

Jan. 28, 1958

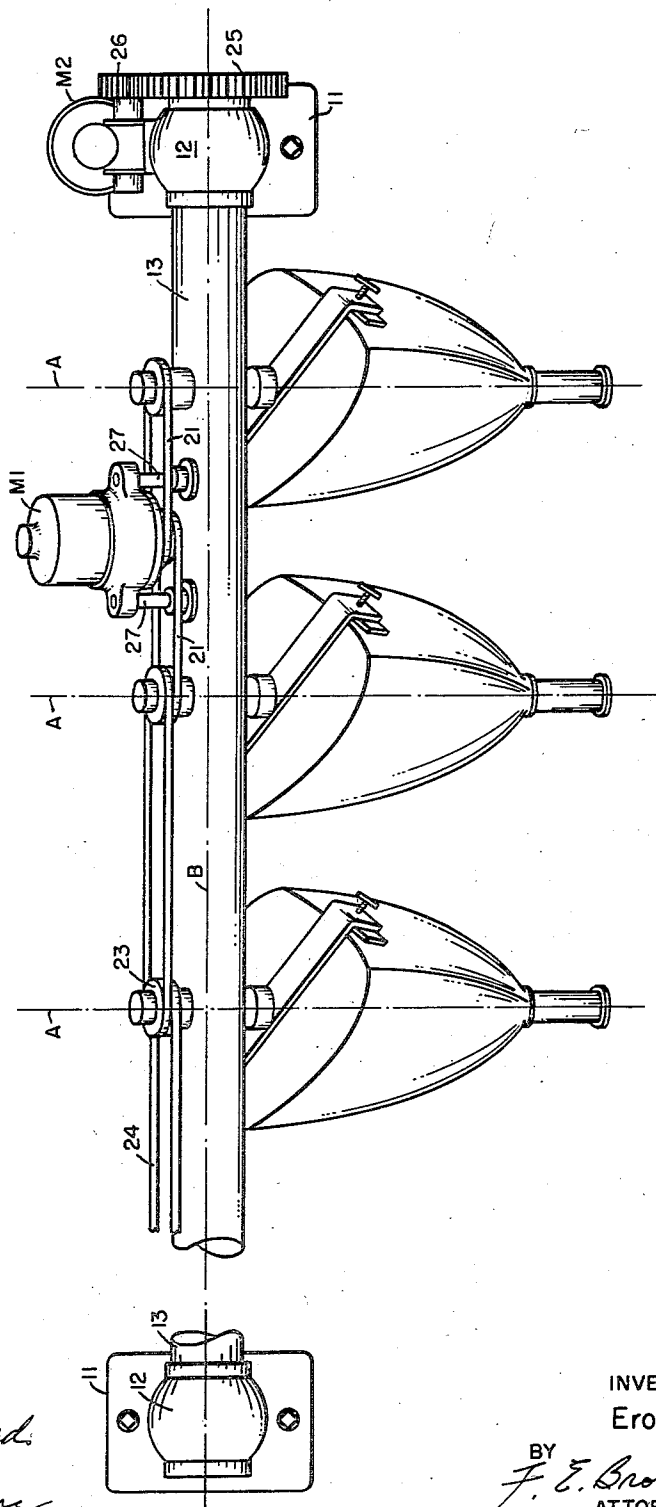
E. ATTI
MACHINE FOR COATING THE INTERIOR
OF CATHODE RAY TUBE BULBS

2,821,160

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4 Sheets-Sheet 1

Fig. 1.



WITNESSES

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4 Sheets-Sheet 2

Fig. 2.

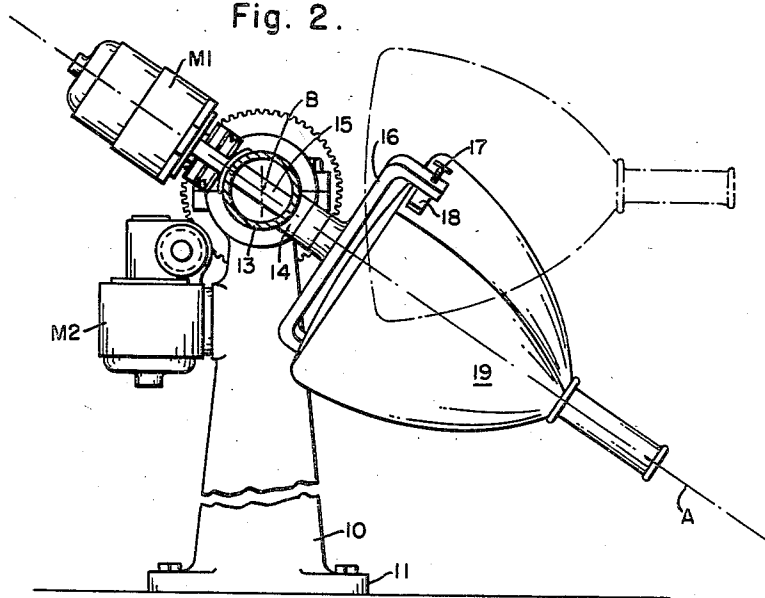
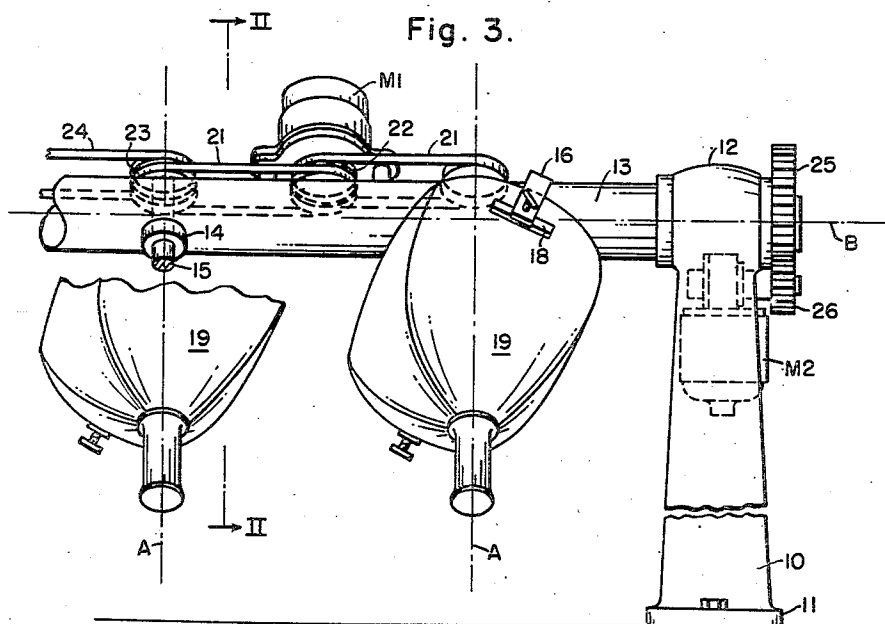


Fig. 3.



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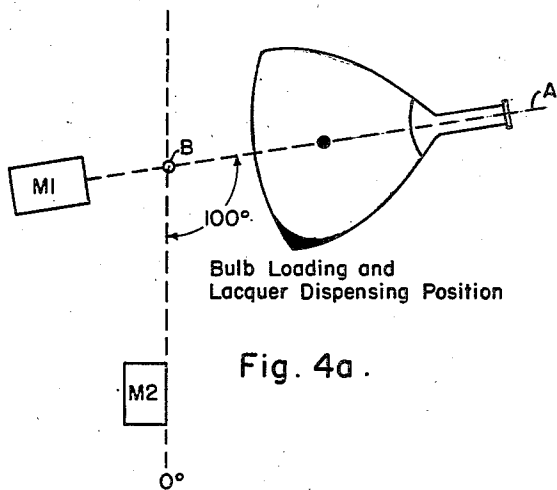


Fig. 4a.

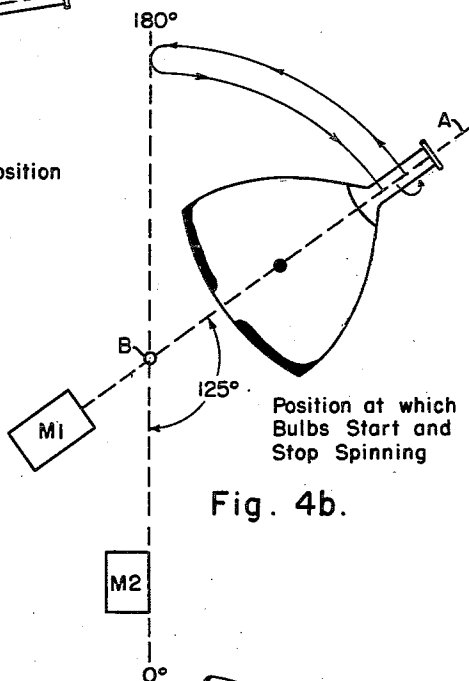


Fig. 4b.

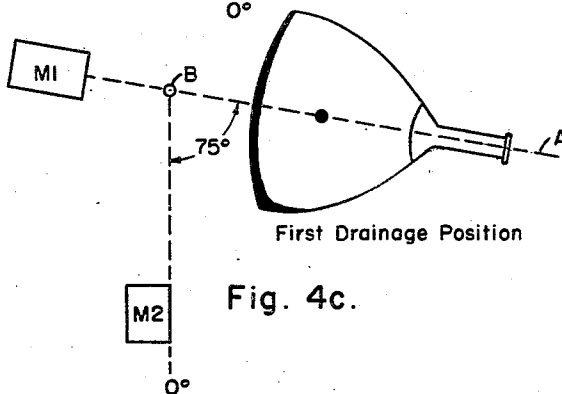


Fig. 4c.

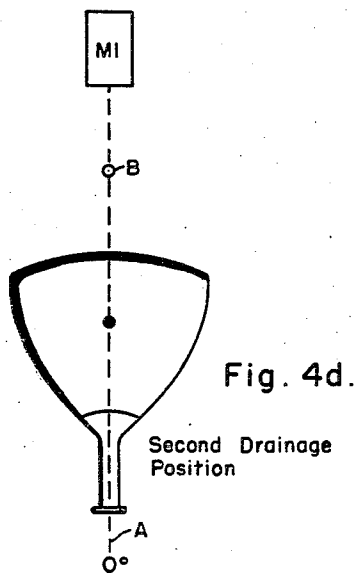


Fig. 4d.

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2,821,160

MACHINE FOR COATING THE INTERIOR OF CATHODE RAY TUBE BULBS

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Application June 25, 1954, Serial No. 439,288

6 Claims. (Cl. 118—11)

This invention relates to the production of cathode ray tubes, and relates more particularly to machines for handling the bulbs of cathode ray tubes during the filming of their phosphor screens prior to aluminizing.

For improving the performance of cathode ray tubes such as are used in television receivers, it is customary to provide aluminum backings for their phosphor screens. For most efficient reflection, the surface of the aluminum film in contact with the phosphor screen should be continuous and smooth. Since the phosphor crystals present an irregular surface with large crevices between them unsuitable for the direct deposit thereon of an aluminum film, it is customary to place a transparent lacquer film on the phosphor for providing a smooth continuous foundation layer upon which the aluminum film is deposited.

My Patent 2,770,557, filed January 5, 1954, discloses improved methods of applying such lacquer films. The present invention is a machine which can be used for the practice of such methods.

In one embodiment of this invention, a horizontally positioned shaft has clamps attached thereto for supporting several bulbs of cathode ray tubes. A motor is provided for rotating the shaft. The clamps attached to the shaft are so arranged that the axes of the necks of the bulbs supported thereby extend at right angles to the axis of the shaft. Another motor is provided for rotating the clamps and the bulbs supported thereby around the bulb axis.

In operation, the horizontal shaft is first rotated to a bulb loading and lacquer dispensing position where the bulbs are clamped in position with the axes of their necks at an angle of about 100° to the vertical with their faceplates downwardly. The proper amounts of lacquer are then poured into the bulbs. The filming machine is started following which the following sequence of operations takes place: The horizontal shaft is rotated by its motor towards a position in which the axes of the necks of the bulbs will extend vertically with the faceplates of the bulbs downwardly. When the axes of the necks of the bulbs reach an angle of about 125° to the vertical, the motor which rotates the bulbs about the axes of their necks is started so that the bulb is submitted to both rotations simultaneously.

The combined actions of the two rotations, one about a horizontal axis, and the other about the axes of the necks of the bulbs, cause the lacquer to sweep the entire surfaces of the screens in spiral paths starting at the outer edges of the screens and ending at their centers.

When axes of the necks of the bulbs are vertical, the motor driving the horizontal shaft is reversed and continues to rotate until the axes of the necks of the bulbs are again at an angle of about 125° to the vertical, at which time the motor which rotates the bulbs about the axes of their necks is stopped. The combined actions of the two rotations of the bulbs from the time of the reversal of the motor which drives the horizontal shaft up to the time the

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motor which rotates the bulbs about the axes of their necks is stopped, cause the lacquer to sweep the entire surfaces of the screens for a second time in a spiral path starting at the centers of the screens and ending at their outer edges.

The motor which rotates the horizontal shaft continues to rotate, carrying the bulbs towards a position in which the axes of their necks will be vertical with faceplates upwardly. However, when the bulbs reach a position in which the axes of their necks are at an angle of about 75° to the vertical, the motor which drives the horizontal shaft is stopped in the first drainage position where the excess lacquer drains from the screens onto the funnel sections of the bulbs and a first timer is started. At the end of about 38–40 seconds, the timer again starts the motor which drives the horizontal shaft, and which drives the shaft until the axes of the necks of the bulbs reach a vertical position with faceplate upwardly, at which time the motor which drives the horizontal shaft is stopped again in a second drainage position where the excess lacquer is drained from the funnel sections of the bulbs. At the same time a second timer is started. At the end of about 80–85 seconds, the second timer energizes a signal which indicates to an operator that sufficient time for the second drainage has elapsed so that the remaining excess lacquer still adhering on the glass wall can be rinsed from the funnel sections of the bulbs by means of a water jet.

An object of this invention is to provide for the quantity filming of the phosphor screens of the bulbs of cathode ray tubes.

Another object of this invention is to provide a machine for filming the phosphor screens of the bulbs of cathode ray tubes.

Another object of this invention is to reduce the cost of filming the phosphor screens of the bulbs of cathode ray tubes.

This invention will now be described with reference to the annexed drawings, of which:

Fig. 1 is a partial plan view looking downwardly upon a filming machine embodying this invention;

Fig. 2 is an end elevation, in section, of the machine, the section being taken along the lines 2—2 of Fig. 3;

Fig. 3 is a partial side elevation, in section, of the machine;

Fig. 4a is a diagrammatic view showing a bulb in its loading and lacquer dispensing position;

Fig. 4b is a diagrammatic view showing the bulb in the position for starting the flow of lacquer spirally on its screen;

Fig. 4c is a diagrammatic view showing the bulb in its first drainage position;

Fig. 4d is a diagrammatic view showing the bulb in its second drainage position, and

Fig. 5 is a circuit schematic showing controls for the automatic operation of the machine of Figs. 1–3.

Referring first to Figs. 1–3, the filming machine comprises the two uprights 10 which have the bases 11 which are adapted to be bolted to a foundation, and which support the bearings 12 at their upper ends. The horizontally extending shaft 13 having the horizontally extending axis B is supported by the bearings, and has attached thereto for rotation therewith, the bushings 14 through which extend the rotary shafts 15. The outer ends of the shafts 15 have attached thereto the brackets 16 which have outwardly turned ends in which are threaded the screws 17 which are rotatably attached to the bulb clamps 18. The bulbs 19 are clamped to the brackets 16 by the clamps 18 with the faceplates of the bulbs adjacent the brackets and extending between their out-

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wardly turned ends. The axes of the shafts 15 extend perpendicular to the axis B of the shaft 13, and the bulbs are so clamped to the brackets that the axes A of their necks extend in alignment with the axes of the respective shafts 15.

The inner ends of the shafts 15 have the pulleys 20 attached thereto and which are driven through the belts 21 and the pulleys 22 by the electric motor M1 which is attached by the bolts 27 to the shaft 13. One of the shafts 15 has another pulley 23 for rotating through another belt 24, another shaft 15 and bulb 19 which are not illustrated.

One end of the shaft 13 has attached thereto the gear 25 which is meshed with the gear 26 which is driven by the electric motor M2 which is attached to one of the uprights 10.

The motors M1 and M2 are conventional electric motors having built-in speed reducing gearing, and can be operated at different pre-settable speeds in order to accomplish the sequence of operations involved. By way of example, the motor M1 could rotate the bulbs 19 about the axes of their necks at about 10 revolutions per minute, and the motor M2 could rotate the shaft 13 at about $\frac{1}{2}$ revolution per minute except that, as described in the following, it may be speeded up at times when the motor M1 is not operating to spin the bulbs 19.

The bulbs 19, the screens of which are to be filmed, are unloaded from the conveyor of the settling room after the phosphor screens have been settled, and are clamped on the bulb holder with their screens still wet of settling solution by the clamps 18 while the machine is in the loading and lacquer dispensing position shown by Fig. 4a. Assuming the bulbs are rectangular, they should be clamped in position with the long sides of their faceplates horizontal for instance and with their anode buttons at the left sides. The axes A of the necks of the bulbs are at an angle which may be from 95° – 105° to the vertical, this angle and the other angles which will be referred to in the following description being measured with reference to the bulbs' position at 0° where the axes A are vertical with faceplates up (neck directed downwards).

The proper amounts of lacquer are then poured into the bulbs, and the motor M2 is started for rotating the shaft 13 to a position at which the axes A will be at an angle of 180° (vertical with faceplates down). When the axes A reach an angle which may be 120° – 130° , the motor M1 is started for starting the spinning of the bulbs about the axes A. Rotation of the shaft 13 continues and when the axes A reach the 180° position, the motor M2 is reversed and then rotates the shaft 13 towards a position where the angle of the axes A will be 0° . When the axes A again reach the angle of 120° – 130° , the motor M1 will be stopped so that the bulbs will stop spinning with the long sides of their rectangular faceplates horizontal within $\pm 10^{\circ}$, the anode buttons still being on the left sides.

The motor M2 continues to rotate the shaft 13 towards a position in which the axes A will be at a 0° angle. When the axes A reach an angle which may be 75° – 80° , the motor M2 is stopped for stopping the bulbs at their first draining position, and a first timer is started. At the end of about 30–40 seconds, the first timer restarts again the motor M2, which then rotates the shaft 13 until the axes A are at an angle of $0^{\circ} \pm 10^{\circ}$ at which time the motor M2 is stopped with the bulbs at the second drainage position. At the same time a second timer is started which at the end of a period of 80–85 seconds energizes a signal indicating to an operator that the second drainage period is over. The operator then rotates the bulbs 180° about the axes A in order to better control the rinsing operation and then rinses the funnel sections of the bulbs, following which the bulbs are removed from the machine and transferred to a drying rack. The second timer could be used also to initiate an automatically performed rinsing.

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Fig. 5 illustrates an automatically operated control circuit which can be used to control the machine during the filming of the screens of the bulbs. The cams C1–C5 are driven by or synchronously with the shaft 13. At the start the noses of the cams are at the same angle as the axes A at the loading and lacquer dispensing position shown by Fig. 4a. A master switch which is not illustrated is closed by an operator for starting the motor M2 which then rotates the shaft 13 to place the bulbs at the position shown by Fig. 4b, the cams C1–C5 being rotated counterclockwise (facing Fig. 5).

When the axes A reach the position shown by Fig. 4b, the nose of the cam C1 closes the switch S1 which completes the energizing circuit of the relay R1, which circuit includes the switch S1, the DC source DCS and the relay R1. The relay R1 then pulls up its armatures which close the switches S2, S3 and S4.

The switch S2 completes a circuit connecting the motor M1 to the power source PS. The motor M1 then starts to spin the bulbs about the axes A.

The switch S3 is a holding switch and is connected in series with the normally closed switch S5 across the switch S1 for maintaining the relay R1 energized after the switch S1 is opened by the reverse motion of the nose of the cam C1 following reversal of the motor M2.

The switch S4 is connected across the resistor Z which is connected in the field circuit of the motor M2, and shorts out this resistor causing the motor M2 to reduce its speed while the bulbs are spinning.

When the axes A reach the 180° position, the nose of the cam C2 closes the switch S6 which closes a circuit which connects the motor reverser MR to the power source PS following which the motor reverser reverses the motor M2.

When the axes A reach the position shown by Fig. 4b following the reversal of the motor M2, the nose of the cam C3 which now rotates in a clockwise direction, closes the switch S7 which completes a circuit connecting the relay R2 to the D. C. source DCS. The relay R2 is then energized and pulls up its armature and opens switch S5 which then opens the circuit of the holding switch S3 causing relay R1 to become deenergized. The motor M1 then stops, the bulbs stop spinning, and the resistor Z is restored to the field circuit of the motor M2 which then increases the speed at which the shaft 13 is rotated.

While the motor M1 is started and stopped at the same angular position of the axes A, in this description it could be started at one angular position and stopped at another angular position. This is another reason for providing the holding switch S3.

When the axes A reach the position shown by Fig. 4c, the nose of the cam C4 opens the normally closed switch S8 which is in series with the power source PS and the motor M2, stopping the latter. At the same time, the switch S9 is closed and completes a circuit connecting the timer T1 to the power source PS. At the end of a period of 38–40 seconds, the timer T1 times out and closes a circuit connecting the motor M2 through the normally closed switch S10 to the power source PS, starting the motor M2 again.

When the axes A reach a 0° position as shown by Fig. 4d, the nose of the cam C5 opens the switch S10, stopping the motor M2. At the same time, the switch S11 is closed and completes a circuit connecting the timer T2 to the power source PS. The timer T2 starts timing and after a period of 80–85 seconds times out and energizes the signal lamp L which lights and indicates to an operator that the second drainage period is over so that the funnel sections of the bulbs can be rinsed.

When the bulbs have been removed from the machine for further processing, an operator would close a switch which is not illustrated, for starting the motor M2 for returning the shaft 13 to the loading and lacquer dispensing position shown by Fig. 4a.

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The timers T1 and T2 can be of the automatic reset type such as are manufactured by the Eagle Signal Company.

More or fewer bulbs than those illustrated by the drawings, could, of course, be handled by a filming machine embodying this invention, and such a machine could be designed to handle but a single bulb at a time.

The positions of the cams C1—C5 and their switches, can be adjusted for varying the angular positions at which the switches are operated. One or more cams could be added to operate an additional switch or additional switches for controlling an additional operation or operations such, for example, as an additional drainage operation if such was desired. Likewise, one or more additional timers could be added for timing an additional operation or additional operations. The timers could be adjusted to provide different timing periods than those described.

The angle and time values here given are typical values which correspond to particular conditions of lacquer viscosity, bulb temperature, screen condition, etc.

They can be easily and readily varied if the conditions in which the screen filming takes place have varied.

The bulbs can be filmed successfully also when they are clamped on the filming machine with their short sides horizontal instead of their long sides.

I claim as my invention:

1. A filming machine comprising a substantially horizontally extending shaft, means including a first motor for rotating said shaft, clamping means for clamping a bulb of a cathode ray tube to said shaft with its faceplate facing said shaft and with its neck extending outwardly away from said shaft with the axis of its neck extending substantially perpendicular to the axis of said shaft, said clamping means having a rotary shaft rotatably attached to said horizontal shaft with the axis of the rotary shaft extending substantially in alignment with the axis of the neck of a bulb clamped thereby, means including a second motor for rotating said rotary shaft and means mounted on said horizontally extending shaft for controlling said second motor in response to movement of said horizontal shaft.

2. A filming machine comprising a substantially horizontally extending shaft, means including a first motor for rotating said shaft, a plurality of clamping means for clamping a plurality of bulbs of cathode ray tubes to said shaft with their faceplates facing said shaft and with their necks extending outwardly away from said shaft and with the axes of their necks extending substantially perpendicular to the axis of said horizontal shaft, each of said clamping means having a rotary shaft rotatably attached to said horizontal shaft with its axis extending substantially in alignment with the axis of the neck of a bulb clamped thereby, means including a second motor for rotating said rotary shafts and means for controlling said second motor in response to movement of said horizontally extending shaft.

3. A filming machine comprising a substantially horizontally extending shaft, means including a first motor for rotating said shaft, clamping means for clamping a bulb of a cathode ray tube to said shaft with its faceplate facing said shaft and with its neck extending outwardly away from said shaft with the axis of its neck extending substantially perpendicular to the axis of said shaft, said clamping means having a rotary shaft rotatably attached to said horizontal shaft with the axis of the rotary shaft extending substantially in alignment with the axis of the neck of a bulb clamped thereby, means including a second

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motor for rotating said rotary shaft, said machine having a bulb loading and lacquer dispensing position in which the axis of the neck of a bulb clamped by said clamping means extends at a small angle to and above a line extending horizontally through the axis of said horizontal shaft and which would coincide with the axis of the neck of the bulb when the axis of the neck of the bulb is horizontal, means for starting said first motor for rotating said horizontal shaft in a direction to place the bulb with its faceplate down and the axis of its neck substantially vertical, means for starting said second motor when the axis of the neck of the bulb reaches a predetermined angle to said horizontally extending line which is greater than said small angle, means for reversing said first motor when the axis of the neck of the bulb reaches a substantially vertical position, means for stopping said second motor when the axis of the neck of the bulb reaches a predetermined angle to and above said horizontally extending line, means for stopping said first motor when the axis of the neck of the bulb reaches a predetermined angle to and below said horizontally extending line, means for restarting said first motor after a predetermined time interval to rotate said horizontal shaft in a direction to place the bulb with its faceplate up and the axis of its neck substantially vertical, and means for stopping the first motor when the axis of the neck of the bulb is substantially vertical.

4. A filming machine as claimed in claim 3 in which the means for starting and stopping the motors includes a plurality of cams driven synchronously with the rotation of said horizontal shaft, and electric switches operated by said cams.

5. A filming machine as claimed in claim 4 in which a timer is provided, in which means is provided for starting the timer when the first motor is stopped when the axes of the necks of the bulbs are vertical, and in which a signal is provided and which is operated by the timer after a predetermined time interval.

6. A filming machine for applying a coating on the inner face of a cathode ray tube of a liquid material introduced into said tube comprising a substantially horizontally extending shaft, means for rotating said shaft, clamping means for clamping the bulb of said cathode ray tube to said shaft, said clamping means having a rotary shaft rotatably attached to said horizontally extending shaft with the axis of said rotary shaft extending substantially perpendicular to the axis of said horizontally extending shaft, said clamping means being adapted to clamp said bulb with the axis of its neck in substantial alignment with the axis of said rotary shaft, means for rotating said rotary shaft about its axis, means for starting rotation of said horizontally extending shaft, means for starting the rotation of said rotary shaft when the axis of the neck of the bulb reaches a predetermined angle above the horizontal plane extending through said horizontally extending shaft to flow said liquid material spirally into the center of the face of said tube and means for reversing the rotation of said horizontally extending shaft when the axis of the neck of said bulb reaches a substantially vertical position to flow liquid spirally to outside edge of the face of said tube.

References Cited in the file of this patent

UNITED STATES PATENTS

996,226	Ebeling	June 27, 1911
1,978,121	Winkler	Oct. 23, 1934
2,166,945	Eberhart	July 25, 1939
2,589,054	Conway et al.	Mar. 11, 1952