Dec. 15, 1936. E. W. STEVENS 2,064,184

LEAD-IN CONDUCTOR

Filed Jan. 14, 1935

Fig. 1.

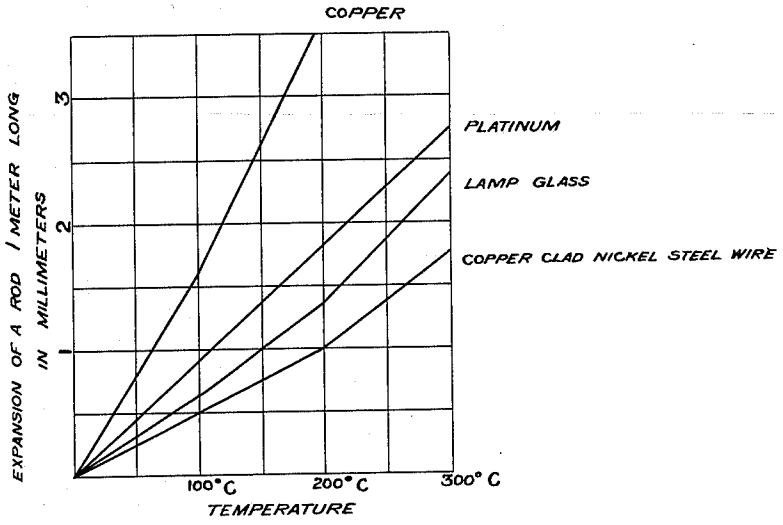


Fig. 2.

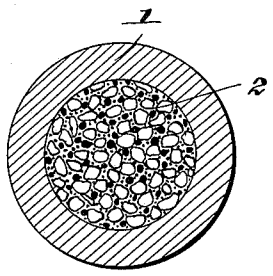
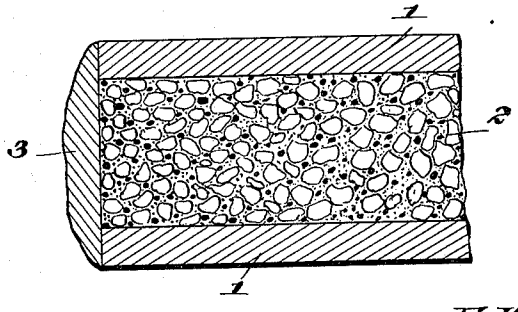


Fig. 3.



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Patented Dec. 15, 1936

2,064,184

UNITED STATES PATENT OFFICE

2,064,184

LEAD-IN CONDUCTOR

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Application January 14, 1935, Serial No. 1,811

1 Claim. (Cl. 176—38)

My invention relates to lead-in conductors for incandescent lamps, radio tubes, mercury rectifiers, and the like, and it consists in the combinations, constructions and arrangements herein described and claimed.

An object of my invention is to provide a lead-in conductor which can be quickly fabricated so as to have substantially the same coefficient of expansion as that of the glass or similar envelope in which it is sealed.

A further object of the invention is to provide a lead-in conductor which can be fabricated while in a cold state and which does not necessitate the welding of the various materials which enter into the composition of the conductor.

Other objects and advantages will appear in the following specification, and the novel features of the invention will be particularly pointed out in the appended claim.

My invention is illustrated in the accompanying drawing forming part of this application, in which:

Figure 1 is a graph showing the rate of expansion of copper-clad nickel steel-wire, ordinarily lamp glass, platinum and copper.

Figure 2 is a cross section of the lead-in wire, and,

Figure 3 is a longitudinal sectional view showing one end of the lead-in wire.

In carrying out my invention I make use of a tube of copper, such as that shown at 1 in the drawing. The copper of which the tube is formed is deoxidized by a treatment with phosphorus and is substantially 99.9 pure. The diameter of the tube and the thickness of the walls thereof would vary according to the uses to which the lead wire is to be put. For instance, with a finished lead-in conductor of twenty-thousandths of an inch outside diameter, I may take a copper tube having an outside diameter of one-half inch with walls thirty-five thousandths of an inch in thickness. This tube is then filled with certain materials having a higher fusing point than the sealing temperature of the ordinary glass lamp. The glass of the ordinary incandescent lamp as given in the July, 1933, number of Industrial and Engineering Chemistry, page 765, in an article entitled "Chemical Composition of Commercial Glasses", is as follows:

SiO_2	62.3%
PbO	22.4
Na_2O	7.0
K_2O	8.3

I may use as a filler such materials as manganese oxide, Mn_2O_3, comminuted carbon, plaster of Paris, china clay, fuller's earth, graphite or the like. These materials have different coefficients of expansion, and thus materials are used which when used with the copper sheath will most nearly approximate the coefficient of expansion of the glass to which the lead-in wire is being sealed. As an example, I may fill the tube with a mixture comprising 90% of manganese oxide, 5% graphite and 5% plaster of Paris.

The filling material of course is in the form of powder and the size of the grains may vary, but I usually prefer to use grains of different sizes, for instance, grains of one-hundred sixty to one-hundred eighty mesh of the manganese oxide, with grains as small as four-hundred mesh of the other ingredients, although the particular size of the grains is not necessarily essential.

The filling material shown at 2 in the drawing is first thoroughly mixed and then tightly packed in the tube. The end of the tube may then be closed as by soldering, as shown at 3 in Fig. 3, or by fusing the ends of the tube, or in any other suitable manner and the lead-in conductor is then fabricated by swaging, in a swaging device, which device is ordinary and forms no part of the present invention.

I find, however, that a better product is effected by the use of a swaging machine than by attempting to draw out the tube. In the swaging machine the forces acting inwardly or toward the center form a more uniform product so that eventually a lead-in conductor of twenty-thousandths of an inch in diameter can be made in which the various sections of the tube will be found to be substantially homogeneous.

The example given above has been found to give substantially the same coefficient of expansion as that of the ordinary glass in an electric-light bulb.

In forming the sealing operation I prefer to apply a coating to the lead-in conductor, preferably zinc borate, although other forms of borate are useful. Zinc borate, however, is non-hygroscopic and when used at a sealing temperature, tends to form a cementing material which is highly efficient because of its tendency not only to cling to the copper, but because it partakes somewhat of the nature of the glass itself, and virtually forms a part thereof at the fusing temperature.

A lead-in wire formed in accordance with this invention has several advantages. It can be quickly prepared with a choice of filling material which experience has shown will give the finished lead-in conductor substantially the same coeffi-

cient as that of the glass, as stated. The filling material being under pressure in the copper sheath, gives a conductor which is not subject to collapse with consequent withdrawal from the edges of the glass, as happens with those conductors made merely of shells or copper or the like.

Furthermore the lead-in conductor is one which is not easily mutilated because the core is under compression as distinguished from hollow lead-in wires. At the same time the conductor has a greater degree of flexibility than other lead-in conductors such for instance as the nickel steel wire mentioned above.

One of the main features of the invention is the fact that the core is made of materials all having a higher fusing point than the temperature of the sealing. The physical characteristics therefore of the materials of the core are not changed and are comparatively unaffected by the sealing heat. For this reason the seal when cold does not have the tendency to open up with consequent leakage of the gas, as is the case with certain of the lead-in conductors heretofore referred to.

While the example given above is a preferred form for glass of a certain quality it is obvious that other ingredients among those named above might be used for the core and that the sheath of copper might be more or less any thickness to suit varying conditions of use.

I claim:—

A lead-in conductor comprising an exterior tube of deoxidized copper and a filler comprising a mixture of manganese oxide, graphite and plaster of Paris.

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