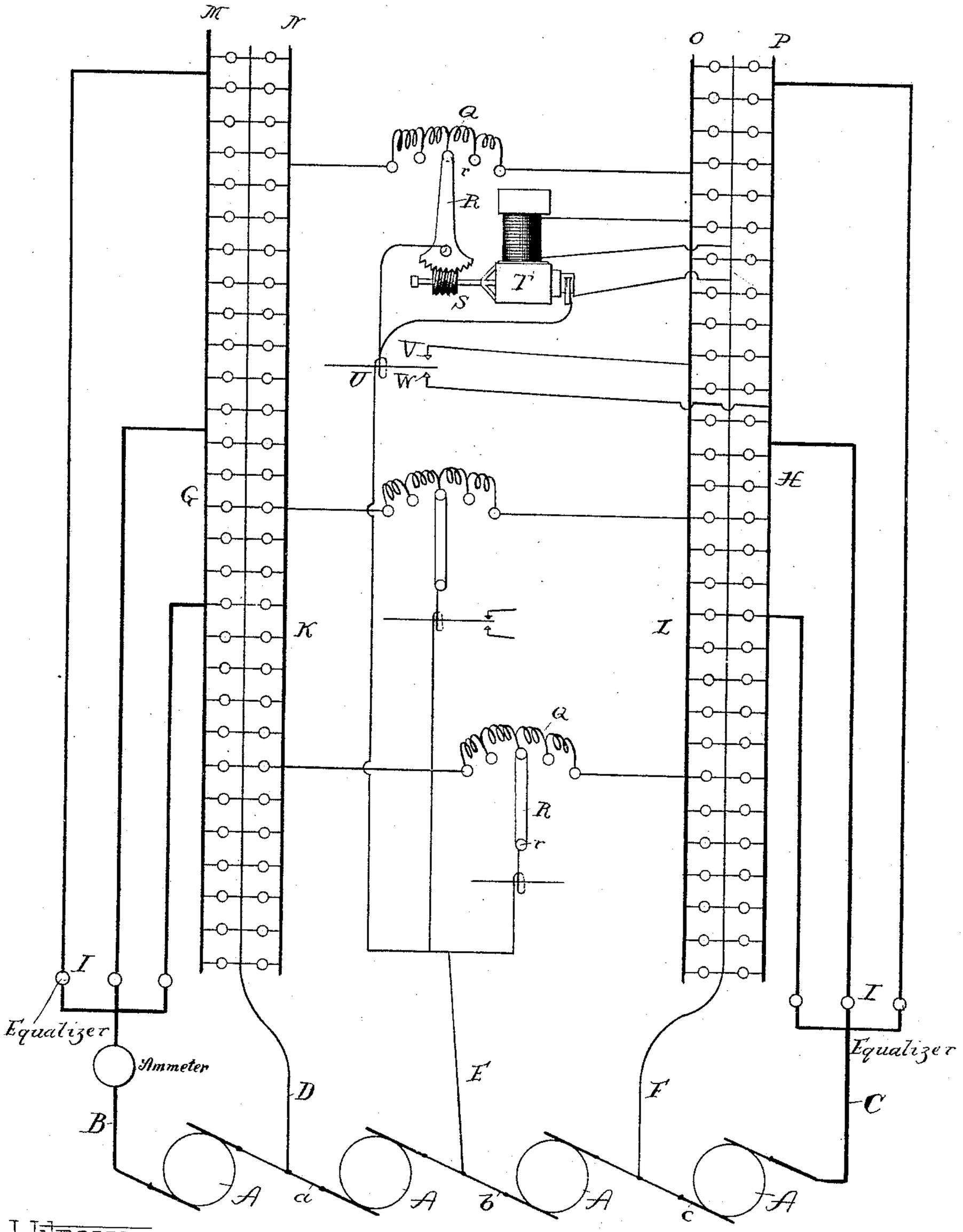
(No Model.)

J. A. LIGHTHIPE.

MULTIPLE WIRE SYSTEM OF ELECTRICAL DISTRIBUTION.

No. 407,485. Patented July 23, 1889.



Witnesses.

G. A. Tauberschmidt.

Wm. A. Rosenbaum

Inventor.

James A. Lighthipe

by his Atty.

W. J. Johnston

UNITED STATES PATENT OFFICE.

JAMES ALFRED LIGHTHIPE, OF WILMINGTON, DELAWARE, ASSIGNOR TO HIMSELF, GEORGE W. BRATTON, OF PHILADELPHIA, PENNSYLVANIA, AND HENRY NUNEZ, OF NEW YORK, N. Y.

MULTIPLE-WIRE SYSTEM OF ELECTRICAL DISTRIBUTION.

SPECIFICATION forming part of Letters Patent No. 407,485, dated July 23, 1889.

Application filed April 25, 1888. Renewed December 28, 1888. Serial No. 294,848. (No model.)

To all whom it may concern:

Be it known that I, JAMES ALFRED LIGHTHIPE, a citizen of the United States, residing in Wilmington, in the county of New Castle and State of Delaware, have invented certain new and useful Improvements in Multiple-Wire Systems of Electrical Distribution, of which the following is a specification.

My invention is designed to provide means whereby electric incandescent lamps or other similar translating devices can be arranged in multiple series in as many circuits as may be desired or as may prove economical under varying circumstances. To a certain extent the result which I seek is accomplished by what is known as the "three-wire system of electrical distribution." This system is in extensive use and works efficiently within its limitations. It has been found, however, that when attempts have been made to increase the number of circuits beyond three trouble has arisen from the fact that there was no way of controlling any of the series of lamps except the two upon the outside. Assuming, for example, that the lamps are arranged in three series, no way has yet been found for compensating for varying resistances in the inner series except within very narrow limits. I illustrate a system in diagram in which four rows or series of lamps are employed and in which I am able to maintain a perfect regulation of the lamps in each series, as will appear hereinafter. The whole constitutes a five-wire system of electrical distribution.

In the drawing, A A A A are four generators of electricity, preferably dynamo or magneto electric machines. These generators are connected in series by means of suitable wires *a b c*, as shown. From the two outer generators are led main wires or feeders B C, and from the connecting-wires *a b c* are led, respectively, the neutral compensating conductors D E F. The main conductors are branched, as shown, and the branches are led to the wires G and H. In each branch is placed an equalizer I, so that the number of volts delivered at the points of connection can be regulated at will. Moreover, an ammeter J is provided to indicate constantly the condition of the circuit. On either side of the wires D and F are arranged a series of lamps or other translating devices. One sesies of lamps, for example, is connected up between the wires G and D and another between D and an inner conductor K. Similarly two series of lamps are joined between the conductors F, H, and L. For convenience the series will be designated from left to right as M N O P.

Now the difficulty has been hitherto that in case of any great variation in the resistance of the lamps in the inner series, caused by cutting out any considerable number of the lamps, too great a current would be thrown upon the compensating conductors or upon the lamps themselves. This has proved a serious defect which it has not been possible to remedy.

I accomplish the result automatically by means which are illustrated in the center of the drawing. It will be seen that I extend my central compensating conductor E to the arm R of a variable resistance Q. More strictly, I branch the said conductor and connect the branches with three variable resistances in the same way. The arm R of each variable resistance is pivoted at *r* and provided at its extremities with a segmental rack engaging with a worm S. Now this worm is mounted upon the shaft of an electric motor T, whose field-magnets are connected up between the wires H and L. In the circuit of each branch of the wire E, I locate a galvanometer U, which is made up of one turn of copper ribbon. The needle of the galvanometer is joined to one terminal of the armature of motor T, the other terminal being joined to the wire H. Within the range of motion of the needle are terminals V W, joined, respectively, to the wires L and H.

The operation is as follows, it being understood that the different series will contain as nearly as possible the same number of lamps or other translating devices: Ordinarily when all the lamps are burning or about an equal number in all the series, the current will pass across from main to main, the compensating conductors carrying very little or

no current. If the balance is disturbed by some of the lamps in the series M or P being cut out, the excess of current is taken up by one or the other of the compensating conductors D or F, and no trouble results. If now the disturbance takes place in one of the inner series, there will be a change of current in the wire E and its branches, causing an effect at the galvanometers U. This effect will vary according to the direction of the current in the wire E, thereby causing the galvanometer-needle to swing into contact with one or the other of the terminals V W. As a result, the armature of the motor P will be traversed by a current the direction of which will determine its direction of rotation. Accordingly the arm R will be swung in one direction or the other, cutting in or out resistance to compensate for the inequalities on opposite sides of the circuit. Thus it will be seen that the automatic variable resistance which I have provided constitutes an efficient compensator for the inequalities of resistance in the inner series of the lamps.

In common with what are known as the "three-wire system of electrical distribution," my system herein described possesses the element of economy in a larger degree. Moreover, as compared with the three-wire system, my own is as largely economical of wire as that is in comparison with the older system. In order to feed and control successfully the four series of lamps which I have shown in my drawing, two three-wire systems would have to be employed.

The advantages of my invention may be applied to any multiple-wire system having more than three wires, and I have simply illustrated a five-wire system as a type.

Having now described my invention, what I claim is—

1. In a system of electrical distribution, a series of generators, two or more groups of translating devices, compensating conductors for the groups connecting with the source of energy, and a central compensator connected with the groups through one or more variable resistances.

2. In a system of electrical distribution, a series of generators, two or more groups of translating devices, and compensating conductors therefor connecting with the source of energy, and one or more central compensators connected to the groups through one or more automatic variable resistances.

In witness whereof I have hereunto affixed my name in the presence of two subscribing witnesses.

JAMES ALFRED LIGHTHIPE.

Witnesses:

L. H. LIGHTHIPE,

CHAS. H. SMITH.