Nov. 17, 1953 A. E. DODD 2,659,880

APPARATUS FOR DETECTING RECURRENT CIRCUIT OPERATION

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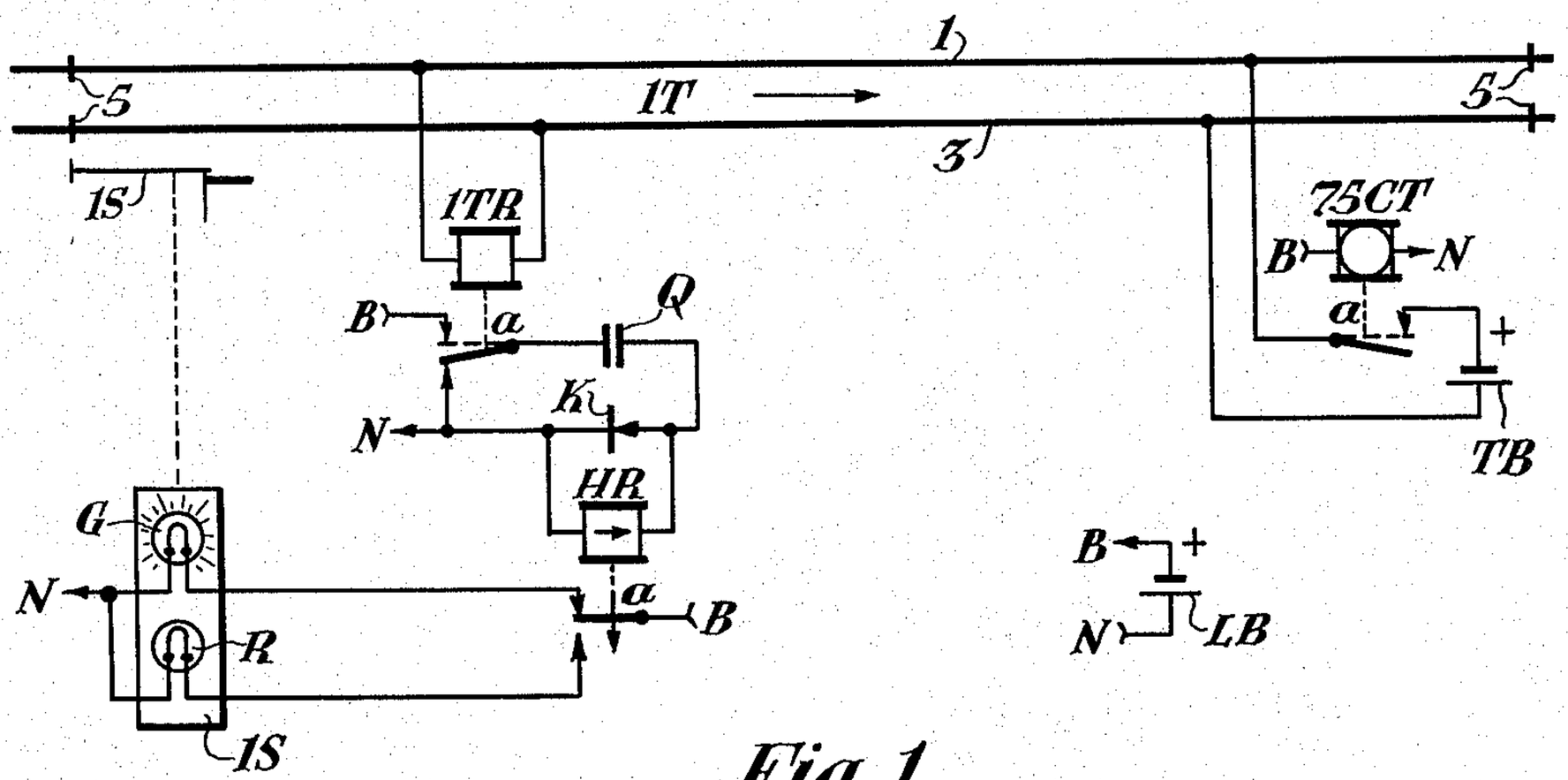

Fig. 1.

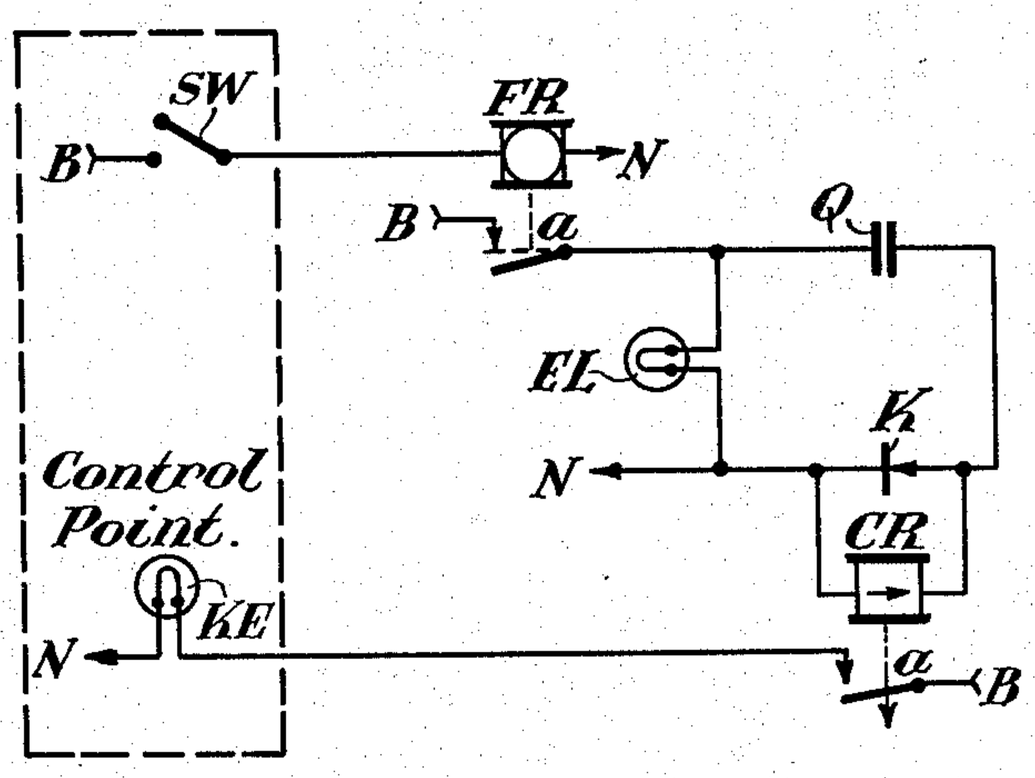

Fig. 2.

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APPARATUS FOR DETECTING RECURRENT CIRCUIT OPERATION

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My invention relates to apparatus for detecting recurrent circuit operation and particularly to improved means for detecting the recurrent operation of a contact in such manner that failure of any part of the apparatus will not result in an erroneous indication of the operating state of the contact.

It has heretofore been proposed to check the recurrent operation of a circuit, or a contact controlling a circuit, by providing a capacitor and a slow release relay, arranged so that energy is periodically supplied to the capacitor and thereafter supplied to the winding of the slow release relay, to energize the relay. The release time of the relay is selected so that its contacts will remain picked up during intervals in which no energy is supplied to the winding from the capacitor. Such arrangements are characterized by liability to failure should the contacts which govern the switching of the capacitor from the source of energy to the winding of the relay become fused or otherwise deranged in such manner that the contacts are bridging, that is, so that the movable contact engages both stationary contacts at the same time. Should this occur, energy will be supplied directly to the winding of the slow release relay, so that the relay would be falsely energized.

Accordingly, it is an object of my invention to provide improved means for detecting recurrent operation of a circuit or a contact governing a circuit arranged so that defects in the contact will not result in improper energization of the code detecting means.

Another object of my invention is to provide improved means for detecting the code-following operation of a contact which may be subject to misalignment, sticking, etc., which might cause the movable member of the contact to simultaneously engage both of the associated stationary contacts.

Another object of my invention is to provide improved means for detecting recurrent operation of a contact or of a circuit element, in which the apparatus is arranged so that any failure of the component parts will not result in improper energization of the relay which detects the recurrent operation of the apparatus.

Still another object of my invention is to provide a novel and improved means for checking the recurrent supply of energy to a lamp or other load, where it is essential that all of the elements be arranged so that any possible failure will not cause an erroneous indication.

Other objects of my invention and features

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of novelty thereof will become apparent from the following description taken in connection with the accompanying drawing.

I shall describe two forms of code detecting apparatus embodying my invention and shall then point out the novel features thereof in claims.

In the drawings, Fig. 1 is a diagrammatic view of code detecting apparatus embodying my invention, as employed in connection with a coded track circuit railway signaling system.

Fig. 2 is a diagrammatic view of code detecting apparatus embodying my invention for checking the proper operation of a flashing electric lamp, to provide an indication of the operation thereof at a point from which the flashing electric lamp is controlled.

In the drawings, similar reference characters refer to similar parts in each of the two views.

In practicing my invention, I provide a capacitor to which energy is supplied when the contact which is recurrently operated is in one of its two positions, and from which energy is supplied to a slow release code detecting relay when the contact is in its other position, the detecting relay winding and capacitor being connected in series, and having an asymmetric unit, such as a rectifier or other similar device, for by-passing the winding of the relay during the charging period of the capacitor. The asymmetric unit is poled so that while the capacitor is discharging energy will flow through the winding of the slow release detecting relay causing it to pick up. This detector relay is slow in releasing so that its contacts will remain picked up during the intervals in which no energy is supplied to its winding. Moreover, the code detecting relay is of the biased type, in which the contacts will pick up when and only when current flows through the winding of the relay in a given direction. The relay is connected so that the energy which may flow through its winding during the charging time of the capacitor will be in the direction opposite to that required to pick the relay contacts up, while the energy which flows through the relay during the discharging of the capacitor is in the proper direction to cause the contacts of the relay to pick up.

Referring to Fig. 1 of the drawings, there is shown a stretch of railroad track having track rails 1 and 3 which are divided by the usual insulated joints 5 into customary track sections. One complete section 1T, and portions of adjoining sections are shown. Traffic normally moves from left to right in the track stretch as

indicated by the arrow, and a signal 1S is located at the left hand or entrance end of section 1T and governs entrance of traffic into the section. At the right hand or exit end of the section, a contact of a continuously operating code transmitter 75CT recurrently connects the track battery TB across the track rails at the exit end of section 1T. The contact of code transmitter 75CT may operate at any appropriate code speed, such as 75 times per minute, to thereby supply impulses of energy to the rails of section 1T. At the entrance end of the section, a code following track relay 1TR is connected across the track rails, and responds to the impulses of energy supplied thereto over the rails from the exit end of the section, causing its contact *a* to recurrently be operated between its release and picked up position, in response to the supply of impulses of energy to the winding of the track relay. The construction of the code transmitter 75CT forms no part of my invention, and it will suffice to say that the code transmitter is of the conventional type, well known in railway signaling systems, which recurrently operates its contact at a specified speed when energy is supplied thereto from a source of low voltage direct current. Energy for operation of the apparatus including the code transmitter 75CT may be furnished by any suitable source of low voltage direct current, such as the battery LB shown, having its positive terminal designated by the reference character B and its negative terminal designated by the reference character N.

When the contact of code transmitter 75CT is closed and the section is vacant, energy from the battery TB picks up the contact of track relay 1TR, with the result that energy is supplied from terminal B over front contact *a* of relay 1TR, to the left hand element of a capacitor Q, the other element of which is connected to the negative terminal N of the battery by a circuit which includes the asymmetric unit K and the winding of the detecting relay HR connected in multiple. The asymmetric unit K is poled so that energy will flow therethrough during the time in which the condenser Q has its left hand element connected to the positive terminal of the battery, so that at this time, with the contact *a* of relay 1TR picked up, the capacitor Q will be charged to the voltage of the battery LB, and as is well known the energy stored in the capacitor at this time will be equal to one-half the value of the capacity times the voltage squared. It will be noted that any flow of energy through the winding of relay HR at this time will be in the direction to prevent the relay from picking up, since this flow of current which of course, is negligible due to the shunting of the rectifier K, will be in the direction opposite the arrow shown on the winding of the detecting relay.

When the contact *a* of the code transmitter 75CT interrupts the connection of battery TB to the section rails, the track relay 1TR at the other end of the section will release its contact *a*. At this time, a circuit is established for supplying the energy stored in capacitor Q to the winding of detecting relay HR. This circuit may be traced from the left hand element of capacitor Q over back contact *a* of relay 1TR, through the winding of the detecting relay HR from left to right, to the right hand element of condenser Q. It will be apparent that the rectifier K is poled in such manner that no energy can flow therethrough at this time, so that the entire amount of energy previously stored in condenser Q is

discharged through the winding of the detecting relay HR, to thereby cause the relay HR to pick up.

During the next picked up period of the contact *a* of the track relay 1TR, the circuit for supplying energy of the capacitor Q to the winding of the detecting relay is interrupted, and the circuit for charging the capacitor Q from the direct current source is again established, as previously described. At this time the asymmetric unit K serves as a snubbing unit to retard the release of relay HR, since the induced energy which tends to flow from the winding of the detecting relay HR is of the polarity such that it circulates through the rectifier K, thereby delaying the decay of flux in the magnetic structure of the relay HR, and thus delaying the release of the relay. The parts are proportioned and arranged so that the relay HR is rendered sufficiently slow in releasing so that its contacts will remain picked up during the intervals in which no energy is supplied to the winding of the relay from the capacitor Q.

As long as track relay 1TR is responding to coded energy supplied over the rails of section 1T the capacitor Q is charged during the picked up period of the track relay and the energy stored in the capacitor is supplied to relay HR during the released period of the track relay, so that the contacts of relay HR are maintained picked up at this time.

With the contact *a* of relay HR picked up, an obvious circuit is established for supplying energy to the green lamp G of signal 1S, to thereby indicate that the track section 1T is clear and that an approaching train may proceed into the section.

When a train enters section 1T, the track relay 1TR is shunted and ceases to respond to coded energy supplied over the section rails, so that its contact *a* releases and remains released and energy is no longer recurrently supplied to the capacitor Q from the direct current source. Accordingly, the energy stored in the capacitor discharges through the relay HR, after which the relay HR is no longer supplied with energy and its contact *a* releases, thereby interrupting the supply of energy to the green lamp G of signal 1S, and establishing a circuit for supplying energy to the red lamp R of the signal, so that signal 1S indicates that the section is occupied.

When the section 1T is vacated, the track relay 1TR is again operated by coded energy so that the capacitor Q is charged during the picked up periods of the relay and energy from the condenser is supplied to relay HR during the released periods of the track relay, with the result that relay HR again picks up and establishes the circuit of the green lamp G, and extinguishes the red lamp R of the signal.

The equipment is arranged so that the relay HR will not be picked up if the movable contact *a* of relay 1TR engages both its front and back points of contact. Under these conditions, the terminals B and N of the source would be connected together by the contacts so that the supply of energy is shunted away from the capacitor Q and the relay HR, and accordingly the relay HR will be released.

If the capacitor Q breaks down so that a circuit is established between its elements, no energy will be stored in the capacitor and therefore cannot be supplied from the capacitor to the relay HR so that the relay is certain to release. If the capacitor breaks down, the relay HR will not be

energized during the picked up period of the track relay, since the flow of energy through the winding of relay HR will be in the direction opposite to that required to pick the relay up, and additionally, the low resistance shunting effect of the asymmetric unit K will cause only a very small portion of the total energy to flow through the winding of relay HR, as previously explained.

If the asymmetric unit or rectifier K breaks down, it will form a low resistance shunt across the terminals of the winding of relay HR during the time energy is being supplied from the capacitor Q, so that insufficient energy will be supplied to the winding of relay HR to pick up the contacts of the relay.

If the asymmetric unit or rectifier K is open, energy will be supplied from left to right through the winding of relay HR during the released periods of track relay ITR, and when contact *a* of relay ITR is picked up, the charging current for capacitor Q will flow through the winding of relay HR from right to left. As a result of the loss of the by-passing and blocking effect of rectifier K due to its being open circuited, the relay HR will not be picked up by the flow of energy to its winding at this time.

From the foregoing, it will be seen that the detecting relay HR is energized when and only when the track relay ITR is operated by coded energy, so that its contact *a* is recurrently picked up and released, but the relay HR will not be energized if the front and back contacts of the relay overlap so as to engage the movable contact simultaneously, and in addition, the detecting relay HR will not be energized as the result of failure of any of the components, including the capacitor Q and the asymmetric unit K. Accordingly, any failure of the apparatus will result in the release of relay HR to cause the red lamp to be lighted and cannot result in improper energization of relay HR with consequent lighting of the green lamp of signal IS.

In signaling circuits, it is sometimes necessary to check whether or not a load is being recurrently supplied with energy. As an example of this situation, an electric lamp is sometimes flashed to provide a certain type of signal indication, and it is desirable to provide means for checking whether or not the lamp is actually flashing. In Fig. 2 of the drawings, there is shown an arrangement for checking the operation of a flashing electric lamp, which arrangement comprises a second embodiment of my invention.

Referring to Fig. 2, there is shown a control point as indicated by the dotted rectangle, from which point the flashing of an electric lamp EL is to be controlled and additionally, an indication is to be provided when the lamp is actually flashing. The control of the electric lamp is provided by a flasher relay FR, which is governed by an obvious circuit including the control switch SW at the control point. When the switch SW is closed, energy is supplied to the winding of the flasher relay, and this relay, well known in the art, is of the type in which the contacts are recurrently opened and closed at a specified rate, for example, 30 times per minute, when energy is supplied to the winding of the relay. As will be seen from the drawings, each time the contact *a* of the flasher relay FR is picked up a circuit is established for supplying energy to the electric lamp EL. This circuit may be traced from terminal B, over front contact *a* of flasher relay FR, and through the lamp EL to the negative terminal N of the source, so that each time that contact *a* is picked up, the electric lamp EL is lighted, and when the contact *a* of the flasher relay FR is opened, the lamp is extinguished. The apparatus for checking the operation of the lamp EL includes the capacitor Q, connected in series with the winding of a checking relay CR, which in turn has connected across it an asymmetric unit K. The checking relay CR has a contact *a* which when picked up establishes an obvious circuit for supplying energy to the indication lamp KE at the control point.

In the normal condition, as shown in the drawings, the switch SW is opened, so that the flasher relay FR is deenergized and its contact *a* is opened. At this time, no energy is supplied to the lamp EL, and no energy flows through the winding of the checking relay CR, so that its contact *a* is released and the indication lamp KE at the control point is extinguished. It will now be assumed that the operator at the control point desires to flash the lamp EL, and accordingly closes the switch SW to energize the flasher relay FR. The recurrent operation of contact *a* of flasher relay FR will supply energy to the electric lamp EL. Additionally, when contact *a* of relay FR is closed energy is supplied from terminal B of the battery to the left hand element of the capacitor Q, the right hand element of which is connected to terminal N of the source through the asymmetric unit K and the winding of relay CR in multiple. The asymmetric unit K is poled so that the charging current of the capacitor will flow therethrough at this time. A small amount of current which is not carried by the asymmetric unit K will also flow through the winding of the checking relay from right to left, but as indicated on the drawings, this direction of current flow is opposite to that required to pick up the relay CR. When contact *a* of the flasher relay opens, the supply of energy to the lamp EL is interrupted, and the lamp is extinguished. However, at this time a circuit is provided for supplying energy which was previously stored in the capacitor Q through the electric lamp EL to the winding of the detecting relay CR. This circuit may be traced from the left hand element of capacitor Q, through the filament of lamp EL, through the winding of the checking relay CR, from left to right, to the right hand element of capacitor Q. The flow of energy through the winding of the relay CR at this time is in the proper direction to cause the contacts of the relay to pick up. Additionally, the parts are proportioned and arranged so that the current which flows through the filament of the lamp EL at this time is insufficient to cause the lamp to become lighted, since the resistance of the relay limits the value of the discharge current of the condenser. The flow of energy at this time is in a direction opposite to that in which the asymmetric unit K is poled, so that all of the energy stored in the capacitor Q is discharged through the winding of the relay CR. When contact *a* of the flasher relay FR again is closed, energy is supplied to the filament of lamp EL, and the capacitor Q is again charged to the voltage of the direct current source. During these charging intervals, following the first interval, the rectifier K acts as a snub across the winding of relay CR, since it is poled in such direction that the induced current will flow therethrough, thereby delaying the decay of flux in the magnetic circuit of the relay. The parts are proportioned and arranged so that the relay CR will maintain its contacts picked

up during the intervals in which no energy is supplied thereto from the capacitor Q. With the contact *a* of relay CR picked up by the recurrent supply of energy from the capacitor Q, the circuit for the indication lamp KE is established, and the operator at the control point is thereby notified that the lamp EL is flashing properly.

If the filament of lamp EL should burn out, thereby causing an open circuit at this point, the lamp of course will be continuously extinguished, and although the contacts of the flasher relay FR will continue to supply charging energy to the capacitor Q, the discharge path of this energy will be interrupted, so that relay CR will release and remain released. Moreover, if for some reason or other, the contact *a* of the flasher relay FR should remain in its picked up position, the lamp EL will be continuously lighted. However, since the capacitor Q will not have an opportunity to discharge its stored energy through the winding of relay CR, the contacts of relay CR will release to indicate that the lamp is not flashing properly. As pointed out in connection with Fig. 1, a failure of capacitor Q or the asymmetric unit K can only cause energy to be supplied through the winding of relay CR in the direction opposite to that required to pick up the relay, so that failure of these components will not cause improper indication.

It will be apparent from the foregoing that apparatus arranged in accordance with my invention as shown in Fig. 2, provides a reliable and economical arrangement for checking the recurrent supply of energy to a load device.

It will be apparent to those skilled in the art that the arrangement is not limited to checking the supply of energy to an electric lamp, but may be employed to check the supply of energy to any type of load which develops a voltage drop when energy is supplied thereto. A further modification of the arrangement shown in Fig. 2 is to replace the lamp EL with a conventional resistance load, in which case the arrangement provides what is known in the art as "single contact" code detection. That is, the resistor replaces the lamp EL and furnishes a discharge path for the capacitor Q.

Although I have herein shown and described only two forms of apparatus embodying my invention, it will be apparent to those skilled in the art that various changes and modifications may be made therein within the scope of the appended claims without departing from the spirit and scope of my invention.

Having thus described my invention, what I claim is:

1. In combination, a contact adapted to be recurrently operated between a first and a second position, a source of electrical energy, a storage device capable of storing energy delivered thereto from said source, an asymmetric device, circuit means governed by said contact in one of its two positions for supplying energy from said source to said storage device through said asymmetric device in its conducting direction, a relay having contacts which are picked up when and only when energy flows through a winding of the relay in a given direction, said relay winding being connected in multiple to said asymmetric device so that energy which is supplied thereto in the nonconducting direction of said asymmetric device will flow through said winding in said given direction, and circuit means effective when said contact is in the other of its two positions for supplying energy from said storage device to said asymmetric device and said relay winding.

2. In combination, a contact adapted to be recurrently operated between a first and a second position, a source of electrical energy, a storage device capable of storing energy delivered thereto from said source, a rectifier, circuit means governed by said contact in one of its two positions for supplying energy from said source to said storage device through said rectifier in its conducting direction, a relay having contacts which are picked up when and only when energy flows through a winding of the relay in a given direction, said relay winding being connected in multiple to said rectifier so that energy which is supplied thereto in the non-conducting direction of said rectifier will flow through said winding in said given direction, and circuit means effective when said contact is in the other of its two positions for supplying energy from said storage device to said asymmetric device and said relay winding.

3. In combination, a contact adapted to be recurrently operated between a first and a second position, a source of electrical energy, a storage device capable of storing energy delivered thereto from said source, an asymmetric device, circuit means governed by said contact in one of its two positions for supplying energy from said source to said storage device through said asymmetric device in its conducting direction, a relay having contacts which are picked up when and only when energy flows through a winding of the relay in a given direction, said relay winding being connected in multiple to said asymmetric device so that energy which is supplied thereto in the non-conducting direction of said asymmetric device will flow through said winding in said given direction, circuit means effective when said contact is in the other of its two positions for supplying energy from said storage device to said asymmetric device and said relay winding, and circuit means governed by said relay.

4. In combination, a contact adapted to be recurrently operated between a first and a second position, a source of electrical energy, a storage device capable of storing energy delivered thereto from said source, a rectifier, circuit means governed by said contact in one of its two positions for supplying energy from said source to said storage device through said rectifier in its conducting direction, a relay having contacts which are picked up when and only when energy flows through a winding of the relay in a given direction, said relay winding being connected in multiple to said rectifier so that energy which is supplied thereto in the nonconducting direction of said rectifier will flow through said winding in said given direction, circuit means effective when said contact is in the other of its two positions for supplying energy from said storage device to said rectifier and said relay winding, and circuit means governed by said relay.

5. In combination, a contact adapted to be recurrently operated between a first and a second position, a source of electrical energy, a capacitor capable of storing energy delivered thereto from said source, an asymmetric device, circuit means governed by said contact in one of its two positions for supplying energy from said source to said capacitor through said asymmetric device in its conducting direction, a relay having contacts which are picked up when and only when energy flows through a winding of the relay in a given direction, said relay winding being connected in multiple to said asymmetric

device so that energy which is supplied thereto in the non-conducting direction of said asymmetric device will flow through said winding in said given direction, and circuit means effective when said contact is in the other of its two positions for supplying energy from said capacitor to said asymmetric device and said relay winding.

6. In combination, a contact adapted to be recurrently operated between a first and a second position, a source of electrical energy, a capacitor capable of storing energy delivered thereto from said source, a rectifier, circuit means governed by said contact in one of its two positions for supplying energy from said source to said capacitor through said rectifier in its conducting direction, a relay having contacts which are picked up when and only when energy flows through a winding of the relay in a given direction, said relay winding being connected in multiple to said rectifier so that energy which is supplied thereto in the non-conducting direction of said asymmetric device will flow through said winding in said given direction, and circuit means effective when said contact is in the other of its two positions for supplying energy from said capacitor to said rectifier and said relay winding.

7. In combination, a contact adapted to be recurrently operated between a first and a second position, a source of electrical energy, a capacitor capable of storing energy delivered thereto from said source, an asymmetric device, circuit means governed by said contact in one of its two positions for supplying energy from said source to said capacitor through said asymmetric device in its conducting direction, a relay having contacts which are picked up when and only when energy flows through a winding of the relay in a given direction, said relay winding being connected in multiple to said asymmetric device so that energy which is supplied thereto in the non-conducting direction of said asymmetric device will flow through said winding in said given direction, circuit means effective when said contact is in the other of its two positions for supplying energy from said capacitor to said asymmetric device and said relay winding, and circuit means governed by said relay.

8. In combination, a contact adapted to be recurrently operated between a first and a second position, a source of electrical energy, a capacitor capable of storing energy delivered thereto from said source, a rectifier, circuit means governed by said contact in one of its two positions for supplying energy from said source to said capacitor through said rectifier in its conducting direction, a relay having contacts which are picked up when and only when energy flows through a winding of the relay in a given direction, said relay winding being connected in multiple with said rectifier so that energy which is supplied thereto in the non-conducting direction of said rectifier will flow through said winding in said given direction, circuit means effective when said contact is in the other of its two positions for supplying energy from said capacitor to said rectifier and said relay winding, and circuit means governed by said relay.

9. In combination, a movable contact adapted to be recurrently operated between a first position in which it engages a first stationary contact and a second position in which it engages a second stationary contact, a source of direct current energy having a first and a second terminal, said first terminal of said source being connected to said first stationary contact, said second terminal of said source being connected to said second stationary contact, a capacitor, a rectifier, circuit means for connecting said rectifier and said capacitor in series between said movable contact and said second terminal of said source, said rectifier being poled in a direction to permit charging current to flow to said capacitor from said source, and a relay having a winding connected across said rectifier, said relay having contacts which are picked up when and only when current flows through the winding of the relay in a given direction, said winding being connected across said rectifier in such manner that the charging current of said capacitor which flows through the relay winding is ineffective to pick up the contacts of said relay.

10. In combination, a movable contact adapted to be recurrently operated between a first position in which it engages a first stationary contact and a second position in which it engages a second stationary contact, a source of direct current energy having a first and a second terminal, said first terminal of said source being connected to said first stationary contact, said second terminal of said source being connected to said second stationary contact, a capacitor, a rectifier, circuit means for connecting said rectifier and said capacitor in series between said movable contact and said second terminal of said source, said rectifier being poled in a direction to permit charging current to flow to said capacitor from said source, a relay having a winding connected across said rectifier, said relay having contacts which are picked up when and only when current flows through the winding of the relay in a given direction, said winding being connected across said rectifier in said manner that the charging current of said capacitor which flows through the relay winding is ineffective to pick up the contacts of said relay, and a circuit governed by the contacts of said relay.

11. In combination, a movable contact adapted to be recurrently operated between a first position in which it engages a first stationary contact and a second position in which it engages a second stationary contact, a source of direct current energy having a first and a second terminal, said first terminal of said source being connected to said first stationary contact, said second terminal of said source being connected to said second stationary contact, a capacitor, an asymmetric device, circuit means for connecting said asymmetric device and said capacitor in series between said movable contact and said second terminal of said source, said asymmetric device being poled in a direction to permit charging current to flow to said capacitor from said source, and a relay having a winding connected across said asymmetric device, said relay having contacts which are picked up when and only when current flows through the winding of the relay in a given direction, said winding being connected across said asymmetric device in said manner that the charging current of said capacitor which flows through the relay winding is ineffective to pick up the contacts of said relay.

12. In combination, a source of direct current energy, a load device adapted to be recurrently energized from said source, and means for detecting the recurrent energization of said load device, comprising a capacitor, an asymmetric device, circuit means for connecting said capacitor and said asymmetric device in series across said load device, said asymmetric device being

poled so that the capacitor is charged from said source each time said load device is energized from said source, and a relay having a winding connected across said asymmetric device, said relay having contacts which are picked up when and only when current flows through said winding in a given direction, said relay winding being connected so that the current which flows therethrough when said condenser is charging is ineffective to pick up the contacts of said relay.

13. In combination, a source of direct current energy, a load device adapted to be recurrently energized from said source, and means for detecting the recurrent energization of said load device, comprising a capacitor, an asymmetric device, circuit means for connecting said capacitor and said asymmetric device in series across said load device, said asymmetric device being poled so that the capacitor is charged from said source each time said load device is energized from said source, a relay having a winding connected across said asymmetric device, said relay having contacts which are picked up when and only when current flows through said winding in a given direction, said relay winding being connected so that the current which flows therethrough when said capacitor is charging is ineffective to pick up the contacts of said relay, and a circuit governed by the contacts of said relay.

14. In combination, a source of direct current energy, a load device adapted to be recurrently energized from said source, and means for detecting the recurrent energization of said load device, comprising a capacitor, a rectifier circuit means for connecting said capacitor and said rectifier in series across said load device, said rectifier being poled so that the capacitor is charged from said source each time said load device is energized from said source, and a relay having a winding connected across said rectifier, said relay having contacts which are picked up when and only when current flows through said winding in a given direction, said relay winding being connected so that the current which flows therethrough when said capacitor is charging is ineffective to pick up the contacts of said relay.

15. In combination, a source of direct current energy, a load device adapted to be recurrently energized from said source, and means for detecting the recurrent energization of said load device, comprising a capacitor, an asymmetric device, circuit means for connecting said capacitor and said asymmetric device in series across said load device, said asymmetric device being poled so that the capacitor is charged from said source each time said load device is energized from said source, a relay having a winding connected across said rectifier, said relay having contacts which are picked up when and only when current flows through said winding in a given direction, said relay winding being connected so that the current which flows therethrough when said capacitor is charging is ineffective to pick up the contacts of said relay, and a circuit governed by the contacts of said relay.

16. In combination, a source of direct current energy, a lamp adapted to be recurrently energized from said source, and means for detecting the recurrent energization of said lamp, comprising a capacitor, an asymmetric device, circuit means for connecting said capacitor and said asymmetric device in series across said lamp, said asymmetric device being poled so that the capacitor is charged from said source each time said lamp is energized from said source, and a relay having a winding connected across said rectifier, said relay having contacts which are picked up when and only when current flows through said winding in a given direction, said relay winding being connected so that the current which flows therethrough when said capacitor is charging is ineffective to pick up the contacts of said relay.

17. In combination, a source of direct current energy, a lamp adapted to be recurrently energized from said source, and means for detecting the recurrent energization of said lamp, comprising a capacitor, an asymmetric device, circuit means for connecting said capacitor and said asymmetric device in series across said lamp, said asymmetric device being poled so that the capacitor is charged from said source each time said lamp is energized from said source, a relay having a winding connected across said rectifier, said relay having contacts which are picked up when and only when current flows through said winding in a given direction, said relay winding being connected so that the current which flows therethrough when said capacitor is charging is ineffective to pick up the contacts of said relay, and a circuit governed by the contacts of said relay.

18. In combination, a source of direct current energy, a lamp adapted to be recurrently energized from said source, and means for detecting the recurrent energization of said lamp, comprising a capacitor, a rectifier, circuit means for connecting said capacitor and said rectifier in series across said lamp, said rectifier being poled so that the capacitor is charged from said source each time said lamp is energized from said source, a relay having a winding connected across said rectifier, said relay having contacts which are picked up when and only when current flows through said winding in a given direction, said relay winding being connected so that the current which flows therethrough when said capacitor in charging is ineffective to pick up the contacts of said relay.

19. In combination, a source of direct current energy, a lamp adapted to be recurrently energized from said source, and means for detecting the recurrent energization of said lamp, comprising a capacitor, an asymmetric device, circuit means for connecting said capacitor and said asymmetric device in series across said lamp, said asymmetric device being poled so that the capacitor is charged from said source each time said lamp is energized from said source, a relay having a winding connected across said asymmetric device, said relay having contacts which are picked up when and only when current flows through said winding in a given direction, said relay winding being connected so that the current which flows therethrough when said capacitor is charging is ineffective to pick up the contacts of said relay, and a circuit governed by the contacts of said relay.

ARTHUR E. DODD.

References Cited in the file of this patent

UNITED STATES PATENTS

Number	Name	Date
2,010,840	Baughman	Aug. 13, 1935
2,454,687	Baughman	Nov. 23, 1948
2,461,452	Thompson	Feb. 8, 1949
2,499,177	Baughman	Feb. 28, 1950