July 6, 1948. R. K. BRAUNSDORFF 2,444,423

INCANDESCENT LAMP AND THE LIKE

Filed Oct. 8, 1945 2 Sheets-Sheet 1

Fig. 1

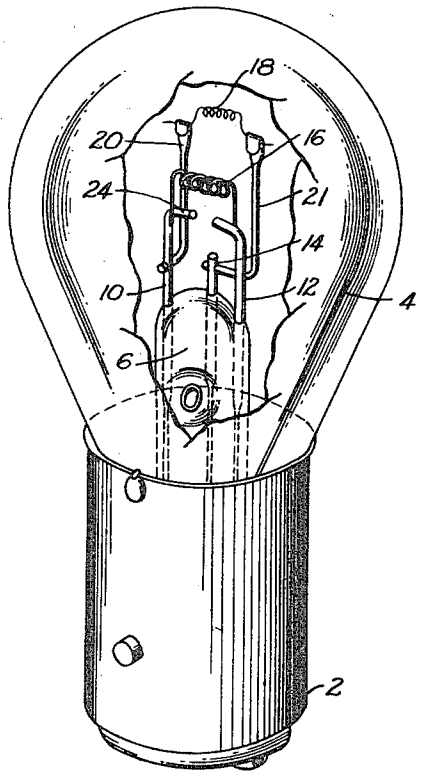

Fig. 3

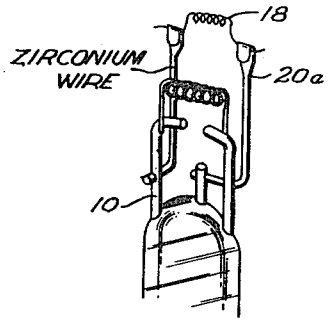

Fig. 4

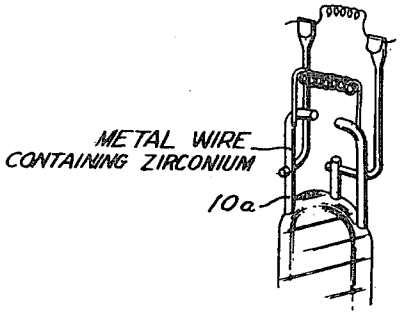

Fig. 2

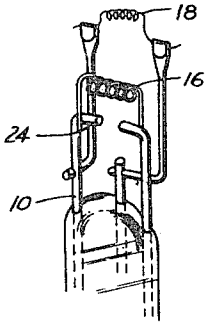

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FIG. 5

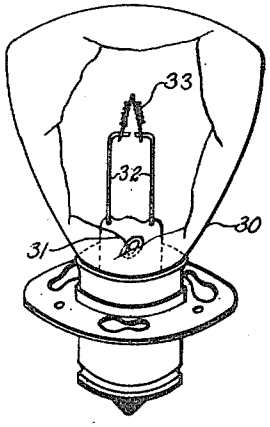


FIG 6

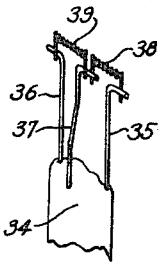


FIG 7

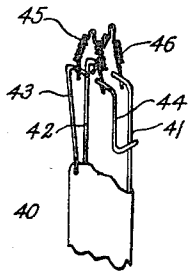


FIG. 8

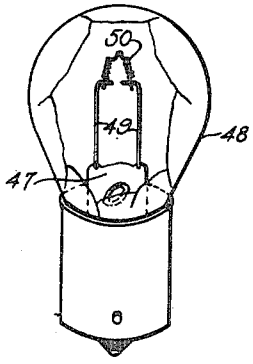


FIG. 9

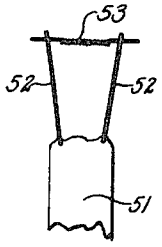


FIG. 10

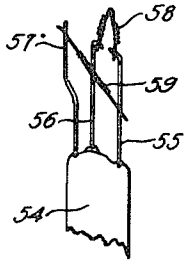


FIG. 11

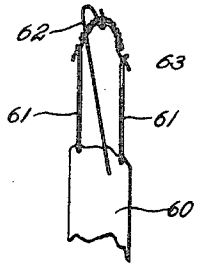


FIG. 12

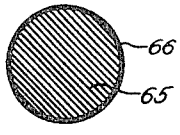
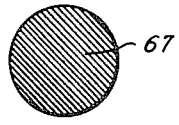


FIG. 13



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2,444,423

UNITED STATES PATENT OFFICE

2,444,423

INCANDESCENT LAMP AND THE LIKE

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Application October 8, 1945, Serial No. 621,047

12 Claims. (Cl. 176—16)

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My invention relates to incandescent electric lamps and the like.

One object of the invention is an improved lamp of the above indicated character which has an extended useful life and which may be economically and safely manufactured.

More particularly the invention relates to an electric incandescent lamp embodying in the structure thereof zirconium metal in solid form as a getter.

Still more particularly the invention comprises an electric incandescent lamp wherein the getter metal is incorporated as a part of the filament support wire or wires of the lamp, and particularly miniature lamps embodying this structure.

Further objects of the invention will hereinafter appear.

For a better understanding of the invention reference may be had to the accompanying drawings forming a part of this application, wherein

Fig. 1 is a perspective view of a two-filament miniature incandescent lamp embodying the invention;

Fig. 2 is a perspective view of the internal structure of a lamp embodying the invention;

Fig. 3 is a perspective view similar to Fig. 2 of another embodiment;

Fig. 4 is a view similar to Fig. 2 of another embodiment;

Fig. 5 is a perspective view of a single-filament lamp embodying the invention;

Fig. 6 is a perspective view of a two-filament mount for a lamp of the character shown in Fig. 5 embodying the invention;

Fig. 7 is a perspective view of another two-filament mount for the lamp of Fig. 5 embodying the invention;

Fig. 8 is a perspective view of another single-filament lamp embodying the invention;

Fig. 9 is a perspective view of a single-filament mount for a lamp of the character shown in Fig. 8;

Fig. 10 is a perspective view of a two-filament mount for a lamp of the character set forth in Fig. 8;

Fig. 11 is a perspective view of another single-filament mount for a lamp of the character shown in Fig. 8 embodying the invention;

Fig. 12 is a sectional view on an enlarged scale of a filament support wire embodying the invention; and

Fig. 13 is a sectional view of another filament support for a lamp embodying the invention.

In Fig. 1 the invention is illustrated as embodied in a two-filament lamp of generally conventional construction comprising a base 2, an envelope 4 and a press 6. Support leads 10, 12 and 14 extend from the press 6 for supporting the two filaments 16 and 18 which in this embodiment are major and minor filaments, respectively. The lead wire supports 10 and 12 extend into the envelope 4 some distance and are provided with right angle bends 24 to which bends are fastened the legs of the major filament 16 as, for example, by welding. The common lead 10 has secured thereto and angle wire section support 20 the free end of which carries one end or leg of the minor filament 18. The lead-in wire support 14 for the minor filament 18 is provided with an angle section wire 21 suitably fastened thereto for supporting the other end or leg of the minor filament 18.

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In accordance with my invention the supporting structure for the filaments 16 and 18 or a part thereof has incorporated therein as a part thereof getter zirconium metal. For example, one or more of the supporting wires 10, 12, 14, 21, and 20 or sections thereof embody zirconium metal as the getter functioning material for the interior of the envelope. For example, the support wires or sections thereof may be formed of a metallic core having a zirconium plate formed or plated thereon as, for example, illustrated in Figs. 2 and 12. One or more of these support wires or sections may be formed of solid zirconium wire as shown in Fig. 3. One or more of these supporting wires or sections thereof may embody zirconium metal as a constituent uniformly dispersed throughout the body of the wire as, for example, shown in Figs. 4 and 13.

The heat generated in the support wires and given off by the filaments during operation of the lamps, causes the zirconium in the supporting structure to combine chemically with gases present, such as hydrogen, oxygen (in the form of oxides on the leads or in occluded form in the leads), nitrogen, carbon monoxide and carbon dioxide in the leads, etc., to form stable compounds of zirconium, which remain stable throughout the life of the lamp while the excess free zirconium tends to continue combining with new gases evolved by the heating of the leads. This action is not dependent on using the powdered form of zirconium whose explosive and inflammable character makes it necessary to handle it with care to avoid burns and fires. The incorporation of the getter metal in and as a part of the filament supporting structure avoids these dangers, and also renders unnecessary the separate gettering operations required in the manu-

facture of the lamps since by the mere mounting of the filaments on the supporting structure in the generally conventional manner, an efficiently gettered lamp or the like is formed which embodies in the supporting structure itself the getter metal in a form and manner free of the dangers incident to the use of zirconium in the powdered form.

In the embodiment of Figs. 2 and 12 the main body **65** of the support wire **10** has incorporated therein a plating **66** of the getter metal. This zirconium or other metal getter plate may be formed by electrolytic deposition on the main body **65** of the support wire and this main body of the support wire may be of any conventional or desired metal, as for example, copper, nickel, etc.

In the embodiment of the invention illustrated in Fig. 3, the zirconium is incorporated directly in the support structure as the angle section **20***a* supporting one end of the minor filament is made of pure zirconium metal wire.

In Fig. 4, as in Fig. 3, the zirconium metal is incorporated in the support structure of the filaments. In this case the lead **10***a*, instead of being of nickel plated iron wire as in the conventional lamp, is of an alloy of zirconium or of a mixture of metals including zirconium. For example, the lead **10***a* may be a mixture of an alloy of silicon, iron and zirconium with additional free zirconium admixed therewith. Alternately the lead **10***a* could be fabricated from iron to which zirconium has been added. For example, the lead **10***a* could be fabricated from a low carbon soft steel made up with excess free zirconium, the excess zirconium being added in a reducing atmosphere. Other means by which zirconium metal may be incorporated in the lead **10***a* will be apparent to those skilled in the art.

I have found that where the getter metal is incorporated in the solid form in the supporting wire structure of the lamp that adequate getter action is obtained notwithstanding the comparatively small outer surface of the support wires; also that the getter functioning is not only efficient during the original manufacture of the bulb but that there is a continuing efficient getter action which maintains the bulb clean and free of blackening throughout the life of the lamp, and further that the useful life of the lamp is thereby found substantially increased. As above indicated, all or only a portion of the supporting wires may have incorporated therein the getter metal. Often only one of the support wires of a single filament lamp or only one or two of the support wires of a multiple filament lamp need have getter metal incorporated therein although as indicated more or all of the support wires may be thus formed. Referring to the embodiments of Figs. 4 and 13, I have found that the percentage of the getter metal contained in the support wire need be of only a small proportion of the whole body of metal. For example, I have obtained quite satisfactory results where the support wire contains as little as $\frac{7}{10}$ or $\frac{3}{4}$ of 1% of zirconium metal as, for example, in a nickel alloy wire containing that small percentage of zirconium metal alloyed or uniformly dispersed therein, the rest of the alloy being nickel except for the presence of impurities. The wire support containing the zirconium may also contain other constituents which do not, or are present in insufficient quantities to, impair the functioning of the getter metal as, for example, a very small percentage of silicon (for example, less than 1%) to add to the tensile strength and improve the drawing quality of the wire. It is understood as described above, that support wires embodying the getter metal constituent may be formed of other metals than those described above.

In Figs. 5 to 11 I have illustrated the invention as embodied in various types of miniature electric incandescent lamps. The embodiments of Figs. 5, 6 and 7 embody an envelope **30** with the base structure indicated generally in Fig. 5. In Fig. 5 the glass press is indicated at **31**, the filament supporting wires at **32** and the single filament at **33**. In Fig. 6 the lamp is a two filament lamp embodying a glass press **34**, support wires **35** and **36** supporting one end of the filaments **38** and **39**, respectively, and a common support wire **37** supporting the other ends of the filaments. In Fig. 7 the mount is also a two filament mount. In this embodiment support wires **41** and **42** extend from the press **40** and carry the filament **46** and for carrying the filament **45** an angle support wire **44** is welded to the support wire **41** intermediate its length while a separate support wire **43** extends at an angle up from the press for supporting the other end of the filament **45**.

In the embodiments of Figs. 8, 9, 10 and 11 the filament mounts are mounted in an envelope **48** having a base of the general character shown in Fig. 8. In Fig. 8 the single filament **50** is carried by the support wires **49** extending from a glass press **47**. In Fig. 9 the single filament **53** is carried by support wires **52** extending from the press **51**. In Fig. 10 a double filament mount is shown comprising a major filament **58** and a minor filament **59**. Support wires **55** and **56** extending from the press **54** support the filament **58**. The minor filament **59** is angularly disposed with one end of the filament welded to the support **55** and with the other end carried by a support wire **57** extending from the press **54**. In the embodiment of Fig. 11 the single filament **63** is jointly supported by a pair of lead-in wires **61** extending from the press **60** and an anchor wire **62** embedded at one end in the press **60** and having a supporting hook engaging and supporting the filament **63** at its intermediate point.

One or more wires of the supporting structure of each of the embodiments of Figs. 5 to 11 has or have incorporated therein the getter metal as above set forth. For example, with all of the support wires of each of the embodiments of Figs. 5 to 10 being of the structure of Fig. 13 the lamps exhibit practically complete freedom from blackening and efficient getter functioning both during manufacture and throughout the lamp life. In the embodiment of Fig. 11 one or more of the support wires **61**, **62** may have incorporated therein the zirconium metal, and good results have been obtained with the anchor wire **62** of solid zirconium metal and with the conventional lead-in support wires **61** having no zirconium therein.

One or more of the wires of the supporting structure for the filaments may be the conventional nickel plated iron wire support nickel or other metal or alloy wire support with zirconium added to the surface. For example, zirconium may be added to the surface of such a support wire by lengthwise abrasion of the wire with the notched tool made of zirconium sheet metal, or zirconium may be transferred to the wire surface by rotation of the zirconium metal wire while held in rubbing contact with the support wire. Support structures having the getter

metal incorporated thereon by abrasion however are not as satisfactory as the above described supporting structures.

While the getter metal zirconium is particularly useful and is the preferred getter metal used in the device of this invention, it is understood that certain features thereof are applicable to the use of other getter metals such, for example, as hafnium, columbium, etc. It is also understood that while the invention as above set forth is particularly applicable to incandescent electric lamps, certain features of the invention are applicable to similar devices, such as radio tubes for the support of the heating filaments and the gettering of the envelope.

This is a continuation in part of application, Serial No. 480,438 filed March 25, 1943, abandoned October 11, 1945.

I claim:

1. In a two-filament incandescent lamp having major and minor filaments supported from the press, the improvement which comprises an angle section of solid zirconium metal wire serving both to support one end of the minor filament and as a getter.

2. An incandescent lamp comprising an envelope, a press, a pair of support wires extending from said press into said envelope and a filament carried by said support wires, one of said support wires being of zirconium metal combined with other metal, the percentage of zirconium metal in said wire being sufficient to serve as a getter during operation of the lamp.

3. In a two-filament incandescent lamp having major and minor filaments supported from the press by support wires of which one serves as the common lead for the filaments, the improvement which comprises the inclusion of zirconium metal in the structure of the common lead to act as a getter for the lamp during operation.

4. The method of preventing blackening of the envelope of a two-filament incandescent lamp which comprises forming the common support wire for the filaments of an alloy containing iron and zirconium metal admixed with free zirconium metal.

5. An incandescent lamp comprising an envelope, a press, a pair of support wires extending from said press into said envelope and a filament carried by said support wires, one of said support wires being of an alloy of steel and zirconium admixed with free zirconium, the percentage of free zirconium metal in said wire being sufficient to serve as a getter during operation of the lamp.

6. An incandescent lamp comprising an envelope, a press, a pair of support wires extending from said press into said envelope and a filament carried by said support wires, one of said support wires being of zirconium metal combined with other metal, the zirconium metal being on the outer surface of the wire and the percentage of zirconium metal being sufficient to serve as a getter during operation of the lamp.

7. In a device of the character set forth, an envelope, a filament and support wires for said filament, one or more of said support wires containing zirconium metal and serving both as filament supporting structure and as a getter functioning element.

8. In a device of the character set forth, an envelope, a filament and support wires for said filament, one or more of said support wires containing a getter functioning metal and serving both as filament supporting structure and as a getter functioning element.

9. In a device of the character set forth, an envelope, a filament and support wires for said filament, one or more of said support wires containing a getter functioning metal and serving both as filament supporting structure and as a getter functioning element, one or more of said support wires being provided with a surface plating getter metal.

10. In a device of the character set forth, an envelope, a filament and support wires for said filament, one or more of said support wires containing a getter functioning metal and serving both as filament supporting structure and as a getter functioning element, one or more of said support wires being of solid getter functioning metal.

11. In a device of the character set forth, an envelope, a filament and support wires for said filament, one or more of said support wires containing a getter functioning metal and serving both as filament supporting structure and as a getter functioning element, one or more of said support wires having the getter functioning metal interspersed therein as a constituent thereof.

12. An incandescent lamp comprising an envelope, a press, a pair of support wires extending from said press into said envelope and a filament carried by said support wires, one of said support wires being of zirconium metal combined with other metal, the percentage of zirconium metal in said wire being sufficient to serve as a getter during operation of the lamp, said getter support wire containing nickel as the major constituent with a small percentage of zirconium.

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