MACHINE FOR VACUUMIZING CONTAINERS

The invention relates to evacuating machines of the type in which containers are moved by a rotary drum and through a vacuum chamber formed in part by the drum.

An object is to improve the construction and consequent operation of machines of this type to the end that a constant and high vacuum may be maintained between a drum and its casing without subjecting these parts to detrimental wear.

Another object is to provide a rotary vacuumizing drum which is continuous in its action without being subject to shock and vibration incident to the introduction of containers into, or their discharge from, the drum, and in which chattering and consequent breakage of the drum casing is eliminated.

According to this invention a drum provided with container-receiving pockets open at the periphery of the drum is partially enclosed in a casing, which, with the walls of the drum pockets, form evacuating chambers. To facilitate the formation and maintenance of these chambers, the casing is preferably formed of segments mounted for movements radially of the drum. Also, to eliminate wear between the drum and casing, the bearing contact between the two is preferably confined to their upper and lower portions, the drum preferably being provided with wear-resisting bearing rings, and the casing with rollers mounted for adjustment to properly contact with the rings. While some of the features of the invention are applicable to machines in which sealed are completely formed in vacuum chambers, others have to do with machines in which the containers are merely evacuated, the caps being subsequently mechanically fastened to the containers. The invention therefore includes the provision of simple and effective means for properly positioning and holding loosely-applied caps firmly upon the mouths of containers while they are being removed from the vacuum chambers.

An illustrative embodiment of the invention is shown in the accompanying drawings, in which Fig. 1 is a vertical section through a container evacuating machine constructed in accordance with the invention, showing the rotary drum, casing and cap positioning mechanism; Fig. 2 a sectional view taken on line II—II of Fig. 1, showing also a plan view of the means used for feeding containers to and conveying them from the drum; Figs. 3 and 4 sectional views taken, respectively, on the lines III—III and IV—IV, Fig. 1; Fig. 5 an elevation of one of the casing members looking in the direction of the arrows on line V—V, Fig. 2; Fig. 6 a sectional view of the casing taken on line VI—VI, Fig. 5; Fig. 7 an enlarged horizontal sectional view through the joint between two casing members; Fig. 8 a vertical section through a casing roller, taken on line VIII—VIII, Fig. 2; Fig. 9 a plan view of the roller shown in Fig. 8; Fig. 10 a development of the cam which operates a cap positioning mechanism, and Fig. 11 a plan view of a portion of the container ejecting mechanism.

Referring to the drawings, a drum 1 is mounted for rotation around a vertical shaft 2, Fig. 1, secured to a housing or frame 3. Driving mechanism for the drum, and other parts of the machine presently to be explained, comprises a motor 5 (Figs. 3 and 4) having its armature shaft 6 connected through a coupling 7 and clutch 8 to a reduction gearing in a casing 8 (Figs. 3 and 4) having its armature shaft 6 connected through a coupling 7 and clutch 8 to a reduction gearing in a casing 8 including a low-speed shaft 10 vertically disposed in suitable bearings 11. The clutch and reduction gearing form no part of this invention, and their forms are so diverse and so well known that no detail description of them is included. A pinion 12 attached to shaft 10 drives a tubular shaft 9 and rotary drum 1 through an idler gear 13 which meshes with a gear 14 keyed on shaft 9. A sprocket wheel 15 is mounted on shaft 9 above gear 14, and in the same plane therewith are two sprockets 16 and 17 mounted on vertical shafts 18 and 19, respectively, which are driven from sprocket 15 by a sprocket chain 20 which engages sprockets 15, 16 and 17 and also an idler sprocket 21 adapted to maintain the chain in driving engagement with sprocket 15. Another sprocket wheel 22 mounted on
shaft 18 drives through a sprocket chain 25, a sprocket 23 keyed to a shaft 24. Attached to shafts 18 and 19, at a height such that their arms will enter the lower portions of container-receiving pockets formed in drum 1, are star wheels 26 and 27, Fig. 2, whose rotation is coordinated with that of the drum to permit successive arms to enter and leave the pockets successively without interference with the rotation of the drum. Filled containers, such as bottles 28, are fed to star wheel 26 by an endless conveyor 29 supported on a table 30 secured to frame 3. Preferably this conveyor comprises links adapted to engage sprocket wheels 31 and 32, the latter being driven by shaft 24 through a bevel gear connection 33. A discharge conveyor 35 is provided at the discharge side of the machine, and may be driven in any suitable manner.

Associated with conveyor 29 and star wheel 26 is a timing mechanism whose purpose is to prevent clogging of the wheel and breakage of containers by permitting but one container to pass to the wheel at a time. This preferably comprises a gate 34 (Fig. 2) which is reciprocated across the conveyor by a pivoted follower arm 35 actuated by a cam 36 carried by shaft 18, the cam being designed to withdraw the gate to permit one container to pass as each arm of the star wheel approaches the container. The arms of the star wheel are adapted to engage the containers 28 which are held against the arms by a guide 37. As the containers carried by star wheel 26 approach the drum, caps or sealing discs are loosely applied on their mouths either manually or otherwise.

The drum and its associated parts and mechanism, which form an essential part of this invention, are illustrated particularly in Figs. 1 and 2. The drum comprises a cylindrical provided with a plurality of peripherally open pockets 39 formed by webs 38, and upper and lower plates 41. The webs and plates being preferably cast integrally with a central tubular shaft 40 surrounding fixed shaft 2 and attached to tubular rotary shaft 9. A casing encloses the rear portion of the drum to seal the container-receiving pockets 39 when rotation of the drum brings them into the casing. Although as far as concerns some features of the invention, the casing may be an integral structure, to facilitate the formation and maintenance of a vacuum it is preferred to form the casing of segments, two of which, 43 and 46, Fig. 2, being here shown. The segments are preferably exteriorly ribbed to strengthen them against breakage by stresses incident to the operation of the machine, and their interior surfaces accurately conform to the cylindrical periphery of the drum.

Each casing segment is mounted on frame 3 for movements radially of the drum and for movements on vertical and horizontal axes to permit it to properly conform to the drum. As shown in Fig. 6, casing segment 46 is mounted on a bracket 47 attached to frame 3 and provided at its upper end with a socket to receive a pin formed on the lower end of an arm 48. At the upper end of arm 48, a lug 58 is pivotally mounted on a horizontal axis by a pin 59, and is provided with a pin 60 which is received by a socket 61 formed on the exterior of segment 46. Through the pin and socket connection at the lower end of arm 48, segment 46 may swing on a vertical axis; through the horizontal pivot pin 59 it may swing on a horizontal axis; and on pin 60 it may move radially of the drum. Thus the segment is mounted for universal movements with relation to the drum.

At their adjacent vertical edges, segments 45 and 46 are connected to each other in such a way as to permit limited relative movement and at the same time form a continuous casing structure. Preferably, as shown in Fig. 7, a flexible sealing strip or gasket 57 extends between and separates the adjacent edges of the segments forming a vertical hinge between them, the rear faces of the segments being provided with lugs 156 connected to each other by bolts or equivalent members.

An important feature of the invention has to do with the provision of means, for eliminating wear on the cross-section of the drum and the interior surface of the casing. To this end, the upper and lower ends of the drum are preferably provided with hardened wearing rings 42 and 43 which are engaged by rollers 49, one of which is mounted at each corner of each casing segment. Provision is made for so adjusting each roller that collectively they space the interior of the casing a slight distance from the vertical edges of pocket-forming webs 35 of the drum. Preferably, as shown in Figs. 8 and 9, each roller 49 forms the outer edge of a ball bearing attached to the upper end of an eccentric projection of a pin 50 mounted between bushings carried in a split bearing 51 which can be drawn together by a screw 51A, thus providing for adjusting and holding pin 50 in any desired position. The rollers are adjustable to permit the casing and drum to run close enough together to maintain the necessary high vacuum, without permitting actual contact at points other than where the rollers bear on the rings.

To create and maintain a high vacuum in the container-receiving pockets formed by and between the drum and casing, casing segments 45 and 46 are provided adjacent to their meeting edges with ports 52 connected by flexible hose 54 to an exhaust line 55. While each container pocket may be evacuated solely through these connections, it is preferred to create a partial vacuum in an entering container pocket by the more com-
plete vacuum previously created in the pocket about to pass out of the casing. To this end, a port 55 is provided in casing segment 45 adjacent to its outer edge, and is connected by a conduit 56 to a corresponding port provided in segment 46. The arrangement here is such as to effect the result just stated.

Before containers enter the drum pockets of the machine illustrated herein, caps are placed loosely on their mouths. When the container-receiving pockets are evacuated, a vacuum is produced simultaneously in the unfilled upper portions of the containers, and, when the evacuated containers are removed from the machine, atmospheric pressure holds the caps temporarily in sealing position.

Centralized in the top of each of the pockets 39 is a reciprocable pressure block adapted to position the caps on the containers when they reach predetermined positions during rotation by the drum, one of the blocks being shown in Fig. 1, in its upper position. It comprises a roller 62 journaled on a horizontal pin in a head 63 formed on a stem 64 which telescopes in a plunger 65 provided on its lower end with a cap-engaging head 69, and intermediate of its ends with a shoulder 66. A spring 67 is arranged between head 63 and the upper side of shoulder 66, and another spring 68 is interposed between the bottom of shoulder 66 and top flange 41 of drum 1. Roller 62 follows an arcuate cam 70 secured to a spider 71 attached to the upper end of fixed shaft 2, the cam being provided with projections 72 and 73, as shown by the development view, Fig. 10. When a roller meets one of the cam projections 72, 73, head 63 is forced downwardly against the resistance of spring 67, and the pressure thus created on shoulder 66 is yieldingly transmitted through plunger 65 to bring head 69 against the top of a cap on a container below it. When a roller passes beyond a cam projection, the plunger is raised above the cap by spring 68. The cam is preferably so positioned as to actuate the plunger head just after a pocket is sealed by entering the casing, and again just before the pocket leaves the casing.

Each of the pockets 39 is provided with a container ejector, which as shown in Figs. 2, 2 and 11, comprises a vertical rod 75 journaled in the top and bottom plates 41, to the upper end of which is connected a bell crank having arms 76 and 77, and to the lower end a kicker arm 78. The arm 77 of the bell crank follows a cam 79 mounted on spider 71, and is urged thereagainst by a spring 80 connected to arm 76. The kicker arm is normally positioned inwardly of the pocket and back of a container; as the pocket leaves the casing, arm 77 enters a depression 81 in cam 79, causing the rod to turn and move the kicker arm 78 outwards to force the container into engagement with the passing arm of star wheel 27, as shown in Fig. 2.

In operation, when motor 5 has been started with clutch 8 engaged, drum shaft 9 is rotated through the driving connections previously explained, and simultaneously the star wheels and conveyors are actuated through their coordinated driving connections. Filled containers are supplied to conveyor 29 and carried by it to gate 34, which passes single containers at timed intervals to the approaching arms of star wheel 26. Rotation of the star wheel advances the containers to drum 1 in the direction shown by the arrow on Fig. 2, and either during this passage, or previously, caps or sealing discs are loosely applied to the mouths of the containers. When the machine is started vacuum is applied through pipe 53 to exhaust the pockets indicated at C and D (Fig. 2) through casing openings 52. As the degree of evacuation increases, atmospheric pressure acts on the exterior of casing segments 45 and 46 to urge them toward the drum for sealing these pockets. At the same time a container fed into pocket A is, upon rotation of the drum, moved in the direction of the arrow to assume position B, and further rotation of the drum carries pocket B entirely into the casing, thereby sealing that pocket. Prior to this time, cam projection 72 actuates the plunger mechanism in pocket B to contact with the container cap and position it, the plunger subsequently rising to permit the container to be exhausted. During the movement of pocket B from the position indicated in the drawing to a position where it is sealed by the casing, pocket D will have moved to a point at which it is ready to leave the casing. This establishes connection between pockets B and D through pipe 56, and the vacuum in D is broken by passage of air from B to D, thus making use of an evacuated pocket to accomplish primary evacuation of an entering pocket. The entering pocket then assumes successively the positions represented by C and D, where it is subjected to direct vacuum and highly evacuated.

Evacuation of the containers carried by the pockets may dislodge the caps, and in this event the vacuum would be lost when the container emerges from the casing. Therefore, just before the vacuum in pocket D is relieved, cam projection 73 actuates the plunger mechanism to position the cap on the container mouth so that atmospheric pressure will hold it in place during a subsequent seal attaching operation. As the pocket moves to position F, kicker arm 78 is actuated to push the container into a notch formed in the arm of star wheel 27, the container then being carried by the star wheel to successive positions G and discharged upon conveyor 35 leading to a machine which mechanically seals the caps upon the containers.

In the operation of the machine casing rollers 49 are adjusted to take up the thrust.
caused by the vacuum, and since they run on hardened steel rings there is substantially no wear or friction. The distance between the drum and casing may be varied by adjusting the eccentric mounting of the rollers. In any position short of actual contact between the face of the drum and the casing the action is perfectly smooth, and no chattering, vibration or other disturbances are set up, because the vacuum maintained by the drum is substantially constant, the vacuum of evacuated pockets is partially broken in the machine before they are discharged to the atmosphere. The drum and casing can be maintained close enough together, but without actual contact of the face of the drum and the casing, to insure a high vacuum in the pockets, through adjustment of the rollers.

According to the provisions of the patent statutes, I have explained the principle and mode of operation of my invention, and have illustrated and described what I now consider to represent its best embodiment. However, I desire to have it understood that, within the scope of the appended claims, the invention may be practiced by other forms of construction than specifically described.

I claim as my invention:

1. In a machine for vacuumizing containers, the combination of a rotary drum element provided with a peripherally open container-receiving pocket, and a casing element enclosing a portion of the drum and forming a vacuumizing chamber with the pocket thereof, one of said elements being laterally movable with relation to the other, and one of said elements being provided with radially adjustable rollers at its upper and lower ends and the other with bearing rings in contact with the rollers.

2. In a machine for vacuumizing containers, the combination of a rotary drum provided with a peripherally open container-receiving pocket, and a casing enclosing a portion of the drum and forming a vacuumizing chamber with the pocket thereof, the casing having bearing contact solely with the top and bottom of the drum and being mounted for free movements radially of the drum to automatically adjust itself to sealing engagement with the periphery of the drum.

3. In a machine for vacuumizing containers, the combination of a rotary drum provided with a peripherally open container-receiving pocket, and a casing enclosing a portion of the drum and forming a vacuumizing chamber with the pocket thereof, the top and lower ends of the drum being provided with bearing rings, and the casing being provided with rollers in contact with the rings and independently adjustable laterally of the rings.

4. In a machine for vacuumizing containers, the combination of a rotary drum provided with a plurality of peripherally open container-receiving pockets, and a segmental casing enclosing a portion of the drum and forming vacuumizing chambers with the pockets thereof, the segments of the casing being mounted for free movements radially of the drum to automatically adjust itself to sealing engagement with the periphery of the drum.

5. In a machine for vacuumizing containers, the combination of a rotary drum provided with a plurality of peripherally open container-receiving pockets, and a segmental casing enclosing a portion of the drum and forming vacuumizing chambers with the pockets thereof, the segments of the casing being mounted for universal movements to conform to the periphery of the drum upon the creations of vacuums within said chambers.

In testimony whereof, I sign my name.

JOHN E. SHARP.