(No Model.) 5 Sheets—Sheet 1.

C. J. BELLAMY & W. E. CRAW.

MACHINE FOR MAKING BOOKS.

No. 539,025. Patented May 14, 1895.

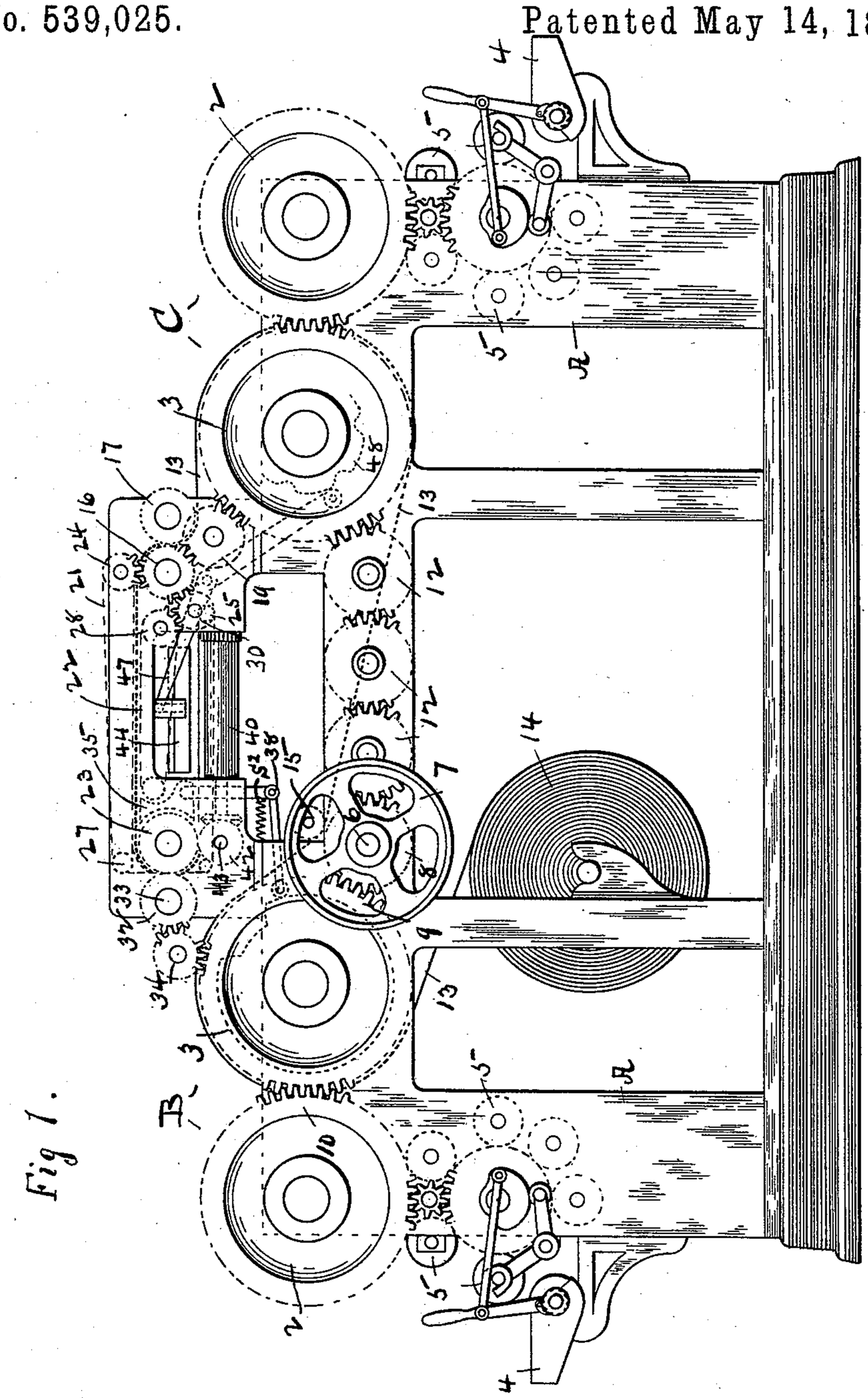

Fig 1.

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(No Model.) 5 Sheets—Sheet 2.

C. J. BELLAMY & W. E. CRAW.

MACHINE FOR MAKING BOOKS.

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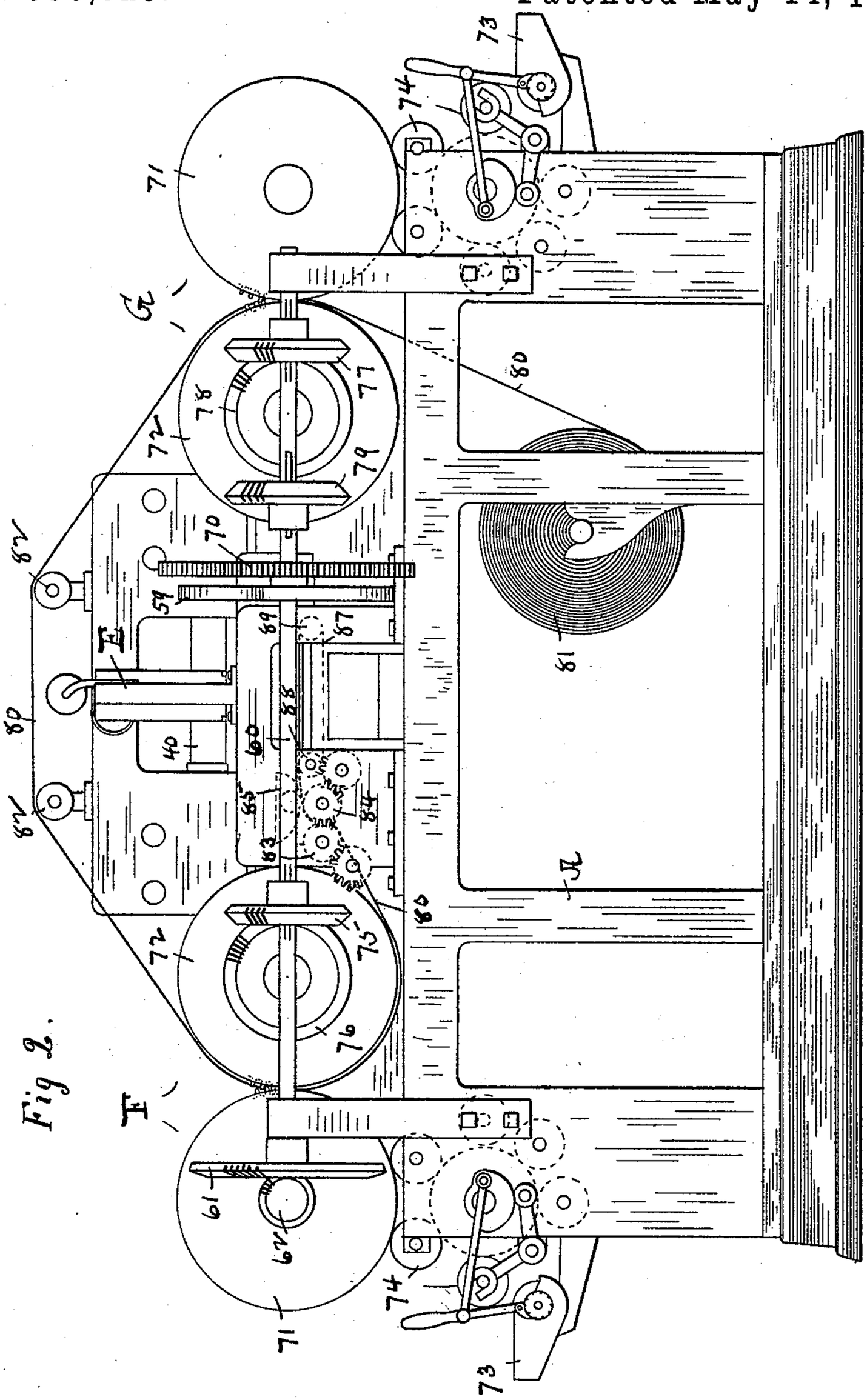

Fig 2.

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(No Model.) 5 Sheets—Sheet 3.

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MACHINE FOR MAKING BOOKS.

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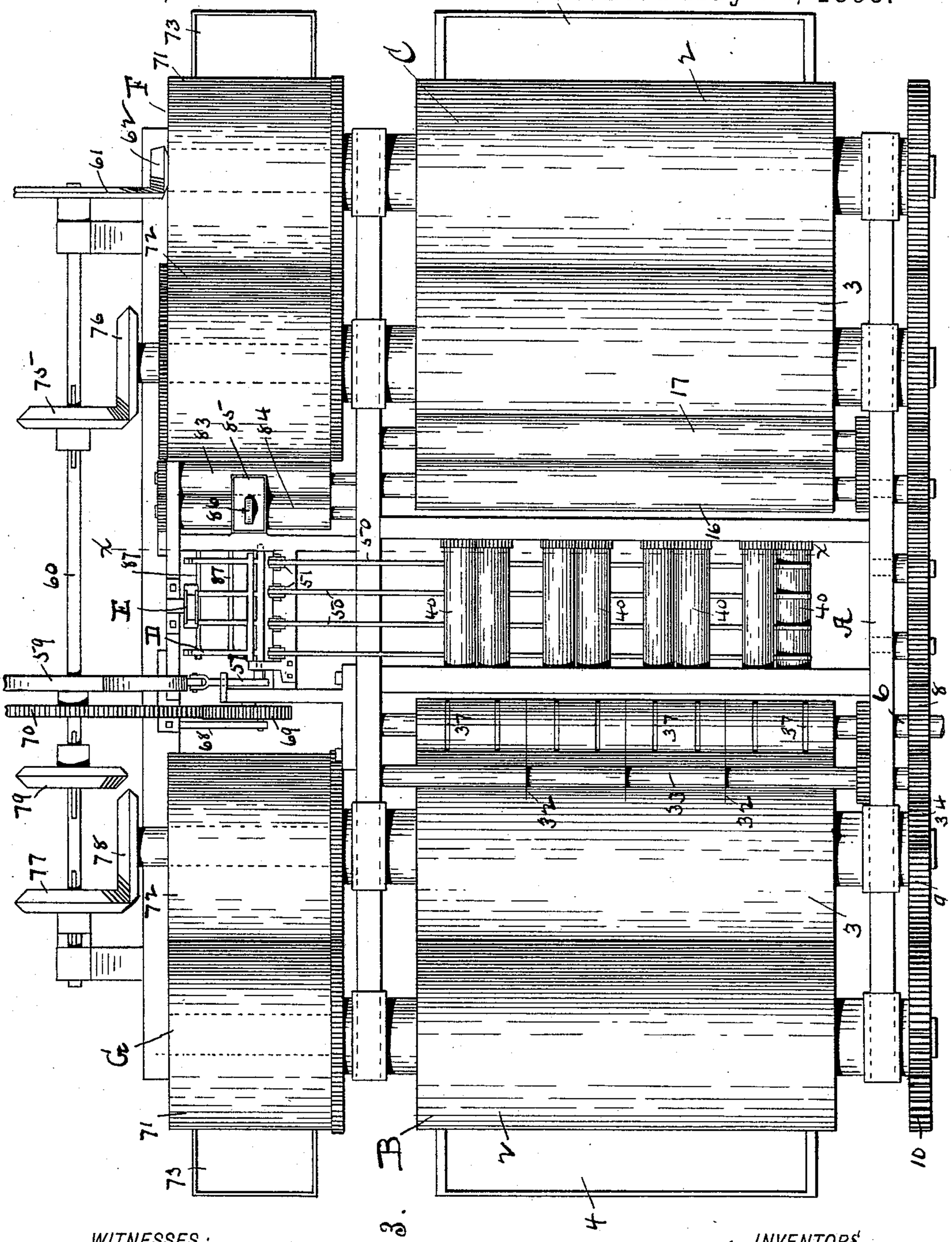

Fig 3.

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(No Model.) 5 Sheets—Sheet 4.

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MACHINE FOR MAKING BOOKS.

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Fig 4.

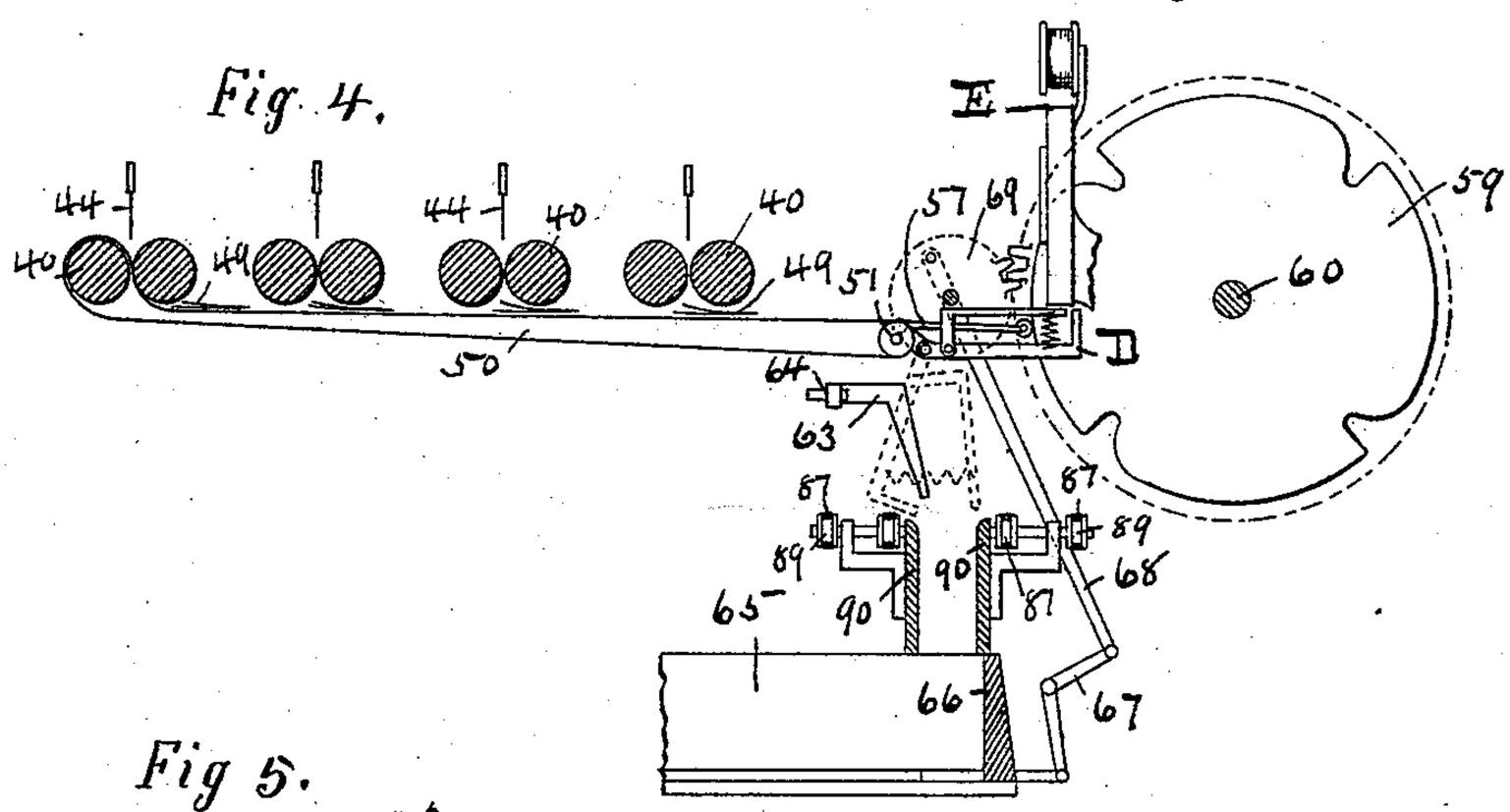


Fig 5.

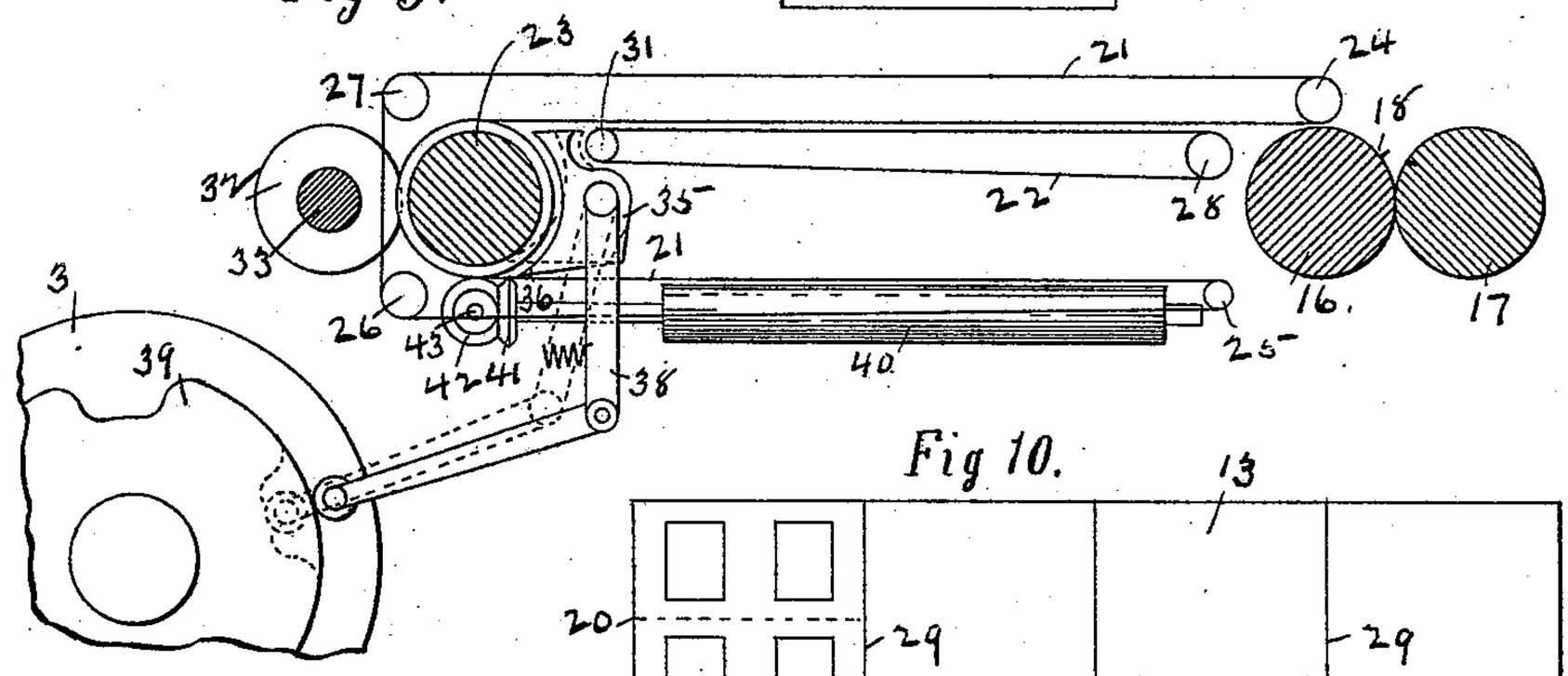
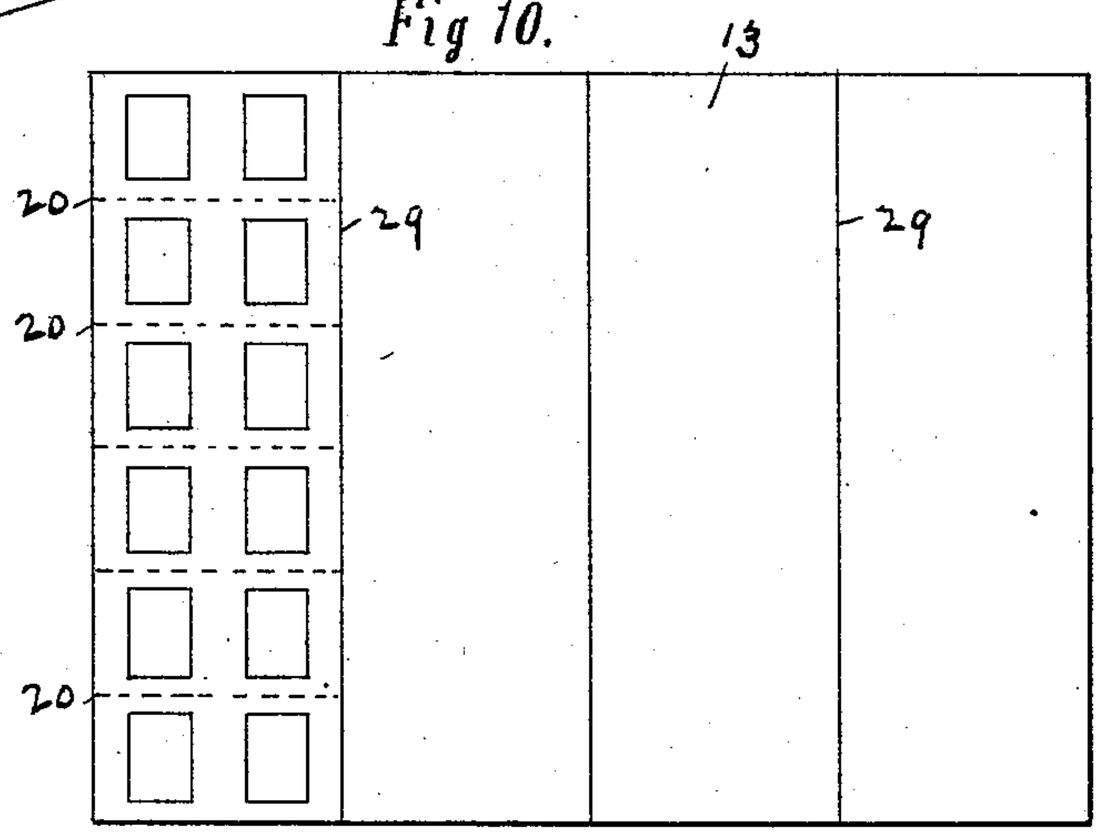


Fig 10.



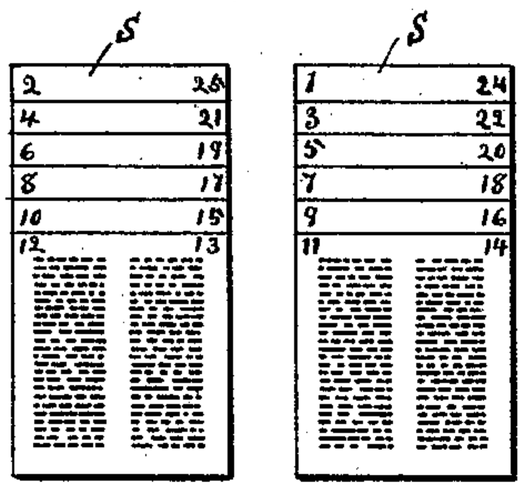


Fig 11.

Fig 12.

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(No Model.) 5 Sheets—Sheet 5.

C. J. BELLAMY & W. E. CRAW.

MACHINE FOR MAKING BOOKS.

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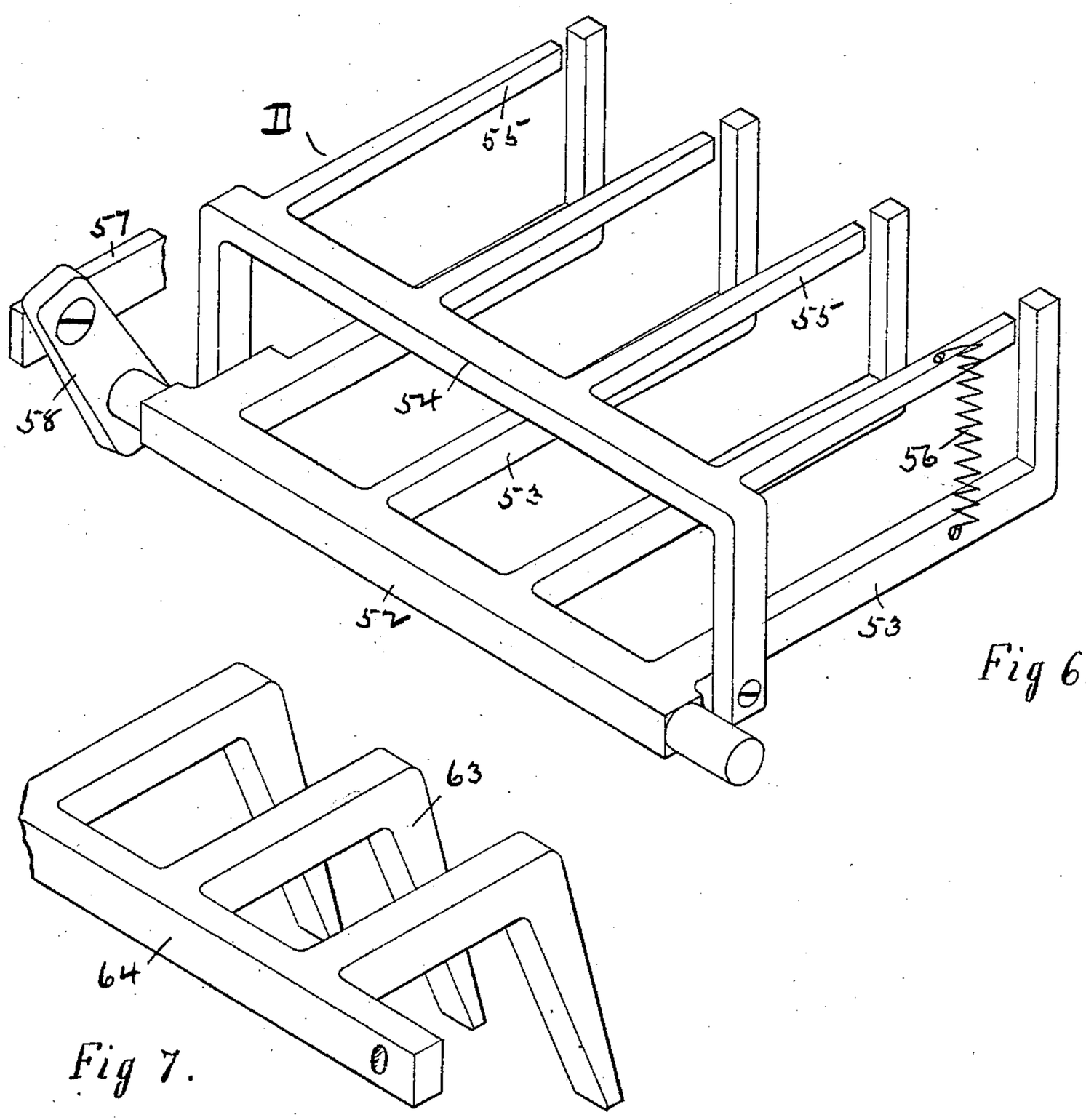


Fig 6.

Fig 7.

Fig 8.

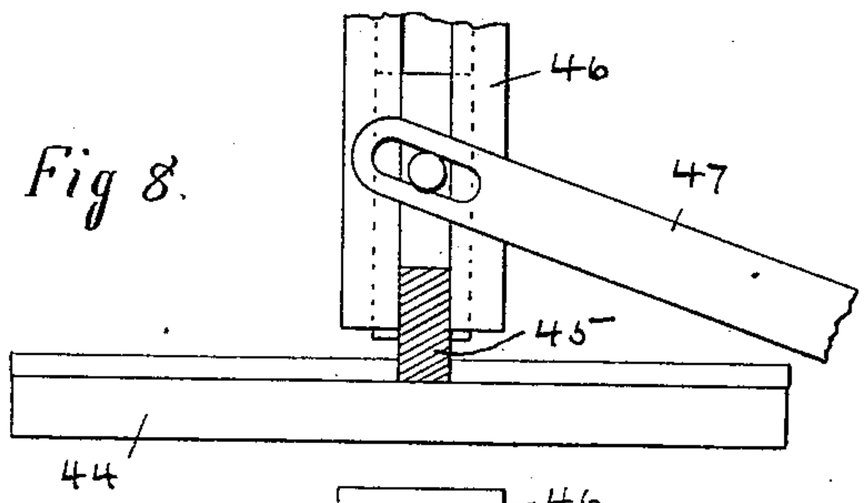
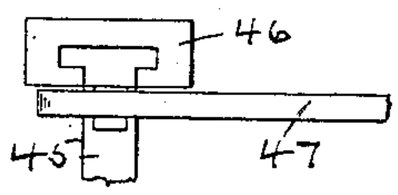


Fig 9.



WITNESSES:
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UNITED STATES PATENT OFFICE.

CHARLES J. BELLAMY, OF CHICOPEE, AND WILLIAM E. CRAW, OF SPRINGFIELD, MASSACHUSETTS.

MACHINE FOR MAKING BOOKS.

SPECIFICATION forming part of Letters Patent No. 539,025, dated May 14, 1895.

Application filed July 9, 1892. Serial No. 439,505. (No model.)

To all whom it may concern:

Be it known that we, CHARLES J. BELLAMY, residing at Chicopee, and WILLIAM E. CRAW, residing at Springfield, county of Hampden, State of Massachusetts, citizens of the United States, have invented a new and useful Machine for Making Books, of which the following is a specification, reference being had to the accompanying drawings, forming part thereof.

Our invention relates to machines for printing books, pamphlets, &c., and has for its object to provide a machine which will, of itself, make a complete book from a web of blank paper, that is to say, which will print upon the paper the pages of an entire book, will separate the same into sheets containing two pages upon the opposite sides thereof, will gather said sheets into signatures or sections of the desired size, will fold said signatures into book form, will collect all the signatures into one pile and stitch them together, and, finally, will print a paper cover for the book and secure it upon the same, so that the book issues from the machine complete in all respects and is ready for sale.

To this end our invention consists in the machine constructed and operating as hereinafter fully described and particularly pointed out in the claims.

Referring to the drawings, in which like characters designate like parts in the several views, Figure 1 is a side elevation of a machine embodying our invention. Fig. 2 is a similar view of the opposite side thereof. Fig. 3 is a plan view with the parts above the folding-rolls removed. Fig. 4 is a partial cross-section taken at line *x x*, Fig. 3. Fig. 5 is a detail view of the cutting and gathering mechanism. Fig. 6 is a perspective view of the receiver for collecting and holding the signatures to be stitched. Fig. 7 is a similar view of the finger-bar for opening the receiver and discharging the stitched book therefrom. Fig. 8 is a side view of one of the folding-blades, a cross-section of the supporting-bar therefor, and a partial view of the means for operating said bar. Fig. 9 is a plan view of the means at one end of said bar for guiding the same in its vertical movement. Fig. 10 shows a portion of the web of paper and the lines upon which it is severed by the cutters. Fig. 11 illustrates the manner of paging the sheets. Fig. 12 illustrates the manner of folding the signatures after they are taken from the gathering-roll.

The letter A designates the frame of the machine, which will be of suitable form to support the mechanisms about to be described.

The letter B designates a printing mechanism, comprising a plate or type cylinder 2, an impression cylinder 3, an ink fountain 4 and suitable intermediate inking and distributing rolls 5, and C designates a second printing mechanism, located at the opposite end of the machine, the corresponding parts of which are designated by the same numerals. These printing mechanisms are or may be of the ordinary form and their operation will be understood by persons skilled in the art without further description.

A shaft 6 suitably journaled in the frame carries a band-pulley 7 by which motion is transmitted thereto by belt from a suitable source of power. Said shaft 6 constitutes the main driving shaft of the machine, and motion is transmitted therefrom to the moving parts of the machine by intermeshing gears, cams and levers, as is customary in this class of machinery. From a spur gear 8 on said shaft motion is transmitted directly to a gear 9 on the shaft of the cylinder 3 of the printing mechanism B, and from thence to a gear 10 on the shaft of cylinder 2, from which gear the motion for the ink feeding and distributing devices 5 is taken in a well known manner. The printing mechanism C is operated from said gear 8 through a series of idler gears 12, whereby the type and impression rolls thereof are driven in an opposite direction.

The web of paper 13 is led from the paper-roll 14, suitably supported on the frame, between the type and impression rolls of printing mechanism B, whereby one side thereof is printed, and from thence, beneath a guide-roll 15, to and between the type and impression rolls of the printing mechanism C, whereby its opposite side is printed.

The stereotyped plates or forms of type are

arranged upon the type rolls of the mechanisms B C in such manner that the forms representing the pages of the book to be printed will lie in a series of rows extending parallel with each other and with the axis of the roll, so that, when printed, the web of paper will have the appearance shown at the left in Fig. 10 upon both of its sides, the number of pages printed thereon at each revolution of the type cylinders forming the total number of pages of the book or books being made. By reference to said Fig. 10 it will be observed that the distance between the page impressions on the web, longitudinally of the type roll, corresponds to the desired side margins of each page of the book, and the distance between said impressions, circumferentially of the roll, corresponds to the desired top and bottom margins of the book. By reference to Fig. 11 it will be observed that said impressions are paged in such manner as to cause them to read consecutively when assembled and stitched together as will be presently described, each signature being paged with reference to the size of the book to be made, as will be clearly understood by persons skilled in the art without further description.

From the printing mechanism C the web of paper is led between two cutter rolls 16 17, the former of which carries a knife 18 extending longitudinally thereof, see Fig. 5, and the latter of which is longitudinally grooved to receive said knife. The cutter roll 16 is driven from the impression cylinder of printing mechanism C by an intermediate gear 19, and said roll in turn drives the roll 17. The knife 18 is notched or otherwise constructed to cause it to partially but not entirely sever the web transversely thereof, as is common in printing machinery, and the movement of said rolls is so timed that said knife will thus partially sever the web at a point midway between each two rows of the page impressions on the web, as indicated by the broken lines 29 in Fig. 10. After passing said cutter rolls the web is seized by a series of upper and lower tapes or endless bands 21 22 and is thereby carried to the gathering roll 23. The upper series of tapes 21 pass about a roll 24, which is driven by gear connection from cutter roll 16, thence about the gathering roll 23, thence about a roll 25 located at a point below and slightly in front of the cutter rolls 16 17, thence about a guide-roll 26 and a second guide-roll 27, back to said roll 24. The lower series of tapes 22 pass about a roll 28, driven by a gear 30 from the gear which operates roll 24, and thence about a roll 31 back to said roll 28. The gathering roll 23 being of greater diameter than the cutter rolls 16 17 a sufficient strain is exerted upon the web to entirely sever it upon the lines partially cut by the knife 18 while the two ends of the web thus formed are supported by the tapes, and the sheets into which the web is so divided are, as before stated, of a length corresponding to the length of the pages of the book and are of a width corresponding to the width of the web. Said sheets are carried to the gathering roll 23 by the tapes, and as they pass about said roll they are severed longitudinally, or in the direction of the lines 29 in Fig. 10, by a series of revolving slitter knives 32, mounted upon a shaft 33 which is driven by a gear 34 from the impression roll of printing mechanism B, see Fig. 1, thus causing each subdivided sheet S to contain two pages of the book upon each of its sides. The sheets S are deposited upon the gathering roll in groups corresponding to the number of subdivisions made by the slitting knives, each sheet of the several groups covering the one before it and being itself covered by the one succeeding it, until the accumulated sheets in each group correspond in number to the number of impressions printed with each complete revolution of the type cylinders, longitudinally of the web, or, in other words, until each group contains the proper number of sheets to form a signature for a book of the predetermined size, whereupon said groups of sheets or signatures are stripped from said roll and are deposited upon the lower portion of the series of tapes 21 previously described, by which they are carried to a point above the folding rollers. For thus stripping said signatures from the gathering roll, we prefer to use a pivotally supported switch-frame 35 provided at its lower end with a series of fingers 36, see Fig. 5, which are adapted to enter circumferential grooves 37 in the gathering roll when said frame is swung toward the latter and thereby pass beneath one end of the lowermost sheet of each signature, sufficient space between the adjacent ends of said sheet being provided by reason of the fact that the sheets are of less length than the circumference of the roll. To automatically cause said switch-frame to swing toward the gathering roll once for each revolution of the type cylinders of the two printing mechanisms, the former is provided with an arm 38 carrying an anti-friction roll at its lower end which bears against a cam 39 on the impression cylinder of printing mechanism C, said cam being shaped to produce in connection with a spring S′, see Fig. 1, one dipping movement of said arm with each revolution thereof, as represented by broken lines in Fig. 5. The row of signatures being thus diverted from the gathering roll to the tapes 21 are, as before stated, carried by the latter to a point immediately over the series of pairs of folding rolls 40, the sheets forming the signatures being in a flat condition and superposed one upon the other. The shaft of one of each of the pairs of rolls 40 is extended and provided with a bevel gear 41 which meshes with a bevel gear 42 on a shaft 43 driven from the gathering roll, as shown of the first of said rolls in Fig. 5, and each roll so driven is geared to its companion roll as shown in Fig. 3, whereby a simultaneous and uniform movement is imparted to all of the rolls of said se-

ries. Said pairs of rolls 40 are so disposed that when the row of signatures arrives at a point immediately over them the center line of each signature, or the line lying midway between the pages printed thereon, will be in the vertical plane of the line of juncture between a roll of one of said pairs and its companion roll, and as soon as the signatures arrive at said point they are engaged by a series of folding blades 44, which blades descend upon the signatures in the vertical plane of the middle line between their pages, and, by forcing them downwardly between the pair of folding rolls immediately beneath them, cause said rolls to grasp them and impart a permanent fold thereto, the signatures, when they issue from said rolls having the appearance shown in Fig. 12. The blades 44 are carried by a bar 45, which bar has T-shaped ends working in vertical guides 46 on the frame, see Figs. 8 and 9, and is operated for vertical movement by levers 47, which levers are in turn operated by cams 48 on the shaft of the impression cylinder of printing mechanism C, as represented by broken lines in Fig. 1. As the folded signatures 49 issue from the folding rolls they are received upon tapes 50, passing about the first folding roll at one end and about rolls 51 at their opposite end, as shown in Fig. 4, and are carried by said tapes to a receiver D. Said receiver, which is shown in detail in Fig. 6, is composed of a pivotally supported bar 52 having projecting therefrom a series of parallel arms 53 having bent up ends, and a second bar 54 having downwardly bent ends which are pivotally connected to the two outermost arms 53 and having projecting therefrom a series of parallel arms 55 the outer ends of which are normally adjacent to the ends of the bent up portions of arms 53, being retained in such position by a spring 56. A basket-like receptacle open at one side is thus formed, which, by reason of the pivotal support of the bar 52, is capable of occupying the position shown in Fig. 6 and by full lines in Fig. 4, and also of being swung downwardly to the position shown by broken lines in Fig. 4. To automatically operate said receiver we utilize a rod 57 suitably guided for longitudinal movement, said rod being pivotally connected at one end to an arm 58 on the bar 52 and carrying at its opposite end an anti-friction roll which bears against a cam 59 carried by a shaft 60 journaled in suitable bearings on the frame, and driven by a bevel gear 61 thereon which meshes with a corresponding gear 62 on the end of the extended shaft of the type cylinder of the printing mechanism C, as shown in Figs. 1 and 2. Said cam 59 is so shaped as to produce the desired number of longitudinal movements of rod 57 and swinging movements of the receiver, according to the number of books being made upon the machine at one time. A stitching mechanism E is so located with respect to the normal position of the receiver that it will stitch together a pile of signatures held within the receiver, which stitching mechanism may be of any of the well known forms now in use, and its construction and mode of operation will be familiar to persons skilled in the art without further illustration or description herein. While the receiver D occupies its normal position, the signatures are discharged therein through its open side, by the tapes 50, in such manner that they are piled one upon the other in regular order with their folded edges resting against the up turned ends of arms 53 and in accurate vertical alignment with each other, and are stitched together by the mechanism E. When the proper number of signatures to form the entire book have been thus discharged into the receiver and stitched, the cam 59 permits the receiver to drop downwardly to the position shown by broken lines in Fig. 4, and just before it completes such movement the book therein is brought into contact with the fingers 63 of a stationary finger-bar 64, shown detached in Fig. 7, which fingers, by their lateral pressure against the book, cause the two hinged members of the receiver to spread apart in opposition to the stress of spring 56, as represented by broken lines in Fig. 4, and thereby permit the book to fall by gravity into a receptacle 65 for the completed books, said receptacle being provided with a reciprocating plunger 66, operated by an elbow lever 67, crank-rod 68, and crank-disk 69, for the purpose of moving the books laterally within the receptacle as they fall therein and keeping a clear space to receive a book beneath the receiver D. Said crank-disk 69 is operated by a gear 70 on the shaft 60, as shown in Fig. 1.

We have now followed the construction and operation of the machine from the time when it begins its operation upon the web of paper until it discharges a printed and stitched book, and it only remains for us to describe the means for forming and applying a cover to the book, reference being had particularly to Figs. 2, 3 and 4 of the drawings.

The letter F designates a printing mechanism, comprising a type cylinder 71, an impression cylinder 72, an ink fountain 73, and ink feeding and distributing rolls 74, and G designates a second printing mechanism corresponding in its parts to the mechanism F, which parts are designated by the same numerals. The length of the type and impression cylinders of said mechanisms corresponds to the width of the paper cover for a book, and to render the machine as compact as possible we prefer to mount said cylinders loosely upon the extended shafts of the type and impression cylinders of the mechanisms B and C, as shown. Said mechanisms F and G are driven from the shaft 60, which is itself driven, as before stated, from the shaft of the type cylinder of mechanism C, said shaft carrying a bevel gear 75 which meshes with a similar gear 76 fixed to the impression cylinder of mechanism F, and a second gear 77 which

meshes with a gear 78 fixed to the same cylinder of mechanism G, the type cylinders of both mechanisms being geared to and driven by said impression cylinders. The gears 75 77 are preferably connected to the shaft 60 by a spline and groove connection, as represented in Fig. 3, whereby either of the printing mechanisms can be thrown out of operation without affecting the other in case it is desired to print the book cover in but one color. Said gears 75 77 it will be observed, are adapted to drive the type cylinders of the two mechanisms F G in the same direction and thereby enable two separate printings to be done upon the same side of the cover and permit two contrasting colors to be used. To enable the same machine to be used for printing both sides of the cover, should it be desired to do so, we add a third gear 79 to the shaft 60, which is adapted to be used interchangeably with gear 77 to drive mechanism G in an opposite direction. The web of paper 80, of the proper width to form the book cover, is led from the paper roll 81 between the type and impression cylinders of mechanism G, and from thence over suitably disposed guide-rolls 82 to and between the same cylinders of mechanism F, see Fig. 2, and from thence it passes between two cutter rolls 83 84, geared to the impression cylinder of mechanism F, by which it is cut into sheets corresponding in length to the length of the book cover. Located immediately above said cutter rolls is a paste fountain 85 containing a narrow roll 86 the periphery of which projects slightly through a suitable opening in said fountain, which roll deposits upon the cover-sheet a narrow line of paste extending from top to bottom thereof and midway between its side edges, or, in other words, upon that portion of the upper surface of said sheet which is designed to engage the rear edge of the stitched book. From the cutting and pasting devices the sheets are carried by endless tapes 87 passing about rolls 88 89, see Figs. 2 and 4, the former of which is driven by gear connection with one of the cutter rolls, to a point beneath the receiver D and into the path of movement of a book from the latter to the receptacle 65. Each cover-sheet, when it arrives at this point, extends across the top of two vertical ways 90, which ways are in open communication at their lower end with the receptacle 65 and are separated from each other a distance but little greater than the thickness of the book being made upon the machine. The central pasted line of the cover-sheet so resting upon the upper end of said ways occupies a position midway between the latter, so that when a stitched book is discharged from the receiver D as before described, with its stitched back lowermost, said back is projected against the pasted portion of the cover-sheet, and, as the book passes downwardly between said ways, the sides or leaves of the cover-sheet are brought by the ways to their proper position against the sides of the book. When the books fall into the receptacle 65 they rest upon their backs, and being pressed closely together by the action of plunger 66, the covers are firmly secured thereon when they are taken from said receptacle, and the book is ready for the market.

We thus provide a machine capable of making a complete book from blank paper, and adapted to perform such operation with great rapidity. By simply disconnecting the cover portion of the machine, the latter is adapted to produce with equal rapidity stitched books ready to at once receive stiff covers. By thus obviating the necessity for handling the book at any stage of its manufacture we are enabled to greatly cheapen the cost of book production.

It will be obvious that various modifications in the details of construction of the machine herein shown and described can be made without departure from the spirit of our invention, since, so far as we are aware, we are the first to devise a machine capable of producing a completed book from a web or webs of blank paper by a single continuous operation.

Having thus fully described our invention, what we claim, and desire to secure by Letters Patent, is—

1. In a machine for making books, the combination with a printing mechanism adapted to print impressions upon both sides of a web of paper, and means for holding and directing a web of paper thereto, of a cutting apparatus for separating said web into sheets, a gathering device for collecting said sheets into signatures, a folding mechanism for folding said signatures to a uniform size, a receiver adapted to receive and hold a plurality of said signatures superposed one upon the other, and a stitching mechanism adapted to stitch together the signatures held by said receiver, substantially as described.

2. In a machine for making books, two printing mechanisms for printing impressions upon both sides of a web of paper and means for directing a web of paper to said mechanisms successively, cutting apparatus for dividing said web both longitudinally and transversely into sheets of a uniform size, a gathering device for collecting said sheets into signatures, a folding device for folding said signatures to a uniform size a receiver for collecting said signatures into book form, a carrier for conducting the signatures from the folding device to said receiver, a stitching mechanism for stitching together the signatures held in said receiver, a main shaft, and intermediate connections substantially as described between said shaft and said printing mechanisms, cutting apparatus, gathering-device, folding device carrier, and stitching mechanism, whereby the latter are operated from the former, combined and operating substantially as set forth.

3. In a machine for making books, the combination with means substantially as described for printing a web of paper, separat-

ing the same into sheets, collecting said sheets into signatures, gathering said signatures into book form, and stitching them together, of a cover printing mechanism and means for directing a web of cover-paper thereto, a cutting apparatus for dividing said paper into cover-sheets, a pasting device for depositing a central line of adhesive material upon each of said cover sheets, and means substantially as described for conducting said cover-sheets to the stitched books and folding them about the latter, arranged and operating substantially in the manner set forth.

4. In a machine for making books, the combination with two web printing mechanisms for printing impressions upon both sides of a web of paper, cutting apparatus for dividing said web into sheets, a gathering device for collecting said sheets into signatures, and means for folding said signatures to page form, arranged and operating substantially as described, of a pivotally supported, basket-like receiver adapted to hold a number of signatures, superposed one upon the other, a carrier for conducting the signatures from the folding means to said receiver, a stitching mechanism adapted to stitch together the signatures within the receiver while the latter occupies its normal position, and means substantially as described for periodically imparting a downward swinging movement to the receiver for the purpose of discharging a stitched book therefrom, substantially as set forth.

5. In a machine for making books, the combination with the pivotally supported receiver for collecting the signatures into book form, said receiver consisting of a basket-like receptacle having one side thereof hinged and normally held in position by a spring, and means for periodically swinging said receiver from a horizontal to a substantially vertical position, of a stationary stop adapted to engage a book held in said receiver, as the latter nears the end of its downward movement, and thereby cause the receiver to open and discharge the book, substantially as described.

6. In a machine for making books, the combination with means for printing a web of paper, cutting the same into sheets, gathering said sheets into signatures, and folding, collecting and stitching said signatures into book form, of means for printing a web of cover-paper, cutting said web into sheets of cover size, and securing said covers to the stitched books, and means substantially as described whereby said cover forming mechanism can be thrown out of operation without affecting the operation of the book-forming mechanism, arranged and operating substantially in the manner set forth.

7. In a book forming machine, the combination with two or more web printing mechanisms, each comprising a plate or type cylinder, an impression cylinder, and ink feeding and spreading devices, of cutters for dividing the web of paper both transversely and longitudinally into sheets, said cutters being carried by shafts whose axes are parallel with those of said type and impression cylinders, a gathering roll for collecting the sheets into signatures, said roll also having its axis parallel with those of said type and impression cylinders, a main driving shaft, gear connections between the shafts of each of said rolls and cutters and said driving shaft, means substantially as described for conducting a web of paper successively to said printing mechanism and to the cutters, and for conducting the sheets of paper from the latter to said gathering roll, an intermittently acting switch for stripping the signatures from said gathering roll and means for actuating the same operatively connected with said main shaft, a series of folding rolls arranged in pairs with their axes standing at a right-angle to those of said type and impression cylinders, intermediate connections substantially as described between the main shaft and said folding rolls whereby the latter are operated simultaneously from the former, the rolls of each pair turning in opposite directions, a series of folding blades located above the lines of contact of said pairs of rolls and means substantially as described for transmitting an intermittent vertical movement thereto from the main shaft, a pivotally supported, basket-like receiver adapted, in its normal position, to receive the signatures and collect them into book form, endless carriers for conducting the signatures from the gathering roll to the folding rolls and from the latter to said receiver, a stitching mechanism adapted to stitch together the signatures held by said receiver while the latter is in its normal position, and means substantially as described for periodically swinging said receiver about its pivotal center to discharge a stitched book therefrom, arranged and operating substantially in the manner set forth.

8. In a book forming machine, the combination with the basket-like receiver adapted to hold a plurality of signatures, a stitching mechanism for stitching together the signatures held by said receiver, and means for automatically discharging the stitched book from the latter, of a receptacle for the books located below the receiver, two parallel ways so located that a book must pass between them in its passage from the receiver to said receptacle, a printing mechanism for printing impressions upon a web of cover-paper, a cutting apparatus for severing said web into cover sheets, a pasting device for applying a line of adhesive material centrally to said sheets, and a carrier for conducting said sheets to a point immediately above said parallel ways, whereby a cover sheet will be folded about and secured to each stitched book as it passes between said ways, substantially as described.

9. In a machine for making books the combination with the folding rolls 40, receiver D and stitching mechanism E, of the endless bands or tapes 50 passing beneath each of said

folding rolls and about a guide-roll located adjacent to said receiver, substantially as and for the purpose described.

10. In a machine for making books the combination with the intermittently moving receiver D and stitching mechanism E of the receptacle 65, parallel ways 90, means substantially as described for printing a web of paper and dividing the same into cover sheets, and means, as the tapes 87, for conducting said cover sheets to the upper end of said parallel ways 90, substantially as set forth.

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WILLIAM E. CRAW.

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