Sept. 23, 1952 L. E. DILTS 2,611,335

APPARATUS FOR COATING COILED FILAMENTS

Filed Dec. 22, 1948

Fig. 1.

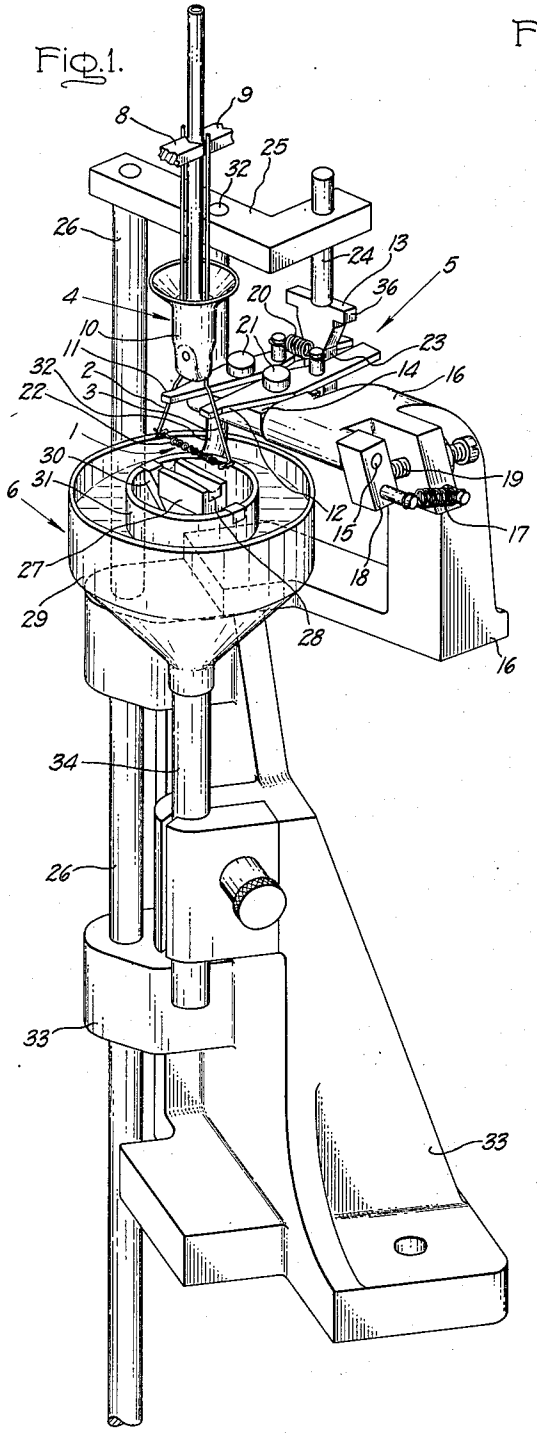


Fig. 2.

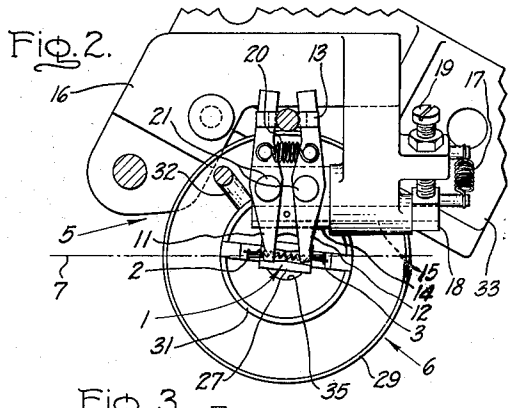
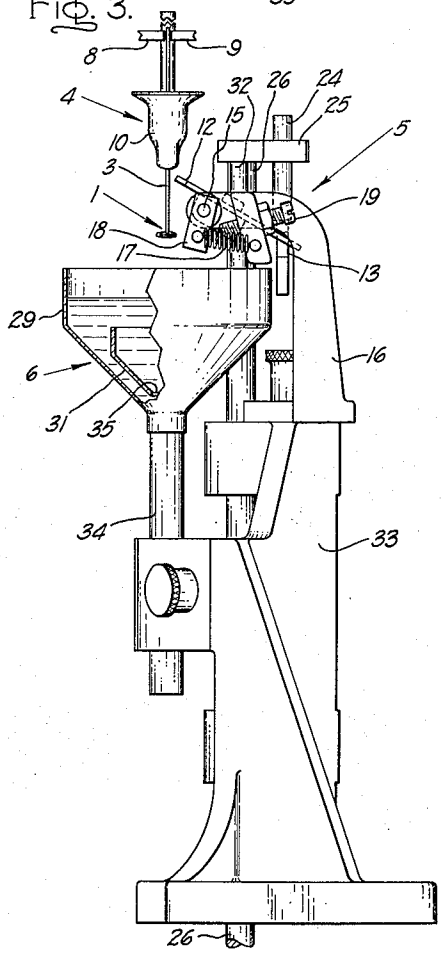


Fig. 3.



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APPARATUS FOR COATING COILED FILAMENTS

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5 Claims. (Cl. 118—33)

1

My invention relates to the application of coating material to a filament. More particularly my invention relates to apparatus for applying an electron emission material to a filamentary coiled cathode and for simultaneously effecting a linear expansion of said cathode to assist in the proper distribution of said emission material therein.

My invention is concerned with a preferred method of applying emission material to a coiled-coil filamentary cathode attached to the leading-in wires of a discharge lamp mount which method provides for the application of a surface coat of the emission material to the exterior and the open secondary coils of the cathode and a complete filling of said emission material in the small primary coils thereof. The emission material is applied in the form of a finely ground solid (usually alkaline earth carbonates) mixed with a vehicle (usually nitrocellulose and amyl acetate) by bathing the cathode in the liquid suspension. Proper distribution of the liquid, and consequently of the emission material, over the cathode is attained by having said cathode in a linearly stretched condition during the application thereof so that the larger secondary coils of the cathode are widely spaced and the liquid does not tend to bridge or flood said coils. This method is not claimed herein, but is the subject matter of patent application Serial No. 66,642, of W. P. Zabel, filed December 22, 1948 and assigned to the assignee of the present invention.

One object of my invention is to provide apparatus for concomitantly effecting the immersion of a coiled filamentary cathode in a liquid containing an emission material and for stretching the cathode linearly prior to the time it is separated from said liquid.

Another object of my invention is to provide a combination of automatically operating apparatus for spreading apart the leading-in wires of a mount to effect the linear expansion of the coils of a filamentary cathode attached thereto and, while the cathode is in a stretched condition, momentarily immersing said cathode in a liquid containing an emission material. The apparatus is preferably in a form particularly suited to occupy a work station of automatic mount making apparatus of the type disclosed in Patent 2,380,742, John Flaws, dated July 21, 1945, and in that connection is arranged and constructed so as to move to and from operative relation to the mount so that clearance is provided about the mount to permit it to move to and from the work station. The apparatus is also constructed so that several of its functions are performed at the same time thereby materially reducing the time required for the complete operation and adapting the method to the rapid operations of such apparatus as the mount making apparatus hereinbefore referred to.

2

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

In the drawing, Fig. 1 is a perspective view of one species of apparatus comprising my invention for effecting the application of emission material to a coiled-coil cathode permanently attached to a discharge lamp mount; Fig. 2 is a plan view of said apparatus as it appears at an interval mid-way in the course of operation thereof, and modified by removal of the overlying operating arm and having only the cathode and adjacent portions of the mount associated therewith; and Fig. 3 is a side elevation of the apparatus and the mount associated therewith as they appear at the start of the operation.

The course of operation of the apparatus appearing in the drawing is begun with the filament or cathode 1, which is attached to the leading-in wires 2 and 3 of the mount 4, at a fixed position with relation to the stretching and emission material applying portions 5 and 6 respectively thereof, and said portions 5 and 6 out of operative relation thereto as shown in Fig. 3. Sufficient space is present between the mount 4 and these portions 5 and 6 of the apparatus for the mount 4 to be advanced to and from position by a horizontal movement in the direction of line 7 (Fig. 2) of the support means for the mount 4 in the manner of the work carrying conveyor of the mount making apparatus of United States Patent 2,380,742, Flaws, hereinbefore referred to. The entire course of operation of my apparatus, however, occurs during the time the mount 4 is held at the above-described relation by the jaws 8 and 9. At such times the cathode 1 is also under relatively slight tension as the inner ends of the leading-in wires 2 and 3 which project beyond the vitreous stem 10 of the mount 4 and which are clamped to opposite ends of said cathode 1 are not then as widely spread as shown in Fig. 1.

Operation of the apparatus immediately effects concomitant actuation of both the spreading and emission material applying portions 5 and 6 of the apparatus. However, the first operation directly associated with the cathode 1 is the actuation of the spreading portion 5 thereof which

lowers the fingers 11 and 12 by pivoting them in a vertical plane from an oblique position (Fig. 3) out of the line of movement of the leading-in wires 2 and 3 and at one side of the projected axis of movement of the applicator 27, to a horizontal position between the wires 2, 3 and across the said axis. This function results from the upward movement of the wedge cam 13, the laterally extending upper ends 36 of which bear against the opposite ends of the spring-biased fingers 11 and 12, and the consequent relieving of pressure thereagainst which causes a partial rotation of said fingers 11 and 12 and the mounting block 14 therefor. The mounting block 14 is attached to a shaft 15 extending through the stationary bracket 16 and turns to the latter position under the constant influence of the contraction force of the spring 17 attached to a post on the arm 18 attached to shaft 15 and a post on the bracket 16. When the fingers 11 and 12 are properly positioned, the arm 18 butts against the stop screw 19 carried in a sideward extending flange in the stationary bracket 16 and stops further rotative movement thereof.

A lateral spreading motion next occurs in the ends of the fingers 11 and 12 adjacent the mount 4 because of the continued upward movement of the cam 13 and the presentation of a narrower lower section 23 thereof between the opposite ends of the fingers 11 and 12. At that time, the contraction force of a helical spring 20 extending between posts in each finger 11 and 12 is free to turn said fingers 11 and 12 about the respective pivot screws 21 attaching them to the block 14 an amount permitted by the change in the shape of the cam 13 and spreads said fingers 11 and 12 into contact with the leading-in wires 2 and 3 and then outward sufficiently to stretch the cathode 1 to the length shown. Relatively, the entire longitudinal readjustment of the cathode 1 appears in increased spacing of the larger, and therefore more resilient, secondary coils 22 of the mid-portion of the cathode 1 and does not appreciably effect the spacing of the much smaller primary coils which extend the full length of the cathode 1. The amount of the spreading movement of the fingers 11 and 12 is, in the present instance, restricted by the flexibility of the leading-in wires 2 and 3, since said leading-in wires 2 and 3 must not be flexed sufficiently to remain permanently out of place; however, it is sufficient to space the secondary coils 22 considerably more than their original spacing. In the instance shown, a 3/8 inch length of secondary coils is spread to a length of 11/16 inch when the operation is complete and the spreading fingers 11 and 12 bear against the narrow lower portion 23 of the cam 13. Support and operation of the cam 13 is effected through the rod 24 and the arm 25 which connect it to the operating rod 26 of the apparatus.

The emission material applying portion 6 of the apparatus now reaches a point in its course of operation whereby a quantity of a liquid containing the emission material is brought up about the secondary coils 22 of the cathode 1 so as to bathe all portions thereof with said liquid. This function of the apparatus is performed by the movements of the applicator receptacle 27 which carries the emission material containing liquid in a trough 28 of a size just large enough to accommodate the secondary coils 22 of the cathode 1 and which is moved upward from the main supply thereof in the cup 29 to a position where said cathode 1 is located within said trough 28. The applicator 27, which is an integral part of the partition or bridge 30 across the top edge of the dipper 31, is completely immersed in the liquid at the start of the operation period and takes the upward course of movement in accord with corresponding movements of the arm 25 to which the dipper 31 is attached by rod 32. These movements correspond to those of the cam 13 effecting operation of the spreading portion 5 of the apparatus and are correspondingly dependent upon the actuation of the operating rod 26 which is the means of operating the entire apparatus. When the apparatus is combined with mount making apparatus of the Flaws Patent 2,380,742 hereinbefore referred to, the operating rod 26 can be operated by a cam in a manner corresponding to the other apparatus thereof. However, it is material that said operating rod 26 be moved vertically upward and then downward once within fixed limits in the course of each operation period of the apparatus. The operating rod 26 moves vertically within guiding portions of a stationary support bracket 33 mounted at a fixed relation with reference to the mount supporting means (jaws 8 and 9).

In its course of movement, the applicator 27 emerges from the main supply of the liquid contained within the cup 29, which is mounted at a fixed position upon the stud 34 extending from the support bracket 33, and causes a vigorous circulation of said liquid whereby the emission material, which is in the form of a finely ground solid, is kept in a homogenous condition throughout the liquid and any other ingredient of the liquid is thoroughly mixed therewith. An opening 35 at the center of the conical bottom of the dipper 31 allows the liquid therein to flow from the dipper 31 as it rises to a position above the surface of the main supply in the cup 29, adding further to the agitation and thorough mixing of the main supply. This manner of operation also has the effect of washing all parts of the applicator 27 and the dipper 31 so that a representative sample of the liquid is always contained within the trough 28 and so that the development of partially dry coagulations on said parts is avoided. The circulation of the liquid occurs throughout the full length of the trough 28 with particular vigor as the opposite ends are open to the full depth thereof.

The proportions of the applicator 27 are selected with the object of causing it to retain a sufficient depth of liquid to immerse the larger secondary coils 22 of the cathode 1 and to retain a pool of the liquid equal to the length of the portion of cathode 1 comprised of said secondary coils 22. The liquid, however, it not confined to the secondary coils 22 since it has a viscosity which causes it to be drawn into the core of the primary coils constituting the end portions of the cathode 1 to within a few turns of the leading-in wires 2 and 3. Almost immediately after the applicator 27 has taken its operative position with respect to the cathode 1, it reverses its direction of movement and is again immersed in the main supply of the liquid in the cup 29. The withdrawal of the applicator 27 carries away from the cathode 1 all of the excess liquid which is not wetting the surface of the secondary coils 22 and is not contained within the core of the primary coils of said cathode 1. The wide spacing of the secondary coils 22 of the cathode 1 at this time prevents these coils 22 from being bridged by the liquid and thereby avoids the de-

velopment of loosely held masses of the emission material thereon.

The final operations of the apparatus occur when the downward movement of the operating rod 26 has progressed to an extent where the applicator 27 is spaced from the cathode 1, at which time the wider or diverging portion of the cam 13 passes between and separates the rear ends of the fingers 11 and 12 so that their front ends are again brought close together. The combined reflex of the leading-in wires 2 and 3 and the tension in the cathode 1 return these parts to substantially their original position. Further downward movement carries the outwardly projecting ears 36 on the cam 13 against the fingers 11 and 12 and forces them to the tilted position (Fig. 3) out of the path of movement 7 of the mount 4. A succeeding cycle of operation of the apparatus occurs immediately after the above-described mount 4 is replaced by a corresponding mount.

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

1. Apparatus for coating a coiled filament extending between and secured at its opposite ends to a pair of flexible leading-in wires extending in the same general direction from the stem of a mount comprising, coating mechanism including an applicator receptacle and means mounting said applicator for vertical reciprocation to carry upwardly a supply of liquid coating material held in said applicator, spreader mechanism located above said coating mechanism, means for supporting a mount adjacent said spreader mechanism and above and in the same general vertical axis as said applicator and with its filament lowermost and in a horizontal position above said applicator, and means for concomitantly actuating said spreader and applicator mechanisms to cause said spreader mechanism to engage temporarily the leading-in wires of said mount and spread them apart to stretch the filament and to cause said applicator to rise and immerse the said filament in the coating material while it is held in its stretched position by said spreader mechanism, said last-named means further effecting lowering of said applicator away from the filament followed by disengagement of said spreader mechanism from said leading-in wires to permit contraction of the filament.

2. Apparatus for coating a coiled filament extending between and secured at its opposite ends to a pair of flexible leading-in wires extending in the same general direction from the stem of a mount comprising, coating mechanism including an applicator receptacle and means mounting said applicator for vertical reciprocation to carry upwardly a supply of liquid coating material held in said applicator, spreader mechanism located above said coating mechanism and including a pair of fingers and means mounting said fingers for spreading movement, means for supporting a mount adjacent said spreader mechanism in a position to receive said fingers between its lead-in wires and with the mount above and in the same general vertical axis as said applicator and with its filament lowermost and in a horizontal position above said applicator, and means for concomitantly actuating said spreader and applicator mechanisms to cause said spreader fingers to engage temporarily the leading-in wires of said mount and spread them apart to stretch the filament and to cause said applicator to rise and immerse the said filament in the coating material while it is held in its stretched position by said spreader fingers, said last-named means further effecting lowering of said applicator away from the filament followed by disengagement of said spreader mechanism from said leading-in wires to permit contraction of the filament.

3. Apparatus for coating a coiled filament extending between and secured at its opposite ends to a pair of flexible leading-in wires extending in the same general direction from the stem of a mount comprising, coating mechanism including an applicator receptacle and means mounting said applicator for vertical reciprocation to carry upwardly a supply of liquid coating material held in said applicator, spreader mechanism located above and to the side of said coating mechanism and including finger means and means mounting said finger means for movement from a position at one side of the projected axis of movement of said applicator to a position across said axis, means for supporting a mount with its filament lowermost and in a horizontal position and for carrying said mount along a horizontal path and into a position above and in the same general vertical axis as said applicator and adjacent said spreader mechanism, and means for comcomitantly actuating said spreader and applicator mechanisms to cause said finger means to first move to a position between the leading-in wires of said mount and to then spread apart to engage the said wires and spread them apart to stretch the filament and to cause said applicator to rise and immerse the said filament in the coating material while it is held in its stretched position by said finger means, said last-named means further effecting lowering of said applicator away from the filament followed by disengagement of said spreader mechanism from said leading-in wires to permit contraction of the filament.

4. Apparatus for coating a coiled filament extending between and secured at its opposite ends to a pair of flexible leading-in wires extending in the same general direction from the stem of a mount comprising, coating mechanism including an applicator receptacle and means mounting said applicator for vertical reciprocation to carry upwardly a supply of liquid coating material held in said applicator, spreader mechanism located above and to the side of said coating mechanism and including a pair of spreader fingers and means mounting said fingers for spreading movement and for pivotal movement in a vertical plane from a position at one side of the projected axis of movement of said applicator to a position across said axis, means for supporting a mount with its filament lowermost and in a horizontal position and for carrying said mount along a horizontal path and into a position above and in the same general vertical axis as said applicator and adjacent said spreader fingers, and means for concomitantly actuating said spreader and applicator mechanisms to cause said fingers to first pivot to a position between the leading-in wires of said mount and to then spread apart to spread said wires and stretch the filament and to cause said applicator to rise and immerse the said filament in the coating material while it is held in its stretched position by said fingers, said last-named means further effecting lowering of said applicator away from the filament followed by disengagement of said spreader mechanism from said leading-in wires to permit contraction of the filament.

5. Apparatus for coating a coiled filament extending between and secured at its opposite ends

to a pair of flexible leading-in wires extending in the same general direction from the stem of a mount comprising, coating mechanism including an applicator having a horizontal portion at its upper end and means mounting said applicator for vertical reciprocation to carry upwardly a supply of liquid coating material held in the trough portion of said applicator, spreader mechanism located above and to the side of said coating mechanism and including a pair of spreader fingers and means mounting said fingers for pivotal spreading movement and for pivotal movement in a vertical plane from a position at one side of the projected axis of movement of said applicator to a position across said axis, means resiliently biasing said fingers to spreading position and to the said position across said axis, wedge cam means arranged to normally hold said fingers in closed position and in the said position at one side of the said axis, means for supporting a mount with its filament lowermost and in a horizontal position and for carrying said mount along a horizontal path and into a position above and in the same general vertical axis as said applicator and adjacent said spreader fingers,

and means for concomitantly actuating said spreader and applicator mechanisms to cause said fingers to first pivot to a position between the leading-in wires of said mount and to then spread apart to engage and spread said wires and stretch the filament and to cause said applicator to rise and immerse the said filament in the coating material while it is held in its stretched position by said fingers, said last-named means further effecting lowering of said applicator away from the filament followed by disengagement of said spreader mechanism from said leading-in wires to permit contraction of the filament.

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