United States Patent

[11] **3,552,351**

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Paris, France
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[33] **France**
[31] **No. 17,277**
Original application May 11, 1966, Ser. No. 549,203, now Patent No. 3,392,230. Divided and this application Feb. 27, 1968, Ser. No. 708,706

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[54] **COATING APPARATUS**
11 Claims, 11 Drawing Figs.

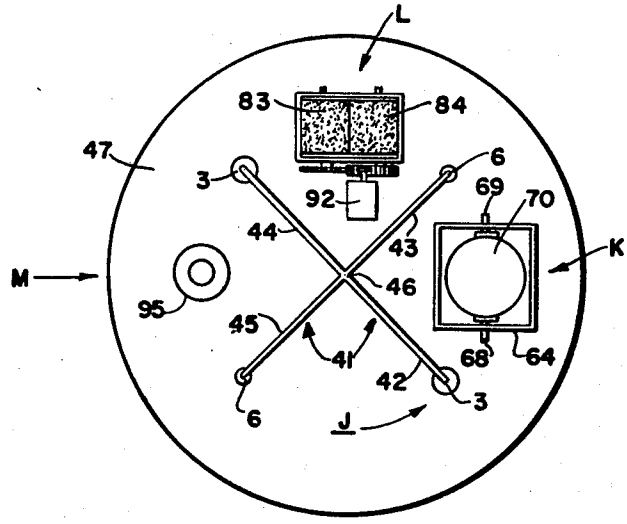
[52] **U.S. Cl.** **118/6,** 118/7, 118/50, 118/63, 118/206, 118/211, 118/230, 118/232, 118/238, 118/308, 118/316, 118/319, 118/321
[51] **Int. Cl.** **B05c 11/12**
[50] **Field of Search** 118/3, 7, 8, 63, 238, 211, 254, 244, 214, 215, 255, 258, 256, 308, 319; 117/17, 111, 94, 95, 97

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ABSTRACT: Apparatus for the in situ formation of and application to electrical insulator parts, of gaskets and pads, preferably of mica fibers, which gaskets and pads are interposed between the interfaces of the parts in their final assembled and rigidly interconnected relation. A rotor turnable about a fixed vertical axis has arms which are automatically and sequentially indexed to a plurality of fixed work stations. Each alternate one of the arms supports a first part, while each of the remaining arms supports a second part which is to be assembled with a first part. At one station means apply a coating of adhesive to the area of the part over which a gasket or pad is to be formed. At a second and subsequent station, flocking is applied to the adhesive-coated area, and at a third station excess flocking adhering to areas not coated with adhesive, is removed and collected for reuse. The flocking may be applied electrostatically to form in situ, a gasket wherein the fibers are parallel and upstanding like the bristles of a brush.



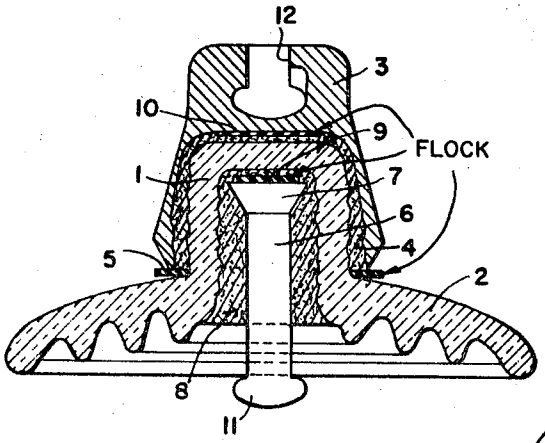


FIG. 1.

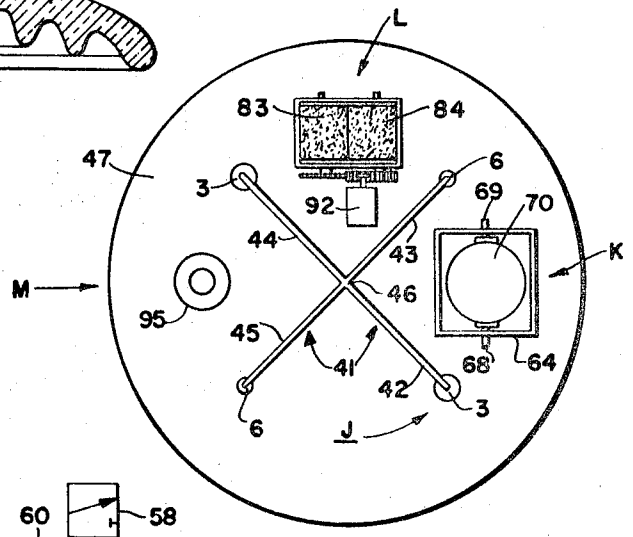


FIG. 4.

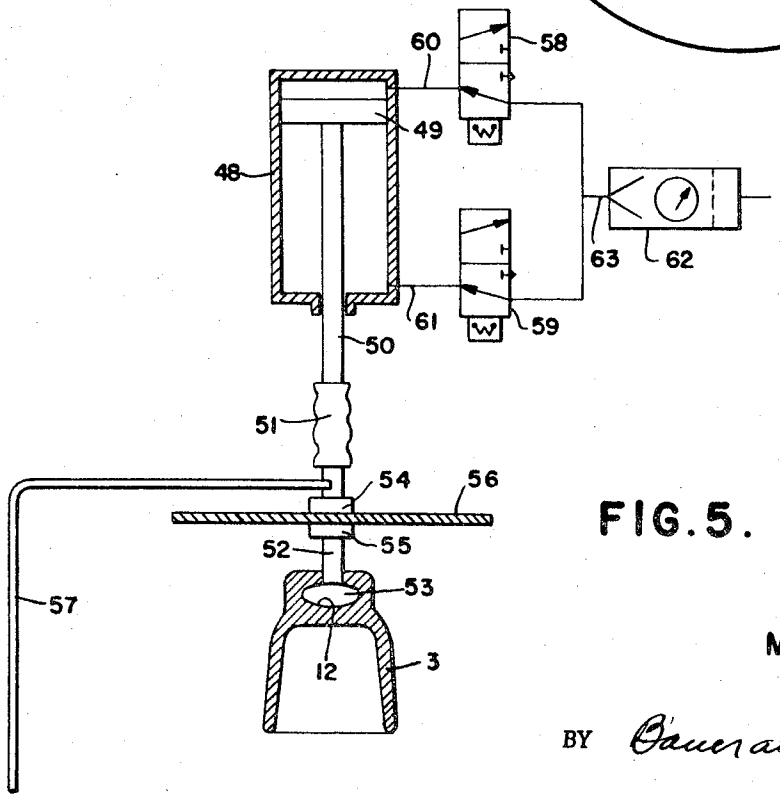


FIG. 5.

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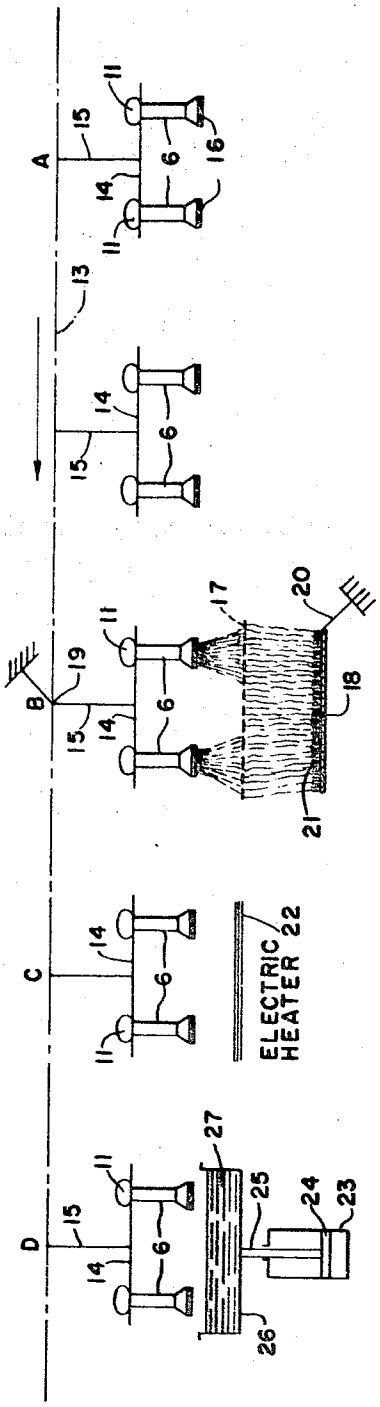


FIG. 2.

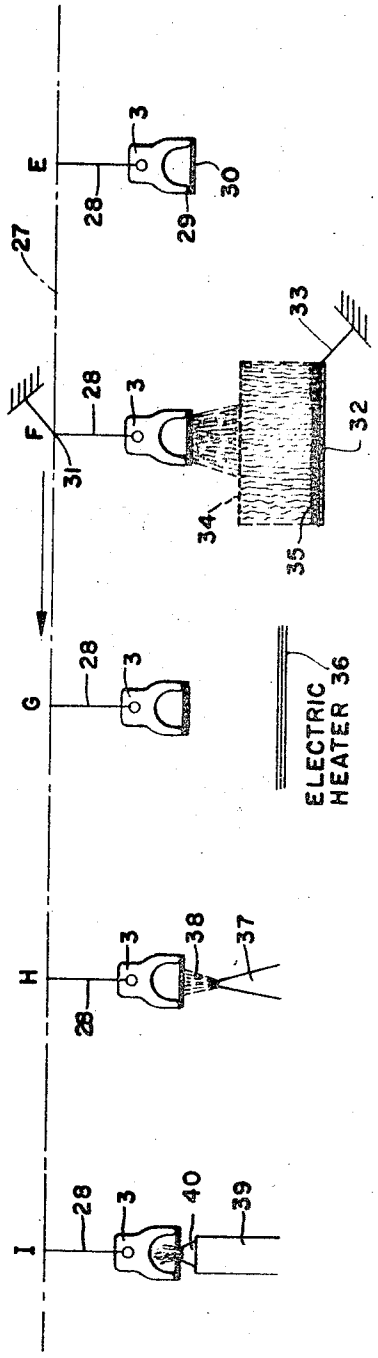


FIG. 3.

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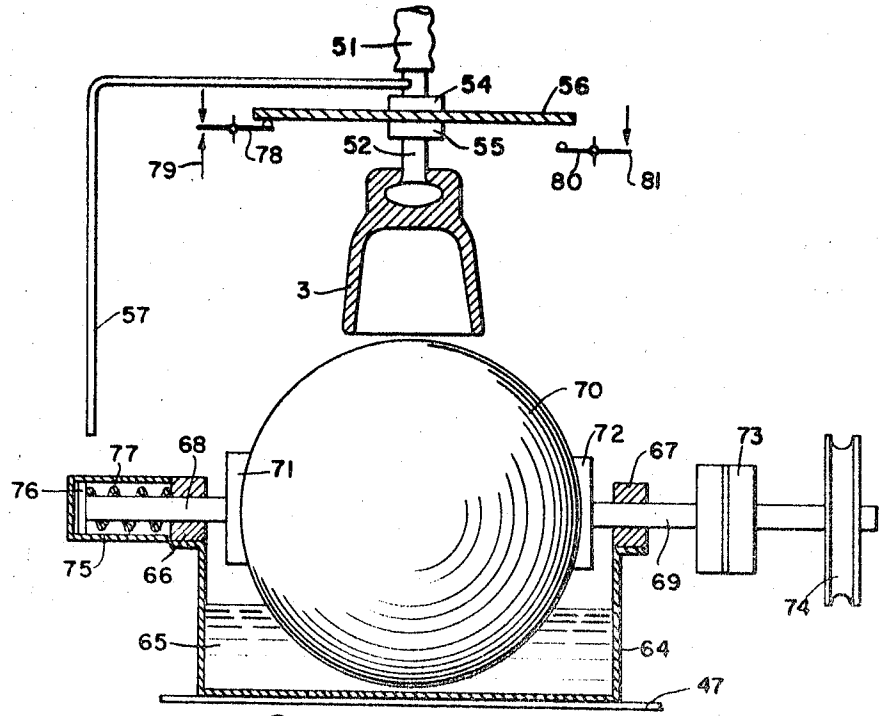


FIG. 6.

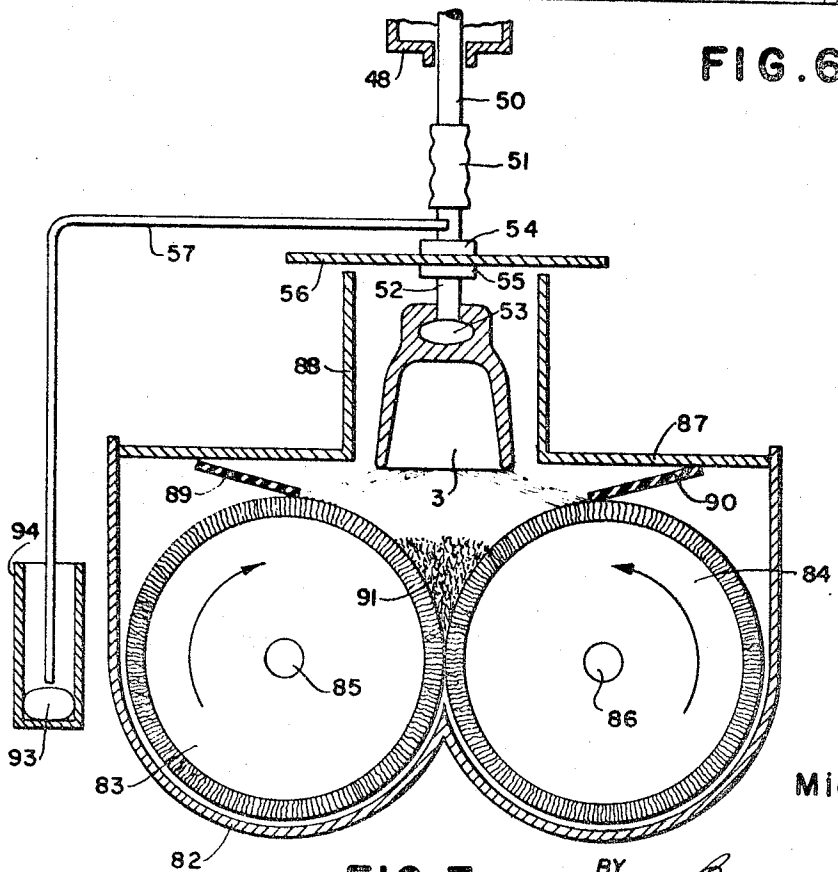


FIG. 7.

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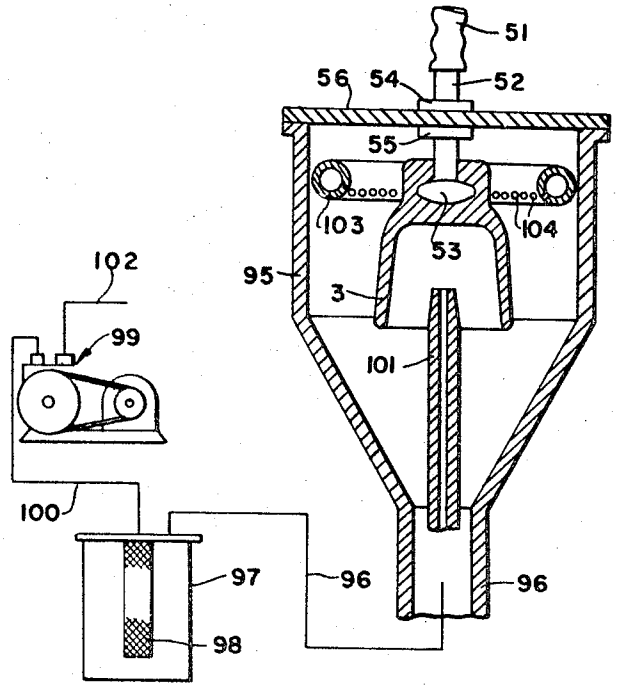


FIG. 8.

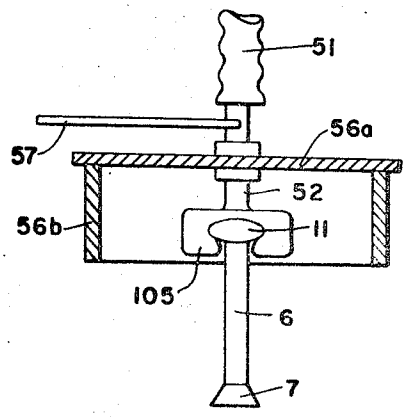


FIG. 9.

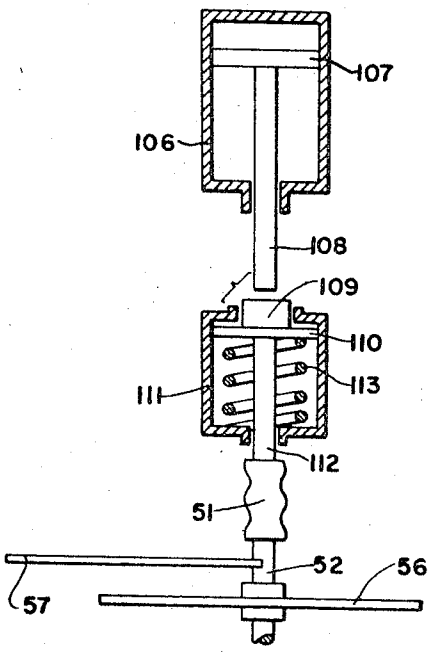


FIG. 11.

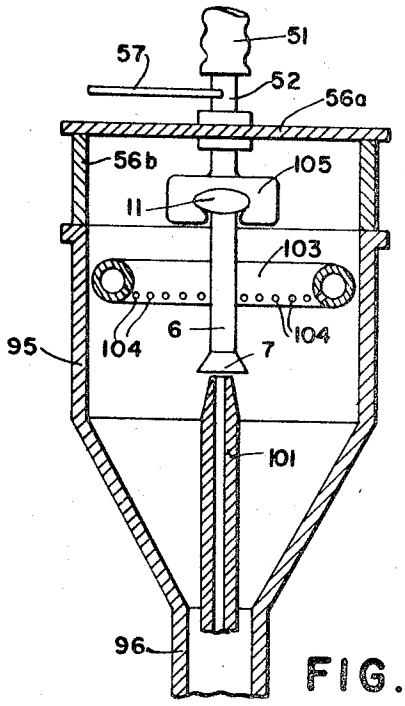


FIG. 10.

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COATING APPARATUS

This application is a division of application Ser. No. 549,203, filed May 11, 1966 and now U.S. Pat. No. 3,392,230.

The invention relates to an apparatus for the production of electrical insulators such, for example, as those used in high voltage transmission lines. Such insulators are used in chain-like series connected in end-to-end relation and suspended from towers. The upper insulator or unit is connected at the distal end of an arm fixed atop the tower, while the lower unit has the transmission cable attached thereto. The number of units connected in series may vary, for instance, in accordance with the voltage the line is designed to carry.

The insulating part of each unit is formed of a tubular shell of high resistance dielectric material such as ceramic, having one end closed and provided with an integral skirt portion flaring outwardly from its open end. A metal cap fits down loosely over and about the closed end of the shell or cylinder and is secured thereto by mortar, cement or plastic adhesive filling the interspace between them.

Experience has shown that for proper sealing or connection between the parts, the cement should be vibrated to assure proper compacting and setting thereof. This makes it desirable to avoid direct contact between the dielectric shell and the metal of the cap and stem, not only to avoid affecting the quality of the seal or connection, but also to avoid deleterious effect upon the electrical resistance of the insulating material due to mechanical or thermal shock, and for other reasons.

Prior to uniting the parts by cement, into a unitary structure, it is customary to apply gaskets or pads of cork, pressed cardboard, asbestos, or like materials, between the interface of the cap and the exterior surface of the base of the insulator cylinder, and also between the interface of the insulator cylinder and stem. It is also customary to secure a rubber ring to the rim portion of the cap, to maintain it out of direct contact with the skirt of the insulator at the location where it merges into the cylindrical portion thereof. This ring is removed after the cement has set. The pads, gaskets or rings just mentioned are usually secured in place by an adhesive, pending complete assembly of the parts into a rigid unitary structure. But while this procedure is theoretically simple and easy, it has serious drawbacks in actual practice. The centering of each gasket or pad with respect to the part to which it is to be adhesively secured, is usually done manually and by eye, so that exact collocation between the gasket and part to which it is to be attached is not practically possible. Furthermore, it frequently happens that before the adhesive has set, the gasket slips or becomes displaced from its desired central position on and with respect to its part, thus aggravating improper emplacement.

If the gasket is thus eccentrically located at the time the adhesive hardens, part of the gasket is offset over the edge of the plane surface to which it was supposed to be attached; and this induces or promotes an eccentric or noncoaxial relation between the parts and results in an improperly assembled unit. At the diametrically opposite area the interfaces are exposed and may come into direct contact and thus defeat the purpose of the gasket. It may also happen that the pad or gasket slides on the surface of the stem and becomes affixed to the side thereof with the result that the mechanical strength of the seal or joint is seriously weakened. Similar improper emplacement may also occur in the case of the gasket normally located within the base of the cap and the end surface of the insulator cylinder.

It is the chief purpose of the invention to provide an apparatus by which the aforesaid drawbacks are overcome and eliminated.

Another object is to provide an apparatus wherein the gaskets or pads are formed in situ and become fixedly and properly attached immediately after formation.

Yet another object is to provide an apparatus which assures that each gasket or pad is centered and emplaced with a high degree of accuracy.

Ancillary to the immediately foregoing object, it is a further object to provide an apparatus which, by reason of the precise, accurate and reliable location, emplacement and affixing of the gaskets, produces insulators which have maximum high electrical resistance, quality, mechanical strength, and long-lived reliability in service.

Still another object is to provide an apparatus which by reason of its possibilities of complete automation, makes possible rapid and reliable production line procedures, reduces costs per unit insulator, and results in an overall satisfactory product.

Another object is to provide an apparatus of the type identified, which is relatively simple, positive and reliable in action, which requires a minimum of attention on the part of operating personnel, which consists of parts which are removable and replaceable, and which may be serviced with relative ease and with a minimum of down time and expense.

Other objects and advantages of the invention will become clear to those skilled in the art, after a study of the following detailed description, in connection with the accompanying drawing.

In the drawing:

FIG. 1 is an axial section of the assembled and completed insulator produced by the apparatus;

FIG. 2 shows schematically the sequence of steps performed by the apparatus and by which a pad or gasket is formed upon the base surface of the stem or shaft constituting a part of the assembled insulator;

FIG. 3 shows schematically the sequence of steps by which the apparatus forms an annular gasket upon the rim of the base of the cap;

FIG. 4 is a plan view of the apparatus for carrying out the steps schematically depicted upon FIGS. 2 and 3;

FIG. 5 is an elevational view, partly in section, of the means by which each cap is supported for controlled vertical movement at the several work stations;

FIG. 6 is a view showing one cap at a work station where its rim is coated with adhesive;

FIG. 7 is an elevational view, partly in section, of means by which the flocking or fibers are applied to the adhesive-coated areas of caps and insulator elements;

FIG. 8 is a vertical axial sectional view of the mechanism by which excess fibers adhering to the uncoated areas of the item then at that station, are removed and collected for reuse;

FIG. 9 is a detail view showing how the stems are supported during treatment;

FIG. 10 is an axial sectional view of the construction by which excess fibers adhering to each stem, are blown therefrom; and

FIG. 11 is a detail view of a modification of means for processing the caps and stems prior to assembly.

Advantageously, fibers of mica, for example, are aligned and oriented by the lines of force of an electrostatic field and become affixed like the bristles of a brush, to a coating of wet varnish previously spread over the surface where the gasket or pad is to be formed, emplaced and affixed.

Referring to FIG. 1, the assembled insulator such as the apparatus is capable of producing, comprises a hollow cylinder 1 of insulating material such as glass or ceramics, having a skirt 2 formed integrally with and flaring outwardly from its lower portion. A metallic cap 3 fits down over the cylinder and is secured thereto by cement 4. An annular ring or gasket 5 is interposed between the rim of the cap and the subjacent area of skirt 2, at the location where it merges into the cylinder.

A stem 6 has an integral frustoconical enlargement 7 at its upper end. This stem is affixed by cement 8 axially within cylinder 1, and a pad or gasket 9 is interposed between the contiguous generally flat surfaces of the interior of the base of the cylinder and the base of enlargement 7. A pad or gasket 10 is interposed between the interfaces of the cap and cylinder. Stem 6 has a bulbous enlargement 11 at its lower end which is constructed, shaped and arranged to fit and to be secured within an opening 12 in the upper end of the cap of the insulator assembly next below, not shown.

FIG. 2 shows the sequence of steps forming a pad or gasket in situ, upon the plane surface of the frustoconical enlargement 7 of stem 6. A conveyor schematically identified at 13, such as an endless chain, moves from right to left as indicated by the arrow, and at regularly spaced intervals therealong, supports pairs of stems 6 which, as shown, are in inverted positions and are supported by their bulbous ends 11 at the respective ends of bars 14. Each bar is fixed to the lower end of a respective one of a plurality of rods 15 each connected at its upper end with conveyor chain 13, in uniformly spaced relation therealong. At, or just prior to arrival at station A, an adhesive coating 16, such as polyurethane, is applied to the downwardly facing surface of the frustoconical ends of the stems at that station.

As each pair of stems move into station B, they pass into an electrostatic field induced between an upper metallic screen or grill 17, and a lower parallel metal plate 18, by a generator, not shown. The connection of the grill and plate to the generator may be made by a contact 19, carried by the conveyor at each point where a rod 15 is connected therewith. A second contact 20 is attached to plate 18. If desirable or necessary, contact 19 may also be utilized to energize a time relay opening the circuit of the motor driving conveyor 13, so that the articles at stations A, B, C, etc., are stopped for a short interval of time, after which the relay operates to restart the conveyor motor. The same motor, not shown, may also drive conveyor 27, FIG. 3, subsequently described, in timed relation with conveyor 13.

Short fibers of mica, for example, indicated at 21, are fed onto plate 18 and by means not shown, uniformly distributed thereover. The distribution may be effected manually or by means of a shaker which is periodically passed over the plate and simultaneously vibrated to produce a dusting of the plate with the fibers.

The electrostatic field thus created between plate 18 and screen 17, causes the fibers to be negatively charged, for example, by the plate and to become erect and move along the lines of force toward the screen or grill. On contact with the grill the fibers lose their negative charge and become positively charged so that some of them drop back onto the plate. But as the result of the interstices in grill 13 and the velocity with which they are projected toward the grill, most of the fibers pass through an impinge upon the flat base of the stem, where they penetrate the adhesive previously applied thereto and are thereby uniformly distributed over and attached to the stem to form a gasket or pad. The remaining fibers, that is, those not thus attached, fall back upon the grill 17 and ultimately pass downwardly onto plate 18.

At station C the adhesive previously mentioned, covering the flat surface of the stems, is hardened or set by the application of heat which may be produced, for example, by an electric heater 22. The mica fibers are thus firmly attached to the surface of the stems and form thereover a gasket of uniform thickness.

At station D there is a vertically disposed cylinder 23 supplied with pressure fluid from a source not shown. The piston 24 has a rod 25 which projects upwardly through a gland in the end of the cylinder and at its top end supports a container 26 for a bath of varnish 27. As each pair of stems comes to rest over the container, a contact not shown, carried by the conveyor chain, momentarily engages a fixed contact, closes a circuit and opens an electromagnetic valve connecting cylinder 23 with a source of pressure fluid. Container 26 is thus elevated until the lower ends of the stems dip into the varnish and are thereby coated. Following this, the pair of stems just coated are transposed leftwardly with the conveyor, to a station not shown, where they are assembled into an insulator unit or combination as depicted upon FIG. 1.

FIG. 3 shows the several steps in forming and affixing a gasketlike ring or annulus of mica fibers to the base rim of cap 3. This ring replaces the rubber gasket which, as has been described, was previously affixed in prior art procedures, to the rim by adhesive.

Some of the disadvantages and drawbacks of prior art procedures have been mentioned. Another one is that this rubber gasket previously used, may slip from its desired position about the rim of the cap, and become displaced so that it is finally improperly located between the sidewall of the cap and the cylindrical wall of the insulator, where it not only fails of its intended purpose but also seriously detracts from the strength of the cement connection between the parts.

The procedures schematically depicted upon FIG. 3 are, in general, analogous to those previously described in connection with FIG. 2. The caps 3 are suspended from conveyor 27 by rods 28 which have their upper ends attached to the conveyor, and at their lower ends are provided with bulbous enlargements releasably fitting respective cavities 12 in the caps. The spacing of these rods along the conveyor is uniform and preferably the same as the spacing of rods 15 on and along conveyor 13.

On arrival at station E, or just prior thereto, the rim 29 of each cap is coated in succession with an adhesive indicated at 30. As each cap advances with movement of the conveyor, it moves to station F where a contact 31 on the conveyor, or rod 28, closes a circuit to establish an electrostatic field by means of a generator not shown, but which may be the same generator as the one producing the field between plate 18 and grill 17, FIG. 2. As in the case of station B, FIG. 2, the field extends between a metal plate 32 connected with the generator at 33, and a screen or grill 34 whose meshes are about 1 cm. on a side and which is held at a positive potential, for example, with respect to plate 32. The separation between the grill and plate may be about 15 cm. As with plate 18 previously described, plate 32 is supplied manually or automatically, with an even distribution of short fibers 35. The fibers are erected and impelled upwardly by the electrostatic field, pass through the interstices in screen 34, and impinge upon cap 3. Those fibers which strike the adhesive coating of rim 29 adhere thereto and form an incipient gasket.

As each cap with its adherent fibers arrives at station G, it passes over a heater 36 by which the adhesive is hardened to firmly affix the fibers to the rim of the cap.

At station H each cap passes over a nozzle 37 which directs a jet of air 38 upwardly into the cavity of, and over and about the cap, to thus blow away any fibers which have lodged in the cavity or on the outer walls thereof.

At station I an apparatus generally identified at adhesive which is preferably electrostatic in nature, effects a spray of varnish 40 which coats the interior of the cap.

The showing of FIGS. 2 and 3 is schematic but serves to explain the sequence of steps which the apparatus carries out. FIG. 4 shows in plan an apparatus by which the caps and stems are alternately and successively treated as and for the purpose described in connection with FIGS. 2 and 3.

A rotor element generally identified at 41, consists of four equiangularly spaced arms 42, 43, 44 and 45 extending in essentially coplanar relation from a common central vertical axis of rotation 46. Each of arms 42 and 44 removably supports a cap 3 at its distal end. Similarly, each arm 43, 45, removably supports a stem 6 at its distal end. Rotor element 41 rotates in the counterclockwise direction as indicated by the arrow, over a fixed platform or base 47. This base carries the items subsequently described. The rotor is turned in steps of 90° each, by means not shown, and which effects a pause or dwell after each rotational step.

At a work station generally identified at J, the treated cap or stem then at that station, is removed from its arm and an untreated item or element, that is, a cap or stem as the case may be, is mounted to the arm. At station K the item carried by the arm at that station, is coated with adhesive. That is to say, in the case of caps 3, the lower rim thereof is coated, while in the case of stems 6 the flat end of the frustoconical enlargement is coated. At station L, fibers are applied to the coated surface of the cap or stem there located, and at station M, excess fibers adhering to the uncoated areas of the item then at that station, are removed. It will be understood that upon FIG. 4 the arms

42, 43, etc. are shown at 45° from their normal or indexed positions, in order to avoid obscuration of details of the apparatus at the respective stations, and that in practice these arms are stopped only in positions over work stations J, K, L and M.

As will be clear from the preceding description of FIG. 4, the operation at station D, FIG. 2, wherein a coating of varnish is applied to the flock previously applied to the lower ends of stems 6, may be omitted.

FIG. 5 shows details of the means for supporting and vertically moving the caps. A pressure fluid cylinder carried for example, at the distal end of arm 42, has a piston 49 therein. A rod 50 fixed at its upper end to the piston, has an electrically insulating separator or insert 51 attached to its lower end. A support rod 52 which is the functional equivalent of rod 28, FIG. 3, forms a continuation of rod 50 and has its upper end attached to separator 51. The lower bulbous end 53 detachably secured to the lower end of rod 52, fits cavity 12 of cap 3 to detachably support the cap thereon. Rod 52 has a pair of collars 54, 55 fixed thereto for locating a disc 56 between them. The collars are adjustable on and along the rod so that a corresponding adjustment of the disc may be effected. An L-shaped contact arm 57 has one end fixed to rod 52 above collar 54. The other end is located in a plane normal to the axis of rod 52, somewhat below the level of the rim of cap 3.

Cylinder 48 is double acting. Flow of fluid such as air, to the upper end of the cylinder is controlled by an electromagnetic valve 58, through pipe 60. Likewise, flow of fluid to the lower end is controlled by electromagnetic valve 59, through pipe 61. These valves may be of a known piston-type. A controller 62 is rotated by a motor, not shown, at the desired time rate of a cycle of operation. This cycle is the time required for any one arm such as 42, to make a complete 360° rotation. The controller effects the necessary sequence of operations for each cycle and thus operates, inter alia, to close the circuit of valves 58, 59, as each arm moves into position at station K, and to maintain the circuit for a predetermined interval of time, after which it operates to open the circuit. Thus, for example, controller 62 will be rotated once for each full 360° rotation of rotor 41 and will close the circuit of valves 58, 59 four times at uniformly spaced time intervals for each rotation. Alternatively, of course, it may rotate four times for each full cycle and close the circuit of the valves once for each rotation. In both cases the circuit will be maintained for a predetermined relatively short time only. Due to piston rod 50 the effective area of the top face of the piston is greater than the corresponding area of the bottom face thereof, so that when both valves are opened the piston is forced downwardly and carries cap 3 with it.

Referring to FIG. 6, one of the caps 3 mounted upon the end of arm 42 or 44, is shown at station K, FIG. 4. A container 64 mounted on base 47 contains a bath of adhesive 65. The container supports horizontally aligned bearings at diametrically opposite locations as indicated at 66, 67. These bearings journal between them a flexible inflatable sphere 70 of rubber or the like, by means of trunnions or shafts 68, 69 whose inner ends bear cages 71, 72 secured to and supporting the sphere between them at diametrically opposite points. Shaft 69 includes an electromagnetic clutch 73. A pulley 74 is secured to the outer end of this shaft and is driven from a source of power, not shown, at a slow rate so that when clutch 73 is energized, sphere 70 is correspondingly turned. A cylinder 75 is fixed with container 64 is mounted coaxially about the outer end of shaft 68. The shaft carries an abutment 76 attached to its end, and a coil spring 77 about the shaft acts on the abutment to urge the shaft, sphere, etc. to the left as viewed upon FIG. 6, to thus urge the two halves of clutch 73 out of engagement when the latter is deenergized. Thus, with the clutch energized, sphere 70 is slowly rotated so that its surface is continuously wetted with adhesive.

A switch arm 78 pivoted between its ends, has a contact 79 in the circuit of the electromagnet of clutch 73. The arm is so positioned that when cap 3, as it is lowered by piston 49, approaches contact with sphere 70, the arm is engaged by disc 56 and the clutch is deenergized to thus stop rotation of the sphere. Then on further descent of the cap its rim contacts the sphere and acquires a coating of the adhesive. At this instant, disc 56 engages a second switch arm 80 having a contact 81 which is in circuit with the solenoid of valve 58. On deenergization, valve 58 is spring-operated to connect the top end of cylinder 48 with atmosphere so that as a result, pressure still effective through pipe 61, elevates the cap out of contact with the sphere. As soon as disc 56 moves upwardly beyond the position shown at FIG. 6, contact is closed at 79, clutch 73 is again energized and rotation of sphere 70 is resumed.

Turning to FIG. 7, there is shown mechanism at station L, FIG. 4, by which flocking or fibers are applied to the adhesive-coated areas of the cap or insulator then positioned at that station. Since cylinder 48, rod 50, separator 51, disc 56, etc. have been previously described, it is not necessary to repeat. The container for fibers 82 is shaped generally to conform to the lower halves of two contiguous cylindrical brushes 83, 84, journaled in the container on horizontal, horizontally-spaced axes 85, 86, respectively. The shafts of the brushes are geared together externally of the casing, as shown upon FIG. 4, and one of the gears is in mesh with a pinion on the shaft of motor 92. Thus, as indicated by the arrows of FIG. 7, the brushes are rotated equally and oppositely.

The container 82 includes a cover 87 secured thereto and having a central opening from which an upstanding sleeve 88 extends. The sleeve is sized to freely accommodate cap 3 as the latter descends thereinto under control of pressure fluid in cylinder 48, and is so dimensioned that when a cap 3 is properly located over and centrally between the brushes, disc 56 rests upon and seals the upper end of the sleeve. Cover 87 supports a pair of rectangular rubber sheets 89, 90. For example, sheet 89 is fixed along one edge thereof to cover 87 and is held and so dimensioned that it extends generally tangential to brush 83 at its top, and with its opposite edge in contact with the bristles of the brush. Sheet 90 is similarly and allochirally related with respect to brush 84.

Thus as the brushes rotate, their bristles are flexed oppositely to their directions of rotation as they contact the respective sheets. As the deflected bristles pass out of contact with the sheets they snap forwardly and project a steady stream of entrained fibers onto the adhesive-coated surface of the cap or stem then at the station. As indicated at 91, a supply of fibers is continuously fed into container 82 so that the brushes are maintained impregnated therewith.

It will be understood that as each arm 42, etc., bearing a cap or a stem, as the case may be, is indexed to position with its distal end over sleeve 88 at station L, a circuit is closed introducing pressure fluid into the cylinder at that station, to thus effect lowering of the element into approximately the position shown upon FIG. 7. The control mechanism for doing this includes a switch lever and contacts such as 80, 81 described in connection with FIG. 6. However, in place of contact means 78, 79, FIG. 6, a control circuit for motor 92 driving brushes 83, 84, includes a mercury globule 93 within capsule 94. This capsule is so constructed and adjustably fixed that when cap 3 is lowered to proper position with respect to the brushes, the end of contact arm 57 touches the mercury and closes a circuit to energize motor 92. The motor then rotates the brushes to spray fibers onto the adhesive-coated surface of the cap or the stem, as the case may be. A predetermined time later, coordinated with or determined by controller 62, the motor circuit is opened, as by a time relay, until valve 58 has been actuated to connect pipe 60 with exhaust and contact 57 has been elevated free of mercury 93. Contact between arm 57 and the mercury is also utilized to energize an electrostatic generator, not shown, but which acts to induce a field at the cap or stem, aligning the fibers as they adhere thereto.

FIG. 8 shows the mechanism located at station M, FIG. 4, where excess fibers adhering to the cap or stem are removed and collected for reuse. An enclosure 95 generally cylindrical

in form, has a frustoconical base continuing downwardly in an exhaust conduit **96** extending to a suction chamber **97**. This chamber contains a filter element **98** through which air is exhausted as it passes from the enclosure to a motor-driven pump **99**, through intake pipe **100**.

A nozzle **101** extends upwardly and centrally within enclosure **95** and is connected with the output pipe of pump **99**, as indicated at **102**. This output pipe is also connected with a hollow torus **103** having a circular ring of apertures **104**, and fixed within the enclosure, as shown.

As a cap **3**, for example, arrives over enclosure **95** at station M, valves **58**, **59** are actuated in the manner described in connection with FIG. **5**, to cause lowering of the cap until disc **56** rests upon the rim of the enclosure. At this point, arm **57** closes a contact starting the motor-driving pump **99**. Air is then forced through nozzle **101** blowing excess fibers from the interior of the cap. Simultaneously, air is blown through apertures **104** thus removing fibers adhering to the exterior of the cap. These excess fibers are drawn through pipe **96** and retained by filter **98** in chamber **97** where they are periodically collected for reuse in container **82**. After a predetermined time, a time-controlled relay opens the circuit of the pump motor and as valve **58** is deenergized to open cylinder **48** to exhaust, the cap is elevated out of the enclosure and the rotor is indexed one step until the cap arrives at station J where it is removed and transferred to a drier or oven for hardening of the adhesive, and another cap is mounted on the arm for treatment. It will be understood that all time functions may be under the control of controller **62**, FIG. **5**, so that all times of operation such as rotation of brushes **83**, **84**, and operation of pump **99** are properly correlated.

It has been previously explained that, referring to FIG. **4**, arms **42** and **44** support caps **3** at their distal ends while alternate arms **43**, **45** support stems **6**. FIG. **9** shows the construction at the distal end of each or arms **44**, **45**, FIG. **4**. Since insulating separator **51**, rod **52** and contact arm **57** may be duplicates of those described in connection with FIG. **5**, they have been identified by the same reference numerals. However, instead of the bulbous enlargement **53**, rod **52** carries a socketed element **105** detachably secured to its lower end to receive and detachably support the bulbous end **11** of stem **6**. Also disc **56***a* has a cylindrical skirt **56***b* depending therefrom coaxially with support rod **52**, for a purpose subsequently explained. Thus as each arm **43** or **45** is indexed into station J, FIG. **4**, a treated stem is removed from its socket, for transfer to a drying means, and an untreated stem is mounted as shown, FIG. **9**.

As each stem is indexed into station K and lowered by the timed introduction or air under pressure into its cylinder **48**, its lower end contacts sphere **70** which, in the manner previously explained, is now motionless, and receives a coating of adhesive. At station L the brushes **83**, **84** dust the adhesive-coated surface with fibers **91**, and at station M the excess fibers adhering to the stem are removed and recovered, as previously explained in connection with FIG. **8**.

Referring to FIG. **10**, one stem **6** is shown at station M. Skirt **56***b* of disc **56***a* is for the purpose of compensating for the greater overall vertical dimension of the stems, and has a width such that when its lower rim contacts the rim of enclosure **95**, it makes a dusttight seal therewith and the adhesively-coated surface of the end **7** of stem **6**, lines just above nozzle **101**. Thus, in the manner previously described in connection with FIG. **8**, when the parts are in the position shown upon FIG. **10**, air jets from nozzle **101** and apertures **104**, blow away excess fibers adhering to the surfaces not coated with adhesive. These fibers are drawn into chamber **97** and collected for reuse.

FIG. **11** shows a modification wherein the pressure fluid cylinders are stationary, one at each of the stations K, L and M, and thus do not rotate as a unit with rotor **41**. The fluid pressure cylinder **106** is one of three. Piston **107** therein has a rod **108** which terminates at its lower end in alignment with a tappet **109** fixed with a plunger **110** slidably fitting a cylinder or guide **111**. A rod **112** corresponding in function with rod **50**, FIG. **5**, has one of the electrically insulating separators **51** secured to its lower end and which, in turn, carries a rod **52** and disc **56** as described in connection with FIG. **5**. Likewise a contact arm **57** may be a duplicate of the one shown at FIG. **5**.

A compression coil spring **113** within cylinder **111** abuts at its upper end against plunger **110** and at its lower end against the base of the cylinder, and thus acts to urge rod **112** and parts attached thereto, into the position shown. There will be one of these assemblies of cylinder **111**, rods **112**, **52**, etc., secured to the end of each of arms **42**, **43**, **44** and **45**. The indexing mechanism which determines the four 90° positions of rotor **41**, is so adjusted that when any arm is in its indexed position at one of the stations K, L or M, its tappet **109** is aligned with the rod **108** at that station and slightly spaced therebelow. When controller **62**, FIG. **5**, energizes valves **58**, **59** to admit air under pressure to cylinder **106**, rod **108** is thereby forced downwardly against the urge of spring **113**, to correspondingly move rod **52**, disc **56**, as and for the purpose previously described. Since each of these three cylinders is fixed, the construction shown upon FIG. **11** does not require any slip-joint or rotary couplings in the air pressure lines.

While I have disclosed the preferred form of the apparatus comprising the invention, numerous changes, substitutions of equivalents, parts and materials, and modifications, will readily occur to those skilled in the art, after a study of the foregoing description. Hence the disclosure should be taken in an illustrative rather than a limiting sense. All changes and modifications within the scope of the subjoined claims, are reserved.

I claim:

1. Apparatus for forming gaskets in situ upon the downwardly facing surfaces only, of a cap element and a stem element prior to assembly of said elements into a unitary electrical insulator, a generally horizontal base, a rotor journaled on said base for rotation on a vertical axis, and for vertical translation along said axis from an elevated position, to a lowered position therealong, said rotor comprising a plurality of arms radiating from said axis in equiangularly disposed relation, for rotation over said base, the improvement comprising, means carried by the distal end of each alternate one of said arms, for supporting a cap element with downwardly facing surface to be coated, means carried by the distal end of each of the remaining ones of said arms for supporting a stem element with a flat end thereof to be coated facing downwardly, means connected with said rotor to periodically index each arm in sequence over first, second, third and fourth work stations sequentially and uniformly angularly spaced about said axis, and for translating said rotor and arms when in indexed position, vertically from said first to said second positions, first means at said first station to apply a coating of adhesive to the downwardly facing surface of the element indexed thereover, second means at said second station to apply a coating of flock to said adhesive-coated surface of the element indexed from said first station, and third means at said third station to remove excess flock adhering to uncoated areas of the element indexed from said second station, completed elements being removed from, and an unfinished element being attached to each arm indexed to said fourth station, application of adhesive, application of flock, and removal of excess flock, as aforesaid, being effected only by and in response to translation of said rotor from its said elevated to its said lowered position.

2. The apparatus of claim **1**, said first means comprising a first container for adhesive, an inflatable sphere of resilient material, means journaling and rotating said sphere within said container about an essentially horizontal diameter thereof, and means responsive to indexing of each arm, in sequence, into said first position, to translate said rotor from said elevated to said lowered position and thereby move the element carried thereby into contact with said sphere.

3. The apparatus of claim **2**, a motor connected with said sphere to rotate the same about said diameter thereof, a normally closed circuit energizing said motor and including

switch means opened by and in response to approach of the element at said first station toward said sphere, to open said circuit.

4. The apparatus of claim 1, said second means comprising a second container for flock, first and second cylindrical brushes, means journaling said brushes in said second container for rotation on spaced parallel axes, means connected with said brushes for rotating the same oppositely, and means engaging and deflecting the bristles of said brushes as they approach an element indexed at said second station, to effect a spray of flock onto and over the element thereat.

5. The apparatus of claim 1, said first-named means comprising a plurality of fluid pressure-operated means each carried by a respective one of said arms for rotation as a unit therewith, each said fluid pressure-operated means including a holder vertically movable by and in response to introduction of fluid under pressure thereinto, each holder carried by each said alternate arm having a bulbous depending end releasably fitting in a cap element, each holder carried by the remaining arms having a depending recessed end to receive and removably hold a bulbous end of a stem.

6. The apparatus of claim 5, each said fluid pressure-operated means comprising a vertically disposed fluid pressure cylinder, piston and rod, each said holder being detachably secured to the projecting end of a respective one of said rods.

7. The apparatus of claim 6, a plurality of containers each fixed at a respective one of said first, second and third work stations and enclosing a respective one of said first, second and third means, and a plurality of covers each fixed with a respective one of said rods and positioned thereon to fit down over the container over which it is indexed, by and in response to downward movement of its rod, controller means operated in timed relation with rotation of said rotor, and valve means operated by said controller to introduce fluid under pressure into each said cylinder substantially simultaneously with indexing of said arms into said stations, as aforesaid.

8. The apparatus of claim 1, first, second and third fluid pressure-operated means each fixed at a respective one of said work stations, each said fluid pressure-operated means including a member vertically reciprocable over the arm indexed at its station, said first-named means including a vertically reciprocable rod, each said rod having its upper end below and spaced from a corresponding one of said members when said rotor is in indexed position, a controller operated in timed relation with said rotor, and valve means operated by said controller to substantially simultaneously introduce fluid under pressure into all said fluid pressure-operated means, by and in response to movement of said rotor into indexed positions, thereby moving said members and rods downwardly, and first, second and third containers at said respective stations, each enclosing a respective one of said first, second and third means, and positioned to receive the elements carried by the arms indexed at the respective stations when moved downwardly in response to introduction of pressure fluid into said fluid pressure-operated means.

9. The apparatus of claim 8, and means yieldingly urging each said rod into a limiting upward position.

10. In an apparatus for the production of electrical insulators of the type described, a container for adhesive, a hollow resilient part mounted in said container for rotation about an axis of symmetry thereof, power driven means connected with said hollow resilient part to rotate the same about said axis, means operable to move an element of an insulator over said part, means energized in response to indexing of the element over said part, to lower said element into contact with said part, and means responsive to lowering of said element adjacent to said part to render said power driven means ineffective.

11. The apparatus of claim 10, said power driven means including a clutch, said last-named means operating to open said clutch.