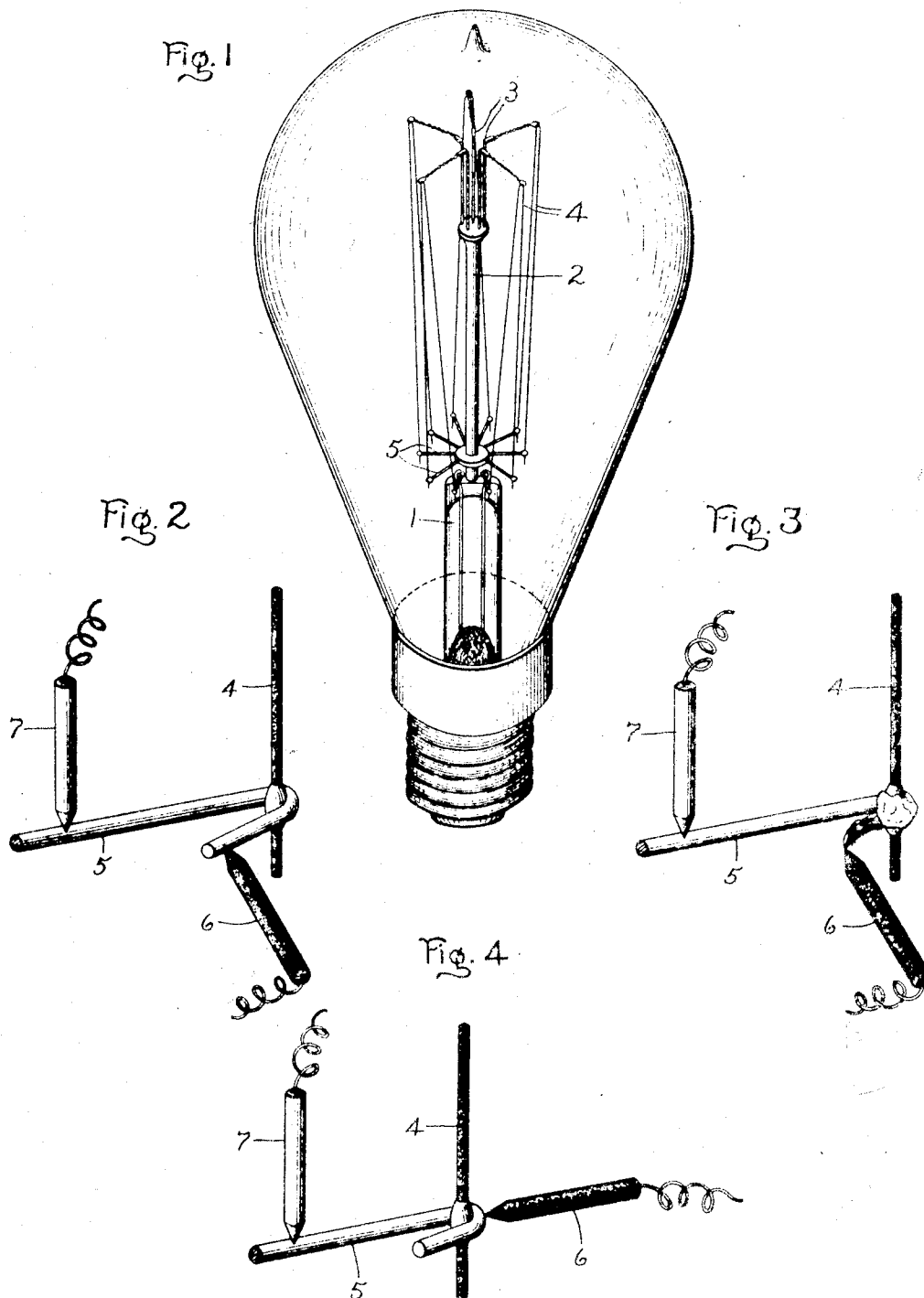


W. HOWELL.
FILAMENT CONNECTION.
APPLICATION FILED AUG. 7, 1907

1,022,482.

Patented Apr. 9, 1912.



WITNESSES:
Benjamin B. White
Allen C. Frost

INVENTOR
JOHN W. HOWELL.
BY *Alfred H. Davis*
ATT'Y.

UNITED STATES PATENT OFFICE.

JOHN W. HOWELL, OF NEWARK, NEW JERSEY, ASSIGNOR TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

FILAMENT CONNECTION.

1,022,482.

Specification of Letters Patent.

Patented Apr. 9, 1912.

Application filed August 7, 1907. Serial No. 387,453.

To all whom it may concern:

Be it known that I, JOHN W. HOWELL, a citizen of the United States, residing at Newark, county of Essex, State of New Jersey, have invented certain new and useful Improvements in Filament Connections, of which the following is a specification.

My present invention relates to the art of lamp manufacture, and more particularly to the art of connecting metal filaments to leading-in wires.

My present invention consists in an improved joint or connection between a leading-in conductor and a metal filament adapted to run at high temperatures.

It also comprises the method whereby this improved joint or connection may be made.

Lamp filaments of refractory metal, such as tungsten, have heretofore been connected with leading-in conductors, say of nickel, by fusing the end of the nickel wire about the tungsten filament by means of an electric arc operated in hydrogen. For certain reasons I may desire that the joint or connection shall be established without complete fusion of the end of the nickel or other leading-in wire, and my present invention comprises a method whereby a firm connection may be established without this fusion.

In the accompanying drawing Figure 1 is a perspective view of a metal filament lamp embodying my invention; Fig. 2 is an enlarged view of the joint between the leading-in conductor and filament before the joint is completed; Fig. 3 is a view of the joint when complete; and Fig. 4 illustrates a modification in the method of forming the joint.

The incandescent lamp illustrated in Fig. 1 comprises a lamp stem 1 on which is mounted a glass pedestal 2 carrying refractory hooks 3 which engage with the refractory metal filament loops 4 of tungsten or other suitable metal. These loops are supplied with current and are connected together at their ends by leading-in conductors 5 of nickel or platinum or other suitable metal or alloy.

To make a firm connection between the leading-in wires 5 and the metal filaments 4, I arrange the parts as shown in Fig. 2. A hook is made in the end of the leading-in conductor 5 and the end of the filament 4 is placed in this hook; the point of contact between the two is then pasted over with

very finely divided tungsten or copper mixed with a little gum arabic. I next draw an arc from the end of the hook by means of electrodes 6 and 7 connected with a source of electrical energy. The fusion of the end of the hook causes a globule of fused metal to run into the paste at the corner of the hook where it fuses with the paste and also with the filament but leaves unfused a part of the paste above the joint. As the paste fuses with difficulty, it is very easy to fuse a part of the paste to the tungsten and still leave the top part simply hardened or sintered together about the filament. This hardened or sintered part forms a protective body just above the joint and appears to protect the filament from the action which has heretofore caused filaments to break at this point.

As a modification in the above described method I have used, with success, that illustrated in Fig. 4. In this case the hook of the leading-in wire is made smaller than that illustrated in Fig. 2 and the arc is applied to the corner of the hook, as shown in the drawing, and is of a strength insufficient to fuse the joint but sufficient to heat it to bright red heat or even to white heat. The arc sinters the paste strongly to the filament and to the leading-in wire and makes a very hard joint between the two. The method, as described, is very easy and quick and is quite suited for commercial application.

The above described arc or sintering operation may be carried out in hydrogen or in other suitable protective atmosphere, as will be readily understood by persons skilled in the art.

What I claim as new and desire to secure by Letters Patent of the United States, is,—

1. The method of connecting a tungsten filament to a conductor, which consists in pasting the joint with copper paste and then sintering the paste by means of an arc.

2. The method of connecting a metal filament to a wire, which consists in pasting the joint and then heating the joint by drawing an arc from the wire to a temperature high enough to sinter the paste but low enough to avoid complete fusion of the joint.

3. The method of connecting a metal lamp filament to a conductor, which consists in pasting the joint and then heating the joint and regulating the temperature so that the

paste above the conductor is sintered while other portions are fused.

4. The method of joining a tungsten filament to a nickel wire, which consists in pasting the joint with finely divided metal held in a binder and heating said joint sufficiently to harden the paste still leaving unfused that part which is above the wire.

5. A connection between a tungsten lamp filament and its conductor, consisting of sintered metallic powder partially fused.

6. A connection between a metal lamp filament and its conductor, which has a fused portion, but which at the point where the filament enters the joint comprises sintered paste.

7. A connection between a metal lamp filament and a conductor, comprising a pasted joint in which part of the paste is fused and part only sintered.

8. A pasted joint for metal lamp filaments having a sintered portion and a fused portion.

9. The method of connecting a metal filament to a wire, which consists in pasting the joint and then fusing a portion of said wire while leaving unfused a part of said paste.

10. The method of connecting a tungsten filament to a conductor, which consists in pasting the joint with metal paste, and then electrically fusing a portion of said conductor and fusing a part only of said paste.

11. A joint between a metal lamp filament and a conductor, part of which has been fused, having a sintered portion and a fused portion.

12. The method which consists in uniting by fusion a filament and an element which is to be secured thereto while the portion of the filament adjacent the point of fusion is protected by the application of suitable material.

13. The method which consists in uniting by fusion a metal filament and an element

which is to be secured thereto while the portion of the filament adjacent the point of fusion is protected by the application of refractory material.

14. The method of connecting a metal filament and a conductor which consists in uniting them by fusion after applying suitable material to said filament to protect the portion of it adjacent the point of fusion from contamination.

15. The method of connecting a metal filament and a conductor which consists in applying protective material to the filament adjacent the conductor and then electrically fusing the latter to unite it with the filament, leaving unfused at least a portion of said protective material.

16. The method of connecting a metal filament to a conductor which consists in applying protective material to the filament adjacent the conductor and then uniting by fusion the conductor and the end portion of the filament.

17. A conductive joint between a refractory metal filament and a metallic member which comprises a fused portion of said member and metal surrounding the filament at the joint adapted to prevent deterioration of the filament by the material of said member.

18. A conductive joint between a refractory metal filament and a metallic member which comprises a fused portion of said member alloyed with said filament near the end thereof and metal adjacent the operating portion of the filament adapted to prevent deterioration of the portion of the filament by the metal of said member.

In witness whereof, I have hereunto set my hand this 5th day of August, 1907.

JOHN W. HOWELL.

Witnesses:

CHAS. H. HEELEY,
J. HARRY ELKINS.