J. A. BOYCE.

PRINTING AND FOLDING MACHINE.

APPLICATION FILED JULY 6, 1909.

963,203.

Patented July 5, 1910.

6 SHEETS—SHEET 1.

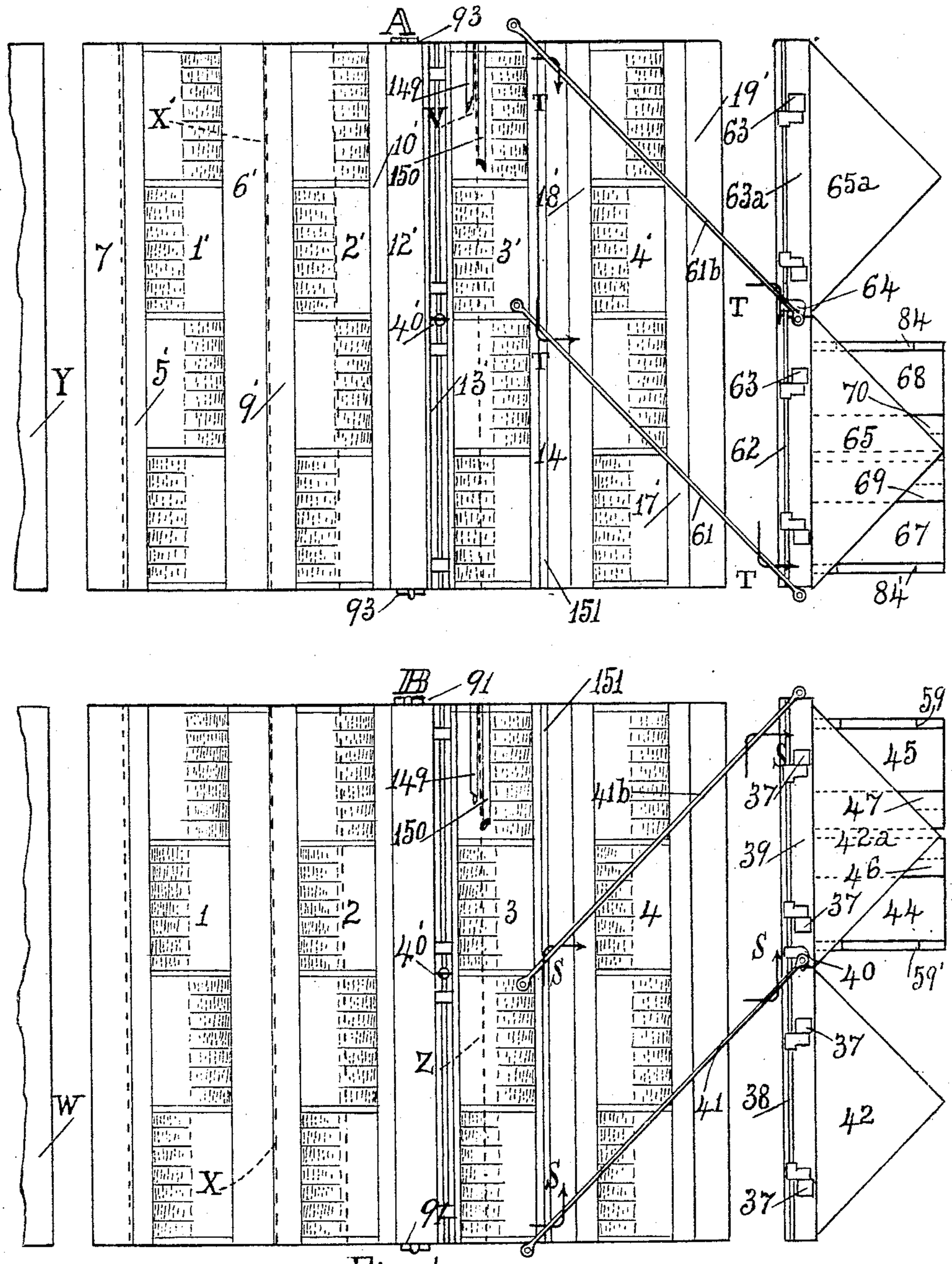

Fig. 1.

Witnesses.

Kathryn Nelson.

Victor Georg.

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By Atty N. DuBois.

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6 SHEETS—SHEET 2.

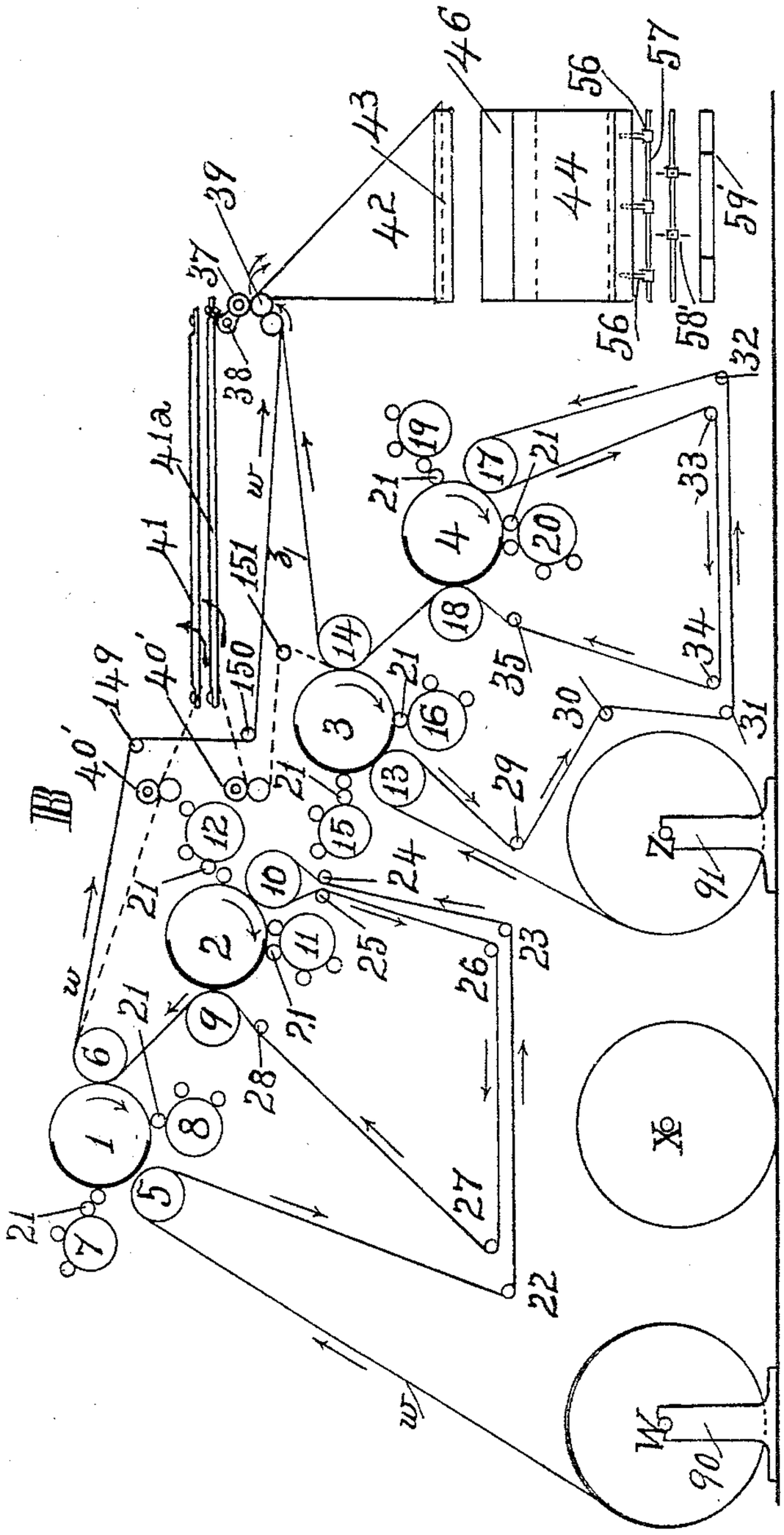

Fig. 2.

Witnesses.

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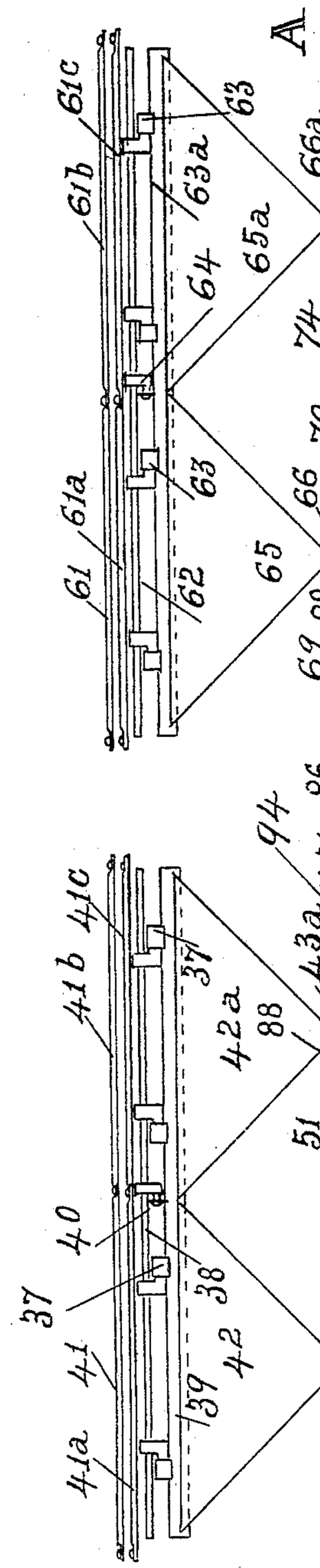

Fig. 3.

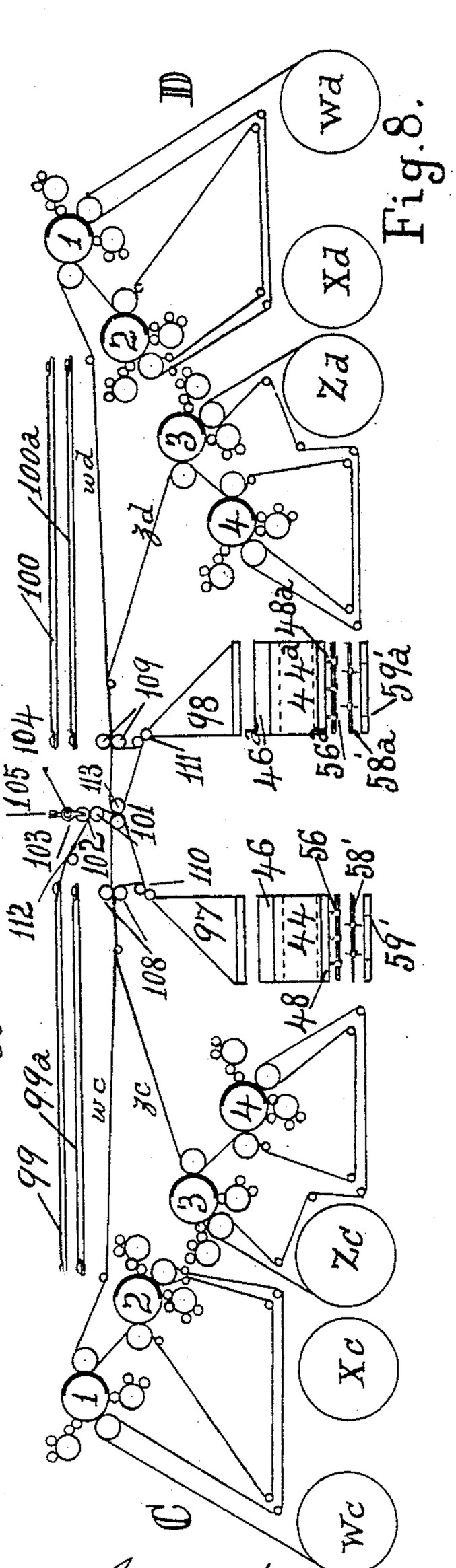

Fig. 8.

Witnesses.

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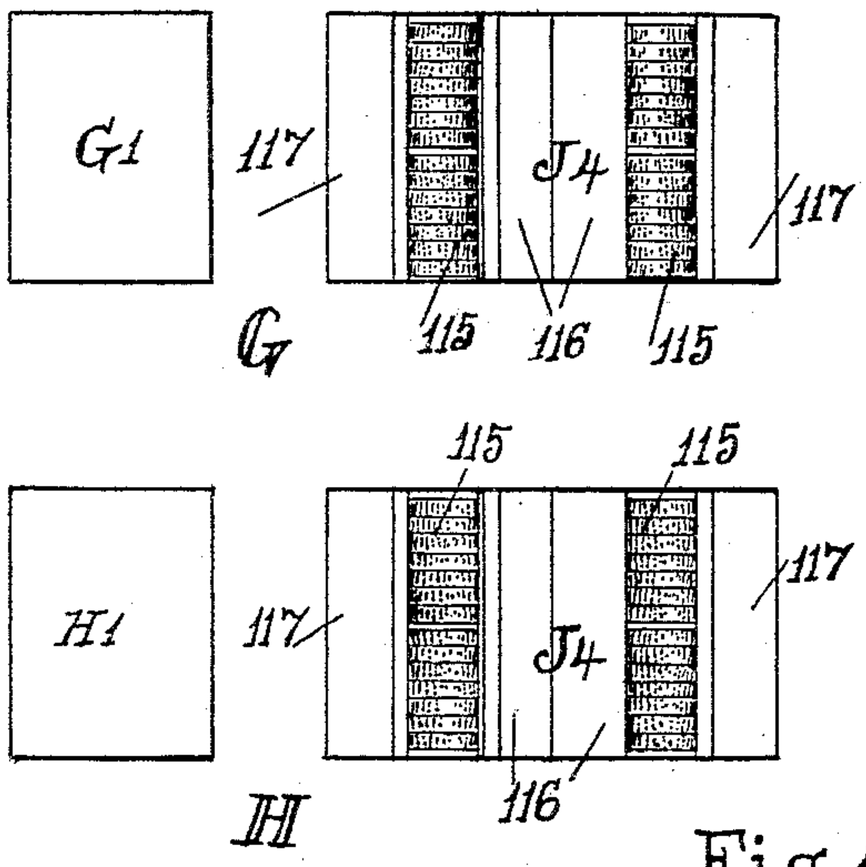
6 SHEETS—SHEET 4.



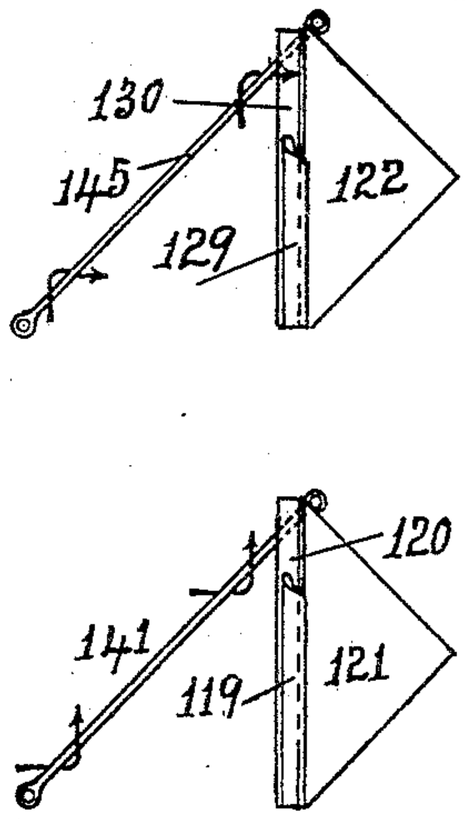


Fig. 4.

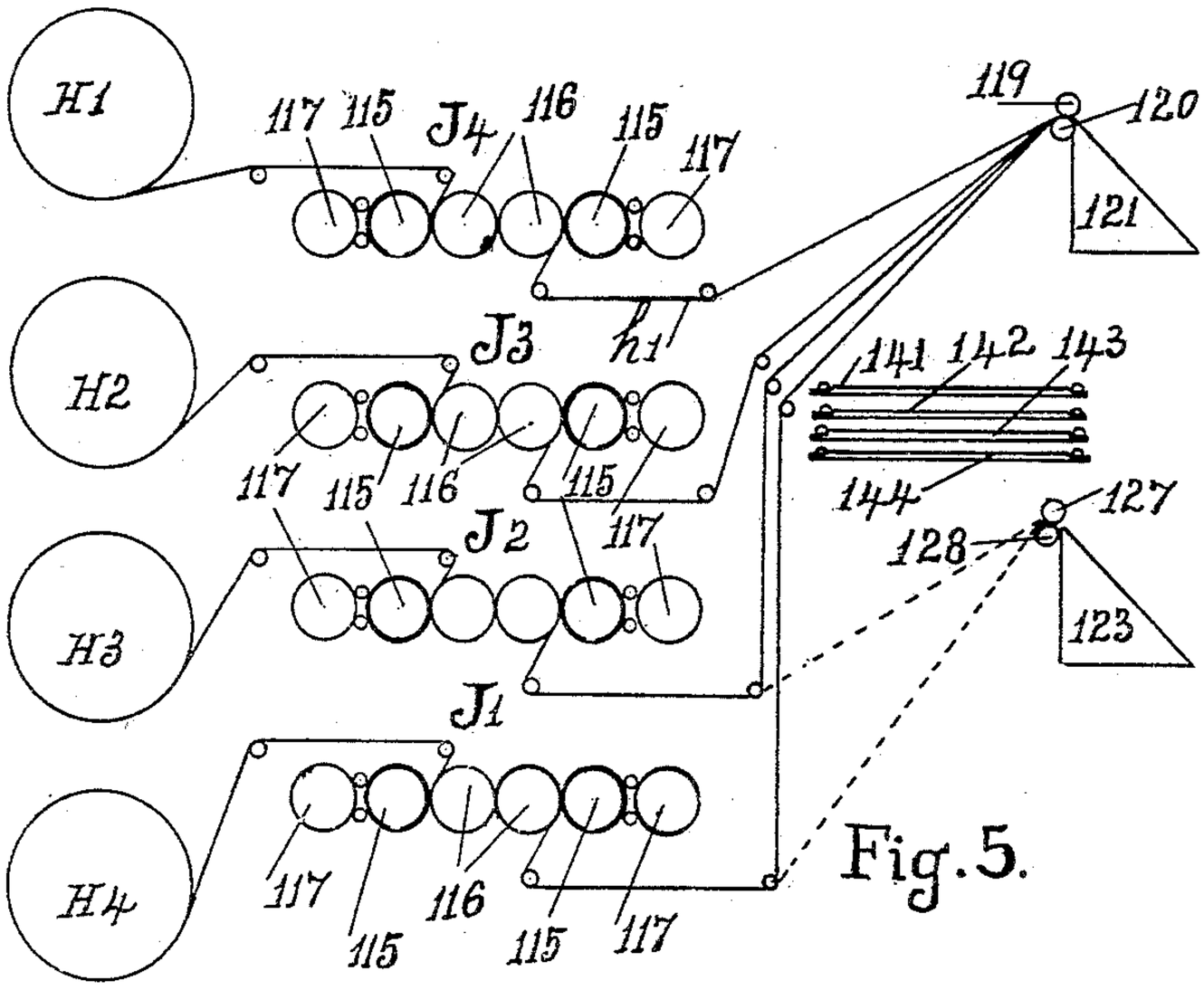


Fig. 5.

Witnesses.

Kathryn Nelson.

Victor Georg

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APPLICATION FILED JULY 6, 1909.

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6 SHEETS—SHEET 6.

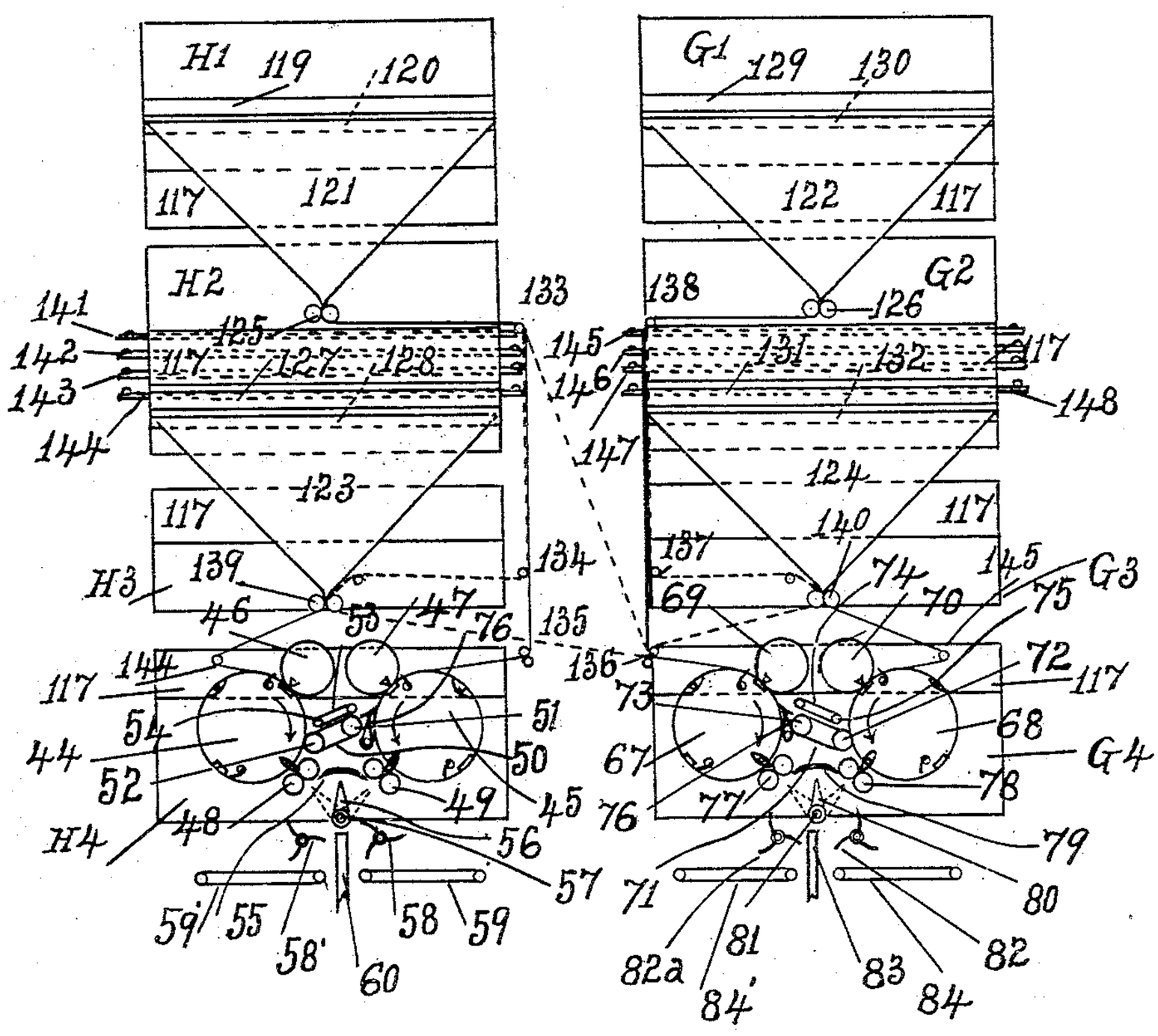

Fig. 6.

Witnesses.
Kathryn Nelson.
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J. A. BOYCE.

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APPLICATION FILED JULY 6, 1909.

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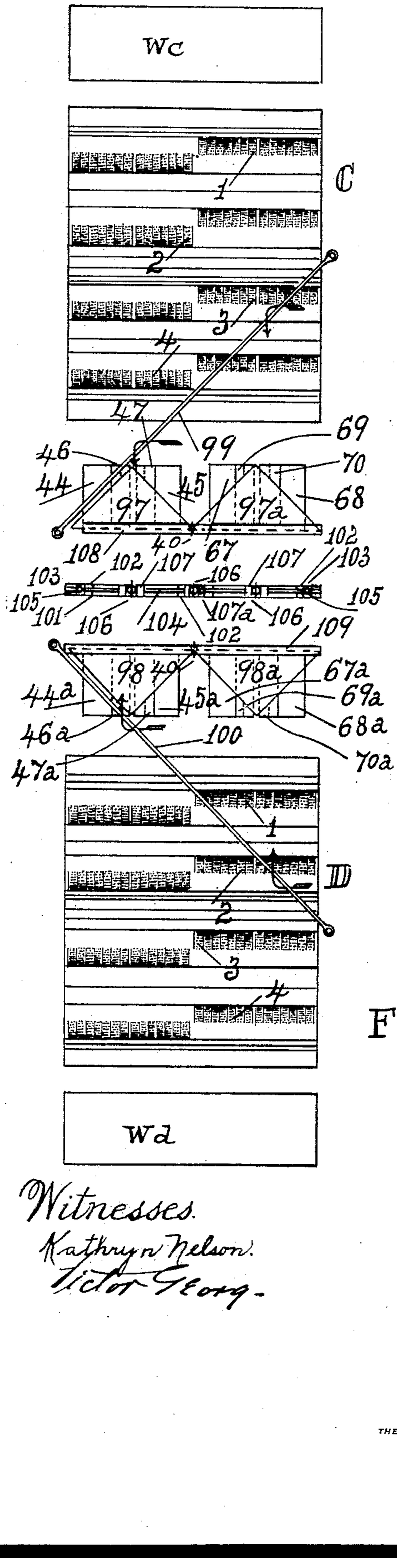

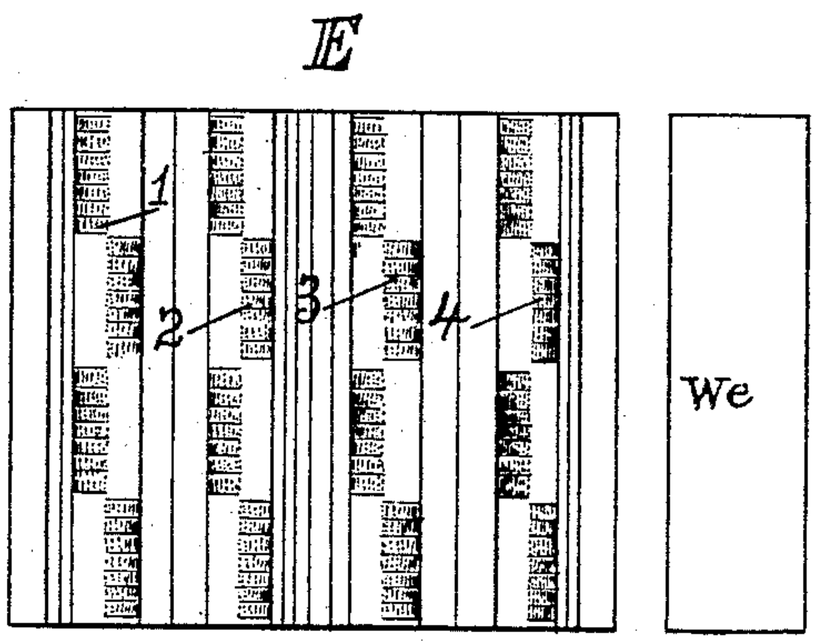

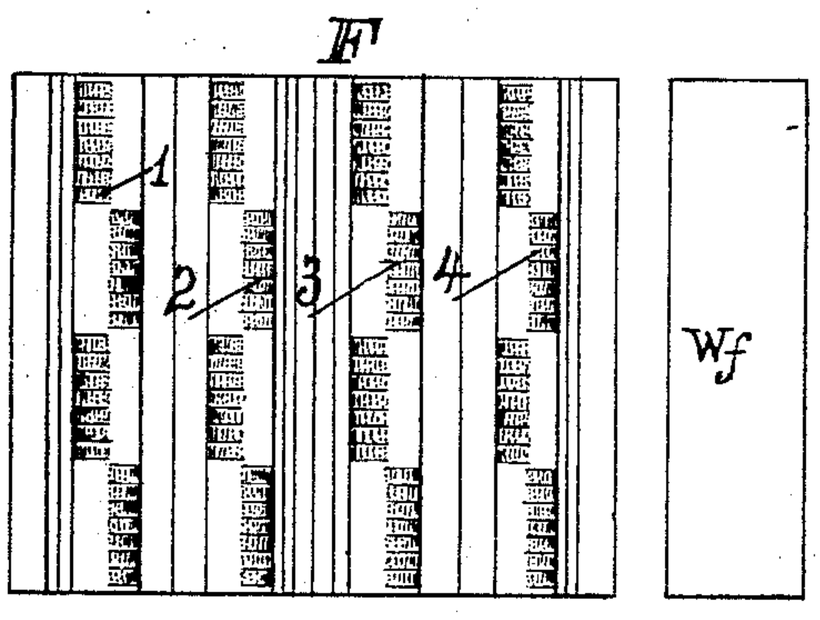

Fig. 7.

Witnesses.
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Victor Georg.

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UNITED STATES PATENT OFFICE.

JOHN A. BOYCE, OF SPRINGFIELD, ILLINOIS.

PRINTING AND FOLDING MACHINE.

963,203. Specification of Letters Patent. Patented July 5, 1910.

Application filed July 6, 1909. Serial No. 506,233.

To all whom it may concern:

Be it known that I, JOHN A. BOYCE, a resident of the city of Springfield, in the county of Sangamon and State of Illinois, and a subject of His Majesty Edward VII, King of Great Britain and Ireland, have invented certain new and useful Improvements in Printing and Folding Machines, of which the following is a specification, which is as full, clear, and exact as will enable others skilled in the art to which it appertains to make and use my said invention.

This invention relates to machines for printing and folding papers and the purpose of the invention is to provide means for printing, collecting in a continuous straight run and folding together the sections of a page-for-plate paper produced from full-speed webs with half the number of stereotype plates heretofore used, and to provide other new and useful features of construction hereinafter set forth; and recited in the claims.

The invention is illustrated in the annexed drawings, to which reference is hereby made and in which similar reference letters, numerals and characters designate like parts in the several views.

The drawings are in the nature of diagrams intended to illustrate new relations and coöperations of mechanisms, the elements of which are mostly well known in the art.

In the drawings plate cylinders, impression cylinders, angle-bars, formers, cutter and carrier cylinders, delivery devices, folder rollers, pulling rollers and slitters are illustrated conventionally.

In case parts of the mechanisms are not illustrated in detail it is to be understood that said parts may be of the usual, or any approved construction, effective for the several purposes recited.

Figure 1 is a diagram showing in top plan an apparatus of the preferred form; Fig. 2 is a side elevation of the mechanism shown in Fig. 1; and Fig. 3 is a front elevation of the same mechanism; Figs. 4, 5 and 6 are respectively a top plan, side elevation and front elevation of an apparatus of modified construction employing plate cylinders one plate in circumference; Fig. 7 is a top plan of an apparatus comprising four printing machines in coöperative relation to two pairs of formers and two sets of cutter, carrier and folder mechanisms; and Fig. 8 is a left-hand side elevation of the apparatus shown in Fig. 7.

The apparatus comprises plate cylinders equipped with plates having columns circumferential to the plate cylinders. The plates are laid in series across each plate cylinder and the plates of each series extend around the plate cylinder the length of one plate.

The apparatus in its entirety may comprise a plurality of printing machines in different relations to each other, that is to say the printing machines may be arranged end to end as shown in Fig. 1, each machine comprising two units in tandem having plate cylinders two plates in circumference as shown in Fig. 2; or the apparatus may comprise a plurality of printing machines arranged end to end and each comprising a plurality of units having plate cylinders one plate in circumference as shown in Figs. 4 and 5; or the apparatus may comprise two machines in line with each other and each consisting of a plurality of units as shown in the left hand part of Figs. 7 and having plate cylinders one plate in circumference, or two plates in circumference; or may comprise four similar printing machines arranged in a quadrangle as shown in Fig. 7.

The invention contemplates the use of a plurality of plural-plate-wide full speed webs; in producing papers in book form with supplement or without supplement; or papers in collected sections folded together, with supplements or without supplements.

A prime purpose of the invention is to provide means for transfer collecting, by which I mean bringing together in a continuous straight run in parallel, two or more sections of a paper, each section comprising a plurality of pages of matter printed on a plurality of longitudinally folded webs brought together before cutting, or a plurality of longitudinally folded two-plate-wide web-members brought together before cutting; or the bringing together in a continuous straight run, in parallel, from a plurality of formers, two or more sections cut by a single cutter or a plurality of cutters before collecting.

I will first describe the apparatus of preferred construction and afterward will describe the apparatuses of modified construction.

The apparatus comprises two printing

machines A and B located with the cylinders of one machine end to end relatively to the cylinders of the other machine, and a passage way between the machines, and each machine comprises a plurality of units each of which operates to perfect a continuously moving web or a plurality of web-members running side by side.

The machines A and B are exactly alike so a description of one will suffice for both.

The printing machine B, Figs. 1 and 2, comprises two units arranged in tandem and each unit adapted to perfect one web. All of the cylinders are revoluble in the usual well known manner by suitable gearing which is not part of the present invention and therefore not shown. Plate cylinders 1, 2, 3 and 4 are in circumference equal to the length of two plates and are equipped with plates arranged in series lengthwise of the plate cylinder and extending around the plate cylinder the length of one plate as clearly shown in Fig. 1. Impression cylinders 5 and 6 and ink drums 7 and 8 coöperate with the plate cylinder 1; impression cylinders 9 and 10 and ink drums 11 and 12 coöperate with the cylinder 2; impression cylinders 13 and 14 and ink drums 15 and 16 coöperate with the cylinder 3; and impression cylinders 17 and 18 and ink drums 19 and 20 coöperate with the cylinder 4. Rollers 21 distribute ink from the ink drums onto the plate surfaces in the usual manner. Rollers 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 149, 150 and 151 lead the webs as hereinafter described.

The machine B comprises two units arranged in tandem, one unit being adapted to perfect a web *w* running from the roll W and the other being adapted to perfect a web *z* running from the roll Z. The rolls W and Z are supported on suitable pedestals 90 and 91 respectively, close to the floor level, so that their rolls may be rolled on the floor into convenient position for mounting them on the pedestals. The roll X is an extra roll in position for quick use in place of the roll Z when the roll Z is run out. This arrangement of the rolls all near the floor level is of great practical advantage because it greatly facilitates the handling of the rolls. Little rollers or pulling wheels 37 adjustably mounted on a fixed horizontal shaft 38 coöperate with the revoluble pulling rollers 39 to propel the associated webs *w* and *z*. A slitter 40 serves to slit the associated webs lengthwise to divide each web into two two-plate-wide web-members. The web *w* runs around the impression cylinder 5, receives the first impression from the cylinder 1, thence runs around the cylinder 10 and receives the second impression from the cylinder 2; thence runs around the cylinder 9 and receives the third impression from the cylinder 2 and thence runs around the cylinder 6 and receives the fourth impression from the cylinder 1. The run of the web *z* is exactly similar to that of the web *w* and the first and fourth impressions on the web *z* are made by the cylinder 3 and the second and third impressions are made by the cylinder 4.

Webs from a plurality of rolls of paper perfected by the printing mechanisms will run to first folder devices of any approved construction. Formers are preferably used for making the first fold lengthwise of the webs but it is obvious that the webs may be cut into sheets before folding and said sheets may be folded by any suitable folder mechanism, such as cylinders equipped with revolving folder blades, or by folder mechanism equipped with chopper blades and may then be collected as hereinafter described.

The printing machine A being the same as the printing machine B, the parts of the machine A are designated by the same characters which designate like parts in machine B, except that to distinguish like parts of the different machines, the reference characters designating the parts in machine A have the exponent prime (′). For example the numerals 1, 2, 3 and 4 designate the plate cylinders of machine B while the characters 1′, 2′, 3′ and 4′ designate like parts of the machine A.

The machine B is equipped with horizontal angle bars 41, 41ª, 41ᵇ and 41ᶜ and machine A is equipped with similar angle bars 61, 61ª, 61ᵇ and 61ᶜ. Slitters 40′ slit the webs lengthwise before they run around the angle-bars. Rolls of paper V, X′ and Y occupy the same relation to machine A that the rolls Z, X and W occupy relatively to the machine B and the rolls V, X′ and Y supply the webs operated upon by machine A. Webs from the rolls Z and W are perfected by machine B and webs from the rolls V and Y are perfected by machine A. A slitter 40 serves to slit lengthwise the associated webs running from machine B to divide each web into two two-plate-wide web-members. A slitter 64 slits lengthwise the associated webs perfected by machine A to divide each web into two two-plate-wide web-members. The slitted webs may be run in a vairety of different ways which will be hereinafter described. Formers 42 and 42ª are in operative relation to machine B and similar formers 65 and 65ª are in operative relation to machine A. Pulling wheels 37 adjustably mounted on a fixed horizontal shaft 38 coöperate with the revoluble roller 39 to propel the webs running over the formers 42 and 42ª and similar pulling wheels 63 mounted on the fixed horizontal shaft 62 coöperate with the roller 63ª to propel the webs running over the formers 65 and 65ª. Sets of pulling rollers 43, 43ª, 66 and 66ª pull the longitudinally folded webs running down-

ward over the formers 42, 42ª, 65 and 65ª respectively. Revoluble carrier cylinders 44 and 45 are mounted in operative relation to the formers 42 and 42ª and similar revoluble carrier cylinders 67 and 68 are mounted in operative relation to the formers 65 and 65ª. Each of the carrier cylinders 44, 45, 67 and 68 is equipped with two diametrically opposite rotating folder blades 85 of usual construction, two sets of pins 86 adapted to be alternately projected and retracted, by and suitable means, not shown and two cutting woods 87. Revoluble cutter cylinders 46, 47, 69 and 70 coöperate with the carrier cylinders 44, 45, 67 and 68 respectively. Each cutter cylinder is provided with a longitudinal blade 88 cutting on the cutting woods 87 of the carrier cylinders respectively. A roller 52 is parallel and runs in close proximity to the cylinder 44 and a similar roller 51 is adjacent and parallel to the carrier cylinder 45. Endless tapes 50 run on the rollers 52 and 51. Rollers 54 above the rollers 51 and 52 carry tapes 53 coöperating with the tapes 50 to propel sections of the paper cut off by the cylinder 47. The cylinder 52 has in its circumference short slots 89 adapted to accommodate the pins 86 of the cylinder 44 so that the pins 86 which are holding the sheets running on the cylinder 44 will engage with and hold the leading end of the section running downward between the tapes 50 and 53 so that the leading end of the section carried by the tapes will register with the leading end of the section then running around the cylinder 44. The rollers 72, 73 and 75 are exactly like the rollers 52, 51 and 54 and the tapes 71 and 74 are exactly like the tapes 50 and 53 and coöperate with the cylinder 68 exactly in the same manner that the tapes 50 and 53 coöperate with the cylinder 44. Strippers 76 are mounted on a horizontal shaft 76ª parallel to the cylinder 45. The shaft 76ª is adapted to oscillate slightly toward the cylinder 45 to cause the points of the strippers to enter suitable grooves (not shown) extending around the cylinder to strip the sections from the cylinder and guide them between the tapes 50 and 53 which lead them downward to the cylinder 44 by which they are carried to the folder rollers 48. If the shaft be turned slightly to the left to withdraw the points of the strippers from the grooves extending around the cylinder 45 there will be clear space between the strippers and the cylinder 45 through which the papers or sections cut on the cylinder 45 will be carried downward on the cylinder to the folder rollers 49 by which they will be folded together. Similar strippers 76, coöperate in like manner with the cylinder 67 and the tapes 70 and 74. Sets of folder rollers 48, 49, 77 and 78 cooperate with the carrier cylinders 44, 45, 67 and 68 respectively. A guard 55 between the sets of folder rollers 48 and 49 prevents miscarriage of the folded sections or papers as the case may be, running from the set of folder rollers, and a similar guard 79 cooperates in like manner with the sets of folder rollers 77 and 78.

It is to be understood that the carrier and cutter cylinders, the folder rollers and the tape rollers are all actuated by suitable gearing not shown to propel the webs, the sections or the papers at the proper speed and that the folder blades are rotated by suitable means not shown and all the parts are connected to operate in due time in a manner in which is well known.

A shaft 57 mounted to oscillate in any suitable support carries a series of upwardly projecting fingers 56 adapted to oscillate under the guard 55 and a similar shaft 81 carries fingers 80 adapted to oscillate under the guard 79. Revoluble delivery wheels 58 and 58′ are in operative relation to the sets of folder rollers 49 and 48 respectively and similar delivery wheels 82 and 82ª are in operative relation to the sets of folder rollers 77 and 78. Suitably actuated endless tapes 59 and 59′ are adapted to carry away the folded papers or sections dropped by the wheels 58 and 58′ respectively and similar endless tapes 84 and 84′ are adapted to carry away the papers or sections dropped by the wheels 82 and 82ª respectively. A vertical stop 60 between the delivery devices 59 and 59′, and a similar stop 83 between the delivery devices 84 and 84′ prevent misplacement of second-folded papers deposited on the several delivery devices. If the shaft 57 be turned to the right the fingers 56 will be in position to guide papers or sections running from the folder rollers 49 onto the delivery wheel 58′ and if the shaft 57 be turned to the left the fingers 56 will be in position to guide papers or sections running from the folder rollers 48 onto the delivery wheel 58.

The printing machines B and A are adapted to operate independently of each other, or to coöperate with each other as will now be explained.

When machines B and A, are operating independently of each other one printing unit of machine B will perfect the web *w* and the other printing unit of the same machine will perfect the web *z*, and the perfected webs will be associated and slitted on the roller 39 and one group of associated two-page-wide web-members will run downward over and be folded lengthwise on the former 42, and the other group of web-members, derived from the same webs will run downward over and be folded lengthwise on the former 42ª. In like manner the webs *y* and *v* will be respectively perfected by the printing units of machine A and will be associated and slitted on the roller 63

and one group of associated two-page-wide web-members will run downward over and be folded lengthwise on the former 65 and the other group of two-page-wide web-members derived from the same webs will run downward over and will be folded lengthwise on the former 65[a]. The associated and longitudinally folded web-members from the former 42 will run to the carrier cylinder 44, whereon they will be cut into eight-page book-form papers by the blade 88 of the cylinder 46; and in like manner the associated and longitudinally folded web-members from the former 42[a] will run to the carrier cylinder 45 and will be cut thereon into eight-page papers. The eight-page-papers running on the cylinder 44 will be folded by the folder rollers 48 and will drop onto the delivery wheels 58′ and the eight-page-papers running on the cylinder 45 will be folded by the folder rollers 49 and will drop onto the delivery wheels 58, and in that case the product of machine B will be two eight-page-papers in book form, dropped onto separate delivery devices; or the switch 56 may be turned to lead the folded papers from the folder rollers 49 to the delivery wheels 58′, or may be turned to lead the folded papers from the folder rollers 48 to the delivery wheels 58, and in either case the product will be two eight-page book-form papers, dropped onto one delivery device. In an exactly similar manner two eight-page-papers in book form may be produced by machine A and dropped onto two delivery devices 82 and 82[a] or dropped onto a single delivery device 82 or 82[a] as already described.

In operating machine B to produce papers in sections two different methods may be employed. To produce a sixteen page paper in two eight-page sections, the associated and longitudinally folded web-members running on the formers 42 and 42[a] may be brought together and associated on the roller 94 and run thence to the cylinder 45 and both sections will then be simultaneously cut off by the blade 88 of the cylinder 47, and the sections will run to the folder rollers 49 which will fold them together, and the paper consisting of two eight-page sections will drop onto delivery wheels 58, or onto the delivery wheels 58′, according to the setting of the switches 56; or the associated and longitudinally folded web-members from the former 42 may run to the carrier cylinder 44 and be cut thereon into eight-page sections by the blade 88 of the cylinder 46, and the associated and longitudinally folded web-members from the former 42[a] may run around the roller 94 to the cylinder 45 and be cut thereon into eight-page sections by the blade 88 of the cylinder 47, and the sections running on the carrier cylinder 45 will be successively stripped off by the strippers 76 and will run between the tapes 50 and 53 to the cylinder 44, and will be engaged by the pins 86 of the cylinder 44, and will run with the section then on the cylinder 44 to the folder rollers 48 which will fold the sections together to produce a sixteen page paper comprising two eight-page sections, and the folded papers will drop onto the delivery wheels 58′ or 58 according to the setting of the switches 56. In an exactly similar manner machine A may be operated to produce a sixteen page paper comprising two sections cut simultaneously by one cutter device and dropped onto one delivery device, or to produce a sixteen page paper comprising two sections cut off separately by different cutter devices, the sections being folded together by one folder mechanism and dropped onto one delivery device.

If desired the two-plate-wide members of the webs *w* and *z* may, after the webs are slitted, be associated so that all the two-page-wide web-members will run together downward over and be folded lengthwise on one former. If all of the associated web-members are to run over the former 42[a] the left-hand two-page-wide member of the webs *w* and *z* (Fig. 1) will be given two quarter turns around the angle bars 41 and 41[b] as indicated by arrows S, to bring them into line with the right-hand two-plate-wide members of the same webs, and all of the alined web-members will be associated and run downward together over the former 42[a]; and in that case the associated and longitudinally folded web-members will run around the roller 94 to the cylinder 45 and the papers will be cut off by the blade 88 of the cylinder 47, and will be folded by the folder rollers 49 and the product will be a sixteen-page book-form paper. In exactly similar manner the right-hand two-page-wide members of the webs *v* and *y* may be given two quarter turns on the angle bars 61[b] and 61 as indicated by arrows T, to aline the two-plate-wide web-members and associate and fold them all longitudinally on the former 65. It will be seen therefore, that one former and one set of cutter, carrier and folder mechanisms may be used; or two formers and two sets of cutter, carrier and folder mechanisms may be used with each printing machine.

When machines A and B are both in use all of the two-page-wide members of the webs *w* and *z* may be associated on the former 42[a] and all of the two-page-wide members of the webs *v* and *y* may be associated on the former 65; and the associated and longitudinally folded web-members from the former 42[a] may run between the rollers 43[a] and around the roller 96 to the carrier cylinder 67, and all of the associated and longitudinally folded webs from the

former 65 may run between the rollers 66 and around the roller 95 to the cylinder 67 and be associated thereon with the associated and longitudinally folded web-members running from the former 42ª, and the blade 88 of the cylinder 69 will simultaneously cut off sections from the associated and longitudinally folded web-members running from both the formers 42ª and 65; and the collected sections running together around the cylinder 67 will be folded together by the folder rollers 77 and dropped onto delivery wheels 82ª, or 82, according to the setting of the switches 80, and in that case the product will be a thirty-two page paper in two sixteen page sections. Under another mode of joint operation of machines A and B all of the formers and all of the cutter, carrier, folder and delivery mechanisms will be in use. The longitudinally folded web-members from the former 42 will run between the rollers 43 and around the roller 94 to the cylinder 45 and the longitudinally folded web-members from the former 42ª will run between the rollers 43ª and around the roller 94 to the cylinder 45 and will be associated on the cylinder 45 with the longitudinally folded web-members running from the former 42 and sections will be cut simultaneously from both groups of longitudinally folded web-members, by the blade 88 of the cylinder 47 and the cut sections will run between and be folded together by the folder rollers 49, and will drop onto the delivery wheels 68 by which they will be deposited on the tapes 59. In an identical manner longitudinally folded web-members from the formers 65 and 65ª will be associated and cut on the cylinder 67 and folded by the rollers 77 and deposited on the tapes 84′. The folded papers derived from webs running on all of the formers and on the tapes 59 and 84′ will run toward each other to a central common place of delivery designated by the letter R. Under still another mode of operation the longitudinally folded web-members from the formers 42 and 42ª may run over the roller 96 to the carrier cylinder 67, and the webs from the formers 65 and 65ª may run over the roller 95 to the cylinder 67, and the groups of longitudinally folded webs assembled on the cylinder 67 will be cut into sections by the blade 88 of the cylinder 69, and the sections will be folded together by the folder rollers 77, and will drop onto the delivery wheels 82ª, or 82, according to the setting of the switches 80.

I have illustrated and described printing machines adapted to perfect two continuously moving webs but it is obvious that printing machines adapted to perfect a greater number of webs may be used without departure from my invention.

In producing book form papers with supplements or papers in sections, each section having a supplement; a two-plate-wide-web-member will be used for the supplement and the matter thereof will be printed on the two-page-wide central part of the lower web *z*. This two-plate-wide web will be slitted longitudinally by the slitter 40 to divide it into one-plate-wide supplement web-members and one of said supplement web-members will run downward along next to one side of the former 42 and will be associated on the former with the two-plate-wide main web-members running thereon and the other one-plate-wide supplement web-member will run downward next to the adjacent side of the former 42ª and will be associated on the former with the two-plate-wide main web-members running thereon. Below the formers the groups of associated web-members including the supplement web-members will be cut and run to separate folder mechanisms to produce book-form papers each with a supplement; or will be associated on the cylinder 44 and cut into sections by the blade 88 of the cylinder 46 and the collected sections will be folded together by the folder rollers 48; or one section will be cut on the cylinder 44 by the blade of the cylinder 46 and the other section will be cut on the cylinder 45 by the blade of the cylinder 47 and the last named section will be carried by the tapes 50 and 53 and will be associated with the section then running on the cylinder 44 and the two sections will be folded together by the folder rollers 48. If one section is to have a supplement and the other section is to be without a supplement a one-plate-wide member of the web *z* will be used for the supplement and will run next to the surface of the former 42ª; the left-hand two-page-wide members of the webs *w* and *z* will be given two quarter turns on the angle bars 41 and 41ᵇ to aline them with the right-hand two-page-wide members of the same webs and the associated one-page-wide supplement web-member and two-page-wide main web-members will run together downward over the former and the two-page-wide web-members will be folded longitudinally thereon. In like manner all of the two-page-wide web-members of the webs *v* and *y* will be alined and associated on the former 65, and the two-page-wide web-members will be folded longitudinally on the former. The section of the paper containing the supplement will run over the former 42ª and the section without a supplement will run over the former 65. The group of associated web-members from the former 42ª including the one-plate-wide supplement web-member will be run over the roller 96 to the cylinder 67, and the group of two-plate-wide associated and longitudinally folded main web-members from the former 65 will run around the roller 95 to the cylinder 67 and

will be assembled or collected thereon with the longitudinally folded web-members running from the former 42ª; the blade 88 of the cylinder 69 will cut into sections both groups of longitudinally folded web-members, and the sections will run to and will be folded together by the folder rollers 77. In that case the paper will have thirty pages and will comprise one section of fourteen pages including supplement, and another section of sixteen pages including supplement.

The printed pages of the perfected webs are located end to end, with the usual margin between the ends of the pages, and during the operation of cutting into sections the associated and longitudinally folded webs, the cut for each section will invariably be made along the margin between two identical pages which have both been printed by one and the same plate extending around one plate cylinder a distance equal to the length of one page plus margins, as distinguished from pages containing the same matter which under the prior practice would have been printed by a plurality of duplicate plates, or different plates, extending around the plate cylinder a distance equal to the sum of the lengths of the pages plus margins. The difference is the difference between one plate extending around the plate cylinder, or a plurality of plates extending around the plate cylinder; and a further difference is the cutting along the transverse margin between the ends of two adjacent pages which have been printed upon the same plate on one plate cylinder, as distinguished from the cutting between the ends of two adjacent pages which have been produced from duplicate plates or different plates on one plate cylinder.

If the machine is operating upon four-plate-wide webs and is equipped with two formers as shown, the first fold of each section of the paper will be made on the formers respectively and the first folded webs from both formers will be brought together and associated on one carrier cylinder and will be cut by one cutter cylinder coöperating with the carrier cylinder and the two sections will then be folded together by one folder mechanism coöperating with said carrier and cutter mechanism and will be dropped onto one delivery device, or the first folded webs from one former may run to one carrier cylinder and the first folded webs from the other former may run to the other carrier cylinder and said webs may be cut into first folded sections by the cutter cylinders coöperating with said carrier cylinders respectively and the cut sections from said last named carrier cylinder will be run through and collected with the section cut on said first named carrier cylinder and the two sections will be folded together by the same folder mechanism and dropped onto the same delivery device.

Each plate cylinder is equipped with a plurality of plates in one series arranged with the widths of the pages crosswise of the plate cylinder and the series of plates extends around the plate cylinder a distance equal to the length of one page plus margins, the plates being so arranged, that measuring around the plate cylinder, never more than one plate will at any given part of the cylinder, occupy on the circumference of the plate cylinder a distance greater than the length of one page plus margins. If a plurality of groups of two-plate-wide associated webs are used, the matter of the plates operating on one group of webs will be different from the matter of the plates operating on any other group or groups of webs and the matter printed on the webs of one group will be the matter of one section of the paper and the matter printed on another group or groups of webs, will be the matter of another section, or sections of the paper. In operation each series of plates will perfect one side of a single web, that is to say; the series of plates on one plate cylinder of a set will perfect one side of a given web and the series of plates on the complemental plate cylinder of the same set will perfect the other side of the same web and when the web is cut into one-page-long sheets the successive cuts of each web will be alike and will have been printed by the same plate extending around the plate cylinder and forming one of a set extending lengthwise of said plate cylinder. Each successive cut when cutting off the sections of the paper is in length equal to the length of one page plus margins, and each successive cut of the same section is perfected by the same plate on each plate cylinder extending the length of one plate around said plate cylinder, the plates being so arranged that successive cuts will be made along the transverse margin between the pages, all the matter of the pages, the transverse margins and the length of the cuts will be the same in every section and the matter will be so arranged that when the cut is made the transverse cut will be made along the margin between the ends of two adjacent pages printed by the same plate.

The apparatus is adapted to produce book-form papers either with supplement or without supplement. If the paper is to have an even number of pages, say eight, twelve, sixteen, twenty or twenty-four pages, and so on; a plurality of two-page-wide webs, or two-page-wide web-members, as the case may be, will be associated and run together over and folded lengthwise upon one former. If book-form papers with supplements are to be produced a plurality of two-page wide main webs or web-members and a one-page-wide supplement web or web-member will be

associated on one former and will run over and the two page wide webs or web-members will be folded lengthwise on said former; in that case the product will be a book form paper having ten, fourteen, eighteen, twenty-two, or twenty-six pages and so on; and in every case the book form paper, either with a supplement or without a supplement, will invariably be a page-for-plate product, and the cutting will invariably be done along the margin between the ends of two pages perfected by one and the same plate lying around one plate cylinder.

In producing papers in collected sections, two or more formers will be used; associated two-plate-wide webs or web-members will run over each former and will be folded lengthwise thereon and the webs from both formers may run to a single cutter device by which they will be cut into sections, the cut in each instance being along the margin between the adjacent ends of two pages perfected by one and the same plate lying around one plate cylinder, and the sections will be folded together by a single second folder mechanism; or the associated webs may run to two cutter devices by which they may be cut in like manner into sections and the sections from both cutters may be brought together and folded together by a single second folder mechanism.

Papers in collected sections, without supplements may comprise two eight-page sections, or two twelve-page sections, and so on; or may comprise a twelve-page and an eight-page section, and so on; and in either case two-plate-wide webs or web-members exclusively, will run over both formers. If both sections are to have supplements a one-plate-wide supplement web or web-member will be associated with the main webs or web-members running on each former. If one section is to have a supplement and the other section is to be without a supplement, a one-plate-wide web or web-member will be associated with the two-plate-wide webs or web-members running on the former carrying the webs from which the section with the supplement is derived, and the webs or web-members associated on the other former will be all two-plate-wide. In either case the cutting and folding below the former will be the same as has been already described. In collecting as described it is obvious that a section comprising eight pages running over one former and a section comprising six pages running over the other former may be collected to form a fourteen page paper; in like manner two eight page sections collected will form a sixteen page paper; an eight page section and a ten page section collected, will form an eighteen page paper; an eight page section and a twelve page section collected, will form a twenty page paper; a ten page section and a twelve page section collected, will form a twenty-two page paper; two twelve page sections collected, will form a twenty-four page paper; a twelve page section and a fourteen page section collected, will form a twenty-six page paper; and so on; and in every case the product will be a page-for-plate product.

The gist of this invention consists in so arranging the printing mechanisms, the associating devices which associate in one group the webs from which one section of the paper is derived and in another group the webs from which another section of the same paper is derived, the formers for folding lengthwise the groups of associated webs respectively, the means for associating said groups of longitudinally folded webs and the cutter mechanisms for cutting the associated groups of webs into sections; that each plate cylinder will be equipped with a plurality of plates extending lengthwise of the plate cylinder and extending around the plate cylinder a distance equal to the length of one plate only and the successive sections of a paper will consist of pages perfected by one and the same plate extending around one plate cylinder of any given printing couple, and when the webs have been associated into groups and the groups of associated webs have been folded longitudinally and run to the cutter mechanism, or cutter mechanisms, the cut will invariably be between two pages perfected by one and the same plate extending around the same plate cylinder of any given printing couple, in contradistinction to a cut between pages containing the same matter but perfected by a plurality of plates extending around the plate cylinder of any given printing couple a distance equal to the sum of the lengths of said plurality of plates.

Under the prior practice in producing papers in sections the pages comprised in one cut of a given section, say the first section, have been produced by plates extending around the plate cylinders and the pages of the next succeeding cut of the same section have been produced from different plates extending around the same plate cylinders. Under the present invention each and every successive cut of any given section of the paper is perfected by one plate on each plate cylinder extending around the plate cylinder the length of only one page and so arranged that the successive cuts for successive sections comprising the same matter will be made along the transverse margin between the ends of the pages, the pages being separated by suitable transverse margins, and each successive page of each successive cut is produced by one and the same plate on one cylinder.

Prior to the present invention two methods of collecting have been commonly used,

which for convenience in description I will designate as method A, and method B, respectively. Under method A the pages constituting the sections which are to be collected are printed by different plates extending around the plate cylinders. Ordinarily the plate cylinders are two plates in circumference and one set of plates occupies one-half the circumference of each plate cylinder and a second set of plates occupies the other half of the circumference of the same plate cylinder. The first set of plates prints the first section of the paper, and the second set of plates prints the second section of the paper. The perfected webs comprising both sections run over and are folded lengthwise upon a single former; the sections in succession are cut off below the former, and both sections are brought together by any suitable means, and the two sections are folded together in the second fold, by any suitable folder mechanism. If a paper in sections is produced under method A the plate cylinders must rotate a distance equal to the length of two pages plus margins for every paper that is produced. Under my method, in order to produce a complete paper either in book form or in sections the plate cylinders rotate a distance equal to the length of only one plate. Under method A, if a supplement is used, there must be a supplement in both sections. It is impossible to produce a paper comprising two sections, one with supplement and the other without supplement. Under method B, (known as transfer collecting,) operating on a four page wide web and using two formers, each plate cylinder is equipped with two sets of plates lying side by side across the plate cylinder and each set of plates comprises an original plate and a duplicate plate lying end to end around the same plate cylinder. A first former and a second former, preferably side by side, are used, and the two-page-wide web-members perfected by one set of plates and comprising the pages of the first section run over and are folded lengthwise upon the first former, and the webs perfected by the second set of plates and comprising the pages of the second section, run over and are folded lengthwise upon the second former. The longitudinally folded two-page-wide web-members running from both formers run to and are simultaneously cut into sections by a single cutter device situated below the formers and the two sections are then folded together by any suitable single second-folder mechanism. Under this method, duplicate plates must be used to perfect the web. If one section has a supplement, an original plate and a duplicate plate around each supplement plate cylinder must be used; and if both sections have supplements an original plate and a duplicate plate for each supplement must be used.

Under all prior methods of transfer collecting it is necessary to use duplicate plates lying around the plate cylinders. Under my improved method of transfer collecting, herein set forth, it is necessary to use only half the number of plates which are necessary in the prior methods of transfer collecting. Under my improved method of collecting the same number of plates will be used that are used under method A; but my method employing a given number of plates and running the webs at a given surface speed, will in a given time, produce twice the number of papers that can be produced under method A when using the same number of plates and operating during the same time upon webs running at the same surface speed. It will be seen therefore that my improved method has great practical advantage over method B in the saving of the number of plates; and great practical advantage over method A in the number of papers which may be produced from a given number of plates in a given time. Under my method the product either in book form or collected sections, is always a page-for-plate product, whether with supplement or without supplement. In every case, my method will in a given time, at a given surface speed, and with a given number of plates, produce twice as many papers as can be produced under either method A, or method B, in the same time, with the same number of plates and the webs running at the same surface speed.

A feature of my invention which clearly distinguishes it from the prior art is that I print, make the first fold of and cut off a complete paper in sections for each distance of web-travel equal to the length of one page, that is to say; if the web travels a distance equal to the length of five pages I cut off five complete papers in sections, or if it travels a distance equal to the length of ten pages I cut off ten complete papers in sections; whereas under the prior art, if the web travels a distance equal to the length of ten pages, only five complete papers in sections can be cut off.

This invention is distinguished from that disclosed in U. S. Patent numbered 924310, granted to me June 8, 1909, for printing machine, in that the mechanism of the patent effective to produce collected sections, comprises plate cylinders equipped with plates in series lengthwise of the plate cylinders and extending the length of a plurality of plates around the plate cylinders, whereas the present invention involves the use of plates in series, the plates of each series extending around each plate cylinder a distance equal to the length of one plate only. The plate cylinders of the machine disclosed in the patent rotate a distance equal to the length of a plurality of plates when operat-

ing to produce the companion sections of a single paper, whereas, under the present invention one plate lying around each plate cylinder perfects the webs comprising the pages of the companion sections of a single paper and the plate cylinders rotate a distance equal to the length of only one plate in perfecting the companion sections of a single paper. In order to collect, the machine shown in the patent must have a series of plates lengthwise of each plate cylinder and each series must comprise a plurality of plates extending around the plate cylinder and the matter of the plates extending around each plate cylinder must be different matter. The present invention involves the use of a series of plates occupying a space across the plate cylinder a plurality of pages in width but never more than one page around the same plate cylinder, and the plates are never duplicated, or multiplied, around the plate cylinder. In the machine shown in the patent the webs from which the two companion sections of a complete paper are cut are associated on one and the same former, whereas in the present invention the associated webs from which the first section of the paper is cut are associated on and run over one former and the associated webs from which the companion or second section of the same paper is cut are associated on and run over another former.

Under the prior practice in transfer collecting, duplicate plates around the plate cylinders must be used; but under the present invention duplicate plates around the plate cylinders are not necessary and are not used.

It will be observed that under the present invention, with a given number of plates operating on webs at a given surface speed, the number of papers running per hour will be twice as great as under the prior practice; and with half the number of plates operating on webs at the same surface speed the number of papers per hour either in collected sections or book form, will be the same as under the prior practice. This is due to the difference in the run of the webs over the formers. The webs running over one former as set forth in the patent must travel the length of two pages to produce the companion sections of a complete paper whereas under the present invention the webs run simultaneously over two formers the length of only one page to produce the companion sections of a complete paper. Another distinction is that the machine set forth in the patent is adapted to produce a page-for-plate paper comprising two sections each having an equal number of pages, but it is not adapted to produce a paper comprising two sections having different numbers of pages, say a ten page section and an eight page section to form an eighteen page paper, or a twelve page section and an eight page section to form a twenty page paper; whereas the present invention is adapted to produce a paper in sections having any desired number of pages and the sections may have equal numbers of pages, or different numbers of pages, or both sections may have a supplement, or one section may have a supplement and the other may be without supplement and all of these various products will be page-for-plate products.

The apparatus of modified construction illustrated in Figs. 7 and 8 comprises four printing machines C, D, E and F arranged in a quadrangle substantially as shown. Machines C, D, E and F are exactly like machines A and B except the arrangement of the plates on the plate cylinders and the position of the presses relative to each other. In machines A, B, E and F the plates are arranged alternately zig-zag on the plate cylinders; in machines C and D the plates are in pairs zig-zag on the plate cylinders but in every case a series of plates on each plate cylinder extends around the plate cylinder a distance equal to the length of only one plate. The zig-zag arrangement of the plates is of practical advantage because it contributes to even operation of the cylinders but the plates may be arranged in series in any other suitable manner provided that any given series of plates does not extend around the plate cylinder a distance greater than the length of one page plus margin. The cylinders of machines E and F are end to end and the cylinders of machines C and D are parallel and in line with each other. Two-plate-wide formers 97 and 97^a are located adjacent to the printing machine C and the noses of the formers point toward the machine. Similar formers 98 and 98^a are adjacent to and their noses point toward printing machine D. Two angle bars 99 and 99^a above machine C are in line with printing machine E and two similar angle bars 100 and 100^a are above machine D and in line with machine F. A pulling roller 101 is located between the formers 97, 97^a and the formers 98, 98^a. Wheels 102 are mounted on arms 103 and the arms are adjustably connected with a fixed horizontal shaft 104 by set screws 105 and the wheels 102 run in contact with the roller 101. Slitters 106 are mounted on arms 107 which are adjustably connected with the shaft 104 by set screws 107^a. The wheels 102 coöperate with the roller 101 to propel the webs running on the roller. There are three slitters 106 cutting on the roller 101 to divide the supplement web into four one-page-wide members. A pair of revoluble pulling rollers 108 are above and parallel to the upper edges of the formers 97 and 97^a and a similar pair of pulling rollers 109 are above and parallel to the upper edge of the formers 98 and 98^a.

Pulling rollers 110 and 111 serve to propel the associated webs at the upper edges of the formers. The cutter, carrier, folder and delivery mechanisms coöperating with the formers 97, 97ª and 98, 98ª are exactly the same as the folder mechanisms coöoperating with the formers 42 and 42ª and shown in Fig. 3.

The apparatus shown in Figs. 7 and 8 is designed to produce papers comprising a greater number of pages than can be produced by the machine illustrated in Figs. 1 and 3 and is designed to utilize a four-page-wide supplement web in producing papers with supplements. Rolls W^c, Z^c and X^c supply webs to machine C; rolls W^d, Z^d and X^d supply webs to machine D; rolls W^e, Z^e and X^e supply webs to machine E and rolls W^f, Z^f and X^f supply webs to machine F. Each machine comprises two units each adapted to perfect one web. Eight pages are printed on each web, so the apparatus as a whole operating on eight webs will produce a sixty-four page paper. A feature of special practical value is that all the rolls of paper are on the floor level, so the rolls may be handled more rapidly and conveniently than would be the case if they were in tiers one above the other. Another advantage is that the papers from all of the folder mechanisms are delivered adjacent to the central passage way between machines C, D, E and F in a most convenient position for disposition of the papers. Owing to the relative position of machines C and D, webs from machine C may run in a straight line between the rollers 108 and 110 to the formers 97 and 97ª and be associated thereon with associated webs from machine D running between the rollers 109 and 110; vice versa, webs from machine D may run in a straight line to the formers 98 and 98ª and be associated thereon with webs running in a straight line from machine C. Webs from machine E may be given a quarter turn around the angle bars 99 and 99ª to aline them with webs from machines C and D and may run with the webs from machines C and D to the formers 97, 97ª; or 98, 98ª or some of the webs from machine E may run to and over the formers 97 and 97ª and some may run to and over the formers 98 and 98ª and may be associated thereon with the webs running on said formers from machines C and D or from machine C or D and in like manner webs from machine F may be given a quarter turn on the angle bars 100 and 100ª to aline them with the webs running from machines C and D and may be associated on the formers 97, 97ª; or 98, 98ª, as the case may be, and may run downward over the formers with the associated webs from either or both of the printing machines C and D. All of the printing units are driven simultaneously at uniform speed by suitable gears, not shown, and all of the webs travel at the same surface speed. Machine C, or machine D, may be operated alone; or machines C and D may be operated together; or machines C and E may be operated together; or machines D and E may be operated together; or machines D and F may be operated together; or machines C, D and E may be operated together; or machines C, D and F may be operated together; or machines C, D, E and F may be operated together. To produce papers with a relatively small number of pages one machine will be operated; for papers comprising a greater number of pages two machines will be operated; for a still greater number of pages three machines will be operated; and for the maximum number of pages four machines will be operated. The webs from machines C, D, E and F may all be associated on the formers 97 and 97ª, or may all be associated on the formers 98 and 98ª. If some or all of the webs are associated on the formers 97 and 97ª the associated webs from the former 97 may run to the carrier cylinder 44 and the associated webs from the former 97ª may run to the carrier cylinder 45 and may be cut into sections and folded as already described or the associated webs from both formers 97 and 97ª may all run to the carrier cylinder 44 or may all run to the carrier cylinder 45 as the case may be and the associated groups of longitudinally folded webs may be cut into sections and folded as already described; or the associated webs from both of the formers may all run to the cylinder 67 or 68, as the case may be, and may be cut, collected and folded as described. In like manner associated webs running on the formers 98 and 98ª may run to the carrier cylinders 44ª or 45ª respectively or all the associated and longitudinally folded webs may run to the cylinder 44ª and be cut and folded as already described, or all may run to the cylinder 45ª and may be cut and folded as already described. In this machine there are four folder units adjacent to the formers 97, 97ª, 98 and 98ª respectively. Each folder unit comprises two carrier cylinders, two cutter cylinders coöperating with said carrier cylinders respectively, tapes for transfer collecting from one carrier cylinder to the other, two sets of folder rollers one set coöperating with each of the carrier cylinders, a switching device intermediate of the sets of folder rollers, delivery wheels on each side of the switch, and delivery tapes coöperating with the delivery wheels respectively as illustrated in detail in Fig. 3. In operating to produce book-form papers both main cutter devices and both sets of folder rollers of the folder unit will be used and in operating to produce papers in sections one set of folder

rollers will be used in coöperation with one main cutter device or two main cutter devices as the case may be, as hereinbefore described. The run of the associated and longitudinally folded webs, after they leave the formers, the associating or assembling of the groups of longitudinally folded webs, the cutting of the papers or sections as the case may be, the collecting of the sections, the folding of the papers or sections as the case may be and the delivery of the papers or sections will be exactly the same as have already been described. To produce papers with supplements all derived from a single four-page-wide web, all of the folder units will be used. The supplement web, which for purpose of illustration is assumed to run from the roll W^e, will be given a quarter turn on the angle-bar 99 and will be run over the roller 101 and the slitters 106 cutting on the roll 101 will divide the web into four web-members and the slitted web will run downward between the rollers 113 and the web-members, reading from left to right, will run as follows: The first web-member will run between the rollers 110 and downward over the left-hand side of the former 97; the second web-member will run between the rollers 111 and downward over the right-hand side of the former 98; the third web-member will run between the rollers 110 and downward over the left-hand side of the former 97^a and the fourth web-member of the web will run between the rollers 111 and downward over the right-hand side of the former 98^a. In each case the supplement web-member will run next to the surface of the former and the main web-members will run on top of the supplement web-member. I have described the supplement web-members as running alternately to the right and the left but it is obvious that the two central supplement web-members may run to the right or left as the case may be and the two outside supplement web-members may run to the right or the left as the case may be. The associated main web-members and supplement web-member running on the formers respectively will be operated upon by the cutter, carrier, collecting, folder and delivery mechanisms exactly as in producing papers without supplements.

The apparatus of modified construction illustrated in Figs. 4, 5 and 6 consists of two machines G and H with the cylinders of one machine end to end relatively to the cylinders of the other. Each machine comprises four printing units arranged in decks J^1, J^2, J^3 and J^4 one above the other. Each printing unit comprises two plate cylinders 115, two impression cylinders 116 coöperating with the plate cylinders, and two ink drums 117 supplying ink to the plate cylinders respectively. Rolls H^1, H^2, H^3 and H^4 respectively supply webs to the printing units of machine H and rolls G^1, G^2, G^3 and G^4 respectively supply webs to the printing units of machine G. The plate cylinders of the printing machines are in circumference equal to the length of one page plus margin and in width equal to the width of two pages plus margin. Two plates side by side occupy the entire surface of each plate cylinder. Two-plate-wide formers 121 and 123 are in line with machine H and the former 121 is above the former 123. Two-plate-wide formers 122 and 124 are in line with machine G and the former 122 is above former 124. Pulling rollers 119 and 120 propel perfected and associated webs h^1 and h^2 running between said rollers to the former 121; pulling rollers 127 and 128 propel associated webs h^3 and h^4 running between said rollers to the former 123; rollers 129 and 130 propel associated webs g^1 and g^2 running between said rollers to the former 122 and pulling rollers 131 and 132 propel associated webs g^3 and g^4 running between said rollers to the former 124; pulling rollers 125, 126, 139 and 140 propel the associated and longitudinally folded webs running over the formers 121, 122, 123 and 124 respectively. Pipe rollers 133, 134, 135, 136, 137, 144, and 145 guide the associated and longitudinally folded webs as hereinafter explained. Angle-bars 141, 142, 143 and 144 are situated adjacent to printing machine H and at an angle of 45 degrees to the sides of the machine. Similar angle-bars 145, 146, 147 and 148 are situated in the same relation to printing machine G. The angle-bars serve to give two quarter turns to full width webs running on machine H to bring them into line with the full-width webs running on machine G; or similar angle bars (not shown) may be used to give two quarter turns to full width webs running on machine G to bring them into line with the webs running on machine H. In case the alined and associated webs are in line with the formers 122 and 124 all of them may run downward over the former 122, or some of them may run downward over the former 122 and others may run downward over the former 124; or in case the alined and associated webs are in line with the formers 121 and 123 all of the alined and associated webs may run downward over the former 121, or some of them may run downward over the former 121 and others may run downward over the former 123. In both cases, if papers in section are being produced, the webs running over one former will contain the matter of one section and the webs running over the other former will contain the matter of the other section and no duplicate plates will be used in producing the matter running over any single former and the completed paper will invariably be a page-for-plate product. In this apparatus the full

width webs perfected on one machine travel across the passage way between the machines and are alined with the webs running on the other machine before the associated webs run over and are folded lengthwise on the former or formers coöperating with said last named machine; whereas in the machine illustrated in Figs. 1 and 2 the plural-plate-wide webs running on machine A are slitted and the two-page-wide members thereof are associated with each other before they run over and are folded lengthwise on the former 65 and the members of the webs running on machine B are in like manner associated before they run over and are folded lengthwise on the former 42ª and the associated and longitudinally folded web-members from the former 65 travel across the passage way between the machines and are associated with the longitudinally folded web-members running on the former 42ª. In one case the full-width webs cross the passage way between the machines and are associated before they receive the lengthwise fold; in the other case the two-plate-wide web-members are associated and folded lengthwise before they cross the passage way between the machines, but in either case the product is invariably a page-for-plate paper produced by plates in series lengthwise of the plate cylinders and extending around each plate cylinder a distance equal to the length of only one plate plus margins, and in either case, if a paper in sections is produced all the matter of one section will be page-for-plate matter and will run over one former and all the matter of the other section will be page-for-plate matter and will run over another former.

In the apparatus shown in Figs. 4–6 one section may run over a former on one level and the other section may run over a former on another level, the formers being one above the other; whereas in the apparatus shown in Figs. 1 and 2 the sections run over formers which are side by side; but in either case the section running over one former is brought together with the section running over the other former, and the two sections may be cut by a single cutter device and folded together by a single folder mechanism; or one section may be cut by one cutter device and the other section may be cut by another cutter device and the two sections may be assembled and folded together as already described, and in every instance the cut will be along the margin between the ends of two identical pages printed by one and the same plate. The folder units adjacent to the lower ends of the formers 123 and 124 respectively are exactly similar to the folder units already described in connection with machines A and B. In practice associated and longitudinally folded webs from the former 121 may run around the rollers 133 and 134 and between the rollers 139 where they will be associated with the longitudinally folded webs running from the former 123 and the assembled groups of webs will run around the roller 144 to the cylinder 44 upon which they will be cut into sections by the blade of the cylinder 46 and the associated sections will run to and be folded together by the folder rollers 48, or the associated and longitudinally folded webs from the former 121 will run between the rollers 125 around the rollers 133 and 135 to the cylinder 45 upon which they will be cut into sections by the blade of the cylinder 47 and the associated and longitudinally folded webs from the former 123 will run between the rollers 139 and around the roller 144 to the cylinder 44 upon which they will be cut into sections by the blade of the cylinder 46; the sections running on the cylinder 45 will be stripped off by the strippers 76 and will run between the tapes 50 and 53 to the cylinder 44 where they will in succession meet and be collected with the sections running on the cylinder 44 and the collected sections will run to the rollers 48 and will be folded together thereby, or the associated and longitudinally folded webs from the former 121 may run between the rollers 125 and around the rollers 133 and 136 to the cylinder 67. The associated and longitudinally folded webs from the former 123 may run between the rollers 139 and around the roller 136 to the cylinder 67 and be associated thereon with the longitudinally folded webs running from the former 121; the longitudinally folded webs from the former 122 may run between the rollers 126 and around the rollers 138 and 136 to the cylinder 67 and be associated thereon with the webs running from the formers 121 and 123 and the webs from the former 124 may run between the rollers 140 and around the roller 136 to the cylinder 67 and be associated thereon with the webs running from the formers 121, 122, and 123 and all of the assembled webs running on the cylinder 67 will be cut into sections by the blade of the cylinder 69 and the assembled sections will run to and will be folded together by the folder rollers 77. In an exactly similar manner which need not be recited in detail the associated webs from all of the formers may be assembled on the cylinder 45 and cut into sections by the blades of the cylinder 47 and folded by the folder rollers 49. One group of associated webs containing the matter of one section of the paper may run over the former 123 and another group of associated webs containing the matter of the other section of the paper may run over the former 124 and the groups of longitudinally folded webs may run to one cutter device which will cut them into sections and the sections will be folded to-

gether by a single set of folder rollers, or one group of associated and longitudinally folded webs may run to one cutter device which will cut it into sections and the other group may run to another cutter device which will cut it into sections and the sections cut from both groups may be collected and folded together by one set of folder rollers. Groups of associated and longitudinally folded webs running on the formers 121 and 122 or 121 and 124, or 122 and 124 may be cut, collected and folded in the same manner.

Owing to the relative arrangement of the printing machines and the formers the matter of the two sections of a paper may be printed by two printing machines end to end and the associated webs containing same may run over two formers side by side or may be printed by a plurality of printing units one above the other and the webs containing same may run over two formers one above the other. In one case the associated webs comprising the two sections travel in parallel in the same horizontal plane and in the other case the associated webs comprising the web sections travel in parallel in different horizontal planes. In every case every web is perfected by plate cylinders equipped with plates crosswise of the web and extending around the plate cylinder a distance equal to the length of one page plus margins and this is true whether the plate cylinders are one plate in circumference or a plurality of plates in circumference.

Having fully described my invention, what I claim as new and desire to secure by Letters Patent is:

1. The combination of a plurality of plate cylinders each equipped with a single series of plates extending across the plate cylinder a distance equal to the width of a plurality of pages plus the usual margins and extending around the plate cylinder a distance equal to the length of one page plus the usual margins, and adapted to print on both sides of continuously moving webs, page-for-plate matter in rows; the printed pages constituting any one row on one side of the web being all identical and all printed from the same plate extending around the plate cylinder a distance equal to the length of a single plate plus the usual margins, means for associating and folding longitudinally the perfected webs, means for again associating the longitudinally folded webs, and a single cutter mechanism adapted to cut into sections the associated and longitudinally folded webs, the cut in every case being made along the margin between the ends of two adjacent and identical pages produced by the same single plate extending around the plate cylinder the length of one page plus the usual margins.

2. The combination of a plurality of plate cylinders each equipped with a single series of plates extending across the plate cylinder a distance equal to the width of a plurality of pages plus the usual margins, and extending around the plate cylinder a distance equal to the length of one page plus the usual margins, and adapted to print on both sides of continuously moving webs, page-for-plate matter in rows; the printed pages constituting any one row on one side of any web being all identical and all printed by the same plate extending around the plate cylinder a distance equal to the length of a single plate plus the usual margins; a plurality of means for associating and folding longitudinally the perfected webs, a plurality of cutter mechanisms respectively acting to cut into sections the associated and longitudinally folded webs running from said means for associating and folding longitudinally the perfected webs, the cut in every case being made along the margin between the ends of two adjacent and identical pages both produced by the same single plate extending around the plate cylinder the length of one plate plus the usual margins; means for assembling said sections; and a single folder mechanism adapted to fold together the assembled sections.

3. The combination of a plurality of plate cylinders each equipped with a single series of plates extending across the plate cylinder a distance equal to the width of a plurality of pages plus the usual margins, and extending around the plate cylinder a distance equal to the length of one page plus the usual margins, and adapted to print on both sides of continuously moving webs, page-for-plate matter in rows; the printed pages constituting any one row on one side of any web being all identical and all printed by the same plate extending around the plate cylinder a distance equal to the length of a single plate plus the usual margins; a plurality of means for associating and folding longitudinally the perfected webs, a plurality of cutter mechanisms respectively acting to cut into sections the associated and longitudinally folded webs running from said means for associating and folding longitudinally the perfected webs, the cut in every case being made along the margin between the ends of two adjacent and identical pages both produced by a single plate extending around the plate cylinder the length of one plate plus the usual margins, and means for assembling said sections.

4. The combination of a plurality of plate cylinders each equipped with a single series of plates extending across the plate cylinder a distance equal to the width of a plurality of pages plus the usual margins, and extending around the plate cylinder a distance equal to the length of one page plus the usual margins, and adapted to print on both

sides of continuously moving webs, page-for-plate matter in rows; the printed pages constituting any one row on one side of any web being all identical and all printed by the same plate extending around the plate cylinder a distance equal to the length of a single plate plus the usual margins, means for associating and folding longitudinally the perfected webs, means for again associating the longitudinally folded webs, a single cutter mechanism adapted to cut into sections the associated and longitudinally folded webs, the cut in every case being made along the margin between the ends of two adjacent and identical pages produced by the same single plate extending around the plate cylinder the length of one page plus the usual margins; and a single folder mechanism adapted to fold together the sections cut by said cutter mechanism.

5. The combination of a primary plate cylinder equipped with a printing surface extending around said plate cylinder a distance equal to the length of one page, a secondary complemental revoluble plate cylinder equipped with a printing surface extending around said secondary plate cylinder a distance equal to the length of one page, duplicate impression cylinders cooperating with said plate cylinders to perfect continuously moving webs having on both sides pages in rows lengthwise of the web, the successive pages in one row on one side of the web being all perforated by one and the same printing surface of said primary plate cylinder and the successive pages of the opposite row on the reverse side of the same web being all perfected by one and the same printing surface extending around said secondary plate cylinder; means for associating said perfected webs and folding them longitudinally, and cutter mechanism adapted to cut along the margin between the ends of adjacent consecutive pages in one row on one side of the web both of which have been printed by one and the same printing surface on one plate cylinder.

6. The combination of a plurality of sets of printing mechanisms each set comprising a plate cylinder equipped with a series of plates arranged with their widths lying across the plate cylinder, and extending the length of one plate around the plate cylinder, and adapted to perfect one side of a plural-plate-wide web, and a complemental plate cylinder equipped with a series of plates arranged with their widths lying across the plate cylinder and extending the length of one plate around said complemental plate cylinder and adapted to perfect the other side of a plural-plate-wide web, formers adapted to carry and fold longitudinally the webs perfected by said printing mechanisms, a carrier in operative relation to said formers and adapted to carry perfected webs folded longitudinally by said formers respectively and means for cutting into sections the longitudinally folded webs running on said carrier.

7. The combination of a plurality of rotating plate cylinders, each equipped with a series of plates extending across the plate cylinder a distance equal to the combined widths of a plurality of plates and extending around the plate cylinder a distance equal to the length of one plate, impression cylinders coöperating with said plate cylinders to perfect on a plurality of plural-plate-wide webs, page-for-plate matter arranged with the width of the pages in series crosswise of said webs, the successive series of pages of matter of each web being all printed by the same series of plates; means for folding said webs longitudinally, means for associating said longitudinally folded webs; means adapted to carry said associated webs, and means adapted to cut said first folded and associated webs into one-page-long sections.

8. In an apparatus of the class described, the combination of printing mechanisms equipped with plates in series extending across each plate cylinder a distance equal to the width of a plurality of pages plus margins and extending around each plate cylinder a distance equal to the length of one page plus margins and adapted to print upon continuously moving webs the matter of pages in rows lengthwise of the webs, the pages of any given row on one side of any given web being all alike and all produced from one and the same plate extending around the plate cylinder the length of one page plus margins, means for associating the perfected webs to form groups, means for assembling the groups of associated and longitudinally folded webs, and means for folding lengthwise the associated webs constituting each group, means for assembling the groups of associated and longitudinally folded webs, and means for cutting said assembled groups of webs into sections, said cutting means being adapted to invariably cut along the margin between the ends of two adjacent and identical pages printed from one and the same plate extending around the plate cylinder a distance equal to the length of one plate plus margins.

9. In an apparatus of the class described, the combination of two sets of end-to-end printing mechanisms, each set adapted to perfect on continuously moving webs, by means of exclusively original plates, the page-for-plate matter of a complete book-form paper, or the page-for-plate matter of a complete paper in sections, each and every time that the perfected webs advance a distance equal to the length of one page plus margins; means for associating in one group the webs perfected by one set of printing

mechanisms; means for associating in another group the webs perfected by the other set of printing mechanisms; means adapted to effect two quarter-turns of the perfected webs of one group to aline the turned webs with the other group of perfected webs and associate in book-form all the webs of both groups before making the first-fold; first-folder means in operative relation to either set, or both sets, of printing mechanisms and adapted to make the first-fold of the respective groups of webs, and severally adapted to make the first-fold of the associated groups of webs; carriers in operative relation to either first-folder means, or both first-folder means and adapted to carry the groups of longitudinally folded webs running from said first-folder means respectively, and severally adapted to carry a group of longitudinally folded webs running from either first-folder means, or associated groups of longitudinally folded webs running from both first-folder means to one carrier; cutters coöperating with said carriers respectively to cut into book-form papers the groups of longitudinally folded webs running on said carriers respectively, or to cut into sections the associated groups of longitudinally folded webs running on one carrier, the cut in every instance being along the margin between the adjacent ends of two identical pages printed by one and the same plate, and second-folder mechanisms coöperating with said carriers respectively to make the second-fold of book-form papers running from said carriers respectively, and severally adapted to fold together in the second-fold two sections derived from webs folded longitudinally by said first-folder means respectively and associate on one carrier before cutting, and also adapted to fold together in the second-fold two sections derived from webs folded longitudinally by said first-folder means respectively and cut on said carriers respectively and the cut sections assembled on one carrier before making the second-fold.

10. In an apparatus of the class described, the combination of a four-plate-wide printing machine equipped with plates in series across the machine and extending around each plate cylinder a distance equal to the length of one page plus margins and having columns circumferential to the plate cylinder, and adapted to perfect page-for-plate matter on continuously moving webs, means for slitting the perfected webs to divide them into two-page-wide web-members, two formers adapted to fold lengthwise said associated two-page-wide web-members, and folder units in operative relation to said formers respectively and adapted to cut, fold and deliver papers derived from the associated webs running on said formers respectively.

11. In an apparatus of the class described; the combination of means for supporting a plurality of plural-plate-wide rolls of predetermined width supplying webs to be operated upon; a plurality of printing machines in number equal to the number of pages occupying the width of one web and each adapted to perfect with exclusively original plates page-for-plate matter on a plurality of webs running from rolls mounted on said roll supports; means for associating in parallel all of said perfected webs; means for slitting one of said webs to form a one-page-wide supplement web-member; and folder units equal in number to the number of pages occupying the width of one web and adapted to fold and deliver page-for-plate book-form papers, printed by exclusively original plates with a supplement in each paper.

12. A printing and folding machine comprising printing mechanisms adapted to perfect on both sides of continuously moving webs, by means of exclusively original plates all the matter of a complete paper in sections each and every time that the perfected webs advance the length of one page, means for cutting off the sections each and every time the webs advance the length of one page, the cut in every instance being along the margin between the adjacent ends of two identical pages printed by one and the same plate, means for separately folding the several sections along the central lengthwise margin between the pages thereof, and means for assembling the first-folded sections and folding them together in the second fold to produce a complete paper in sections each and every time that the perfected webs advance the length of one page, the matter of all the sections of one paper being different and the matter of each section being printed by exclusively original plates.

13. The combination of printing mechanisms; first-folder means adapted to fold webs lengthwise; cutters adapted to cut the longitudinally folded webs into book-form papers, or to cut said webs into sections; two carriers severally adapted to carry book-form papers or sections; two sets of second-folder mechanisms coöperative with said carriers respectively to make the second-fold of book-form papers, and severally coöperative with either carrier to make the second-fold of papers in sections; and delivery devices adapted to receive second-folded book-form papers running from said second-folder mechanisms respectively, and severally adapted to receive two at a time, book-form papers running from both second-folder mechanisms, or to receive one at a time, papers comprising two sections folded together in the second-fold by either second-folder mechanism.

14. In an apparatus of the class described, the combination of a four-plate-wide printing machine equipped with plates in series across the machine and extending around each plate cylinder a distance equal to the length of one page plus margins and having columns circumferential to the plate cylinder, and adapted to perfect page-for-plate matter on continuously moving webs, means for slitting the perfected webs to divide them into two-page-wide web-members, two formers adapted to fold lengthwise said associated two-page-wide web-members and a single folder unit in operative relation to both of said formers and adapted to cut, collect, fold and deliver papers in sections derived from the associated webs running on both of said formers.

15. In an apparatus of the class described, the combination of two four-plate-wide printing machines in line with each other and equipped with plates in series crosswise of the machine and extending around each plate cylinder a distance equal to the length of one page plus margins with columns circumferential to the plate cylinders and adapted to perfect continuously moving main webs and a four-plate-wide supplement web, slitters between opposite formers and adapted to slit into one-page-wide web-members a supplement web running from either of said machines, slitters adapted to slit into two-page-wide web-members a plurality of main webs perfected by said printing machines respectively, four formers in operative relation to both of said printing machines, and means for associating with the two-page-wide web-members on each former a one-page-wide supplement web-member, and folder units in operative relation to said formers respectively and adapted to cut, fold and deliver papers each having a supplement derived from said supplement web.

16. In combination with two sets of printing mechanisms, each set equipped with exclusively original plates and adapted to perfect page-for-plate matter on a plurality of continuously moving webs; means for associating in groups the webs perfected by said sets of printing mechanisms respectively; means for associating said groups of webs; two first-folder means adapted to fold longitudinally the respective groups of webs perfected by said sets of printing mechanisms and severally adapted to fold longitudinally the associated groups of webs perfected by both sets of printing mechanisms; two carriers in operative relation to either first-folder means and also in operative relation to both first-folder means; cutters coöperating with said carriers respectively and severally adapted to cut the groups of longitudinally folded webs running from said first-folder means respectively, and also adapted to cut the associated groups of longitudinally folded webs running from both first-holder means to one carrier, the cuts on said carriers respectively, or severally, being along the margin between the adjacent ends of two identical pages printed by one and the same plates; second-folder mechanisms in operative relation to said carriers and adapted to make the second-fold of book-form papers running from said carriers respectively and severally adapted to fold together in the second-fold two sections of a paper running from one of said carriers, one section being derived from the group of webs folded by one first-folder means and the other section being derived from the group of webs folded by the other first-folder means; and two delivery devices in operative relation to either second-folder mechanism and also in operative relation to both second-folder mechanisms and adapted to receive two at a time, second-folded book-form papers given the first-fold by said first-folder means respectively and given the second-fold by said second-folder means respectively, and severally adapted to receive one at a time, second-folded papers each comprising two sections, one section being derived from webs given the first-fold by one first-folder means and the other section being derived from webs given the first-fold by the other first-folder means.

17. In an apparatus of the class described, the combination of a plurality of plural-plate-wide printing mechanisms equipped with plates in series crosswise of the plate cylinders and extending around each plate cylinder the length of one plate plus margins and adapted to perfect page-for-plate matter on a plurality of plural-plate-wide webs, means for slitting the perfected webs to divide them into groups of two-page-wide web-members, running side by side, means for effecting two quarter turns of the two-page-wide web-members of one group to bring them into line with the two-page-wide web-members of the other group, means for associating the alined groups of two-plate-wide web-members, means for folding centrally and longitudinally the associated groups of two-plate-wide web-members, a carrier device adapted to carry the longitudinally folded web-members, means for leading the longitudinally folded web-members to said carrier device, a cutter device adapted to cut the associated and longitudinally folded web-members into one-page-long papers, the cut in every instance being along the margin between the ends of two identical pages printed by one and the same plate, and means for making the second fold of said papers.

18. In an apparatus of the class described the combination of a plurality of printing machines arranged end to end and each comprising a plurality of plate cylinders

equipped with plates arranged in series lengthwise of said plate cylinders and extending around each plate cylinder a distance equal to the length of one page plus margins and adapted to perfect page-for-plate matter on a plurality of webs or web-members, one or more formers in operative relation to said printing machines respectively and adapted to fold lengthwise along the central margin two-page-wide webs or web-members associated on said formers, means for associating on each of said formers a plurality of webs or web-members, means for again associating the longitudinally folded webs or web-members running from said formers, a carrier device in operative relation to said plurality of formers and adapted to carry associated and longitudinally folded webs or web-members running from all of said formers, a cutter adapted to cut into one-page-long sections the associated and longitudinally folded webs or web-members running on said carrier, the cut in every instance being along the margin between the ends of two adjacent and identical pages printed by one and the same plate, and a second folder mechanism adapted to fold together the sections cut by said cutter.

19. In an apparatus of the class described, the combination of a plurality of plural-plate-wide printing mechanisms equipped with plates in series lengthwise of the plate cylinders and extending around each plate cylinder the length of one page plus margins and adapted to perfect page-for-plate matter on a one-page-wide supplement web-member and a plurality of two-page-wide main web-members, a slitter adapted to slit the plural-plate-wide webs to divide them into groups of two-plate-wide web-members and a supplement web-member, means for effecting two quarter turns of one group of two-plate-wide main web-members to aline it with the other group comprising two-plate-wide web-members and a one-plate-wide supplement web-member, a former in line with the associated groups of web-members and adapted to fold along the central margin said associated groups of two-plate-wide web-members with a supplement web-member inserted in one group and running on one side of the former, a carrier in operative relation to said former, a cutter adapted to cut into papers the longitudinally folded two-page-wide main web-members and the supplement web running on said carrier, the cut in every instance being made between the ends of two adjacent and identical pages printed by one and the same plate, and folder mechanism adapted to effect the second fold of said first folded papers including supplements.

20. In an apparatus of the class described, the combination of a plurality of printing mechanisms equipped with plates arranged in series lengthwise of the plate cylinders and extending around each plate cylinder a distance equal to the length of one page plus margins and adapted to perfect page-for-plate matter on a plurality of webs or web-members, formers in operative relation to said printing mechanisms and adapted to fold lengthwise along the central margin, two-page-wide webs or web-members associated on said formers, means for associating on each of said formers a group of webs or web-members comprising page-for-plate matter exclusively, means for associating said groups of longitudinally folded webs or web-members running from said formers, carrier devices in operative relation to and adapted to carry the longitudinally folded webs or web-members running from said formers respectively, and cutter devices adapted to cut into one-page-long papers the longitudinally folded webs or web-members running on said carriers respectively, the cut in every instance being along the margin between the ends of two adjacent and identical pages printed by one and the same plate.

21. In an apparatus of the class described the combination of a plurality of printing mechanisms equipped with plates arranged in series lengthwise of the plate cylinders and extending around each plate cylinder a distance equal to the length of one page plus margins, and adapted to perfect page-for-plate matter on a plurality of two-plate-wide web-members and a one-plate-wide supplement web-member, means for slitting the webs lengthwise to separate the two-plate-wide web-members and the one-plate-wide supplement web-member, means for associating in line all of the two-page-wide web-members and the supplement web-member a former in line with the associated web-members and adapted to fold lengthwise along the central margin the associated main web-members running on said former with the supplement web-member inserted between the pages of the main web-members running on the former, means for carrying the associated and longitudinally folded web-members and means for cutting into one-page-long papers the associated and longitudinally folded web-members running on said carrier, the cut in every instance being made along the margin between the ends of two adjacent and identical pages printed by one and the same plate.

22. In an apparatus of the class described, the combination of a printing machine having plate cylinders equipped with plates in series lengthwise of the plate cylinders and extending around each plate cylinder a distance equal to the length of one plate plus margins and the plates occupying one part of the length of each plate cylinder being

adapted to print the page-for-plate matter of one section of a paper and the plates occupying another part of each plate cylinder being adapted to print the page-for-plate matter of another section of the same paper, means for associating in one group the webs comprising the page-for-plate matter of one section of the paper, means for associating in another group the webs comprising the page-for-plate matter of the other section of the same paper, means adapted to fold longitudinally the respective groups of associated web-members, means for bringing together the groups of longitudinally folded webs, and a single cutter device adapted to cut into sections the assembled groups of longitudinally folded webs, the cut in each instance being along the margin between the adjacent ends of two identical pages printed by one and the same plate.

23. In an apparatus of the class described, the combination of a printing machine having plate cylinders equipped with plates in series lengthwise of the plate cylinders and extending around each plate cylinder a distance equal to the length of one plate plus margins and the plates occupying one part of the length of each plate cylinder being adapted to print the page-for-plate matter of one section of a paper and the plates occupying another part of each plate cylinder being adapted to print the page-for-plate matter of another section of the same paper, means for associating in one group the webs comprising the matter of one section of the paper, means for associating in another group the webs comprising the matter of the other section of the same paper, means adapted to fold longitudinally the respective groups of associated web-members, means for bringing together the groups of longitudinally folded webs, a single cutter device adapted to cut into sections the assembled groups of longitudinally folded webs, the cut in each instance being along the margin between the adjacent ends of two identical pages printed by one and the same plate and a folder mechanism adapted to fold together the sections cut by said cutter device.

24. In an apparatus of the class described, the combination of a printing machine having plate cylinders equipped with plates in series lengthwise of the plate cylinders and extending around each plate cylinder a distance equal to the length of one plate plus margins and the plates occupying one part of the length of each plate cylinder being adapted to print the page-for-plate matter of one section of a paper and the plates occupying another part of each plate cylinder being adapted to print the page-for-plate matter of another section of the same paper, means for associating in one group the webs comprising the matter of one section of the paper, means for associating in another group the webs comprising the matter of the other section of the same paper, means adapted to fold longitudinally the respective groups of associated web-members, a plurality of cutter devices each adapted to cut into sections one group of longitudinally folded webs and means for bringing together the sections cut by said cutter devices.

25. In an apparatus of the class described, the combination of a printing machine having plate cylinders equipped with plates in series lengthwise of the plate cylinders and extending around each plate cylinder a distance equal to the length of one plate plus margins and the plates occupying one part of the length of each plate cylinder being adapted to print the page-for-plate matter of one section of a paper and the plates occupying another part of each plate cylinder being adapted to print the page-for-plate matter of another section of the same paper, means for associating in one group the webs comprising the matter of one section of the paper, means for associating in another group the webs comprising the matter of the other section of the same paper, means adapted to fold longitudinally the respective groups of associated webs, a plurality of cutter devices each adapted to cut into sections one group of longitudinally folded webs, the cut in each instance being along the margin between the adjacent ends of two identical pages printed by one and the same plate and means for bringing together the sections cut by said cutter devices.

26. In an apparatus of the class described, the combination of a printing machine having plate cylinders equipped with plates in series lengthwise of the plate cylinders and extending around each plate cylinder a distance equal to the length of one page plus margins and the plates occupying one part of the length of each plate cylinder being adapted to print the page-for-plate matter of one section of a paper and the plates occupying another part of each plate cylinder being adapted to print the page-for-plate matter of another section of the same paper, means for associating in one group the webs comprising the matter of one section of the paper, means for associating in another group the webs comprising the matter of the other section of the same paper, means adapted to fold longitudinally the respective groups of associated webs, a plurality of cutter devices each adapted to cut into sections one group of longitudinally folded webs, the cut in each instance being along the margin between the adjacent ends of two identical pages printed by one and the same plate, means for bringing together the sections cut by said cutter devices and a single

folder mechanism adapted to fold together the sections cut by said plurality of cutter devices.

27. In combination with plate cylinders two plates in circumference equipped with plates in series lengthwise of each plate cylinder and extending around each plate cylinder a distance equal to the length of one plate plus margins, and duplicate impression cylinders coöperating with said plate cylinders respectively; slitters adapted to slit the webs perfected by said plate cylinders to divide them into two-page-wide web-members; means for alining all of said two-page-wide web-members and associating them on one former; a single former adapted to fold lengthwise said alined and associated two-page-wide web-members; a carrier in operative relation to said former; a cutter coöperating with said carrier; and folder-mechanism coöperating with said carrier.

28. In combination with plate cylinders two plates in circumference equipped with plates in series lengthwise of each plate cylinder and extending around each plate cylinder a distance equal to the length of one plate plus margins, and duplicate impression cylinders coöperating with said plate cylinders respectively; slitters adapted to slit the webs perfected by said plate cylinders to divide them into two-page-wide web-members; means for alining all of said two-page-wide web-members and associating them on one former; a single former adapted to fold lengthwise said alined and associated two-page-wide web-members; a carrier in operative relation to said former; a cutter coöperating with said carrier; folder-mechanism coöperating with said carrier; duplicate delivery devices in operative relation to said folder mechanisms and a switch adapted to cause papers folded by said folder-mechanisms to drop onto either of said delivery devices.

29. The combination of printing mechanisms comprising revoluble plate cylinders equipped with plates in series lengthwise of the plate cylinders and extending around each plate cylinder a distance equal to the length of one page plus margins and equipped with plates having columns circumferential to the plate cylinder, and impression cylinders coöperating with said plate cylinders to perfect both sides of continuously moving webs a plurality of pages in width; means for associating and slitting the webs perfected by said printing mechanisms; two formers side by side and adapted to fold lengthwise associated two-plate-wide web-members running on said formers respectively; right and left and opposite carriers in operative relation to both formers; cutters adapted to cut into sheets in length equal to the length of one page plus margins, the longitudinally folded web-members running from said formers respectively, the cut in every instance being along the margin between the ends of two identical pages printed by one and the same plate; second-folder mechanisms coöperating with said carriers respectively; two delivery devices in operative relation to either set or both sets of second-folder mechanisms; and a switch adapted to cause second-folded papers to run from both second-folder mechanisms to either of said delivery devices and also adapted to cause second-folded papers to run from the respective second-folder mechanisms to said delivery devices respectively.

30. In an apparatus of the class described, the combination of printing means having plate cylinders equipped with plates in series lengthwise of the plate cylinder and extending around each plate cylinder a distance equal to the length of only one plate plus margins and adapted to perfect page-for-plate matter on continuously moving webs, a plurality of formers adapted to fold lengthwise and effect a quarter turn of the perfected webs to aline said longitudinally folded webs, a single cutter device adapted to cut into one-page-long sections said longitudinally folded and alined webs, the cut in every instance being along the margin between the ends of two adjacent and identical pages printed by one and the same plate and a single second folder mechanism adapted to fold together in a page-for-plate paper the sections cut by said cutter device.

31. In an apparatus of the class described, the combination of two end to end printing machines having plate cylinders equipped with plates in series lengthwise of the plate cylinders and extending around each plate cylinder a distance equal to the length of only one page plus margins and adapted to print page-for-plate matter on plural-plate-wide webs, turners converging in the direction of the run of the web and adapted to effect two quarter turns of the webs perfected by one of said machines to aline them with the webs perfected by the other machine, before making the first lengthwise fold of said webs, means for associating said alined webs, means for folding lengthwise said alined and associated webs, and means for cutting into one-page-long page-for-plate papers said longitudinally folded webs, the cut in each instance being along the margin between the pages of two adjacent and identical pages printed by one and the same plate.

32. In an apparatus of the class described the combination of two end to end printing machines having plate cylinders equipped with plates in series lengthwise of the plate cylinders and extending around each plate cylinder a distance equal to the length of only one page plus margins and adapted to

print page-for-plate matter on plural-plate-wide webs, means for effecting two quarter turns of the webs perfected by one of said machines to aline them with the webs perfected by the other machine, before making the first lengthwise fold of said webs, means for associating said alined webs, means for folding lengthwise said alined and associated webs, means for cutting into one-page-long page-for-plate papers said longitudinally folded webs, the cut in each instance being along the margin between the pages of two adjacent and identical pages printed by one and the same plate and a second folder mechanism adapted to make the second fold of said first-folded papers.

33. The combination of a plurality of printing mechanisms comprising revoluble plate cylinders equipped with exclusively original plates in series lengthwise of the plate cylinders and extending around each plate cylinder a distance equal to the length of one page plus margins and equipped with plates having columns circumferential to the plate cylinder, impression cylinders coöperating with said plate cylinders to perfect on both sides of continuously moving webs all the page-for-plate matter of a complete paper in sections each and every time that the perfected webs advance the length of one page, means for associating and slitting the webs perfected by said printing mechanisms to divide each web into web-members; two formers side by side and adapted to fold lengthwise groups of associated two-page-wide web-members running on said formers respectively, and each group comprising the matter of one section of the paper; right and left and opposite carriers in operative relation to both formers; cutters adapted to cut into sheets in length equal to the length of one page plus margins, the longitudinally folded web-members running from said formers respectively, the successive cuts of each section in every instance being along the margin between the ends of identical pages printed by one and the same plate; means for assembling all of the sections on one carrier; and second-folder mechanism coöperating with said last named carrier to fold together the assembled sections, to produce a second-folded paper comprising a plurality of sections the matter of all the sections of one paper being different matter printed by exclusively original plates and a complete second-folded paper in sections being produced each and every time that the perfected webs advance the length of one page.

34. The combination of printing mechanisms comprising revoluble plate cylinders equipped with plates in series lengthwise of the plate cylinders and extending around each plate cylinder a distance equal to the length of one page plus margins and equipped with exclusively original plates having columns circumferential to the plate cylinder, and duplicate impression cylinders coöperating with said plate cylinders to perfect on both sides of continuously moving webs two or more pages in width all the matter of a complete paper in sections, means for alining and associating the webs perfected by said printing mechanisms; two formers adapted to fold lengthwise associated two-page-wide webs or web-members running on said formers respectively; a carrier in operative relation to both formers; cutters adapted to cut into sheets in length equal to the length of one page plus margins, the longitudinally folded webs or web-members, running from said formers respectively, the cut in every instance being along the margin between the ends of two identical pages printed by one and the same plate; means for assembling on said carrier sections derived from longitudinally folded webs running from both formers; second-folder mechanism coöperating with said carrier to fold together the assembled sections cut from the webs running from both formers; duplicate delivery devices adjacent to said second-folder mechanism; and a switch adapted to lead second-folded papers from said second-folder mechanism to either of said delivery devices.

35. The combination of printing mechanisms adapted to perfect on both sides of continuously moving webs, by means of exclusively original plates, all the page-for-plate matter of a plurality of sections of a paper in sections, or all the matter of a plurality of book-form papers, each and every time that the perfected webs advance a distance equal to the length of one page plus margins; means for associating the perfected webs in a number of groups equal to the number of sections comprised in one paper, or the number of book-form papers which are to be produced; first-folder means adapted to fold lengthwise the respective groups of associated and perfected webs; right and left and opposite carriers in operative relation to any or all of said first-folder means; cutters adapted to cut book-form papers, or sections, from the groups of webs running from any or all of said first-folder means to and on said carriers respectively, and one of said cutters being likewise adapted to cut two sections from associated groups of longitudinally folded webs running on one carrier; the cut in every instance being along the margin between the adjacent ends of two identical pages printed by one and the same plate; second-folder mechanisms respectively effective to make the second-fold of book-form papers running from said carriers respectively, and one of said second-folder mechanisms being likewise effective to fold

together in a single paper two sections cut by both cutters and running from both carriers; delivery devices in operative relation to said second-folder mechanisms; and means for effecting the run of second-folded book-form papers to either or both of said delivery devices; or the run of papers in sections to either of said delivery devices.

36. In combination with printing means adapted to print with exclusively original plates page-for-plate matter on a plurality of continuously moving webs; slitters adapted to slit said webs into two-page-wide main web-members and a one-page-wide supplement web-member; two formers in operative relation to said printing means and adapted to fold length-wise the two-page-wide web-members perfected by said printing means; means for associating said supplement web-member with the main web-members associated on one former; carriers in operative relation to said formers; cutters coöperating with said carriers respectively to cut in every instance along the margin between the adjacent ends of two identical pages printed by one and the same plate; and folder-mechanisms coöperating with said carriers respectively.

37. In combination with printing means adapted to print with exclusively original plates page-for-plate matter on a plurality of continuously moving webs; slitters adapted to slit said webs into two-page-wide main web-members and a one-page-wide supplement web-member; two formers in operative relation to said printing means and adapted to fold length-wise the two-page-wide web-members perfected by said printing means; means for associating said supplement web-member with the main web-members associated on one former; carriers in operative relation to said formers; cutters coöperating with said carriers respectively to cut in every instance along the margin between the adjacent ends of two identical pages printed by one and the same plate; means for transferring to one carrier the sections cut on the other carrier; and a folder-mechanism cooperating with one of said carriers to fold together the sections cut on both carriers.

38. In combination with printing means adapted to print with exclusively original plates page-for-plate matter on a plurality of continuously moving webs; slitters adapted to slit said webs into two-page-wide main web-members and a one-page-wide supplement web-member; two formers in operative relation to said printing means and adapted to fold length-wise the two-page-wide web-members perfected by said printing means; means for associating said supplement web-member with the main web-members associated on one former; a carrier in operative relation to both formers; a cutter coöperating with said carrier to cut in every instance along the margin between the adjacent ends of two identical pages printed by one and the same plate; and folder-mechanism coöperating with said carrier to fold a paper comprising two sections, one with supplement and the other without supplement.

39. The combination of printing mechanisms comprising revoluble plate cylinders equipped with plates in series lengthwise of the plate cylinders and extending around each plate cylinder a distance equal to the length of one page plus margins and equipped with plates having columns circumferential to the plate cylinder, and impression cylinders coöperating with said plate cylinders to perfect continuously moving webs a plurality of pages in width; means for associating and slitting the webs perfected by said printing mechanisms; formers adapted to fold said webs lengthwise; carriers in operative relation to said formers; cutters cutting on said carriers respectively and adapted to cut into sections, in length equal to the length of one page plus margins, the longitudinally folded web-members running on said carriers respectively, the cut in every instance being along the margin between the ends of two identical pages printed by one and the same plate; means for transferring to one carrier sections cut on the other carrier; a second-folder mechanism adapted to fold together sections cut on both carriers; duplicate delivery devices in operative relation to said second-folder mechanisms; and a switch adapted to lead second-folded papers folded by said second-folder mechanism to either of said delivery devices.

40. A carrier, cutter, folder and delivery unit comprising a carrier cylinder rotating clockwise, a parallel carrier cylinder rotating counter-clockwise, cutter cylinders intermediate of and cutting on said carriers respectively, transfer mechanism intermediate of said carriers and adapted to transfer to one carrier sheets cut on the other carrier, folder mechanisms coöperating with said carriers respectively, delivery devices in operative relation to said carriers singly or collectively, and a switch adjustable to cause folded papers to run from both folder mechanisms to one delivery device, and also adjustable to permit folded papers to run from the respective folder mechanisms to said delivery devices respectively.

41. The combination of means for perfecting page-for-plate matter on a plurality of continuously moving webs, the successive pages constituting a row on either side of each web being end-to-end and separated by the usual margins and each successive page being printed by the same plate extending around the plate cylinder; a plurality of first-folder means each adapted to fold associated page-for-plate webs lengthwise, along

the margin between the pages; a plurality of second-folder units in operative relation to each and all of the first-folder means and each adapted to cut, fold and deliver, a single page-for-plate book-form paper, or a plurality of page-for-plate book-form papers, and each adapted to cut into sections the page-for-plate associated and longitudinally-folded webs running from each or all of said first-folder means, and assemble said sections and fold them together, to produce two or more papers in sections, each section comprising the matter of longitudinal folded webs running from one or more of said first-folder means; the matter of all the longitudinally folded webs running from any one of said first-folder means being page-for-plate matter, and the cut in every instance being along the margin between the adjacent ends of two successive pages printed by one and the same plate extending around the plate cylinder.

42. The combination of a plurality of printing mechanisms adapted to perfect by means of exclusively original plates the matter of all the pages of a complete paper each and every time that the perfected webs advance the length of one page; a plurality of formers adapted to fold longitudinally webs perfected as described and associated in groups on said formers, respectively; a carrier adapted to carry a single group of longitudinally folded webs running from one former to said carrier, or a plurality of groups of longitudinally folded webs running from a plurality of formers to said carrier; and a cutter cutting on said carrier to cut into sections one group, or a plurality of groups, of longitudinally folded webs running on said carrier, the cut in every instance being along the margin between the adjacent ends of two identical pages printed by one and the same plate; and a folder mechanism coöperating with said carrier and adapted to fold in succession the sections cut from one group of longitudinally folded webs and also adapted to fold together the sections derived from a plurality of groups of longitudinally folded webs running and cut simultaneously on said carrier.

43. Means for assembling and folding together in a single paper sections cut on two carriers respectively; comprising a carrier rotating clock-wise and equipped with retractile pins; a carrier rotating counter-clockwise and equipped with retractile pins; cutters cutting on said carriers respectively; a stripper adapted to strip the sections from one carrier; a transfer device adapted to transfer in a straight line to one carrier the sections cut on and stripped from the other carrier, said transfer sections being timed to be engaged by the same pins that hold the sections running on the carrier to which the transferred sections run; and folder mechanism adapted to fold together the assembled sections.

44. In combination with printing mechanisms equipped with plates having columns circumferential to the plate cylinders and adapted to perfect on continuously moving webs, by means of exclusively original plates, all the matter of two complete book-form papers, each and every time that the perfected webs advance a distance equal to the length of one page plus margins; two first-folder means adapted to make the first fold parallel to the columns of the pages of the respective papers; carriers in operative relation to said first-folder means respectively; cutters adapted to cut the perfected webs into one-page-long sheets, the cut of each paper in every instance being along the margin between the ends of two identical pages printed by one and the same plate; second-folder mechanisms coöperating with said carriers respectively; two delivery devices in operative relation to both second-folder mechanisms and also in operative relation to either second-folder mechanism and adapted to receive book-form papers dropped one at a time onto each of said delivery devices and also adapted to receive book-form papers dropped two at a time onto either of said delivery devices; and a switch effective to control the run of the second-folded papers from the second-folder mechanisms to the delivery devices.

45. In combination with printing means adapted to perfect on continuously moving webs with exclusively original plates for each paper all the matter of two complete book-form papers each and every time that the perfected webs advance a distance equal to the length of one page plus margins; two first-folder means adapted to fold longitudinally the webs comprising the matter of the respective papers; carriers in operative relation to said first-folder means; cutters adapted to cut into one-page-long sheets the longitudinally folded webs running from said first-folder means respectively, the cut of each paper being in every instance along the margin between the adjacent ends of two identical pages printed by one and the same plate; second-folder mechanisms coöperating with said carriers respectively; two delivery devices in operative relation to both second-folder mechanisms and also in operative relation to either second-folder mechanism and adapted to receive book-form papers dropped one at a time onto each of said delivery devices and also adapted to receive book-form papers dropped two at a time onto either of said delivery devices; and a switch effective to control the run of the second-folded papers from the second-folder mechanisms to the delivery devices.

46. In combination with printing means adapted to perfect on continuously moving

webs with exclusively original plates for each section, all the matter of a complete paper comprising a plurality of sections each and every time that the perfected webs advance a distance equal to the length of one page plus margins; a plurality of first-folder means respectively adapted to fold longitudinally the webs comprising the matter of the respective sections; two carriers in operative relation to all the first-folder means; means for associating on each carrier the longitudinally folded webs comprising the matter of a plurality of sections; cutters adapted to cut into one-page-long sections the longitudinally folded webs associated on said carriers, the cut in every instance being along the margin between the adjacent ends of two identical pages of each section printed by one and the same plate; second folder mechanisms coöperating with said carriers respectively to fold together the sections running on the respective carriers; two delivery devices in operative relation to both second-folder mechanisms and also in operative relation to either second-folder mechanism, and adapted to receive second-folded papers each comprising a plurality of sections, said papers being dropped one at a time onto each of said delivery devices, and also adapted to receive second-folded papers each comprising a plurality of sections, said papers being dropped two at a time onto either of said delivery devices; and a switch effective to control the run of the second-folded papers from the second-folder mechanisms to the delivery devices.

47. A second-folder and delivery unit comprising two second-folder mechanisms jointly operable at full-speed to simultaneously make the second-fold of two book-form papers, or jointly operable at full-speed to simultaneously make the second-fold of a book-form paper and the second-fold of a paper in sections; and severally operable at full-speed to make the second-fold of successive book-form papers or severally operable at full-speed to make the second-fold of successive papers in sections, and a delivery device adapted to simultaneously receive two book-form papers folded by two second-folder mechanisms, or a book-form paper folded by one second-folder mechanism and a paper in sections folded by the other second-folder mechanism, and likewise adapted to receive in succession book-form papers, or papers in sections, folded by either second-folder mechanism.

48. A second-folder and delivery unit comprising two second-folder mechanisms jointly operable at full-speed to simultaneously make the second-fold of two book-form papers, or jointly operable at full-speed to simultaneously make the second-fold of a book-form paper and the second-fold of a paper in sections; and severally operable at full-speed to make the second-fold of book-form papers, or to make the second-fold of papers in sections; and two delivery devices operable to receive two second-folded book-form papers running simultaneously from said second-folder mechanisms to said delivery devices respectively, to receive two papers in sections running simultaneously from said second-folder mechanisms to said delivery devices respectively, or receive on one delivery device a second-folded paper in book-form running from one second-folder mechanism and a second-folded paper in sections running from the other second-folder mechanism; and severally operable to simultaneously receive on one delivery device two second-folded book-form papers running from said second-folder mechanisms respectively, or to receive a book-form paper running from one second-folder mechanism and a paper in sections running from the other second-folder mechanism, or to receive a book-form paper, or a paper in sections, running from either of said second-folder mechanisms.

In witness whereof I have hereunto signed my name at Springfield, Illinois, this 2d day of July, 1909.

JOHN A. BOYCE.

Witnesses:
KATHRYN NELSON,
JESSIE J. NETTLETON.