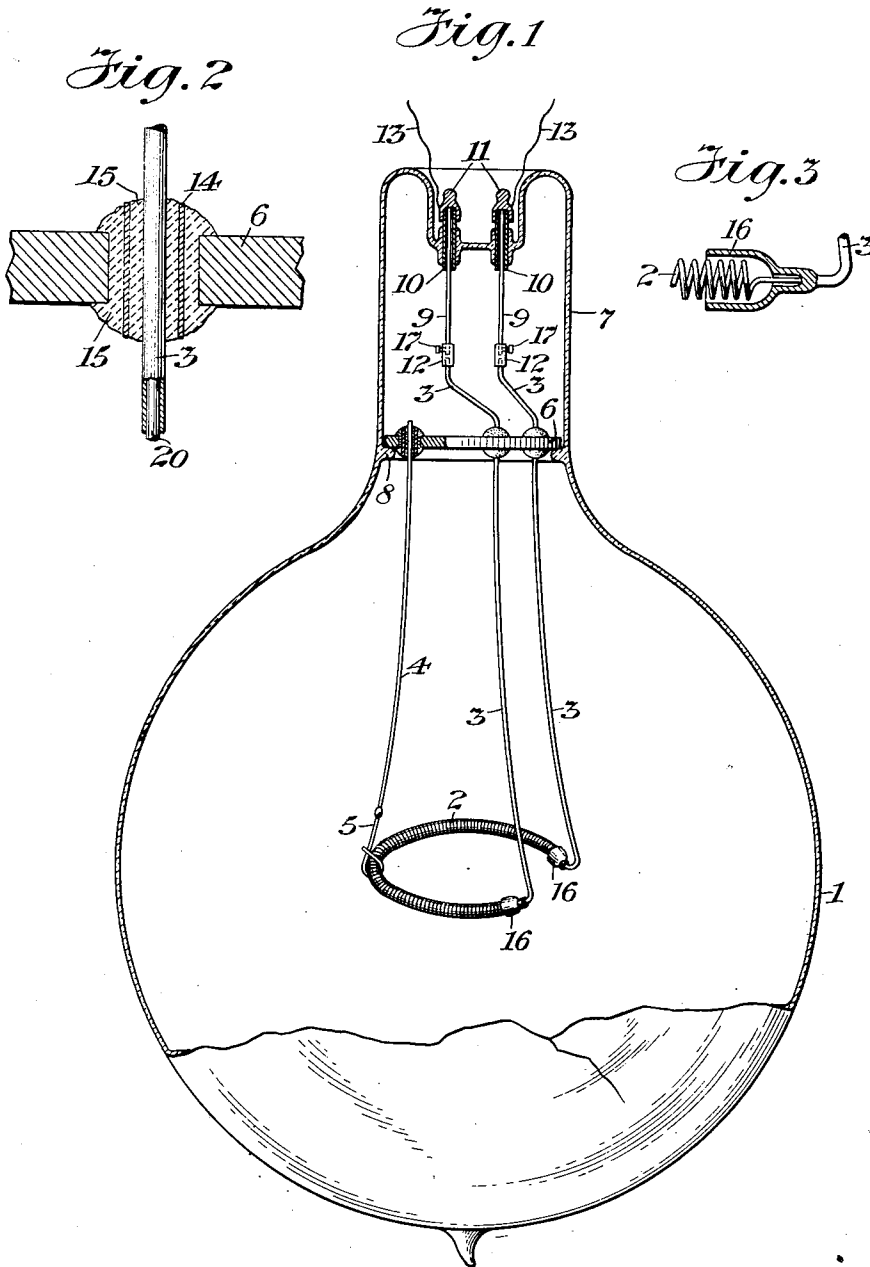


F. G. KEYES.
ELECTRIC LAMP.

APPLICATION FILED JAN. 17, 1916. RENEWED MAY 2, 1919.

1,306,259.

Patented June 10, 1919.



WITNESS

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ELECTRIC LAMP.

1,306,259.

Specification of Letters Patent.

Patented June 10, 1919.

Application filed January 17, 1916, Serial No. 72,407. Renewed May 2, 1919. Serial No. 294,345.

To all whom it may concern:

Be it known that I, FREDERICK G. KEYES, a citizen of the United States, and resident of Hoboken, county of Hudson, State of New Jersey, have invented certain new and useful Improvements in Electric Lamps, of which the following is a specification.

The present invention relates to improvements in tungsten lamps, more particularly lamps of that class having high candle power. The central feature of these novel lamps is a tungsten filament of considerably larger diameter than is now customarily used for the filaments of constant potential tungsten lamps, the same being connected with heavy lead wires. With the arrangement thus described the potential of tungsten lamps may be considerably reduced, while the current carrying capacity thereof is correspondingly increased. The result is that with the same expenditure of electrical energy a lamp having far less fragility than usual is provided and by reason of the lower applied potential, the lamp operates within a less limited sphere and escapes certain of the limitations imposed by the usual commercial supply voltages.

In the commercial forms of filament lamp now in use, the largest value of the current is about 2.5 amperes. In the metal filament lamps here represented, a current of over 18 amperes may be utilized. In speaking hereinafter of heavy filaments or filaments of considerable diameter, the intention is to make such terms apply to filaments having the capacity indicated above, that is to say, capable of carrying current of above 18 amperes.

Whatever attempts may have been made heretofore to produce lamps having the characteristics of the lamp herein described have been defeated by the failure of the seals which, in the usual form, are unable to sustain currents of the indicated magnitude for more than a brief period.

Another feature of the lamp resides in the mode of securing the proper sealing of the lead wires and of the anchors which support the tungsten filament which in the present invention usually appears in the form of a spiral.

Special means are also provided for making stable connections between the ends of

the tungsten spiral and the iron leads and other details are present which will be described in due course in the present specification.

My invention is illustrated in the accompanying drawings in which Figure 1 is a vertical section of one of my lamps, a portion of which is shown in full lines; Fig. 2 is a sectional detail of the seal and support for what may be called the inner leads of the tungsten spiral and Fig. 3 is a detail, also mainly in section, of the connection between an end of the tungsten spiral and one of the inner leads.

In the drawings, 1 is a globe for one of my lamps and 2 is a tungsten filament, here shown in the form of a spiral, located approximately at the center of the globe 1. The filament is attached at its ends to lead wires 3, 3, say of copper sheathed with iron, the copper being utilized for its good conducting qualities and the iron being employed for its stiffness or rigidity to prevent the bending or distortion of the copper wire under the influence of the high temperature developed within the globe.

In Fig. 2 the copper conductor is shown at 20 and the iron sheathing at 3. An iron anchor rod is shown at 4, the same being provided with a tip portion 5 of tungsten wire which is sealed to the iron rod and may be bent around at its outer end so as to surround completely or partially the central portion of the tungsten spiral 2, and support the same along its middle. It will be understood that several of such anchor rods may be employed if found desirable or necessary.

The leads 3, 3, and the rod 4 pass through a disk or diaphragm 6, of aluminum lying within a tubular extension, 7, of the globe 1 and being arranged just above a shoulder, 8, near the bottom of said extension. The object of the diaphragm 6 is to shut off from the tubular extension and from the lamp seals, presently to be described, near the upper end of said extension, all unnecessary heat. The diaphragm 6 does not necessarily form any part of the support for the leads 3, 3, although the anchor rod 4 is supported by the said diaphragm through intermediate connections.

What I have called the inner leads 3, 3, are provided with sockets 12, 12, suitably

sealed thereto and having any convenient depth. Into these sockets extend copper leads 9, 9, which form mechanically a part of the seals of the lamp. The rods 9, 9, pass through platinum tubes 10, 10, constituting the main conducting portion of the lamp seals. On the outer ends of the tubes 10, 10, are placed iron caps 11, 11, which are welded to the tubes 10, 10, and the rods 9, 9, by means of an oxy-acetylene flame. The external leads may be copper wires 13, 13, fused or soldered to the caps 11, 11, as shown.

The significant portion of each seal having the elements named is the thin tube 10 which is preferably of platinum, as already stated, and which has a coefficient of thermal expansion greater than that of the material of the container, the container itself being of glass or quartz, as the case may be. In general, the characteristics of the seals are the same as those shown, described and claimed in United States patent to Charles A. Kraus, No. 1,093,997, dated April 21st, 1914. It is by virtue of the qualities of this seal that the light structure herein described operates with such excellence.

It will be observed that the seals are made within a reëntrant portion of the extension 7, whereby the danger of fracture from mechanical causes is reduced. The tubes 10, 10, are sealed within the said reëntrant portions. The entire interior of the lamp is thus sealed off from exposure to the external air and a structure is provided which will admit of the safe and continuous application thereto of currents ranging from 3 to 50 amperes. In this way lamps of exceedingly high candle power are obtainable without unduly shortening the life of the lamps.

The mode of connection between one of the inner leads 3, and the aluminum disk 6 is illustrated in Fig. 2. An opening being made in the diaphragm at the proper point the tube of copper and iron, surrounded by a tube 14 of quartz is passed through the diaphragm and the entire inner space is then packed with a suitable cement, 15, such as might be formed by the mixture of ground silica and sodium silicate. This prevents the contact of the inner leads with the aluminum disk and thus obviates the danger of short circuiting between said leads. By similar construction the anchor rod 4 is supported in the disk and insulated therefrom and from the inner leads 3, 3.

At the inner terminals of the leads 3, 3, the iron coverings are attached to or formed into cups 16, 16, into which the ends of the tungsten spiral extend and within which they are attached to the said cups or welded thereto so as to form good electrical connection therewith.

As a means for joining the heavy copper

leads 9, 9, to the inner leads 3, 3, through the medium of the sockets 12, 12, I may make use of any suitable sort of juncture. For example, I may extend the lower ends of the leads 9, 9, down into the sockets 12, 12, and hold them there by means of set-screws 17, 17.

The thin tube of platinum which carries the current through the seal and constitutes the main significant feature thereof acts, by reason of the predominating tenacity of the union between the metal and the container, to cause the seal to resist the joint-rupturing strain due to the cooling of the metal. In other words, the union between the platinum tube and the container material is of such tenacity as to permit of the stretching of the metal rather than loosening its hold. In this way the platinum tube serves its purpose.

The present application is a continuation in part of my application Serial No. 811,002 filed January 8th, 1914.

I claim as my invention:

1. In a tungsten lamp, a container, a filament of tungsten capable of being brought to brilliant incandescence by currents of above 18 amperes, leads connected with the terminals of said filament, and tubular seals for the said leads consisting of a metal tube sealed through the wall of the container and whose coefficient of thermal expansion is greater than that of the container material, the leads constituting the conducting portion of the seals.

2. In a tungsten lamp, a container, a filament of tungsten capable of being brought to brilliant incandescence by currents of above 18 amperes, leads connected with the terminals of said filament, and tubular seals for the said leads consisting of a tube of platinum sealed through the wall of the container and whose coefficient of thermal expansion is greater than that of the container material, the leads constituting the conducting portion of the seals.

3. In a high candle power tungsten lamp, a container, a filament of tungsten capable of being brought to brilliant incandescence by currents of above 18 amperes, leads connected with the terminals of said filament, and tubular seals for the said leads consisting of a metal tube sealed through the wall of the container and whose coefficient of thermal expansion is greater than that of the container material, the leads constituting the conducting portion of the seals.

4. In a high candle power tungsten lamp, a container, a filament of tungsten capable of being brought to brilliant incandescence by currents of above 18 amperes, leads connected with the terminals of said filament, and tubular seals for the said leads consisting of a tube of platinum sealed through the wall of the container and whose coefficient

cient of thermal expansion is greater than that of the container material, the leads constituting the conducting portion of the seals.

5 5. In a high candle power lamp, a container, a filament capable of being brought to brilliant incandescence by currents of moderate potential and high amperage, leads connected with the terminals of said filament, and tubular seals for the said leads
10 consisting of a metal tube sealed through the wall of the container and whose coefficient of the thermal expansion is greater than that of the container material, the leads constituting the conducting portion
15 of the seals.

6. In a high candle power tungsten lamp, a container, a tungsten filament capable of being brought to brilliant incandescence by currents of moderate potential and high
20 amperage, leads connected with the terminals of said filament, and tubular seals for the said leads consisting of a metal tube sealed through the wall of the container and whose coefficient of thermal expansion
25 is greater than that of the container material, the leads constituting the conducting portion of the seals.

7. In an incandescent lamp, a container, a filament, leads connected with the terminals of the filament, and sealing devices for the said leads, the leads constituting the
30 conducting portion of the seals.

8. In an electric device, a container, a conductor therein, leads connected with the terminals of the said conductor, and sealing devices for the said leads, the leads constituting the conducting portion of the seals.
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9. In a tungsten lamp, a container evacuated with respect to injurious gases, a tungsten filament, leads connected with the terminals of the filament and tubular seals for the said leads, the leads at the sealing ends consisting of heavy metal rods and constituting the conducting portion of the seals.
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45 10. In a tungsten lamp, a container evacuated with respect to injurious gases, a tungsten filament, leads connected with the terminals of the filament and tubular seals for the said leads, the leads at the sealing ends consisting of heavy copper rods and constituting the conducting portion of the seals.
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11. In a tungsten lamp, a container evacuated with respect to injurious gases, a spiral of tungsten, leads connected with the terminals of the spiral, and tubular seals for the said leads, the leads at the sealing ends consisting of heavy metal rods and constituting the conducting portion of the seals.
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12. In a tungsten lamp, a container evacuated with respect to injurious gases, a spiral of tungsten, leads connected with the terminals of the spiral, and tubular seals for the
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said leads, the leads at the sealing ends consisting of heavy copper rods and constituting the conducting portion of the seals. 65

13. In a tungsten lamp, a container evacuated with respect to injurious gases, a filament of tungsten, leads connected with the terminals of the filament and tubular seals for the said leads, the leads constituting the
70 conducting portion of the seals.

14. In a tungsten lamp, a container evacuated with respect to injurious gases, a filament of tungsten adapted to be made luminous by currents of from 20 to 50 amperes, leads connected with the terminals of the filament and tubular seals for the said leads, the leads consisting of heavy copper rods, and constituting the conducting portion of the seals, whereby currents of great
75 magnitude may be utilized for rendering the filament luminous and rupture of the seals is avoided. 80

15. In a tungsten lamp, a container evacuated with respect to injurious gases, a filament of tungsten adapted to be made luminous by currents of from 20 to 50 amperes, leads connected with the terminals of the filament, those portions of the leads which are directly exposed to the heat developed in the lamp being of iron clad copper and the remaining portions of the leads consisting of heavy copper rods joined to the seals and constituting the conducting portion of said seals. 85
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16. In a tungsten lamp, a container evacuated with respect to injurious gases, a filament of tungsten adapted to be made luminous by currents of from 20 to 50 amperes, leads connected with the terminals of the filament, tubular seals for said leads, those portions of the leads which are directly exposed to the heat developed in the lamp being of iron clad copper, and the remaining portions of the leads consisting of heavy copper rods joined to the seals and constituting the conducting portion thereof, and a diaphragm separating the inner or exposed portions of the leads from the remaining portions thereof. 95
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17. In an electric device, a container evacuated with respect to injurious gases, a filament of tungsten, leads connected with the terminals of the filament, and tubular seals for the said leads, the leads constituting the conducting portion of the seals. 115

Signed at New York, in the county of New York, and State of New York, this tenth day of January, A. D. 1916.

FREDERICK G. KEYES.

Witnesses:

HAROLD B. WOODWARD,
THOS. H. BROWN.