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E. O. THOMPSON

ALTERNATING CURRENT RELAY

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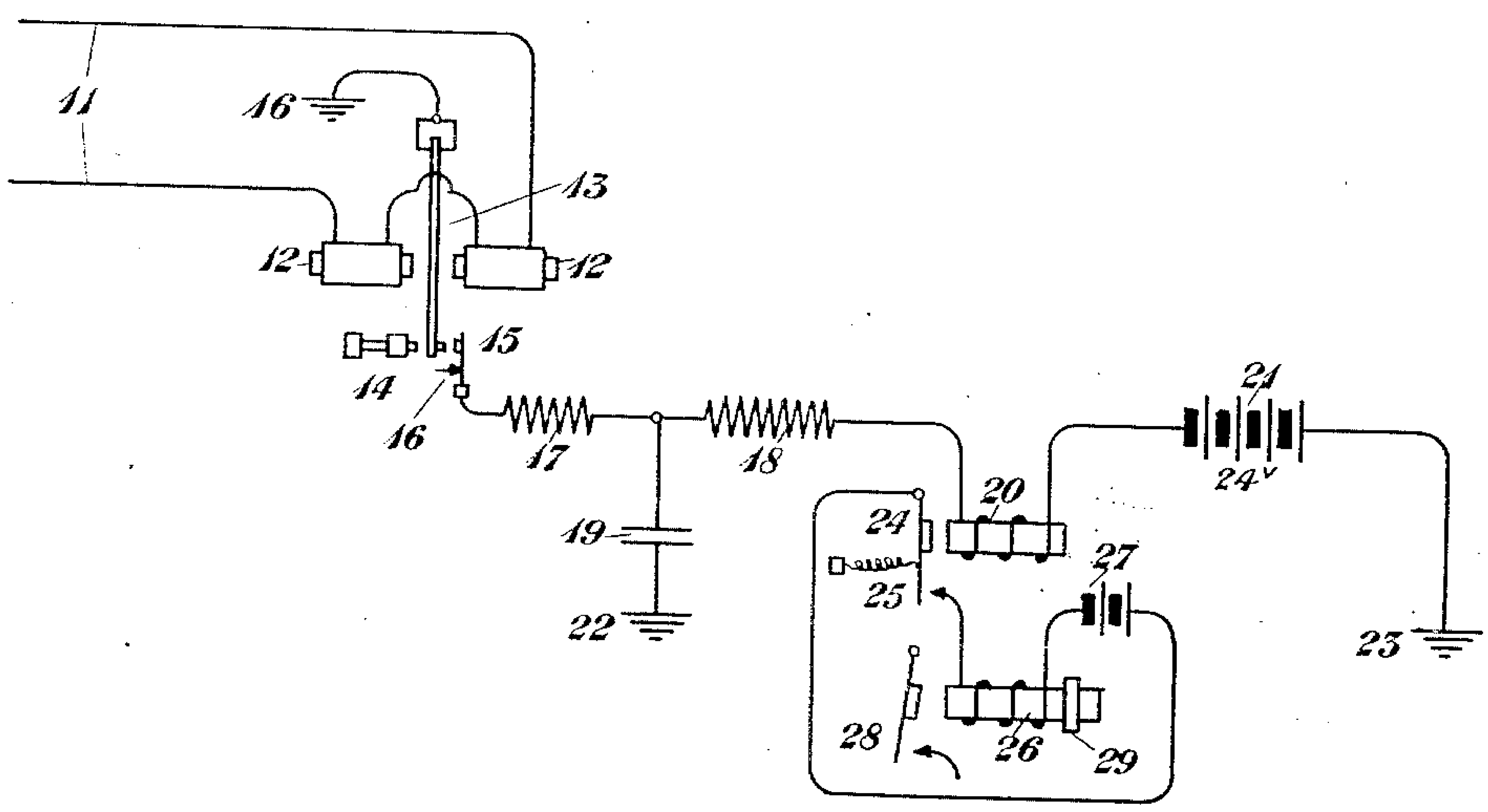

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UNITED STATES PATENT OFFICE.

ELMER O. THOMPSON, OF TOMPKINSVILLE, NEW YORK, ASSIGNOR TO AMERICAN TELEPHONE AND TELEGRAPH COMPANY, A CORPORATION OF NEW YORK.

ALTERNATING-CURRENT RELAY.

Application filed December 29, 1921. Serial No. 525,727.

To all whom it may concern:

Be it known that I, Elmer O. Thompson, residing at Tompkinsville, in the county of Richmond and State of New York, have invented certain Improvements in Alternating-Current Relays, of which the following is a specification.

The principal object of my invention is to provide a new and improved relay system adapted to be selectively responsive to alternating currents approximating to a particular frequency. Another object of my invention is to provide such a relay in combination with a condenser so arranged that the condenser is successively charged and discharged by the vibration of the relay armature, and local apparatus is governed by the condenser current. Another object of my invention relates to providing an alternating current relay of the tuned reed type, normally on open circuit, in combination with a magnet to be actuated by a condenser current governed by the making and breaking of the relay controlled circuit. These and other objects of my invention will become apparent on consideration of a specific example which I have chosen for illustration in the accompanying drawing. With the understanding that the invention will be defined in the appended claims, I now proceed to disclose this particular embodiment thereof.

Alternating currents coming in over a long telephone line, and therefore considerably attenuated, are applied over the conductors 11 to the windings of the relay magnet 12. The reed armature 13 is tuned to vibrate naturally at the rate of 135 cycles per second. Currents of other frequencies may come in on the conductors 11 and also aperiodic currents of greater or less intensity. The design of the system is to give a selective response only to periodic currents that approximate closely to the frequency of 135 cycles per second. These currents are employed for signaling and lie somewhat below the lower limit of necessary voice range frequencies.

The armature 13 being free and undamped and out of contact with the yielding terminal 15 and the stop 14, it vibrates readily in response to 135 cycle current and presently makes intermittent contact with the terminal 15.

When the terminal at 15 is out of contact with the reed 13, the condenser 19 will be in a condition of steady charge from the battery 21. During the brief time that the reed 13 is in contact with the terminal 15, the condenser 19 will discharge to ground, the circuit being traced as follows: 22—19—17—15—13—16. The resistance 17 is great enough to spread out the discharge current from condenser 19 and avoid such injury to the contacts at 15 as might be caused by a large current. This resistance 17 is large enough to make the discharge non-oscillatory. But the resistance 17 is not so large as to prolong the discharge beyond the period of closure of reed 13 with contact 15. The interposed resistance 18 and the time constant of the magnet winding 20 are such that, by the time the closure at 15 terminates, the current from the battery 21 will not have risen to a considerable value. This being the case and the descharge of the condenser 19 being practically complete, as already stated, it follows that when the contact breaks at 15 there will be very little current flowing through that contact, and hence sparking will be negligible. The resistance 18 is also large enough so that in ordinary slow frequency forced vibrations such as at 16 cycles, the current through the contacts will be limited to such an extent that there will be no sparking or breaking of the circuit at 15.

During the time for the reed 13 to swing away from the terminal 15 to the stop 14 and back again to the terminal 15, the battery 21 will practically completely charge the condenser 19, and a static condition will have been attained. The resistance 18 is such that the charging circuit is non-oscillatory. The greater the inductance of windings 20 the greater should be the resistance 18. It will be seen that the integral charging current for condenser 19 passes one way through the windings of magnet 20.

During the sustained vibration of the armature 13 an intermittent charging current flows from the battery 21 to the condenser 19 through the magnet 20. The integrated current through the magnet 20 will be sufficient to attract the armature 24 and close the local circuit of battery 27 at 25. This last mentioned circuit includes the winding of a slow-acting relay 26. One advantage secured by making it slow-acting is that it will respond only to a sustained alternating current of the proper frequency acting on the reed 13. Mechanical jars or current impulses of considerable magnitude may close the circuit at 15 once or a few times in succession, but in such event the relay 26 will not be actuated.

Armature 24 of magnet 20 must be rapid enough in its operation and release so as not to remain closed if the reed makes contact at 15 at a rate much less than 135 times a second. This makes the system free from strong interfering current impulses of frequencies much less than 135 cycles.

By the provision of a single contact gap for the vibratory relay, I secure ease of adjustment, for the employment of two opposite gaps on respective sides of the reed presents a difficult task to adjust them to equal widths.

What is claimed is:

1. In combination, a tuned reed polarized relay, a single contact on one side of the reed and normally spaced therefrom, a battery and a condenser in series in a circuit, a shunt path around said condenser adapted to be closed by the engagement of said reed with said contact, and a device to be actuated by the condenser current.

2. In combination, a tuned reed polarized relay, a contact to be engaged by said reed, a battery, a condenser adapted to be charged and discharged intermittently by the intermittent engagement of the reed with said contact, a magnet in series with the condenser and a slow acting device subject to the control of said magnet.

3. In combination, a tuned reed relay with a single normally open contact gap, a battery, a condenser adapted to be repeatedly charged from the battery and discharged by the intermittent operation of said contact gap, and a device to be actuated by the condenser current.

4. In combination, a tuned reed polarized relay, a single yielding contact on one side of the reed and normally spaced therefrom, a battery and a condenser in series in a circuit, a shunt path around said condenser adapted to be closed by the engagement of said reed with said contact, and a device to be actuated by the condenser current.

5. In combination, a relay with a single normally open contact gap, a battery, a condenser adapted to be repeatedly charged from the battery and discharged by the intermittent operation of said contact gap, a resistance in series with the condenser to make the condenser current non-oscillatory, and a device to be actuated by the condenser current.

6. In combination, a condenser, two multiple branch circuits therefor, a vibratory relay controlling one branch, a magnet in the other branch, and sufficient resistances in the respective branches to make the condenser current non-oscillatory in each branch.

7. In combination, a condenser, two multiple branch circuits therefor, a vibratory relay controlling one branch, a magnet in the other branch, and sufficient resistances in the respective branches to make the condenser current non-oscillatory in each branch, the resistance in the relay branch being small enough to permit attainment of condenser equilibrium during the period of contact closure of the relay.

8. In combination, a relay with a normally open contact gap, a battery, a condenser adapted to be repeatedly charged from the battery and discharged by the intermittent operation of said contact gap, an electromagnet having its windings connected to be traversed by the condenser current, and a resistance in series of sufficient magnitude compared to the inductance of the magnet windings to make the current therethrough non-oscillatory.

9. In combination, a relay with a normally open contact gap, a battery, a condenser, and circuit connections to charge and discharge the condenser from the battery by the operation of said contact gap, the circuit for the condenser having a resistance high enough to make its discharge non-oscillatory.

10. In combination, a relay with a normally open contact gap, a battery, a condenser and circuit connections to charge and discharge the condenser from the battery by the operation of said contact gap, the circuit for the condenser having a resistance high enough to prevent the discharge from burning the contacts and to make it non-oscillatory.

11. In combination, a relay with a normally open contact gap, a battery, a condenser adapted to be charged and discharged intermittently by the intermittent engagement of the reed with said contact, a magnet in series with the condenser, an armature for said magnet, and means tending quickly to open the armature when the magnet impulses thereon are less in frequency than a certain critical number per unit of time.

12. In combination, a relay with a normally open contact gap, a battery, a condenser adapted to be charged and discharged intermittently by the intermittent engagement of the reed with said contact, a device to be actuated by the condenser current, and a resistance in series with the contact to keep the integral current below the value for series sparking when the contact is opened after long closure.

In testimony whereof, I have signed my name to this specification this 28th day of December, 1921.

ELMER O. THOMPSON.