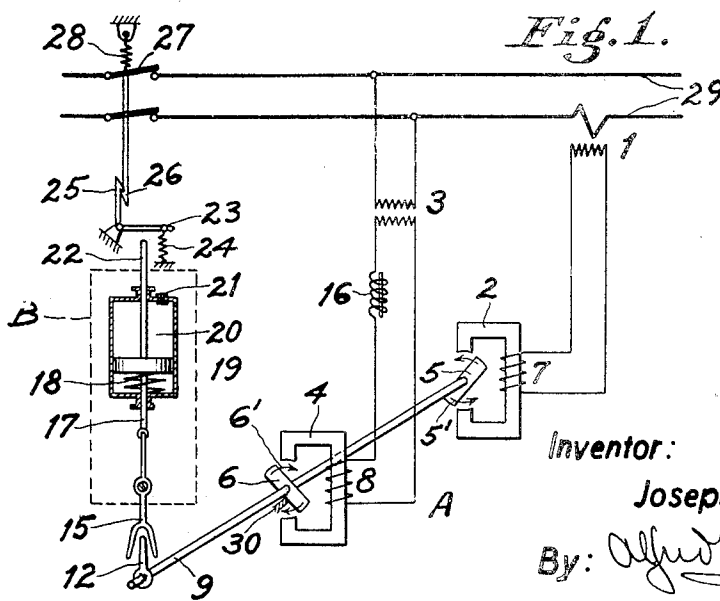
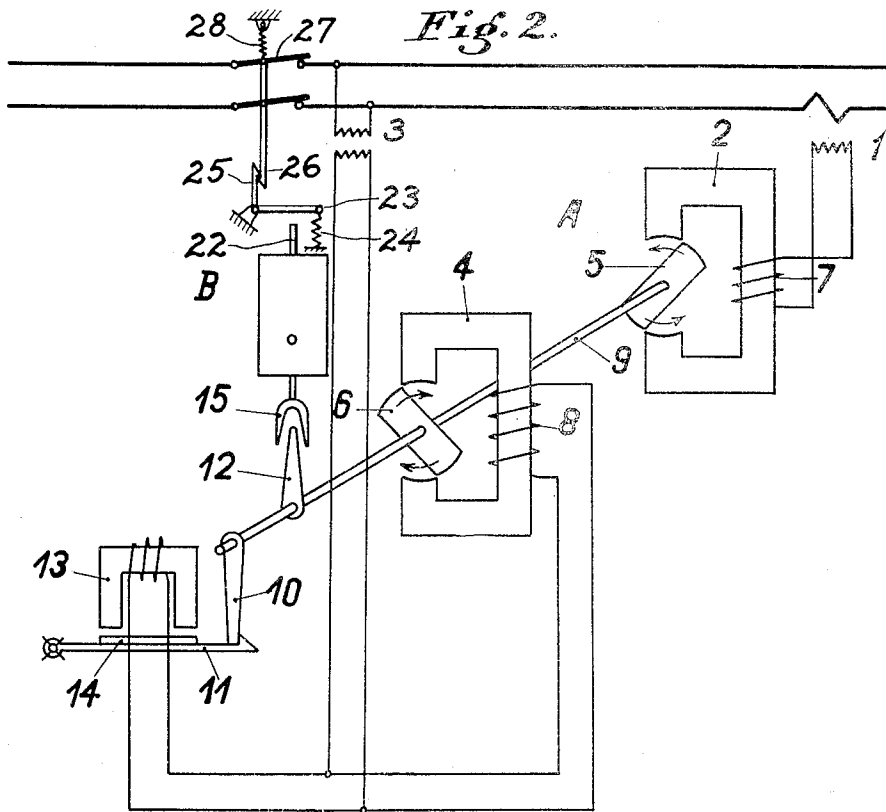


Sept. 5, 1933.

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SELECTIVE RELAY FOR ALTERNATING CURRENT NETWORKS
WHICH IS DEPENDENT ON RESISTANCE
Filed Aug. 13, 1928

1,925,469



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UNITED STATES PATENT OFFICE

1,925,469

SELECTIVE RELAY FOR ALTERNATING
CURRENT NETWORKS WHICH IS DE-
PENDENT ON RESISTANCE

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Application August 13, 1928, Serial No. 299,192,
and in Germany August 15, 1927

6 Claims. (Cl. 175—294)

Selective relays which are dependent on re-
sistance are known, in which the time element
which is dependent on resistance undertakes the
function of differentiating as regards the direc-
tion of energy and the operation of which is re-
leased by a separate responsive member which
is dependent on the impedance between the re-
lay and the point where the short circuit occurs.
In a three-phase network such relays may be
connected up in all three phases and the voltage
coil of each relay be connected to the line volt-
age.

Should a three-phase short circuit occur suf-
ficiently close to the point where the relays are
connected up, the impedance will drop below a
certain extreme value and the responsive mem-
bers dependent on the impedance will release all
three relays.

Should there be a short circuit, on the other
hand, between two phases, the short circuit cur-
rent will flow in two phases only, while only
one voltage, that between the two phases af-
fected by the short circuit will form a measure of
the distance of the point of disturbance. Hence
only one of the three relays, namely that with
short circuit current and collapsed voltage will
work correctly. The second relay, it is true, re-
ceives the short circuit current, but it receives a
line voltage which is only slightly influenced by
the disturbance, while the third relay carries no
short circuit current at all and has a high voltage
and will therefore not be responsive.

The response of the second relay carrying a
short circuit current and a relatively high volt-
age is uncertain and depends on the kind of
short circuit or on the magnitude of the cur-
rent and on the selected responsive impedance
of the relay. It would not be necessary to take
into account the responsiveness of the second re-
lay, if it were possible to arrange the relay in
such a manner that its time of operation would
be greater than that of the first relay. Since
the voltage of this second relay in all circum-
stances is greater than that of the first relay, it
would be possible, by suitably selecting the phase
position between the current and the voltage
system of the second system which regulates the
period of operation and is dependent on resist-
ance, to delay the operation of the second relay.
This method cannot in most cases, however, be
adopted, as the phase position referred to is al-
ready determined by the desired character of
the member which is dependent on resistance,
that is to say, by its being constructed in the form
of a pure ohmmeter or of a reactance meter.

According to the invention the uncertainty in
the behaviour of the second relay may be over-
come by preventing the responsive member, which
is dependent on the impedance, from responding
when the voltage which is connected to the relay
exceeds a certain amount.

This locking may for instance be effected by
the responsive impedance of the responsive mem-
ber being reduced to such an extent for instance
by interposing a saturated iron choke in its volt-
age circuit that upon a certain voltage being ex-
ceeded (of for instance 50% of the normal net-
work voltage), the response above this limiting
voltage is prevented. It is also possible to ob-
tain the desired effect by mechanically locking
the responsive member which is dependent on
the impedance above the limiting voltage by
means of a voltage magnet.

Figure 1 shows diagrammatically one embodi-
ment of the invention, and Fig. 2 a modification
thereof.

In Fig. 1, A is the impedance dependent mem-
ber comprising a magnet 2 which is fed by the
current transformer 1, and a magnet 4 which is
fed by the voltage transformer 3. The armatures
5 and 6 of these magnets are fixed to the axis
9 at different angles respectively, and when the
current increases in the exciting winding 7 or
the voltage decreases in the exciting winding 8,
they try to turn in the direction of the arrow 5'
shown on armature 5. In normal operation, with
no short-circuit between phases, the circuits of
the impedance responsive device are so arranged
that the action of magnet 8 is stronger than that
of magnet 7 and shaft 9, therefore, tends to ro-
tate in the direction of the arrow 6' of armature
6. Rotation of the shaft in the latter direction
beyond the desired point is prevented as by arma-
ture 6 striking a stop 30. Upon occurrence of a
short-circuit between two phases, the relay cor-
responding to that one of the phases in which
the short-circuit current flows but in which the
line voltage is only slightly reduced by the short-
circuit, remains as in normal operation, that is,
with armature 6 against stop 30, since rotation
in the direction of arrow 5' is prevented by the
action of the saturated iron reactance 16 which
is in series in the excitation circuit of voltage
coil 8. Only if the network voltage applied to
transformer 3 drops to substantially a given value
lower than the normal operating value will the
action of reactance 16 cease to prevent shaft 9
from rotating in the direction of arrow 5'. If
such a drop of the network voltage occurs, then
the current in the circuit including winding 8

and reactance 16, is reduced to a value such that the action of magnet 7 is stronger than that of magnet 8. The shaft 9, therefore, turns in the direction of the arrow 5'. Lever 12, attached to shaft 9, then contacts with the fork 15 of the time device B, whereby the piston rod 17 is released. The spring 18 presses the piston 19 upwardly and the damping air escapes through the valve opening 21. After a certain time the thrust arm 22 presses against the bell-crank lever 23 under the action of the force of the spring 24. The latch 25 then releases the opposing latch 26 whereby the network switch 27 is opened by the spring 28 and the damaged network portion 29 is disconnected.

In Fig. 2, impedance dependent member A comprises, as in Fig. 1, magnet 2 fed by current transformer 1 and magnet 4 fed by voltage transformer 3 and mounted on a shaft 9 under different angles respectively, said magnets trying to turn in the direction of arrow 5' when the current increases in exciting winding 7 or decreases in exciting winding 8. Under normal circumstances the axis 9 is prevented from turning by the latch 11 against which pushes the lever 10 fixed to the axis 9. As soon as the voltage decreases to such an extent that the electro-magnet 13 releases its armature 14 and therewith the latch 11, the axis 9 is free to turn. Thus it operates the time element B by means of the lever 12 and the fork 15, which time element after its expiration disconnects the endangered net part in the same manner as described in connection with Fig. 1.

What I claim is:

1. In a protective system for an A. C. network comprising a time delay device, an impedance-responsive element comprising a voltage coil, the said element being operative responsive to impedance of the said network below a predetermined value to initiate operation of the said device, and means comprising a reactance connected in series with the said coil and having an iron core which is saturated at a voltage above a predetermined fraction of the normal operating value of the said network voltage to prevent operation of the said element when the said network voltage exceeds a predetermined fraction of its normal operating value, the said element being responsive to a value of impedance which value diminishes in proportion as the said network voltage exceeds a predetermined fraction of its normal operating value.

2. In a protective system for alternating current circuits, an alternating current line divided into sections, a switch operative to establish and interrupt connections of sections of said line, a time delay device operative to actuate said switch, an element responsive to the impedance of said line only when reduced to a predetermined fraction of its normal value for initiating operation of said device, the said element comprising a coil energized responsive to and in dependence upon the value of current flowing in said line, and a coil energized responsive to and in dependence upon the value of the potential of said line, and a reactance coil connected in series circuit with the second said coil operative to limit the extent of energization thereof to thereby prevent operation of said element when the potential of said line exceeds a predetermined fraction of its normal operating value.

3. In a protective system for alternating current circuits, an alternating current line divided into sections, a switch operative to establish and interrupt connections of sections of said line, a

time delay device operative to actuate said switch, an element operative responsive to and in dependence upon the impedance of said line only when reduced to a predetermined fraction of its normal value for initiating actuation of said device, the said element comprising a coil energized responsive to and in dependence upon the value of current flowing in said line, and a coil energized responsive to and in dependence upon the value of the potential of said line, and a reactance coil connected in series circuit with the second said coil operative to control the extent of energization thereof to thereby permit operation of said element when the potential of said line is reduced to a predetermined fraction of its normal value, the said device being operative to effect actuation of the said switch in a predetermined time independently of the value of the impedance of said line.

4. In a protective system, in combination with an alternating current circuit, and apparatus to be operated in dependence upon impedance conditions of said circuit, of an element operable only in response to a reduction in the impedance of said circuit below a predetermined value, electromagnetic means responsive to the potential of said circuit operable to permit operation of said element only upon reduction of the potential of said circuit to a predetermined fraction of its normal operating value, a time-delay device operable to cause operation of said switch a predetermined time after initiation of operation of said device, and means actuated responsive to operation of said element for initiating operation of said device substantially simultaneously with said reduction of the impedance and said reduction of the potential of said circuit to thereby effect operation of said apparatus a predetermined time thereafter independently of subsequent variation of the impedance of said circuit and independently of subsequent variation of the potential thereof.

5. In a protective system, in combination with an alternating current circuit divided into sections, and a switch operable to establish and interrupt the connection of sections of said circuit, of an element operable only in response to a reduction in the impedance of said circuit below a predetermined value, means responsive to the potential of said circuit operable to permit operation of said element only upon reduction of the potential of said circuit to a predetermined fraction of its normal operating value, a time-delay device operable to cause operation of said switch a predetermined time after initiation of operation of said device, and means actuated responsive to operation of said element for initiating operation of said device substantially simultaneously with said reduction of the impedance and said reduction of the potential of said circuit to thereby effect operation of said switch to interrupt connection of said sections of said circuit a predetermined time thereafter independently of subsequent variation of the impedance and potential of said circuit.

6. In a protective system, in combination with an alternating current circuit divided into sections, and a switch operable to establish and interrupt the connection of sections of said circuit, of an element operable only in response to a reduction in the impedance of said circuit below a predetermined value, an electromagnet responsive to the potential of said circuit operable to permit operation of said element only upon reduction of the potential of said circuit to a pre-

determined fraction of its normal operating value, a time-delay device operable to cause operation of said switch a predetermined time after initiation of operation of said device, and means 5 actuated responsive to operation of said element for initiating operation of said device substantially simultaneously with said reduction of the impedance and said reduction of the potential of said circuit to thereby effect operation of said switch to interrupt connection of said sections of said circuit a predetermined time thereafter independently of subsequent variation of the impedance and potential of said circuit. 80

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