

Jan. 7, 1958

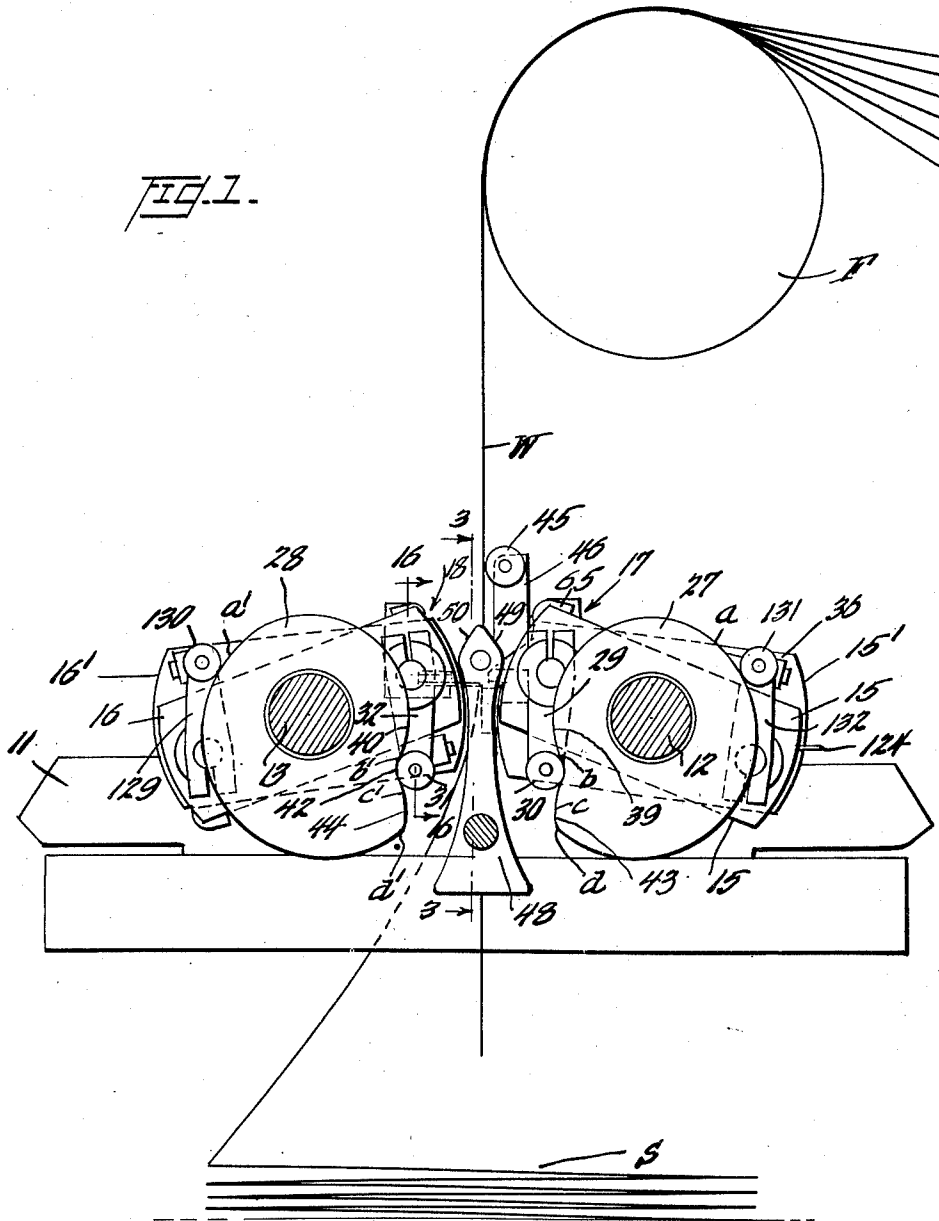
R. M. LOASE

2,819,068

ZIG-ZAG INTERFOLDING MACHINE

Filed Aug. 17, 1954

6 Sheets-Sheet 1



INVENTOR,
Raymond M. Loase.

BY

Watson, Cole, Gruidl & Nelson, ATTORNEYS.

Jan. 7, 1958

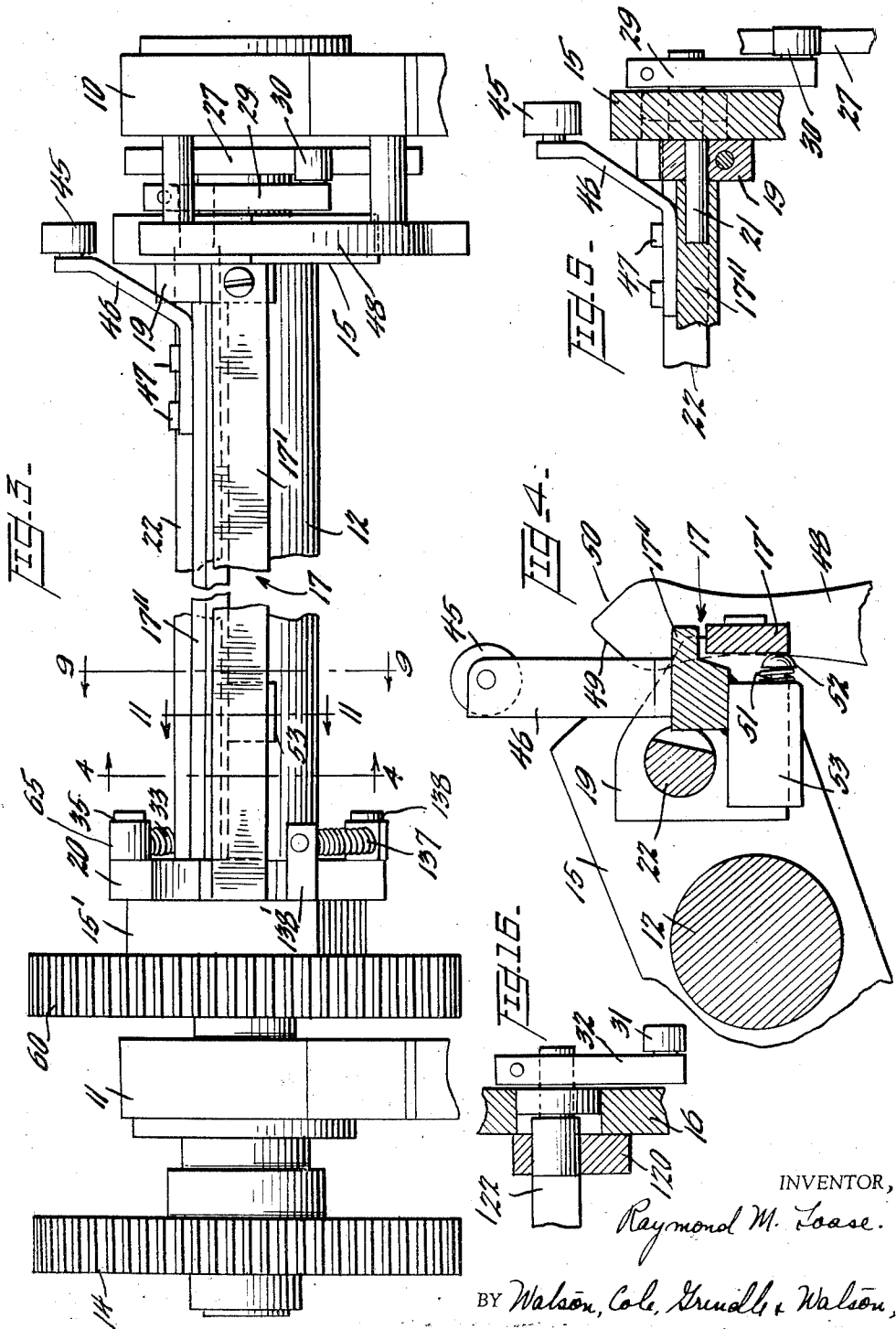
R. M. LOASE

2,819,068

ZIG-ZAG INTERFOLDING MACHINE

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6 Sheets-Sheet 3



INVENTOR,
Raymond M. Loase.

BY *Watson, Cole, Krudler & Watson,*
ATTORNEYS

Jan. 7, 1958

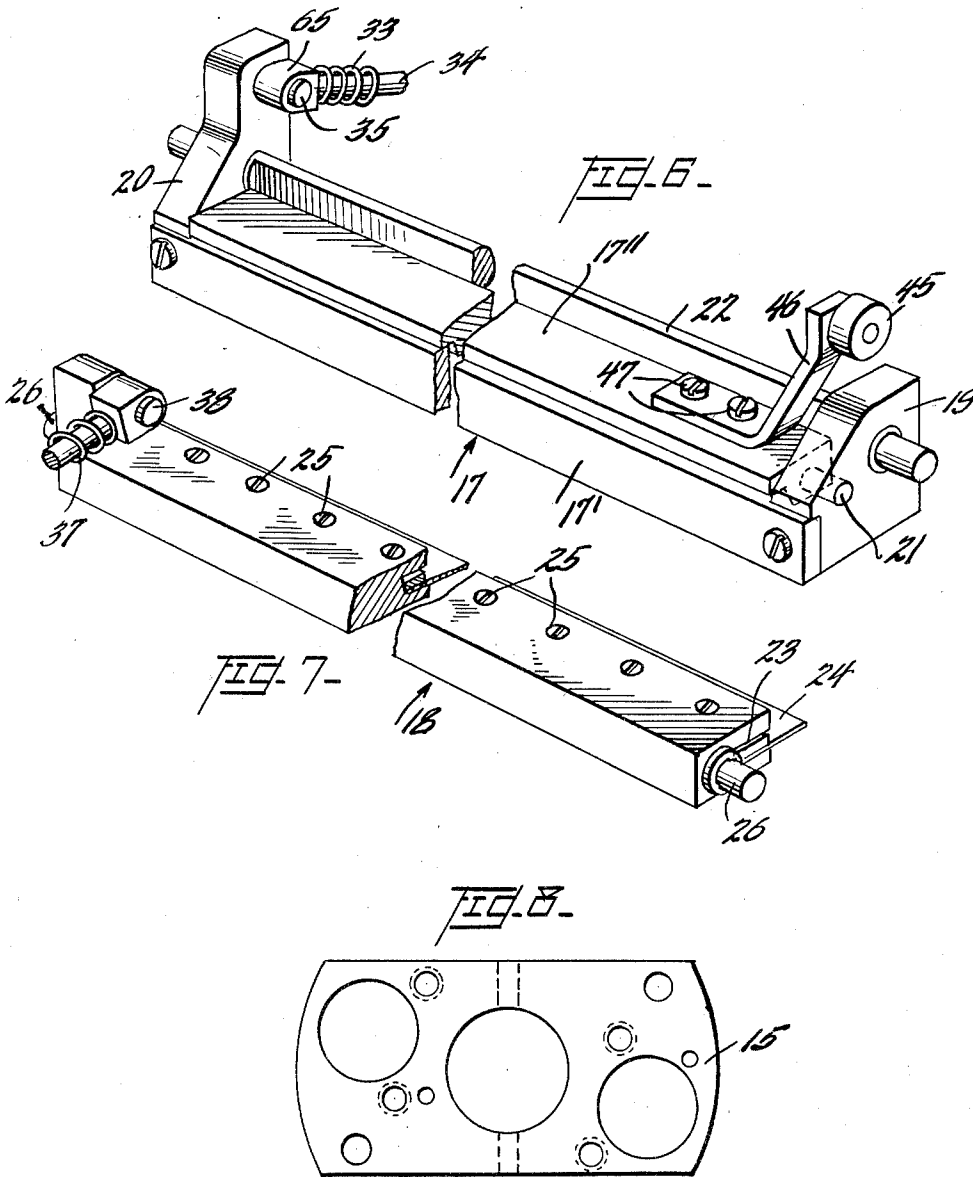
R. M. LOASE

2,819,068

ZIG-ZAG INTERFOLDING MACHINE

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6 Sheets-Sheet 4



INVENTOR,

Raymond M. Loase.

BY Watson, Cole, Grindle & Watson

ATTORNEYS.

Jan. 7, 1958

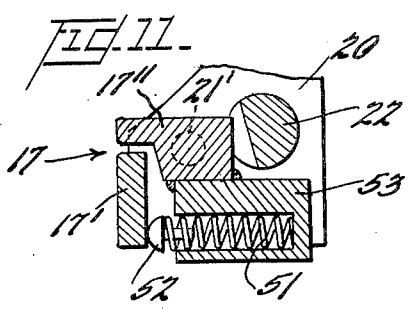
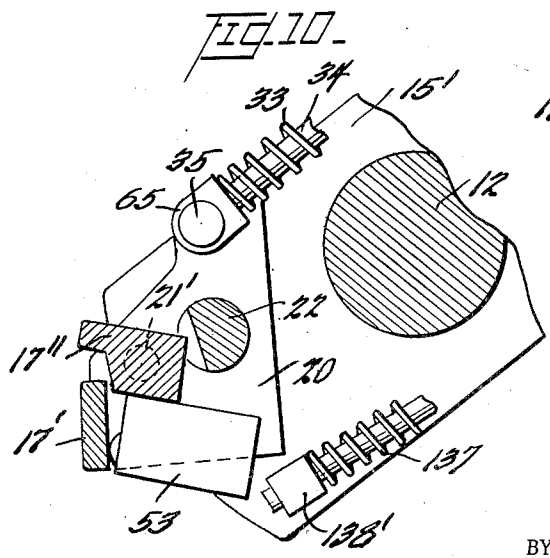
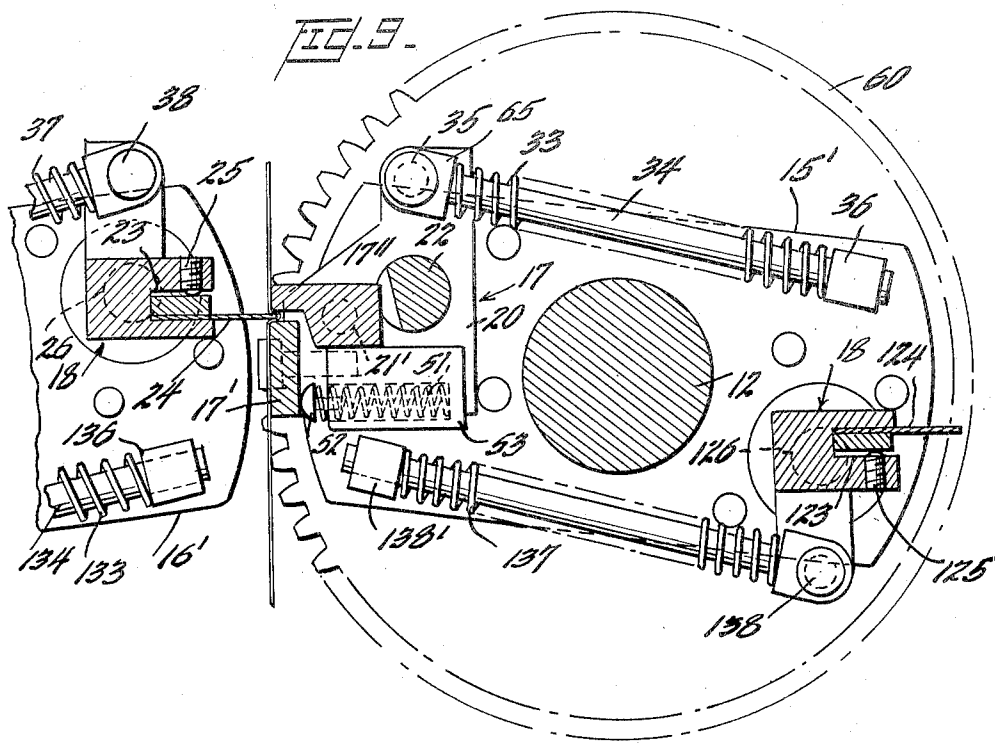
R. M. LOASE

2,819,068

ZIG-ZAG INTERFOLDING MACHINE

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6 Sheets-Sheet 5



INVENTOR,
Raymond M. Loase.

BY
Nelson, Cole, Grindler & Nelson, ATTORNEYS.

Jan. 7, 1958

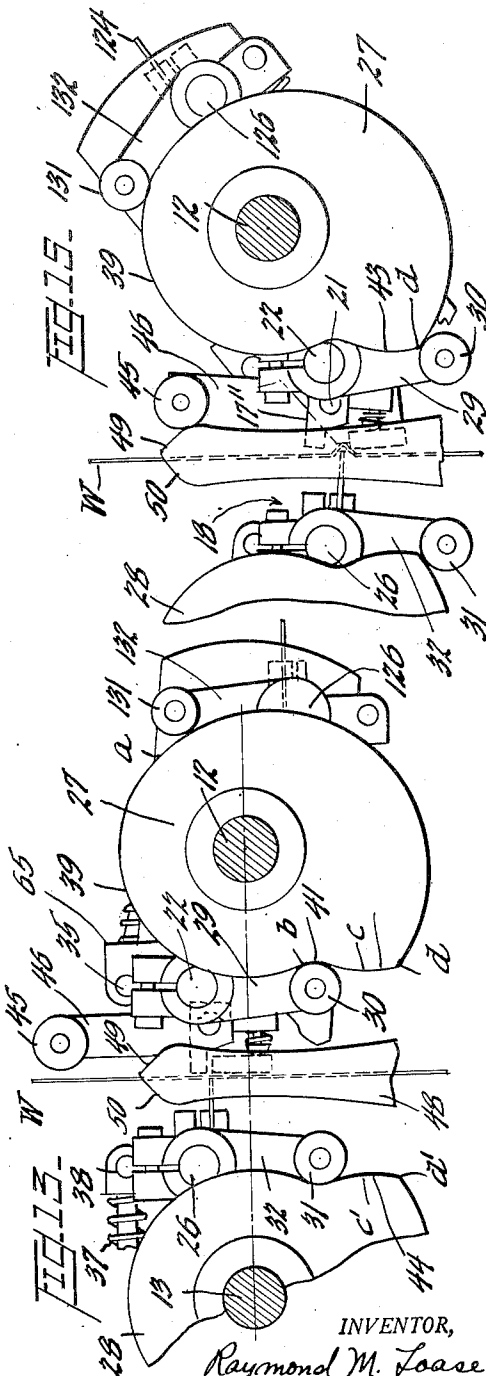
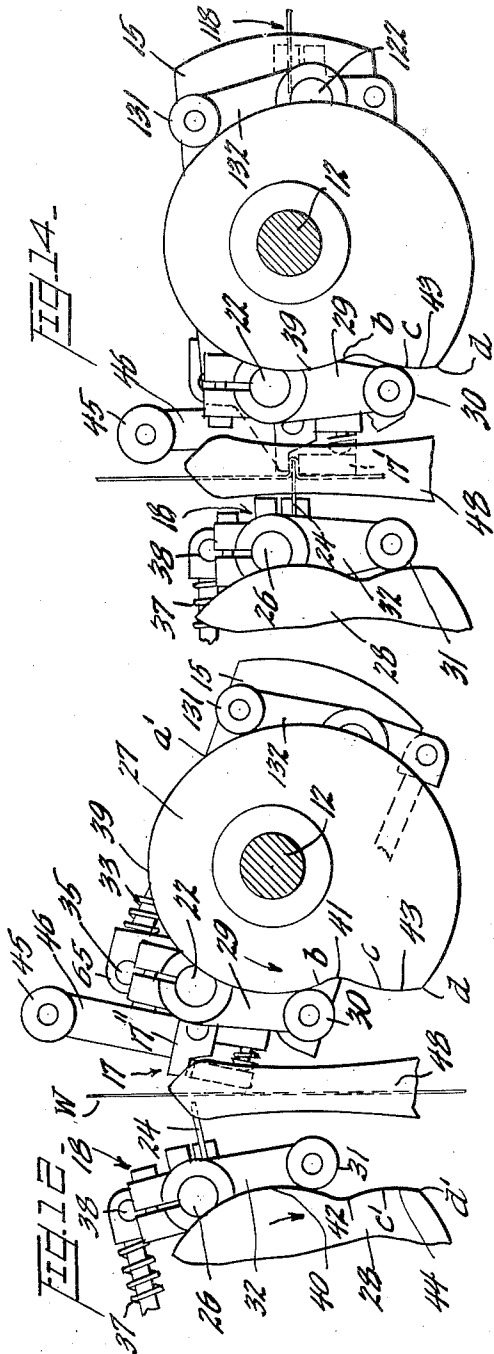
R. M. LOASE

2,819,068

ZIG-ZAG INTERFOLDING MACHINE

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6 Sheets-Sheet 6



INVENTOR,
Raymond M. Loase.
BY
Watson, Cole, Grindley & Watson,
ATTORNEYS.

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2,819,068

ZIG-ZAG INTERFOLDING MACHINE

Raymond M. Loase, Hawthorne, N. Y., assignor, by mesne assignments, to American Type Founders Co., Inc., Elizabeth, N. J., a corporation of Delaware

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3 Claims. (Cl. 270-73)

This invention relates to rotary folding mechanisms and more particularly to machines for folding and creasing continuous webs of material, such as paper, to form a stack of zigzag configuration.

High speed folding machines of this general type are well-known, wherein a pair of cooperating folding cylinders carry about their peripheries a plurality of tucker blades and jaw pairs in such a manner that the tucker blades of each cylinder are received by coating jaw pairs of the other cylinder. It is also well-known that at this tucking point the web is under a substantial pull or tension and subject to frequent tearing or bursting. It is therefore the primary object of the present invention to obviate the above difficulties by providing a machine wherein the pull on the web during the tucking operation is greatly minimized.

In machines of this general type, due to the circular path which the cylinders follow, the tucker blades are moved into and out of the bite of the jaw pairs through a series of sharp angles decreasing as the blade first begins to enter the bite, to an angle of 0° when the jaws have fully received the blade and then increasing as the blade is finally withdrawn from the jaws. This sharp angular relation between the blades and jaws has not only proved disadvantageous due to the excessive pull placed on the web, but also due to this cocking action, it is difficult to accurately position the line of fold. It is therefore a further object of the invention to provide means for moving the cooperating tucker blades and jaw assemblies in a substantially coplanar relation throughout their passage through the tucking zone, to thereby move the tucker blades substantially straight into and out of the bite of the jaws, thus eliminating the sharp angular relation between the blades and the jaws during a tucking operation and overcoming the above mentioned difficulties.

In accordance with this invention, and as exemplified by a preferred embodiment thereof, there is contemplated the elimination of the generally regarded standard pair of cooperating cylinders, and the provision of a pair of rotatable frame members each having a pair of spaced end plates and a plurality of tucker blades and coating jaw assemblies pivotally mounted adjacent their peripheries, in such a manner that the blades of each frame are moved into and out of association with the cooperating jaws of the other frame. A pair of mutually facing stationary cams are positioned one adjacent each frame and in the rotational path of cam followers carried by said blade and jaw assemblies. A plurality of webs or a single web which is to be folded is fed in a conventional manner preferably in a vertical plane downwardly between the rotating frames, with the cams so designed and constructed that the cooperating blade and jaw assemblies are pivotally moved relative to their rotating supports and thus moved downwardly through the tucking zone in substantially coplanar relation, the blades being moved slowly into and out of the jaw bites to effectively engage the web and produce the desired fold. Another stationary cam is positioned in the path

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of cam followers carried by the movable upper jaws of the jaw assemblies of each frame to effect an opening of the jaws subsequent to the tucking action and facilitate the release of the fold to allow the web to fall by gravity into a zigzag stack.

Other objects and advantages will be apparent from the following more detailed description of one embodiment of the present invention read in conjunction with the accompanying drawings in which

10 Figure 1 is an elevational view with the frame broken away to show the folding mechanism of the present invention;

Figure 2 is a plan view of the same;

15 Figure 3 is a vertical sectional view taken along the line 3-3 of Figure 1;

Figure 4 is a vertical sectional view taken along the lines 4-4 of Figure 3;

Figure 5 is a detailed elevational view showing the mounting for a jaw assembly;

20 Figure 6 is a view in perspective of a jaw assembly;

Figure 7 is a similar view of a tucker blade assembly;

Figure 8 is a view in elevation of one of the plate members;

25 Figure 9 is a vertical sectional view taken along the lines 9-9 of Figure 3;

Figure 10 is a fragmentary view similar to Figure 9 showing the plate further rotated and the upper jaw raised;

30 Figure 11 is a vertical sectional view taken along the lines 11-11 of Figure 3;

Figures 12-15 are fragmentary elevational views showing various positions of the tucker blade and jaw assemblies during a tucking operation; and

35 Figure 16 is a vertical sectional view taken along the lines 16-16 of Figure 1.

To facilitate an understanding of the invention, reference is now made specifically to the drawings, and as can be seen in Figure 2, the folding mechanism is mounted on a frame which includes a pair of spaced upright 40 panels 10 and 11. A pair of spaced parallel shafts 12 and 13 are suitably journaled in these side panels with shaft 12 extending through panel 11 and having a driving gear 14 mounted adjacent its extended end. A pair of meshing gears 60 and 61 are also secured adjacent 45 one end of shafts 12 and 13 respectively, and it is apparent therefore that upon shaft 12 being rotated through the drive gear 14, shaft 13 will be rotated in the opposite direction. The drive for gear 14 is not shown since it forms no part of the invention; however, it might be noted that folding mechanisms of this type are frequently used in connection with printing presses or like machines with the drive for gear 14 being taken from the press in 50 synchronism with the working parts of the press.

A pair of rotational frames are rigidly supported on the shafts and include a pair of spaced plates 15, 15' and 16, 16' which are secured adjacent the ends of shafts 12 and 13 respectively by any conventional means such as keys or the like. A plurality of jaw pair assemblies 17 and tucker blade assemblies 18 are carried adjacent the 60 peripheries of plates 15, 15' and 16, 16' in such a manner that upon rotation of the plates in opposite directions through shafts 12 and 13, the jaw pairs of one plate receive the tucker blades of the other plate. As shown in Figure 1, a web W, which is to be folded, is fed in a 65 vertical plane downwardly between the rotating plates, and after folding it falls by gravity into a zigzag stack formation S. When a plurality of webs are to be folded, they can first be fed over a feed roll F to bring them into a superposed position and then fed downwardly in a 70 like manner as a single web.

In the embodiment of the invention illustrated in the drawings, each rotatable frame carries a tucker blade

assembly and a jaw assembly disposed 180° in phase from the blade assembly, and since the assemblies of each frame are identical, only one of each will be fully described. The jaw and tucker blade assemblies which are controlled by cams 27 and 28 in a manner set forth hereinafter will be the assemblies which are fully described; however, to facilitate a reading of the drawings, the jaw and tucker blades which are controlled by the opposite cams and alternately brought into engagement upon rotation of their supporting plates will be designated by a similar reference numeral plus 100. The jaw assembly 17, as can be best seen in Figure 6, comprises an elongated fixed lower jaw 17' rigidly secured between a pair of supporting blocks 19 and 20 and a movable upper jaw 17'' overlying the lower jaw and pivotally supported on pins 21 and 21' (Fig. 2) suitably journaled in the supporting blocks. The jaw assembly is mounted for pivotal movement relative to plates 15, 15' and 16, 16' by means of a shaft 22, to which the supporting blocks 19 and 20 are rigidly secured, being suitably journaled in the plates.

As can be seen in Figure 7, the tucker blade assembly 18 comprises an elongated supporting block having longitudinally extending channels 23 cut therein, with a tucker blade 24 being rigidly clamped in the channel by means of bolts or the like 25. The tucker blade assembly is also mounted for pivotal movement relative to the end plates 15, 15' and 16, 16' by means of pins 26 suitably journaled in the end plates.

To control the path of movement of the respective tucker blade and jaw assemblies, a pair of stationary cams 27 and 28 are rigidly secured to the end panel 10 of the main frame, one surrounding each of the shafts 12 and 13 adjacent their ends remote from the driving end. A cam follower arm 29 (Fig. 13) is rigidly mounted on the supporting shaft 22 of the jaw assembly, with a follower roller 30 being carried adjacent the free end of this arm and offset therefrom to lie in engagement with the surface of cam 27. Likewise, a cam follower 31 carried adjacent the free end of an arm 32, which is rigidly mounted on the tucker blade assembly, engages the cam 28 to control movement of the tucker blade. As shown best in Figure 9, jaw assembly 17 is urged in a counterclockwise direction about its pivot 22, to hold the cam follower 30 in engagement with cam 27, by means of a compression spring 33, one end of which bears against an enlargement 65 adjacent one end of a rod 34, with its other end bearing against a block 36 mounted on plate 15'. The supporting rod 34 is positioned within and enveloped by spring 33 with one end thereof pivotally secured to a pin 35 carried by block 20 of the jaw assembly and the other end slidably received in an aperture in block 36. On the other hand, tucker blade assembly 18 carried by plates 16, 16' is urged in a clockwise direction by means of a like construction which includes a coil spring 37, one end of which bears against a pin 38 carried by the tucker blade assembly and the other end of which bears against a block 38' secured to the plate 16'. (Fig. 2.) It is apparent, therefore, that as the plates are rotated, the jaw assemblies and tucker blade assemblies are constantly urged into engagement with their respective cams, and thus their path of travel is controlled by the shape of the cams.

The shape of these cams which effect the novel and desired folding interaction between the tucker blades and jaws will now be discussed. Looking at Fig. 1 and Figs. 12-15, it can be seen that the surfaces 39 and 40 of cams 27 and 28 respectively, which extend between points *a*, *b* and *a'*, *b'* on the respective cam surfaces, are concentric with and of a smaller diameter than the circular paths described by the respective pivotal points 22 and 26 of the jaw and tucker blade assemblies. It will be seen, therefore, that as shaft 12 rotates in its counterclockwise direction and cam follower 30 rides along cam surface 39, jaw assembly 17 will be forced to rotate about its

pivot 22 in a counterclockwise direction relative to its supporting plates 15, 15'. At the same time, cam-follower 31 follows cam surface 40 of cam 28 to thereby rotate the tucker blade assembly 18 about its pivotal axis 26. With these assemblies being rotated relative to their rotating supporting plates and therefore being swung about the axes of rotation of the supporting plates at a faster rate, it can be seen that they will be brought into coplanar relation in a plane parallel to but lying above the plane through the rotational axis of their supporting plates for purposes described more fully hereinafter.

Second surfaces on cams 27 and 28 lying immediately below surfaces 39 and 40 and extending from points *b* and *b'* to *d* and *d'* on the respective cam surfaces are formed by striking an arc of a circle whose axes lie substantially below the axes of rotation of the supporting plates. The high point of these arcuate surfaces are designated *c* and *c'* respectively, and it can be seen that as the supporting plates continue to rotate and the cam followers ride over surfaces 41 and 42, the jaw and tucker blade assemblies will be pivoted clockwise and counterclockwise respectively about their pivotal axis 22 and 26, thus retarding their rotational movement with respect to the supporting plate axes to thereby maintain the assemblies in substantially coplanar relation, however at the same time moving them toward each other. As the cam followers continue to ride over surfaces 43 and 44, the assemblies are moved away from each other in a like manner. For the purposes of illustration, the arcuate surfaces 41, 43 and 42, 44 were struck with their axes at the point of intersection between the vertical plane through the axes of rotations of shafts 12 and 13 and the horizontal plane through the high points *c*, *c'* of the arcuate surfaces. It will be understood, however, that the radius of curvature of these arcuate surfaces can be readily changed to effect the desired movement of the jaw and tucker blade assemblies relative to each other.

Describing the operation of the folding mechanism thus far covered, it can be seen that as the plates 15, 15' and 16, 16' are rotated to the position of Figure 12, the jaw assembly 17 and tucker blade assembly 18 have been rotated counterclockwise and clockwise respectively about their axes 22 and 26, due to the aforementioned smaller radius of curvature of the cam surfaces 39 and 40, to a position approaching a coplanar relation. As the plates continue to move to the position of Figure 13, wherein the cam followers 30 and 31 have reached points *b* and *b'* on the respective cam surfaces, the jaw and tucker blade assemblies lie in a coplanar relationship, which plane is transverse to the plane of feed of the web *W* and substantially parallel with and lying above the plane running through the rotational axes of shafts 12 and 13. It can also be noted in Figure 13, that with the assemblies in this position, they abut the web *W* but as yet have not begun any tucking action.

As the plates continue to rotate, the cam followers 30 and 31 move along the surfaces 41 and 42 respectively of the cams to urge the jaw assembly and blade assembly to pivot clockwise and counterclockwise respectively about their pivots 22 and 26. It is apparent, therefore, that due to the pivotal movement of the assemblies relative to the plates and in a direction opposite to the rotation of the plates, that the assemblies will move downwardly in a substantially coplanar relation. At the same time, however, due to the slight radius of curvature of cam surfaces 41 and 42 and the fact that their axes 22 and 26 are following a radius from centers 12 and 13, the assemblies are moving toward each other, with the movement of the blade into the jaw bite forcing a portion of the web *W* into the jaws. When rotation of the plates has brought the jaw and blade assemblies to the position shown in Figure 14, they lie on the center line connecting the axes of shafts 12 and 13, with the jaws having received the blade to its farthest predetermined extent, to thereby

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complete the folding or tucking. As the plates continue to rotate, with the cam followers riding over surfaces 43 and 44, it is apparent that the jaw and tucker blade assemblies will continue to be urged in a clockwise and counterclockwise direction respectively about their pivots 22 and 26 thereby maintaining them in a substantially coplanar relation and at the same time moving them apart.

It can be seen from the above description of the coplanar path of travel of the jaw and tucker blade assemblies with the blade and jaws moving toward each other in a substantially horizontal movement, that the previous difficulties arising from the cocking and sharp angle meshing of the blades and jaws in the cooperating cylinder type folders have now been eliminated.

To facilitate the removal of the folded portion of the web from the folding mechanism and allow it to fall by gravity into a zigzag stack formation, a cam follower 45 is mounted on an arm 46 extending upwardly from and secured to the movable upper jaw 17" by any suitable means such as bolts or screws 47, while a stationary cam 48 is mounted on the frame with inclined surfaces 49 and 50 on either side thereof adjacent its upper end. The upper jaw portion 17" is normally held in a fixed relation with respect to the lower stationary jaw 17' by means of a spring 51 having a cap 52 at one end abutting jaw 17' with the other end thereof abutting a block 53 which is secured as by welding to the upper jaw 17". (Figures 10 and 11.) As the plates rotate to a position shown in Figure 15, cam follower 45 is brought into engagement with the inclined surface 49 of the fixed cam 48 to rotate jaw 17" about its pivotal axis 21 in a clockwise direction, and thereby move it away from the lower jaw to thus allow the folded web to fall freely into its zigzag stack. It will be apparent that a similar cam follower on the jaw assembly 117 of plates 16, 16' will engage the cam surface 50 upon continued rotation of the plate for the same purpose.

From the foregoing description, although only one of the coating jaw and tucker blade assemblies have been described, it will be understood that the operation of the jaw and blade assemblies 117 and 118, which are mounted on plates 16, 16' and 15, 15' respectively and alternately brought into engagement with the web upon continued rotation of the plates, will be identical. It should also be understood that any changes which might occur to one skilled in the art are contemplated by the present invention within the scope of the following claims.

Having thus described the invention, what is claimed as new and desired to be secured by Letters Patent is:

1. In an interfolding machine for folding a web in zig-zag fashion, blade means and jaw means mounted for bodily translation about parallel axes to insert said blade means into the bite of said jaw means to introduce a fold in said web, said blade means and said jaw means being adapted for rotation about axes independent of said axes of translation, cam means for rotating the blade means and jaw means in directions contrary to the direction of translation to maintain the blade means coplanar with the bite of said jaw means through a common arc of the paths of translation which extends both above and below the plane of the axes of translation, said jaw means

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comprising two jaws one of which is rockable independently of its translation and rotation, means urging said rockable jaw toward said other jaw to define the bite thereof, and independent cam means for rocking said rockable jaw away from said other jaw at the end of said common arc to release the folded web.

2. An interfolding machine for folding a web in zigzag fashion which comprises a pair of rotatable frames, a tucker blade as a unit carried for pivotal movement by one of said frames, a pair of coating jaws carried for unitary pivotal movement by the other of said frames, one of said jaws being mounted for independent rocking movement away from and toward the other jaw, means biasing said rockable jaw to a position at which it coacts with said other jaw, cam means for pivoting said blade and for pivoting said pair of jaws as a unit in directions contrary to the direction of rotation of the respective rotatable frames for bringing said blade and the bite of said jaws into co-planar relationship above the plane of the rotational axes of said frames and for moving the blade and the bite of said jaws from coplanar relationship below said plane, and independent cam means for rocking said rockable jaw against said biasing means to open the jaws only at the termination of that portion of travel of said blade and jaws during which they are co-planar.

3. In a machine for introducing zig-zag folds into a web, a pair of frames mounted for rotation about parallel axes, supporting members carried by each of said frames and adapted for independent rotation with respect thereto, a blade supported by the members on one frame and a pair of coating jaws supported by the members on the other frame, rotation of the frames causing the insertion of the blade in the jaws to fold said web, a stationary cam mounted adjacent each frame, a cam follower for the supporting members on each frame, spring means urging the supporting members in the same direction as that of the rotation of their corresponding frames to maintain said followers in contact with said cam, said cams being adapted to rotate said supporting members against the urging of said spring means to maintain said blade and the bite of said jaws in co-planar relationship through a common arc in the rotation of the frames, said arc extending both above and below the plane of the frame axes, one of said jaws being fixed with respect to the supporting members and the other being independently rockable with respect thereto, spring means urging said rockable jaw toward the fixed jaw to a position defining the normal bite thereof, a cam follower for said rockable jaw, and a stationary cam independent of said first-mentioned cam for rocking said jaw away from the fixed jaw at the end of said common arc to facilitate the release of the folded web.

References Cited in the file of this patent

UNITED STATES PATENTS

1,588,524	Cannard	June 15, 1926
1,595,992	Cannard	Aug. 17, 1926
1,869,694	Hudson	Aug. 2, 1932
1,966,885	Crafts	July 17, 1934

FOREIGN PATENTS

627,367	Great Britain	Aug. 8, 1949
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