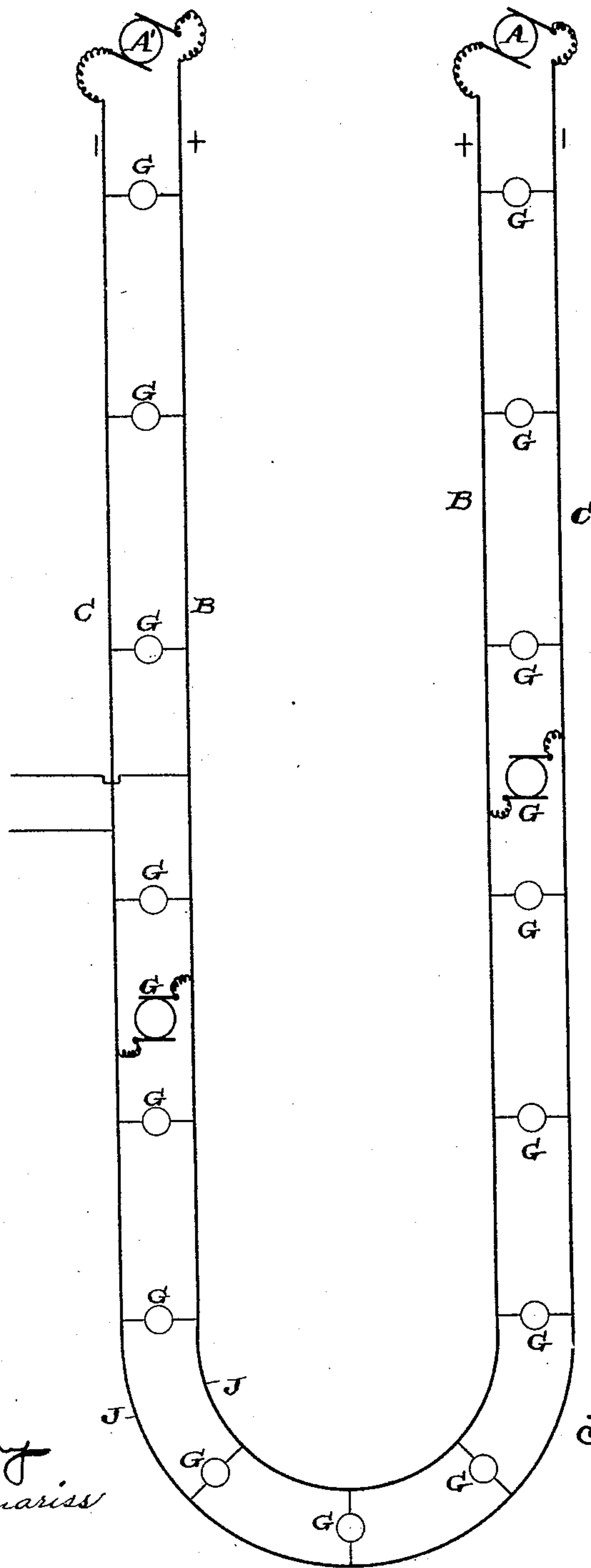


(No Model.)

F. A. LA ROCHE.  
SYSTEM OF ELECTRICAL DISTRIBUTION.

No. 453,597.

Patented June 2, 1891.



Witnesses:

*Henry Dwyer*  
*Walter Farnsworth*

Inventor:

*Frederick A. La Roche*  
*by his atty.*  
*Mark Wilkes Collet*

# UNITED STATES PATENT OFFICE.

FREDRICK A. LA ROCHE, OF PHILADELPHIA, PENNSYLVANIA, ASSIGNOR  
TO THE LA ROCHE ELECTRIC WORKS.

## SYSTEM OF ELECTRICAL DISTRIBUTION.

SPECIFICATION forming part of Letters Patent No. 453,597, dated June 2, 1891.

Application filed May 17, 1890. Serial No. 352,256. (No model.)

*To all whom it may concern:*

Be it known that I, FREDRICK A. LA ROCHE, a citizen of the United States, and a resident of the city of Philadelphia, and State of Pennsylvania, have invented a new and useful Improvement in Systems of Electrical Distribution, of which the following is a clear and sufficient specification, reference being had to the drawings annexed.

My invention relates to that class of systems of electrical distribution in which the current passes over leads, between which at various points are connected electrically the lamps or other translating devices, on which the electricity is consumed. In such systems heretofore much annoyance has been caused by the drop in electro-motive force or decrease in the difference of potential between the leads on the portions of the line away from the generator. This caused a greater strength of current to pass over the translating devices nearer the generator than over other translating devices of an equal resistance at a distance therefrom. Attempts have been made heretofore to remedy this defect by rendering the difference in potential between the leads more constant. Some of these attempts have been directed to causing the portions of current fed to each translating device to traverse an equal line-resistance, and have accomplished this by carrying one of the currents to the end of the circuit and returning it on a conductor parallel to the conductor bearing the current of the other sign. This device was objectionable on account of the great resistance introduced into the circuit. Another attempt to remedy the drop in electro-motive force, or, rather, to prevent it from being sufficient to interfere with the practical operation of the translating devices, has been to carry the current to "centers of distribution," whence comparatively short line conductors, offering consequently but slight resistance to the current, and on which consequently the drop in electro-motive force was slight, carried the current from these centers to the translating devices, which were electrically connected between these conductors. Prior to my invention, also, line-wires on which flowed currents of the same sign have been electrically connected at various points on the

circuit, whereby a more equable flow of current has been obtained on each. The fluctuations in strength of the current have also been diminished on the wire by inserting dynamos at different parts in the circuit.

With reference to the scientific principles on which I conceive my invention and discovery to rest I would mention the following phenomena: It is well known that an insulated conductor charged with static electricity has the same height of potential at all points on its surface, and that currents drawn from different points thereon exhibit identical qualities. It is also known that under certain circumstances a charge of static electricity is produced by the action of currents upon conductors not insulated. This charge has been considered to be the cause of the sparking of the circuit and the dynamo when the current is suddenly broken. Such a charge disappears almost immediately by conduction. The phenomena known as the "extra current," commonly attributed to induction, has also frequently been attributed to a charge of static electricity. It has also been conjectured that a static charge is created on a line-wire, which is connected to a pole of a working-generator and otherwise insulated and without means of electrical connection with the ground or with a lead connected with the other electrode of the generator.

It has frequently been conceived that if a charge of static electricity could be maintained upon the leads of electric circuit with a slightly greater difference of potential between these charges than between the currents on the leads the static charge would control the currents on the translating devices and a circuit on which the difference of potential between the leads was throughout the line substantially absolutely constant would be obtained.

My discovery, on which I base my invention, is that if two currents of the same sign and of substantially the same electro-motive force are projected in opposite directions over the same metallic lead and the other electrodes of the generators are connected with the ground this lead will acquire a height of potential which will be practically absolutely equal throughout its length, and if the other



electrodes of the generators are connected electrically to a second metallic lead the difference in potential between the two leads will be substantially absolutely constant throughout the length of the leads. This result takes place in any reasonably long circuit—say two and one-half miles of line-wire—so thoroughly even on a circuit of high resistance that the variation in the strength of current (which is a direct function of the electro-motive force at the point of electrical connection between the translating-circuit and the lead) passing over two translating devices of equal resistance, (sixty ohms,) placed one near the extremity of the circuit and one near the middle point, is practically exactly equal, (the difference being less than one-thousandth of an ampère,) and the difference of electro-motive force at the points of electrical connection with the leads of the branch circuits is also practically constant, (differs in above case less than a tenth of a volt.) This constancy of potential throughout the line is unaffected by the number of translating devices electrically connected between the leads or of the quantity of current used. I explain this discovery on the hypothesis that two currents of electricity of like sign and substantially equal electro-motive force thus transmitted act on each other to charge the leads with charges of static electricity, the difference in potential between which is slightly greater than the difference of potential between the currents on the lead, and that the constantly equal difference in potential between these charges controls the strength of the current on the translating devices electrically connected between the leads. By the use of currents of equal electro-motive force I cause also points of equal electro-motive force of the current itself to arrange themselves symmetrically around a center of resistance between the generators and cause the drop in electro-motive force of the current to be very greatly decreased, besides producing the symmetrical arrangement.

The figure is a plan view of my invented system.

In applying my discovery to produce my practical system I connect, through the leads B B', the like electrodes of the two generators A A' of substantially the same electro-motive force. The practical though empirical test of the generators, being sufficiently equal in electro-motive force, is for an ordinary circuit that the point must exist in the line between the generators at which the electro-motive force of the current which either generator operating by itself will produce is equal. In order to secure the action of the currents upon each other to produce the desired result, I find so far that the generators have to be at the extremities of the circuit. I do not, however, conceive that this will continue to be a limitation of my discovery, but that it is one that is requisite until a more through practical knowledge of opera-

tion of the system and of the exact actions of the currents upon each other has been attained.

Between the leads B B, I electrically connect the translating devices G G G G, which may be lamps or other devices on which the electricity is consumed. I interpose resistance, if any is employed, in direct proportion to the current required without regard to the distance from the generator of the point of connection with the main circuit. The difference in potential being always, as before stated, constant between all portions of the leads, the necessity for resistances proportional to the varying differences of potential between the leads on an ordinary circuit is not felt in my invented system. These translating devices do not make up to any reasonable number any difference in the equality of height or constancy of difference of potential. I have tested a large number in the circuit and have found the difference of potential the same and as constant as where but two were connected between the leads.

I prefer to run one of the generators, as A', merely to produce electro-motive force and to furnish the quantity of current required from the other, as A. I have found a very convenient way of operating my system when dynamos are used as generators to drive the dynamo running for electro-motive force alone by means of a motor fed from the circuit after an initial impulse has been given to it from a storage-battery or similar means. In this way I can obviate the necessity for steam-power at each end.

In working my system I start the dynamos or other generators in the usual way, taking care that the electro-motive force generated by each is substantially equal, and the substantially absolutely equal difference in potential between the leads throughout their length becomes almost instantly accomplished.

I do not claim, broadly, placing generators in a system of electrical distribution, their like electrodes electrically connected with each other and to the same conductor, nor such a system with translating devices connected between the leads at points upon said leads between the generators; nor do I claim a system in which the strength of current is equalized by connecting at various places conductors bearing currents of the same sign; neither do I claim any system in which the generators or the currents are arranged for equal strength alone on the main-line conductors.

What I claim, and desire to secure by Letters Patent, is—

1. The combination, in an electric circuit, of two generating sources of substantially equal electro-motive force, a lead connecting electrically the positive poles of said sources, a lead connecting electrically the negative poles of said sources, and translating devices electrically connected between said leads at



various points, substantially as and for the purpose described.

2. The combination, in an electric circuit, of a lead impressed at the opposite ends by  
5 currents of substantially the same electro-motive force and of the same sign, a lead bearing the electricity of the opposite sign, translating devices electrically connected between said leads at various points, and sources  
10 of electricity adapted to furnish the electricity to said leads, substantially as described.

3. The combination of metallic leads, each

impressed at the opposite ends by a current of like sign and substantially the same electro-motive force, and translating devices electrically connected between said leads at various points along the line, and sources of electricity adapted to furnish the electricity to said leads, substantially as described.

FREDRICK A. LA ROCHE.

Witnesses:

MARK WILKS COLLET,  
JOS. MCMORRIS, Jr.

It is hereby certified that Letters Patent No. 453,597, granted June 2, 1891, upon the application of Fredrick A. La Roche, of Philadelphia, Pennsylvania, for an improvement in "Systems of Electrical Distribution," was erroneously issued to the La Roche Electric Works as owner of the entire interest in said invention; that said Letters Patent should have been issued to said *Fredrick A. La Roche and the La Roche Electric Works jointly*, said La Roche Electric Works being assignee of one-half interest only in said invention as shown by the assignments of record in this office; and that said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed, countersigned, and sealed this 28th day of July, A. D. 1891.

[SEAL]

CYRUS BUSSEY,  
*Assistant Secretary of the Interior.*

Countersigned:

NATHANIEL L. FROTHINGHAM,  
*Acting Commissioner of Patents.*