Nov. 14, 1967 D. PRESTON 3,352,553

CONTINUOUS FORMS FOLDER MACHINE

Filed Oct. 14, 1965 4 Sheets-Sheet 1

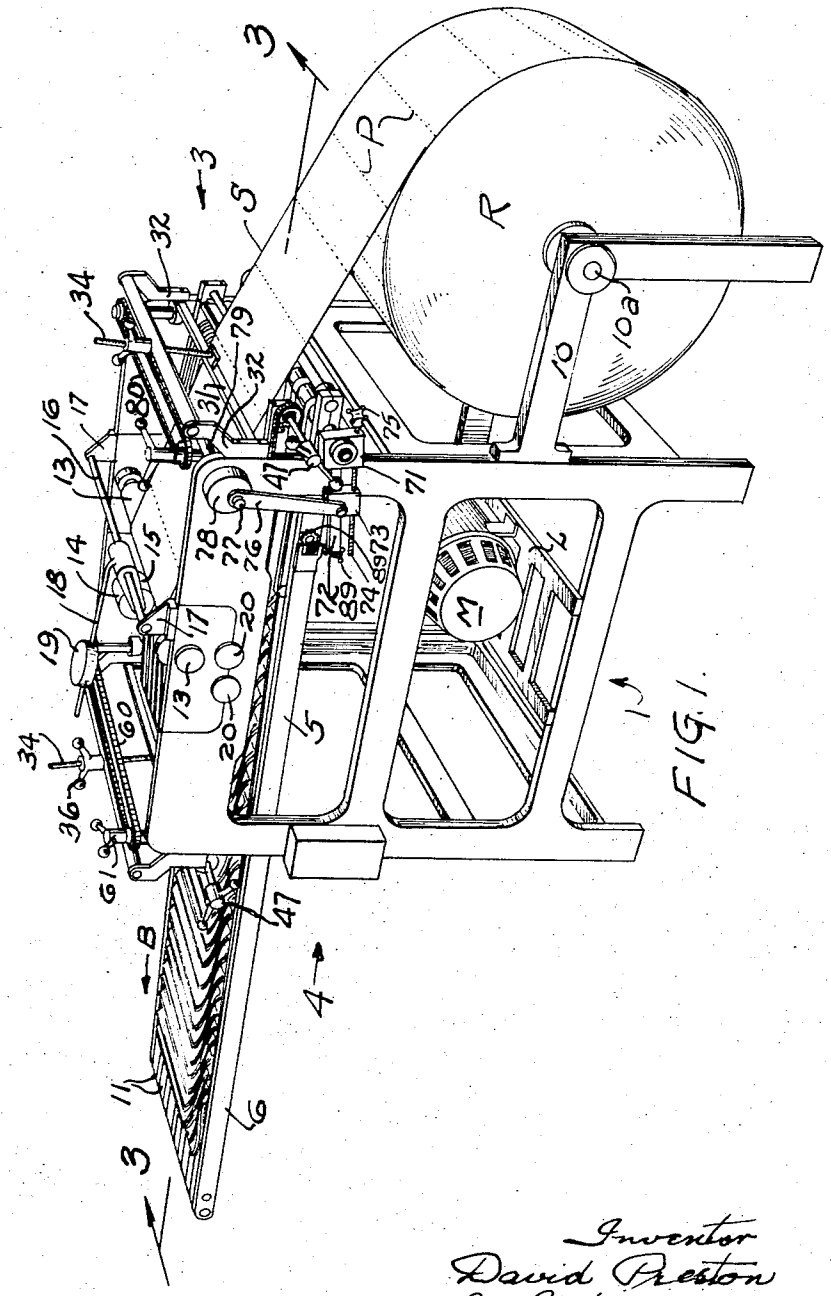

FIG. 1.

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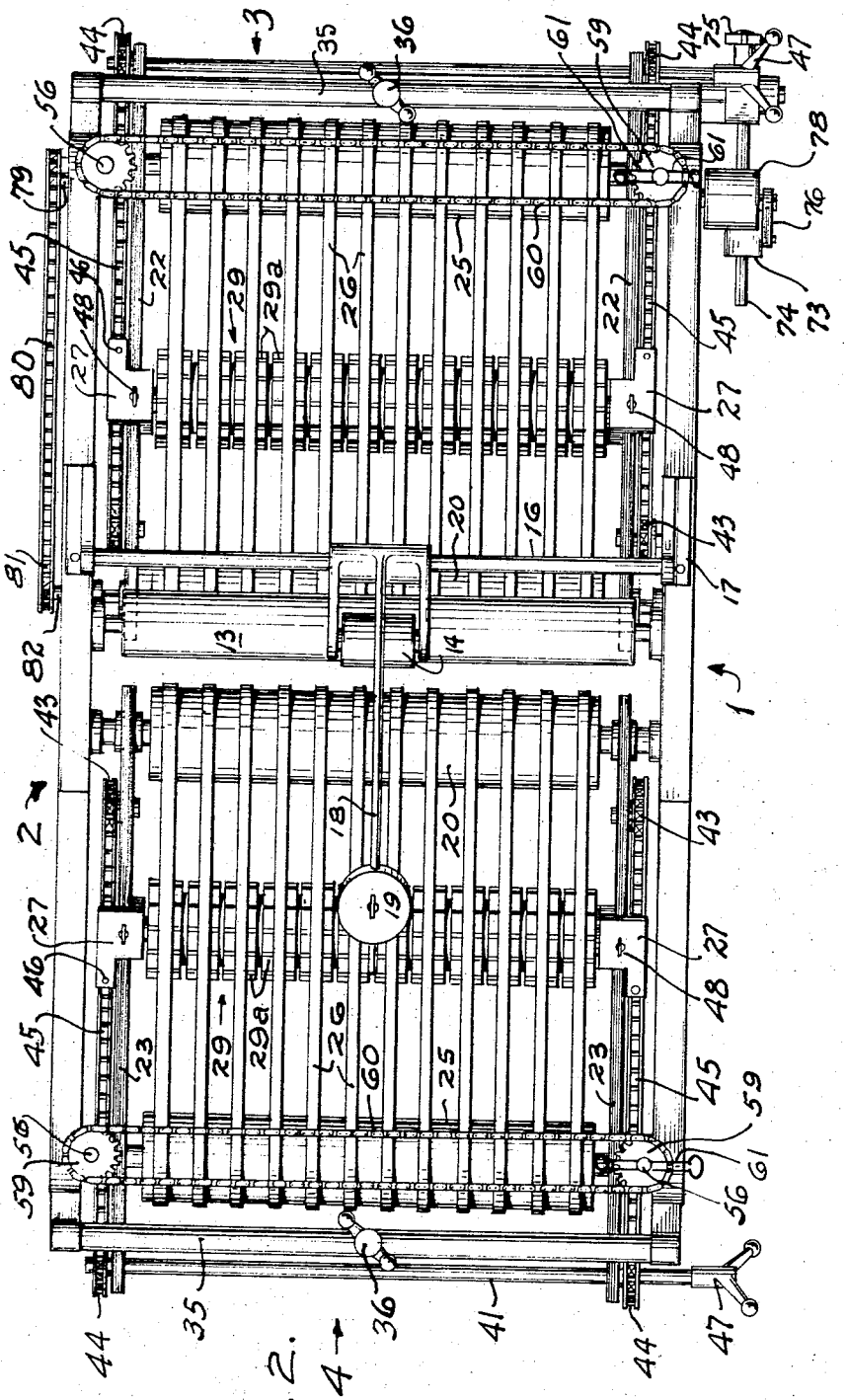

FIG. 2.

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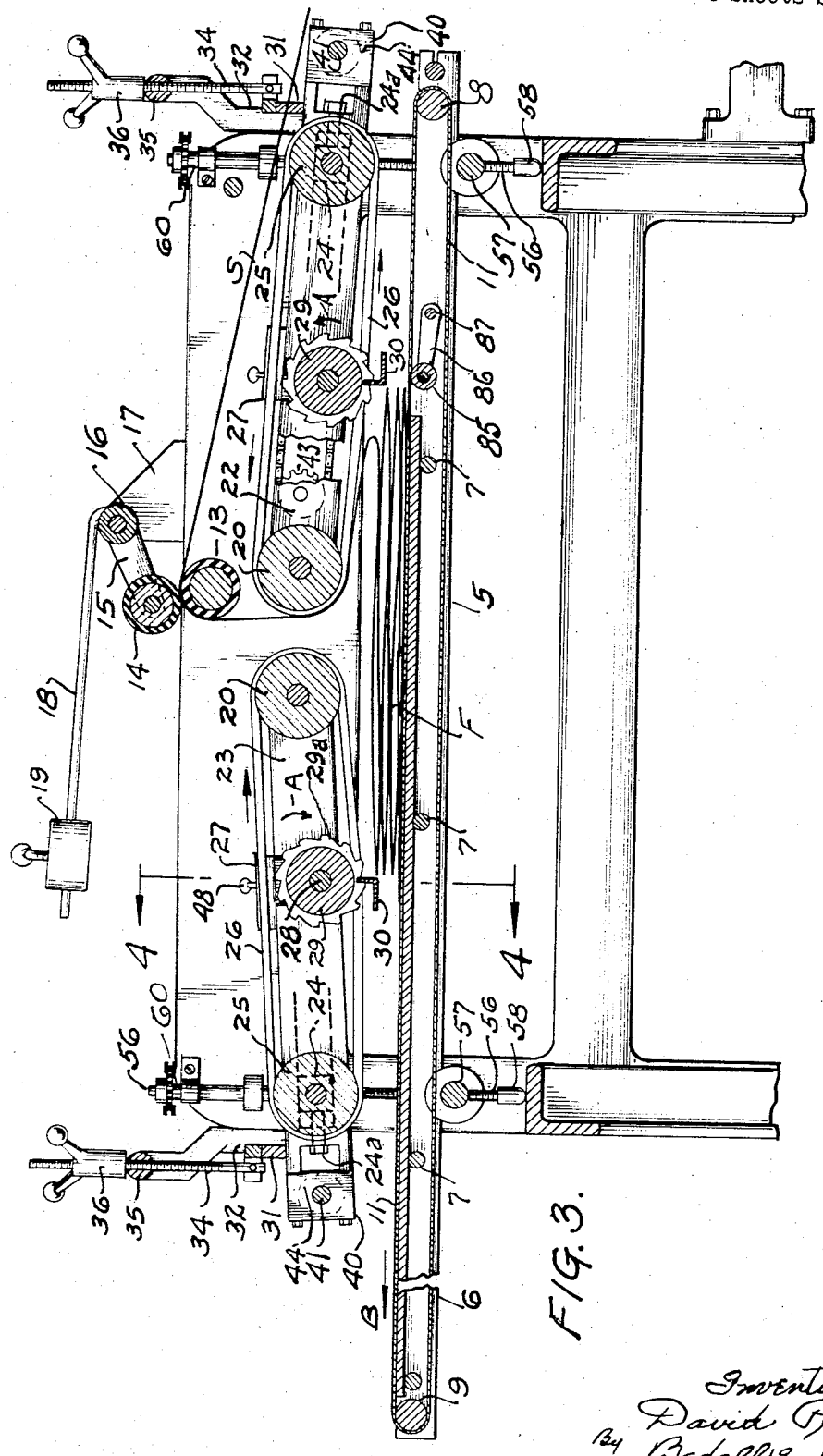

FIG. 3.

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CONTINUOUS FORMS FOLDER MACHINE

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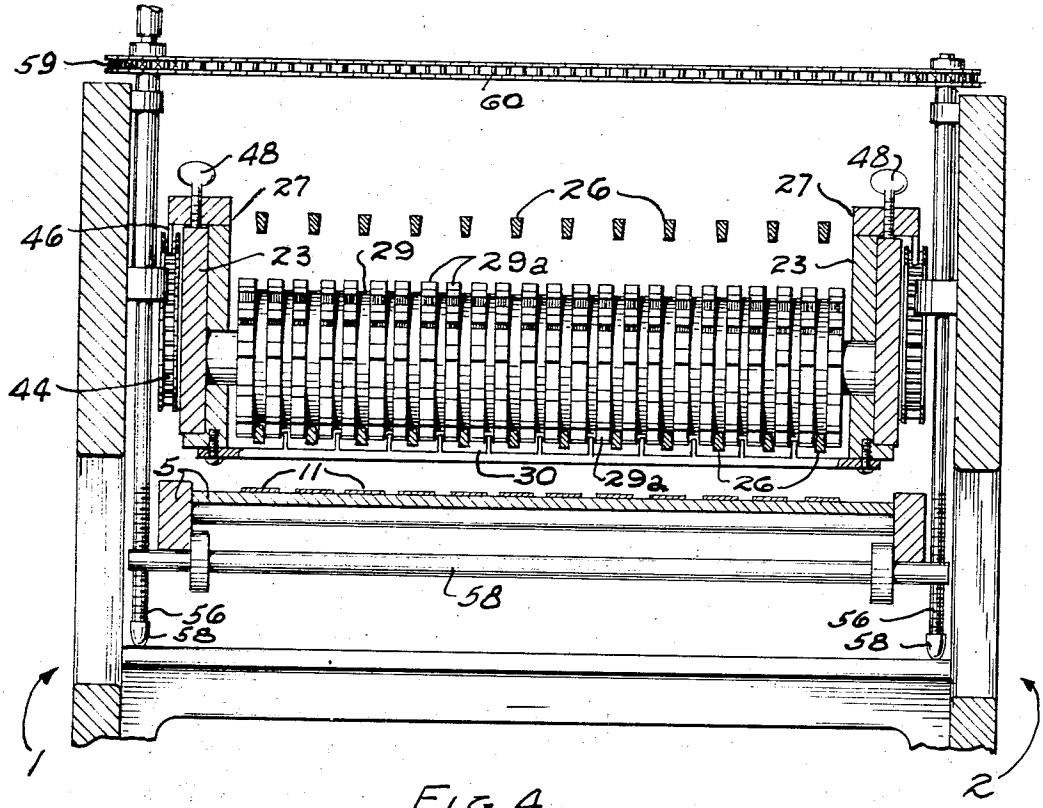

FIG. 4.

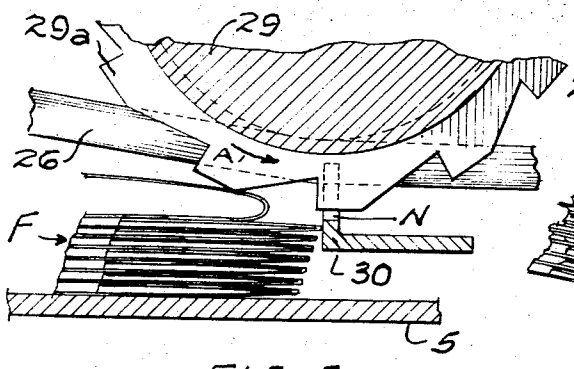

FIG. 5.

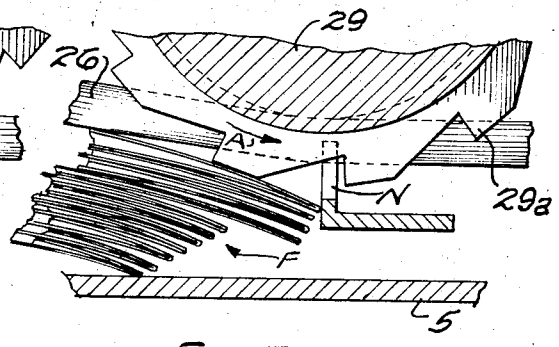

FIG. 6.

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3,352,553

CONTINUOUS FORMS FOLDER MACHINE

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9 Claims. (Cl. 270—79)

ABSTRACT OF THE DISCLOSURE

A machine for rapidly producing zigzag folds in an elongated strip of paper and discharging a multifold product with folds in overlapped relation. The machine feeds the strip toward a table to loop the strip alternately in opposite directions between stops spaced along the table, there being rollers cooperating with the stops to flatten the loops into sharp folds.

The invention relates to a machine for zigzag folding of a continuous strip of material as supplied usually from a roll of paper.

The main object of the invention is to expedite the flat and accurate folding of the material in the strip by thrusting alternate loops of the folds against spaced opposing stops and simultaneously subjecting the individual loops to creasing compression by impacts from coacting machine elements as distinguished from folding machines previously made in which successive folds are fed against stops by friction elements and are subject to creasing pressure mainly as the folds increase substantially in number.

This general object is attained by feeding looped areas of the strip against a stop and simultaneously sharply pressing the sides of each fold toward each other. Preferably the mechanism includes a surface for supporting the paper as it is folded back and forth, spaced apart stops above the supported surface, spaced apart belts and cylinders extending transversely of the supporting surface for feeding the strip toward the stops alternately, the strip-engaging portions of the stops and cylinders being grooved and ridged to enable the rollers to rapidly and sharply impact and compress the strip loop during its folding by the machine.

These and other specific objects are attained by the machine shown in the accompanying drawings illustrating a selected embodiment of the invention, in which:

FIG. 1 is a perspective of the machine.

FIG. 2 is a top view of the machine.

FIG. 3 is a longitudinal vertical section on line 3—3 of FIG. 1.

FIG. 4 is a transverse vertical section of the machine approximately on line 4—4 of FIG. 3.

FIGS. 5 and 6 are detail sections showing successive positions of the paper contacting elements of the machine during the completion of a fold.

The machine includes a substantially rigid frame having a front side **1**, where the operator is stationed normally, a rear side **2**, an input end **3** and an output end **4**. Brackets **10** on the input end mount a spindle **10***a* which carries a roll of paper R. The paper in the roll has been perforated or scored previously transversely of its length at regular intervals and the function of the machine is to flatten successive folds or loops facing in opposite directions along the transverse lines of perforations or scorings P.

A table **5** is mounted on frame **1** and extends substantially the full length of the frame and projects at **6** to

the left of the frame. Transverse rollers **8**, **9** at the ends of table **5**, **6**, and transverse bars **7** between rollers **8**, **9** mount conveyor tapes **11** which run lengthwise of the table and feed the folds F, formed in paper strip S, along extension **6** for manual removal from the machine.

Paper strip S from roll R is led over a feed roller **13** having a shaft journaled in the sides of the machine frame. A hold-down roller **14** is journaled on the swinging ends of arms **15** pivoted on a spindle **16** seated in brackets **17** on the sides of frame **1**. A rod **18** extends to the left from spindle **16** and a weight **19** slidable along rod **18** provides for adjustment of the friction between rollers **13**, **14** and the paper strip. Roller **13** is driven by a belt from a motor M mounted on a transverse frame platform L.

Transverse feed belt rollers **20** include shafts journaled in the sides of the machine frame intermediate the ends of the frame and are belt driven from roller **13**, the shafts of rollers **13** and **20** being geared to each other. Flat bars **22**, **23** (FIGS. 3, 4) are disposed end to end lengthwise of the machine and have their adjacent ends pivoted on the shafts of rollers **20**, **20**, respectively. The opposite end portions of bars **22**, **23** slidably mount bearings **24** for the shafts of idler belt rollers **25**. Bearings **24** are adjustable along bars **22**, **23** by screws **24***a*. A plurality of V-belts **26** are seated in grooves in rollers **20**, **25**.

Intermediate each roller **20** and associated roller **25** is a short channel section bearing block **27** (FIG. 4) slidable along the bar **22**, **23** but retained at desired position as explained below. Each pair of blocks **27** at front and rear of the machine journals a shaft **28** mounting a cylinder **29** each having a plurality of spaced rows of teeth **29***a* and the grooves between the rows of teeth receive the lower flights of belts **26** and drive the cylinders in the direction of arrows A. Beneath each cylinder **29** is an angle stop **30** extending transversely of the machine and secured at its ends to bars **22**, **23** respectively and having its upright leg notched at N (FIGS. 5, 6) to receive the cylinder teeth. The horizontal leg of each angle stop is spaced above tapes **11** and table **5** but this space may be adjusted as explained below.

As the paper strip is fed downwardly by roller **13** it contacts belts **26** and is moved toward tapes **11** and doubles along the perforation lines P to assume oval loop forms beneath the lower flights of the belts. As the paper strip begins to loop, the upper leaf of each loop is engaged by the lower flights of the V-belts and is frictionally moved toward a corresponding stop **30**. Then successive teeth **29***a* contact the end portions of the loops and press them downwardly from the belt and toward the stops. As successive loops accumulate, the teeth press the loops closer to the tapes and table and reduce the height of the loops and crease their folds more sharply. As the folds accumulate between belts **26** and tapes **11**, sufficient friction is created to cause the tapes to move a group of the folded sheets to the left from beneath the cylinders and the friction-induced movement carries the folds to the discharge extension **6** indicated in FIG. 1, from where they are removed manually by the attendant at intervals. The lower flights of left-hand belts **26** contribute to this feeding of the folds after they pass beneath left-hand stop **30**.

To effect desired rapidity and accuracy of the action of belts **26**, cylinders **29** and tapes **11** requires varying the spacing of these parts according to the thickness and stiffness of the paper strip. It is to be understood that the most effective action will result from a careful coordination of

the tape speed, tautness of the belts and tapes, the distances between the belts and tapes and between the opposed stops, the distances between the cylinders, their stops, and the table and tapes, all varying with the thickness and stiffness of the paper and with the width and length of the folded loops. Such adjustments are readily effected, as described below, by an attendant stationed at the front of the machine.

The ends of the bars remote from rollers **20** are supported by individual transverse carriers **31** (FIGS. 1, 3), the ends of which are slidable vertically along brackets **32** on the machine frame. An upstanding threaded shaft **34** is attached at its lower end to the middle portion of each carrier **31** and extends upwardly therefrom through a horizontal bar **35** supported on brackets **32**. A hand wheel **36** threaded on each shaft **34** supports that shaft and associated carrier **31** and provides means for readily adjusting the height of the outer ends of the associated pair of bars **22, 23**.

Each bar **22, 23** is provided with an adjustable extension **40** which includes a bearing for a transverse shaft **41**. Journaled in each pair of bars **22, 23** and associated shaft **41** are a pair of spaced sprockets **43, 44** which mount an endless sprocket chain **45** engaged by a finger **46** depending from bearing block **27**. The shaft of each sprocket **44** is rotatable by a hand wheel **47** at the front of the machine. Thus the associated front and rear chains **45** and bearing blocks **27** for a cylinder **29** are moved simultaneously by the attendant without leaving the front of the machine. Each block **27** has a lock screw **48** for clamping the adjusted block to its supporting bar **22, 23**.

Also the table is raised and lowered by upright threaded shafts **56** threaded through table supporting carriers **57** and having lower end bearings **58** on end pieces of the machine frame. Sprockets **59** on the upper ends of shafts **56** at front and rear of the machine are connected by chains **60**. A hand wheel **61** on the front shaft **56** only of each pair of shafts provides for simultaneous and equal raising and lowering of the front and rear ends of each carrier **57** and of the corresponding end of the table.

Tapes **11** are moved along table **5** intermittently by the overriding clutch **71** (FIG. 1) oscillated by a lever **72** connected by a block **73** positioned along lever **72** by a screw **74** rotatable by a hand wheel **75** and connected by a pitman **76** to an adjustable eccentric pin **77** on a drum **78** at the end of a shaft **79** driven by a chain **80** (FIG. 2) and a sprocket **81** on a shaft **82** geared to the shaft of feed roller **13**. Hand wheel **75** facilitates ready variation of the extent of the step-by-step advancement of the tapes.

A tape elevating roller **85** (FIG. 3) is mounted on the free ends of crank arms **86** on a shaft **87** journaled in the machine frame and manually adjustable by a worm wheel **88** and handle **89** (FIG. 1). This device facilitates vertical adjustment of tapes **11** immediately beneath the right hand angle stop **30**. Similar adjustment is not required beneath the other stop as the movement of the tapes, indicated by arrow B, delivers the folds to the left as shown in FIG. 1.

All the critical adjustments are identical at front and rear of the machine and are readily effected by the attendant operating a single control for each adjustment. The adjustments may be made while the machine is operating and throughout the range of machine speeds and while the paper folding is in full view of the attendant. This greatly reduces the set-up time as well as making possible high speed production operation.

The details of the structure may be varied widely in details without departing from the spirit of the invention and exclusive use of modifications embodying the spirit of the claims is contemplated.

What is claimed is:

1. In a machine for making continuous zigzag folds in a strip of flexible material, a table-like support, stop members above said support and spaced apart lengthwise thereof and facing each other, means intermediate said stop members to feed a strip of material toward said support from above and thereby loop the strip as it contacts said support, each stop member having upstanding teeth at intervals along its length, a roller extending alongside each stop member, belt means associated with the rollers and including flights facing the table and moving past the rollers away from the space intermediate the rollers for engaging the strip as it leaves said feeding means and guiding the strip toward said stop member alternately, each of said rollers having spaced circumferential grooves receiving the teeth of the associated stop member to engage looped portions of the strip adjacent the stop member and then thrust the stop member engaging portion of the strip loop toward the adjacent stop member and toward the table to flatten the loop into a sharp fold.

2. A machine according to claim **1** in which portions of each roller between its spaced grooves are notched transversely at angular intervals about the roller periphery to provide spaced apart impact elements circumferentially of the roller periphery.

3. A machine according to claim **1** which includes means for adjusting the distance between the roller axis and the associated table-like support to vary the depth of reception of the stop teeth into the roller grooves during folding operations of the machine.

4. A machine according to claim **1** which includes a frame supporting the table-like support, stop members and rollers, and includes means to adjust the support on the frame toward and away from the stop members to vary the pressure of the rollers on the strip folds resting on the support.

5. A machine according to claim **1** which includes means for adjusting the distance between the support and the rollers, and other means for adjusting the distance between the teeth of each stop member and the adjacent roller.

6. In a machine for making continuous zigzag folds in a strip of flexible material, a frame, a table-like support thereon, stops above said support and spaced apart lengthwise thereof and facing each other, means intermediate said stops to feed the strip of material downwardly freely toward said support from above into contact wih said support and to bend the strip alternately toward respective stops to double the strips into loops facing toward the middle of the distance between the stops, a rotating cylinder extending alongside each stop with its lower surface moving toward the stop to engage and flatten the loops, vertically spaced belts and tapes moving together transversely of and beneath one of said cylinders and the associated stop to discharge the folded loops toward one end of the machine, and manually operable means for adjusting said belts and tapes relative to each other during normal operation of the machine.

7. A machine according to claim **6** which includes drum rollers mounting the belts and tapes and extending substantially parallel to the strip-engaging cylinders and provided with bearings movably mounted on opposite sides of the machine frame, there being mechanism for shifting the bearings at opposite ends of each roller vertically relative to the table-like support and relative to each other and including means for shifting said bearings simultaneously.

8. A machine according to claim **6** in which the belts are mounted on rollers each journaled in a pair of spaced bearings positioned at opposite sides of the machine frame, and the manually operative means includes mechanism at one side of the frame for vertically adjusting both of the bearings for each roller simultaneously and equally.

9. A machine as described in claim **1** which includes vertically spaced belts and tapes movable along the table above and below the flattened folds to frictionally engage the folds and convey them along the table for discharge from one end thereof, and manually operable means for

adjusting said belts and tapes relative to each other from the front of the machine during normal operation of the machine.

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