

April 21, 1925.

1,534,945

F. B. L. HAIN

ELECTRIC RELAY

Filed Aug. 9, 1922

2 Sheets-Sheet 1

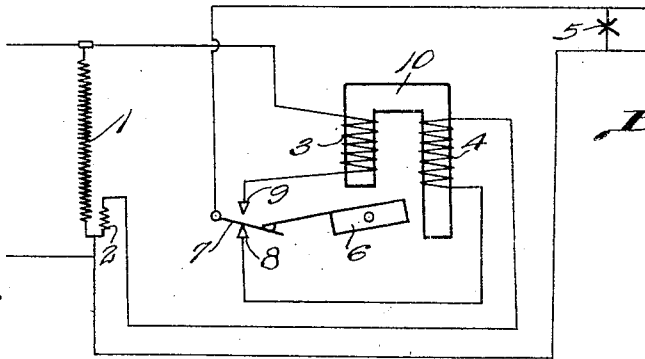


Fig. 1.

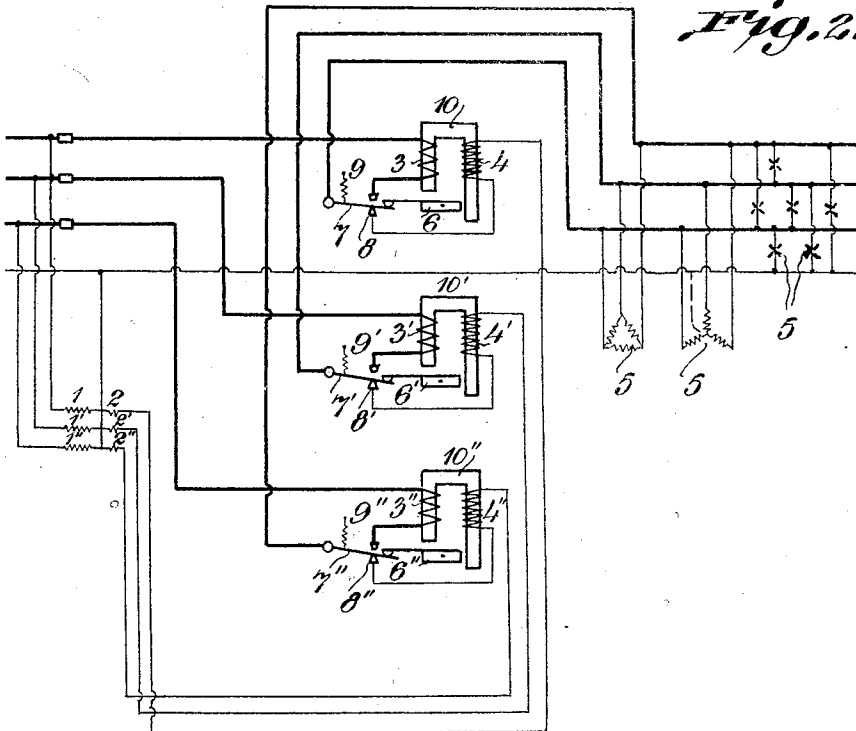


Fig. 2.

Inventor:
F. B. L. Hain,

Langue, Parry, Card & Langue

Att'ys.

April 21, 1925.

1,534,945

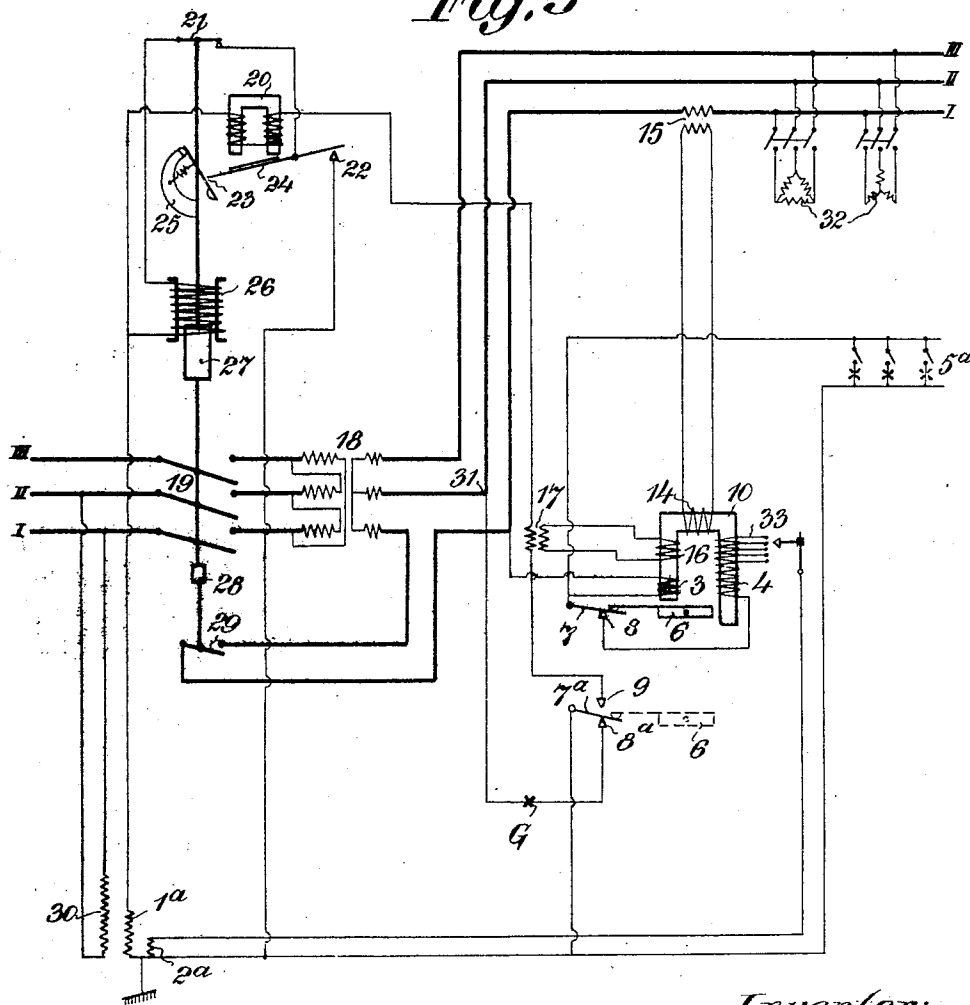
F. B. L. HAIN

ELECTRIC RELAY

Filed Aug. 9, 1922

2 Sheets-Sheet 2

Fig. 3



Inventor:

F.B.L. Hain,

Langner, Parry, Card & Langner

Att'ys.

UNITED STATES PATENT OFFICE.

FOLKE BROR LORENS HAIN, OF MALMO, SWEDEN.

ELECTRIC RELAY.

Application filed August 9, 1922. Serial No. 580,792.

To all whom it may concern:

Be it known that I, FOLKE BROR LORENS HAIN, a citizen of Sweden, residing at Malmo, in the county of Malmohus, Sweden, have invented certain new and useful Improvements in Electric Relays; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention relates to a system for electric circuit control which may be used for a plurality of different purposes. One object of the invention is to cut out the main line automatically from a network when the load is cut off or lowered under a certain, predetermined value and to cut in the main line automatically when the load is switched on or raised above the said certain value. Another object of the invention is to prevent no-load losses in transformers by automatically disconnecting the same from the main line, when no load is required.

The essential feature of the invention is a certain relay construction, and all the various objects are achieved by one and the same type of relay, though in different combinations and employing different diagrams of connections.

The invention is illustrated in the accompanying drawings.

Fig. 1 shows the invention used in connection with a two-wire or one-phase installation.

Fig. 2 shows the invention used in connection with a three-wire or three-phase installation.

Fig. 3 shows the invention used in connection with a three-phase installation and the object of the invention is to cut out a three-phase transformer automatically from the main lines, when no current is used in the installation.

Referring to Fig. 1 the main line is represented by the secondary 1 of a transformer, and the source of the auxiliary current is represented by another secondary winding 2 supplying a low voltage current, but it is to be understood that the invention is also adaptable for direct current, in which case 1 represents the voltage across the two main lines and 2 the voltage of a low voltage battery. The iron core of the relay is indicated by 10 and its oscillatory armature by 6. The

one leg of the iron core carries a winding 3 adapted to carry the load current of the installation and the other leg carries another winding 4 adapted to carry the auxiliary current. 5 indicates the load and 7, 8, 9 show a contact making and breaking device cooperating with the armature 6. When all the load 5 is cut out by means of the switch 35, the relay will be demagnetised and the armature 6 rests by its own weight on the switch lever 7 keeping the same in contact with the contact point 8. When magnetising the relay the armature 6 is attracted and the lever 7 is lifted by means of the spring 36 and rests on the contact point 9.

Fig. 1 shows the arrangement at the moment when there is no load on the network and thus the switch lever is in engagement with the contact point 8. If an apparatus 5 consuming current is put in circuit, a current passes from the auxiliary source 2 through the relay winding 4, contact point 8, switch lever 7, the apparatus 5 and back to the auxiliary source. The armature 6 is thus attracted and the switch lever 7 is disconnected from the contact point 8 and connected with the contact point 9. At this moment the full working voltage is applied to the load 5 and current passes from the main line or secondary 1 of the transformer through the relay winding 3, the contact point 9, the switch lever 7, the load and back to the main line. As soon as the load ceases the relay is demagnetised and the armature returns to its initial position shown in the drawing.

It is obvious that instead of the whole load current a part of the same only may be made to pass through the relay winding 3 for instance by shunting the main current or by using a current transformer.

In Fig. 2 a three-wire or three-phase installation is shown with load between the different leads or phases as well as between one lead or phase and earth, and in the example shown a three-phase tension transformer 2, 2', 2'' with earthed neutral wire is used, serving as source of the auxiliary current for the circuit control. In this case three relays must be used. The cores of these relays are denominated 10, 10', 10'' the load current carrying windings 3, 3', 3'' the auxiliary current carrying windings 4, 4', 4'', the armatures 6, 6', 6'' and the contact making and breaking devices 7, 8, 9, 7', 110

8', 9', 7'', 8'', 9''. The armatures 6, 6', 6'' may be mounted on a common shaft either securely fixed to the same or loosely mounted. If the armatures are securely fixed to the common shaft all the phases will be cut in simultaneously irrespective of one or more phases being loaded, and if they are made to oscillate independently of each other the phase or the phases only that are loaded will be switched on.

The invention may also be adapted for cutting out and cutting in transformers, in which case the relay above described is used for controlling a separate, electrically operated switch. A device of this type used in connection with a three phase installation is shown in Fig. 3 and described in the following.

Motors 32 and lamps 5^a are connected to the network and the lamps are connected between one of the phases and earth. The source of the auxiliary current consists in this case of the secondary winding 1^a of a voltage transformer 30 from which winding and from a separate coil 2^a suitable voltage is obtained. The operating current necessary for the transformer switch 19 is obtained from the secondary winding 1^a. In one phase of the motor mains I, II, III, that is the phase in which the lamps are connected up, a current transformer 15 is interposed, the secondary winding of which is connected with the winding 14 of the relay 10, which latter in addition carries the windings 3', 4 and 16. Through the winding 4, the contact point 8 and the switch lever 7 the unloaded network is connected with the auxiliary current voltage (the coil 2^a). The coil 3 is in series with the circuit of the lamps 5 and the coil 16 is connected with one winding of a transformer 17, the other winding of which is in series with a voltage relay 20 for operating the transformer switch 19. The armature 6 rests by its own weight on two switch levers 7 and 7^a when the network is unloaded. These levers are for the sake of clearness shown underneath each other, though it is obvious that they in reality ought to be placed alongside of each other in the direction of the axis of oscillation of the armature 6. When the armature 6 is not attracted by the relay the switch lever 7 is kept in contact with the contact point 8 and the switch lever 7^a with the contact point 8^a, which by means of a wire carrying a lamp G is connected at 31 with one of the phases that are not connected with any of the windings on the relay 10. 18 indicates the transformer which is to be cut in or cut out by means of the switch 19, and 29 indicates a switch mechanically connected with the switch 19 for the secondary phase with which the lamp load 5 is connected. 28 indicates an insulating connecting mem-

ber between the switches 19 and 29, and 26 represents a lifting magnet with its iron core 27. 23, 25 is a pawl, 20 a voltage relay and 24 its armature, 22 is a switch contact and 21 a limit switch.

The operation of the arrangement is as follows:

If an incandescent lamp 5^a is switched on the relay 10 will be magnetised by the winding 4. The armature 6 is lifted and the switch lever 7 breaks the auxiliary current voltage (the coil 2^a) from the network, simultaneously the switch lever 7^a cuts in the secondary voltage (the coil 1^a) on the voltage relay 20. The armature 24 of the latter is lifted and closes at the contact 22 the circuit of the lifting magnet 26, in which circuit the switch 21 is interposed. When the magnet 26 is energized the armature 27 is raised and closes the switches 19 and 29. These switches are kept in closed position by the pawl 23 which is mechanically connected with said switches and after passing the armature 24 the pawl and thus said switches are prevented from returning, although the circuit of the lifting magnet simultaneously has been broken at 21. At the same moment as the switches 19 and 29 are closed the network is put under voltage and load current passes through the circuit of the lamp 5^a, whereby the winding 3 on the relay 10 the armature 6 is kept in attracted position. As long as the load remains on the network the armature 6 is kept in this position, and thus the network also is kept under working voltage and the switches 19, 29 are closed, but as soon as the load ceases the relay is demagnetised and the armature 6 falls down and breaks the circuit of the voltage relay 20 at 9. The armature 24 is then released and the switches 19 and 29 are opened by their own weight. The arrangement operates in the same way as described, if one of the motors 32 is started.

In order to obtain a closed auxiliary current circuit also in the case when the motors are delta-connected or if the neutral wire of a star-connected motor is not connected to earth, one of the other phases (phase II) of the secondary winding of the transformer 18 not connected with the relay 10 must be included in the auxiliary current circuit. This is attained by connecting a point 31 on the said secondary phase II with the contact point 8^a. The auxiliary current circuit being closed at the starting moment of the motor passes as follows: from the source of auxiliary current 2^a through the relay winding 4, the contact point 8, the switch lever 7, the winding 3 and the stator winding of the motor 32 to the phase II, the point 31 on the latter through the incandescent lamp G, the contact point 8^a, the switch lever 7^a and back to the source of current 2^a. The lamp

G is provided for preventing short-circuit in case the switches 19 and 29 should not break properly or rapidly enough. Thus it also ensures that the switch device operates in a proper way and in reality disconnects the transformer when all load ceases.

The winding 16 connected in series in the circuit of the voltage relay 20, either directly or through the current transformer 17, is not able alone to keep the armature in raised position. It has for its object to assist in connecting the device and at a sudden total disconnection of the load on the network to have a demagnetizing effect on the relay.

By making the number of turns in the windings 4 variable by means of a suitable device 33 the relay 10 can be made more or less sensible to the auxiliary current circuit.

What I claim is:—

1. A system for electric circuit control comprising a relay provided with two windings, a main circuit and an auxiliary circuit, contact making means adapted to interpose the said windings alternatively between one pole of the supply circuit to be controlled and the one pole of the main line and the one pole of the auxiliary circuit respectively, connections between the other pole of the main line and of the auxiliary circuit respectively and the other pole of the supply

circuit, and means for interrupting the said connections.

2. A system for electrical circuit control comprising a main circuit and an auxiliary circuit, two constant points, an oscillatory contact making member, an oscillatory armature, means to transfer the oscillating movements of the armature to the oscillatory contact making member, a magnet for actuating said armature, a winding on the one leg of the magnet interposed between the one contact point and the one pole of the main line, a winding on the other leg of the magnet interposed between the other contact point and the one pole of the auxiliary circuit, connections between the contact making member and the one pole of the supply circuit to be controlled, connections between the other poles of the main line and the auxiliary circuit, connections between the last named connections and the other pole of the supply circuit, and means for cutting out the load from the supply circuit.

In testimony whereof, I have signed my name to this specification in the presence of two subscribing witnesses.

FOLKE BROR LORENS HAIN.

Witnesses:

G. BRAUZELL,

PHILIP WILKENS.