W. L. VAN KEUREN.

LEADING-IN CONDUCTOR.

APPLICATION FILED DEC. 29, 1913. RENEWED FEB. 7, 1918.

1,268,647. Patented June 4, 1918.

Fig. 1.

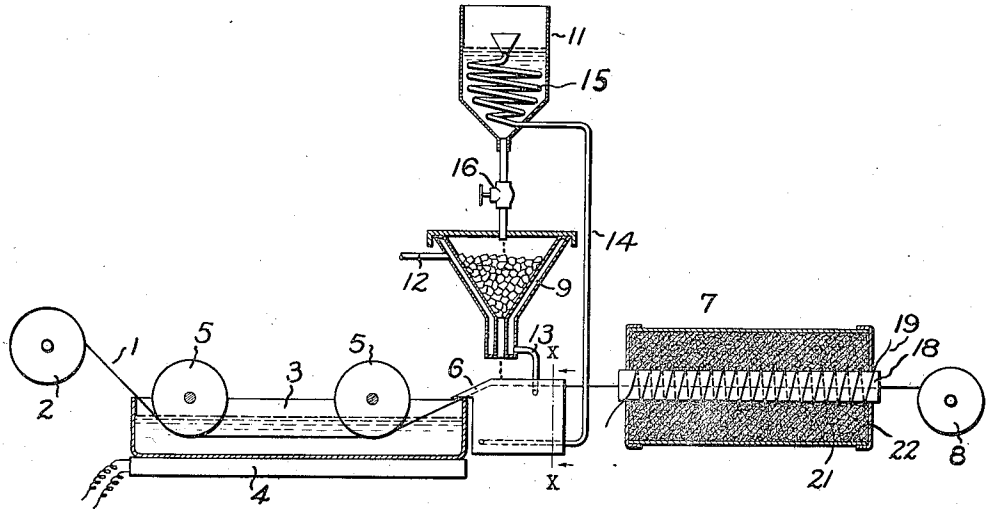
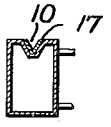



Fig. 2.

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# UNITED STATES PATENT OFFICE.

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## LEADING-IN CONDUCTOR.

1,268,647. Specification of Letters Patent. Patented June 4, 1918.

Application filed December 23, 1913, Serial No. 808,208. Renewed February 7, 1918. Serial No. 215,926.

*To all whom it may concern:*

Be it known that I, WILLIAM LLOYD VAN KEUREN, a citizen of the United States, residing at North Bergen, county of Hudson, State of New Jersey, have invented certain new and useful Improvements in Leading-In Conductors, of which the following is a specification.

My present invention relates to improvements in leading-in conductors for incandescent lamps, gas electric lamps, mercury rectifiers and apparatus of a similar nature in which a glass or vitreous envelop is used and in which it is necessary to provide means for conducting electrical energy from the power circuit to the space inclosed by the envelop. Platinum is well suited for use as a leading-in conductor for the current in apparatus of this nature, both because of the fact that it has a coefficient of expansion which is substantially the same as that of ordinary glass and also because it is non-oxidizable and always presents a clean contact surface to the material of the envelop. On account of these advantages the seal made with a platinum conductor is not affected by changes in temperature and it is comparatively easy to secure a close adherence of the envelop to the metal.

The great cost of platinum has always been, however, a serious objection to its use for such purposes and many efforts have been made to secure a suitable substitute. By making a compound wire of two or more metals or by choosing suitable alloys, conductors have been prepared which have a temperature coefficient very nearly if not exactly the same as that of the material used for such envelops. Attempts have also been made to produce seals with conductors having a somewhat different coefficient of expansion than the material of the envelop. For various reasons, however, difficulty has been experienced in making seals with these substitutes which will be absolutely air-tight and permanent in character. One of the causes of failure to secure good results in the use of such conductors is the fact that they are usually covered with a thin and porous coating of oxid. This film of oxid prevents the formation of a close union between the material of the envelop and the leading-in conductor and the resulting seal is not efficient. While in some instances the oxid will be absorbed by the glass and a tight seal can be made, the making of such a seal requires special care and skill on the part of the operator and also takes more time than the formation of a platinum seal.

I have found, however, that if the conductor is covered with a thin coating of a borate, made to adhere closely to the wire by the application of a temperature sufficient to bake it, the borate coating is readily absorbed by the glass and a perfect seal can be easily and quickly made whether there is any oxid coating on the conductor or not. This film of borate also protects the conductor from further oxidation when the heat necessary for the sealing in operation is applied. One way by which this change can be made to take place is to coat the conductor with a film of borate and then subject it to a temperature preferably considerably higher than that required to fuse the borate. As a result I secure a hard closely adherent film like coating which, if there is any oxid on the wire, is colored accordingly. If the wire is perfectly free from oxid the coating will be transparent. What the exact nature of this coating upon oxid covered wire is I am unable to state definitely but from the behavior of the coating in the sealing-in operation it seems very likely that it consists of a chemical combination of the original borate with the oxid. One form of conductor which I have treated in this way with very satisfactory results is one composed of a core of an alloy of iron and nickel surrounded by a sheath of copper. The parts of this conductor are so chosen that it has practically the same coefficient of expansion as glass. I have, however, made perfect seals with conductors prepared by my process and having a substantially different coefficient of expansion than glass, as for example, a solid copper conductor. My experiments, in fact, have led me to believe that the method which I use is of great utility if applied to any conductor whose conducting properties are such that it is suitable for a leading conductor.

I have found that borax $Na_2B_4O_7$, is well adapted for use in forming this film on the conductor though borates of zinc, copper, and other metals may also be successfully employed.

My invention will be best understood by reference to the accompanying drawing in which I have illustrated one of the numer-

ous ways in which the coating may be formed on the conductor and in which Figure 1 is an elevation of the complete apparatus and Fig. 2 is a section through the line $x$—$x$ of Fig. 1. The conductor 1 which is to be treated is unwound from the reel 2 and passed through a tank 3 containing a concentrated solution of the borate which is to be used to form the desired coating. This solution may be kept heated by means of a hot plate 4 on which the tank rests or by any other convenient method. The wire is guided in its passage through the solution by means of the pulleys 5, 5, under which it passes. After leaving the tank the conductor is passed over the hollow guide 6, and through a furnace 7 in which the deposit is baked on to the conductor. It is then wound upon a reel 8 and is ready for use for sealing into the lamps. In order to provide a constant supply of the concentrated solution to replenish the tank 3 a hollow funnel 9 may be located directly over the groove 10 of hollow guide 6, which funnel contains a supply of the borate which is to be used. Water is allowed to drip from the tank 11, through this borate and the concentrated solution thus formed passes down through the funnel into the groove 10 and from thence flows into the tank 3. In order to keep this part of the apparatus heated so that the solution supplied will always be at the desired temperature steam is led into the hollow wall of the funnel 9 through the pipe 12. This steam passes from the hollow wall of the funnel through the connecting pipe 13 to the interior of the hollow guide 6; from thence it passes by the connecting pipe 14 to the heating coil 15 in the tank 11 and thus provides a supply of hot water for forming the solution. The stop cock 16 controls the supply of water in order to provide the desired amount of solution. To prevent the wearing of the guide a hardened steel insert 17 may be placed in the groove over which the wire passes. The furnace 7 may comprise a porcelain tube 18 around which is wound a heating coil 19 designed to bring the furnace to a temperature high enough to bake the coating on the wire. I have found that when a copper conductor or a copper sheathed conductor is used with borax a temperature of 800° to 900° C. gives the best results. Both ends of the furnace are open to the air and the tube is covered with a body of non-conducting material 20 inclosed in a casing 21. When the conductor enters the furnace the water of the solution is first evaporated leaving a thin and uniform coating of the borate on its surface. The water of crystallization is driven off and the coating melted and baked until it becomes hard. If there is a layer of oxid on the conductor the coating takes on the same color or approximately the same color as the oxid. If there is no oxid present the coating is transparent.

This coating adheres closely to the conductor and when brought into contact with the material of the envelop at the high temperature necessary for the sealing-in operation, protects the wire from further oxidation, is readily absorbed by the glass, and a perfect seal formed. The precise nature of the action which takes place between the leading-in conductor and the material of the envelop I am unable to state at the present time. I have found, however, that the time required for forming the seal is much less than that required when a conductor is used without any coating or with a coating applied without the use of heat, the temperature required is not as great and a greater percentage of the seals made are perfect.

What I desire to secure by Letters Patent of the United States, is:—

1. The method of improving the seal forming property of a leading-in conductor other than platinum which consists in the formation on the surface thereof of a moisture free coating of a borate.

2. The method of improving the seal forming property of a leading-in conductor other than platinum which consists in the formation on the surface thereof of a baked-on coating of a borate.

3. The method of improving the seal forming property of a leading-in conductor of a base metal or metals which consists in the formation on the surface thereof of a baked-on coating of a borate.

4. The method of improving the seal forming property of a leading-in conductor having a copper surface which consists in the formation on the surface thereof of a baked-on coating of a borate.

5. The method of imparting to an electrical conductor other than platinum the property of platinum, of readily forming a persistent air-tight joint with glass which consists in the formation on the surface thereof of a baked-on coating of a borate.

6. The method of imparting to an electrical conductor of a base metal or metals the property of platinum, of readily forming a persistent air-tight joint with glass which consists in the formation on the surface thereof of a baked-on coating of a borate.

7. The method of imparting to an electrical conductor having a copper surface the property of platinum, of readily forming a persistent air-tight joint with glass which consists in the formation on the surface thereof of a baked-on coating of a borate.

8. The method of imparting to an electrical conductor of a base metal or metals having a film of oxid on its surface, the property of platinum, of readily forming a persistent air-tight joint with glass which

consists in the formation on the surface thereof of a baked-on coating of a borate.

9. A leading-in conductor having a baked-on coating of a borate.

10. A leading-in conductor composed of a base metal or metals and having a baked-on coating of borate.

11. A leading-in conductor having a cupreous surface covered with a baked-on coating of a borate.

12. A leading-in conductor composed of a base-metal or metals having an oxidized surface covered with a baked-on coating of a borate.

13. A leading-in conductor of a base-metal or metals having a surface layer composed of oxid of the surface metal combined with a borate.

14. A leading-in conductor having a cupreous surface covered with a layer of copper oxid combined with a borate.

15. A leading-in conductor having a moisture free coating of a borate.

16. A leading-in conductor of a base metal or metals and having a moisture free coating of a borate.

17. A leading-in conductor having a cupreous surface covered with a moisture free coating of a borate.

18. A leading-in conductor composed of a base metal or metals having an oxidized surface covered with a moisture free coating of a borate.

19. A leading-in conductor of a base metal or metals having a surface layer composed of oxid of the surface metal combined with a borate.

20. A leading-in conductor having a cupreous surface covered with a moisture free layer of copper oxid combined with a borate.

21. A leading-in conductor consisting of a core of an alloy of nickel and iron and a copper sheath having a baked-on layer of a borate.

22. A leading-in conductor consisting of a core of an alloy of nickel and iron and a copper sheath having a moisture free coating of a borate.

In witness whereof, I have hereunto set my hand this 24th day of December, 1913.

WILLIAM LLOYD VAN KEUREN.

Witnesses:

S. N. WHITEHEAD,

J. H. ELKINS.