

Dec. 30, 1952

J. H. HOLSTEIN
BANDING MACHINE

2,623,673

Filed Aug. 6, 1949

6 Sheets-Sheet 1

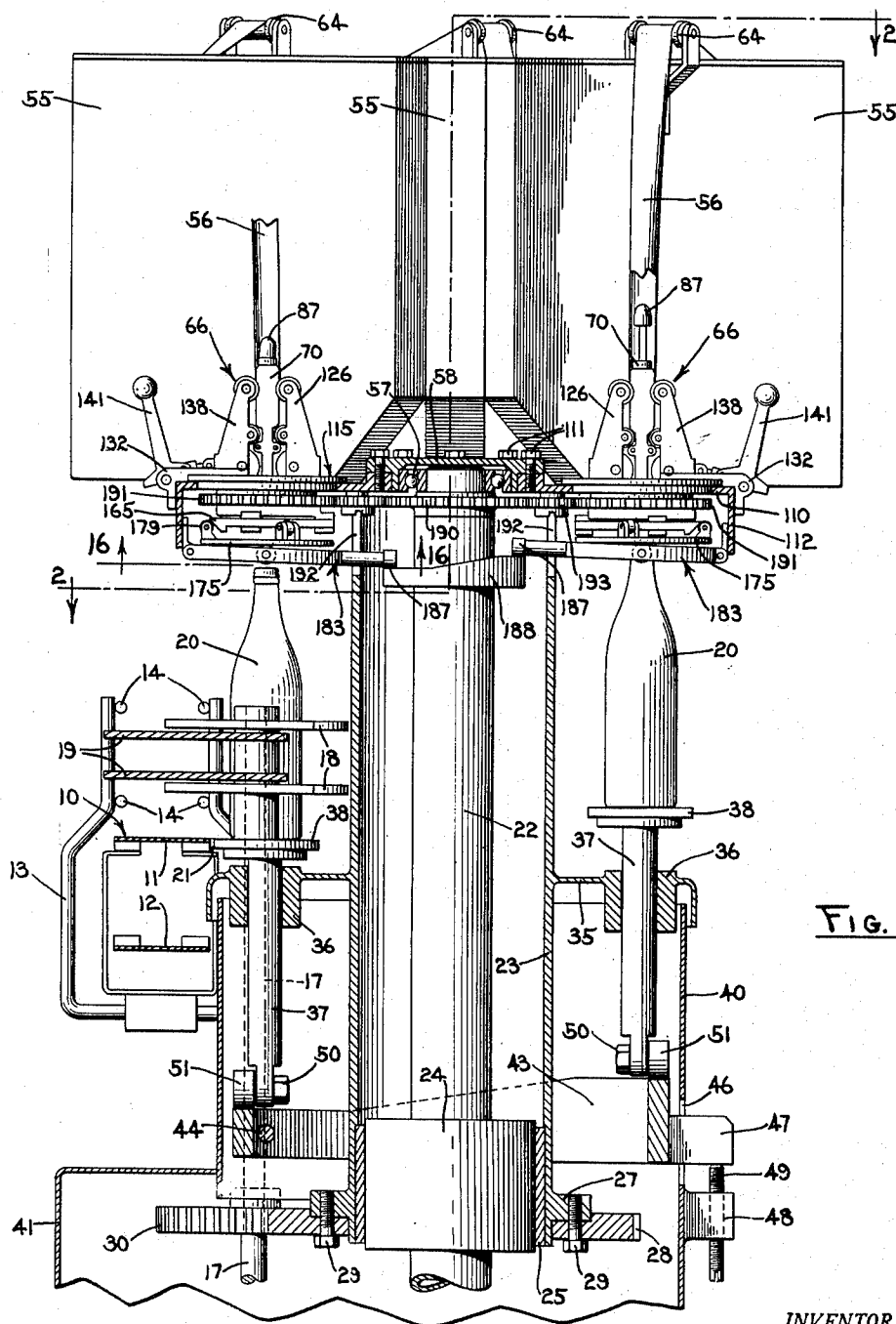


FIG. 1

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6 Sheets-Sheet 3

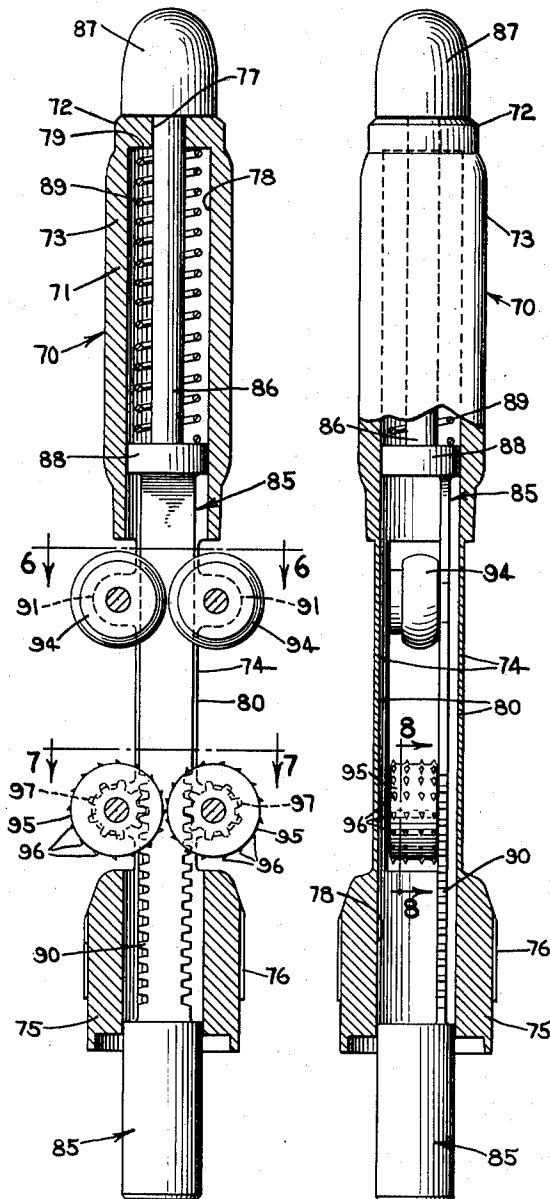


FIG. 4.

FIG. 5.

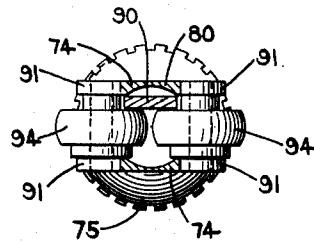


FIG. 6.

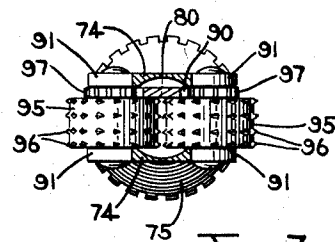


FIG. 7.

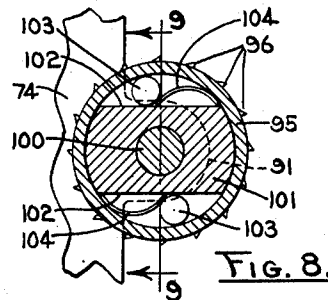


FIG. 8.

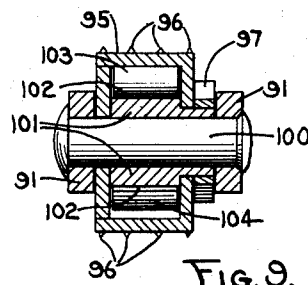


FIG. 9.

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6 Sheets-Sheet 5

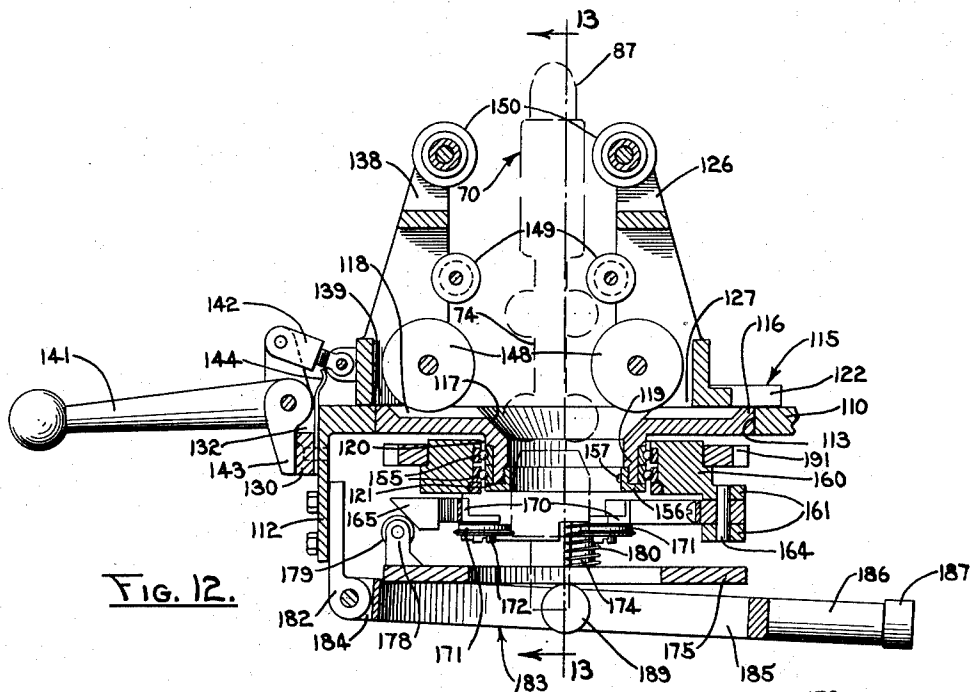


FIG. 12.

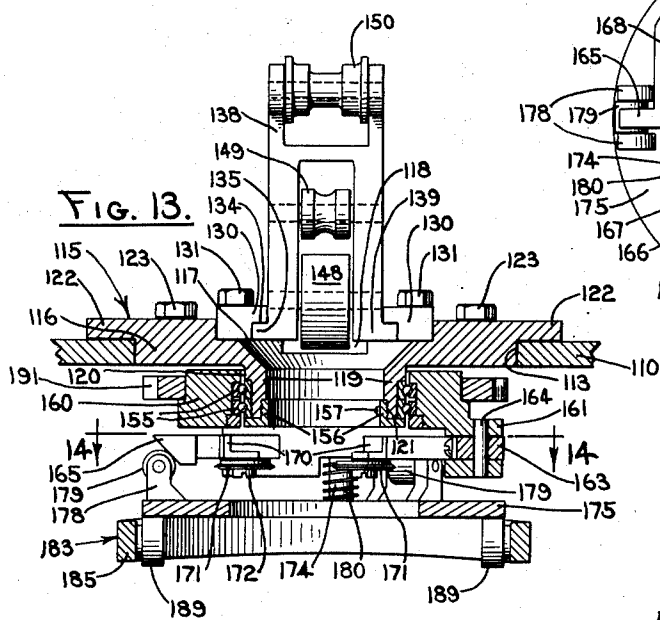


FIG. 13.

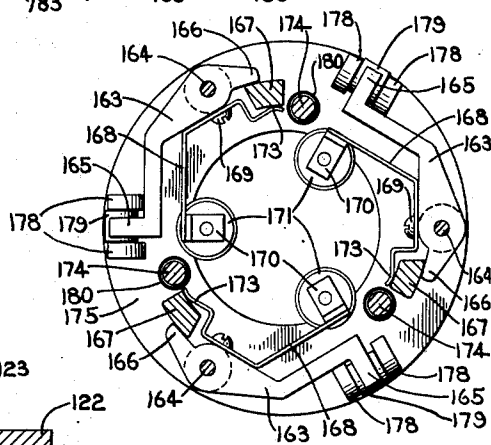


FIG. 14

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BANDING MACHINE

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Application August 6, 1949, Serial No. 109,002

13 Claims. (Cl. 226-80)

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The present invention relates to mechanical sealing apparatus and more particularly to a device for feeding flexible tubular material from a substantially continuous supply thereof predetermined distances downwardly over the upper ends of bottles and other containers previously corked, capped, or otherwise closed, and for cutting sections from said tubular material fed onto the containers for tamper-proof interconnection of the containers and their respective closing members.

In the bottling of wines and other alcoholic beverages, it has become the conventional practice to cap or plug the bottles and to apply a seal interconnecting the bottles and their plugs or caps in tamper-proof overlapping relation. The seals present a more attractive product, are a sanitary measure, and possess utility in insuring air and vapor tight integrity.

Various types of seals, such as thermo-plastic setting tapes, regenerated cellulose, and other materials have been employed which, when positioned in interconnecting relation between a container and its closure, shrink tightly into place precluding opening of the container without destroying the seal. The seals are conventionally tubular in form and maintained while stored in formaldehyde, alcohol, glycerine, or other suitable liquid precluding premature shrinking thereof.

For storage convenience, the tubular material is flattened and conventionally for mounting convenience, cut into predetermined lengths suitable for mounting on the containers of the type desired. The containers are filled with fluids, closed by means of plugs, caps, or other closing members, and subsequently have manually positioned thereon the precut tubular banding material. The operation of applying the band is time consuming and productive of considerable labor expense, in that the flattened tubular members must be distended and accurately positioned speedily and accurately to achieve the desired result. The bands manually positioned in haste frequently miss overlapping of the containers and their closures in which event they are of no effect.

An object of the present invention is to provide means for economically and dependably sealing closure members, such as corks, caps and the like, to containers such as bottles and jars.

Another object is to provide an apparatus for feeding a flexible elongated tubular member of shrinkable material downwardly over the tops of successive containers and their closures, and forming circumscribing sealing bands thereon by

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severing sections of said member positioned on the containers.

Another object is to provide an automatic mechanism for quickly and easily applying seals to containers and their closures in rapid succession.

Another object is to provide an apparatus for use in conjunction with a conveyor for containers adapted automatically to remove containers from the conveyor, to seal the containers, and to return the same to the conveyor.

Another object is to provide for the automatic feeding of banding material onto containers and their closures and for the cutting of the banding material in predetermined lengths.

Another object is to provide a floating mandrel adapted to receive flexible tubular material thereover and to be supported by the embracing of the mandrel through the flexible material.

Another object is to provide a floating mandrel having feed means operable from an end thereof adapted to receive thereover flexible tubular material having an open end portion and for motivation of the feed means through the open end of the tubular material.

Another object is to provide, in a banding machine, a combined feeding and cutting mechanism mounted for corresponding revolutionary movement and automatic motivation and timing in response to their azimuthal positions during revolution.

A further object is to provide a bottle sealing mechanism driven by bottle engagement with remains quiescent in the absence of the proper positioning of a bottle to receive sealing material, thus obviating upset of synchronous operation by bottle misalignment or timed positioning and resultant waste of sealing material.

A still further object is to provide an apparatus, including mobile container support means, for automatically feeding tubular sealing material downwardly over the tops of containers and for cutting sections from the tubular material positioned on the containers, in which motivation of the feeding and cutting operations is derived from movement of the support means.

Additional objects and advantages will become apparent in the subsequent description in the specification.

Fig. 1 is a vertical sectional view through a structure embodying the principles of the present invention.

Fig. 2 is a plan view, partially in horizontal section, of the device shown in Fig. 1. For ready

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correlation of Figs. 1 and 2, Fig. 1 may be deemed as taken on line 1—1 of Fig. 2.

Fig. 3 is a comparative representation of a cutting control cam and a band feeding cam employed in the device of the present invention illustrating their azimuthal relations.

Fig. 4 is an enlarged vertical section of a floating mandrel adapted to receive thereover tubular banding material to be applied to containers and their closures as taken on a line radially of the apparatus shown in Fig. 2.

Fig. 5 is a view of the floating mandrel shown in Fig. 4 as seen radially of the apparatus shown in Fig. 2, or 90 degrees from the position viewed in Fig. 4.

Fig. 6 is a section taken on line 6—6 of Fig. 4 illustrating thrust rollers employed in the floating mandrel.

Fig. 7 is a section taken on line 7—7 of Fig. 4 showing feed rolls for the tubular material employed in the floating mandrel.

Fig. 8 is an enlarged sectional view taken on line 8—8 of Fig. 5 showing a uni-directional drive linkage or overrunning clutch employed in the floating mandrel for uni-directional motivation of the feed rollers.

Fig. 9 is taken on line 9—9 of Fig. 8 and serves further to demonstrate the uni-directional drive linkage of Fig. 8.

Fig. 10 is an enlarged sectional view of the device of the present invention as viewed from line 10—10 of Fig. 2, illustrating the condition of the feeding means in the present invention preliminary to the feeding operation.

Fig. 11 is similar to Fig. 10 and demonstrates elements shown therein at the termination of the feeding operation for the tubular material.

Fig. 12 is similar to Figs. 10 and 11, but demonstrates the opening of a holding chuck for the floating mandrel as for removal of the mandrel to thread or unthread the tubular banding material.

Fig. 13 is a vertical section taken on line 13—13 of Fig. 12.

Fig. 14 is a horizontal plane view of the cutting mechanism for the tubular material as viewed from line 14—14 of Fig. 13.

Fig. 15 is a horizontal plane view of a portion of the mechanism of the present invention as viewed from line 15—15 of Fig. 10.

Fig. 16 is a fragmentary horizontal section taken on line 16—16 of Fig. 1 and viewed upwardly demonstrating the motivating linkage for the cutting means of the present invention.

Referring in greater detail to the drawings:

It is conventional practice to employ endless conveyors in the filling, capping, and labelling of bottled beverages and the like. Such a conveyor is shown generally at 18, in Fig. 2, having an upper run 11 and a return lower run 12. The conveyor is motivated in any suitable manner and periodically along its length provides brackets 13 upwardly extended adjacent thereto mounting guide rods 14 longitudinally of the conveyor to retain bottles thereon for their transportation from point to point.

A pair of shafts 17 are rotatably mounted in substantially erect positions adjacent to the conveyor 10 and spaced longitudinally thereof. A pair of elevationally spaced star cams are mounted on each of the shafts 17 for rotation in partially overlaying relation to the conveyor 10. Horizontally intermediate the star cams are a pair of fixed bottle directing plates 19, which in association with the star cams serve to remove

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bottles, indicated generally at 20, from the conveyor and to bottle supporting tables, subsequently described in greater detail, and after banding the bottles, to return them from the supports to the conveyor. To facilitate this transitional movement, transition platforms 21 are mounted at the same height as the conveyor 10 and positioned to provide a sliding path from the conveyor to the tables and from the tables back to the conveyor. This relationship is most clearly evident in Fig. 2 and constitutes a suitable well known means of removing articles from the endless conveyor for treatment at a station and their return from the station to the conveyor.

As shown in Fig. 1, a support shaft 22 is fixedly mounted in any suitable manner in a substantially erect position adjacent to the conveyor 10. A tubate housing 23 is mounted concentrically on the shaft 22 for rotation thereabout by means of a fixed bearing 24 integral with the shaft 22 and a movable bearing 25 rotatably mounted on the fixed bearing and integral with the housing. An annular flange 27 is provided on the lower end of the housing and a spur gear 28 mounted concentrically of the housing by connection to the flange, as shown at 29. Driven interconnection is provided between one of the shafts 17, the housing 23, and the other shaft 17 by mounting pinion gears 30 on each of the shafts 17 in engagement with the spur gear 28. One of the shafts 17 is power driven in any suitable manner and through its pinion gear 30 rotates the housing 23 and thence the opposite shaft 17. The timed relation of the rotation of the housing 23 and the star cams 18 mounted on the shafts 22 will subsequently become apparent.

An annular bracket 35 is radially extended from the housing 23 and provides a plurality of erect bearings 36 therein in a horizontal annular arrangement. Support posts 37 are mounted in the bearings 36 for reciprocal elevational movement and provide bottle supporting tables 38 at their upper end portions above the bracket 35. The peripheral edge of the bracket 35 is preferably downwardly turned and a substantially cylindrical fixed housing 40 received within the down turned edges and fixedly mounted therebelow. The housing is conveniently extended as at 41 in Fig. 1 to contain the drive linkage, previously described including the shafts 17, pinion gears 30 and spur gear 28.

An annular cam 43 is pivotally mounted, as on a fulcrum line 44 interconnecting the points of entry and departure of the bottles 20 from the tables 38, in the fixed housing 40 concentrically of the tubate housing 23. Opposite to the pivotal mounting 44, the housing 40 is vertically slotted as at 46, and a tipping control flange 47 extended outwardly through the slot for external control. A bracket 48 is weldably secured to the fixed housing 40 below the control flange 47 and a manually rotatable control rod 49 screw threadedly mounted in the bracket in flange engagement. Rotation of the control rod serves pivotally to elevate and to lower the cam 43. The configuration of the cam 43 and its relation to the conveyor is illustrated in Figs. 2 and 3. The cam is shown in elongated form in Fig. 3 with the degrees of revolution thereof correlated therewith to indicate cam function and configuration. The cam is pivotally mounted at its point of nearest proximity to the conveyor and thus may be visualized as beginning centrally of the plate 19 at a "0" degree of revolution. The cam is substantially horizontal for the first 45

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degrees of clockwise progression, as the mechanism is viewed in Fig. 2, and thence slopes upwardly for approximately 60 degrees. The cam has a dwell, or flattened portion, between approximately 105 degrees and 255 degrees of revolution and thence declines for approximately 60 degrees of further progression. The succeeding 45 degrees of the cam is flat and continuous with the first 45 degrees thereof. It will be obvious that the tipping of the cam about the pivotal mounting 44 will cause a responsive change in inclination or declination of the portions thereof but their relative attitudes will remain constant during such tipping. Further, the portions of the cam directly below the points of entry and departure of the bottles remain at a constant elevation independent of such pivotal movement because of the positioning of the fulcrum. It will be apparent that the cam may be adjustably tipped while the apparatus is in operation.

Stub axles 50 are mounted transversely in the lower end portions of the posts 37 and radially extended relative to the annular cam 43. A cam follower 51 is journaled on each of the stub axles in rolling engagement with the cam 43. It will thus be apparent that as the tubate housing 23 is rotated, the bottle supporting tables 38 will be caused to revolve thereabout and will be elevationally positioned in response to the cam 43, being flush with the upper run 11 of the conveyor when adjacent thereto, remaining at a substantially constant elevation for approximately 45 degrees, being elevated during the succeeding 60 degrees, carried at the elevated level for 150 degrees, lowered during the succeeding 60 degrees and thence carried at substantially the elevation of the upper run of the conveyor to the starting point. Thus, bottles 20 removed from the conveyor 10 by one of the star cams 13 are positioned on the bottle support tables 38, elevationally reciprocated as the tables revolve unitarily with rotation of the housing 23, and are returned to the conveyor from the support tables by the second star cam.

Magazines 55 for supplies of tubular banding material, indicated at 56, are provided individual to the bottle support tables 38 thereabove. The magazines are preferably fluid tight and may conveniently be supported by means of a bearing 57 supported on the upper end of the shaft 22 having a cap 58 bearing an assembly mounting plate, subsequently described, which in turn bears magazine mounting brackets 59 rotatably positioned thereon. It has been found convenient to mount the magazines in radially extended positions relative to the shaft 22 but it is to be understood that any suitable magazine configuration or supporting position may be employed without departing from the spirit or scope of the present invention. In fact, one or a plurality of magazines may be employed from which a plurality of bottle banding stations are supplied. The banding material, indicated at 56, is tubular in form but flattened for storing convenience and maintained in the magazines in any desired fluid precluding premature shrinking. The banding material may be of thermo-plastic type, regenerated cellulose, or any other material which may conveniently be shrunk on the upper ends of containers and their closures for sealing purposes and of course the fluids employed in the magazines must be of a type appropriate to the banding material employed. To facilitate feeding of the tubular banding material from the magazines, a feeding spool 64 is mounted on each of

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the magazines and serves to facilitate withdrawal of the tubular material from its respective magazine. For purposes of convenience, the banding stations to which the banding material is fed are indicated at 66.

The tubular banding material is fitted over a floating mandrel, indicated generally at 70, whose individual components are most clearly shown in Figs. 4 to 9, inclusively. The mandrel has a body 71 having a leading end 72, a guide portion 73, a narrowed central portion 74, and a flared trailing end 75. The leading end is conveniently cylindrical and terminates in a plane substantially normal to the longitudinal axis of the mandrel. The guide portion 73 is delineated by substantially parallel guide ways or faces generally in transverse rectangular or square arrangement. The purpose of the guide portion is to permit embracing of the body of the mandrel through the flexible tubular material 56 fitted thereover and to resist rotational movement of the mandrel during operation. Thus, any guide ways suitable to the purpose may be employed in the guide portions without departing from the spirit or the scope of the present invention. The trailing end is substantially cylindrical in form and may provide longitudinal flutes 76 for handling convenience to minimize surface contact with the banding material and resulting frictional engagement therewith yet to provide dependable distention for banding purposes. A bore 77 is formed longitudinally through the body and a counterbore 78 formed from the trailing end to a position short of the leading end providing a shoulder 79 at the leading end circumjacent the bore 77. At the central portion 74, elongated segments of the body defining the counterbore 78 are removed leaving a pair of substantially parallel strut portions 80 shown in Figs. 4, 5, 6, and 7.

A plunger 85 is mounted in the counterbore 78 for slideable movement longitudinally of the body and is extended from opposite end portions of the body. The plunger provides a rod 86 slideably fitted to the bore 77 and mounting a distending nose 87 at the leading end of the body. Spaced from the nose 87 and within the counterbore 78 is provided a cylindrical spring stop 88 integral to the rod 86 and slideably fitted to the counterbore. A compression spring 89 is located under initial compression between the shoulder 79 and the stop 88 and urges the plunger into trailing end extension from the body, as limited by engagement of the nose 87 on the leading end. At the trailing end of the body, the plunger is cylindrical in form and slideably fitted to the counterbore 78. The cylindrical portion of the plunger at the trailing end of the mandrel is connected in fixed spaced relation to the spring stop 88 by a rack gear member 90 which is laterally offset from coaxial alignment with the remaining portions of the plunger, as shown in Fig. 5.

A pair of flanges 91 are laterally extended from each of the struts 80 adjacent each of the opposite ends of the central portion 74, corresponding flanges on the struts being positioned in transverse alignment.

A pair of thrust rollers 94 are positioned between the struts 80 and rotatably mounted in the upper pair of flanges 91. The thrust rollers preferably provide peripheries which are axially arcuate for guiding convenience.

A pair of feeding rollers 95 are positioned between the struts 80 and journaled in the lower

pair of flanges 91. The feeding rollers bear peripheral serrations 96 to facilitate positive feeding of the tubular banding material by internal engagement therewith. As shown in Fig. 7, spur gears 97 are mounted coaxially with the feed rollers 95 and meshed with the rack gear 90 of the plunger 85.

Inasmuch as it is desired to impart uni-directional rotational movement to the feed rollers 95 upon reciprocal movement of the plunger 85 and its rack gears 90, a uni-directional drive linkage, or over-running clutch, provides driving connection between the spur gears 97 and the feed rollers 95, as shown in Fig. 9. Mounting pins 100 are extended between the corresponding flanges 91 of the struts 80. Cam blocks 101 are journaled on the pins 100 and provide one or more chordally flattened surfaces 102. The feed rollers 95 are provided with enlarged concentric inner bores and are rotatably mounted on the cam blocks 101. The spur gears 97 are journaled on the pins 100 and connected to the cam blocks 101 for unitary rotational movement therewith. Cylindrical catch-bearings 103 are positioned between the chordally flattened surfaces 102 of the cam blocks 101 and their respective circumjacent feeding rollers 95. Fracto-cylindrical springs 104 are rested on the chordally flattened surfaces intermediate the cylindrical bearings and the circumjacent feed rollers, as shown in Fig. 8, on the sides of their respective cylindrical bearings toward which their respective circumjacent feed roller is to be motivated. As viewed in Fig. 9, when the cam block 101 is rotated in a clockwise direction, the cylindrical bearings 103 roll outwardly on the flattened surfaces 102 and provide binding interconnection between the cam block and the circumjacent feed roller. When the cam block is rotated in a counterclockwise direction, the cylindrical bearings roll from feed roller engagement against the fracto-cylindrical springs 104 and in such position either disengage the feed roller entirely or contact the same at such a frictional angle that rotation is freely permitted between the cam block and its respective feed roller. This uni-direction drive linkage between the spur gears 97 and their respective feed rollers 95 illustrates a suitable form that may be employed, it being understood, that any other suitable uni-directional drive linkage may be employed for the purpose described. The bearings 103 and the fracto-cylindrical springs 104 are held axially in place by circular plates 105 positioned at opposite ends of the cam blocks 101 and rotatably fitted within the feed rollers 95.

The floating mandrel 70 is adapted to be threadably received in the open end portion of flexible tubular banding material, to be supported in predetermined substantially erect positions by embracing thereof through the tubular member, and positively to feed the tubular member toward the trailing end thereof in response to reciprocal positioning of the plunger 85 by driving engagement with the portion of the plunger extended from the trailing end of the mandrel accessible through the open end of the tubular member by the previously capped, plugged, or otherwise closed upper end portion of a bottle supported on one of the bottle supporting tables 38.

As shown in Fig. 1, the cap 58 is provided with a radially extended circumscribing flange. An assembly mounting plate 110 is concentrically mounted on the flange portion of the cap member 58 by cap screws 111 screw-threadably interconnecting said flange portion and the plate. The

mounting plate has a circular periphery and a circumscribing down turned edge 112 integral therewith. Circular openings 113 are pierced in the mounting plate in elevational alignment with the bottle support tables 38 at each of the banding stations 66. The openings provide convenient nesting locations for a mounting structure for the floating mandrels 70 and a mechanism for cutting the banding material 56, as shown most clearly in Figs. 10, 11, 12, and 13.

A base member 115 is provided with a circular lower portion 116 fitted to the opening 113. A funnel shaped opening 117 is provided concentrically in the base member and facilitates threaded reception of the floating mandrel 70. The lower portion 116 is preferably provided with a machined upper surface and has a roller accommodating groove 118 formed therein radially of the assembly mounting plate 110 in which it is mounted. Concentrically of the funnel shaped opening a depending cylindrical portion 119 constitutes a bearing support. The cylindrical portion provides a circumscribing shoulder 120 adjacent to the upper end thereof and is formed with a groove 121 inwardly disposed the lower end of said portion. Segmentally cylindrical upper portions 122, clearly evident in Figs. 13 and 15, are formed integrally with the lower portion 116 and overlay the plate 110. A plurality of cap screws 123 secure the base member 115 to the assembly mounting plate 110. The segmentally cylindrical portions 122 are provided with parallel adjacent edges defining a channel therebetween.

Adjacent and radially inwardly relative to the assembly mounting plate 110 from the opening 117, a fixed bracket 126 having a base 127 is rigidly mounted in the channel defined by the parallel edges of the segmentally cylindrical portions 122, as by cap screws 128, and upwardly extended from the mounting plate. The cap screws 128 rigidly mount the fixed bracket 126 on the lower portion 116 of the base member 115 and for convenient removal from the plate 110 integrally with the base member.

Radially outwardly of the assembly mounting plate 110 from the funnel shaped opening 117, a bifurcated member 130 is fixedly mounted, as by cap screws 131 engaged in the lower portion 116 of the base member, between the segmentally cylindrical portions 122 of said member. The bifurcated member is extended downwardly over the down turned edge 112 of the mounting plate 110 and provides a pair of spaced ears 132 radially related to the plate 110 outwardly of the periphery of said plate as a convenience in mounting a manual control lever therein. As shown in Fig. 13 and in dotted line in Fig. 15, the bifurcated portions of the member 130 are undercut as at 134 to provide in association with the machined upper surface of the lower portion 116, a pair of juxtapositioned channels 135.

A movable bracket 138 is provided with a laterally extended base 139 which is slidably received in the channels 135 for slidable radial movement of the movable bracket relative to the plate 110 and adjustable spacing of the movable bracket relative to the fixed bracket 126.

To facilitate adjustable positioning of the movable bracket 138 longitudinally in the juxtaposed channels 135, a manual control arm 141 is pivotally mounted in the spaced ears 132. The control arm and the movable bracket 138 are pivotally interconnected by means of a toggle linkage 142. A stop 143 is provided on the manual control arm which abuts the down turned portion of the

bifurcated member 130 to limit the outward and downward pivotal movement of the control arm and resultant outward movement of the movable bracket 138. It will be apparent that rotation of the assembly mounting plate 110 will impart a measure of centrifugal force to the manual control arm 141 tending to throw the same outwardly and to separate the brackets 138 and 126. To resist this tendency a spring 144 is mounted, as by a cap screw 145 engaged in the down turned portion of the bifurcated member 130, and extended upwardly for engagement with the toggle linkage 142 so as to urge the movable bracket 138 through the toggle linkage inwardly. The main inwardly holding action, however, is achieved by arranging the toggle linkage 142 so that upon full inward movement of the movable bracket 138 the toggle linkage pivots downwardly from alignment between the pivotal mounting of the control arm 141 and the pivotal connection of the toggle linkage to the movable bracket 138. This downward movement of the toggle linkage is limited by engagement of a portion of the control arm 141 and/or the toggle linkage 142 with the plate 110.

A cylindrical mounting roller 148 is journaled horizontally in each of the brackets 138 and 126 at a corresponding elevation. The groove 121 in the lower portion 116 of the base member accommodates the rollers 148. As shown in Figs. 10 and 11, the mounting rollers are of such a size as simultaneously to engage the feed rollers 95 and the thrust rollers 94 when the mandrel 70 is positioned therebetween and the bracket moved inwardly. The peripheries of the mounting rollers 148 extend between the thrust rollers 94 and the feed rollers 95 and resist downward thrust on the mandrel by engagement with the thrust rollers. Inasmuch as the feed rollers 95 have peripheral serrations 96 which tend to rupture the tubular banding material 56 when brought too forcibly to bear against the roller 148, vertical thrust on the mandrel is resisted by a pair of thrust resisting rollers 149 mounted adjacent to each other in the brackets 126 and 138 in engagement with the upper portions of the thrust rollers 94. The thrust resisting rollers each have a circumscribing groove complementary to the axially arcuate peripheries of the thrust rollers 94 evident in Fig. 6.

A pair of torque resisting rollers 150 are rotatably mounted in the upwardly extended portions of the brackets 126 and 138 in engagement with the guide portion 73 of the mandrel. As evident in Figs. 13 and 15, the torque resisting rollers have circumscribing grooves complementary to the guideways of the guide portion so that the guide portion of the mandrel is embraced by the rollers 150 through the tubular banding material 56 in torque resisting relation when the bracket 138 is moved inwardly. Although the mounting rollers 148, thrust resisting rollers 149 and torque resisting rollers 150 have been described as engaging portions of the mandrel 70, it is of course understood that no direct engagement is made because the banding material 56 is fitted downwardly over the mandrel. The flexibility of the banding material accommodates mandrel embracing by said rollers and dependable holding therethrough.

As evident in Figs. 10, 11, 12 and 13, a roller bearing 155 is mounted on the cylindrical portion 119 of the base member 115 against the shoulder 120. A flanged collar 156 is received in the groove 121 and dependably locked in bearing retaining position, as by set screws 157. The roller bearing 155 provides an outer race to which

is fixedly mounted an annular cutter mounting plate 160. A plurality of ears 161, evident in Figs. 12 and 13, are downwardly and radially extended from the cutter mounting plate. A cutter arm 163 is mounted on each of the ears 161 by downwardly extended pins 164 for pivotal movement in a common plane substantially parallel to the cutter mounting plate 160. The cutter arms 163 are positioned in a generally circular arrangement, as shown in Fig. 14, and have controlling end portions bearing substantially vertically positioned wedge shaped cams 165 downwardly disposed. Oppositely extended from the controlling end portions of the cutter arms are stops 166 adapted for engagement with depending bosses 167 integral with the mounting plate 160 to limit outward pivotal movement of the controlling end portions of the arms.

A strip spring 168 is mounted on each of the cutter arms as by a cap screw 169 engaged with the arm adjacent to its pivotal mounting. The springs are arranged in the plane of the cutter arms 163 and have end portions extended generally in the direction of the controlling end portions of the arms and radially inwardly of the circular arrangement of the arms. Brackets 170 are radially inwardly extended from the extended end portions of the springs and rotatably mount cutting wheels 171 on stub axles 172. It will be apparent from observation of Fig. 14 that pivotal movement of the control arms 163 resiliently moves the cutting wheels 171 radially of the cutter mounting plate 160. The springs have opposite end portions 173 extended for engagement with the bosses 167 and in association therewith urge their respective cutter arms outwardly to positions limited by the stops 160.

A plurality of rods 174 are slidably mounted in the mounting plate 160, as at 176, and downwardly extended therefrom. An annular control plate 175 is fixedly mounted on the dependent ends of the rods 174 for axial elevational movement relative to the cutter mounting plate 160 and for unitary rotational movement therewith. The rods are held in slidable engagement with the mounting plate 160 by a control arm in supporting relation to the control plate, as presently described. A pair of parallel flanges are provided in substantially vertical alignment with the wedge shaped cams 165 and upwardly extended from the control plate. A rotary cam follower 179 is mounted in each of the pair of flanges for engagement with their respective adjacent wedge shaped cams. Helical springs 180 are arranged circumjacent the rods 174 under initial compression between the mounting plate 160 and the control plate 175 and serve to urge the control plate downwardly on the rods 174 to remove the cam followers 179 from engagement with the wedge shaped cams.

A depending strap 182 is mounted on the down turned edge 112 of the assembly mounting plate 110 in a position in radial alignment with the center of the control plate 175 and the main support shaft 22. Control arms, indicated by the numeral 183, have bifurcated end portions 184 pivotally mounted in the depending end portions of the straps 182 and are radially inwardly extended therefrom. Each of the control arms provides a circular central portion 185 concentrically disposed to their respective control plates 175 and a radially inwardly extended end portion 186 mounting a cam follower 187 rotatably thereon. The cam followers 187 ride on a cut-off cam 188 shown in Figs. 1, 2, 3, and 16. The cam 188 is

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fixedly mounted on the shaft 22 with the followers in engagement with the upper surface thereof. As shown in Fig. 3 the cut-off cam has a relatively flat portion for the first 105 degrees of revolution from the zero point, as previously designated, inclines upwardly during the next approximate thirty degrees of revolution, has a flattened upper dwell for the succeeding 120 degrees, then declines for approximately 60 degrees to a flattened lower portion for the remaining 45 degrees of revolution which is at the same elevation as the first 105 degrees of revolution. This is most clearly evident in Figs. 1, 13, and 16. A pair of rollers 189 are mounted on the control arm 183 at substantially equal distances from the pivotal mounting of the control arm and for diametrically opposite engagement with the control plate 175. Thus, pivotal positioning of the control arm elevationally positions the control plate.

Rotation of the assembly mounting plate 110 in response to rotation of the sleeve 23 through the gear linkage 29—30 previously described, results in the revolving of the various banding stations 66 and positive rotation of the annular cutter mounting plates 160. A drive gear 190 is fixedly mounted concentrically on the shaft 22. A driven gear 191 is fixedly mounted concentrically on each of the annular cutter mounting plates 160. The sleeve 23 is ported at 192 in alignment between each of the driven gears 191 and the drive gear 190 and a reach gear 193 rotatably mounted on the assembly mounting plate 110 in mesh with the drive gear 190 and each of the driven gears 191. The gear ratios are such that the annular cutter mounting plates 160 rotate a minimum of at least 120 degrees while their respective cam followers traverse the 120 degree extent of the upward dwell of the cut-off cam 188 so that the employment of the three cutting wheels 171 completely severs the banding material 56.

Operation

The operation of the device of the present invention is believed to be clearly apparent and is briefly summarized at this point. The manual control arms 141 are pivoted outwardly to retract their respective brackets 138 from their cooperative fixed brackets 126 to release the floating mandrels 70 for removal. Each mandrel is threadedly inserted into the open end portion of the tubular banding material 56 fed from its adjacent magazine 55. The banding material is retained in a submerged condition in a suitable liquid in its magazine so as to avoid premature shrinking whenever the apparatus of the present invention is not in operation. The banding material from each of the magazines is fitted downwardly over its respective floating mandrel until the end portion thereof is adjacent to the trailing end 75 of the mandrel.

The mandrels are inserted between their brackets 126 and 138 and the control arms 141 elevated moving the bracket 138 toward the bracket 126 so that the mounting rollers 148, thrust resisting rollers 149, and torque resisting rollers 150 embrace the mandrel through the tubular banding material fitted thereover. With the mandrels mounted between their brackets, the apparatus is conditioned for operation.

The mandrels located adjacent to the conveyor 10 have the plungers 85 thereof downwardly extended for bottle engagement under the urging of the mandrel springs 89 and the control arms 183 of banding stations located adjacent to the

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conveyor are downwardly pivoted as permitted by their respective cut-off cams 188 lowering the control plates 175 relative to their respective cutter mounting plates 165 and retracting the cutting wheels 171, all as illustrated in Fig. 10.

Bottles 20, or other containers, having been previously filled and capped, plugged, or otherwise closed are positioned on the conveyor 10 and the conveyor motivated to transport the bottles toward the apparatus of the present invention and to convey the bottles after having been sealed away from the apparatus. One of the star cam shafts 17 is power driven, as previously described, so that as each bottle passing down the conveyor 10 reaches the first star cam 18, said cam engages the bottle and directs it along the edges of the bottle directing plates 19 from the conveyor. The pinion gear 30 of the driven star cam shaft engages the spur gear 28 mounted fixedly on the housing 23 and through said pinion gear rotates the housing and the spur gear 30 on the opposite star cam shaft 17. Rotation of the housing 23 revolves the bottle supporting tables 38 synchronously with rotation of the star cams 18 so that as a bottle 20 is moved from the conveyor over the slide platform 21, a supporting table 38 is positioned to receive the bottle and as a bottle passes from the apparatus of the present invention, the second star cam 18 is synchronized to remove a bottle from its respective supporting table 38 adjacent to the table and to direct the same along the edges of the bottle directing plates 19 over the second slide platform 21 back upon the conveyor 10. The rotation of the star cams 18 and the revolutionary movement of the supporting tables 38 are continuous, their synchronous motivation precluding any need for stepped positioning.

It is to be remembered that the banding stations 66 including the mandrels 70, their mounting brackets 126 and 138, and the cutting mechanisms described revolve about the shaft 22 with their respective bottle supporting tables 38 in vertical alignment therewith. Shortly after a table 38 receives a bottle, revolutionary movement of the table elevates the table by the riding of its respective cam follower 51 on the cam 43. This elevation results in a corresponding elevation of a bottle 20 supported on the table, the closure of which is brought into engagement with the lower end of the plunger 85 thrusting said plunger upwardly against resistance offered by the spring 89. This upward movement of the plunger in response to elevation of a bottle continues until the bottle is brought closely adjacent to the trailing end 75 of its respective floating mandrel 70. The movement of the plunger 85 upwardly in its mandrel 70 rotates both of the feed rollers 95 mounted thereon by engagement of the spur gears 97 and the rack gear 90. The rotation of the feed rollers 95 aided by their peripheral serrations 96, positively draw downwardly on the banding material 56 and the open end portion of the tubular banding material is fed downwardly over the upwardly extended end of the bottle and its closure, as shown in Fig. 11.

The extent, or length, of the tubular banding material 56 fed downwardly over a bottle may be controlled by pivotally positioning the cam 43 about its mounting 44. For example, when a longer length of banding material is desired on a series of bottles, the control rod 49 is run upwardly in its bracket 48 to elevate the free end portion of the cam 43. Thus, the tables 38 are elevated higher during their revolutionary move-

ment and a correspondingly longer length of tubular banding material is fed downwardly over bottles borne by the tables. Obviously, to shorten the length of banding material employed, the control rod 49 is lowered in its bracket 48 to lower the free end of the cam 43. It will further be obvious, that for bottles of different height different cams may be employed compensating for the varied bottle lengths by increased or decreased cam axial thickness. Only simple modifications are required to adapt the apparatus of the present invention to bottles or other containers of various heights and to control the extent of the banding material fed downwardly thereover.

As shown in Fig. 3, the feeding cam 43 maintains the tables 38 at a substantially constant elevation on an elevated dwell between 105 and 255 degrees of revolutionary movement of the tables. While the tables and their bottles are elevated on the dwell and after the feeding of the tubular banding material over the upper portions thereof, the cam followers 187 ride upwardly on the cut-off cam 188 and their respective control plates 175 are elevated relative to their annular cutter mounting plates 160. This condition is demonstrated in Fig. 11. Upon elevation of the control plates 175, the cam followers 179 roll upwardly against their respective wedge shaped cams 165 forcing the same radially inwardly and pivoting the cutter arms 163 to move the cutting wheels 171 resiliently inwardly. It will be recalled that whenever the bottle supporting tables 38 are rotated, the cutter mounting plates 160 are rotated by engagement of the gears 190, 193 and 191 evident in Fig. 16. As shown in Fig. 11, the upward pivotal movement of the control arms 183 in response to traversal of the cut-off cam 188 by the cam followers 187 results in the inward urging of the cutting wheels 171 into engagement with the tubular banding material 163 overlaying the trailing end 75 of the floating mandrel 70. The revolutionary movement of the cutting wheels 171 in response to rotation of the cutter mounting plate 160 rolls the cutting wheels about the extreme lower end portion of the mandrel and severs the tubular banding material at that point by cutting action against the mandrel. It will be observed in Fig. 11 that the point of severing the banding material is approximately flush with the upper end portion of the closure of the bottle.

Subsequent revolutionary movement of the bottle supporting tables 38 through the actions of the cams 43 and 188 causes the tables to return to their initial elevation and the cutter wheels to retract from mandrel engagement by lowering of the control plate 175 under the urging of springs 180 relative to the cutter mounting plate 160.

As each of the tables 38 returns toward the conveyor 10, its bottle is engaged by the second star cam 18 and swept from the table, which then is at the same elevation as the conveyor, onto the conveyor along the edges of the bottle directing plates 19. The bottles are thence transported by the conveyor to a labeling, packaging, or other station as desired.

Whenever the apparatus of the present invention is permitted to remain stationary or inoperable for a time sufficient to endanger the tubular banding material 63 where it is removed from the immersing liquid contained in the magazines 55, the operating levers 141 are pivoted outwardly, moving the brackets 138 away from the brackets 126 and freeing the floating mandrels 70 for removal. This condition is demonstrated in Fig. 12. Upon removal of the man-

drels, the tubular banding material is removed therefrom and returned to the magazines for immersion and protection against premature shrinking before use.

The banding material which is applied to the containers shrinks thereon and provides dependable seals between containers and their closures in the manner well known in the art. The device of the present invention permits the dependable and speedy banding of containers and their closures in a fully automatic manner and with complete uniformity. There are no misplaced bands and no containers are passed through the operation without being banded. The lengths of the bands are conveniently regulated, and the apparatus readily adjusted to accommodate containers of various heights. The extensive labor incident to manual band opening and fitting is eliminated.

Although I have herein shown and described my invention in what I have conceived to be the most practical and preferred embodiment, it is recognized that departures may be made therefrom within the scope of my invention, which is not to be limited to the details disclosed herein, but is to be accorded the full scope of the claims so as to embrace any and all equivalent device or apparatus.

Having described my invention, what I claim as new and desire to secure by Letters Patent is:

1. A banding machine comprising a bottle support, a floating mandrel adapted threadably to receive thereover a continuous supply of tubular banding material, means holding the mandrel in an erect position above the bottle support, means periodically elevationally reciprocating the bottle support and the mandrel holding means relative to each other, feed rolls mounted on the mandrel adapted to receive the tubular banding material thereover, a feed plunger mounted for elevational reciprocal movement in the mandrel and having driving connection with the feed rolls, said feed plunger being downwardly extended for endward engagement with the top of a capped bottle arranged on the bottle support in alignment therewith and endwardly reciprocated during such engagement by relative elevational movement of the bottle support and mandrel holding means and through the feed rolls to feed the tubular banding material downwardly over the top of such a bottle, and a cutter for the banding material automatically operated to cut predetermined lengths therefrom synchronously and following the feeding thereof downwardly over such bottles, the cutter providing a cutting edge rotated about the mandrel and reciprocally moved to and from mandrel engagement intermediate movement of the bottle support and mandrel relatively to and from each other during their relative elevational reciprocation.

2. A banding machine comprising a bottle support, a floating mandrel adapted threadably to receive thereover a continuous supply of tubular banding material, means holding the mandrel in an erect position above the support by embracing the mandrel through the tubular material, means periodically elevationally reciprocating the support and the mandrel holding means relative to each other, feed means mounted in the mandrel for internal engagement with the tubular material and having a portion thereof extended for engagement with the tops of bottles rested on the support and through such engagement deriving motivation from reciprocal elevational spacing of the support and mandrel holding

means, an annular member rotatably mounted below the mandrel and in concentric relation thereto, a plurality of rotary cutting wheels borne by the annular member in a common plane normal to the mandrel for reciprocal radial movement to and from mandrel engagement, control means mounted for movement in spaced axial relation to the annular member, and a control linkage interconnecting the control means and the cutting elements and translating axial movement of the control means relative to the annular member into responsive radial positioning of the cutting elements to and from mandrel engagement.

3. A machine for placing shrinkable tubular banding material on capped bottles comprising a bottle support, driven means mounting the support for elevational movement therein and for horizontal travel from a bottle receiving station to a bottle discharging station, a cam operatively associated with the bottle support and elevationally reciprocating the support in response to movement thereof from receiving to discharging stations, a mandrel adapted threadably to receive thereover tubular banding material, means mounting the mandrel in substantially erect vertical alignment with the support in the driven means, feed rollers rotatably mounted in the mandrel for internal engagement with the tubular banding material, and a plunger having unidirectional driving connection with the feed rollers mounted for vertical reciprocation in the mandrel having a downwardly extended portion disposed for bottle engagement and an end upwardly extended from the mandrel pointed for distention of banding material threaded thereover.

4. A machine for placing shrinkable tubular banding material on capped bottles comprising a bottle support, driven means mounting the support for elevational movement therein and for horizontal travel from a bottle receiving station to a bottle discharging station, a cam having an upper dwell operatively associated with the bottle support and elevationally reciprocating the support in response to movement thereof from receiving to discharging stations, a mandrel adapted threadably to receive thereover tubular banding material, means mounting the mandrel in substantially erect vertical alignment with the support in the driven means, feed rollers rotatably mounted in the mandrel for internal engagement with the tubular banding material, a plunger having unidirectional driving connection with the feed rollers mounted for vertical reciprocation in the mandrel having a downwardly extended portion disposed for bottle engagement and an end upwardly extended from the mandrel pointed for distention of banding material threaded thereover, and a radially reciprocal cutter mounted in the driven means for rotation concentrically of the mandrel, a drive linkage translating horizontal travel of the driven means into rotation of the cutter in the driven means, and a cam operatively associated with the cutter radially reciprocating the cutter to and from mandrel engagement during traversal of the upper dwell of the bottle support cam by said support.

5. The combination of a carrier mounted for rotation about a substantially erect axis; a bottle support table mounted for reciprocal elevational movement eccentrically in the carrier; synchronous means for delivering capped bottles in erect attitude to the support table at a receiving

station and removing bottles therefrom at a removing station rotationally spaced therefrom; a circular feeding cam mounted concentrically of the carrier operatively associated with the support table having an inclined portion, an upper dwell, and a declined portion in succession in the direction of carrier rotation from the receiving to the removing station; an elongated mandrel adapted to receive tubular banding material thereover; mounting means for grasping the mandrel through the tubular banding material mounting the mandrel in the carrier in a substantially erect attitude in constant vertical alignment with the support table and in elevationally spaced relation thereto; feed rollers rotatably mounted in the mandrel on axes transversely of the mandrel; a plunger having unidirectional driving connection with the feed rollers mounted for reciprocal movement longitudinally of the mandrel having a downwardly extended portion disposed above the bottle support for bottle engagement and a nose portion upwardly extended from the mandrel for distention of banding material threaded over the mandrel; a radially reciprocal cutter mounted in the carrier for rotation concentrically of the mandrel; a drive linkage connected to the cutter translating revolving of the cutter incident to rotation of the carrier into rotation of the cutter in the carrier; and a circular cut-off cam mounted concentrically of the carrier having an inclined portion and an upper dwell in a radial position corresponding to the radial position of the upper dwell of the feeding cam and operatively associated with the cutter radially reciprocating the cutter to and from mandrel engagement at a position below the feed rollers thereof in response to traversal of the upper dwell of the cut-off cam during carrier rotation.

6. A machine for placing shrinkable tubular banding material on capped bottles comprising a carrier mounted for rotation about a substantially erect axis; means for rotating the carrier in a predetermined direction; a bottle support table mounted eccentrically in the carrier for reciprocal elevational movement; a circular feeding cam pivotally mounted on a horizontal axis and positioned concentrically of the carrier having a lower dwell, an inclined portion, an upper dwell, and a declined portion successively in the direction of carrier rotation operatively associated with the support table for vertical reciprocation thereof in response to revolving thereof during carrier rotation; means releasably securing the feeding cam in adjustably pivoted position elevationally positioning the upper dwell thereof; means driven synchronously with carrier rotation for delivering capped bottles to the table in advance of upward movement of the table and for removing bottles therefrom subsequent to lowering of the table; an elongated mandrel; feed rollers rotatably mounted transversely in the mandrel on opposite sides thereof and having outwardly disposed peripheral portions oppositely disposed from the mandrel; pairs of elevationally spaced positioning rollers rotatably mounted horizontally in the carrier and by receipt of the feed rollers therebetween locating the mandrel in a substantially erect position in vertical alignment with the support table; a plunger mounted for reciprocal movement longitudinally of the mandrel having a lower end downwardly extended from the mandrel for bottle engagement and an upper end upwardly extended from the mandrel adapted to receive thereover tubular

banding material, said plunger having uni-directional driving connection to the feed rollers for rotating the outwardly disposed peripheral portions thereof downwardly in response to upward movement of the plunger; a radially reciprocal cutter mounted for rotation in the carrier concentrically of the mandrel; a drive linkage connected to the cutter and translating rotation of the carrier into rotation of the cutter; and a circular cut-off cam operatively associated with the cutter and mounted concentrically of the carrier for radially reciprocating the cutter to and from engagement with the mandrel below the feed rollers thereof during traversal of the upper dwell of the feeding cam by the support table.

7. A banding machine for sealing closed bottles comprising a bottle support, a floating mandrel adapted threadedly to receive thereover elongated tubular banding material, means holding the mandrel in an erect position above the bottle support, feed means mounted on the mandrel adapted to receive the tubular banding material thereover, motivating means elevationally positioning the bottle support and the mandrel relative to each other, the feed means being motivated by said relative elevational positioning of the support and the mandrel, and a cutting mechanism operated in following timed relation to the feeding of the tubular banding material over the bottles cutting said banding material adjacent to the tops thereof with predetermined lengths of the banding material remaining on the bottles.

8. A banding machine comprising a bottle support, means motivating the support in a circular path, a floating mandrel adapted threadedly to receive thereover tubular banding material, means holding the mandrel in an erect position above the bottle support for travel in a circular path in vertical alignment with the support, a cam imparting relative elevational movement to the support and mandrel during traversal of the path, feed rolls mounted on the mandrel adapted to receive the tubular banding material thereover, and a feed plunger mounted for elevational reciprocal movement in the mandrel and having driving connection with the feed rolls, said feed plunger being downwardly extended for endward engagement with the top of a capped bottle arranged on the bottle support in alignment therewith.

9. A banding machine comprising a bottle support, means for periodically elevationally reciprocating the support, said means being adjustable to regulate the distance of elevational travel of the support during reciprocation thereof, a floating mandrel adapted threadably to receive thereover tubular banding material, means mounting the mandrel at a predetermined elevation and in vertical alignment above the support by engagement with the tubular banding material threaded thereover, feed rollers rotatably mounted on the mandrel engageable with the interior of the tubular banding material threaded over the mandrel, a plunger having a rack gear mounted for elevational reciprocal movement in the mandrel having a downwardly disposed end disposed for engagement with the top of a capped bottle arranged on the bottle support in alignment therewith, pinions rotatably mounted in the mandrel in engagement with the rack gear of the plunger, and means providing uni-directional driving connection between the pinions and the feed rollers whereby upward movement of the plunger rotates the feed

rollers to feed tubular banding material downwardly thereover and the pinions are released from driving connection with the feed rollers on downward travel of the plunger.

10. A banding machine comprising a bottle support, a floating mandrel adapted threadedly to receive thereover a continuous supply of tubular banding material, means holding the mandrel in an erect position above the support by embracing the mandrel through the tubular material, means periodically elevationally reciprocating the bottle support and the mandrel holding means relative to each other, feed rolls mounted on the mandrel adapted to receive the tubular banding material thereover, and a feed plunger mounted for elevational reciprocal movement in the mandrel and having driving connection with the feed rolls, said feed plunger being downwardly extended for endward engagement with the top of a capped bottle arranged on the bottle support in alignment therewith and endwardly reciprocated during such engagement by relative elevational movement of the bottle support and mandrel holding means and through the feed rolls feeding the tubular banding material downwardly over the top of such a bottle.

11. A banding machine comprising a bottle support, means motivating the support in a circular path, a floating mandrel adapted threadedly to receive thereover a continuous supply of tubular banding material, means holding the mandrel in an erect position above the bottle support, means periodically elevationally reciprocating the bottle support and the mandrel holding means relative to each other, feed means mounted on the mandrel adapted to receive the tubular banding material thereover, a feed plunger mounted for elevational reciprocal movement in the mandrel and having driving connection with the feed means, and said feed plunger being downwardly extended for endward engagement with the top of a capped bottle arranged on the bottle support in alignment therewith and endwardly reciprocated during such engagement by relative elevational movement of the bottle support and the mandrel holding means, and a cutter for the banding material automatically operated to cut predetermined lengths thereof synchronously and following the feeding thereof downwardly over such bottles, the cutter providing a cutting edge rotated about the mandrel and reciprocally moved to and from mandrel engagement intermediate movement of bottle support and mandrel relative to and from each other during their relative elevational reciprocation.

12. A machine for placing shrinkable tubular banding material on capped bottles comprising a bottle support, driven means mounting the support for elevational movement therein and for horizontal travel from a bottle receiving station to a bottle discharging station, a feeding cam pivotally mounted on a horizontal axis having a lower dwell, an inclined portion, an upper dwell, and a declined portion successively from the bottle receiving station to the bottle discharge station operatively associated with the bottle support for elevational reciprocation of the support in response to movement thereof from the receiving to the discharging stations, means releasably securing the cam in adjustably pivoted position elevationally to position the upper dwell thereof, a mandrel adapted threadably to receive thereover tubular banding material, means mounting the mandrel in substantially erect vertical alignment

with the support in the driven means, feed rollers rotatably mounted in the mandrel for internal engagement with the tubular banding material, and a plunger having unidirectional driving connection with the feed rollers mounted for vertical reciprocation in the mandrel having a downwardly extended portion disposed for bottle engagement and an end upwardly extended from the mandrel pointed for distention of banding material threaded thereover.

13. A banding machine comprising a bottle support, a floating mandrel adapted threadably to receive thereover a continuous supply of tubular banding material, means holding the mandrel in an erect position above the support by embracing the mandrel through the tubular material, means periodically elevationally reciprocating the support and mandrel holding means relative to each other, means for adjusting the extent of relative elevational reciprocation of the support and mandrel, and feed means mounted in the mandrel for internal engagement with the tubular material and having a portion thereof extended for engagement with the tops of bottles rested on the support and through such engage-

ment deriving motivation from reciprocal elevational spacing of the support and mandrel holding means, and said feed means being adapted to feed lengths of tubular banding material adjustably predetermined by adjustment of the extent of relative reciprocation of the support and mandrel downwardly over tops of bottles engaged by the feed means.

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