Oct. 15, 1940. C. SPAETH 2,218,346

GAS-FILLED INCANDESCENT ELECTRIC LAMP

Filed July 8, 1933

Fig. 1.

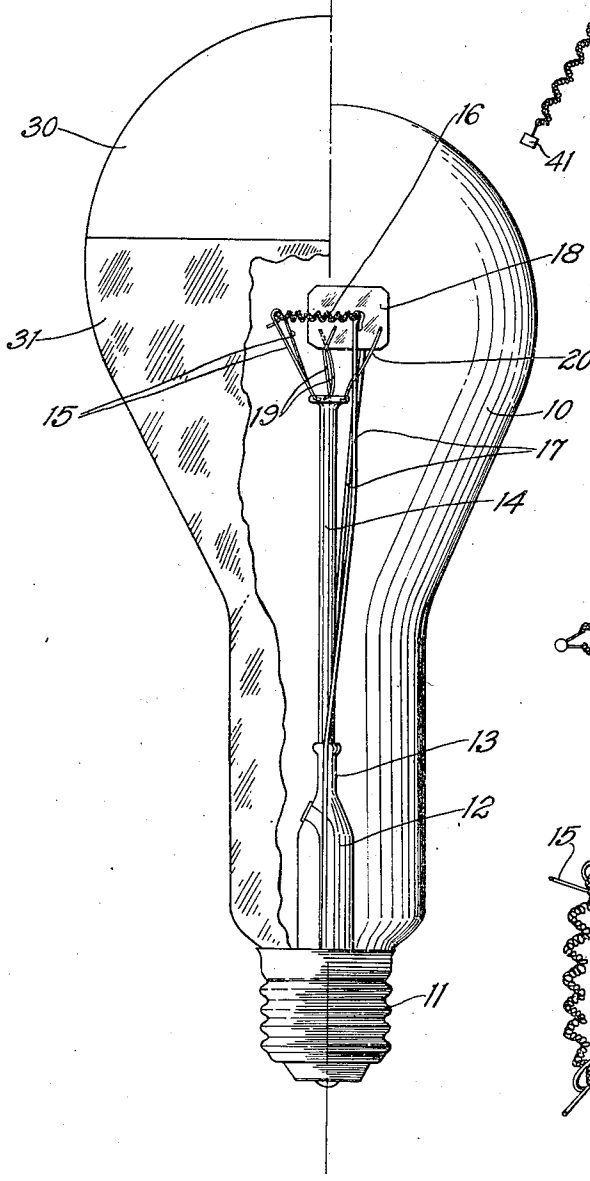


Fig. 2.

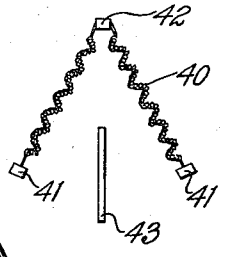


Fig. 3.

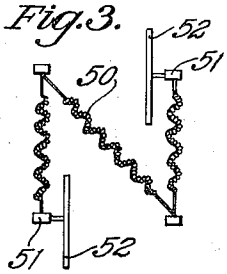


Fig. 4.

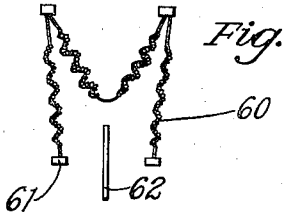


Fig. 5.

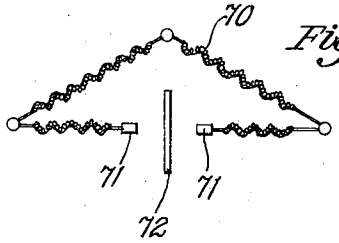
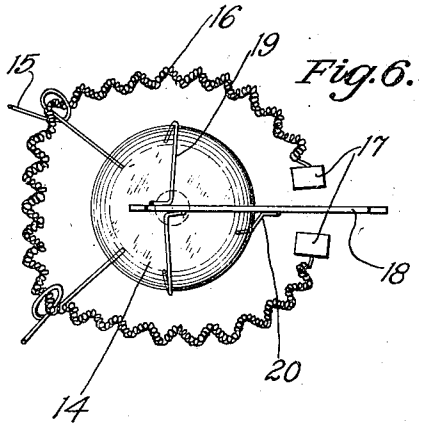


Fig. 6.



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UNITED STATES PATENT OFFICE

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GAS-FILLED INCANDESCENT ELECTRIC LAMP

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Application July 8, 1938, Serial No. 218,224

5 Claims. (Cl. 176—34)

This invention relates to incandescent electric lamps of the gas filled type. Its general object is to provide gas filled lamps which shall be free from the danger of arcing between points of high potential difference in the filament or in the light source system whatever it may be.

In gas filled lamps as heretofore constructed the shape and manner of mounting the filament has been controlled to a large extent by the tendency to arc which is brought about by the incidental flow of electrons and ions between heated portions of the filament as to which exists a substantial potential difference when the lamp is energized. For example, it has always been necessary to support the ends of a filament at their point of connection with the lead wires by a distance sufficient to prevent an arc striking across it, even at the expense of waste space in the lamp and undesirable enlargement of the filament pattern. Similarly it has been necessary to spread or space intermediate portions of the filament and thus sacrifice an otherwise desirable concentration of the light source.

The tendency to arc has also had the effect of restricting lamp manufacturers to the use of a gaseous filling containing a substantial proportion of nitrogen, whereas pure argon, krypton, xenon or other inert gases of low heat conductivity might oherwise be used to produce lamps of greater luminous efficiency. Since in a gas filled lamp pure argon aggravates or facilitates arcing it is generally restricted to not more than 84% to 86% of the gas mixture.

The tendency to arc is especially aggravated in lamps having reflecting surfaces therein since the electrons and ions are likely to be reflected into the critical spaces between points of high potential difference in the filament and so assist in the formation of an arc.

The present invention rests upon my discovery that arcing may be prevented in a gas filled electric lamp by interposing a baffle or obstacle in the path of electron flow between points of high potential difference in the light source system. For example, I have discovered that by interposing a plate in the space between the branches of a looped filament arcing is effectively prevented even through the branches may be located much closer together than has heretofore been regarded as practicable in the manufacture of lamps. The precise character of the baffle member is of secondary importance so long as it is effective to interrupt the electron flow which would otherwise take place. It may comprise a thin metal plate or a plate or block of mica, porcelain or alundum or other refractory material. Preferably it will present light reflecting surfaces in order that the output of the lamp may not be reduced. It may be electrically neutral in the system or it may be connected to one side of the circuit so that it will be charged and act to deflect the electrons as well as to obstruct their flow. I may employ a single baffle or a plurality of baffles depending upon the pattern of the light source system.

Lamps employing features of the present invention present many important and valuable advantages. In the first place, all danger of destruction of the lamp by arcing is eliminated. In the second place, the filament or light source may be concentrated and thus brought more accurately into optical focus. In the third place, my invention permits the use of pure or substantially pure argon, or krypton or xenon in the gaseous filling of the lamp with an attendant increase of 4% to 15% in the luminous efficiency of the lamp. All of these advantages are emphasized in lamps of the reflector type, particularly those having an inside coating of metallic silver or aluminum or other reflecting material in which, as already noted, the tendency to arc has always been particularly troublesome.

These and other features of the invention will be best understood and appreciated from the following description of certain preferred embodiments thereof selected for purposes of illustration and shown in the accompanying drawing in which:

Fig. 1 is a composite view in elevation, one half showing my invention as embodied in a lamp having a clear bulb of one size and the other half showing a lamp having a silver coated bulb of a larger size.

Figs. 2, 3, 4, and 5 are diagrammatic views showing different arrangements of filaments equipped with electronic baffles, and

Fig. 6 is a plan view on an enlarged scale of the filament shown in Fig. 1.

The right hand side of Fig. 1 shows one half of an electric lamp having a clear glass bulb 10 equipped with the usual metallic base 11 and hollow mount 12 terminating in a solid press 13 from which projects a glass arbor 14 terminating in an enlarged head. Metallic supporting wires 15 are embedded in the head of the arbor and extend outwardly and upwardly, each being provided with a turn or twist for the reception of the filament 16. The wires 15 may be of molybdenum or other refractory metal adapted for use under conditions of high temperature. The filament

herein shown is a coiled coil of fine tungsten wire arranged in a loop and disposed in a plane at right angles to the longitudinal axis of the bulb. Preferably the filament will be formed in the manner disclosed in applicant's co-pending application Ser. No. 15,605, although the material and shape of the filament are not critical features of the present invention. The ends of the filament 16 are brought close together and connected to lead-wires 17 which are sealed into the press of the mount in the usual manner.

The drawing together of the ends of the filament 16 is permitted only by the employment of a baffle member between them in accordance with the present invention. As herein shown this baffle may comprise a thin plate 18 of molybdenum, nickel or the like arranged vertically in edgewise position and extending substantially equal distances above and below the plane of the filament 16. As herein shown the baffle plate 18 is supported by a pair of wires 19 embedded in the head of the arbor 14 and by a single forwardly inclined supporting wire 20 similarly embedded in the head of the arbor and connected to the forward portion of the baffle plate 18. The wires 19 and 20 give the baffle plate a three-point support, holding it securely against vibration which might otherwise tend to break the points of connection. As already explained the function of the baffle plate 18 is to interrupt the flow of electrons which would otherwise take place between the heated ends of the filament when subjected to appreciable difference of potential. The effect of the baffle 18 is to eliminate or largely reduce the flow of electrons between these points of the filament to such an extent that the danger of arcing is practically obviated between the ends of the filament and between adjacent intermediate portions thereof.

The left side of Fig. 1 discloses one half of an electric lamp having a bulb 30 provided upon one surface with a metallic reflecting coating 31 of silver, aluminum or the like. The coating extends from the neck of the bulb to its line of maximum diameter and has the effect of concentrating the light of the lamp and directing it outwardly in a single well-defined beam. In a reflecting lamp of this kind the filament is preferably located wholly within the silvered area of the bulb as indicated in the left hand portion of Fig. 1 where the filament is shown as located entirely below the upper boundary of the metallic coating. When so located in a reflecting lamp it is good practice to dispense with the glass arbor 14 and to support the filament upon the ends of supporting wires of refractory metal sealed into the press of the mount. As already explained the present invention has a particularly useful application in reflecting lamps since these are more likely to arc on account of electrons being reflected into the critical space between portions of the filament between which there exists a high potential difference when the lamp is energized. A gas-filled lamp of the reflecting type equipped with a baffle between adjacent portions of the filament, as suggested in Fig. 1, therefore constitutes a particularly desirable and useful embodiment of the present invention.

In Figs. 1 and 6 the filament is shown as arranged in the form of an open loop with its ends brought relatively close together and separated by the baffle 18. There are however many other arrangements of filament in which the baffle of my invention may be advantageously employed. Some of these arrangements are illustrated in Figs. 2–5 in a somewhat diagrammatic form. For example in Fig. 2 the filament 40 is disposed substantially in the shape of a V having its forward ends connected to lead wires 41 and its vertex supported by a neutral wire 42. In this instance the maximum drop in potential occurs between the ends of the filament where they are connected to the lead wires 41. In accordance with the present invention an electron baffle plate 43 of suitable refractory material is disposed edgewise between the ends of the filament and substantially symmetrically in respect to a line between them. Electron flow between the two ends of the filament is thus interrupted and danger of arcing eliminated. It will be apparent that between the intermediate portions of the filament located to the rear of the baffle plate 43 the potential danger in the circuit is reduced below the danger point.

In Fig. 3 the filament 50 is shown as disposed substantially in the shape of an N and connected at its ends to lead wires 51. The intermediate vertices of the filament may be supported in any desired manner. In this instance two baffle plates 52 may be provided, one located adjacent to each lead wire 51 and supported thereby. The baffle plates 52 as above are arranged symmetrically in respect to the plane of the filament 50 and project at their inner ends into the line joining the ends of the filament thus effectively interrupting electron flow in this path. It will be noted that the baffle plates 52 are not electrically neutral when mounted upon the lead wires but are charged when the lamp is energized and consequently act not only to interrupt the electron flow in a mechanical sense but also to repel the electrons in an electro-magnetic sense. This is because the direction of current in the two outside branches of the filament is also in the same direction, that is, when the current is flowing upwardly in the left hand branch as shown in Fig. 3 it is also flowing upwardly in the right hand branch. The points of maximum potential difference are thus separated by the maximum dimension of the filament pattern and safeguarded by the baffle plates as already explained. The plates 52 are however, not directly heated by the passage of electric current and so do not themselves emit electrons in substantial amount, that is to say, in an amount that would induce arcing. The N shaped arrangement of filament constitutes a feature of the present invention whether it is employed with a baffle plate or without one. Further, the baffle plates, when used, may be connected to the lead wires as shown in Fig. 3, or they may have insulated supports or be of non-conductive material so that they are neutral in the system.

In Fig. 4 the filament 60 is shown as arranged in the shape of an M the two ends of the filament being connected to lead wires 61 and the intermediate vertices supported in any desirable manner. A baffle plate 62 is disposed between the forward ends of the filament and across the line connecting the points of maximum potential difference and these points thus safe-guarded against arcing. As already explained, the employment of the baffle 62 permits arranging the filament in compact design and drawing together its ends close together although the maximum drop in potential occurs between them.

In Fig. 5 the filament 70 is shown as arranged in triangular form with its ends brought inwardly toward each other and connected to lead

wires 71. The intermediate vertices of the filament may be supported in any desirable manner and an electron baffle plate 72 is disposed between the ends of the filament and symmetrically in respect to a line joining them. In this instance the transverse branches of the filament may be deflected if desired and disposed obliquely with respect to a transverse plane passing through its points of connection with the lead wires. For example, one of the end sections of the filament may be inclined upwardly from its point of connection with one lead wire and the other end section may be inclined downwardly from its respective point of connection, instead of being disposed in alignment with the other filament section.

In certain types of lamps the filament may be U-shaped and located with its axis coinciding with the major axis of the lamp. In such a lamp the electronic baffle will be located in the bight or loop of the filament and between its ends. Similarly, the intermediate section of an N-shaped filament may be deflected in a curve out of the plane of the end sections thus affording space in its bight for a baffle located between the points of connection with the lead wires.

While it is of course well recognized that there can be no arcing in a perfect vacuum, nevertheless even in a so-called vacuum lamp there may be gases present in small quantities, these gases originating from the water vapor or from some other source and being sufficient under certain circumstances to cause an arc. It must therefore be understood that my invention contemplates the use of a baffle in any lamp which has even a very insignificant quantity of gas present but in which arcing might conceivably take place if my baffle were not used in connection with the filament mount.

Having thus disclosed my invention and described certain embodiments thereof in detail, I claim as new and desire to secure by Letters Patent:

1. An electric lamp comprising a gas-filled bulb having a metallic reflecting coating upon a portion of its surface, a filament therein, lead wires secured to the ends of the filament, and an electron baffle disposed between the ends of the filament and having reflecting surfaces for directing rays from the filament outwardly in the bulb and for directing electrons coming from the reflecting coating away from the space between the ends of the filament.

2. An electric lamp comprising a gas-filled bulb provided with an inner silver reflecting coating, a filament therein, and an electron baffle located between points of high potential difference in the filament and having a reflecting surface for directing rays coming from the filament outwardly in the bulb and for directing electrons coming from the reflecting coating away from the space between said points of high potential difference in the filament.

3. An electric lamp comprising a bulb filled with a substantially pure gas of low heat conductivity selected from the group: argon, krypton and xenon, an internal metallic coating, a coiled tungsten filament, and an electron baffle located in line with points of high potential difference in the filament and having a reflecting surface for directing electrons coming from the reflecting coating away from the space between said points of high potential difference in the filament.

4. A reflecting electric lamp comprising a bulb having a partial internal reflecting surface, a filament having branches extending into proximity to each other, lead wires connected to the ends of the filament and a single intermediate baffle plate located substantially midway between the ends of the filament and having reflecting surfaces for directing rays from the filament outwardly in the field of the lamp and for directing electrons coming from the reflecting coating away from the space between the ends of the filament.

5. An electric lamp having a gas filled bulb provided with a partial metallic reflecting coating, a coiled tungsten filament, refractory supporting wires locating the filament within the metallic-coated area of the bulb, and an electron baffle located between the ends of the filament and having a reflecting surface for directing electrons and rays coming from the filament and the reflecting coating away from the space between the ends of the filament.

CHARLES SPAETH.