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TELEGRAPH REPEATER

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FIG. 1

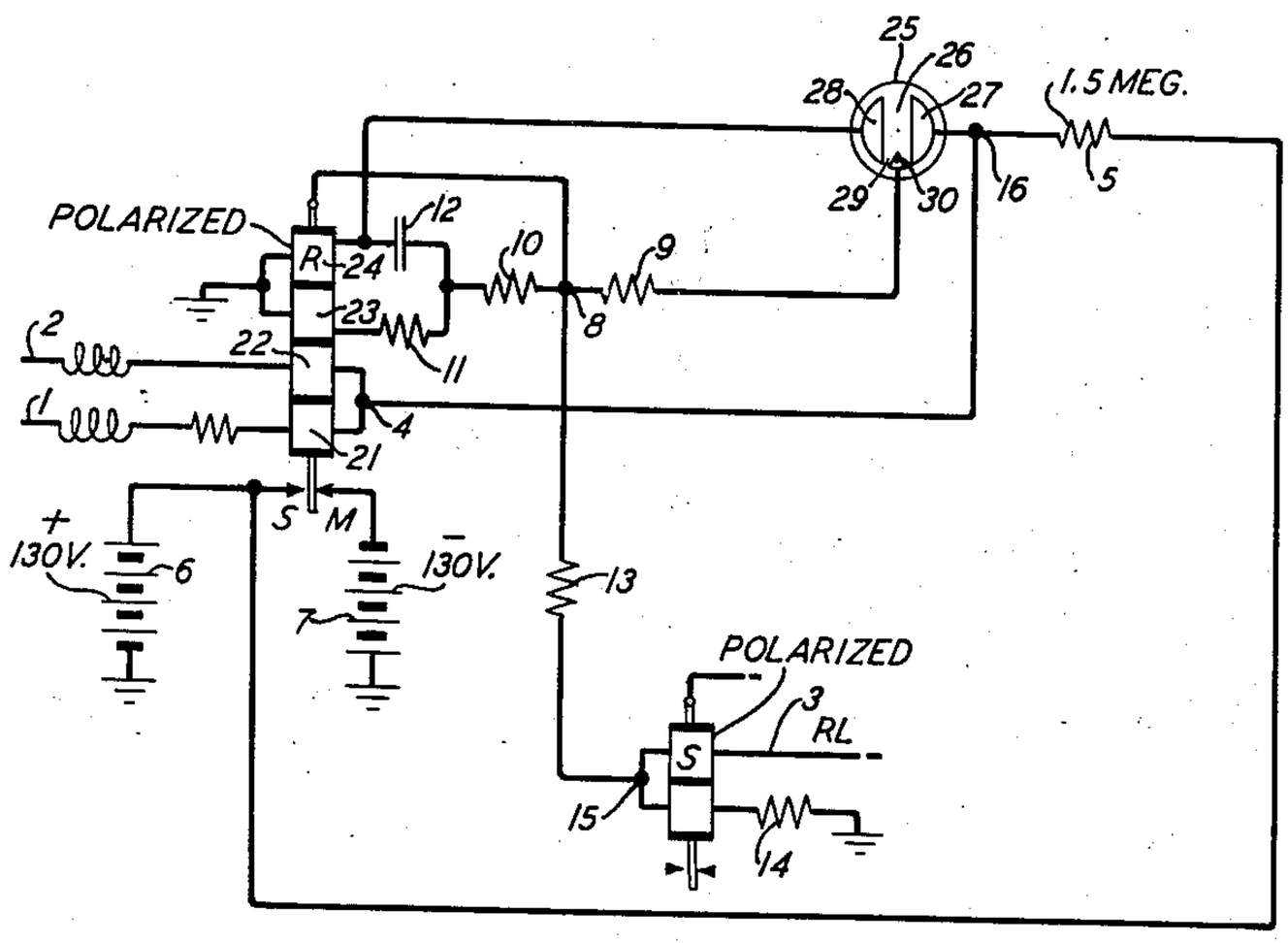
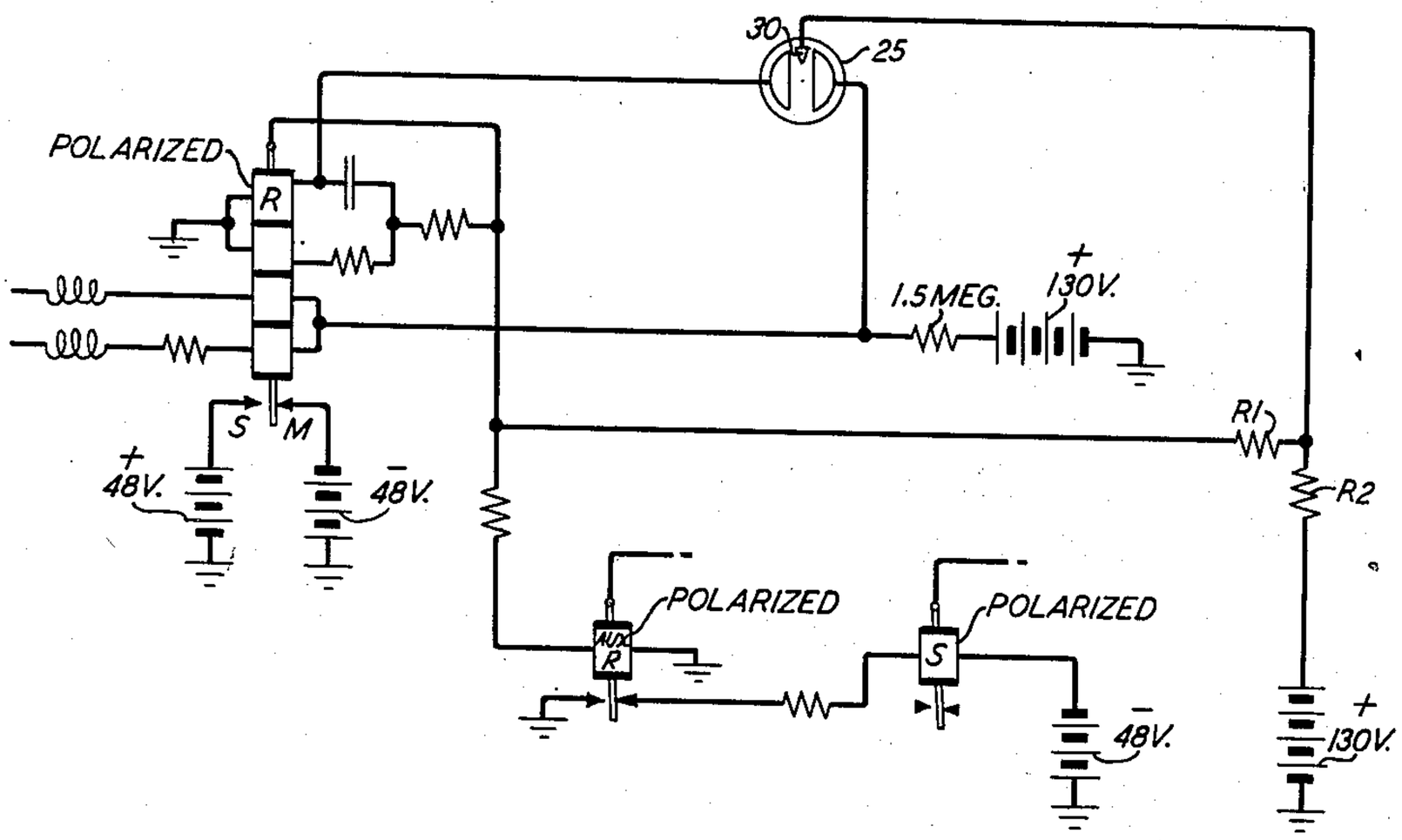



FIG. 2

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2,625,609

## TELEGRAPH REPEATER

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5 Claims. (Cl. 178—70)

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This invention relates to telegraph systems and more particularly to an improved telegraph repeater.

As is well known certain types of direct-current magnetic relay repeaters have receiving relays which are equipped with so-called vibrating windings to increase the speed of the relay armature in transition between contacts. Such relays are subject to a difficulty in that if the line between repeater stations is either opened or disconnected from the receiving relay, the relay armature will vibrate. This vibration, if unobserved, will continue indefinitely causing the relay contacts to deteriorate, at least, if not more serious difficulty.

An object of the present invention is to prevent the abnormal armature vibration of certain telegraph relays under certain conditions.

A feature of the invention is a protective circuit connected to the windings of a telegraph receiving relay which is equipped with vibrating windings to prevent abnormal vibrations of the relay armature.

This and other features of the invention may be understood from the following detailed description when read with reference to the associated drawing, which taken together disclose two preferred embodiments in which the invention is presently incorporated. It is to be understood, however, that the invention may be incorporated in other embodiments which will be suggested from a consideration of the following by those skilled in the art.

In the drawing Fig. 1 shows the antivibrating circuit of the invention applied to a polar receiving telegraph relay equipped with vibrating windings; and Fig. 2 shows a second embodiment of the invention.

It is to be understood that when the values of constants, such as the magnitudes of potentials, resistances, etc., are mentioned in the following, they are given by way of example only, and are not to be considered as limitations in the mode of operation of the circuit.

Refer now to Fig. 1 which shows a polar telegraph receiving relay R and a polar telegraph sending relay S interconnected to form a direct-current telegraph repeater. The receiving relay R is equipped with four windings, 21, 22, 23 and 24. The receiving relay R is connected by means to two metallic conductors 1 and 2 to a telegraph repeater at a distant station, say to the west. The sending relay S is connected by a single conductor 3 to a telegraph repeater at a distant station, say to the east. Metallic conductor 1 extends through winding 21 of relay R

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and metallic conductor 2 extends through winding 22 of relay R and the two conductors are then joined at junction 4. At the distant station the conductors pass through telegraph switching means, such as relay contacts, and are connected to the opposite terminals of a battery, so that current flows around the loop formed by conductors 1 and 2 in a first direction for the marking or steady idle condition. In response to this the armature of relay R is actuated to engage its right-hand or marking contact M. For a spacing condition the switches at the distant terminal are actuated to reverse the polarity of the battery connected to conductors 1 and 2 and in response to this the armature of relay R is actuated to engage its left-hand or spacing contact.

When the armature of relay R is in engagement with its right-hand or marking contact, a circuit may be traced from negative battery 7 through the right-hand or marking contact and armature of relay R and resistance 13 to apex 15 where it branches. One branch extends through the top or line winding of relay S and conductor 3 to the distant east station where it passes through a telegraph repeater and terminates, it will be assumed in positive battery. The other branch extends through the bottom or biasing winding of relay S and resistance 14 to ground. For this condition the effect of the current flowing in the top winding of relay S tends to actuate the armature of relay S to engage its right-hand or marking contact and this effect is dominant over the countereffect of the current in the bottom or biasing winding of relay S, so that the armature of relay S engages its right-hand or marking contact. When the armature of relay R is actuated to engage its spacing contact no current flows through the line winding of relay S and the effect of current in the bottom winding of relay S is reversed so that the armature of relay S remains in engagement with its right-hand or marking contact. When a spacing signal is transmitted from the eastern terminal, conductor 3 is terminated thereat in negative battery. No current flows through the top winding of relay S for this condition and its armature engages its spacing contact under the effect of current flowing from negative battery on the marking contact of relay R through the bottom winding of relays S.

Relay R is equipped with a vibrating circuit connected to its windings 23 and 24 the function of which is to speed up the transition of its armature when moving between contacts.

When the armature of relay R is in engagement

with its marking contact a circuit may be traced from negative battery 7 through the marking contact and armature of relay R, junction 8 and resistance 10 to parallel branches. One branch extends through resistance 11 and winding 23 of relay R to ground. The other branch extends through capacitance 12 and winding 24 to ground. It will be assumed that steady state conditions have been attained. Current from the negative battery 7 will be flowing through resistance 11 and the right-hand terminal of condenser 12 will be charged negatively. The effect of the current flowing through winding 23 will be tending to actuate the armature of relay R to engage with its left-hand or spacing contact. At the instant that the armature of relay R breaks from its marking contact there will be a rush of current of negative polarity from condenser 12 through resistance 11 and winding 23 the effect of which will accelerate the armatures of relay R toward the spacing contact. On the opposite transition the polarity of the current will be changed and the effect will accelerate the armature toward the marking contact.

If now the loop through conductors 1 and 2 is opened or if, as is the case in practice, the repeater is at times removed from service and conductors 1 and 2 are disconnected from windings 21 and 22 the armature of receiving relay R will be under the influence of windings 23 and 24 only.

When the armature of relay R engages its marking contact the effect of the current from battery 7 in winding 23 will actuate the armature of relay R to its spacing contact. Condenser 12 will accelerate the transition. When the armature of relay R engages its spacing contact the effect of the current from positive battery 6 will actuate the armature of relay R toward its marking contact. Condenser 12 will accelerate the transition. The relay will vibrate continuously under this condition.

The arrangement of the present invention prevents the abnormal vibration of relay R. The protection circuit in the present embodiment comprises the well known three element gas discharge tube 25 having two gaps, a control gap 26 between control element 27 and cathode 28 and a main gap 29 between cathode element 28 and anode element 30. The control element 27 is connected through a 1.5 meghom resistance 5 to positive battery 6. The anode element 30 is connected through resistance 9, which may be, for instance, 5000 ohms, junction 8 and the armature and marking contact of relay R. Cathode element 28 is connected between capacitance 12 and winding 24 and the path through the winding is connected to ground.

When the loop through conductors 1 and 2 is connected, the potential between junction 4 and ground will be substantially one-half of the potential of the battery connected between conductors 1 and 2 at the distant station. The potential of this battery may be positive 34 volts for the marking condition so that the potential of points 4 and 16 may be positive 17 volts with respect to ground. The potential of element 28 may be for instance positive 2 volts with respect to ground. The potential across control gap 26 is therefore approximately 15 volts which is too low to ionize the control gap, which requires about 70 volts.

When the loop formed by conductors 1 and 2 is disconnected or opened, the armature of relay R will start to vibrate abnormally. Positive 130 volts is impressed through the 1.5 megohm resistor 5 between elements 27 and 28 ionizing control gap 26. When the armature of relay R engages its spacing contact a circuit is established from positive battery 6 through the spacing contact and armature of relay R, resistance 9, anode element 30, gap 29, cathode element 28 and winding 24 to ground. The effect of the current flowing in winding 24 of relay R due to the ionization of the main gap of tube 25 locks the armature of relay R to its spacing contact, preventing further vibration.



In the arrangement per Fig. 2 the invention is shown applied to a full metallic repeater having an auxiliary receiving relay and arranged slightly differently than the arrangement per Fig. 1. With respect to the present invention, however, the essential difference is in the arrangement of the circuit connected to the anode 30 of tube 25. In Fig. 2 the voltage applied to the anode 30 is obtained from a potentiometer, formed by resistances R1 and R2 which are equal. The potentials applied to the marking and spacing contacts are negative and positive 48 volts for instance and the potential connected to the lower terminal of R2 is positive 130 volts. When the R relay is in the marking condition the potential applied to the anode 30 will be approximately positive 41 volts, one-half the difference between negative 48 and positive 130 volts, and when the R relay is spacing the potential will be one-half the sum of positive 48 and positive 130 volts or positive 89 volts. These values afford desirable operating values. The operation of the circuit which prevents vibration of the armature relay R is in all other respects the same.

What is claimed is:

1. In a telegraph system a relay, an armature thereon, a vibrating circuit connected to said relay to accelerate transition of said armature between contacts, said relay subject to abnormal vibration of said armature, and a circuit connected to said relay to prevent said abnormal vibration, said circuit comprising a space discharge device responsive to a condition of said relay tending to produce said abnormal vibration and armature holding means on said relay responsive to said space discharge device.

2. In a telegraph system, a polar telegraph receiving relay having an armature, a line winding and a vibrating winding for vibrating said armature, said relay subject to abnormal vibrations of said armature, and a circuit connected to said relay for locking said armature to prevent said abnormal vibration, said circuit comprising a space discharge device responsive to an open condition of a line connected to said line winding and holding means on said relay responsive to said space discharge device.

3. In a telegraph system, a polar telegraph signaling relay, an armature on said relay, a line winding and a vibrating winding on said relay, a line connected to said line winding, a space discharge device connected to said relay, said space discharge device having an input circuit connected to said line winding and responsive to an open condition of said line and an output circuit including said vibrating winding responsive to said input circuit to hold said armature in a particular position to prevent abnormal vibration thereof.

4. In a telegraph system, a polar telegraph signaling relay having two line windings thereon connected in series with a telegraph line and an armature susceptible to abnormal vibration under a particular condition of said line, a space

discharge device having a control element connected to the junction of said windings for impressing a potential characteristic of said condition on said device to change the condition of said device and connections between said device and said relay responsive to said change for locking said relay.

5. In a telegraph system, a polar telegraph signaling relay having an armature, a line winding and a vibrating winding, a line connected to said line winding, said armature vibrated abnormally by said vibrating winding while a particular condition of said line prevails, and a vibration prevention circuit, said circuit comprising a space discharge device having joint controls, said joint controls comprising a first connection between a first element in said device and said line winding, the potential of which connection is variable responsive to the condition of said line winding,



and a second connection between a second element in said device, a potentiometer, and said armature, the potential of which second connection is variable dependent on the position of said armature, and a connection between an anode in said device and said vibrating winding.

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