

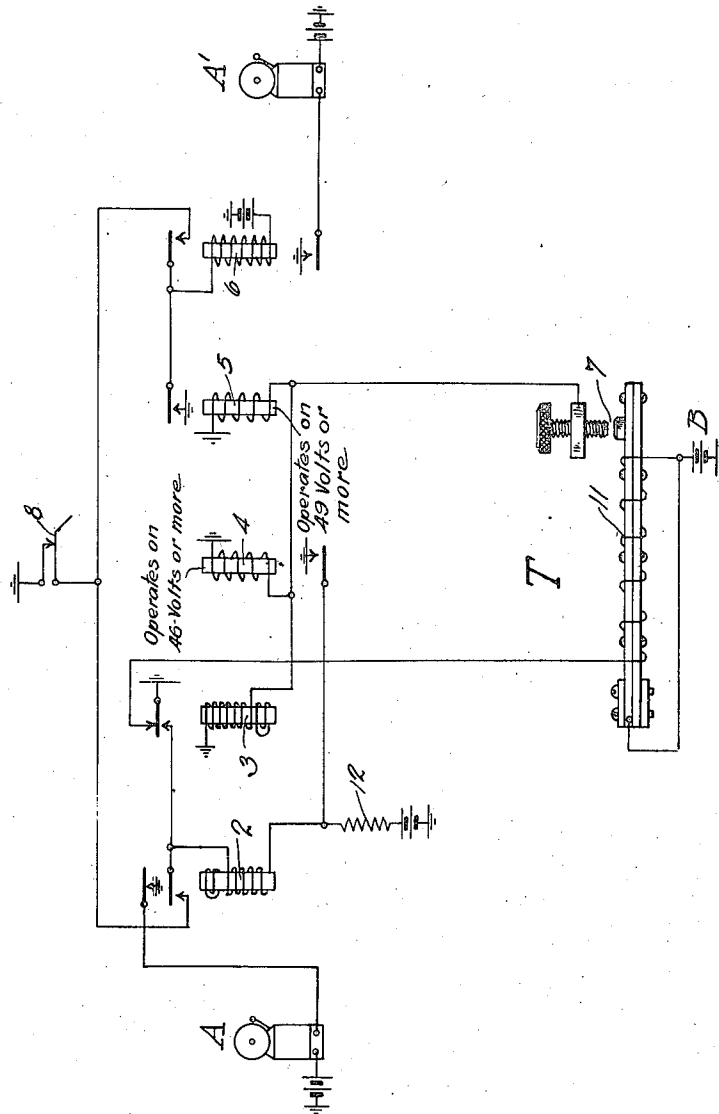
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HIGH AND LOW VOLTAGE ALARM EQUIPMENT

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—Inventor—

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HIGH AND LOW VOLTAGE ALARM EQUIPMENT.

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The present invention relates in general to high and low voltage alarm equipment, but is concerned more particularly with the provision of equipment for actuating an alarm when the voltage of a storage battery rises above or falls below certain predetermined values.

An object of the invention is to provide equipment for accomplishing the above which is of simple construction, and more positive in operation than was heretofore considered possible.

A further object is the provision of equipment which is well adapted for use in controlling automatic charging and voltage regulating systems.

A brief description of the nature of the equipment shown in the drawing will now be given, so that a better understanding may be had of the detailed description of operation which is to follow. Referring to the drawing, in which has been shown by means of conventional circuit diagrams one manner of carrying out the invention, alarm signals A and A' may be of any desired type, but as shown are ordinary vibrating bells. Relays 2, 3, and 6 are of well known type used in telephone systems. The relay 2 has a copper lug on the armature end to make the same slow to pull up, while the relay 3 has a copper lug on the heel end to make it slow to release. The thermostat T is of well known construction, and is adjusted to operate to close its contacts 7 once about every three to five seconds. Relays 5 and 4 are the high and low voltage testing relays. In order to insure permanence of adjustment relays of the gravity type should be used, as the relays of this type are not appreciably affected by changes in temperature. With respect to the windings of the testing relays, good results have been secured by winding to 315 ohms resistance with No. 26 Advance wire, although it is to be understood that the invention is not limited to the precise resistance or the particular type of wire mentioned.

A detailed description will now be given, and for this purpose it will be assumed that a 48 volt battery is used. It will further be assumed that an alarm is desired when the battery voltage falls to 46 volts, or rises to 49 volts. Under control of the thermostat, relays 4 and 5 test the battery voltage periodically as described below.

A circuit is originally closed for the heat-

ing element 11 of the thermostat T. In a few seconds the thermostat operates, and closes at its contacts 7 a multiple circuit for relays 3, 4, and 5. Relay 3 always operates in response to the closure of contacts 7, while relay 4 operates only if the battery voltage exceeds 46 volts, and relay 5 operates only when the battery voltage reaches 49 volts. Relay 4 in operating shunts battery from relay 2, while the operation of relay 3 causes ground to be removed from the heating element 11 of the thermostat T, the same ground being switched to the winding of relay 2. As previously stated, battery is shunted from relay 2 by the operation of relay 4, and therefore relay 2 cannot operate at this time. As soon as the thermostat cools sufficiently, the operating circuit for relays 3 and 4 is opened at contacts 7. The relay 4 falls back slightly before the relay 3, causing the shunt to be momentarily removed from relay 2, but relay 2 being slow to pull up is not actuated at this time. The relay 3, being sluggish in falling back, acts to slow up the operation of the thermostat T. As soon as the relay 3 falls back the operations above described are repeated.

It will now be assumed that the battery potential has fallen to 46 volts or lower. This time when the contacts 7 of the thermostat T close, relay 4 will not be operated. The relay 3 however, operates as before to remove ground from the thermostat T, and to apply the ground to the winding of relay 2, which latter relay will now operate. Relay 2 in operating, at its lower armature completes a locking circuit for itself, through the key 8 to ground, and at its upper armature applies ground to operate the alarm signal A. The operation of the alarm A informs the attendant that the battery voltage is low, whereupon the attendant stops the alarm by operating key 8, and then adjusts the voltage by cutting out counter cells, or by starting the charging equipment in any well known manner.

It will now be assumed that the battery potential has been increased to 49 volts. When this occurs, and the contacts 7 of the thermostat T are again closed, relays 3, 4, and 5 operate. The operation of relays 3 and 4 prevent the operation of the low voltage signal A, the same as if the battery voltage were at normal. The operation of relay 5, however, completes a circuit for relay 6, which locks up over a circuit similar to that of relay

2, and which at the same time completes an operating circuit for the high voltage alarm A'. The attendant upon hearing the alarm A' operates the key 8 to permit relay 6 to fall back, and proceeds to readjust the voltage by cutting in counter cells, or by stopping the charge in any well known manner.

On rare occasions it may occur that an excess amount of current is momentarily withdrawn from the battery, causing the potential to take a momentary drop to 46 volts. When this occurs it is not desired that the attendant be required to operate the key 8 to stop the alarm, nor is this necessary, for as soon as contacts 7 again close relay 4 will energize (the battery voltage having risen to normal), and will short circuit relay 2, causing the latter relay to restore.

Although the testing system herein described has been illustrated in simple form, as having the function of operating high and low voltage alarms, it will be understood that it is so shown merely for convenience, and that in practice it may be used in connection with any of the well known types of voltage regulating and automatic battery charging systems employing high and low voltage relays to control the cutting in and out of the counter cells and the starting and stopping of the charging apparatus.

From the foregoing it will be seen that I have devised a new and highly improved apparatus for closing an alarm or other circuit when the voltage of a storage battery or other source of potential falls below or rises above certain predetermined limits. The principle advantage I claim for the invention is due to the use of normally deenergized testing relays which are periodically connected across the battery instead of being permanently bridged, and which, referring particularly to the low voltage testing relay, energize rather than deenergize to indicate an abnormal voltage. Normally deenergized high voltage relays have been used before, but so far as I am aware low voltage relays have previously all been of the normally energized type required to fall back when the voltage falls below the limit. These relays are difficult to adjust and uncertain in operation, and the present invention, therefore, which uses a normally deenergized relay, constitutes a decided improvement. A further advantage which should be mentioned is more or less incidental to the scheme of momentary testing as distinguished from the permanent bridge arrangement. Since the testing relays are not permanently bridged across the battery they may be of relatively low resistance, and it is well known that low resistance relays are in general more accurate and positive in response than relays of relatively high resistance.

Having described the invention, what I consider to be new, and desire to have pro-

tected by Letters Patent will be pointed out in the appended claims.

What I claim is:

1. In combination, a source of current, current test and alarm equipment including a pair of alarm control relays and circuits therefor, operating means for completing an operating circuit for one of said alarm control relays, means operated by said alarm control relay for opening the circuit of said operating means and for closing a circuit for the other alarm control relay, and means operated when the potential of said current source is normal for preventing the operation of said other alarm control relay.

2. In combination, a source of current, current test and alarm equipment including a pair of alarm control relays and circuits therefor, operating means for completing an operating circuit for one of said alarm control relays, means controlled by said alarm control relay for opening the circuit of said operating means and for closing a circuit for the other alarm control relay, and a test relay connected in parallel with one of said alarm control relays for rendering the other alarm control relay inoperative.

3. The combination of voltage testing equipment with means for periodically connecting the equipment across a source of current, means operated by said testing equipment for controlling said connecting means, and means controlled by said connecting means to in turn control the connection of the testing means to said source.

4. In an alarm signal device, a battery normally of one potential, but subject to variation above and below said normal potential, a battery testing relay, another relay, an alarm relay, an alarm signal, switching means for including said battery relay and said other relay in the circuit of said battery, means operated by said other relay to render said switching means ineffective and to close a circuit for said alarm relay, means operable by said alarm relay to close a circuit for said alarm signal, and means controlled by said battery relay for preventing the operation of said alarm relay.

5. In a voltage testing and signalling device, a storage battery normally of one potential, a test relay connected to said battery in a series of successive tests, an alarm relay, means for operating said alarm relay on a test when the potential of the battery is below normal, means operated by said alarm relay to close a locking circuit for itself, and means controlled by said test relay on a subsequent test for automatically deenergizing and unlocking said alarm relay, should the potential of the battery have returned to normal.

In witness whereof, I hereunto subscribe my name this 29th day of June, A. D., 1922.

CLARENCE E. LOMAX.