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H. W. LEONARD.

RESISTANCE FOR RHEOSTATS, ELECTRIC HEATERS, &c.

(Application filed Aug. 26, 1901.)

(No Model.)

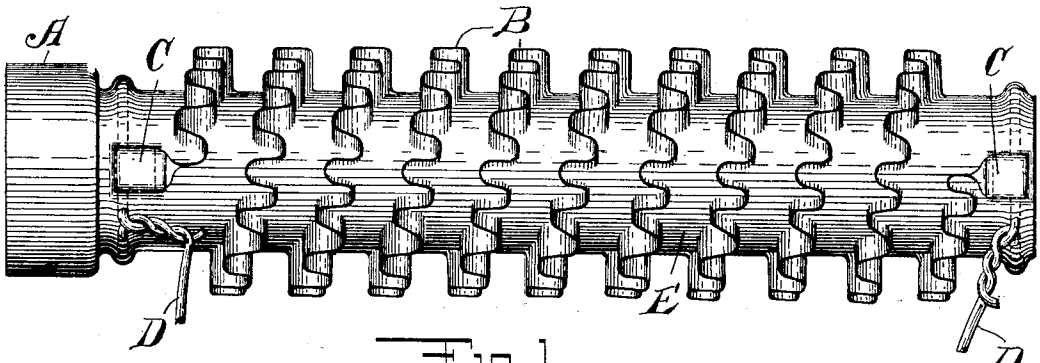


Fig. 1

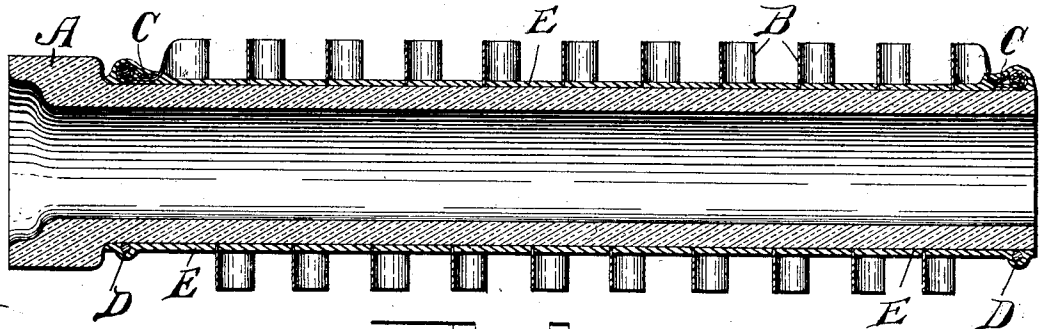


Fig. 2

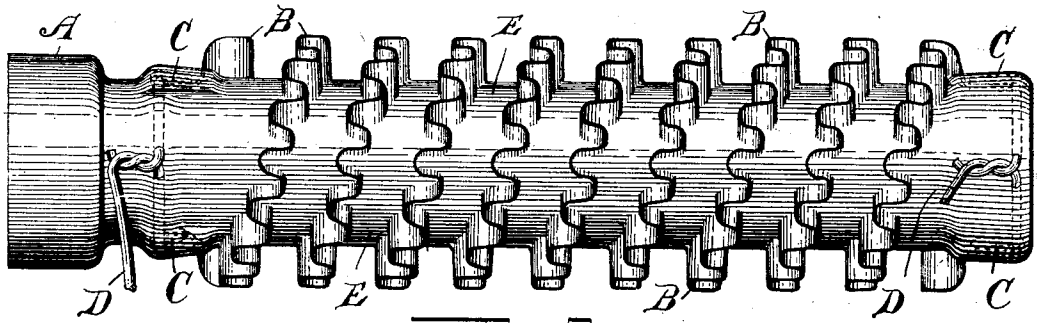


Fig. 3

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UNITED STATES PATENT OFFICE.

HARRY WARD LEONARD, OF BRONXVILLE, NEW YORK.

RESISTANCE FOR RHEOSTATS, ELECTRIC HEATERS, &c.

SPECIFICATION forming part of Letters Patent No. 707,244, dated August 19, 1902.

Application filed August 26, 1901. Serial No. 73,241. (No model.)

To all whom it may concern:

Be it known that I, HARRY WARD LEONARD, a citizen of the United States, residing at Bronxville, in the county of Westchester and State of New York, have invented a certain new and useful Improvement in Resistances for Rheostats, Electric Heaters, &c., of which the following is a specification.

In my application, Serial No. 42,753, filed January 10, 1901, I describe a support of mineral insulating material—such as soapstone, lava, slate, glass, porcelain, brick, terra-cotta—the preferred material being pottery in the form of a tube and having a conductor arranged thereon and held thereto by means of a vitreous glaze, such as enamel, having a relatively low fusing-point, preferably as low as 750° Fahrenheit. Such resistance-tubes I have found by actual use give highly-satisfactory results; but when I attempted to utilize tubes of large diameter to receive conductors of comparatively large cross-sectional area I found that the results were not as satisfactory and in many instances the expansion of the conductor was so great relative to the support that it became distorted or disarranged on the support to such an extent as to cause adjacent sections at numerous places to come into contact, and thus render the device useless for the purpose for which it was intended. I have found by experiments that this difficulty is avoided when the conductor is in the form of a thin ribbon, preferably reflexed and wound edgewise upon the tubular support, the conductor being held in position by means of the tension of the elastic metallic ribbon and being held in its final form by an attaching-glaze of relatively low fusing-point. I sometimes use a ribbon which is three-quarters of an inch in width and .002 of an inch thick. Such a conductor has an extremely-large surface as compared with a round conductor of equivalent cross-section, and hence it can dissipate by radiation and convection a very much larger amount of heat energy than an equivalent round wire. The ribbon is so thin that even when heated quickly to a bright red heat while attached by the enamel to the tube it does not produce any strain which causes the enamel to crack. The ribbon can be heated to a red heat and cooled again for an indefinite number of times without affecting the firm attachment of the ribbon to the tube. The total cubic space occupied by a resistance made in this way is extremely small as compared with any other form of resistance which would have an equivalent continuous heat-dissipating capacity. Therefore this form of resistance becomes very valuable for the many forms of resistances in which it is important to have a large continuous heat-dissipating capacity in a small space. The weight of such a resistance is also very little as compared with customary forms of equivalent capacity, which is often a feature of value. I have found that I can readily attach the ribbon resistance to tubes the diameter of which is as much as seven inches or even more; but the tube I prefer to use has an outside diameter of from one to two inches. In the case of large tubes I prefer to make the tubes of a material which is largely composed of fire-clay and silica. I have found by repeated tests that if I take two tubes exactly identical and wind one with a wire to secure the best result possible and wind the other with my reflexed ribbon resistance the capacity of the ribbon-tube for continuous watt dissipation is about twice as much as in the case of the wire-wound tube. Sometimes I wind the tube so that it has two or more ribbons wound in multiple. I do this when it is necessary to secure low ohms and large ampere capacity. It will be seen that if the several ribbons were combined in one the single ribbon would have to be either thicker or wider, and there is a limit to the practicable width, and it is desirable to have the ribbon as thin as possible. The multiple winding is also of advantage where wires are employed instead of ribbons. In the case of wires I can obtain much better results with two wires wound in multiple as compared with one large wire the cross-section of which is equal to the cross-section of the two smaller wires, as will be readily understood by those skilled in the art. Hence the multiple winding enables me to secure a great advantage where very low ohms and large amperes are desired.

My invention is illustrated in the accompanying drawings, in which—

Figure 1 is an elevation of a pottery or equivalent tube having a reflexed ribbon con-

ductor wound edgewise thereon and attached by a layer of vitreous material. Fig. 2 is a longitudinal section of the tube and resistance, and Fig. 3 is a view illustrating the employment of resistances connected in multiple between terminal leads.

Referring to the drawings, A is the tubular support of mineral insulating material, such as pottery, and B is the thin ribbon conductor, preferably reflexed, as shown. This conductor is preferably wound as a thread around the cylindrical or other shaped support. The preferred form of support is a cylindrical tube made wholly or partly of any of the materials above stated. The ends of the ribbon are bent flatwise to the tube and inserted between clamping-plates C, between which are also placed terminal wires D, which are preferably wrapped one or more times around the tube (after the ends of conductor B are secured by the clamps) and twisted so as to hold the clamping-plates and the ends of the ribbon in position. The clamping-plates are of copper and much thicker than the ribbon conductor. The plate is preferably an oblong strip doubled over, and when the terminal wire and ribbon end are inserted the plate is hammered down, producing intimate surface contact between the parts. The ends of the ribbon may be coiled around wires D and then inserted between the clamping-plates, which are then hammered down. The conductor in its final shape is held to the support by a thin layer of vitreous glaze or enamel E, having a comparatively low fusing-point, preferably as low as 750° Fahrenheit, as pointed out in my application above referred to. However, I have found in my experiments that the reflexed ribbon arrangement will permit the use of a glaze having a higher melting-point. A glaze fusing at 1,500° Fahrenheit may be employed with a reflexed ribbon conductor. If desired, I may coat the entire conductor B with a thin layer of this enamel; but in practice I prefer to leave it exposed to the atmosphere. I also prefer to coat the clamping-plates C and wires D, thus sealing the joint and serving also to further secure the terminal wires and joints in position. While I have shown two terminal wires D, one at each end, it will be understood that one or more intermediate terminal wires may be attached by means of clamps C to ribbon B to divide the resistance into steps or sections. As shown in Fig. 3, several conductors B may be wound upon the tube and connected in multiple between the terminal leads D. If, as shown, two ribbons are employed, the ends are secured to wire B by clamps C, so that when in position the clamps will be at diametrically opposite points and the ribbon being wound like a double thread.

The resistance-tube shown may be employed in various ways, as will be readily understood. It may be separately employed as a resistance, or it may be mounted upon a base, preferably of good heat conducting or absorbing material, such as cast-iron, or a number of such sections may be employed as the sections or steps in various forms of rheostats or heaters.

In manufacturing my improved resistance the ribbon B is attached to a terminal wire D by a clamp C, either by simply placing the wire and ribbon end between the clamp and then hammering the clamp, or by first giving the ribbon end a few turns around wire D and then placing clamp C over such joint and then hammering down the clamp. Wire D is then wound around the tube and secured by twisting the short and long ends together, as shown, leaving a long end for circuit connection, as will be well understood. The other end of the ribbon is similarly connected to a terminal lead, and then the reflexed ribbon is wound edgewise upon the tube, the second wire D being wound around the tube and twisted together when the ribbon is all in position. The elasticity of the reflexed ribbon when wound with a slight tension holds it closely to the support, and when heated after the application of the attaching material will not change its position relative to the support as readily as conductors otherwise arranged thereon, the important point being an arrangement which gives a maximum tension effect. The tube is now coated with a thin layer of the low-fusing glaze, only a small portion of the inner edge of the ribbon being embedded therein. This glaze is preferably in the form of a thick paste, which is dried on the tube and then fired in a muffle-furnace, the tube being removed immediately as the glaze becomes fused. When the glaze is cooled and set, the conductor will be attached to the support thereby and the terminal wires on the tube and the joints will be covered and sealed by the glaze.

What I claim is—

1. As a new article of manufacture, a metallic electrical conductor in the form of a ribbon arranged edgewise under tension around an electrical insulating-surface capable of withstanding heat.

2. As a new article of manufacture, a metallic electrical conductor in the form of a reflexed ribbon arranged edgewise under tension around an electrical insulating-surface capable of withstanding heat.

3. As a new article of manufacture, a metallic electrical conductor in the form of a ribbon wound edgewise around an electrical insulating-surface capable of withstanding heat.

4. As a new article of manufacture, a metallic electrical conductor in the form of a ribbon wound edgewise under tension around an electrical insulating-surface capable of withstanding heat.

5. As a new article of manufacture, a metallic electrical conductor in the form of a reflexed ribbon wound edgewise under tension around an electrical insulating-surface capable of withstanding heat.

6. As a new article of manufacture, a metallic electrical conductor in the form of a ribbon arranged edgewise under tension around a cylindrical electrical insulating-surface capable of withstanding heat.

7. As a new article of manufacture, a metallic electrical conductor in the form of a reflexed ribbon arranged edgewise under tension around a cylindrical electrical insulating-surface capable of withstanding heat.

8. As a new article of manufacture, a metallic-ribbon conductor arranged edgewise upon a support of mineral insulating material, said conductor being secured to the support by means of a vitreous glaze having a fusing-point so low that it fuses before the conductor becomes so loose on the support as to materially change its position thereon.

9. As a new article of manufacture, a metallic-reflexed-ribbon conductor arranged edgewise upon a support of mineral insulating material, said conductor being secured to the support by means of a vitreous glaze having a fusing-point so low that it fuses before the conductor becomes so loose on the support as to materially change its position thereon.

10. As a new article of manufacture, a metallic-ribbon conductor arranged edgewise around a cylindrical electrical insulating-surface capable of withstanding heat, and said conductor being secured to said surface by means of a vitreous glaze having a fusing-point so low that it fuses before the conductor becomes so loose on said surface as to materially change its position thereon.

11. As a new article of manufacture, a metallic-reflexed-ribbon conductor arranged edgewise around a cylindrical electrical insulating-surface capable of withstanding heat, and said conductor being secured to said surface by means of a vitreous glaze having a fusing-point so low that it fuses before the conductor becomes so loose on said surface as to materially change its position thereon.

12. As a new article of manufacture, a metallic-ribbon conductor wound edgewise upon a support of mineral insulating material and provided with one or more terminals or leads, said conductor being secured to the support by means of a vitreous glaze.

13. As a new article of manufacture, a metallic-ribbon conductor arranged edgewise upon a support of mineral insulating material, and having one or more terminals or leads, and metal clamping-plates for maintaining electrical connection between the conductor and each lead, said conductor being secured to the support by means of a vitreous glaze.

14. As a new article of manufacture, a metallic-ribbon conductor arranged edgewise upon a tubular support of mineral insulating material, said conductor being secured to the support by means of a vitreous glaze.

15. As a new article of manufacture, a metallic-ribbon conductor arranged edgewise upon a pottery-tube, said conductor being secured to the tube by means of a vitreous glaze.

16. As a new article of manufacture, a metallic-reflexed-ribbon conductor arranged edgewise upon a tubular support of mineral insulating material, said conductor being secured to the support by means of a vitreous glaze.

17. As a new article of manufacture, a metallic-reflexed-ribbon conductor arranged edgewise upon a pottery-tube, said conductor being secured to the tube by means of a vitreous glaze.

18. As a new article of manufacture, a metallic-ribbon conductor arranged edgewise upon a tubular support of mineral insulating material, said conductor being secured to the support by means of a vitreous glaze having a fusing-point so low that it fuses before the conductor becomes so loose on the support as to materially change its position thereon.

19. As a new article of manufacture, a metallic-ribbon conductor arranged edgewise upon a pottery-tube, said conductor being secured to the tube by means of a vitreous glaze having a fusing-point so low that it fuses before the conductor becomes so loose on the tube as to materially change its position thereon.

20. As a new article of manufacture, a metallic-reflexed-ribbon conductor arranged edgewise on a tubular support of mineral insulating material, said conductor being secured to the support by means of a vitreous glaze having a fusing-point so low that it fuses before the conductor becomes so loose on the support as to materially change its position thereon.

21. As a new article of manufacture, a metallic-reflexed-ribbon conductor arranged edgewise upon a pottery-tube, said conductor being secured to the tube by means of a vitreous glaze having a fusing-point so low that it fuses before the conductor becomes so loose on the support as to materially change its position thereon.

22. As a new article of manufacture, a metallic-reflexed-ribbon conductor arranged edgewise upon a pottery-tube, and provided with one or more terminals or leads, said conductor being secured to the tube by means of a vitreous glaze having a fusing-point so low that it fuses before the conductor becomes so loose on the tube as to materially change its position thereon.

23. As a new article of manufacture, a metallic-reflexed-ribbon conductor arranged edgewise upon a pottery-tube, and having one or more terminals or leads, and metal clamping-plates for maintaining electrical connection between the conductor and each lead, said conductor being secured to the tube by means of a vitreous glaze having a fusing-point so low that it fuses before the conductor becomes so loose on the tube as to materially change its position thereon.

24. As a new article of manufacture, two or

more metallic conductors arranged in multiple between terminal leads upon a support of mineral insulating material, said conductors being secured to the support by means of a vitreous glaze.

25. As a new article of manufacture, two or more metallic-ribbon conductors arranged in multiple between terminal leads upon a support of mineral insulating material, said conductors being secured to the support by means of a vitreous glaze.

26. As a new article of manufacture, two or more metallic-reflexed-ribbon conductors arranged in multiple between terminal leads upon a support of mineral insulating material, said conductors being secured to the support by means of a vitreous glaze.

27. As a new article of manufacture, two or more metallic conductors arranged in multiple between terminal leads upon a support of mineral insulating material, said conductors being secured to the support by means of a vitreous glaze of low fusing-point.

28. As a new article of manufacture, two or more metallic-ribbon conductors arranged in multiple between terminal leads upon a support of mineral insulating material, said conductors being secured to the support by means of a vitreous glaze of low fusing-point.

29. As a new article of manufacture, two or more metallic-reflexed-ribbon conductors arranged in multiple between terminal leads upon a support of mineral insulating material, said conductors being secured to the support by means of a vitreous glaze of low fusing-point.

30. As a new article of manufacture, two or more metallic conductors arranged in multiple between terminal leads under tension upon an electrical insulating-surface.

31. As a new article of manufacture, two or more metallic conductors arranged in multiple between the terminal leads under tension upon a cylindrical electrical insulating-surface.

32. As a new article of manufacture, two or more metallic conductors wound like a double thread in multiple between terminal leads under tension upon an electrical insulating-surface.

33. As a new article of manufacture, two or more metallic conductors wound like a double thread in multiple between terminal leads under tension upon a cylindrical electrical insulating-surface.

This specification signed and witnessed this 15th day of August, 1901.

H. WARD LEONARD.

Witnesses:
HARRY F. DAVIDSON,
WM. PELZER.