Nov. 27, 1928. 1,692,961

E. O. THOMPSON

ALTERNATING CURRENT RELAY

Filed Dec. 29, 1921

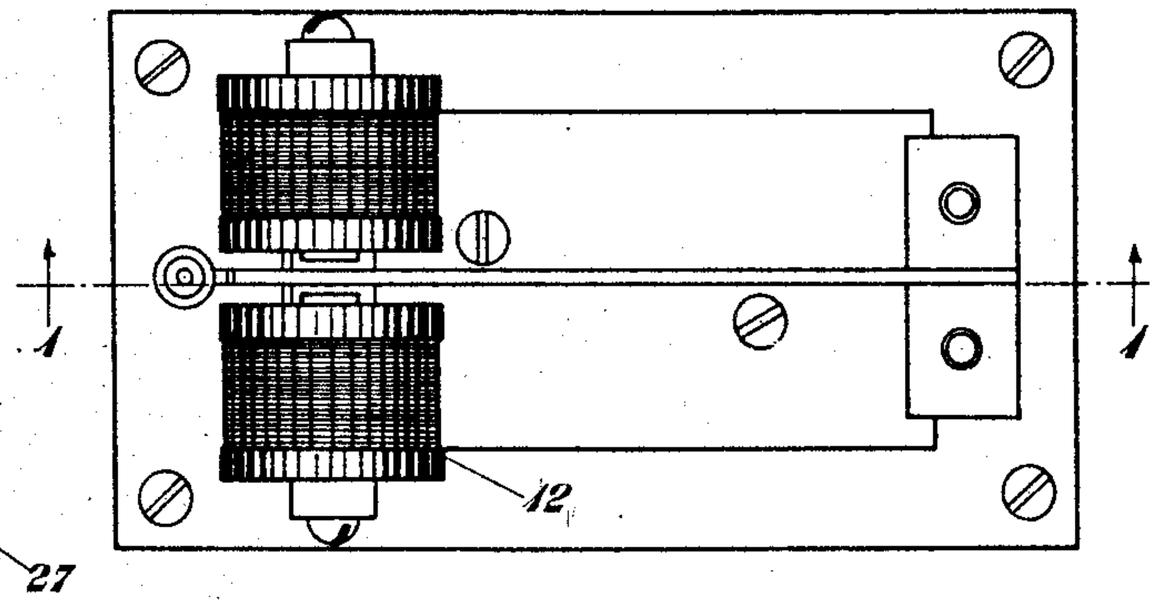


Fig. 2

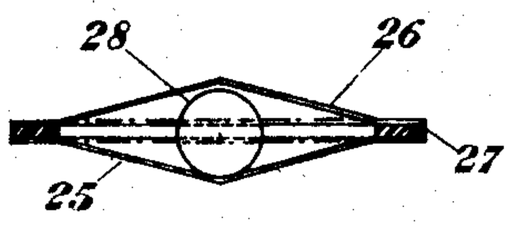


Fig 3

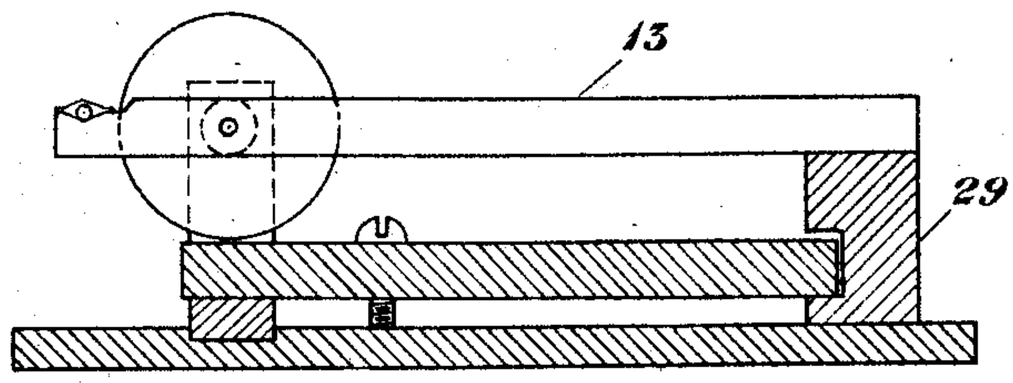


Fig. 1

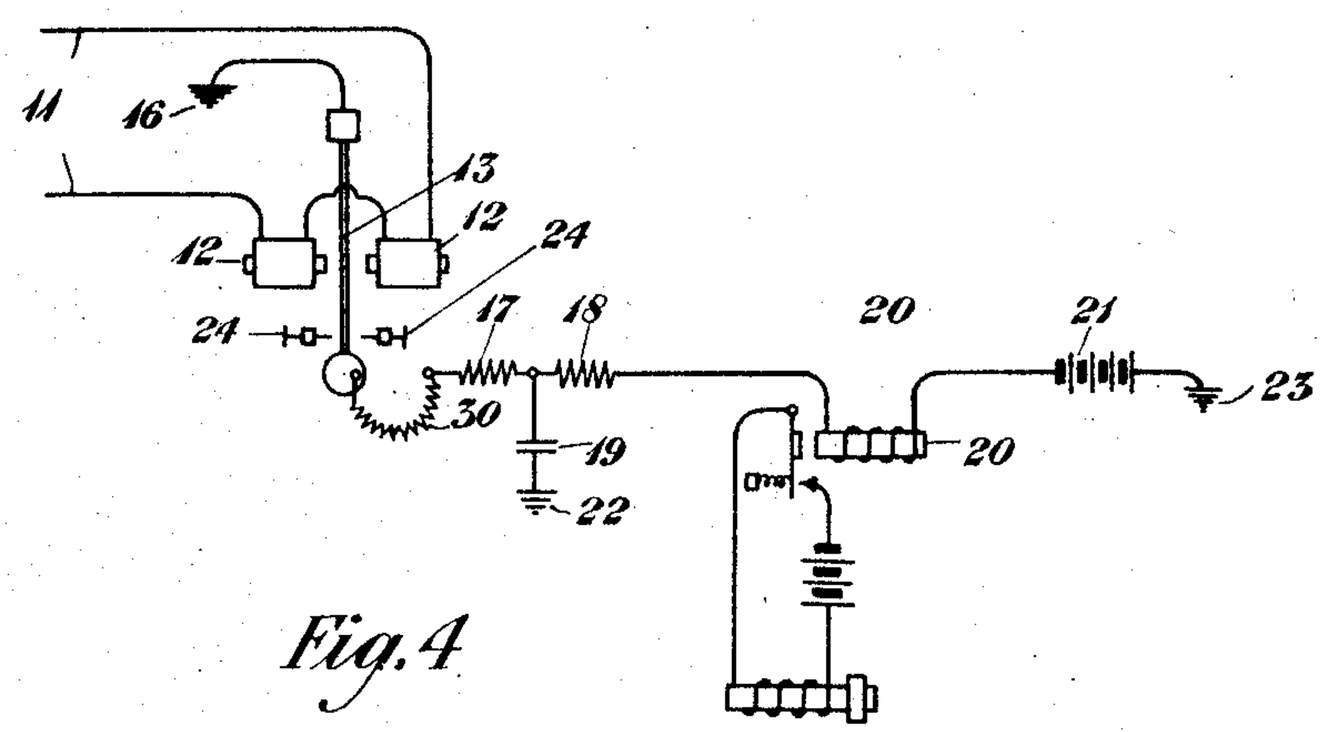


Fig. 4

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# UNITED STATES PATENT OFFICE.

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## ALTERNATING-CURRENT RELAY.

Application filed December 29, 1921. Serial No. 525,728.

The principal object of my invention is to provide a new and improved alternating current relay adapted for selective response to attenuated currents of a certain frequency. Another object of my invention is to provide a sensitive relay of this character adapted to operate by intermittent closure of a circuit and thereby to control a condenser current which in turn energizes the device intended to be controlled by the relay. These objects and various other objects of my invention will be made apparent upon consideration of a specific example which I have chosen for disclosure in the following specification. It will be understood that the invention is pointed out in the appended claims.

In the drawings, Fig. 1 is a section of a device embodying my invention, this section being taken along the dot-dash line 1—1 in Fig. 2 looking in the direction of the arrows; Fig. 2 is a top plan view; Fig. 3 is an enlarged sectional detail; and Fig. 4 is a diagram for the associated circuits.

The example of my invention, as shown in the drawing, is a relay intended to respond to ringing current of 135 cycles per second coming in from a long telephone line over the conductors 11. Currents of other frequencies may come over these conductors 11 as well as aperiodic impulses of considerable magnitude. It is desired to make the relay selectively responsive to this 135 cycle frequency. The relay actuating current passes through the windings of the magnet 12 between which is the reed 13 mounted at one end in a fixed support and tuned to vibrate at a natural frequency of 135 cycles per second.

At its free extremity the reed 13 carries a shallow metal cup 25. Opposed to this cup 25 is a similar cup 26 separated by a washer 27 of insulating material. Within the closed cell between the two cups 25 and 26 is a metal ball 28 which does not quite touch the upper cup 26 when lying at rest in the bottom of the lower cup 25.

The lower cup 25 is grounded at 16 by metallic connection with the reed 13. The upper cup 26 is connected by a flexible conductor 30 through the resistance 17 to the condenser 19, the other side of this condenser 19 being grounded at 22. Between the resistance 17 and the condenser 19 is connected the circuit of battery 21 and in series are the resistance 18 and the device 20 to be actuated.

In a normal condition of rest there is no conductive connection between the metal cups 25 and 26, and the condenser 19 is in a condition of static charge from the battery 21. When currents of 135 cycle frequency come in over the conductors 11, they act cumulatively on the reed 13 and build up its vibration. The little ball 28, by its inertia, tends to stand still and thus is displaced relatively from the axis of the conical cups 25 and 26. Thus the ball 28 makes contact between the cups 25 and 26, first on one side and then on the other, making 270 such contacts per second for 135 cycle frequency.

During each such contact, the condenser 19 discharges to ground, the circuit being as follows: 22—19—17—30—26—28—25—13—16. This discharge is practically completed during the brief period of contact, so that no current is flowing when the ball 28 breaks the contact between the cups 25 and 26. The resistance 18 and the constants of the device 20 are such that the current from the battery 21 does not build up to any considerable extent during the period of contact of ball 28 with both cups 25 and 26.

While the reed 13 swings across and the ball 28 is out of contact with both cups 25 and 26, the battery 21 again charges the condenser 19, and at the next contact within the cup 25—26 the cycle is repeated as just described.

The cell 25—26 may be filled with argon, or other suitable inert gas, so that the little sparking that may occur within causes a minimum of deterioration. By making the interior of the cell free from moisture, permanency of conditions within the cell is secured. The width of a gap in air at ordinary atmospheric conditions may not be less than about 0.0015 inch, for if smaller, a film of moisture may form that will bridge across the gap and give a temporary closure. But there is no such limit to the size of the gap in the moisture free interior of my cell.

After the proper proportioning and assembling of the parts, no adjustment of the gap is desirable and none is practicable, so that in this respect the device is substantially fool-proof.

My improved relay is selective against aperiodic currents, or mechanical jars, because a single closure or a few closures of its gap do not give such a sustained current in relay 20 as will be necessary to close and hold its controlled circuit closed for the necessary length of time. A heavy aperiodic

current or mechanical jar cannot set up a prolonged vibration of the reed 13, because the stop pins 24 will prevent it.

What is claimed is:

1. In a selective alternating current relay, a tuned reed, two members carried thereby and normally separated, one of them having inertia and being capable of displacement relatively to the other member and being adapted on vibration intermittently to make contact with the other, and a circuit to be closed and opened correspondingly.

2. A relay having a closed cell on its armature, the cell walls comprising one part insulated from another part and a loose member within the cell adapted by its inertia to make contact between the two parts of the cell, said cell having an inert gas therein.

3. A relay armature carrying a closed cell formed of two opposed cups one vertically above the other with an insulating washer between their edges and a ball within said cell adapted upon sudden displacement of the armature to make contact between said cups.

4. A relay having a closed cell on its armature, said cell being filled with an inert gas, and a member within said cell normally insulated from at least a part of the cell wall, and adapted by relative displacement on vibration of the armature to close a circuit.

5. A relay having a closed cell on its armature, the cell walls comprising one part insulated from another part, one part being vertically above the other part, and a loose member within the cell adapted by its inertia to make contact between the two parts of the cell, said cell having its interior free from moisture.

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

ELMER O. THOMPSON.