July 7, 1936. A. F. BAHLKE ET AL 2,046,360

BULB COATING MACHINE

Filed Nov. 16, 1934 6 Sheets-Sheet 1

Fig. 1.

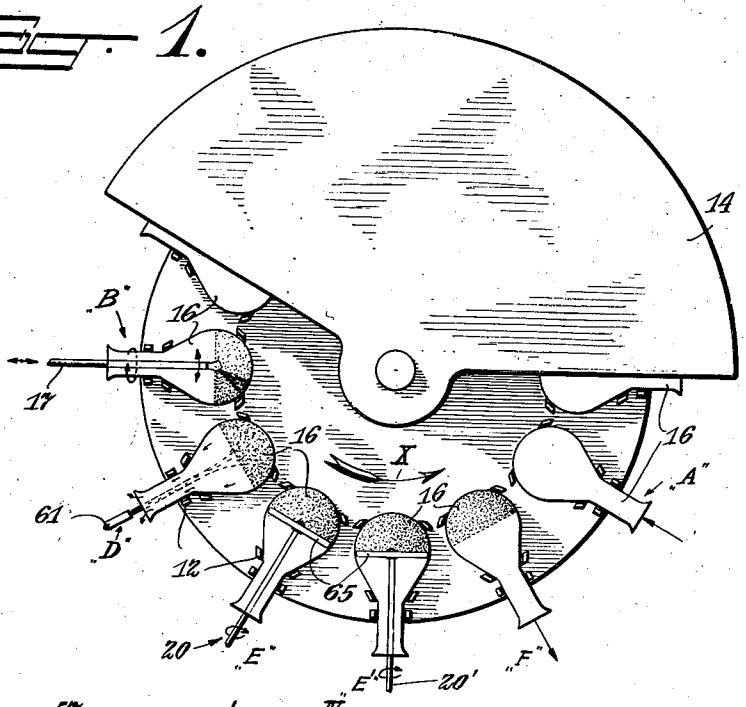


Fig. 3.

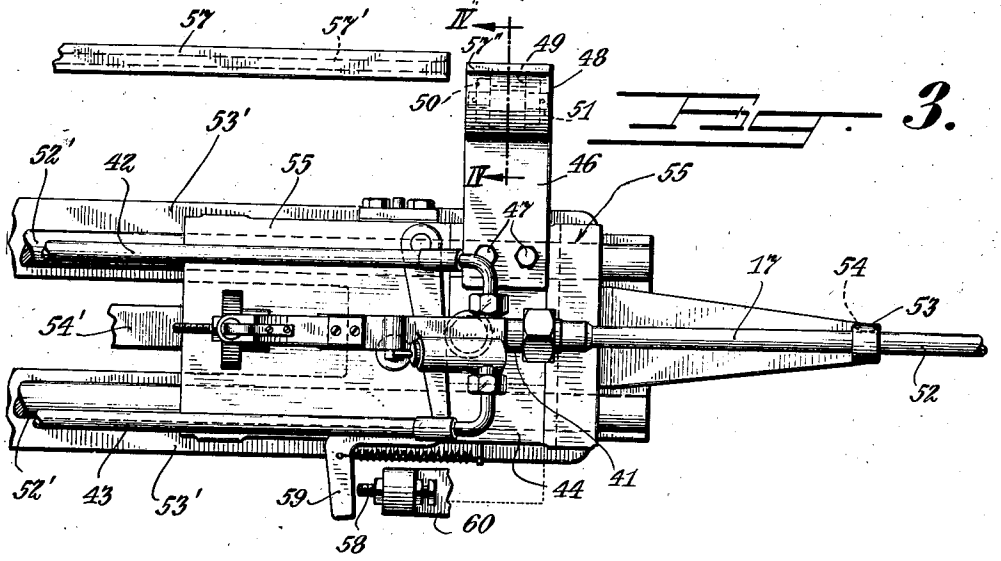
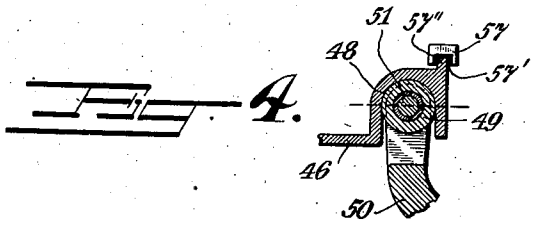


Fig. 4.



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BULB COATING MACHINE

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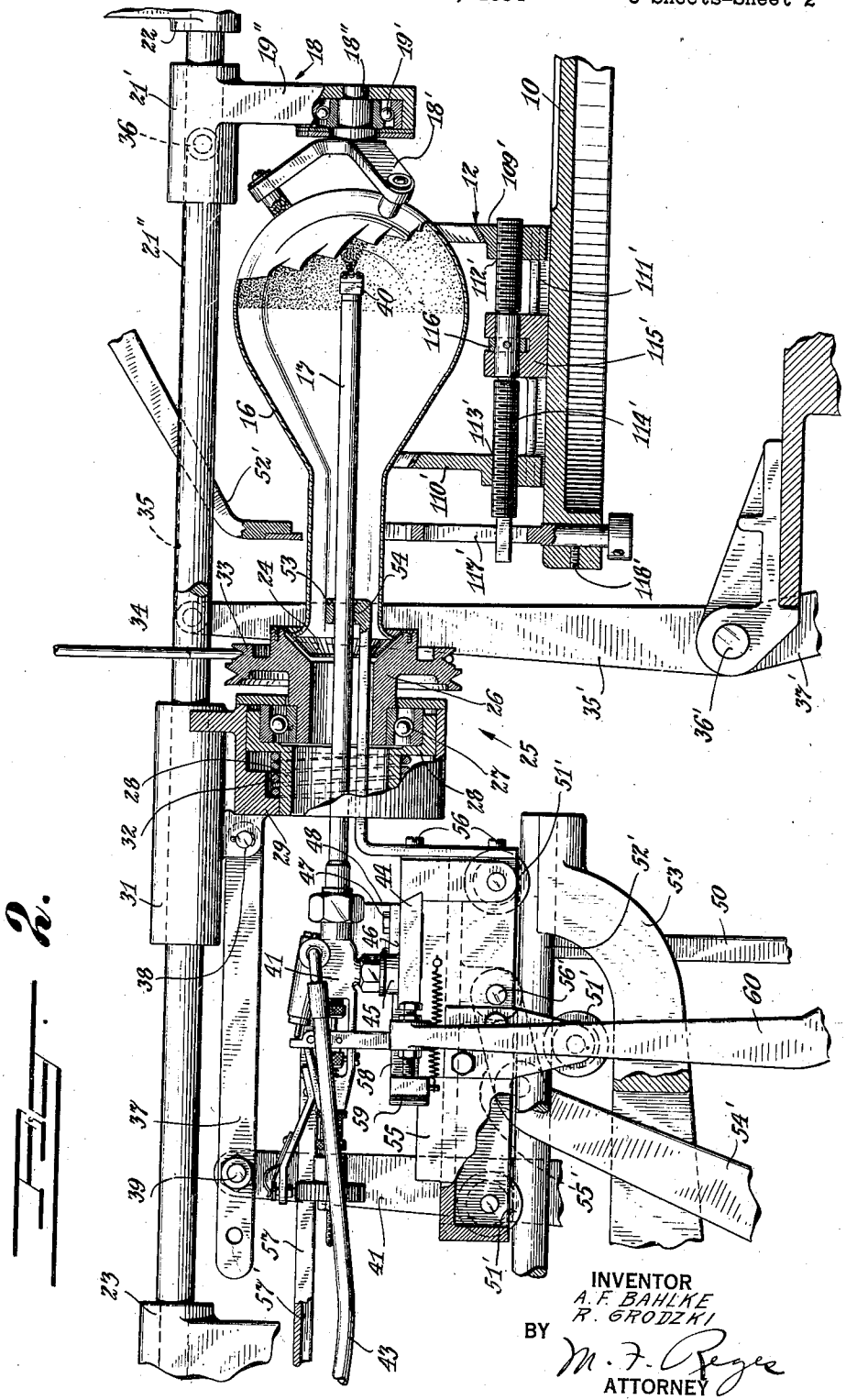


Fig. 2.

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BULB COATING MACHINE

Filed Nov. 16, 1934 6 Sheets-Sheet 3

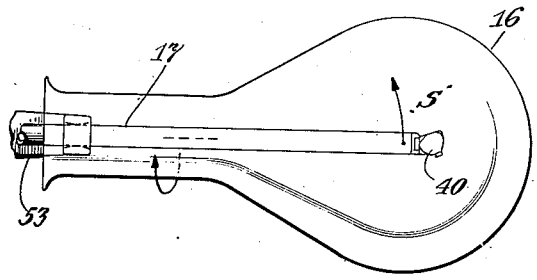


Fig. 5.

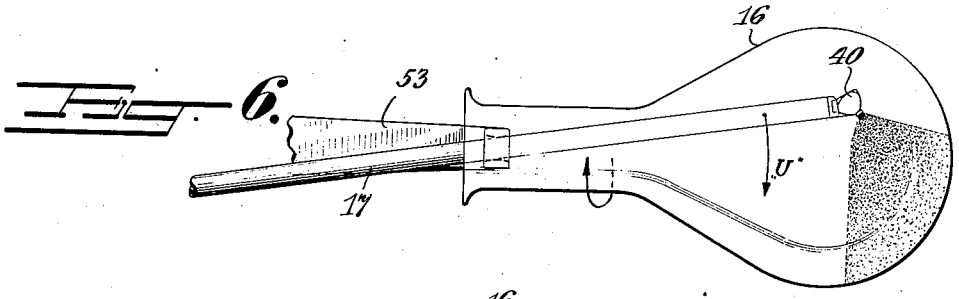


Fig. 6.

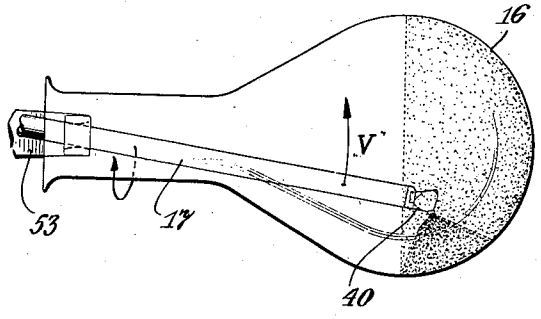


Fig. 7.

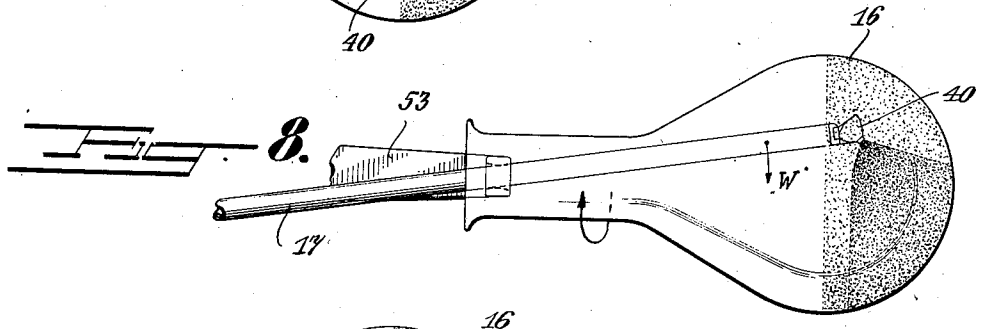


Fig. 8.

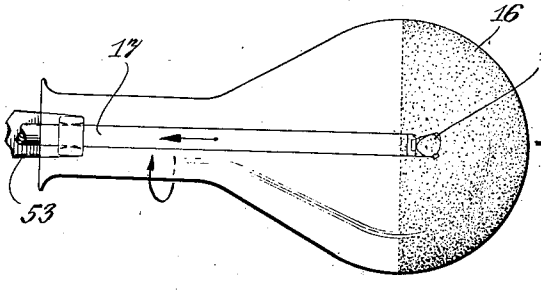


Fig. 9.

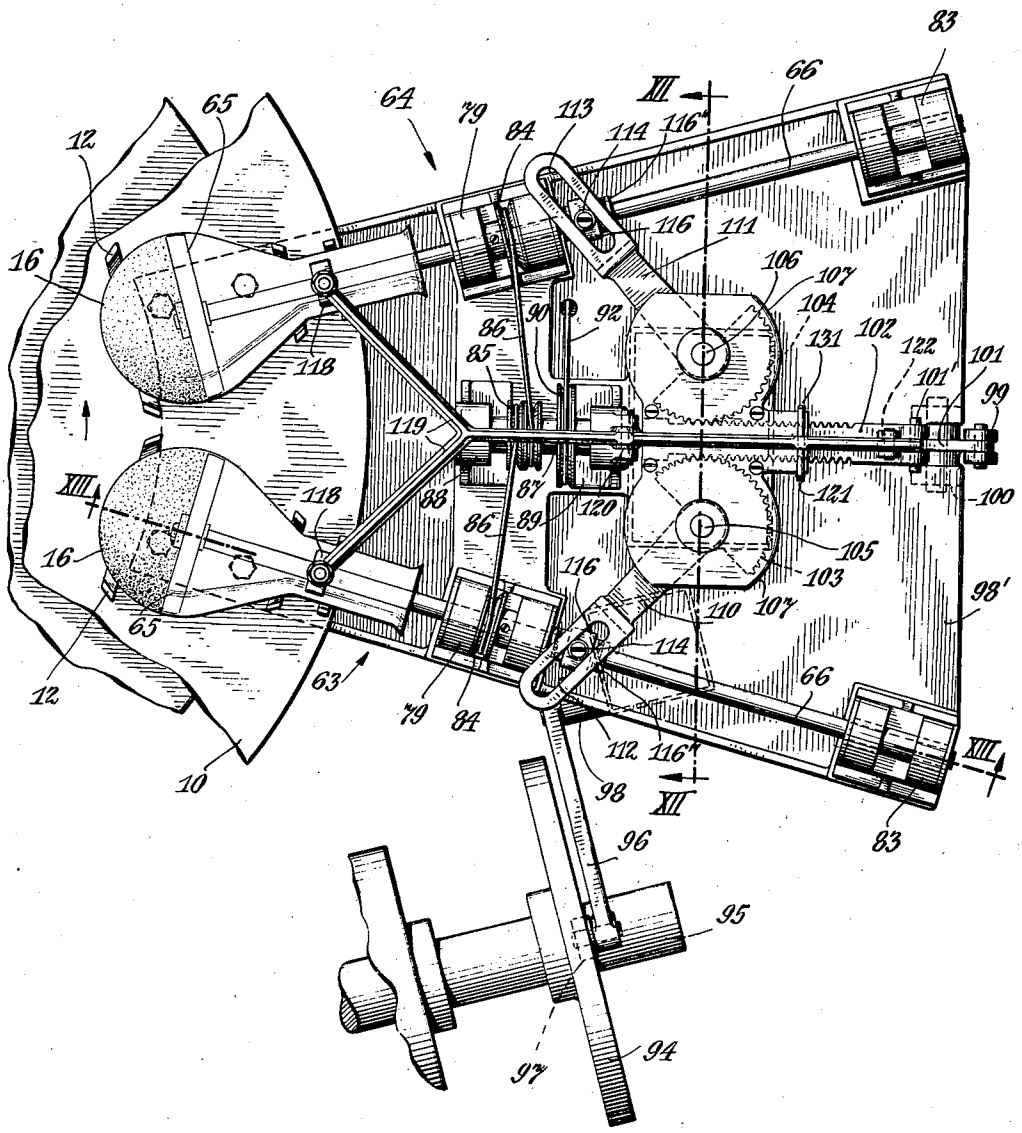
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BULB COATING MACHINE

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Fig. 10.



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BULB COATING MACHINE

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Fig. 11.

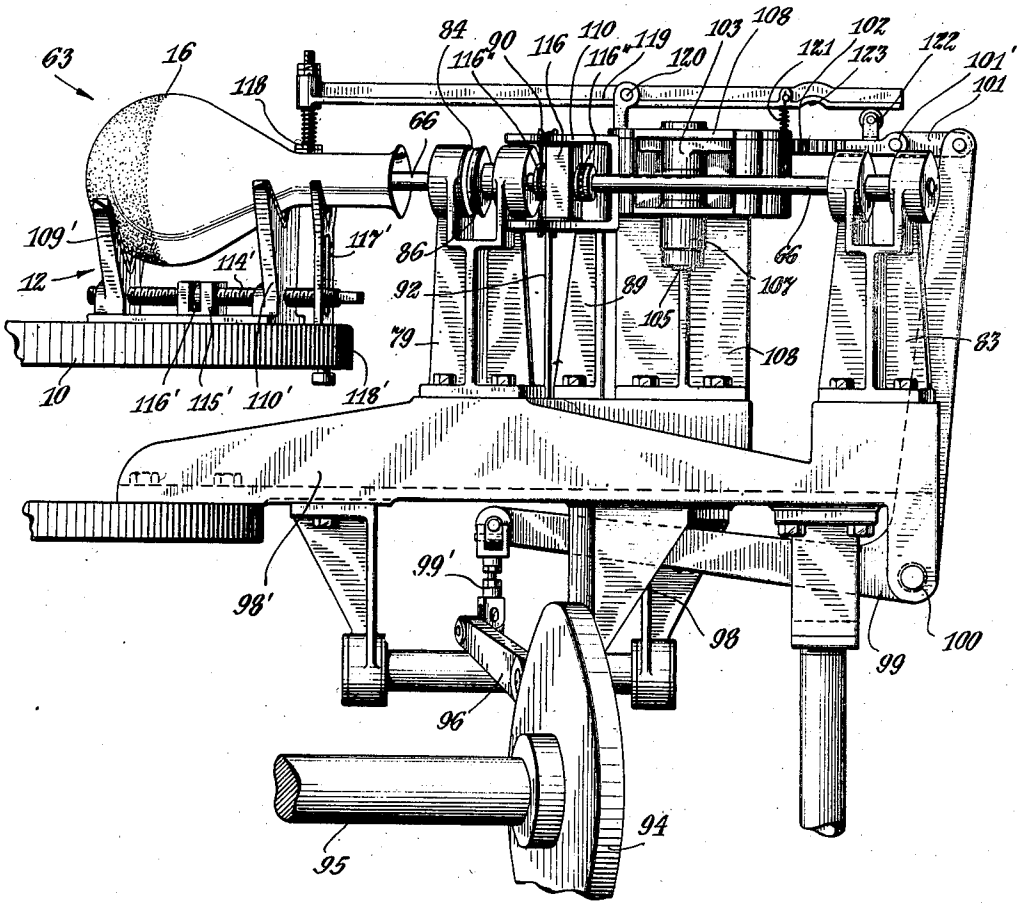


Fig. 14.

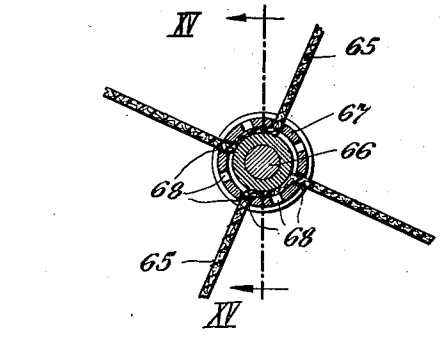
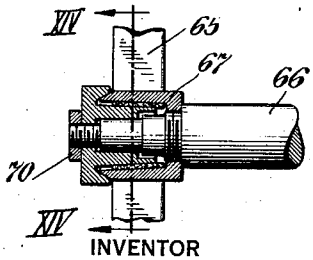


Fig. 15.



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BULB COATING MACHINE

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Fig. 12.

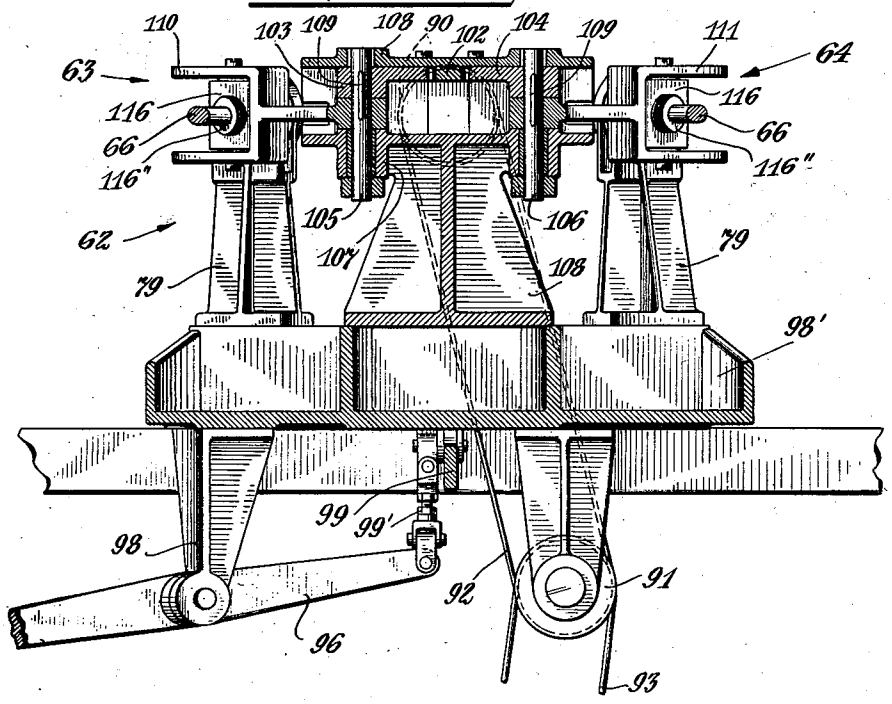
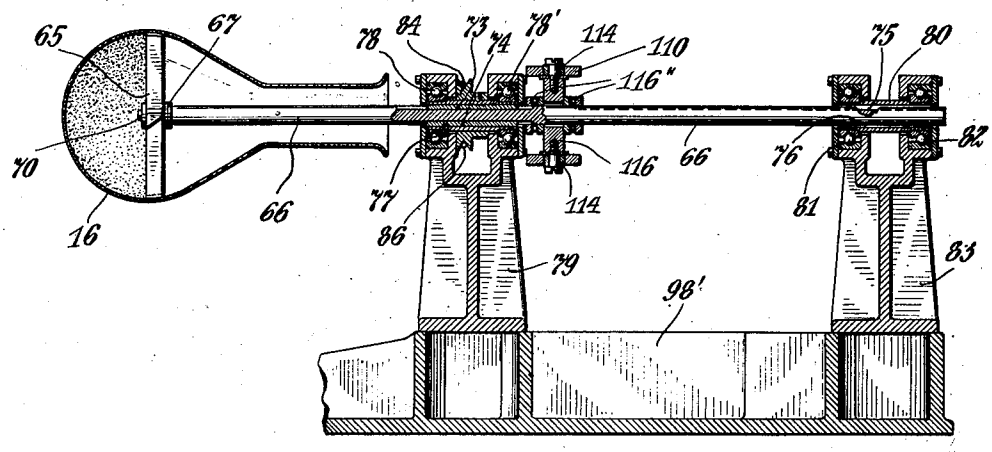


Fig. 13.



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Patented July 7, 1936 2,046,360

UNITED STATES PATENT OFFICE

2,046,360

BULB COATING MACHINE

Alfred F. Bahlke, Bloomfield, and Romuald Grodzki, Newark, N. J., assignors to Westinghouse Lamp Company, a corporation of Pennsylvania

Application November 16, 1934, Serial No. 753,252

17 Claims. (Cl. 91—59)

This invention relates to a machine for coating the interior surfaces of hollow bodies and relates more particularly to a machine constructed and arranged to deposit a layer of light-diffusing material on the inner surface or what is termed the "bowl" portion of an incandescent electric lamp bulb.

In the manufacture of incandescent electric lamps it is important to provide a bulb with a light-diffusing coating and, whereas heretofore coatings of this character have been applied to the outside surfaces of bulbs, it has recently become the practice to coat the interior surfaces as, for example, in the manner shown and described in Patent Number 1,900,104 issued March 7, 1933, which discloses a machine for coating the entire interior surfaces of bulbs.

In certain types of lamps, however, such as high wattage gas-filled lamps, it is desirable to coat only a portion of the interior surfaces of the bulbs. In gas-filled lamps a coiled filament is mounted normal to the axis of the lamp and positioned in a plane where the bulb is of the greatest diameter, and it is desirable to coat that portion of the bulb surrounding the filament. Roughly, the portion of the bulb coated is from the tip of the bulb to a plane transverse to the longitudinal axis of the bulb in which plane the filament is disposed. This portion of the bulb is designated as the bowl. In lamps where it is desirable to reflect a great portion of the light the lamp is burned with the tip down and the coated portion or bowl serves to shade the eye from the high intensity light source, the uncoated portion of the bulb serving to transmit light which is reflected and thus diffused.

The operation of coating only the bowl portion of a bulb presents a problem which differs materially from that encountered when coating the entire surface of a bulb. It is essential to provide a bowl portion with an evenly distributed layer, to provide this layer with a sharply defined boundary, and to be able to perform these operations in a rapid and effective manner.

It is an object of the present invention, therefore, to provide a machine whereby lamp bulbs may be fed and automatically positioned for the performance of a coating operation on a given portion of the inside surface of a bulb.

Another object of the invention is to provide a machine whereby a bulb may be moved through a series of manipulative steps to receive a coating on the inner surface of the bowl portion thereof.

Another object of the invention is to provide a machine for coating the inner surface of the bulb portion of a lamp so as to leave a sharply defined edge on the coated portion.

Another object of the invention is to provide a machine for automatically coating a portion of the inner surface of a bulb and for removing irregularities along the edge of the coated surface.

Other objects and advantages will be more clearly understood by reference to the accompanying drawings in which

Fig. 1 is a diagrammatic plan view of an apparatus for practicing the present method, showing the different operations;

Fig. 2 is a side elevational view of the spray gun within the bulb and its mechanism, partly broken away for the sake of clarity;

Fig. 3 is a plan view of the spray gun mechanism shown in Fig. 2;

Fig. 4 is a section on line IV—IV of Fig. 3;

Fig. 5 shows a bulb in position to be sprayed, with the spray gun moved inwardly along the axial line of the bulb;

Fig. 6 is a view similar to Fig. 5 which shows the spray gun within the bulb in a position projecting a discharge of spray, onto the surface of the bulb;

Fig. 7 shows the spray gun in operation after completing an oscillatory movement applying a coat of material onto the bowl end of the bulb;

Fig. 8 is a view showing the spray gun in its returned position and at the completion of its spraying operation;

Fig. 9 shows the spray gun in a position about ready to be moved out along the axial line of the bulb;

Fig. 10 is a plan view of the inside bulb wiper elements and its mechanism;

Fig. 11 is a side elevational view of Fig. 10;

Fig. 12 is a sectional view on line XII—XII of Fig. 10;

Fig. 13 is a sectional view on line XIII—XIII of Fig. 10;

Fig. 14 is a sectional view on line XIV—XIV of Fig. 15 and more clearly illustrates the wiper; and

Fig. 15 is a sectional view on line XV—XV of Fig. 14.

A machine constructed in accordance with the present invention may comprise a rotary conveyor 10 suitably supported for rotation and provided with a plurality of bulb holders 12.

Any number of bulb holders may be employed and in the present embodiment of the inven-

tion twelve such holders are indicated. The conveyor is positioned and arranged to move through an oven 14 which extends about the conveyor and through which the bulb holders move during a portion of their travel. The oven may be heated by any suitable means such as gas flames or by electric heating (not shown). The conveyor is moved intermittently so that the bulb holders will be positioned at their various stations for a given time interval. The driving mechanism for rotating the conveyor may be of any suitable construction such as a Geneva drive (not shown).

In the diagrammatic view, Fig. 1, is clearly shown the different stations into which the holders are moved to support bulbs during the various operations.

The conveyor moves in the direction of the arrow X and at position A a bulb 16 is placed in a holder and, as the conveyor moves, the bulb is carried through the oven 14 where it is heated to prepare it to receive a deposit of light-diffusing material. This light-diffusing material may consist of a mixture of sodium silicate, a filler such as kaolin, a pigment and a suitable amount of water to give a homogeneous mixture. The coating material may vary as to its ingredients, however, as in some cases it may be desirable to use only a pigment with a soluble vehicle such as alcohol. The oven for heating the bulbs may be arranged to raise the temperature of the bulbs to about 350° centigrade during their travel through the oven.

As a heated bulb moves out of the oven it travels into position B and a spray gun or nozzle 17 enters the bulb and is actuated to spray the coating material on the inner hemispherical surface or bowl portion of the bulb. The operation of the spray gun and the means for moving it into and out of the bulb will be hereinafter described.

The bulb then moves to position D and air under pressure is directed into the bulb to remove any loose particles of coating. In the next two stages E and E' wipers 20 and 20' in the form of flexible radial strips move into the bulb and are rotated at high speed in such manner as to remove all irregularities along the margin of the coating giving the coated surface a sharply defined border. The bulb is then ready for removal and may be discharged at position F.

Referring now to the operation practiced at position B, it will be evident that the spray gun 17 must be moved and operated in proper time relation with the conveyor to perform the spraying operation during the stationary period of the conveyor. Although the spray gun nozzle may be constructed to rotate it has in practice been found more practical to rotate the bulb.

As shown in Figs. 2, 3 and 4, the bulb 16, which is disposed in the holder 12, is lifted from the holder and secured by rotatable head 18. This head includes a rotatable holder or gripper member 18' in the form of a triple arm spider having a stub shaft 18'' mounted to rotate in a ball race 19' carried in a depending support 19'' integral with a bearing 21' slidable on a support rod 21''. The rod 21'' may be mounted in suitable supports 22 and 23.

The spider or gripper member 18' is provided with contact pads arranged to engage the bowl portion of the bulb to move the neck portion thereof onto a seat 24 provided in another rotatable holder 25. The holder 25 includes a spindle 26 rotatable in a ball race 27 mounted in a slidable bearing 28 which is arranged to slide in a housing 29 depending from and integral with a slide bearing 31, movable along the rod 21''. In the construction shown the holder 25 is continuously rotated, and as the bulb is picked up it is rotated about its longitudinal axis.

A spring 32 between a shoulder of the housing 29 and the bearing 28 serves as a resilient backing for the holder 25. Thus the holder 25 is adjustable making it possible to accommodate bulbs which may have slight variations in their overall lengths. The holder is provided with a cone pulley 33 to receive a belt 34 driven by any suitable means as for example a motor, not shown.

The holder 18' and the holder 25 are movable along the rod 21'' whereby a bulb may be engaged or released by a relative movement of the holders. The member 18' which is carried on the support 19'' is moved by means of a link 35 pivoted at 36 to the slide bearing 21'. The link 35 is pivoted to one end of a rocker arm 35' pivoted at 36' to the frame of the machine, and the holder 25 is moved by means of a link 37 pivoted at 38 on the bearing 31 and pivotally connected at 39 to a rocker arm 41. The operation of the link 21'' and the link 37 may be accomplished by suitable connection with cam members operated in timed relation with the movement of the conveyor through the agency of the rocker arms 35' and 41 respectively.

When a holder 12, having a bulb positioned thereon, is moved to be gripped for rotation in the head 18, a movement of the holder 18' serves to lift the bulb from the holder 12 and align it with relation to the seat 24 of the holder 25. The bulb is then rotated about its longitudinal axis and the spray gun 17 is moved to position nozzle 40 within the bulb. The spray gun mechanism may comprise a casing 41 having an inlet 42 for the coating material and an inlet 43 for the atomizing fluid as, for example, air. The spray gun may be of the same general construction as shown in copending application Serial No. 645,261 filed December 1, 1932 and assigned to the present assignee.

The nozzle shown in the said copending application is so constructed as to project a cone of spray material of such form that the edge of the deposited layer or coating is relatively even. It is desirable, however, to obtain as perfect an edge as possible and the means provided by the present invention make it possible to approach the perfection sought.

As clearly described in the first above mentioned patent it is essential in obtaining a uniform deposit of spray material to move the spray nozzle through an arc when within the bulb. In the present construction this is accomplished in generally the same manner as in the patent, by having the spray gun mounted swivelly on a slide plate 44 by means of a pin 45. The slide plate is mounted on a carriage to be later described.

The plate 44 is provided with a guide bar 46 held by tap bolts 47 which guide bar is provided on one end with a concave groove 48, more clearly shown in Fig. 4. A roller 49 is attached to a cam operated lever 50 by means of stud 51. The roller engages the groove 48 when the spray nozzle 40 is in its innermost position with respect to the bulb 16. The spray nozzle is connected with the spray gun proper by means

of a tubular extension 52 which moves through a guide member 53 in the form of a ring having a convex interior wall 54 to permit the tubular extension to rock relative to the longitudinal axis of the bulb.

The guide member 53 may be secured by tap bolts 56 to a carriage 55 which carries the spray gun mechanism. This carriage is provided with rollers 51' which move on tracks 52' mounted on a bracket 53' integral with the frame of the machine. The carriage is moved by means of a lever 54' which moves link 55' pivotally attached at 56' to the carriage. An actuation of the lever 54' causes a reciprocation of the carriage moving the spray nozzle into and out of the bulb. The lever 54' may be actuated by a cam or other means (not shown) in timed relation to the movement of the conveyor and so arranged that the proper degree of rectilinear movement will be given to the nozzle 40 in forward and rearward directions.

A guide 57 rigidly secured to the frame of the machine may be provided to extend along the pathway of the carriage 55. This guide is provided with a grooved lower surface 57' to ride over a flange 57'' integral with the carriage (see Fig. 4). The guide holds the carriage in axial alignment with respect to the longitudinal axis of the bulb and is so proportioned that the guide disengages with the carriage when the carriage has reached its final position (see Fig. 3). When the carriage is in its final or operating position, the groove 48 will be in engagement with roller 49 of cam-operated lever 50.

The lever 50 causes an oscillation of the spray gun and by reason of the curved surface 54 the nozzle 40 will be rocked through an arc determined by the degree of movement imparted to the slide plate 44.

Obviously, in the operation of the spray gun it is important to cause the spray material to be discharged when the nozzle reaches a predetermined position. This is accomplished by providing a contact element 58 which engages a lever arm 59 to operate a valve controlling the flow of spray material. The contact element 58 is mounted on a rocker arm 60 which may be operated by a cam, not shown. When the spray gun has moved to position a nozzle within the bulb a predetermined distance the lever arm is engaged during the spraying period, the movement of the said arm being dependent on the position of the nozzle.

As hereinbefore mentioned, it is important when spraying the inside bowl portion of a bulb to deposit a layer of translucent material of uniform thickness and density, having a definite boundary. The control of the discharge must, therefore, be such that the deposit of material is limited to the surface to be sprayed. It has been found desirable during the spraying operation to move the spray nozzle in a predetermined arc inside the bulb and to start and terminate the spraying operation after predetermined movement of the nozzle.

Figs. 5 to 9 illustrate the different steps of operation. Fig. 5 shows a spray nozzle 40 in its innermost position and substantially on the longitudinal axis of the bulb ready to be moved in the direction of the arrow S while the bulb is rotated rapidly about its axial line. The nozzle then moves in the direction of the arrow S and, as it reaches the end of this movement, the valve is opened and a discharge of spray material is projected against the wall of the bulb, as shown in Fig. 6.

It will be noted that the orifice of the spray nozzle is removed a relatively great distance from the surface being sprayed. This gives the particles of spray material a relatively long distance of travel so that they are partially dehydrated. Thus when they contact with hot surfaces of the bulb they quickly dry and set on the rotating bulb. After the first layer of spray material is deposited on the bulb, the nozzle moves in the direction of the arrow U in what may be considered a return movement and the spray continues to be discharged, as shown in Fig. 7.

The nozzle is then given a return movement to the starting position depositing on the bulb another layer of particles which have had a time interval during their travel to the bulb to become partly dried. When the nozzle reaches the end of its travel or its initial arcuate position it then moves to its initial position as shown in Fig. 9 and is ready to be removed. As the carriage travels to remove the nozzle from the bulb the valve closes and the discharge of spray material is terminated.

It will be evident that the actual spraying operation is accomplished in one complete oscillatory movement of the nozzle; that is, in one forward movement and one return movement. The nozzle is so constructed as to discharge the spray material laterally with respect to the axial line of the nozzle extension and a layer of translucent material is deposited of a uniform thickness in density with a relatively sharp edge or border.

When the spray nozzle is removed from the bulb the rotatable holders comprising the spider 18' and the holder 25, move in opposite directions permitting the bulb to again rest on the holder 12.

It has been found that when spraying the inside surface of a bulb fine particles of the spray material in the form of a powder become deposited on the uncoated surface of the bulb and these particles are removed when the bulb is conveyed to position D. At this position the inside of the bulb is subjected to a stream of air under pressure from a suitable source (not shown) by means of a pipe 61. The bulb is then moved to position E. At this position the edge of the coating is subjected to a wiping operation.

In lamps of the character to which the present invention relates it is essential to avoid any irregularities along the edge of the coated bowl. Although the operation of the spray gun is controlled to a very fine degree and the border of the coated material is relatively even in appearance, it has been found desirable to more sharply define the border by wiping away any particles of material that might exist, producing minute irregularities.

As shown in Figs. 10 to 15, a pair of rotary wipers are provided. One wiper is disposed at position E and the other at E' so that when the bulb is positioned at station E it receives a wiping operation and an additional wiping operation when it moves to station E'. The wiping apparatus is indicated as a whole by the reference numeral 62 and consists of two units 63 and 64.

After a bulb has been subjected to the compressed air cleaning operation and is moved to position E, a rapidly rotating flexible wiper 65 disposed at one end of a shaft 66 is moved along

the axial line of the bulb and into the bulb a definite distance to dispose the wiper in position to operate along the edge of the coating on the bowl.

It has been found that by providing a wiper comprised of a plurality of flexible radial arms, a rotation thereof provides an effective wiping means since the flexible arms are forced outwardly by reason of the centrifugal force and provide effective wiping members.

The flexible wiper 65, as shown, is composed of a plurality of strips of any suitable polishing or cleaning material and it has been found that chamois strips give good cleaning results. In practice four strips are used and disposed in slots 68 at the end of a holder 67. The strips are locked in place by male and female tapered surfaces and held by a lock nut 70. The flexibility of the wiper allows it to enter the constricted neck bulb and when within the bulb the centrifugal force resulting from a rotation of the wiper causes the strips to move outwardly and into contact with the inner surface of the bulb.

The strips are so proportioned that when the wiper reaches its operating position, which is approximately the largest diameter of the bulb, the ends of the strips sweep the edge of the coating and clean off any irregularities. Inasmuch as the strips are of sufficient length to engage the largest diameter of the bulb, it will be obvious that as the wiper is removed from the bulb the strips are also maintained in contact with the surface of the bulb and clean off surplus coating material. At position E' the same process is repeated to give the bulbs a final wiping and cleaning before removal by an operator or other means at position F.

Each wiper is provided with a shaft 66 and, as shown in Fig. 13, the shaft is provided with keyways to accommodate keys 73, 74, 75 and 76. Keys 73 and 74 are fastened tightly in a bushing 77 which is journaled at its ends in ball bearings 78 and 78', supported on a bearing bracket 79, which supports the ball bearings, in such a position as to align the shaft 66 with the axial line of the bulb.

Keys 75 and 76 are securely attached to a bushing 80 having ball bearings 81 and 82 at its opposite ends. A bearing bracket 83 is arranged to support the ball bearings in alignment with the ball bearings on the brackets 79. Each shaft 66 is provided with a pulley 84 secured by a set screw to the bushing 77. These pulleys are driven from a double pulley 85 by means of belts 86. The double pulley 85 is mounted on a shaft 87 journaled in bearings 88 and 89 and a driving pulley 90 is secured to the shaft 87 and is in turn driven, by motion translated to a belt 92, from a main driving pulley 91. The pulley 91 may be driven by means of a belt 93 from any source of power as, for example, an electric motor, not shown.

For the purpose of moving the wipers into and out of the bulbs, with the proper degree of movement as well as the necessary speed and time relation, a power-driven cam 94 on a drive shaft 95 is provided. This cam operates a rocker arm 96 through the agency of a cam follower 97 (see Figs. 10 and 11). The rocker arm 96 is pivoted on a bearing 98 fastened to a base plate 98' rigidly secured to the frame of a machine. The rocker arm 96 is connected with one arm of bell crank member 99 by means of a universal joint 99'. The bell crank member is pivoted at 100 on the base plate 98' and the other arm of the bell crank member 99 is pivotally connected to a link 101 which in turn is pivotally connected at 101' to one end of a slidable rack 102.

A rack 102 is provided with rows of teeth on its opposite edges engageable with gear segments 103 and 104. The gear segments are provided with stub shafts 105 and 106 respectively journalled in bearings 107 supported in a housing 108 secured to the frame of the machine. The segments may be secured to the stub shafts by suitable means such as keys 109. The shafts 105 and 106 are provided with driving arms 110 and 111 provided with slots 112 and 113 respectively to receive rollers 114. The rollers are mounted on blocks 116 held in position on the shaft 66 by thrust ball bearings 116'', the shafts being free to rotate in the blocks.

As above described, the holder 12 supports the bulbs during their movement from one position to another. When a bulb is sprayed, however, it is lifted from the holder but during the cleaning or wiping operation the bulb remains supported on the holder. During the wiping operation it is essential to hold the bulb with its longitudinal axis in a definite position with respect to the axis of rotation of the cleaning member. Each holder 12 is, therefore, so constructed as to be adjustable so that bulbs of different sizes may be held in a given relative position. It will be noted that the holder includes two V-shaped supports 109' and 110'. These supports are slidable along a guide 111' and are provided with threaded portions 112' and 113' respectively to receive a threaded member 114'.

The member 114' is provided with right and left threads and is supported in a bearing block 115' having a slot to receive a nut 116' so that the threaded member may be rotated without endwise movement. A rotation of the member 114' causes the support member 109' and 110' to move toward or away from each other making an adjustable seat for the bulb. A bulb neck support member 117' is provided and may be adjusted and held in a definite position by a set screw 118'.

During the wiping operation a spring pressed finger 118 bears upon the upper surface of the bulb neck to hold the bulb firmly upon its seat. The presser finger 118 is disposed at one end of a rocker arm 119 pivoted at 120 to the bearing 89. Springs 121 hold the free end of the rocker arm 119 in contact with a roller 122 which is carried on the sliding rack 102. When the sliding rack is moved forward as when the wiper members are retracted or removed from the bulb, the roller 122 becomes positioned in notch 123 thus allowing the free end of the rocker arm to move downwardly and the spring finger 118 to lift, releasing the bulb.

The operation of the wiping of a bulb is performed when a bulb reaches position E at which time the rack 102, operated by link 101, rocker arm 99, universal joint 99', rocker arm 96, and cam 94, moves the rack in a direction away from the bulb thus causing the levers 110 and 111 to move the wiper members into the bulb. The wiper members then rotate by reason of motion imparted to the shafts 66 which shafts travel freely in the blocks 116. The wiper members being of flexible material readily enter the bulb neck and as the shafts 66 rotate, the flexible arms of the wiper members are projected into contact with the sides of the bulb so that as the

wiper members move into the bulb, the uncoated portion of the bulb is wiped.

When the wiper members are in their final position within the bulb, they are disposed so that when rotated they wipe the edge or margin of the coating carrying away any particles of coating or irregularities along the edge. As the members are removed, the shafts continue to rotate and the remaining uncoated portion of the bulb is wiped clean.

It will be understood that in operation two bulbs are always in position for a wiping operation. At position E they receive the first wiping or cleaning operation and at position E' a second or final cleaning operation, thus insuring the removal of all particles of coating or other foreign matter on the uncoated portion of the bulb.

As mentioned above, the bulb is then moved to position F, by the mechanism above described, the spring finger 118 having been lifted to permit the movement of the bulb to position F for removal.

It will be evident from the foregoing that the present machine provides for the inside coating of a definite portion of a hollow body and by reason of the cooperating mechanism it is possible to provide a bulb so coated with the marginal line of the coating sharply defined and without any light obscuring particles disposed on the uncoated surface of the body.

The cleaner or wiping elements provided in connection with the coating operation, make it possible to not only define the edge of the coating, but since it is desirable to provide the edge of the bowl coating in a definite position with respect to the light source, it is possible by means of the wiper elements, to take off enough coating to bring the edge of the coated surface in a desired plane transverse to the longitudinal axis of the bulb. For example, it is often difficult to control the spray coating with the spray nozzle alone and some of the spray material may be deposited beyond the desired line of demarcation. The present wiping elements make it possible to remove any overlying coating and bring the border of the coated surface in a definite position.

The present machine makes it possible to perform a delicate and difficult operation in a practical and efficient manner at a relatively high speed. The arrangement of the cooperating machine elements employed is such that the coating operation is automatic from the reception of a bulb into the machine to the removal of a bulb having the bowl surface coated and with the border of the coated surface sharply defined.

Although a preferred embodiment of the invention is shown and described herein, it is to be understood that modifications may be made therein without departing from the spirit and scope of the invention as set forth in the appended claims.

What is claimed:

1. A machine for coating a portion of the interior surface of a lamp bulb with a layer of light diffusing material having a sharply defined border comprising means for depositing a coating of said material on a given area of the inner surface of said bulb and means for removing excess coating material along an edge of said coating to produce said defined border.

2. A machine for coating a portion of the interior surface of a lamp bulb with a light diffusing coating having a sharply defined border comprising means for depositing a coating of said material on a portion of the inner surface of said bulb and rotary means for removing the coating material along an edge of said coating to produce said defined border.

3. A machine for coating a portion of the interior surface of a lamp bulb with a light diffusing coating having a defined border comprising means for depositing a coating of said material on a portion of the inner surface of said bulb, a flexible coating removing member and means for moving said member in contact with the inner surface of said bulb adjacent to an edge of said coating to produce said defined border.

4. A machine for depositing a layer of light diffusing material having a sharply defined border on a given portion of the inner surface of a lamp bulb, comprising a spray gun, means for moving said spray gun into said bulb a definite distance, operating said gun to spray a portion of said surface and means for removing particles of coating material along an edge of the coated portion of said surface to produce said defined border.

5. A machine for depositing a layer of light diffusing material having a sharply defined border on a given portion of the inner surface of a lamp bulb, comprising a spray gun, means for moving said spray gun into said bulb a definite distance, operating said gun to spray a portion of said surface, a wiping member, means for moving said member into said bulb and means for operating said member to remove irregularities along an edge of said coating to produce said defined border.

6. A machine for depositing a layer of light diffusing material having a sharply defined border on a given portion of the inner surface of a lamp bulb, comprising a spray gun, means for moving said spray gun into said bulb a definite distance, operating said gun to spray a portion of said surface, a rotary wiper member, means for moving said member into said bulb and means for rotating said member to remove particles of coating material along the edge of said coated surface to produce said defined border.

7. A machine for coating a portion of the interior surface of a lamp bulb with a layer of light diffusing coating having a sharply defined border, a conveyor for holding a plurality of bulbs, means for moving said conveyor, a spray gun disposed adjacent to the path of said conveyor, a cleaning element, means for moving said conveyor to position a bulb adjacent said spray gun, means for moving said gun into said bulb for the deposit of coating material on a portion of the interior surface of said bulb and means for actuating said cleaning element to remove irregularities from the edge of said deposited coating.

8. A machine for coating a portion of the interior surface of a bulb with a layer of light diffusing material having a sharply defined border, comprising a conveyor movable intermittently, a plurality of holders for bulbs on said conveyor, a spray gun, a wiper for removing coating material from said bulb, and means for operating said spray gun to coat a portion of the interior surface of a bulb during one stationary period of said conveyor and means for operating said wiper during another stationary period of said conveyor to remove coating material along

the edge of said portion to produce said defined border.

9. A machine for coating a portion of the interior surface of a bulb with a layer of a light diffusing material having a sharply defined border, comprising a conveyor movable intermittently, a plurality of holders for bulbs on said conveyor, a spray gun, a wiper for removing coating material from said bulb, and means for operating said spray gun to coat a portion of the interior surface of a bulb during one stationary period of said conveyor and means for simultaneously removing a portion of the material along the edge of the coating in another bulb to produce said defined border.

10. A machine for coating a portion of the interior surface of a bulb with a layer of a light-diffusing material having a sharply defined border comprising a conveyor alternately movable and stationary, a plurality of bulb holders on said conveyor, a spray nozzle movable into a bulb during a stationary period of the conveyor for depositing a layer of coating material, a wiper member movable into a bulb during a stationary period of the conveyor to remove material from the edge of said layer to produce said defined border and means for operating said spray nozzle and wiper during each stationary period.

11. A machine for applying a light-diffusing material to the interior wall of a lamp bulb comprising, a spray gun for depositing an aqueous solution of a light diffusing material, means for moving said gun into said bulb for the deposit of a layer of said material on the interior surface thereof, means for heating to cause said material to adhere to said surface, an abrasive element for removing a portion of said coating, means for moving said element into said bulb and means for operating said element to remove a portion of said deposited material.

12. A machine for applying a light-diffusing material to the interior wall of a lamp bulb comprising, a spray gun for depositing an aqueous solution of a light-diffusing material, means for moving said gun into said bulb for the deposit of a layer of said material on the interior surface thereof, means for heating to cause said material to adhere to said surface, an abrasive element for removing a portion of said coating, means for moving said element into said bulb and means for operating said element to remove a portion of said deposited material.

13. A machine for coating a portion of the interior surface of a lamp bulb with a light-diffusing material comprising means for rotating a bulb, a spray nozzle, means for moving said nozzle into said bulb a predetermined distance, means for operating said nozzle, means for moving said nozzle laterally into said bulb to deposit a layer of coating material on the inner surface of the bowl portion of said bulb and means for removing the coating material along the edge of said layer.

14. A machine for coating a portion of the interior surface of a lamp bulb with a light-diffusing material comprising means for rotating a bulb, a spray nozzle, means for moving said nozzle into said bulb a predetermined distance, means for operating said nozzle, means for moving said nozzle laterally in said bulb to deposit a layer of coating material on the inner surface of the bowl portion of said bulb and a rotary abrasive member for removing the coating material along the edge of said layer.

15. A machine for coating a portion of the interior surface of a lamp bulb with a light-diffusing material comprising means for rotating a bulb, a spray nozzle, means for moving said nozzle into said bulb a predetermined distance, means for operating said nozzle, means for moving said nozzle laterally into said bulb to deposit a layer of coating material on the inner surface of the bowl portion of said bulb, a rotary cleaning element having flexible radial arms, means for rotating said element to cause said arms to project, means for moving said element through said bulb neck whereby said arms extend under centrifugal force and press against the interior wall of said bulb and means for controlling the movement of said element to cause said arms to remove irregularities from the edge of said layer.

16. A machine for coating a portion of the interior surface of a hollow body and for cleaning an uncoated portion of said surface comprising, means for depositing a layer of coating material on a portion of said surface, a rotary member having radial arms of flexible material, means for rotating said member to project said arms, and means for moving said member into said body to cause said arms to wipe the uncoated interior surface of said body, said last mentioned means operating to rotate the rotary member to remove irregularities along the edge of said layer.

17. A machine for coating a portion of the interior surface of a hollow body and for cleaning an uncoated portion of said surface comprising, means for depositing a layer of coating material on a portion of said surface, a rotary member having radial arms of flexible material, means for rotating said member to project said arms, means for moving said member into said body to cause said arms to wipe the uncoated interior surface of said body and means for limiting the inward movement of said member to cause said arms to remove particles of coating along the edge of the coated portion of the body.

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