L. P. BROWN.

BOTTLE MAKING MACHINE.

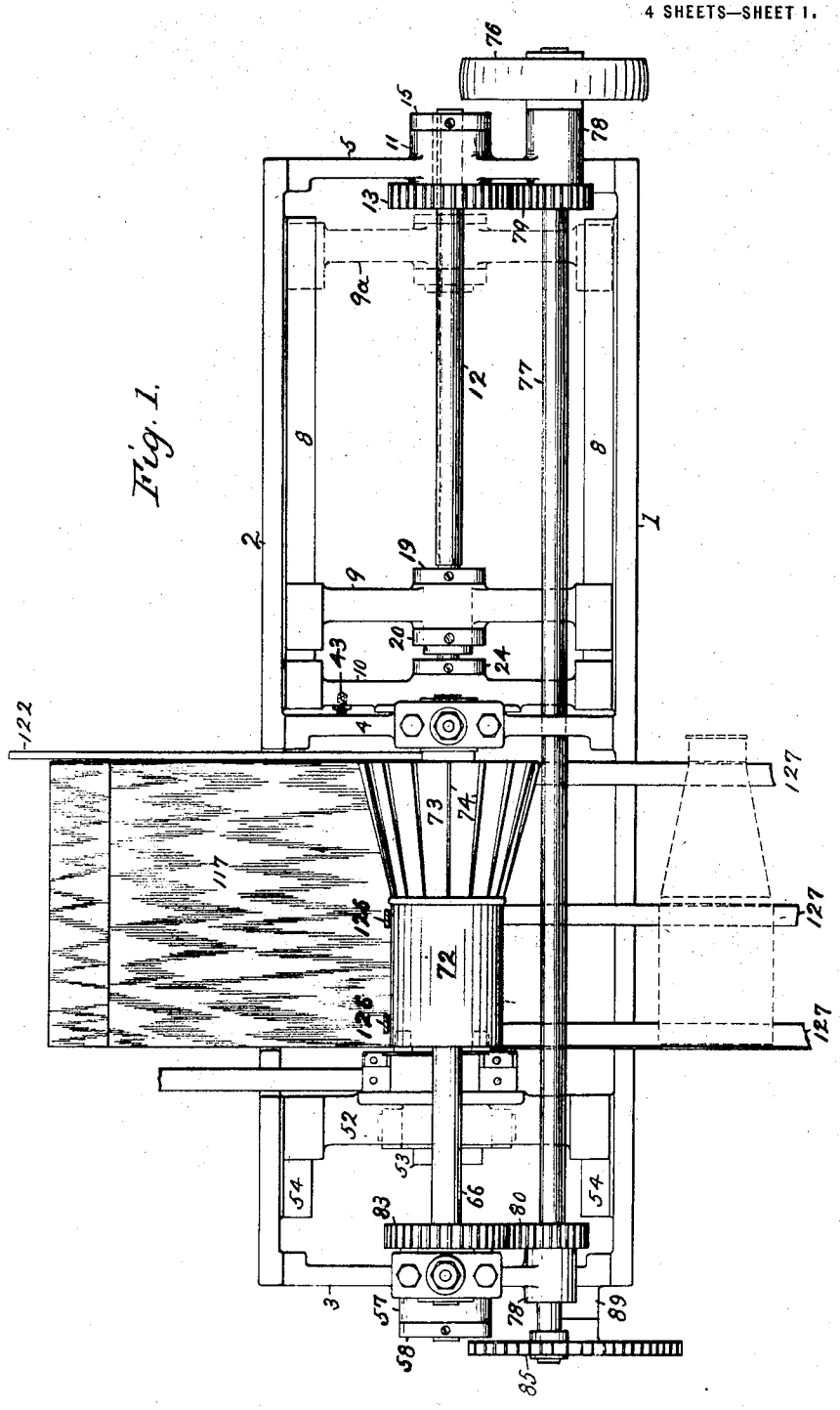
APPLICATION FILED AUG. 15, 1910. RENEWED SEPT. 1, 1915.

1,186,466.

Patented June 6, 1916.

4 SHEETS—SHEET 1.

Fig. 1.



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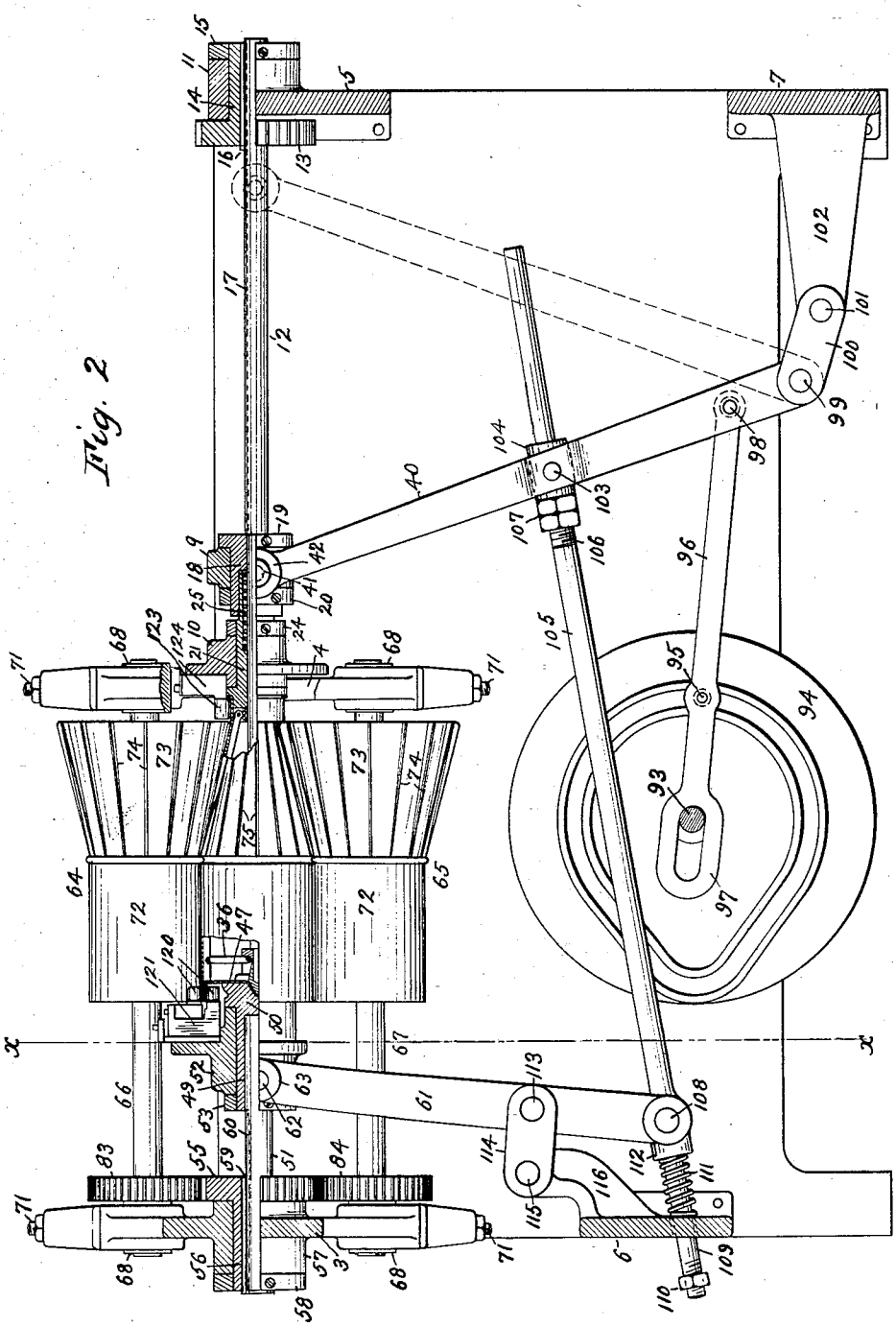
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4 SHEETS—SHEET 2.

Fig. 2



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4 SHEETS—SHEET 3.

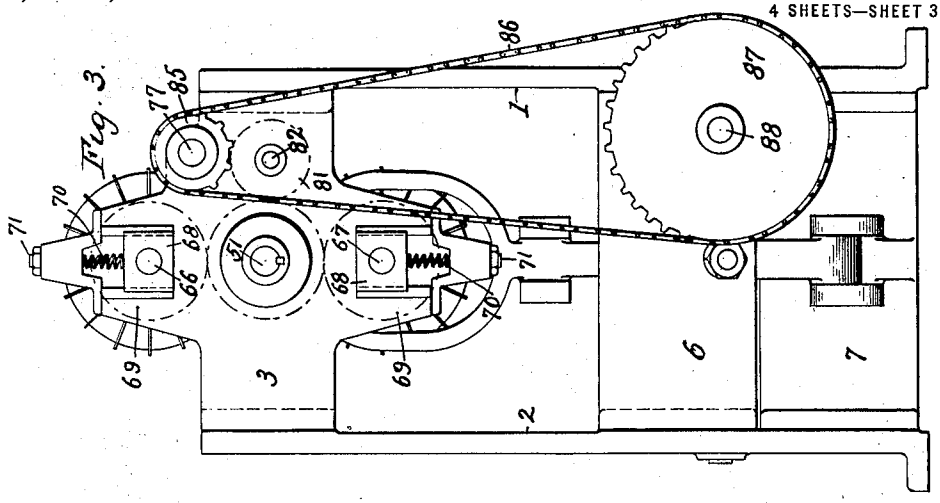


Fig. 3.

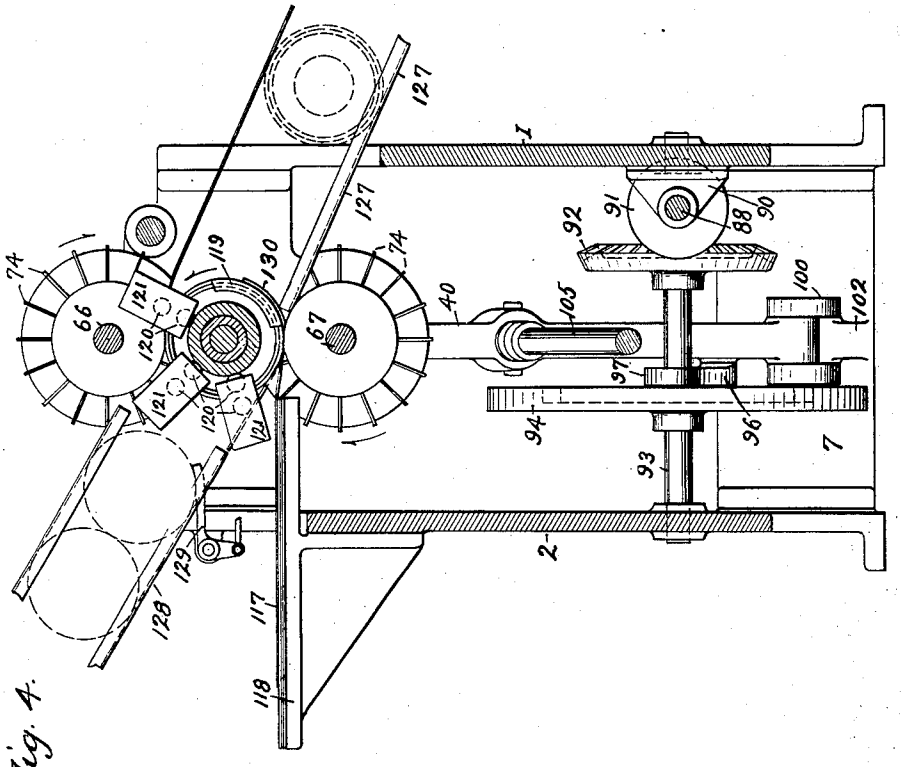


Fig. 4.

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4 SHEETS—SHEET 4.

Fig. 5.

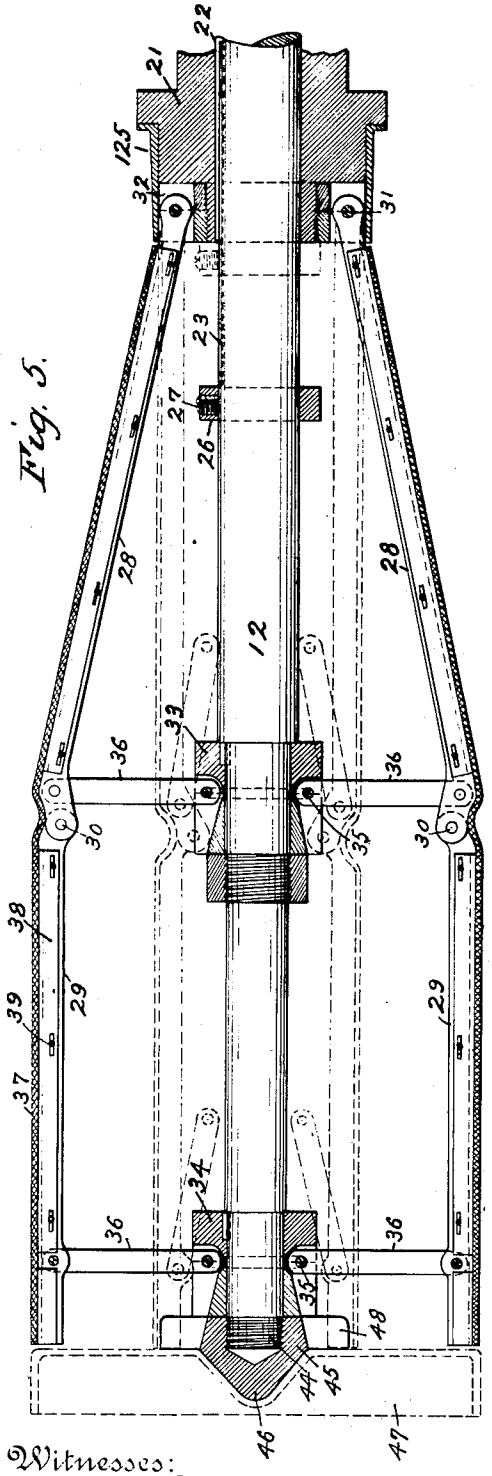


Fig. 7.

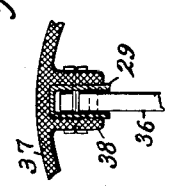


Fig. 8.

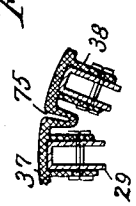
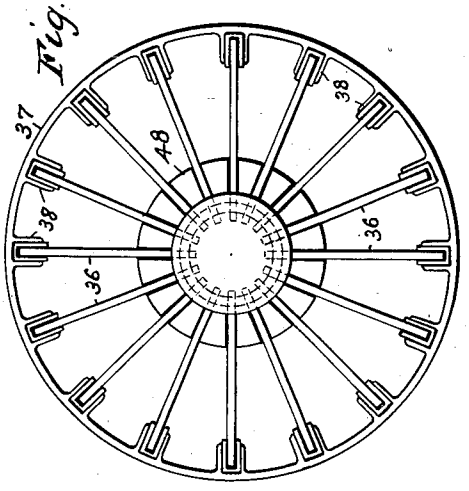


Fig. 6



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UNITED STATES PATENT OFFICE.

LUTHER P. BROWN, OF RAMSEY, NEW JERSEY, ASSIGNOR, BY DIRECT AND MESNE ASSIGNMENTS, TO UNIVERSAL PAPER BOTTLE COMPANY, OF NEW YORK, N. Y., A CORPORATION OF DELAWARE.

BOTTLE-MAKING MACHINE.

1,186,466. Specification of Letters Patent. Patented June 6, 1916.

Application filed August 15, 1910, Serial No. 577,369. Renewed September 1, 1915. Serial No. 48,573.

To all whom it may concern:

Be it known that I, LUTHER P. BROWN, a citizen of the United States, and resident of Ramsey, in the county of Bergen and State of New Jersey, have invented certain new and useful Improvements in Bottle-Making Machines, of which the following is a specification.

The invention relates to bottle-making machines for the formation of bottles or other containers from paper or similar flexible material suitably tempered and treated with an adhesive.

The objects of the invention include the provision of a flexible form for shaping bottles having contracted necks and mouths, means for adjusting the form and clamping thereto a previously formed bottle-blank constituting the bottom of the bottle to be formed, means for rotating the form to shape the bottle thereon, means to unite the bottom-blank and side walls of the bottle, means for shaping the contracted neck and mouth, means for applying reinforcing bands for the formation of the mouth, and means for collapsing and withdrawing the form from the bottle thus shaped.

Further objects include certain details of construction hereinafter set forth.

In describing the invention in detail reference is had to the accompanying drawings, forming part of this specification, and wherein like characters of reference are used to designate like parts throughout the several views, and in which:

Figure 1 is a ground plan of the machine embodying the present invention; Fig. 2, is a side elevation, with the front frame removed, and parts shown partially in section; Fig. 3, an exterior end elevation; Fig. 4, a transverse sectional elevation on line x—x, Fig. 2; Fig. 5, an enlarged longitudinal sectional view of the form, shown in connection with its supporting parts; Fig. 6, an end view of the bottom of the form; Fig. 7, a cross-sectional view showing a portion of the covering of the form in connection with one of the ribs and the expansion links; and Fig. 8 is a transverse section of a fragment of the tapered neck-forming portion of the form, showing a recess in the cover for receiving the creasing blades of the forming rolls.

In the drawings, numerals 1 and 2 designate respectively the front and rear main frames of the machine, laterally connected by the cross-braces 3, 4, 5, 6 and 7, and provided with the inwardly-extending ways 8 for slidingly supporting the cross-heads 9 and 10, which, together with the bearing 11, formed on cross-brace 5, rotatively support the form-shaft 12. For rotating this shaft a gear 13 is provided, having an outwardly-extending hub 14, journaled in bearing 11, and positioned therein by collar 15. An inwardly-extending key 16 is fixed within the hub of the gear and slidingly engages a key-way 17 formed longitudinally in the shaft for permitting a lengthwise movement of the latter.

Intermediate of its length, the form-shaft 12 is provided with a sleeve 18, which is fixed thereon and mounted for rotative movement in the cross-head 9, the sleeve being positioned in the latter by the outwardly-extending side flange 19 and the set-collar 20. The sleeve is further provided at its inner end with an annular recess or counter-bore for slidingly receiving the tubular end of a head or hub 21, mounted for longitudinal sliding movement upon the form-shaft, and arranged for rotation therewith by a key 22, fixed in the hub and engaging a key-way 23, in the shaft, as shown in dotted lines in Fig. 5. The head or hub 21 is retained for rotative movement in the cross-head 10 by the set-collar 24. An annular recess or counter-bore is also provided in the tubular end of this hub adjacent the sleeve 18, and within said recess is loosely mounted a spirally-wound compression spring 25, the ends of which abut the terminal walls of the recess of the hub and sleeve and normally tend to urge or slide the former inward against the stop-collar 26 and in opposition to the fixed sleeve, the stop-collar being longitudinally adjustable on the shaft by the set screw 27.

The form, as shown in detail in Figs. 5, 6 and 7, is carried upon the overhanging inner end of the form-shaft 12, and includes a frame composed of a plurality of extensible bars or ribs, each consisting of an inner section 28 and an outer section 29, U-shaped in cross section, and pivotally connected together at 30. The inner sections of the ribs are hingedly connected at their inner ends by the ring 31 to the two-part annular blocks 32, having radial slots to receive the

ribs, and provided with detaching means to hub 21. Also, detachably fixed to shaft 12 are similar two-part blocks 33 and 34, having rings 35 for pivotally connecting the inner ends of the expansion-links 36, the outer ends of the latter being pivotally connected to the several rib-sections comprising the frame. Upon this frame, and conforming therewith, is detachably secured an outer flexible cover 37, preferably formed of rubber and provided with inwardly-extending ridges 38, connected to the ribs of the frame in any suitable manner, as by a pin 39 fixed therein and extending through slots in the ridges.

From the foregoing description pertaining to the collapsible mandrel it will be understood that said mandrel embodies a rotatable and reciprocable mandrel shaft, a series of bars 29 linked to the mandrel shaft so as to be retained in parallel relation therewith, a second series of bars 28 having pivotal connection with the mandrel shaft, said second series of bars having pivotal connection, also, with the bars of the first series, and said second series of bars being adapted to assume positions inclined to the axis of the mandrel shaft and to the bars of the first series, and means operated by an endwise movement of the mandrel shaft for moving the bars of the two series to their expanded operative positions and, also, to their collapsed positions.

As locked in the extended position indicated by the full lines, it will be evident that the form may be rotated to shape a bottle thereon, and that by sliding the shaft through the hub 21 to the engagement of the latter with the stop collar 26, the form will be collapsed and assume the position indicated by dotted lines, the flexible parts of the cover between the ribs folding upon themselves, and the whole sufficiently reduced in size to readily permit of its removal through the contracted portion of the formed bottle by the continued forward movement of the shaft. For effecting this longitudinal movement of the form shaft, an oscillatory arm 40 is provided and connected at its upper end by trunnions 41 to bosses 42, formed on the cross-head 9, which latter is arranged to slide horizontally back and forward on the ways 8, the sliding connections thereto being of any approved construction. The cross-head 9 being longitudinally fixed upon the form-shaft, as above described, and the cross-head 10 longitudinally slidable thereon to a limited extent, corresponding to the movement necessary for the extension and collapse of the form, it will follow that the latter cross-head will travel with the former one over the ways and be normally held separated for the collapse of the form by the compression spring 25, the outward extreme of movement of the cross-head 9 being indicated by the dotted lines 9^a. Stop-screws 43 are adjustably secured in the cross-head 10 for limiting the latter's inward movement by the engagement of the projecting screw-end with the fixed cross-brace 4. Upon the inward or forward movement of the form-shaft and connected cross-heads, the form will remain collapsed until the movement of cross-head 10 is arrested, from which point the form will be gradually extended by the continued movement of the shaft and cross-head 9, which effects a compression of the spring 25 and causes an outward movement of the expansion-links 36. It is to be noted that the parts as thus arranged provide for the expansion and contraction of the form without necessitating a longitudinal movement thereof.

Upon the inner free end of the form-shaft a thread 44 is provided which is engaged by a nut 45, which serves to detachably secure a section of the two-part block 34, and is also provided with an outwardly-projecting conical end 46, conforming with the centrally-cupped portion of a bottom-blank 47, constituting the bottom of a bottle, and shown positioned thereon in dotted lines. This nut is further provided with an outwardly-extending flange 48, suitably recessed to form clearances for the movement of the several expansion-links 36.

For centralizing and clamping the bottom-blank to the form, a hub 49 is employed, having a head 50, provided with a central recess conforming with the cupped portion of the bottom-blank. The hub is fixed upon clamp-shaft 51, and is journaled in cross-head 52, in which it is positioned by the collar 53, this cross-head being arranged to slide on ways 54, formed on the front and rear main frames, in a manner similarly described for cross-heads 9 and 10. For rotating clamp-shaft 51, a gear 55 is provided which is formed with an extended hub 56, journaled in a bearing 57, of cross-brace 3, the gear being positioned by the collar 58, secured to the hub. A drive-key 59 is fixed in the gear and slidingly engages an extended keyway 60 in the clamp-shaft to rotate the same and to permit of relative longitudinal movement, this latter movement being effected by the rock-arm 61, having at its upper end a drive-pin 62 which is journaled in a lug 63, formed on the cross-head 52.

Arranged above and below the form and coacting therewith, are the forming-rolls 64 and 65, respectively fixed upon the shafts 66 and 67, which are journaled in boxes 68, slidably mounted upon ways 69, similarly disposed on the cross-braces 3 and 4. Springs 70, having tension-adjusting screws 71, are provided for each of the boxes and yieldingly urge the rolls into action with the form. Each of the forming-rolls is con-

structed with a smooth cylindrical portion 72, shaped to suit the body of the bottle to be formed, and is also provided with an outwardly-tapered or frusto-conical portion 73 to engage and shape the contracted neck of the bottle. Projecting from, and equally spaced about the peripheral surfaces of this latter portion of the rolls, and radially fixed therein, are a series of creasing or tucking blades 74, which coact with recesses 75, formed in the corresponding portion of the form, the projection of the blades above the surface of the rolls being variable with respect to their length to accord with the superficial variation of the bottle for creasing the material of the latter to form uniform inwardly-extending plaited ribs and present a smooth exterior surface.

For imparting motion to the machine, a driving-pulley 76 is provided and fixed to one end of a main-drive-shaft 77, which is mounted for rotation in bearing 78, formed on the cross-braces 3 and 5. To this shaft are fixed the gears 79 and 80, which intermesh with lower idler-gears 81, shown in dotted lines in Fig. 3, the latter gears being loosely mounted on studs 82, fixed in the cross-braces 3 and 5. Through these idlers the gears 79 and 80 drive respectively the form-shaft gear 13 and the clamp-shaft gear 55 at a uniform rate of speed, the shafts thereof being axially disposed in a common line to effect a register of their adjacent interlocking ends to clamp the interposed bottom-blank and provide an added support for this end of the form-shaft. Upon the forming-roll shafts 66 and 67 are respectively fixed the gears 83 and 84, which are driven from the clamp-shaft gear 55. A chain-wheel 85 is fixed on the opposite end of the main driving-shaft 77, and carries a drive-chain 86, engaging a larger wheel 87, fixed upon shaft 88, the latter being journaled at its outer end in a bearing 89, formed on the cross-brace 6, and at its inner end in a journal-box 90, secured upon the interior of the side-frame 1. Upon shaft 88 is fixed a bevel-pinion 91, which engages a bevel-wheel 92, secured upon shaft 93, the latter being mounted in bearing formed in the side frames 1 and 2. A cam-wheel 94 is fixed upon the latter shaft and engages a roller 95, mounted upon a central stud, secured to the connection-rod 96, which is provided with a slotted end 97 engaging shaft 93. At its opposite end the rod is pivotally connected at 98 to the oscillatory arm 40 for imparting motion thereto. The above system of gearing extending from the main shaft and driving the form-shaft and the oscillatory arm is continuously driven and so proportioned that a plurality of turns of the form will be made to one backward and forward movement of the arm, constituting a cycle of the machine.

The oscillatory arm 40 is pivotally mounted at its lower end upon a stud 99, fixed in the outer end of the vibratory arm 100, which latter is pivotally mounted upon a pin 101, fixed to the bracket 102, of the cross-brace 7. As thus arranged the arm 40 at its upper end will have a horizontal path maintained by the cross-head 9, and at its lower end its movement will be in a circular arc about the pin 101. Upon the arm 40 is secured a stud 103, upon which is hingedly mounted a box 104, having a central aperture to slidingly receive the outer end of an actuating-rod 105, an intermediate portion of which is threaded at 106 to adjustably engage the double nut 107, which serves as an abutment for the engagement of the box 104. At its inner end the rod 105 is pivotally mounted upon a stud 108, fixed to the lower end of rock-arm 61, and upon this stud is also pivotally mounted one end of a spring-rod 109, the opposite end of which passes through a perforation in the cross-brace 6 and is provided with a screw thread engaged by an adjustable stop-nut 110. Loosely surrounding the rod is a spiral compression spring 111, one end of which engages the cross-brace while its opposite end thrusts against a shoulder 112 formed on the rod, and yieldingly urges the lower end of rock-arm 61 inward. This rock-arm is pivotally supported intermediate of its ends upon a stud 113, fixed to a vibratory arm 114, which latter is pivotally mounted upon a pin 115, fixed to the bracket 116, formed on the cross-brace 6. As thus supported for movement about the pin 115, the upper end of the rock-arm is free to move horizontally and actuate the cross-head 52, the inward or clamping movement of which is effected by the latter portion of the inward movement of the arm 40, which movement is transmitted through the hinged box 104, nut 107 and actuating-rod 105 to the rock-arm 61, the nut serving by its adjustment upon the rod to vary the clamping tension upon the blank 47. During this forward movement of rod 105, the spring-rod 109 is also moved in a like direction for the compression of spring 111, which latter upon its release, during the return movement of rod 105, serves to impart a return movement to the rock-arm 61 and cross-head 52.

The bottle-forming mechanism as shown in full lines is positioned to receive a sheet of adhesively-prepared paper 117, shown in Figs. 1 and 4, supported upon the table 118, fixed to the rear frame of the machine. The paper passes between the form and the lower forming-roll and is thereby compressed, one edge thereof being thus affixed to the outwardly-extending flange of the positioned bottom-blank 47, and the neck portion thereof tucked into the recesses 75 of the form. As thus secured upon the form,

the sheet is carried around thereby a number of turns corresponding to the number of layers of material required for the formation of the bottle, during which rotative movement the upper forming-roll similarly acts to shape the bottle and to equalize the stress upon the form from the oppositely disposed roll. For additional security the margin of the sheet is turned over and secured to the inner surface of the flange of the bottom-blank, which operation is effected by the forming-blade 119, which is secured to the cross-head 52 and serves to gradually turn inward the damp adhesive margin for the successive engagement of presser-rollers 120. These rollers are yieldingly mounted in blocks 121, adjustably secured to the adjacent cross-head, and act by rolling pressure upon the opposite surfaces of the flange to affix the margin thereto. Presser-rollers are also provided for shaping the mouth portion of the bottle and affixing an adhesively-prepared band 122. These presser-rollers, indicated by the single roller 123, yieldingly mounted upon the block 124, adjustably secured to the cross-head 10, coact with the forming sleeve 125, fixed upon the form-hub 21, shown in Fig. 5.

The cam-wheel 94, which makes one revolution per cycle of machine, is arranged with a concentric cam portion which holds the arms 40 and 61 in their inward extreme of movement during the formation of the bottle, from which point a rise in the cam causes arm 40 to move outward, the initial portion of which movement acts through rod 105 to release spring 111 for effecting the outward movement of arm 61 to an extent limited by the stop-nut 110, the initial movement also acting to separate cross-heads 9 and 10 for the collapse of the form. Upon the continued outward movement of arm 40, the pivotally-connected box 104 slides loosely along the outer end of rod 105, and the cross-head 9 is also driven to its outer extreme of movement for the withdrawal of the collapsed form from the finished bottle. During the withdrawal of the form, the bottle is retained between the rotating forming-rollers 72 by the tucking-blades 74 and the suitably-positioned back-stops 126, fixed to the frame of the machine. Upon the complete withdrawal of the form, the yieldingly-supported inner shaft-end of the upper forming-roll is slightly raised, in any convenient manner, for the release of the tucking-blades, which permits the forward discharge of the finished bottle over the delivery bars 127.

For feeding the bottom-blank to the machine, downwardly-inclined feed-bars 128 are used, and in connection therewith a movable stop-lever 129 is arranged which permits the feeding of a single blank at a time to the guide-bars 130, which serve to position the blank approximately central with respect to the form, such positioning being effected while the cross-head 52 and its connected presser-rollers 120 are in their outer extreme of movement.

The continued rotation of the cam causes a return or inward movement of the arms 40 and 61 for the repositioning and expansion of the form and the clamping of a new blank thereto for the formation of a new bottle.

What I claim as my invention and desire to secure by Letters Patent, is:

1. In a machine for making containers from fibrous material, a collapsible mandrel embodying a reciprocating and rotating shaft, a collar the diameter of which is less than that of the mandrel when expanded, a series of ribs each composed of two members pivoted together, one member of each rib being pivoted to said collar and inclined with respect to the other member when the mandrel is expanded into operative position, means controllable by the reciprocating movement of the shaft for expanding and contracting the mandrel, and means for imparting rotative movement to the mandrel whereby the material is coiled thereon so as to produce a bottle the neck portion of which is tapering to conform to the inclination of the rib members.

2. In a machine for making containers from fibrous material, a collapsible mandrel embodying a series of ribs each composed of two members pivoted together, one member of each rib being inclined with respect to the other member when the mandrel is expanded into operative position, in combination with a shaft positioned centrally with respect to the ribs, means for pivotally connecting the inclined rib sections to said shaft, means for imparting endwise movement to the shaft, and means actuated by said endwise movement for enlarging and decreasing the diameter of the mandrel.

3. In a machine for making containers from fibrous material, a collapsible mandrel embodying a rotatable and reciprocating shaft, a collar the diameter of which is less than that of the mandrel when expanded, a series of ribs each rib being composed of two members, one member of each rib being pivoted to said collar and to the other rib member, and expansion devices connecting the shaft and the ribs intermediate the ends of the latter, said expansion devices being operated by the reciprocating movement of the shaft and acting to move the ribs outwardly or inwardly relative to the shaft, one member of each rib being inclined relative to the other member of said rib when the mandrel is expanded whereby the material wrapped upon the mandrel produces a container the neck portion of which tapers correspondingly to the inclination of the members of said ribs.

4. In a machine for making containers from fibrous material, a collapsible mandrel embodying a rotatable shaft, a series of members each pivoted at one end to said shaft, a second series of members each pivoted at one end to an adjacent end of a member of the first series, sliding collars on said shaft, and expansion links pivoted to said collars and to the members of the two series for effecting an increase or decrease in the diameter of the mandrel, the members of the first series being movable into position inclined relative to the members of the second series when the mandrel is expanded.

5. A form comprising a central supporting shaft, a hub mounted thereon for longitudinal sliding movement with respect thereto, blocks fixed to said shaft exterior of said hub, a plurality of form-ribs, each comprising an inner and an outer section pivotally connected together, said inner section of each rib being inwardly converged and pivotally secured to said hub, a flexible form-cover having an inwardly converged portion and connected to said inner and outer sections of form-ribs, and means for longitudinally sliding said shaft with respect to said head.

6. A form comprising a central supporting shaft, a hub mounted thereon for longitudinal sliding movement with respect thereto, blocks fixed to said shaft exterior of said hub, a plurality of form-ribs, each comprising an inner and outer section pivotally connected together, said inner sections being inwardly converged and pivotally secured to said hub, and expansion-links pivotally secured at their opposite ends to said block and form-ribs.

7. In a machine for making containers from fibrous material, the combination of a plurality of reciprocating crossheads, a form shaft mounted in said crossheads so that one end portion of said form shaft is free, means for rotating the form shaft, a collapsible mandrel carried by the form shaft, means for feeding a sheet of material relative to the mandrel and thereby wind or coil said sheet upon the mandrel when the latter is rotated with the form shaft to form a container body thereon, means for expanding and contracting the mandrel, and means for imparting reciprocating movement to the mandrel and shaft whereby the collapsed mandrel may be withdrawn from the container.

8. In a machine for making containers from fibrous material, a rotatable and reciprocal shaft, a collapsible mandrel carried by the shaft, means for expanding and contracting the mandrel, means for feeding material to the mandrel to effect the winding of the material upon said mandrel, a reciprocating crosshead operating on the shaft to effect the expansion and contraction of the mandrel and a second reciprocating crosshead operating subsequently to the first crosshead for imparting reciprocating movement to the shaft and the collapsed mandrel, whereby the mandrel is withdrawn from the container thereon.

9. In a bottle-making machine, the combination of a rotatable form-shaft mounted for longitudinal movement, blocks fixed to said shaft, a hub mounted on said shaft for longitudinal sliding movement with respect thereto and rotatable therewith, a plurality of form-ribs having pivotal connections to said blocks and hub, a spring mounted on said shaft and engaging said hub for normally contracting said ribs, and means actuated by the longitudinal movement of said shaft to extend said ribs against the action of said spring.

10. In a bottle-making machine, the combination of a rotatable form-shaft mounted for longitudinal movement, blocks fixed to said shaft, a hub mounted on said shaft for longitudinal sliding movement with respect thereto and rotatable therewith, a plurality of form-ribs having pivotal connections to said blocks and hub, a stop-collar fixed upon said shaft intermediate said blocks and hub, a sleeve fixed to said shaft exterior said hub, a spring mounted on said shaft intermediate said hub and sleeve and normally urging said hub into engagement with said stop-collar for contracting said ribs, and means for longitudinally moving said shaft and arresting said hub to extend said ribs.

11. In a machine for making containers from fibrous material, the combination of a collapsible mandrel upon which is adapted to be wound the material to form a container body, means coöperating with said mandrel for positioning a flange bottom blank in operative relation to the mandrel, means for feeding a sheet of material to said mandrel in a direction to overlap the bottom blank, means for imparting rotary motion to the mandrel to effect the operation of winding the sheet of material upon the mandrel and upon the flanged portion of the bottom blank, and means for imparting reciprocating motion to the mandrel subsequent to the formation of a container thereon, said mandrel being withdrawable in a collapsed condition from the container present thereon.

12. In a machine for making containers from fibrous material, the combination of a collapsible mandrel upon which is adapted to be wound a sheet of material to form a container body, means coöperating with said mandrel for retaining a flanged bottom blank in rotative relation to the mandrel, means for feeding a sheet of paper to the mandrel and to the flanged bottom blank in such manner that an edge of said sheet protrudes beyond the flange of the bottom blank, means for imparting rotary motion

to the mandrel to effect the operation of winding the sheet of paper upon the mandrel and the flange of the bottom blank, means for folding the protruding ends of said sheet of paper inwardly with respect to the flange of the bottom blank, and means for imparting reciprocating motion to the mandrel subsequent to the formation of a container thereon, said mandrel being withdrawable, in a collapsed condition, from the container present thereon by imparting endwise movement to the mandrel.

13. In a paper bottle machine, the combination of a form shaft, a collapsible mandrel thereon, means for imparting rotative movement thereto, means for feeding a sheet of adhesively prepared paper to said mandrel, a reciprocating and rotative clamp shaft in alinement with said form shaft, means for feeding bottom blanks into position between the form shaft and the clamp shaft, and means for imparting reciprocating movement to the form shaft and for withdrawing the mandrel, in a collapsed condition, from the container present thereon.

14. In a paper bottle machine, the combination of a reciprocating and rotating form shaft, a clamp shaft, means for feeding bottom blanks between the adjacent ends of the form shaft and the clamp shaft, centralizing means positioned for engagement with the bottom blanks for positioning said bottom blanks in concentric relation to the form shaft, a mandrel on the form shaft, means for imparting reciprocating movement to the clamp shaft, other means for imparting reciprocating movement to the form shaft, said mandrel when collapsed being withdrawable from the container by the movement of the form shaft in one direction, and means for feeding a sheet of paper to the mandrel.

15. In a paper bottle machine, the combination of a reciprocating and rotating form shaft, a collapsible mandrel thereon, means for feeding a web of material to the mandrel, a clamp shaft, means for imparting reciprocating and rotative movement to the form shaft, means for imparting rotative and reciprocating movement to the clamp shaft, means for feeding bottom blanks into position between the form shaft and the clamp shaft when the two shafts are separated, and means for collapsing the mandrel subsequent to the formation on the mandrel of a container, said mandrel when collapsed being withdrawable from the container by the reciprocating movement of the form shaft.

16. In a collapsible mandrel, the combination of a rotatable and reciprocable mandrel shaft, a series of bars linked to and parallel with said shaft, a second series of bars pivoted to said shaft and adapted in the operative positions thereof to assume positions inclined to the shaft and to the bars of the first series, and means operable by an endwise movement of the shaft for moving the bars of the two series to their expanded operative positions and to their collapsed positions.

17. In a collapsible mandrel, the combination with a mandrel shaft, of a series of bars linked to and substantially parallel with said shaft, a second series of bars positioned in register with the bars of the first series, said bars of the second series being pivoted to the shaft and adapted when in their operative positions to assume positions inclined to the mandrel shaft and to the bars of the first series, and means for imparting movement to the two series of bars for expanding or collapsing the mandrel.

18. In a collapsible mandrel, the combination with a mandrel shaft, of a head mounted loosely thereon, a series of bars pivoted to said head and adapted to assume positions inclined to the mandrel shaft when the mandrel is expanded, another series of bars pivoted to the bars of the first series, and means for moving the bars of the two series into a collapsed relation to the mandrel shaft or expanding them into operative relation to said mandrel shaft.

19. In a collapsible mandrel, the combination of a mandrel shaft, a plurality of collapsible members substantially parallel thereto, means connecting said members with the shaft whereby they may be collapsed or expanded with reference to said shaft, a plurality of inclined collapsible members pivotally connected with the specified collapsible members, and a head mounted on the mandrel shaft and pivotally connected to those ends of said inclined collapsible members opposite to that at which they are connected to the parallel collapsible members.

20. In a collapsible mandrel, a mandrel shaft, a plurality of members normally parallel with said mandrel shaft, links connecting said members to said mandrel shaft, a head on the mandrel shaft, other members each pivoted at one end to the head and at the other end to one of said first-named members, said members being movable to inclined and parallel positions relative to the mandrel shaft.

Signed at Ramsey, in the county of Bergen and State of New Jersey, this 11th day of August, A. D. 1910.

LUTHER P. BROWN.

Witnesses:
LILLIE MAE BROWN,
MATILDA LEACH.