April 24, 1962 H. C. BRIEN 3,031,185

FOLDING OF CELLULOSIC PRODUCTS

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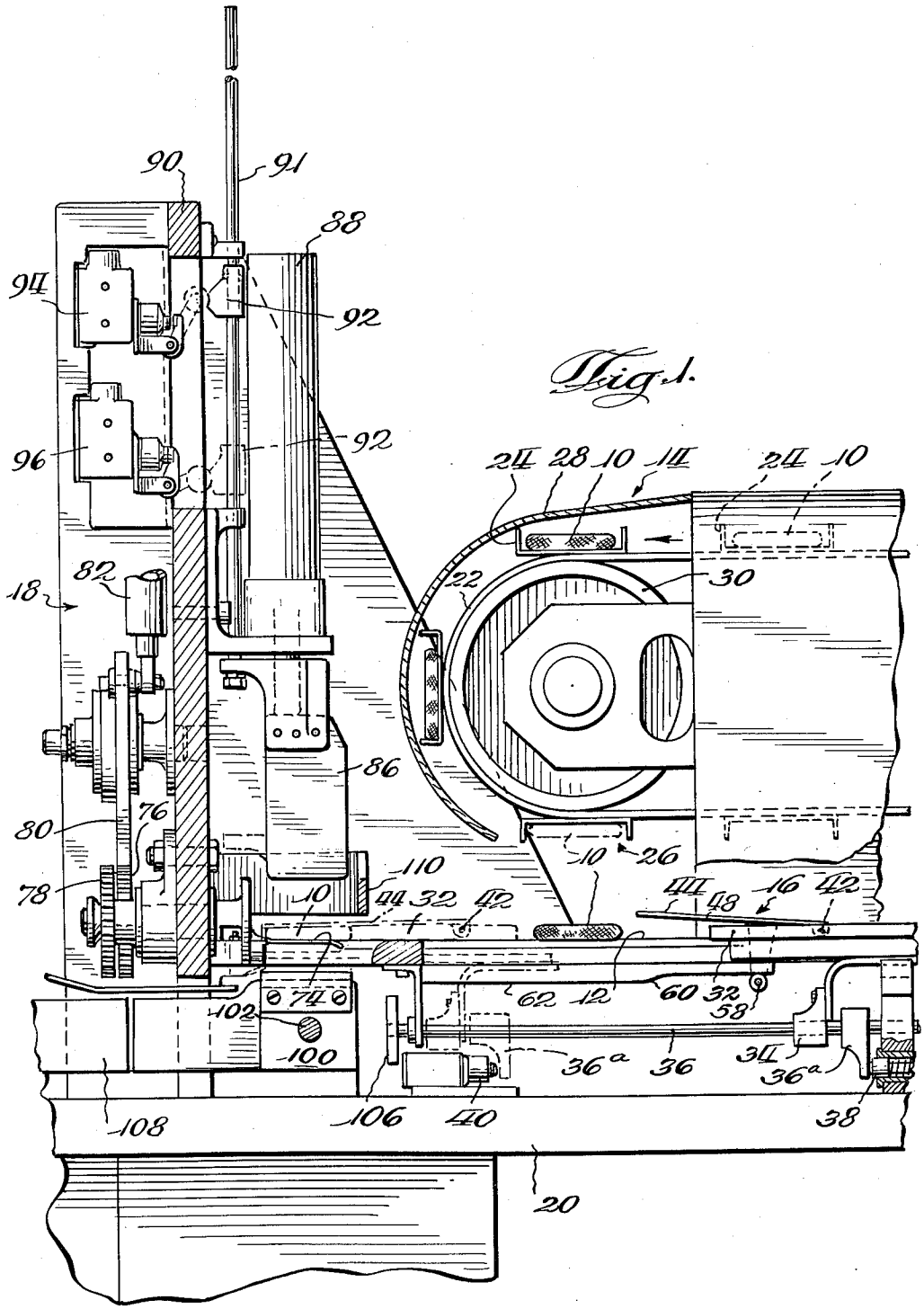


Fig. 1.

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Fig. 3.

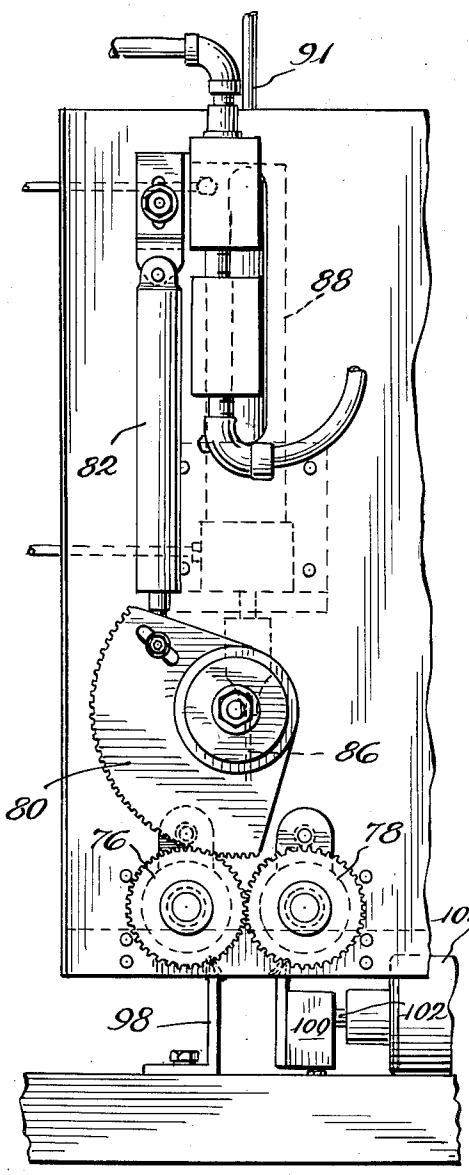
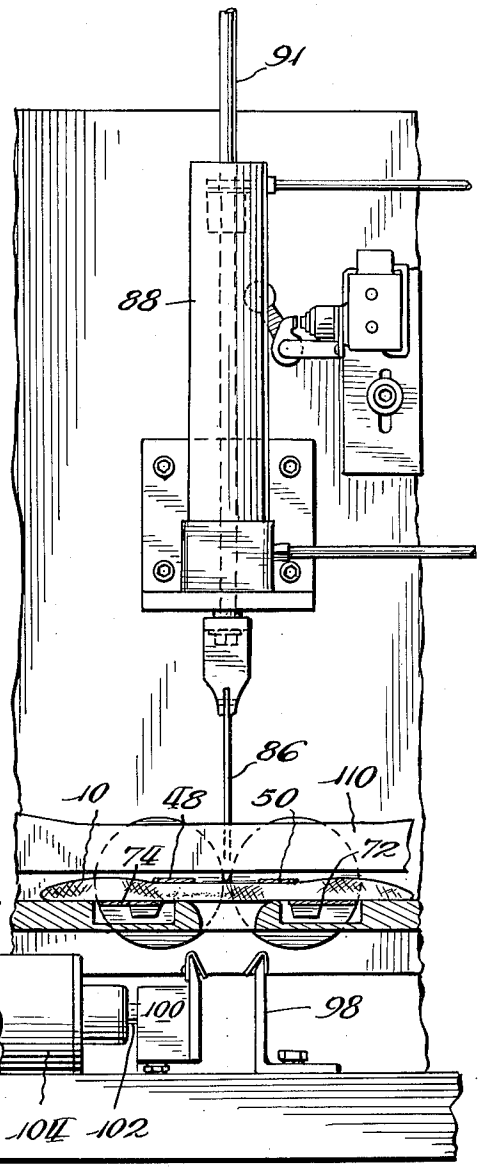


Fig. 2.

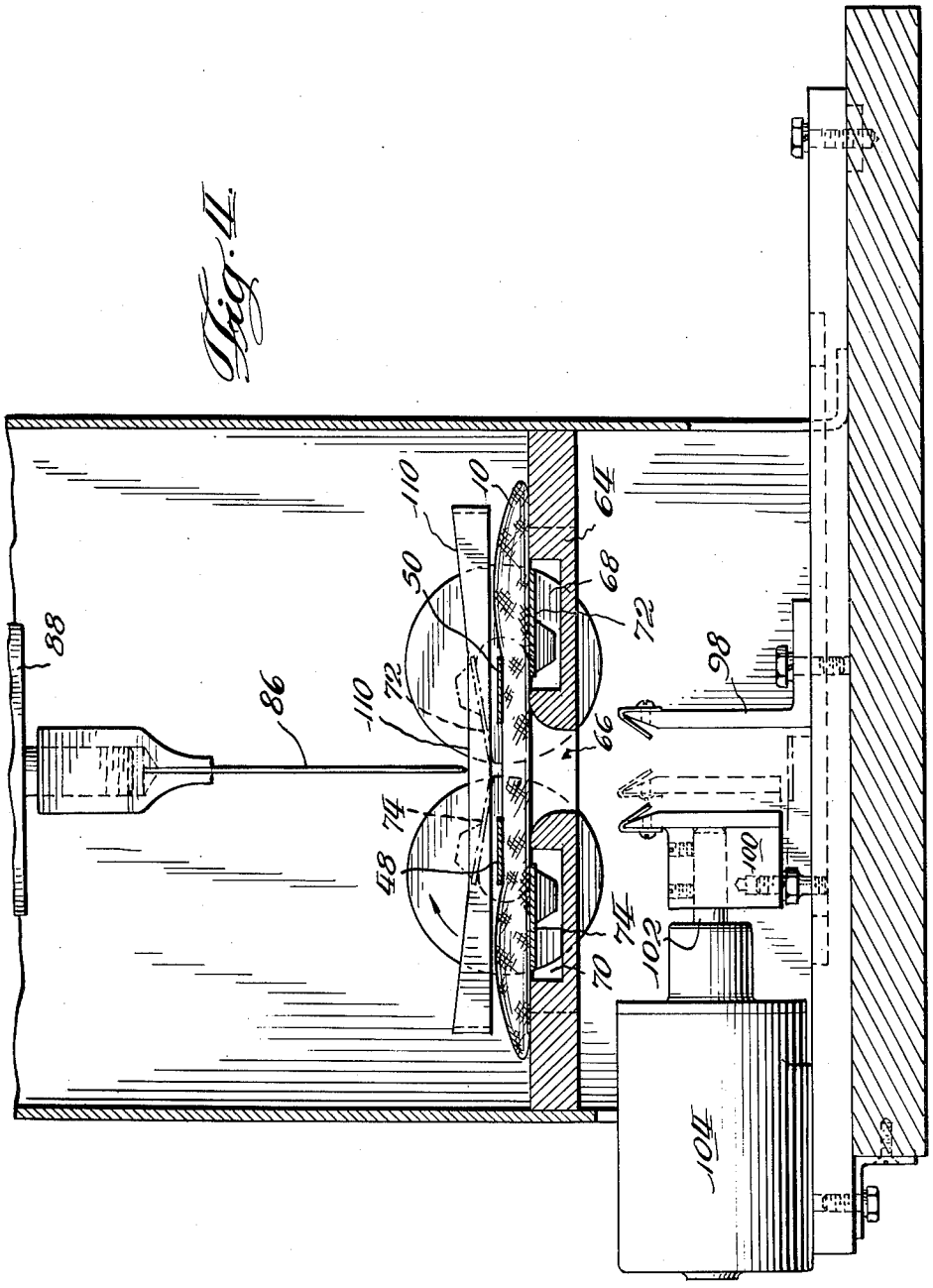


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Fig. 4.



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Fig. 5.

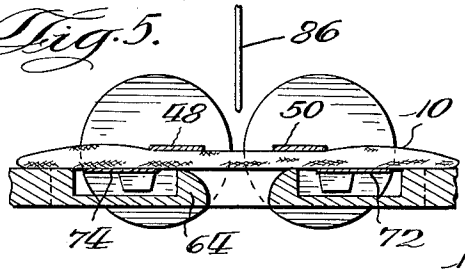


Fig. 6.

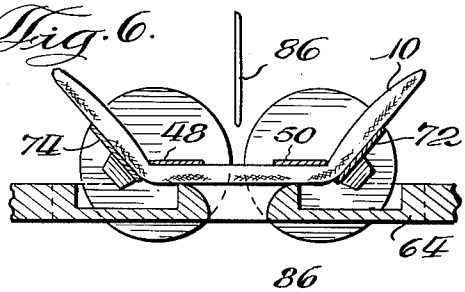


Fig. 7.

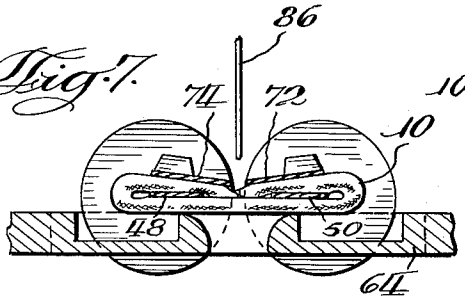


Fig. 8.

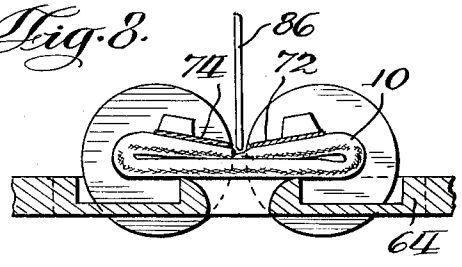


Fig. 9.

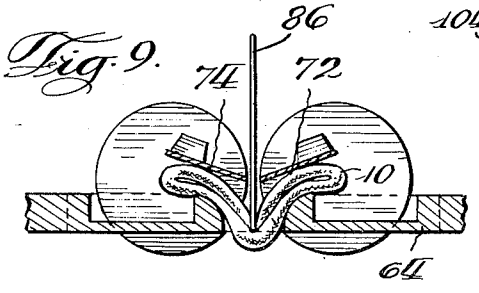


Fig. 10.

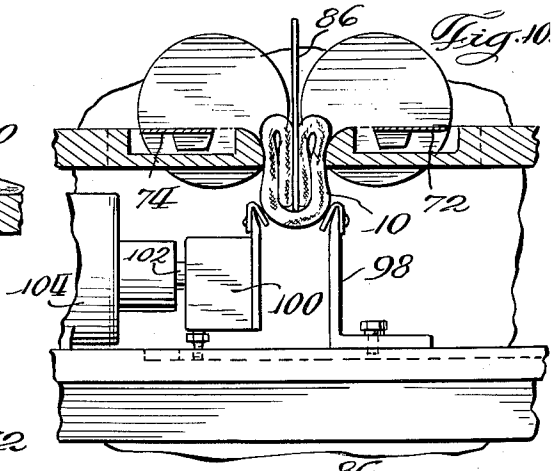


Fig. 11.

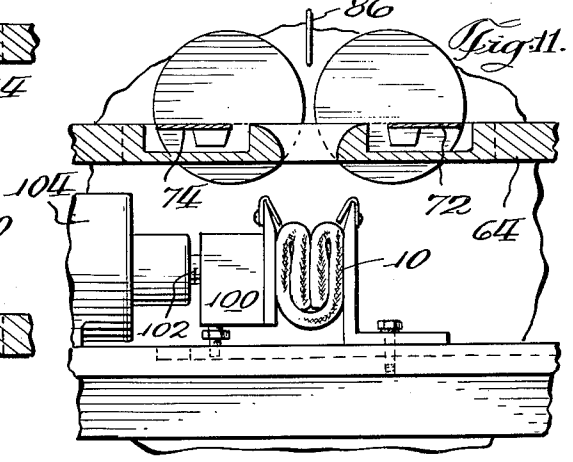
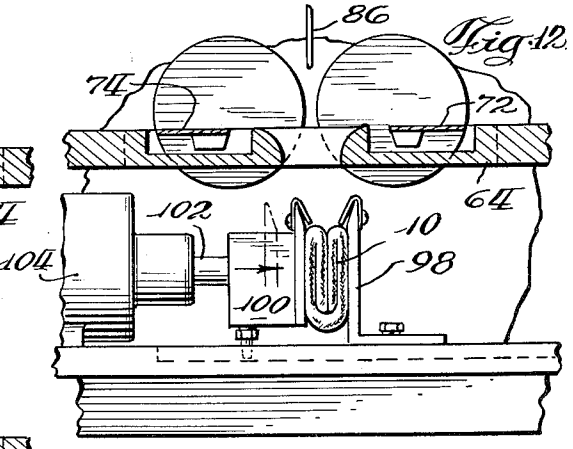


Fig. 12.



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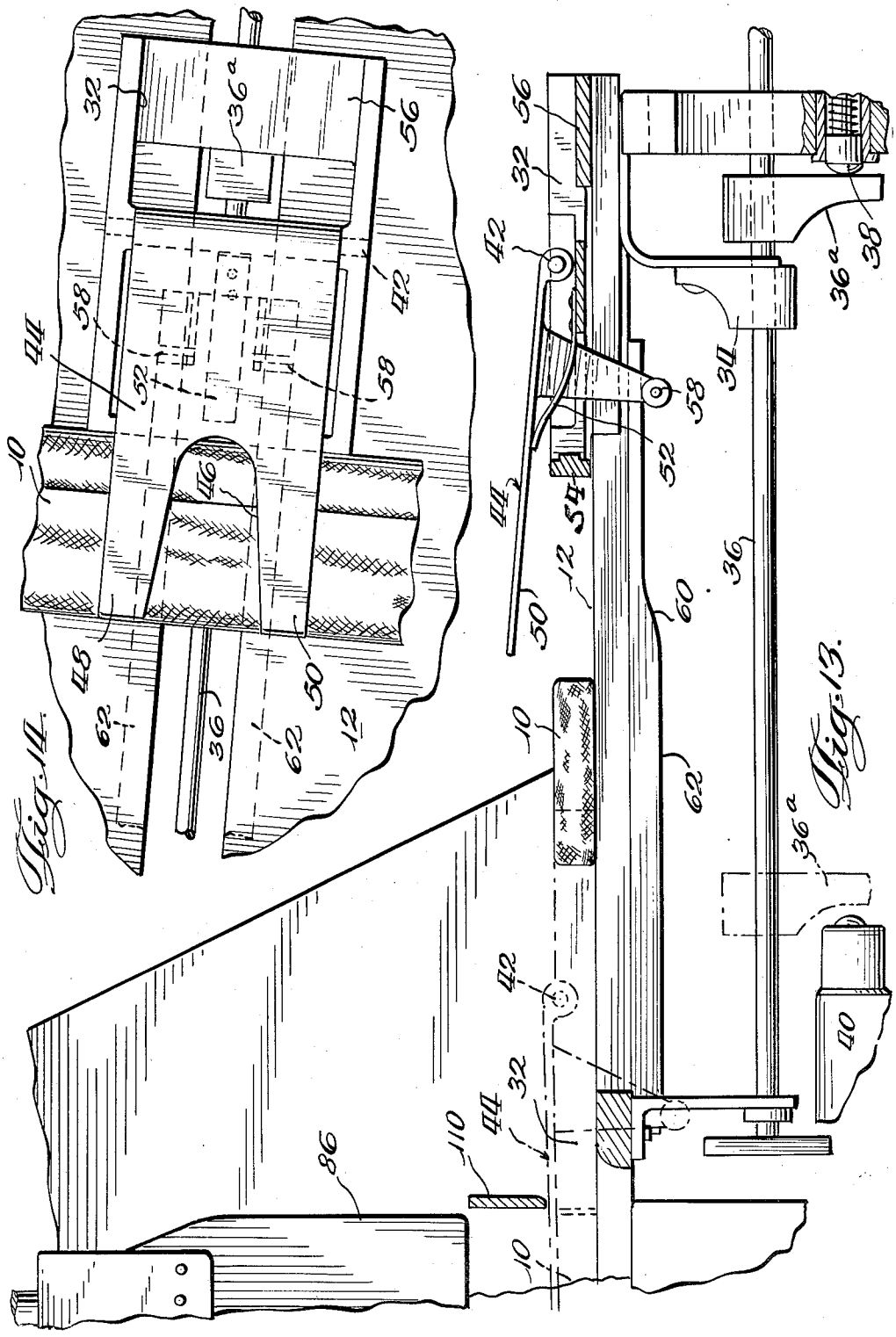


Fig. 14.

Fig. 13.

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3,031,185

FOLDING OF CELLULOSIC PRODUCTS

Huron C. Brien, Neenah, Wis., assignor to Kimberly-Clark Corporation, Neenah, Wis., a corporation of Delaware

Filed Feb. 23, 1960, Ser. No. 10,486
8 Claims. (Cl. 270—62)

This invention relates to improvements in folding apparatus, and more particularly to apparatus for folding articles such as medical bandages and sanitary napkins.

A primary object of the invention is to provide an improved mechanism for the involute folding of sanitary napkins or the like preparatory to the individual packaging thereof in folded configuration.

Another object is to provide an improved folding mechanism of relatively simple design adapted for use with known sanitary napkin production and packaging apparatus.

Still another object is to provide improved apparatus for both feeding articles to be folded to the folding mechanism and removing them therefrom after being folded.

Other objects and advantages will become readily apparent to persons skilled in the art upon examination of the drawings and description, the scope of the invention being defined by the appended claims.

In the drawings, in which like parts are identified with the same reference numerals:

FIGURE 1 is a side elevational view, partially in section, of apparatus incorporating the invention,

FIGURE 2 is a front elevational view, partially in section, of the device of FIGURE 1,

FIGURE 3 is a rear elevational view, also partially in section, of the device of FIGURE 1,

FIGURE 4 is an enlarged front elevational view of the device of FIGURE 1,

FIGURES 5 through 9 illustrate sequentially various steps during the folding of a sanitary napkin by the apparatus of FIGURE 1, and

FIGURES 10 through 12 illustrate the final stage of involute folding of the napkin shown in FIGURES 5 through 9 and the deposit and final compression thereof in a well-like pocket preparatory to transfer to packaging equipment.

FIGURE 13 is a fragmentary elevational view, partially in section, showing details of the transfer mechanism also shown in FIGURE 1.

FIGURE 14 is an enlarged fragmentary plan view of the device of FIG. 13.

FIGURE 1 shows improved folding mechanism adapted sequentially to receive and involutely fold sanitary napkins **10** for gravity deposit on a transfer platform **12** by an endless belt type conveyor mechanism **14**. Platform **12** provides a horizontal surface along which individual napkins **10** are sequentially fed by a transfer mechanism **16** to a folding mechanism **18**. Major components are supported on a suitable framework **20**. Conveyor mechanism **14** includes a known endless belt **22** intermittently moving in the arrow direction. Belt **22** has attached thereto at uniformly spaced intervals a plurality of upwardly open article receiving trays **24** for the step-by-step feeding of articles positioned transversely of belt **22** onto platform **12**. As belt **22** moves into article transfer area **26** it enters an article retaining housing **28** permitting the belt and trays to move in a counter-clockwise direction onto a guide pulley **30** and into the inverted position at **26** before gravity deposit of each tray-positioned sanitary napkin **10** downwardly onto platform **12**. Napkin **10** is shown dotted before gravity deposit on platform **12** and in heavy lines after deposit thereon.

Following the deposit of napkin **10** in the position shown on platform **12**, FIG. 1, a slidably mounted push

bar **32**, operatively connected to a bracket **34** mounted for sliding movement along a guide rail **36**, is actuated by means not shown such as a pneumatic cylinder, to move bracket **34** and push bar **32** from the full-line positions shown at the right of the figure into the dotted line positions shown at the left. The stroke of bracket **34** is determined by a depending stop member **36**, shown engaging a micro-switch **38** in the right hand full-line position and shown dotted and engaging a second micro-switch **40** when in the extreme left hand position. Microswitches **38** and **40** are connected in a known manner to circuitry which controls the movement of push bar **32** in synchronism with the intermittent article feeding of conveyor mechanism **14** and the folding operation cycle of mechanism **18**.

As best shown in FIG. 13, push bar **32** has pivotally attached thereto at **42** an article clamping element **44** the free end of which is notched at **46** to provide a pair of spaced fingers **48** and **50** which cam down to engage and hold article **10** during movement of the push bar from a position outwardly of the retracted heavy line position shown to the dotted line position with the clamp fingers securely positioning the article on a support provided in the folding mechanism. A leaf spring **52** retains clamp element **44** at an upward incline as shown in FIG. 13 during retraction of push bar **32** to permit that bar, which is provided at the front end with a suitable bearing **54** and at the rear end with bearing **56**, to move into abutting engagement with article **10** without interference from element **44**. During continued movement of bar **32** and the engaged article **10** toward folding mechanism **18**, a cam follower **58**, bracket attached to element **44**, is cammed downwardly along a widening portion **60** of a fixed cam **62** to cam the bifurcated free end of element **44** downwardly into pressure engagement with the upper surface of article **10**. Follower **58** continues to ride along the lower surface of the widened portion of cam **62** to retain clamp element **44** in snug engagement with article **10** during and after transfer of the article to a desired position on a folding plate **64**.

Referring to FIGS. 1 and 4, completion of the stroke of push bar **32** positions article **10** transversely of folding plate **64** and over a centrally disposed folding and ejection throat **66** provided therein as best shown in FIG. 4. With the central portion of article **10** extending across throat **66** the article is held in snug contact with folding plate **64** by clamp fingers **48** and **50** which are retained cammed in pressure engagement therewith. Folding plate **64** is provided with a pair of well-like spaced recesses **68** and **70** in which are recessed a pair of eccentrically mounted folding blades **72** and **74**, suitably mounted to a pair of intermeshed drive gears **76** and **78**, FIG. 3. Gear **76** is driven by a sector gear **80** actuated in response to known control mechanism by a pneumatic cylinder **82** or the like to rotate, as shown in FIGS. 5 through 9, folding blades **72** and **74** from a recessed position flush with folding plate **64** through arcs which include the various positions shown in FIGS. 6 through 9. Involute folding of an article, as clearly shown in FIGS. 5 through 9, is effected after the positioning of napkin **10** as shown in FIG. 5, with the spaced portions of the napkin securely held against folding plate **64** outwardly of the throat thereof by clamp fingers **48** and **50**. Upon completion of the transfer cycle, with push plate **32** moved from the heavy to the dotted line positions shown in FIG. 1, napkin **10** is supported both by the folding plate **64** and the folding blades **72** and **74**, as shown in FIG. 4. A suitable known control mechanism then actuates cylinder **82** to rotate gears **76** and **78** and their associated folding blades **72** and **74** from their horizontal FIG. 5 positions upwardly toward the position of tilt shown in FIG. 6. Since clamp fingers **48** and **50** are securely cammed

into pressure engagement with napkin **10**, the outermost portions of the napkin are caused to fold or bend around the outer edges of the clamp fingers to be completely folded around the clamp fingers into engagement with both the upper surfaces of the clamp fingers, with the outermost portions thereof engaging the central portion of the napkin between the fingers, as shown in FIG. 7. Thereafter, a known control mechanism is automatically actuated to cause withdrawal of bar **32** and consequent withdrawal of clamp fingers **48** and **50** from the folded portion of napkin **10** as bar **32** returns to its original full-line position, FIG. 1.

As shown in FIGS. 1, 2 and 4, folding mechanism **18** also includes a vertically positioned center folding blade **86** mounted for vertical reciprocation centrally of throat **66** by a piston housed within cylinder **88**, the cylinder being bracket attached to a vertical supporting member **90** of framework **20**, member **90** also providing journalling support for the actuating mechanism which drives the eccentrically mounted end folding blades **72** and **74**. A guide rod **91**, fixed to vertical blade **86**, is slidably mounted within suitable bearings for vertical reciprocation, and carries an actuating cam **92** which reciprocates between the full-line and dotted positions shown in FIG. 1 to cam control devices **94** and **96** when blade **86** is in its two extreme positions. Control devices **94** and **96** are connected to a pneumatic or hydraulic power source in a known manner to cause blade **86** to move downwardly through throat **66** after completion of the above described end folding operation, and then to retract to an upper position of rest as shown where it remains until completion of a subsequent end folding operation. Since cam operated control mechanisms of this sort are well known in the art, details which form no part of this invention are not shown.

As shown in FIG. 4, center folding blade **86** is positioned to pass through the space between the end folding blades **72** and **74** when those blades have travelled through their respective arcs and are at rest in the positions shown dotted in FIG. 4, and in heavy lines in FIG. 8. As the center folding blade **86** moves downwardly as shown in FIGS. 5 through 9, it engages the central portion of the end folded article as shown in FIG. 8, and continues to move downwardly as shown in FIG. 9 to force that portion downwardly into throat **66** in involute configuration as shown in FIG. 10. Continued downward motion of center blade **86** forces the involutely folded article **10** through plate **64** and between the fixed bracket **98** and a slidable compression plunger **100**. At the bottom of the center-blade stroke, folded article **10** is positioned as shown in FIG. 11, with the lowermost portion thereof spaced above the supporting framework to avoid damage of the article by the blade. Plunger **100** is then driven toward bracket **98** by rod **102** actuated by piston **104**. The piston is energized by known means not shown during the return stroke of center-blade **86** to its retracted position above the folding plate. Following transverse compression of the involutely folded article **10** as shown in FIG. 12, piston **104** retracts rod **102** and member **100** to the position shown in FIG. 10, and as the next folding cycle starts, a push plate **106**, FIG. 1, slidably mounted within guide element **36**, moves to the left with push bar **32** to which it is connected, for lateral conveyance of the folded article into a pocketed transfer turret **108** for removal from the device.

Since the withdrawal of clamp element **44** from its pressure engaging position with article **10** must be done prior to the return of member **44** to its position of tilt as shown in FIG. 13, a stripper bar **110** is suitably positioned as shown in FIG. 1 to allow passage of article **10** thereunder during the feeding operation, but to constrain article **10** from being withdrawn from beneath center folding blade **86** by member **44** after the end folding thereof. Since the space between the bottom edge of stripper member **110** and platform **12** is greater than the unfolded thickness of article **10** but less than the folded thickness thereof, article withdrawal is prevented by engagement between the folded article end portions and the stripper bar as the article is urged outwardly by pressure fingers **48** and **50**.

During operation of the device, as above described, the intermittently operative article conveyor mechanism **14** sequentially deposits individual articles **10** transversely of platform **12** and in a position to be conveyed from the position of deposit to a position above end folding blades **72** and **74**, with the article positioned under center-folding blade **86**, to be involutely folded first by blades **72** and **74** and then by blade **86** and projected downwardly during the latter phase of that operation into a holding and compression device and transversely compressed, and then conveyed by means of a transfer turret, for example, to packaging equipment forming no part of this invention.

Further modifications and adaptations of the invention will become readily apparent to persons skilled in the art without departure from the inventive concepts herein taught.

I claim:

1. A folding mechanism having in combination, a fixed apertured member for the support of a foldable article, means for positioning an article on said member with the central portion thereof extending over the aperture, clamp means for holding spaced portions of the article inwardly of the ends thereof against said member, a pair of folding blades eccentrically mounted for movement from positions beneath the ends of the article and outwardly of the clamp means to positions above the clamp means to effect folding of the end portions of the article about the clamp means, means for the withdrawal of said clamp means from between the end folded portions of the article, and a center-folding blade mounted for vertical reciprocation and projection through the member aperture to effect center folding of the end folded article while forcing the article through said apertured member.

2. In a device of the character described, a rigid support having a substantially planar supporting surface provided with an aperture, means for positioning an article to be folded on said support with the central portion of the article extending over said aperture, a pair of spaced clamp fingers, cam means for maintaining said fingers in pressure engagement with said article laterally of the support aperture, a pair of folding blades mounted for movement from positions beneath end portions of said article and outwardly of the clamp fingers to positions above and inwardly of said clamp fingers to end fold said article over said fingers, means for the withdrawal of said clamp fingers from between the folded ends of said article, and a center folding blade movable from above said support to extend through said aperture, whereby to center fold said end folded article to effect an involute configuration thereof while forcing said article through the support aperture.

3. In combination, a reciprocably mounted blade-like folding element, means for the reciprocation of said element, a supporting member provided with an apertured planar surface positioned to permit said folding element to move through the aperture thereof for the center folding of a supported article, and means for end folding said article prior to center folding by said blade-like element, said end folding means comprising a pair of spaced clamp fingers operable from a position laterally of said supporting member to a position thereabove to maintain portions of said article inwardly of the ends thereof in pressure engagement with said supporting element, and a pair of end folding blades movable from positions beneath the ends of said article and outwardly of the clamp elements to positions above and inwardly of the clamp elements.

4. A folding mechanism having in combination, a fixed member for the support of a foldable article, means for

positioning an article on said member, clamp means for holding spaced portions of the article inwardly of the ends thereof against said member, a pair of folding blades eccentrically mounted for movement from positions beneath the ends of the article and outwardly of the clamp means to positions above the clamp means to effect folding of end portions of the article about said clamp means, means for the withdrawal of said clamp means from between the end folded portions of the article, and means for center folding said end folded article to define an involute configuration.

5. In a folding mechanism, support means defining a folding and ejection throat for the support of a foldable article with the central portion of said article extending across the throat, means for positioning an article on said member including a pair of spaced clamp fingers, means for maintaining said fingers in clamping engagement with spaced portions of the article inwardly of the ends thereof during and after positioning said article on said member, a pair of folding blades eccentrically mounted for movement from positions beneath the ends of said article and outwardly of the clamp means to positions above the clamp means to effect folding of the end portions of said article about outer margins of the clamp fingers, means for the withdrawal of said clamp means from beneath the end portions of the folded article, and a center-folding blade mounted for reciprocal movement from a position above said member to extend through the throat defined therein, and means for moving said center-folding blade against a central portion of the end folded article and through the throat to effect involute folding of the article and projection thereof while so folded through said throat.

6. An apparatus for the involute folding of sequentially fed bandages and the like comprising in combination, a transfer platform, means for the sequential deposit of articles to be folded on said platform, an apertured folding plate associated with said platform at a position spaced from the position of article deposit, an article contacting member reciprocally operative along said platform for the transfer of articles deposited on the platform to the folding plate, clamp means associated with said article contacting member and operable during transfer of an article to the folding plate to maintain said article in clamped engagement with the folding plate through areas spaced inwardly of the ends of the article and outwardly of the folding plate aperture, a pair of folding blades associated with said folding plate, said blades being movable from positions beneath the article and outwardly of the clamp means to positions above the clamp means, said folding blades being synchronously driven simultaneously to fold the non-clamped article end portions over the clamp means and in partial engagement with the article between the clamped portions thereof, means for the withdrawal of said clamp means subsequent to end folding of the article, and a center folding blade reciprocally mounted for movement from a position above an article thus end folded to a position of engagement with the folded article intermediate the clamped portions thereof and above the folding plate aperture, and means for lowering said center folding blade into article contacting engagement and continuing said movement sufficiently to cause said end folded article to be center folded and forced through said folding plate aperture to effect an invoulte fold thereof.

7. The apparatus of claim 6 including holding means for receiving said involutely folded article upon passage through said folding plate aperture, means associated with said folding means for compressing said article in a direction normal to its planes of fold, and means for removing said compressed article from its position beneath said folding plate aperture.

8. A device of the character described having in subcombination, a fixed folding plate provided with a pair of spaced upwardly open chambers and a throat-like passageway extending through said plate at a position intermediate said chambers, means for positioning an elongate foldable article on said folding plate with the center of the article positioned over said throat and opposite end portions of said article extending over and beyond said chambers, a pair of spaced clamp elements in pressure engagement with the upper surface of said article at positions to clamp the article to said folding plate in areas intermediate the spaced chambers and the throat, a pair of eccentrically mounted and synchronously driven end folding blades movable from positions within said chambers to rotated positions around and above said clamp elements to effect U-shaped folding of the article ends back against the upper central portion thereof, means for the withdrawal of said clamp elements upon completion of said end folding operation during positioning of said folding blades above said folding plate to maintain the folded article pressure engaged with the folding plate during withdrawal of the clamp elements, and a center folding blade operable from a position above the center of said throat to a position of projection therethrough to effect involute folding of said article and the projection thereof through said throat.

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