Oct. 4, 1927. 1,644,024

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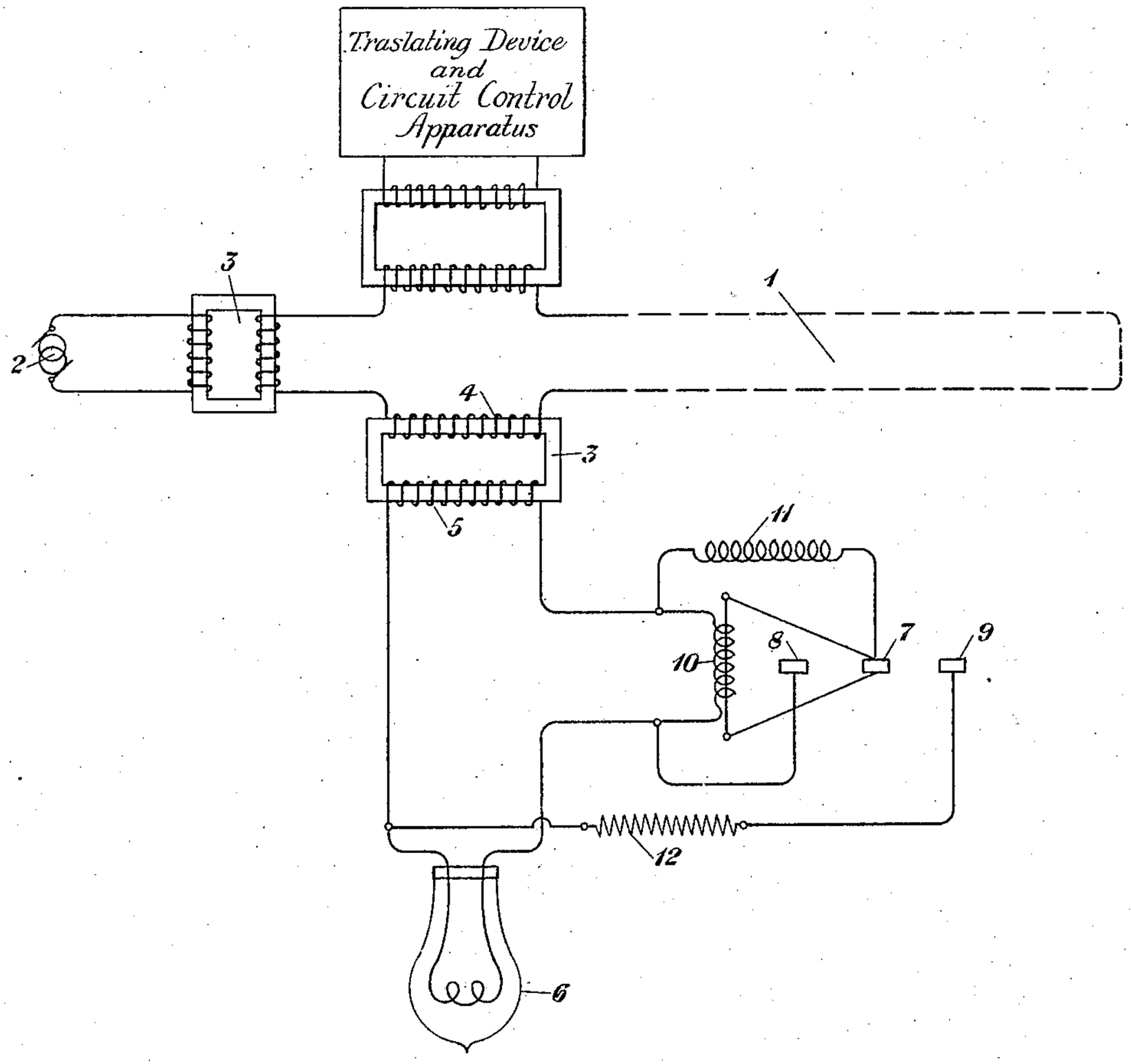
LIGHTING CIRCUIT

Filed June 1, 1925



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Patented Oct. 4, 1927. 1,644,024

UNITED STATES PATENT OFFICE.

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LIGHTING CIRCUIT.

Application filed June 1, 1925. Serial No. 34,225.

This invention relates to electrical distributing systems, and especially to distributing systems which supply power to a plurality of translating devices such as incandescent lamps and the like, and which are connected either singly or in groups in series relationship with one another, and disposed at isolated points in the circuit. More particularly, this invention refers to devices which are adapted to be inserted in circuits of the above mentioned character in order to insure continuity of service and to avoid any wave form distortion in the circuits.

In former arrangements of alternating current lighting systems employing incandescent lamps connected directly in circuit and in series relationship with one another, it was usual to provide means for closing the circuit whenever the filament of an isolated incandescent lamp broke. Such devices usually consisted of automatic circuit closers which, when subjected to the full line potential momentarily impressed thereupon as a result of the interruption in the main line circuit, closed the main line circuit and thereby reestablished normal service conditions. Automatic circuit closers heretofore employed were not of such construction as to permit them to be repeatedly used for similar service, but it was necessary to replace such devices either wholly or in part before they could be restored to the initial conditions.

In other former arrangements the lamps were connected to the secondaries of the individual transformers whose primaries were connected in series with one another. When the filament of a lamp burned out, thereby opening the circuit of the transformer secondary, the current of the lighting circuit caused an over-saturation of the transformer core. Thus, a distortion of the voltage and current waves occurred and the voltages and currents of the harmonics of the fundamental frequency were introduced in the lighting circuit. The present invention provides arrangements for eliminating from the main line circuit the harmonics of the fundamental wave frequency when the secondary of a transformer is open-circuited, and further provides self-adjusting means for bringing the circuit into operation on replacement of a lamp which has failed.

This invention may be more fully understood from the detailed description hereinafter following when read in connection with the accompanying drawing, the figure of which represents one embodiment of the invention.

Referring to the drawing, an alternating current series circuit 1 is supplied with power from a source 2 through a constant current transformer 3. At an isolated point in circuit 1 a series transformer 3 may be disposed, the primary winding 4 thereof being connected in series relationship with other transformers in the main circuit. The secondary winding 5 of the transformer 3 is arranged in a local circuit, comprising a translating device or incandescent lamp 6, which is connected in series relationship with the secondary winding 5 of the transformer 3. It will be understood that the local circuit may comprise a secondary winding 5 and a single translating device 6 or a plurality of translating devices.

When the lamp of the local circuit burns out or is broken, thereby interrupting the circuit through the secondary winding 5 of the transformer 3, means are provided for automatically short-circuiting the secondary winding 5 with suitable reactance and resistance thereupon. To this end a thermal relay is provided (the details of which are not shown) having a moving arm 7, front and back contacts 8 and 9, respectively, and a heating coil 10, which is in series relationship with the filament of the lamp 6.

When the filament of the lamp fails there is no current in the heating coil 10, and the moving arm 7 closes the back contact 9, thereby shunting the lamp through a reactance coil 11 and a resistance 12. When the lamp is replaced the local circuit is again energized so that the potential drop across the shunt reactance 11 and resistance 12 is such as to cause a current through the heating coil and the lamp filament which is considerably less than the normal current, and may preferably be about one-fourth of the normal current. The relay is arranged to operate when this current flows through the heating coil thereof. Upon operation of this relay the back contact 9 opens, removing the shunt around the lamp 6 through the reactance coil 11 and resistance 12, and the moving arm 7 closes the front contact 8, thereby shunting

the heating coil 10 with the reactance 11. The impedance of this reactance is such as to permit normal current to flow through the filament of the lamp 6 when the front contact 8 is closed and to limit the current in the heating coil of the relay to about the same value as immediately before operation thereof.

When the lamp 6 fails, the current in the heating coil is reduced to zero so that the moving arm 7 opens the front contact 8 and closes the back contact 9. This closes the circuit of the transformer secondary through the reactance coil 11 and the resistance 12 and thereby avoids the wave form distortion which would otherwise result if the transformer secondary remained open.

An improved application of the present invention is in connection with the elimination of interference in telephone circuits due to currents induced therein from adjacent series lighting circuits. The fundamental wave of voltage and current in the lighting circuit is generally of about 60 cycles, and is of too low a frequency to cause any audible disturbance in a telephone circuit. However, when the secondary of a transformer in such a lighting circuit is opened there are generated harmonics of the fundamental wave which are in the audible range. These harmonics cause noise in the telephone circuit. This invention provides a self-adjusting means for eliminating the harmonics of the fundamental wave when the secondary of the transformer in a series lighting circuit is opened.

While this invention has been disclosed in one particular arrangement which is deemed desirable, it is to be understood that it is capable of embodiment in many and widely varied organizations without departing from the spirit of the invention and the scope of the appended claims.

What is claimed is:

1. In combination, a main circuit comprising a plurality of transformers having their primaries in series with each other, a source of current of fundamental frequency for said main circuit, a constant current transformer interposed between said source and said main circuit, and means including a thermal relay for short-circuiting the secondary of any one of said transformers with a reactor of suitable reactance and resistance upon failure of the lamp filament associated therewith, said resistance and reactance being so related to the individual transformers that only waves of the fundamental frequency are freely impressed upon the main circuit, while waves of harmonics of the fundamental frequency become substantially suppressed.

2. In a device for obviating the wave shape distortion caused by the presence of a transformer having an open-circuited secondary in an electrical circuit comprising a plurality of said transformers having their primaries connected in series with each other and supplied with current of a fundamental frequency by a source associated with the circuit by means of a transformer having a large impedance, a thermal relay having its winding associated with the secondary of said transformer, a resistor, and a reactor, said relay being arranged to shunt the secondary of said transformer with said resistor and said reactor when the transformer secondary becomes open-circuited, said resistor and said reactor being so related to the primary of said transformer when the transformer secondary is shunted by said resistor and reactor that the harmonics of the fundamental frequency are greatly reduced while the fundamental frequency is freely transmitted.

3. In combination, a main circuit comprising a plurality of transformers having their primaries in series with each other, a source of current of fundamental frequency in said main circuit, a plurality of translating devices associated with the secondaries of said transformers, a plurality of thermal relays each having a front contact and a back contact, a plurality of reactances, the heating coil of each of said relays being associated with a corresponding transformer secondary and a reactance, each of said reactances being arranged to shunt the secondary of a transformer on closure of the back contact of the relay and to shunt the heating coil of the relay on closure of the front contact, the back contact being closed when no current flows through each translating device and the corresponding heating coil associated with one of said transformers, the front contact being closed thereafter when current does flow through said translating device and the corresponding heating coil.

4. In an electrical circuit, the combination of a translating device and means including a thermal relay for controlling the circuit thereof, said controlling means comprising a reactor which is provided to shunt said translating device on failure thereof, the impedance of said reactor being such that the harmonics of the fundamental frequency will be substantially suppressed on failure of said translating device, the waves of the fundamental frequency being the only waves present in said electrical circuit.

5. In a circuit comprising a source of current of fundamental frequency and a transformer having its primary in said circuit, a translating device associated with the secondary of said transformer, a reactor, and means including a thermal relay for shunting the secondary of said transformer with said reactor when said translating device fails, said reactor being of such inductance when the transformer secondary is shunted

thereby that the harmonics of the fundamental frequency will be substantially suppressed.

6. In combination, a main circuit comprising a plurality of transformers having their primaries in series with each other, a source of current of fundamental frequency in said main circuit, translating devices associated with the secondaries of said transformers, a thermal relay for each of said transformers, a reactor of suitable reactance for each of said transformers, each relay being arranged to shunt the associated translating devices with the corresponding reactor on failure of one of said translating devices, and to shunt the winding of said relay with said reactor upon replacement of the translating device that has failed, the reactance of each reactor being so related to the corresponding transformer that waves of the fundamental frequency become impressed on the main circuit when the secondary of the transformer becomes open-circuited, while the harmonics of the fundamental frequency become suppressed.

7. In combination, an electrical circuit, a source of current of fundamental frequency in said electrical circuit, a transformer having its primary in said electrical circuit, and a local circuit comprising a translating device, the secondary of said transformer, a reactor, and a thermal relay, said reactor being associated with the electrical circuit by said relay when the local circuit fails and being adjusted in reactance to freely transmit currents of the fundamental frequency on said electrical circuit when the local circuit fails, while substantially reducing currents of harmonics of the fundamental frequency.

In testimony whereof, I have signed my name to this specification this 25th day of May, 1925.

RALPH G. McCURDY.