H. S. MARTIN.

ELECTRICAL RESISTANCE DEVICE.

APPLICATION FILED JULY 13, 1908.

919,908. Patented Apr. 27, 1909.

FIG. 1.

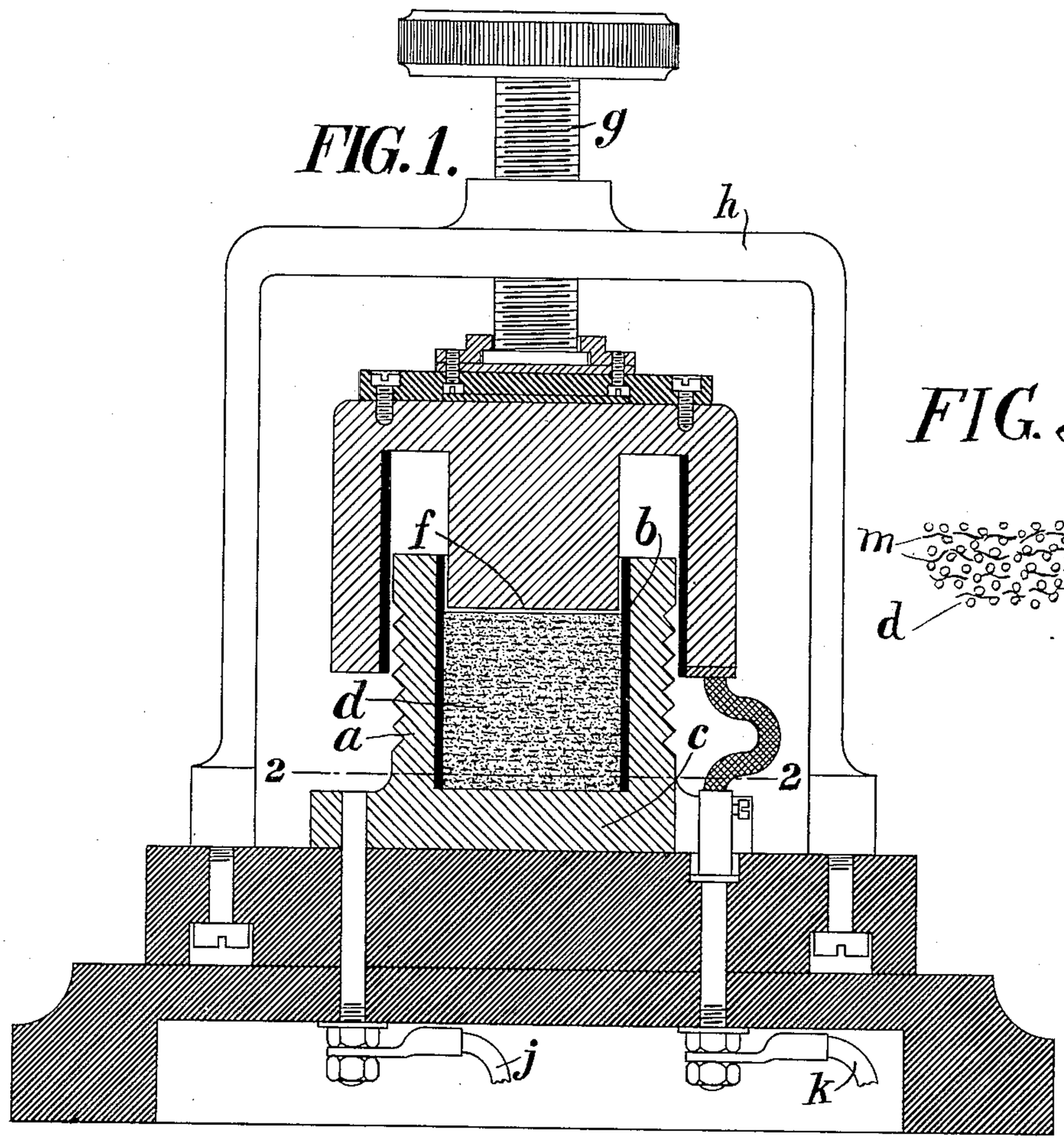
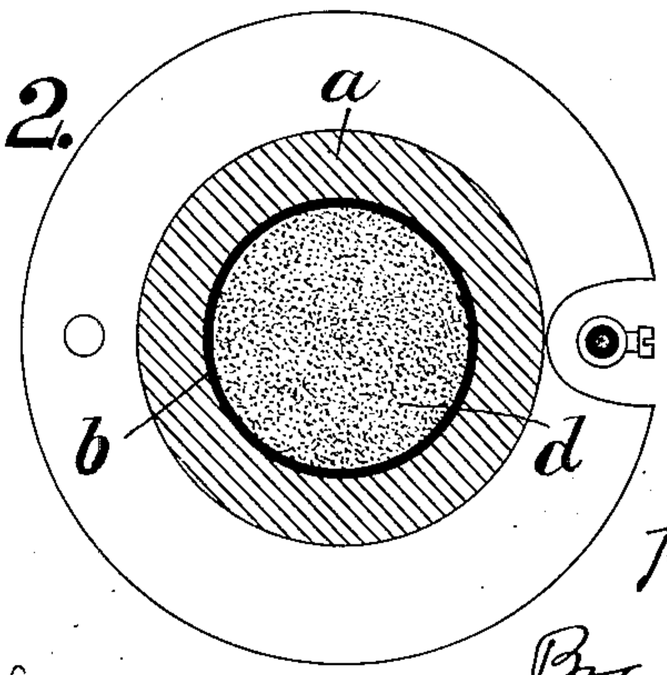


FIG. 3.

FIG. 2.



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ELECTRICAL-RESISTANCE DEVICE.

No. 919,908. Specification of Letters Patent. Patented April 27, 1909.

Application filed July 13, 1908. Serial No. 443,208.

To all whom it may concern:

Be it known that I, HAROLD SHEEN MARTIN, subject of the King of Great Britain, residing at Liverpool, in the county of Lancaster, in the Kingdom of England, have invented certain new and useful Improvements in Electrical-Resistance Devices, of which the following is a description.

This invention relates to an improved electrical resistance device adapted to be used for all purposes to which such devices are applied, the device being of the kind in which the resistance can be adjusted by hand or otherwise to suit varying requirements, for instance, when used in a lamp circuit the device may be adjusted to vary the current flowing through the lamp and so permit a variation in the amount of light given by the lamp.

The resistance body consists of a mixture of the kind hereinafter more fully described, the resistance of which varies as the pressure exerted upon it is increased or decreased, the resistance being decreased when the pressure is increased. The mixture consists essentially of a conducting material in granular or powdered form and a non-conducting material in the form of small scales. Suitable substances are graphite for the conductor and mica for the insulating material. There is mixed with these two substances some other granular material, such for instance as sand. It would appear that the decrease in the resistance is produced by bringing the grains of the conducting material into intimate contact by means of applying pressure to the mixture, the increase in the resistance being brought about by the separation of the grains of conducting material under the action of the scales of insulating material, which on the release of the pressure tend to move out of the constrained positions into which they have been forced. The scales of mica act as springs which are distorted when pressed against the granular material (sand) in the mixture. On the removal of the pressure the flakes tend to return to their original positions moving away from each other and carrying with them the powdered conducting material. The proportions of the constituents of the mixture may vary widely depending on the purpose for which the resistance is to be used and the range of resistance and current-carrying capacity required. For instance if a low resistance of comparatively small range is required the relative proportion of the graphite and contact surfaces is larger whereas, if higher resistance with greater range is required, these proportions will be reduced. As an example of proportions which have been found in practice satisfactory for some purposes the following is given:—

Powder graphite	2	grams	by	weight
Mica flakes	1	"	"	"
Sand	1	"	"	"

A quantity of this mixture weighing 4 grams when placed between circular pressure plates of 12 mms. diameter, gives a range of resistance of 73 to 220,000 ohms.

I will now refer to the accompanying drawings which show one form of device in which the resistance body is used.

In these drawings, Figure 1 is a vertical sectional view of the device; and Fig. 2 is a horizontal sectional view on line 2—2, Fig. 1. Fig. 3 is an enlarged view, showing the scales or flakes of insulating material as forced into the constrained position, wherein the resistance is decreased.

The device consists of a hollow cylinder *a* lined with insulating material *b* and provided at each end with a metal disk. The disk *c* at the bottom of the cylinder forms one of the surfaces between which the mixture *d* is compressed, the other surface being formed by means of a disk *f* at the end of a plunger carried by a rod *g* which is screw-threaded and works through a screw-threaded aperture in a bridge piece *h* located over the other end of the cylinder. The two compression members *c* and *f* are connected to the electric wires *j* and *k* as shown and the resistance of the circuit adjusted by rotating the screwed rod *g* so as to move the member *f* carried by it nearer to or farther from the opposite surface *c*, thus exerting greater or less pressure upon the mixture *d* located between the plates.

In Fig. 3, the mixture *d* is shown on a very much enlarged scale, and the flakes of mica *m* are shown in the distorted condition.

It is obvious that the movement of the adjustable pressure plate may be produced by other means than by the means above described, for instance a pivoted lever having a cam surface pressing upon this disk may be used.

This form of device is suitable for all ordi-

nary purposes where currents of normal magnitude are being dealt with. In cases however where very large currents are being dealt with, the surfaces of one or both of the pressure plates in contact with the material may be varied in addition to the adjustment of the pressure in order to adjust the resistance. This may be effected by forming one or both of these plates of a number of rings fitting one within the other, the number of which rings in contact with the mixture may be varied as desired. The same result may be produced by forming the plate or plates of a spring strip of metal which may be bent in such a manner that only part of it normally comes in contact with the mixture, the remaining part however being pressed down against the material when it is desired to decrease the resistance.

It is obvious that although specific forms of this device have been described in detail, considerable modifications may be made therein without departing from the invention.

In addition to graphite I can add rare earths which become conductors when heated to certain temperatures, such as zirconia, magnesia or thoria mixed with a large or small proportion of another oxid or other substance, yttrium, cerium, orbium and didymium oxids, boric acid, calcium chlorid and tungstic acid. The effect of heating is produced in my device by heat generated by the passage of the initial current through the graphite. The addition of these rare earths is with the object of increasing the current-carrying capacity in a conducting body of given bulk, and preserving at the same time a high initial resistance.

I declare that what I claim is:—

1. An electrical resistance device comprising a resistance body in which are intimately mixed together a material in the form of springy scales or flakes and a material in the form of grains.

2. An electrical resistance device comprising a resistance body consisting of a mixture of a non-conducting material in the form of springy scales or flakes, a granular material, and a finely divided electrically conducting material.

3. An electrical resistance device comprising a resistance body in which are intimately mixed together mica in the form of scales or flakes and a material in the form of grains.

4. An electrical resistance device comprising a resistance body consisting of a mixture of mica in the form of scales or flakes, a granular material and a finely divided electrically conducting material.

5. An electrical resistance device comprising a resistance body consisting of a mixture of mica in the form of scales or flakes, a granular material, and finely divided graphite.

6. An electrical resistance device comprising a resistance body consisting of a mixture of a non-conducting material in the form of scales or flakes, a granular material, a finely divided conducting material, and a material which becomes a conductor when heated to a suitable temperature.

7. An electrical resistance device consisting of a resistance body in which are intimately mixed together a material in the form of springy scales or flakes and a material in the form of grains, a receptacle for said body, and means for varving the pressure upon said body so as to vary the electrical resistance thereof.

8. An electrical resistance device consisting of a resistance body in which are intimately mixed together a material in the form of springy scales or flakes and a material in the form of grains, a receptacle for said body, two conducting plates disposed opposite to each other in said receptacle, and means for varying the distance apart of said plates so as to vary the pressure upon said resistance body.

9. An electrical resistance device consisting of a resistance body in which are intimately mixed together a material in the form of springy scales or flakes and a material in the form of grains, a receptacle for said body, two conducting plates disposed opposite to each other in said receptacle, means for varying the distance apart of said plates, and means for varying the conducting area in contact with said body.

In witness whereof, I have hereunto signed my name this 2nd day of July 1908, in the presence of two subscribing witnesses.

HAROLD SHEEN MARTIN.

Witnesses:

RICHD. L. CLEAVER,

WM. G. TRAVIS.