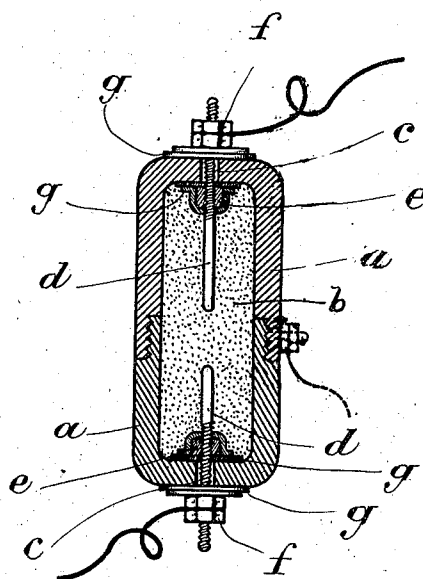


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ELECTRIC RESISTANCE APPARATUS.
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942,555.

Patented Dec. 7, 1909.



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UNITED STATES PATENT OFFICE.

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ELECTRIC RESISTANCE APPARATUS.

942,555.

Specification of Letters Patent.

Patented Dec. 7, 1909.

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To all whom it may concern:

Be it known that I, MAX HANKIN, a citizen of the United States, residing at Brussels, Belgium, have invented new and useful Improvements in Electric Resistance Apparatus, of which the following is a specification.

This invention has for object to provide an improved apparatus for insertion in an electric circuit for use as a resistance to the flow of the electric current.

Electric heating apparatus are known in which the conducting resistance constituting the heating material is composed of a mixture of particles of metallic substances and insulating substances.

Now the present invention is based on the use of materials in the condition of more or less fine particles for constituting a resistance to the flow of an electric current. For this purpose there may be employed a mixture of metallic particles and particles of insulating substances in proportions varying according to the degree of resistance which it is desired to produce. Or metallic particles only may be used, and more particularly particles of cast iron.

The particles constituting the resisting material are charged into a conducting metal envelop that is entirely closed in which two metal terminals are embedded. Each of the terminals projects through one of the ends of the envelop to effect the entry and exit of the electric current. These terminals are insulated from the parts of the envelop through which they extend, and their ends may be separated from each other by a greater or less distance according to the degree of resistance which it is desired to produce.

One form of apparatus constructed according to this invention is illustrated by way of example in the accompanying drawing in cross section.

The conducting metal envelop is preferably composed of two cups or cylindrical vessels, *a*, screwed together and filled with the resisting material, *b*. A hole, *c*, extends through the closed end or bottom of each of the cups *a*. The terminals, *d*, are introduced through the holes, *c*. These holes, *c* are sufficiently large to allow of providing an insulating space between their sides and the terminals, *d*, when the latter are fixed in place by means of nuts, *e f* and insulating washers, *g*

of mica or equivalent material. The terminals *d*, may be screwed to a greater or less depth into the resisting material *b*, the space between their ends being greater than the distance that separates them laterally from the envelop and preferably less than or at most equal to twice the said distance. Part of the electric current passes from one terminal to the envelop and thence to the other terminal and the more the terminals are distant from one another the greater will be the part of the current which thus passes by the envelop. The resistance to the passage of the current may be diminished by fixing in the envelop a supplementary terminal "*h*," by which the current can be taken off after passing only through the resisting material between one terminal and the envelop.

When a resisting material is used consisting of a mixture of metal particles and insulating particles such a mixture may be advantageously composed by way of example of the following substances in the proportions stated:

Refractory earth	50	parts by weight.	80
Plumbago	7.5	" " "	
Asbestos fiber	1	" " "	
Granulated cast iron	58.5	" " "	85

and its resistance may be increased or diminished by varying the proportion of the granulated cast iron. As already stated hereinbefore, the resisting material may also be constituted by granulated cast iron reduced to particles of more or less fineness.

For use with a current of low amperage the particles should be finer, and the metal terminals *d*, should be of smaller cross section than for a current of greater amperage. On the other hand the internal dimensions of the envelop *a*, should be increased in direct proportion to the current voltage so that the higher the voltage the greater will be the thickness of the resisting material which must be traversed by the current.

The particles are well moistened at first with water, and then dried by exposure to the air with the object of producing an oxidation of the surface of each metal particle in order to increase its resistance to the passage of the current. Before the particles are charged into the envelop *a*, water is

added to the particles so as to form a paste which is then rammed firmly into the envelop.

The resisting material might be introduced into the envelop immediately after the first addition of water without being allowed to dry, but in that case it would offer much less resistance to the flow of the current.

Apparatus constructed in the manner hereinbefore described may be employed in the manufacture of rheostats. They are especially suitable for use as automatic resistances for starting motors. When such apparatus are included in an arc lamp circuit, they insure a great constancy in the intensity of the light, obviate fluctuations, and diminish considerably the consumption of current, while lengthening the "life" of the carbons. When used in a glow lamp circuit, these apparatus effect likewise a saving of current; they improve the light and increase the efficient "life" of the lamps.

Generally on lighting the lamps, the light increases gradually without flickering, and the current is regulated in such a manner that a better light is obtained with the same voltage with a less consumption of amperes.

What I claim as my invention and desire to secure by Letters Patent is:—

1. In a device for use as a resistance in an electric circuit, in combination, a closed conducting metal envelop, particles of a resisting material filling said envelop and two

terminals extending through and insulated from opposite ends of the said envelop and embedded in the said particles.

2. In a device for use as a resistance in an electric circuit, in combination, a closed conducting metal envelop, particles of a resisting material filling said envelop and two terminals extending through and insulated from opposite ends of the said envelop and embedded in the said particles, the said terminals being separated from each other by a distance of about twice the distance that separates them laterally from the envelop.

3. In a device for use as a resistance in an electric circuit, in combination, a closed conducting metal casing, particles of cast iron filling said casing and two terminals extending through and insulated from opposite ends of the said envelop and embedded in the said particles.

4. In a device for use as a resistance in an electric circuit, in combination, a closed conducting metal casing, rusty particles of cast iron filling said casing and two terminals extending through and insulated from opposite ends of the said casing and embedded in the said particles.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

MAX HANKIN.

Witnesses:

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Ad. VOGEL