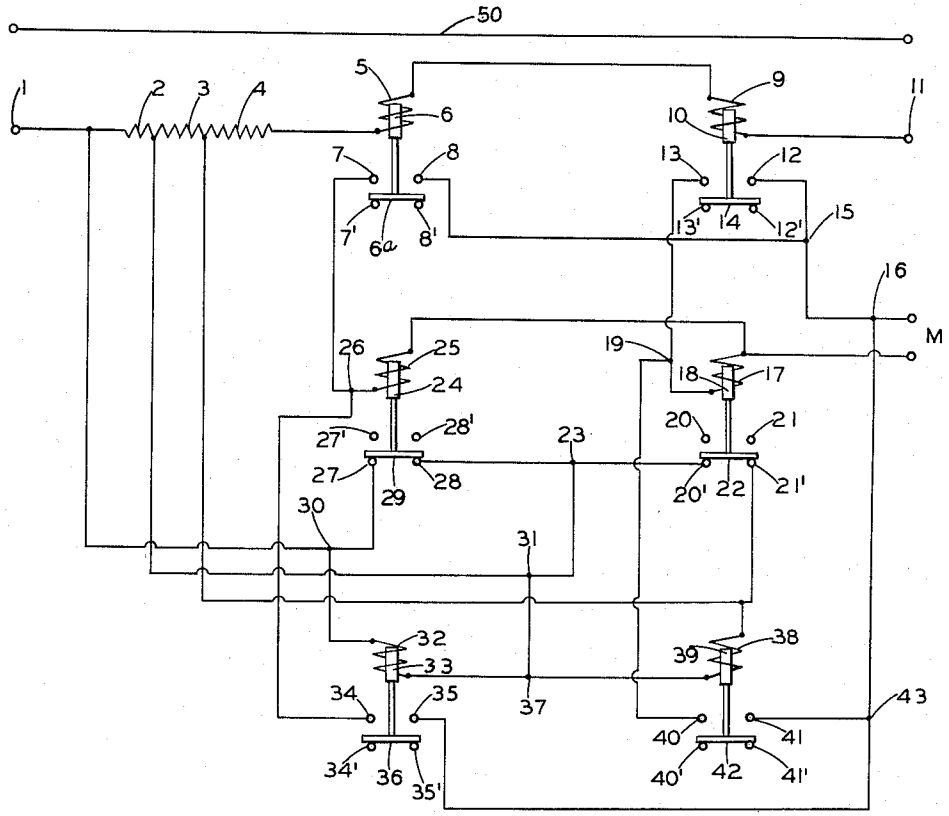
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CURRENT REGULATING SYSTEM

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CURRENT REGULATING SYSTEM

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The present invention relates to a control system for stabilizing the operation of electrofilters which are supplied from a source by means of a high voltage transformer.

A primary object of the present invention is to eliminate releases in the operation of the electrofilter which are occasioned by sudden rises of current, for example, when changing the operation of the filter.

A further object of the present invention is to provide a control system which obviates the necessity for manual control of the voltage of an electrofilter.

These and other objects of the present invention and the various features and operation thereof are more fully set forth hereinafter with reference to the accompanying drawing, in which,

The figure is a schematic wiring diagram of a protective circuit for the power supply of an electrofilter.

The invention contemplates a control system wherein a given number of series resistances are connected into the primary circuit of the high voltage transformer of the electrofilter. The number of resistances corresponds to the number of regulating steps desired to prevent excessive current in the electrofilter. For each resistor, a current responsive relay is connected in series in the primary circuit to effect insertion or removal of the resistances from the circuit.

Referring now to the drawing, a control circuit having terminals 1 and 11 is inserted in one side of the primary circuit of a high voltage transformer, the other side being indicated at 50. The transformer supplies power to an electrofilter. The terminals 1 and 11 are connected through a pair of resistances 2 and 3 in series with a fixed resistance 4 and a pair of current responsive relays 6 and 10, respectively. Each relay controls a resistance; for example, the relay 6 controls the resistance 2 and the relay 10 controls the resistance 3.

The relays 6 and 10 are connected in the control circuit in similar manner and in order to facilitate a description thereof only the connections affecting the relay 6 and the operation thereof will be described in detail.

The relay 6 controls a pair of contacts 7 and 8 by means of a switch arm 6a responsive to the current in the coil 5 of the relay. The contacts 7 and 8 are normally open but are adapted to be closed when the current through the relay coil 5 exceeds a predetermined maximum value and actuates the switch arm 6a from the rest contacts 7' and 8' to the working contacts 7 and 8. The contacts 7 and 8 are connected in series with the relay coil 25 of a second relay 24 so that when the relay 6 is energized the second relay 24 will also be energized. The circuit for this runs from the upper side of an auxiliary source M through the junctions 16 and 15, the contacts 8 and 7, the junction 26, the relay coil 25, and back to the other side of the source M. The relay 24 is provided with a pair of normally closed contacts 27 and 28 which are adapted to be open when the relay is energized, for example, when the current through the relay 6 exceeds the predetermined maximum value.

The contacts 27 and 28 control the insertion and removal of the resistance 2 from the primary circuit. When the switch arm 29 is in its normal position against the rest contacts 27 and 28, the resistance 2 will be shunted out of the primary circuit by means of the shunt circuit running from the left hand end of the resistance through the junction 30, the contacts 27 and 28, the junctions 23 and 31 and back to the right hand side of the resistance 2. Thus, when the relay 24 is deenergized, the resistance 2 will be shunted out of the circuit and the current through the primary circuit will be at a maximum. Should the current rise above the desired level, the relay 6 will be energized which in turn will energize the relay 24 to open the shunt circuit of the relay 2 by raising the arm 29 against the contacts 27' and 28'. Opening the shunt circuit causes the current in the primary circuit to pass through the resistance 2, increasing the resistance in the circuit, and thereby reducing the current.

Means is provided to prevent deenergization of the relay 24 when the current through the primary circuit is reduced to a safe value. In the present instance, the means comprises a holding circuit for the coil 25 which is controlled by a voltage responsive relay 33. The voltage responsive relay 33 has its coil 32 connected across the resistance 2 as indicated at the junctions 30 and 37, 31. Thus, when the resistor is shunted out, as when the relay 24 is deenergized, there is no voltage drop across the resistor and the relay 33 is deenergized so that its arm 36 lies against the rest contacts 34' and 35'. When the shunt circuit for the resistor 2 is broken, however, the current flowing through the resistor 2 effects a voltage drop between the points 30 and 31, which energizes the relay 33. The relay 33 has a pair of normally open working contacts 34, 35 which are operable to provide an alternative circuit for energizing the relay coil 25 of the relay 24. This alternative circuit runs from the source M through the junctions 16 and 43, the contacts 35 and 34, the junction 26, the coil 25, and back to the other side of the source M. In this manner, as soon as the shunt circuit for the resistor 2 is broken, the relay 33 is energized to hold the relay 24 open until the voltage drop across the resistor 2 falls below a predetermined minimum value. When this occurs, the relay 33 is deenergized, and the arm 36 falls against the resting contacts 34' and 35', opening the circuit through the contacts 35 and 34, deenergizing the relay 24, and closing the shunt circuit for the resistor 2. The resistor 2 is then shunted out of the primary circuit which causes the current to rise again to the desired level.

Other means may be provided to present deenergization of the coil 24 when the shunt circuit for the resistor 2 is broken initially. For example, the current relay 6 may be provided with a series resistance which is operable to be disconnected after actuation of the current relay. In another modification, the current relay 24 may be provided with two counteracting windings, one of which is connected only upon actuation of the relay. As an additional modification, the current relay may be possessed of a relatively high energization current and a lower deenergization current. In each of these modifications, the relay 33 and its associated circuits may be eliminated from the system and modified current coil will replace the current coil 6.

The second resistor 3 and its associated relay 10 provide a further regulation of the current through the primary circuit. If when the relay 24 is energized to insert the resistance 2 the current rises above a safe value, the resistance 3 will be inserted in the circuit by breaking its shunt circuit through the contacts 20' and 21'. The components of the circuit for controlling this shunt circuit comprise the current responsive relay 10 having a coil 9 and a switch arm 14 operable between the con-

tacts 12', 13' and 12, 13, a second relay 18 having a coil 17 and an arm 22 operable between the contacts 20', 21' and 20, 21, and a voltage-responsive relay 39 having a coil 38 and a switch arm 42 operable between the contacts 40', 41' and 40, 41. The relays 10, 18 and 39 operate like the relays 6, 24, and 33 respectively to control the shunt circuit for the resistor 3 and thereby the current in the primary circuit.

If the possible current variation in the primary circuit is greater than that that can be compensated for by the two resistances 2 and 3, a greater number of resistances may be added to provide the desired amount of regulation. Each of the additional resistors will be controlled by a current responsive relay similar to the relays 6 and 10.

While the particular embodiments have been illustrated and described herein, it is not intended to limit the invention to such description, but changes may be made therein and thereto within the scope of the following claims.

What I claim is:

1. In a power supply for a primary coil, a primary circuit comprising at least one resistor and a current-responsive relay both in series with said primary coil, said relay having normally open contacts operable to be closed when the current through said primary circuit exceeds a predetermined minimum value, a second relay connected to a source through said normally open contacts and having normally closed contacts operable to be opened when the second relay is energized, a short-circuit shunt for the resistor through said normally closed contacts, the latter contacts, upon energization of said second relay, opening said shunt and reducing the current through said primary circuit, and means rendered operative upon energization of said second relay to maintain said shunt circuit open until the current through the primary circuit falls below a predetermined minimum value.

2. A power supply according to claim 1 wherein said last-mentioned means comprises a voltage responsive relay connected in parallel with said normally closed contacts and operable to be energized when the latter contacts are open and the current through said resistor in the primary circuit exceeds said predetermined minimum

value, said voltage responsive relay having normally open contacts operable when closed to complete a holding circuit operable to retain said second relay energized.

3. A power supply according to claim 1 wherein said current-responsive relay includes a series resistance operable to be disconnected from said relay upon actuation thereof to constitute said last-mentioned means.

4. A power supply according to claim 1 wherein said current-responsive relay comprises two counteracting windings, one of which is operable to be disconnected upon actuation of said current-responsive relay to constitute said last-mentioned means.

5. A power supply according to claim 1 wherein said current-responsive relay is operable to be de-energized only when the current therethrough falls below said predetermined minimum value to constitute said last-mentioned means.

6. In a power supply for a primary coil, a primary circuit comprising a plurality of current-responsive relays and a resistor for each said relay all in series with said primary coil, each said relay having normally open contacts operable to be closed when the current through said primary circuit exceeds a predetermined maximum value, a plurality of second relays, each connected to a source through said normally open contacts of one of said current-responsive relays and having normally closed contacts operable to be opened when the second relay is energized, a short-circuit shunt for each resistor through said normally closed contacts of one of said second relays, the latter contacts upon energization of said second relay, opening said shunt and reducing the current through said primary circuit, and means rendered operative upon energization of said second relay to maintain said shunt circuit open until current through the primary circuit falls below a predetermined minimum value.

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