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ELECTRIC HEATER.

APPLICATION FILED APR. 18, 1905.

Fig. 1.

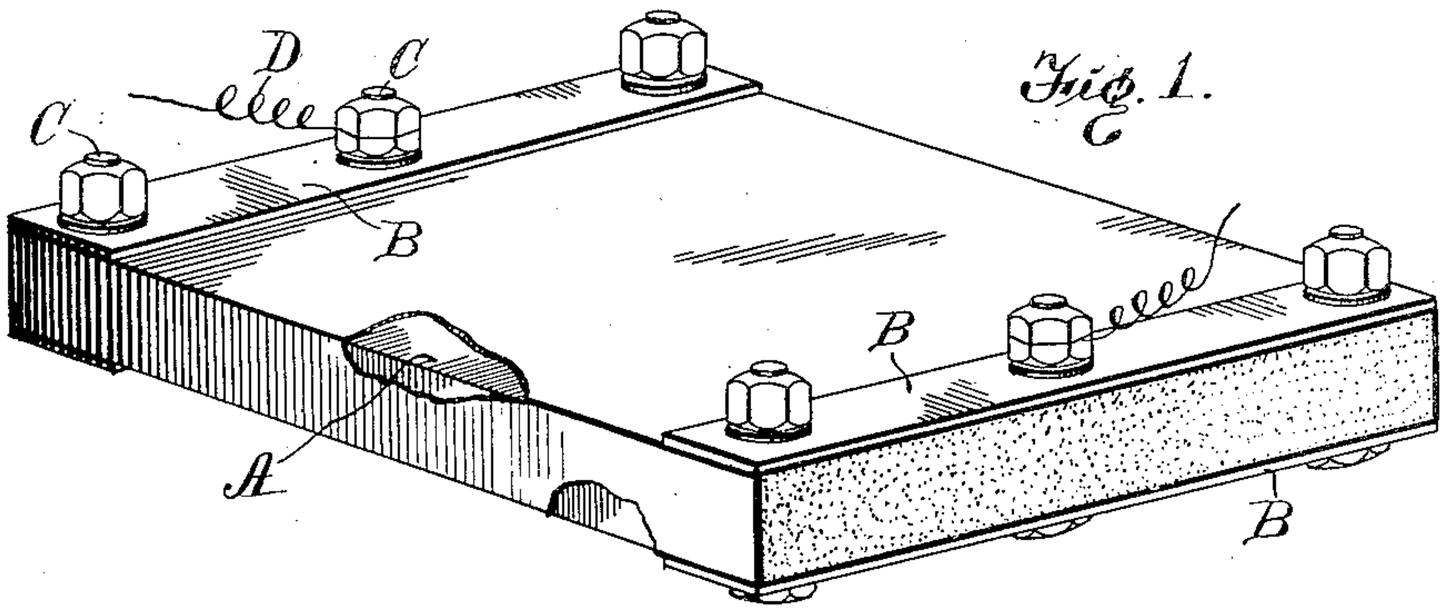


Fig. 2.

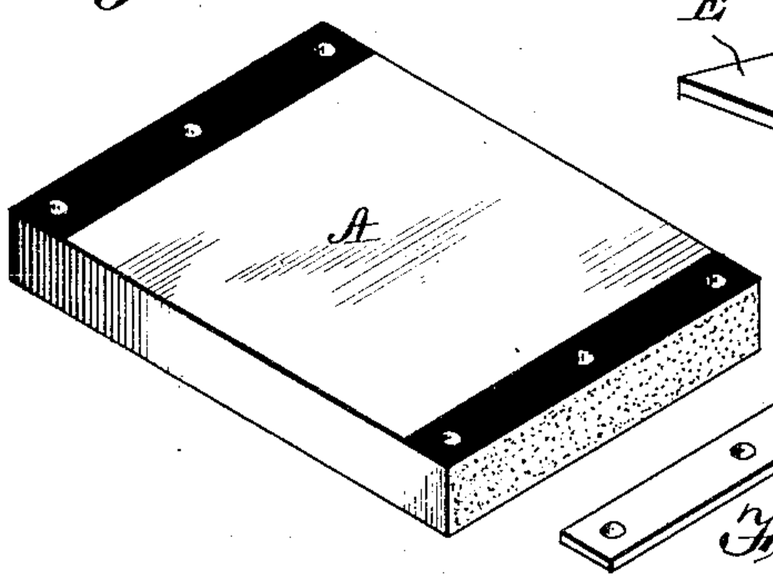


Fig. 3.

Fig. 4.

Fig. 6.

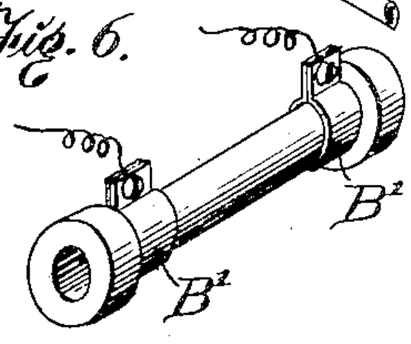
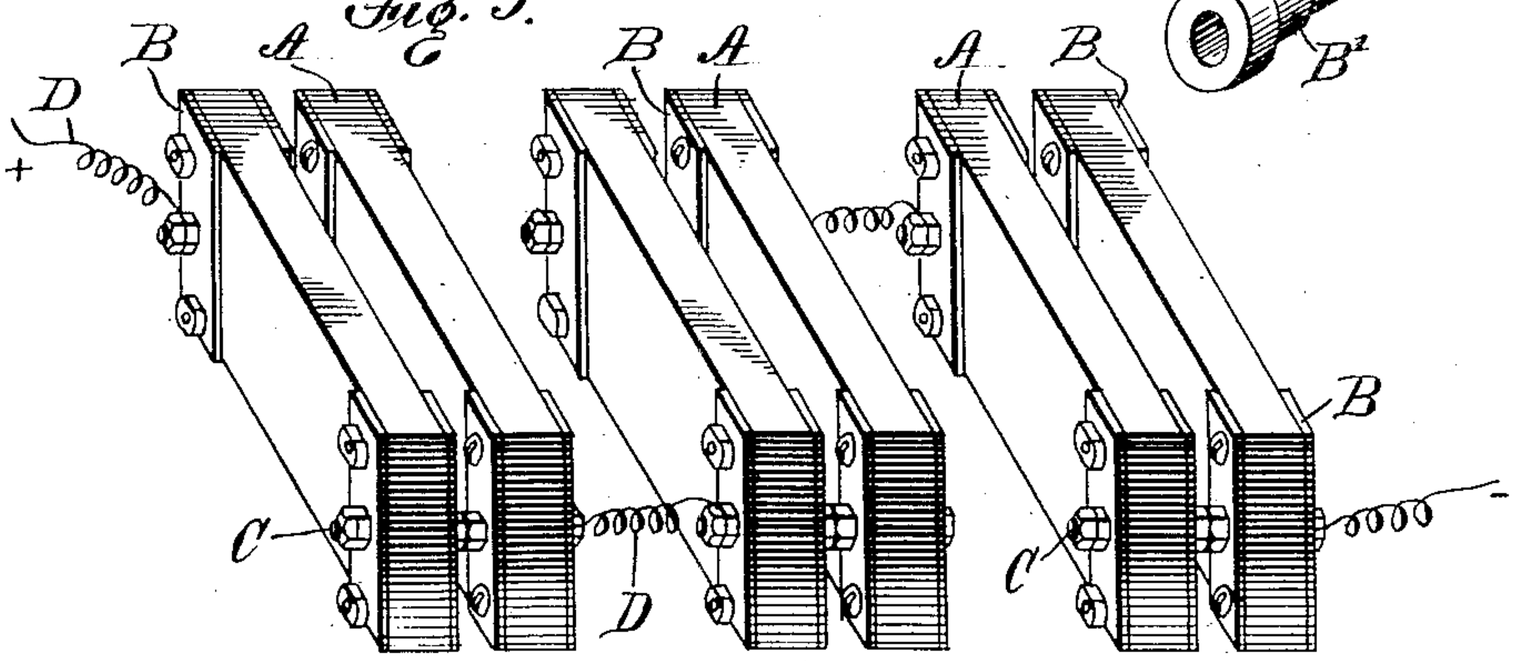


Fig. 5.



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UNITED STATES PATENT OFFICE.

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ELECTRIC HEATER.

No. 816,172. Specification of Letters Patent. Patented March 27, 1906.

Application filed April 18, 1905. Serial No. 256,229.

To all whom it may concern:

Be it known that we, HARMON N. MORSE and JOSEPH C. W. FRAZER, citizens of the United States, residing in the city of Baltimore and State of Maryland, have invented certain new and useful Improvements in Electric Heaters, of which the following is a specification.

The object of our invention is to provide an electric heater of an improved construction which may be cheaply manufactured, will efficiently convert electricity into sensible heat, and will be strong and durable, standing wear, as well as being easily adapted to the use of electric currents whose voltage varies within wide limits.

We have found that if a slab of soapstone be spread with a thin layer of graphite a fairly good resistance element for an electric heater may be obtained. Soapstone is usually the best material to form the base or support for the resistance medium, because it is easily cut to the desired shape, its surface can be made very smooth, which is essential to the best results, and it withstands better than any other available non-conducting material great and sudden changes in temperature. Graphite not only conducts electricity, but its conductivity increases with rising temperature, and when applied the thin layer provides the desired resistance to produce heat. While we have specified that soapstone is the preferred material for the base, we wish it understood that so far as part of our invention is concerned porcelain, terra-cotta, and other materials may be used for the non-conducting base.

If dry graphite be rubbed upon the smooth surface of soapstone or like material, a sufficiently thick or heavy coating cannot be obtained to conduct the requisite amount of current. A thicker covering of graphite may be obtained by repeated applications of it in a wet condition with a flat camel's-hair brush. The surface to which it is applied must, however, be hot enough to evaporate the water almost instantaneously; otherwise the deposit will be quite uneven; but although a sufficiently thick coating may be thus obtained the results are not satisfactory, as the material lacks adhesiveness, and when an attempt is made to harden it by polishing with a stiff brush much of the graphite is detached, and the surface which is produced is easily injured by handling or by contact with other objects. We have discovered that if we mix with graphite a suitable quantity of washed and bolted clay and make a thin paste of the mixture with water a suitable substance is obtained which may be applied to a smooth surface like that of soapstone, which will adhere thereto, which may be polished, and which will be durable and in every way efficient. We have also found that the addition of a little soap gives even better results, and also that such a paste may be applied with good results to other non-conducting substances, such as porcelain, terra-cotta, &c.

In carrying out our invention we mix graphite and clay and sometimes a little soap with water, as above described, in proper proportions to obtain a thin paint or paste. We then by means of a camel's-hair brush coat the smooth surface of a block or slab of soapstone or other non-conducting base with the paste while the base is being heated, so that the water of the paste will be quickly evaporated. After the slab is thus coated the graphite-surface is vigorously polished with a stiff brush, and subsequent coatings may be applied and polished in the same way. The several coatings, with the intermediate polishings, are made for the purpose of increasing the conductivity of the heater to the desired degree to carry the amount of current necessary to obtain a good heat. After the first application and polishing the resistance of the coating is so high that very little current can pass, and therefore little heat is produced; but by repeated coatings and polishings the conductivity of the heater may be increased until the requisite resistance is obtained to permit the passage of the desired amount of current.

In the drawings, Figure 1 is a perspective view of an electric heater constructed in accordance with our invention. Fig. 2 is a perspective view of the slab or piece of non-conducting material before it is coated. Fig. 3 is a perspective view of one of the plates employed for attaching the circuit-wires. Fig. 4 illustrates the manner in which the non-conducting base is heated while the coating is being applied. Fig. 5 is a perspective view showing a modification of our invention in

which the slabs are arranged vertically in pairs and electrically connected with each other. Fig. 6 is a perspective view of a heater in which the non-conducting base is in the form of a tube.

Referring to Figs. 1 to 5, inclusive, it may be assumed that the slab or block A, as before stated, is preferably of soapstone, although porcelain or some other materials would be suitable in some cases. The metal plates B are applied to the ends of the slab and secured thereto by bolts C, the circuit-wires D being connected with the bolts as illustrated. Preferably the top, bottom, and two sides of the slab are covered with the graphite mixture, the surfaces to which the mixture is applied being made perfectly smooth in order that the coating may be of absolutely uniform thickness. In applying the coating the plates B first have their inner surfaces covered with the mixture of graphite and clay, and those portions of the soapstone which are afterward covered by the plates are evenly spread with a rather thick layer of the paste. The plates are then bolted to the stone in the manner indicated in Fig. 1. The circuit-wires D are connected with an electric circuit, including an ammeter. Then the slab is heated by means of a lamp or other heater, a board of asbestos E being preferably interposed between the lamp and the slab. When the stone is hot enough to evaporate water with rapidity, but without sputtering, the paste, much thinned with water, is evenly applied with a flat camel's-hair brush whose width is preferably about twenty-five millimeters. The whole surface should be covered each time; but the brush should not pass more than once over any one spot during each application. After each application the surface is vigorously polished with a stiff brush, such as a toothbrush.

An even distribution of the graphite is of great importance, for if it is unevenly distributed the resistance in different regions will vary and more heat will be developed at some points than at others and the graphite will burn out in certain spots, while the whole amount of heat developed is much less than the surface ought to bear with safety.

As soon as the conductivity of the graphite covering is increased to a point where the current suffices to maintain the proper temperature the block is removed from the asbestos-board and its surface is carefully explored with a voltmeter with reference to the uniformity of the distribution of resistance. The subsequent applications of the graphite mixture are regulated with a view to securing uniform conductivity over the whole surface—that is, those spots which are found by the voltmeter to exhibit a higher resistance are painted more thickly than they were before. With care it is easy to prepare a heater in a short time on which the graphite is very evenly distributed and so firmly adhered that it will not visibly soil the fingers in handling. If as the painting proceeds the surface becomes so hot that the water is evaporated with explosive violence and the surface presents a spotted appearance, owing to an uneven spreading of material, the circuit should be broken and the stone allowed to cool before making another application of the paint.

The thickness of the graphite coating should be regulated with a view to the most economical expenditure of energy in the subsequent use of the heater—in other words, with a view to dispensing with as much as possible of the external resistance which is always inserted in the circuit for the purpose of regulating the temperature where the heater is used—for instance, in an air-bath.

The clay used with the graphite is employed not only as a binder, but as a spreading agent. It produces with the graphite a finely-divided homogeneous mixture and makes it easy to give a uniform distribution over the surface to which the paste is applied, so that the resistance may be equal at all points and a fine polish can be obtained, presenting a hard smooth surface not easily injured, and yet the coating may be thick enough to obtain the requisite conductivity, but is not so thick that it is apt to flake off. A high temperature can also be obtained when clay is employed with graphite, because clay does not lose its water until the temperature has reached about 425° centigrade. A constant temperature of, say, about 400° centigrade may be used for a long time without injuring the coating.

Any suitable soap may be mixed with the graphite, clay, and water. Preferably we use only a small quantity of concentrated solution of soap, which decomposes at 350° centigrade.

The proportions of graphite and clay or graphite, clay, and soap may be easily determined by experience. The proportions cannot be rigidly adhered to in preparing the coating mixture, because experience has shown that it is necessary to vary the percentage of the ingredients considerably, according to the quality of graphite and the nature of the clay used in order to secure a mixture which will have the necessary spreading, polishing, hardening, and adhering qualities. The following proportions have been found to work well: graphite, 54.8 per cent.; soap, twenty-three per cent.; clay, 22.2 per cent.

In Fig. 5 we have shown slabs covered with the graphite paste similar to that shown in Fig. 1. In this instance the slabs are preferably arranged vertically. They are shown as electrically connected in series, but may be connected in parallel, if desired.

In Fig. 6 we have shown a tube coated with the graphite mixture. In this instance the base or tube may be made of porcelain. B′ indicates collars clamped to the tube and to which the circuit-wires may be connected.

It is obvious that our improvements may be used as a resistance medium as well as for heating purposes.

We claim as our invention—

1. The method herein described of forming an electric heater or resistance, which consists in coating a smooth non-conducting base while heated with a paste containing graphite, clay and water.

2. The method herein described of forming an electric heater or resistance which consists in coating a smooth non-conducting surface while heated with a paste containing graphite and clay and polishing the coating to harden it.

3. The method herein described of forming an electric heater or resistance which consists in coating a non-conducting base while heated with a paste containing graphite and clay, polishing the coating to harden it and then applying subsequent coatings and polishing them until the desired degree of conductivity is obtained.

4. An electric heater or resistance comprising a non-conducting base and a thin even unbaked coating containing graphite and clay.

5. An electric heater or resistance comprising a slab of soapstone and an unbaked coating containing graphite and clay.

6. An electric heater or resistance comprising a non-conducting base and a coating containing graphite, clay and soap.

7. An electric heater or resistance comprising a slab of soapstone and a coating containing graphite, clay and soap.

8. An electric heater or resistance comprising a slab of soapstone having a smooth surface and a coating thereon of uniform thickness and even distribution containing graphite and clay.

9. An electric heater or resistance comprising a non-conducting base and a thin coating of uniform thickness and even distribution containing graphite, clay and soap.

10. An electric heater or resistance comprising a non-conducting base having a smooth surface and a series of coatings or layers of a paste containing graphite and clay, each of which layers is polished to harden it and the thickness of the coating being such as to give the required conductivity.

In testimony whereof we have hereunto subscribed our names.

HARMON N. MORSE.
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Witnesses:
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A. J. GRAPE.