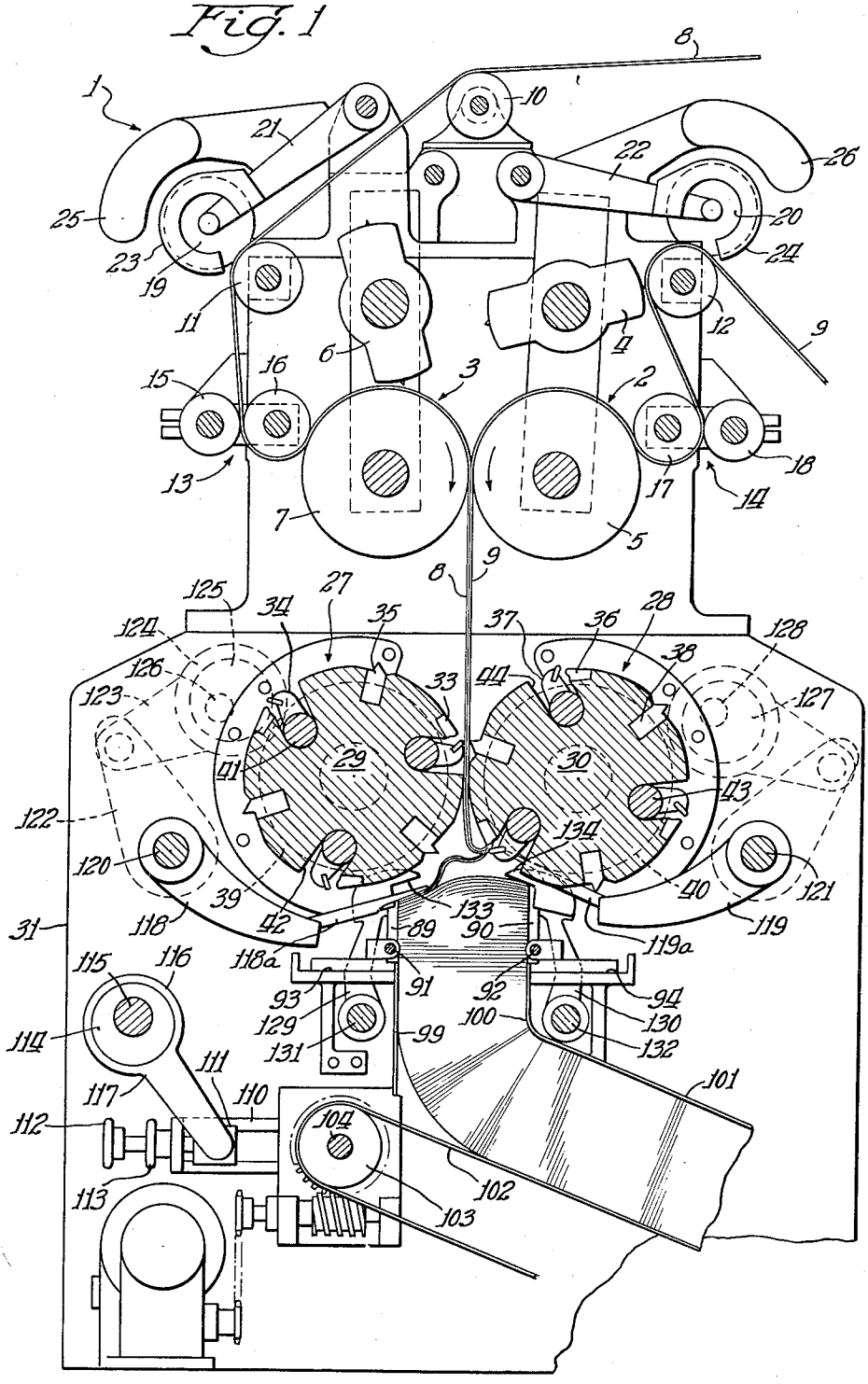
July 17, 1962 C. T. BANKS 3,044,766

PAPERMAKING MACHINE

Filed Dec. 20, 1960 5 Sheets-Sheet 1

Fig. 1

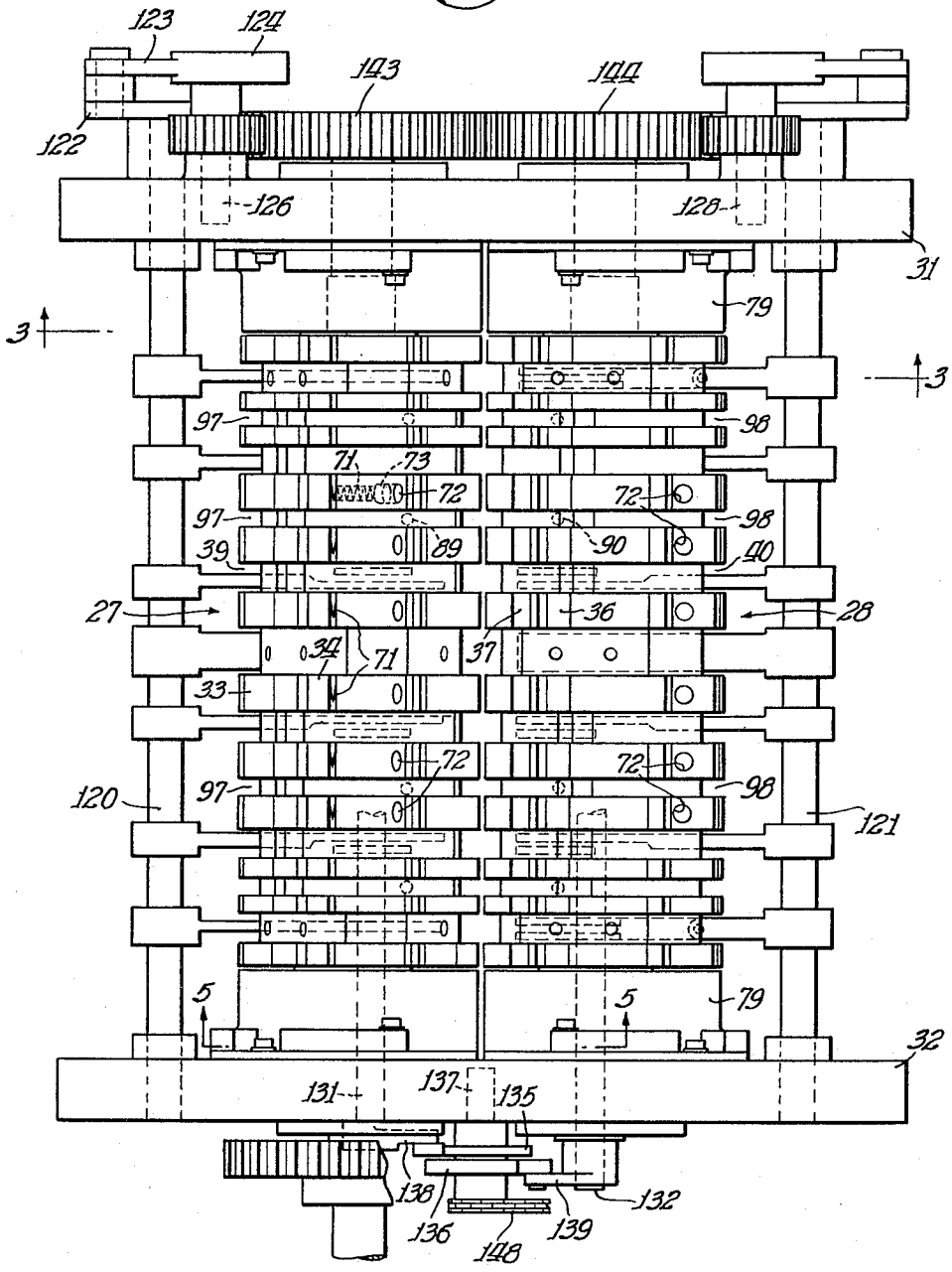


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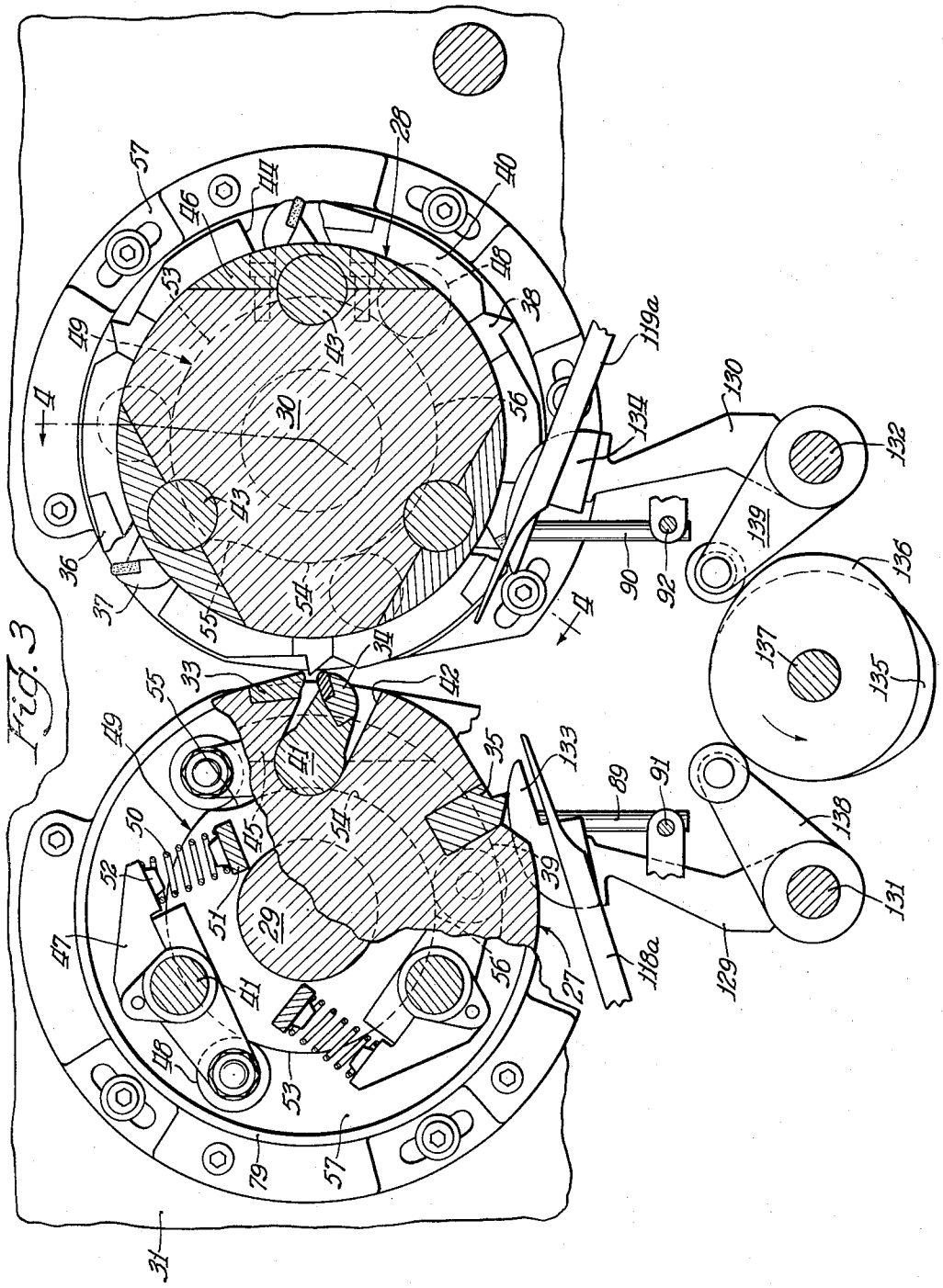
Fig. 2



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Fig. 8

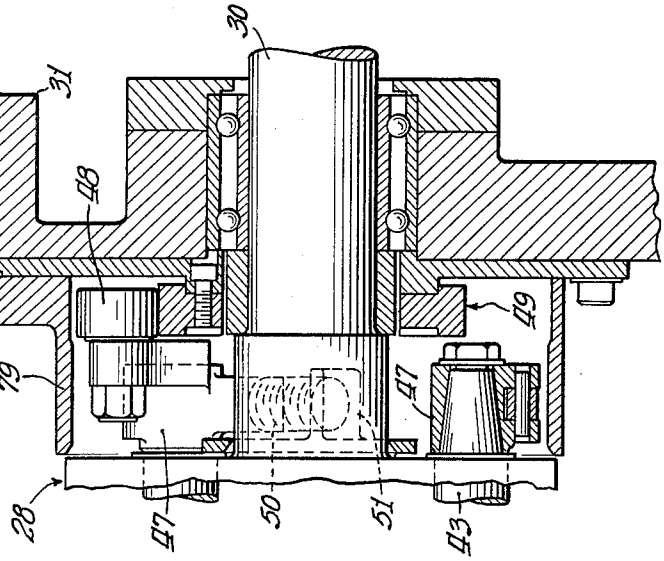


Fig. 10

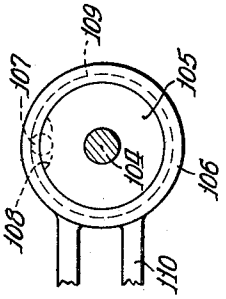
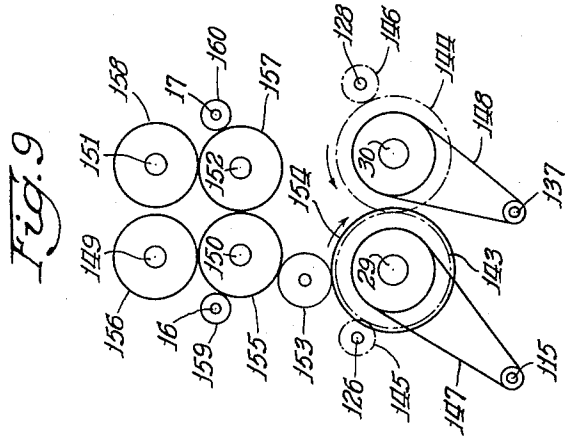


Fig. 9



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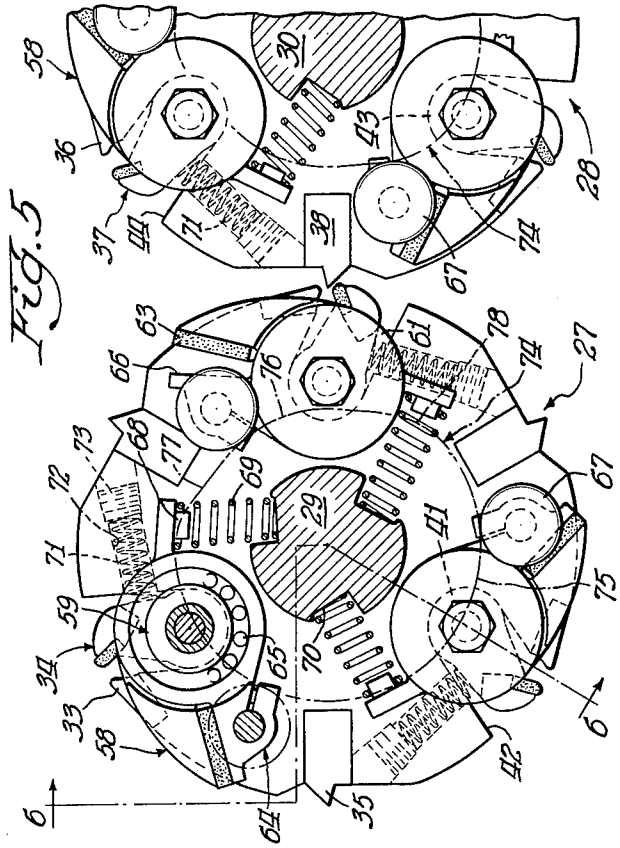


Fig. 5

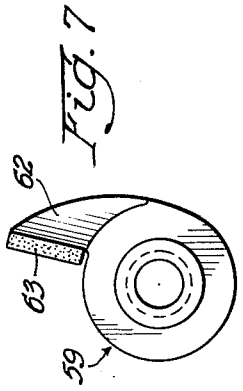


Fig. 7

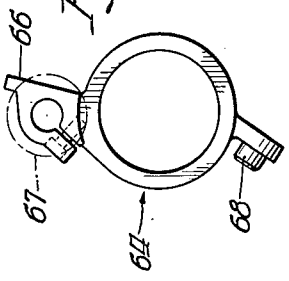


Fig. 8

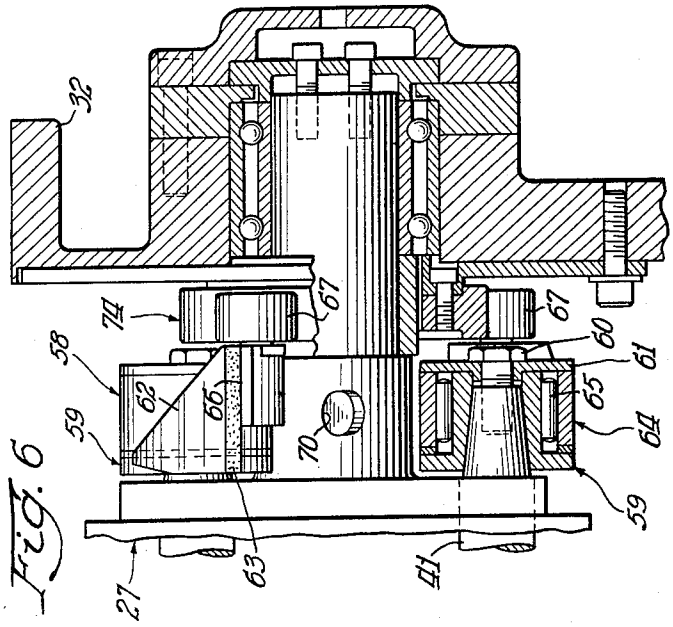


Fig. 6

United States Patent Office 3,044,766 Patented July 17, 1962

3,044,766
PAPERMAKING MACHINE

Charles T. Banks, Neenah, Wis., assignor to Kimberly-Clark Corporation, Neenah, Wis., a corporation of Delaware

Filed Dec. 20, 1960, Ser. No. 77,048
3 Claims. (Cl. 270—73)

The invention relates to a tissue folding method and apparatus, and it is particularly (but not exclusively) concerned with a method and apparatus for interfolding thin lightweight tissues of a soft flimsy character having but little tensile strength.

In one form of machine for interfolding such tissues, such as is disclosed in Patent No. 2,631,846, issued to R. N. Sabee on March 17, 1953, two continuous webs of tissue paper are separately fed between cutting rolls which sever the webs transversely in such manner as to leave a few very slight bonds connecting the web portions on opposite sides of the line of severance. Such webs are then fed into face-to-face relation with the lines of severance of one web in staggered relation to the lines of severance in the other, after which the sheet areas between succeeding lines of severance are folded approximately midway between the lines of severance. Folding is effected in such a manner that the bonds connecting successive sheet areas of one web are enclosed between the folds of the other web and preferably at the fold line thereof.

Folding in the Sabee machine is accomplished by a pair of folding rolls or cylinders each of which carries a plurality of tuckers fixed to the folding roll and each of which also carries pairs of tissue gripping jaws between which the tuckers insert the webs prior to closure of the jaws. The tuckers are operative to insert the tissues between the jaws slightly above a line connecting the centers of the two rolls, and the jaws are closed as the rolls rotate so as to provide folds in the webs on opposite sides of a stack of the webs as folded. The jaws are opened as they approach the sides of the folded webs so as to deposit the webs as folded into the stack.

Each of the jaw pairs include a fixed jaw and a movable jaw, and the movable jaws are opened and closed with respect to the fixed jaws by means of cams and cam followers taking the form of roller carrying arms. In order to assure that the jaws are tightly closed at the proper points in the rotation of each of the jaw carrying rolls, the cams have been designed so that the rollers arranged to open the jaws are out of contact with their cams during part of the rotation of the rolls and the rollers strike transition portions of the cams when jaw opening is initiated. Such striking action of the rollers gives rise to considerable noise as the machine operates.

It is an object of the present invention to provide an improved tissue interfolding machine of this type which is substantially quieter in operation than prior such machines. To this end, it is an object of the invention to provide follower mechanisms cooperating with jaw opening cams having lost motion built into them and which are cushioned in action.

The invention consists of the novel constructions, arrangements and devices to be hereinafter described and claimed for carrying out the above stated objects and such other objects as will be apparent from the following description of a preferred embodiment of the invention, illustrated with reference to the accompanying drawings, wherein:

FIG. 1 is a vertical section through the working parts of a machine embodying the principles of the invention and including a pair of tissue folding rolls having jaw pairs which are opened and closed by means of cam and follower mechanism;

FIG. 2 is a sectional view taken on line 2—2 of FIG. 1;

FIG. 3 is a sectional view on an enlarged scale taken on line 3—3 of FIG. 2;

FIG. 4 is a sectional view taken on line 4—4 of FIG. 3;

FIG. 5 is a sectional view taken on line 5—5 of FIG. 2 and illustrating cams and cam follower arms for opening the jaws on the rolls;

FIG. 6 is a view partially in elevation and partially in section taken on line 6—6 of FIG. 5;

FIGS. 7 and 8 are views of the follower arms shown in FIG. 5;

FIG. 9 is a more or less diagrammatic view illustrating an arrangement for driving the various operating parts of the machine; and

FIG. 10 is a detailed view of a driving element, appearing also in FIG. 1, showing means for operating one of the shafts of the machine.

Like characters of reference designate like parts in the several views.

The illustrated machine embodies a unit of mechanism designated in its entirety by the reference numeral 1. The unit comprises cooperating cutter roll pairs 2 and 3, the roll pair 2 embodying a knife roll 4 and an anvil roll 5 and the roll pair 3 comprising similar knife and anvil rolls 6 and 7 respectively. Paper webs 8 and 9 are fed over suitable guide rolls 10 and 11 for the web 8 and a roll 12 for the web 9 to feed roll pairs 13 and 14 respectively. The feed roll pair 13 includes cooperating rolls 15 and 16, at least one of which is positively driven at a predetermined rate of speed to effect travel of the web 8 at the desired rate of travel. Similarly, the roll pair 14 comprises rolls 17 and 18 at least one of which is positively driven at a predetermined rate of speed to propel the web 9 at the required speed which is the same as the speed of travel of the web 8. The rolls of the feed roll pairs 13 and 14 are preferably adjustably mounted so as to facilitate control of the pressure with which the webs fed between them are gripped by the respective roll pairs. The specific means for mounting these rolls forms no part of the present invention and is, therefore, not described in detail.

In the arrangement illustrated, the knife and anvil rolls of the cutting roll pair 3 are so set with respect to the knife and anvil rolls of the cutting roll pair 2 that the successive lines of severance formed in the web 8 will be located subsequently midway between successive lines of severance formed in the web 9 when the webs 8 and 9 are delivered in face to face relation from between the anvil rolls 5 and 7 as shown in FIG. 1.

Commercial forms of facial tissue are usually in the neighborhood of 10 inches in width. It is convenient to interfold a double width of tissue and to subsequently break the double width into separate sections of the required width. Accordingly, the apparatus is provided with slitters 19 and 20 carried on the free ends of the arms 21 and 22 respectively, which are suitably pivotally mounted through the agency of supporting shafts carried by the frames of the upper unit of mechanism.

The slitters 19 and 20 are preferably enclosed by suitable guards 23 and 24 which are carried by the arms 21 and 22, and weighted arms 25 and 26 associated with the respective slitter arms 21 and 22 serve to urge the slitters 19 and 20 toward the respective guide rolls 11 and 12 with sufficient force to slit webs 8 and 9 longitudinally intermediate their widths. The slitting is not quite complete and does not actually separate the webs into two strips, sufficient but easily breakable bonding remaining to preserve continuity of the divided webs.

The mechanism for Z folding and for interfolding the paper is supported by side frames immediately below the above described web feeding, slitting and severing mechanism. The webs 8 and 9 in face-to-face relation travel downwardly between a pair of folding rolls 27 and 28 which are carried respectively by shafts 29 and 30 which are suitably journalled in the side frames 31 and 32, re-

spectively, of the mechanism (see FIG. 2). The rolls 27 and 28 are so mounted relative to each other that their surfaces are spaced apart a distance which will cause the rolls to guide the webs 8 and 9 downwardly between them without gripping or exerting any positive feeding effect. The rolls are continuously rotated in opposite directions, the roll 27 being rotated clockwise and the roll 28 counterclockwise as viewed in FIG. 1.

Each of the rolls 27 and 28 carries three sets of jaws and three tuckers, the tuckers being located intermediate the pair of jaws. In the present embodiment of the invention, three pairs of tuckers and three jaws are employed, but it is apparent that by using smaller or larger carrying rolls, or to adapt the apparatus to the interfolding of tissue sheets of shorter or longer length than those for which the present machine is designed, or for other reasons, the number of jaws and tuckers may be varied.

The roll 27 is provided with jaw pairs each embodying a fixed jaw element 33 and a movable rubber tipped jaw element 34. The tuckers provided in the roll 27 are indicated by the reference numeral 35, these tuckers being fixedly mounted in the roll. Similarly, the roll 28 has jaws comprising fixed jaws 36 and movable, rubber tipped, jaws 37 and fixed tuckers 38. The jaws and tuckers extend for the entire length of the respective rolls, but they are grooved transversely in conformity with the grooves provided in the rolls 27 and 28 for the reception of certain elements which will presently be described. Certain of such grooves are indicated at 39 and 40 in the rolls 27 and 28, respectively. The movable jaws 34 are formed with short shaft sections 41 intermediate the lengths of the jaws and at their ends. The jaws are rockably positioned in grooves 42 in the body of the roll 27. Similarly, the movable jaws 37 of the roll 28 are provided with intermediate and end shaft sections 43, and grooves 44 in the roll receive the jaws. The intermediate shaft sections 41 and 43 are located in alignment with the grooves 39 and 40 in the respective rolls and are seated in bearing surfaces prepared for that purpose. Bearing caps 45 and 46 are bolted to the rolls 27 and 28 over the jaw shaft sections hold the jaws in place.

The end shaft sections 41 and 43 on the end of each of the movable jaws 34 and 37 adjacent the side frame 31 are provided with solid arms which carry rolls on their free ends for engagement with cams whereby the jaws may be closed in predetermined synchronism with cooperating elements of the mechanism. One of the solid jaw mechanisms is shown in FIG. 3 wherein the projecting end shaft 41 of the roll 27 is shown as being provided with a solid arm 47. Each arm 47 is provided on its free end with a roller 48 for engaging a cam 49 surrounding the shaft section 41 or 43. Each roller 48 is urged into engagement with the cam by means of a spring 50 compressed between spring seats 51 and 52, the spring seat 51 being fixedly mounted with respect to the roll 27 or 28 and the spring seat 52 being carried by the arm 47. Each of the cams 49 is an external type of cam and has a high dwell portion 53, a low dwell portion 54, an inwardly extending transition portion 55 and an outwardly extending transition portion 56. Each of the cams 49 is fixed with respect to the frame part 31 by means of a cam plate 57.

The end shaft sections 41 and 43, on the other side of the machine, adjacent the frame 32, are each provided with lost motion arm assemblies 58. Some of the lost motion arm assemblies are shown in FIGS. 5 and 6. Each of the end shaft sections 41 and 43 on these ends is tapered; and, as shown in FIG. 6, a movable jaw arm 59 has a corresponding internal tapered surface and fits on the end of the shaft section. The movable jaw arm is fixed with respect to the shaft section by a stud 60, which is screw threaded into the end of the shaft section, and a washer 61 held in place by the stud. The arm 59 is provided with an outwardly extending portion 62 to which is fixed a radially extending slab 63 of rubberlike material. A cam follower arm 64 is rotatably disposed on each jaw arm 59 by means of a bearing 65. The arm 64 is provided with a radially

extending surface 66 adapted to contact the slab 63 of the jaw arm 59. Each cam follower arm 64 carries a roller 67 and is provided with a spring seat 68 in the form of a stud. A spring 69 is disposed on each seat 68 and extends into a corresponding flat bottomed depression or seat 70 provided in the shaft 29 or 30.

Springs 71 are provided for some of the movable jaws 34 and 37. Referring to FIG. 5, it will be observed that the springs 71 each extends through a cylindrical cavity 72 provided in the roll 27 or 28. A plug 73 is screw threaded in the end of each cavity 72 for holding the respective spring 71 in place.

A jaw opening cam 74 of the external type surrounds each of the shafts 29 and 30 adjacent the frame 32, and the rollers 67 contact the cams 74. The cams 74 are fixed with respect to the side frame 32 by means of cam mounting plates 57. Each of the cams 74 is provided with a high dwell portion 75, a low dwell portion 76, an inwardly extending transition portion 77 and an outwardly extending transition portion 78.

A cover 79 is preferably provided adjacent the side frames 31 and 32 for shielding the cams 74 and 49 and the rollers 67 and 48 running on the cams.

As shown in the drawings, the rolls 27 and 28 with their alternate jaw pairs and tuckers are so related to each other that each tucker of one roll cooperates with a pair of jaws of the other roll. The arrangement is such that each tucker tucks the webs 8 and 9 of tissue into the opposite or cooperating jaw while the jaws are open, the tucker being also fully withdrawn from between the jaws before they close and before the jaws actually grip the tucked in webs. At the time of first contact of a tucker and its cooperating jaw pair with the web to be folded (or the webs to be interfolded), the tucker 35 or 38 is preferably located in registry with a radius extending upwardly at about an angle of 12 degrees from a horizontal radius of the roll.

As the rolls 27 and 28 continue their rotation from this point, the end of the tucker enters the space between the opposite jaws 33 and 34 or 36 and 37 and moves the web between the jaws. When the tucker point is in registry with the horizontal radius of its roll 27 or 28, the tucker has reached its position of greatest penetration between the opposite jaws, and the subsequent travel of the tucker results in withdrawal thereof from between the jaws. On further rotation of the rolls 27 and 28, the tucker point is withdrawn from between the opposite jaws, and complete withdrawal is reached when the tucker point has traveled so that it is on a radius of its roll extending downwardly at about an angle of six degrees from the horizontal radius. The opposite jaws at this point of travel of the rolls 27 and 28 are beginning to close on that part of the web that has been tucked between the jaws by the tucker, and the jaws continue their closing action as the rolls 27 and 28 rotate farther, so that when the point of the tucker registers with a radius of its roll extending downwardly at about an angle of ten degrees of the horizontal, the tucker is then completely withdrawn from between the jaws, but the movable jaw has not yet completely closed on the fixed jaw. As the rolls 27 and 28 continue their rotation for approximately another two degrees, the jaw 34 or 37 has been closed on the jaw 33 or 36, and the tucked in portions of the webs are effectively gripped between the jaws.

Pivotal closing movements of the movable jaws are thus effected by a relatively small travel distance, jaw pivoting beginning at about the time that a cooperating tucker and jaw pair are centered on a horizontal line extending between the axis of the rolls 27 and 28 and proceeding gradually so as to avoid any pinching of the webs against the faces of the tuckers, and the movable jaws are not closed to grip the web against the fixed jaws until the tuckers are completely withdrawn.

After the jaws are closed, they remain closed until

the gripped web fold is just about over the edge of the stack in which the folded material is deposited. The pivoted jaw is then opened, with the opening being so timed that the web fold is discharged before the jaws reach their fully open position.

Tautness of the web during the tucking operation is prevented by causing the web feed rolls to deliver the web or webs to the folding rolls 27 and 28 at a speed which is slightly greater than the normal surface speed of the folding rolls, so as to develop a slight amount of slack in the web length extending from the anvil rolls 5 and 7 to the folding rolls 27 and 28 and by so spacing the folding rolls 27 and 28 that the web is free to slip between them incident to the higher feed rate of the web as compared with the travel of the jaws and roll surfaces. By providing slack, both above and below the folding rolls 27 and 28, the tucks may easily be formed without drawing the webs tight over any of the jaw and tucker surfaces or edges. The provision of frictional material jaw tips aids in avoiding withdrawal of the tucks incident to withdrawal of the tuckers and also aids retention of each tuck for a short time after opening of the jaws is started.

The closing of the jaws 34 and 37 is controlled by the rollers 48 carried by the arms 47 following about the cams 49. As the rollers travel from the high dwell cam portions 53 onto the low dwell portions 54 inwardly along the transition portions 55, the springs 50 and the springs 71 move the jaws 34 and 37 to close with the respective fixed jaws 33 and 36.

The opening of the jaws is controlled by the cams 74. As each roller 67 carried by an arm 64 on an end shaft section 41 or 43 travels from a low dwell portion 76 onto a high dwell portion 75 across a transition portion 78, the respective cam follower arm 64 is rotated on a bearing 65. After a predetermined amount of rotation, the radial surface 66 on the arm 64 contacts the adjacent resilient slab 63 of the respective jaw arm 59 and rotates the arm 59 and the jaw 34 or 37 connected thereto. The rotation of the arm 64 is against the action of the associated spring 69, and the jaw opening movement is against the action of the springs 71 acting on the particular jaw. The surface 66 and the resilient slag 63 are separated from each other on the initial rotation of the cam follower arm 64; and, after predetermined rotation of the arm 64, contact is made with the associated slab 63. There thus exists a lost motion connection between the cam follower arm 64 and the movable jaw arm 59. Each of the rollers 67 thus rides on its cam 74 for 360 degrees of movement of the associated roll 27 or 28. Therefore, there is no noise due to the rollers 67 coming into contact with portions of a cam 74 just prior to opening of the respective movable jaws, and the contact of the radial surface 66 of each of the arms 64 with respect to the respective movable jaw arm 59 is cushioned by a rubberlike slab 63.

Since there is no corresponding lost motion in the arms 47 which control the closing of the movable jaws 34 and 37, the rollers 48 separate from the low dwell portions 54 of the cams 49; however, there is no undue noise due to closing of the jaws 34 and 37, since the jaws themselves are rubber tipped. Thus, both the opening and closing of the movable jaws 34 and 37 is cushioned by members of rubberlike material.

The interfolded webs are delivered to a stack located immediately below the rolls 27 and 28, such stack being formed between guide posts or fingers 89 and 90 which are supported at their lower ends on transverse rods 91 and 92. The rods 91 and 92 are carried by bracket members such as 93 and 94 which are fastened to the side frames of the machine. The stack guide members 89 and 90 respectively extend upwardly into suitable grooves 97 and 98 in the rolls 27 and 28, there being a sufficient number of these guide members 89 and 90 spaced across the lengths of the rolls to adequately support the tissue stack as shown in FIG. 1. The guides 89 and 90 are, in effect, extended downwardly by tissue channel-forming plates 99 and 100, which are also supported by attachment to the said brackets 93 and 94. The plate 100 is extended forwardly at an angle as indicated at 101 to form the top wall of a horizontally and downwardly extending chute or channel, the bottom wall of which is formed by the upper reach of a conveyor belt 102. The guide plate 99 terminates a short distance above the conveyor belt 102 as shown. The belt 102 is normally driven at a very slow rate of speed approximately corresponding to the rate of travel of the stack of tissues resulting from the addition of folded sheet after sheet to the top of the stack and downward feeding of the stack top by stripping and hold-down devices presently to be described.

The belt 102 is driven from a pulley 103 (FIG. 1) carried by a shaft 104 which is suitably journalled in the frame structure of the machine. At a suitable point in the length of the shaft 104 it has secured to it a clutch disc 105 (see FIG. 10) which is surrounded by a clutch ring 106. The clutch ring 106 is rocked and has an operative connection to the clutch disc 105 of such character that when the ring 106 moves in one direction, the disc 105 and shaft 104 will be advanced while movement of the ring 106 in the opposite direction will be independent of any movement of the disc 105 and shaft 104. Any suitable one-way clutch may be employed, and in this instance, it is represented as constituting a ball type of clutch embodying one or more balls or rollers 107 housed in recesses such as 108 in the disc 105 and grooves such as 109 in the ring 106. The bottoms of the receseses 108 are so related to the circumference of the disc that when the ring 106 turns in one direction, the balls will become wedged between the bottoms of the grooves 109 and the bottoms of the recesses 108 so as to effect unitary movement of the ring 106, the clutch disc 105 and shaft 104. Movement of the ring in the other direction serves, of course, to release the clutch balls or rollers so that reverse movement of the ring 106 is not imparted to the disc and shaft 104.

The ring 106 is provided with an arm 110 (see FIG. 1) which is slotted to adjustably receive a pivot block 111. The position of the pivot block 111 in the slotted arm may be adjusted and fixed by any suitable means such as an adjusting screw 112 and a lock nut 113 to thereby facilitate adjustment of the amount of travel imparted to the belt by each operative movement of the clutch ring. Rocking motion is imparted to the arm 111 by means of an eccentric 114 carried by a shaft 115 suitably journalled in the machine frame. An eccentric ring 116 surrounds the eccentric 114 and is connected to the clutch arm 110 by means of an arm 117 formed integrally with the ring and pivoted to the block 111. The shaft 115 is continuously rotated by a suitable driving connection which will hereinafter be explained.

The jaws 33 and 34 of the roll 27 and the jaws 36 and 37 of the roll 28 serve to alternately deposit web folds at the opposite sides of the stack. To insure stripping of the folds from the jaws which are automatically opened as they approach the vertical planes of the front and rear sides of the stack, there are provided a plurality of stripper arms 118 and 119 respectively associated with the rolls 27 and 28; and the grooves 39 and 40, previously referred to, serve to receive such strippers in their elevated positions. The strippers 118 and 119 are carried respectively by shafts 120 and 121 which are suitably journalled in the side frames of the machine, and these shafts together with their strippers are rocked in properly timed relation to the travel of the jaws of the respective rolls so that the end or finger portions 118*a* and 119*a* of the respective strippers will be operative to strip the folded webs from the jaws of the respective rolls and

pack the folded web down on top of the stack of folded tissues.

The shaft 120 is rocked by means of an arm 122 which is carried by the shaft 120 and connected by means of a pin and slot connection to an arm 123 which has an eccentric ring 124 surrounding an eccentric disc 125 carried by a driven shaft 126. The shaft 121 is rocked by similar operating connections to an eccentric 127 carried by a driven shaft 128. The pin and slot connections in the arms serve to permit adjustment of the throw of the stripper fingers 118*a* and 119*a* and their timing may be adjusted by adjustment of the eccentric discs 125 and 127 about the shafts 126 and 128. In addition, the arm 122 on the shaft 120 and its counterpart on the shaft 121 may be adjustably connected to the shaft to permit adjustment of the position of the respective stripper fingers.

When one of the stripper fingers 118*a* or 119*a* is in a down position (in which the stripper 118*a* is illustrated in FIG. 1) the other stripper is in an elevated position. Also, the stripper fingers have an intermediate position in which they are both located about midway between their upper and lower positions. In order to hold the top of the stack against upward displacement when the stripper fingers 118*a* and 119*a* are in elevated relation to the normal top level of the stack, there are provided holding arms or hooks 129 and 130 respectively carried by shafts 131 and 132 which are rockably mounted in the frame sides of the machine. The arms 129 and 130 are provided at their upper ends with heads 133 and 134 respectively which move from a position overlying the respective margins of the stack to retracted positions clear of the top area of the stack. In their retracted positions the heads of the hold-down arms are received in the aforementioned grooves 39 and 40 at the sides of the respective stripper fingers 118*a* and 119*a* as indicated in FIG. 2. The hold-down arms 129 and 130 are secured to the shafts 131 and 132 which are rocked in such synchronism with the movement of the stripper fingers that the hold-down members are brought into operative engagement with the top of the stack before the associated stripper finger leaves the top of the stack. Therefore, the top of the stack is at all times restrained against upward movement beyond a desired level.

The shafts 131 and 132 may be rocked in the required timed relation to the operation of the strippers by any suitable means, such as typified by cams 135 and 136, carried by a frame carried stub shaft represented at 137. The cams are rotated by a suitable connection to one of the other rotating parts of the machine whereby the proper timed relationship will be maintained. The cams 135 and 136 respectively act against rollers carried at the free ends of arms 138 and 139 which are respectively secured to the rock shafts 131 and 132.

One arrangement of driving connections for the various parts of the machine is illustrated in FIG. 9. For driving purposes, one of the shafts 29 or 30 may be driven by a suitable chain drive connection to an electric motor, this primary drive being not shown. The shafts 29 and 30 are geared together by gears represented at 143 and 144 secured to the respective shafts 29 and 30. The shafts 126 and 128 may be driven in properly timed relation to the drive of the interfolding rolls by means of gears represented at 145 and 146 carried by the respective shafts 126 and 128 and meshing with the gears 143 and 144 respectively. For driving the shaft 115 from which the normal feed of the tissue stack is obtained, there may be provided a chain drive represented at 147 from a suitable sprocket mounted on the roll shaft 29 to engage a suitable sprocket mounted on the eccentric shaft 115. The hold-down actuating cams which are carried by the shaft 137 may also be driven by a chain 148 which engages suitable sprockets carried by the respective shafts 30 and 137.

The shafts 149 and 150 of the cutter roll pair 3 and the shafts 151 and 152 of the cutter roll pair 2 may be driven by means of an idler gear 153 which meshes with a gear 154 on the interfolder roll shaft 29 and a gear 155 on the cutter roll shaft 150. The gear 155 meshes with another gear 156 on the knife roll shaft 149 and with a gear 157 on the cutter roll shaft 152, said gear 157 also meshing with a gear 158 on the cutter roll shaft 151. The innermost rolls of the web feed roll pairs 13 and 14 may be driven from the respectively adjacent gears 155 and 157 of the anvil rolls through the agency of gears 159 and 160 secured to the respective feed roll shafts and meshing with the respectively adjacent anvil roll gears 155 and 157. The outer rolls 15 and 18 of the tissue feed roll pairs may be frictionally driven from the inner rolls, said outer rolls being arranged to gravitate toward the driven inner rolls or provided with spring means urging them toward said inner rolls. The gears and sprockets for the chain drives are, of course, properly selected as to their pitch diameters and number of teeth to produce the required rotation of the various driven parts.

Due to the fact that the rollers 67 are continuously in contact with the cams 74, there is no noise from the rollers striking the cams. The jaw arms 59 and 64 have lost motion between them allowing such continuous contact of the rollers 67 on the cams 74, and when this lost motion is taken up, the surfaces 66 strike the resilient slugs 63 to deaden any noise that might result. The resilient tips of the movable jaws 34 and 37 cushion the closing of the jaws and prevent undue noise from such closing, even though the rollers 48 separate from the closing cams 49 when the rollers 48 are over the low spots 54 of the cams 49.

I wish it to be understood that the invention is not to be limited to the specific constructions and arrangements shown and described, except only insofar as the claims may be so limited, as it will be understood to those skilled in the art that changes may be made without departing from the principles of the invention.

I claim:

1. In a rotary folding machine, the combination of a pair of folding rolls mounted for rotation in opposite directions, means for feeding a web to be folded to said folding rolls, a pair of jaws and a tucker carried by each of said rolls, means for driving said rolls in such timed rotation that the tucker of each roll enters between the jaws of the other roll and is withdrawn therefrom as an incident to the rotation of the rolls, cam mechanism for causing the opening of the jaws of each of said rolls prior to movement of the tucker of the other roll between said jaws, and cam mechanism for causing the closing of the jaws of each of said rolls as the tucker of the other roll is withdrawn from between the jaws, one of said cam mechanisms for each of said jaw pairs including a cam and a cam follower in constant contact with the cam and first and second thrust transmitting parts connected respectively to said follower and to a movable one of the jaws of the jaw pair, said first and second thrust transmitting parts being so arranged that said first part after a predetermined movement under the action of said cam contacts said second part to apply thrust on the second part to move the jaw connected therewith.

2. In a rotary folding machine, the combination of a pair of folding rolls mounted for rotation in opposite directions, means for feeding a web to be folded to said folding rolls, a pair of jaws and a tucker carried by each of said rolls, means for driving said rolls in such timed rotation that the tucker of each roll enters between the jaws of the other roll and is withdrawn therefrom as an incident to the rotation of the rolls, a cam and cam follower mechanism for the jaw pair on each of said rolls for causing opening of the jaws just prior to insertion of a tucker of the other roll between the jaws, and a cam and cam follower mechanism for the jaw pair on each of said rolls for causing closing of the jaws subsequent to withdrawal of a tucker on the other roll from between the jaws, said

first named follower mechanism for each of said jaw pairs including a cam and a roller in constant contact with the cam and a pair of follower arms one of which is connected to a movable one of the jaws of the jaw pair and the other of which carries said roller so that the jaw connected follower arm has thrust applied to it to open the jaw pair after a predetermined preliminary movement of said roller carrying follower arm as the roller follows its cam, and a resilient thrust transmitting part between said pair of follower arms so disposed that the force for opening the jaws is transmitted through the resilient part to provide a relatively noiseless opening of the jaws.

3. In a rotary folding machine, the combination of a pair of folding rolls mounted for rotation in opposite directions, means for feeding a web to be folded to said folding rolls, a pair of jaws and a tucker carried by each of said rolls, spring means effective on a jaw of each jaw pair for urging the jaw to close with the other jaw of the jaw pair, means for driving said rolls in such timed rotation that the tucker of each roll enters between the jaws of the other roll and is withdrawn therefrom as an incident to the rotation of the rolls, a jaw opening cam and a jaw closing cam for each of said rolls and disposed coaxially with and at opposite ends of the rolls, a cam

follower connected to one jaw of each of said jaw pairs and cooperating with the jaw closing cam for the respective roll for allowing closing of the jaws by said spring means just subsequent to withdrawal of a tucker carried by the other roll from between the jaws, and a cam follower mechanism connected with each of said jaw pairs and cooperating with the jaw opening cam for the respective roll, said last named follower mechanism including a pair of arms a first of which carries a roll to contact with the jaw opening cam of the respective roll and the second of which is connected to one jaw of the jaw pair, a spring effective on each of said first arms for holding the roller carried thereby in constant contact with the respective jaw opening cam, said arms having a lost motion between them and one carrying a resilient thrust transmitting member contacted by the other arm for opening the respective jaw pair, one of the jaws of each of said pairs being provided with a resilient tip for cushioning the closing of the jaws.

References Cited in the file of this patent

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