electromagnet mounted at one end of said frame, a pair of tuned reeds mounted at the opposite end thereof and extending in spaced parallel relation to points adjacent a pole of said electromagnet, armatures on the free ends of said reeds symmetrically disposed on opposite sides of the axis of said pole, a pair of spring arms secured respectively to said reeds near their mounted ends, and a pair of cooperating contacts mounted respectively on said spring arms, both said reeds having the same natural period of vibration.

3. A frequency selective relay comprising a frame, an electromagnet mounted at one end of said frame, a pair of tuned reeds of the same natural period mounted at the opposite end thereof and extending in spaced parallel relation to points adjacent a pole of said electro-magnet, armatures on the free ends of said reeds symmetrically disposed on opposite sides of the axis of said pole, and a pair of sheet metal spring arms secured respectively to the inside faces of said reeds, adjacent to the mounted ends of said reeds, and having their free ends spaced from said reeds and in spaced parallel relation to each other, and cooperating contacts on the adjacent faces of said free arm ends, whereby said contacts will be closed responsive to the movement of said reeds toward each other.

4. A frequency selective relay comprising an electro-magnet, a pair of reeds mounted in spaced parallel relation, armatures on the free ends of said reeds disposed in symmetrical relation on opposite sides of a pole of said electro-magnet, and a pair of cooperating contacts controlled respectively by said reeds, and springs connecting said contacts and their respective reeds whereby engagement of said contacts does not substantially interfere with the normal vibration of said reeds.

CLARENCE HUETTEN.

CERTIFICATE OF CORRECTION.

Patent No. 2,356,791. August 29, 1944.

CLARENCE HUETTEN.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 2, second column, line 62, claim 1, for the word "face" read --free--; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 10th day of October, A. D. 1944.

Henry Van Arsdale

(Seal) Acting Commissioner of Patents.

CERTIFICATE OF CORRECTION.

Patent No. 2,356,791. August 29, 1944.

CLARENCE HUETTEN.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 2, second column, line 62, claim 1, for the word "face" read --free--; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 10th day of October, A. D. 1944.

Henry Van Arsdale

(Seal) Acting Commissioner of Patents.