Aug. 22, 1950 L. HEIDMANN 2,519,467

SIGNALING AND ELIMINATION OF DEFECTIVE CIRCUITS

Filed July 21, 1947

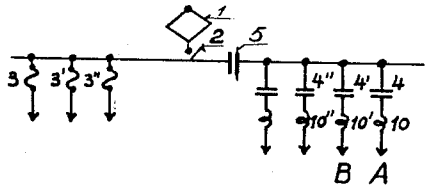

Fig.1

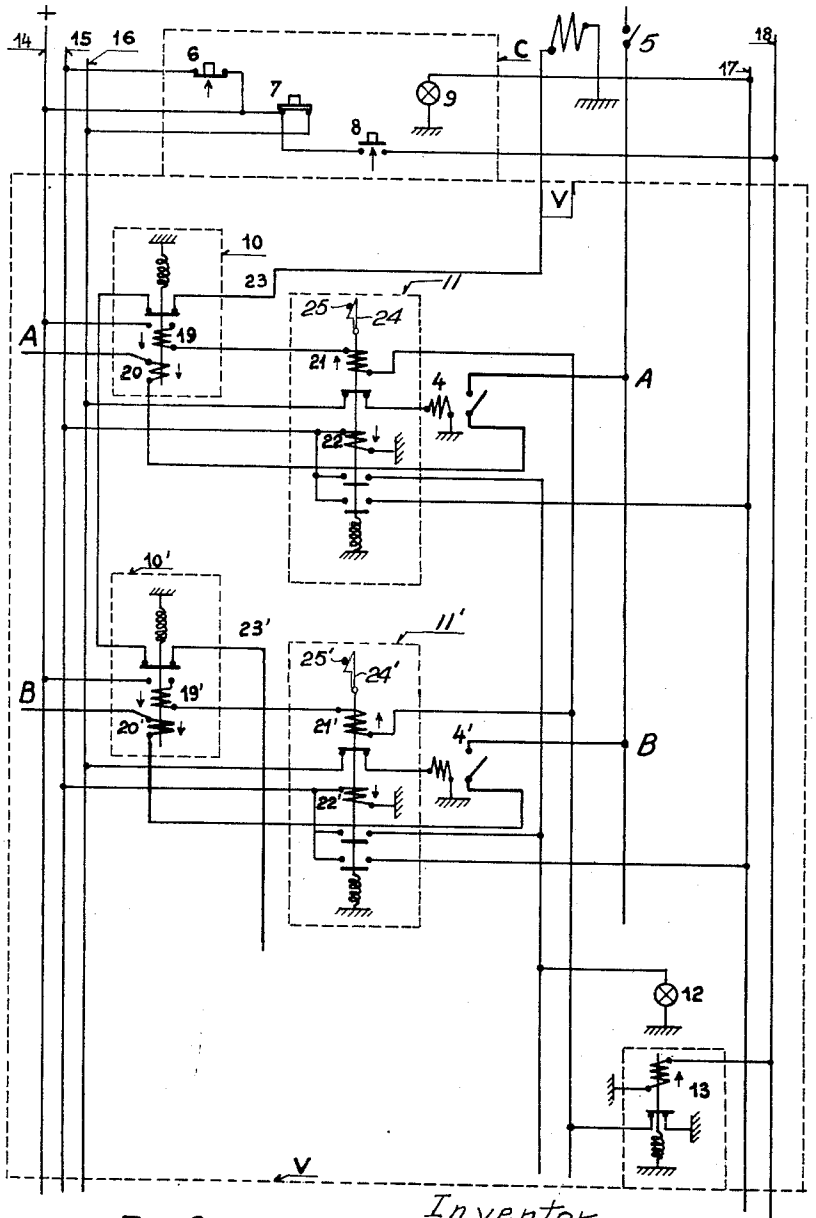

Fig.2

Inventor
L. Heidmann
By E. F. Wenderoth
Attorney

Patented Aug. 22, 1950

2,519,467

UNITED STATES PATENT OFFICE

2,519,467

SIGNALING AND ELIMINATION OF DEFECTIVE CIRCUITS

Leon Heidmann, Jeumont, France, assignor to Societe Anonyme dite: Forges et Ateliers de Constructions Electriques de Jeumont, Paris, France, a corporation of France

Application July 21, 1947, Serial No. 762,432
In France November 13, 1945

Section 1, Public Law 690, August 8, 1946
Patent expires November 13, 1965

7 Claims. (Cl. 177—311)

1

This invention relates to a system for signalling and eliminating defective circuits.

In complex electrical equipment comprising a plurality of main circuits and more particularly a plurality of motors, as in certain hoists or in multiple unit traction systems, it is desirable to quickly localize and to easily eliminate defective circuits in order to reduce to a minimum the losses in time and the interruptions to service. The corresponding operations have to be extremely simple and rapid, enabling the operator to restore rapidly all the non-defective circuits and to continue his work without leaving his place; the devices provided for signalling and localizing the defects as well as for putting the defective circuits out of service have to be rugged, small and easily accessible; they also have to require slight maintenance and present at the same time the maximum of security.

The numerous arrangements which have been proposed for this purpose being in a general way incapable of securing simultaneously all of those conditions, the present invention has for an object to solve the problem by a reduced number of simple and reliable relays controlled by push buttons and associated with indicating elements such as signalling lamps and mechanical signals.

According to the invention each circuit provided with signalling and eliminating means comprises a normally closed protective relay, arranged to be held in its open position, and a special signalling relay, arranged for remaining inoperative in case of the action of the said protective relay as long as the operator has not pressed upon a special button, which interrupts a locking current immobilizing the armature of the signalling relay; the latter being thus unlocked opens definitely the defective circuit, makes a visual signal appear to identify the defective circuit, closes appropriate signalling circuits and remains mechanically locked in its new position.

A further object of the invention is to group all the control elements of the system at a control post which may comprise the above mentioned locking button, a control button, provided for controlling the protected circuits, a resetting button designed to reclose the general circuit breaker of the installation and a signalling device.

2

The other characteristics, objects and advantages of the invention will be more fully understood with relation to the description of the particular example of the application of the means.

Referring to the drawings:

Fig. 1 is a diagrammatical showing of a type of installation to which the invention is applied, and

Fig. 2 is a diagrammatical showing of the invention.

The invention is shown as applied for instance to a plurality of multiple units such as self-propelled electric vehicles of which each comprises according to Fig. 1 of the annexed drawing, a pantograph 1, an insulating switch 2, a main circuit breaker 5, a plurality of auxiliary circuits (such as those of a high tension voltmeter, of counters, of no-voltage relays, etc.) protected by appropriate fuses 3, 3', 3'', and a plurality of main circuits A, B, etc., each comprising a corresponding contactor 4, 4', 4'', etc., and a protective relay 10, 10', 10'', etc. In the embodiment shown in Fig. 2, the invention is used in connecton with the main circuits A, B, etc., only.

Referring to Fig. 2, the elements of a general remote control post are enclosed by the rectangle C shown in dotted lines. The devices provided for testing, signalling and eliminating of defective circuits of each individual self propelled electric vehicle are enclosed by the rectangle V also shown in dotted lines. The remote control post C comprises a locking push button or switch 6, a control push button or switch 7, a resetting or testing push button or switch 8, and a general signalling device such as a lamp 9, common to all of the vehicles. The button 6 is maintained in a closed position by a spring not shown acting in the direction of the arrow and the button 7 is normally closed, but may be opened permanently.

The equipment of each vehicle comprises for each protected circuit A, B, etc., a protective relay 10 or 10', etc., and a signalling relay 11 or 11', etc. For all the protected circuits A, B, etc., of every vehicle there has been provided a common local signalling device such as a lamp 12 and a resetting relay 13.

The buttons, relays and lamps above are connected as shown to the following conductors

which run the entire length of the train: a control feeder 14, a locking wire 15, a trip control wire 16, a general signalling wire 17, and a breaker-reclosing wire 18.

Each protective relay 10 or 10' etc. may be of the type shown having its upper contacts normally closed by a spring and comprising an armature attracted downwardly by the coil 20 or 20', etc.

This armature can be maintained upon the lower contacts by the action of a locking coil 19 or 19' etc. The coil 20 or 20' etc. is connected in series with a contactor 4 or 4' etc. of the corresponding main circuit A, B, etc., as shown.

All the circuits 23, 23' etc., can be connected in series with the operating coil of the main circuit breaker 5.

The armature of each of the signalling relays 11 or 11' etc. is urged downwardly by the spring shown or by gravity, and it is locked or immobilized in this lower position by the locking coil 22 or 22' etc., connected to the locking wire 15; this armature may be raised by the coil 21 or 21' etc. if the corresponding locking coil is deenergized. Once raised, it is mechanically maintained in its upper position by a latch 24 or 24' etc. cooperating with a pin 25, 25' etc. and causing a visual signal to appear in the upper position. The two upper contacts which are normally closed by each of the relays 11 or 11' etc., complete the circuit closing the corresponding contactor 4 or 4' etc., controlling the respective main circuit A, B, etc.

In a traction equipment, these contacts can close the advance circuit of a traction controller. The two pairs of lower signalling contacts, which are normally open, are connected respectively between the locking wire 15 and the local signalling lamp 12 of the vehicle or the wire 17 of the general signalling lamp 9 provided for the whole train.

Upon Fig. 2 the short arrows traced at the side of the various coils of the relays indicate the directions of attraction of the coils.

The operation of the system described is as follows: In case of a fault in a main circuit A, B, etc., the corresponding protective relay 10 or 10' etc., is operated downwardly by the coil 20 or 20' etc.; it opens the circuit 23 or 23' etc., deenergizing and opening the general circuit breaker 5, and closes at its lower contacts the circuit of the locking or maintaining coil 19 or 19' etc., connected in series with the coil 21 or 21', as well as with the contacts of the resetting relay 13 which are normally closed.

The relay 11 does not operate in spite of the action of its coil 21, because its armature is locked in the lower position by the locking coil 22 constantly excited by the locking wire 15 which receives current through the normally closed locking button 6.

But, as stated before, the operation of a protective relay results in the deenergization and opening of the main circuit breaker 5. The operator who in such a case immediately brings back his main controller (not shown) to the zero position, knows that an interruption has somewhere occurred, but he does not know yet which electric vehicle nor which circuit is involved.

He then presses the resetting or testing button 8 exciting through the reclosing wire 18 the resetting relays 13 of all vehicles. Each relay 13 opens the circuit of all corresponding coils 21, 21', etc., and of the locking coils 19, 19', etc. If the defect has disappeared, the relay 10 or 10', etc., which has operated returns to its normal upper position as shown, and all the circuits A, B, etc., are normally excited by the reclosure of the main circuit breaker 5 resulting from the completion of the circuits 23, 23', etc.

If after this test the defect persists, a new interruption of the breaker 5 is produced, and in order to finally eliminate the defective circuit, the operator presses an instant upon the locking button 6, deenergizing the locking wire 15 and the locking coils 22, 22', etc. The relay 11 or 11', etc., of the defective circuit being thus unlocked, its coil 21 or 21', etc., acting alone attracts its armature which remains now mechanically locked in its upper position by the action of the elements 24 and 25. The contactor 4 or 4' of the defective circuit (or the progression circuit of a traction controller) is definitely opened, a visible signal appears upon the relay 11 or 11', etc., the local signalling lamp 12, and through the wire 17, the general signalling lamp 9 at the control post C are both lighted.

The conductor then presses again upon the resetting button 8 exciting the resetting relay 13 which results in deenergizing the coils 19, 19', etc., so that all the relays 10, 10', etc., close their upper contacts; the main circuit breaker 5 is thus reclosed, and all the main circuits receive line current, except the defective circuit, which remains opened because the corresponding relay 11 or 11', etc., is maintained as stated before in its upper position by the above mentioned mechanical locking device, so that the corresponding contactor 4 or 4', etc., remains in its opened position.

The general signalling lamp 9 indicates to the operator that there is a defective circuit in the train; the local signalling lamp 12 shows in which vehicle it is, and the operator only has to look upon the signalling relays 11, 11', etc., of this vehicle in order to locate the defective circuit through the corresponding visual signal. After having repaired the damage, the operator can reset by hand the corresponding relay 11 or 11', etc.

In acting upon the control button 7, the operator can deenergize the trip control wire 16 and open all contactors 4, 4' etc. without opening the main circuit breaker 5.

It is obvious that the arrangement described above by way of example may be modified in various ways and that the application of the invention is not limited to electrical traction.

From the above description it follows that the operation of the system disclosed herein comprises the following four stages:

1. *Automatic tripping*

A defect in the circuit A—A results in an excessive current; the coil 20 draws the armature downwardly, excites the coil 19 and the armature of the relay 10 remains held in lower position. The circuit 23 being cut the main circuit breaker 5 of the vehicle opens.

The excitation of the coils 19 and 21 does not bring about the operation of the relay 11, because the coil 22 remains permanently excited; the relay 11 therefore does not yet react.

2. *Test*

The operator makes a "test" by pressing the button 8. The relay 13 cuts the current in the coils 19 and 21. The relay 10 returns upwardly, recloses the circuit 23 and the switch 5 closes.

If the defect in the circuit A—A has disappeared in the meantime, a normal current passes through the coil 20 and the relay 10 remains upwardly and all the circuit A, B, etc., are normally energized.

If the defect continues the reclosing of the switch 5 produces an overcurrent in the coil 20 and the relay 10 will descent again bringing about a new tripping of the switch 5 and will remain in the lower position through the effect of the coil 19.

3. *The elimination of the defective circuit*

The operator, seeing that his test has not succeeded, presses the button 6: this deenergizes the line 15 and the coil 22. The relay 10 being still below, the coil 21 is energized in series with 19; this coil acts alone, without being restrained by the coil 22 and raises its armature which is hooked in upward position by any mechanical arrangement. When the operator lets go of the button 6, the relay 11 remains hooked in upward position. The coil of the contactor 4 is thus cut; the contactor opens and remains definitely open, with the appearance of a visual signal such as a disc signal upon the relay 11. The defective circuit is eliminated.

4. *Reclosing*

By pressing again the button 8 the operator again makes a test by cutting the current in 19 and 21. All the relays 10 close upwardly, 5 recloses and all the circuits receive current except the defective circuit.

I claim:

1. In an electrical equipment having a general circuit breaker, a plurality of separate power circuits and an individual circuit contactor in each of said circuits a system for testing, signalling and eliminating defective circuits comprising a general remote control post, a normally closed locking switch, a normally opened testing and resetting switch and a general signalling lamp in said post, a normally closed resetting relay, a plurality of local signalling lamps, in each of said power circuits a protective relay and a signalling relay, an operating coil and a locking coil in each of said protective and signalling relays and general arrangement according to which each protective relay is of the overcurrent type with normally closed contacts connected in series with the operating coil of said circuit breaker, the operating coil of said protective relay is connected in series with the corresponding circuit contactor and its locking coil is connected in series with the operating coil of the corresponding signalling relay and with the normally closed contacts of said resetting relay, while the locking coil of each signalling relay is normally excited in series with said locking switch to maintain said signalling relay in an inoperative position in which its normally closed contacts are energizing the corresponding contactor coil, and each of said signalling relays is provided with normally open contacts connected in series with said signalling lamps, and with a mechanical latching device having the form of a visual signal, said latching device being adapted to maintain said signalling relay in its operative position.

2. In an electrical equipment according to claim 1 and consisting of a plurality of self-propelled vehicles, one local resetting relay and one local signalling lamp in each vehicle, this lamp being connected to be energized upon operation of any of the signalling relays of the vehicle.

3. In an electrical equipment according to claim 1 and consisting of a plurality of self-propelled vehicles, a general signalling lamp located in said general remote control post and connected to be energized upon operation of any of the signalling relays of all vehicles.

4. In an electrical equipment, including a general circuit breaker, a plurality of separate power circuits and a plurality of corresponding circuit contactors, a system for signalling, testing and rapidly eliminating defective circuits, comprising a general remote control post including a normally opened resetting switch, general and local signalling devices, a resetting relay connected to be excited by the closure of said resetting switch, a locking relay, and in each of said separate power circuits a protective relay connected to energize in its normal non-operative position said general circuit breaker, a locking coil upon said protective relay connected to maintain it in its operative position until said locking coil is deenergized, and a signalling relay provided with contacts which are connected to close in its normal non-operative position the said corresponding circuit contactor, said signalling relay being provided with an operating coil connected in series with the locking coil of said protective relay, a normally excited locking coil which is normally excited to maintain said signalling relay in its non-operative position until said latter mentioned locking coil is deenergized, normally opened signalling contacts and mechanical means for definitely locking said signalling relay in its operative position whereby the corresponding circuit is definitely eliminated, and for producing a visual indication of said operative position.

5. In a complex electrical equipment having a plurality of separate power circuits, individual contactors in said circuits and a general circuit breaker, a system for signalling, testing, and rapidly eliminating defective circuits by reclosing all non-defective circuits, comprising a common resetting relay, a general remote control post including a locking switch, a normally closed control switch connected to open said individual contactors, a normally opened resetting switch connected to excite said resetting relay in order to reclose said circuit breaker and thereby effect a test of said separate circuits, and a general signalling device, each of said separate power circuits including a normally closed protective relay of the overload type comprising a locking coil excited upon operation to lock magnetically said protective relay in its open position, a signalling relay connected to be excited by the operation of said protective relay, but comprising a locking coil which is normally excited to maintain it in its normal non-operative position, unlocking switching means formed by said resetting switch and connected to liberate said protective relay by deenergizing its locking coil, unlocking switching means formed by said locking switch and connected to liberate said signalling relay by deenergizing its locking coil, mechanical holding means for immobilizing said signalling relay in its operative position, signalling means for visual indication of said latter mentioned operative position, upon said signalling relay contacts normally connected to close said individual contactors and normally opened contacts connected to energize said general signal-

ling device upon operation of said signalling relay.

6. In a complex electrical equipment consisting of a plurality of multiple units, each of said units having a general circuit breaker and a plurality of separate circuits with individual contactors, a remote control system for signalling, testing and rapidly eliminating defective circuits by a reclosure all of non-defective circuits, comprising a common remote control post including a normally closed locking switch, a normally closed control switch connected to open said individual contactors, a normally opened resetting switch connected to reclose said general circuit breaker and a general signalling lamp, a resetting relay in each of said multiple units connected to be excited by the closure of said resetting switch and a local signalling device, and a normally closed protective relay in each of said separate circuits connected to open in the case of an overcurrent said general circuit breaker, a locking coil upon said protective relay connected to maintain it in its open position until said locking coil is deenergized by said resetting switch and by said resetting relay, whereby the said circuit breaker is reclosed, a signalling relay connected to be excited upon operation of said protective relay, a locking coil upon said signalling relay normally excited to maintain it in its normal non-operative position until the latter mentioned locking coil is deenergized by said locking switch, a mechanical latch device upon said signalling relay for holding said signalling relay in its operative position, signalling means adapted to give a visual indication of the latter mentioned operative position and contacts upon said signalling relay connected to open said individual contactor, whereby the corresponding circuit is definitely eliminated, and to energize said general signalling device and said local signalling device.

7. In an electrical equipment having a general circuit breaker, a plurality of separate power circuits and an individual circuit contactor in each of said circuits, a system for testing, signalling and eliminating defective circuits comprising a general remote control post, a normally closed locking switch, a normally opened testing and resetting switch and a general signalling lamp in said post, a normally closed resetting relay, a plurality of local signalling lamps, in each of said power circuits a protective relay and a signalling relay, an operating coil and a locking coil in each of said protective and signalling relays and general arrangement according to which each protective relay is of the overcurrent type with normally closed contacts connected in series with the operating coil of said circuit breaker, the operating coil of said protective relay is connected in series with the corresponding circuit contactor and its locking coil is connected in series with the operating coil of the corresponding signalling relay and with the normally closed contacts of said resetting relay, while the locking coil of each signalling relay is normally excited in series with said locking switch to maintain said signalling relay in an inoperative position in which its normally closed contacts are energizing the corresponding contactor coil, and each of said signalling relays is provided with normally open contacts connected in series with said signalling lamps, and with a mechanical latching device having the form of a visual signal, said latching device being adapted to maintain said signalling relay in its operative position, the said testing and resetting switch being connected in series with the operating coil of said resetting relay, whereby said normally closed contacts of the resetting relay are opened upon closing said resetting switch, and normally closed control switch, located in the said control post, being connected in series with the operative coils of all circuit contactors, whereby said contactors are opened by said control switch without opening the circuit breaker.

LEON HEIDMANN.

REFERENCES CITED

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

UNITED STATES PATENTS

Number	Name	Date
1,654,928	Field et al.	Jan. 3, 1928
2,116,947	Ketay	May 10, 1938
2,127,343	Parlett	Aug. 16, 1938
2,278,939	Muehter	Apr. 7, 1942