Sept. 15, 1936. W. G. REYNOLDS ET AL 2,054,167

BOOK FOLDING MACHINE

Filed Jan. 8, 1935 5 Sheets-Sheet 1

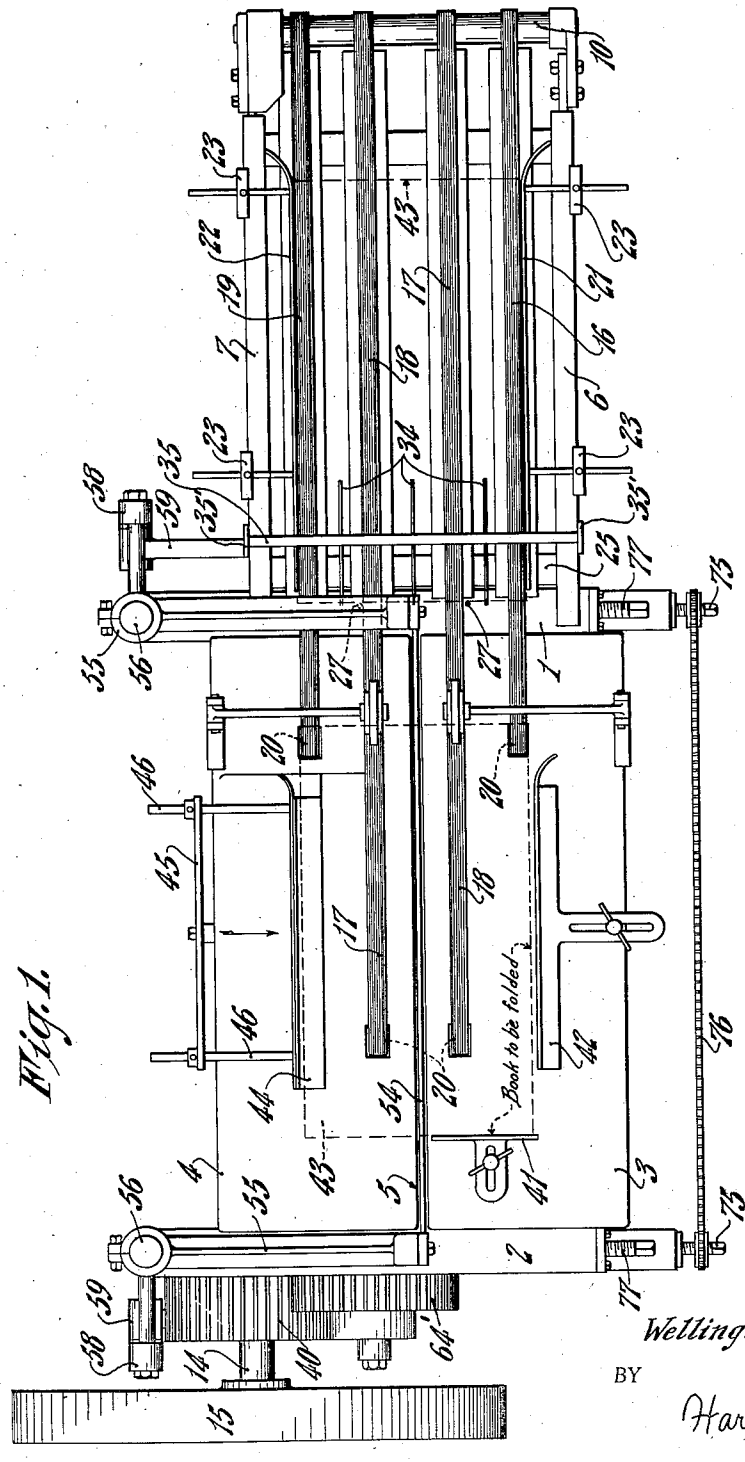


Fig. 1.

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BOOK FOLDING MACHINE

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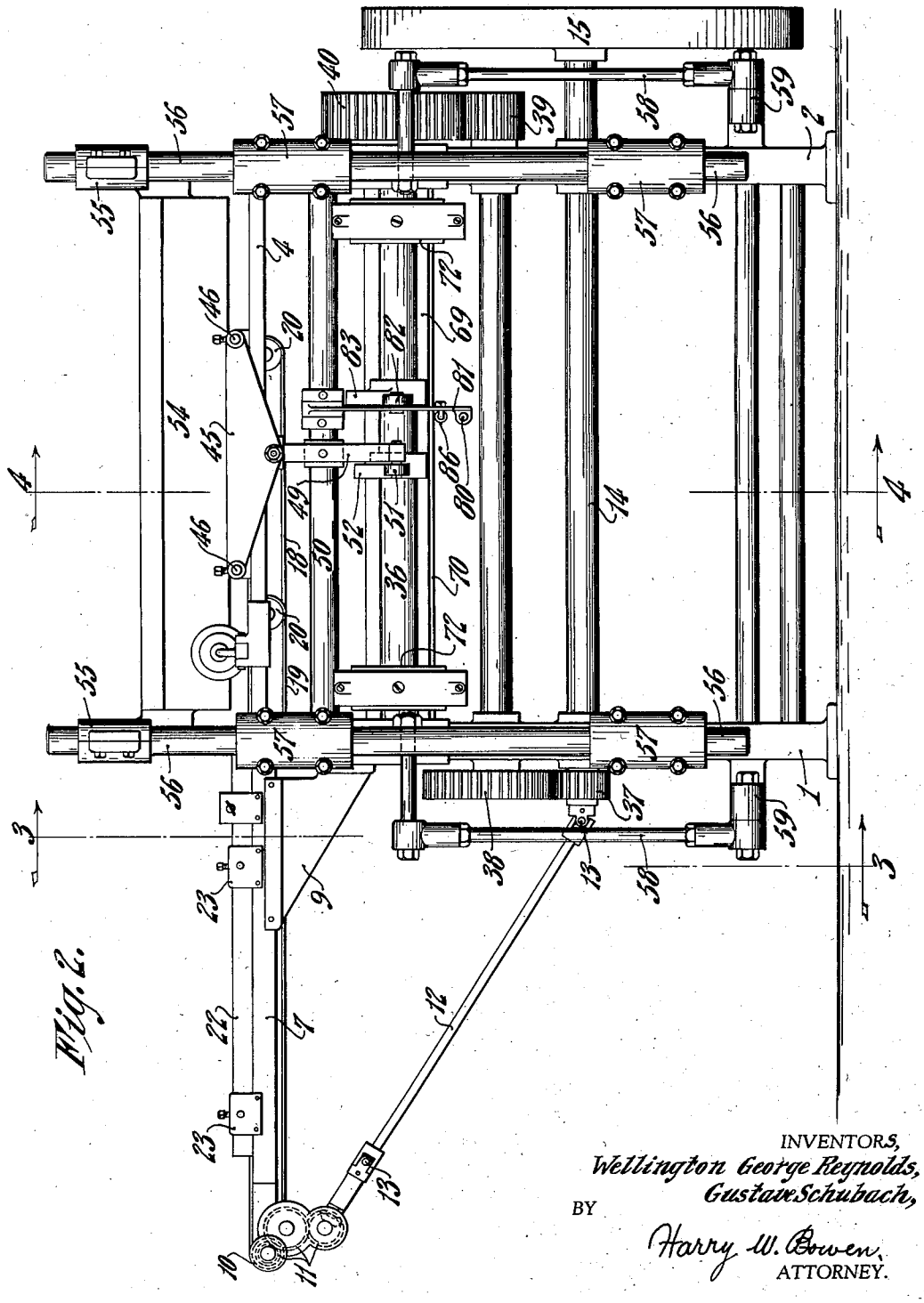


Fig. 2.

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BOOK FOLDING MACHINE

Filed Jan. 8, 1935 5 Sheets-Sheet 3

Fig. 3.

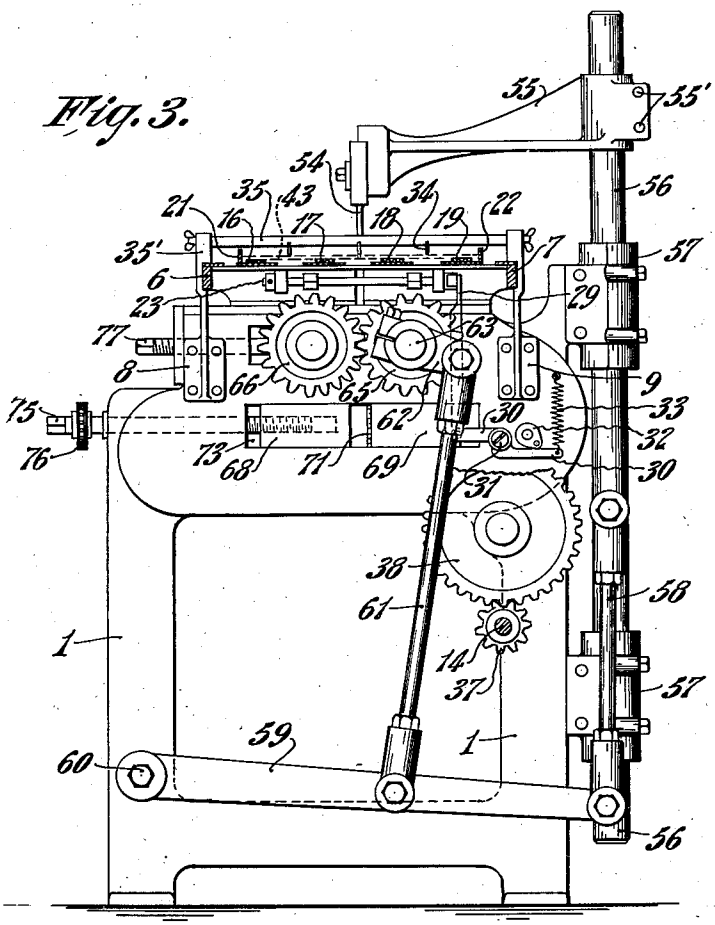


Fig. 8.

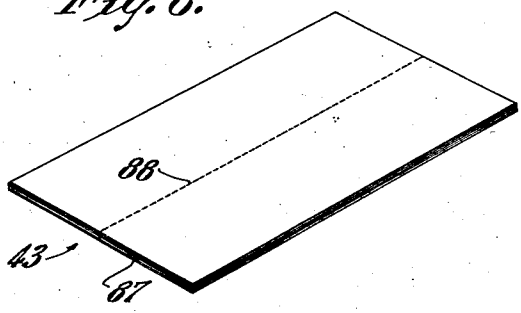
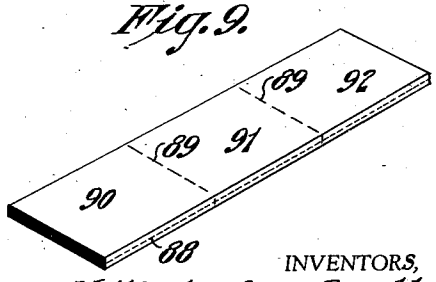


Fig. 9.



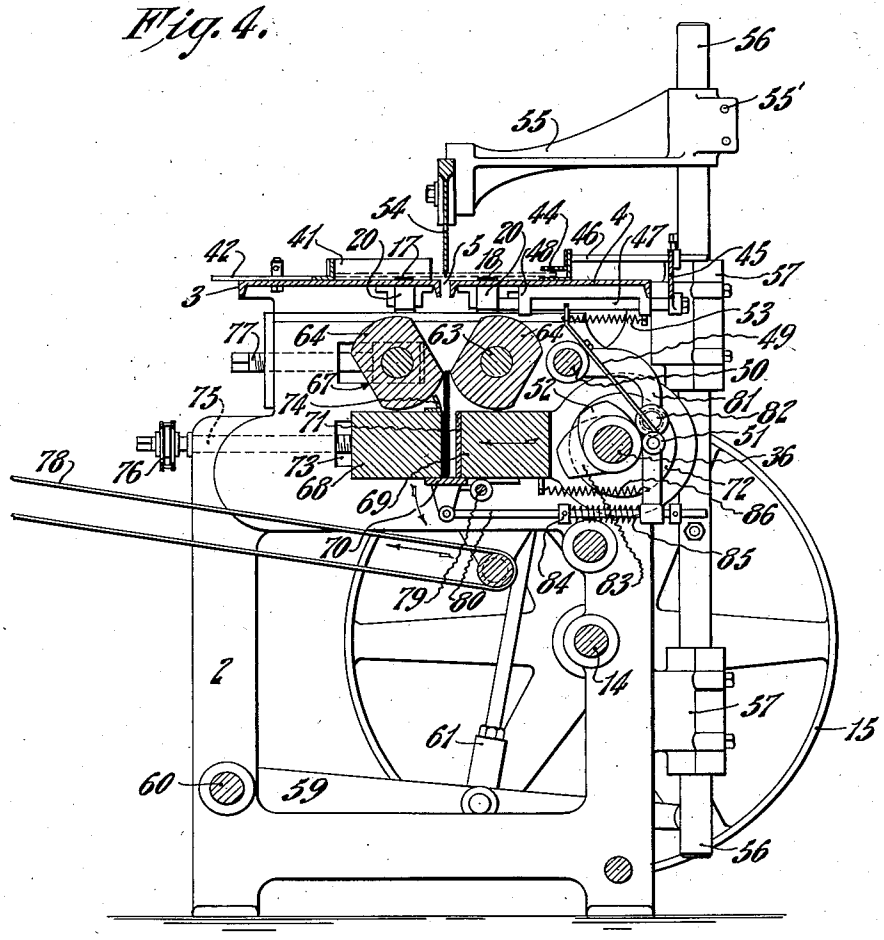
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BOOK FOLDING MACHINE

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Fig. 4.



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BOOK FOLDING MACHINE

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Fig. 5.

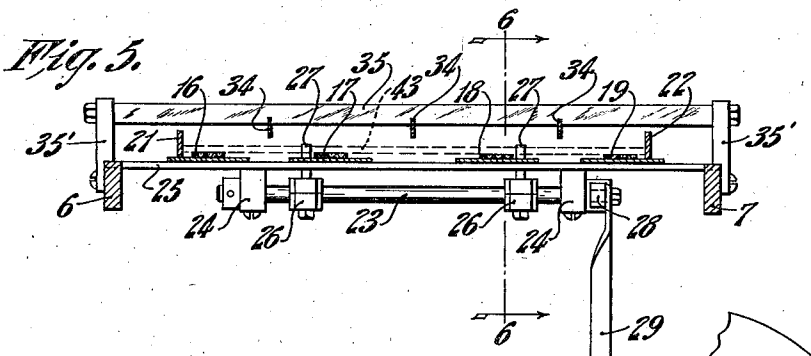


Fig. 7.

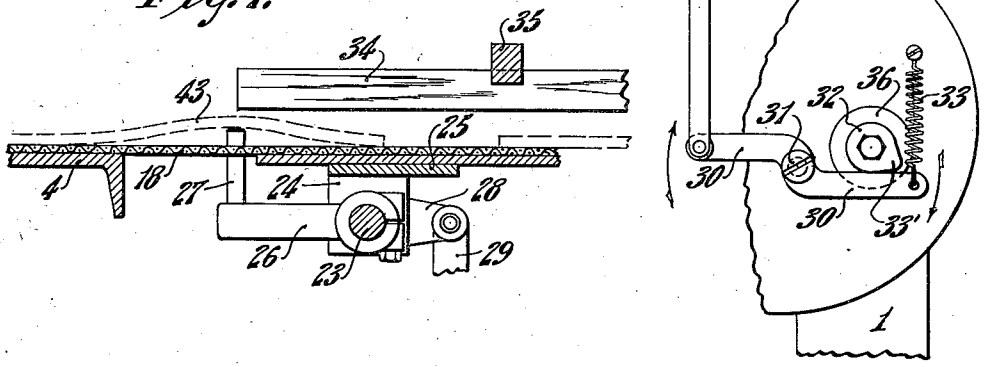
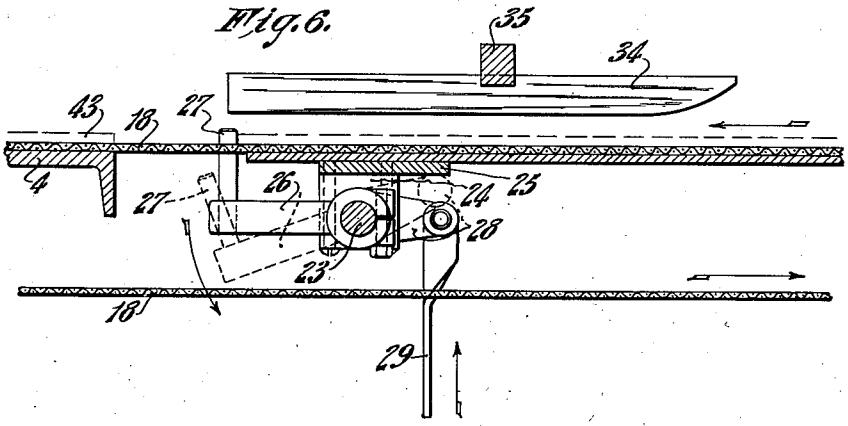


Fig. 6.



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Patented Sept. 15, 1936 2,054,167

UNITED STATES PATENT OFFICE

2,054,167

BOOK FOLDING MACHINE

Wellington George Reynolds and Gustave Schubach, Holyoke, Mass., assignors to The Reynolds Manufacturing Company, Holyoke, Mass., a corporation of Massachusetts

Application January 8, 1935, Serial No. 840

8 Claims. (Cl. 270—83)

Our invention relates to improvements in book folding machines, and more particularly to that type of book folding machine adapted for use in the manufacture of blank books and note books, similar to those in use extensively in our public schools, as well as private schools and colleges.

An object of our invention is to provide a book folding machine which will automatically fold the book, and press, or "set", the fold, after the book has been folded, so that the folded books may be stacked, or piled, conveniently, without tipping, or sliding.

A further object of our invention is to provide such a machine, which may be used efficiently, as an individual unit, or in co-operation with book stitching or stapling machines, and also, in co-operation with book binding, or taping machines.

This invention is also an improvement in the folding unit of the book stitching and folding machine disclosed in Patent #1,937,979, issued to Wellington George Reynolds, dated December 5, 1933.

It has been customary, in the trade, to use a separate machine for folding the books and a separate, or different machine, for pressing the books, after folding, requiring manual handling from one machine to the other, between these operations. It is an object of this invention to combine the operations of folding and pressing in a single machine.

These, and other objects and advantages of our invention, will be more completely disclosed and described in the specification, the accompanying drawings, and the appended claims.

Broadly, our invention comprises a machine having a folding table, provided with a folding slot, carrier belts for conveying the leaves of a book to be folded onto the folding table, a folding blade, means for operating the blade for forcing the leaves of a book through the folding slot and thereby folding the same, adjustable and movable press blocks below the folding table, means for positioning the folded book between the press blocks, feed rolls for moving the folded book from the folding slot to the positioning means, means for operating one of the press blocks for pressing the folded book, and carrier belt for removing the folded and pressed book from the machine.

A preferred embodiment of our invention is illustrated in the accompanying drawings, in which:—

Fig. 1 is a plan view of the machine.

Fig. 2 is a rear elevational view.

Fig. 3 is a sectional view on the line 3—3 of Fig. 2.

Fig. 4 is a sectional view on the line 4—4 of Fig. 2.

Fig. 5 is a detail view, illustrating the mechanism for holding the leaves and cover of a book stationary on the carrier belts, until the proper time for moving the book onto the folding table.

Fig. 6 is a sectional view on the line 6—6 of Fig. 5.

Fig. 7 is a view similar to Fig. 6, showing the stop pins raised, before the book has completely passed them.

Fig. 8 indicates the unfolded book, and

Fig. 9 indicates the leaves of a folded book, before it is cut into the required book lengths.

Referring now to the drawings in detail, in which like numerals refer to like parts throughout:—

Frames 1 and 2 have supported thereon plates 3 and 4, (see Figs. 1 and 4), which are spaced from each other to form a folding slot 5. The plates 3 and 4 co-operate to form a folding table upon which the leaves and cover of a book, to be folded, may be placed ready for the folding blade. Side frames, or arms 6 and 7, secured on the frame 1 by brackets 8 and 9 (see Fig. 3), support a belt roll 10. The roll 10 is driven, by means of gears 11, shaft 12, and universal joints 13, from a main drive shaft 14, supported in the frames 1 and 2, and having mounted thereon a drive pulley 15. Carrier belts 16, 17, 18, and 19, supported between the roll 10 and idler rolls 20, revolvably secured on the under side of the plates 3 and 4, provide means for conveying the leaves and cover of an unfolded book, shown in Fig. 8, with stitches 88, placed therein, onto the plates 3 and 4. Side guide plates 21 and 22, (see Fig. 5), adjustably secured in brackets 23, are arranged to accommodate any desired width of unfolded book. In operation, when an unfolded book, as shown in Fig. 8, is placed on the carrier belts 16, 17, 18, and 19, between the upright guides 21 and 22, it will be moved by the belts toward the folding table, comprising the plates 3 and 4, having the slot 5 in which a folding blade operates.

In order to properly time the arrival of an unfolded book on the folding table, movable stop pins, or studs 27, are provided against which the forward edge of a book, approaching the folding table, impinges, thus holding the book back, until the stop pins are moved out of engagement with the unfolded book. The construction and operation of this timing mechanism is best illustrated in Figs. 5, 6, and 7. A shaft 23', revolvably secured in bearing members 24, secured on a plate 25, supported on the frame members 6 and 7, has

secured thereon arms 26 in which the pins, or studs 27, are secured, which are normally positioned to project above and at the side of the belts 17 and 18, as indicated in Figs. 5, 6, and 7. A crank 28, secured on the shaft 23', is operatively connected by a link 29 to an oscillating two-arm lever 30, pivotally secured on the frame 1 at 31. One arm of the lever 30 is held against the surface of a cam 32 by a contractile spring 33. When the extended portion 33' of the cam 32 engages the lever 30, the shaft 23' is oscillated to bring the studs 27 below the carrier belts, as shown by dotted lines in Fig. 6, which are then free to carry the unfolded book onto the folding table 3 and 4. In order to provide for varying lengths of books, this operation is timed to bring the studs 27 back into holding position, before a book, being carried to the folding table, has completely, or fully, passed over them, as indicated in Fig. 7. This arrangement also insures that, if adjoining, or following books, are closely spaced, or even butted together, the following book will be stopped by the raised studs 27. Depending guide bars 34, secured on a cross bar 35, supported on the members 6 and 7 by the posts 35', will prevent a book from "jumping", or passing over, the pins 27. The cam 32 is secured on an end of a cam shaft 36, which is operatively connected to the drive shaft 14 by gears 37, 38, 39, and 40. (See Figs. 2 and 3.)

As an unfolded book 43 is released by the stop pins, or studs 27, it is carried onto the plates 3 and 4, by the belts 16, 17, 18, and 19, and is stopped in proper position by a stop plate 41 adjustably secured on the plate 3. (See Fig. 1). The end stop member 41, and a side guide member 42, also adjustably secured on the plate 3, may be set to the exact dimensions of the book to be folded. After an unfolded book 43, indicated by dotted lines in Fig. 1, has been carried against the end stop member 41, a movable centering member 44 is moved against the edge of the book to push it against the member 42, thus accurately centering the book over the folding slot 5. As shown in Fig. 4, the centering member 44 is adjustably secured to a plate, or bracket 45, by arms 46. The plate 45 is secured on a bar 47, which is slidably supported in bearings 48, on the under side of the table plate 4. An operating lever 49, pivotally supported on a shaft 50, is operatively connected to the bar 47, and bears a cam roll 51 which is maintained in operative engagement with a cam 52 by a contractile spring 53. The cam 52, through the roll 51 and lever 49, moves the bar 47 to slide the guide 44 forward and backward on the table plate 4.

After the unfolded book 43 has been properly positioned on the folding table by the members 41, 42, and 44, a folding blade 54 is caused to descend, engage the leaves and cover of a book on its center line, and force the leaves and cover of the book through the folding slot 5. The blade 54 is secured in bracket members 55, which are adjustably secured, by means of the bolts 55', on vertical shafts 56 that are slidably supported in bearing boxes 57 on the frames 1 and 2. The shafts 56 are connected, by link members 58, to operating arms 59, which are pivotally secured at 60 on the frames 1 and 2, as shown in Fig. 4. The arms 59 are actuated by links 61, connected to cranks 62, secured on a feed roll shaft 63, which is operatively connected to the drive shaft 14 through gears 64 and 40. As the shaft 63 revolves, the arms 59 are caused to oscillate, thus moving the shafts 56 up and down, and raising and lowering the folding blade 54.

After passing through the folding slot 5, the folded book is then engaged by feed rolls 64, operably connected by gears 65 and 66, and the feed rolls 64 then carry the folded book downwardly between the faces of the two press blocks 68 and 69, until its folded edge rests upon a gate member 70. The rolls 64 are formed with flat sides 67, for the purpose of providing a dwell period during the operation of the press blocks 68 and 69. The movable press block 69 is provided with a leather facing 71, and is operably connected to the cam shaft 36 by bearings 72, eccentrically positioned on the shaft 36. As a folded book comes to rest on the gate member 70, the press block 69 is moved forwardly, toward the block 68, by revolution of the cam shaft 36, until pressure is exerted on the book between the faces of the blocks 68 and 69. The blocks 68 and 69 are slidably supported in slots 73, formed in the frames 1 and 2. The book, as it passes between the rolls 64, is guided into the space between the blocks 68 and 69 by a guide strip 74, secured on the top of the block 68. Adjustment of the block 68 is provided by means of adjusting screws 75, which are caused to move simultaneously by a connecting chain 76, for the purpose of maintaining the face of the block 68 parallel to the face of the block 69. The pressure exerted on a book, by the feed rolls 64, may be varied by adjusting screws 77. These adjusting means for the block 68 and rolls 64 also provide for variations in the thickness of the books.

After the folded book is pressed, the gate 70 is opened to permit the book to drop through onto a carrier belt, or belts 78, which will remove the folded and pressed book from the machine. The gate 70 is pivotally secured by hinge members 79 to the movable block 69, and has secured thereto an operating rod 80. A cam arm 81, pivotally supported on the shaft 50, and carrying a cam roll 82, which is engaged by a cam 83 on the shaft 36, is slidably connected on the rod 80. A compression spring 85, on the rod 80, between the arm 81 and a collar 84, fixed on the rod 80, provides a medium for actuating the gate 70 and at the same time, for compensating for the relative movement of the block 69 and cam 83, due to the different timing required for each. A contractile spring 86, secured to the arm 81 and the block 69, holds the cam roll 82 in engagement with the cam 83.

In operation, an unfolded book 43 is laid, or otherwise placed, on the carrier belts 16, 17, 18, and 19, and is carried toward the folding table, until halted by the studs 27, which hold it stationary, until the folding blade 54 is raised above the folding table. The stop pins, or studs 27, are then actuated, or lowered, to release the unfolded book, which is carried onto the folding table against the plate 41 by the carrier belts, and centered laterally over the folding slot 5 by the stops 41 and 42 and the centering member 44. The blade 54 then descends, carrying the book with it, through the folding slot 5 and thus folding the book, which is then picked up by the feed rolls 64 and deposited on the gate 70, between the blocks 68 and 69. The press block 69 is then moved forwardly, pressing the book between itself and the block 68, and then moved back again to free the folded and pressed book. The gate 70 is then opened to permit the book to drop, or slide, down onto the removing belt 78.

Fig. 8 shows the leaves 87 of the unfolded book

with a center line of stitches 88. Fig. 9 shows the leaves folded on the center line of stitches. The lines 89 indicate the lines where the folded leaves are to be cut, in order to form three of the folded books, 90, 91 and 92.

What we claim is:—

1. In combination, in a book folding machine, a frame member, a table on the frame formed with a slot, a plurality of conveyor members on which the leaves of a book to be folded are placed, means for operating the conveyor members for transferring the leaves onto the slotted table, automatic means for positioning the leaves to be folded on the said table both laterally and transversely with reference to said slot, a folding blade located over the slot for engaging the leaves for moving the same through the slot for effecting the folding of the leaves, means for operating the folding blade, means comprising a fixed and a movable block member for compressing the folded leaves, and gate means on the movable compressing block for releasing the folded leaves after being compressed.

2. In a book folding machine, a folding table formed with a slot, a folding blade, means for moving the blade into and out of the slot, means for conveying leaves of a book to be folded onto said table, intermittent stop means for limiting the movement of the leaves on the table and on the conveyor means, feed roller means with flat surfaces below the slot for advancing the folded book, automatic book pressing means below the feed roller means, and a gate device for discharging the folded book after the pressing operation.

3. In combination, in a book folding machine, a slotted table, means for moving the leaves of a book onto the said table, a folding blade operable in the slot, feed rollers adjacent the slot and each formed with a flat and curved surface for producing a dwell in the movement of the book during its passage through the rolls, and means for compressing the book during the dwell after its delivery from the feed rolls.

4. In a book folding machine, a slotted folding table, on which the leaves of a book to be folded are placed, press means, blade means operable in the slot for moving the leaves through the slot for folding the same, roller means for advancing the folded book to the press means, means for operating the press means, stop means for preventing the folded book from passing beyond the press means before the press means are operated, means for removing the stop means after the press means is operated, the book advancing means being formed with curved and flat surfaces to provide a dwell period while the press means is being operated, and operative connecting means between the roller means and the blade means.

5. In a book folding machine, a slotted folding table, on which the leaves of a book to be folded are placed, press means, blade means operable in the slot for moving the leaves through the slot for folding the same, roller means for advancing the folded book to the press means, means for operating the press means, stop means for preventing the folded book from passing beyond the press means before the press means are operated, means for removing the stop means after the press means is operated, the book advancing means being formed with curved and flat surfaces to provide a dwell period while the press means is being operated, operative connecting means between the roller means and the blade means, and means for simultaneously moving the opposite ends of one of the press means an equal distance, whereby equal pressure is maintained during the pressing operation.

6. In a machine for the purpose described, a folding table provided with a slot, a folding blade, means for moving the blade into and out of the slot, feed rolls below the slot, opposed fixed and movable press blocks slidably supported below the feed rolls, spaced and connected means for adjusting one of said blocks relative to the other and at the same time maintaining the face of the adjustable block parallel to the face of the opposing block, and intermittent means for moving the opposing block toward and away from the adjustable block.

7. In a book-folding and pressing machine, a table formed with a slot to receive the leaves of a book to be folded, means for moving the leaves through the slot for folding the same, a pair of feed rolls below the slot to receive and advance the folded leaves, two compression members below the feed rolls to receive the folded leaves, one of the compression members being adjustable, the other being mounted for movement toward and away from the adjustable member, a gate carried by the movable compression member, and resilient means for controlling the gate as the movable compression member is operated.

8. In a machine for the purpose described, a pair of compression members, means for simultaneously adjusting the opposite ends of one of the members, means for moving the other compression member towards and away from the adjusted member, gate means on the movable compression member for normally closing the space at the lower sides of the compression members, means for opening the gate means, and compensating means for controlling the gate relative to the movement of the movable compression member.

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