April 27, 1943. H. F. CYPSER 2,317,888

OPERATING CIRCUIT FOR ELECTRICAL DEVICES

Filed Dec. 10, 1940

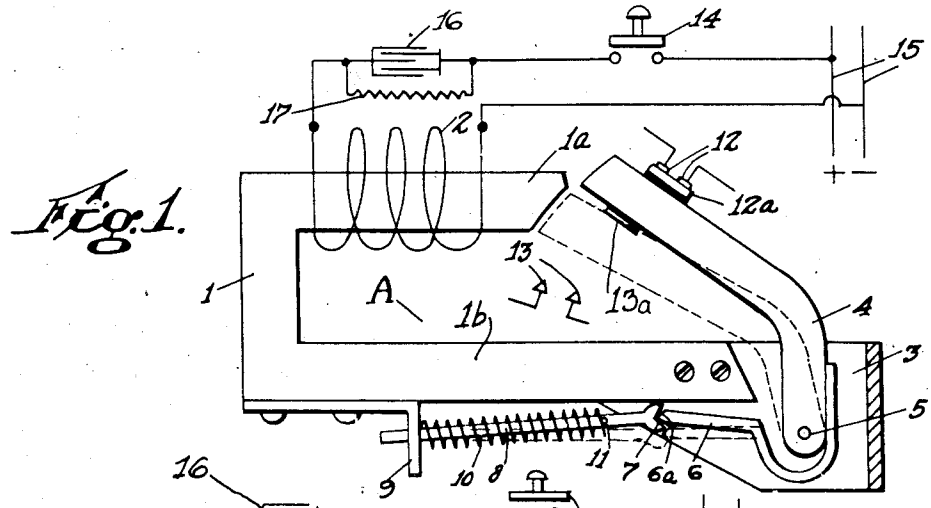


Fig. 1.

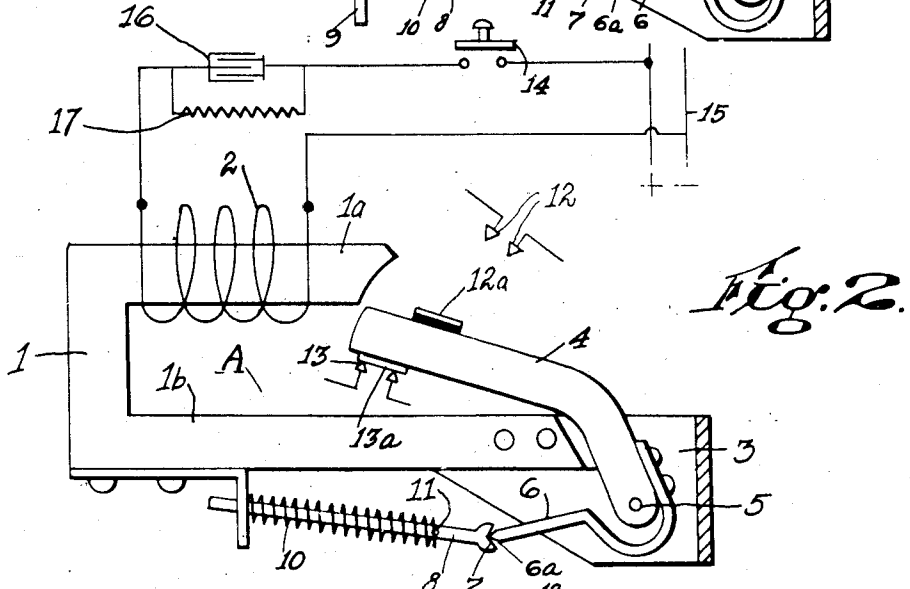


Fig. 2.

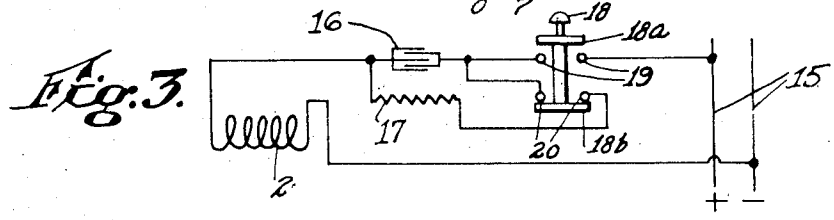


Fig. 3.

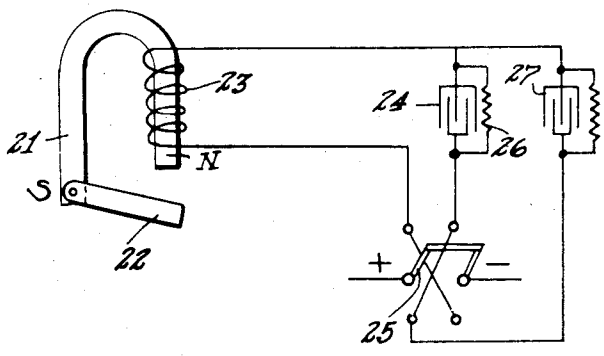


Fig. 4.

Inventor:
Hugo F. Cypser
By Owen W. Kennedy
attorney

Patented Apr. 27, 1943

2,317,888

UNITED STATES PATENT OFFICE

2,317,888

OPERATING CIRCUIT FOR ELECTRICAL DEVICES

Hugo F. Cypser, New York, N. Y., assignor to Signal Engineering & Manufacturing Company, New York, N. Y., a corporation of Massachusetts

Application December 10, 1940, Serial No. 369,466

5 Claims. (Cl. 175—375)

The present invention relates to an operating circuit for electrical devices, such as circuit controllers or relays that are adapted to move from one extreme position to another in response to separate current impulses, such relays being known in the art as "impulse" relays.

According to the invention, there is provided a circuit whereby an electrical device of the impulse relay type can be caused to move from one position to another, in response to each closure of the operating circuit, without the utilization of any auxiliary circuit interrupting devices, such as have been heretofore employed in connection wth relays of this character. That is to say, the operating circuit is adapted to automatically function in such a manner as to permit only a momentary flow of current sufficient to operate the relay, after which the current is reduced to a non-operating value, irrespective of how long the circuit remains closed.

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

Fig. 1 is a diagram of an electrical circuit embodying the invention, and showing the controlled relay in non-operating condition.

Fig. 2 shows the circuit of Fig. 1, with the relay moved into its other extreme position.

Fig. 3 is a diagram, illustrating a modification of the circuit of Fig. 1.

Fig. 4 is a circuit diagram showing the invention as appiled to the control of a different type of relay.

Referring to Fig. 1, the circuit of the present invention is shown, for purposes of illustration, as being utilized to operate a relay A of the impulse type. The relay A consists of a magnetic core 1, having a short leg 1a carrying an energizing winding 2, while the longer core leg 1b provides a suitable yoke 3, in which a magnetic armature 4 is mounted on a pivot 5. The armature 4 extends in the direction of the core leg 1a, and provides near the pivot 5 an operating extension 6 terminating in a knife edge 6a received in a notch 7 provided at the end of a throw-over arm 8.

The arm 8 is freely mounted for longitudinal movement within a bracket 9, with a spring 10 surrounding the arm between the bracket 9 and a stop 11, exerting a force on the arm, to thrust it in the direction of the armature extension 6. The spring 10 is thus adapted to yieldingly maintain the edge 6a of the extension seated in the notch 7, and since the line of thrust of the arm 8 passes to one side of the pivot 5, the armature 4 is subjected to a turning force. With the parts occupying the position of Fig. 1, the thrust of the arm 8 is such as to maintain the armature 4 against a suitable stop, with its free end displaced from the end of the core leg 1a by a relatively small air gap. As shown, the armature stop can be in the form of spaced stationary contacts 12, adapted to be engaged by a bridging member 12a, carried by the armature, so that the relay is adapted to govern the flow of current through a controlled circuit.

When the operating winding 2 is energized, the armature 4 is drawn into the dotted line position of Fig. 1, wherein the armature extension 6 and the thrust arm 8 are substantially in alinement with the pivot 5. However, should the impetus of the turning movement of the armature 4 be sufficient to carry the extension 6 past the mid position indicated in dotted lines in Fig. 1, then the compressed spring 10 will cause the arm 8 to exert a thrust tending to throw the armature into the position of Fig. 2, wherein spaced stationary contacts 13 serve as a stop, in cooperation with a bridging member 13a.

In order to operate the relay so as to move positively from one position to another, a quick impulse of current is necessary, such as might be obtained by closing and immediately opening a suitable switch 14 in one of the supply mains 15 from which the winding 2 is energized. In operation of the relay, it is essential that the current impulse for energizing the winding 2 be of such short duration as to just swing the armature 4 in one direction or the other past the dead center point, wherein the thrust of the arm 8 passes through the pivot 5. Otherwise, continued energization of the winding 2 for any appreciable period would tend to center the armature 4 between its two extreme positions, as indicated in dotted lines in Fig. 1, wherein the magnetic pull would tend to hold the armature 4 against turning movement in either direction.

As previously pointed out, the circuit of the present invention is adapted to so function as to permit a momentary flow of current through winding 2 only sufficient to pull in the armature 4, to which end a condenser 16 is connected in series with the winding 2. When the switch 14 is closed, the winding 2 will be fully energized by the rush or kick of the so-called displacement current, which flows for a very short period as the condenser 16 becomes charged. However, by the time the armature 4 has swung past its mid posi-

tion, the current traversing the winding 2 will have fallen to such a low value, due to charging of the condenser, that the thrust of the arm 8 will be sufficient to complete turning movement of the armature into the position of Fig. 2. This will happen in response to initial closure of the switch 14, regardless of how long the switch remains closed.

Upon opening of the switch 14, the condenser 16 will immediately discharge through a resistor 17, so that when the switch 14 is again closed, a second impulse or kick will be given to the relay to cause the armature 4 to move from the position of Fig. 2 back to the position of Fig. 1. Therefore, the relay armature 4 will shift its position every time the switch 14 is opened and then closed, irrespective of the length of time that the switch may remain closed between successive operations.

Referring now to Fig. 3, there is shown a modification of the circuit, wherein the switch is in the form of a push button 18 providing bridging members 18*a* and 18*b*, adapted to alternatively engage pairs of stationary contacts 19 and 20. The contacts 19 are in one supply main 15, while the contacts 20 are connected in series with a discharging resistance for the condenser 16. Therefore, when the switch 18 is pushed down, to bridge the line contacts 19 and energize the winding 2 by the condenser charging current, the resistor 17 will be removed from across the terminals of the condenser by opening of the previously closed contacts 20. As a result, there is no current consumption by the winding 2 through the then fully charged condenser 16, even though the switch is held closed, since the discharging resistance 17 is then entirely out of circuit. Upon opening of the switch 18 to unbridge the contacts 19, closure of the contacts 20 will cause the condenser 16 to discharge through the resistor 17, so that the circuit will be in readiness to again operate the relay, upon reclosure of the switch 18.

Referring now to Fig. 4, there is shown a further application of the control circuit of the present invention, in connection with a relay of the type having a magnetic hold-in for the armature, so that no holding current is required by the winding after the relay has pulled in. Such a relay usually comprises a permanently magnetized core 21, of such strength that when the armature 22 is pulled in, upon energization of the winding 23, the armature will be held by magnetic attraction alone, even though the winding be no longer energized. Such magnetically held-in relays have heretofore required the use of a mechanically operated contact to break the winding circuit, and the present invention provides a control circuit for the relay in which this auxiliary contact is eliminated.

As shown in Fig. 4, a condenser 24 is connected in circuit with the winding 23, so that when the double throw switch 25 is closed, in one direction, the kick of the charging current will cause the armature 22 to pull in, with the permanent magnet serving to hold the armature when the current in the winding 23 is reduced substantially to zero as the condenser 24 becomes fully charged. Therefore, there will be no appreciable current consumption by the relay while it remains closed, and the condenser charge will leak off through the resistor 26 when the switch 25 is open.

In order to release the armature 22, a second condenser 27 is provided in circuit with the winding 23, which is charged in the opposite direction, upon closure of the switch 25 in the other direction. The resulting reversal of the polarity of the side of the core leg upon which the winding 23 is wound, causes the armature 22 to be repelled when the second condenser 27 is charged, although there will be no appreciable current consumption by the winding when the relay has been so released.

I claim:

1. An operating circuit for electrical devices, comprising in combination a source of electrical energy, an electrical device comprising a movable member, means for yieldably maintaining said member in either one of two extreme positions and an energizing winding adapted to actuate said movable member from one extreme position to another in response to each energization of said winding, and means included in circuit with said source and said device for permitting a momentary flow of current through said winding sufficient only to actuate said device from one position to another, with said device remaining in its second extreme position, irrespective of continued closure of said circuit.

2. An operating circuit for electrical devices, comprising in combination a source of electrical energy, an electrical device comprising a movable member, means for yieldably maintaining said member in either one of two extreme positions and an energizing winding adapted to actuate said movable member from one extreme position to another in response to each energization of said winding, and means included in circuit with said source and said device for permitting a momentary flow of current through said winding of sufficient strength to actuate said device from one position to another, after which said current is reduced to a non-operating strength irrespective of continued closure of said circuit with said device remaining in its second extreme position.

3. An operating circuit for electrical devices, comprising in combination a source of electrical energy, a relay providing a winding, a magnetic armature movable in response to energization of said winding, and including means for yieldably maintaining said armature in either one of two extreme positions independently of said winding, means for establishing a circuit between said source and said winding, and means in said circuit for permitting a flow of current from said source through said winding for a period sufficient only to move said armature from one position to another wherein said yieldably maintaining means is effective to hold said armature in its new position, irrespective of continued closure of said circuit.

4. An operating circuit for electrical devices, comprising in combination a source of uni-directional current, a relay providing a winding, a magnetic armature movable in response to energization of said winding, and including means for yieldably maintaining said armature in either one of two extreme positions independently of said winding, means for establishing a circuit between said source and said winding, and a condenser in said circuit for permitting the flow of current through said winding in sufficient strength to move said armature from one position to another only during the charging period of said condenser, with said armature remaining in its new position, irrespective of continued closure of said circuit.

5. An operating circuit for electrical devices,

comprising in combination a source of uni-directional current, a relay providing a winding, a magnetic armature movable in response to energization of said winding, and including means for yieldably maintaining said armature in either one of two extreme positions independently of said winding, means for establishing a circuit between said source and said winding, and a condenser in said circuit for permitting the flow of current through said winding in sufficient strength to move said armature from one position to another only during the charging period of said condenser, irrespective of continued closure of said circuit, after which the charged condenser limits the current in said winding to a value insufficient to overcome the effect of said maintaining means on said armature in its new position, and until said condenser has been discharged.

HUGO F. CYPSER.