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ROSS REFERENCE
EXAMINER
252

April 18, 1939. D. E. ELMENDORF 2,154,500

APPARATUS FOR PREFOCUSING LAMPS

Filed June 21, 1937 3 Sheets-Sheet 1

Fig. 1.

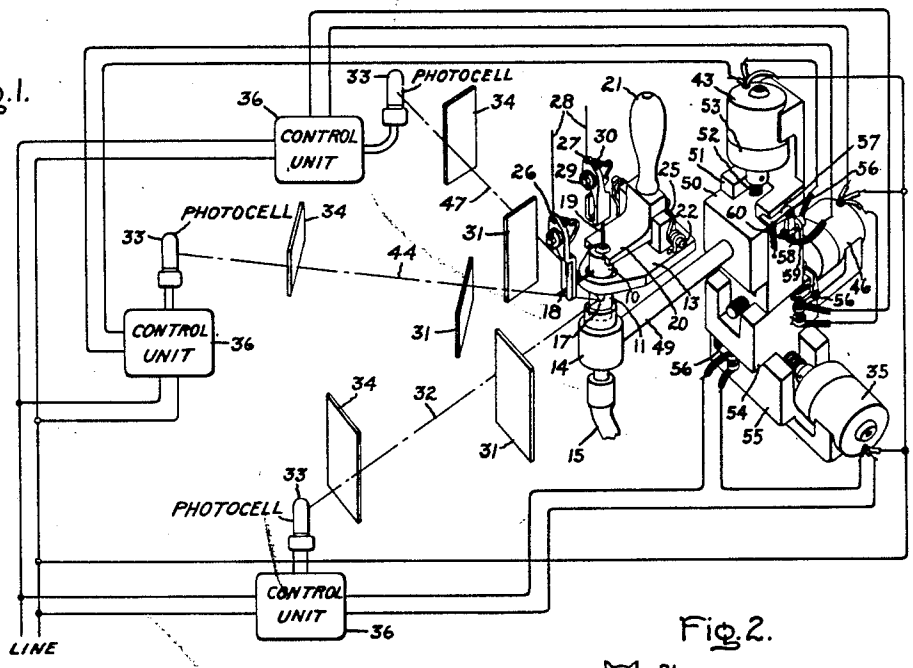


Fig. 2.

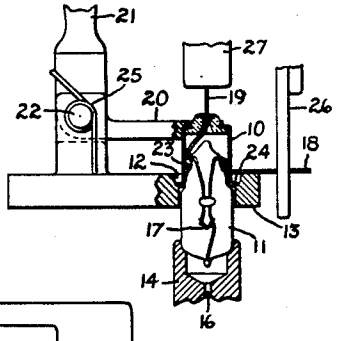
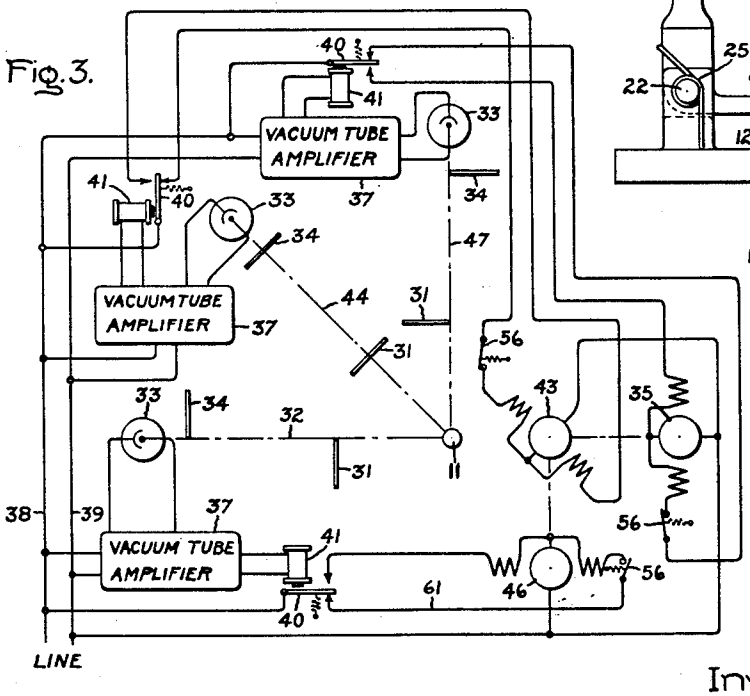


Fig. 3.



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Fig. 4.

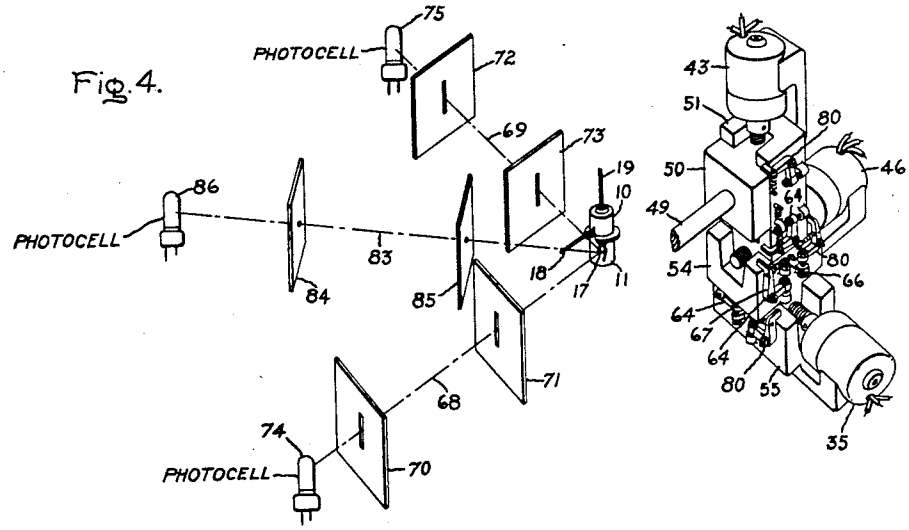
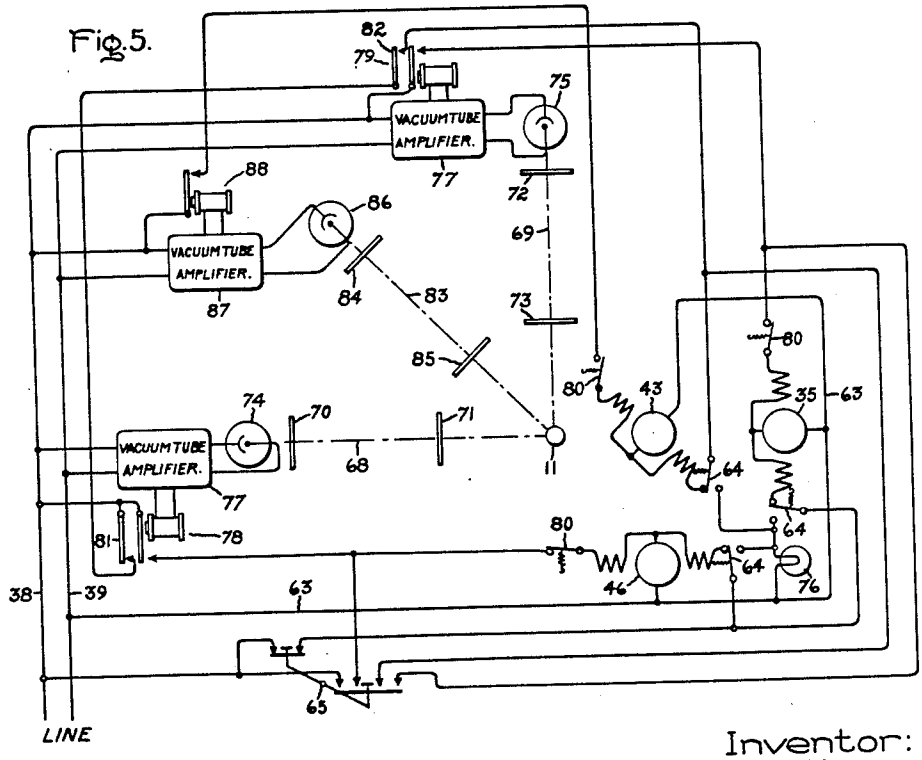


Fig. 5.



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Fig. 6.

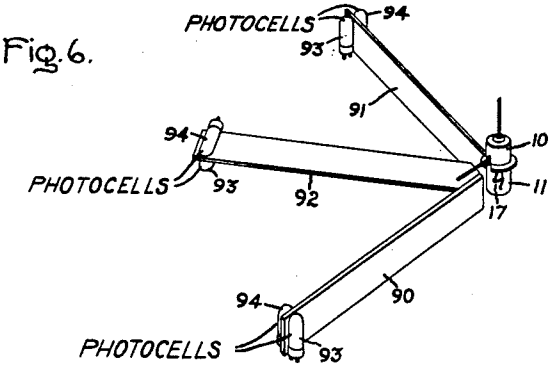
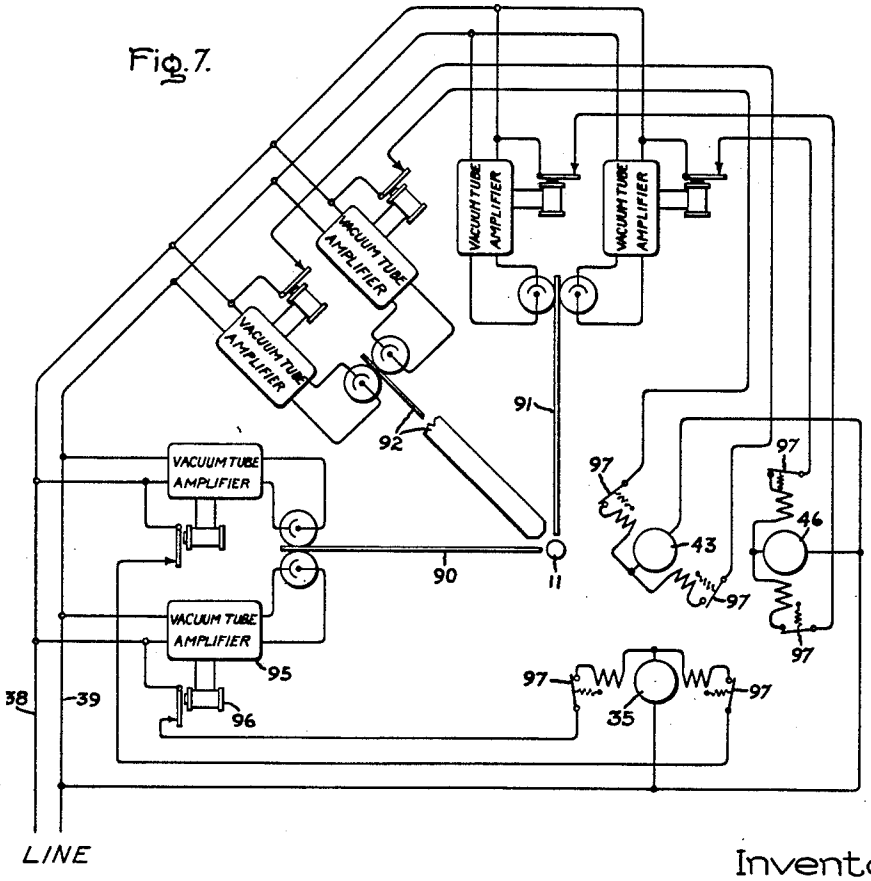


Fig. 7.



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Patented Apr. 18, 1939

2,154,500

UNITED STATES PATENT OFFICE

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APPARATUS FOR PREFOCUSING LAMPS

Duryea E. Elmendorf, Shaker Heights, Ohio, assignor to General Electric Company, a corporation of New York

Application June 21, 1937, Serial No. 149,454

8 Claims. (Cl. 176—3)

My invention relates to the manufacture of electric incandescent lamps and more particularly to methods and apparatus for automatically adjusting the bulb of a lamp with reference to the base or a portion thereof to accurately locate the filament sealed therein in a predetermined position with respect to said base or portion thereof. Heretofore, the filaments have been adjusted manually with the assistance of optical means for showing their position and mechanical means for facilitating adjustment thereof.

One of the objects of my invention is to eliminate all manual operations in the adjustment of the lamp to reduce the cost and increase the speed and accuracy thereof. To attain this object, I provide means for moving the lamp bulb containing the filament, preferably in each of three directions at right angles to each other. This adjustment may be made by separate electric motors, for instance. The light emitted by the filament is shielded in various ways so as to change the amount of light falling on light-sensitive cells which are located in the path of the light and control the adjustment by controlling the operation of the electric motors. I have disclosed herein three species of method and corresponding apparatus for producing the adjustment control desired and a single common method and means for adjusting the bulb. In each of the species, similar means are provided for controlling and producing the necessary adjustment in each of the three directions referred to, and for discontinuing the adjustments in each of these directions when the filament is at the correct location.

In one of the species of my invention one or more transverse screens is located some distance from the lamp with an edge extending in a direction at right angles to the direction of adjustment of the lamp. The adjustment is controlled by the photocell which causes it to take place in one direction if it receives light from the filament and in the opposite direction if it does not. Similar arrangements control the adjustments in each of the three directions specified. In another species of my invention I provide one or more screens between the filament and each of the three photocells having apertures therein which permit the light from said filament to strike the photocells when it is correctly located. Additional apparatus is provided to cause the lamp bulb supporting the filament to be adjusted back and forth in each direction to bring the filament to the correct position, the motion being terminated by means actuated by the photocells. In still another species of my invention I provide screens extending between the lamp bulb and the photocells and located in planes at right angles to the directions of the adjustments. The said screens shield the light emitted by the filament from pairs of photocells located at opposite sides of the screens when the filament is correctly located. If the filament is out of position, the light falls on one of the photocells which causes the bulb to be moved in such a direction as to cause the shield to come between the photocell and the filament.

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

In the drawings, Fig. 1 is a diagrammatic perspective view of one species of my invention; Fig. 2 is a side elevation, partially in section, showing a lamp with its base and supporting means therefor; Fig. 3 is a wiring diagram for the apparatus shown in Fig. 1; Fig. 4 is a perspective view of the essential parts of a second species of my invention; and Fig. 5 is a wiring diagram therefor; and Fig. 6 is a perspective view of the lamp, screens, and photocells in their proper relation as used in a third species, and Fig. 7 is a wiring diagram therefor.

Referring to Figs. 1, 2 and 3, the apparatus shown therein comprises separate means for supporting and clamping the lamp base 10 in a fixed position, for supporting the lamp 11 and adjusting it with respect to the said base 10, and for controlling the adjustment of the said lamp 11. The lamp 11 is inserted in an inverted position into the aperture 12 in plate 13 and is allowed to fall into the cup 14, as shown in Fig. 2. The end of the lamp 11 fits snugly in the said cup 14 which holds said lamp 11 by suction provided through the flexible hose 15 and the channel 16 in the said cup from a source not shown. In this position of the lamp, the coiled filament 17 is located between the cup 14 and the plate 13 so that when it is energized the light therefrom is allowed to pass to the adjustment control means. The filament 17 is attached to the lead-in wires 18 and 19 which are bent so as to extend sideward and upward respectively from the lamp 11.

The base 10 is inserted in the device after the arm 20 has been lifted from the position shown by pressure on handle 21 which causes it to swing about the pin 22. The said base 10 contains a ring of semiplastic cement 23 and is placed over the neck of the lamp 11 with the

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cement 23 in contact therewith and the leading-in wire 18 extending through a slit in the base shell and wire 19 threaded through the base eyelet. In this case, the rim of the base shell is provided with an outwardly extending flange 24 for purposes of positioning the lamp 11 in the equipment in which it is used and is inserted in the aperture 12 in the plate 13 so that said flange 24 rests upon the shoulder therein. The rim of the base flange 24 fits snugly in the portion of the aperture 12 in which it is located and is held firmly in place by the arm 20 which moves down into contact with the end of the base 10 when released. The arm 20 is supported by the pin 22 which extends through a pair of lugs extending upward from plate 13 and is turned, so as to engage the base 10, by the torsion spring 25. The said spring 25 has its ends located in apertures in the plate 13, is coiled around the ends of the pin 22 and is looped back of a portion of arm 20 as shown.

After the base 10 and the lamp 11 have been properly inserted, the filament 17 is energized, whereupon the adjusting operation is automatically performed. The filament 17 is connected to a source of current of the correct potential by the pairs of jaws 26 and 27 which engage leading-in wires 18 and 19 respectively and which are connected through the flexible leads 28—28 to said source. Each of the pairs of jaws 26 and 27 is mounted on a stationary pin 29 and is closed on the leading-in wires by a spring 30. The adjustment of the lamp 11 is performed by three duplicate adjusting and control means each adapted to move the lamp 11 back and forth in a direction at right angles to the direction of movement of each of the other means. In each case, a transverse screen or shield 31 is located relatively near the lamp 11 (one inch therefrom, for instance) with one straight edge at right angles to the direction of movement of that particular adjusting means and intersecting the direct path, indicated by the dot-dash line 32, 44 or 47, connecting the desired position of the filament 17 and the respective photocell 33. A second screen or shield 34 is also located between the lamp 11 and each of the photocells 33 is preferably one inch or more from the first screen 31 and similarly placed at the opposite side of the direct path 32, 44 or 47 therebetween. The screens 31 and 34 prevent the light from the filament 17 from falling on the photocell 33 when the said filament is to one side of the straight edges thereof and do not interfere with the light when the lamp 11 is at the other side of said straight edges. For example, referring to the path 47 in Fig. 3, the apparatus is so adjusted as to cause the amount of movement of the lamp 11 to the right (at right angles to said path) to be so limited that light from said lamp 11 always falls on a portion of the photocell 33 when the said lamp is to the right of screen 31. When the light strikes a photocell 33, the lamp 11 is moved in a direction which causes the light to be cut off therefrom, by an electric motor 35, 43 or 46 whose direction of rotation is set by its control unit 36. As shown in Fig. 3, each of the control units 36 comprises a conventional vacuum tube amplifier 37 which is connected to the line conductors 38 and 39 and which amplifies the current changes taking place in the photocell 33 so that they are of sufficient strength to operate the armature 40 of the relay 41. The motors 35, 43 and 46, as shown, are series wound with separate sets of field windings for each direction of rotation which are connected to the contacts engaged by the armature 40 which in turn is connected to the line conductor 38.

As shown in Fig. 1, the electric motor 43 is provided to move the lamp 11 vertically so as to cause the light from the filament 17 to fall along path 44, and motors 35 and 46 are provided to move the lamp 11 in two directions at right angles to each other in a horizontal plane so as to cause the light to fall along paths 32 and 47 respectively. The cup 14 which holds the lamp 11 is mounted, by means of the arm 49, on the slide 50 which is moved up and down in its ways in block 51 by the screw 52. The screw 52 in turn is connected through a speed reducer 53 to the motor 43 which is mounted on the block 51. The block 51 in turn is mounted in the ways of block 54 in which it is moved by motor 46 and the block 54 in turn is mounted in ways of block 55 in which it is moved by motor 35. Each of the motors 43, 35 and 46 operates through a similar screw and speed reducer.

Since a defective lamp 11 may be placed in the apparatus which would cause the motors to run continuously in one direction so as to normally cause the light to pass by the screens 31 and 34, a limit switch 56 is provided on each of blocks 51, 54 and 55 to prevent damage to the device. Each of the limit switches 56 comprises a lever 57 pivoted on the associated block 51, 54 or 55, and a pair of contacts 58 and 59, one of which is mounted on the lever 57. The other of said contacts is mounted on the same block 51, 54 or 55 and the lever 57 is moved so that said contacts 58 and 59 are separated by engagement with the particular slide 50 or block 51, or 54, sliding thereon. The lever 57 is normally held by spring 60 in such a position that the contacts 58 and 59 are touching each other. The contacts 58 and 59 are connected in the lead 61 to the field windings of the motors 43, 35 and 46 which are connected to the line conductor 38 through the relay 41 when said relay 41 is not energized. With this arrangement, all of the adjusting means are operating at the same time and when the lamp 11 is in the correct position all the relays 41 are moving rapidly from position to position with practically no movement of the lamp 11. The adjustment of the apparatus may be such that a small amount of light falls on the photocells 33 even when the filament 17 is in the correct position. To reduce wear on the adjusting device, the line connection thereto is preferably interrupted while heat is applied to the base 10 to harden the cement 23 and fasten the lamp 11 therein in the correct position. If desired, the base holding means and the lamp holding and adjusting means can be built into single heads of a multiple head turret type machine and the optical means and motors may be made to register with the head at one position thereof. In that instance, the lamps 11 may be based much more rapidly than in the device shown since the heating, which takes the longer time, may then be done at several positions while other lamps are being adjusted. The device may be used very efficiently where a separate base portion, such as a collar for instance, is fastened in the correct relation to the filament on a base already attached to the lamp. If desired, one of the screens 31 or 34 may be eliminated, the movement of the lamp in any of its three directions being terminated just as the light is admitted to or obstructed from the photocell by the screen.

The second species of my invention, shown in Figs. 4 and 5, makes use of the same base holding, lamp adjusting and lighting means shown and described in connection with the first species. In this case, the lamp 11 is first correctly located with reference to the longitudinal vertical axis of the base 10 and is then located at the correct distance from the base 10. At first the lamp 11 is moved simultaneously in two directions at right angles to each other in a horizontal plane by the motors 35 and 46 which are connected to the line conductor 39 through the lead 63, and through the double pole limit switches 64 and the two-push-button walking-beam switch 65 to the line conductor 38. This movement is always in one direction in each instance as the mechanism is previously set to one side of the desired position before the device is operated. The spring 66 of each of the limit switches 64 keeps the lever 67 thereof in a position in which the contact thereof is in engagement with the contact connected to the particular field windings of the motors 35 and 46 causing the desired direction of rotation. During the movement, the lamp 11 reaches a position in which the light from the filament 17 thereof falls along paths 68 and 69 and passes through the apertures or slits in the screens 70—71 and 72—73 to the photocells 74 and 75. The apertures in the screens 70, 71, 72 and 73 are preferably very narrow so that both edges thereof are substantially in paths 68 and 69. If the filament 17 has failed to light, the lamp 11 is carried to the end of the limit of movement which causes blocks 54 and 51 to strike the levers 67 of the limit switches 64 and move them so that the circuit to the motors 35 and 46 is broken and the warning light 76 is lighted. Each of the limit switches 64 comprises a lever 67 having a single contact which is in engagement with either of two stationary contacts which are connected to the motor field windings or to one lead of the warning light 76. All three contacts of each limit switch 64 are insulated from their supporting means. Single screens may be used instead of the pair shown in this case which have vertical slits .003 of an inch wide and are spaced one inch from the lamp 11 and the photocells 74 and 75 respectively and six inches from each other. The light received by the photocells 74 and 75 causes the adjusting motion to stop since the photocells 74 and 75 actuate, through the conventional vacuum tube amplifiers 77, the relays 78 and 79 which connect a second field winding of the motors 35 and 46, tending to turn the motor armature in the opposite direction, to the line conductor 38. The two field windings of the motors 35 and 46 enable them to be stopped quickly and prevent the momentum thereof from turning the motor and mechanism connected thereto farther and thereby moving the lamp 11 out of position. The limit switches 80 connected in the leads to the second field windings of the motors 35 and 46 remain closed during the whole of the adjusting operation and are used only to prevent over-movement when the said motors are returned to their former positions, as later described.

Adjacent of the lamp 11 axially, or vertically in this case, to fix the light center length takes place only after both relays 78 and 79 are closed. As shown, relay 78 is provided with a second armature 81 which is connected to the line conductor 38 and which swings so as to engage a contact connected to a second armature 82 of the relay 79 when said relay 78 is operated. The second armature 82 serves to close the circuit through a contact engaged by it and another double throw limit switch 64 to the field windings of the motor 43, causing the lamp 11 to be moved down. Because of the series arrangement of the armatures 81 and 82, the vertical adjustment can only take place after the other two adjustments. The downward movement of the lamp 11 continues until the light from the filament 17 thereof falls along the line 83 and passes through the apertures in screens 84 and 85 and strikes the photocell 86. The photocell 86 actuates the relay 88 and the limit switch 80 as in the previous instances, through a conventional vacuum tube amplifier 87. The screens 84 and 85 are preferably placed in the same relation to the lamp 11 as in the other instances but each has only a round hole therein, of .003 inch diameter, for instance.

The base 10 is then fastened to the lamp 11 and the various parts of the apparatus are returned to their former positions before another lamp 11 is placed therein. The said parts of the apparatus are returned by changing the position of the walking-beam switch 65 which breaks the connection to the first-mentioned field winding of the motors 43, 35 and 46 and connects each of the other field windings of the said motors to the line conductor 38, causing them all to turn in one direction to carry the adjusting means to its limit of movement. The movement stops when the levers of the limit switches 80 are engaged by the slide 50 and blocks 51 and 54 respectively and the circuit to the motor field winding is interrupted thereby. The walking-beam switch 65 is returned to its former position before another lamp 11 is adjusted.

The third species of my invention, shown in Figs. 6 and 7, makes use of the base holding, lamp lighting and adjusting means shown in the first embodiment. In this case, three screens 90, 91 and 92 are used and each is mounted in abutting relation to the lamp 11 and shields the light from the filament 17 from the photocells 93 and 94 when said filament 17 is in the correct position.

The screens 90, 91 and 92 extend from the lamp 11 in planes perpendicular to the directions of adjustment, screens 90 and 91 being in vertical planes and screen 92 in a horizontal plane. Each of the photocells 93 and 94 is connected to a conventional vacuum tube amplifier 95 which increases the current change taking place within the photocell when it receives light from the filament 17 so that the relay 96, which is connected thereto, is energized and connects one of the field windings of the motors 43, 35 and 46 to the line conductor 38. The connections are such that the photocell 93 or 94 struck by the light from the filament 17 causes the motor 43, 35 or 46 to move the lamp 11 toward the screen 90, 91 or 92 and the other photocell 93 or 94. The edges of the screens 90, 91 and 92 abutting the lamp bulb are in substantially the direct path between the correct position of the filament 17 and each of the photocells 93 and 94. A limit switch 97 is connected in each lead to the field windings of the motors 43, 35 and 46 in order to cause the circuit therethrough to be broken in case the adjusting parts reach the limit of motion due to a defective lamp 11. In the wiring diagram shown in Fig. 7, the end of the screen 92 is shown turned 90° from its actual position in order to show both photocells 93 and 94.

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

1. Apparatus for accurately locating a filament

sealed in the bulb of an incandescent lamp with respect to a portion of a base, comprising a holder for said base portion, means for supporting said bulb adjacent to said base portion, a plurality of light-sensitive cells disposed in predetermined spaced relationship to said holder, a plurality of screen means disposed adjacent to the paths between said light-sensitive cells and a predetermined point at which said filament is to be located, means for energizing said filament to cause it to emit light, means for shifting the position of said bulb with respect to said base portion, said screens serving to control the passage of light to said cells, and means for discontinuing said shifting motion when the said filament is located at said predetermined point, said last-named means being controlled by said light-sensitive cells.

2. Apparatus for accurately locating a filament sealed within the bulb of an incandescent lamp with respect to a portion of a base comprising a holder for said base portion, means for supporting said bulb adjacent to said base portion, a plurality of photocells, one located to one side of an axis through the desired position of the filament and a pair located in a plane substantially perpendicular to said axis and in directions therefrom at right angles to each other, means for connecting the filament to a source of current to cause it to emit light, screen means located between the said holder and photocells for changing the amount of the light falling on said cells when the filament is out of position, means for automatically moving the said lamp bulb parallel to said axis and in directions at right angles to each other in said plane to cause the said screen means to effect the light change, and means controlled by said photocells for discontinuing the movement in each of said directions when said light change occurs and the filament is correctly located.

3. Apparatus for accurately locating a filament sealed within the bulb of an incandescent lamp with respect to a portion of a base comprising a holder for said base portion, means for supporting said bulb with the filament therein at approximately the desired position with reference to said holder and base portion, a plurality of photocells, one located to one side of an axis through the desired position of the filament and a pair located in a plane substantially perpendicular to said axis and in directions therefrom at right angles to each other, means for connecting the filament to a source of current to cause it to emit light, screens located between said holder and the photocells with an edge thereof extending substantially through the direct path between said cells and the desired location of the filament, means for automatically moving the said bulb parallel to said axis and also in two directions in said plane at right angles to the said paths between said cells and the desired location of the filament to cause the edges of the screens to effect a change in the amount of light falling on said cells and means controlled by said cells for discontinuing the movement in each of said directions when said light change occurs and the filament is correctly located.

4. Apparatus for accurately locating a filament sealed within the bulb of an incandescent lamp with respect to a portion of a base comprising a holder for said base portion, means for supporting said bulb with the filament therein at approximately the desired position with reference to the said holder and base portion, a plurality of photocells, one located to one side of an axis through the desired position of the filament and a pair located in a plane substantially perpendicular to said axis and in directions therefrom at right angles to each other, means for connecting said filament to a source of current to cause it to emit light, screens located between said holder and the photocells with one edge extending through the direct path between said cells and the desired location of the filament, means for automatically moving said bulb back and forth in directions at right angles to the path between said cells and the holder and at right angles to the said edges of the screens to effect a change in the amount of light falling on said cells, and means controlled by said cells for discontinuing the movement in each of said directions when said light change occurs and the filament is correctly located.

5. Apparatus for accurately locating a filament sealed within the bulb of an incandescent lamp with respect to a portion of a lamp base comprising a holder for said base portion, means for supporting said bulb with the filament therein at approximately the desired position with reference to said holder and base portion, a plurality of photocells, one located to one side of an axis through the desired position of said filament and a pair located in a plane substantially perpendicular to said axis and in directions therefrom at right angles to each other, means for connecting the filament to a source of current to cause it to emit light, screens located between said holder and the photocells with apertures therein in the direct path between said cells and the desired position of the filament, means for automatically moving said bulb parallel to said axis and in two directions at right angles to each other in said plane to cause the light passing through the apertures in said screens to shift toward and finally fall on the said cells, and means controlled by said cells for discontinuing the movement in each of said directions when said cells receive said light and the filament is correctly located.

6. Apparatus for accurately locating a filament sealed within the bulb of an incandescent lamp with respect to a portion of a base comprising a holder for said base portion, means for supporting said bulb with the filament therein at approximately the desired position with reference to said holder and base portion, light-sensitive means located to one side of an axis through the desired position of the filament and other light-sensitive means located in a plane perpendicular to said axis and in directions therefrom at right angles to each other, means for connecting said filament to a source of current to cause it to emit light, screens located between said holder and each of said light-sensitive means adapted to shield the light emitted by said filament from said light-sensitive means when said filament is in the desired position, means for automatically moving said bulb parallel to said axis and in two directions at right angles to each other in said plane when the filament is incorrectly positioned and the screens do not shield the light from said light-sensitive means, and means controlled by said light-sensitive means for discontinuing the movement when the light is shielded therefrom and the filament is correctly located.

7. Apparatus for accurately locating a filament sealed within the bulb of an incandenscent lamp with respect to a portion of a base comprising a holder for said base portion, means for supporting

said bulb with the filament therein at approximately the desired position with reference to said holder and base portion, a pair of screens located at right angles to each other in planes passing through an axis through the desired position of the filament, a third screen located in a plane at right angles to said axis, pairs of photocells located on opposite sides of each of said screens and shielded thereby from the light from the filament when said filament is at the desired position, means for moving the said lamp bulb in directions at right angles to each of said screens when the filament is incorrectly positioned and some of the photocells are receiving light therefrom, and means controlled by said cells for discontinuing the movement when the light is shielded therefrom and the filament is correctly located.

8. Apparatus for accurately locating a filament sealed within the bulb of an incandescent lamp with respect to a portion of a base comprising a holder for said base portion, means for supporting said bulb with the filament therein at approximately the desired position with reference to said holder and base portion, a plurality of photocells, one located to one side of an axis through the desired position of the filament and a pair located in a plane substantially perpendicular to said axis and in directions therefrom at right angles to each other, means for connecting the filament to a source of current to cause it to emit light, screens located between said holder and the photocells with apertures therein in the direct paths between said photocells and the desired position of the filament, means for automatically moving the said bulb parallel to said axis and in two directions in said plane at right angles to the said paths between said pair of cells and the desired location of said filament, means for causing operation of said means for moving the bulb in the said plane, relays operated by the said pair of photocells for discontinuing said movement when the light from the filament passing through the apertures of a pair of screens falls on said photocells and thereafter causes operation of the said means for moving the lamp bulb axially, and a relay operated by the first-mentioned photocell for discontinuing operation of the said means causing the axial movement when the light from the filament passing through the aperture in the third screen falls on the photocell and said filament is correctly located.

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