(No Model.)

J. H. DELANY.

ELECTRIC HEATER OR RHEOSTAT.

No. 535,321. Patented Mar. 5, 1895.

Fig. 1.

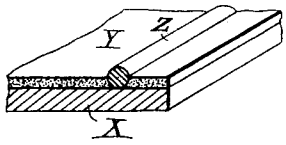


Fig. 2.

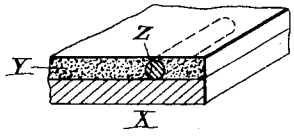


Fig. 3.

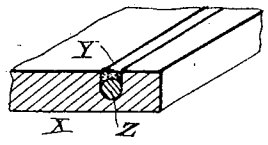


Fig. 4.

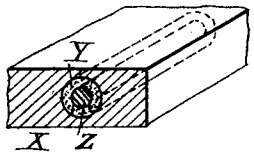


Fig. 5.

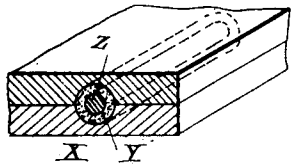


Fig. 6.

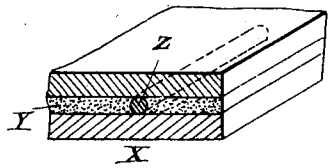


Fig. 7.

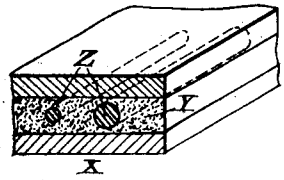


Fig. 8.

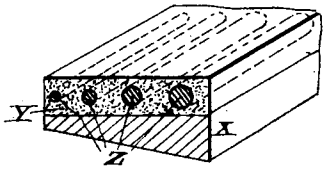


Fig. 9.

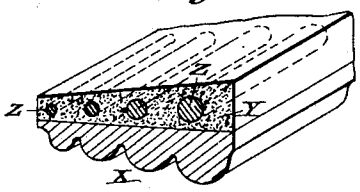


Fig. 10.

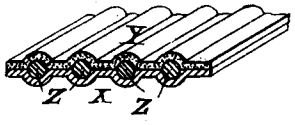


Fig. 11.

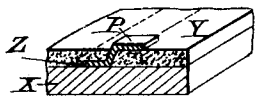


Fig. 12.

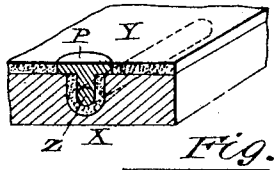


Fig. 16.

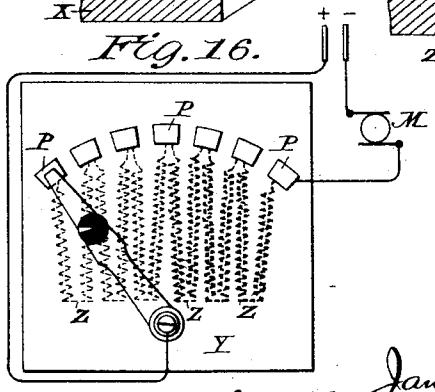


Fig. 14.

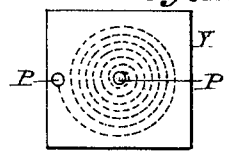


Fig. 13.

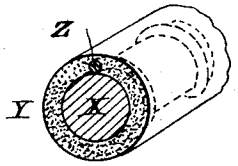
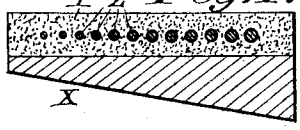


Fig. 15.

Fig. 17.



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UNITED STATES PATENT OFFICE.

JAMES H. DELANY, OF NEW YORK, ASSIGNOR TO EZRA T. GILLILAND, TRUSTEE, OF PELHAM MANOR, NEW YORK.

ELECTRIC HEATER OR RHEOSTAT.

SPECIFICATION forming part of Letters Patent No. 535,321, dated March 5, 1895.

Application filed November 23, 1894. Serial No. 529,725. (No model.)

To all whom it may concern:

Be it known that I, JAMES H. DELANY, a citizen of the United States, residing in New York city, in the county and State of New York, have invented certain new and useful Improvements in Electric Heaters or Rheostats, of which the following is a specification.

Heretofore in this class of devices it has been proposed to mold around the heating or resistance conductors an insulating mass of plastic material that subsequently "sets" or is hardened by baking. Special means are required to hold the conductors in proper relative position during the placement of the mass around them, and difficulty is experienced in securing proper relative positions of the conductors or separate sections of the same conductor, in the finished article. A more serious objection to this class of such devices is due to the different degrees of expansion and contraction of the conductors and the inclosing mass, and the liability of the mass, when baked, to crack or check, there being a tendency to cleavage in the planes in which the conductors lie. Where the mass is not baked but is of a character to "set" under ordinary atmospheric conditions, it lacks the requisite hardness and stability and is liable to granulation or disintegration because of variations of atmospheric conditions or changes of temperature due to the heating and cooling of the conductors. In these ways the integrity of position and insulation of the conductors or sections of conductors, are impaired and the usefulness of the apparatus deteriorated. It has also been proposed as in the Carpenter enamel rheostat and heater to attach the heating or resistance conductors to a metal base or support by enamel or vitreous material applied as a wash or powder that is hardened by firing. The usual process is to first coat the metal base with a layer of such enamel or vitreous material and harden it by firing. The conductors are then placed upon such coating, a layer of powdered or liquid enamel dusted or washed over them and then fired, several such layers being applied and each separately fired. Such devices so made have gone into use to some extent, but they are expensive and possess certain objectionable features not incident to my improved devices.

My invention consists in the employment of a base or support of china, porcelain, terra-cotta, tiling, or such like earthy or vitreous material molded in manufacturing to which the heating or resistance conductors are united or attached by vitreous enamel, making a homogeneous mass under heat. The material of which the base is composed is in its process of manufacture fired at relatively high temperatures, and may of course be molded into such form as is required. The vitreous enamel which is an article well known in the art and familiar to those skilled in the art of what is known as enamel rheostats is also fired at a relatively high temperature, say from 1,500° to 2,000°, when applied to the base to attach and cover the wires. The enamel and the base of the character described have practically the same co-efficient of expansion. That is to say, the grade of enamel employed may be selected with reference to the known expansive qualities of the base, so that the co-efficient of expansion of the enamel and base shall be the same or substantially the same; and shall be so nearly the same that there is no disruption of the enamel or base when the article is raised to high temperatures either in use or during the course of its manufacture. The base and enamel have more or less elasticity that compensates for any difference, if such there be, between the co-efficients of expansion of the conductor and enamel and base. When the enamel is applied to the base either in the form of a dust or wash and fired a most perfect junction between the two is secured. One or more coats of enamel may be applied to attach the conductors or semi-conductors to the base and as each coat is relatively thin any difference in expansion between the base, conductor and enamel will not cause impairment of the enamel coating in firing, and by successive coats and firings a layer of solid enamel of the desired thickness may be obtained.

Among the advantages incident to my invention the following may be mentioned:

First. The insulating base or support may

be molded in any desired shape and may be formed with projections around which the heating or resistance conductors may be arranged; or with recesses or apertures within which the conductors may be placed, the enamel being then applied as indicated. Whether the base or support be so shaped or has a plane surface to which the conductors are secured, no preliminary surfacing with enamel or insulating material is required, as is necessary where a conducting base is used, that is to say the bare conductors may be placed directly in position and the enamel coating applied, and as before mentioned the enamel and base unite more intimately and securely than where the base is of metal.

Second. There is no chance for the grounding or short circuiting of the conductors through the base, and inductive action that would occur if the base were a mass of metal is eliminated.

Third. Since the base is of non-conducting material there is no chance for the breaking down of the insulation between the base and conductor as might occur from disruptive discharge or from the use of currents of high intensity or frequency when the base is of metal.

Fourth. The base is a poor conductor of heat and hence will act as a reflector of heat and tend to concentrate it at points desired according to the arrangement of the conductors upon the surface of the base. This feature is more especially advantageous in the case of heating and cooking devices.

Fifth. Since the base is of insulating material no special provision against the grounding of terminal contacts of the conductors need be employed, and after firing, such terminals may be readily finished in an acid bath—a mode of finishing that cannot be readily practiced when a base of iron for instance is used, because the acid will attack the base, and the use of copper or similar metal as a base would be too expensive.

Sixth. Owing to the material of which my devices are constructed, they may be used in acids or in the presence of gases that would have a destructive effect on a metal base.

Seventh. Since in my apparatus, there is no liability of the insulation breaking down or the conductors being grounded through the base, the fire risk is greatly reduced.

Having thus described the general characteristics of apparatus constructed in accordance with my invention I will now refer to a number of specific forms in which the invention may be embodied, some of which have specific features of novelty in construction and arrangement.

In the accompanying drawings, Figures 1 to 13 inclusive are respectively detail views in section illustrating a small portion of apparatus constructed in accordance with my invention. Fig. 14 is a plan view indicating a heating or rheostat plate. Fig. 15 is a cross-section thereof, and Fig. 16 a plan view of a starting rheostat showing ordinary circuit connections and indicating the motor. Fig. 17 is a cross-section of Fig. 16.

In all the figures the non-conducting base of the character described is indicated by the letter X. The enamel or vitreous coating is indicated by Y, and Z indicates the conductor.

In Fig. 1 the conductor is laid upon the base and enamel applied to the surface of the base at the sides of the conductor, but without entirely covering it.

In Fig. 2 the enamel completely covers the conductor.

In Fig. 3 the conductor is disposed in a groove in the base, and enamel is placed in the groove over the conductor.

Fig. 4 shows a base formed with an aperture through it within which the conductor is placed with the enamel around it, filling the annular space between the conductor and base.

Fig. 5 shows two base plates or supports with corresponding grooves in contiguous faces. The wire is placed in the aperture or passage way thus formed, and is surrounded by the enamel.

In Fig. 6 two flat bases or supports are arranged face to face with the conductor between them, and the intervening spaces filled with enamel, the upper and lower faces of the conductor being in contact with the adjacent faces of the plates. A similar arrangement is shown in Fig. 7, except that the layer of enamel between the two plates is of such thickness as to completely surround the conductors, two of which of different cross-sectional area are shown.

In Fig. 8 the plate or base is beveled, being thinnest at one edge, the purpose being to obtain a more equal distribution of heat. The conductors Z are shown as of different cross-sectional area, and are designed to carry currents of different strength or quantity, and the mass or thickness of the plate at any particular point is intended to be in proportion to the relative amount of current which the conductor Z there situated is to carry.

Fig. 9 shows a precisely similar construction, except that the exterior face of the plate is ribbed or corrugated, the ribs being located opposite the respective conductors.

In Fig. 10 the base is corrugated, channels being thereby formed in which the conductors are placed, and are covered by a coating of enamel conforming to the shape of the base plate, the intention being to obtain a better radiation and distribution of the heat.

In Fig. 11 the conductor Z is indicated as a flat strip which has attached to it, or formed thereon a contact terminal P, which extends above the enamel and is held in position by it.

Fig. 12 shows a contact terminal P in the

form of a stud, whose shank is seated in a recess in the base, being retained by the enamel and whose head is exposed above the surface of the enamel. The conductor which may be of any shape or cross-section is indicated by the dotted line.

In Fig. 13, the base or support is in the form of a cylindrical rod around which the heating or resistance conductor is coiled, and retained in place as in the other cases by the enamel coating.

A coiled conductor is shown in Fig. 14 as arranged upon the face of the plate, with exposed contact terminals P P. Fig. 15 is a cross-section of this plate.

Fig. 16 indicates a familiar arrangement of conductors used as a variable resistance or starting box, P being the terminals that may be swept by the switch arm of the device. M indicates the electric motor.

Such constructions as are indicated in Figs. 4, 5, 6 and 7 are intended more especially as rheostats, while the other modifications shown are intended more especially as heaters, although they may of course be used as rheostats.

In all of the illustrations the mass or thickness of the enamel is perhaps greater than is desirable, but this is a point that may be varied at pleasure.

In such constructions as are shown in Figs. 1, 2, 3, 8, 9, 10, 11 and 12, the heating or resistance conductors may be located at or slightly below the surface of the enamel coating and the base being relatively a non-conductor of heat, the heat will be concentrated upon or at the enamel surface, a feature that is especially desirable in devices for heating and cooking.

In my improved device as before stated the base is of a vitreous earthy character, and is capable of withstanding very high temperatures. The enamel is of a similar character and the two being united at a high temperature an intimate union is effected; and since the co-efficient of expansion of the two is substantially the same and may be approximately that of the heating or resistance conductor, the heater or rheostat may be raised to relatively high temperatures without injuring it, or in any way affecting its integrity.

I claim as my invention—

1. In an electric heater or rheostat, a non-conducting base or support of tiling, porcelain or such like material, a heating or resistance conductor arranged thereon, and a layer or coating of vitreous enamel intimately united with the base or support and attaching the conductor thereto.

2. An electric heater or rheostat, consisting of a base or support of porcelain or such like material, a heating or resistance conductor applied thereto, and a coating of vitreous enamel intimately united with the base and conductor, and securely uniting them, and an exposed contact plate or terminal embedded in and secured in position by the enamel coating.

3. An electric heater or rheostat, consisting of a base or support of porcelain, tiling or similar non-conducting material, a heating or resistance conductor disposed upon the face thereof, and a relatively thin coating of vitreous enamel applied over the conductor and face of the base and intimately united thereto.

4. An electric heater or rheostat, consisting of a base or support of porcelain, tiling or such like non-conducting material, a layer of vitreous enamel intimately united therewith, and a heating or resistance conductor embedded in and completely surrounded by the layer of enamel.

5. An electric heater or rheostat, consisting of a base or support of varying thickness, heating or resistance conductors of different cross-sectional area, and a layer or coating of enamel uniting the base and conductors, and intimately united therewith, the conductors of greatest cross-section being placed on or opposite that portion of the base of greatest thickness or mass.

In testimony whereof I have hereunto subscribed my name.

JAMES H. DELANY.

Witnesses:
EDWARD C. DAVIDSON,
LLOYD B. WIGHT.