April 17, 1962 W. PROSKAUER 3,029,776

APPARATUS FOR SPRAYING PARTS

Filed Aug. 24, 1959 4 Sheets-Sheet 1

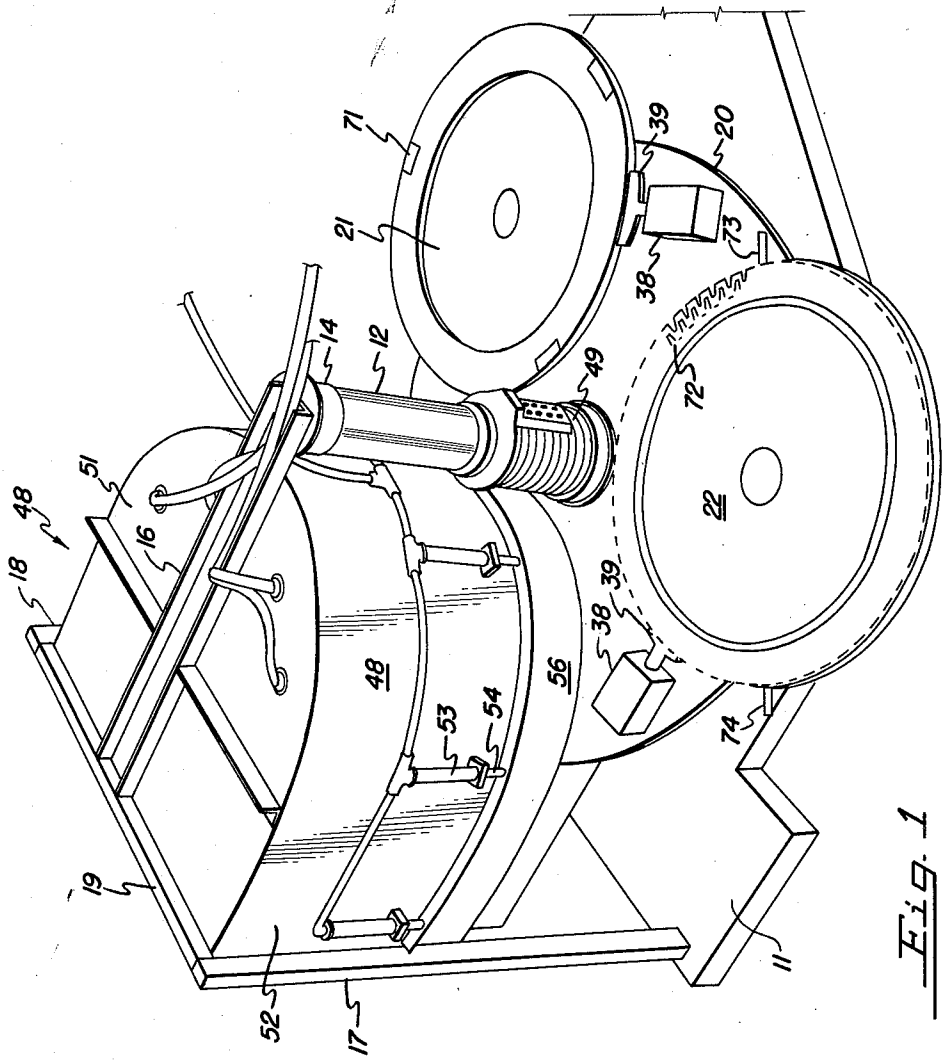


Fig. 1

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APPARATUS FOR SPRAYING PARTS

Filed Aug. 24, 1959 4 Sheets-Sheet 2

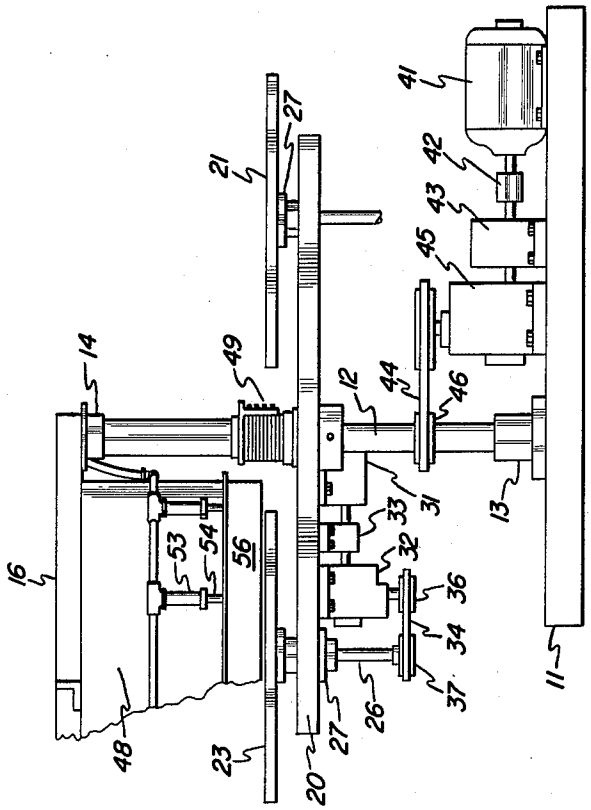


Fig. 2

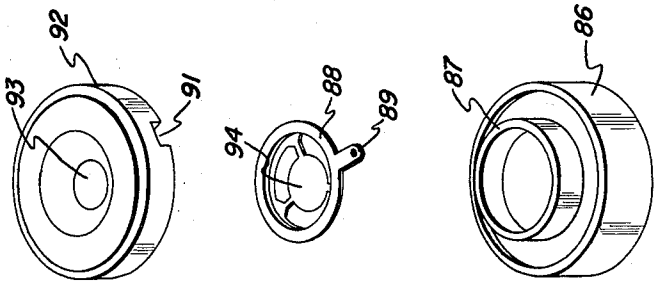


Fig. 5

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APPARATUS FOR SPRAYING PARTS

Filed Aug. 24, 1959 4 Sheets-Sheet 3

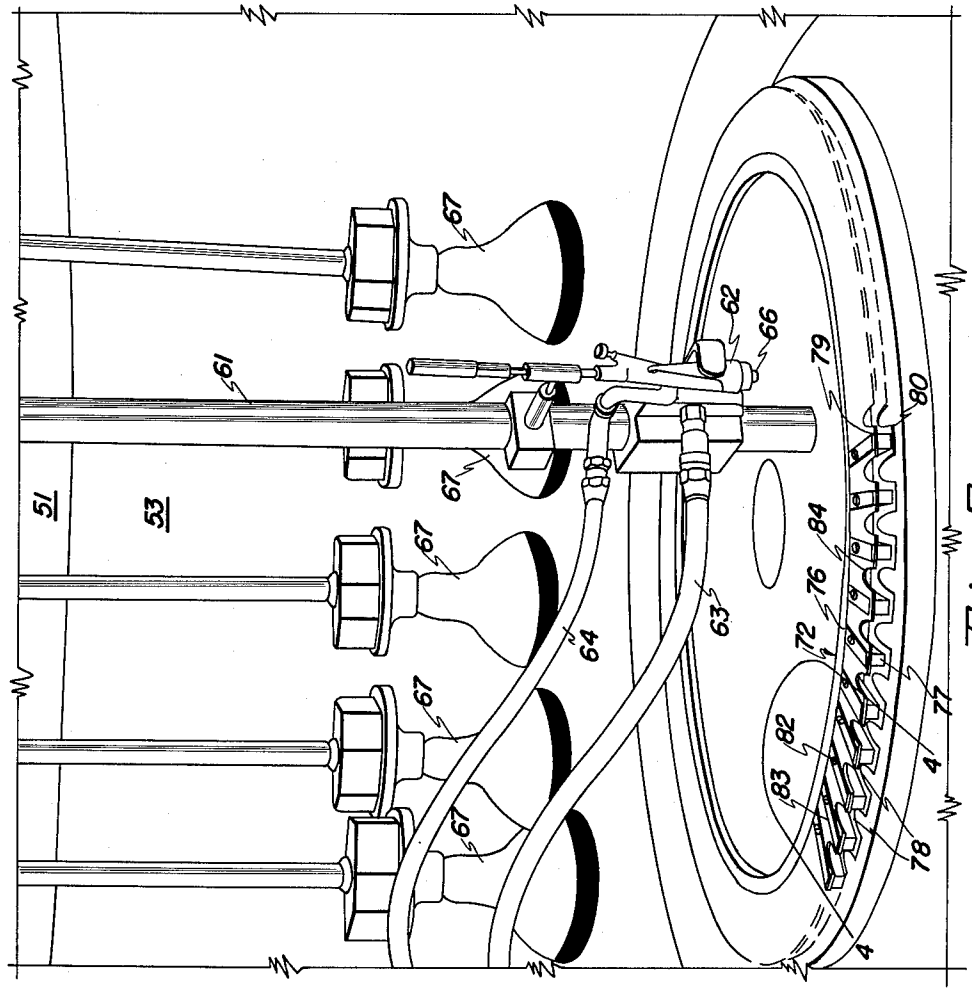


Fig. 3

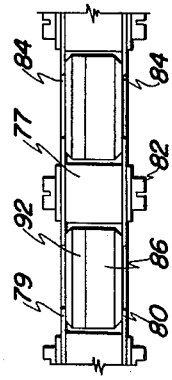


Fig. 4

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APPARATUS FOR SPRAYING PARTS

Filed Aug. 24, 1959 4 Sheets-Sheet 4

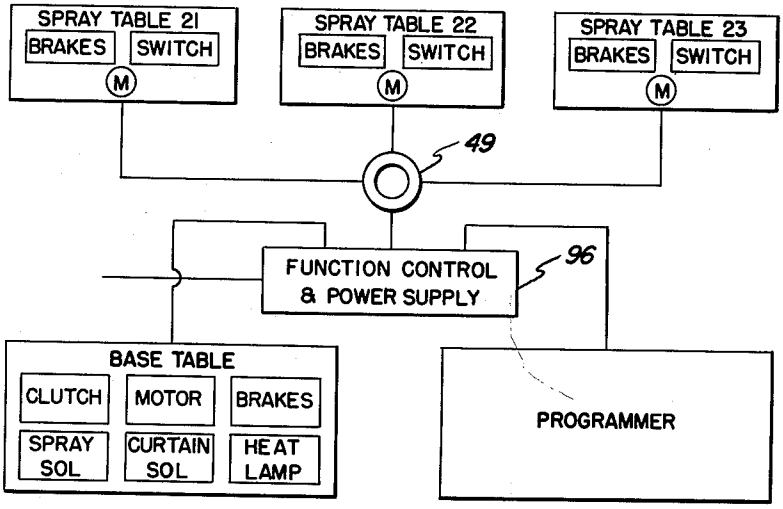


Fig 6

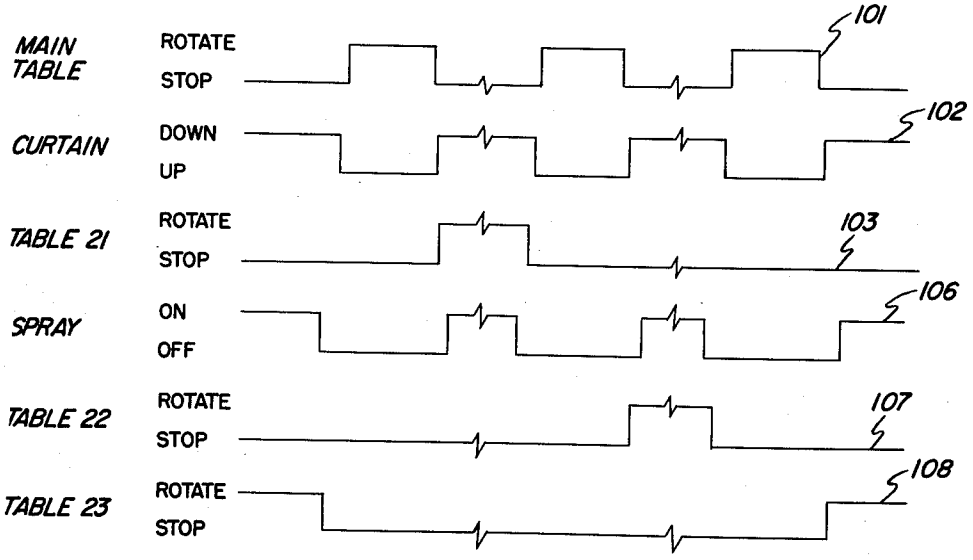


Fig. 7

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APPARATUS FOR SPRAYING PARTS

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9 Claims. (Cl. 118—9)

This invention relates generally to a coating apparatus and more particularly to a coating apparatus suitable for providing a uniform emissive coating to cathode surfaces.

In many types of vacuum tubes, the close spacing between the cathode and adjacent element dictates that the cathode coating be uniform in thickness. Otherwise, there may be shorting to adjacent elements. A uniform coating from one cathode surface to another is required for uniformity of tube characteristics so that all tubes having a predetermined spacing and element configuration will have substantially identical electrical characteristics.

In the prior art, emissive coatings have, in general, been manually applied. Consequently, the coatings are not ideally uniform in thickness, and the thickness may vary from one cathode to another, the variations being largely dependent upon the person applying the coating. Many tubes are rejected as not having characteristics which are within preset specifications.

It is a general object of the present invention to provide an apparatus for automatically applying uniform thin coatings.

It is another object of the present invention to provide a coating apparatus for spraying emissive coatings of uniform thickness on cathode surfaces.

It is still a further object of the present invention to provide a semi-automatic coating apparatus for coating cathode surfaces with emissive coating of uniform thickness.

It is a further object of the present invention to provide a coating apparatus in which a given coating is subjected to a plurality of spraying and drying cycles to assure a uniform, relatively thin coating.

These and other objects of the invention will become more clearly apparent from the following description when taken in conjunction with the accompanying drawing.

Referring to the drawing:

FIGURE 1 is a perspective view of a coating apparatus in accordance with the present invention;

FIGURE 2 is a side elevational view schematically illustrating the drive means for the base table and spray tables;

FIGURE 3 is an enlarged view showing the interior of the spray booth;

FIGURE 4 is a partial view taken along the lines 4—4 of FIGURE 3;

FIGURE 5 is an exploded view of a typical mask and cathode;

FIGURE 6 is a schematic block diagram showing the circuitry for cycling the apparatus; and

FIGURE 7 is a timing chart for the apparatus illustrated in the figures.

Referring to the drawings, particularly FIGURES 1 and 2, the coating apparatus is carried on a base 11. A main drive shaft 12 extends upwardly from the base with its lower end accommodated in a bearing 13 supported by the base. A spaced bearing 14 supported on the arm 16 engages the other end of the shaft. The arm 16 is attached to the upright spaced posts 17 and 18 by a cross member 19.

The main shaft 12 carries a base table 20 which, in turn, mounts three spaced spray tables 21, 22 and 23. The tables 21, 22 and 23 are each carried on a driven shaft 26 which extends through bearings 27 carried by

the base table. Suitable drive means are associated with each of the shafts 26 for rotating the respective turntables 21–23, individually. One such means is illustrated in conjunction with the table 23 and includes a motor 31 which supplies power to a gear reduction 32 through a clutch 33. A belt 34 engages the pulleys 36 and 37, one of which is secured to the gear reduction shaft and the other of which is secured to the shaft 26 of the turntable 23. A braking assembly 38 is associated with each of the turntables and includes a solenoid operated brake band 39 which engages the periphery of the associated turntable to apply a frictional braking force thereto. In operation, the clutch 33 is disengaged before the brakes are applied.

The base table 20 is driven by the motor 41 which is coupled 42 to a clutch 43. The output shaft of the clutch 43 drives the belt 44 through a gear reduction 45. The belt 44 engages the pulley 46 on the shaft 12 to rotate the turntable.

Thus, it is seen that each of the spray tables 21–23 includes an individual drive means together with clutching and braking means. The base table includes a drive means to move the main table to bring the spray tables 21, 22 or 23 into the spray booth designated generally by the reference numeral 48.

The spray booth is supported on the spaced upright legs 17 and 18 and includes an upper wall 51 and a downwardly extending side wall 52. The portion 52 of the side wall is cylindrical to follow the contour of the spray tables. The side wall carries a plurality of drive means, for example, air actuated pistons 53 which activate rods 54. The rods 54 support a curtain 56 which is adapted to be urged downwardly against the surface of the base table to thereby completely seal the spray booth during a spray operation. The front of the booth includes a sliding door or window (not shown) which may be opened for access to the interior of the booth.

Referring to FIGURE 3, the booth includes a support post 61 which serves to support a spray head 62. Coating material is supplied to the spray head through the tube 63 while compressed air is supplied to the tube 64. A spray pattern is formed by the nozzle 66. The spray impinges upon the exposed surfaces of the cathodes to be coated which lie opposite the nozzle, as will be presently described.

A plurality of heating means, for example, heat lamps 67, are supported within the spray booth and serve to irradiate the sprayed parts to thereby dry the parts.

Each of the spray tables 21–23 includes spaced support platforms 71 (FIGURE 1) which are adapted to receive cathode support rings 72. The rings 72 may be provided with spaced handles 73 and 74 for applying and removing the rings. Any suitable means, for example, screws, may be employed for securing the rings 72 to the associated spray table.

Each of the rings includes a core 76 (FIGURE 3) having a plurality of radially extending finger-like elements 77 to form a series of slots 78 adapted to receive a cathode masking assembly, as will be presently described. Thin rings 79 and 80 are secured to the opposite surfaces of the main ring 76, as, for example, by screws 82. Reinforcing elements 83 may be provided. Slots 84 are provided in the thin rings 79 and 80 and register with the slots 78.

The cathode to be coated is placed within a suitable masking assembly whereby only the portion of the surface to be coated is exposed to the spray. Referring particularly to FIGURE 5, a mask suitable for use with a disc-type cathode of the character used in ceramic tubes is illustrated. The mask includes a base 86 which has an upwardly extending platform 87 adapted to receive a cathode 88. The cathode tab 89 extends outwardly and

is accommodated within the slot 91 formed in the masking element 92. The masking element includes an opening 93 of predetermined size to expose a predetermined portion of the upper surface 94 of the cathode.

The cathode is placed within the mask and the mask portions assembled. The complete assembly is then urged into one of the slots 78 between the members 79 and 80 and is held therein by the spring action of the thin rings 79 and 80. The slot 84 provides means for exposing the opening 93 to the spray gun for spraying operation and also for easily grasping the masking assembly.

Referring to the schematic diagram in FIGURE 6, the function control and power supply 96 serves to supply power to the motors associated with the spray tables 21, 22 and 23, and the base table motor. Power is supplied to the spray table motors through the slip ring assembly 49. The function control also serves to control the base table motor, clutch and brakes so that the base table is rotated and indexed after a spraying operation for one spray table has been completed. The function control also serves to control the cycling of the curtain raising and lowering the spraying and the heating cycle, as will be presently described.

Each of the turntables includes associated means, for example, switches, which serve to provide an output signal for each revolution of the turntable. These signals are, in turn, applied through the function control to a programmer which may, for example, include a preset counter which serves to provide an output signal to the function control when a predetermined number of revolutions has been undergone by a turntable within the spray booth. The function control then cycles the apparatus to stop the spraying operation, raise the curtain and index the base table to a new position, as will be presently described.

Referring particularly to FIGURE 7, the main table is periodically rotated as indicated by the waveforms 101. Waveform 102 represents the motion of the curtain. It is to be observed that while the main table is rotating, the curtain is raised. When the base table stops, the curtain is lowered to enclose the spray booth.

Referring to the curve 103, rotation of the spray table 21 is indicated. After the spray table 21 is rotated under the spray booth, the main table stops, and the curtain is lowered, the table 21 begins to rotate. Simultaneously, the spray cycle begins as indicated in the curve 106. It is observed that during the period of time that table 21 is rotating, tables 22 and 23 are stationary, curves 107 and 108. It is further observed that turntable 23 has just completed its spray cycle and that turntable 22 will be the next to cycle. While the spray table 23 is in the spray booth, spray table 21 is being loaded, and the parts on spray table 22 are inspected, to ensure that the coating thickness is correct. Similary, when spray table 21 is in the spray booth, spray table 22 is loading and spray table 23 is being inspected.

It is seen that the apparatus has three stations: a spray station, an inspection station, and a loading and unloading station. While a spray table is in the spray booth, one of the other turntables is being loaded and unloaded while the other has its samples subjected to inspection. In the event the inspection shows that the samples have not been provided with a coating of sufficient thickness, the spray table may be manually indexed back into the spray booth for additional spraying.

In accordance with the present invention, the spray table in the spray booth begins to rotate simultaneously with the commencement of the spray, or shortly before. The table is rotated at a relatively high velocity, typically between 20 and 60 r.p.m., during each pass under the spray nozzle. Thus, only a small fraction of the final coating is applied. The sprayed part then passes under the drying means 67 and is again cycled under the spraying apparatus.

This is an important feature of the present invention since it provides means whereby coatings of relatively uniform thickness can be formed. If the parts were coated in a single pass under the nozzle, any non-uniformity of the spraying pattern over the surface of the part would make the coating relatively non-uniform. However, by moving the sample under the spray, it is subjected to various parts of the spray pattern and the differences in the spray pattern tend to be ironed out during each cycle. Furthermore, any changes from one cycle to another are also ironed out since the part passes under the spray gun many times. The result is to give a monogeneous uniform coating.

Thus, there is provided an improved coating apparatus which is capable of coating many parts simultaneously. Each of the parts has a uniform coating and the many parts have a coating of substantially the same thickness.

I claim:

1. A spraying apparatus comprising a rotatable base table, at least one spray table rotatably carried on the base table, means for mounting a plurality of similar parts on the periphery of said spray table, a spray booth disposed above the base table and adapted to receive the spray table, means for driving the base table so that the spray table is moved into the spray booth, means carried by the base table for rotating the spray table at least twice while in said spray booth, and spray means carried within the booth adapted to project a spray towards each of the similar parts as said spray table rotates for uniformly coating said parts.

2. A spraying apparatus for spraying parts comprising a rotatable base table, at least one rotatable spray table adapted to carry a plurality of similar parts carried on the base table, a spray booth disposed above the base table and adapted to receive the spray table, means for driving the base table so that the spray table is moved into the spray booth, means carried by the base table for rotating the spray table at least twice while in said spray booth, spray means carried within the booth adapted to project a spray towards each of the parts as said spray table rotates, and drying means disposed within the booth and adapted to dry the parts after spraying and before re-spraying.

3. A spraying apparatus comprising a rotatable base table, at least one spray table rotatably carried on the base table, means for mounting a plurality of similar parts on the periphery of said spray table, a spray booth including a top wall and side walls extending downwardly and spaced from the base table, said spray booth adapted to receive the spray table, a movable curtain carried by the side walls of the spray booth, means carried by the base table for rotating the spray table at least twice while in said spray booth, means for urging the curtain towards the base table to close the spray booth, and means for driving the base table so that the spray table is moved into the spray booth.

4. A spraying apparatus comprising a rotatable base table, at least one spray table rotatably carried on the base table, means for mounting a plurality of similar parts on the periphery of said spray table, a spray booth having downwardly extending side walls and a top wall, a movable curtain carried by the side walls, means for driving the curtain towards the base table, means for driving the base table so that the spray table is moved into the spray booth, means for energizing the curtain drive means when the spray table is beneath the booth to thereby urge the curtain downwardly to enclose the spray table in the booth, means carried by the base table for rotating the spray table at least twice while in said spray booth, and spray means carried within the booth and adapted to project a spray towards each of said parts in turn as said spray table rotates.

5. A spraying apparatus comprising a rotatable base table, at least one spray table rotatably carried on the base table, means for mounting a plurality of similar

parts on the periphery of said spray table, a spray booth having extending side walls and a top wall, a movable curtain carried by the side walls, means for driving the curtain towards the base table, means for driving the base table so that the spray table is moved into the spray booth, means for energizing the curtain drive means when the spray table is in the booth to thereby urge the curtain to enclose the spray table, means carried by the base table for rotating the spray table at least twice while in said spray booth, spray means carried within the booth and adapted to project a spray towards each of said parts as said spray table rotates, means adapted to begin rotation of the spray table when the spray table is in the spray booth, and means for commencing a spraying cycle when the spray table is rotating.

6. A spraying apparatus for spraying parts comprising a rotatable base table, at least one spray table adapted to receive parts rotatably carried on the base table, means for mounting a plurality of similar parts on the periphery of said spray table, means carried by the base table for driving the spray table, a spray booth above said base table having downwardly extending side walls and a top wall, a movable curtain carried by the side walls, means for driving the curtain downwardly against the base table, means for driving the base table so that the spray table is disposed in the spray booth, means for energizing the curtain drive means when the spray table is beneath the booth to thereby urge the curtain downwardly and enclose the spray table in the booth, spray means carried within the booth and adapted to project a spray towards each of the parts as said spray table rotates, means adapted to begin rotation of the spray table when the spray table is within the spray booth, means for commencing a spraying cycle when the spray table is rotating, means for generating a signal indicative of the number of revolutions of the spray table, preset counting means adapted to receive said signal and form an output signal upon a predetermined number of revolutions, means responsive to the said last signal for ending the spray cycle, means responsive to said last signal for stopping the spray table after a predetermined time lapse, and means for lifting the curtain when the spray cycle is completed.

7. A spraying apparatus comprising a rotatable base table, a plurality of spray tables rotatably carried on the base table, means for mounting a plurality of similar parts on the peripheral of said spray table, a spray booth disposed above the base table and adapted to receive one

of the spray tables, means for periodically driving the base table so that the spray tables are individually presented to the spray booth, means carried by the base table for rotating the spray table at least twice while in said spray booth, and spray means carried within the booth and adapted to project a spray towards each of said parts as said spray table rotates.

8. A spraying apparatus for spraying parts comprising a rotatable base table, at least one rotatable spray table carried on the base table, a ring adapted to accommodate a plurality of parts, means for removably securing said ring to the spray table, a spray booth disposed above the base table and adapted to receive the spray table, means for driving the base table so that the spray table and ring are moved into the spray booth, means carried by the base table for rotating the spray table at least twice while in said spray booth, spray means carried within the booth adapted to project a spray towards each of the parts as said ring and spray table rotate, and drying means disposed within the booth and adapted to dry the parts.

9. A spraying apparatus including three stations: a spray station, an inspection station, and a loading station; a rotatable base table; a spray booth disposed above a portion of the base table and forming said spray station; a plurality of spray tables rotatably mounted on said base table; means for mounting a plurality of similar parts on the periphery of each of said spray tables; means for periodically rotating said base table so that each of said spray tables is sequentially indexed to one of said stations; means carried by the base table for individually rotating the spray tables at least twice while indexed to the position in said spray booth; and means for spraying each of said parts on said spray table which is rotating in said spray booth.

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