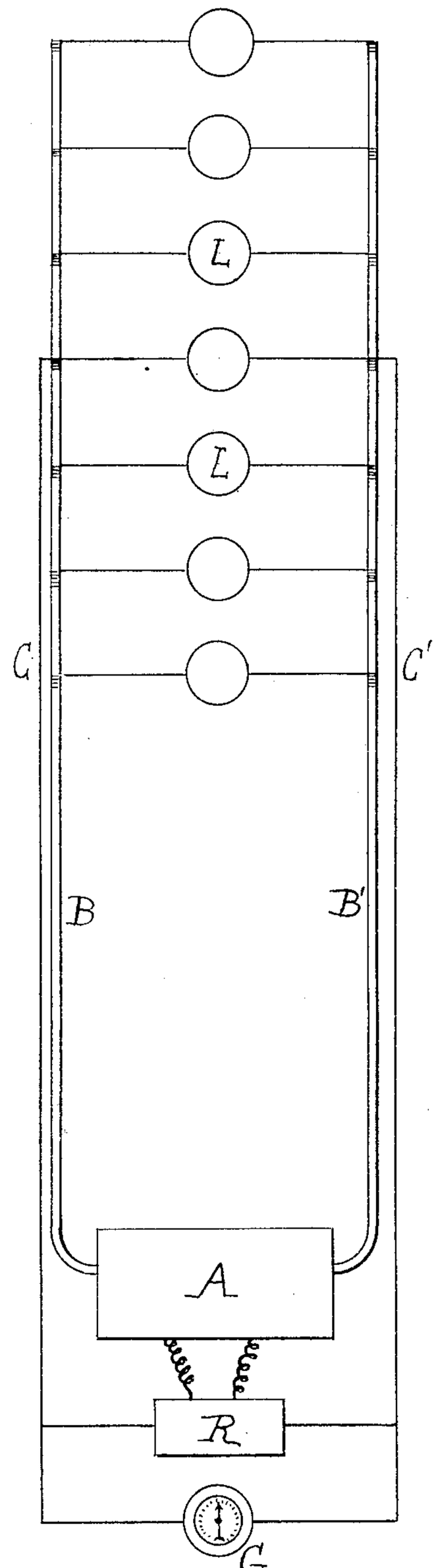
(No Model.)

H. S. MAXIM.

SYSTEM OF ELECTRICAL GENERATION AND DISTRIBUTION.

No. 256,910. **Patented Apr. 25, 1882.**



Witnesses;-
Parker W. Page.
Wm. H. Bates.

Inventor;-
Hiram S. Maxim

UNITED STATES PATENT OFFICE.

HIRAM S. MAXIM, OF BROOKLYN, ASSIGNOR TO THE UNITED STATES ELECTRIC LIGHTING COMPANY, OF NEW YORK, N. Y.

SYSTEM OF ELECTRICAL GENERATION AND DISTRIBUTION.

SPECIFICATION forming part of Letters Patent No. 256,910, dated April 25, 1882.

Application filed April 21, 1881. (No model.)

To all whom it may concern:

Be it known that I, HIRAM S. MAXIM, a citizen of the United States, residing in Brooklyn, in the county of Kings and State of New York, have invented certain Improvements in Systems of Electrical Generation and Distribution, of which the following is a specification.

My invention appertains to the art of generating and distributing electric currents from a central or main generating-station to devices for utilizing the same, as in the deposition of metal or in the production of heat, light, or power; and it relates more especially to systems of lighting in which a large number of incandescent lamps are employed, its object being to maintain a constant ratio between the amount of current generated or thrown into the line and the number of active lamps in circuit.

In systems of this kind the usual method of distributing the currents is by means of two main conductors, connected respectively with the positive and negative sources of current from one or a number of dynamo-electric machines located at a central generating-station. With these conductors the lamps are connected in multiple or derived circuits and a regulator employed, also in a derived circuit the functions of which are to cause an increase or reduction in the amount of current generated, according to the number of lamps in circuit. The regulators exert an influence usually on the generative capacity of the machines themselves, and for this reason they are placed in their immediate vicinity and the current actuating them obtained by tapping the main wires close to the machines. By this means it would appear that the light in the individual lamps should be maintained of uniform intensity irrespective of the number in circuit. This, however, is the case only when the lamps are situated in the immediate vicinity of the generators, or when from other causes the resistance of the main conductors does not enter to an appreciable extent as a factor in the determination of the total resistance of the circuit. As a theoretical explanation of this phenomenon, let it be supposed that a certain isolated district is to be illuminated by a current from a central station so remote that the length or size of the intervening conductors offers a resistance of one ohm to the passage of the current. If the conductors be joined by a single lamp of one hundred ohms resistance, a complete circuit is formed containing a total resistance of one hundred and one ohms, of which $\frac{100}{101}$ is contained in the lamp circuit, while $\frac{1}{101}$ is contained in the conductors, which offer therefore a little less than one per cent. of the total resistance. If the number of lamps be increased to ten, the total resistance is reduced to eleven ohms, of which the main conductors now constitute nearly ten per cent. of the whole. If the number of lamps be still further increased to one hundred, the resistance becomes only two ohms—one for the lamps and one for the main conductors—so that these latter now constitute fifty per cent. of the total resistance. It is therefore evident that a regulator included in a cross-circuit taken off close to the generator and having this constant resistance to contend with will not respond properly to the variations of resistance due to the removal or insulation of lamps in the multiple circuits, for the resistance which influences the regulator being made up of two elements—one variable and representing the resistance of the lamp-circuits, the other constant, representing that of the main conductors—it obviously follows that the amount of current thrown into the line by the regulator will always be less than the lamps require, the deficiency being greater as the number of lamps is increased.

To overcome this difficulty and to regulate the intensity of lights placed at any distance from the generator, I have devised the means illustrated in the accompanying drawing, and which consists in operating the regulator by a circuit taken across from the main lines at a point where their influence as a varying factor in the resistance will be nearly if not entirely eliminated.

The general disposition of circuits will be understood by reference to the drawing, where A represents one or more generators, from which the conductors B B′ lead off to a distant group of lamps, L L. C C′ is the regulator-circuit taken off from the main wires at a point as near as may be to the center of the group

of lamps. The wires C C′ are brought back to the station, where they connect through the regulator R and galvanometer G, which latter is used in its ordinary capacity to indicate the condition of the line. By this means the regulator, when once adjusted, is controlled entirely by the variations in resistance due to the removal or insertion of the lamps, as whatever the resistance of regulating-circuit may be it is affected in the same manner as though it were taken from the main wires close to the generator in cases where their resistance is inappreciable. And so, in general, when the resistance of the main conductors intervening between the source of supply and the branches or cross-circuits containing the lamps amounts to an appreciable element of the total resistance of the circuit, I control the amount of current generated or thrown into the line by a regulator included in a branch or derived circuit, which is taken off from the main conductors at or near the center of the group of lamps and brought back to the generator.

The character of the regulator employed or its location in the branch circuit by which it is operated will of course be governed by circumstances. For general convenience, however, I prefer to use a regulator which shifts the position of the commutator-brushes and to locate it in close proximity to the generator or the engine which drives it.

It may be stated that in the foregoing the regulator has been left out of the consideration of the resistance due to the connections between the two main conductors, and this notwithstanding the fact that it is in a constantly closed circuit. The regulating-magnets, however, are of very high resistance and take up so little of the current that they may be disregarded entirely.

Having thus described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. The combination, with a main circuit and a group of branch or multiple-arc circuits containing devices for utilizing and converting the current, of a branch circuit taken off from the main conductors at or near the center of the group of branch circuits and containing devices for regulating the amount of current supplied to the main circuit, substantially as set forth.

2. The combination, in a system for generating and distributing electric currents, of one or more generators, A, main conductors B B, and two or more cross-circuits containing the devices for converting the current, with circuit C C′, taken from the main wires at or near the center of the group of cross-circuits and brought back to operate the regulator R, connected with the generators, as and for the purpose set forth.

In testimony whereof I have hereunto set my hand.

HIRAM S. MAXIM.

Witnesses:
GEO. F. RILEY,
PARKER W. PAGE.