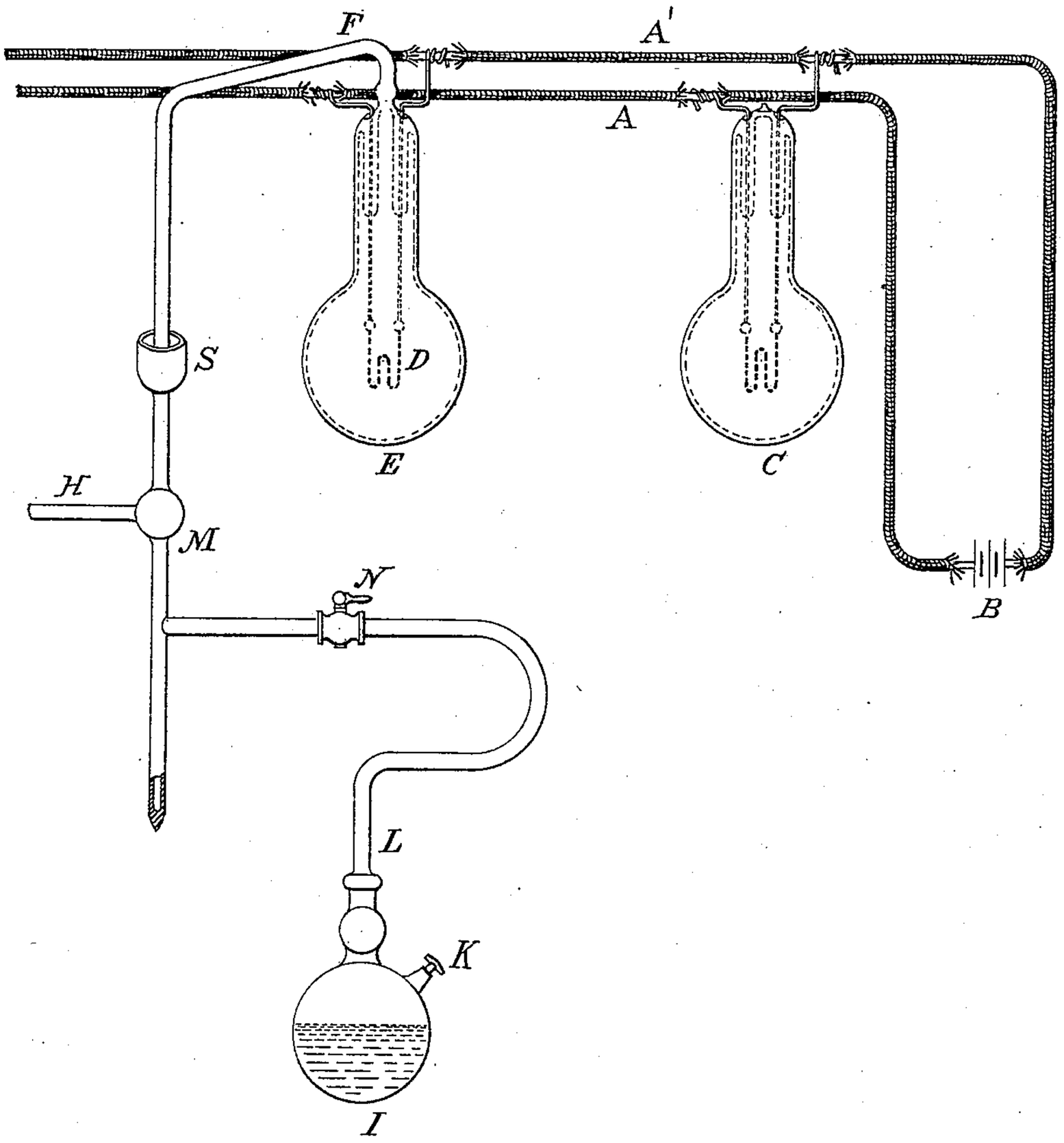
(No Model.)

H. S. MAXIM.

MANUFACTURE OF FILAMENTS FOR ELECTRIC LAMPS.

No. 405,170. Patented June 11, 1889.



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MANUFACTURE OF FILAMENTS FOR ELECTRIC LAMPS.

SPECIFICATION forming part of Letters Patent No. 405,170, dated June 11, 1889.

Application filed January 14, 1881. Serial No. 24,001. (No model.) Patented in England February 15, 1881, No. 639, and in Germany February 21, 1881, No. 15,301.

To all whom it may concern:

Be it known that I, HIRAM S. MAXIM, of the city of Brooklyn, in the county of Kings and State of New York, have invented a new and useful Mode of Preparing Carbons for Electric Lamps, (for which I have obtained German Letters Patent No. 15,301, dated February 21, 1881, and British Letters Patent No. 639, dated February 15, 1881,) of which the following is a specification.

This invention relates to electric lamps of the class known as "incandescent," in which the light-giving portion is a continuous conductor of high resistance, commonly of carbon.

The object of the invention, hereinafter fully explained, is to provide a means of preparing these carbons, whereby they may be made of a uniform standard illuminating-power.

By the modes heretofore generally practiced for the making of electric carbons it is impossible to obtain any considerable number which, under a current of given intensity, will develop the same light. Where the conductors are made out of the carbon deposits formed on the interior of gas-retorts, whether by shaping such carbon into the required form with cutting-tools or by grinding it up and then molding it into shape under pressure, it is practically impossible to secure two conductors having precisely the same radiating-surface, or, if this, having the same resistance. The same difficulty attends the ordinary modes of manufacturing incandescent conductors by shaping a fibrous material into the desired form and then carbonizing it. Differences in the superficial area of the carbons, or in their resistance, will produce corresponding differences in their relative illuminating-power. Manifestly, in any system of electric lighting equality of light-giving capacity in the lamps employed is an object exceedingly desirable. The mode by which this result may be attained, and which constitutes the present invention, consists, generally stated, in subjecting the carbon conductor, while surrounded by an atmosphere of hydrocarbon vapor or other carbonaceous gases which deposit their carbon at high temperatures, to the action of an electric current in the presence of some standard light. The intense heat generated by the passage of the current dissociates the elements of the gas, and the carbon set free therefrom is deposited in a state of exceedingly minute subdivision in the pores and upon the exterior of the carbon under treatment, gradually reducing its resistance and correspondingly changing its illuminating capacity. When this has been brought to the desired point, as indicated by the standard of comparison, the operation of building up is arrested, and the finished carbon is ready to be sealed up in the globe in which it is to be used.

The best means heretofore discovered for regulating the extent of the change to be effected in the resistance of electric carbons in order to produce uniformity of illuminating-power is to use a standard electric lamp, connecting it with the circuit in the same manner as the carbon to be treated. This method is fully illustrated in the accompanying drawing, in which—

A A′ are the main wires of the circuit leading from the source of electric energy B.

C is a standard lamp placed in a branch between the main wires of the circuit, and D is a carbon to be treated, arranged in a coordinate branch between the two main wires. These branches are provided with switches of any known and suitable character. The carbon D is approximately of the same size as that of the lamp C, but is of higher resistance, and is inclosed in a glass receiver E, whose only outlet is the tube F. Through this tube the globe is attached to an exhausting-pipe at S by any tight connection, preferably a joint of ground glass and a mercury seal. A tube H leads to an exhausting apparatus capable of producing a high vacuum—such, for instance, as a Sprengel or a Geissler pump.

I is a vessel containing gasoline or some other very volatile hydrocarbon oil. This vessel may be filled through the tube K, which should be hermetically sealed by a ground-glass stopper or otherwise. By opening the cock N communication may be established between this vessel and the interior of the receiver E through the pipes L, M, and F. Of course all the joints and connections should be perfectly tight to prevent all ingress of air.

The operation is as follows: The cock N being closed, the air is exhausted from the globe

E as perfectly as possible, after which a current of electricity may be passed through the conductor D in order to expel from it the occluded gases, which should also be pumped from the globe. Then upon opening the cock N the vapor of gasoline will flow from the vessel I into the globe, filling it to the required degree. Practically a pressure of about an inch of mercury, more or less, will be found sufficient. Now, inasmuch as the conductor to be treated is of higher resistance than the lamp C, it will be found upon switching the current onto the conductor and the lamp that a smaller portion of the current will flow through D than through the lamp C, and the light developed in it will be correspondingly less; but as the conductor D builds up by the deposition upon it of carbon from the surrounding gas, as above explained, its resistance gradually falls, permitting an increased flow of the current through it and correspondingly increasing its illuminating-power. When the light has become equal to that of the standard lamp, the operation is to be arrested, and if the receiver E is to be used as the globe of the finished lamp the excess of gas is to be pumped out and the globe sealed up, when the lamp will be ready for use. Otherwise the conductor is to be transferred from the receiver E and sealed up in any suitable globe inclosing a high vacuum, which, preferably, may be a highly-attenuated atmosphere of hydrocarbon or equivalent vapor, as described in Letters Patent No. 230,954 to Hiram S. Maxim, under date of August 10, 1880.

Instead of arranging the standard lamp and the carbon to be treated in parallel series in branches of the main circuit, as above described, they may be arranged in consecutive series in the main circuit. In this case, as the entire current would be made to pass through both the carbon D and the lamp C, the light at first developed in the carbon will, by reason of the greater resistance of the carbon, be greater than that of the lamp; but as the building up of the carbon by the decomposition of the surrounding gas proceeds with a corresponding diminution in its resistance the heat and, of course, the light developed by the passage of the current will gradually be diminished until the latter is brought to the same intensity as that of the standard lamp.

Another mode of accomplishing the same result is to subject the carbons to be treated to the action of a constant or uniform electric current, comparing the changing intensity of the light developed as the decomposition of the gas goes on with any uniform standard light—as, for example, the flame of an ordinary Carcel burner—and arresting the operation when the illuminating-power of the carbon as thus indicated has reached the required point. It will readily be understood that this mode involves the same general principle as the one first described, since the uniform current employed in the last method is a current capable of developing a uniform light of given intensity in a standard lamp. The first method will, however, be found in practice the most convenient, as, when an electric lamp of standard illuminating-power is used, it is not necessary that the operator should be constantly careful to keep the current at the same strength. It is also specially convenient for the operator to be able to compare his work directly with a light of the same capacity and the same quality as that which he seeks to produce.

It may be observed that several carbons may be treated simultaneously under the foregoing process, with a corresponding economy in time and labor; but the means of doing this will form the subject of a special application.

The present invention, it should be remarked, is not limited to the use of any specific gas in the receiver E. It is only necessary that it be a gas of such a nature that its elements will be more or less dissociated by the passage of the current through the conductor D with a resulting change in the resistance of such conductor. Neither is the present invention to be limited to the use of such a gas at a pressure of one inch of mercury. A low pressure is found to produce the best results; but a higher pressure would not be without substantial effects in the same direction.

The building up of illuminating-carbons for incandescent electric lamps by the deposition of carbon from a surrounding atmosphere of carbonaceous gas does not, in itself considered, form a part of the present invention. The present application relates rather to the regulation of such process of building up with a view to producing definite and uniform results.

What is claimed as new is—

1. The above-described improvement in the art of equalizing the illuminating-power of the carbonized conductors of incandescent lamps, which consists in electrically heating the said conductors in the presence of a hydrocarbon or equivalent vapor until their electrical resistance and illuminating-power for a definite intensity of current have been brought to a predetermined standard, substantially as set forth.

2. The above-described mode of heating the carbonized conductors for incandescent lamps, which consists in subjecting them in the presence of a hydrocarbon or equivalent vapor to the action of an electric current until by the decomposition of the said vapor their illuminating-power is brought to the same intensity as that of a standard lamp included in the same circuit or in a branch thereof, as described.

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Witnesses:
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