June 9, 1959 P. V. WISDOM 2,890,044

SHEET FOLDING AND PLEATING MACHINE

Filed March 15, 1957 6 Sheets-Sheet 1

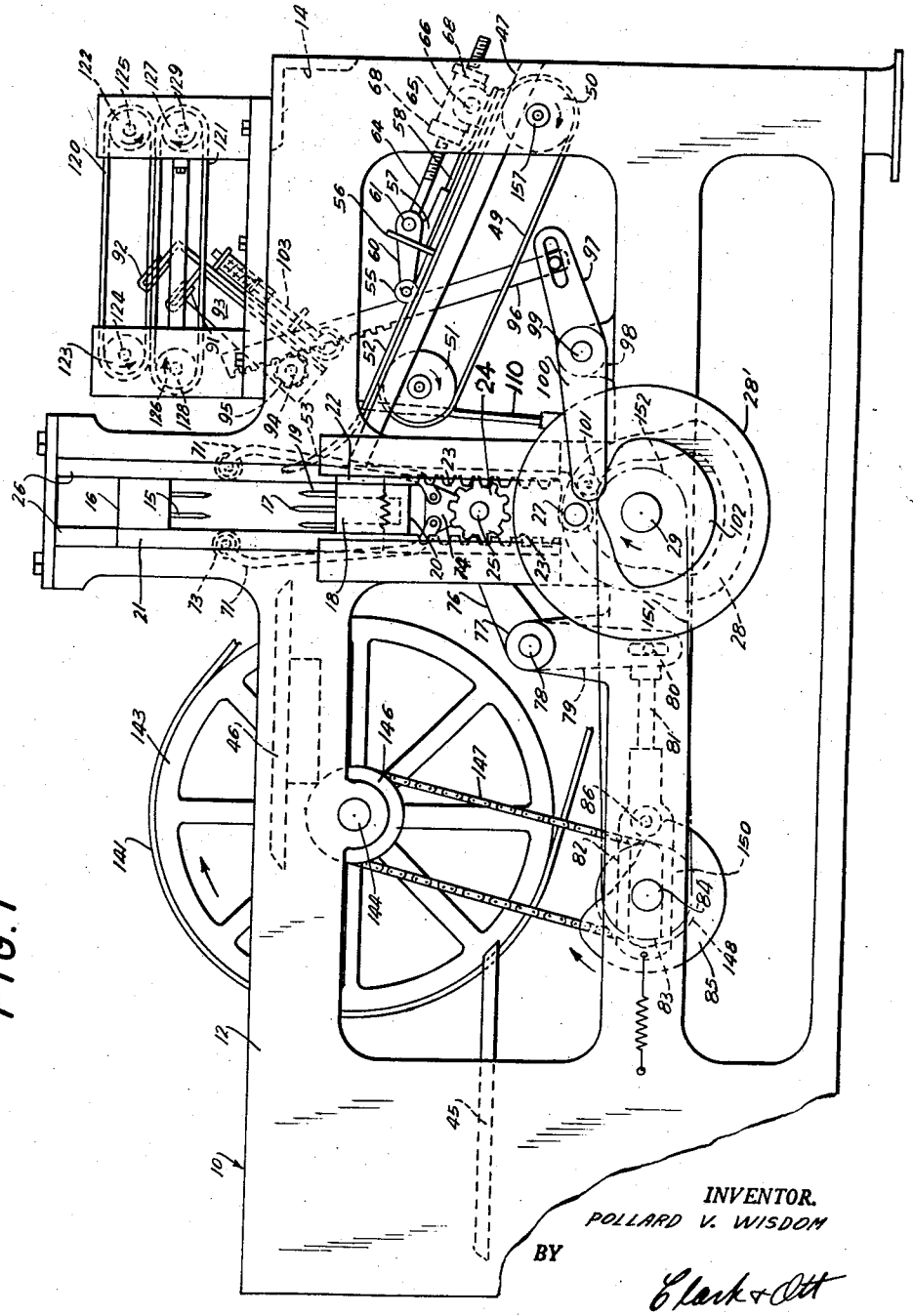


FIG. 1

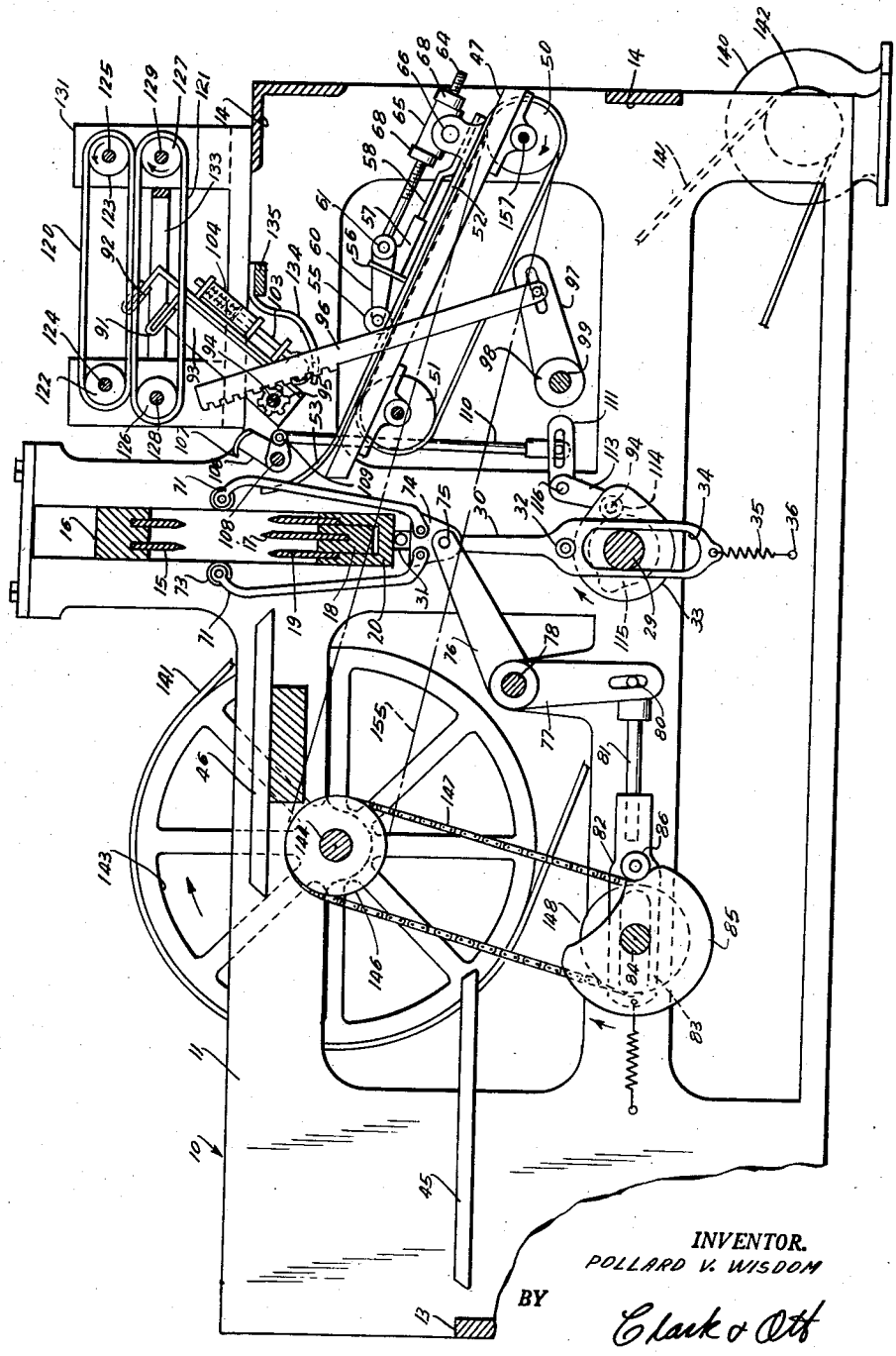
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SHEET FOLDING AND PLEATING MACHINE

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FIG. 2



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SHEET FOLDING AND PLEATING MACHINE

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6 Sheets-Sheet 3

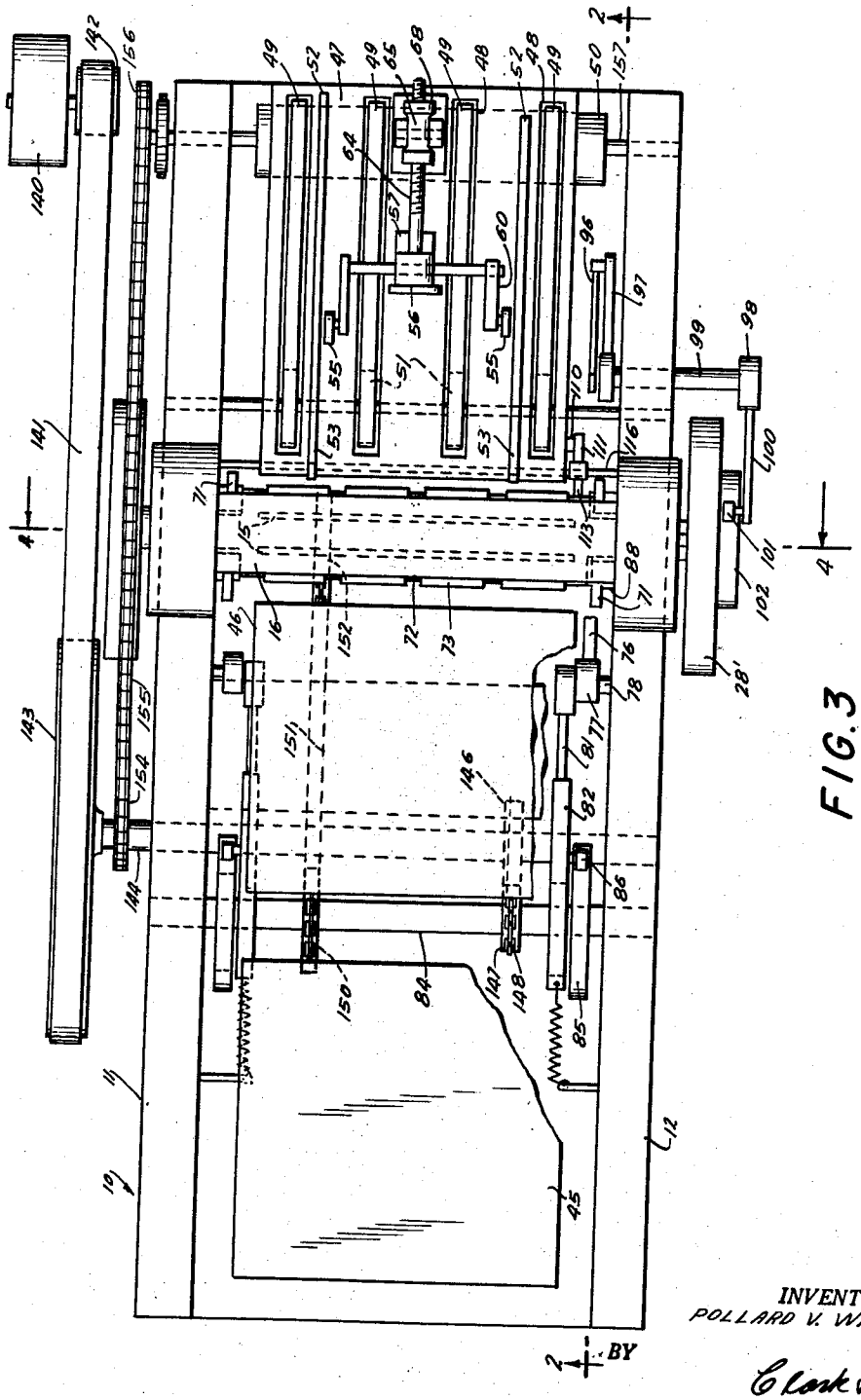


FIG. 3

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SHEET FOLDING AND PLEATING MACHINE

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FIG. 7

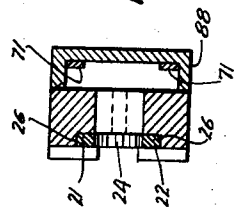
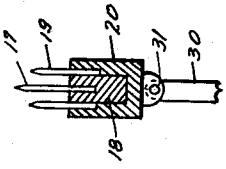


FIG. 8



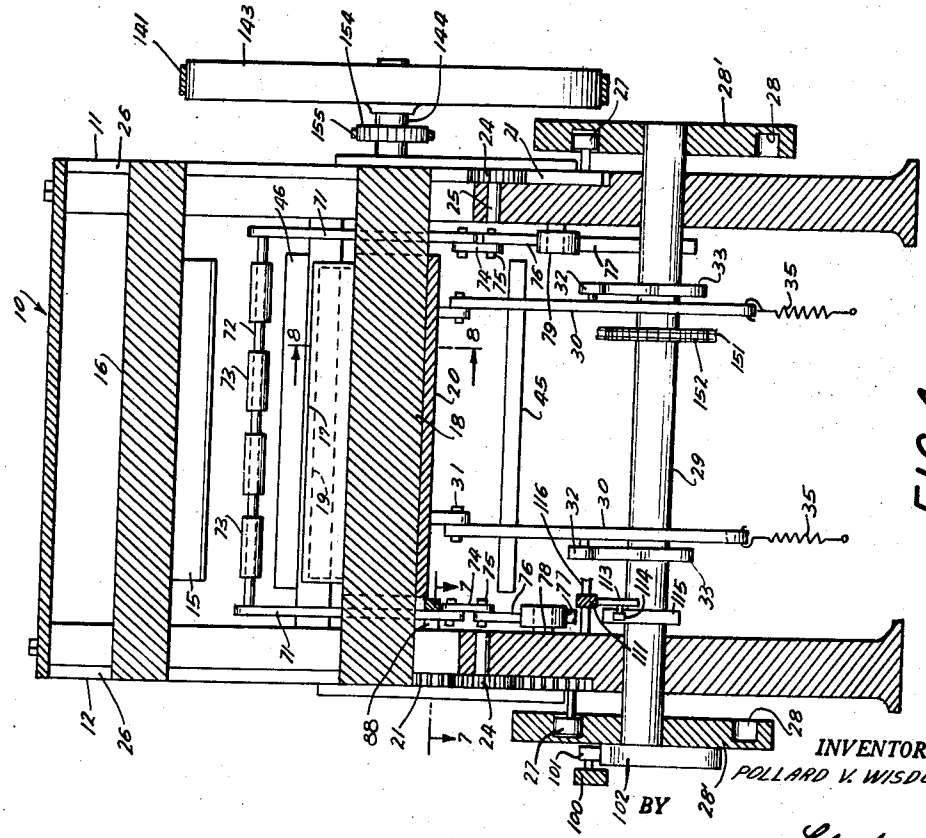


FIG. 4

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SHEET FOLDING AND PLEATING MACHINE

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FIG. 6

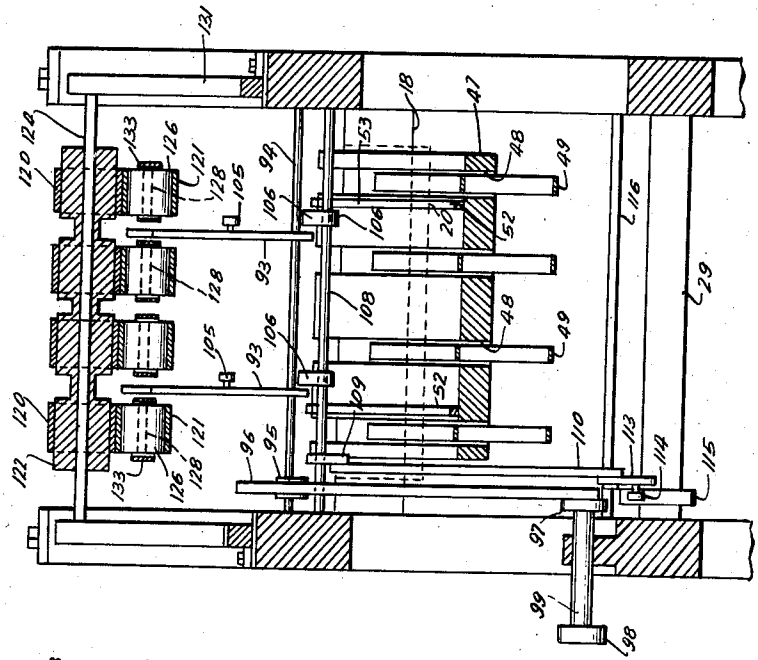
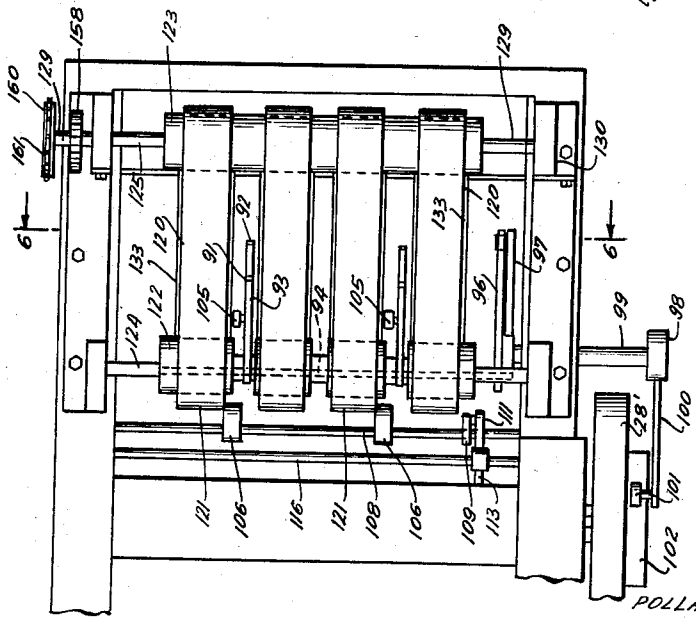


FIG. 5



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SHEET FOLDING AND PLEATING MACHINE

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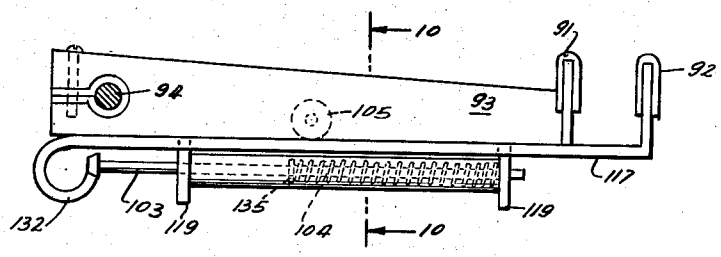


FIG. 9

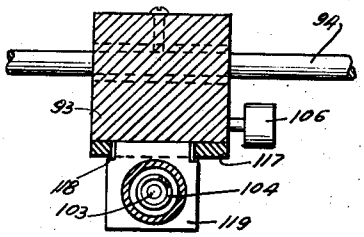


FIG. 10

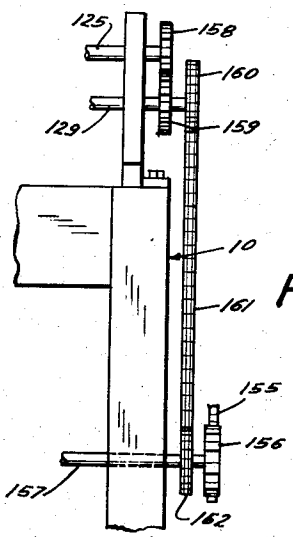


FIG. 11

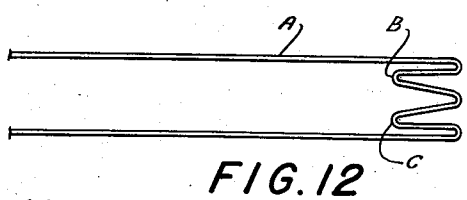


FIG. 12

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United States Patent Office 2,890,044 Patented June 9, 1959

2,890,044

SHEET FOLDING AND PLEATING MACHINE

Pollard V. Wisdom, Great Neck, N.Y., assignor, by direct and mesne assignments, of one-fourth each to Lacy Wisdom, Marshalls Creek, and Newton K. Savage, Parker Ford, Pa., and Thomas Lancer, Bethpage, N.Y.

Application March 15, 1957, Serial No. 646,450

4 Claims. (Cl. 270—79)

This invention relates to a sheet folding and pleating machine. More particularly, the invention relates to a machine for successively feeding sheets of paper and the like between creasing blades for forming one or more pleats intermediate the ends of each sheet and for folding together the portions of each sheet lying on opposite sides of the pleats. The pleated sheets of paper and the like are primarily adapted for use as a brief back or a binder for loose leaf pages inserted and secured between the pleats.

The sheets are fed from a stack one at a time between upper and lower creasing blades and an important feature of the invention is the provision of means for supporting the inner portion of the sheet in downwardly directed angular relation against limit means and in engagement with tensioned rollers and conveyor strips operating in timed relation with take off mechanism for removing the pleated sheet.

Another object of the invention is the provision of improved means for pressing together the opposite sides of the pleat after the pleating operation is completed and when the sheet is positioned between the creasing blades and for holding the sheet during the movement of the upper and lower blades to spaced apart relation.

Still another object of the invention is the provision of swingably mounted gripping fingers which function in timed relation with the movement of the sheet pressing and holding means for gripping and swinging the pleated sheet away from the pressing and holding means and for delivering the sheet to a take off conveyor means.

Still another object of the invention is to provide an improved sheet folding and pleating machine which operates at relatively high speed and which functions to expeditiously and economically perform the operation of folding and pleating sheets and the like.

With the foregoing and other objects in view, reference is now made to the following specification and accompanying drawings in which the preferred embodiment of the invention is illustrated.

In the drawings:

Fig. 1 is a side view of a sheet folding and pleating machine constructed in accordance with the invention.

Fig. 2 is a longitudinal vertical sectional view taken approximately on line 2—2 of Fig. 3.

Fig. 3 is a top plan view of the apparatus with the sheet take-off conveyor means removed to show the underlying parts.

Fig. 4 is a vertical cross-sectional view taken approximately on line 4—4 of Fig. 3.

Fig. 5 is a fragmentary top plan view showing the take-off conveyor means.

Fig. 6 is a vertical sectional view taken approximately on line 6—6 of Fig. 5.

Fig. 7 is a horizontal sectional view taken approximately on line 7—7 of Fig. 4.

Fig. 8 is a vertical sectional view taken approximately on line 8—8 of Fig. 4.

Fig. 9 is a side view of one of the heads of the take-off mechanism.

Fig. 10 is a sectional view taken approximately on line 10—10 of Fig. 9.

Fig. 11 is a fragmentary view of one end of the mechanism showing the driving means for the take-off conveyors.

Fig. 12 is an end view of a sheet which is folded and pleated as the same is delivered from the machine for use as a brief back or binder.

The sheet folding and pleating machine includes a frame 10 composed of opposite longitudinally extending side frame members 11 and 12 which are connected together in spaced relation by transversely extending frame members 13 and 14.

Extending transversely of the frame 10 are upper and lower pleating blades. As illustrated, two upper blades and three lower blades are employed. The upper blades 15 are affixed in depending relation to a cross bar 16. The lower middle blade 17 is affixed in upstanding relation to a lower cross bar 18 and the lower outermost blades 19 are affixed to a U-shaped cross bar 20. The upper cross bar is provided with depending bars 21 at the opposite ends thereof, while the lower cross bar is provided with depending bars 22. The depending bars 21 and 22 are disposed in confronting relation at each end and have their inner faces formed with rack teeth 23 which are in meshing engagement with a gear 24 mounted on a stud 25. The upper and lower cross bars 16 and 18 are mounted for vertical reciprocatory movement in guide slots 26 formed in the opposite side frames 11 and 12, while the U-shaped cross bar 20 is mounted for vertical reciprocatory movement on the lower cross bar 18. The upper blades 16 and the lower blades 17 are moved toward and away from each other and for this purpose the depending bars 22 are provided adjacent the ends thereof with cam followers 27 which are disposed in engagement with cam slots 28 of cam disks 28' mounted on the ends of a shaft 29 journaled for rotation in the side frames 11 and 12. The outermost blades have reciprocatory movement imparted thereto by links 30 pivoted to the U-shaped cross bar 20 adjacent the ends thereof on pivot pins 31 and having cam followers 32 on the lower ends thereof disposed in engagement with cams 33 affixed to the shaft 29. The links 30 are formed with slotted portions 34 through which the shaft protrudes for guidedly mounting the links for vertical reciprocatory movement. The cam followers 32 are tensioned against the cams 33 by means of springs 35 secured to the lower ends of the links 30 and anchored at their lower ends to the frame 10 as at 36.

The sheets to be pleated are arranged in a stack on a table 45 and are fed onto tables 46 and 47 between the upper and lower blades. The table 46 is disposed horizontally while the table 47 is directed downwardly in angular relation. The table 47 is formed with a plurality of longitudinally extending laterally spaced slots 48 through which projects rotating endless tapes 49 mounted on rollers 50 and 51 journaled for rotation in the side frames 11 and 12. Also supported by the table 47 are stiff guide straps 52 which are secured to the lower end thereof and with the portions of the straps in the region of the endless tapes disposed in narrowly spaced relation with the table and in the plane with the upper face of the endless tapes. The forward free end 53 of the straps extends upwardly in curved relation to permit of the convenient feeding of the sheets between the table and the straps and into engagement with the endless tapes. The tapes support the sheets and move the same on the table and into engagement with rollers 55 and against a stop 56. The stop 56 extends trans-

versely of the table between the tapes 49 and the same is affixed to a bracket 57 slidably mounted on a rod 58 disposed in parallel relation with the table and with the lower end thereof bent downwardly and secured to the table. The rollers 55 are mounted for rotation on the outer ends of arms 60 pivotally connected with the bracket 57 on a pivot pin 61 and having a coil spring 62 carried by the pin 61 and tensioned against the arm for tensioning the roller and pressing the sheets against the tapes. The bracket 57 is affixed to a longitudinally extending screw 64 which threadedly engages through a head 65 pivoted on a pivot pin and mounted on the upper face of the table 48 for swinging movement of the rollers 55 and stop 56 about the pivot pin 66. The head 65 is provided with interiorly threaded lock members 68 adapted to be turned for locking the screw 64 in set position in the head 65. The screw 64 is adjustable longitudinally of the head 65 for disposing the stop 56 in the desired position with reference to the table 47.

With the movement of the upper and lower blades to crease and pleat a sheet, the sheet is engaged by holding means which retains the sheet with the pleated and folded portion thereof disposed in position between the blades.

The holding means consists of a pair of oppositely disposed arms 71 arranged at each side of the frame. The upper ends of the arms 71 are curved inwardly and the arms of each pair are connected together by rods 72 on which rubber coated rollers 73 are rotatably mounted. The arms are also inwardly directed at their lower ends and each pair is pivoted to a link 74 which is pivoted on a pin 75 to an arm 76 of a crank 77. The cranks 77 are located in close relation to the inside faces of the side frames 11 and 12 respectively and are pivoted for rocking movement on pins 78 extending inwardly from the frame members respectively. The cranks 77 have arms 79 which are pivotally connected on pins 80 to rods 81 having heads 82 formed with slots 83 through which a cross shaft 84 extends with the ends of the shaft journaled for rotation in the side frames 11 and 12. Cams 85 are affixed to the shaft 84 and are engaged by cam followers 86 rotatably carried by the heads 82 respectively for effecting rocking movement of the cranks 77 and upward and downward movement of arms 71 with the rotation of the cross shaft 84.

The arms 71 at each side extend through guides 88 affixed to the side frames to effect inward swinging of the upper ends of the arms with the downward movement of the arms against the tension of expansion springs 89 which bias the arms apart. The arms move downwardly in timed relation with the movement of the upper and lower blades to effect engagement of the rollers 73 against the portions of the sheet overlying the outer blades 19 substantially coincident with the creasing and pleating operations. With the completion of this operation the rollers 73 grippingly engage the sheet and retain the same in position during the movement of the upper and lower blades to separated relation out of engagement with the sheet. The folded sheet is then engaged by a take-off mechanism which lifts the pleated and folded sheet from the tables 46 and 47 and conveys the same upwardly in folded relation to an endless conveyor for removing the pleated and folded sheet from the machine.

The take-off mechanism includes laterally spaced pairs of gripping spring fingers 91 and 92, each pair being carried by a head 93 affixed to a cross shaft 94 journaled in the side frames 11 and 12. A pinion 95 affixed to the cross shaft 94 is engaged by a reciprocatory rack 96 to effect swinging of the heads 93 in unison. The rack 96 is pivoted to an arm 97 of a crank 98 affixed to a stub shaft 99 journaled in the frame 10. An arm 100 of the crank 98 is provided with a cam follower 101 disposed in engagement with a cam 102 mounted on one end of the cross shaft 29. With the rotation of the cam 102 the rack 96 is caused to move upwardly to thereby

swing the heads 93 on the cross shaft 94 so as to position the fingers 91 and 92 of each pair on opposite sides of the folded and pleated portion of the sheet. This takes place immediately after the upper and lower blades are moved to spaced apart relation and when the folded and pleated portion of the sheet is held between the rollers 73. Coincident with the swinging movement of the heads 93, rollers 105 carried by said heads are engaged by swinging arms 106 to thereby move the gripping fingers 92 into a clamping relation to clamp the folded portion of the sheet between the fingers 92 and 93. The heads 93 are then swung rearwardly by the downward movement of the racks 96 to thereby deliver the folded sheet to take-off conveyor means. With the delivery of the sheet to the take-off conveyor means, the arms 106 swing free of the rollers 105 so as to release the gripping fingers 92 which are moved away from the fingers 91 of the heads by springs 104 to thereby release the folded sheet. The take-off conveyor means includes a plurality of sets of upper and lower endless conveyors 120 and 121 arranged with the conveyors in each set disposed in spaced relation for receiving the folded sheets therebetween as shown in Figs. 1, 2, 5 and 6 of the drawings. The conveyors 120 are arranged on rollers 122 and 123 while the conveyors 121 are arranged on rollers 126 and 127. The rollers 122, 123 and 127 are mounted on shafts 124, 125 and 129 supported by the frame 131 as shown in Figs. 2, 5 and 6. The rollers 126 are spaced apart for receiving between adjacent rollers the heads 93 carrying the fingers 91 and 92 and said rollers are mounted on short shafts 128 journaled in bars 133 supported by the frame 131.

The arms 106 are affixed to a cross shaft 108 journaled at its ends in the side frames 11 and 12. The cross shaft 108 is provided with an arm 109 to which a rod 110 is pivoted at its upper end. The rod 110 is pivotally connected at its lower end to an arm 111 of a crank 113 provided with a cam follower 114. The cam follower is disposed in engagement with a cam 115 mounted on the cross shaft 29 for swinging the arms 106 with the rotation of said cross shaft. The crank 113 is mounted on a cross shaft 116 journaled in the side frames 11 and 12.

The gripping finger 92 of each head 93 is affixed to the outer end of a slotted bar 117 having a rounded free end 132. The slotted bar 117 is slidable in notches 118 in spaced shoulders 119 affixed to its head 93 with the shoulders extending through the slot in the bar 117. A rod 103 is slidably mounted in aligned apertures in the shoulders 119 and has a spring 104 thereon disposed between one of the shoulders 119 and a stop 135. The spring 104 tensions the enlarged end of the rod 103 against the rounded end 132 of the bar 117. Each of the rounded ends 132 engage a cam 134 which retains the finger 92 in open relation with reference to the finger 91 until the head 93 is swung forwardly to permit the spring 104 to move the finger 92 into adjacent relation with the finger 91 after which the rollers 105 are engaged by the arms 106 as hereinbefore described. The cams 134 are affixed to a cross member 135 affixed at its ends to the side frames 11 and 12.

The sheet folding and pleating mechanism is driven by an electric motor 140. A belt 141 is trained over the driving wheel 142 of the electric motor and over a driven wheel 143 mounted on a cross shaft 144 journaled in bearings in the side frames 11 and 12. The cross shaft 144 constitutes the drive shaft for turning the cross shafts 84, 29 and 157 in a clockwise direction as viewed in Figs. 1 and 2 of the drawings. For this purpose the drive shaft 144 and the cross shaft 84 have sprockets 146 and 148 affixed thereto over which is trained a sprocket chain 147. The cross shaft 84 and the cross shaft 29 have sprockets 150 and 152 affixed thereto over which is trained a sprocket chain 151. The drive shaft 144 and the cross shaft 157 have sprockets 154 and 156 mounted thereon over which is trained a sprocket chain 155. The cross

shaft **157** is journaled in the side frames **11** and **12** and on which the roller **50** is mounted for effecting rotation of the rollers **50** and **51** in a clockwise direction as viewed in Figs. 1 and 2 of the drawings. The cross shafts **125** and **129** of the take-off conveyor means are provided with meshing gears **158** and **159** for turning the rear roller **123** in a counter clockwise direction and the roller **127** in a clockwise direction as viewed in Figs. 1 and 2 of the drawings for moving the superposed endless conveyors **120** and **121** for taking off the folded sheets when delivered thereto by the gripping fingers. The cross shaft **129** also has a gear **160** affixed thereto over which is trained a sprocket chain **161** engaging over a sprocket **162** affixed to the cross shaft **157** for effecting rotation of the cross shaft **129** as described.

A folded and pleated sheet A as delivered from the machine for use as a brief back or binder is illustrated in Fig. 12 of the drawings. The back or binder is adapted for receiving pages (not shown) between the pleats B and C. The blades **15**, **17** and **19** may be varied as to thickness and depth for producing different depth and thickness of pleats.

While the preferred form of the invention has been shown and described herein, it is to be understood that the same is not so limited but shall cover and include any and all modifications thereof which fall within the purview of the invention.

What is claimed is:

1. In a machine for transversely pleating a sheet intermediate the ends thereof including oppositely disposed upper and lower creasing blades arranged on opposite sides of said sheet for creasing the same in opposite directions to form a pleated structure, tables arranged forwardly and rearwardly of said creasing blades for supporting a sheet durinng the creasing operation, said rearwardly located table being disposed in rearwardly declining relation, stop means arranged on said table, a plurality of inclined endless conveyors protruding through slots in said rearwardly located table for moving the sheet to be pleated against said stop means, swingably mounted arms arranged on each side of said blades provided with laterally extending members for grippingly engaging the opposite sides of the pleated structure when the sheet is in engagement with the blades, means mounting said arms for reciprocatory up and down linear movement, means for moving said arms downwardly and the upper free ends thereof inwardly in timed relation with the movement of the blades to said interfitted relation to thereby disposed said laterally extending members in holding relation against opposite sides of the pleated portions of said sheet when engaged by said blades, said laterally extending members retaining the folded portion of the sheet in position therebetween during the movement of said blades to separated relation, means for removing the pleated sheet in doubled over relation including gripping fingers mounted for swinging movement into straddling relation with the pleated portion of the sheet, means for swinging said fingers toward and away from said straddling relation, and means imparting relative movement to said fingers for gripping the pleated portion of the sheet when the sheet has been pleated and the blades moved from pleating relation.

2. In a machine for transversely pleating a sheet intermediate the ends thereof in accordance with claim 1 in which the upper ends of the swingably mounted arms provided with the laterally extending members are inwardly directed, and said arms extend through fixed guides for effecting inward movement of said laterally extending members into engagement with the pleated portions of the sheet with the downward movement of said arms.

3. In a machine for transversely pleating a sheet intermediate the ends thereof in accordance with claim 1 in which the gripping fingers consist of spaced pairs, a plurality of spaced sets of upper and lower conveyor means are provided for receiving the pleated sheets from said pairs of fingers with one pair of said fingers movable between adjacent sets of said conveyor means, means controlling the movement of said fingers for moving the fingers apart to thereby release the pleated sheets with delivery thereof to said conveyor means, said means for driving said conveyor means for moving said pleated sheets rearwardly.

4. In a machine for transversely pleating a sheet intermediate the ends thereof in accordance with claim 1 in which the rearwardly declined table is provided with a plurality of stiff straps affixed thereto at their lower ends with the remaining portion of said straps spaced from said table and extending longitudinally of said inclined conveyors and with said straps disposed substantially in the plane of the upper faces thereof for receiving the outer end of the sheet between said inclined conveyors and said straps and for retaining the sheet against said stop.

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