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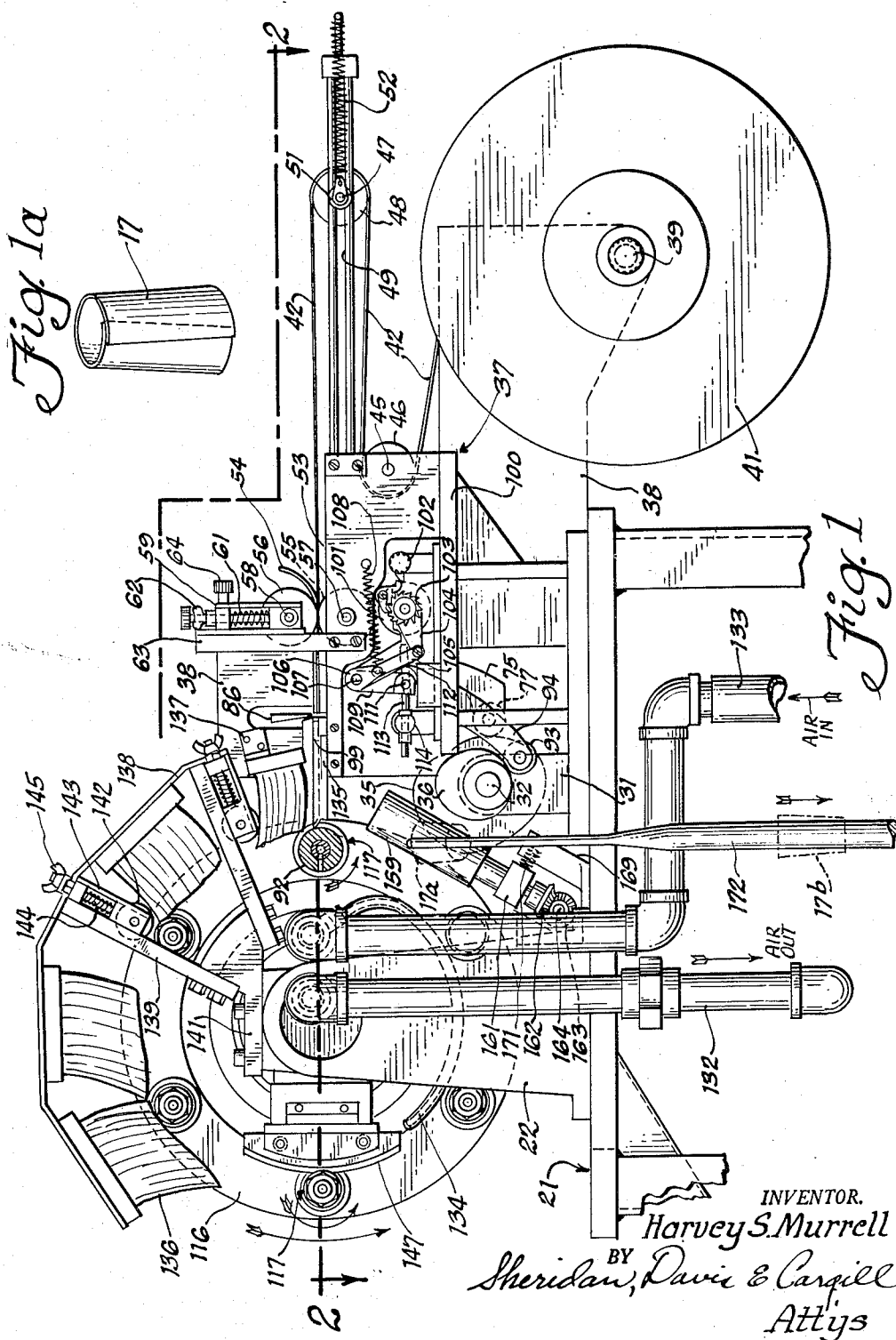
H. S. MURRELL

2,867,956

TAPERED TUBE FORMING AND APPLYING MECHANISM

Filed July 3, 1953

8 Sheets-Sheet 1



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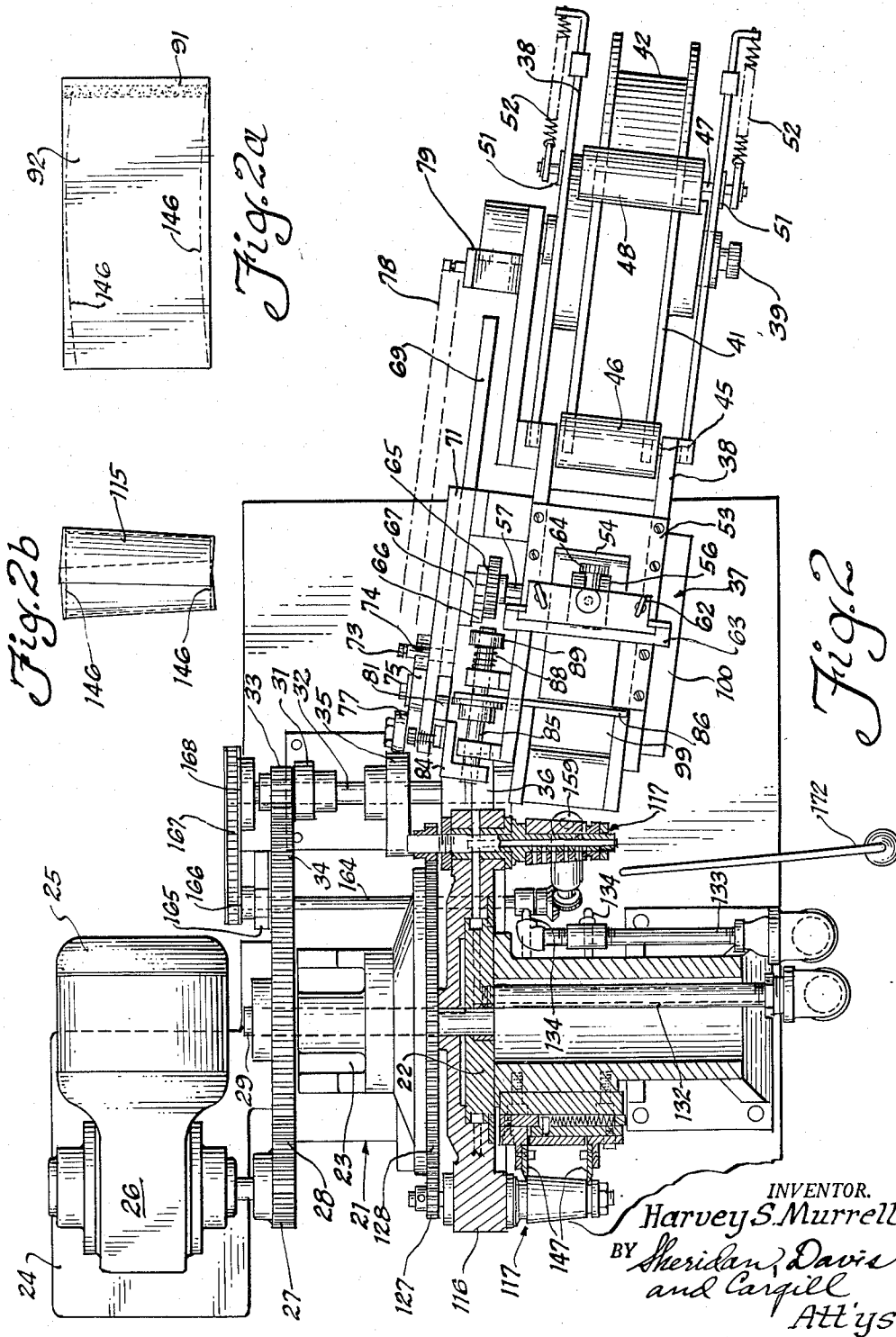
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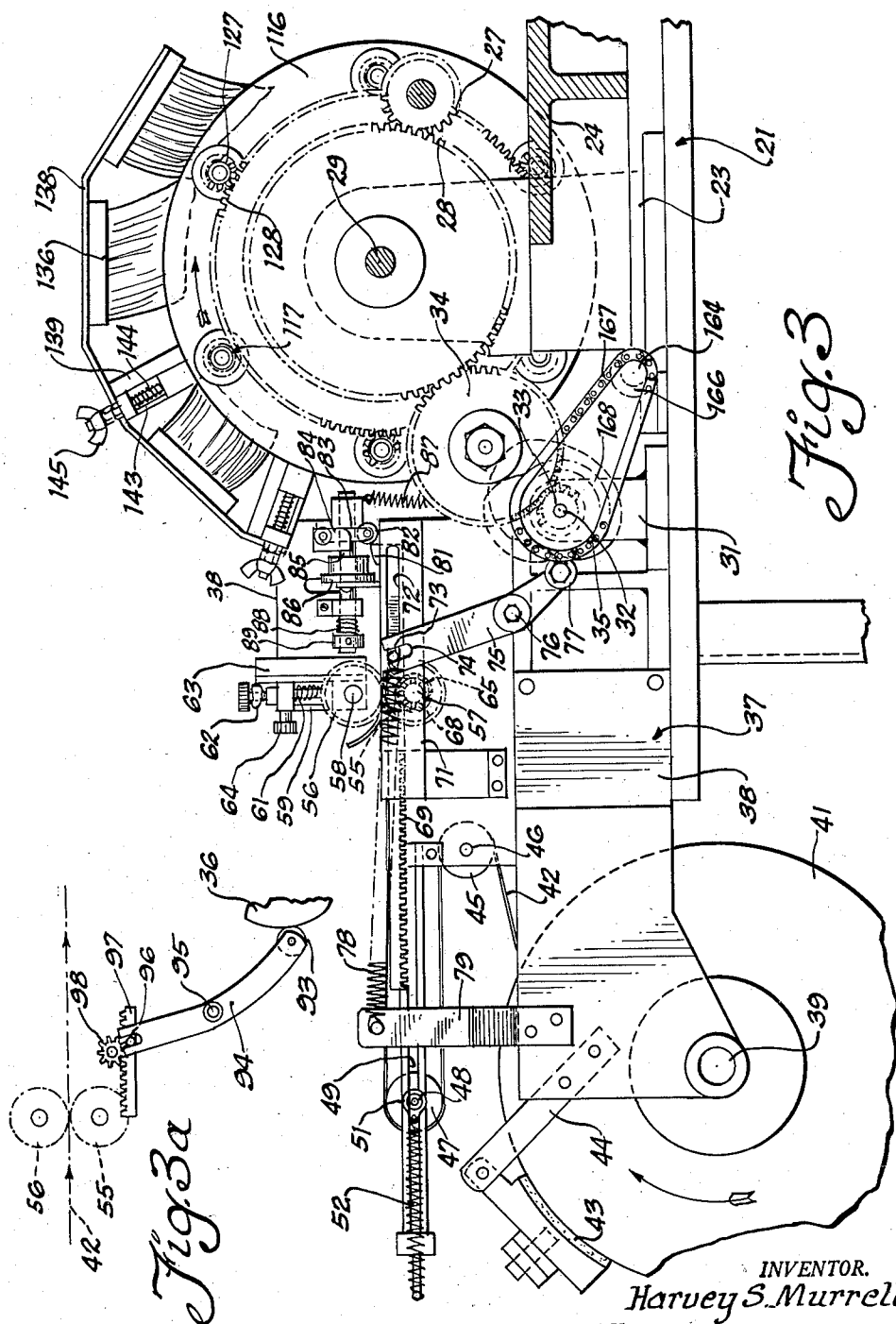
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TAPERED TUBE FORMING AND APPLYING MECHANISM

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8 Sheets-Sheet 3



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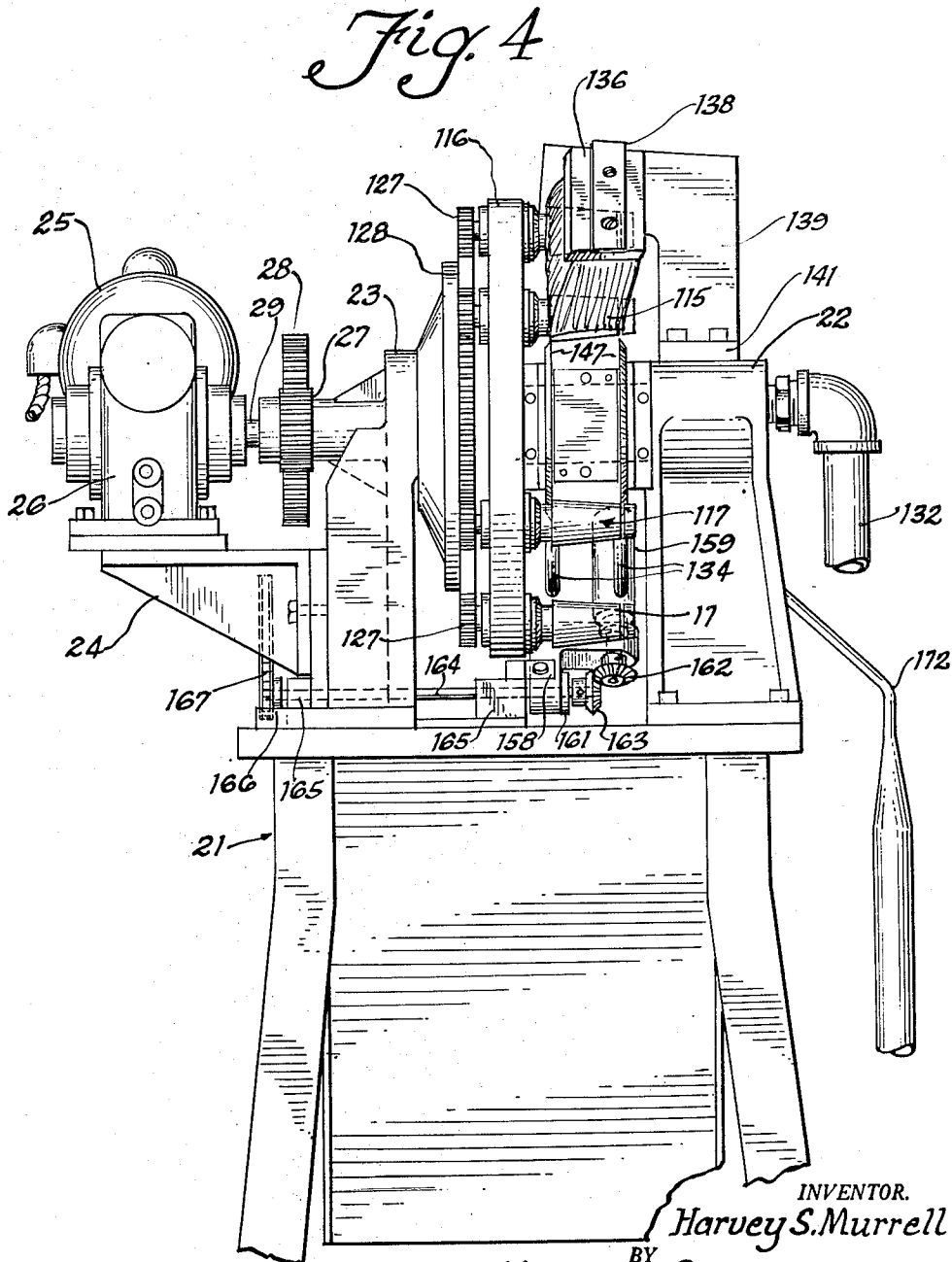
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8 Sheets-Sheet 4



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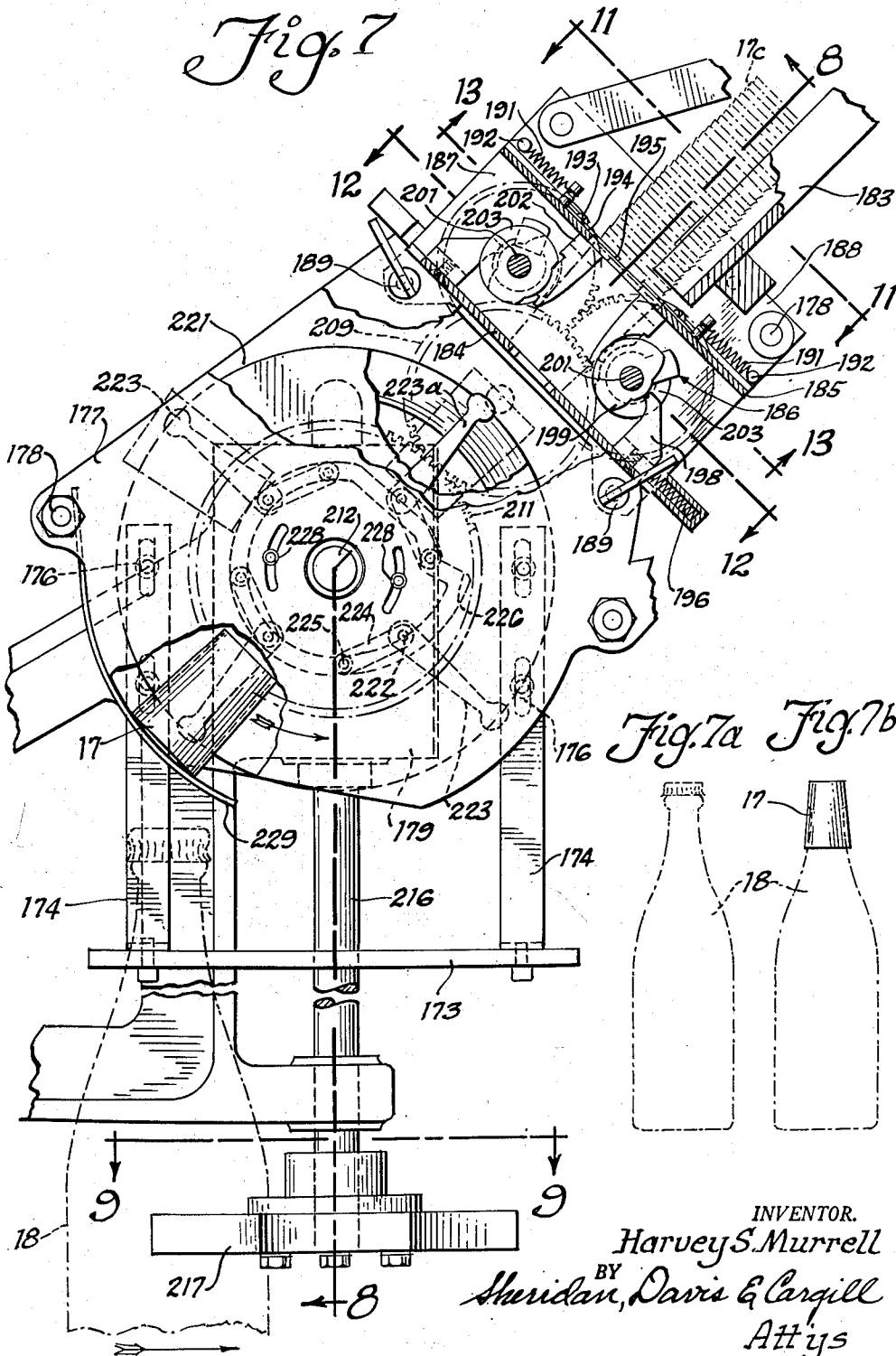
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TAPERED TUBE FORMING AND APPLYING MECHANISM

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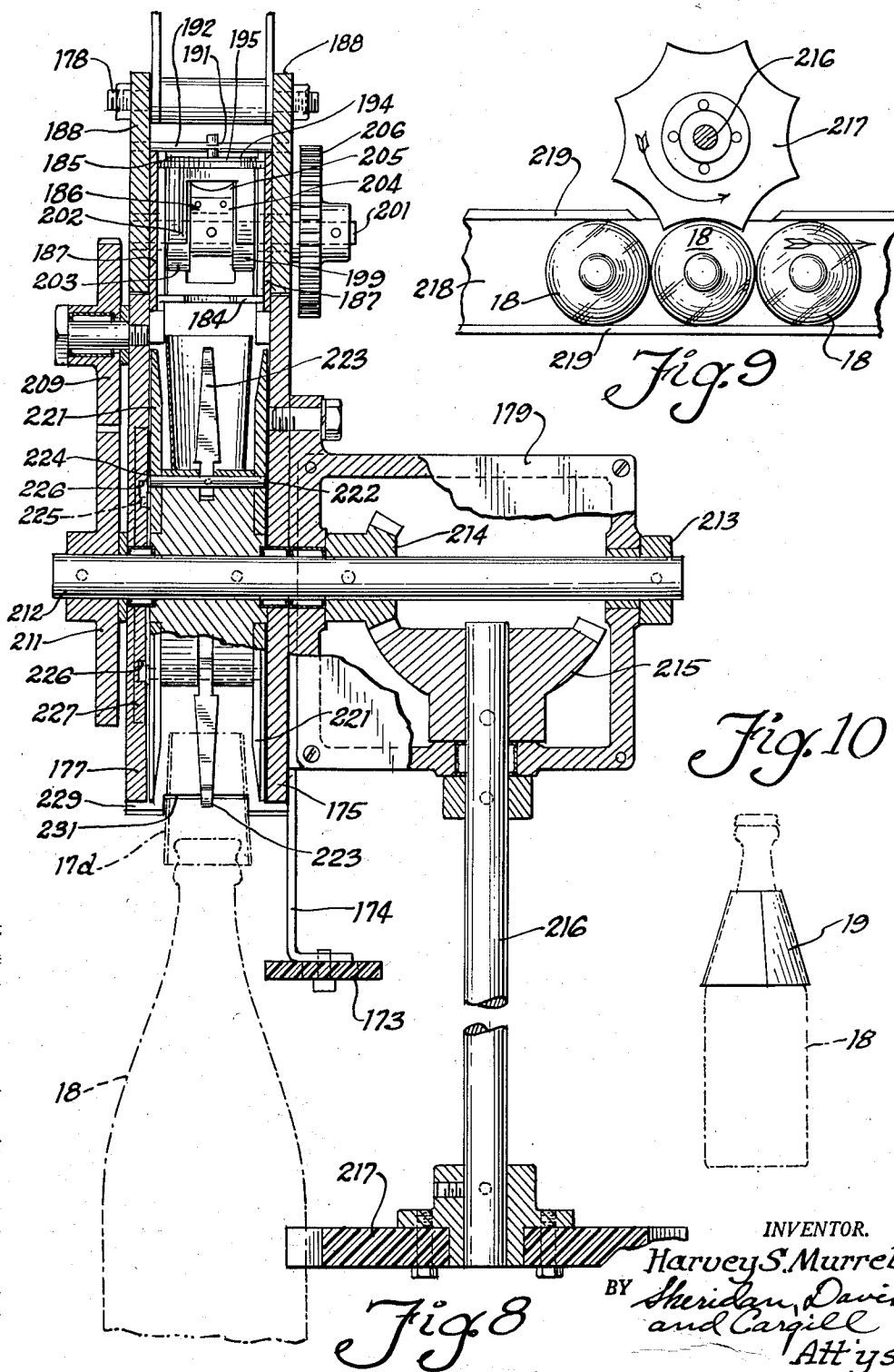
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TAPERED TUBE FORMING AND APPLYING MECHANISM

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8 Sheets-Sheet 7



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TAPERED TUBE FORMING AND APPLYING MECHANISM

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8 Sheets-Sheet 8

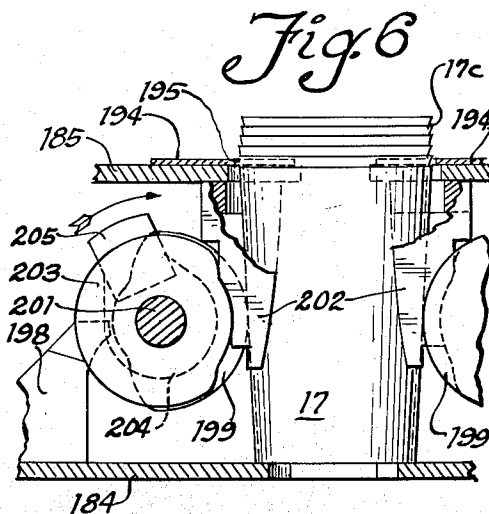
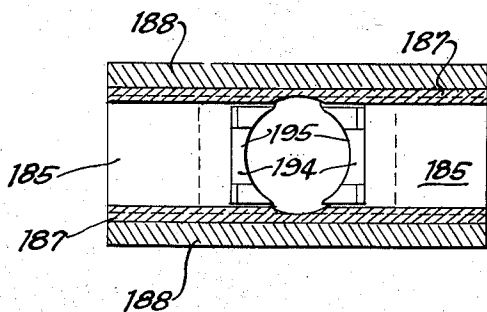
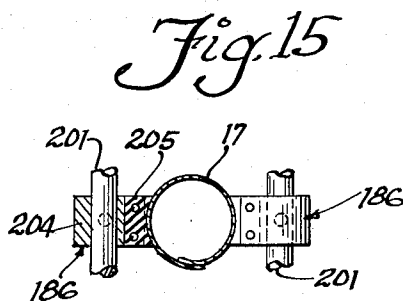
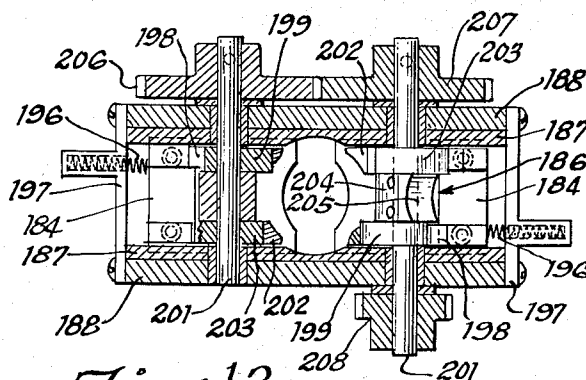
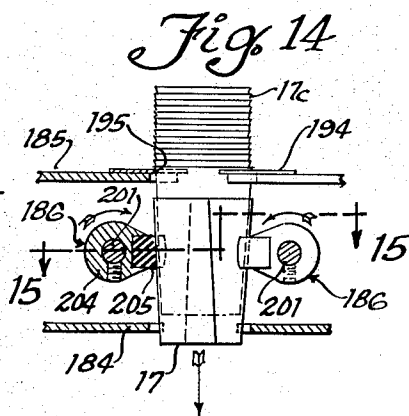
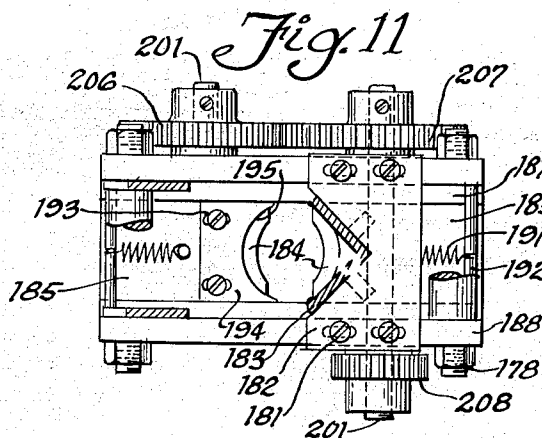


Fig. 13

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1

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TAPERED TUBE FORMING AND APPLYING MECHANISM

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7 Claims. (Cl. 53—296)

This invention relates in general to tube forming machines, and more particularly to mechanism for forming hollow truncated cones or tapered tubes from a continuous web or strip of material and individually and serially applying the resulting completed tapered tubes to the necks of bottles.

Heretofore, in applying labels or protective coverings to the neck portions of bottles, it has been the practice to employ preshaped flat blanks, usually die-cut, and either to glue the same directly to the neck portion of the bottles, or to roll them into the form of hollow truncated cones and drop the latter over the upper ends of the bottles.

A principal object of the instant invention is to simplify and reduce the cost, both of the process of applying such objects to bottles, and of the mechanism employed for that purpose. Generally, this object is attained by eliminating manual handling of the material, and materially increasing the speed and efficiency of the process by making it a continuous one, particularly in continuously rotating those operating parts of the machine having the greatest mass, so as to save the energy which would be required to overcome the inertia of that mass if intermittent stopping and starting of those parts were employed.

Another important object of the invention is the provision of novel mechanism for automatically forming hollow truncated cones or tapered tubes in a continuous operation from an endless web or strip of material.

Another object is to enable a continuous web of material in roll form to be rotated at a uniform rate of speed, and to enable a forming device, for rolling successive end portions of the web into tapered tubes, also to be operated continuously at a constant and uniform rate, while at the same time effecting maximum accuracy in severing identical portions from the end of the web and in presenting the same to the forming device, by the provision of novel mechanism for imparting intermittent feeding movements to the free end of the web in timed relationship relative to the operation of the forming device and converting such intermittent movements of the free end of the web into continuous rotation of the roll of material.

A further important object of the instant invention is the provision of mechanism which nests the completed tapered tubes in stack form and thereafter serially removes the tubes from the lower end of such stack, inverts the same, and drops them over the upper ends of the bottles to which they are to be applied.

Another object of the invention is the provision of means for insuring the proper timing of such tapered tube applying operation with relation to the rate of movement of the bottles delivered thereto.

A further object is to provide improved trimming mechanism for accurately and cleanly removing the excess material from both ends of a hollow cone formed by rolling a rectangular strip of material onto a tapered mandrel.

2

Another object is to provide mechanism for removing the completed tube from its mandrel without damaging the tube in any way.

A further important object of the invention is to enable a producer or distributor of bottled merchandise, such as soft drinks, to render the product more attractive and sanitary, as well as to facilitate the advertising of other products incidental to the sale of that merchandise, by providing an improved method and apparatus for forming and applying tapered tubes, as from extremely thin, paper-backed foil for protection of the dispensing end of the bottle necks, and/or from paper carrying printed advertising matter for mounting on a lower or intermediate portion of the bottle necks, which not only reduces the amount of material required and waste of material to a minimum, but effects tremendous savings by virtue of the speed and accuracy of the operations performed, and the substantial elimination of manual handling.

Numerous other objects and advantages of the invention will be apparent as it is better understood from the following description, which, when taken in connection with the accompanying drawings, discloses a preferred embodiment thereof.

In the drawings:

Figure 1 is a front elevational view of a preferred embodiment of the tapered tube forming portion of the instant mechanism;

Fig. 1a is a perspective view of a completed tapered tube or hollow truncated cone made in accordance with the present invention;

Fig. 2 is a plan view of the mechanism of Fig. 1, with parts thereof shown in section, as taken substantially on the line 2—2 of Fig. 1;

Fig. 2a is a plan view of a severed end portion of a strip of material used to form the tapered tube of Fig. 1a;

Fig. 2b is a plan view of a tube as formed from the blank of Fig. 2a in an intermediate stage of its manufacture;

Fig. 3 is a rear elevational view, with parts thereof in vertical section, of the mechanism shown in front elevation in Fig. 1;

Fig. 3a is a detail rear elevation similar to Fig. 3 of the means for driving the adhesive applying mechanism;

Fig. 4 is an end elevational view as seen from the left side of Fig. 1 and the right side of Fig. 3;

Fig. 5 is an enlarged front elevation of a portion of the tube forming mechanism, with parts thereof and of the trimming mechanism shown in vertical section;

Fig. 6 is a transverse sectional view taken substantially on the line 6—6 of Fig. 5;

Fig. 7 is a front elevational view, with parts thereof shown in vertical section, of a preferred embodiment of the tube applicator portion of the mechanism for applying the formed tapered tubes to the upper ends of suitable bottles;

Fig. 7a is a broken-line elevational view of a bottle to which the tapered tubes may be applied;

Fig. 7b is a view similar to Fig. 7a showing one of the tapered tubes mounted on the upper end of the neck portion of the bottle;

Fig. 8 is a transverse sectional view taken substantially on the line 8—8 of Fig. 7;

Fig. 9 is a horizontal section taken substantially on the line 9—9 of Fig. 7, and showing a bottle conveyor and the means for driving the tube applicator mechanism;

Fig. 10 is an elevational view similar to Figs. 7a and 7b showing a larger type of tapered tube applied to the intermediate neck portion of a bottle;

Figs. 11, 12 and 13 are detail transverse sectional views taken substantially, respectively, on the lines 11—11, 12—12, and 13—13 of Fig. 7;

Fig. 14 is a detail vertical section of the means for serially removing the lowermost tubes from stack or nested relationship;

Fig. 15 is a detail horizontal section taken substantially on the line 15—15 of Fig. 14; and

Fig. 16 is an enlarged detail front elevation similar to Fig. 7 of the mechanism shown in Fig. 14, with parts thereof in section.

Considering the embodiment of the invention illustrated in these drawings, its specific description will be subdivided hereinafter for convenient reference into separate sections dealing, respectively, with its following component parts: web feeding mechanism A, including means for rotatably supporting a continuous web of strip material in roll form, means for applying intermittent feeding movements to the free end of the web, and take-up means for transmitting such intermittent movements into continuous rotation of the roll supporting means; cut-off means B for severing the end portion from the web as the feeding mechanism presents the same thereto; adhesive applying means C for applying a thin strip of adhesive transversely across the end portion of the web; tube forming means D, including a rotatably mounted drum member carrying a plurality of tapered mandrels in peripherally spaced relationship, drive means for continuously rotating the drum member and the mandrels relative thereto on their individual axes, and for driving the web feeding mechanism to deliver an end of each severed portion of the web into the path of movement of the mandrels, and means for retaining each severed web portion on a mandrel during continued rotation of the latter to wind the material onto the mandrel as a tube; trimming means E operable to trim both ends of each of the tapered tubes so formed; ejector means F, including mechanism rotatably driven by the drive means for removing the finished tubes from the mandrels, and means for stacking the tapered tubes in nested relationship with their smaller ends lowermost; and applicator mechanism G, including means for serially removing the lowermost tubes from such stack, means for receiving the removed tubes and inverting the same to present their larger ends lowermost, and means for presenting bottles serially to the receiving means in timed relationship therewith to enable a tapered tube to be dropped thereby over the upper end of each bottle.

As generally described hereinbefore, the final product resulting from operation of this mechanism preferably comprises a tapered tube or hollow truncated cone 17 (Fig. 1a) of extremely thin foil laminated on a suitable paper backing for application to the upper or dispensing end of a bottle 18 (Fig. 7b), such as that containing a soft drink, to protect that portion of the bottle and maintain it in the same clean or sanitary condition obtaining as it leaves the bottling machine until it is to be opened by the ultimate consumer; or a similar and larger tapered tube 19 (Fig. 10) carrying printed advertising matter, or the like, for mounting on a lower or intermediate portion of the bottle neck for advertising other products incidental to the sale of that contained in the bottle. Whether for these or other intended uses, however, the tapered tubes may be made and applied most economically by the instant mechanism in the following manner.

Web feeding

Referring more particularly to Figs. 1-4 of the drawings, reference numeral 21 indicates in general a mechanism supporting frame structure of any suitable design which includes front and rear vertical standards or trunnions 22 and 23 spaced from each other (Fig. 4) and a motor supporting shelf 24 secured to and extending rearwardly from the rear standard 23. Mounted on this shelf 24 is a drive unit comprising an electric motor 25 (Figs. 2 and 4) of suitable size, and a speed reducer 26 of any desired construction actuated by the motor to rotate a drive gear or pinion 27. This pinion 27

meshes with a gear 28 which is secured in any desired manner to the rear end of a main shaft 29 extending between and suitably journaled in the upper portions of the trunnions 22, 23. A suitable auxiliary bearing bracket 31 (Figs. 2 and 3) rotatably supports a cam and auxiliary drive shaft 32 having a pinion 33 secured to its rear end which meshes with an intermediate gear 34, in turn meshing with the gear 28. The motor 25 thus is adapted to continuously rotate both of the shafts 29 and 32 in timed relationship to each other, the former to actuate the tube forming mechanism D; and the shaft 32 to actuate the web feeding mechanism A and the cut-off means B, and the adhesive applying mechanism C, respectively, by means of cams 35 and 36 (Fig. 2) rigidly secured to the shaft in any suitable manner.

An auxiliary frame, indicated generally by reference numeral 37, for supporting these mechanisms A, B and C is mounted on the right end of the main frame 21 (Figs. 1, 2 and 3), and includes parallel front and rear plates 38 rotatably supporting at their outer ends the horizontal shaft 39 of a drum 41, comprising means for rotatably supporting a continuous web of strip material 42 in roll form. If desired, suitable brake means may be provided to maintain a uniform resistance to rotation of drum 41 regardless of the quantity of strip material 42 remaining thereon. Such brake means is illustrated in Fig. 3 as comprising a weighted brake shoe 43 frictionally engaging the periphery of roll supporting drum 41 and pivotally mounted on an outward extension 44 of the rear frame plate 38.

The feed mechanism A also includes a "stationary" roller 45, freely rotatably mounted on a fixed shaft 46 extending between the frame plates 38, around which the free end of the web of strip material 42 passes from the roll carried by drum 41. From the roller 45 the strip of material moves outwardly (to the right in Fig. 1 and to the left in Fig. 3) and around (under and over) a "movable" or take-up roller 47 which is freely rotatably mounted on a shaft 48. This shaft 48 extends through, and is slidably mounted in, horizontally extending slots 49 provided in the front and rear auxiliary frame plates 38 and has suitable guide flanges or spacer rings 51 secured to it (Fig. 2) for maintaining its axis parallel with that of shaft 46. Each end of shaft 48 is connected in suitable manner to the inner end of a take-up spring 52 which is secured at its outer end to the end of the associated frame plate 38.

From the take-up roller 47 the web of strip material 42 passes inwardly between a lower horizontal feed plate 53 (Fig. 1) and an upper curved guide plate 54, and lower and upper feed rollers 55 and 56, respectively. The lower feed roller 55 extends substantially the full distance between the auxiliary frame plates 38, is fixedly secured to a horizontal shaft 57 extending through and rotatably supported by these frame plates, and preferably is made of a suitable metal. The upper feed roller 56 preferably is made of rubber, is of narrower width than roller 55, and is mounted on a shaft 58. This upper feed roller shaft 58 is mounted for limited vertical sliding movement in a frame 59 and is resiliently urged downwardly by springs 61, the compressive action of the latter being adjustable by wing nuts 62 in well-known manner. To facilitate initial threading of the web of material between the feed rollers 55, 56, without affecting the adjustment of wing nuts 62, the upper feed roller frame 59 is slidably mounted on uprights 63 (Fig. 1) and securable thereto in operative position, and releasable for limited upward movement relative thereto, in well-known manner by a suitable retaining screw 64. During operation of the machine, the springs 61 thus maintain an adjustable pressure of the upper roller 56 against the web of strip material 42 and the lower feed roller 55.

Consequently, rotation of feed roller 55 in a counter-clockwise direction in Fig. 1 (clockwise in Fig. 3) will

5

impart inward translational movement to the web of strip material 42. Such rotation of feed roller 55 is effected intermittently to successively move incremental portions of predetermined length of the web of strip material 42 inwardly, to present the same serially to the cut-off means B, adhesive applying mechanism C and tube forming means D, in the following manner. Rigidly secured to, and mounted upon, the shaft 57 is a ratchet wheel 65 (Fig. 2) with which a pawl 66 cooperates which pivotally mounted on a ratchet lever 67. The lever 67 is rotatably mounted on the shaft 57 and is secured in any suitable manner to a gear 68 also rotatably mounted on shaft 57. A longitudinal rack 69 meshes with this gear 68 and is supported and guided for reciprocal movements relative thereto by a channel member 71 (Fig. 3) which is secured to the auxiliary frame 37 and provided with a horizontal slot 72. A pin 73 is slidably disposed in slot 72, is secured at its forward end to the rack 69, and engages, at its rear or outer end, a slot 74 in the upper end of an actuating lever 75. This lever 75 is pivoted intermediate its ends at 76 and provided at its lower end with a cam roller 77 rotatably engageable with the cam 35 mounted on the auxiliary drive shaft 32. A spring 78 connected at one end to the pin 73 is connected at its other end to an upstanding bracket 79 which is secured at its lower end to the rear auxiliary frame plate 38.

These several parts of the above-described web feeding mechanism A normally are in their positions of Fig. 3, and perform the following complete cycle of operations and return to such position in response to each rotation of cam 35. In this normal position, cam roller 75 engages a low part of cam 35, so that rotation of the latter acts against spring 78 to move rack 69 inwardly (to the right in Fig. 3), and then permits spring 78 to return the rack outwardly. The inward movement of rack 69 rotates gear 68 in a clockwise direction in Fig. 3, and the same rotation is imparted to the lower feed roller 55 through the agency of the pawl and ratchet mechanism 65, 66 and 67. The return or outward movement of rack 69 by spring 78, on the other hand, comprises an idle stroke, ratchet pawl 66 idly passing over the teeth of ratchet wheel 65 in well-known manner. Consequently, each rotation of cam 35 effects a feeding rotation of roller 55, so that a predetermined length of the web of strip material 42 is moved inwardly, the upper feed roller 56 maintaining the web in feeding engagement with roller 55.

As previously explained, it is desired that this feeding of the web of strip material 42 thus be effected in such intermittent manner in order to properly and accurately present incremental portions thereof successively to the cut-off means B, the adhesive applying mechanism C, and the tube forming means D, and have such web portions stationary when these mechanisms B and C operate thereon and when they are picked up by the forming means D which is continuously rotated. At the same time, it also is important that the web roll and its supporting drum 41, which have an appreciable mass and inertia, be rotated at a substantially constant rate of speed. This desired function is performed in the following manner by the take-up means comprising roller 47 and springs 52. As the free end portion of the web is fed inwardly by rollers 55, 56, springs 52 yield to permit take-up roller 47 to move inwardly, its shaft 48 sliding in slots 49. During the return or idle stroke of rack 69 when the free end of the web of strip material 42 is stationary, take-up springs 52 return roller 47 outwardly. These springs 52 are so designed relative to the mass of the roll of material and the drum 41 and the retarding effect of the brake 43, that a substantially constant speed of rotation is imparted by the web of material to the roll supporting drum from the feeding of the free end of the web by rollers 55, 56, the feeding movements of the free end of the web being at a lineal rate of speed sub-

6

stantially greater than that of that portion of the web extending inwardly from the drum 41 to the roller 45. Thus the springs 52 are extended during feeding of the free end of the web to compensate for this greater lineal speed of that portion of the web, and thereafter expend the energy so stored therein by contracting, while the free end of the web is stationary, to continue the rotation of drum 41. Reduced to specific values, by way of explanatory example, if the lineal speed of the free end of the web during its inward feeding is 10 feet per second, and the time interval of this feeding action by rollers 55, 56 is the same as the interval during which these feed rollers are stationary, the lineal rate of reciprocation of shaft 48, as well as the lineal speed of the web extending from drum 41 to roller 45, will be 5 feet per second. Of course, in actual practice this same speed ratio will not necessarily obtain; since the feeding movement must accelerate from zero, and the inward feeding action of rack 69 is effected in more than one-half of a revolution of shaft 32 and cam 35.

Web severing

In addition to effecting operation of the web feeding mechanism A, the above-described reciprocation of rack 69 actuates the cut-off means B for accurately severing incremental portions of predetermined length from the inner end of the web of strip material 42. Referring particularly to Figs. 2 and 3, the inner end of rack 69 is provided on its upper surface with an upstanding cam lug 81 for cooperation with a roller 82 (Fig. 3) rotatably mounted on the lower end of a vertical lever 83. This lever 83 is pivotally mounted at its upper end on a rearwardly and outwardly extending arm of a right-angled bracket 84 which prevents outward (to the left in Fig. 3) swinging of the lower end of lever 83 and its roller 82 from their position of Fig. 3, but permits free inward swinging thereof by cam lug 81 during inward feeding movement of rack 69 by cam 35, as previously described. The other arm of bracket 84 is mounted upon, and rigidly secured any desired manner to, the inner end of a horizontal cutter blade shaft 85 suitably rotatably mounted on the auxiliary machine frame 37. Securely mounted on this shaft 85 is the rear end of a cutter blade 86 extending forwardly through a suitable aperture in the rear plate of frame 37 (Fig. 1) and overlying the path of movement of the web of strip material 42. This blade 86 is normally held in its raised position of the drawings by a spring 87 (Fig. 3), and a coil spring 88 surrounding shaft 85 between one of its supporting brackets and a collar 89 on the outer end of the shaft (Fig. 2) insures proper shearing action between the blade 86 and the inner end of the lower horizontal web feed plate 53 when shaft 85 is rotated against the action of spring 87 to swing the forward end of the blade 86 downwardly. Such web severing action of blade 86 is effected by spring 78 as it returns rack 69 outwardly, immediately following an inward web feeding movement of the rack, through the action of cam lug 81 raising roller 82 and lever 83 to rotate bracket 84 and shaft 85. Continued outward movement of rack 69, following such severing of the web, moves lug 81 outwardly from engagement with roller 82 (slightly beyond the position of lug 81 shown in Fig. 3) to permit spring 87 to return or raise blade 86 to its normal position out of the path of the web of strip material 42 before another inward feeding thereof.

Adhesive applying

At substantially the same instant that each such web severing action of the cut-off means B is effected, the adhesive applying means C, now to be described, applies a thin strip or band of suitable adhesive to the under surface of the blank or incremental portion of the web transversely thereof and adjacent its trailing end, as indicated at 91 on such a blank 92 in Fig. 2a. The adhesive

applying means C is cyclically actuated by the cam 36 on the auxiliary drive shaft 32 through the agency of a roller 93 engaging that cam (Fig. 1) and rotatably mounted on the lower end of a cam lever 94. As shown in Fig. 3a, this lever 94 is pivoted intermediate its ends at 95, and is provided with a slot at its upper end in engagement with a pin 96 extending rearwardly from a horizontally reciprocable rack 97. A pinion 98 in mesh with rack 97 is mounted in any suitable manner for rotation on the rear auxiliary frame plate 38 with an open ended hub portion extending forwardly of the machine having a bore of non-circular cross section. The remainder of the adhesive applying means C, except for a stationary platen or backing plate 99 (Fig. 1) which is disposed above and directly inwardly of the web severing end of plate 53, is removably mounted as a unit on a horizontal shelf 100 forming part of auxiliary frame 37 and extending between the frame plates 38, the front plate 38 being cut away to provide access to this removable unit.

This unit comprises a base and frame forming an open-topped tank for the adhesive within and across which is disposed a feed roller 101 and a parallel wiper blade means 102 adjustable toward and away from the outer (right hand in Fig. 1) side of roller 101 to determine the amount or thickness of adhesive that will be permitted to adhere to the roller as it is rotated in a counterclockwise direction. A ratchet wheel 103 is secured to the front end of the shaft of roller 101 outside of the adhesive tank to effect such rotation of the roller through the agency of a well-known ratchet pawl pivotally mounted on the upper end of a lever 104 which is pivoted on the roller shaft between the tank and ratchet wheel 103. The other end of ratchet pawl lever 104 is pivotally interconnected by a link 105 to an arm 106 secured to a shaft 107, and a spring 108 is attached to the pivotal connection between arm 106 and link 105 to urge the same to the right in Fig. 1. Thus, clockwise rotation of shaft 107 (viewing Fig. 1) against the action of spring 108 will lift the left end of ratchet pawl lever 104 in an idle stroke, and return of the parts by spring 108 will impart a partial rotation to feeder roller 101 in a counterclockwise direction.

Also secured to, and depending from, the shaft 107 are a pair of trunnion arms 109 between the lower ends of which is rotatably mounted a shaft 111. Secured to the shaft 111 and of substantially the same length as roller 101 is one longitudinal edge portion of an adhesive applicator bar 112, the other or free longitudinal edge of which is adapted to transfer adhesive from feed roller 101 up to the under surface of the incremental end portion of the web of strip material 42. The outer end of a rod 113 is secured to shaft 111 or bar 112, and this rod 113 slidably extends through a sleeve 114 that is rotatably mounted in any suitable manner. The rear end of shaft 107 is non-circular in cross section and is slidably engageable in the similarly shaped bore of the hub portion of pinion 98, as the adhesive applying unit is slid rearwardly into place on the shelf 100, so that reciprocation of rack 97 by cam 36 to oscillate pinion 98 will oscillate shaft 107. When the cam roller 93 engages the low point on cam 36, spring 108 will be permitted to move the parts to the right of their positions of Fig. 1 to press the free edge of bar 112 against adhesive feed roller 101. Subsequent rotation of cam 36 will rotate shaft 107 to swing arms 109 upwardly and inwardly (to the left in Fig. 1) into a substantially horizontal position. Due to the guiding action of rod 113 and pivoted sleeve 114, this swinging of arms 109 will result in the free edge of bar 112 (now containing a predetermined quantity of adhesive) being pressed upwardly into contact with the web of strip material 42 and against the platen or backing plate 99 to deposit the desired strip of adhesive 91 (Fig. 2a) onto the blank 92 adjacent the trailing edge thereof. It will be understood that the timing of this adhesive applying action preferably substantially coincides

with the severing action of knife blade 86, and that the relationship between these two operations may readily be determined by the specific design and relative rotational positioning of the two actuating cams 35 and 36 on the auxiliary drive shaft 32.

Forming of tapered tubes

Operation of the above-described mechanisms A, B, and C results in serially and intermittently presenting identical incremental portions of the continuous web of strip material 42, in the form of rectangular blanks 92 (Fig. 2a) with a narrow strip of adhesive 91 applied to the under surface of the trailing end thereof, to the tapered tube forming means D, now to be described, which winds each such blank into an unfinished or intermediate tubular blank 115, as illustrated in Fig. 2b. The tube forming means D comprises a drum member or disc 116 secured in any suitable manner to the main drive shaft 29, as by keying, adjacent the forward end of the shaft and the rear side of the front standard or trunnion plate 22 (Figs. 2 and 6). This member 116 carries and rotatably supports a plurality (here shown as six) of tapered mandrels 117 equally spaced from each other peripherally of member 116, disposed in suitable bearing sleeves extending therethrough, and having their individual axes parallel with each other and with that of main shaft 29. The specific form of these mandrels is not important to the instant invention, so long as they will function in the manner hereinafter detailed, but in their preferred form each includes a replaceable frustoconical sleeve 118 (Fig. 6) defining peripheral end shearing surfaces 119 perpendicular to the axes of rotation, and having a plurality of air inlet holes 121 spaced longitudinally in one radial plane and communicating at their inner ends with a longitudinal bore 122 in an arbor portion 123, the ends of the bore 122 being closed. The rear end of the bore 122 communicates with a peripheral groove 124, in turn communicating with the outer end of a radially disposed aperture 125 extending inwardly through a peripheral, forwardly disposed flange portion of drum member 116. The arbor portion 123 of each mandrel 117 is retained in its bearing sleeve by a suitable tapped lock ring 126 and has a planetary gear 127 mounted upon its rear end and secured thereto in any desired manner.

As best seen in Figs. 2, 3 and 4, a stationary ring gear 128, mounted coaxially with the main shaft 29 and secured in any suitable manner to the rear standard or trunnion 23, is in mesh with each of the several planetary gears 127, so that rotation of drum member 116 by shaft 29 will result in continuous individual rotation of all of the mandrels 117 on their own axes relative to the drum member and in the same direction. Thus, as shown in Fig. 1, rotation of drum member 116, which is counterclockwise therein, is accompanied by individual counterclockwise rotation of each of the mandrels 117 about its own axis. Each of the mandrels 117 therefore is carried upwardly past the horizontal plane of the free end of the web of strip material 42 once during each complete rotation of drum member 116, and as it approaches or reaches that point in its travel indicated in broken lines at 117a in Fig. 5, it is at the starting point of its own individual cycle of operations, where it comes into contact with the leading end of a blank 92 that has been placed in its broken line position of Fig. 5 by the feeding mechanism A in the manner previously described.

Means are provided for insuring grasping and retention of the leading end of blank 92 by the mandrel 117 at this point, and thereafter for the major portion of the cycle of operation of the mandrel, which includes the air inlet holes 121, bore 122, and groove 124 in the mandrel, the associated radial aperture 125 in the drum member 116, and the following members which complete this air system. An interrupted annular recess 129 is provided in the front trunnion or main shaft support 22 (Figs. 5 and 6) in alignment with the radial apertures 125 and

communicating with the inner end of each of these apertures 125 for most of each complete rotation of drum member 116. The recess 129 is connected by an aperture 131 to the upper end of a suction or air inlet pipe 132 which is connected at its lower end to an air pump of any desired construction. The discharge or outlet side of this air pump is connected to the lower end of an air discharge pipe 133, the upper end of which is connected to two arcuate blower tubes or air discharge conduits 134 (Figs. 1, 2 and 4) which are slotted or apertured along their lower surfaces for a purpose to be described hereinafter. This complete air system thus includes suction or air inlet means in the form of the apertures 121 in each of the mandrels 117 and blower or air discharge means in the form of the apertures in each of the conduits 134. As each mandrel 117 approaches the starting point of its cycle of operations (117a in Fig. 5), the associated radial aperture 125 comes into communication with the upper end of recess 129, so that air is being sucked into its inlet holes 121. The gear ratio of gears 127, 128 is such that, as a mandrel reaches that starting point, its air inlet holes are disposed as shown in Fig. 5 so their outer ends will be covered by the blank 92 adjacent its leading edge, guide rails 135 (Fig. 1) preferably being provided to insure such proper positioning of the blank. Continued movement of the mandrel will be upward about the axis of drum 116 and rotative in a counterclockwise direction about its own axis (viewing Fig. 1) to wind the blank 92 tightly about the tapered arbor portion 123 of the mandrel, as illustrated by the right-hand mandrel 117 in Fig. 1.

Means are provided for insuring smooth and accurate winding of the blank 92 upon the mandrel which is particularly important in the instant case because the blank is rectangular in shape while the mandrel is tapered. Incidentally, it will be noted from Fig. 2 that the auxiliary frame 37 is angularly disposed relative to the main frame 21, the longitudinal axis of this auxiliary frame (sideways of the machine) being substantially normal or perpendicular to the horizontal element of the outer tapered surface of the frusto-conical portion 118 of a mandrel disposed at the starting point of its cycle of operations. In other words, this arrangement enables the leading edge of a blank 92 being presented to the tapered mandrel to result in an overlap of its ends, when wound upon the mandrel to form the intermediate tubular blank 115 of Fig. 2b, that is uniformly shaped at each side of its medial element. This arrangement thus results in an appreciable conservation of the strip material and reduces to a minimum the amount of material required to be trimmed from each end of such intermediate blank 115 in order to make those ends perpendicular to the longitudinal axis of the blank. The means for insuring smooth winding of the blank 92 on the mandrel comprises a plurality of brush members 136 (Figs. 1, 3 and 4) having their inner ends disposed in the path of movement of the outer surfaces of the frusto-conical sleeves 118 of the several mandrels 117 as they are carried upwardly and around in a counterclockwise direction (Fig. 1) by the drum member 116 from the starting point of their individual cycle of operations. The first such brush 136 engaged by each of the mandrels is mounted by a bracket 137 (Fig. 1) on the rear plate of frame 37 adjacent the aperture therein through which cutter blade 86 extends. The remaining ones of these brush members 136 are carried by a bracket 138 supported by arms 139, the inner ends of which are secured to a bracket 141 mounted upon the upper end of the front standard 22 (Fig. 4). The bracket 138 also mounts a plurality of pressure rollers 142 by means of individual frames 143, each roller being backed by a coil spring 144 in well-known manner, the compression of these springs being adjustable by means of wing nuts 145. These pressure rollers 142 have their lower surfaces disposed in the path of movement and parallel to the outer elements of the frusto-conical sur-

faces of the sleeves 118 of the several mandrels 117, so that pressure is thereby applied uniformly against a longitudinal portion of the intermediate blank 115 on each mandrel as the latter passes each of these pressure rollers 142. The latter are spaced peripherally of the drum member 116 so that such pressure will be applied directly upon that portion of each blank comprising its original trailing edge, to the underside of which the strip of adhesive 91 has been applied as previously described. As best seen in Fig. 2b, this particular portion of the intermediate blank 115 comprises the overlapping portion of its ends. The purpose of these pressure rollers 142 thus will be seen to be the application of material pressure to the end-overlapping portions of the intermediate blank 115 to insure perfect sealing thereof by the adhesive strip 91. With this arrangement, by the time a mandrel 117 has progressed from the starting point of its cycle of operations beyond engagement with the last in line of the several brush members 136, or has been carried by the drum member 116 through an angle of approximately 150 degrees from its starting point, forming of the intermediate blank 115 thereon has been completed.

Tube trimming

As best seen in Fig. 2b, the central portion of that end of the overlap of the intermediate tubular blank 115 at the larger end thereof extends substantially beyond a plane perpendicular to its longitudinal axis and passing through the innermost portions of the outer edges of this end of the blank. Conversely, such outer edge portions of the blank at its smaller end extend outwardly beyond this end of the overlap. It is therefore necessary to trim this intermediate blank 115 at each end along the lines indicated in Fig. 2b at 146. These trim lines comprise circles in planes normal to the axis of the mandrel, but are shown at 146 in Fig. 2a as developed on the rectangular blank 92 to better illustrate those portions thereof that are trimmed off. These trim lines 146 are defined by each mandrel 117 by its end shearing surfaces 119 (Fig. 6), which comprise part of the trimming means E, and constitute the inner surfaces of a pair of peripheral grooves formed in the outer surface of the mandrel. Co-operating, respectively, with each of these end shearing surfaces 119 is an arcuately shaped knife blade 147, this pair of blades being spring-biased toward each other in a manner to be described, and having their lower ends converging slightly toward each other, so that they are self-aligning with the several associated shearing surfaces 119 and will always effect a clean trimming of the ends of the intermediate blanks 115, regardless of the specific type of material being employed to form such blanks. This arrangement also has the advantage of permitting greater tolerances in the longitudinal positioning of the several mandrels 117, and completely compensates for normal wear of the shearing surfaces 119. Each of the blades 147 is of such arcuate length that substantially at the same instant that a leading mandrel 117 moves out of engagement therewith, the next trailing mandrel comes into engagement with the upper ends thereof. The specific means herein illustrated for so mounting these knife blades 147 comprises a bracket 148 for each blade to which the blades is removably secured to facilitate rapid replacement or periodic sharpening. Each of these brackets 148 is secured to a plate 149, with the plate of the forward blade disposed outwardly relative to that of the rear blade, and these two plates 149 are slidably disposed within a recess 151 (Fig. 5) provided in the outer face of a main bracket 152 secured at its inner end in any suitable manner to the front standard 22. A keeper plate 153 (Figs. 5 and 6) is disposed between the brackets 148 and in slidable engagement with the outer surface of the outer plate 149, the front and rear vertical edges of the plate limiting the converging movements of the brackets 148 and their blades 147. The top and bot-

tom edge portions of this keeper plate 153 are secured by bolts 154 (Fig. 5) to the main bracket 152 to retain the plates 149 in the recess 151. The plate 149 for the front knife blade 147 is spring-urged rearwardly by a coil spring 155 (Fig. 6) interposed between a pin 156 extending inwardly (to the right) from plate 149 and an adjustable screw plug 157 disposed in a horizontal flange portion of the main bracket 152, the other or inner plate 149 being suitably recessed to provide clearance for these parts. A similar spring mounting is provided therebelow for urging the rear knife blade 147 forwardly. The inner opposed surfaces of the upper ends of the knife blades 147 may be chamfered slightly if desired to assure proper initial engagement between the knife blades and their associated shearing surfaces 119, and the springs 155 maintain proper contact thereafter between the opposed surfaces of the knives and the shearing surfaces 119 to effect a clean cutting action thereby as each mandrel sleeve 118 is rolled downwardly between the knife blades. The ratio between the mandrel planetary gears 127 and the stationary ring gear 128, and the arcuate length of the knife blades 147 are such that each mandrel completes approximately one and one-half revolutions between its points of engagement and disengagement with the knife blades 147. This further assures a clean and complete trimming of the ends of the intermediate tapered blank 115, and the blank will have assumed its final form, as shown in Fig. 1a, as the mandrel 117 upon which it has been wound moves beyond the lower ends of the knife blades 147.

The immediately following portion of the cycle of operations of each mandrel 117, comprising the period in which it is carried through approximately the next 90 degrees of its movement peripherally of the drum member 116, is employed to insure removal of the trimmed end portions of the intermediate blank 115 from the mandrel. The rotation of the mandrel on its own axis will assist such removal, and particularly of that trimmed portion at the forward or smaller end of the mandrel, but the trimmed portion at the rear or larger end may comprise a complete ring encircling the mandrel, so means are provided for severing any such ring, in the form of a stationary auxiliary blade 158 (Fig. 4) disposed adjacent the bottom of the drum member 116. It is during this portion of the cycle of operations of each mandrel 117 that the arcuate blower tubes 134 function to insure complete removal of the trimmed material from the mandrels, the outlet apertures in these tubes being disposed in substantial alignment with the shearing surfaces 119 to blow the trimmed material downwardly therefrom. Throughout the cycle of operations of each mandrel 117 so far described, the intermediate blank 115 and the completed tube 17 resulting therefrom is firmly retained upon the mandrel by the suction produced by the air pump at inlet apertures 121.

Removal of completed tubes

Following the last described phase of each cycle of operations of a mandrel 117, in which the trimmed material is removed therefrom, the inner end of the associated radial aperture 125 passes upwardly beyond the lower end of the interrupted annular recess 129 (Fig. 5) to shut off the air suction from the air pump to the inlet holes 121, so that the completed tube 17 is free to be removed from the mandrel. This removal is accomplished by ejector means F (Figs. 1, 2 and 4) which comprises a rubber roller 159 disposed with its axis in a vertical plane and inclined upwardly and to the right of the machine, with its outer surface spring-held in the path of movement of the outer surfaces of the tapered sleeve portions 118 of the mandrels 117. This roller 159 is rotated in a counterclockwise direction, as viewed from above in Fig. 2, by the main drive means in the following manner. The shaft of roller 159 is rotatably supported in the forwardly extending arm of a right-

angled bearing bracket 161 (Fig. 4) and is provided at its lower end with a bevel gear 162. This gear 162 meshes with a similar gear 163 secured to the forward end of a horizontal shaft 164 on which the other or downwardly extending arm of bracket 161 is rotatably mounted. Shaft 164 is supported in well-known manner for rotation by bearing brackets 165, and the rear end of this shaft has a sprocket wheel 166 secured thereto (Figs. 3 and 4) which is driven by a chain 167 from a sprocket wheel 168 secured to the rear end of the auxiliary drive shaft 32. Referring back to Fig. 1, it will be seen that angular movement of roller 159 about the center of shaft 164, as permitted by the right-angled bracket 161, is limited in an outwardly direction, or to the right, by the upstanding arm of a stop 169 disposed in the path of movement of bracket 161. A spring 171 is interposed between these two members 161 and 169 to yieldably maintain the ejector roller 159 in contact with the frusto-conical sleeve 118 of each mandrel 117, and the completed tapered tube 17 thereon, as the mandrel passes through its position 117c of Fig. 5. Since the auxiliary drive shaft 32 is constantly rotating, the above-described connections therefrom to roller 159 will rotate the latter in a counterclockwise direction (looking down upon its upper end), so that such engagement of each mandrel 117 with roller 159 will result in the latter sliding the completed tube 17 therefrom forwardly of the machine, which is the direction in which the smaller end of mandrel sleeve 118 faces.

Means are provided for receiving all of the completed tapered tubes 117 thus ejected by roller 159 in the form of a rod 172 (Figs. 1, 2 and 4), the smaller upper end of which is bent rearwardly to terminate in position to receive each tube as it is rotatably slid forwardly off its mandrel 117, as shown in broken lines at 17a in Fig. 1. The lineal speeds of rotation of the engaging surfaces of the sleeves 118 of the mandrels 117 and of the ejector roller 159 are substantially identical, so that this method and means of removing the tubes 17 from the mandrels not only will impart a continuing rotation to the tubes, but also will insure against any crinkling or other damaging of the tubes 17. The lower portion of the tube-receiving rod 172, which is supported in any suitable manner, preferably is enlarged to a diameter just less than that of the inner diameter of the smaller ends of the completed tubes 17, so that the latter will come to rest thereon in stack or nested relation with the smaller ends lowermost, as illustrated at 17c in Figs. 7, 14 and 16.

Application of tubes to bottles

From such nested relationship, the tapered tubes are individually and serially removed automatically from the stack (Figs. 7-9) and (11-16), inverted to dispose their larger ends downwardly, and deposited over the upper end of a bottle 18 (Figs. 7a and 8), to come to rest thereon, either at the uppermost end of the bottle as a decorative and protective tube 17 (Fig. 7b) to maintain that dispensing end of the bottle clean and sanitary until it is desired to open the bottle, or at a lower point on the larger portion of the bottle neck as an advertising collar 19 (Fig. 10), depending upon the size of the tube, the material that was selected for making it, and the particular end function previously determined as being desirable for it to perform. The means for so mounting the tapered tubes on bottles constitutes the applicator mechanism G previously mentioned, the preferred embodiment thereof herein disclosed comprising means for removing the lowermost tube from the stack, means for receiving the tubes so removed and inverting the same, and means for presenting bottles serially to the receiving means, the bottles functioning as driving means for the removing and receiving means to insure properly timed operation thereof.

As shown in Figs. 7 and 8, a supporting frame for the applicator mechanism G is provided which com-

13

prises a suitable horizontal rail 173, a pair of bracket arms 174 upstanding therefrom, a vertical back frame plate 175 adjustably mounted on arms 174 at 176, a complementary front frame plate 177 secured in parallel relationship at 178 to the back plate 175 by suitable nuts, bolts and spacer sleeves, and a bearing and gear housing 179 also mounted in any desired manner on the back plate 175. Mounted at 181 (Fig. 11) for adjustable transverse movement is a bracket 182 to which the lower end of a trough or channel member 183 is secured. This trough 183 is substituted in the applicator mechanism G for the guide rod 172 as a more accurate means of insuring proper alignment of the tubes 17 in their stack or nested form for presenting the same to the removing means. The latter includes means for supporting the stack of tapered tubes alternately, at the bottom of the lowermost tube, and by peripheral engagement with the marginal portion of the upper end of the penultimate tube, comprising pairs of lower and upper sliding plates 184 and 185, respectively, and a pair of wiper arms 186 rotatable toward each other to frictionally engage the outer surface of the lowermost tube and separate it downwardly from the stack as the upper plates 185 engage the penultimate tube and the lower plates 184 are separated from stack-supporting engagement with the lower end of the lowermost tube. These two pairs of plates 184, 185 are mounted in parallel relationship to each other and perpendicular to the axis of the nested tubes 17 by means of grooved plates 187 secured in any suitable manner to the inner walls of auxiliary frame plates 188 (Fig. 8) removably mounted on the upper ends of frame plates 175 and 177, as extensions thereof, by means of bolts 189 (Fig. 7). These auxiliary plates 188 are secured together in parallel relationship at 178 in similar manner to plates 175, 177, and it is to their upper edges that bracket 182 is secured.

Each upper sliding plate 185 is spring-urged outwardly by a coil spring 191 interconnected between an upstanding pin on the plate and a rod 192 extending between the auxiliary frame plates 188 (Fig. 7). Adjustably mounted on the top surface of each of these upper plates 185 by means of a suitable screw and slot connection 193 is a thin plate 194, the inner edge of which is arcuately recessed at 195 (Fig. 11) for peripheral engagement with the adjacent marginal portions of the upper end of the penultimate tapered tube 17 in the stack, as best seen in Figs. 7 and 16. The thickness of these tube-engaging plates 194 is required to be somewhat less than the width of the marginal portions of the upper ends of the tapered tubes exposed when the latter are disposed in tightly nested relationship, so that the arcuate edges 195 will engage the outer surface of only one tapered tube when the upper plates 185 are moved inwardly toward each other against the action of their springs 191. The lower pair of sliding plates 184 are similarly mounted in appropriate grooves in the supporting side plates 187 (Fig. 12), and are urged inwardly by springs 196 interposed between the plates and stationary end plates 197 having outwardly extending spring housings secured thereto or formed integrally therewith to receive the outer ends of these springs. Each of these lower sliding plates 184 is provided adjacent its outer end with an upstanding cam lug 198 (Fig. 7), with the lug on the right-hand plate 185 disposed adjacent its forward edge, and that on the left-hand plate disposed adjacent its rear edge. The two plates 184 thus are interchangeable. The upper, inwardly extending nose portion of each cam lug 198 is held by its associated spring 196 in engagement with a cam 199 longitudinally aligned therewith and secured to a transverse shaft 201. Each of the upper sliding plates 185 similarly is provided with a depending cam lug 202 held by its associated spring 191 in engagement with a cam 203 secured to cam shaft 201 (Fig. 16). As best seen

14

in Fig. 12, the depending cam lug 202 on the right-hand upper plate 185 is disposed adjacent the rear edge of the plate, while the lug 202 on the left plate 185 is disposed adjacent the front edge thereof, so that each cam 203 is mounted on its shaft 201 in laterally opposed relationship to the cam 199 for the associated lower plate 184 and these upper plates also are interchangeable with each other. Interposed between each pair of cams 199, 203 and rigidly secured to each cam shaft 201 is a disk 204 (Figs. 14 and 15) mounting a rubber pad 205, the disk 204 and pad 205 comprising the wiper arms 186 above referred to which are engageable with the outer surfaces of the lowermost tube 17 in stack to remove the same therefrom.

The cam shafts 201 are suitably journaled in and extend through the auxiliary frame plates 188, and the left one of these cam shafts is provided at its rear end (Figs. 8, 11 and 12) with a gear 206 secured thereto. This gear 206 meshes with a similar gear 207 mounted on the rear end of the right cam shaft 201, so that the two cam shafts are rotated in unison. The forward end of the right cam shaft 201 is provided with a pinion 208 meshing with an intermediate gear 209 (Figs. 7 and 8), which in turn meshes with a drive gear 211. Gear 211 is secured to the forward end of a transverse shaft 212 extending through and suitably journaled in the frame plates 175 and 177 and the front and rear walls of the gear housing 179, the rear end of shaft 212 being provided with an axial movement limiting collar 213. Within the gear housing 179 (Fig. 8) is disposed a pair of meshing bevel gears 214 and 215, the smaller gear 214 being mounted upon and secured to the shaft 212, and the larger gear 215 being similarly mounted upon the upper end of a vertical shaft 216 which is journaled in, and extends through, the bottom wall of gear housing 179. Secured to the lower end of this vertical shaft 216 is a star wheel 217 that is engaged and rotated in well-known manner by the bottles 18 as they are moved by and along the usual conveyor 218 (Fig. 9) provided at the discharge end of any bottling machine with which the instant mechanism is adapted to be employed. As is customary with such conveyor means, lateral guide rails 219 are provided to direct such movement of the bottles, with the rear guide rail being interrupted as shown in Fig. 9 to accommodate the star wheel 217. It will thus be seen that as each bottle is moved by the conveyor 218 past the star wheel, the latter is rotated incrementally for one eighth of a revolution, the star wheel 217 being provided with eight similar bottle-engaging, arcuate recesses in its peripheral edge. Due to the gear ratio employed, each such incremental rotation of the star wheel 217 results in one complete rotation of the cam shafts 201 toward each other, the right-hand shaft 201 thus being rotated in a counterclockwise direction and the left shaft in a clockwise direction, viewing Figs. 7, 14 and 16.

Each such cycle of operations comprising a complete rotation of the cam shafts 201 from their normal positions of Figs. 7 and 16, first moves the upper plates 185 inwardly into engagement with the exposed upper marginal edge of the penultimate tapered tube 17 in the stack, then moves the lower plates 184 outwardly away from each other and out of supporting engagement with the lower end of the lowermost tube in the stack, and then engages the wiper arms 186 with the outer surface of the lowermost tube to remove the same from the stack and move it downwardly, as illustrated in Fig. 14. It will thus be seen that the lower sliding plates 184 initially support the stack of tapered tubes 17 by engagement with the lower edge of the lowermost tube, and that the stack-supporting function is then taken over by the upper sliding plates 185 as they are moved toward each other into engagement with the next to the last tube in stack to permit the wiper arms 186 to separate the lowermost tube from the stack. Each such cycle of

15

operations of the cam shafts 201 is completed, following discharge of the lowermost tube from this stack-supporting mechanism and past the lower plates 184, by return of these lower plates to their normal position of Figs. 7 and 16, and subsequent release of the stack by the upper sliding plates 185 in response to their outward movement by springs 191, whereupon the stack falls by gravity until the new lowermost tube 17 strikes the upper surface of the lower sliding plates 184. The action of the wiper arms 186 insures separation of the lowermost tube 17 from the stack and sufficiently rapid downward movement thereof to pass beyond the opposed edges of the lower sliding plates 184 while the same are in their extreme separated position and before cams 199 are rotated to a position to permit springs 196 to return these lower plates toward their innermost position. As shown in Fig. 7, it is preferred that the trough or guide member 183 be disposed longitudinally at an angle to the vertical so that it will also function as a partial support for the stack of tapered tubes 17, thus relieving the upper sliding plates 185, 194 from the necessity of supporting the full weight of the stack when in their inner position of Fig. 14.

As each tapered tube 17 is removed individually from the stack, it is picked up and inverted by the receiving means now to be described and deposited thereby over the upper end of a bottle 18 in the following manner: Mounted upon and secured to the transverse shaft 212 intermediate the back and front frame plates 175, 177 is a drum 221 (Fig. 8) which is provided with a plurality of transverse apertures spaced equally peripherally thereof and each having a rod 222 journaled therein. Centrally mounted upon and rigidly secured to each rod 222 is the inner end of a tube-receiving pin 223. Rigidly secured to the forward end of each rod 222 is one end of a link 224, the other end of which has a forwardly extending pin 225 mounted therein. The pins 225 are slidably disposed in a cam groove 226 provided in a stationary plate 227 that is mounted in a suitable recess provided in the rear surface of the front frame plate 177 and rigidly and adjustably secured thereto by means of suitable screws and slots 228 (Fig. 7). An arcuate guide in the form of a strip 229 is secured in any suitable manner to the frame plates 175, 177 and extends from a point somewhat above the shaft 212 at the left side of the machine to a lower point short of a vertical plane through the center line of this shaft, a distance slightly more than the largest diameter of a tube 17.

The drum 221 is rotated by its shaft 212 in timed relationship to the operation previously described of the means for separating and delivering the tubes from the stack to this receiving means, so that a tube 17 is moved downwardly over each of the pins 223 as the latter are brought into their upper, right-hand position of Fig. 7. From that point, the drum being rotated in a counter-clockwise direction in this figure, each tube 17 is carried to a lowermost position, by the drum and the pin 223, to be dropped over the upper end of a bottle 18. During this movement, the tube 17 is inverted, and the guide strip 229 prevents premature falling of the tube out of engagement with its carrying pin 223. The cam groove 226 is shaped as illustrated in Fig. 7 in order to accelerate movement of the outer free end of each pin 223 relative to the drum 222 just prior to the pin being brought into the tube-receiving position indicated at 223a in Fig. 7, and to cause the pin 223 to be restrained instantaneously in the position to insure proper reception thereby of the tube. The gear ratio is such that, as each successive bottle 18 reaches the position of the central one shown in Fig. 9 with its axis in the vertical plane defined by the axes of shafts 212 and 216, the drum 221 will have carried one of the pins 223 into depending vertical alignment therewith, and the guide strip 229 will have permitted the tapered tube 17 being delivered

16

by that pin 223 to fall from the pin and over the upper end of that bottle. A tube 17 is shown in broken lines at 17d in Fig. 8 as it is thus passing downwardly from its pin 223 onto a bottle. If desired, the lower end of the guide strip 229 may be centrally recessed at 231 (Fig. 8) to provide lateral guide surfaces to assist in maintaining proper vertical alignment of the tubes 17 as they are passing downwardly through this position 17d. Depending upon their size relative to that of the bottle, as determined by their intended use, the tapered tubes will come to rest either in the position illustrated in Fig. 7b, or that shown in Fig. 10. It will be appreciated that the applicator mechanism G may be employed separately from the tube forming mechanisms A to F, since the latter obtain their operating power from the motor 25, while the applicator mechanism G, including the means for removing the tubes from stack and the means for receiving the tubes therefrom, inverting them and delivering them to the bottles, is driven by the star wheel 217 which is rotated by the bottles, but it is primarily intended that the instant machine be employed directly with a standard bottle-filling machine to obviate separate handling and enable the completed product of Fig. 7b or 10 to flow from the conveyor 218 as an end result of such automatic cooperation of these machines with each other. It will also be appreciated from Fig. 9 that a completed tapered tube will be delivered by the applicator mechanism G only in response to movement of a bottle by conveyor 218 past the star wheel 217, and that such delivery of a tapered tube cannot take place unless a bottle is properly positioned to receive it, as illustrated by the center bottle 18 in Fig. 9. In other words, if the bottles are disposed in spaced relationship to each other on the conveyor 218, the applicator mechanism G will be operated thereby intermittently, rather than continuously as when the bottles are in successive contacting relationship to each other, but in any event the applicator mechanism G will be actuated automatically in accurately timed relationship to the movement of the bottles therepast.

It should be noted that when thin paper-backed foil is used to form the tapered tubes 17 and they are employed as illustrated in Fig. 7b to protect the dispensing portion of bottles, while gravity alone initially maintains a tapered tube on the bottle, subsequent handling, as in depositing the bottle in the usual carrying case, will result in crimping of the tube about the smallest portion of the bottle neck to insure its being retained thereon until the bottle is to be opened. Also, one of the major advantages of this construction, as compared to the prior art wrapping of a strip of similar material around, and gluing of the same directly to, this neck portion of a bottle, is that the instant tapered tube 17 readily may be removed when desired merely by grasping it between the thumb and forefinger and imparting a quick downward movement thereto relative to the bottle, which will split the tapered tube longitudinally and completely free it from the bottle without having that portion of the bottle previously covered by the tube ever having been touched from the time of its entry into the sterilizer of the bottling machine. This emphasizes an extremely important aspect of the instant invention, namely, the complete elimination of all disadvantages attendant upon gluing of such a protective member directly to the bottle, including difficulty of removal thereof when the contents of the bottle are to be dispensed, inadvertent introduction of portions thereof into the bottle during the process of removing the bottle cap, and the requirement of hand scrubbing or other special washing of the emptied bottles to remove the glue or other adhesive and fragments of the glued member therefrom.

It is thought that the invention and many of its attendant advantages will be understood from the fore-

17

going description, and it will be apparent that various changes may be made in the form, construction and arrangement of the parts without departing from the spirit and scope of the invention or sacrificing all of its material advantages, the form hereinbefore described being merely a preferred embodiment thereof.

I claim:

1. In a machine of the class described, means for guiding a stack comprising a plurality of tapered tubes nested with their smaller ends lowermost, means for serially removing the lowermost tubes from said stack one at a time, means for individually receiving the tubes from said removing means and inverting the same to dispose each tube with its larger end lowermost, and means for presenting bottles serially to said receiving means in timed relationship therewith to enable a tapered tube to be dropped thereby over the upper end of each bottle.

2. A machine according to claim 1, in which said guide means is angularly inclined, and said removing means comprises two pairs of reciprocable plates perpendicular to said guide means, said pairs of plates being spaced from each other a distance slightly greater than the length of said tubes and alternately engageable, respectively, with the bottom edge of the lowermost tube, and with the outer surface of the upper marginal portion of the penultimate tube, whereby said guide means and said removing means together support said stack, and means operable in timed relationship to said reciprocable plates for frictionally engaging the outer surface of the lowermost tube in said stack and moving the same downwardly between the lower pair of said plates while the penultimate tube is engaged by the upper pair of said plates.

3. A machine according to claim 1, wherein said receiving means comprises a rotatable drum disposed below said removing means, a plurality of tube-receiving fingers spaced peripherally of said drum, means for pivotally mounting the inner end of each said finger on said drum on an axis parallel with that of the drum, and cam means operable to maintain each said finger radial to said drum during a portion of each rotation of the drum and to instantaneously stop the outer end of each said finger as it is moved upwardly into a position directly adjacent said removing means to receive a said tapered tube.

4. In a machine according to claim 3, a stationary arcuate guide member mounted adjacent the periphery of said drum to maintain the tubes on said fingers as they are inverted thereby.

5. In a machine for forming tubes in which a strip of material is presented to a rotatable mandrel at a first position, is wrapped around the mandrel and adhered to itself to form a tube as the mandrel moves between said first and a second position, and the tube is trimmed at each end as the mandrel moves between said second and

18

a third position; means for trimming the ends of the roll, comprising shearing means formed on said mandrel, a stationary supporting member, a pair of knives mounted substantially parallel to each other on said member for limited lateral movements, and resilient means for urging said knives toward each other and maintaining proper engagement thereof with said shearing means as said mandrel moves from said second to said third position, said knives converging slightly toward each other in the direction of the movement of the mandrel from said second to said third position.

6. In a machine for forming tubes in which a strip of material is presented to a rotatable mandrel at a first position, is wrapped around the mandrel and adhered to itself to form a tube as the mandrel moves between said first and a second position, and the tube is trimmed at each end as the mandrel moves between said second and a third position; means for trimming the ends of the roll, comprising shearing means formed on said mandrel, a stationary supporting member, a pair of knives mounted substantially parallel to each other on said member for limited lateral movements, resilient means for urging said knives toward each other and maintaining proper engagement thereof with said shearing means as said mandrel moves from said second to said third position, an air blower, inlet means to said blower connected to the interior of the mandrel and through the walls of the latter to provide suction means for maintaining the strip of material on the mandrel during movement thereof from said first to said third position, and outlet means connected to said blower and terminating in nozzle means disposed adjacent said knives to assist in clearing the trimmed material from the mandrel.

7. In a machine according to claim 6, an auxiliary knife mounted on said stationary supporting member adjacent the supported end of the mandrel, as the latter moves from said third position, to sever any selvage rings formed by the action of said trimming means and blown into contact therewith by air from said nozzle means.

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