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M. L. ALMQUIST

ALTERNATING CURRENT RELAY

Filed March 29, 1926

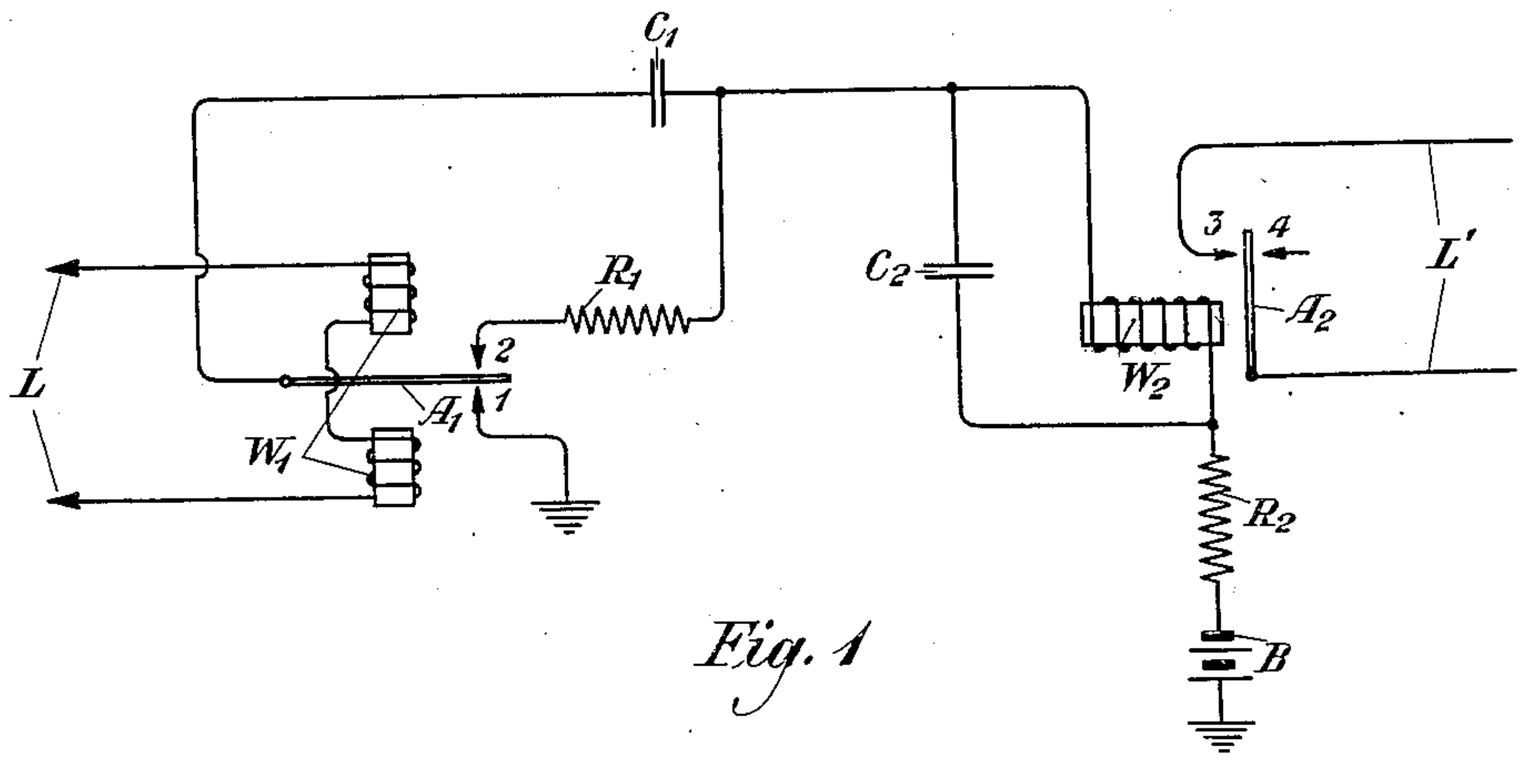

Fig. 1

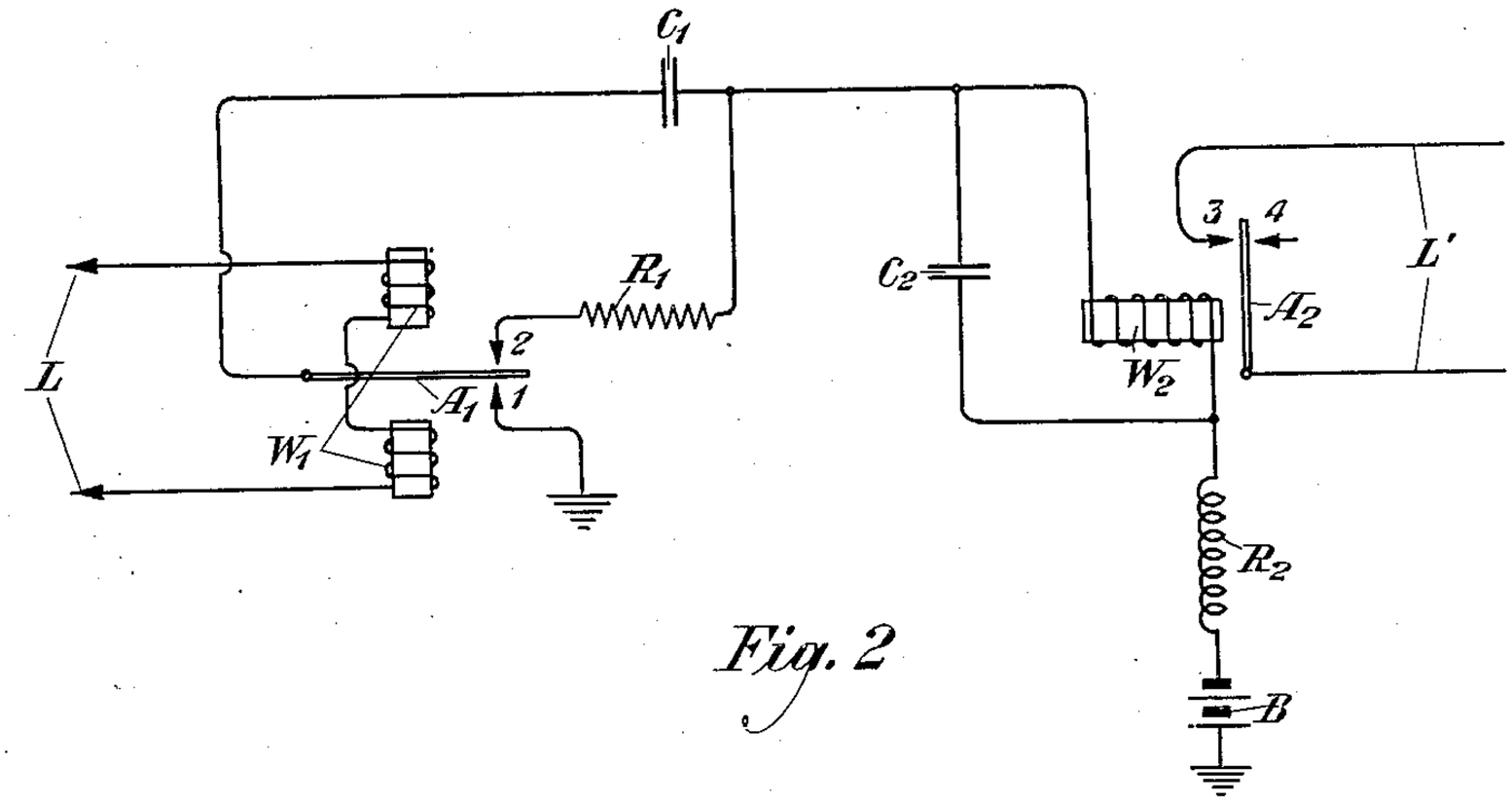

Fig. 2

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ALTERNATING-CURRENT RELAY.

Application filed March 29, 1926. Serial No. 98,403.

This invention relates to electromagnetic relays, and particularly to arrangements for operating a direct current relay from the contacts of an alternating current relay.

Alternating currents are generally employed for the transmission of signals. At the transmitting end of a signaling system a high frequency current of, for example, 1,000 cycles, is modulated by a low frequency current of, for example, 20 cycles, for transmission to a distant station. At the distant station a demodulator is provided for demodulating the low frequency current of 20 cycles from the high frequency current of 1,000 cycles. A polar relay is provided at the distant station which is arranged so that its armature vibrates at the frequency of the detected signaling current. It is also necessary in such a system to provide circuit arrangements for continuously operating a second relay from the contacts of the polar relay whenever the polar relay is energized by the low frequency signaling current. This second relay may be employed for recording the signal.

In former arrangements the polar relay was associated with a condenser, an alternating current relay, and a battery so that the polar relay alternately charged and discharged the condenser through the winding of the alternating current relay, the charge and discharge current of the condenser continuously operating the alternating current relay. However, in those arrangements the armature of the polar relay had to close each contact for an appreciable period of time in order that the charge and discharge current of the condenser might be sufficient to keep the alternating current relay continuously operated.

It is an object of this invention to provide arrangements for interconnecting a polar relay, or any relay the armature of which vibrates at the frequency of the alternating current, or at a multiple of the frequency, when alternating current is applied thereto, and a direct current relay so that the direct current relay may be continuously operated from the contacts of the alternating current relay, the operation of the direct current relay not being dependent upon the length of time that the armature of the alternating current relay closes each contact.

While the nature of the invention will be pointed out with particularity in the appended claims, the invention itself both as to its objects and features will be better understood from the detailed description hereinafter following when read in connection with the accompanying drawing in which Figure 1 represents one embodiment of the invention, and Fig. 2 represents a slightly different embodiment of the invention. Similar parts will be designated by similar reference characters wherever they appear throughout the drawing. With the understanding that the invention will be defined in the appended claims, the following description is given.

A polar or alternating current relay is designated by the reference character W_1 having an armature A_1 and contacts 1 and 2 which are associated therewith, the armature A_1 resting against either of these contacts. When alternating current of the signaling frequency is applied to leads L, the armature A_1 will vibrate between the contacts 1 and 2 at the frequency of the current applied. A direct current relay is designated by the reference character W_2 and has an armature A_2 associated therewith which moves between contacts 3 and 4. When the armature A_2 closes contact 3, a circuit L′ connected between contact 3 and the armature A_2 is operated. Two condensers, C_1 and C_2, are provided in this system, and a battery B is employed for charging these condensers. There are two resistances R_1 and R_2 included in the system, the resistance R_1 being employed for controlling the discharge of the condenser C_1 and the resistance R_2 for controlling the rate of charge of these condensers, as will be understood from the description hereinafter following.

When the armature A_1 of the relay W_1 vibrates with sufficient amplitude, it will alternately make contacts 1 and 2. When contact 1 is made by the armature A_1, the condensers C_1 and C_2 will be charged from the battery B, the circuit including the battery B, the resistance R_2, condenser C_2, condenser C_1 and the armature A_1. Resistance R_2, being in series in this circuit, prevents sparking at the contact 1, which might be caused by the charge of the condensers at too high a rate. Condenser C_2, being in shunt with the

winding of the relay W_2, discharges through this relay causing it to remain operated until the armature A_1 travels from contact 1 to contact 2 and back again to contact 1.

When the armature A_1 associated with the alternating current relay W_1 closes contact 2, the condenser C_1 will be discharged through the resistance R_1, this resistance being of a value sufficiently large to prevent sparking from taking place at contact 2. Thereafter, the armature A_1 again closes contact 1, charging up condensers C_1 and C_2, and so it continues. The condenser C_2 is of a sufficiently high capacity to keep relay W_2 operated for at least the time required by the armature A_1 to travel back and forth between contacts 1 and 2. Also relay W_2 will remain operated as long as the armature A_1 continues to move between contacts 1 and 2 in response to the flow of alternating current through the winding of the relay W_1. By having the condensers C_1 and C_2 of the proper capacities and by employing a winding for the relay W_2 of the proper impedance, it is possible to definitely limit the lowest frequency at which the vibration of the armature A_1 will cause continuous operation of the relay W_2.

The upper limit of the frequency at which the system will operate is determined largely by the maximum frequency at which relay W_1 will respond. Obviously, if current of a frequency greater than the upper limit is applied to the winding of the relay W_1, the armature A_1 of that relay will not be responsive. If the energy level which can be supplied to the winding of the relay W_1 is limited by the use of a current limiting device of any type well known in the art, the limits of frequency at which the system will be responsive may be kept close together, thus rendering the system quite selective with respect to the frequency range. The current that flows through the winding of the relay W_2 is practically independent of the intensity with which the relay W_1 is operated. The current that flows through the winding of the relay W_2 is also independent of the time that the armature A_1 of the relay W_1 rests against either contact. Thus, the relay W_2 is kept continuously operated as long as the armature A_1 of the relay W_1 vibrates with sufficient amplitude to strike both contacts 1 and 2.

Fig. 2 shows a modification of the arrangements disclosed in Fig. 1 in which the elements are similar to those in Fig. 1 with the exception that a retardation coil R_2 is included in place of the resistance in Fig. 1. However, in this embodiment of the invention the time necessary for the armature to rest against contact 1 is increased in order to continuously operate the relay W_2.

Although two resistances have been associated with Fig. 1, the preferred embodiment of the invention, it is to be distinctly understood that by slight modifications of the invention well known to those skilled in the art one resistance may be employed in place of these two resistances.

While the arrangements of this invention have been shown and described in two particular embodiments, it is to be understood that the invention is capable of embodiment in other and widely varied organizations without departing from the spirit of the invention and the scope of the appended claims.

What is claimed is:

1. In combination, an alternating current polarized relay connected to a source of alternating current, a direct current relay, a battery, two condensers, and a resistance, one condenser being in shunt with the winding of the direct current relay, the armature of the alternating current polarized relay causing the charge of the two condensers from the battery on closure of one contact thereof, the resistance regulating the rate of charge of the condensers, the armature of the alternating current relay causing the discharge of the second condenser on closure of the other contact thereof.

2. A system for continuously operating a direct current relay from the armature of an alternating current relay when current of predetermined frequency flows through the winding of the alternating current relay, comprising two condensers, a battery, and a resistance, said condensers being charged by the battery through the resistance on closure of one of the contacts associated with the armature of the alternating current relay, one of said condensers being connected to the winding of the direct current relay and being discharged to operate the direct current relay on closure of the other of the contacts associated with the armature of the alternating current relay.

3. In combination, a polarized alternating current relay having a normally open contact gap, a battery, a direct current relay, two condensers, a resistance, and circuit arrangements to operate the direct current relay from the contacts of the polarized alternating current relay by the charging current of the battery and by the discharging current of one of the condensers connected to the winding of the direct current relay, the battery being employed for charging the condensers, the resistance being sufficiently large to control the rate of charge of the condensers.

4. In combination, a polarized alternating current relay having a normally open armature contact gap, a battery, a direct current relay, two condensers, two resistances, and circuit arrangements to operate the direct current relay from the armature con-

tacts of the polarized alternating current relay, the condensers being charged by the battery through one resistance when the armature of the polarized alternating current relay engages one contact, the condensers being discharged when the armature of the polarized alternating current relay engages the other contact, one condenser being in parallel relationship with the direct current relay and being of a sufficiently high capacity to keep the direct current relay operated during the time necessary for the armature of the polarized alternating current relay to move back and forth between its contacts, the other condenser being discharged through the other resistance when the armature of the polarized alternating current relay is on the other contact.

5. In combination, an alternating current relay having an armature which moves between its contacts when current of a frequency between predetermined limits flows through the winding thereof, a direct current relay, two condensers, a battery, and a resistance, said direct current relay being in parallel relationship with one condenser which is of sufficient capacity to hold said direct current relay operated during the time required for the armature in the alternating current relay to move back and forth between its contacts, said condensers being charged by the battery through the resistance on closure of one contact of the alternating current relay.

6. A system for operating a direct current relay from the contacts of a vibrating contact polar relay, comprising two condensers, the direct current relay being operated by the discharge of one condenser when the armature of the polar relay closes one of its contacts, a resistance, the other condenser being discharged through the resistance when the armature of the polar relay closes the same contact, and a battery, the condensers being charged by the battery when the armature of the alternating current relay closes the other contact.

7. A system for operating a direct current relay from the contacts of a vibrating contact polar relay, comprising two condensers, a resistance, and a battery, the condensers being charged by the battery when the armature of the polar relay closes one of its contacts, one condenser being discharged through the direct current relay to keep it operated and the other condenser being discharged through the resistance when the armature of the polar relay closes the other of its contacts, the capacity of the condenser discharging into the direct current relay being sufficiently large to keep it operated for at least one complete movement of the armature of the polar relay between its contacts.

In testimony whereof, I have signed my name to this specification this 24th day of March 1926.

MILTON L. ALMQUIST.