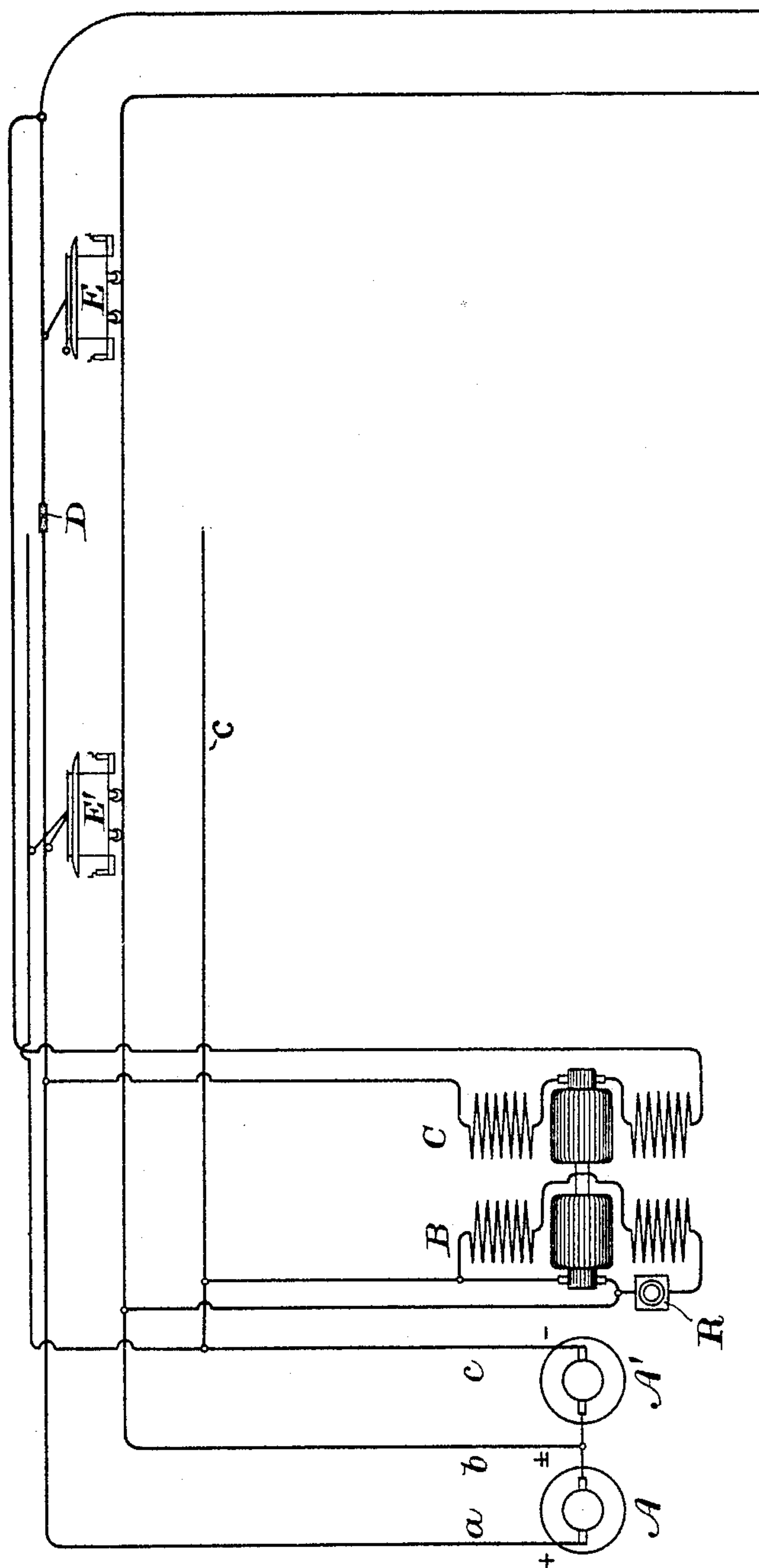


(No Model.)

E. W. RICE, Jr.  
SYSTEM OF DISTRIBUTION.

No. 584,482.

Patented June 15, 1897.



WITNESSES.

*A. H. Abell.*

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INVENTOR,  
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by  
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*Att'y.*

# UNITED STATES PATENT OFFICE.

EDWIN W. RICE, JR., OF SCHENECTADY, NEW YORK, ASSIGNOR TO THE  
GENERAL ELECTRIC COMPANY, OF NEW YORK.

## SYSTEM OF DISTRIBUTION.

SPECIFICATION forming part of Letters Patent No. 584,482, dated June 15, 1897.

Application filed February 7, 1896. Serial No. 578,338. (No model.)

*To all whom it may concern:*

Be it known that I, EDWIN W. RICE, JR., 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 Distribution, (Case No. 354,) of which the following is a specification.

My invention relates to systems of distribution, particularly to those of the three-wire type, in which a plurality of sources of electromotive force are connected in series, with a neutral wire running from the intermediate connection, as in various well-known systems already patented. The particular application of this system which I have illustrated and described is to an electric railway having peculiar features. I do not, however, mean to exclude its application to other systems, as it might be used under some circumstances, but its most extended application will be found in electric railways.

In a three-wire system as applied to electric railways (for example, as illustrated and described in the patent to William B. Potter, No. 548,388, issued October 22, 1895) it is sometimes desirable to divide up the road into sections, some of which are operated on the two-wire system. For instance, in suburban or interurban traffic the three-wire system as described in that patent would be employed, but where the road was extended within city limits it would be more convenient to operate by the two-wire or single trolley system and avoid the complications of numerous wires in the overhead structure where two trolleys were used. In such a system it would be most convenient, ordinarily, to put the divided source of electromotive force in some place where land is cheap and the station can be conveniently enlarged from time to time. This being the case there would necessarily be a drop in voltage between the station and city lines. It is the object of the present invention to compensate for the drop in voltage between the station and the two-wire part of the line and at the same time to reduce the unbalancing of the system, so that as the load increases the percentage of unbalancing becomes less. To this end I have devised the present method and apparatus for

effecting the proper distribution of load in such a system as that which I have indicated, the method consisting, briefly, in feeding the two-wire part of the line from both sides of the three-wire system, for which purpose I prefer a combination of apparatus such as is indicated diagrammatically in the accompanying drawing, which represents a three-wire system and a two-wire extension thereof supplied with current at proper potential from both sides of the three-wire system.

Referring by letter, A A' are two generators connected in series supplying the mains *a b c* with current, these being, respectively, the positive, neutral, and negative lines of the system, it being understood that in the case illustrated the ordinary railway-potentials would be used and that the neutral wire would be intermediate between the positive and negative, as is customary. The three-wire part of the system extends as far as the section-insulator D shown in the positive wire. Upon this part of the system a double-trolley railway-car E' is diagrammatically indicated, making traveling contact with both sides. Upon the two-wire part of the system beyond the insulator D a tram-car E, having a single trolley, is shown, the other trolley being held down out of engagement with the wire.

It is of course immaterial what form of car is used, as a separate system of tram-cars suited for street travel may be operated within the city and long-distance trains of larger cars run without.

So far the description of my invention conforms substantially to that in the patent already referred to. The improved means which I have provided for feeding the two-wire system, as illustrated, consists of two "dynamo-electric machines" (using the term in its general sense) B and C. B is a shunt-wound machine or motor coupled between the negative wire *c* and the neutral and having a resistance in its field-magnet circuit to determine its output. Upon the same shaft is fixed the armature of the series machine C, the field-magnet of this machine being, as is understood, in series with its armature and the machine itself being in series in the main *a*, the feeder passing from this main to the two-wire part of the system upon the other side



of the insulator D. By adjusting the resistance R the effect of the combination of machines just described may be determined, so as to supply the two-wire part of the system with current at any desired potential necessary to compensate for the drop, and, as will be observed, the two armatures being connected together, the machines are run from both sides of the system, the current passing from machine A through the series machine and being raised in potential, the series machine acting as a booster in well-known ways, while part of the work necessary to perform this operation is done by the shunt-motor B, which operates upon the side of the system supplied by the machine A'.

A feature of my invention is that the two-wire part of the line may be operated at any desired potential, the combination of machines being adjusted to suit required conditions. The potential might be higher or lower than the three-wire portion of the system, and the load would divide, as herein pointed out.

If the machines be located in the powerhouse or near the generators, they tend to assist the compounding, as the speed of the shunt-motor is proportional to the potential at its terminals. When the load rises, the potential also rises, (from the usual over-compounding of the main generators,) thus accelerating the motor, which in turn speeds up the booster, raising the voltage in accordance with well-known principles.

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

1. The method of maintaining potential upon a two-wire system of distribution connected with a three-wire system, which consists in supplying the two-wire system with energy from both sides of the three-wire system.

2. In a system of distribution, a divided

source of electromotive force, positive, negative and neutral wires, forming a three-wire system, a two-wire distribution, and means interposed between the systems for supplying the two-wire system with energy from both sides of the three-wire system.

3. In a system of distribution, a divided source of electromotive force, positive, negative and neutral mains forming a three-wire system, a pair of dynamo-electric machines connected one on one side of the system, the other upon the other side, and a two-wire system connected with the three-wire through the dynamo-electric machines; whereby the energy supplied to the two-wire system is derived from both sides of the three-wire.

4. In a system of distribution, a three-wire system, a two-wire system, a booster in one side of the three-wire system supplying current to the two-wire distribution, and a motor in the other side of the three-wire system, the motor driving the booster.

5. A three-wire distribution, a two-wire system connected therewith, a series machine in one side of the three-wire system feeding the two-wire distribution, and a motor in the other side of the system driving the series machine.

6. A three-wire distribution, a two wire system connected therewith, a dynamo-electric machine in one side of the three-wire system feeding the two-wire distribution, a motor in the other side of the system mechanically connected with and driving the dynamo, and means for regulating the output of the machines.

In witness whereof I have hereunto set my hand this 3d day of February, 1896.

EDWIN W. RICE, JR.

Witnesses:

B. B. HULL,

A. F. MACDONALD.