

(No Model.)

3 Sheets—Sheet 1.

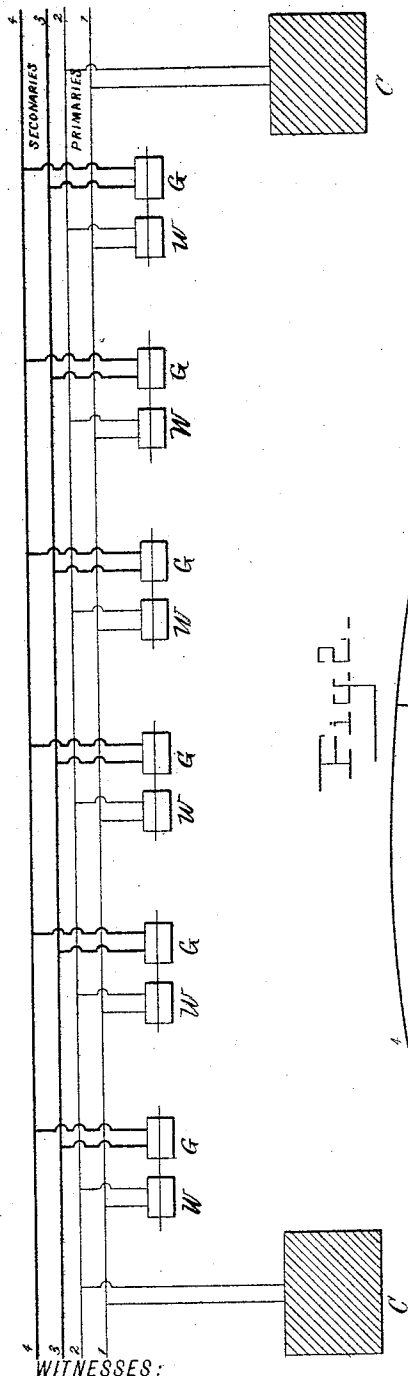
C. ZIPERNOWSKY.

SYSTEM OF SUPPLYING CURRENTS TO ELECTRIC RAILWAYS.

No. 498,603.

Patented May 30, 1893.

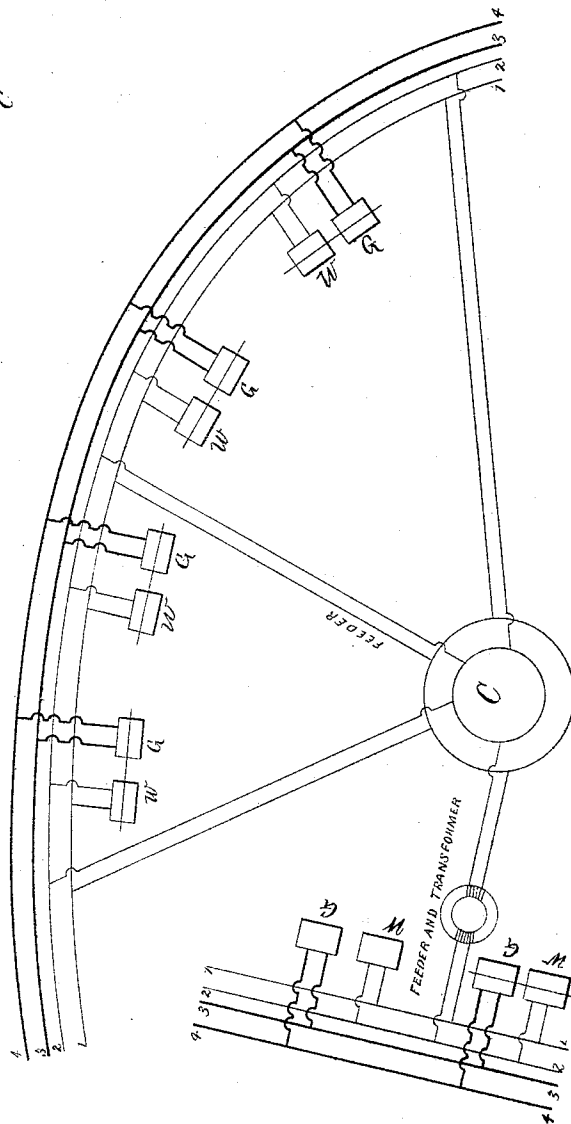
Fig. 1.



WITNESSES:

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Fig. 2.



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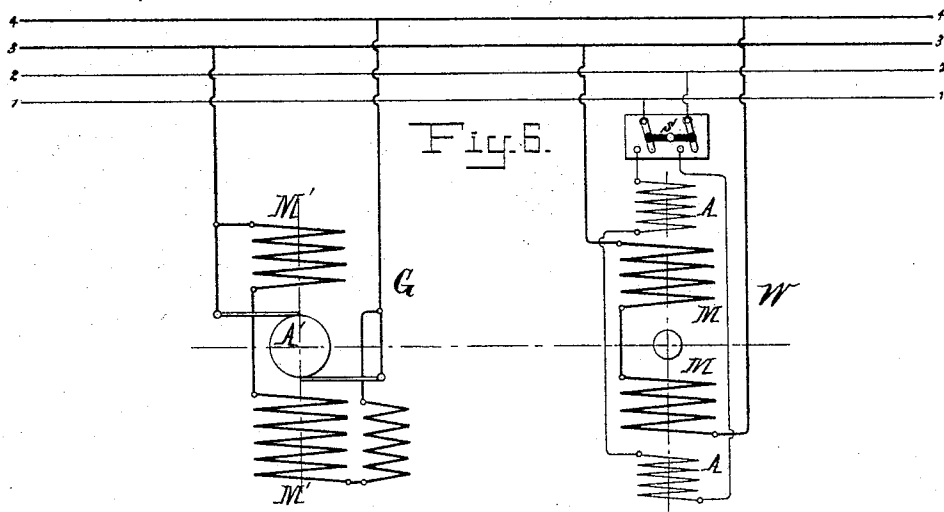


Fig. 6.

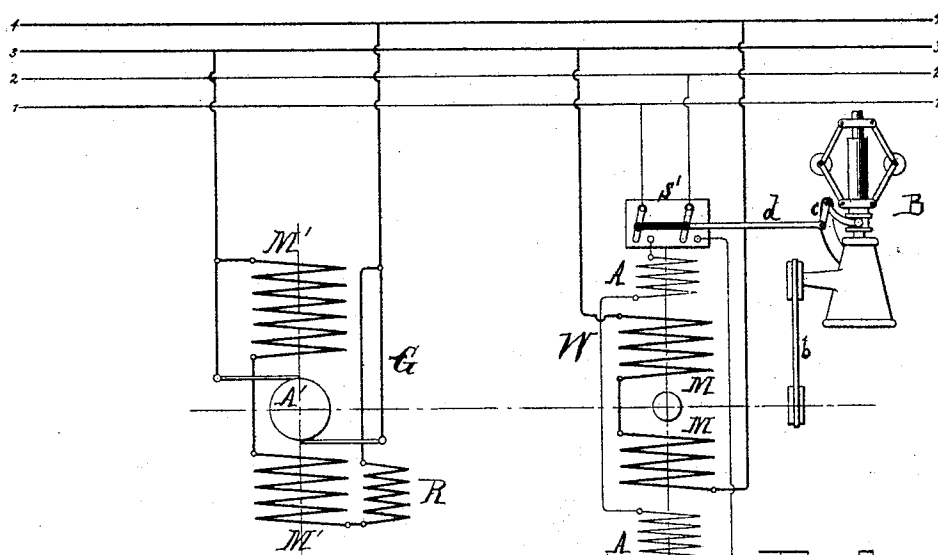
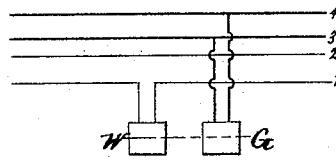
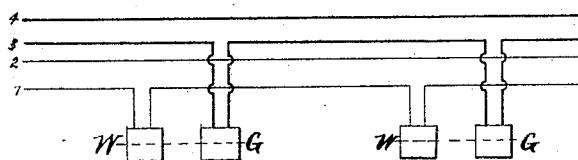


Fig. 7.

Fig. 8.



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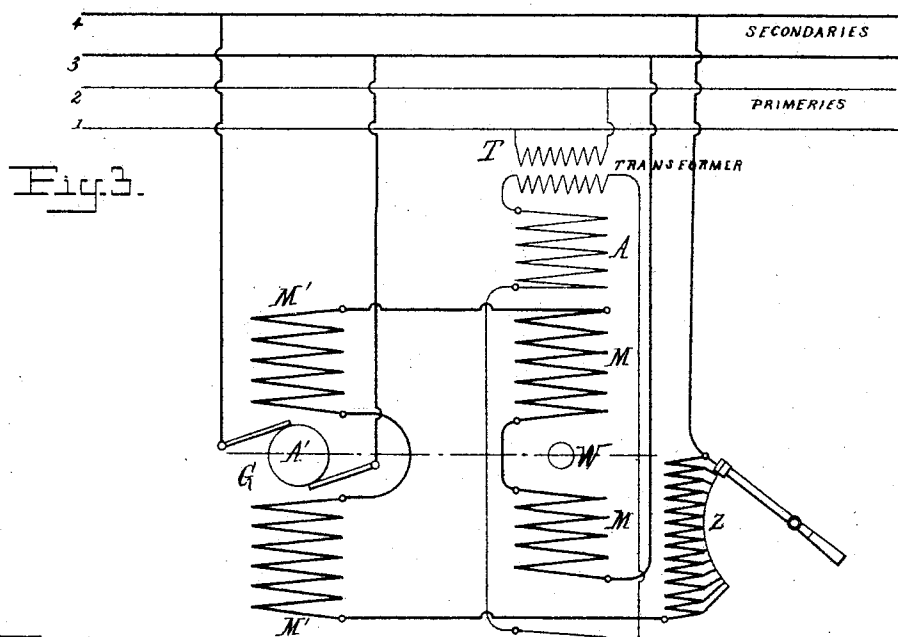


Fig. 4.

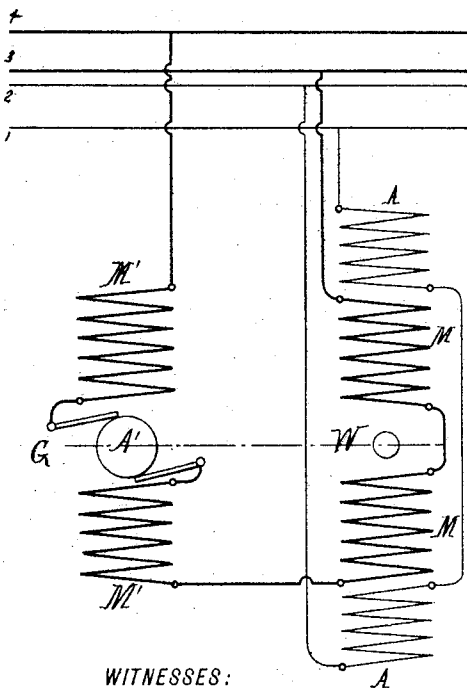
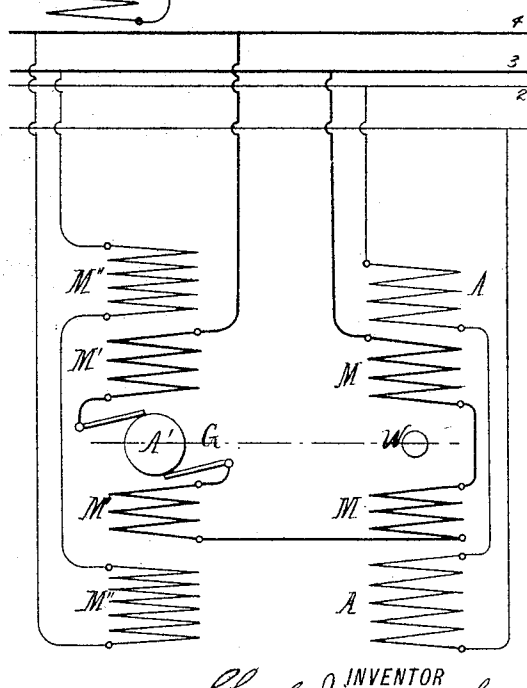


Fig. 5.



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UNITED STATES PATENT OFFICE.

CHARLES ZIPERNOWSKY, OF BUDA-PESTH, AUSTRIA-HUNGARY.

SYSTEM OF SUPPLYING CURRENTS TO ELECTRIC RAILWAYS.

SPECIFICATION forming part of Letters Patent No. 498,603, dated May 30, 1893.

Application filed March 7, 1891. Serial No. 384,112. (No model.)

To all whom it may concern:

Be it known that I, CHARLES ZIPERNOWSKY, a subject of the King of Hungary, residing at Buda-Pesth, Austria-Hungary, have invented a new and useful Improved System of Supplying Currents to Electrical Railways and other Appliances from Central Stations, of which the following is a specification.

By the present new system of distributing electrical energy it is intended to supply in an economical manner a very extended consumption area with suitable currents of electricity. This energy may be conducted by mains from central stations over a considerable distance, along which the consumption of the current takes place by the employment of consumption devices of any kind, more especially for purposes of transmitting power as for instance for electric railway lines and so on; or the current may be distributed by means of a suitably arranged feeder system of conductors over an extended distance or area for purposes of lighting, transmitting power, &c.

To advantageously conduct electrical energy to great distances, it is necessary, as is well known, to use high tensions, and this requirement is for practical reasons only to be met by the use of the alternating current. In the production of continuous currents, at the present time, it is difficult or even impossible to produce such high tensions of, for instance, a ten thousand voltage and over, as are required, while on the other hand such tensions, as is well known, are practically applicable with alternating currents. Alternating currents of high tension and conducted to great distances are conveniently transformed afterward at the places of the consumption devices into currents of any desired tension, or they are converted by means of suitable converting apparatus to satisfy all practical needs. According to this invention such alternating currents generated say at a central station and conducted to long distances are converted into continuous currents of any required tension for the working of motors and the transmission and distribution of power, and especially for the operation of electric railways. The consumption circuit is supplied with a continuous current by means of alternating current motors and continuous current dyna-

mos. The alternating current, it is true, is in the same manner as the continuous current, adapted to work motors at the same efficiency, but continuous current motors in starting under load have advantages over some alternating current motors, and especially synchronous alternating current motors, so that for certain motor purposes, as for working electric railway lines, which is the use had more particularly in view in this invention, the employment of a continuous current motor is preferred. Therefore the new system of distributing electrical energy uses the two kinds of electric current, *i. e.* an alternating current to be produced at the central station or other generating point and transmitted to distant points in the system, where a continuous current is needed for the consumption devices.

The general arrangement of the system is shown by the diagrams Figures 1 and 2 of the accompanying drawings, while Figs. 3 to 7, inclusive, show special constructions of current converting apparatus which may be used, and Figs. 8 and 9 show modified arrangements of circuits. The arrangement of the system is that a high tension alternating current is produced by alternate current generators at central stations C, and is supplied to primary main long distance conductors 1, 2 of Fig. 1, or to a feeder system such as is shown in Fig. 2. Alongside these primary mains or feeder system I provide common secondary conductors 3, 4 of Fig. 1, or a secondary system 3, 4 of Fig. 2, the secondary mains or system being supplied with a continuous current through the medium of a number of current-converting appliances W G placed at suitable points. These converting apparatus W G are, with or without the intercalation of alternating current transformers (as indicated in Figs. 2 and 3), connected up in parallel arc (Figs. 1 to 7) or in series (Fig. 8) on both sides of the primary and secondary conductors; or one part of the converting apparatus may be connected in series and the other in parallel arc, as illustrated for instance in Fig. 9. They generally consist of the combination of an alternating current motor W and a continuous current dynamo G, mechanically coupled together. The alternating current motor W for instance has its armature A connected up

in parallel with the primary mains and can be cut out by a hand switch, S, as illustrated in Fig. 6, or an automatic switch as illustrated in Fig. 7.

- 5 The regulation of the whole system is provided for maintaining the continuous current in the secondaries at a constant or nearly constant tension or potential by suitable and well known means of aiding and regulating
10 electricity.

The current-converting appliances are shown in Figs. 3 to 6, for instance, with several ways which may be employed of connecting up their respective coils of magnets M M' 15 M'' and armatures A A'. The continuous current dynamo G mechanically coupled with its alternating current motor W has to do double work; first, in commencing the work, it has to start the alternating current motor, which
20 having reached the necessary number of revolutions, then has its armature switched automatically or by hand to the alternate current conductors, and secondly, this dynamo has, after switching the motor to the primaries, to
25 serve as a continuous current generator and now driven by the motor, it has to supply the secondary common conductors 3, 4 with continuous current. The continuous current dynamo G is supplied with current from the
30 secondaries 3, 4 only in commencing the work, but the magnet coils M of the motor W are usually supplied with current from the secondary conductors.

A hand switch S to throw the armature coils A into circuit with the high tension conductors 1, 2 is illustrated in Fig. 6, while in Fig. 7 are illustrated means for moving a switch S' automatically. These means consist of a centrifugal governor B driven by a belt b
40 from the same shaft which carries the moving parts of the motor dynamo W G, the movable collar of the governor controlling a bell-crank c and a rod d, which latter is connected to the switch.

45 The current necessary for starting the converting appliances W G is always at disposal in the continuous current conductors inasmuch as such converting appliances are also provided in the alternate current central stations. The same object can be secured by well-known means, as for instance, current accumulating apparatus. Now either the whole energy supplied to the motor can be used for the generation of continuous current
55 for the secondaries, or a part of it can be taken off the motor-shaft as mechanical work and can be for instance used for exciting the magnet coils of the appliances. The operating or starting of the motor dynamo W G and the change of the work of motor and dynamo are done automatically, the current in the dynamo G decreasing in proportion as the motor runs with increasing velocity, so that it reaches zero when the motor has got the
65 necessary number of revolutions, and the motor is then switched to the alternate current conductors. The current flows then in the

opposite direction and is supplied back to the continuous current conductors. The dynamo G may have its field magnet coils as well in shunt as in compound winding or in series. 70

In Fig. 3 the magnet coils M and M' are shown in series, together with an additional regulating resistance Z and are derived by common wires from the continuous current
75 conductors. Similarly but separately the dynamo armature A' is connected in parallel with the continuous current conductors. In Fig. 4, on the other hand all the coils—except the alternate current armature A of the motor W (which is supplied from the alternate
80 current conductors), are connected in series with each other and connected up in parallel are to the continuous current conductors by a common couple of wires. The manner of connecting the coils in Fig. 5 is similar but with the variation that the dynamo magnets have a second series of coils M'', supplied with continuous current separately from the secondaries and regulating like a compound coil the
85 exciting of the field magnets of the whole of the apparatus. Besides these methods of connecting the coils, shown only as examples, several other methods are possible, with regulating resistances, which secure all
90 the various relations of the coils in the current-converting appliance or apparatus. By this arrangement of conductors with primary alternating currents supplied from alternate current generators or central stations
95 C and secondary common continuous mains or system and intercalated converting appliances W G, a system of distributing energy—especially for motor work and electric railway traffic—is obtained, which unites
100 the well-known advantages and economical qualities of the high tension alternating current with those favorable qualities of the continuous current, which guarantee a satisfactory result in continuously and surely
105 supplying very extended areas of long distances with currents for purposes of lighting, transmission and distribution of power or motor work of all kinds and especially also and in the first place for purposes of electric railway
110 work over great distances.

I claim as my invention—

1. In a system of electrical distribution and conversion, high potential alternating current primary conductors and low potential continuous current secondary mains in combination with a number of intermediate converting appliances, each consisting of a combined alternating current motor and continuous current dynamo connected up to the primary
120 and secondary conductors which latter are common to the several converting appliances, substantially as described, whereby the dynamo of each converting appliance is first supplied with continuous current from the common secondary mains to start its motor, and the latter then drives the dynamo to supply current to said secondary mains. 125

2. In a system of electrical distribution and

conversion, a high potential alternating current primary feeder system and low potential continuous current secondary mains in combination with a number of intermediate converting appliances, each consisting of a combined alternating current motor and continuous current dynamo, connected up substantially as described to the primary feeder system and to the secondary mains, which are common to the several converting appliances, whereby the dynamo of each converting appliance is first supplied with continuous current from the common secondary mains, to start its motor, and the latter then drives the dynamo to the supply current to said secondary mains.

3. In a system of electrical distribution and conversion, a high potential alternating current primary circuit and low potential continuous current secondary mains, in combination with a number of intermediate converting appliances, each consisting of a combined alternating current motor and continuous current dynamo, the latter being connected up to the secondary mains, which are common to the several converting appliances, while the field magnets of the motors are connected to the primary circuit and the armatures of the motors are connected to the secondary mains, all substantially as and for the purpose set forth.

4. In a system of electrical distribution and conversion a high potential alternating current primary circuit and low potential con-

tinuous current secondary mains, in combination with a number of intermediate converting appliances, each consisting of a combined alternating current motor and continuous current dynamos connected up, substantially as described, to the primary circuit and to the secondary mains, and switching means to throw the armature of the motor into and out of circuit with the alternating current primary conductors, all substantially as and for the purpose set forth.

5. The mode herein described of operating electrical railway and other electrical distribution systems, by supplying high tension alternating currents over long-distance primary conductors to operate thereby at a number of suitable points alternating current motors, driving continuous current dynamos from the motors, supplying low tension continuous current from such dynamos to common secondary mains, but supplying to each dynamo starting continuous current from the secondary mains to start the motor and then supplying alternating current from the primary conductors to operate the dynamo, all substantially as described.

In testimony whereof I have, this 21st day of January, 1891, signed my name to this specification in the presence of two subscribing witnesses.

CHARLES ZIPERNOWSKY.

Witnesses:

WILLIAM MÁRIÁSSY,
GERSTERÖDÖN.