(No Model.)

H. H. GRUBBE.

INCANDESCENT ELECTRIC LAMP.

No. 307,389. Patented Oct. 28, 1884.

Fig. 1.

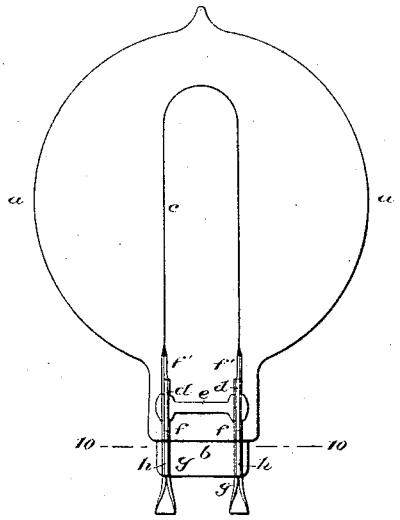


Fig. 2.

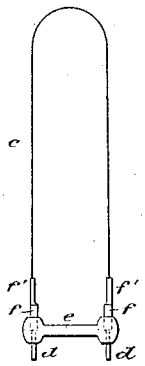


Fig. 3. Fig. 4. Fig. 5. Fig. 6. Fig. 7. Fig. 8. Fig. 9.

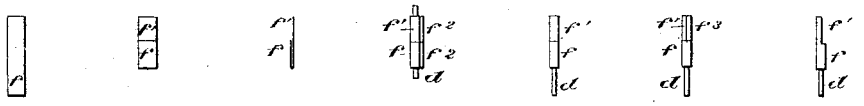


Fig. 10.

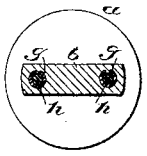
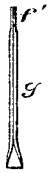


Fig. 11.



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UNITED STATES PATENT OFFICE.

HUBERT H. GRUBBE, OF LONDON, ENGLAND, ASSIGNOR OF ONE-HALF TO CHARLES HORACE BENTON, OF SAME PLACE.

INCANDESCENT ELECTRIC LAMP.

SPECIFICATION forming part of Letters Patent No. 307,389, dated October 28, 1884.

Application filed February 16, 1884. (No model.)

To all whom it may concern:

Be it known that I, HUBERT HENRY GRUBBE, of London, England, have invented certain new and useful Improvements in Incandescent Electric Lamps, of which the following is a specification.

My invention relates, first, to the formation of the joint between the carbon filament and the platinum supports of incandescent electric lamps; and, secondly, to the formation of the joint between the leading-in conductors and the glass neck of the lamp flask or bulb.

My improvements consist, first, in forming a sound electrical joint between the carbon filament and each of its platinum supports by means of a strip of very thin foil of platinum or other suitable metal which is formed into a cylinder or tube, so as to receive the end of the filament and the platinum support; secondly, in forming a tight joint between the glass neck of the bulb or flask and the leading-in conductor by employing, as the leading-in conductor, a strip of foil of platinum or other suitable metal bent into an approximately tubular form, or other form capable of receiving an internal piece or support of glass.

In the accompanying drawings, Figure 1 is an elevation, partly in section, of an incandescent electric lamp embodying my improvements. Fig. 2 is an elevation showing the platinum supports, with the carbon filament connected thereto by means of the joint of platinum foil, and showing also a glass rod which holds the two platinum supports in position. Figs. 3 to 9 are detail views illustrating the mode of making said joint between the filament and the platinum supports. Fig. 10 is a section on a larger scale on line 10 10 of Fig. 1. Fig. 11 is a view illustrating a modified form of my invention, in which a strip of platinum foil is employed of sufficient length to form both the leading-in conductor and the tubular holder for the end of the carbon filament.

In these figures, *a* is the lamp flask or bulb, which may be of any desired shape. *b* is the neck of same. *c* is the carbon filament. *d d* are the platinum supports. *e* is a glass rod for holding said supports in position. *f f' f f'* are the platinum foils, which form the joints between the ends of the filament *c* and the supports *d d*. *g g* are the platinum foils, which form the leading-in conductors. *h h* are rods or pieces of glass which act as supports to the foils *g g* and assist in making the joint in the neck.

Referring first to the joint between each end of the carbon filament and the corresponding support, *d*, I take a strip of very thin platinum foil, (see Fig. 3,) say about five ten-thousandths of an inch thick, nine-sixteenths of an inch long, and one-eighth of an inch broad. I heat it in a Bunsen flame or otherwise, in order to render it soft and non-elastic, and I then fold one-third of it (more or less) upon the middle portion, (see Figs. 4 and 5,) so that its length is reduced to three-eighths of an inch, one half, *f*, of this length being double the thickness of the other half, *f'*. I next bend the foil around the platinum wire, (see Fig. 6,) and by pressing together that part of the foil which overlaps the side of the wire I cause it to fit firmly around it. I then cut off the superfluous foil—that is to say, the part marked f^2 in Fig. 6—and I slide the cylinder thus formed to the end of the wire until one-half *f'* projects beyond the end, (see Fig. 7,) the portion *f*, which is of double thickness, remaining around the wire. I then heat the cylinder of foil and the wire by means of a Bunsen flame or a blow-pipe, to cause the foil to shrink tightly upon the wire, and thereby make a perfectly sound electrical contact; but in order to insure that the cylinder of foil shall always remain in its position, I melt each end of the glass rod *e*, Fig. 2, which holds the two platinum wires in position, partly onto the cylinder of foil and partly onto the platinum wire. Into this portion, *f'*, I insert a small rod of hard metal, of the same diameter as the filament whose end is to be afterward inserted. I pinch flat so much of the foil, (see f^3, Fig 8,) as is in excess beyond that required to surround the rod tightly. The cylinder of foil is thus reduced to the diameter of the metal rod. The excess foil f^3 is then cut off, (see Fig. 9,) and the rod withdrawn. I run the ends of the filament *c* into the portions *f'* of the cylinders, and in order that the platinum support may remain comparatively cool when the filament

is incandescent it will be well to deposit carbon from a hydrocarbon compound upon a certain length of the filament next the foil, whereby its resistance is reduced and its radiating surface increased. It is in order to prevent cooling during the process of depositing carbon, as just stated, that I make that portion of the cylinder of foil into which the filament is inserted of only half the thickness of the remaining portion.

Prior to my invention the ends of the filament have been joined to the leading-in wires by flattening one end of each each wire and bending the flattened portion into tubular form by drawing it through dies, thus making a socket into which the end of the filament is thrust.

My invention provides an improved method of making this socket, whereby I avoid flattening the end of each wire and drawing it through dies, and utilize instead the advantages of platinum foil, from which I make a double socket, one end of which embraces the wire and the other end the filament. I thus produce a neat joint without undue enlargement at a less cost than heretofore and by a better mode of manufacture.

Referring, now, to the joint between the glass neck *b* and the leading-in conductors *g g*, I take for each of these conductors a strip of platinum foil and bend it into a form which will receive an internal support of glass. The form which I prefer is that shown in the drawings, Figs. 1 and 10, being approximately tubular or of C section. Into this bent foil or tube *g*, I insert or melt a correspondingly-shaped piece of glass, *h*, to act as an internal support to same, and to assist in making the joint while the neck is being closed by the ordinary glass-blowing process the outer ends of the strips of foil *g g* should be left unbent or flat, as seen in Fig. 1, so as to be the more easily connected to the line-wires. By forming the leading-in conductors of foil, as above described, a more perfectly tight joint with the glass neck is obtained than when wires are employed.

I am aware that it has been proposed to seal into the glass socket strips of very thin platinum, about one-quarter inch wide, but I am not aware that leading-in conductors of platinum foil have ever been successfully employed prior to my invention. As I arrange it, the foil being bent around a rod of glass, which expands and contracts equally with the glass of the socket or neck, is embraced between two like bodies, and is itself so thin that it cannot expand or contract independently of them; hence there is no movement between the metal and glass surfaces, and leakage is thus avoided.

In the modification represented in Fig. 11 the platinum foil *g* is made sufficiently long to form the holder for the carbon filament, its inner end, *f'*, being reduced to the necessary diameter in the manner already explained. In this modification the separate platinum wires or supports *d d*, Figs. 1 to 9, are dispensed with.

What I claim is—

1. In an incandescent electric lamp, the combination, with the carbon filament and the metallic supports thereof, of tubular sockets formed of thin platinum foil, and each embracing the end of one support and one end of the filament, substantially as set forth.

2. In an incandescent electric lamp, the combination, with the carbon filament *c* and platinum supports *d d*, of the tubular sockets *f f* of platinum foil, each embracing one end of the filament and the end of one support, the glass bar *e* with its ends fused around the sockets *f f* and platinum supports *d d* at their junction, and suitable leading-in conductors, substantially as set forth.

3. In an incandescent electric lamp, the combination, with the glass neck of the flask and the carbon filament, of leading-in conductors consisting of strips of metallic foil, each bent around a piece of glass, and the said pieces of glass fused thereto, substantially as set forth.

In witness whereof I have hereunto signed my name in the presence of two subscribing witnesses.

HUBERT H. GRUBBE.

Witnesses:
JOHN C. MEWBURN,
GEORGE C. BACON.