No. 716,889. Patented Dec. 30, 1902.

M. W. HANKS.

ELECTRIC LAMP.

(Application filed May 18, 1901.)

(No Model.)

Fig. 1.

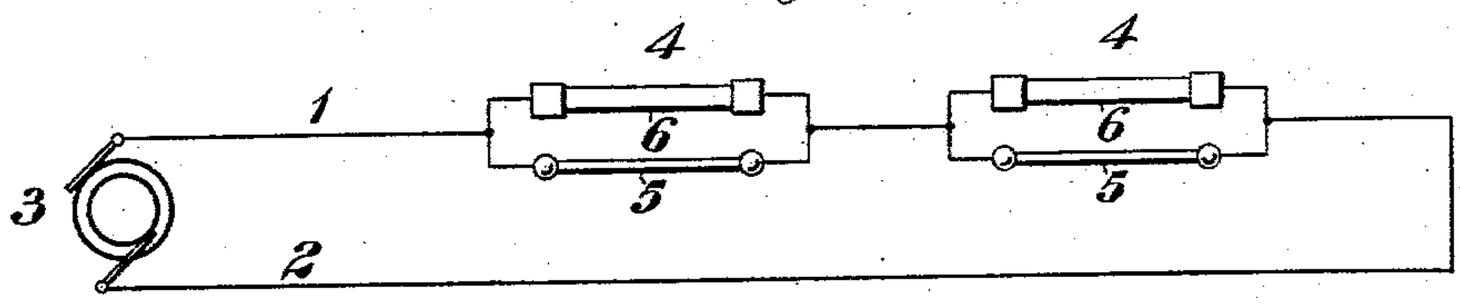
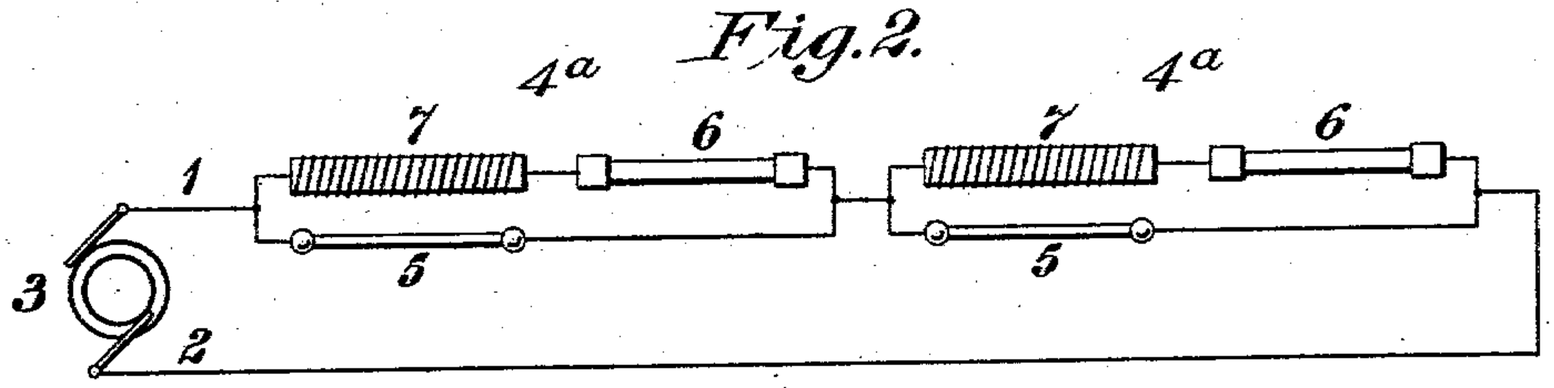


Fig. 2.



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ELECTRIC LAMP.

SPECIFICATION forming part of Letters Patent No. 716,889, dated December 30, 1902.

Application filed May 18, 1901. Serial No. 60,908. (No model.)

To all whom it may concern:

Be it known that I, MARSHALL W. HANKS, a citizen of the United States, residing at Pittsburg, in the county of Allegheny and State of Pennsylvania, have invented a new and useful Improvement in Electric Lamps, of which the following is a specification.

My invention relates to electric lamps of the type in which the light-giving members are non-conductors when cold and become conductors only when heated to comparatively high temperatures.

The object of my invention is to provide lamps which shall be adapted for operation in series in an electric circuit and in which the heaters shall cease to take any substantial quantity of current when the glowers become conductive, but which shall automatically operate to take current if the corresponding glowers become broken or for any other reason fail to permit the passage of current therethrough, all without the employment of moving parts.

My invention involves the employment of current-controlling bodies as elements of lamps having the above-indicated characteristics which are substantially non-conductors of electricity under normal conditions and which become relatively good conductors when their temperatures are raised, either by externally-applied heat or by current, due to an increase of the potential at the terminals of such bodies.

In practicing my invention the current-controlling bodies may be utilized either as heaters for raising the glowers to conducting temperatures or in series with heaters that are conductors under normal conditions of heat and electromotive force.

Referring now to the drawings, Figure 1 is a diagram of an electric circuit having a plurality of lamps which are constructed in accordance with my invention. Fig. 2 is a similar diagram illustrating a modification.

In Fig. 1 the circuit 1 2 is supplied with energy from a generator 3, and in this circuit are connected in series a plurality of lamps 4, the number of which will obviously depend upon the amount of energy flowing in the circuit. Each lamp 4 comprises one or more glowers 5, which are non-conductors at ordinary temperatures and which become conductors when sufficiently heated. Located adjacent to each glower or set of glowers 5 and connected in parallel therewith is a body 6, the composition of which is such that it is substantially a non-conductor or, at least, a very poor conductor under the conditions which obtain when the glower is operating. If the materials and dimensions of the glower 5 and body 6 are properly determined, however, the electromotive force upon the terminals of the lamp, prior to the lighting up of the glower, will cause current to travel through the body 6, which in this instance serves as a heater for the glower. When the lamp is first connected in circuit, the electromotive force that is impressed upon the body 6 will cause sufficient current to pass through it to slightly raise its temperature, and such rise in temperature will increase the conductivity of the body, since it has a negative temperature coefficient. The increase of current with the increase of conductivity will be productive of sufficient heat to raise the temperature of the glower to the conducting-point. When the glower becomes heated sufficiently to be conductive, a portion of the current will be shunted through it, and the current through the heater will therefore be correspondingly decreased and the potential difference between its terminals also decreased. The glower will thus be heated to normal incandescence and the potential difference on the heater will be reduced until it becomes so low that the heater will cease to take any substantial quantity of current. If the glower should be broken, the potential difference on the heater would instantly rise until the heater would again take current, and thus take the place of the broken glower and maintain the resistance of the circuit approximately constant.

In Fig. 2 each lamp 4^a comprises a glower 5, a heater 7 of ordinary construction, and a body 6, corresponding as regards the material of which it is composed and its operation to the heater 6. (Shown in Fig. 1.) The operation of the lamps in this system is the same as that described in connection with

the system shown in Fig. 1, except that the bodies 6 are employed merely as controlling devices, instead of having the combined functions of controlling devices and heaters.

I have found that a mixture suitable for the controlling-bodies 6 consists of approximately fifty per cent. of magnesia, fifty per cent. of finely-powdered iron, a very small quantity of tragacanth as a binder to hold the materials together, and enough water to form a dough that may be molded into rods of the desired form and dimensions. While I have found this mixture to be suitable for use in the relations described, I do not intend to limit the invention either to the exact materials or to the proportions specified, it being sufficient for the purpose of my invention that the mixture employed shall be one which has substantially the operative characteristics hereinbefore set forth.

I claim as my invention—

1. In an electric lamp of the class described, a glower and a body connected in parallel and out of contact therewith that is substantially a non-conductor of electricity when subjected to a difference of potential that is less than the normal lamp-voltage and is a conductor when subjected to the normal lamp-voltage.

2. In an electric lamp of the class described, a glower, a heater therefor and a body connected in series with the heater that is substantially a non-conductor of electricity when subjected to a difference of potential that is below a certain critical amount and is a conductor when subjected to a difference of potential that is above such amount.

3. In an electric circuit, a plurality of lamps, each of which comprises a glower and a body connected in parallel and out of contact therewith that is substantially a non-conductor of electricity when subjected to a difference of potential that is below the normal lamp-voltage and is a conductor when subjected to the normal lamp-voltage.

4. In an electric lamp of the class described, a glower and a body located in proximity thereto but out of contact therewith and connected in parallel therewith that is substantially a non-conductor of electricity when subjected to a difference of potential that is less than the normal lamp-voltage and is a conductor when subjected to the normal lamp-voltage.

5. In an electric lamp of the class described, a glower and a controlling-body permanently connected in parallel and out of contact therewith that serves as a conductor for the current supplied to the lamp when the glower is not in service and becomes substantially non-conductive under the voltage to which it is subjected during the time that the glower is taking its normal current.

In testimony whereof I have hereunto subscribed my name this 15th day of May, 1901.

MARSHALL W. HANKS.

Witnesses:

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WESLEY G. CARR.