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ELECTRICAL CIRCUIT CONTROLLING DEVICE

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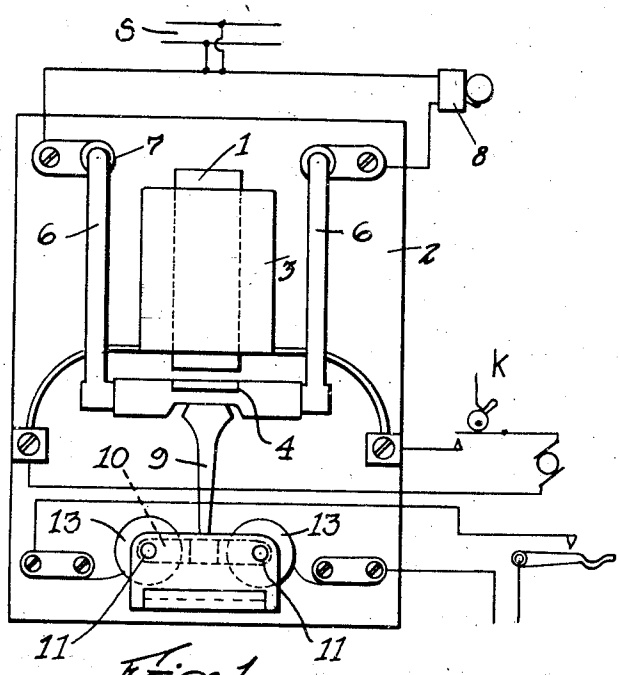


Fig. 1.

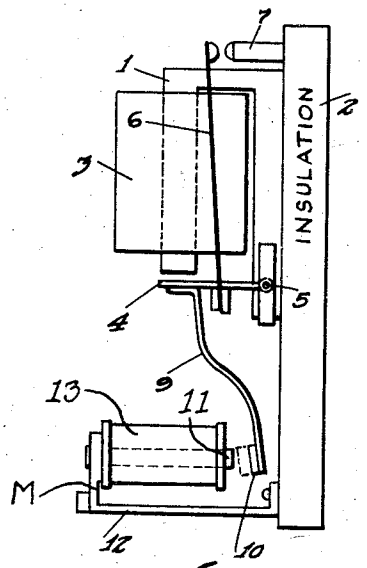


Fig. 2.

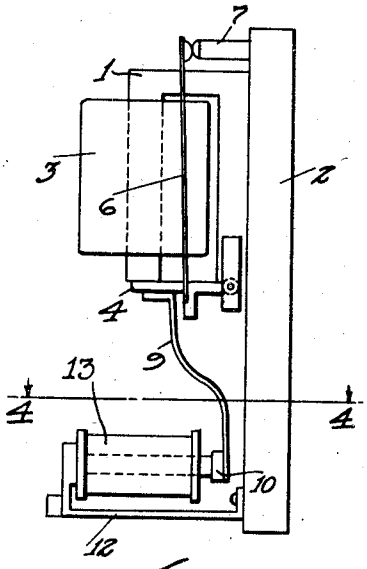


Fig. 3.

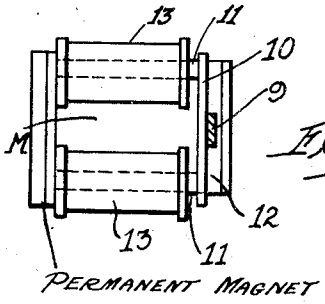


Fig. 4.

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## ELECTRICAL CIRCUIT CONTROLLING DEVICE

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3 Claims. (Cl. 200—98)

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The present invention relates to electrical circuit controlling devices or relays, particularly adapted for use in a telephone extension signal circuit employing a relay responsive to telephone ringing current to actuate an audible or visual signal. When a relay of this character is energized by telephone ringing current, it closes and completes a circuit from a suitable source of power to the extension signal, and in many instances, it is desirable to have the extension signal remain continuously energized until the person called answers the telephone.

Heretofore, telephone extension relays have been provided with various types of mechanical latching devices, which serve to hold up the relay armature after the first application of ringing current, so as to maintain the circuit of the extension signal closed. Such mechanical latching devices are usually released by a manual operation, so as to deenergize the extension signal when the person called answers the telephone. It has also been proposed to provide for the release of mechanical latching devices by electromagnetic means, operable by telephone talking current which flows when the receiver is lifted.

However, because of the feeble nature of telephone talking current, and the necessity for limiting the electrical resistance of the latch-releasing winding, the force available for releasing a mechanical latch mechanism by talking current is extremely small, and is effective only through a very limited movement. As a consequence, the mechanical latch mechanism of such magnetic release relays must be very delicate, with only a small permissible movement of the parts thereof; and past experience has shown that such relays are unreliable in the presence of external vibration or mechanical shock.

According to the present invention, there is provided an improved relay, particularly adapted for the control of telephone extension signals, which relay is entirely free of the objections and difficulties encountered with previous mechanical latch relays. The relay of the present invention is particularly characterized by a hold-in and release device that operates entirely on a magnetic principle, so that it will be reliably held in position without requiring any delicate adjustments, or being subject to displacement by external vibration or shock. Furthermore, the

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magnetic hold-in of the present relay is adapted to be readily released by the feeble current of the telephone talking circuit, without the necessity of developing any force such as would be required for releasing a mechanical latch.

The above and other advantageous features of the invention will hereinafter more fully appear from the following description, considered in connection with the accompanying drawings, in which:

Fig. 1 is a view in front elevation of a relay embodying the present invention, with its associated circuit connections shown diagrammatically.

Fig. 2 is a view in side elevation of the relay shown in Fig. 1, in an open circuit condition.

Fig. 3 is a view in side elevation, showing the relay in a closed circuit condition.

Fig. 4 is a fragmentary sectional view along the line 4—4 of Fig. 3, looking in the direction of the arrows.

Referring to the drawings, the relay comprises a U-shaped magnetic core 1 mounted on an insulating base 2, with one leg of the core 1 surrounded by an energizing winding 3. The other core leg carries an armature 4 pivoted at 5, and the armature 4 carries contacts 6 extending upwardly in the direction of spaced contacts 7 mounted on the base 2.

The stationary contacts 7 are connected across a suitable source of electrical energy S in series with a signal 8 of any desired type, so that bridging of the contacts 7 by the connected contacts 6 mounted on the armature 4, will cause energization of the signal 8. The terminals of the winding 3 are adapted to be connected to a source of telephone ringing current, as by means of a key K, so that an impulse of ringing current will cause the armature 4 to pull up from the position of Fig. 2 into the position of Fig. 3, and thereby cause energization of the telephone extension signal 8, upon bridging of the contacts 7.

As previously pointed out, the relay of the present invention contemplates the provision of means for magnetically holding in the relay armature 4 following energization of the relay winding 3 by ringing current, so that the telephone extension signal 8 will remain energized until the armature 4 is magnetically released in response to the flow of telephone talking current

when a receiver is lifted. To this end, the armature 4 provides a downwardly extending member 9 of resilient material, the lower end of which carries an auxiliary held-in armature 10 of magnetic material.

At best shown in Figs. 2 and 4, the armature 10 is normally spaced away from the ends of the poles 11 of a permanent magnet M, supported from the base 2 by means of a bracket 12. However, when the relay armature 4 is drawn upwardly through energization of the winding 3 by an application of ringing current, the armature 10 will be moved into the position of Fig. 3, wherein attraction of the armature 10 by the poles 11 will hold the armature in this position, with resultant flexure of the member 9, for a purpose which will shortly appear. With the armature 10 so held by the magnet M, deenergization of the winding 3, upon discontinuance of ringing current, will not result in dropping out of the armature 4, and the contacts 6 will remain in engagement with the contacts 7, to maintain the circuit of the extension signal 8.

The poles 11 of the magnet M are surrounded by release coils 13, and these coils are so wound that the flow of current therethrough will create a demagnetizing effect, tending to reduce the magnetic flux through the armature 10 between the poles 11. As indicated in Fig. 1, the coils 13 are adapted to receive telephone talking current when a receiver is lifted, and the flow of this relatively feeble current is sufficient to release the hold-in armature 10, due to the demagnetizing effect of the coils 13, and the releasing force stored in the flexed member 9.

As previously pointed out, the member 9 is flexed when the armature 10 is held attracted by the poles 11, as shown in Fig. 3. This flexure is due to the fact that the armature 10 would not actually engage the poles 11, were the armature 4 to be tuned slowly about its pivot 5 to engage the end of the core leg on which the winding 3 is mounted. That is to say, with the armature 10 occupying the dotted line position of Fig. 2, slightly separated from the poles 11, there would be no flexure of the member 9.

However, in the actual operation by the relay, the armature 4 is moved very quickly into contact with the core 1, in response to energization of the winding 3 by ringing current. As a result of such rapid movement, the inertia of the hold-in armature 10 at the free end of the member 9 is quite sufficient to carry the armature 10 past the dotted line position of Fig. 2, into actual engagement with the ends of the poles 11. The resulting attraction of the armature 10 by the poles 11 is then sufficient to hold the armature 10 in the position of Fig. 3, wherein the member 9 is flexed to such a degree that a retractive force is built up and maintained therein as long as the armature 10 is held by the poles 11.

With the armature 10 occupying the position of Fig. 3, a relatively feeble current flowing through the demagnetizing coils 13, will reduce the magnetic flux flowing through the armature 10 and poles 11 to a value insufficient to overcome the retractive force of the then flexed member 9. Thereupon, the armature 10 will release to permit the main armature 4 to fall back by gravity and open the circuit of the telephone extension signal 8 through separation of the relay contacts 6 and 7. It has been found that the flow of normal telephone talking current through coils 13, when a receiver is lifted, is quite sufficient to so demagnetize the poles 11 as to quickly release the armature 10. In fact, tests have shown that the current consumption of the coils 13 when releasing the armature 10, is only about one-half of the current required by relays employing a magnetically operated trip for a mechanical latch that requires the performance of work by an armature, in order to obtain the tripping movement.



From the foregoing, it is apparent that by the present invention there is provided an improved circuit controlling device, characterized by the provision of a hold-in operating entirely on a magnetic principle, so that it is not subject to displacement by ordinary vibration or shock, and is releasable in response to the flow of a feeble current, such as is available in a telephone talking circuit.

I claim:

1. An electrical circuit controlling device comprising in combination a magnetic core carrying a winding, a stationary contact, a main armature pivotally mounted on said core and carrying a contact movable into engagement with said stationary contact in response to attraction of said armature by said winding, an extension of flexible material carried by said armature and terminating in a secondary armature of magnetic material, a permanent magnet providing poles opposite the ends of said secondary armature, with said secondary armature being held by said magnet with said extension in flexed condition when said main armature moves to close said contacts in response to energization of said winding and means for neutralizing said permanent magnet to release said secondary armature through the retractive force of said flexed armature extension.

2. An electrical circuit controlling device comprising in combination a magnetic core carrying a winding, a stationary contact, a main armature pivotally mounted on said core and carrying a contact movable into engagement with said stationary contact in response to attraction of said armature by said winding, an extension of flexible material carried by said armature and terminating in a secondary armature of magnetic material, a permanent magnet providing poles opposite the ends of said secondary armature, with said secondary armature being normally separated from said magnet poles by an air gap, which is closed when said main armature moves in response to energization of said winding to bring said contacts into engagement, and with the attraction of said secondary armature by said magnet serving to hold said armature contacts closed, and said extension in flexed condition, following deenergization of said winding and means for neutralizing said permanent magnet to release said secondary armature through the retractive force of said flexed armature extension.

3. An electrical circuit controlling device comprising in combination a magnetic core carrying a winding, a stationary contact, a main armature pivotally mounted on said core and carrying a contact movable into engagement with said stationary contact in response to attraction of said armature by said winding, an extension of flexible material carried by said armature and terminating in a secondary armature of magnetic material, a permanent magnet providing poles opposite the ends of said secondary armature and a second winding for neutralizing said permanent magnet, with said secondary armature being separated from said magnet poles by

an air gap of such width that said secondary armature will be attracted and held only when said main armature moves in response to energization of said winding to close said contacts and with said extension being flexed in the attracted position of said secondary armature to store energy effective to accelerate release of the main armature following deenergization of said first winding and neutralization of said permanent magnet by the energization of said second winding.

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