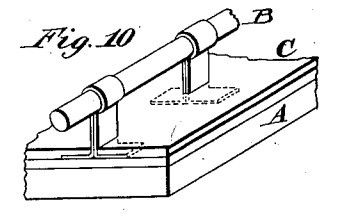
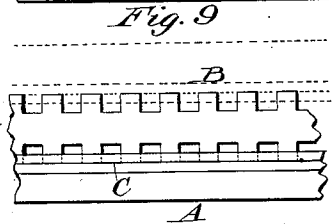
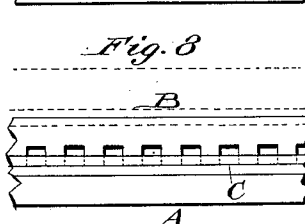
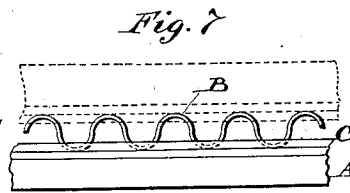
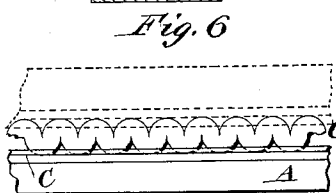
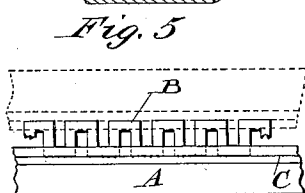
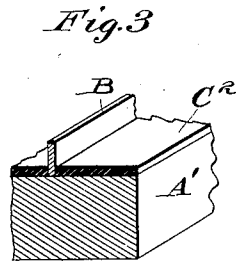
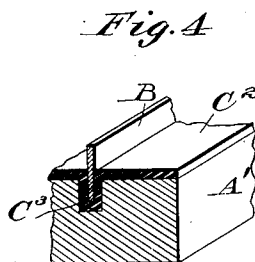
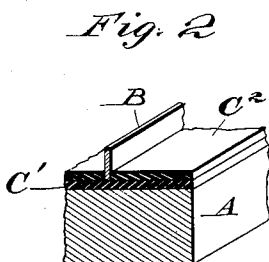
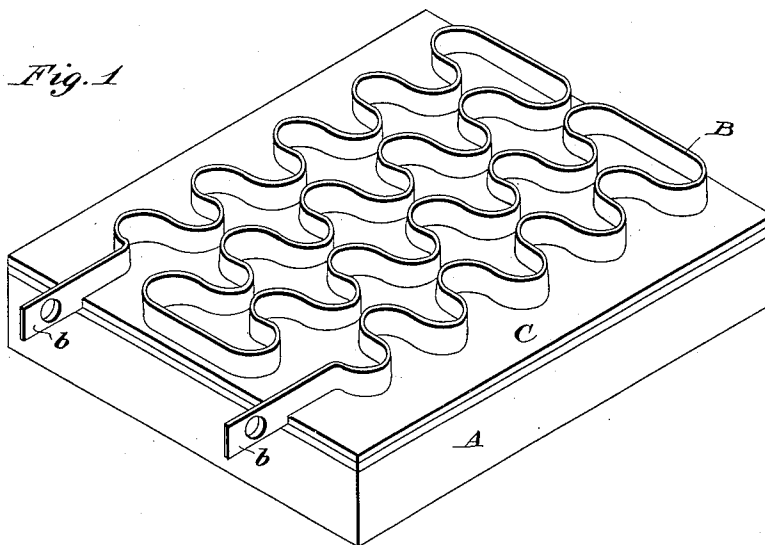


(No Model.)

H. P. BALL.
RHEOSTAT AND ELECTRIC HEATER.

No. 600,057.

Patented Mar. 1, 1898.



Witnesses
Jas. F. Coleman
W. H. Byler

Inventor
H. P. Ball
By his Attorneys
Rich. V. Dyer

UNITED STATES PATENT OFFICE.

HENRY PRICE BALL, OF BROOKLYN, NEW YORK, ASSIGNOR TO THE WARD
LEONARD ELECTRIC COMPANY, OF BRONXVILLE, NEW YORK.

RHEOSTAT AND ELECTRIC HEATER.

SPECIFICATION forming part of Letters Patent No. 600,057, dated March 1, 1898.

Application filed October 30, 1897. Serial No. 656,864. (No model.)

To all whom it may concern:

Be it known that I, HENRY PRICE BALL, a citizen of the United States, residing at Brooklyn, in the county of Kings and State of New York, have invented a certain new and useful Improvement in Rheostats, Electric Heaters, and Similar Apparatus, of which the following is a specification.

My invention relates to rheostats, electric heaters, and other apparatus in which electric energy is converted into heat and in which the conductor is attached to a support by means of an adhesive material.

In the construction of electric heaters and rheostats it is almost the universal practice to attach the conductor to the support by means of vitreous material, such as enamel, and heretofore it was the practice to entirely embed the conductor in the vitreous material. In such apparatus I have found in practice that the rate of expansion of the conductor is considerably greater than the rate of expansion of the vitreous material. This difference in expansion causes the vitreous material to flake or crack and in many instances causes the vitreous material to strip from the support, so as to render the apparatus unfit for use. This difficulty is overcome by my invention, which consists in greatly increasing the radiating-surface of the conductor without increasing the cross-sectional area and in only partially embedding the conductor in the adhesive material. In carrying my invention into effect I preferably employ a conductor in the form of a broad thin strip or ribbon and attach it edgewise to the support. In practice the ribbon-like conductor is reflexed, so that a greater length of the conductor may be conveniently placed within a given space, and the reflexing of the ribbon-like conductor makes it self-supporting on the support during the operation of attaching it to the support by the adhesive material. By arranging the conductor in this way the strains caused by expansion are practically eliminated, except strains in a direction parallel to the surface of the support—that is, compressive strains. The enamel or equivalent material is capable of withstanding such strains to a considerable extent without rupture, and I have found in practice that the

conductor when arranged in accordance with my invention may be heated to the melting-point without rupturing the enamel or equivalent material.

In the accompanying drawings various forms are shown for applying my invention to electric heaters and rheostats.

Referring to Figure 1, A is a supporting-body, which may be of metal or other suitable material and of any desired shape. B is the reflexed ribbon-like conductor, attached edgewise to the support by one or more layers C, of vitreous material, such as enamel. The conductor B in practice will be provided with terminals *b*, adapted to be attached to contact-plates or binding-posts, as is well understood.

In Fig. 2, A represents a metal support, to which is applied a coating of insulating material C', commonly called the "ground coat," and which coat may be of a vitreous or other suitable material. The conductor B is placed edgewise upon this coating, and then a coating C² of vitreous material, such as enamel, is applied, and which coating is fused and upon cooling attaches the conductor to the support.

Fig. 3 represents a support A', made of insulating material, such as porcelain or any other suitable insulating material. The conductor B is placed edgewise upon this support and attached thereto by a layer of vitreous material C².

In Fig. 4 is illustrated a modification of the form shown in Fig. 3, A' being the support of insulating material, and B the conductor. In this form the supporting-body is slotted, as shown, and the conductor placed edgewise in the slot, which is filled on both sides of the conductor with a layer of vitreous material C², and the surface of the support is coated by a layer of vitreous material C², both layers C² and C² adhesively attaching the conductor to the support. In this form the layer of vitreous material C² might be dispensed with and the slot made quite narrow, so that the conductor will fit snugly therein and the layer of vitreous material C² be alone employed to hold the conductor in place. This form of support might be made of metal and the walls of the slot insulated and the con-

ductor placed therein and secured by a coating of enamel. The slotted form of support is desirable when an extremely wide ribbon-like conductor is employed.

5 Figs. 5, 6, and 7 show conductors stamped from strip metal into various shapes and attached edgewise to the support A by one or more layers of enamel C. Conductors formed in this way may be employed where increased
10 resistance is desired for a given space. In this form the conductor is attached only at intervals to the support instead of throughout its length, as shown in Figs. 1 to 4, inclusive. With this arrangement the tendency to rupture the attaching material is further decreased, because the conductor is free to expand in all directions between the points of support without affecting the attaching material.

20 Figs. 8 and 9 show a further modification of the feature of attaching at intervals. In this form the conductor is provided with a series of lateral projections, which may be of any desired shape, and which projections are
25 partially or entirely embedded in the attaching material, the body of the conductor being exposed.

In Fig. 10 is illustrated a still further modification of the feature of attaching the conductor at intervals to the support. In this form the conductor is carried by a series of clips, which are embedded in the attaching material, the conductor itself being entirely exposed except where the clips surround it.
30 In this structure the clips may be of any desired form and the conductor may be round, as illustrated, or rectangular, or any other desired shape, the supporting-clips, of course, being constructed accordingly.

40 In all of the forms illustrated, except Fig. 10, the conductor may be held between two supporting-plates, as indicated in dotted lines, Figs. 5, 6, 7, and 9.

What I claim is—

45 1. The combination of a ribbon-like conductor, a supporting-body and a layer of adhesive material by which the conductor is attached to the support and in which the conductor is only partially embedded, substantially as set forth.

50 2. The combination of a ribbon-like conductor, a supporting-body and a layer of vitreous material by which the conductor is attached to the support and in which the conductor is only partially embedded, substantially as set forth.

55 3. The combination of a ribbon-like conductor, a metal supporting-body, and a layer of adhesive insulating material between the conductor and support, and by which the conductor is attached to the support and in which the conductor is only partially embedded, substantially as set forth.

60 4. The combination of a ribbon-like conductor, and a metal supporting-body, and a layer of vitreous insulating material between

the conductor and support, and by which the conductor is attached to the support and in which the conductor is only partially embedded, substantially as set forth.

70 5. The combination of a ribbon-like conductor, a supporting-body and a layer of adhesive material by which the conductor is attached edgewise to the support and in which the conductor is only partially embedded, substantially as set forth.

75 6. The combination of a ribbon-like conductor, a supporting-body and a layer of vitreous material by which the conductor is attached edgewise to the support and in which the conductor is only partially embedded, substantially as set forth.

80 7. The combination of a ribbon-like conductor, a metal supporting-body, and a layer of adhesive insulating material between the conductor and support, and by which the conductor is attached edgewise to the support and in which the conductor is only partially embedded, substantially as set forth.

85 8. The combination of a ribbon-like conductor, and a metal supporting-body, and a layer of vitreous insulating material between the conductor and support, and by which the conductor is attached edgewise to the support and in which the conductor is only partially embedded, substantially as set forth.

90 9. The combination of a reflexed ribbon-like conductor, a supporting-body and a layer of adhesive material by which the conductor is attached to the support and in which the conductor is only partially embedded, substantially as set forth.

100 10. The combination of a reflexed ribbon-like conductor, a supporting-body and a layer of vitreous material by which the conductor is attached to the support and in which the conductor is only partially embedded, substantially as set forth.

105 11. The combination of a reflexed ribbon-like conductor, a metal supporting-body, and a layer of adhesive insulating material between the conductor and support, and by which the conductor is attached to the support and in which the conductor is only partially embedded, substantially as set forth.

110 12. The combination of a reflexed ribbon-like conductor, and a metal supporting-body, and a layer of vitreous insulating material between the conductor and support, and by which the conductor is attached to the support and in which the conductor is only partially embedded, substantially as set forth.

115 13. The combination of a reflexed ribbon-like conductor, a supporting-body and a layer of adhesive material by which the conductor is attached edgewise to the support and in which the conductor is only partially embedded, substantially as set forth.

120 14. The combination of a reflexed ribbon-like conductor, a supporting-body and a layer of vitreous material by which the conductor is attached edgewise to the support and in

which the conductor is only partially embedded, substantially as set forth.

15. The combination of a reflexed ribbon-like conductor, a metal supporting-body, and
5 a layer of adhesive insulating material between the conductor and support, and by which the conductor is attached edgewise to the support and in which the conductor is only partially embedded, substantially as set
10 forth.

16. The combination of a reflexed ribbon-like conductor, and a metal supporting-body, and a layer of vitreous insulating material between the conductor and support, by which
15 the conductor is attached edgewise to the sup-

port and in which the conductor is only partially embedded, substantially as set forth.

17. The combination of a ribbon-like conductor, two plates between which the conductor is disposed edgewise, and a layer of
20 adhesive material on each plate in which the conductor is partially embedded and by which the conductor is attached to the plates, substantially as set forth.

This specification signed and witnessed this
25 29th day of October, 1897.

HENRY PRICE BALL.

Witnesses:

W. BELZER,

EUGENE CONRAN.