June 26, 1956 R. J. BARTLETT ET AL 2,751,735

DEVICE FOR APPLYING BANDS TO CONTAINERS

Filed Nov. 13, 1951 4 Sheets-Sheet 1

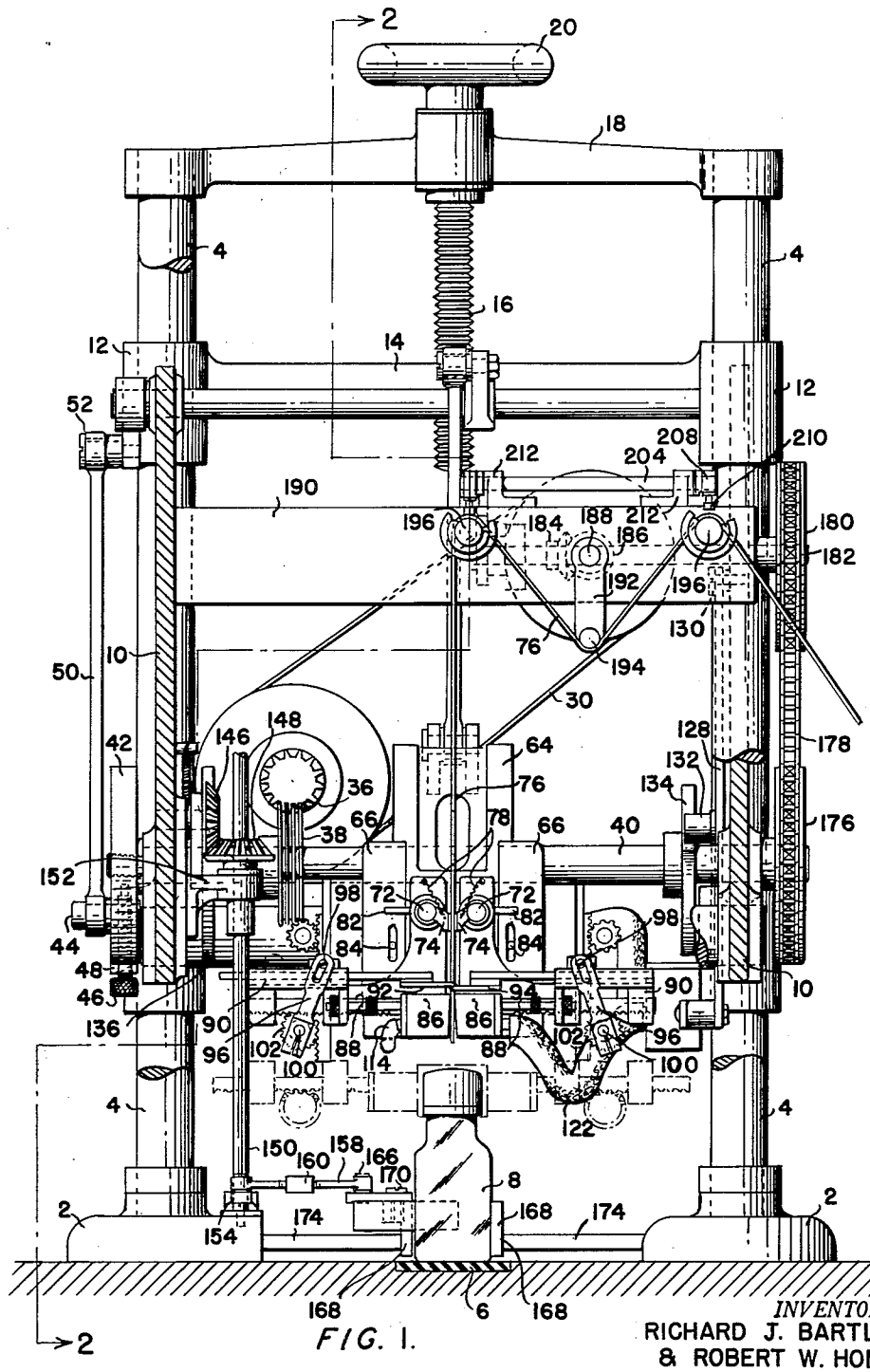


FIG. 1.

INVENTOR.
RICHARD J. BARTLETT
& ROBERT W. HOMPE
BY
Bacon and Smith
ATTORNEYS

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DEVICE FOR APPLYING BANDS TO CONTAINERS

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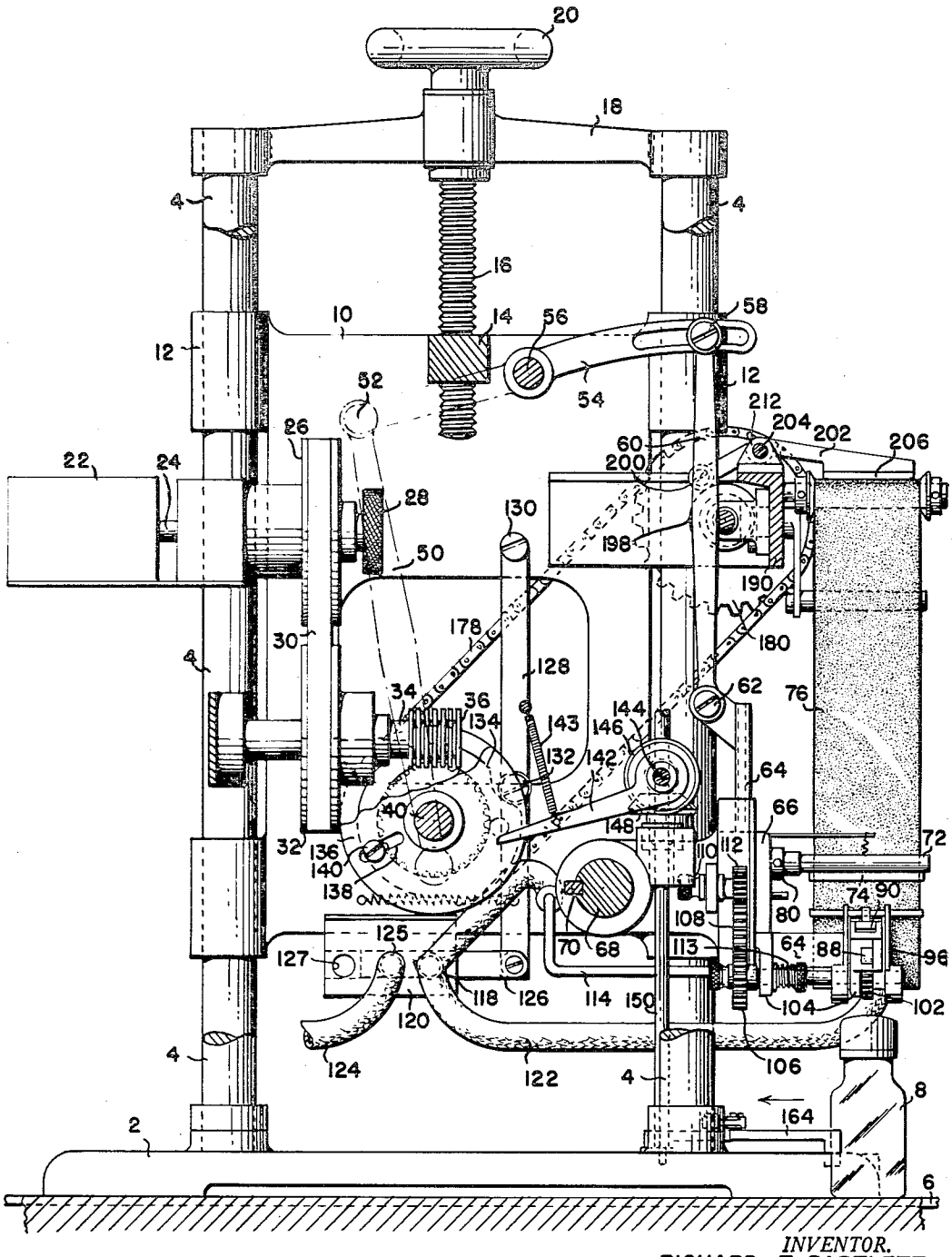


FIG. 2.

INVENTOR.
RICHARD J. BARTLETT
& ROBERT W. HOMPE
BY
Busser and Smith
ATTORNEYS

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DEVICE FOR APPLYING BANDS TO CONTAINERS

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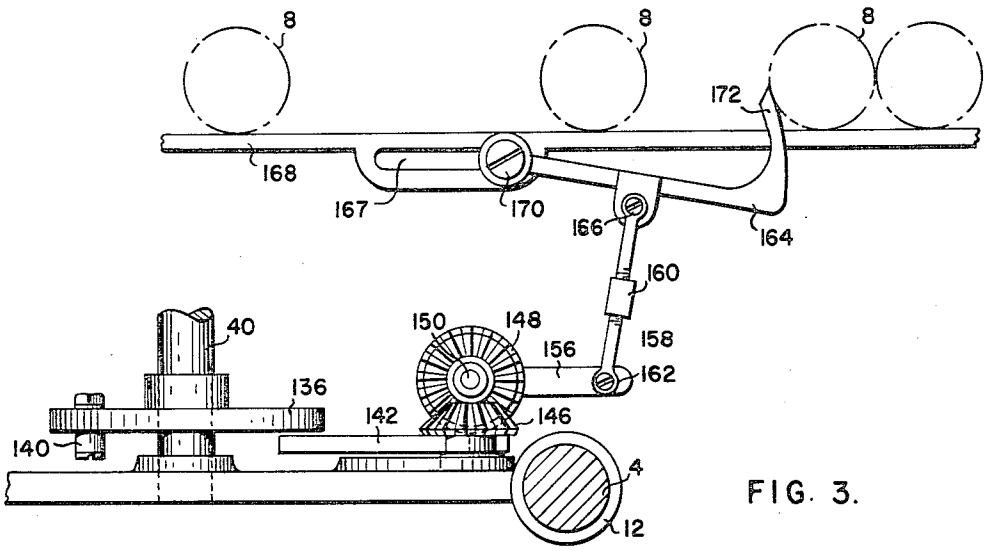


FIG. 3.

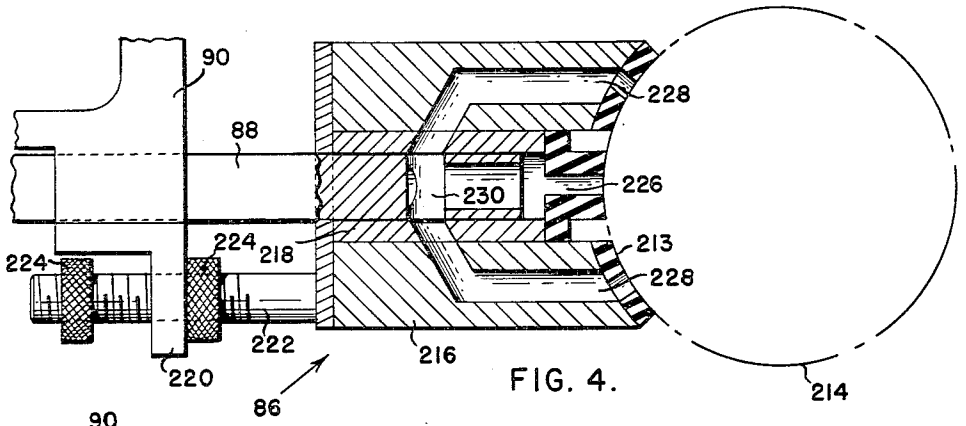


FIG. 4.

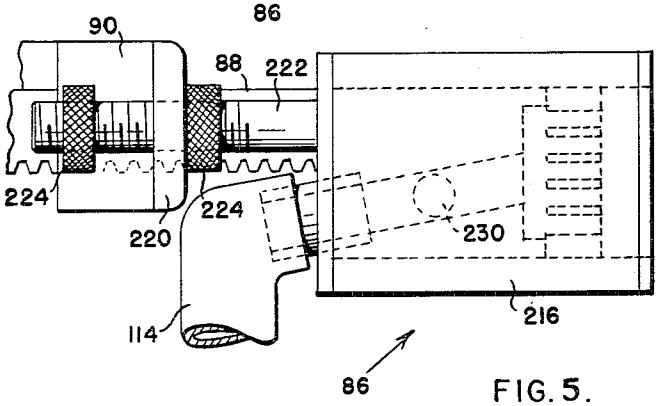


FIG. 5.

INVENTOR.
RICHARD J. BARTLETT
& ROBERT W. HOMPE
BY
Burner and Smith
ATTORNEYS

June 26, 1956 R. J. BARTLETT ET AL 2,751,735

DEVICE FOR APPLYING BANDS TO CONTAINERS

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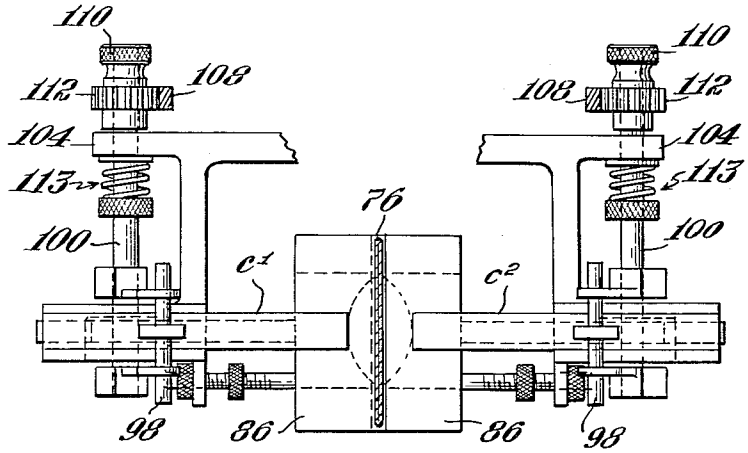


Fig. 6

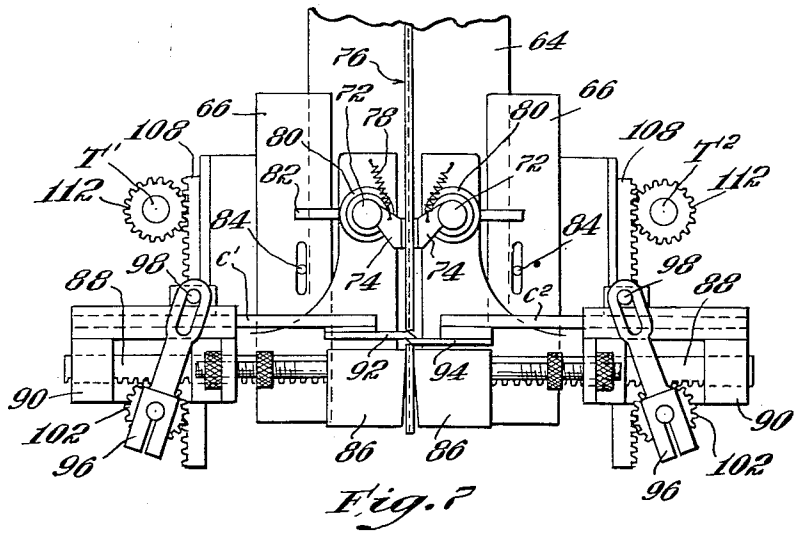


Fig. 7

Inventors
Richard J. Bartlett
Robert W. Hompe
by Roberts Cushman & Grover
Att'ys.

United States Patent Office 2,751,735 Patented June 26, 1956

2,751,735

DEVICE FOR APPLYING BANDS TO CONTAINERS

Richard J. Bartlett, Chalfonte, and Robert W. Hompe, Ithan, Pa., assignors, by mesne assignments, to Geo. J. Meyer Manufacturing Co., Cudahy, Wis., a corporation of Wisconsin

Application November 13, 1951, Serial No. 256,016

31 Claims. (Cl. 53—292)

This invention pertains to band-applying machines designed to apply seamless bands of suitable material, for instance regenerated cellulose or the like, to an article of a diameter such that the band may be slipped thereon, for example the neck of a bottle. Such a band, when applied to a bottle neck, is usually intended to seal the cork or other top closure. The application of such sealing bands is customarily done by hand, although mechanism has heretofore been proposed for applying bands automatically. As a hand operation it is slow and laborious.

The band-forming material employed for this purpose is desirably of a kind which, after application to a bottle neck, for instance, will shrink so as automatically to form a good seal. When regenerated cellulose is the material selected, the bands (flattened to conserve space) are usually stacked in a container in which the bands are moist and soft and from which they are removed one-by-one and opened to circular form before they are slipped onto the bottle neck.

The present invention has for its principal object the provision of an automatically operated machine capable of applying bands to necks of bottles, which are advanced one after another by conveyor means to a band-applying station, and which is capable of operating at the high speed necessary to keep up with other operations performed on bottles, for example labeling, and which will operate certainly and with precision.

A further object is to provied a machine so designed as, by easy adjustment, to adapt it to the banding of bottles of widely different heights and/or neck diameters. A further object is to provide an automatic machine of the above type wherein the band is formed just prior to its application, by cutting off from flattened tubing of the selected material a length just sufficient to constitute a single band, and comprising means whereby the length of the piece of tubing so severed from the supply may readily be varied thereby to provide bands of different widths. A further object is to provide a machine of automatic type for applying seamless bands to articles such as the necks of bottles and which is of simple, relatively inexpensive and durable construction and of great versatility in respect to the sizes of the articles to be banded. Other and further objects and advantages of the invention will be pointed out in the following more detailed description and by reference to the accompanying drawings wherein:

Fig. 1 is a front view of one embodiment of the invention;

Figure 2 is a sectional view of the embodiment of the invention shown in Figure 1, taken on line 2—2 of Figure 1;

Figure 3 is a detail view of the bottle stopping mechanism;

Figure 4 is a horizontal sectional view of one of the vacuum cups employed in the invention;

Figure 5 is a detail side view of one of the vacuum cups;

Fig. 6 is a fragmentary, plan view, to much larger scale than Fig. 1, illustrating the means whereby the cutting blades and suction cups are moved in properly timed arrangement; and

Fig. 7 is an elevation showing the parts illustrated in Fig. 6.

Referring specifically to Figures 1 and 2, the device is mounted on two supports 2 having four vertical posts 4 mounted thereon. A conveyor 6 runs between the supports 2 and carries a plurality of bottles 8 which travel from right to left, as viewed in Figure 2. Mounted on posts 4 is a vertically adjustable carriage comprising side plates 10, said side plates 10 being secured to bearings 12 which are slidably mounted on posts 4. Side plates 10 are joined at their upper ends by a cross member 14 which is drilled and tapped and receives a screw 16. Screw 16 is rotatably journalled in a bridge member 18 fixed to the upper ends of the posts 4. The screw may be rotated by hand wheel 20 mounted on the upper end thereof thereby to adjust the carriage up or down.

Mounted at the left side of the device, as viewed in Figure 2, is an electric drive motor 22 connected to shaft 24, said shaft driving variable speed pulley 26. Pulley 26 is provided with a hand wheel 28 for varying the effective diameter thereof. Power is transmitted from variable speed pulley 26 through belt 30 to sheave 32. Sheave 32 is mounted on shaft 34, said shaft also having worm gear 36 mounted thereon. Worm gear 36 engages with gear 38 (Fig. 1) mounted on main cross shaft 40.

Main cross shaft 40 has a crank disk 42 mounted on the left-hand end thereof, as viewed in Figure 1. A crank pin 44 is mounted in a slot in crank disk 42 and is secured in said slot by screw 46. Screw 46 is threaded into crank disk 42 and engages with cooperating threads in stud 44. Screw 46 may be locked in position by lock nut 48. Pivoted to crank pin 44 is a connecting rod 50 which is pivotally secured at its upper end, as shown at 52 (Fig. 2) to lever 54. Lever 54 is fulcrumed on a cross shaft 56 carried by the side plates 10. Attached to the right-hand end of lever 54, by a pin and slot connection at 58 (Fig. 2), is a connecting link 60. Connecting link 60 is pivotally secured at its lower end, as shown at 62, to a vertically movable slide 64.

Slide 64 reciprocates in a supporting bracket 66 which is secured to a non-rotating cross bar 68, as by key 70. The ends of the cross bar 68 are fixed to the side plates 10 of the vertically adjustable carriage.

Mounted on the front of slide 64 are two rotatable shafts 72 (Figs. 1 and 7), each of which is provided with a gripper 74 which engages a continuous tube of banding material 76. The grippers are biased toward each other by tension springs 78. Mounted on each of shafts 72 is a collar 80 (Fig. 2) each of which has a pin 82 (Fig. 1) projecting therefrom. The pins 82 are adapted to engage, on the downward stroke of the slide, with pins 84. Pins 84 are adjustably mounted in slots in the bracket 66 so that the vertical position thereof may be changed.

As the grippers 74 move down with the banding material gripped between them they advance a length of banding material (sufficient to form one band) between the vacuum cups (hereinafter described) which are separated in time to permit the downwardly advancing end of the banding material to enter between them.

Also mounted on slide assembly 64 are the two vacuum cups 86 (Figs. 1, 6 and 7) which are supported on the ends of two horizontally slidable racks 88. Racks 88 are slidably mounted in supporting brackets 90 which are fixedly secured to the slide 64. Mounted above vacuum

cups 86 is a cutter comprising two blades 92 and 94. Blades 92 and 94 are fixed to carriers C^1 and C^2 which are horizontally slidable in the supporting brackets 90. Knife blades 92 and 94 are actuated by levers 96 which are connected to the carriers for the blades 92 and 94 by pin and slot connections, as shown at 98. Levers 96 are secured at their lower ends to two shafts 100, said shafts 100 also having gears 102 mounted thereon, said gears meshing with racks 88. Shafts 100 are mounted on slide 64 in bearings 104.

A gear 106 (Fig. 1) is mounted on the left-hand end of each of the shafts 100 and these gears mesh with the lower portions of normally stationary but vertically adjustable racks 108 which are slidably mounted on the supporting bracket 66. The slidable racks 108 may be adjusted vertically by turning the knurled heads 110 on the ends of horizontal shafts T^1 and T^2 (Figs. 2, 6 and 7) having gears 112 fixed thereto which mesh with the upper portions of the racks 108. Also mounted on each of the shafts 100 is a clutch assembly 113 consisting of a fibre disc, compression spring, and thumb nut. The friction of the fibre discs against bearings 104 prevents any further rotation of gears 106 when they leave engagement with racks 108.

Secured to the left vacuum cup 86, as viewed in Figure 1, is a rigid vacuum line 114 which has a flexible vacuum hose 116 secured to the other end thereof, as best seen in Figure 2. Vacuum hose 116 is secured to one port 118 of a vacuum slide valve 120. Also secured to port 118 of the vacuum slide valve is a flexible vacuum hose 122 which is secured to the right-hand vacuum cup 86, as shown in Figure 1. Vacuum hose 124 (Fig. 2) is secured to port 125 of vacuum valve 120 and may be connected at its opposite end to a conventional vacuum pump. Vacuum valve 120 is also provided with exhaust port 127. Vacuum slide valve 120 is provided with a rod 126 which has a lever 128 secured thereto, said lever 128 being rotatably pinned to side plate 10, as shown at 130. Lever 128 is provided with a cam follower 132 which engages cam 135 mounted on main cross shaft 40.

Also mounted on main cross shaft 40 is a disk 136, having a radial slot 138 therein, in which is secured pin 140. As plate 136 rotates, pin 140 engages an arm 142 during a portion of each revolution. Arm 142 is biased upwardly by tension spring 143. Arm 142 is secured to a shaft 144, said shaft 144 also having a bevel gear 146 mounted thereon. Shaft 144 is journaled in one of the side plates 10. Bevel gear 146 engages with bevel gear 148, which is secured to a vertical shaft 150. Vertical shaft 150 is journalled at its upper end in a bracket 152 (Fig. 1) secured to one of the side plates 10 and at its lower end in a bracket 154 fixed to one of the supports 2. Vertical shaft 150 has a lever secured to its lower portion, which actuates the bottle stopping mechanism.

Referring specifically to Figure 3, lever 156 is secured to the lower end of shaft 150 and has link 158 connected thereto. Link 158 is adjustable, and the length thereof may be varied by rotating turnbuckle 160. Link 158 is rotatably pinned to lever 156, as shown at 162, and is also rotatably pinned to bottle stop lever 164, as shown at 166. Bottle stop lever 164 is rotatably pinned in slot 167 in a horizontal flange on one of the bottle guide rails 168, as shown at 170, and has an angular end 172 constituting a gate which projects through an aperture in the bottle guide rail 168, so that it may engage a bottle 8.

Referring to Figure 1, it will be seen that the spaced, parallel bottle guide rails 168 are mounted on supporting members 174, said supporting members 174 being slidably mounted in supports 2, in order that the distance between the rails may be varied.

Mounted on the right-hand end of main cross shaft 40, as viewed in Figure 1, is a sprocket 176 having chain 178 mounted thereon, said chain 178 driving a sprocket 180. Sprocket 180 is mounted on a shaft 182, said shaft 182 having a bevel gear 184 mounted thereon, which engages a bevel gear 186 mounted on a shaft 188. Shaft 188 is journalled in a supporting plate 190 forming a part of the vertically adjustable carriage. Mounted on shaft 188 is an arm 192 having a roller 194 mounted thereon which engages the tube of banding material 76. The tube of banding material passes over two freely rotatable rollers 196 (Fig. 1), said rollers 196 being mounted on the supporting plate 190. Mounted on cross shaft 182 is a cam 198 (Fig. 2), having a cam follower 200 engaging therewith. Cam follower 200 is carried by a lever 202 which is rotatably mounted on the left-hand end of a shaft 204. The shaft 204 is mounted in brackets 212 which are fixed to the supporting plate 190. Lever 202, at its right-hand end, as viewed in Figure 2, has a gripping face 206 which compresses the tube of banding material between said gripping face and the left-hand one of the rollers 196 (as viewed in Fig. 1), when the high side of the cam is in engagement with the cam follower 200. Rotatably mounted on the right-hand end of shaft 204, as viewed in Figure 1, is a second lever 208 having a gripping face 210 thereon, which compresses the continuous tube of banding material between said gripping face and the left-hand roller 196, as viewed in Fig. 1, when the low side of cam 198 engages cam follower 200. Lever 208 is actuated by a cam and cam follower (not shown) similar to 198 and 200, but having the high side of the cam rotated 180° with respect to cam 198.

Referring specifically to Figures 4 and 5, one of the vacuum cups 86 is shown in detail. It has a rubber facing material 213 where it engages a cut band 214 indicated in broken lines. Sleeve member 216 is slidably mounted on member 218 which is secured to rack bar 88. Secured to bracket 90 is a bracket 220 having rod 222 slidably received therein, the right-hand end of the rod, as viewed in Fig. 4, being fixed to the sleeve 216. The rod 222 is threaded at its left-hand end and provided with spaced thumb nuts 224.

Movement of the rack 88 to the right (Fig. 4) initially causes the sleeve 216 also to move to the right due to the friction between the parts 218 and 216, but eventually the sleeve 216 stops while the part 218 continues to move. This is due to the fact that the movement of the part 216 is limited by engagement of the left-hand thumb nut 224 with the bracket 220. At the end of its right-hand motion the concave right-hand surface of the central portion of the cup, which is carried by the part 218, contacts one of the flat faces of the flattened band of material. This central part of the cup is provided with a vacuum port 226 which communicates with a passage 230 leading to the vacuum line 114. The marginal portions of the cup formed by the sleeve 216 are provided with vacuum ports 228 which also communicate with the aperture 230 when the vacuum cup is fully retracted, as shown in Figs. 4 and 5. It may be noted at this point that the arcuate surface of the vacuum cup as a whole is of the order of 90° in extent while the central portion of the cup, carried by the part 218, is of only about 30° of arcuate extent.

When the vacuum cup 86 is in its advanced position, that is to say in a position for its central portion to engage the flat surface of the banding material, the port 226 only is in communication with the vacuum line since at this time the rear ends of the ports or passages 228 are closed by portions of the member 218. Thus the central part only of each cup engages the flattened band and since the curvature of these central portions is relatively slight, it is possible for these central portions to make close contact with the flat surface of the band so that suction at the port 226 may firmly grip the band. When the cup 86 is retracted for opening the band the flat surface of the band is initially gripped at the port 226 and the band is thus pulled partly open. However, as the member 88 continues to move outwardly, the other of the nuts 224 engages the bracket 220, thus stopping motion of the part 216, whereupon the ports 228 are opened to the vacuum line and suction is created at these

ports, thus conforming the band to the substantially circular curvature of the entire cup, the band being held to the concave surface of the cup at three separate points about its periphery. Thus the two cups, in cooperation, hold the band in very nearly circular form so that it is readily slipped down over the neck of the bottle.

The operation of the device is as follows:

Electric motor 22 is energized, and power is supplied to the main cross shaft 40 through shaft 24, variable speed pulley 26, belt 30, pulley 32, and worm gear 36, which meshes with gear 38 mounted on cross shaft 40. As cross shaft 40 rotates, crank disk 42 is also rotated and a reciprocating motion is imparted to lever 54 through stud 44 mounted on crank wheel 42, and link 50 connected to stud 44, and lever 54. As lever 54 reciprocates, main slide assembly 64 is also reciprocated, due to the connection between slide 64 and lever 54 through link 60, which works in pin and slot connection 58, at the right-hand end of lever 54, as viewed in Figure 2.

It is assumed that the grippers 74 have advanced a length of the banding material downwardly so that it is between the suction cups (the length thus advanced being determined by the engagement of pins 82 with the vertically adjustable pins 84) and that the cutter blades have severed this band-forming length from the supply.

As slide 64 moves downwardly, the action of gears 106 against stationary racks 108 begins to separate vacuum cups 86, due to the connection between gears 102 and racks 88, while vacuum is established at the suction ports inside the vacuum cups, due to the action of slide valve 120. Thus the bands are opened out to a rounded contour. When the separating of the vacuum cups has opened the band to maximum diameter, gears 106 roll off the ends of stationary racks 108, which terminates separation of the cups. The final downward movement of the vacuum cup assembly slips the open band over the neck of a bottle positioned between the vacuum cups at the bottom of the downward stroke, as shown in phantom in Figure 1. At this point, the vacuum is cut off and the slide begins its return stroke to the closed position, as viewed in Figure 1.

During the downward stroke of the slide 64, gripping face 210 holds the banding material stationary against roller 196 while the opposed grippers 74, attached to slide assembly 64, pull the slack banding material into position for the next cut. The slack material is pulled from a roll during the return stroke by the rotation of crank arm 192, while gripping face 206 clamps the material and gripping face 210 releases it.

The bottle changing operation takes place during the upward stroke of the slide assembly 64. The stop or gate 172 is disengaged from the bottle 8 by the action of eccentric roller 140 (Fig. 2) striking lever 142. This movement is transmitted to the bottle stop (Fig. 3) through gears 146 and 148, vertical shaft 150, lever 156 and link 158. Tension spring 143 (Fig. 2) returns the bottle stop or gate to its original position.

To compensate for different bottle heights, the carriage which comprises the side plates 10 may be raised or lowered on rails 4 by turning hand wheel 20. Thus it will be seen that when hand wheel 20 is turned so that the side supporting plates 10 are raised, the clearance between the conveyor 6 and the vacuum cups 86 is increased, thus permitting a larger bottle to pass beneath the device. Guide rails 168 (Fig. 1) are adjustably mounted so that the distance therebetween may be increased or decreased to compensate for different bottle diameters. The bottle stop or gate 172 is adjusted by turnbuckle 160 in link 158, and pin 170 in slot 167.

As previously noted, the horizontal travel of the vacuum cups 86 is varied in accordance with the diameter of the band to be applied. This travel is controlled by the length of the downward motion of slide 64 before the gears 106 disengage the normally stationary racks 108. This may be varied by rotating the knurled heads 110 on the shafts which carry the gears 112, this having the effect of varying the heights of the lower ends of the racks 108.

Although the banding material used with the disclosed embodiment of the invention has been specifically disclosed as a continuous tube of wet regenerated cellulose which has the property of shrinking upon drying, it is obvious that other types of banding material could also be employed, and all other suitable types of banding materials are also included within the scope of this invention.

From the foregoing description, it is obvious that the device of this invention performs an operation (which, if done manually, is tedious and slow) with speed and accuracy and by the use of a minimum of mechanical parts. It will be appreciated by those skilled in the art that many modifications may be made within the scope of the invention, and the invention is to be restricted only in accordance with the appended claims.

What is claimed is:

1. A device for applying bands to containers comprising a frame, means for supporting a bottle with its axis substantially vertical, a vertically reciprocable slide carried by the frame, means for reciprocating the slide, opposed vacuum-type gripper devices designed to hold an open band in axial alignment with the bottle as the slide completes its downward stroke, cutting means mounted on the slide designed to cut a band from a continuous tube, means actuable by downward motion of the slide to operate the cutting means, gripping means mounted on the slide and which are operative to feed a continuous tube of banding material into operative engagement with the cutting means, and means actuable by downward motion of the slide for operating the band-feeding means.

2. In a machine of the class described, a frame, means for supporting a bottle, with its axis vertical, at the lower part of the frame, a vertically movable carriage carried by the frame, means for adjusting the carriage to different heights thereby to accommodate bottles of different heights, a slide mounted on the carriage for vertical movement, means for reciprocating the slide, means supported by the slide for measuring a length from a supply of flattened tubing and for severing said length from the supply, means mounted on the slide for opening the severed length of tubing, and means for varying the position of the carriage whereby said length of material so severed may be varied at will.

3. In a machine of the class described, a frame, means for supporting a bottle, with its axis vertical, at the lower part of the frame, a vertically movable carriage carried by the frame, means for adjusting the carriage to different heights thereby to accommodate bottles of different heights, a slide mounted on the carriage for vertical movement, means for reciprocating the slide, means supported by the slide for measuring a length from a supply of flattened tubing and for severing said length from the supply, the means for measuring off the length of material comprising a pair of grippers mounted on the slide and which are engageable with opposite faces of the band, and means operative to release the band from the grippers at a predetermined point in the downward movement of the slide.

4. In a machine of the class described, means for supporting a bottle with its axis vertical, a frame, a vertically movable carriage supported by the frame, a slide mounted for vertical reciprocating motion in guides on the carriage, band-advancing means, band-cutting means and band-opening means, all mounted on the slide, and means for moving the slide up and down relatively to the carriage, normally stationary parts mounted on the carriage with which parts carried by the slide cooperate whereby downward movement of the slide actuates the band-advancing and cutting means and the band opening devices in timed relation.

5. In a machine of the class described, means for supporting a bottle with its axis vertical, a frame, a vertical-

ly movable carriage supported by the frame, a slide mounted for vertical reciprocating motion in guides on the carriage, band-advancing means, band-cutting means and band-opening means, all mounted on the slide, means for adjusting the carriage thereby to accommodate bottles of different heights, and parts mounted on the carriage which cooperate with parts on the slide for actuating the band-advancing, band-cutting and band-opening means all in timed relation as the slide is moved downwardly relatively to the carriage.

6. In a machine of the class described, means for supporting a bottle with its axis vertical, a frame, a vertically movable carriage supported by the frame, a slide mounted for vertical reciprocating motion in guides on the carriage, band-advancing means, band-cutting means and band-opening means, all mounted on the slide, normally stationary but vertically adjustable racks mounted on the carriage, and pinions journaled on the slide which engage the racks during a portion, at least, of the downward motion of the slide and thereby actuate the means for cutting and opening the band.

7. In a machine of the class described, a vertically reciprocable slide, a pair of rotatable grippers mounted on the slide, spring means tending to move the grippers toward each other thereby to grip banding material interposed between them so as to advance the banding material as the slide moves downwardly, a plurality of clamping devices spaced apart longitudinally of the banding material, and all of which are engageable with the banding material before the latter reaches the grippers, means whereby the clamping devices are made effective alternately, and means interposed between the clamping devices for drawing off banding material from a supply.

8. In a machine of the class described, a reciprocable slide, a pair of rotatable grippers mounted on the slide, spring means tending to move the grippers toward each other thereby to grip banding material interposed between them so as to advance the banding material as the slide moves in one direction, a pair of clamping devices spaced longitudinally of the banding material, and both of which engage the banding material before the latter reaches the grippers, means for closing that clamping device which is nearer the grippers as the slide starts to move in the opposite direction and for simultaneously opening the other clamping device, means interposed between the successive clamping devices for drawing off banding material from a supply, and means operative, as the slide again starts its reverse motion to close the clamping device which is more remote from the grippers and to open the clamping device which is nearer to the grippers.

9. In a machine of the class described, a frame, means for supporting a bottle, with its axis vertical, at the lower part of the frame, a vertically movable carriage carried by the frame, means for adjusting the carriage to different heights thereby to accommodate bottles of different heights, a slide mounted on the carriage for vertical movement, means for reciprocating the slide, means supported by the slide for measuring a length from a supply of flattened tubing and for severing said length from the supply, means carried by the slide for opening the flattened band to approximately circular form and for holding it coaxial with the bottle neck while the slide completes its downward movement thereby to place the band on the bottle neck, and means responsive to movement of the slide for actuating the measuring, severing means, and band-opening means in properly timed relation.

10. In a machine for applying open ended bands to bottle necks and including means for supporting a bottle in position to receive a band, means for advancing a length of flattened tubular band-forming material, from a supply, sufficient to form a single band, means for severing said length from the supply and means for opening the severed length to approximately circular contour and for moving the opened length in an axial direction thereby to apply it to the bottle neck, said opening and applying means

comprising, in combination, a pair of opposed suction devices operative to grip the severed length of material at its opposite flat faces, means for moving the suction devices apart thereby to open the severed length to approximately circular contour, means for moving the suction devices axially of the bottle thereby to slip the band over the bottle neck, and means for varying the amount of such movement of the suction devices axially of the bottle thereby to determine the location of the band on the bottle neck.

11. In combination in a machine for applying an open ended band to a bottle neck and wherein the band to be applied is initially in the form of a length of flattened tubing, means including a suction element engageable with the central part of each respective external face of the flattened tube, means for moving said suction elements in opposite directions thereby to initiate opening of the tube, and auxiliary suction elements, associated with each of the first-named suction elements which also engage the outside surface of the tube and which cooperate with the first-named suction elements to complete the opening of the band, and means operative to separate the first-named suction elements thereby partially to open the band, and means operative to create suction at the auxiliary suction elements thereby to complete distention of the band.

12. In combination in a machine for applying an open ended band to a bottle neck and wherein the band to be applied is initially in the form of a length of flattened tubing, suction means including relatively movable primary and secondary suction elements engageable with the opposite faces of the flattened tube, means operative first to contact the primary suction elements with said opposite faces respectively and to separate the primary elements thereby to initiate opening of the band, and means operative thereafter to create suction at the secondary elements thereby to complete distention of the band.

13. In combination in a machine for applying open ended bands to the necks of bottles and wherein the band to be applied is initially in the form of a flattened tube, means for distending the flattened tube to circular form preparatory to applying it to the bottle neck, said distending means comprising a rigid, concave, arcuate element whose radius of curvature is approximately that of the band when the latter is fully distended, a suction pad operative to engage the central portion of one of the flat faces of the band and to draw it outwardly toward the concave surface of said rigid part, the latter having suction ports in its concave face, and means for creating suction at said ports thereby to conform the band to said concave surface.

14. In combination in a machine for applying open ended bands to the necks of bottles and wherein the band to be applied is initially in the form of a flattened tube, means for distending the flattened tube to circular form preparatory to applying it to the bottle neck, said distending means comprising spaced, coaxial, rigid, concave, arcuate elements whose radius of curvature is approximately that of the band when the latter is fully distended, a suction pad interposed between said elements, means for creating suction at the suction pad thereby to cause the central portion of the flat face of the band to adhere thereto, and means thereafter operative to create suction at said arcuate elements to conform portions of the band at opposite sides of the pad to said concave elements.

15. In combination in a machine for applying open ended bands to the necks of bottles and wherein the band to be applied is initially in the form of a flattened tube, means for distending the flattened tube to circular form preparatory to applying it to the bottle neck, said distending means comprising a rigid, concave, arcuate part whose radius of curvature is approximately that of the band when the latter is fully distended, a suction pad constituting the central portion of said concave part, two concavely

curved elements constituting the marginal portions of said curved part, said pad and each of said elements having therein suction ports, means for moving the suction pad in a direction to distend the band, and means whereby, after the pad has moved a predetermined distance, suction is created at the suction ports of the curved elements at either side of the pad.

16. A band-distending device comprising a primary suction element and an auxiliary suction element, each element having a band-engaging face provided with a suction port, a suction chamber in the primary suction element, suction passages in the auxiliary and primary elements, respectively, means for moving the primary and auxiliary elements simultaneously a predetermined distance toward band-contacting position, means for stopping the auxiliary element before the primary element contacts the band, valve means closing the opening to the passage in the auxiliary element while the parts are in the last-named position, and means for moving the elements outwardly and during such movement to open said valve thereby to create suction at the suction ports of the auxiliary element.

17. A suction device for use in a banding machine, said suction device comprising a core and a sleeve slidable thereon, the core having a suction port in its end and an interior chamber with which the port communicates, the sleeve having a plurality of suction ports in its end, passages leading from said suction ports and which at times communicate with the chamber in the core, the core and sleeve frictionally engaging so that the sleeve tends to move with the core when the latter is moved axially, means for reciprocating the core along a path of predetermined extent, and means for stopping the sleeve after it has moved with the core in either direction before the core has completed its movement.

18. In a machine for applying open ended bands to bottle necks and including means for supporting a bottle in position to receive a band, means for advancing a length of flattened tubular band-forming material, from a supply, sufficient to form a single band, means for severing said length from the supply, and means for opening the severed length to approximately circular contour and for moving the opened length in an axial direction thereby to apply it to the bottle neck, said opening and applying means comprising, in combination, a pair of opposed suction devices each having a concave face of an arcuate extent such as to contact approximately 90° of the circumference of the opened band and each having a plurality of circumferentially spaced suction ports, means for creating suction at all of the ports of each suction device, means for moving said suction devices apart thereby to open the length of material to approximately circular form, and means for moving the suction devices axially of the bottle thereby to slip the opened band onto the bottle neck.

19. In a machine for applying open ended bands to bottle necks and including means for supporting a bottle in position to receive a band, means for advancing a length of flattened tubular band-forming material, from a supply, sufficient to form a single band, means for severing said length from the supply, and means for opening the severed length to approximately circular contour and for moving the opened length in an axial direction thereby to apply it to the bottle neck, said opening and applying means comprising, in combination, a pair of opposed suction devices each having a concave face of an arcuate extent such as to contact approximately 90° of the circumference of the band when fully opened, each of said concave faces comprising a central portion, of an arcuate extent of the order of 30°, having therein a suction port, and marginal portions each having therein a suction port, said central and marginal portions being relatively movable, means for moving the central portion of the respective suction devices forwardly from the marginal portions and into contact with the opposed faces respectively of the severed length of flattened tubular material, means for creating suction at the ports in said central parts and for retracting said central parts thereby to initiate opening of the band, and means operative thereby to create suction at the ports in the marginal portions of the suction devices thereby to distend the band substantially to circular contour.

20. In a neck banding machine of the kind wherein conveyor means advances a bottle to and removes it from a band-applying station at which it dwells with its axis substantially vertical while the band is being applied and wherein the band is held in opened position by a pair of suction devices and is slipped over the bottle neck by relative movement of the bottle and the suction devices axially of the bottle, and wherein the band is a length of material which is cut from a supply of flattened tubing, in combination, a carriage located above the band-applying station, means supported by the carriage for advancing a band-forming length of flattened tubing between the suction devices, means supported by the carriage for severing said band-forming length from the tube, means supported on the carriage for supporting the suction devices and for so actuating them as to open the band-forming material so introduced between them, means supported on the carriage for moving the same suction devices downwardly a predetermined distance while holding the opened band thereby to slip the opened band over the bottle neck, and means for adjusting the carriage vertically thereby to vary the position of the horizontal plane of the lower edge of the band as the latter arrives at its final position on the bottle neck.

21. A neck banding machine according to claim 20 comprising means for varying the distance to which the suction devices move horizontally in opening the band thereby to adapt the machine for use with bands of different diameters.

22. In apparatus of the class described, means for supporting a bottle with its axis substantially vertical, a slide movable up or down axially of the bottle and above the latter, a pair of opposed suction devices carried by the slide, said devices being movable away from each other thereby to open a band held between them, vertical, normally stationary, racks, pinions journaled on the slide and which engage the racks during the earlier part, at least, of the downward motion of the slide, means actuable by rotation of the pinions to separate the suction devices thereby to open the bands, the racks being of such length that the pinions continue to engage them as the slide descends until the suction devices have been separated sufficiently to open the band whereupon the pinions roll off from the lower ends of the racks and the suction devices remain at a fixed distance apart during the remainder of the downward motion of the slide.

23. Apparatus according to claim 22 having means for adjusting the racks vertically thereby to vary the separation of the suction devices so as to accommodate bands of different diameters.

24. A device for applying bands to containers comprising a framework adapted to be mounted above a conveyor, a pair of vertically and horizontally movable vacuum heads, means for causing a container to dwell in band-receiving position with its axis vertical, means for introducing a band-forming length of flattened tubing between said vacuum heads, means for creating suction at said vacuum heads and for simultaneously moving the vacuum heads horizontally in opposite directions away from the axis of the container thereby to open the band material, means for simultaneously moving the heads vertically down while holding the open band thereby to slip the band over the container, and means for varying the lower limit of the path of movement of the vacuum heads.

25. A device for applying bands to containers comprising a framework adapted to be mounted above a conveyor, means for causing a container to dwell in band-receiving position, a pair of vertically and horizontally

movable vacuum cups, a vertical movable slide on which the vacuum cups are mounted for horizontal movement, means for reciprocating the slide vertically along a path of predetermined extent, means for introducing a flattened band beneath the vacuum cups, means for moving the cups oppositely in a horizontal direction thereby to open the band and to hold the band open while the slide moves vertically down so as to slip the band over the container, and means for varying the lower limit of movement of the slide to accommodate the device to containers of different sizes.

26. A device for applying bands to containers comprising a frame, means for holding a bottle, with its axis vertical, in band-receiving position, a vertically adjustable but normally stationary carriage supported by a frame, a vertical reciprocable slide mounted on the carriage, means for reciprocating the slide, horizontally movable vacuum heads mounted on the slide, means carried by the slide for introducing a band-forming length of flattened tubing between said heads, means for creating suction at said heads, means responsive to downward motion of the slide for simultaneously moving the heads horizontally in opposite directions away from the axis of the bottle thereby to open the band material, and means for determining the lower limit of movement of the slide thereby properly to locate the band on the bottle.

27. A device for applying bands to containers, comprising a frame, means for supporting a bottle with its axis substantially vertical at the lower part of the frame, a vertically reciprocable slide, a pair of opposed vacuum-type grippers, carriers for the grippers mounted to move horizontally along guides carried by the slide, means on the slide for advancing a length of flattened tubing between the grippers, means on the slide for cutting off said length of tubing thereby to produce a single band, means for moving the grippers oppositely thereby to open the band, the same grippers being operative to hold the band open while the slide moves downwardly thereby to place the band on the bottle neck, and means responsive to downward movement of the slide for actuating the cutting means.

28. In combination, in a machine for applying bands, open at both ends, to the necks of bottles and wherein the band to be applied is initially in the form of a flattened tube having opposed walls which are substantially in contact with each other, means for distending the flattened tube to circular form preparatory to applying it to the bottle neck, said distending means comprising two opposed relatively movable vacuum cups, each band-distending vacuum cup comprising means operative to define a cylindrically curved, band-contacting surface whose radius of curvature is approximately that of the fully distended band and which is of an arcuate extent of approximately 90°, each cup having a plurality of suction orifices disposed in a row extending circumferentially of said cylindrically curved surface.

29. In combination in a machine for applying bands, open at both ends, to the neck of bottles and wherein the band to be applied is initially in the form of a flattened tube having opposed walls which are substantially in contact with each other, means for distending the flattened tube to circular form preparatory to applying it to the bottle neck, said distending means comprising two opposed relatively movable vacuum cups, each of said band-distending vacuum cups comprising means operative to define a cylindrically curved, band-contacting surface whose radius of curvature is approximately that of the fully distended band, the radial planes which define the lateral bounds of said surface being approximately 90° apart, the band-contacting surface of each respective cup having at least one suction orifice in its central portion, and means whereby said central portion of the band-contacting surface of each cup is contacted with the band prior to the contact of the band with the lateral portions of said surface.

30. In combination in a machine for applying bands, open at both ends, to the necks of bottles and wherein the band to be applied is initially in the form of a flattened tube having opposed walls which are substantially in contact with each other, means for distending the flattened tube to circular form preparatory to applying it to to the bottle neck, said distending means comprising two opposed, relatively movable vacuum cups, each of said band-distending vacuum cups comprising means operative to define a cylindrically curved band-contacting surface whose radius of curvature is approximately that of the fully distended band and which is of an arcuate extent of approximately 90°, the cylindrically curved surface of each cup comprising a central portion in which there is at least one suction orifice, said central portion being of an arcuate extent of approximately 30° and being movable relatively to the lateral portions of said cylindrically curved surface.

31. In combination in a machine for applying bands, open at both ends, to the necks of bottles and wherein the band to be applied is initially in the form of a flattened tube having opposed walls which are substantially in contact with each other, means for distending the flattened tube to circular form preparatory to applying it to the bottle neck, said distending means comprising two opposed, relatively movable vacuum cups, each of said band-distending vacuum cups comprising means operative to define a cylindrically curved band-contacting surface whose radius of curvature is approximately that of the fully distended band and which is of an arcuate extent exceeding 60°, each band-distending vacuum cup having therein a plurality of spaced suction orifices which are arranged in a row which extends circumferentially of said cylindrically curved surface, the curved surface of each cup being so constructed and arranged as to impart an accurately cylindrical curvature to that portion of the periphery of a band which contacts said surface.

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