

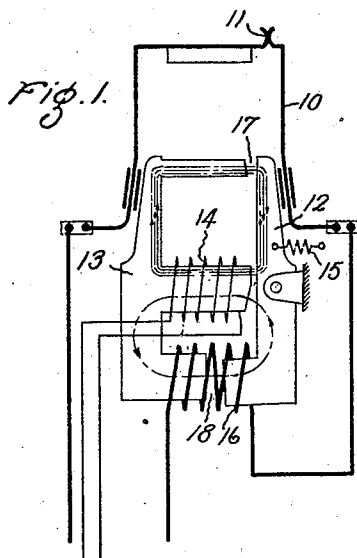
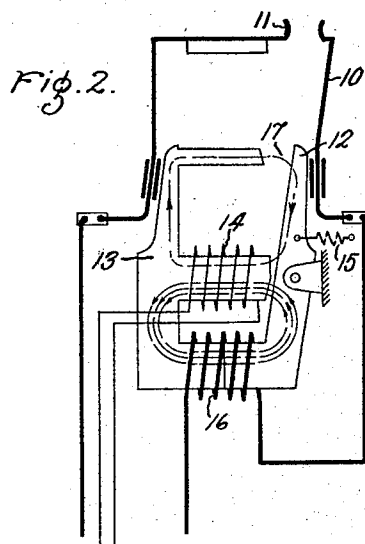
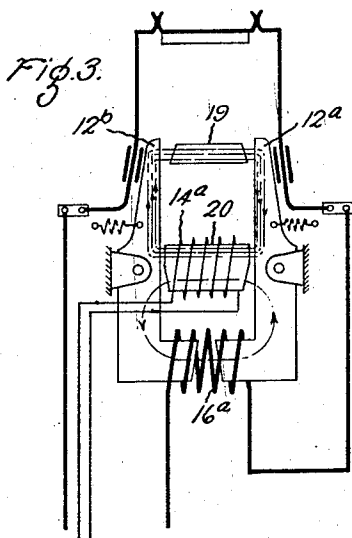
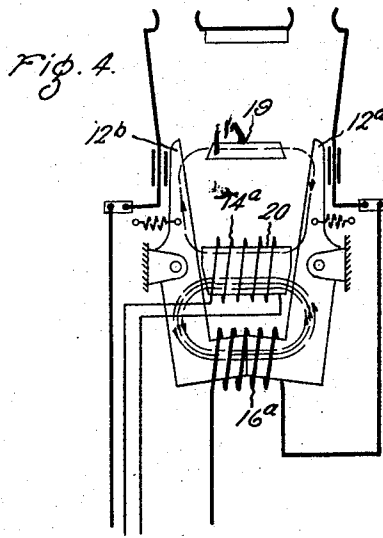
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1,581,830

A. BESCHNITT

CIRCUIT INTERRUPTER

Filed May 14, 1923



Inventor:
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UNITED STATES PATENT OFFICE.

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CIRCUIT INTERRUPTER.

Application filed May 14, 1923. Serial No. 632,759.

To all whom it may concern:

Be it known that I, ALBERT BESCHNITT, a citizen of the German Realm, residing at Berlin, Germany, have invented certain new and useful Improvements in Circuit Interrupters, of which the following is a specification.

One of the objects of the invention is to provide an improved interrupter for electric circuits which will positively and quickly interrupt the controlled circuit in response to a predetermined condition, such, for instance, as an overload condition.

A further object of the invention is to provide an improved interrupter which is magnetically held closed and magnetically opened.

A still further object of the invention is to provide an improved interrupter which does not require the use of triggers, latches and the like for holding the switch contact mechanism in the closed position.

A still further object of the invention is to provide an interrupter which is held closed by an electromagnet having a shunt winding and opened by means responsive to the current in the controlled circuit, the arrangement being such that the flux of the shunt winding is automatically shifted to assist in opening the controlled circuit.

Another object of the invention is to provide an improved circuit interrupter in which a plurality of switch contact members are arranged to be connected in series relation in a circuit to be controlled and the switch members are held in the closed position by a single electromagnet having a shunt holding coil and the switch members are operated to the open position under the control of a series winding which opposes the normal effect of the shunt winding. These and other objects of the invention as will be either apparent to those skilled in the art or as will be pointed out fully hereinafter are attained in the electromagnetic switch illustrated in the accompanying drawings.

Referring to the accompanying drawings, Fig. 1 shows very diagrammatically a circuit interrupter in accordance with the invention, the single switch member of the interrupter being magnetically held in the closed position; Fig. 2 is a very diagrammatic view showing the relative positions of the parts when the circuit breaker is in

the open position; Fig. 3 is a diagrammatic view of a double pole circuit breaker in accordance with the invention, with the switch contact members in their respective closed positions; and Fig. 4 is a view showing the relative positions of the parts of the switch illustrated in Fig. 3 when the switch members are in their respective open positions.

Referring to the drawings, Figs. 1 and 2, the movable switch member 10 is adapted to make engagement with the stationary switch contact 11 so as to complete the circuit controlled by the switch. The switch member 10 is under the control of electromagnetic means having a magnetic structure comprising the armature 12 which is pivotally mounted intermediate its ends and the E-shaped magnetic structure 13. The armature 12 and the switch member controlled thereby are held in their respective closed positions in response to the magnetic flux set up by the shunt winding 14. This shunt winding 14 is disposed on the middle leg of the E-shaped magnetic structure, and it will be observed that while the magnetic structure provides two multiple connected paths, the switch member is held in the closed position by reason of the flux in the upper portion of the paths. The pivotal mounting of the armature 12 is preferably opposite the middle leg or the common part of the two paths for the magnetic flux of the electromagnet, so that when the armature 12 is in the position shown and the shunt winding 14 is energized the magnetic pull exerted on the upper portion of the armature predominates over the magnetic pull on the lower portion of the armature and the switch member will be held in the closed position against the bias of the spring 15 which tends to open the switch.

The switch is magnetically opened under the control of the series winding 16 which may either be included directly in the circuit controlled by the switch or energized responsively to the current in the controlled circuit, as will be understood by those skilled in the art. The series winding is disposed on the lower leg of the E-shaped magnetic structure and since this winding embraces the lower of the multiple connected paths of the magnetic structure, it is in close inductive relation with the shunt winding 14. As long as the attractive force of the magnetic flux of the shunt winding 14 acting

on the upper portion of the armature 12 predominates over the attractive force of the magnetic flux set up by the series winding 16 on the lower portion of the multiple connected paths of the electromagnet, the switch will be magnetically maintained closed against its bias to the open position and against the effect of the series winding tending to open the switch. However, when the magnetic pull of the flux set up by the series winding predominates over the magnetic pull set up by the shunt winding, the switch will be opened, thereby protecting the controlled circuit from abnormal current conditions. The arrangement is preferably such that the direction of the flux set up by the shunt winding and the direction of the flux set up by the series winding through the common part of the multiple connected paths is in the same direction, so that when the armature 12 starts to move away from the closed position under the control of the series winding so as to thereby increase the air gap 17 and decrease the air gap 18, the flux of the holding winding 14 will diminish through the upper portion of the magnetic paths and will be shifted so as to pass through the lower portion of the magnetic paths and thus assist the series winding and the biasing spring 15 in opening the switch. This is an important feature of the invention, for the reason that the holding magnet serves to normally hold the switch member in the closed position as long as conditions in the controlled circuit are normal, but when the conditions in the controlled circuit become abnormal, the flux of the holding magnet is made effective to assist in the opening of the switch. Due to the inductive relation between the series winding 16 and the shunt winding 14, a very rapid shifting of the flux of the shunt winding is effected upon a rapid increase in the current through the series winding and a very quick interruption of the controlled circuit is thereby effected.

By reference to Fig. 2 it will be seen that the flux set up by the holding magnet through the upper portion of the magnetic circuit is materially less than the flux set up through the lower portion of the multiple connected magnetic paths. The flux is indicated by the dot and dash lines with the arrows indicating the direction of the fluxes, in a manner which will be well understood by those skilled in the art. It will be understood, of course, that after the switch contacts have opened and the controlled circuit has been interrupted, the spring 15 will be effective to complete the opening movement of the switch, since when the circuit is interrupted, the pull set up by the series winding will cease. It will also be noted that the flux lines as indicated in Fig. 2 are

not necessarily of the exact relative values as shown after the switch has opened, it being the intention of this figure to rather indicate the distribution of the fluxes while the switch is in the act of opening.

By reference to Fig. 3 it will be observed that my invention is applicable to an arrangement in which two switch members connected in series in the controlled circuit are controlled by a common electromagnetic device in accordance with the invention, as explained in connection with Figs. 1 and 2. By reference to Fig. 3, it will be seen that two pivotally mounted armatures 12^a and 12^b are provided and that these armatures, together with the magnetic pole pieces 19 and 20, form a magnetic structure which is essentially the same as the magnetic structure of the switch illustrated in Figs. 1 and 2. Each of the armatures 12^a and 12^b is biased to the open position by its respective spring as indicated, and the shunt winding 14^a is effective to hold the two armatures and their controlled switch members in their respective closed positions as long as the flux set up by this shunt winding through the upper portion of the multiple connected magnetic paths predominates over the flux set up by the series winding 16^a through the lower portion of the magnetic paths. The operation of this form of my invention is in principle the same as the operation of the arrangement shown in Figs. 1 and 2, and it is believed that from the previous description given, it will be understood by those skilled in the art that the switch members will be magnetically held in their closed positions until the flux set up by the series winding predominates so as to attract the lower portions of the armatures 12^a and 12^b toward each other so as to simultaneously interrupt the controlled circuit at both interrupting gaps. When the effect of the series winding predominates to open the switch, the flux of the shunt winding will be shifted so as to assist in opening the switch members in the same manner as explained in Figs. 1 and 2. When the switch is thus opened, the parts will be in their relative positions, as shown in Fig. 4, and it will be understood that the direction and magnitude of the flux lines indicated in this figure are to be taken as representing the conditions while the switch members are moving away from their respective closed positions toward their respective open positions.

It will be observed that my improved electro-magnetically controlled switch or circuit interrupter is arranged to be magnetically held closed and magnetically opened, and that there is no necessity for the use of triggers, latches and the like which are troublesome and likely to get out of repair, and which are also objectionable for the reason that delays in the opening of the con-

trolled circuit are introduced thereby. It will also be observed that the holding winding is in close inductive relation with the series winding in order to render the former effective to assist the series winding in the opening of the switch after the opening movement has begun, thereby effecting a very quick interruption of the controlled circuit upon a rapid increase in current through the series winding.

In accordance with the provisions of the patent statutes, I have described the principle of operation of my invention, together with the apparatus which I now consider to represent the best embodiment thereof, but I desire to have it understood that the apparatus shown is only illustrative and the invention may be carried out by other means.

What I claim as new and desire to secure by Letters Patent of the United States, is:—

1. A circuit interrupter comprising a switch member biased to the open position, an electromagnet having a centrally pivoted armature and a shunt winding acting on one end of the armature for holding the switch member in the closed position, and means responding to the current in the controlled circuit acting on the other end of the armature for shifting the magnetic flux of the shunt winding to the said other end of the armature, to permit the switch member to open the controlled circuit.

2. A circuit interrupter comprising two switch members arranged to be connected in series in an electric circuit to be controlled, an electromagnet having a separate pivotally mounted armature connected to each of said switch members and a shunt winding for holding the said switch members in their closed positions, and means responsive to the current in the controlled circuit for attracting the said armatures to open the controlled circuit.

3. A circuit interrupter comprising two switch members biased to their open positions and arranged to be connected in series in an electric circuit to be controlled, an electromagnet having a separate pivotally mounted armature connected to each of said switch members and a shunt winding for setting up a flux to hold the said switch members in their closed positions, and means responsive to the current in the controlled circuit for shifting the magnetic flux of the shunt winding to assist the bias of the said switch members to their open positions.

4. A circuit interrupter comprising a switch member, an electromagnet having a pivotally mounted armature and a shunt winding disposed on a part of the magnetic structure of the said electromagnet opposite the pivot of said armature and cooperating with one end of the armature for holding the said switch member in the closed position, and a series winding disposed with

respect to the said armature to produce a flux acting substantially entirely on the other end of the said armature for effecting the interruption of the controlled circuit in response to the current through the series winding.

5. A circuit interrupter comprising a switch member, an electromagnet having a centrally pivoted armature and a shunt winding disposed on a part of the magnetic structure of the said electromagnet opposite the pivot of said armature and co-operating with one end of the armature for holding the said switch member in the closed position, and a series winding acting upon the other end of said armature for shifting the magnetic flux of the said shunt winding to assist the flux of the series winding to effect the interruption of the controlled circuit in accordance with the current through the series winding.

6. A circuit interrupter comprising a switch member, an electromagnet having a magnetic structure with two multiple connected paths for the flux of the electromagnet and a shunt winding disposed on the common part of the said paths for setting up a magnetic flux through one of said paths for magnetically holding the said switch member in the closed position, and a series winding disposed in inductive relation with said shunt winding on the other of the said paths to set up a flux through the said common path in the same direction as the flux of the shunt winding for magnetically operating the switch member from the closed position toward the open position.

7. A circuit interrupter comprising a pivotally mounted switch member, and an electromagnet having a magnetic structure with two multiple connected paths for the flux of the electromagnet, the common part of the said paths disposed substantially opposite the pivotal mounting of the said switch member, a shunt winding disposed on the said common part of the said paths for setting up a magnetic flux through one of said paths on one side of the said pivotal mounting of the switch member for magnetically holding the switch member in the closed position, and a series winding for magnetically operating the switch member from the closed position toward the open position, the said series winding disposed in inductive relation with said shunt winding on the other of said paths so as to set up a flux therein which is in the same direction through the said common part of the paths as the flux of the said shunt winding.

8. A circuit interrupter comprising a switch member and an electromagnet having a centrally pivoted armature, a magnetic structure cooperating therewith to form multiple connected flux paths through opposite ends of said armature, a shunt winding

disposed on the common part of said paths
for setting up a magnetic flux through one
of said paths for magnetically holding the
said switch member in the closed position,
5 and a series winding disposed in inductive
relation with said shunt winding on the
other of said paths to set up a flux in the
same direction through the said common

part as the flux of the shunt winding for
magnetically operating the switch member 10
from the closed position toward the open
position.

In witness whereof, I have hereunto set
my hand this 24th day of April, 1923.

ALBERT BESCHNITT.