No. 755,775. PATENTED MAR. 29, 1904.

L. L. HOLLADAY.

SYSTEM OF ELECTRICAL DISTRIBUTION.

APPLICATION FILED AUG. 21, 1902.

NO MODEL.

Fig. 1.

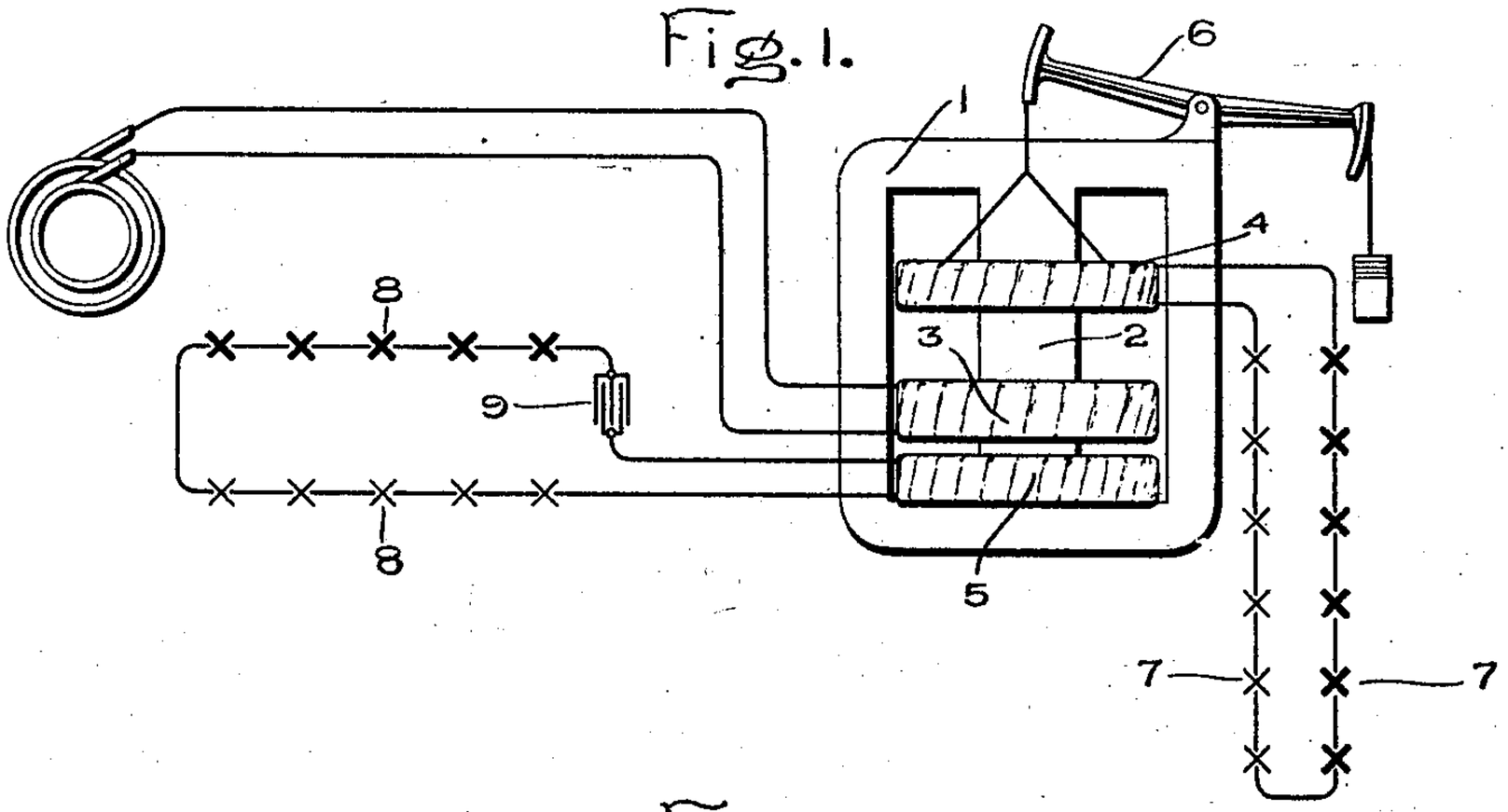
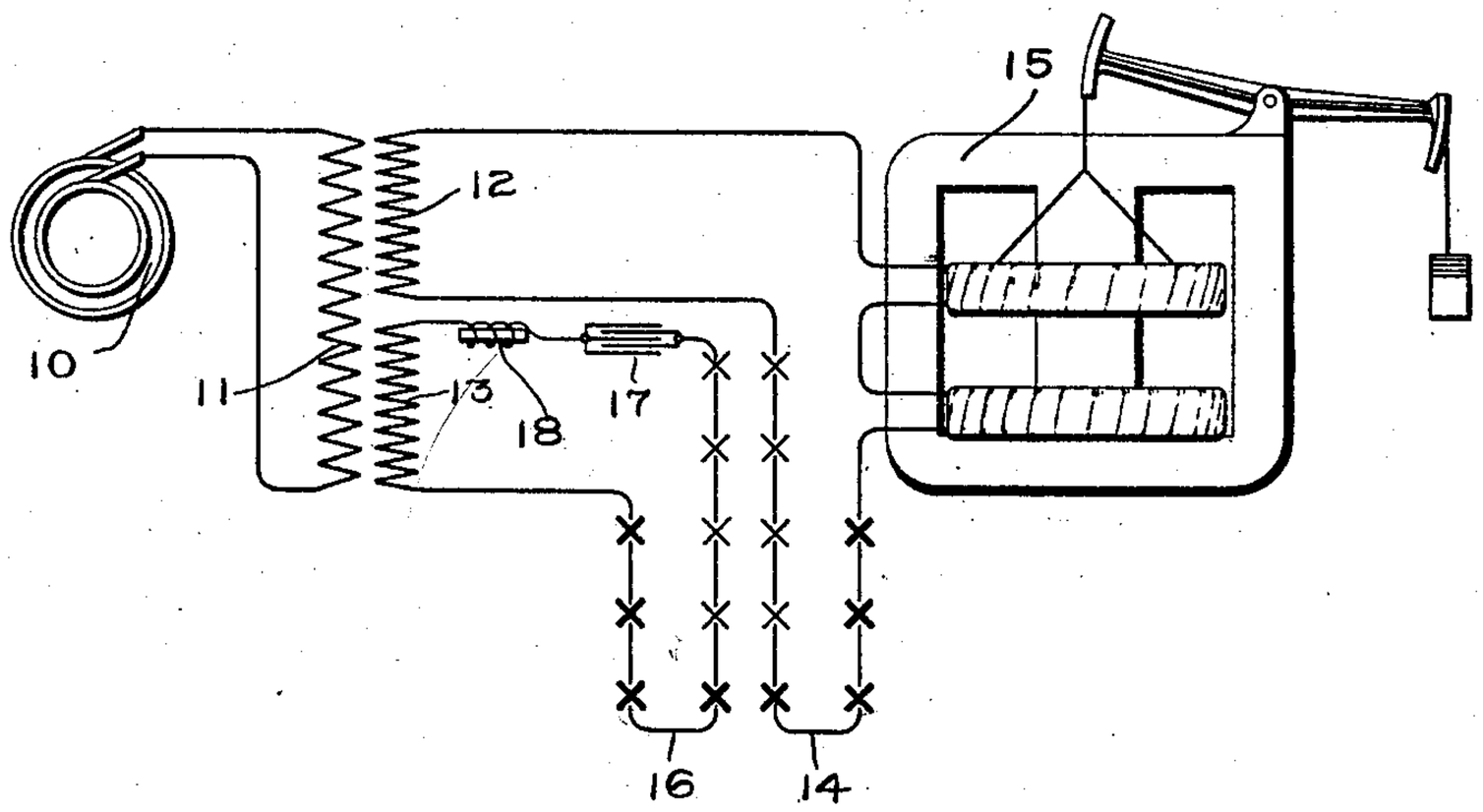


Fig. 2.



Witnesses:
George G. Thornton.
Helen O. Ford

Inventor:
Lewis L. Holladay,
by Allen B. Davis,
Att'y.

No. 755,775. Patented March 29, 1904.

UNITED STATES PATENT OFFICE.

LEWIS L. HOLLADAY, OF LYNN, MASSACHUSETTS, ASSIGNOR TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

SYSTEM OF ELECTRICAL DISTRIBUTION.

SPECIFICATION forming part of Letters Patent No. 755,775, dated March 29, 1904.

Application filed August 21, 1902. Serial No. 120,487. (No model.)

To all whom it may concern:

Be it known that I, LEWIS L. HOLLADAY, a citizen of the United States, residing at Lynn, county of Essex, State of Massachusetts, have invented certain new and useful Improvements in Systems of Electrical Distribution, of which the following is a specification.

My invention relates to alternating-current systems in which constant-current-translating devices are supplied with constant current, and comprises certain improvements whereby such a system may be operated at relatively high power factor.

My invention includes various features of novelty which I have endeavored to point out with particularity in the appended claims, the invention itself being described in detail in the following specification, which is to be taken in connection with the accompanying drawings, in which—

Figures 1 and 2 are diagrammatic representations of modified forms of my invention.

In carrying my invention into practice I supply energy inductively to a number of constant-current circuits. In Fig. 1, for example, two such constant-current circuits are indicated. One of the circuits is provided with a means for automatic regulation of such character that the current in the circuit lags behind its electromotive force during all values of load. The other circuit is provided with regulating means such that the current is leading through practically its whole range of regulation. The effect of the lagging current in one of the circuits as it is reflected back upon the supply system is counterbalanced in whole or in part by the opposite action of the other consumption-circuit, whereby the operation of two such circuits or of duplications thereof from a single source of supply is not attended by the objectionable lowering of power factor heretofore observed in most constant-current systems.

The particular arrangement shown in Fig. 1 consists of a transformer resembling the well-known constant-current transformer with relatively movable coils, but differing therefrom in certain particulars. This transformer is provided with a shell-like core 1, having an intermediate connecting member or core 2, which carries the flux flowing through the side branches of the core and upon which the coils of the transformer are mounted. These coils consist, first, of the primary coils 3, which in this instance is mounted in fixed relation to the core, and of two secondary coils 4 and 5, respectively. The coil 4 is movable relatively to the coil 3, and its weight is partially counterbalanced by the weighted lever 6, from one end of which it is suspended. This coil supplies current to a series circuit containing translating devices—such, for example, as arc-lamps, (indicated conventionally at 7.) The current in this circuit is maintained constant by the automatic movement of the coil 4 toward or away from the primary coil 3, the mode of action being one which is well understood in the art, and therefore requiring no special description. The other secondary coil 5 is of course mounted in inductive relation to its primary 3, but is separated therefrom by a certain space in order to permit a leakage of lines of force between the two coils, whereby a certain amount of inductance is introduced into the secondary circuit connected to the coil 5, from which circuit translating devices, such as arc-lamps 8, are supplied. In order to regulate the current in this last-mentioned circuit, I connect in series with the circuit a condenser 9 of sufficient value not only to counterbalance the effect of inductance produced by the relatively poor mutual inductive relation between the primary and secondary coils 3 5, but also to provide such a resulting impedance as to cause the desired value of current to flow in the secondary circuit when the translating devices are cut out. As the translating devices are cut into circuit the inductance thereof counterbalances a part of the condensance of the regulating-condenser 9, the resulting reduction in the reactance factor of the impedance of the circuit being accompanied by an increase in the resistance factor of the circuit provided by the resistance of the translating devices cut into circuit. The resulting impedance of the circuit therefore remains prac-

tically constant, thereby causing a substantially constant current to flow regardless of the load on the system.

It is found in practice that if any harmonics exist in the current-wave the condenser tends to magnify their effect, with the result that the constant-current regulation is seriously impaired. The inductance introduced into the system by permitting leakage to take place between the primary and secondary coils, as above described, operates to damp or smooth out the harmonics in the current-wave, thereby preventing the accentuation thereof and consequent deterioration in the regulating action of the system.

In Fig. 2 a somewhat different arrangement for accomplishing the same general result is shown. In this case current derived from any suitable source of constant potential, such as the generator 10, is conveyed to a transformer of the ordinary constant-potential type provided with a single primary winding 11 and two secondary windings 12 and 13. One of the secondary windings supplies a series circuit of translating devices 14, in which the current is maintained constant through the instrumentality of a constant-current reactive coil 15 of that well-known type in which the reactance is varied by the automatic relative movement of coils arranged on a core in inductive relation to each other. Inasmuch as the construction of such a regulating device is well understood in the art, no further description thereof seems necessary. The other secondary 13 supplies a separate circuit of translating devices, such as arc-lamps 16, the current in this circuit being automatically maintained constant through the inclusion therein of a condenser 17 of such capacity that when all the translating devices are cut out of circuit current of the desired value will flow. The regulation of the system is effected in the same manner as that of the circuit supplying the translating devices 8 in Fig. 1.

In order to prevent the magnification of harmonics in the circuit fed from the secondary 13 and the consequent impairment of the regulation of the circuit, I insert a device 18, possessing inductance in series, in the circuit, this device producing the same effect as the inductance in the condenser-circuit in Fig. 1, due to the partial separation of the primary coils 3 and 5. The effect of the inductance 18 upon the circuit in which it is included is counterbalanced by correspondingly increasing the amount of condenser 17. The inductance therefore has no effect in reducing the amount of current flowing in the circuit. Inasmuch, however, as the condenser is proportioned so as to counteract the effect of the inductance at the normal frequency of the system it is evident that no such compensating action takes place for waves of higher frequency than the normal, so that the inductance therefore powerfully opposes all such waves, and thereby prevents distortion of the current-wave and consequent impairment of the regulation of the system.

The current in the secondary 12 is a lagging current and that in the secondary 13 a leading current, so that their mutual reaction upon the primary 11 causes the current therein to be of higher power factor than if one only of the consumption-circuits were used.

What I claim as new, and desire to secure by Letters Patent of the United States, is—

1. The combination of a source of current of constant potential, a transformer fed thereby, a plurality of secondary coils on said transformer, a circuit taking lagging current fed from one of said secondaries, and a consumption-circuit taking leading current fed from another of said secondaries.

2. The combination of two consumption-circuits, one taking leading current and the other taking lagging current, a source of current of constant potential, and an inductive connection between said circuits and said source of current.

3. The combination of a core, a primary coil thereon, a secondary coil on said core and movable relatively to the primary coil, another secondary coil on said core and in fixed relation to said primary coil, and separate circuits fed respectively from said secondary coils.

4. The combination of a source of current of constant potential, two series circuits, means for supplying one of said circuits with a variable electromotive force derived inductively from said source, means for supplying the other circuit with a substantially constant electromotive force derived inductively from said source, and means for maintaining a substantially constant current in the last-mentioned circuit.

5. The combination of a source of current of constant potential, a transformer fed thereby and including relatively movable coils, a circuit taking lagging current fed from one of said coils, and a circuit taking leading current fed from another of said coils.

6. The combination of circuits, one taking leading current and the other taking lagging current, a source of current-supply, and a variable inductive connection between one of said circuits and said source of current-supply.

In witness whereof I have hereunto set my hand this 14th day of August, 1902.

LEWIS L. HOLLADAY.

Witnesses:
ALEX. F. MACDONALD,
DUGALD MCK. MCKILLOP.