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R. E. SMITH
ELECTRIC INCANDESCENT LAMP

2,597,681

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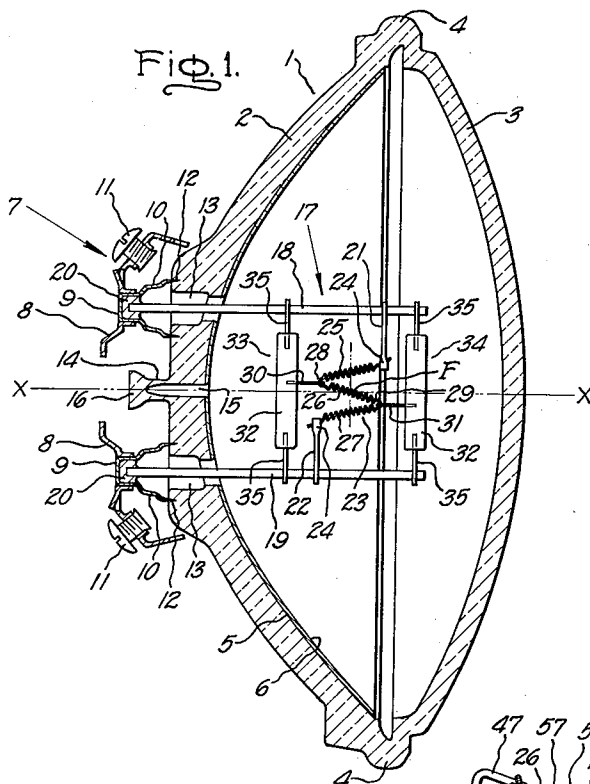


FIG. 2.

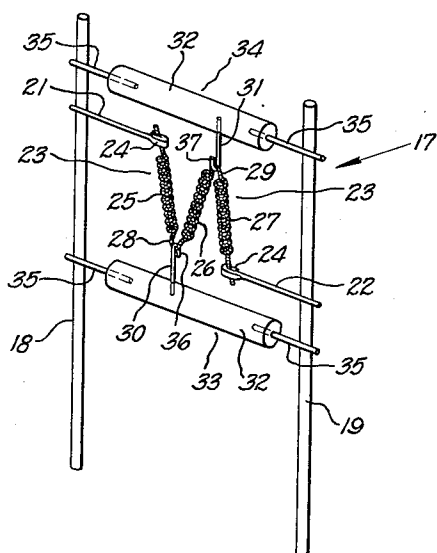
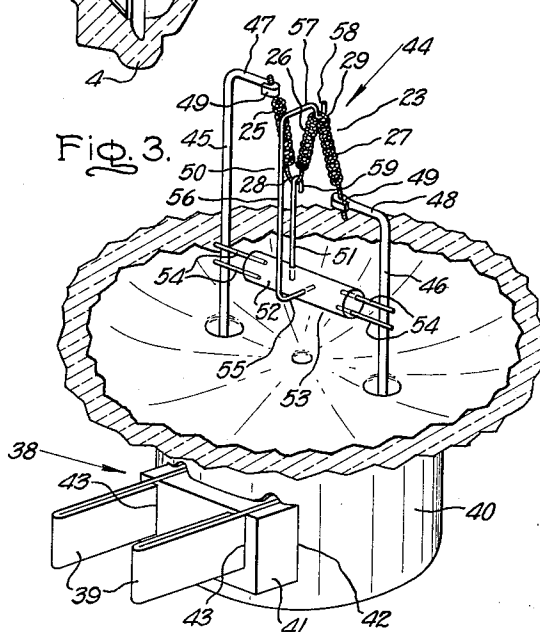


FIG. 3.



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UNITED STATES PATENT OFFICE

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ELECTRIC INCANDESCENT LAMP

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6 Claims. (Cl. 313—113)

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My invention relates in general to electric incandescent lamps, and more particularly to a reflector type incandescent lamp adapted to project a concentrated light beam of high intensity.

Reflector type electric incandescent lamps of the so-called sealed beam type described and claimed in U. S. Patent 2,148,314, D. K. Wright, and comprising glass reflector and cover glass sections fusion-sealed together to form the lamp envelope and having a concentrated light source located at or closely adjacent the focus of the reflector are well known in themselves and are in wide-spread use in many applications as, for example, in vehicle headlights, airplane landing lights, floodlights and spotlights, to mention a few. Another useful application is for a small portable spotlight or as a spotlight for general service, such as store lighting and display for instance, which is operable from a commercial power line and is capable of projecting an intense light beam over an extended distance.

It is an object of my invention, therefore, to provide a relatively high-wattage electric incandescent lamp of the above-mentioned sealed beam type which is operable from a commercial or household power source and which will produce a concentrated high-intensity light beam of more or less circular cross section and of great projection distance.

Another object of my invention is to provide an electric incandescent lamp of the above character which is of rugged construction and capable of withstanding impacts or sudden jars without breakage of the filament or distortion thereof which would result in premature filament burn-out and shortened lamp life.

Still another object of my invention is to provide an electric incandescent lamp of the above character having a filament which is concentrated about the focal point of the focusing reflector of the lamp envelope and which is effectively supported to protect it against physical shock and maintain it in proper position substantially free from sagging during operation.

According to one aspect of the invention, a coiled-coil tungsten wire filament of proper length and resistance for operation from an ordinary commercial or household power line of from 110-120 volts, for instance, is divided into a plurality of separate leg portions or segments which are disposed in a single plane and at an acute angle to one another to form either an N or Z shape or some other similar multi-segment or concentrated planar shape, and the so-formed filament is arranged substantially symmetrically

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about the focal point of the focusing reflector of a sealed beam type lamp such as disclosed in the above-mentioned U. S. Patent 2,148,314, with the plane of the filament located in an axial plane of the reflector axis.

According to another aspect of the invention, the above-described N-shaped filament is firmly supported in place in the lamp envelope to withstand physical shock and maintain its initial position free from sagging in an axial plane of the lamp reflector by having its opposite ends clamped or otherwise securely fixed to the inner ends of rigid inlead conductors and by being additionally supported intermediate its length, at its bights or connecting loops between adjacent coil legs or segments, by supplementary supports anchored to an insulating bridge or bridges fastened across the rigid inlead conductors.

Further objects and advantages of my invention will appear from the following detailed description of species thereof and from the accompanying drawing.

In the drawing, Fig. 1 is a sectional view of an electric incandescent lamp comprising my invention; Fig. 2 is an enlarged perspective view of the mount structure of the lamp shown in Fig. 1; and Fig. 3 is an enlarged fragmentary perspective view of a modification of the invention illustrating a modified mount structure and also a modified lamp base construction.

Referring to the drawing, the electric incandescent lamp according to the invention is of the "sealed beam" type disclosed and claimed in the above-mentioned U. S. Patent 2,148,314, D. K. Wright, and comprises a sealed glass envelope or bulb 1 consisting of a preformed pressed glass reflector section 2 and a preformed pressed glass cover section 3 fusion-sealed together at their peripheries, as indicated at 4. The cover section 3 may be made of clear glass, or it may be stippled or otherwise rendered light-diffusing. The inner surface 5 of the reflector section 2 is provided with a reflecting coating 6 and is formed of substantially paraboloidal shape, with a focal length of approximately $1\frac{1}{8}$ inch or thereabouts, so as to redirect light rays from a concentrated light source at the focus of the reflector 6 into a long beam of substantially parallel rays. The reflecting coating 6 may be of aluminum, silver or other similar light-reflective material.

Mounted on the rear outer side of the reflector section 2 at the region of the apex or center thereof is a base structure 7 of the general type shown and described in U. S. Patent 2,272,512, Cotman, and comprising a pair of terminal con-

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tacts 8, 8 in the form of metal straps or lugs which are suitably fastened, as by soldering for instance, to the closed nipped ends 9 of respective metal ferrules or thimbles 10, 10. The contact lugs 8, 8 are provided with screw terminals 11 for connecting current supply wires thereto. The ferrules 10, 10 are formed of a suitable metal which will readily "wet" and adhere to the glass of the reflector section 2 and they are provided with skirt portions 12 which are feathered to knife edges embedded and fused in the glass of the reflector section 2 around respective openings or passageways 13 through the wall thereof. The envelope 1 is provided with an exhaust tubulation 14 communicating with the interior of the envelope through an exhaust opening 15 in the envelope wall at the apex of the reflector section 2. After exhaustion of the envelope through the tubulation 14 and, if desired, introduction of a suitable gas filling such as nitrogen or argon, the tubulation 14 is sealed or tipped-off as indicated at 16.

Mounted within the envelope 1 and supported solely from the metal ferrules 10, 10 is a lamp mount structure 17 according to the invention and comprising a pair of rigid wire inleads 18, 19 secured and anchored at their outermost ends within the nipples 9 of the ferrules, as by solder 20 as shown. The inleads 18, 19 are made of any suitable material, such as molybdenum, nickel or iron, which will withstand the heat to which they are subjected during lamp fabrication and operation, and they are of large enough diameter to render them relatively rigid. In the particular case illustrated, for example, the inleads 18, 19 are made of 50 mil diameter nickel-plated iron wire. From the ferrules 10, 10, the inleads 18, 19 extend in more or less parallel spaced relation (1¼ inch apart in the particular case shown) through the openings 13, 13 in the wall of the reflector section 2 and into the envelope 1. The inleads 18, 19 extend approximately parallel to and lie in a plane containing the axis $x-x$ of the reflecting surface 6, and they are substantially symmetrically disposed on opposite sides of the said axis. Adjacent their inner ends the inleads 18, 19 are provided with inwardly offset end portions 21, 22 which extend transversely of and toward the inleads 18, 19 and lie substantially in the same plane as, but are spaced apart longitudinally of, the main inlead portions 18, 19. In the lamp illustrated, the inwardly offset or directed end portions 21, 22 are formed as separate members (25 mil nickel-iron in the case shown) which are welded or otherwise securely fastened to the main inlead portions 18, 19, but if desired they may be formed instead as continuations of the said main inlead portions 18, 19. At their innermost ends, the inleads 18, 19 are suitably connected, as by clamping or welding, to the terminal ends or extremities of an electric energy translation element or filament 23. In the particular case shown, the innermost ends of the inlead offset portions 21, 22 are flattened and reversely bent back upon themselves to form hooks or clamps 24 within which the filament ends are clamped to thereby securely fix the filament ends and fixedly position and rigidly support them from the inleads in the plane of the latter, and provide a good electrical connection therebetween. The filament 23 comprises a fine tungsten wire of suitable design or size, i. e., length and diameter, to operate at the particular voltage and wattage for which the lamp is

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designed, for example, from a conventional commercial or household power line of from 110-120 volts and at a wattage of say 100 to 300 watts, for instance, and it is coiled throughout its length into small or minute minor coils and then into larger or major coils to form a coiled-coil wire. By employing a filament in the form of a coiled-coil wire, the over-all length of the filament body is shortened to impart ruggedness thereto and concentrate it as much as possible.

The coiled-coil filament 23 is divided into three straight leg portions or segments 25, 26 and 27 defined by the larger or major coils of the filament, which segments are arranged at an acute angle relative to each other to form an N shape and are joined at the apices of the N by connecting loops or bights 28, 29, each formed by opening up one of the major or larger coil turns of the coiled-coil filament wire. As shown, the filament 23 is clamped to the inleads 18, 19 substantially along the axes of the two end segments 24, 26, some of the small or minor coils of the single coiled end portions of the filament being crushed between the two sides of the inlead hooks 24 within which the filament is clamped. The angle of divergence or spread of adjacent segments of the filament 23 is made sufficiently small or narrow to concentrate the filament about the focal point F of the reflecting surface 6, and the three segments 25, 26, 27 are disposed in a plane containing the axis of the reflector, and preferably in that axial plane thereof which includes the inleads, in order to present the smallest possible projecting area to obstruct the light rays reflected from the central regions of the reflecting surface 6 toward the front of the envelope. The N-shaped filament 23 is mounted substantially symmetrically or centered about the focus F of the reflecting surface 6 with the midpoint of the center segment 26 located at the focus F of the reflector, and with all the segments 25, 26, 27 extending in the general direction of the reflector axis and the center segment 26 crossing the reflector axis at an acute angle (e. g., around 10° to 20° or thereabouts) varying from approximately one-half to equal the angle between the center segment 26 and either end segment 25 or 27.

The filament 23 is additionally supported at the bights 28, 29 thereof to maintain the apices of the filament substantially in the plane of the inleads 18, 19 and hold the filament in place against sagging during operation, by a pair of intermediate supports, i. e., an inner intermediate support 30 and an outer intermediate support 31. The said intermediate supports 30, 31 may be made of 10 mil diameter molybdenum wire, for instance, and they are embedded at one end in the glass rod 32 of inner and outer insulative bridges or cross bars 33, 34 which are fastened across the two inleads 18, 19, in positions respectively inward and outward of the filament, by support wires 35 extending from the opposite ends of the glass rods 32 and welded or otherwise secured to the inleads to thereby rigidly tie the latter together. The intermediate filament support wires 30, 31 extend from their respective glass rod supports 32 toward the filament in a direction substantially parallel to and substantially in the common plane of the inleads 18, 19 and filament 23. At their other or free ends the intermediate support wires 30, 31 are bent back upon themselves to form U-shaped hooks 36, 37, respectively, which are located substantially in the common plane of the inleads 18, 19 and filament 23 and on

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which the bights or connecting loops 28, 29 of the filament are respectively supported to thereby position and support the filament at its apices, free from sagging, substantially in the plane of the inleads 18, 19. The filament bights 28, 29 are loosely hooked or looped over the U-shaped hooks 36, 37 of the support wires 30, 31 in order to permit a limited amount of free movement of the filament bights in the hooks longitudinally of the filament segments during operation of the lamp to compensate for the expansion and contraction of the filament segments, and also in order to space the filament segments, at the apices of the filament, sufficiently far apart to prevent contact therebetween when the lamp is subjected to a physical shock. As shown in Fig. 2, the U-shaped hooks 36, 37 are sufficiently deep and practically parallel to one another to thereby function as guiding means for the apices of the filament and prevent displacement or disengagement of the filament from the support hooks 36, 37 when heated during the operation of the lamp. Preferably, the intermediate filament support wires 30, 31 are initially set to exert a sufficient pull on the apices of the filament in opposite directions lengthwise of the inleads 18, 19 so as to draw the filament segments more or less taut between their points of support, thus tending to keep the filament substantially taut and free from sagging in the plane thereof during lamp operation so as to maintain the light rays in proper focus relative to the reflector. The intermediate supports 30, 31 are sufficiently rigid to prevent permanent displacement of the filament from its initial position, but the slight resiliency of these supports permits the filament to move slightly when the lamp is subjected to a physical shock so that there is less danger of filament breakage than would be the case if all strains had to be taken up by each individual segment of the filament.

The modified lamp construction illustrated in Fig. 3 differs from that shown in Figs. 1 and 2 in that, among other things, in place of having the lug type base 7 of Fig. 1, it is provided instead with a base structure 38 of the side-prong type shown and described in U. S. patent application Serial No. 171,766—Geissbuhler et al., filed of even date herewith and assigned to the assignee of the present invention, and comprising a pair of terminal contacts 39, 39 in the form of metal prongs or contact blades which are rigidly secured and electrically connected at one end to the closed nipple ends 9 of the metal ferrules or thimbles 10 of the lamp. The contact prongs 39 are preferably secured to the nipple ends 9 of the ferrules 8 by being wrapped therearound and soldered thereto, and as shown, they extend laterally of the reflector section 2 and project outwardly from the side of a generally cylindrical metal cup or cap 40 which is securely fastened to the base end or apex of the reflector section to enclose the projecting ferrules 10 and exhaust tip 16 located thereat. The contact prongs 39 are firmly held in spaced relation, insulated from each other and from the metal cap 40, by an insulative spacer block 41 of porcelain or other suitable insulating material which projects through an opening 42 in the cylindrical wall of the metal cap 40 and is slotted, as indicated at 43, to receive and hold the prongs 39 therein.

The modified mount construction 44 illustrated in Fig. 3 differs from the mount 17 of Figs. 1 and 2 in the form of the inlead conductors and the supports for the filament 23 which is of the same construction as the filament shown in Figs. 1

and 2. In Fig. 3, the filament 23 is connected to and supported at its extremities by a pair of wire inleads 45, 46 which extend from the ferrules 10, 10 on the reflector section 2 into the envelope 1 in spaced parallel relation to each other and substantially in an axial plane of the reflecting surface 6. One of the inleads (45) is longer than the other, and they are both bent or turned inward at their inner ends to form inwardly directed end portions 47, 48 which extend toward the reflector axis and lie in the same plane as the main inlead portions 45 and 46 but are spaced apart longitudinally of the reflector axis by reason of the difference in lengths of the inleads. The innermost ends of the inleads 45, 46 are formed with hooks 49 within which the filament extremities are clamped substantially along the axes of the two outer or end segments of the filament to thereby firmly support the filament in place at its extremities. As in the case of the previous form of the invention, the N-shaped filament 23 of Fig. 3 is likewise mounted in the same axial plane of the reflecting surface 6 as that containing the two inleads 45, 46, and it is symmetrically disposed and centered about the focus F of the reflecting surface 6 in the same manner as in Figs. 1 and 2.

The filament 23 in Fig. 3 is additionally supported at the bights 28, 29 thereof, to hold it in place against sagging during operation, by a pair of intermediate supports 50 and 51, respectively. The said intermediate supports may be made of 12 mil diameter molybdenum wire, for instance, and they are each embedded at one end in the glass rod 52 of an insulative bridge or cross bar 53 which is similar to the bridges 33 and 34 of Figs. 1 and 2 and is fastened across the two inleads 45, 46 by pairs of support wires 54, 54 extending from the opposite ends of the glass rod 52 and welded or otherwise secured to the inleads, to thereby rigidly tie the said inleads together. One of the intermediate filament support wires (50) is longer than the other support wire 51 and it extends from the glass insulator rod 52 in a direction transversely to the plane of inleads 45, 46 as indicated at 55 and is then bent to extend outwardly of the reflecting surface 6 in a direction more or less parallel to or at a slight angle to the axis of the reflector, as indicated at 56. The free end of the support wire 50 is bent inwardly toward the filament to form an in-turned arm 57 formed with a U-shaped loop or hook 58 within which the upper bight 29 of the filament is loosely hooked to thereby position and support the filament at its outer apex against sagging. The other or shorter support wire 51 extends from the glass insulator rod 52 in a direction outwardly of the reflector 2 and substantially parallel to the reflector axis and in the plane of the filament 23, and is likewise provided at its free end with a U-shaped loop or hook 59 within which the lower bight 28 of the filament is loosely hooked to thereby position and support the filament at its inner apex against sagging.

The angle of divergence or spread of adjacent segments 25, 26, and 27 of the N-shaped filament 23 of Figs. 1 to 3 is made relatively small, for example, of the order of 20° or thereabouts. This, coupled with the coiled-coil construction of the filament, serves to concentrate the filament at and adjacent the focal point of the reflector 6 sufficiently so as to produce a light beam which is of substantially circular or slightly elliptical section and free from a dark spot or area at the center thereof, the center filament segment 26

producing a more or less bright spot of light at the center of the beam and the two outer segments 25 and 27 producing bright spots of light slightly to either side of the center spot depending on the spread of the segments. This is in marked contrast to the beam produced by a V-shaped coiled-coil filament mounted symmetrically about the focus F of the reflector so as to lie in an axial plane of the reflector with its apex pointed outward and located on the axis of the reflector, such a beam being characterized by a darkened spot at the center of the beam due to the fact that the two diverging legs of the V filament product bright spots located slightly to either side of the center of the beam.

From the above description, it will be apparent that I have provided a sealed beam type of lamp for operation from a power line of any suitable voltage, such as a conventional commercial or household power line of 110 to 120 volts for example, and which will operate to project a concentrated and substantially circular light beam of high intensity for a relatively great distance. The filament is composed of a plurality of angularly disposed coiled-coil segments or portions which concentrate the filament so as to approximate the desired point source of light for use with the focusing reflector, and an effective supporting arrangement is provided to support the filament rigidly at its terminal extremities as well as at points intermediate its ends to thereby protect it against physical shock and maintain all portions thereof substantially in their initial position, free from sagging, in an axial plane of the reflector during all operating conditions throughout the life of the lamp.

Although preferred species of my invention have been disclosed, it will be understood that the invention is not to be limited to the specific construction and arrangement of parts shown, but that they may be widely modified within the spirit and scope of my invention as defined by the appended claims.

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

1. An electric incandescent lamp comprising a sealed envelope having a focusing reflector for producing a long beam of substantially parallel rays, a coiled-coil filament in said envelope comprising a plurality of individual segments disposed in a common plane and arranged at substantially the same acute angle with respect to each other, a pair of spaced rigid inlead conductors in said envelope extending substantially parallel to and disposed substantially in a plane containing the focal axis of said reflector and having inwardly directed portions extending laterally of and toward the axis of the reflector so as to lie substantially in said plane, said inwardly directed conductor portions being spaced apart longitudinally of the reflector axis and being connected to the ends of said filament to rigidly support the said filament ends in said plane, and means for additionally supporting the filament at the junctions between the said segments thereof to hold it substantially centered about the focal point of the reflector and in said plane with its segments extending in the general direction of the reflector axis and its center segment arranged at an acute angle to the axis of the reflector and extending through the focal point thereof, said additional supporting means maintaining the filament substantially in said plane under the operating conditions of the lamp

whereby to maintain the light beam from the lamp properly focused.

2. An electric incandescent lamp comprising a sealed envelope having a focusing reflector for producing a long beam of substantially parallel rays, a coiled-coil filament in said envelope comprising three individual segments arranged in substantially an N-shape, a pair of spaced rigid inlead conductors in said envelope extending substantially parallel to and disposed substantially in a plane containing the focal axis of said reflector and having inwardly directed portions extending laterally of and toward the axis of the reflector so as to lie substantially in said plane, said inwardly directed conductor portions being spaced apart longitudinally of the reflector axis and being connected to the ends of said filament to rigidly support the said filament ends in said plane, and means for additionally supporting the filament at the junctions between the said segments thereof to hold it substantially centered about the focal point of the reflector and in said plane with its segments extending in the general direction of the reflector axis and its center segment arranged at an acute angle to the axis of the reflector and extending through the focal point thereof, said additional supporting means maintaining the filament substantially in said plane under the operating conditions of the lamp whereby to maintain the light beam from the lamp properly focused.

3. An electric incandescent lamp comprising a sealed envelope having a focusing reflector for producing a long beam of substantially parallel rays, a coiled-coil filament in said envelope comprising three individual segments arranged in substantially an N-shape, a pair of spaced rigid inlead conductors in said envelope extending substantially parallel to and disposed substantially in a plane containing the focal axis of said reflector and having intumed inner end portions extending laterally of and toward the axis of the reflector so as to lie substantially in said plane, said intumed conductor portions being spaced apart longitudinally of the reflector axis and being connected to the ends of said filament to rigidly support the said filament ends in said plane, and means for additionally supporting the filament at the junctions between the said segments thereof to hold it substantially centered about the focal point of the reflector and in said plane with its segments extending in the general direction of the reflector axis and its center segment arranged at an acute angle to the axis of the reflector and extending through the focal point thereof, said additional supporting means maintaining the filament substantially in said plane under the operating conditions of the lamp whereby to maintain the light beam from the lamp properly focused.

4. An electric incandescent lamp as set forth in claim 1 wherein the additional support means for the filament comprises a pair of insulative bridge members fastened across the said inlead conductors at positions respectively outward and inward of the filament and provided with support wires each having a hook on which the respective junctions between the filament segments are hooked.

5. An electric incandescent lamp as set forth in claim 3 wherein the additional support means for the filament comprises an insulative bridge member fastened across the said inlead conductors at a position inwardly of the filament and provided with a pair of support wires each hav-

ing a hook on which respective junctions between the filament segments are hooked.

6. An electric incandescent lamp as set forth in claim 2 wherein the center segment of the said N-shaped filament crosses the axis of the reflector at an acute angle ranging from approximately one-half to equal the angle between the center segment of the filament and an adjacent segment thereof.

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