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SUPERVISORY DEVICE BOTH FOR COMPARATIVELY SMALL AND COMPARATIVELY LARGE VOLTAGE VARIATIONS

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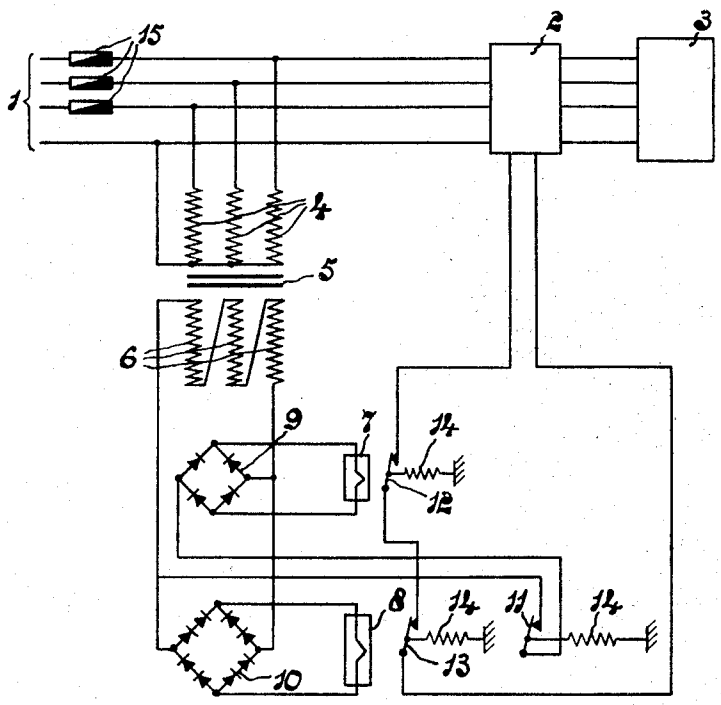


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## SUPERVISORY DEVICE BOTH FOR COMPARATIVELY SMALL AND COMPARATIVELY LARGE VOLTAGE VARIATIONS

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4 Claims. (Cl. 175—294)

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This invention relates to devices which will disconnect an electrical load from its source of voltage upon excessive voltage variation of said source. Such a load may, for example, be a voltage stabilizer which will maintain a substantially constant output voltage for voltage variations in the voltage source which do not exceed ±10%. If, however, these voltage variations exceed ±10%, the stabilizer is often unable to compensate for this increased variation, so that the stabilizer output voltage will vary. In such case the stabilizer should be disconnected, as soon as the voltage variations of the voltage source exceed ±10%.

Conventional magnetic switches cannot be used as such a disconnecting device because they can only be operated on much smaller voltage variations. It is possible to use an electro-magnetic relay which will respond to variations of more than ±10%. However, should these variations greatly exceed ±10%, say ±60%, the energizing coil of the relay must be sensitive enough to respond to small variations, and yet must be able to withstand large variations. Sensitivity to small variations requires coils of low voltage and current handling capacity; ability to withstand large variations requires coils of high voltage and current handling capacity. These two requirements are mutually incompatible for one relay.

This invention meets both of the requirements described above by using at least two electromagnetic relays, whose energizing windings are connected in parallel with each other and which are adapted to be connected between a voltage source and an electrical load. One of these relays, the first relay, responds to a small variation of the voltage source, the other relay, the second relay, responds to a large variation of the voltage source. In the last-mentioned case, the first relay is de-energized with the use of contacts connected in series with the first relay and associated with the second relay.

The first relay will withstand a maximum voltage which is at most 5 times the value of the minimum voltage to which this relay will respond, a preferred ratio for this maximum-minimum voltage relationship being 6. The second relay will withstand a maximum voltage which is also 6 times the value of the minimum voltage to which this relay will respond. The minimum voltage of the second relay has 6 times the value of the minimum voltage of the first relay. Thus the relay system will withstand a maximum voltage of 6×6 or 36 times the value of the minimum voltage that will operate the first relay. Relays

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with larger maximum-minimum voltage ratios may be used so that a greater maximum voltage can be withstood. When a voltage which will energize the second relay is supplied to the paralleled energizing windings, both relays are energized, but energizing the second relay de-energizes the first relay as described above. Thus the first relay winding is protected from large voltages.

According to another feature of the invention the parallel-connected relay windings, when used in conjunction with a three phase voltage source, are connected in series with the secondary windings of three single-phase transformers, the primary windings of which are adapted to be connected in star-connection to the three phase voltage source.

In order that the invention may be more clearly understood and readily carried into effect, it will now be described more fully with reference to the accompanying diagrammatic drawing, given by way of example.

A control apparatus 2 which is used to connect and disconnect a load 3 is connected to a four wire, three-phase network 1. To the mains 1 are at the same time connected the star-connected primary windings 4 of three- single-phase transformers 5, the secondary windings 6 being arranged in series with two parallel-connected relays 7 and 8. For a smoother operation of these relays two Grätz-connected rectifiers 9 and 10 are used. The first relay 7 is so proportioned as to respond, for example, to a voltage variation exceeding +10% or −10% of one of the phases, whereas the relay 8 becomes energized only at a voltage 6 times as high. A contact 11 of relay 8 is connected in series with the relay 7. Furthermore a contact 13 of relay 8 is connected in series with a contact 12 of relay 7. The contacts are kept normally closed by means of a spring 14 or the like. The two-series-connected contacts 12 and 13 are connected to the control apparatus 2.

Since the secondary windings 6 are delta-connected, the resulting secondary voltage at symmetrical phase voltages will be equal to zero. Upon a variation in any of the phase voltages the equilibrium is broken, however, and a certain difference voltage will be set up across the relays.

If the load 3 is to be disconnected upon a supply voltage variation exceeding 10% in any of the phases, this is effected by energizing the relay 7 with the result that the contact 12 is opened and the load 3 is disconnected by the control

apparatus 2. It may happen, however, that a 30-fold voltage is set up across the relay 7, for example, if two of the three main fuses 15 are defective and the two disconnected phases are fed by return voltage from the remaining phase by way of engaged electrical apparatus. In this event the three transformers constituted by a primary winding 4 and a secondary 6, carry primarily the same voltage so that they are connected in parallel, whereas the three secondary windings 6 are connected in series, hence the resulting secondary voltage becomes three times as high as the voltage of a single winding, or 30 times as high as the voltage variation of 10% to which the relay 7 will respond. When this occurs the relay 8 is energized, since its minimum energizing voltage is only 6 times as large as the minimum energizing voltage of relay 7. When relay 8 is energized, contact 11 is opened so that relay 7 is de-energized and thus cannot be damaged. At the same time contact 13 is opened, since the contact 12 is closed automatically when relay 7 is de-energized, so that the control apparatus 2 disconnects the load 3.

What I claim is:

1. Apparatus for disconnecting an electrical load from a voltage source subject to voltage variation when the voltage of said source varies beyond a predetermined amount comprising a first electromagnetic relay including an energizing winding and contacts actuated thereby, a second electromagnetic relay including an energizing winding and contacts actuated thereby, means for coupling the energizing windings of both relays in parallel relation to said voltage source, the energizing winding of said first relay having a predetermined sensitivity at which this winding is energized upon occurrence of a relatively small variation in source voltage, the energizing winding of said second relay having a predetermined sensitivity at which this winding is energized upon occurrence of a relatively large variation in source voltage, means interposing contacts of said second relay between the energizing winding of said first relay and said source to effect de-energization of said first relay upon energization of said second relay, means including contacts of both relays for disconnecting said load from said source under given energization conditions of said two relays.

2. Apparatus, as set forth in claim 1, wherein the voltage variation required to energize the second relay is at most eight times as large as the voltage required to energize the first relay.

3. Apparatus for disconnecting an electrical load from a voltage source subject to voltage variation when the voltage of said source varies beyond a predetermined amount comprising a first electromagnetic relay including an energizing winding and contacts actuated thereby, a second electromagnetic relay including an energizing winding and contacts actuated thereby, means for coupling the energizing windings of both relays in parallel relation to said voltage source, the energizing winding of said first relay having a predetermined sensitivity at which this winding is energized upon occurrence of a relatively small variation in source voltage, the energizing winding of said second relay having a predetermined sensitivity at which this winding is energized upon occurrence of a relatively large variation in source voltage, means interposing contacts of said second relay between the energizing windings of both relays in parallel relation to said voltage source, the energizing winding of said first relay having a predetermined sensitivity at which this winding is energized upon occurrence of a relatively small variation in source voltage, the energizing winding of said second relay having a predetermined sensitivity at which this winding is energized upon occurrence of a relatively large variation in source voltage, means interposing contacts of said second relay between the energizing windings of said first relay and said source to effect de-energization of said first relay upon energization of said second relay, means including contacts of both relays for disconnecting said load from said source in a first condition wherein said first relay is energized and said second relay is de-energized and in a second condition wherein said second relay is energized and said first relay, after being momentarily energized, is de-energized.

4. Apparatus for disconnecting an electrical load from a three phase voltage source subject to voltage variation when the voltage of said source varies beyond a predetermined amount comprising a first electromagnetic relay including an energizing winding and contacts actuated thereby, a second electromagnetic relay including an energizing winding and contacts actuated thereby, three single phase transformers whose primary windings are adapted to be star connected to the three phase voltage source and whose secondary windings are connected in series, means for coupling the energizing windings of both relays in parallel relation to the serially-connected secondary windings, the energizing winding of said first relay having a predetermined sensitivity at which this winding is energized upon occurrence of a relatively small variation in source voltage, the energizing winding of said second relay having a predetermined sensitivity at which this winding is energized upon occurrence of a relatively large variation in source voltage, means interposing contacts of said second relay between the energizing windings of said first relay and said source to effect de-energization of said first relay upon energization of said second relay, means including contacts of both relays for disconnecting said load from said source under given energization conditions of said relays.

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## REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS


| Number | Name | Date |
|---|---|---|
| 1,798,687 | Lanasmann | Mar. 31, 1931 |
| 2,462,212 | Mosley | Feb. 22, 1949 |
| 2,520,792 | Yarrick et al. | Aug. 29, 1950 |