

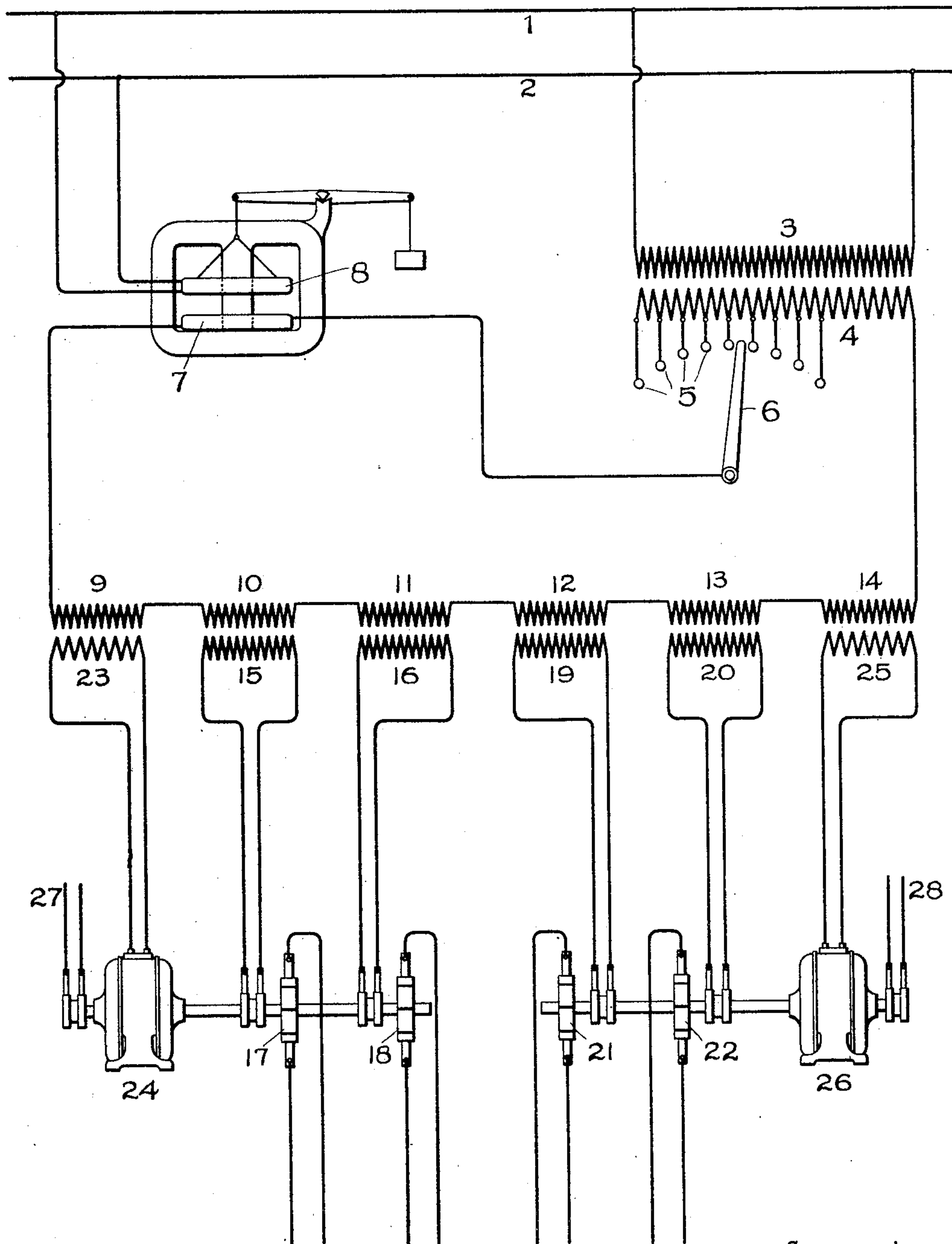
No. 706,123.

Patented Aug. 5, 1902.

C. P. STEINMETZ.
SYSTEM OF ELECTRICAL DISTRIBUTION.

(Application filed June 30, 1900.)

(No Model.)



Witnesses:

Lewis E. Bell.
Alexander S. Lunt.

Inventor.

Charles P. Steinmetz,
by *Albert G. Davis*
Atty.

UNITED STATES PATENT OFFICE.

CHARLES P. STEINMETZ, OF SCHENECTADY, NEW YORK, ASSIGNOR TO
GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

SYSTEM OF ELECTRICAL DISTRIBUTION.

SPECIFICATION forming part of Letters Patent No. 706,123, dated August 5, 1902.

Application filed June 30, 1900. Serial No. 22,133. (No model.)

To all whom it may concern:

Be it known that I, CHARLES P. STEINMETZ, a citizen of the United States, residing at Schenectady, in the county of Schenectady, State of New York, have invented certain new and useful Improvements in Systems of Electrical Distribution, (Case No. 1,456,) of which the following is a specification.

Constant-current circuits feeding arc-lights or the like are frequently supplied with current through rectifiers connected to suitable sources of alternating current. In stations employing systems of this character it is usual to find a number of rectifiers each fed from a separate source of constant current—such, for example, as a constant-current transformer either of the three-phase or quarter-phase type. This arrangement involves the inconvenience of operating a considerable number of transformers, the increased expense of the apparatus, a larger floor-space, decreased efficiency, &c. I have found that these and other objections as well may be obviated by making use of one large source of constant current to supply current for all of the rectifiers of the station, or at least a group of rectifiers, and to feed each individual rectifier from the secondary of a transformer the primary winding of which is in series with the primary windings of the companion transformers and in circuit with the source of constant current.

My invention, both as to its construction and mode of operation as well as to certain adaptations of the same, will be better understood by reference to the following description, taken in connection with the accompanying drawing.

The drawing represents a system embodying the characteristics above mentioned and including certain modifications whereby the cost of the apparatus is much reduced and the power factor largely increased.

Constant-potential-supply mains are indicated at 1 2, and across these mains is connected the primary 3 of a transformer of the constant-potential type, having a secondary winding 4, from points in the length of which extend taps 5. A switch-arm 6 or other appropriate contact-making device is adapted to make connection with any one of the taps

5. The secondary 4 is connected in series with the secondary winding 7 of a constant-current transformer, the primary winding 8 of which is connected across the mains 1 2. This transformer is of the well-known type having relatively movable primary and secondary windings, and its construction and mode of operation being well understood in the art no further explanation of the same is necessary here. It is to be understood, however, that instead of an automatic constant-current-regulating device of this character I may employ any other automatic regulating device performing substantially the same function. Thus instead of the constant-current transformer I may employ a constant-current reactive coil, which, as is well known, differs from the transformer only in that the two windings are connected into series with each other and with the circuit to be regulated. The constant-current circuit, including the two secondaries 4 7, leads to and passes through a plurality of transformers 9 to 14 of the constant-potential type. Some of these transformers are arranged so as to feed rectifiers, while others are used for supplying current to a synchronous motor or motors for driving the rectifiers. Thus, for example, the secondaries 15 and 16 are appropriately connected to rectifying-commutators 17 18, respectively, while the secondaries 19 20 are similarly connected to the rectifiers 21 and 22. The secondary 23 of the transformer 9 supplies current to the synchronous motor 24, while in a similar manner the secondary 25 of the transformer 14 supplies current to the synchronous motor 26. Instead, however, of dividing up the rectifiers into groups and operating each group from a separate synchronous motor I may of course drive all of the rectifiers from a single synchronous motor. Whatever be the number of synchronous motors employed, it is to be understood that their fields are to be excited by direct current obtained from any suitable source. In the drawing I have merely indicated direct-current leads 27 28 for conveying the field-exciting current to the motors.

In the operation of the apparatus described the constant current in the main supply-circuit is obtained by the conjoint regulating

action of the two transformers whose secondaries 4 and 7 are in series with each other, as shown. For large variations in load the regulating-switch 6 is moved so as to bring the
 5 current within an approximation of constancy, whereupon the constant-current transformer comes into operation and by means of relative motion between its primary and secondary windings 8 7 automatically brings the
 10 current to its normal value. The switch-arm 6 may be operated by an attendant and should be moved so that the movable coil or coils of the constant-current-regulating device should be brought to some intermediate position in
 15 their regulating stroke or strokes. Automatic regulation for the smaller variations from normal current will be then taken care of by the constant-current device.

The system thus described possesses many
 20 advantages, among which is that of steadier operation, since each individual lamp or even circuit is a lesser part of the system than is the case where each circuit is fed from its own source of supply. Furthermore, the syn-
 25 chronous motor or motors being operated by the total current of the system will be less liable to hunt, due to the greater steadiness of this current, thereby avoiding serious difficulties with the commutating action of the
 30 rectifiers.

It is obvious that my invention is capable of many modifications and adaptations, and I wish the same to be included within the scope of my claims. Moreover, although I have
 35 shown my invention as embodied in a single-phase system I have done so merely for convenience of illustration, since it may be, and, indeed, generally is, used in connection with a multiphase system.

40 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 substantially constant value, a plurality of rectifiers, and means for supplying said rec-
 45 tifiers with current from said source.

2. The combination of a source of current of substantially constant value, a plurality of rectifiers, and means for deriving current from

said source inductively and supplying it to said rectifiers. 50

3. The combination of a source of constant current, a synchronous motor, a rectifying-commutator driven thereby, and means for starting and supplying both the synchronous motor and the rectifying-commutator with
 55 current derived from said source.

4. The combination of a constant-current circuit carrying alternating current, a plurality of transformers having windings in series therewith, and rectifying-commutators fed
 60 from said transformers.

5. The combination of a constant-current circuit, and a plurality of rectifying-commutators supplied with current thereby.

6. The combination of a transformer having
 65 a divided secondary, a constant-current-regulating device in series with said secondary, and a consumption-circuit fed by said secondary and regulating device.

7. The combination of a plurality of sources
 70 of variable alternating electromotive force in series, and rectifying devices fed from said sources.

8. The combination of a constant-current circuit, a plurality of transformers having
 75 windings in series with said circuit, and rectifying-commutators fed from other windings on said transformers.

9. The combination of a constant-current circuit, means for deriving other constant-cur-
 80 rent circuits therefrom, and means for rectifying current flowing in the constant-current circuits last mentioned.

10. The combination of constant-potential
 85 mains, a transformer having its primary connected across said mains, a constant-current circuit including the secondary of said transformer, and means for varying the number of active turns of said secondary.

In witness whereof I have hereunto set my
 90 hand this 29th day of June, 1900.

CHARLES P. STEINMETZ.

Witnesses:

BENJAMIN B. HULL,
 MABEL E. JACOBSON.