

(No Model.)

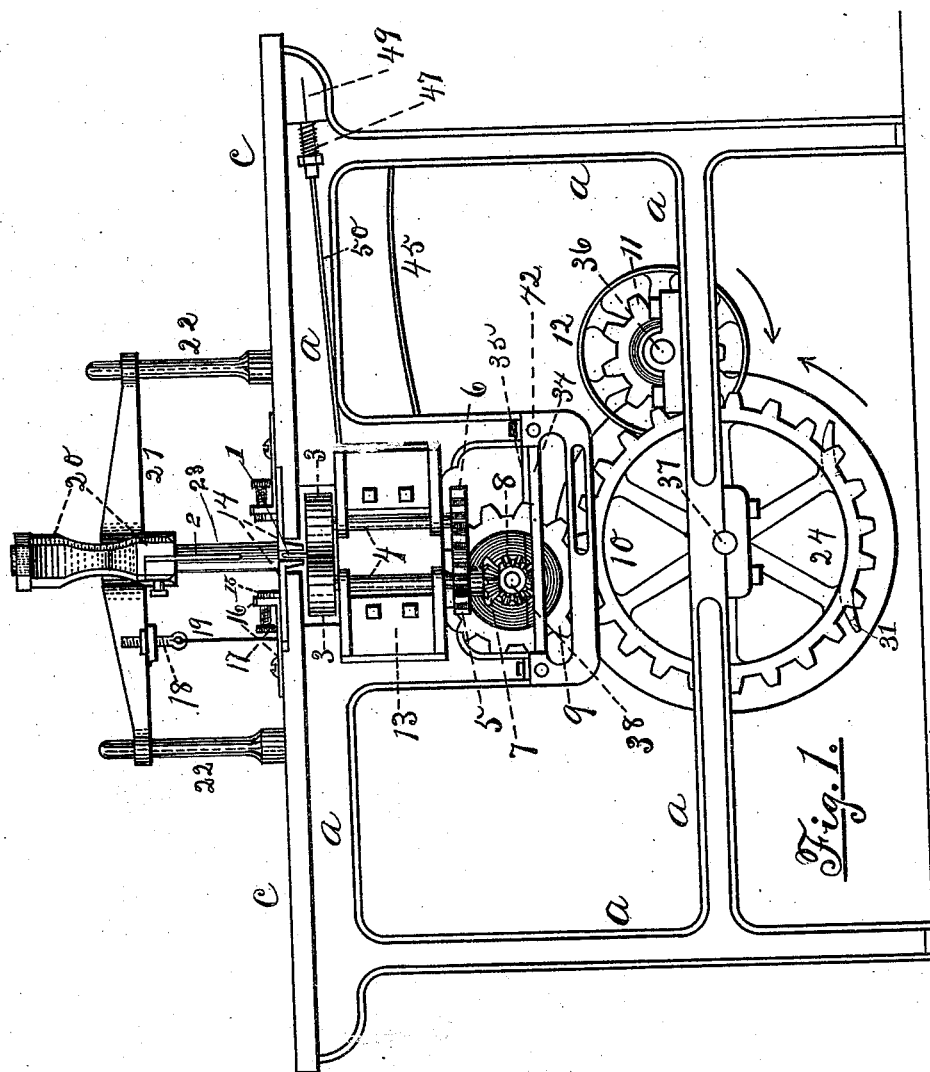
4 Sheets—Sheet 1.

E. T. HAZELTINE & F. A. WELD.

BOOK FOLDING MACHINE.

No. 345,506.

Patented July 13, 1886.



Witnesses:  
Edward B. Grimes  
Robert Johnson

Inventors:  
Ezra Taylor Hazeltine,  
Frank A. Weld,  
per E. P. Robbins, M. E., Att.

(No Model.)

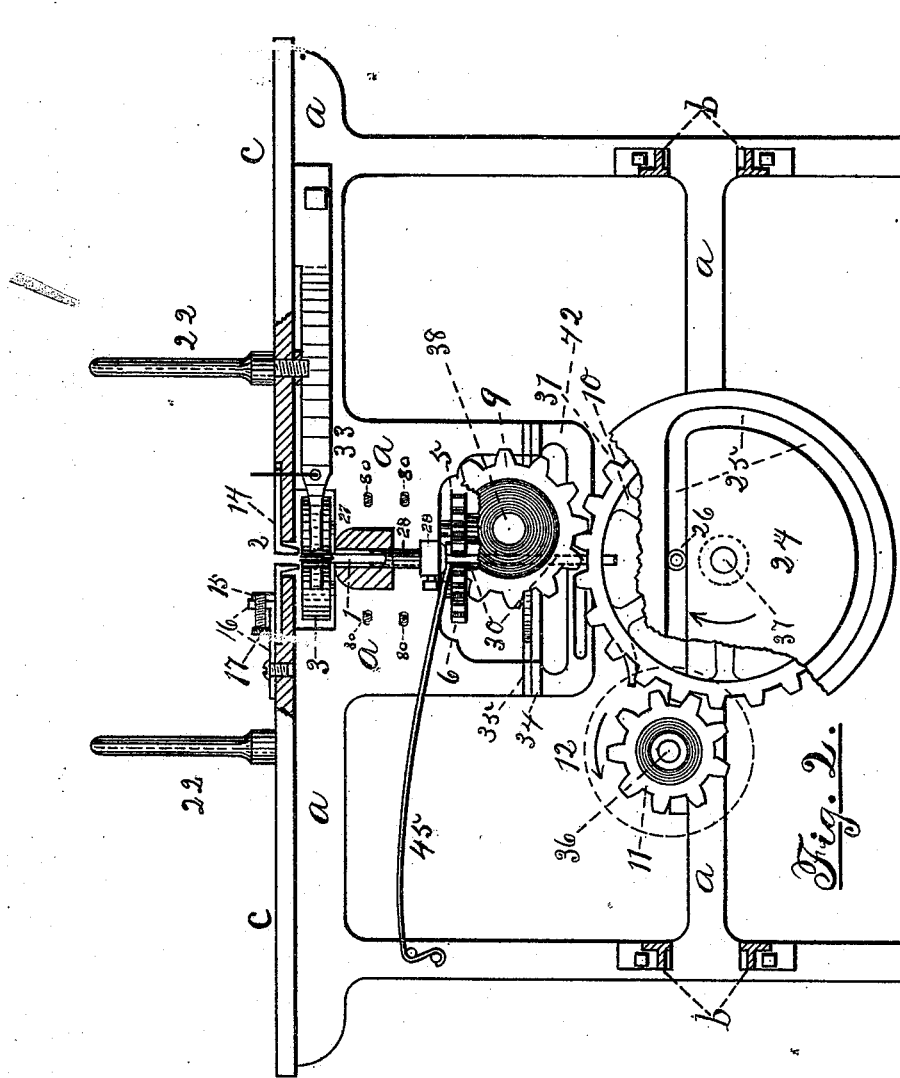
4 Sheets—Sheet 2.

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Witnesses:  
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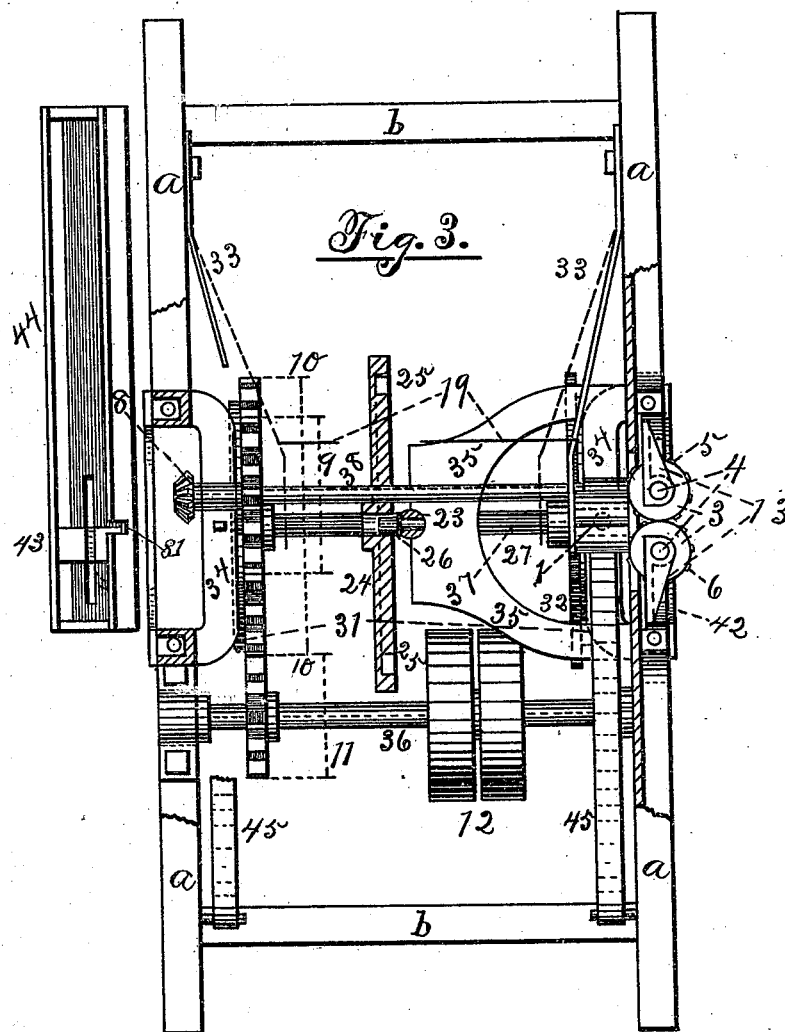
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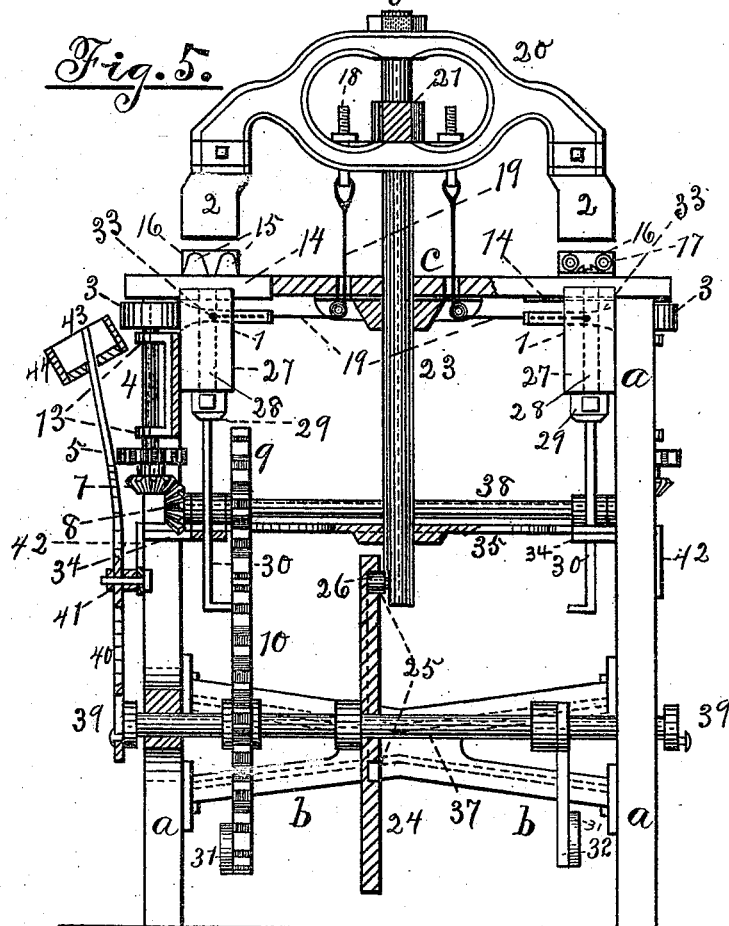
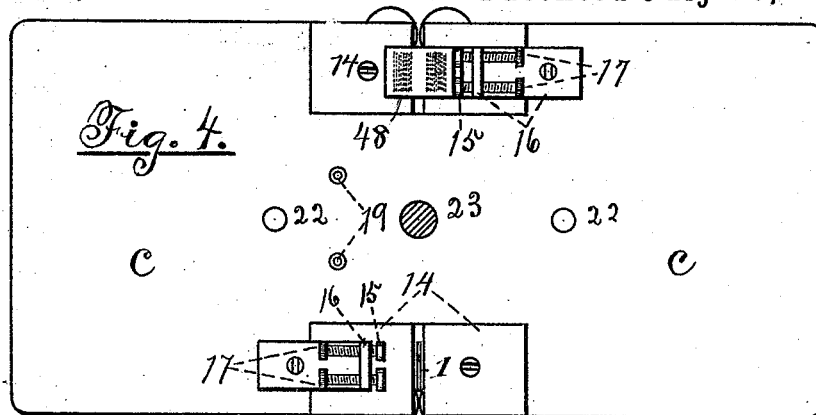
Inventors:  
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# E. T. HAZELTINE & F. A. WELD.

## BOOK FOLDING MACHINE.

No. 345,506.

3. Patented July 13, 1886.



Witnesses:  
Edward B. Grimes.  
Robert J. Hines

Inventors:  
Ezra Trazlor Hazeltine,  
Frank A. Weld,  
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# UNITED STATES PATENT OFFICE.

EZRA TAYLOR HAZELTINE, OF WARREN, PENNSYLVANIA, AND FRANK ALBERT WELD, OF STANTON, NEBRASKA.

## BOOK-FOLDING MACHINE.

SPECIFICATION forming part of Letters Patent No. 345,506, dated July 13, 1886.

Application filed April 23, 1884. Serial No. 198,907. (No model.)

*To all whom it may concern:*

Be it known that we, EZRA TAYLOR HAZELTINE and FRANK ALBERT WELD, citizens of the United States, residing, respectively, at Warren, in the county of Warren and State of Pennsylvania, and at Stanton, in the county of Stanton and State of Nebraska, have invented a new and useful Book-Folding Machine, of which the following is a specification.

Said book-folding machine, although complete in itself as a folding-machine, is used in connection with a book-pasting machine of our invention, which is also complete in itself; but the functions of these two (2) machines are intimately connected in the process of manufacturing books or pamphlets, said process being also new and constituting one of the three (3) elements of our entire invention and the above two (2) machines the other two (2) elements.

The object of our entire invention is to cheapen the manufacture of small books. The kind of books especially intended are small pamphlets with flexible covers—such as almanacs, advertising-circulars, &c.

The method or process of manufacturing is completely set forth in a separate application.

There are four plates of drawings with five figures illustrating our improved book-folding machine.

Figure 1 is a side elevation; Fig. 2, a longitudinal sectional elevation from the side opposite that shown in Fig. 1, the cross-heads 20 and 21 being removed; Fig. 3, a plan of the machine with the top removed, and partly in section; Fig. 4, the plan of the table, and Fig. 5 an end elevation, partly in section.

The sections are not intended as continuous sections through certain parts of the entire machine at certain locations, but parts are shown in section or shown removed in the different views, as will enable the construction and operation to be well shown and explained.

The same letters or numerals designate the same parts in all of the figures.

The letters *a a* designate the side-frame castings of the machine, and the letters *b b* the cross-frame pieces. Where no particular methods, or none at all, are shown for fastening one part to another, ordinary methods of fastening similar parts together are presumed.

An operator sits on each side of the table of the folding-machine and places one of the flattened-out books, back downward, upon the guide-plate 14 at the time the cross-head 20 is elevated. When the cross-head descends, the vertical blade 2, which is carried by the latter, strikes the book along the fold-line and presses it down upon a vertical blade, 1, which is held in a position such that its top edge is just below the book-back. The lower edge of the upper blade, 2, is chamfered to correspond to a groove along the upper side of blade 1, and the two (2) blades come close enough together for the upper blade to press the book at the fold-line into the said groove of the lower blade, 1, and to clamp or pinch the book. The motions of the two (2) blades thereafter are coincident and downward. They consequently draw the book downward between the guides, (shown on the guide-plates 14,) and sufficiently far that the fold-line of the book may be in a horizontal line passing between the rollers 3. The blades 1 and 2 then release their hold upon the book and separate, blade 2 ascending, leaving the book folded loosely between the guides 14. As soon as blade 2 has risen sufficiently a spring, 33, pushes the book endwise until it is grasped between the rollers 3, which rotate toward each other in a direction outward from the center of the table. One of the rollers is pressed against the other by means of a spring, (shown at 47 in Fig. 1.) Consequently the book in passing between the said rollers is pressed along the line of the fold. The books are delivered from the rollers into trays 44, attached in a suitable manner to the sides of the machine. One only is shown in the drawings. The books are shoved along in the trays automatically by means of the blocks 43. There are three (3) principal shafts running crosswise of the machine—viz., 36, 37, and 38. Upon shaft 36 are the belt-pulleys 12, for the driving-belt; also a pinion, 11, which engages with a spur-wheel, 10, on shaft 37. The said spur-wheel in turn engages with a smaller spur-wheel, 9, upon shaft 38. The cross-head 20 is fastened to the upper end of a vertical shaft, 23, which slides up and down through guide-bearings in the table-top *c c*, and in the cross-frame plate 35, and is guided

by the cross-head 21 sliding upon the posts 22. Said shaft 23 is operated by means of a disk-cam, 24, upon the shaft 37. A groove, 25, is made in one face of the disk, and a roller, 26, turning about a pin projecting from the lower end of shaft 23, is made to roll along the groove as the disk rotates. One part of said groove 25 follows the arc of a circle, while the remaining portion follows a chord of that circle. As the disk moves in the direction of the arrow in Fig. 2, the roller 26 and consequently the shaft 23, are elevated from the position in Fig. 2 to the position shown in Figs. 1 and 5. While the roller is following the circular portion of the groove the cross-head remains elevated. After the roller reaches the end of the circular part it descends along the chord until it reaches its lowest position, as seen again in Fig. 2. The cross-head 20 is one continuous piece divided and spread out at the middle, and having a downward-projecting arm on each side, which carries one of the folding-blades 2. Another cross-head, 21, is placed through the opening of cross-head 20, and is also secured to shaft 23 and at right angles to cross-head 20. Cross-head 21 has eyes at its ends fitted to slide upon vertical guide-posts 22. Said guide-posts are fastened to the top plate or table, *c.* They serve to guide the cross-heads, so that the folding-blades 2 always move in the same vertical planes, and in line. The blades 2 are thin metal plates of the shape shown, and are secured to the cross-head 20 by means of binding-blocks and screws, as seen in Figs. 1 and 5. The springs 33, which serve to push the books between the rollers 3, are fastened to the insides of the side-frame castings, *a.* Said springs are connected by means of strings 19 to adjusting-screws 18, carried by cross-head 21. Said screws pass through a short piece fastened crosswise to the under side of cross-head 21, have eyes at their ends, to which the spring-strings are attached, and nuts above the piece for adjusting the lengths of the strings. The strings 19 pass through holes in the table, and over little pulleys held in a pulley-frame which is fastened to the under side of the table. After the spring has pushed a book between the rollers 3, and before blade 1 is allowed to rise, cross-head 21 draws the strings 19 taut, and pulls the spring back and holds it out of the way until blade 1 rises to its elevated position. When the cross-head descends, the spring is relieved, and, coming in contact with the side edge of blade 1, is held there until the latter is drawn down out of the way again, when it pushes the succeeding book into the rollers. Blade 1 is guided in a slot in a block, 27, which is secured to the inside of the side-frame casting, *a.* Said block 27 has a vertical hole through its center, through which a short stem, 28, can freely slide. The lower edge of blade 1 is secured in a slot in the top of stem 28. The lower end of stem 28 carries a boss, 29, into which the hooked rod 30 is secured by means of a set-screw. Said rod also passes

through and is guided by frame-plate 34. The hook on its lower end engages with a cam-piece, 31, secured to the side of the spur-wheel 10. The corresponding cam-piece for operating the corresponding hook on the opposite side of the machine is carried by a sector, 32, having a boss fastened onto shaft 37. A spring, 45, fastened to one end of the side-frame casting, and having a slot at the free end through which cam-rod 30 passes, presses against the under side of boss 29, and when the hook on cam-rod 30 is disengaged from the cam 31 said spring keeps the blade 1 in its elevated position just beneath the top surface of the table by holding the boss 29 against the bottom of guide-block 27. Blade 2, in descending, then presses the book at the fold-line down upon and into the shallow groove in the top edge of blade 1, and in further descending pushes the book and blade 1, and the parts 28, 29, and 30, attached to the latter, along before it until blade 2 reaches the end of its stroke, the spring 45 in the meantime holding the book firmly against the lower edge of the operating-blade 2. By this means the book is creased along the fold-line, and is left loosely folded between the parallel downward-projecting guides on the guide-plates 14, and when relieved by the separation of the blades 1 and 2 the book is in a position to be pushed endwise by the spring 33 between the rollers 3, which give the book the final pressing and deliver it into the tray 44 at the side of the machine. A slot is made in each side of the table along its cross-center line, and of a width to accommodate the guide-plates 14. One of said plates is inserted into the top of the table on each side of the slot, and with its guiding end projecting down into the slot. Said plates are secured to the table by means of screws, and can be adjusted endwise to leave any desired width of opening between the plates. It is necessary that the flattened book should be placed squarely upon the guide-plates, and so that the fold-line will be in the plane of the folding-blades 1 and 2. In order to enable the operator to readily and certainly so place the books, a device is attached to the guide-plate on the left of the operator, which serves that purpose. It consists of a plate, 16, having a vertical branch, and provided with two (2) milled-headed screws, 17, each of which carries a block, 15, whose lower side coincides with the top surface of the left guide-plate, 14. Plate 16 is secured to the top of the table by means of a screw, and can be adjusted by rotation about the said screw, so that its end may come parallel with the edge of a book to be folded. The screws 17 can be moved independently, and when a book, 48, is placed against the blocks 15 by turning one or the other screw the book may be brought into proper adjustment for folding. The machine works continuously, and the operator has ample time to place a book while the folding-blade 2 remains elevated.

48 in Fig. 4 represents a book properly

adjusted to be folded. The pressing-rollers 3 are fastened to the upper ends of parallel vertical spindles 4, which are supported by the spindle-bearing blocks 13. The bases of the latter are parallel plates, which fit against plane surfaces of slightly-projecting portions of the side-frame castings, *a*. Each said bearing-block is attached to the frame-casting *a* by means of two (2) bolts, as seen in Fig 1, and can be adjusted in position, the bolt-holes being oblong, as seen at 80 in Fig. 2. The one on the right in Fig. 1 is adjusted loosely enough to be under the control of the spring 47, shown placed on the side of the machine. Said spring is coiled around a short pin, which works loosely in a hole in a split block, 49, and has a nut at its outer end for regulating the tension on the spring. A rod, 50, secured in the end of said pin, presses with its opposite end against the edge of the bearing-block. Other forms of springs might be used, which might be attached to the side-frame casting near the bearing-block. One of the roller-spindles has a small miter-wheel on its lower end, which engages with another miter on the end of cross-shaft 38. Said shaft is carried in bearings supported by the side-frame plates, 34, as best seen in Fig. 5. The roller-spindle to which the miter is attached carries a spur-wheel just above the miter, which engages with and drives a similar wheel upon the lower end of the other roller-spindle. The side-frame plates, 34, and the cross-frame plate 35 are secured to the under sides of the pendent branches of the middle portions of the side-frame castings by the same bolts. The slotted side piece, 42, is fastened against the ends of the above frame-castings. A stud, 41, is secured in the slot of side piece, 42, which serves as a support for a vibrating arm, 40, and about which arm 40 oscillates. The lower end of arm 40 is slotted, and a pin in a small disk-crank, 39, slides in said slot and gives the arm an oscillating motion about stud 41. A tray, 44, is attached to the side of the framing *a*, and the books are propelled by the rollers 3 through a slot, 81, Fig. 3, into the tray. The upper end of the arm passes through a slot in the bottom of tray 44, and through a slot in the block 43. Consequently the block 43 is made to reciprocate in the tray, whereby it propels the books along toward the opposite end of the tray. A tin shield is placed over the vibrating arm 40 and its connections to prevent the operator's clothing from catching onto them.

We claim as new and desire to secure by Letters Patent—

1. The combination of the book-adjusting device, consisting of the plate-frame 16, the adjusting-screws 17, and the blocks 15, with the two (2) guide-plates 14, having folding-guides at their adjacent ends, between which a book is to be drawn and guided and held in the process of folding.

2. In a book-folding machine, the folding mechanism consisting of the combination of

the folding-blade 2, the back-acting folding-blade 1, the cross-head 20, the vertical shaft 23, the spring 45, which maintains the back-acting blade 1 elevated, the cam-rod 30, for depressing the back-acting blade 1, the cam 31, the cam-shaft 37, the cam 24, operating the said vertical shaft 23, and the spring 33, connected, as set forth, to the cross-head.

3. The combination of the folding-blade 2, the back-acting folding-blade 1, the guiding-block 27, the stem 28, the cam-rod 30, and the cam 31, the said blades 1 and 2 being operated together and intermittently by means of suitable connecting mechanism, substantially as set forth.

4. The combination of the guide-plates 14, the feeding-spring 33, the pressing-rollers 3, the cross-head 21, guiding-pulleys 82, the flexible connection 19, connecting the said spring 33 with the cross-head 21, and means for transferring a book from the folding-blades to the pressing-rollers.

5. The folding mechanism consisting of the combination of the folding-blade attached to the cross-head of the vertical reciprocating shaft of the machine, the side spring for pushing the book endwise into the pressing-rollers, said spring being connected to the same vertical reciprocating parts as the said folding-blade by means of a flexible connection, as a string, and controlled by said parts, and the back-acting folding-blade controlled by the movements of the upper folding-blade by the resistance of a flat spring and by the action of a cam upon the rod, to which the back-acting folding-blade is attached, and said flat metal spring, and the guide-block in which the back-acting blade is guided, and the stem, to which the blade is attached, and the rod which is acted upon by the cam, and which moves the said stem, and the guide-plates between which the folding-blades operate, and which guide and support the sides of the book in the process of folding.

6. The combination of the folding mechanism consisting of the folding-blade 2, attached to the cross-head of the vertical reciprocating shaft 23, the said cross-head, the shaft 23, the back-acting folding-blade 1, folding guide-block 27, stem 28, cam-rod 30, cam 31, cam-shaft 37, and the cam 24, with the pressing mechanism consisting of the roll-feeding spring, the pressing-rollers 3, parallel spindles 4, and the engaging-pinions 5 and 6, suitable mechanism being provided for communicating motion to one of the said parallel shafts 4, and the cam 24, giving an intermittent motion to the vertical shaft 23, as set forth.

EZRA TAYLOR HAZELTINE.

FRANK ALBERT WELD.

Witnesses as to Ezra Taylor Hazeltine:

CHAS. DINSMOOR,

JAMES CABLE.

Witnesses to signature of F. A. Weld:

LEVI MILLER,

F. MCGIVERIN.

It is hereby certified that in Letters Patent No. 345,506, granted July 13, 1886, upon the application of Ezra Taylor Hazeltine, of Warren, Pennsylvania, and Frank Albert Weld, of Stanton, Nebraska, for an improvement in "Book-Folding Machines," an error appears in the printed specification requiring correction, as follows: In line 86, page 3, the word "and" should read *as*; and that the Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed, countersigned, and sealed this 27th day of July, A. D. 1886.

[SEAL.]

H. L. MULDROW,  
*Acting Secretary of the Interior.*

Countersigned:

M. V. MONTGOMERY,  
*Commissioner of Patents.*