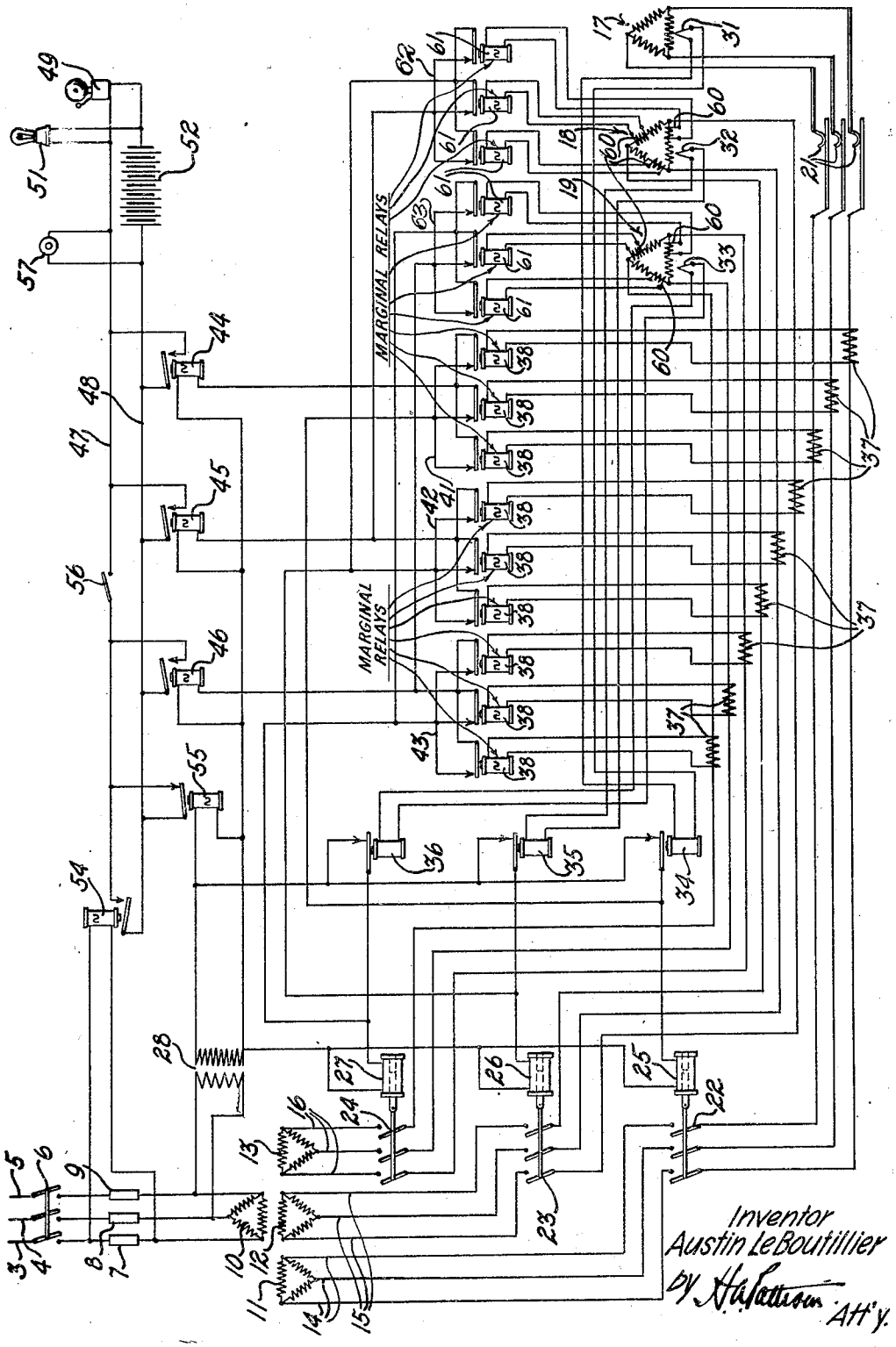
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SIGNALING SYSTEM

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SIGNALING SYSTEM.

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This invention relates to a signaling system, and more particularly to a signaling system for indicating a current failure in a lead of a supply circuit.

An object of the invention is to provide a signaling system which will indicate when an electrically operated device is not operating at its highest efficiency.

The invention contemplates the provision of means associated with each of a plurality of leads of a supply circuit to indicate when a total or partial failure of current occurs therein. In accordance with one embodiment, a series transformer is placed in each of the leads of a supply circuit to indicate a failure of current therein and a relay responsive to the current in the transformer for operating a signaling circuit is connected across the terminals of a coil of a magnetically operated switch in the supply circuit to prevent an indication in the signal element when the coil is deenergized and the current in a predetermined number of leads is interrupted by the normal operation of the switch.

It is believed that a complete understanding of the invention may be had by reference to the following description taken in conjunction with the accompanying drawing, in which a signaling system is diagrammatically represented as applied to an electric annealing furnace.

Referring to the drawing, a three phase line of alternating current 3, 4, 5 is shown leading through a main switch 6 through fuses 7, 8, 9 to the primary of a transformer 10 which is provided with three secondaries 11, 12, 13 which supply secondary circuits 14, 15 and 16, respectively. The secondary circuits lead to delta connected heating elements 17, 18 and 19 of any suitable type which may be associated with an electric annealing furnace. It is customary in furnaces of this type to provide a plurality of heating elements which are located in various parts of the furnace. The heating element 17 in the present instance is diagrammatically represented as connected to the secondary circuits through movable elements such as shoes 21 engaging tracks for the reason that one of the heating elements is in many instances located in the car in which the material to be annealed is carried into the furnace.

The secondary circuits 14, 15 and 16 are provided with switches 22, 23 and 24 which are operated by electro-magnetic coils 25, 26 and 27, respectively. The coils are energized by means of a transformer 28 which is connected across conductors 4 and 5 of the primary circuit. In the vicinity of the heating elements 17, 18 and 19 in the furnace thermocouples 31, 32 and 33 are located which operate pyrometric control switches 34, 35 and 36, respectively, in the circuits of the magnetic switches 25, 26 and 27. Whenever the temperature in the vicinity of a given heating element rises above a predetermined value the corresponding pyrometric control switch will be opened which will result in the opening of the switch in the secondary of the supply circuit until the temperature has dropped to a predetermined value when the switch will again be closed. A series transformer 37 is associated with each of the conductors leading to the heating elements and has in circuit therewith a relay 38 having normally closed contacts. The relays are arranged in groups of three comprising three groups 41, 42 and 43, and each group is connected across the terminals of a coil of the secondary switches 25, 26 and 27, respectively. The groups 41, 42 and 43 have also in circuit therewith relays 44, 45 and 46 of a signal circuit having normally open contacts. The signal circuit comprises two conductors 47 and 48 which are connected in parallel to a bell 49 and a signal lamp 51, and one of the conductors has a direct current source 52 in series therewith so that whenever a contact is made between the two conductors the bell and lamp will produce a signal.

The relays in circuit with the series transformers may be so adjusted that when the current in a conductor becomes less than a predetermined amount, the contacts of the relay associated therewith will be permitted to close, establishing a circuit through one of the relays 44, 45 and 46 depending upon the group in which the contacts of the relay were closed, thereby closing the signal circuit and producing a signal. It will be seen that whenever one of the secondary switches 22, 23 or 24 is opened, the current in the corresponding secondary leads will be interrupted and the contacts of relays associated therewith will be closed. However, the normally open relay in the signal circuit will not be operated for the reason that the second-

ary circuit of the transformer 28 will be interrupted through the relays 44, 45 and 46 whenever it is interrupted through the corresponding magnetic switch, since the relays 44, 45 and 46 are connected across the terminals of the coils 25, 26 and 27, respectively, of the magnetic switches. A signal will therefore be given only when one of the pyrometric control switches 34, 35 or 36 is closed and the current in one or more of the secondary leads fails by reason of a high resistance contact in the circuit or the burning out of one of the heating elements of the furnace.

The signal circuit is also adapted to be operated when one of the fuses in the primary circuit is destroyed. For this purpose a relay 54 having normally open contacts is provided which is connected across the terminals of the fuse 7 in the line 3 so that when the fuse in this line is destroyed the relay will be subjected to the line voltage closing the relay and operating the signal circuit. If either of the fuses 8 or 9 is destroyed, the voltage applied to the transformer 28 is reduced to one-half the normal voltage, which is insufficient to operate a relay 55 causing its normally closed contacts which are maintained in an open position while the relay is energized to close and operate the signal circuit. In order to operate the apparatus it is merely necessary to close the primary switch 6 and then close a switch 56 in the signal circuit. The closing of the primary switch will energize the transformer 28, closing the secondary circuits by means of the magnetic switches. When the transformer 28 is energized, the relay 55 is energized completely opening the signal circuit until such a change in the operating conditions of the apparatus occurs as will cause a signal. A push button switch 57 is provided in the signal circuit to test the signal devices for the purpose of determining whether they are in proper operating condition.

In addition to the series transformers associated with the secondary leads, a series transformer 60 may be associated with each branch of the delta connected heating elements in the furnace as shown. It is customary to bring the leads of all the heating elements of a furnace to the exterior and make the delta connection there, so that the series transformers may be conveniently connected with each branch of the heating elements of the furnace. The series transformers 60 when used are connected in circuit with relays 61 which comprise two groups 62 and 63 which are connected in parallel with groups 42 and 43, respectively. The operation of a relay in group 62 or 63 will therefore have the same effect as the operation of a relay in the respective parallel group 42 or 43. When the additional transformers are used the accurate adjustment of the relays in circuit with the series transformers in the secondary leads is not necessary and the latter may be so adjusted as to indicate only a complete current failure in the lead.

It will be understood that the embodiment of the invention herein described and illustrated is merely a convenient and useful form of the invention which is capable of many other modifications without departing from the spirit and scope of the invention.

What is claimed is:

1. A signaling system for a supply circuit having a plurality of leads divided into a plurality of groups, a switch for each group of leads, a transformer associated with each of the leads, said transformers being arranged in groups corresponding to the switches, a signal circuit, a relay associated with each group of transformers to energize the signal circuit in response to predetermined low current conditions in a lead of that group, and means to prevent the relay from energizing the signal circuit when the switch of the group is opened.

2. A signaling system for a supply circuit comprising a switch operated by a magnetic coil, a transformer associated with a lead of the supply circuit, a signal circuit connected across the terminals of the magnetic coil, a relay for operating the signal circuit, means for energizing the relay when the current in the transformer decreases to a predetermined low value, and means for preventing an energization of the relay when the switch is open.

3. A signaling system for a supply circuit having a plurality of supply leads comprising a signal circuit, means for energizing the signal circuit when the current in one of the leads decreases to a predetermined low value, and means for preventing the energization of the signal circuit when the current in a predetermined number of the leads is normally interrupted but causing its energization when abnormally interrupted.

4. In a signaling system for a circuit for supplying a plurality of heating devices, a plurality of supply leads for each of the heating devices, a signal circuit, means for energizing the signal circuit when the current in one of the leads decreases to a predetermined low value, and means for preventing the energization of the signal circuit when the current in all of the leads for one heating device is normally interrupted.

5. In a signaling system for a circuit for supplying a plurality of heating devices, a plurality of leads for each of the heating devices, a signal circuit, means for energizing the signal circuit when the current in a lead decreases to a predetermined low value, means for interrupting the current in the leads of one of the heating devices in response to temperature conditions, and means for preventing the energization of the signal circuit when the current in the leads of a heating de-

vice is interrupted in response to temperature conditions.

6. In a signaling system for a circuit for supplying a plurality of electrically operated devices, a plurality of leads for each of said devices, a signal circuit, means for energizing the signal circuit when the current in a lead decreases to a predetermined low value, means for disconnecting one of said electrically operated devices in response to predetermined conditions, and means for preventing the energization of the signal circuit in response to the disconnection of the electrically operated device.

In witness whereof, I hereunto subscribe my name this third day of December A. D. 1926.

AUSTIN LE BOUTILLIER.