

Nov. 30, 1965

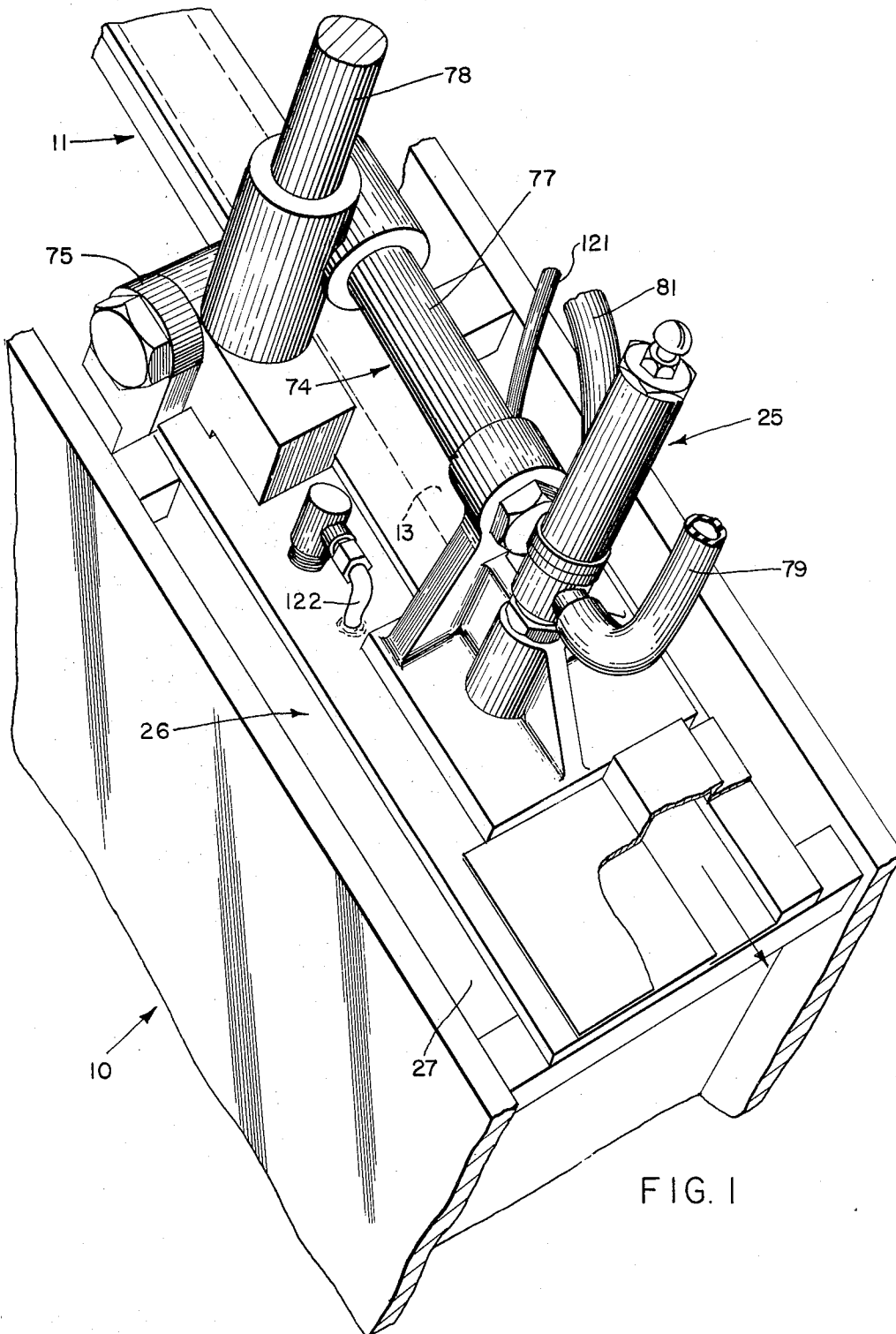
W. I. ALHOLM

3,220,381

CONTAINER CLOSURE LINING MACHINE

Filed Nov. 9, 1962

4 Sheets-Sheet 1



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4 Sheets-Sheet 2

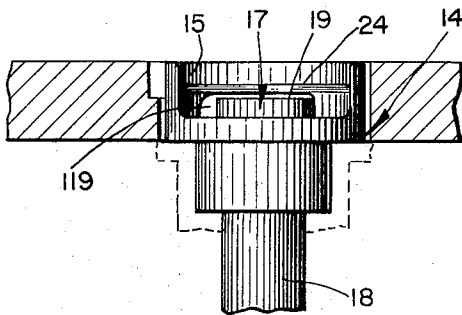


FIG. 2

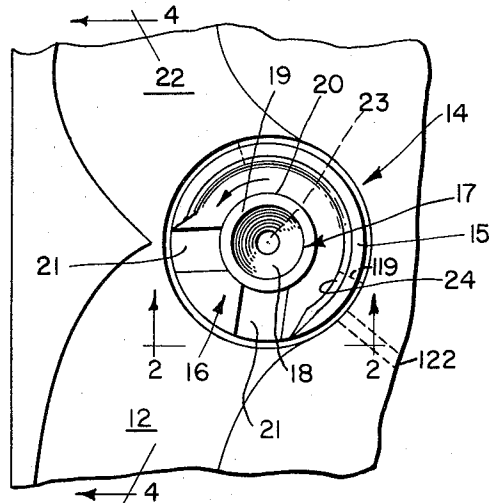


FIG. 3

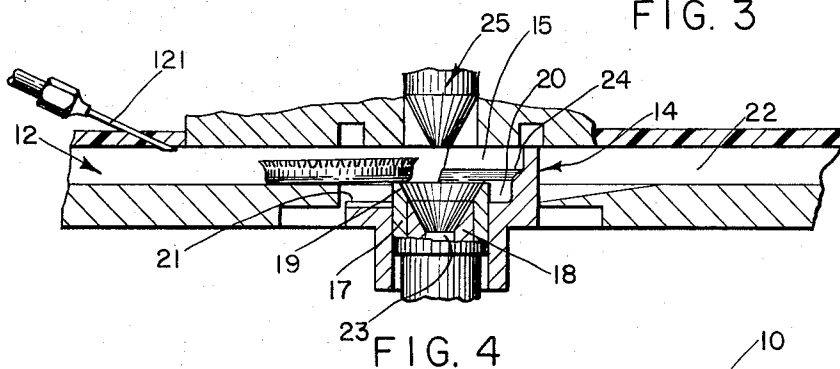


FIG. 4

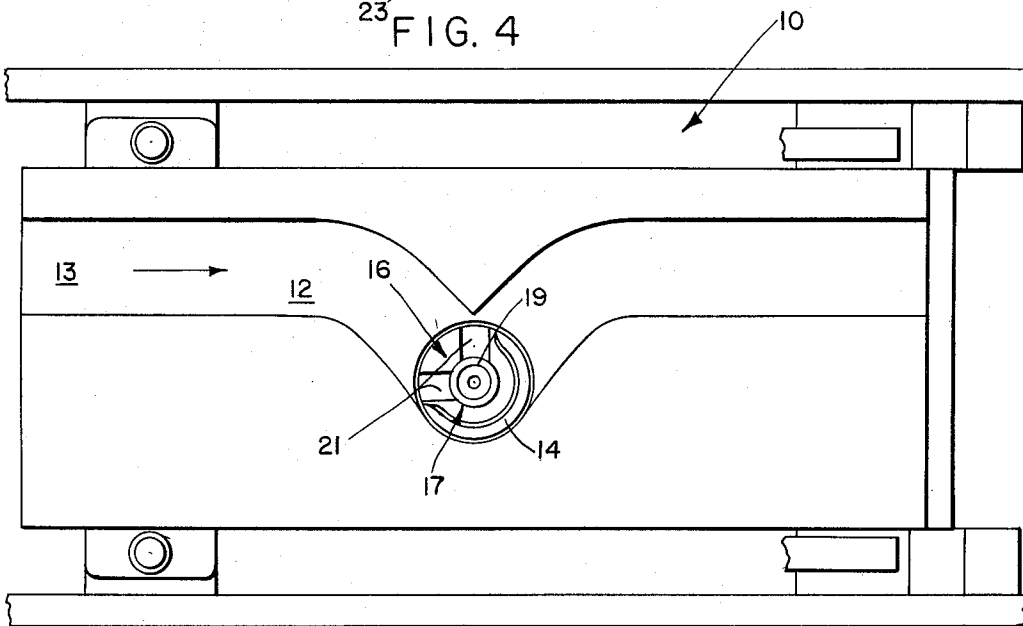


FIG. 5

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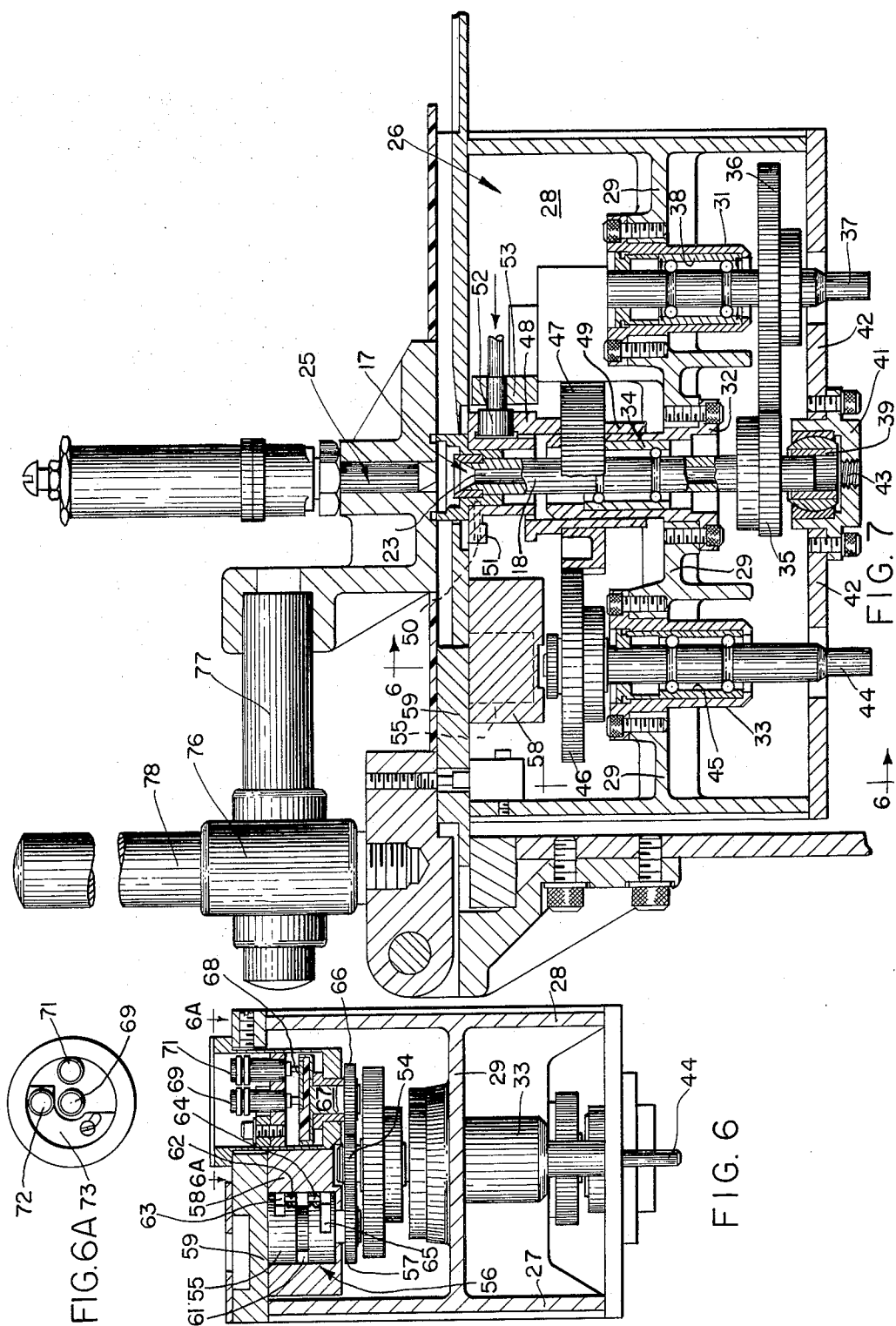
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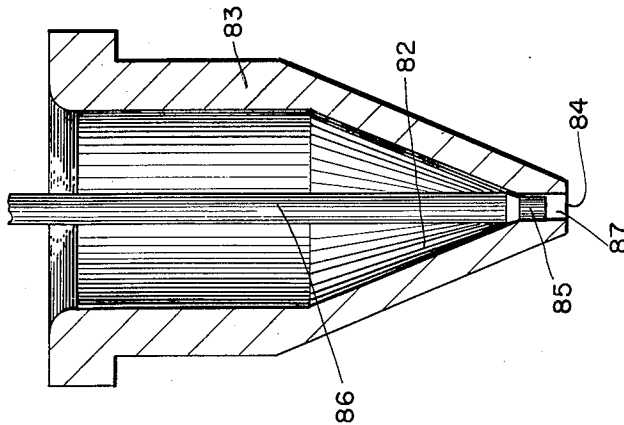


FIG. 9

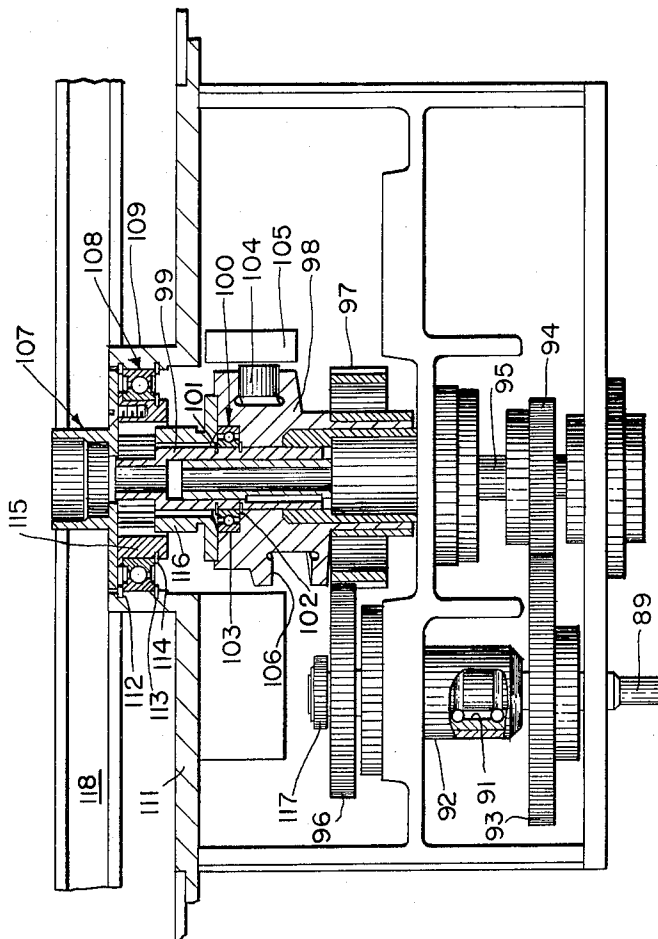


FIG. 8

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CONTAINER CLOSURE LINING MACHINE

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This invention is concerned with a container closure lining machine capable of depositing either annular or over-all linings on closures which are formed with a skirt or curl.

In the container closure art, the gasket which is interposed between the mating parts of the container and which permits the container to be hermetically sealed, is known as the "lining." In the majority of closures, the gasket is formed from a liquid or flowable composition which, in the lining operation, flows through a small nozzle onto the closure. Subsequently, the closure is heated to convert the liquid compound into a solid substance either by drying if the suspending medium in the compound is water or solvent or by "fluxing" if the sealing compound is a plastisol.

Lining machines form two types of linings—over-all and annular. The over-all lining appears most commonly in bottle crowns. In such closures, the lining, considered by itself, is a disc with thickened margins which covers all parts of the interior surface of the crown except its fluted skirt. The lining is formed by placing the charge of lining compound, metered by the nozzle, on the center of the crown and then spinning the crown so rapidly that the compound spreads across the entire interior surface and banks against the crown's skirt.

Annular linings are universally used for jar and can closures and also in the valved closure for aerosol bombs. The ring of compound which seals the joint between the container body and the closure is formed by placing the nozzle closely above the sealing periphery of the closure. Then as the nozzle discharges its compound and the unlined closure revolves, a band or annulus of compound, which covers only the mating area of the closure with the body, is formed.

Obviously, annular lining requires exact synchronization of the opening and closing of the nozzle with the radial position of the closure as that which obtained when the nozzle opened. Otherwise either a gap or an overlap will appear in the lining.

In over-all lining there is no requirement for synchronizing the opening and closing of the nozzle with the radial position of the closure. The time that the nozzle remains open merely determines how much compound will be applied to the crown. An additional distinction is that, compared to annular lining, the chuck speed is very high. For the common bottle crown, speeds of from 3000 to 6600 r.p.m. are used, because the compound must be flung outwards uniformly from the central point on which it was placed.

But, whether over-all or annular linings are to be formed, the feed and chuck loading and unloading mechanisms are of the same type in both machines. These mechanisms may be of one of two types—first, the "slide," a reciprocating plate equipped with "knives" which "cuts" the lowermost of a vertical stack of closures from the stack and pushes that closure on to the chuck—removing the previously lined closure in the same stroke. The second is the rotary index feed where the closure, received from the in-feed chute and fitted between the projecting fingers of a star wheel, is intermittently but progressively swept into the lining station.

Although these machines are accurate and dependable, they are bulky and heavy for it has been found to be necessary to make the base and the supporting parts quite

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heavy in order to withstand the stress of the rapid acceleration and deceleration forces which the slide or indexing mechanisms experience.

The objects of the present invention are: to produce a lining machine which is much lighter and far more compact than previously has been possible; to avoid the use of reciprocating slides or stop and go motions; to produce a machine unit which may be readily ganged with similar units to form a multiple head lining machine having very high output but low floor-space requirements; and to produce a machine which will operate with minimum difficulty from jams and hang-ups.

Inasmuch as the closure-moving parts of the machines which are the subject of this invention are or may be the same and the principle of their operation whether over-all or annular linings are to be produced is identical, these parts of the machine will be described first without a specific reference to the mechanical means by which they are driven. The drive mechanisms for each of the two types, annular and over-all, will be described in two later sections.

Instead of a slide or an indexing head, loading and unloading closures on the rotary chuck is accomplished by a single cup-shaped escapement or closure pocket working in combination with an air-flow pattern which, at the moment of loading, lifts the closure out of mechanical contact with the fixed elements of the machine. Timed jets of air which swiftly accelerate the movement of the closure at the moments of loading and unloading also contribute to the successful operation of the device.

In the attached drawings:

FIGURE 1 is a perspective view of the machine.

FIGURES 2, 3, and 4 are designed to show the relationships only of the escapement pocket, vacuum chuck, in-feed and out-feed channels, and air flow pattern at the moment of loading.

FIGURE 2 is an elevation on the line 2—2 of FIGURE 3.

FIGURE 3 is a top plan view.

FIGURE 4 is a vertical section on the line 4—4 of FIGURE 3.

FIGURE 5 is a top plan view of the work surface of the machine.

FIGURE 6 is an elevation of a partial section on the line 6—6 of FIGURE 7.

FIGURE 6A is a plan view of the electrical contacts shown in elevation of FIGURE 6.

FIGURE 7 is a section through the gear box of the over-all machine.

FIGURE 8 is a section through the gear box of the annular machine.

FIGURE 9 is a vertical section of the nozzle tip and valve needle.

The machine, 10, is inclined at an acute angle and receives closures from an inclined in-feed chute from a closure feeding device, not part of this invention. The chute, 11, terminates in an open-faced channels, 12, (FIGURE 5). In the over-all machine this channel is cut in the top surface of the gear case cover plate. In the annular machine it is cut in a separate plate which is mounted above the gear case cover. Both the depth and the width of channel, 12, are determined by the dimensions of the closure. They equal, plus the necessary clearance, the height and the diameter of the closure itself. After a short, straight entering section, 13, the channel curves through an angle of 45° and is interrupted by a rotary pocket, 14, shown in section in FIGURE 5. Preferably, the center lines of the entrance and the exit channels form an angle of 90°—the apex of the angle lying on the common rotational axis of the pocket and the chuck. Pocket, 14, is a short, hollow, internally shouldered, cylindrical element having a sufficient portion of its cylindrical wall, 15, cut away to form a gate,

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16, through which the closures may enter. A vacuum chuck, 17, projects through a central aperture in the floor, 20, of pocket, 14. Like pocket, 14, chuck, 17, rotates continuously. Its hollow spindle, 18, is connected to a vacuum source through an appropriate end bearing. The nature of the actual source is unimportant provided it has sufficient air-moving capacity.

As the figure shows, the rim, 19, of chuck, 17, lies above floor, 20. The amount of elevation is variable depending on the specific shape of the closure—but in the two machines which will be described in this specification one, a lining machine for bottle crowns—the over-all type) and two, a lining machine for aerosol bomb closures (the annular type), the elevation of the chuck rim, 19, above the floor, 20, of the pocket at the moment of loading is from .015 to .030 inch for bottle crowns to no elevation for aerosol bomb closures.

Additionally, a groove, 21, or two grooves, 21—21, as shown in FIGURE 3 are formed in the floor, 20, within the confines of the gate, 16. For the closures named, the groove may be $\frac{5}{16}$ inch wide by $\frac{1}{32}$ inch deep.

The out-feed channel, 22, is essentially symmetrical with in-feed channel, 12. It, too, may be cut in the cover plate and so placed that its center line as it approaches pocket, 14, forms an angle of 90° with the center line of in-feed channel, 12.

Either the pocket, 14, or the chuck, 17, is arranged to reciprocate with respect to the other element. Assuming a fixed chuck and a reciprocating pocket, the operation is as follows: as pocket, 14, now in a raised position with the grooved portion of its floor, 20, level with the floor of in-feed channel, 12, turns to present its gate, 16, to the in-feed channel, the rush of air pouring into the bore, 23, of the vacuum chuck, 17, concentrates in large measure in the grooves, 21—21. However, the intruding air dams up against the projecting chuck spindle, 18, forming a layer of relatively static air. The high velocity air humps up over this relatively static air mass and, at the instant of loading, is of sufficient volume and velocity to float the closure free of contact with the floor of the channel, 12, as well as the floor, 20, of the pocket. At this instant also a timed, relatively high pressure jet of air directed at the interior upstanding wall of the closure shoots the floating closure out of channel, 12, through the gate, 16, and into pocket, 14.

There, with its forward motion arrested by the pocket wall, the closure is directly centered above the chuck. Immediately thereafter, a cam drops the pocket far enough to allow the closure to be seated positively on the chuck and held there by atmospheric pressure. As it seats, the closure begins to revolve and compound is ejected on to it from the nozzle, 25, and flung outwards to form the over-all lining which has been described.

In over-lining, the rotational speed of the pocket is far less than that of the chuck. In the bottle crown lining machine described in this specification, the pocket speed, which is also the machine out-put speed, is 300 r.p.m. The chuck speed is a variable, depending upon the rheology of the specific lining compound, but usually lies between 4500 and 9000 r.p.m.

As the pocket turns to face the out-feed channel, 22, it rises, carrying the closure with it. The closure is shot out of the pocket and into the out-feed channel, 22, by the combined action of the rotary motion of the closure contacting the shoulder 24 and a timed jet of high-pressure air, the former being predominant action. The pocket then continues its revolution and receives the succeeding closure as it turns to face the in-feed channel, 12.

The action of breaking the vacuum and releasing the closure from the chuck is the same whether the pocket rises and falls to seat and unseat the closure or whether the chuck rises and falls and the pocket remains at a fixed elevation. In the case of annular linings where the radial position of the chuck and the pocket must be definitely correlated, it has been found more convenient to move the

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chuck. The two types of drives adapted to secure over-all and annular linings will be described in separate sections.

THE OVER-ALL LINING MACHINE

(a) The vacuum chuck and drive gearing

In this machine, the chuck and the pocket are driven from two independent power sources, both, preferably, variable speed motors. The gear case, 26, which houses the gear trains, the cam, and the timing mechanism, is an H-shaped casting having side walls, 27 and 28, and an integral web, 29. Web, 29, supports three bearing housings, 31, 32, and 33. The high-speed vacuum spindle, 18, is a tube supported by a radial bearing, 34, in bearing housing, 32, and is turned by gear, 35, which is keyed to spindle, 18. Gear, 35, meshes with gear, 36, which is keyed to the stub shaft, 37. Shaft, 37, in turn is supported by radial bearing, 38, inserted in bearing housing, 31.

The bottom end of the vacuum spindle, 18, terminates in a sleeve bearing, 39, set into bearing housing 41. Housing, 41, is fitted through the plate, 42, which forms the floor of the gear case. Port, 43, in housing, 41, is connected to the vacuum source. The top portion of the spindle, 18, terminates in the vacuum chuck, 17. Shaft, 37, is operatively connected to a variable drive motor (not shown).

(f) The pocket and its gear train

The motions of the pocket and the timing mechanisms of the device are driven by a train which derives its power through shaft, 44, driven by the second motor not shown. Shaft, 44 is supported by a radial bearing, 45, set in housing, 33. Gear, 46, is keyed to the upper end of shaft, and meshes with the cam gear, 47. This gear surrounds and is fastened to the cylindrical cam, 48, which rotates and reciprocates on a guide bearing, 49, turned on the upward projecting portion of the bearing housing, 32. A cam track, 51, is cut circumferentially around cam, 48. Cam follower, 52, supported by a bracket, 53, which projects from the side-wall, 28, of the gear case, 26, rides in the cam track, 51. Consequently, as cam 48 revolves it is raised and lowered, sliding vertically on as well as revolving about the guide bearing, 49. Pocket, 14, is fitted into a recess formed at the top face of cam, 48, and is secured by the screw, 50.

A small gear, 54, fastened on the upper end of shaft, 44, turns the rotary member, spool, 55, of the air jet control and timing valve, 56, by meshing with gear, 57. Its valve housing, 58, attached to the top plate, 59, contains air passages which conduct air to slots cut in the spool as follows: slot, 61, cut circumferentially around spool, 55, receives air under pressure. A vertical slot, 62, in spool, 55, leads air from slot, 61, to a short slot, 63, which extends circumferentially around spool, 55, a distance which allows air to flow through the slots and into the in-feed jet conduit, 121, while the spool turns from zero to approximately 45° . A longer slot, 65, cut in spool, 55, receives air from slot, 61, through vertical slot, 64, and allows air to flow into the out-feed accelerating jet conduit, 122, while the spool turns from approximately 45° to approximately 135° .

The electrical timer for the nozzle valve is also driven by gear, 54, on shaft, 44, through its gear, 66. This timer can be one of several rotary electrical timing devices, i.e., comparable in structure to an automotive ignition timer, but in this case is a disc surmounting shaft, 67, having an inserted current-carrying segment, 68. Current is conducted to the segment through a fixed, centrally located brush, 69. Brush, 71, energizes the on-coil. The on- and off-contacts are timed relative to each other by the third brush, 72, which is mounted on a movable sector, 73.

NOZZLE ASSEMBLY

Lining compound is applied to the closure through

an electropneumatic nozzle, 25, which is supported above the pocket by a hinged bridge generally indicated at 74, which can be swung upwards for pocket and chuck cleaning. Bridge, 74, is hinged on brackets, 75—75, which project beyond the entrance-end wall of the gear case, 26.

The in-feed and out-feed closure accelerating air jets are small bore passages which are drilled in the bridge. The in-feed bore, 121, is directed to project a needle-like blast along the center line of the in-feed passage angled to hit the forward interior wall of the closure skirt. The out-feed jet, 122, projects air through the slot, 119, in the vertical wall of the pocket, 14, and so pushes against the rear exterior wall of the closure. Flexible tubes connect the jets to the rotary air valve, 56.

The position of the nozzle, 25, may be adjusted by sliding the holding clamp, 76, on the support rods, 77 and 78. Hose conduits, 79 and 81, only the ends of which are shown in the drawing, connect the nozzle to an external pressurized source of compound and to the compressed air supply.

When using the usual conical needle valve located in the tip of the nozzle which is used in conventional lining machines, a hair-like "pig-tail" may occasionally be flung across the flutes of a crown closure, dependent on the fluidity of the sealing compound. This difficulty can be overcome by forming the valve seat, 82, in the nozzle tip, 83, about $\frac{3}{32}$ of an inch behind the tip opening, 84, and providing a pilot, 85, extending beyond the conical portion of the needle, 86, which fills the tip bore, 87, but lifts free of the bore when the needle is lifted (see FIGURE 9). A full diameter flow and not the wispy flow which characterizes an opening needle valve starts immediately when the pilot, 85, lifts above the bore, 87. This flow stops as soon as the pilot re-enters the bore as the valve closes.

The pneumatic needle operator located immediately above the tip is conventional, for example, see Patent 2,983,400, and will not be further described. The electropneumatic spool valve which controls the operator is any of several well known commercial valves.

ANNULAR LINING MACHINE

In the machine which is adapted for annular lining, only one power source is used. The power shaft, 89, which is operatively connected to a variable speed motor, is supported by a double row radial bearing, 91, in bearing housing, 92. Gear, 93, mounted on shaft, 89, meshes with gear, 94, which is fastened to the vacuum spindle, 95. Gear, 96, meshes with gear, 97, which has a double-face width and is keyed to the cylindrical cam, 98. Vacuum chuck, 99, fits over and is keyed to vacuum spindle, 95, and supports the inner race of radial bearing, 100, which is held in position by the snap rings, 101 and 102. The outer race of bearing, 100, is fitted into the bearing seat, 103, provided in the top face of the cam, 98. Cam roller, 104, which projects from the bracket, 105, attached to the gear case wall rides in the cam slot, 106. The pocket, 107, is supported on a radial bearing, 108, held in position on an upward extension, 109, formed in the gear case cover, 111, by the snap rings, 112 and 113. Its inner race is supported by the snap ring, 114, and is fitted about spline ring, 115. Splined extension member, 116, held on the top of the cam, 98, by screws, fits into the splined ring. The rotary air valve and electrical timer are driven by gear, 117, on shaft, 89. They are identical with the units which previously have been described. The ratio of turns of the chuck to turns of the pocket is determined by the gears, 93 and 94, which may be changed as desired. In this machine a two to one ratio is shown; but the gear ratios are one to one or simple multiples. The in-feed and out-feed channels are formed in a separate plate, 118, mounted above the gear case cover.

In operation, as gear, 96, turns the cam, 98, through double-faced gear, 97, the cam rises and falls carrying with it vacuum chuck, 99. In the case of the present machine (a lining machine for aerosol bomb closures), the total vertical motion of the chuck is $\frac{1}{2}$ inch. The nest maintains a fixed horizontal position but is rotated by torque transmitted to the internally splined ring, 115, from the externally splined extension, 116.

By this arrangement, the radial position of the pocket, 107, and the vacuum chuck, 99, can be pre-determined and fixed. And, since the air valve and the electrical nozzle timer are driven by the main power shaft, 89, the sequence of operations performed by this machine can be operatively synchronized.

The machine runs without significant vibration. It is accurate and dependable and is notably free from jams and hang-ups which are caused by occasional burrs and wire edges catching on the moving parts of mechanically actuated chuck feeds.

I claim:

1. A container closure lining machine having a rotating escapement pocket provided with an upstanding wall and a floor, a gate formed in the said upstanding wall, an infeed channel adapted to guide closures into the pocket, an exit channel adapted to receive lined closures from the pocket, means, including vacuum chuck, having an axial air passage and an annular rim arranged to rotate coaxially within the pocket and adapted to engage a closure on said rim and to rotate said closure within the pocket, means to connect the axial passage to an air displacement device, means, including a nozzle operatively associated with timing means controlled by the radial position of the pocket to place lining compound on such rotating closures, means providing a relative axial movement between the chuck and the pocket and operative at the moment when the said pocket has turned to present its said gate opposite said exit channel to break the vacuum and release a closure from said pocket and power means to drive the machine.

2. A machine according to claim 1 wherein two separate power sources are provided, the first of such power sources being operatively connected to the chuck, and the second power source being operatively connected to the pocket, whereby the said chuck and the said pocket may be rotated at different and independent rotational speeds.

3. A container closure lining machine including an in-feed channel leading to and an exit channel leading away from a lining station, rotary means at said station including a vacuum chuck to rotate closures, escapement means forming a rotary pocket surrounding and concentric with said chuck adapted to receive closures successively from the channel and to release closures into the exit section, one of said means being linearly reciprocatable, closure accelerating means including an air jet operating in time relation to the radial position of the pocket to accelerate closures into the pocket, lining means including an electropneumatic nozzle mounted above the lining station to eject lining compound on to such rotating closures, means to time the discharge of the nozzle, a second closure accelerating means including an air jet operative at the exit radial position of the pocket to accelerate lined closures into the exit channel, and power means to drive the chuck and the pocket.

4. A machine according to claim 1 having a chuck-rotating gear-train and an elevating cam so arranged that, at the moment of closure loading, the rim of the vacuum chuck is elevated above the floor of the pocket, and wherein a sufficient flow of air is established through said chuck to cause the air flow pattern in the said pocket to become laminar, the higher velocity air passing over a relatively static air mass dammed against the upwardly projecting wall of the said chuck, and wherein the inflow of the said higher velocity air into the said chuck is maintained at a level sufficient to lift an entering closure upwardly from the floor of the said pocket and thereby per-

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mit the quick, unimpeded entry of the closure into the rotating pocket.

5. A machine according to claim 1 having means including an infeed and an outfeed air jet and a slot in the escapement pocket to accelerate the linear motion of a closure into and out of the escapement pocket, said infeed air jet being directed to project a needle-like blast along the center line of the infeed passage and angled to impinge upon the forward interior wall of a closure skirt, the outfeed jet being directed to project its blast through the slot in the wall of said pocket and against the exterior wall of the skirt of a closure in said pocket, and means to time the jets of air to correspond to the infeed and outfeed positions of said pocket.

6. A machine according to claim 1 wherein the means to break the vacuum resulting from the seating of a closure on the chuck includes a cylindrical cam arranged to elevate the pocket together with the closure with respect to the chuck and thereby permit air to flow beneath the freed closure.

7. A machine according to claim 1 wherein the means to break the vacuum resulting from the seating of a closure on the vacuum chuck includes a cylindrical cam arranged to lower the chuck with respect to the closure and the pocket and thereby permit air to flow beneath the freed closure.

8. A machine according to claim 1 wherein the angle

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between the center lines of the closure entrance and the exit channels is 90° and the apex of the angle lies on the common rotational axis of the pocket and the chuck.

9. A machine according to claim 1 wherein, when viewed from above, the pocket turns counterclockwise and the release of a closure from the pocket occurs after the pocket has completed a turn of 270° from its closure entering position.

10. A machine according to claim 1 in which the closure escapement pocket is provided with a groove formed in the floor of the pocket in the said gateway, and wherein, during the operation of the machine, a sufficient flow of air through said groove and beneath the entering closure and into said axial passage is established to lift the said closure free of the floor as the closure enters the pocket.

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