

(No Model.)

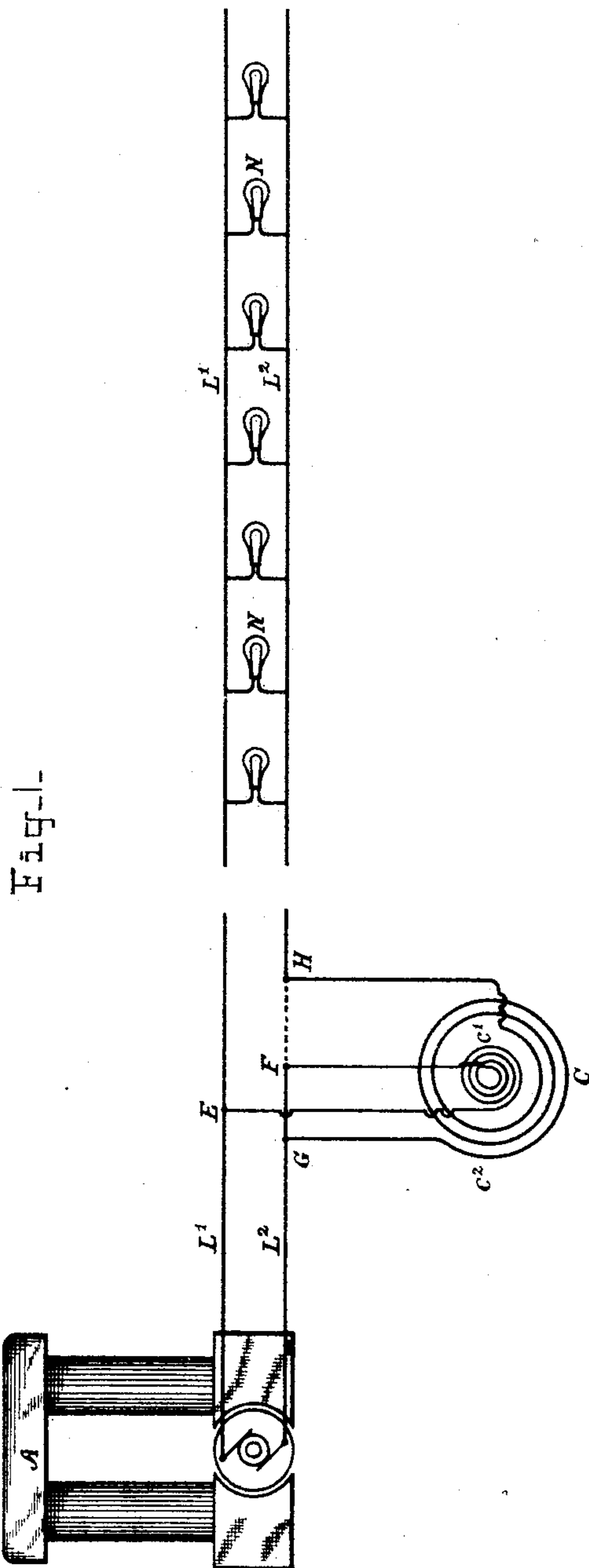
2 Sheets—Sheet 1.

J. HOPKINSON.

METHOD OF CONTROLLING CURRENTS UPON ELECTRIC CIRCUITS.

No. 444,553.

Patented Jan. 13, 1891.



WITNESSES:

George Brown Jr.
Wm. B. Brown

INVENTOR,

JOHN HOPKINSON.

Charles A. Tully
Att'y.

(No Model.)

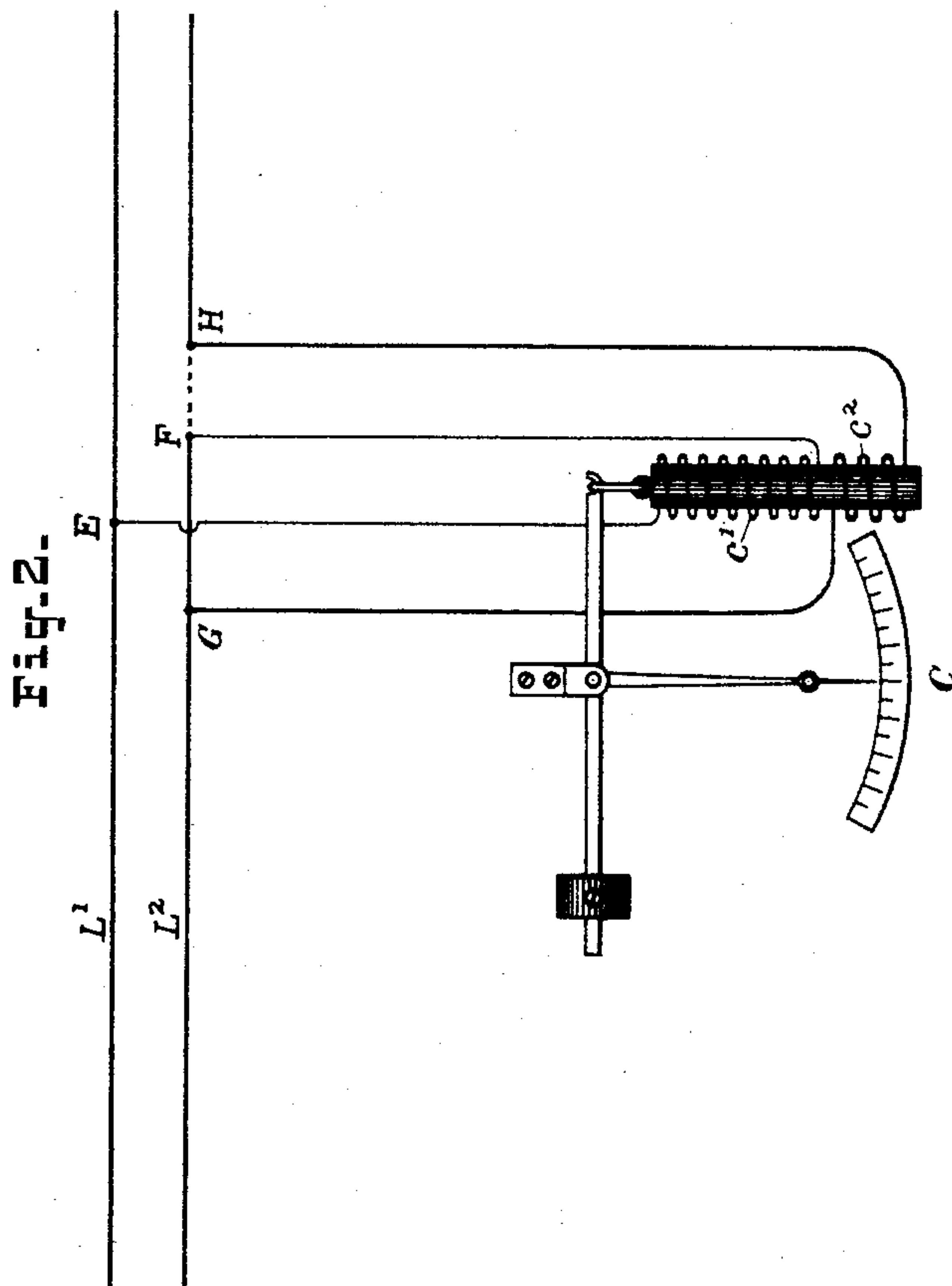
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METHOD OF CONTROLLING CURRENTS UPON ELECTRIC CIRCUITS.

No. 444,553.

Patented Jan. 13, 1891.



WITNESSES:

George Brown, Jr.
James H. Smith.

INVENTOR,

JOHN HOPKINSON.

Charles A. Terry.

Att'y.

UNITED STATES PATENT OFFICE.

JOHN HOPKINSON, OF HOLMWOOD, ENGLAND, ASSIGNOR, BY MESNE ASSIGNMENTS, TO THE WESTINGHOUSE ELECTRIC AND MANUFACTURING COMPANY, OF PITTSBURG, PENNSYLVANIA.

METHOD OF CONTROLLING CURRENTS UPON ELECTRIC CIRCUITS.

SPECIFICATION forming part of Letters Patent No. 444,553, dated January 13, 1891.

Application filed February 23, 1889. Renewed November 10, 1890. Serial No. 370,858. (No model.) Patented in England July 27, 1882, No. 3,576.

To all whom it may concern:

Be it known that I, JOHN HOPKINSON, a subject of the Queen of Great Britain, residing in Holmwood, Wimbledon Common, South-west, Westminster Chambers, England, have invented a certain new and Improved Method of Indicating and Controlling Currents upon Electric Circuits, (Case No. 280,) (for which Letters Patent of Great Britain No. 3,576, bearing date of July 27, 1882, have been granted to me,) of which the following is a specification.

My invention relates especially to a method of determining the difference of potential existing at a given point in a system of electric circuits supplying translating devices, the special object being to provide an indicator in which the varying drop or loss of potential upon a circuit may be readily compensated for at all times. When current is supplied by means of main conductors to points more or less distant from a central station, there is a fall of potential due to the resistance of the conductors, and as the current flowing increases the fall of potential also increases, so that if it is desired to maintain a constant difference of potential at the distant points special means must be employed for determining the loss under any given load. To accomplish this I employ an indicator wound with two opposing coils, one of comparatively high resistance and connected across the terminals of the source of electricity and the other of low resistance so connected as to be traversed by all or a determinate proportional part of the current flowing to the translating devices. If now the current flowing to the work-circuit increases, the effect of the series-coil increases correspondingly. If the difference of potential at the terminals of the source be maintained at a normal value, the difference of potential at the terminals of the translating devices will not be as great as before because of the greater loss or drop upon the circuit which accompanies the transmission of the increased current, so that in order to maintain the proper difference of potential upon the work-circuit it is necessary to increase the difference of potential at the

terminals of the source. The increase in difference of potential thus required for compensating for the drop or loss may be determined by properly adjusting the relative effects of the two coils of the indicator.

In the accompanying drawings, there is shown in diagram, in Figure 1, an organization of apparatus for carrying out the invention. Fig. 2 is a diagram showing the application of the coils to an indicator.

Referring to the figures, A represents a dynamo-electric machine, and N lamps or other translating devices of any suitable character connected in multiple arc between the conductors L' L^2 , leading from the terminals of the machine.

The indicating apparatus is represented at C. It is constructed with two coils c' c^2 , opposing each other. The one coil c' is connected across the poles of the generator A or between the lines L' L^2 at the points E and F. This coil is of fine wire and has a comparatively large number of convolutions. The second coil c^2 is of thick wire having comparatively few convolutions. It is connected either directly in one of the conductors L' or L^2 or in a circuit derived therefrom, so that either the whole current or a proportional part thereof will pass through it from the point G to the point H. The current passing through the coil c^2 opposes in effect that through the shunt-coil c' . I usually prefer to use a proportional part of the current, rather than all the current passing through the line L^2 . It is then easy by properly adjusting the relative resistance of the two circuits including the two coils to indicate the compensation required for any given value of resistance of the main lines, and thus secure a constant difference of potential between the two conductors at the distant points. The shunt-coil c' may be made of German silver for the purpose of preventing it from varying materially in its resistance; but this is not necessary.

The differential apparatus may assume various different forms without departing from the essential features of the invention. It may be arranged to indicate directly to the

eye when the value of the difference of potential upon the work-circuit requires regulation. It will be evident that an increase of current flowing to the main line will increase the effect of the coil c^2 of the indicator, thereby tending to correspondingly operate the indicator. If no change takes place in the difference of potential at E F, then the indicator will be thrown out of balance. The increased effect of the series-coil c^2 in the indicator may be balanced by increasing the difference of potential between the points E and F. By properly adjusting the relative effects of the two coils, therefore, the additional difference of potential required to bring the indicator to its normal position may be made to exactly compensate for the increased drop upon the line, so that the difference of potential at the terminals of the translating devices will be maintained approximately constant if the index of the indicator is kept in a normal position.

I claim as my invention—

1. In a system of electrical distribution, the hereinbefore-described method of controlling or indicating the difference of potential upon the work-circuit, which consists in producing an effect proportional to the currents flowing to the work-circuit, opposing thereto an effect proportional to the difference of poten-

tial at the source of current, and in causing the variations in the effect produced by a variation in the current flowing to the work-circuit to approximately equal the variations in the effect proportional to the difference of potential at the source of current.

2. In a system of electrical distribution, the hereinbefore-described method of controlling or indicating the difference of potential upon the work-circuit, which consists in producing an effect proportional to the currents flowing to the work-circuit, opposing thereto an effect proportional to the difference of potential at the source of current, and in causing the variations in the effect produced by a variation in the current flowing to the work-circuit to approximately equal the variations in the effect produced by such change in the difference of potential at the source as is required to compensate for the variation in the loss or fall of potential upon the circuit.

In testimony whereof I have hereunto subscribed my name this 9th day of February, A. D. 1889.

JOHN HOPKINSON.

Witnesses:

S. CRANSON,

E. A. HALL,

*Both Clerks to Messrs. John Newton & Sons,
9 Birchin Lane, London, Public Notaries.*