

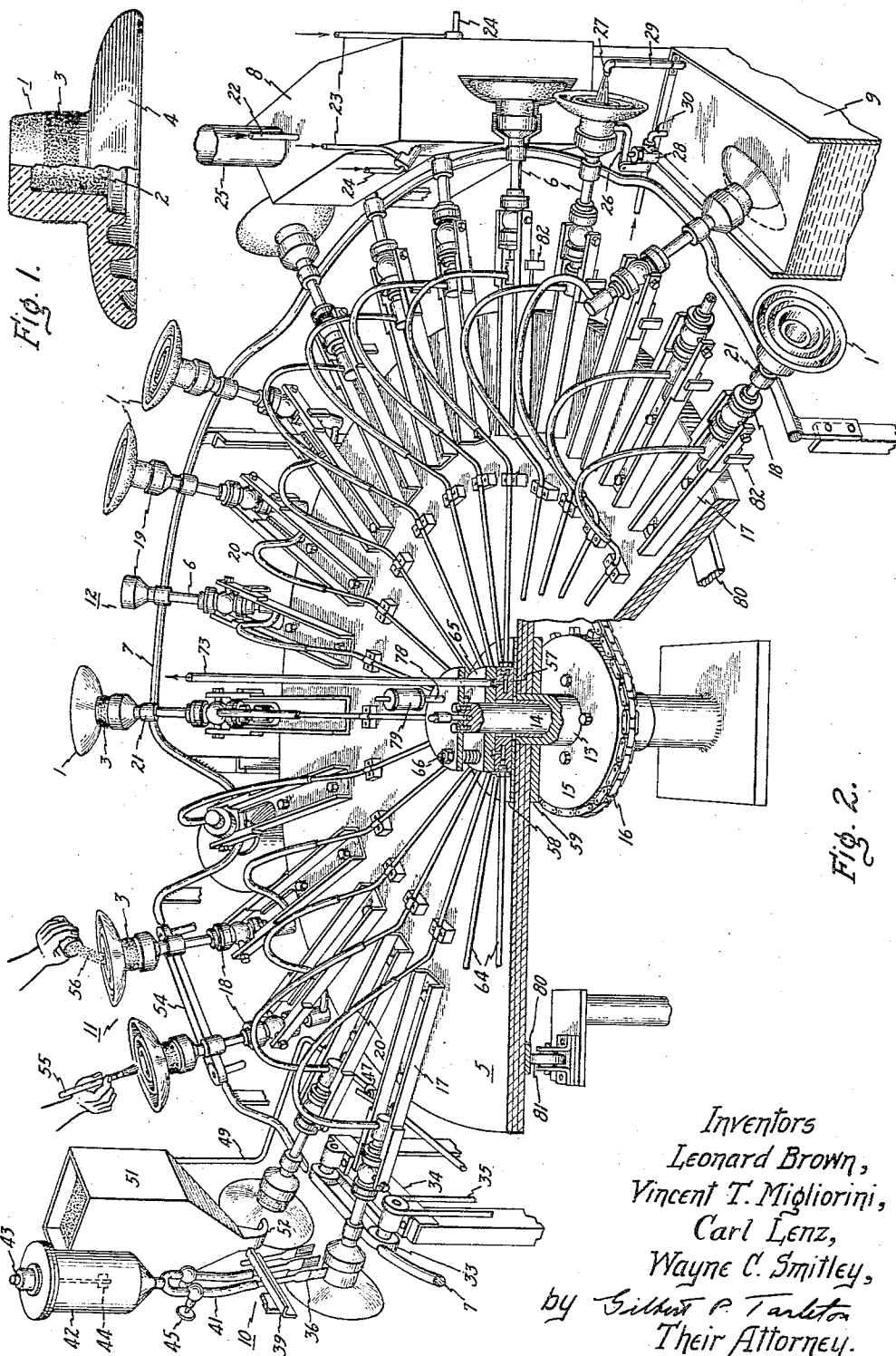
Jan. 28, 1958

L. BROWN ET AL
MACHINE FOR COATING BELL-SHAPED
ELECTRICAL SUSPENSION INSULATORS

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4 Sheets-Sheet 1



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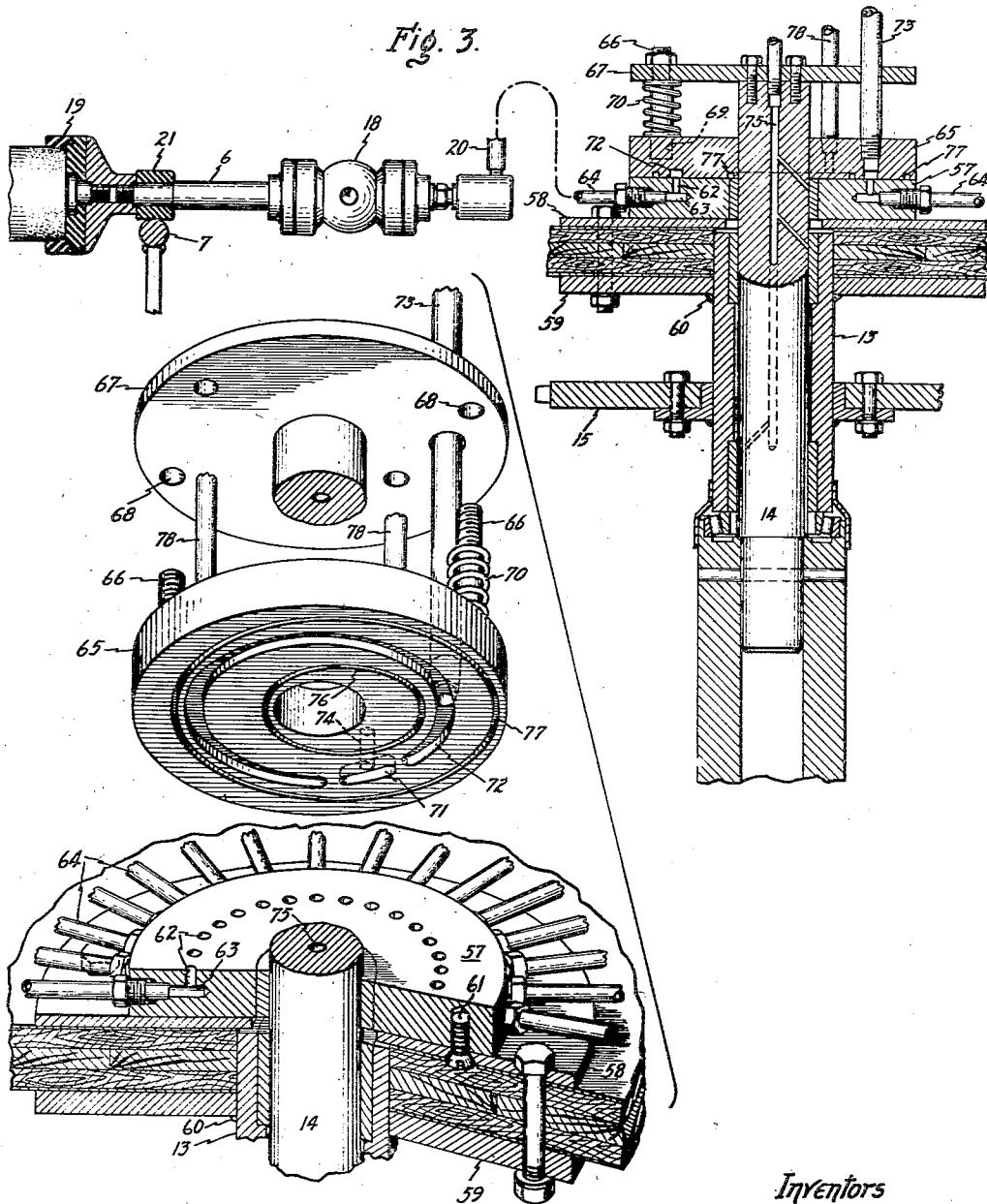


Fig. 4.

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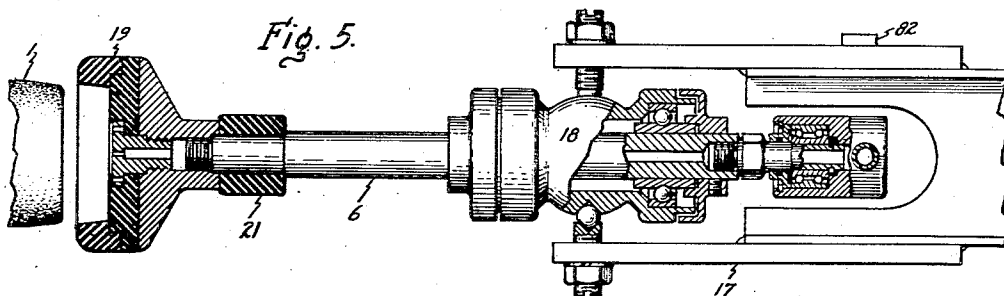
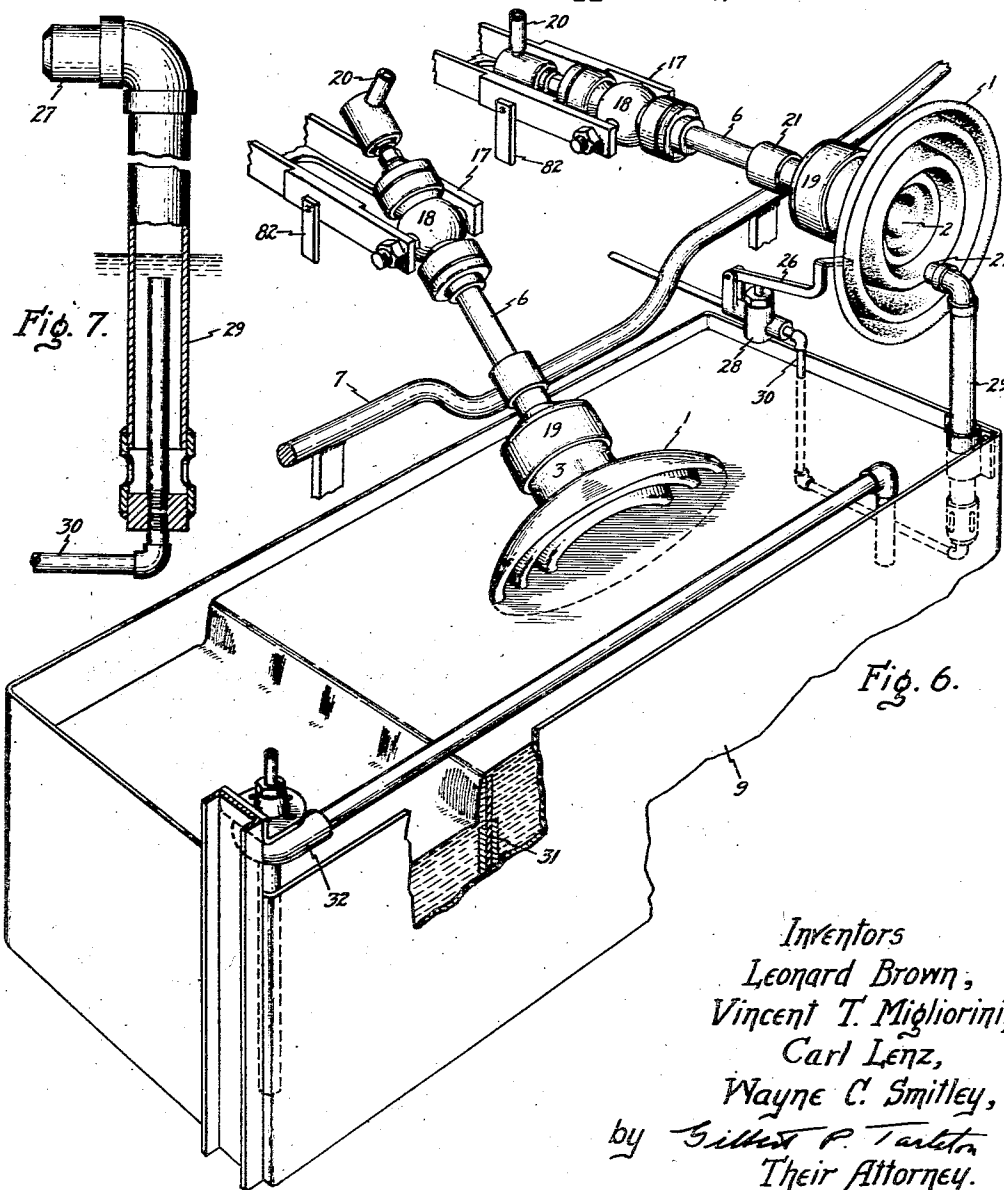
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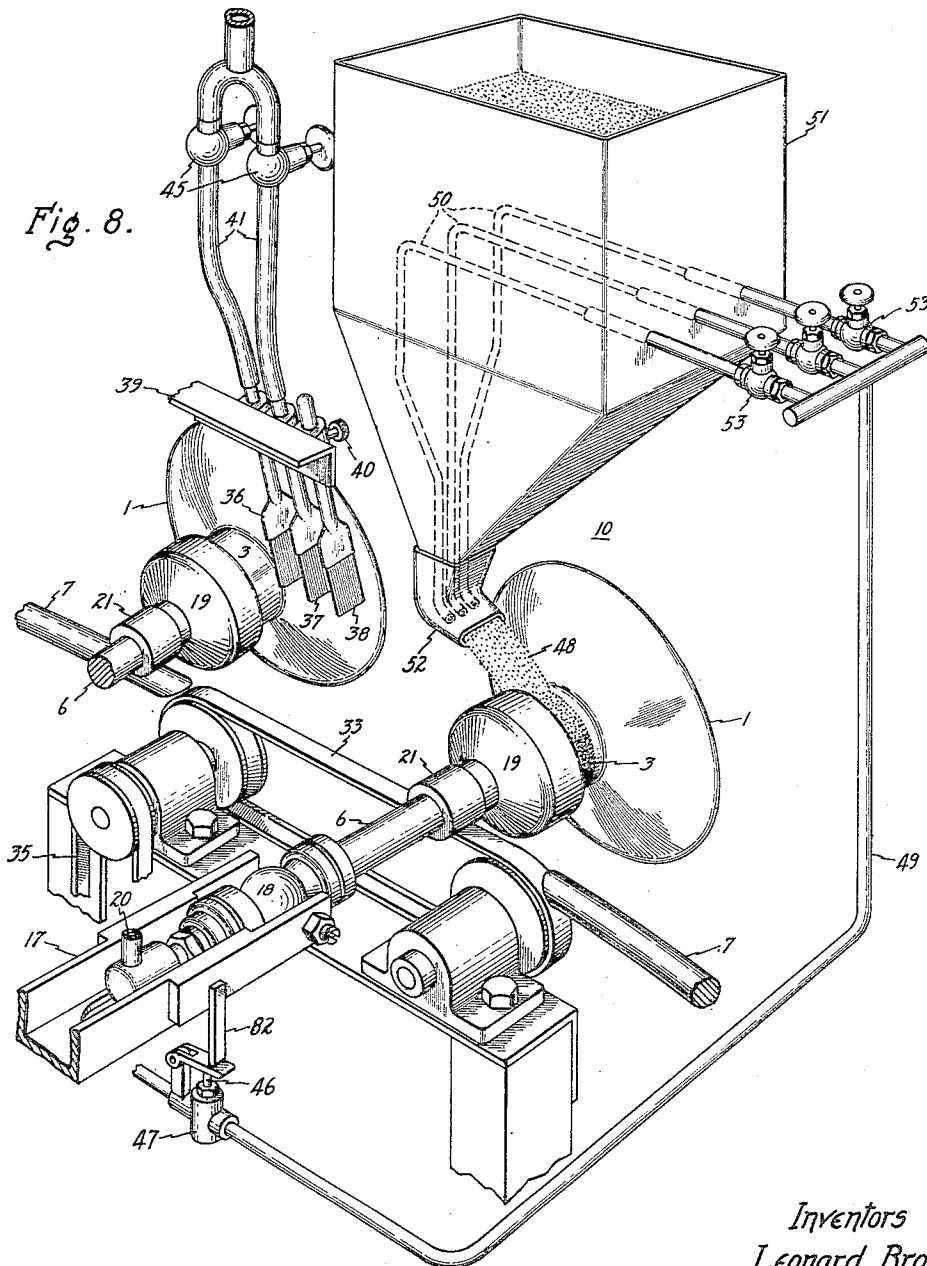
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MACHINE FOR COATING BELL-SHAPED ELECTRICAL SUSPENSION INSULATORS

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15 Claims. (Cl. 118—2)

This invention relates to a machine for manufacturing electrical insulators, and more particularly, to improvements in a machine or apparatus for uniformly and repetitively applying a liquid glaze coating and a sand grip surface to porcelain or ceramic electrical insulators.

In the manufacture of ceramic or porcelain electrical suspension insulators having a bell-shaped configuration, a glaze coating is applied to the insulators to improve their mechanical and electrical properties. Also, a sand grip surface is formed in the pinholes of the insulators and a sand grip band is formed on the exterior neck-
portions of the insulators to facilitate their suspension mounting and assembly with each other. Heretofore, these manufacturing operations have been conducted primarily manually. Manual manufacturing operations are high in cost and result in a high spoilage rate due to the errors of operator judgment.

Accordingly, it is an object of this invention to provide an improved machine or apparatus for uniformly and repetitively applying a glaze coating and sand grip surfaces to ceramic or porcelain electrical insulators at a reduced cost substantially free of operator judgment.

Our invention comprises a revolving table or frame carrying a plurality of radially extending rotary spindles or arms. As the table or frame revolves, the spindles or arms ride along a track or rail and have rotary movement imparted thereto. The insulators to be processed are held on the outer ends of the spindles or arms by a novel vacuum holding and atmospheric pressure release means correlated with the various operations to be performed by the machine or apparatus whereby loading and unloading of the spindles or arms is facilitated along a predetermined portion of the track or rail. The loaded spindles first carry the insulators to be processed to an automatically operable cleaning and moistening means. The cleaned and moistened insulators then pass to an automatically operable spray means where the insulators have their pinholes uniformly sprayed with liquid glaze. Next, the insulators pass a liquid glaze tank. The spindles or arms are pivotally connected to the table or frame and the track or rail adjacent to the tank is so configured whereby the insulators are automatically dipped and whirled through the tank at a predetermined inclination to have a uniform liquid glaze coating applied thereto. Thereafter, the insulators pass another station having automatically operable means for uniformly applying an exterior sand grip band to the necks of the insulators. At this last-mentioned station, means are provided for accelerating the rotary movement or spinning of the insulators. After this, the insulators move to another station for the semi-automatic application of a roughened surface to the pinholes. At the pinhole roughening station the track or rail is so configured to make the insulator pinholes face first upwardly and then downwardly to facilitate the pinhole roughening operation. Also, while the pinholes are facing upwardly, the rotary movement or spinning of the insulators is accelerated. Finally, the articles reach the previously mentioned loading and

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unloading track or rail portion. Here, the heretofore mentioned vacuum holding and atmospheric pressure release means is automatically operable to release the processed insulators whereby the processed insulators can be unloaded and new insulators can be loaded. Also, the loading and unloading track or rail portion is so configured to cause the outer ends of the spindles or arms to point upwardly to facilitate loading and unloading. One operator can do the loading and unloading, and another operator can do the pinhole roughening. All other operations are automatic, rapid, low cost and substantially free of operator judgment. The pinhole roughening operation is subject to a certain degree of operator judgment. However, in the pinhole roughening operation our invention reduces costs and increases the rate of production.

The features of our invention which we believe to be novel are set forth with particularity in the appended claims. Our invention itself, however, both as to its organization and method of operation, together with further objects and advantages thereof may best be understood by reference to the following description taken in connection with the accompanying drawings.

In the drawings, Fig. 1 is a side view, partly in section, of an electrical insulator processed by the machine or apparatus of our invention. Fig. 2 is a perspective view, partly in section, of a preferred form of our invention. Fig. 3 is a detailed side elevation view of the vacuum pressure holding and atmospheric pressure release means of our invention. Fig. 4 is an exploded perspective view of the vacuum pressure holding and atmospheric pressure release means. Fig. 5 is a detailed top view of one of the rotary arms or spindles of our invention. Fig. 6 is a perspective view of the pinhole spray means and main liquid glazing means of our invention. Fig. 7 is a detailed view of the pinhole spray means. Fig. 8 is a perspective view of the sand grip banding station of our invention. Like reference numerals will be used throughout the various figures to indicate identical parts.

Referring now particularly to Fig. 1, shown therein is a ceramic or porcelain electrical suspension insulator 1 having a bell or cup-shaped configuration. The pinhole has a roughened or sand grip surface 2 formed therein, and the exterior neck portion has a roughened or sand grip band surface 3 formed thereon. Prior to formation of the roughened or sand grip surfaces 2 and 3, the insulator 1 has its pinhole sprayed with a liquid glaze, and all but the uppermost portion of the insulator is dipped into a liquid glaze. After formation of the roughened or sand grip surfaces 2 and 3 the insulator 1 is fired whereby the liquid glaze coating is transformed into a smooth exterior glassy finish 4.

The just mentioned operations of forming sand grip surfaces and glaze coating the pinhole and body portion have heretofore been conducted primarily manually. Said manual operations are slow, costly, and introduce flaws in the finished product due to errors in operator judgment. In Fig. 2 is shown an improved machine or apparatus which will perform said operations rapidly at a low cost substantially free of operator originated imperfections. As will be more clear hereinafter, the use of the apparatus or machine of Fig. 2 is not necessarily confined to insulators particularly configured as shown in Fig. 1, and such machine or apparatus can be used to perform all or any number of said operations.

Referring now to Fig. 2, shown therein is a preferred form of our invention comprising a flat generally horizontally disposed rotary generally circular table or frame member 5. Distributed about the outer circumference of table 5 and carried thereby are a plurality of radially extending rotary spindles or arms 6. Arms or spindles 6 are adapted for pivotal movement within radially extending

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planes disposed generally normal to the table 5. A generally circular closed track or rail 7 is concentrically disposed with respect to and radially outward of table 5. As table 5 is rotated clockwise the arms 6 simultaneously ride along the track 7 and have rotary motion imparted thereto due to frictional engagement between the track 7 and the overlying rotary arms 6. The radially outermost ends of the rotary spindles 6 are adapted to have insulators mounted thereon. First, the insulators pass through a cleaning and moistening cabinet 8 where they are cleaned and moistened. Almost immediately after leaving the cabinet 8 the insulators are pinhole sprayed with a liquid glaze. Thereafter, the insulators are dipped into and spun through a liquid glaze tank 9. At station 10, the necks of the insulators have sand band grips formed on the exterior portions thereof. At station 11 the pinholes are sand grip surfaced. At station 12 the processed insulators are unloaded and new insulators are loaded.

Referring to Figs. 3 and 4 in conjunction with Fig. 2, it will be seen that table 5 is concentrically fixed to a rotary axially fixed vertically disposed collar or sleeve 13. Sleeve 13 is concentric with and rotary about an immovable vertically disposed shaft 14. Concentrically fixed to sleeve 13 is a large circular gear plate 15 having a plurality of teeth formed on the outer periphery thereof. An endless pulley chain 16 engageable with said teeth is driven by a not shown motor or the like to rotate the table 5.

Referring now to Fig. 5 in conjunction with Fig. 2, it will be seen that a plurality of radially extending spoke-like support arms 17 are fixed to table 5. The radially outermost portions of support arms 17 extend beyond table 5 and are forked. To said forked portions are pivotally connected radially extending cylindrical bearing members 18. Spindles or arms 6 are rotatably journaled within cylindrical bearing members 18. Thus, besides rotating about their axes, the opposite ends of the spindles 6 can also be pivoted above or below the horizontal plane of table 5.

Connected to the radially outermost ends of spindles 6 are rubber or the like radially outward facing cup-shaped vacuum or suction insulator holding members 19. The rotary spindles or arms 6 are hollow throughout. The radially inner ends of the hollow spindles 6 are connected by flexible hoses 20 to a source of vacuum pressure for holding the insulators on the radially outer ends of the spindles 6, or to a source of atmospheric pressure to free the insulators from the radially outer ends of the spindles 6.

Fixed to the spindles 6 between the bearing members 18 and the radially outer ends of spindles 6 are rubber or the like friction collars 21. As seen from Figs. 2 and 3, collars 21 make frictional engagement with track or rail 7 whereby spindles 6 are rotated as table 5 revolves.

At station 12 of Fig. 2 the track 7 rises above the horizontal plane of table 5 thereby causing the radially outer ends of spindles 6 to be pivoted upwardly thereby facilitating loading and unloading of the insulators. Thereafter the track 7 returns to the horizontal plane of table 5. Within the cabinet 8 is positioned a not shown air spray connected by a hose 22 to a source of high air pressure. Said not shown air spray is directed against the insulators to blow off the insulators. Also positioned within the cabinet 8 are two not shown water sprays connected by hoses 23 to a source of water, and by hoses 24 to a source of high air pressure. Said two water sprays are directed against the insulators to moisten said insulators preparatory to the application of a liquid glaze coating thereto. If so desired a not shown baffle can separate the air spray and water spray cabinet portions. An exhaust pipe 25 connected to a not shown exhaust pump or the like is in communication with the air spray cabinet portion to remove dust and the like therefrom. A drain or the like can be connected in a well known manner to the bottom of cabinet 8 to remove accumulated water therefrom.

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Referring now to Figs. 6 and 7 as well as Fig. 2, it will be noted that as the insulators leave the cabinet 8, their path of travel about track 7 is obstructed by a lever arm 26. A liquid glaze spray nozzle 27 positioned radially outward of the moving insulators is directed toward the pinholes of the moving insulators. As the neck portions of the insulators ride over the lever arm 26 the spray nozzle 27 is positioned immediately opposite the pinholes. Depression of the lever arm 26 causes opening of an air valve 28 whereupon the pinholes are sprayed with liquid glaze. The spray nozzle 27 is connected by a stand-pipe 29 to a main body of liquid glaze in liquid glaze tank 9. The lower end of the standpipe 29 has a plurality of openings formed therein whereby the liquid level in the standpipe 29 will be identical to the liquid level of the main body of liquid glaze in tank 9. The outlet side of the air valve 28 has a conduit 30 extending therefrom into the standpipe 29 just below said liquid level. Therefore, when the air valve 28 is opened high air pressure sprays liquid glaze through spray nozzle 27.

Still referring to Fig. 6, the glaze tank 9 is divided by an adjustable overflow barrier 31 into two compartments. A pump 32 is used to continuously transfer liquid glaze from the left-hand compartment to the right-hand compartment while the right-hand compartment is continuously overflowing into the left-hand compartment. This continuous recirculation of the liquid glaze between the two compartments maintains the liquid glaze at a constant specific gravity. The liquid level of the liquid glaze within the right-hand compartment can be varied by adjusting the overflow barrier 31. The portion of track 7 along the right-hand compartment dips below the plane of table 5 by a predetermined amount thereby causing the insulators to be dipped into the liquid glaze within the right-hand compartment at a predetermined angle. The number of turns each insulator makes through the right-hand compartment liquid glaze and the time of immersion is predetermined by the length of said track portion.

Referring now to Fig. 8 in conjunction with Fig. 2, when the insulators reach the exterior neck portion sand grip banding station 10 their rotary motion is accelerated. The track or rail 7 adjacent station 10 has a gap or interruption therein. Track or rail 7 adjacent station 10 is completed by a movable endless open pulley belt 33 having the upper portion thereof arranged as a continuation of the track or rail 7. Said pulley belt upper portion is movable in a direction opposite to the direction of movement of the insulators about the track or rail 7. The two pulleys of the endless open pulley belt 33 are rotatably supported from a support 34, and one of said pulleys can be driven by a not shown motor or the like connected to said one pulley by another endless open pulley belt 35.

Disposed within the path of travel of the insulators along the upper portion of pulley belt 33 are three paint brushes or the like 36, 37, and 38. The brushes or applicators 36-38 are supported from a position vertically above the necks of the insulators by a support 39. The brushes 36-38 can be adjusted upwardly or downwardly by virtue of thumb screws 40, only one of which is shown.

The first two paint brushes 36 and 37 have their stems or handles hollowed. These hollowed stems or handles are connected by conduits 41 to a container 42 of liquid binding mixture, comprising liquid glaze and adhesives or the like, mounted above the brushes. A motor 43 actuates an agitator 44 within the container 42 to maintain the liquid binding mixture at uniform consistency. Also, valves 45 in the conduits 41 can be adjusted to vary the flow of liquid binding mixture to the brushes 36 and 37. The two brushes 36 and 37 apply liquid binding mixture to the exterior neck portions of the insulators. The third brush 38 which is not hollowed spreads the liquid binding mixture to the desired width.

Inasmuch as the insulators are accelerated in rotation

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during their travel along the upper portion of pulley belt 33, a circumferential band of liquid binding mixture will be applied to the exterior neck portions of the insulators as they pass beneath the paint brushes.

Still referring to Fig. 8 and station 10 of Fig. 2, after the insulators pass the paint brushes, while the rubber collars 21 are still riding along the upper movable portion of pulley belt 33, cams 82 fixed to support arms 17 will cause depression of a plunger or the like 46. Depression of plunger 46 causes opening of an air valve 47. When air valve 47 is open, high pressure air causes sand 43 to be poured on the previously applied exterior neck portion liquid binding mixture band. One side of air valve 47 is connected to a source of high air pressure. The other side of air valve 47 is connected by a hose 49 to three hoses 50. The hoses 50 extend into a container 51 of sand. Container 51 is positioned above the insulators and has a generally right angle oval cross-section funnel 52. The lower open end of hoses 50 extend into funnel 52. When high pressure air is ejected out of the lower open ends of hoses 50, sand 43 will be poured out of the funnel 52 which is superposed with respect to the neck portions of the passing insulators. Each of the hoses 50 has a valve 53 therein. The width of the poured sand spout 48 can be varied by proper manipulation of the valves 53.

After the exterior neck portions of the insulators have been sand grip banded, the insulators pass through station 11 of Fig. 2. At station 11, the track or rail 7 leaves the horizontal plane of table 5 and first rises above the table 5 and then dips below the table 5. Such curvature of the track or rail 7 causes the radially outer end of the spindles 6 to first pivot generally vertically upward and then generally vertically downward thus causing the pinholes of the insulators to first face upwardly and then downwardly. The raised portion of track or rail 7 adjacent station 11 is interrupted and completed by a movable endless open pulley belt 54 similar to previously described pulley belt 33 at station 10 to again accelerate rotation of the insulators. While the insulators are accelerated in rotation and have their pinholes facing upwardly an operator can apply a liquid binding mixture to the pinholes by a paint brush 55 or the like with one hand. Immediately thereafter said operator can with his other hand pour sand 56 into the liquid binding mixture painted pinholes. When the insulators reach the dipped track portion of station 11, since the pinholes are then facing downwardly, excess sand in the pinholes will be ejected therefrom.

After the insulators have been dipped downwardly at station 11 to expel excess sand from the pinholes, the track or rail 7 again rises above the plane of table 5 at the unloading and loading station 12 of Fig. 2 to make the interiors of the cup-shaped holding members 19 face upwardly thereby facilitating loading and unloading of the spindles 6 by another operator. As the spindles 6 ride along the station 12, the heretofore mentioned vacuum pressure created in the hollow spindles 6 and female suction cups 19 to hold the insulators on the outer ends of the spindles 6 is automatically cut off and replaced by atmospheric or higher than vacuum pressure whereby the processed insulators can readily be removed from the female suction cups 19. The automatically operable vacuum pressure holding means and atmospheric pressure release means will now be described in conjunction with Figs. 2 to 4.

Referring particularly to Figs. 3 and 4, it will be seen that rotatably disposed about the shaft 14 is a flat horizontally disposed circular valve plate 57. Valve plate 57 is concentric with shaft 14, and is superposed with respect to and fixed to table 5. Two annular clamping plates 58 and 59 are concentric with respect to table 5 and sleeve 13, and are clamped to table 5 on opposite sides thereof by nuts and bolts or the like. The lower clamping plate 59 is fastened to the sleeve 13 by a weld 60 or the like. The

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upper clamping plate 58 and the annular valve plate 57 are connected together by a screw 61 or the like. Accordingly, when the chain 16 rotates the sleeve 13 about the shaft 14, the table 5, clamping plates 58 and 59, and the valve plate 57 will simultaneously rotate about shaft 14. Table 5 is prevented from wobbling by virtue of a track 80 fastened to the underside of table 5. As seen from Fig. 2, track 80 rides on a plurality of rollers 81, only one of which is shown.

Valve plate 57 has a plurality of axially extending blind bores 62 formed in the upper surface thereof. Bores 62 are distributed along an imaginary circle concentric with respect to shaft 14. Each of bores 62 is in communication with a radially extending blind bore 63 formed between the opposite sides of valve plate 57. Tubes 64 connect the radially outer open ends of blind bore 63 with the radially inner ends of flexible hoses 20.

Another horizontally disposed flat circular or annular valve plate 65 is concentric with respect to shaft 14 and superposed with respect to valve plate 57 for broad flat surface engagement therewith. Upper valve plate 65 is stationary inasmuch as it is connected by a pair of bolts or pins 66 and an end plate 67 to stationary shaft 14. Shaft 14 protrudes through and vertically above plate 65. Circular end plate 67 is fixed to the upper end of shaft 14 by screws or the like and is vertically spaced with respect to the upper face of plate 65. Bolts or pins 66 pass through two apertures 68 formed in end plate 67, and the lower ends thereof slidably enter two blind bores 69, only one of which is shown, formed in the upper side of plate 65. Coil springs 70 surround each of bolts or pins 66 and bear downwardly against the plate 65 to continuously urge the underside thereof in broad flat surface contact with the top side of plate 57.

Formed in the underside of plate 65 are two mutually isolated arc-like channel grooves or furrows 71 and 72. These two grooves 71 and 72 have equal radii and are positioned along an imaginary circle equal to the previously mentioned imaginary circle for bores 62, both of said imaginary circles having a common axis and equal radii. The groove 71 is substantially shorter than the groove 72 and both grooves 71 and 72 are superposed with respect to and in communication with bores 62. A conduit 73 in communication with groove 72 passes through an aperture formed in end plate 67 and connects the groove 72 to a not shown source of vacuum pressure. The groove 71 is connected to an atmospheric pressure or higher than vacuum pressure source, as by bore 74 extending from groove 71 to the ambient air. However, as will be obvious to those skilled in the art, groove 71 can also be connected to a source of pressure greater than atmospheric pressure for the purpose of releasing the insulators from spindles 6.

By correlating Fig. 4 and Fig. 2, it will be seen that the small groove 71 is positioned radially inward of and opposite to unloading and loading station 12 of Fig. 2. Accordingly, as each of the hollow spindles 6 passes through station 12 its corresponding bore 62 will be in communication with atmospheric pressure release groove 71 during which it is free to be unloaded and loaded. During the remaining portion of travel of each hollow spindle 6 about the track or rail 7 its corresponding bore 62 will be continuously in communication with vacuum pressure holding groove 72 whereby the insulators are securely held on the radially outer end of the spindles.

The shaft 14 has an axially extending oil groove 75 in communication with radially extending oil grooves formed in shaft 14 for lubricating the bearings of rotary plate 57 and rotary sleeve 13. Also, formed on the underside of plate 65 are two off-center oil grooves 76 and 77 to adequately lubricate the contacting faces of plates 65 and 57 to insure that said contacting faces meet with air tight engagement to make the grooves 71 and 72 leakproof. The oil grooves 76 and 77 are fed with oil by conduits 78 which passes through apertures formed in end plate 67

for communication at the upper end thereof with sealed oil sources 79.

To obtain uniformly accurate sanding and glazing of the insulators 1, it is important for each of the insulators to identically fit the rubber cups 19 and truly rotate about their axes throughout all their different positions. For instance, if the insulators do not truly rotate about their axes the sand grip bands 3 will be crooked. In our invention the rubber cups are constructed so as to ensure loading of the insulators whereby their axes will coincide with the axes of the rubber cups 19. This is accomplished by making the rims of the cups 19 out of a soft material and the bases of the cups 19 out of a hard material. The softer outer rims readily conform to the exterior side surfaces of the insulators above the sand bands 3 to form a good vacuum seal therebetween and simultaneously permit an operator to quickly push the exterior flat surfaces of the bases of the insulators against the interior flat harder surfaces of the bases of the cups 19 as illustrated in Fig. 3. As shown in Figs. 3 and 5, rubber suction cups having soft rims and hard bases can be attained by making the cups 19 two piece cups, with the rims thereof composed of a soft material while the bases thereof are composed of a hard material, and then attaching the rims and bases together as by a cement or adhesive.

While there has been shown and described a particular embodiment of the invention, it will be obvious to those skilled in the art that changes and modifications may be made without departing from the invention, and that it is intended by the appended claims to cover all such changes and modifications as fall within the true spirit and scope of the invention.

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

1. A semi-automatic machine for coating the interiors of cup-shaped objects with an abrasive material comprising a rotary frame generally disposed in a horizontal plane, at least one radially extending cylindrical bearing member pivotally carried by said frame whereby said cylindrical bearing member is free for pivotal movement within a radially extending plane substantially normal to said horizontal plane, a radially extending spindle journaled in said cylindrical bearing member for rotary movement, a radially outermost end of said spindle having means thereon for carrying one of said objects whereby the interior of said one object faces radially outward, a track radially outward of said frame, a portion of said spindle between said radially outermost end and said cylindrical bearing member frictionally engageable with said track whereby said spindle rotates along said track during rotation of said frame, said track first rising above said horizontal plane and then dipping below said horizontal plane wherein said interior is caused to first face upwardly and then downwardly thereby facilitating manual coating of said interior with an adhesive and manual pouring of an abrasive material in said interior while facing upwardly to form an abrasive material coating therein after which excess abrasive material is automatically ejected from said interior while facing downwardly.

2. A machine for holding a plurality of articles and simultaneously moving said articles along a generally circular path and then automatically releasing said articles before said articles have made one complete turn of said circular path comprising two superposed flat plates having a common axis and making flat surface contact with each other at one of their sides, a plurality of bores formed in said one side of one of said plates, said one plate being rotary and the other of said plates being stationary, said bores distributed along the circumference of an imaginary circle concentric with said axis, two arc-like isolated channel grooves formed in said other plate one side, said grooves superposed with respect to said bores and communicating therewith, a vacuum pressure

source communicating with one of said grooves and a pressure source higher than said vacuum pressure source communicating with the other of said grooves, a plurality of tubular arms extending radially outward with respect to said rotary plate and movable simultaneously therewith, radially extending bores formed in said rotary plate between opposite sides thereof communicating with said first mentioned bores and the radially inner ends of said tubular arms, and vacuum holders on the radially outer ends of said tubular arms.

3. An apparatus for moving a plurality of articles about a circular path whereby a plurality of manufacturing operations can be performed on said articles comprising a fixed vertically disposed shaft, an axially immovable rotary sleeve on said shaft, a flat circular table concentrically fixed to said sleeve and rotary therewith, a flat annular plate concentric with respect to said shaft overlying said table, said plate fixed to said table and rotary therewith, another flat annular plate concentrically fixed to said shaft, the underside of said another plate making intimate flat surface contact with the top side of said rotary plate, a plurality of bores formed in said top side, said bores concentrically disposed with respect to shaft, two mutually isolated arc-like grooves formed in said underside, said grooves superposed with respect to and in communication with said bores, a plurality of hollow tubular arms extending radially outward of said table and movable therewith, a source of vacuum pressure in communication with one of said grooves, a source of atmospheric pressure in communication with the other of said grooves, and means for connecting said bores with the radially inner ends of said tubular arms whereby said articles can be mounted on the radially outer ends of said arms and retained thereon by vacuum pressure during movement thereof about said circular path and then automatically released therefrom by atmospheric pressure subsequent to said manufacturing operations.

4. An apparatus for semi-automatically forming a roughened surface on the interiors of articles comprising a plurality of radially extending rotary pivotally mounted arms moving and spinning along a circular rail, radially outward facing suction cups disposed on the radially outer ends of said arms and vacuum pressure source means cooperative therewith for mounting said articles on said arm ends whereby said interiors face radially outward, a portion of said rail convexly configured for pivoting said arm ends upwardly thereby facilitating the adhesive painting of and pouring of sand into the interiors of articles mounted on said arm ends, another portion of said rail concavely configured for pivoting said arm ends downwardly whereby excess sand poured into the interiors of articles mounted on said arm ends will be jettisoned therefrom, said convexly configured rail portion comprising a track movable in a direction opposite to said arms along said rail for accelerating said spinning of said arms.

5. A machine for uniformly coating the interiors of bell-shaped ceramic electrical suspension insulators with a liquid glaze and for uniformly sand grip banding the exterior neck portions of said insulators comprising a plurality of radially extending rotary arms moving and spinning along a generally circular rail, radially outward facing cup-shaped suction elements mounted on the radially outer ends of said arms and vacuum means cooperative therewith for holding said insulators on said elements with said insulator interiors facing radially outward, automatically operable insulator interior liquid glaze coating means positioned along a portion of said rail comprising a liquid glaze spray nozzle disposed radially outward of said rail portion and pointing radially inward, and an actuating lever protruding between said rail portion and spray nozzle for actuating said spray nozzle, an automatically operable insulator exterior neck portion sand grip banding means disposed along another portion of said rail, said another rail portion comprising a track

moving in a direction opposite to said arms for accelerating said spinning of said arms.

6. An apparatus for manufacturing electrical insulators having pinholes comprising an immovable vertically disposed shaft, an axially immovable rotary sleeve on said shaft, a rotary flat circular table concentrically fixed to said sleeve, a flat rotary annular plate fixed to said table concentric with said shaft, another flat annular plate fixed to said shaft and having the underside thereof making flat surface engagement with the top side of said rotary plate, a plurality of bores formed in said top side concentrically disposed with respect to said shaft, two mutually isolated arc-like grooves formed in said underside, said grooves superposed with respect to and in communication with said bores, one of said grooves being substantially longer than the other of said grooves, said one groove in communication with a vacuum pressure source, said other groove in communication with an atmospheric pressure source, a plurality of radially extending fork-like arms fixed to said table, cylindrical bearing members pivoted to said fork-like arms, rotary hollow tubular spindles journaled in said bearing members, said spindles overlying and frictionally engaging a circular track concentrically disposed with respect to said table, flexible conduits connecting said bores with the radially inner ends of said spindles whereby said insulators can be held on the radially outer ends of said spindles by vacuum pressure, a first station along said track for facilitating manual loading and unloading of said spindles with said insulators, a second station along said track having automatically operable means for cleaning and moistening said insulators, a third station along said track having automatically operable means for spraying said pinholes with a liquid glaze, a fourth station along said track having automatically operable means for coating said insulators with a liquid glaze, a fifth station along said track having automatically operable means for applying an exterior sand band grip to said insulators, and a sixth station along said track for facilitating manually applying a sand grip surface to said pinholes, said track at said first station rising above said table, said track at said fourth station dipping below said table, said track at said sixth station first rising above and then dipping below said table, the remainder of said track disposed in the plane of said table, and said other groove disposed radially inward of and opposite to said first station.

7. A machine for applying a uniform liquid glaze coating to electrical insulators comprising a rotary frame member generally disposed in a horizontal plane, a plurality of radially extending bearing members pivotally carried by said frame member whereby said bearing members are free for pivotal movement within radially extending planes disposed substantially perpendicularly with respect to said horizontal plane, rotary spindles journaled in said bearing members, the radially outer ends of said rotary spindles adapted for carrying electrical insulators thereon, a track disposed radially outward of said frame member, portions of said spindles disposed between said outer ends and bearing members overlying said track and frictionally engaged therewith whereby when said frame member is rotated rotary movement is imparted to said spindles about the axes thereof, an air cleaning and moistening cabinet disposed along a portion of said track, said cabinet having air and water spray means therein, said radially outer spindle ends movable through said cabinet during rotation of said frame member, a tank of liquid glaze coating material disposed along another portion of said track, said another portion of said track disposed below said horizontal plane whereby during travel of said spindles along said another track portion said radially outer spindle ends are dipped toward said liquid glaze coating material.

8. An apparatus for automatically and repetitively applying a uniform coating of liquid glaze material to hollow ceramic electrical insulators comprising a plu-

5 rality of radially extending arms oriented along the outer circumference of a circle, and means for simultaneously moving said arms about said circle, the radially outer ends of said arms having pivot portions, radially extending bearing members pivotally connected to said pivot portions, rotary radially extending spindles carried by said bearing members, the radially outer ends of said spindles being adapted to carry hollow electrical insulators whereby the hollows of said insulators face radially outward, friction collars on said spindles between said spindle ends and said bearing members, a track underlying said collars and frictionally engaged thereby to spin said spindles as said arms are moved about said circle, a liquid glaze material spray nozzle disposed radially outward of said spindle ends for spraying the hollows of hollow electrical insulators which said spindle ends are adapted to carry, means for actuating said spray nozzle as said spindle ends move about said circle opposite to said spray nozzle, a liquid glaze material tank disposed along a portion of said track, said track portion being curved to dip said spindle ends toward said liquid glaze material tank.

9. An apparatus for repetitively applying a uniform sand band to articles comprising a plurality of rotary radially extending spindles disposed along the circumference of an imaginary circle and movable thereabout, the radially outer ends of said spindles being adapted for carrying articles to be sand banded, said spindles having friction collars thereon, a track generally concentric with said circle underlying said collars and frictionally engaged thereby wherein rotary movement is imparted to said spindles when said spindles are moved about said circle, a part of said track comprising a portion of an endless open pulley belt which is movable in a direction opposite to said spindles whereby said rotary movement is accelerated when said collars are engaged with said belt portion, a container of liquid adhesive material communicating with a brush, said brush being disposed adjacent the path of movement of said spindle ends along said belt portion whereby said brush will apply a band of adhesive to articles which said spindles are adapted to carry, a source of sand, and means adjacent said path of movement for actuating pouring of said sand on articles which have had adhesive bands applied thereto by said brush.

10. An apparatus for applying a uniform exterior sand band grip to electrical insulators comprising a generally horizontally disposed rotary frame having a plurality of rotary arms extending radially outward therefrom, a track surrounding said frame, the radially outer ends of said arms being adapted to have electrical insulators mounted thereon, portions of said arms radially inward of said ends overlying said track and frictionally engageable therewith whereby when said frame is rotated said arms rotate about the axes thereof, a gap in said track, said gap being closed by an endless movable belt, said radially inward arm portions also frictionally engageable with said movable belt and accelerated in rotation during engagement therewith, a brush disposed adjacent the path of movement of said radially outer ends during said accelerated rotation for applying a band of adhesive to insulators which said arms are adapted to carry, and a sand spout adjacent said path of movement for pouring sand during said accelerated rotation on insulators which have had adhesive bands applied thereto by said brush.

11. A semi-automatic machine for liquid glaze coating bell-shaped electrical suspension insulators, applying an exterior sand grip band to the necks of said insulators, and applying a sand grip to the interiors of said insulators, said machine comprising a rotary generally horizontally disposed frame having a plurality of rotary spindles projecting radially outward therefrom, the radially outer ends of said spindles adapted to have said insulators mounted

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thereon, said spindles adapted for pivotal movement of said outer ends below and above said frame, a track disposed radially outward of said frame and said spindles frictionally engaging said track whereby when said frame is rotated rotary movement is imparted to said spindles about the axes thereof, a first station along said track for facilitating manual loading and unloading of said spindles with said insulators, a second station along said track having means whereby said insulators are automatically air and water sprayed, a third station along said track having means whereby said insulator interiors are automatically sprayed with a liquid glaze, a fourth station along said track having means whereby said insulators are automatically dipped into a liquid glaze tank and whirled therethrough to apply a uniform liquid glaze coating to the base portions of said insulators, a fifth station along said track having means whereby the necks of said insulators have exterior sand grip bands automatically applied thereto, and a sixth station along said track for facilitating manually applying a sand grip to said interiors.

12. In a machine having a plurality of radially extending hollow spindles moving and rotating along a substantially circular track, means for holding articles on the radially outer ends of said spindles comprising a suction element mounted on said outer ends, a flat circular valve plate positioned radially inward of said spindles and movable simultaneously therewith, another flat circular valve plate superposed with respect to said movable plate and making flat surface contact at one side thereof with one side of said movable plate, said another plate being fixed against movement, said movable plate one side having a plurality of ports formed therein spaced equidistantly of and arranged circularly about the axis of said movable plate, and means connecting said parts with said hollow spindles said another plate one side having two mutually isolated arc-like furrows formed therein which are superposed with respect to said circularly arranged ports and in communication therewith, and one of said furrows being connected to a source of vacuum pressure and the other of said furrows being connected to a source of atmospheric pressure.

13. A machine for carrying objects through a cycle of manufacturing operations and then releasing said objects comprising a horizontally disposed circular table rotatable about the axis thereof, at least one radially extending hollow tubular arm connected to said table and simultaneously movable therewith, a horizontally disposed valve plate fixed to the top side of said table and rotatable simultaneously therewith, another horizontally disposed valve plate fixed against movement, the underside of said another plate making surface engagement with the upper surface of said rotatable plate, two arc-like grooves formed in said underside, said two arc-like grooves having equal radii and concentrically disposed with respect to the axis of said table, a blind radially extending channel formed in said rotatable plate between the opposite sides thereof, a vertically extending channel formed in said rotatable plate from said upper surface to said radially extending channel, said vertically extending channel disposed from said axis at a distance equal to said radii and communicating with first one of said grooves and then the other of said grooves during rotation of said table, one of said grooves connected to a vacuum pressure source, the other of said grooves connected to an atmospheric pressure source, the radially outer end of said radially extending channel connected by a conduit to the radially inner end of said hollow

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tubular arm, and a vacuum holder on the radially outer end of said tubular arm.

14. An apparatus for applying an external uniform sand band grip to articles comprising a rotary frame having a plurality of radially extending and rotatably mounted hollow spindles distributed about the circumference thereof, a circular track disposed about said frame, said spindles riding along said track and having rotary movement imparted thereto when said frame is rotated, means along a portion of said track automatically operable to apply an external uniform sand band grip to articles carried by said spindles, said track portion comprising an endless open pulley belt portion movable in a direction opposite to said frame whereby rotary movement of said spindles is accelerated when riding along said track portion, means for holding articles on said spindles and for facilitating manual loading and unloading of articles on said spindles along another portion of said track comprising a plate fixed to said frame and movable simultaneously therewith and a stationary plate making surface engagement at one side thereof with one side of said movable plate, said movable plate one side having a plurality of bores formed therein which are spaced equidistantly from the rotary axis of said frame and equal in number to said spindles, said stationary plate one side having two arc-like mutually isolated channel grooves formed therein in superposed relationship with respect to said bores, one of said grooves communicating with a source of vacuum pressure and disposed radially inward of and opposite to said another track portion, and means for connecting said bores with said hollow spindles.

15. An apparatus for manufacturing bell-shaped electrical suspension insulators comprising a generally horizontally disposed rotary table, a plurality of radially extending bearing members carried by said table and pivotally mounted thereon for pivotal movement within radially extending planes disposed substantially perpendicular to said table, rotary spindles journaled in said bearing members extending radially outward of said table beyond said bearing members, the radially outer ends of said spindles having vacuum holding means for mounting said insulators thereon, a closed track disposed about said table, portions of said spindles between said radially outer ends and bearing members superposed with respect to said track and frictionally engageable therewith whereby when said table is rotated said spindles are simultaneously spun about the axes thereof, automatically operable apparatus positioned along said track whereby the interiors of said insulators are sprayed with a liquid glaze, the base portions of said insulators are covered with a uniform coating of liquid glaze, and the necks of said insulators have an exterior sand band grip applied thereto before one complete cycle of said insulators about said track, and means automatically releasing said vacuum holding means just short of one complete cycle of said insulators about said track.

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