A. S. KNIGHT.

MEANS FOR CONSTRUCTING INCANDESCENT LAMPS.

APPLICATION FILED MAY 13, 1909.

1,034,917.

Patented Aug. 6, 1912.

2 SHEETS—SHEET 1.

Fig. 1.

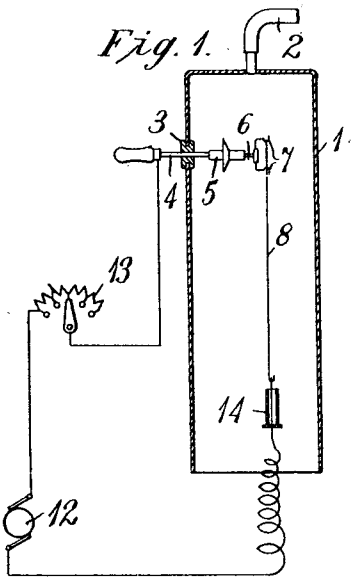

Fig. 2.

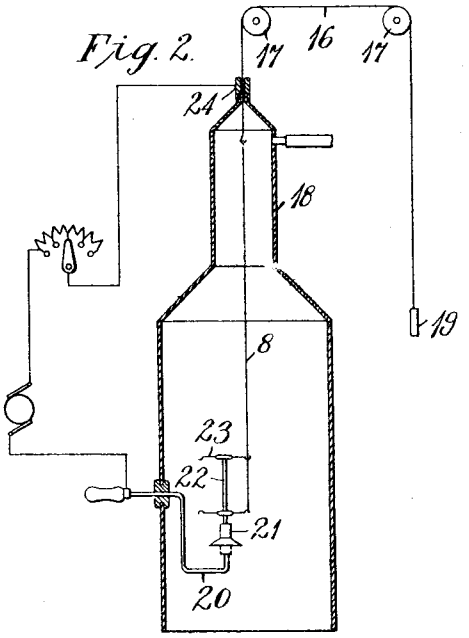

Fig. 6.

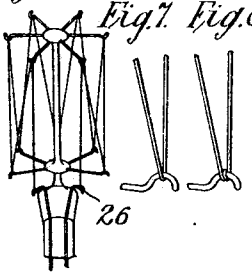

Fig. 7. Fig. 8.

Fig. 3.

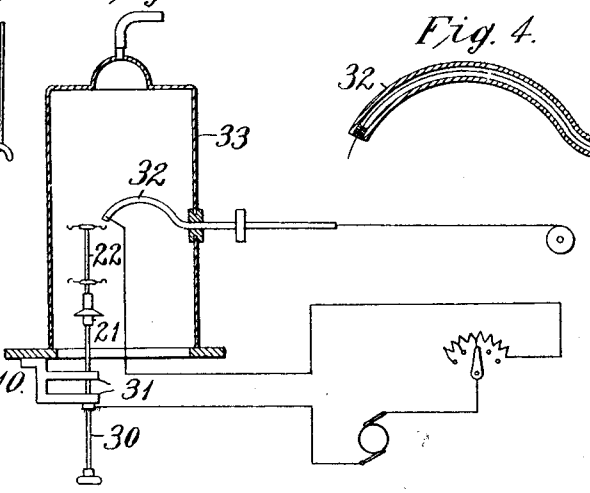

Fig. 4.

Fig. 9.

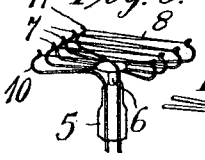

Fig. 10.

Fig. 5.

WITNESSES:

Fred. H. Miller

Otto S. Schairer.

INVENTOR

Arthur S. Knight

BY

Wesley G. Carr

ATTORNEY

A. S. KNIGHT.

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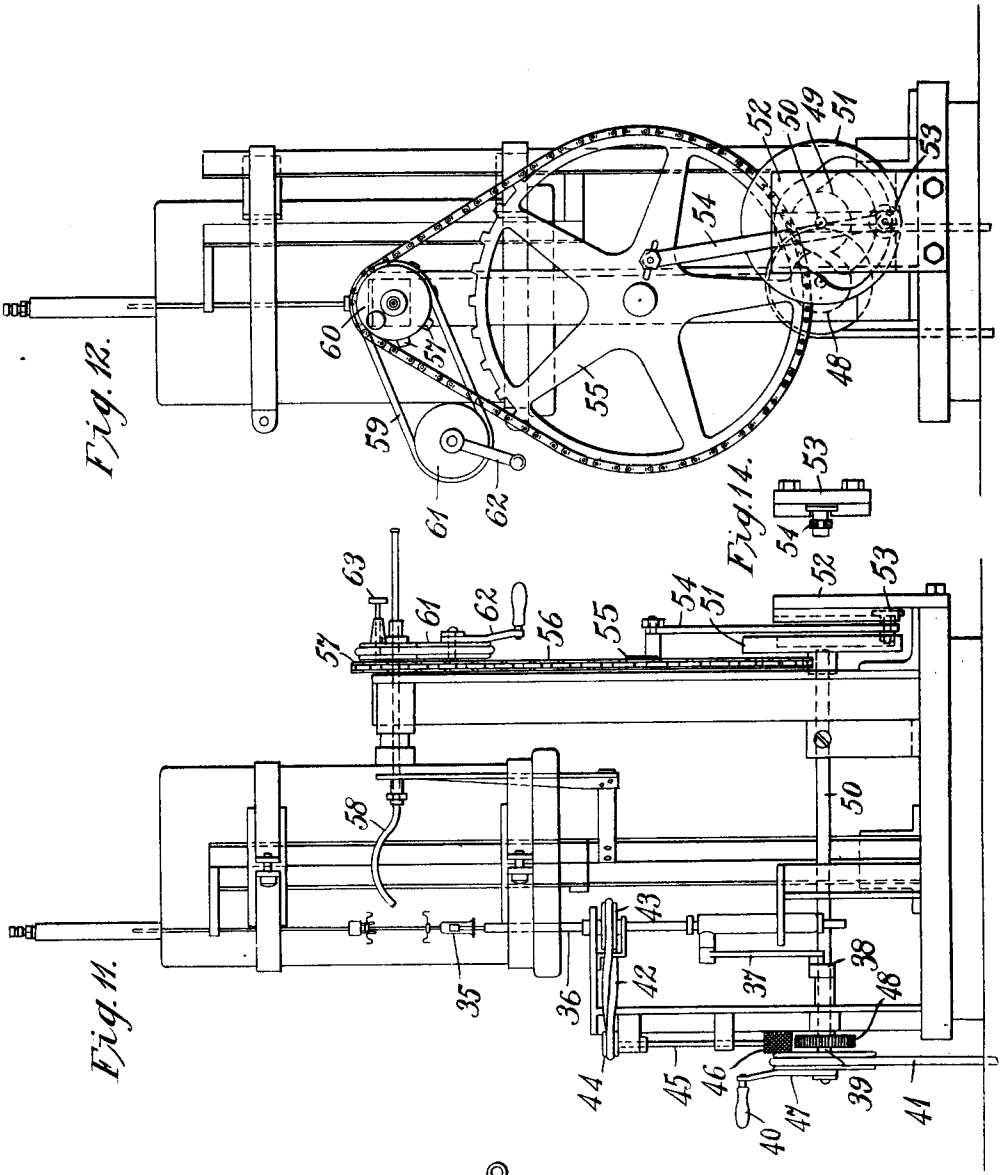

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Otto S. Schairer.

INVENTOR

Arthur S. Knight

BY

Hadley & Carr

ATTORNEY

UNITED STATES PATENT OFFICE.

ARTHUR S. KNIGHT, OF NEWARK, NEW JERSEY, ASSIGNOR TO WESTINGHOUSE LAMP COMPANY, A CORPORATION OF PENNSYLVANIA.

MEANS FOR CONSTRUCTING INCANDESCENT LAMPS.

1,034,917. Specification of Letters Patent. **Patented Aug. 6, 1912.**

Application filed May 13, 1909. Serial No. 495,787.

To all whom it may concern:

Be it known that I, ARTHUR S. KNIGHT, a subject of the King of Great Britain, and a resident of Newark, in the county of Essex and State of New Jersey, have invented a new and useful Improvement in Means for Constructing Incandescent Lamps, of which the following is a specification.

My invention relates to incandescent lamps, and particularly to lamps having filaments composed of, or containing, tungsten, and it has for its object to provide a method of, and means for so applying conducting filaments to supports that durable and satisfactory lamps may be conveniently and expeditiously constructed.

Owing to the difficulty that has heretofore existed of producing filaments composed of, or containing, tungsten, and similar filaments, in considerable lengths, or in lengths sufficient for the complete circuit within the lamp, the filaments have been produced in comparatively short pieces of U- or hairpin-shape which have been fused together and to their supports at their extremities. The fusing of the filament to its supports not only rigidly and unyieldingly secures the same thereto at intermediate points of its length so that it is not well adapted to withstand shocks and vibrations without breakage adjacent to the points of fusing, but the fusing also often weakens the filament.

According to the present invention, a single continuous filament of sufficient length for the complete circuit within a lamp may be applied in zig-zag form to supports therefor with but little liability of breakage thereof, and without fusing or otherwise unyieldingly securing the filament to its supports, with the result that the finished lamp is capable of sustaining severe shocks and vibrations without breakage of the filament.

The invention is more fully set forth in connection with the accompanying drawing, Figures 1, 2 and 3 of which represent three different forms of apparatus for applying filaments to their supports. Fig. 4 is an enlarged sectional view of one of the filament guides of the apparatus shown in Fig. 3. Fig. 5 is an enlarged view of a modification of the filament guide of the apparatus shown in Fig. 3. Figs. 6 to 10, inclusive, illustrate general and detail features of two modified forms of lamps constructed by the use of the present invention. Fig. 11 is a view in front elevation of a machine adapted to practise the method and embodying the structural features of my invention. Fig. 12 is a side view of the same machine. Fig. 13 is a face view of a crank and connecting rod mechanism constituting a part of the machine, and Fig. 14 is a similar view of another connecting rod and its guide which also constitute parts of the machine.

The apparatus of Fig. 1 comprises a bell jar 1, or other suitable receptacle, that is filled with a gas or with gases free from oxygen, such, for instance, as a mixture of nitrogen and hydrogen, which is supplied to the receptacle through a tube 2. Projecting through an aperture in one side of the receptacle and surrounded by a soft rubber or other pliable bushing 3 that permits movement thereof in all directions, is a rod 4, upon the inner end of which is a suitable holder 5 for a stem 6 that is provided with two sets of oppositely bent supporting members 7, 10 and 11 having hook-shaped extremities upon which a filament 8 is mounted. As indicated in Fig. 9, the terminal supporting members 10 and 11 are extended downwardly through the stem to constitute terminals of the lamp.

In applying the filament to the supports, one end is first secured to one of the terminal supports 10 and 11, and it is then heated by passing an electric current therethrough from any suitable source, such as that shown at 12, a resistance device 13 being preferably included in circuit for the purpose of adjusting the amount of current. The terminals of the source are connected, respectively, to the free end of the filament 8, and to the rod 4, which is, in turn, electrically connected to either or both of the terminal supports 10 and 11. In order to maintain the filament taut, a suitable weight 14 is attached to its lower free end. The filament may, of course, be heated by other means than an electric current, if desired, as, for instance, by hot gases or by the application of heat directly from a burner.

The heating of the filament 8 renders it sufficiently pliable to permit of its bending around the supports 7 without breaking, this result being effected by giving the holder 5 a reciprocating and rotary movement. When the conductor is completely applied to the hook-shaped supports, it is of zig-zag form and is loosely or yieldingly supported

intermediate its ends, which are suitably attached to the terminal supports 10 and 11. As the filament is yieldingly supported intermediate its ends, it is capable of sustaining shocks and vibrations with but a minimum amount of breakage, and the process of applying the filament to the supports is very greatly facilitated.

In some instances, it may be preferable to suspend the filament above the stem which carries the supporting hook-shaped members, and, in Fig. 2, I have shown a modified form of apparatus in which the filament 8 is suspended from a wire 16, or other suitable conductor, that passes over pulleys 17 and through an aperture in the top of a receptacle 18, the wire and the filament being maintained taut by means of a weight 19. Projecting through the side of the receptacle 18 is a crank-shaped rod 20 that carries a holder 21 for a stem 22 upon which two sets of hook-shaped supporting members 23 for the filament are mounted. The top of the receptacle 18 is provided with a terminal 24 through which the conductor 16 passes, the aperture through the terminal being filled with mercury, or being provided with any other suitable means for making electrical contact with the conductor.

In applying the filament to the supporting members 23, it is first attached, at its lower end, to one of the terminal supporting members 26 which passes outwardly through the stem and constitutes one of the lamp terminals. The stem is then given such rotary and lateral movements that the filament is bent around the supporting members in a zig-zag form substantially as shown in Fig. 6, the filament being heated at the same time to render it pliable by passing current through it, as before described.

Another modified form of apparatus is shown in Fig. 3, in which the stem 22 and the holder 21 are adapted to have only reciprocating and rotary movements, the rod 30, which carries them, being mounted in guides 31 that prevent lateral movement thereof. The filament passes through a tubular guide 32, by means of which it is applied to the supporting members, the guide projecting into the receptacle 33 and its inner end being hook shaped. In applying the filament to its supporting members, it is necessary to both properly rotate the guide 32 and reciprocate and rotate the stem 22, in a manner which is obvious from an inspection of the drawing. The filament is also heated, as before, to render it sufficiently pliable to permit of its bending around the supporting members, and, in order to insure good electrical contact between the filament and the guide 32, a small body of mercury may be placed in the end of the guide, as shown in Fig. 4.

In Fig. 5 is illustrated a modified form of guide for the filament which is simply a straight tube having its inner end somewhat flared, it being necessary, with this form of guide, to merely reciprocate the stem 22 and rotate it gradually about its axis as the filament is applied to its supporting members.

In some instances, it may be desirable to loop the filament twice around the supporting members, as indicated in Fig. 8, which may obviously be done with any of the forms of apparatus shown and described.

The type of apparatus illustrated in Fig. 3 lends itself especially to automatic machine operation, and, in Figs. 11 and 12, a machine is illustrated whereby the holder for the lamp stem and the guide for the filament are actuated in the desired and correct relations with respect to each other. The holder 35 for the lamp stem is mounted upon the upper end of a rod 36 that is given a reciprocating motion by means of a link 37 and a crank 38, the latter of which is mounted upon one end of a shaft 39 that may be actuated either manually by means of a crank 40, or by means of a belt 41. The holder 35 is also given a rotary movement by means of a belt 42 that passes over a pulley 43 upon the rod 36 and a pulley 44 upon the upper end of a counter shaft 45, on the lower end of which is a knurled handle 46 for manually actuating the same. During operation of the machine, the holder is rotated between each upward and downward movement of the holder 35, one-half the angular distance between adjacent filament supports that are carried by the stem and arbor of the lamp. The length of the stroke of the holder 35 may be adjusted by adjusting the point of connection of the lower end of the link 37 to the crank 38, thereby varying the diameter of the circle of movement of the lower end of the said link. Mounted upon the shaft 39, is a gear 48 that meshes with another gear 49 upon one end of a counter shaft 50, the other end of which carries a cam 51. Engaging the cam surface and directed in a vertical reciprocating movement by means of a guide 52, is a block 53 that is pivotally connected to the lower end of a link 54, the upper end of which is pivotally connected to a sprocket wheel 55 at a suitable distance from its center, the link 54 serving to drive the sprocket wheel. A chain 56 operatively connects the sprocket wheel 55 to another sprocket wheel or pinion 57 that is adapted to drive a tubular guide 58 for the filament. The guide 58 may also be operated manually, for adjustment or other purposes, by means of a belt 59 that operatively connects pulleys 60 and 61, the latter of which may be actuated by a crank 62 and the former of which may be connected to or disconnected from the sprocket wheel 57 by means of a pin 63.

The shape of the cam 51 is such, and the proportions and relations of the remainder of the parts are also such, that the guide 58 is intermittently rotated in opposite directions as the holder 35 reaches the limits of its stroke, the filament being thus applied to the supporting members therefor in a zig-zag form.

I claim as my invention:

1. In apparatus for applying a filament to supports therefor, the combination of an adjustable holder for the supports, and an adjustable guide for the filament.

2. In apparatus for applying a filament to supports therefor, the combination with means for maintaining the filament taut, and means for applying electric current thereto, of an adjustable holder for the filament supports.

3. In apparatus for applying a filament to supports therefor, the combination with an adjustable holder for the filament supports, of means for directing the filament upon the supports.

4. In apparatus for applying a filament to supports therefor, the combination with a receptacle, of a holder for the filament supports, and a guide for the filament, both the holder and the guide being located within the receptacle and adjustable from the exterior thereof.

5. In apparatus for applying a filament to supports therefor, the combination with a holder for the filament supports and means for reciprocating and rotating the said holder, of a filament guide, and means for intermittently rotating the same.

6. In apparatus for applying a filament to supports therefor, the combination with a holder for the filament supports and means for reciprocating and rotating the said holder, of a filament guide, and means for intermittently rotating the same in opposite direction.

7. In apparatus for applying a conducting filament to supports therefor, the combination with a holder for the filament supports, means for reciprocating the holder, and means for rotating the holder a predetermined degree between successive strokes of the holder, of a filament guide and means for intermittently rotating the same at the completion of each stroke of the holder.

8. In apparatus for applying a filament to supports therefor, the combination of a receptacle, and an adjustable holder for the supports that projects into the receptacle.

9. In apparatus for applying a filament to supports therefor, the combination of a receptacle, a holder for the supports that projects through the receptacle, and a pliable bushing surrounding the holder where it passes through the receptacle.

10. In apparatus for applying a filament to supports therefor, the combination of a receptacle, an adjustable holder for the supports that projects into the receptacle and is electrically connected to one of them, and means for making electrical connection to the filament as it enters the receptacle.

In testimony whereof, I have hereunto subscribed my name this 30th day of April, 1909.

ARTHUR S. KNIGHT.

Witnesses:
J. F. DONOVAN,
H. D. MADDEN.