July 6, 1926. 1,591,910

R. S. BURNAP

INCANDESCENT LAMP

Original Filed July 23, 1920

Fig. 1.

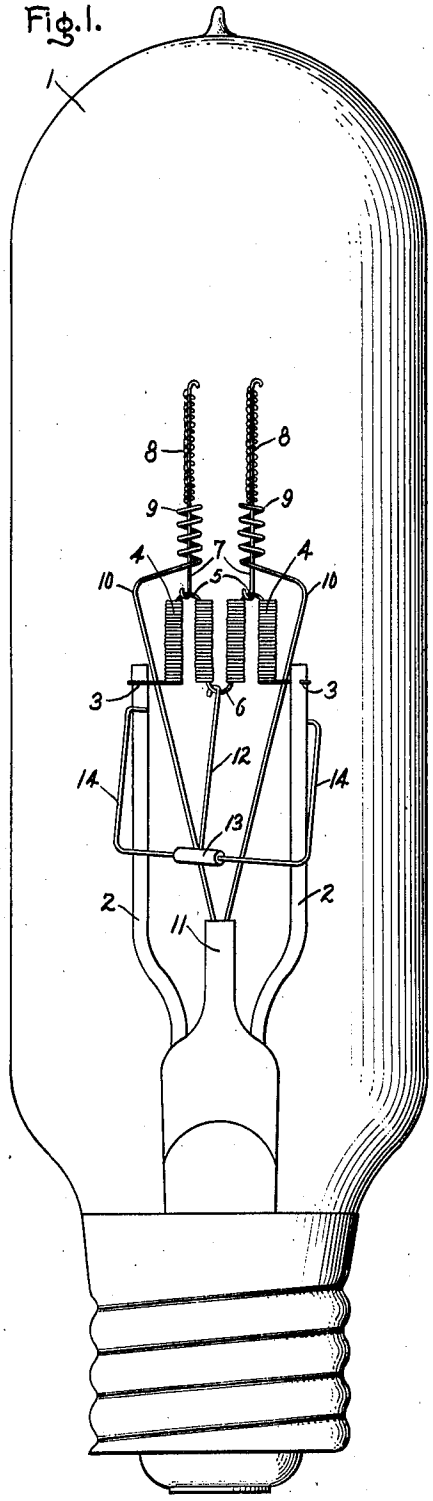


Fig. 2.

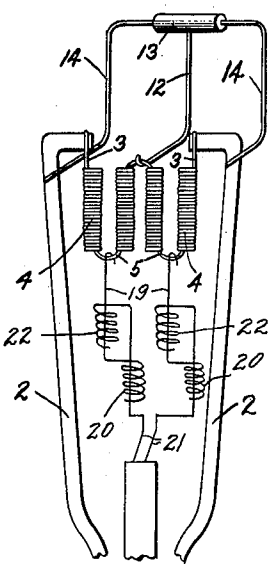
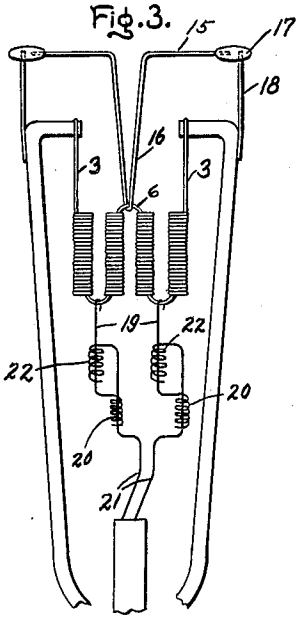


Fig. 3.



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UNITED STATES PATENT OFFICE.

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INCANDESCENT LAMP.

Application filed July 23, 1920, Serial No. 398,594. Renewed April 14, 1926.

My invention relates to incandescent lamps and more particularly to incandescent lamps intended to be used as a source of light in moving picture projectors and similar devices.

In order to obtain a source of light which is a close approximation to an incandescent flat surface, the filament of a type of incandescent lamp often used in moving picture projectors is made in the form of a number of parallel straight coils as close together as feasible and all in the same plane. This filament is placed in focus as accurately as possible, and even a slight change or distortion in the shape or relative position of the coils will produce objectionable changes in the light thrown on the screen. These filaments, which are usually made of tungsten, operate at temperatures so high that the filament is easily pulled out of shape while hot. There is also a marked tendency for the coils of the filament to twist and to move out of normal position.

One object of my invention is to provide an incandescent lamp in which there will be only a negligible change in the position or shape of the filament during the life of the lamp. Another object of my invention is to so construct the lamp that all parts subject to deterioration by heat do not attain a dangerously high temperature while the lamp is lighted. A further object is to support and hold the filament that none of the coils can twist or move out of their normal plane. Still another object is in general to provide an improved incandescent lamp sufficiently rugged and long lived to be a desirable source of light for moving picture projectors.

The novel features of my invention are pointed out with particularity in the appended claims, but the invention itself will best be understood in connection with the accompanying drawings in which Fig. 1 shows one form of moving picture lamp embodying my invention; Fig. 2 shows another form; and Fig. 3 shows bottom anchors which prevent twisting of the coils and hold them in the plane of the filament.

The particular form of lamp shown in Fig. 1 is of the gas filled type and comprises a glass bulb 1 containing an inert gas such as nitrogen or argon. The lamp is designed to operate in a vertical position with the tip up and is provided with two heavy leads 2, usually made of nickel, which not only supply current to the filament but also mechanically support the filament.

The particular type of coiled tungsten filament shown in Fig. 1 comprises straight ends 3 welded or otherwise securely attached to the leads 2, and four straight coils 4 arranged in one plane side by side as close together as feasible and connected by two intermediate bends 5 and a middle bend 6. The intermediate bends 5 are resiliently supported by anchors 7 controlled by coil springs 8 and slidably mounted in guides or eyes 9 formed by coils on the free ends of two anchor guides 10 sealed into a glass rod 11 on the stem of the lamp.

To prevent distortion of the hot and comparatively weak filament, the middle bend 6 is held in such a manner that its position relative to the ends 3 of the filament is always the same, regardless of the temperture of the metal parts of the lamp. To hold the middle bend 6, I provide what may be called a compensating bridge comprising a compensating anchor 12 sealed into a glass button 13 carried upon standards 14, which are attached to the leads 2 at points adjacent the filament ends 3. This compensating bridge holds the middle bend 6 in a definite relation to the ends 3 of the filament during all the changes in temperature which occur when the lamp is turned on and off. If, for example, the lamp is lighted the filament immediately becomes very hot and comparatively soft. Gradually the leads 2, the standards 14 and the compensating anchor 12 heat up by conduction. As the leads 2 elongate they lift the entire filament bodily to a slight extent. At the same time the expansion of the standards 14 lowers the button 13 with reference to the ends 3 of the filament, carrying the compensating anchor 12 down with the button far enough to pull the filament out of shape if the anchor remained of constant length. However, the compensating anchor 12, which is of substantially the same shape and length as the parallel parts of the standards 14, elongates just enough to compensate for the elongation of the standards. Although, as the lamp heats up, the glass button 13 moves away from the middle bend 6 due to expansion of the standards 14, the hook or engaging end of the compensating anchor moves in the opposite direction an equal

amount due to the expansion of the anchor, so that the bend 6 is always in the same relative position to the ends of the filament and consequently there is no distortion of the filament, and no strains tending to pull it out of shape.

In the modification shown in Fig. 2 the filament is suspended from the upper ends of the leads 2 and the standards 14 extend upward instead of downward, so that the glass bead 13 is above the filament. In this case, gravity takes the place of the pull exerted by the springs 8 shown in Fig. 1. The standards 14 and the compensating anchor 12 are all of the same length and are all bent to same shape to hold the glass bead 13 to one side of the filament and out of the convection currents of hot gas. The effect of any displacement of the bead 13 by the expansion of the standards 14 is compensated for by the equal and opposite expansion of the anchor 12.

In the form of mount illustrated in Fig. 3, the filament is suspended by its ends 3 from the upper ends of the leads 2, and the middle bend 6 is held in unchanged relation to the ends 3 by means of a bridging bar 15 having an anchor 16 for engaging the filament and mounted on but insulated from the leads by means of hard glass buttons or beads 17 on the upper ends of pedestals 18 welded to the leads so as to project beyond the ends of the leads. When the lamp is lighted the metal parts are heated whereupon the bridging bar 15 is moved bodily upwards by the expansion of the pedestals 18 and at the same time, the filament moves bodily downward due to the expansion of its straight portions 3 so that the distance between the transverse part of the bridging bar and the middle point 6 of the filament increases to an amount equal to the expansion of a pedestal 18 plus the expansion of a straight portion 3 of the filament. The anchor 16 of the bridging bar is of such a metal and such a length that it increases in length, due to its expansion by heat when the lamp is lighted, an amount substantially equal to the increase in distance between the bridging bar and the middle point 6 of the filament due to heating, and thereby counteracts the distortion which would occur when the lamp is lighted if the middle point of the filament were compelled to move with the bridging bar 15. The result is that the middle bend 6 of the filament is always in the same position with relation to the ends 3 of the filament. In this construction the beads 17, although in the same plane as the filament, are in alignment with the leads, but are out of the current of hot gas rising from the filament.

To prevent twisting or uncoiling of the coils 4, I secure to the bends 5 anti-twisting or guide anchors mounted to raise and fall freely with the bends, but controlled to prevent twisting of the coils out of the plane of the filament. The particular form of anti-twisting anchor shown in Fig. 3 has a sliding anchor member 19 which is so mounted that it can slide vertically but cannot turn. In the specific construction shown, which is well adapted for lamp purposes, the fixed member is a wire, which at the free end is coiled to form a guide 21 for the sliding anchor. The free end of the sliding anchor is formed into an eye or guide loop 22 which is eccentric to the guide 21. The coils 4 cannot twist or turn out of the filament plane without rotating the sliding anchor member 19 in the journal 21, but this rotation is resisted by the guiding eye or loop 22 and the fixed member 20. This anti-twisting anchor permits the bends 5 to rise and fall freely, but holds them in such a position that the coils of the filament are always in the proper plane.

By my invention I provide the filament with three supports, such as the two leads and the compensating anchor so constructed and proportioned as to have equal and parallel components of movement at the ends and a middle point of the filament in response to heat from the filament, so that the ends and the intermediate point of support of the filament are always in the same relative position and also support and control the filament at other points so as to allow motion only along the axis of the coils. The wires which form the compensating bridge are preferably made of the same size so that they will heat up at the same rate. This compensating bridge mounted upon the leads eliminates changes in the relative position of the anchors and ends of the filament during heating and cooling of the metal parts of the lamp so that distortion of the filament is avoided.

My invention may be embodied in many other forms than those shown in the drawings and the principle may be applied to supporting filaments comprising more than four parallel coils, and therefore I do not wish to be restricted to the particular embodiment shown, but intend to cover all changes and modifications which are within the spirit of my invention and the scope of the appended claims.

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

1. An incandescent lamp comprising two leads, a filament having its ends attached to said leads, a metallic anchor engaging an intermediate point of said filament at one end and having its other end embedded in insulating material, and standards for supporting said insulating material secured to said leads at substantially the same points as the ends of the filaments, said standards having portions parallel to and of substantially

the same length as said anchor to counteract by their expansion the effect of expansion of said anchor due to heat of the filament.

2. An incandescent lamp comprising two leads, a filament having its ends secured to the ends of said leads, a compensating bridge with its ends mounted upon said leads at points adjacent the ends of the filaments and having an anchor intermediate its ends with one end thereof embedded in insulating material to hold the middle point of the filament, said bridge being proportioned to maintain the filament engaging end of said anchor in fixed relation to the ends of the filament during temperature variations in the lamp, and thereby to prevent distortion during the heating of the filament, and other anchors engaging other points on the filament to hold the filament substantially in the plane of the bridge.

3. An incandescent lamp comprising two leads, a filament suspended by its ends from said leads, and a compensating bridge for supporting the middle point of said filament without distortion comprising two standards secured to said leads adjacent the ends of the filament and carrying an insulating button to one side of the filament to protect said button from the heat of the filament, and a compensating anchor embedded at one end in said button and engaging at the other end the middle point of said filament, said standards having portions parallel to said anchor of substantially the same length and shape as said anchor.

4. An incandescent lamp comprising two leads, a filament secured at its ends to said leads, and a filament support for the middle point of said filament comprising a standard secured to one of said leads adjacent an end of said filament, an insulating button positioned on said standard to be out of alignment with the filament and out of the current of gas caused by said filament, and an anchor for the bight of said filament secured to said button and of such shape and length as to produce by its expansion when the filament is heated a movement of its filament engaging point which in direction is opposite to the movement of said button by the expansion of said standard and in amount is sufficient to hold said filament undistorted.

5. An incandescent lamp comprising a filament having parallel coils connected by a bend and non-twisting anchor for said bend comprising a slidable anchor member in engagement with the bend and a cooperating fixed anchor member said members having cooperative means to guide said sliding member and to permit free movement thereof in the plane of the filament but prevent rotation of said sliding anchor member.

6. An incandescent lamp comprising a filament having parallel sections connected by a bend, of an anchor for said bend comprising a sliding anchor member mounted to reciprocate freely in the plane of the filament and a fixed anchor member having means cooperating with said sliding member to prevent rotation thereof in a plane normal to the plane of the filament.

7. An anti-twisting anchor for incandescent lamps comprising a fixed member having a straight section and a guide eccentric to said straight section and a slidable anchor member mounted to reciprocate freely in said guide and having an eye for engaging the straight section of said fixed member.

In witness whereof, I have hereunto set my hand this 21st day of July, 1920.

BOBERT S. BURNAP.