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LEAD-IN WIRE FOR ELECTRIC LAMPS AND SIMILAR DEVICES

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Fig. 1

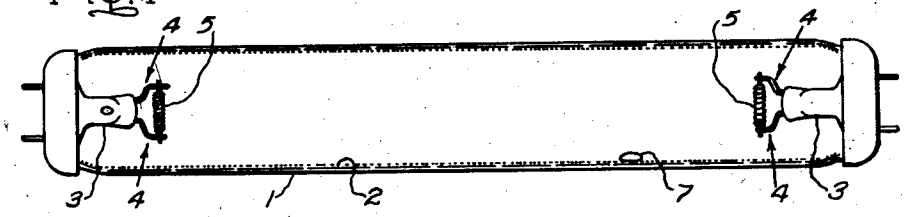


Fig. 2

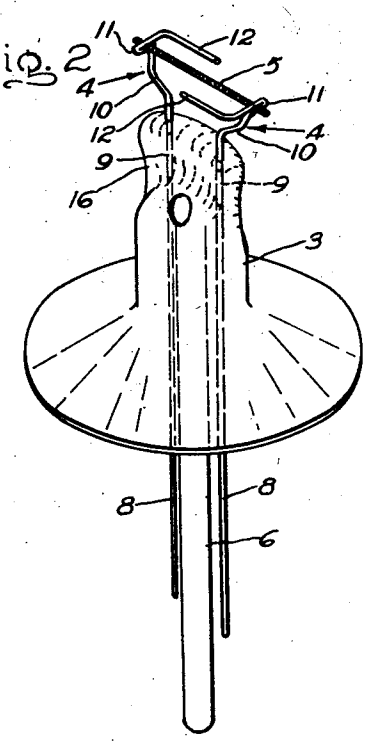
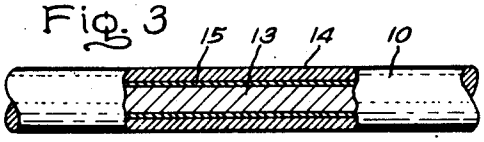


Fig. 3



Inventors:
Paul B. Jordan,
Marvin Pipkin,
by Vernet C. Kauffman
Their Attorney.

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LEAD-IN WIRE FOR ELECTRIC LAMPS AND SIMILAR DEVICES

Paul B. Jordan and Marvin Pipkin, Cleveland Heights, Ohio, assignors to General Electric Company, a corporation of New York

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3 Claims. (Cl. 176—126)

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Our invention relates to electric lamps or similar devices comprising a sealed envelope containing a filament or other electric energy translation element mounted on lead-in wires projecting into the said envelope. More particularly, our invention relates to the composition of such lead-in wires.

It has been found desirable in devices of this type to provide lead-in wires at least the surface of which consists of metallic aluminum. The aluminum has been found to substantially reduce discoloration or blackening of the envelope which normally occurs during operation of the device. In the well-known fluorescent lamps, for instance, the discoloration appears as a heavy blackening at the ends of the tubular envelope which is internally coated with white fluorescent powder. Such use of aluminum has been found to also improve the maintenance and the efficiency of such lamps.

The aluminum surface may be provided by making the lead wires of solid aluminum, but this has certain disadvantages since aluminum wire is difficult to work with. An alternative which gives good results is to make the lead wires of another metal such as iron or deoxidized copper and provide them with a layer or coating of aluminum, for example by dipping them in, or brushing them with an aluminum paint consisting of aluminum powder suspended in a suitable binder such as a solution of nitrocellulose in amyl acetate. However, this process has the drawback that it is not particularly well adapted to high speed automatic manufacture.

It is therefore an object of our invention to provide a lead-in wire having an aluminum surface which will improve lamp life, lumen maintenance and lamp end discoloration and which can be manufactured economically at high speeds. Another object is to provide such a wire constituting the inner lead section of a three-part butt-welded conventional lead wire assembly which can be assembled by conventional methods on conventional high speed equipment. Another object is to provide such a wire capable of being fabricated into a lamp on the ordinary high speed machinery used in that art without employing special precautions.

A feature of our invention, whereby these objectives are attained, is the provision of a composite lead-in wire composed of a copper core and an outer sheath or covering of metallic aluminum with an intervening layer of a metal which prevents alloying between the aluminum and the copper at elevated temperatures such as those

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encountered during lamp making. Further features and advantages of our invention will appear from the following detailed description of species thereof.

In the drawing, Fig. 1 is an elevation of a form of gaseous electric discharge lamp embodying our invention; Fig. 2 is a perspective view, on an enlarged scale of a mount structure at each end of the lamp; and Fig. 3 is a partially sectional elevation of a portion of an inner lead-in wire comprising the invention.

Referring to the drawing, the lamp shown therein is generally representative of the well-known fluorescent lamps of low pressure mercury vapor positive column type. The lamp comprises an elongated tubular envelope 1 of glass or the like having on its interior surface a coating 2 of fluorescent material such as, for example, manganese-activated zinc beryllium silicate or magnesium tungstate or mixtures thereof. The ends of the envelope are sealed by mounts such as shown in Fig. 2 and each comprising a glass stem 3 through which extend lead-in wires 4, 4 between which is mounted a thermionic activated electrode 5 which may be a coiled or coiled-coil filament of tungsten wire coated with an electron emissive material such as one or more of the oxides of alkaline earth metals like barium or strontium. One of the stems may be provided with the usual exhaust tube 6. The envelope may be filled with a rare gas at a pressure of a few millimeters, for example argon at about 2 to 5 mm. pressure, and a small amount of mercury 7. Such lamps are ordinarily operated at a current density such as to result in a mercury vapor pressure of the order of magnitude of 10 microns.

Each of the lead-in wires 4 usually consists of three butt-welded sections, including an outer lead 8 usually of copper, a short press lead 9 consisting of a copper-sleeved nickel-iron core, and an inner lead 10. The inner leads 10 are here shown as of the form disclosed and claimed in the Flaws Patent 2,312,245, which is assigned to the same assignee as the present application, wherein intermediate portions of the inner leads 10 are shaped to form hooks 11 clamped around the ends of the filament 5 and the extremities of the leads are bent to extend parallel to the filament to constitute anode portions 12.

According to our invention the inner leads 10 are composed of a copper core 13, an outer sleeve or sheath 14 of metallic aluminum, and an intermediate layer 15 preferably of nickel. It has been found that if a sheath of aluminum is applied directly to the copper core the heat of stem

making (i. e., sealing the leads 4, 4 into the press portion 16 of the stem 3) apparently causes an alloying of the copper and aluminum, which produces a lead so brittle that it breaks at the press 16 upon bending of the leads. Examination of the broken ends shows no evidence of the original copper core. However, the presence of the intervening layer of nickel 15 has been found to prevent such alloying. Although nickel is preferred for the layer 15, use may be made of other bright metals that do not oxidize readily and have a melting point above about 1000° C., such as, for example, platinum, chromium, rhubidium and zirconium.

Successful results have been obtained with 25 mil aluminum clad, nickel-plated deoxidized copper core wires drawn down from a core of .080 inch copper wire plated with a .0025 inch thick layer of nickel and enclosed in an aluminum tube of .028'' wall thickness. Good results may also be obtained by drawing down a smaller copper core of .050 inch diameter with a heavier plating of nickel and smaller aluminum tubing of .125 inch outside diameter. The nickel may be applied as a sleeve, if desired, rather than a plating. This combination drew down very well and required no annealing until the diameter of 25 mils was reached.

In finished wires the copper core measured 11 mils in diameter, the nickel coating was about 1.4 and 1.5 mils thick, and the aluminum layer was about 5.3 and 5.8 mils thick. While the intermediate layer of nickel or other metal can be made too thin for good results it seems that it might be reduced to as low as 0.5 mil and still prove satisfactory in lamp making on high speed equipment. The thickness of the aluminum outer layer is not too critical. Moreover, we may use composite inner lead wires of other diameters in the range of 10 to 30 mils on the high speed equipment.

Comparative tests have shown that lamps with such leads possess advantages of substantially less end blackening, better maintenance of light output during life, and longer life, as compared with lamps having leads of material such as iron and nickel.

What we claim as new and desire to secure by Letters Patent of the United States is:

1. An electrical device comprising a sealed envelope, a filament therein, and lead-in wires comprising an inner portion located within said envelope and connected to said filament, said inner lead-in wires comprising a drawn composite wire consisting of a copper core and an outer layer of aluminum with an intervening layer of nickel.

2. An electrical device comprising a sealed envelope, a filament therein, and lead-in wires comprising an inner portion located within said envelope and connected to said filament, said inner lead-in wires comprising a drawn composite wire consisting of a copper core and an outer layer of aluminum with an intervening layer of a bright metal which is not readily oxidized and which has a melting point above about 1000° C.

3. A sectional lead-in wire for electric lamps and similar devices comprising an outer section of copper, an intermediate section adapted to seal to glass and consisting of a copper-sheathed nickel-iron core wire, and an inner section of drawn composite wire consisting of an aluminum-clad copper core with an intervening layer of nickel to prevent alloying of said aluminum with said copper upon heating thereof during fabrication of the lamp.

PAUL B. JORDAN.
MARVIN PIPKIN.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
723,717	Nicholson	Mar. 24, 1903
1,637,033	Basch	July 26, 1927
1,724,465	Engels	Aug. 13, 1929
1,952,428	Forst	Mar. 27, 1934
2,279,907	Atchley	Apr. 14, 1942
2,300,400	Axline	Nov. 3, 1942

FOREIGN PATENTS

Number	Country	Date
10,622	Great Britain (1906)	Jan. 17, 1907
101,909	Australia	Aug. 25, 1937