

April 8, 1924.

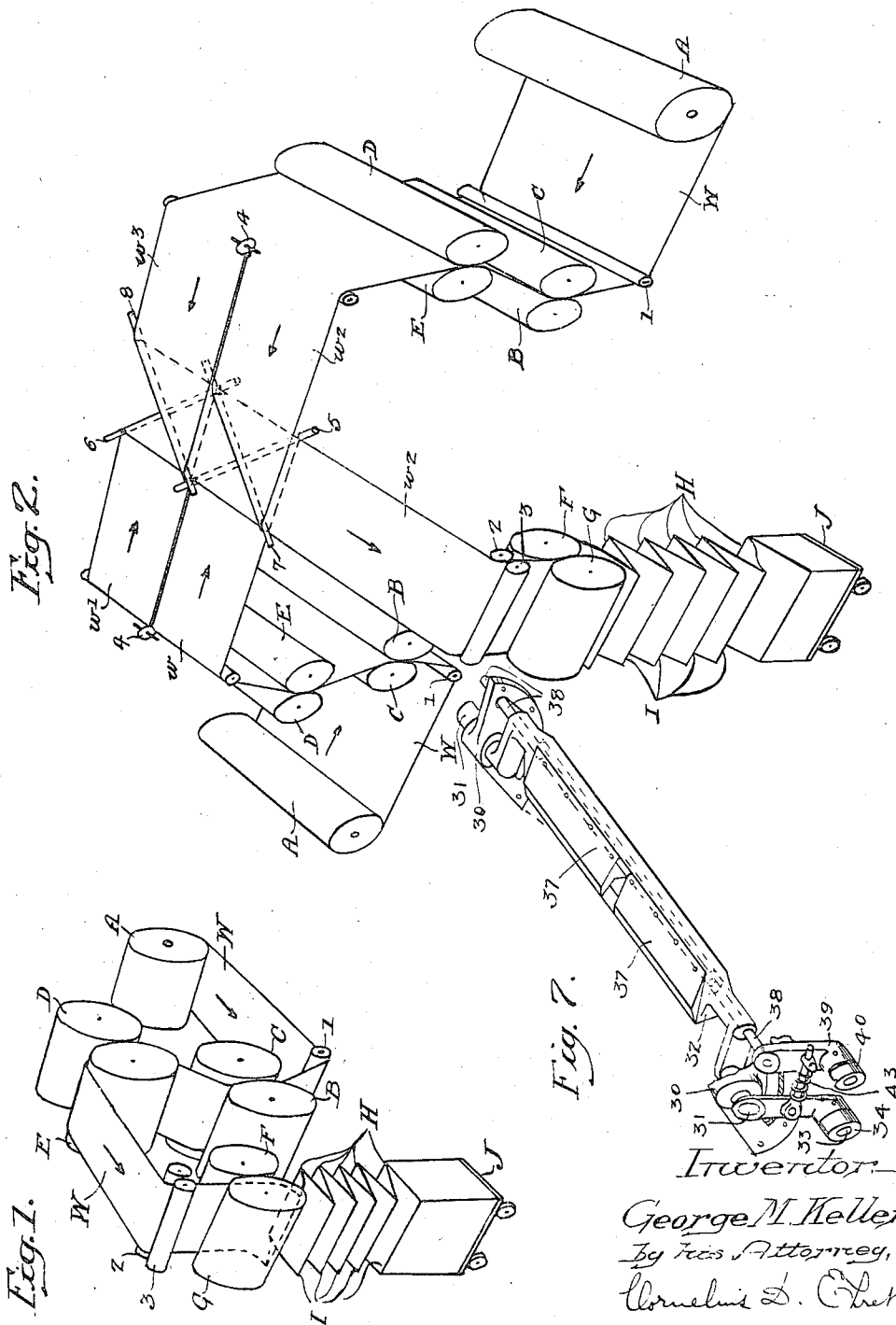
1,489,833

G. M. KELLER

METHOD OF OPERATING UPON PRINTED WEBS

Filed Dec. 30, 1919

7 Sheets-Sheet 1



Inventor:
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 By His Attorney,
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April 8, 1924.

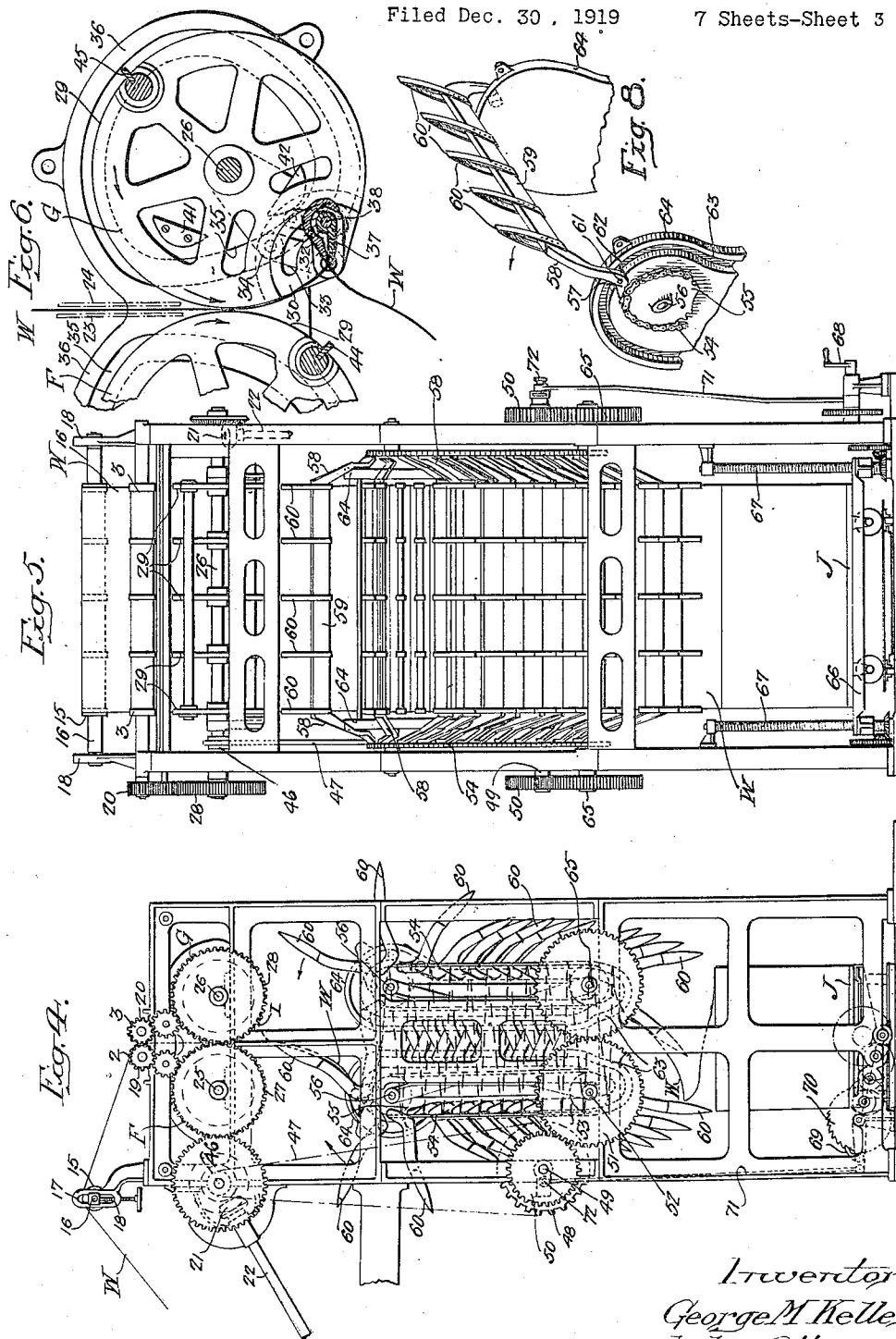
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METHOD OF OPERATING UPON PRINTED WEBS

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7 Sheets-Sheet 3



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METHOD OF OPERATING UPON PRINTED WEBS

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7 Sheets-Sheet 4

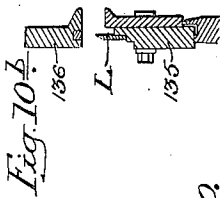
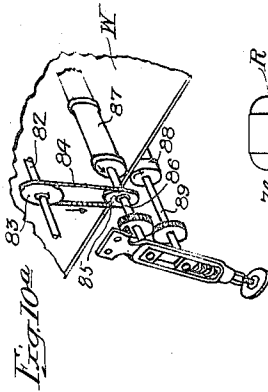
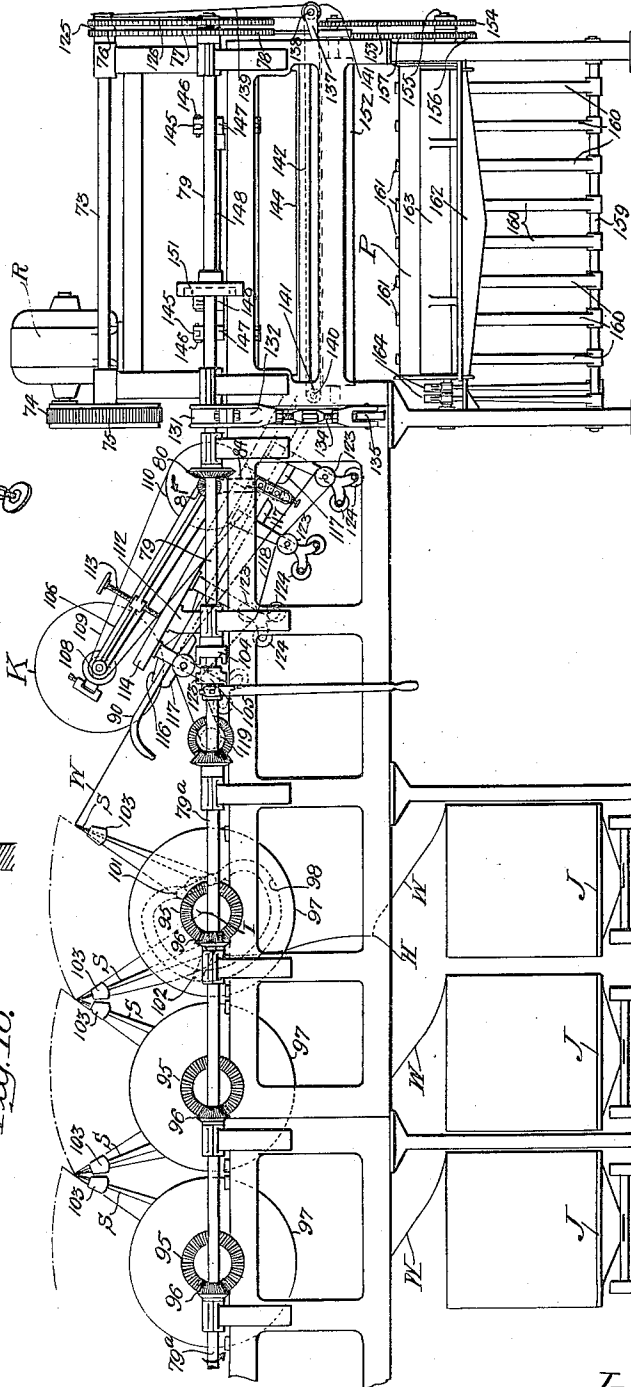


Fig. 10.



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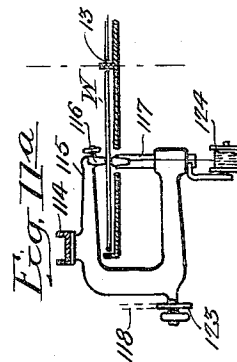
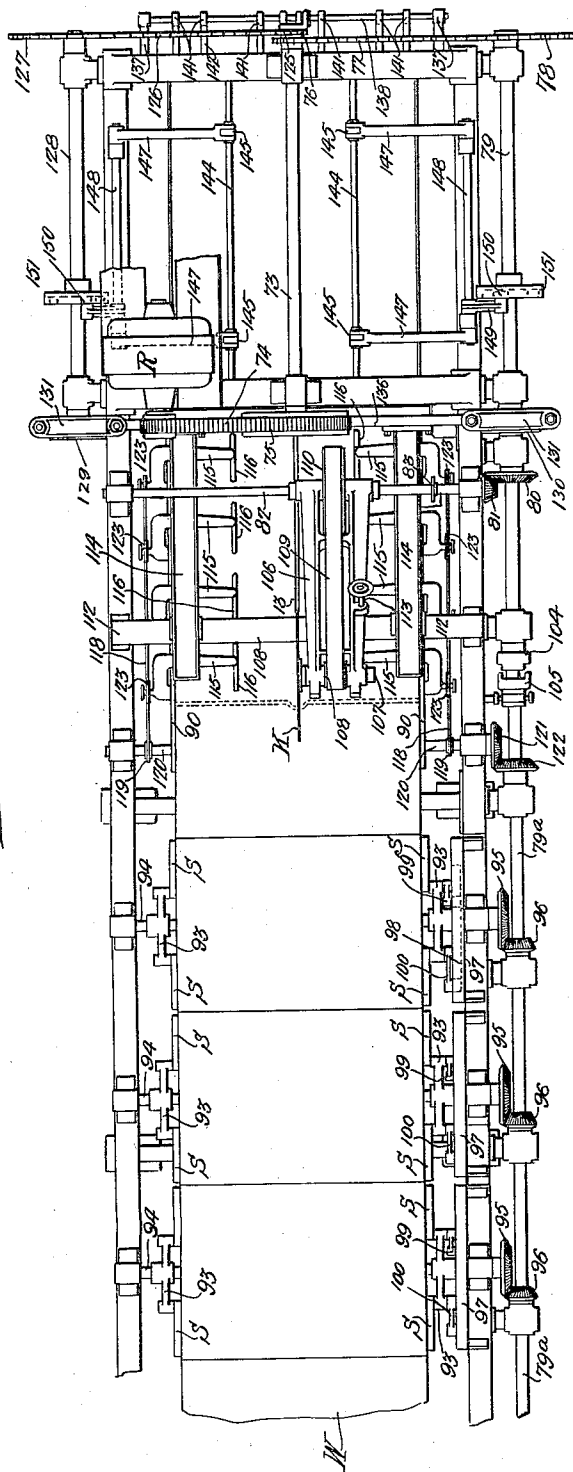
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METHOD OF OPERATING UPON PRINTED WEBS

Filed Dec. 30 , 1919

7 Sheets-Sheet 5



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METHOD OF OPERATING UPON PRINTED WEBS

Filed Dec. 30, 1919

7 Sheets-Sheet 6

Fig. 12.

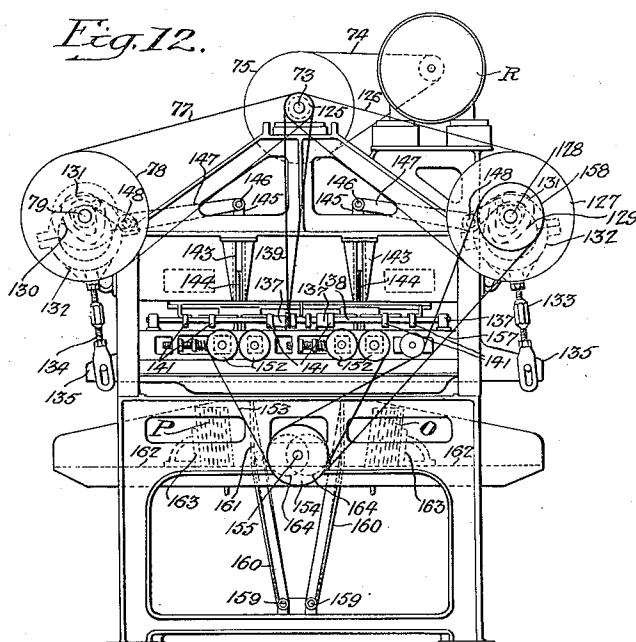
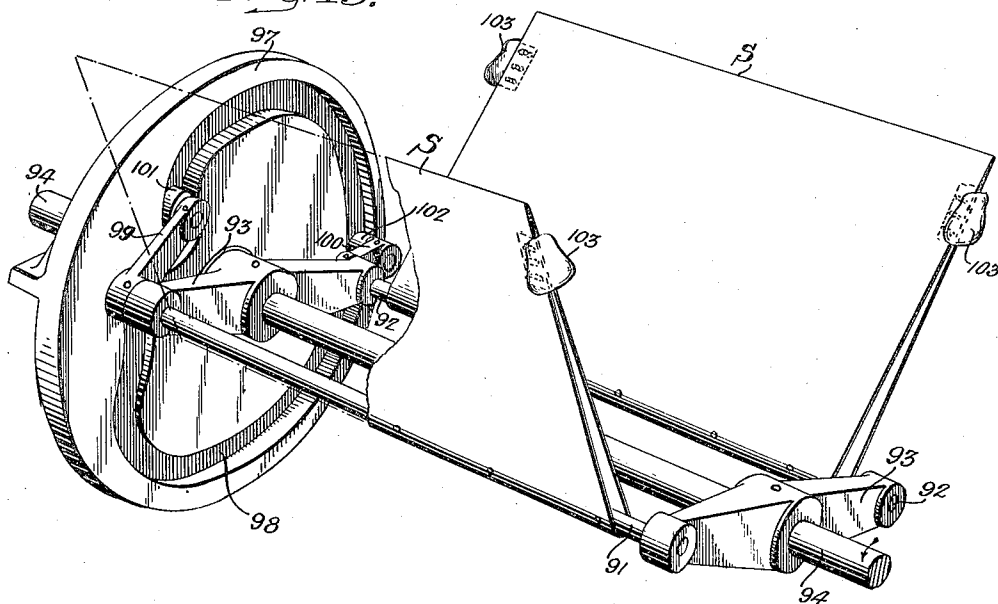


Fig. 13.



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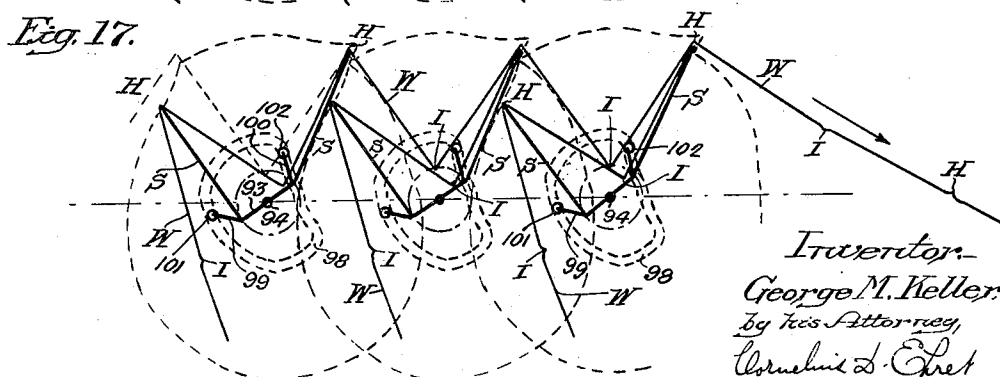
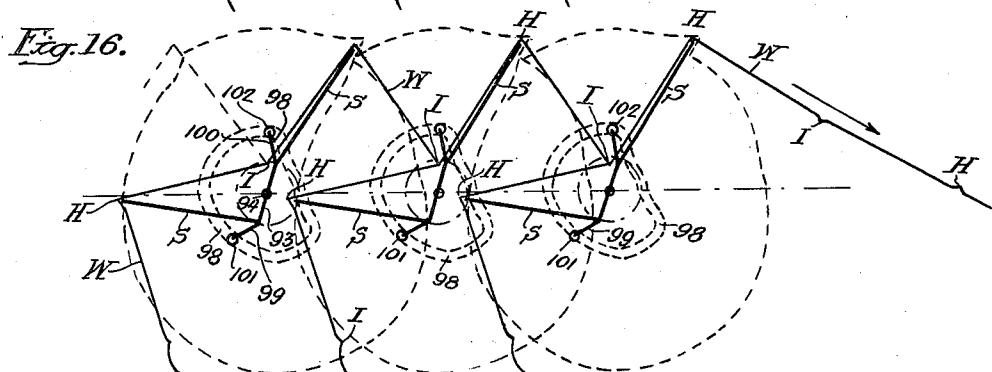
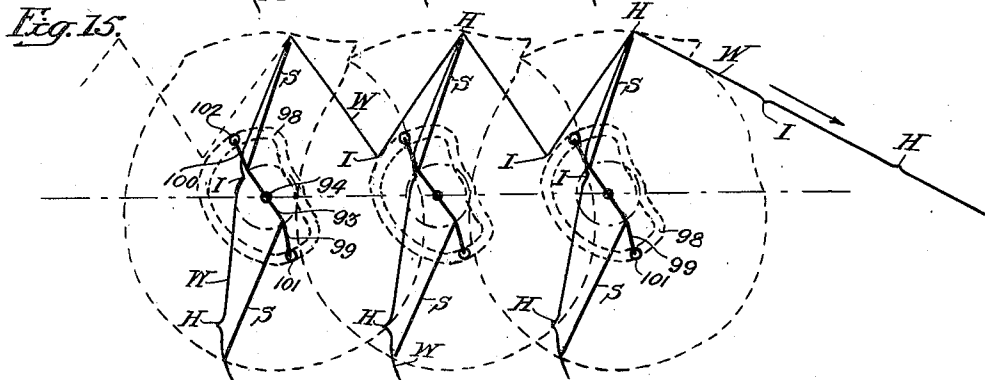
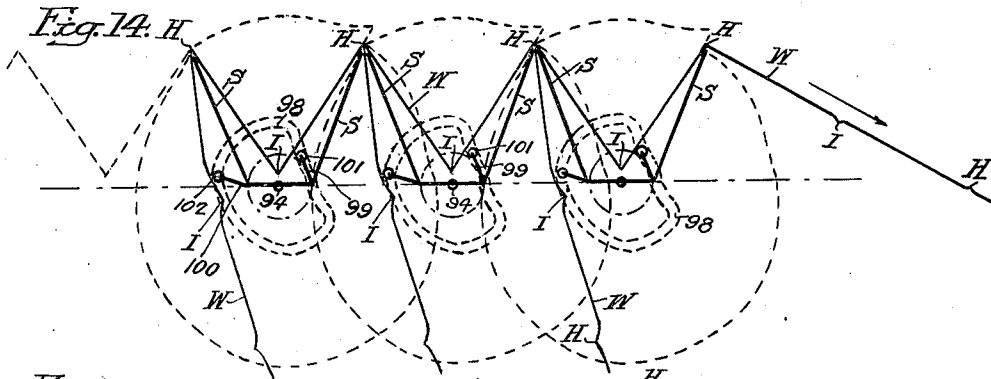
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METHOD OF OPERATING UPON PRINTED WEBS

Filed Dec. 30, 1919

7 Sheets-Sheet 7



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UNITED STATES PATENT OFFICE.

GEORGE M. KELLER, OF PHILADELPHIA, PENNSYLVANIA.

METHOD OF OPERATING UPON PRINTED WEBS.

Application filed December 30, 1919. Serial No. 348,282.

To all whom it may concern:

Be it known that I, GEORGE M. KELLER, a citizen of the United States, residing in the city and county of Philadelphia, State of Pennsylvania, have invented new and useful Improvements in Methods of Operating Upon Printed Webs, of which the following is a specification.

My invention relates to the production from a continuous printed web or webs of books, pamphlets, magazines, periodicals, newspapers, folders and the like.

It is the object of my invention to simplify and cheapen the production of the character referred to particularly by variation in the mode of procedure after printing of the web.

In accordance with my invention the printed web is not immediately severed into sheets of uniform dimensions comprising one or more signatures, followed by separating and folding the individual signatures, and thereafter assembling and binding the signatures, but remains whole and is so operated upon that it shall have a structure or formation whereby it may be fed as a continuous web and longitudinally cut, if it is a plurality of signatures wide, stitched or otherwise fastened, cut transversely into lengths of one or more units or signatures, and then folded if desired, and, if a plurality of signatures or units in length, severed into finished books or units; and, more particularly, the web is transversely creased or folded, successive creases or folds being in opposite directions, whereby an accordion fold is produced, such creases serving to effect register and assembly of a plurality of webs into a web group and, both when a single web or a web group is involved, serving to control the feed of the continuous web or web group during or for the longitudinal cutting, stitching, and transverse cutting.

My invention resides in the method of producing books, pamphlets, periodicals, newspapers, etc., by printing on one or both sides of a web single or multiple two or four page signatures and leaving the web whole, feeding it continuously, with or without intervening storage, for later operations suitable to the character, imposition and number of signatures as cutting, stitching, folding and severing, the web being so oper-

ated upon during or after the printing operation as to provide it with means whereby it is controlled during the subsequent cutting, stitching and such other operations as may be suitable or desirable.

More particularly my invention resides in printing a plurality of webs, leaving each whole, and providing each with means or formation whereby the webs may be collated or assembled in registry with each other to form a web group and, with or without intervening storage, continuously fed while in register with each other, and thereafter operated upon by cutting, stitching, folding, etc., as may be suitable to the character of the signatures involved.

My invention resides more particularly in so operating upon the single or multiple printed web as to impart thereto at uniform distances longitudinally thereof transverse creases, successive creases being preferably in opposite directions, whereby the web is capable of partaking of an accordion or zig zag fold, in which form it may be stored or may immediately be fed for the later operations of assembling, cutting, stitching, folding, etc., by employment of the creases or folds for effecting register when a plurality of superposed webs are employed, or in any event adapted for controlling the feed of the single web or web group during or for the subsequent operations of cutting, stitching, folding, etc.

My invention resides also in employing in lieu of any single web above referred to a multiple web unit consisting of a plurality of superposed webs simultaneously delivered from web printing press structure and simultaneously creased or otherwise operated upon in manner suitable to my purposes.

To these ends I have devised the herein-after described method and apparatus.

For an understanding of one of various modes of practicing my method, and for an illustration of one of various forms my apparatus may take, reference is to be had to the accompanying drawings, in which:

Fig. 1 is a diagrammatic perspective view of a web printing press in combination with which is the web creasing and delivery mechanism.

Fig. 2 is a diagrammatic perspective view of apparatus for printing a plurality of

webs and superposing them for simultaneous creasing and delivery.

Fig. 3 is a diagrammatic view of the mode of assembling the different webs, flattening them out, stitching, and cutting longitudinally, then cutting transversely and then folding along the stitches.

Fig. 4 is a side elevational view of the creasing and delivery mechanism.

Fig. 5 is an end elevational view of the same.

Fig. 6 is an enlarged fragmentary side elevational view of the creasing cylinders.

Fig. 7 is a fragmentary perspective view of the floating jaw members of the creasing mechanism.

Fig. 8 is a perspective view of a vane member in association with its driving means and controlling cam, all a part of the delivery mechanism.

Fig. 8^a is a perspective view on enlarged scale of a fragment of the finger actuating mechanism.

Fig. 9 is a horizontal sectional view of the vane controlling cams in combination with the supporting mechanism for the chain driving sprockets.

Fig. 10 is a side elevational view of apparatus for bringing into register a plurality of folded webs, for cutting them longitudinally, stitching them, transversely severing the same, and folding them.

Fig. 10^a is a fragmentary perspective view illustrating means for exerting tension upon the web group.

Fig. 10^b is a fragmentary sectional view of the knife bar and associated parts.

Fig. 11 is a top plan view of the mechanism shown in Fig. 9.

Fig. 11^a is a fragmentary sectional view, partly in elevation, of stitching mechanism.

Fig. 12 is an end elevational view, looking from right toward the left in Fig. 9, of the severing and folding mechanism.

Fig. 13 is a perspective view of a unit of the mechanism for registering the webs and controlling their longitudinal feed.

Figs. 14 to 17 inclusive are end elevational views of the web group forming and controlling mechanism in successive positions.

Referring to Fig. 1, A indicates a roll of continuous web W of unprinted paper travelling in the direction of the arrow around the idler roller 1, and between the plate cylinder B and tympan cylinder C, whereby one side of the web is printed, and then between the plate cylinder D and tympan cylinder E whereby the opposite side is printed. The web after leaving the printing press structure proper passes between the driven feed rolls 2 and 3, by which it is drawn from the press structure and fed downwardly between the creasing or folding cylinders F and G, these creasing cylinders being provided, as hereinafter described, with means cooperat-

ing with auxiliary apparatus for producing at predetermined intervals longitudinally of the web W transversely extending folds or creases H and I, neighboring creases H and I being produced in opposite faces of the web, whereby the unsevered or continuous web partakes of an accordion or zig zag fold and is stacked or stored upon any suitable removable means, as a truck J, which may then be removed to storage.

While there have been above described the operations of printing, creasing and delivering a single web, multiple or composite web units may be produced by mode and apparatus one form of which is diagrammatically indicated in Fig. 2. The printing press structures of Fig. 2 are in general similar to those described in connection with Fig. 1. Each is provided, however, with a rotary knife or cutting instrument 4 severing the broad web W from the left hand press into the narrower webs w and w^1 , and the broad web W from the right hand press into the narrower webs w^2 and w^3 . The webs w and w^1 pass over the diagonally positioned rollers or bars 5 and 6, whereby the direction of their movement is shifted through 90 degrees; similarly, the webs w^2 and w^3 pass over the rollers or bars 7 and 8 for similar change of direction, whereby the four webs w , w^1 , w^2 and w^3 continue in their travel in the direction of the arrow in superposed position. In this relation they pass, as if a single web, simultaneously and together between driven feed rollers 2 and 3, and thence between the creasing or folding cylinders F and G, with which cooperates auxiliary apparatus hereinafter described, whereby a composite web oppositely creased at H and I is formed and delivered as before on to a truck J.

In either of the modes of procedure of Figs. 1 or 2 it will be understood that to take the place of the usual slip sheets or sheets for keeping adjacent printed faces apart, an unprinted web of paper may be in superposition upon the printed web or webs, and creased or accordion folded therewith to operate as separators between adjacent printed faces.

In Fig. 3 a plurality of trucks J are shown side by side and each having thereon a single web, of the character referred to in Fig. 1, or a composite web of the character referred to in connection with Fig. 2, or part of one type and part of the other. The webs on the several trucks J may have been simultaneously produced by different printing, creasing and delivery structures, or may have been produced in succession by a single printing, creasing and delivery structure. In any event, the webs upon all the trucks contain single or multiple signatures, either two or four page each, required for the completed book, periodical, newspaper or other finished

or semi-finished product; and they are so related or positioned that in the assembly one form of which is about to be described, the pages of the various signatures will come in consecutive order in the finished book or product.

By apparatus hereafter to be described, the webs are fed in such wise that their successive creases or folds H all come into register with each other, and their successive creases or folds I likewise come into register with each other, the web at the left end of the series in Fig. 3 becoming the upper one, and those in succession to the right coming into register with those above in the same order of position as their trucks J. These superposed single or composite webs form a web group fed in the direction of the arrow.

In the example indicated, the web is two signatures wide, each being a four page signature. The top side of a single four page signature is indicated by the rectangles 9 and 10 representing the printed matter on the upper pages of the signature. The second signature besides the aforesaid signature similarly comprises pages having thereon the printed matter indicated by the rectangles 11 and 12.

If the webs are more than one signature wide, the web group may be longitudinally cut, as indicated at 13, by any suitable cutting means, as a rotary knife K, in the space between neighboring signatures.

In cases similar to the example illustrated, the webs constituting the web group are stitched to each other, with wire staples, thread or equivalent, as indicated at 14, longitudinally of the web between neighboring pages of a signature. It will be understood, however, that when suitable or desirable the stitching may extend transversely of the web.

Generally, while the web group or groups is or are stationary for the stitching operation, they are transversely severed, as by knife L, into suitable lengths, generally a multiple of signature or page heights.

At this stage, in the example illustrated, there are two web groups side by side each four signature heights or book lengths long. These units are then folded, along the stitching, by passage between the folding rollers M and N, respectively, yielding folded units O and P, still four signature heights or book units in length, but later severed either in self-contained or by auxiliary apparatus into the final product or book units Q.

While in the foregoing description that mode of procedure has been described wherein the printed and folded webs are stored before assembly, it will be understood that my invention comprehends also the immediate use of the printed and folded webs, as by printing, creasing and delivering continuously and directly to the mechanism for assembling, registering the webs into a web

group and thereafter operating upon the web group.

From the methods above described arise substantial advantages, among which are the following:

(a). As distinguished from the common practice of cutting the printed webs into sheets on the press or before further handling, by my method single or multiple webs are maintained continuous and thereafter in a sense woven or stranded together, and in such condition later operated upon as to cutting, stitching, folding, etc., and thereby saving time over the prior method involving intermittent handling of single or individual pieces, and further avoiding the likelihood and opportunity characteristic of prior practice of and for missing or misplacing signatures, and avoids further the cost and delays incident to correction of such errors if discovered.

(b). By my method the web is continued whole immediately after the printing, as distinguished from common prior practice wherein the web is immediately cut into sheets, which are then folded a suitable number of times and in suitable directions to form a folded signature later to be assembled with others to form a completed book or product. In this prior practice a substantial waste of paper is involved, due to the frailty of a single sheet handled individually and the necessity for trimming the fold edges of the signatures; prior practice incurs also relatively higher cost of labor for both the operation of the folding machines and later the binding and trimming machines, since the folding and binding machinery require manual feeding and control and manual removal of product.

(c). By the herein described delivery of the transversely creased web a considerable portion of the web is for a considerable time exposed, as the open folds descend to compact relation on the truck, to the air or any artificial ink drying or oxidizing means, whereby a more rapid drying is effected than in the case of printed sheets immediately stacked one upon the other, likely to adhere to some extent to each other and to smudge the printing, or cause offset, and requiring a rolling or wiping action later to separate them. With the accordion or equivalent fold, however, in accordance with my invention, the later separation of folds is accompanied by a separation in a direction practically normal to the neighboring surfaces, with a minimum liability to tear because of adhesion, if any. In case the printed and creased webs are immediately assembled in register with each other, smudging is substantially eliminated because adjacent webs in coming into register with each other move in direction substantially normal to their adjacent faces, and there is a minimum of wipe

or slide of adjacent webs upon each other, whereby both speed and quality are enhanced.

(d). By my method are avoided or materially reduced the difficulties due to static electricity in handling the paper.

(e). Dependence upon the front edges of sheets for guiding as in prior practice is dispensed with, thereby avoiding the difficulties occasioned by tears, lack of rigidity, moisture or other causes.

(f). Where, as in multi-color work or for other reasons, it is desirable to pass the web through different printing presses in succession or through the same press at different times, it is possible after passage through the first press to crease and fold as described, and thereafter by employment of the creases as control means, again to feed the web to a printing press for the application of a second or dissimilar print, as a different color, the web when discharged from the second press still retaining its creases, which may be employed for controlling the later operations upon the web as to cutting, stitching, severance into suitable lengths, etc. This same mode of repassing the accordion folded web through another machine is applicable also to cases where a second machine performs operations other than printing, as for example, for application or removal of coatings, dust or powder, such as talc, bronze powder, etc.

(g). By my method there is saved time otherwise lost in the prior methods of handling flat printed work from web presses occasioned by delay necessary for drying, followed by further delay necessary for folding prior to binding.

(h). In my method it is preferred that the signatures shall be of basic sizes, as two or four page signatures, in which case maximum flexibility or freedom of distribution in the finished product is possible. For example, where pages in colors are to be distributed among pages of printing in black, it is often the preference of an advertiser whose material is printed in color to have his advertisement placed in suitable position with respect to reading matter, and further to have it so placed that it shall not be adjacent other advertising matter in color; and to the end that matter printed in color may be so distributed, my method is peculiarly adaptable.

(i). By my method it is possible to use thinner or cheaper paper, since rigidity and stiffness of the paper are not so important as in prior practice where individual sheets must be handled and where rigidity or stiffness are essential.

For a more detailed description of one of various forms of my invention and for carrying out my method, reference is had to Figs. 4 to 13 inclusive.

Referring to Figs. 4 to 7 inclusive, the web as it leaves the printing press, of the character shown in Figs. 1 and 2, passes over the idler roller 15, whose bearing or shaft 16 is adjustable vertically in slots 17 in the members 18 to adjust the web length between the plate cylinder of the press and the creasing means about to be described, to ensure that the transverse creases or folds shall always come mid-way in the margins or gutters between signatures lying adjacent each other longitudinally of the web, the web length between the plate cylinder and the creasing means varying from time to time because of variations in the circumferential positions of the printing plates upon the plate cylinder of the press, lengthening or shortening of the web material due to variations in tension thereon, or variations in weather conditions, as moisture, etc.

The web then passes downwardly between the feed rolls 2 and 3 driven by the pinions 19 and 20 driven through any suitable means, as gear trains, in turn driven by the bevel gear 21 rotated by shaft 22, which is in turn driven in definite time or phase relation with the plate cylinders of the printing presses.

As seen more clearly in Fig. 6, the web W, after passing between rolls 2 and 3, passes between the guide members 23 and 24 into the restricted passage between the creasing cylinders F and G, secured upon and rotated by the shafts 25 and 26, respectively. These shafts are driven, respectively, by gears 27 and 28 driven by the aforesaid bevel gear 21, the cylinders F and G each consisting of a plurality of narrow cylinder members or disks 29 engaging the web preferably in longitudinal gutters or margins between printed matter.

On the end-disks 29 of each of the cylinders F and G is secured a bracket member 30, Figs. 6 and 7, which provides a pivot bearing for the short shafts 31 to which are secured and rotatable therewith the transversely extending floating jaw member 32, the shaft 31 having the crank arm 33 carrying at its end a roller 34 engaging in the cam slot 35 in the stationary cam member 36.

Cooperating with the aforesaid floating jaw member 32 is the companion jaw member or members 37 supported on the pivot shaft 38 having bearings in the jaw member 32, the shaft 38 having secured to its one end the crank 39 carrying roller 40, which engages in succession and is actuated by the stationary cam blocks 41 and 42 in opposition to spring 43, which holds the jaw members 32 and 37 normally closed in position indicated in Fig. 6.

Coacting with the floating jaw structure on the cylinder G is the tucker member 44 carried by and extending transversely of the cylinder F. And similarly, with the

floating jaw structure on the cylinder F, not shown, coacts the tucker member 45 carried by and extending transversely of the cylinder G.

Driven by the shaft 22 is a sprocket 46, which drives the sprocket chain 47, which in turn drives the sprocket 48, which rotates shaft 49, upon which are secured on opposite ends thereon the gears 50, 51, meshing with and driving the gears 51, 51, on opposite sides of the machine, each gear 51 being secured upon and rotating a stub shaft 52. On the inner end of each of the stub shafts 52 is a sprocket wheel 53 driving the sprocket chain 54 passing over the idler sprocket 55 on shaft 56. In the chain 54 at suitable equal intervals are special links, from each of which projects a pin 54^a engaging in a pivot hole in a short arm 57, Figs. 8 and 8^a, integral with the arms 58 joined by the transversely extending bar 59, to which are secured the feeler fingers 60.

At 61, Figs. 8 and 8^a, there is secured to each of the arms 58 a roller 62 engaging in the cam slot 63 in the vertically extending stationary cam member 64.

The sprocket wheels 53, 55, sprocket chain 54, cam 64 and the feeler finger structure is duplicated in the reverse position, as indicated in Fig. 4, and driven by the gears 65 meshing with and driven by the aforesaid gears 51. In the duplicate apparatus, however, the special links in the duplicate sprocket chain 54 are so positioned as to be mid-way between corresponding links in the sprocket chain 54 of the first described mechanism, whereby the fingers 60 of the left hand mechanism, Fig. 4, perform their hereinafter described function alternately, with respect to the corresponding finger structure of the right hand mechanism.

As the web W passes downwardly between the guides 23, 24, the floating jaw structure on cylinder G is first opened by engagement of roller 40 with stationary cam element 41, simultaneously or immediately thereafter the tucker member 44 on cylinder F tucks the web into the open jaw, which is now closed by spring 43 upon the web and creases it to form the crease or fold I, Fig. 1, the tucker member 44 having in the meantime receded. The creased web is held in the jaw structure and moves therewith as the jaw member rotates with cylinder G, and is released at any desired point by engagement with the stationary cam member 42 of the roller 40, which opens the jaw structure in opposition to spring 43, releasing the creased web, the jaw structure continuing its rotation and again closing under influence of spring 43.

Substantially simultaneously with opening of the jaw structure to release the web therefrom, a feeler finger structure 60 of the left hand group, Fig. 4, swings suddenly or

rapidly, due to the shape of the cam slot 63, in clockwise direction about its pivot, as viewed in Fig. 4, and engages in the crease I immediately theretofore formed by the jaw structure on cylinder G, and carries the web downwardly away from the cylinder G.

By similar action the jaw structure on cylinder F immediately thereafter coacts with the tucker member 45 upon cylinder G to form the succeeding web crease H, the jaw structure later releasing the web, whereupon the finger structure of the right hand group, Fig. 4, engages in the newly formed crease H and carries the web downwardly. And so on, by alternate action of the jaw members, tuckers and feeler fingers the creases H and I are formed in succession, the web carried downward and stacking itself automatically fold upon fold upon any suitable receiving device as a truck J suitably disposed on platform structure or upon a frame 66, which at the beginning of operation has been elevated by the screws 67 actuated through suitable gearing by hand crank 68 and automatically slowly lowered as the folds accumulate by actuation of the screws 67 in opposite direction through suitable gearing, as pawl and ratchet 69 and 70, by connecting rod 71 pivoted upon a crank pin 72 adjustable to different radial distances upon one of the gears 50.

This truck elevating and lowering device is, per se, a mechanism common to the art.

When there has accumulated upon the truck J a suitable height of folded web, it is removed and an empty truck substituted therefor and the operation repeated.

For assembling in register the different webs in accordance with the mode indicated in Fig. 3, any suitable apparatus may be employed, one, for example, of which is illustrated in Figs. 10 to 13 inclusive.

R is an electric motor driving the jack shaft 73 through silent link chain 74 and sprocket 75. It will be understood, however, that the jack shaft 73 may be driven by any other suitable source of power. Secured upon the jack shaft 73 is a sprocket wheel 76 driving the sprocket chain 77 in turn driving the sprocket wheel 78 secured upon shaft 79. Rotated by the shaft 79 is the bevel gear 80 driving the bevel gear 81 upon the cross shaft 82, upon which is secured a sprocket wheel 83 which drives the downwardly extending sprocket chain 84, which drives the sprocket wheel 85 secured upon shaft 86, upon which is secured the feed roller 87 between which and the feed roller 88 is drawn the composite web assemblage or web group W, the lower roller 88 being driven by gear secured upon its shaft 89 and meshing more or less loosely for reason of adjustment to varying composite web thickness with a gear secured upon shaft 86.

The web group is in consequence continuously subjected to adjustable tension by the feed rollers 87, 88 through the trough 90, which receives it from the last of the web registering and feed controlling fingers S. A pair of fingers S is provided for each folded web element brought into position beneath the same upon its truck J, the number of web elements or truck loads being one or any greater number according to the size and composition of the finished product desired.

The fingers S of a pair are secured, as best indicated in Fig. 13, upon pivoted shafts 91 and 92 supported in opposite ends of yokes 93 secured upon and rotated by the shaft 94 having secured thereon the bevel gear 95 driven by the meshing bevel gear 96 secured upon and rotated by the shaft 79^a aligned with shaft 79 and adapted to be coupled therewith or uncoupled therefrom by the coaction of the jaw coupling members 104 and 105, of such structure that the driven shaft 79^a must always be coupled in proper angular or phase relation with respect to the shaft 79.

Secured upon the frame of the machine is a stationary cam member 97 having the cam slot 98. Secured upon the aforesaid shafts 91 and 92, respectively, are the arms 99 and 100, carrying at their outer ends the rollers 101 and 102, respectively, engaging in the cam slot 98.

Carried on the edges of and extending normal to the side faces of the finger members S are the adjustable guides 103 against whose guide faces may engage the longitudinal edges of the web group W and the single web elements as they are brought to coaction with the fingers S and the web group.

Pivoted upon the cross shaft 82 is the upwardly inclined frame 106 carrying at its outer end the shaft 107 driven by pulley 108 driven by belt 109 driven by pulley 110 secured upon shaft 82.

Secured upon the shaft 107 is the disk knife K which cuts or severs the web group longitudinally, as indicated at 13, the trough 90 being provided with a suitable slot through which the knife K may extend, as indicated in Fig. 10.

Extending across the framework of the apparatus is the arch-shaped member 112 against which engages the adjusting screw 113 threaded through a lug on the frame 106 for adjustably positioning the knife K.

To the longitudinally extending upwardly inclined beams 114, Figs. 10, 11 and 11^a, disposed adjacent opposite edges of the web group, are secured the inwardly extending arms 115 carrying at their ends the longitudinally extending anvils 116 of stitching or stapling mechanism, and cooperating therewith are the movable stitcher heads

117 on the under side of the web group W and supported at the ends of arms forming with the aforesaid arms 115 a C-shaped structure embracing the edges of the web group. This stitching mechanism is of any suitable character, and as indicated, the heads 117 are actuated toward and away from the web group and their coacting anvils 116 by a sprocket chain 118 driven by the sprocket wheel 119 driven by shaft 120 driven by bevel gear 121 driven by bevel gear 122 driven by shaft 79^a. The sprocket chain 118 engages and drives the stitcher head operating sprockets 123 pivoted on the aforesaid C-shaped frames upon which are carried also the spools 124 on which is stored the thread or staple wire fed to the stitcher heads 117.

Driven by a sprocket wheel 125 secured upon shaft 73 is the sprocket chain 126, which in turn drives the sprocket wheel 127 secured upon the shaft 128.

Secured upon the left end of the shaft 128, as viewed in Fig. 11, and upon the shaft 79 at a point directly opposite the aforesaid end of shaft 128, are the eccentrics 129 and 130, respectively, said eccentrics being held between the eccentric straps 131 and 132 actuating, respectively, the connecting rods 133 and 134 having at their lower ends pin and slot or lost motion connection with the vertically movable knife bar 135 disposed on the under side of the web group and carrying upwardly, as well understood in the art, a knife, as L of Fig. 3, in alignment with which above the web group is the cooperating bar 136, against which is pressed the web group by the usual clamping bar provided with means for imparting to the upwardly moving knife bar 135 a motion having a component transverse to the web group to produce a cutting action, as well understood in the art.

In brackets 137 is supported a shaft 138 driven by belt 139 in turn driven by shaft 73. Upon the shaft 138 and a corresponding idler shaft 140, Fig. 10, are disposed any suitable number of pulleys 141 driving the conveyer tapes 142, whose upper sides travel from left toward the right, Fig. 10.

Movable vertically in the guides 143, Fig. 12, are the tucker blades 144 actuated vertically by the connecting links 145 pivoted at 146 to the arms 147, pivoted at 148 and having the arm extension 149 carrying the roller 150 engaging in a cam slot in the cam member 151, secured upon and rotated by the shafts 79 and 128.

Beneath the tucker blades 144 are the folding rollers M, N driven in conjunction by spur gears by chain 153 driven by sprocket wheel 154 secured upon shaft 155 upon which is secured sprocket wheel 156, driven by sprocket chain 157 driven by sprocket wheel 158 secured upon shaft 128. One of

each pair of the folding rollers M, N is spring pressed towards its companion, the spring pressure being adjusted by any suitable means.

Upon the shafts 159 are pivoted the rock arms 160, actuated by eccentrics 164 driven by shaft 155 carrying at the upper ends the book unit pushers or packers 161 movable transversely, as viewed in Fig. 12, in slots in the receiving tables 162, upon which slide outwardly as the folded units O and P accumulate the weighted backing members 163.

The operation of the structure illustrated in Figs. 10 to 13 is as follows:

As viewed in Fig. 10, the forward and rear fingers S of each pair engage in the concave or reentrant sides of immediately adjacent creases H of the web group W, the creases I hanging downward between the fingers S as indicated in Fig. 10. The movements of the two finger shafts 91 and 92 of each pair are dephased 180 degrees, each rotating at uniform rate with the shaft 94, but being rocked by the cam structure 97 in such manner that the outer tip of each finger S also partakes of uniform motion about the shaft 94 for that part of the cam slot 98 which is concentric with the shaft 94, but partaking of retarded or accelerated movement when in certain angular positions, each finger S coming practically to rest at a point substantially in the position indicated in Fig. 10 respecting the forward or right hand fingers of each pair, to allow time of rest for the web group to undergo stitching and transverse cutting.

The action of the fingers S in performing their dual functions of inserting webs from trucks J and controlling the advance of the web group W will be understood upon reference to Figs. 14 to 17 inclusive, wherein four phase positions of the fingers S and auxiliary apparatus are shown.

In Fig. 14 the fingers S of each pair are shown in that phase in which they are symmetrically disposed about a line extending vertically through shaft 94, this phase being similar to that indicated in Fig. 10. At this stage the web group W is undergoing transfer from the right hand finger S of each pair to the left hand finger of the pair immediately adjacent to the right, and simultaneously there has been added to the web group W one or more webs from one or more trucks J, Figs. 3 and 10, by bringing the fold or folds H of the one or more webs into register with the folds H of the web group W.

Upon further rotation of shafts 94, the fingers take a phase position indicated in Fig. 15, wherein the left hand finger of each pair as viewed in Fig. 14 has raised and advanced toward the right the web group W because of the engagement of that finger within the fold H; simultaneously the right hand finger S of each pair has par-

taken of relatively greater and more rapid movement and takes the position indicated in Fig. 15 coming into contact with the web unfolding from a truck J, the lowermost finger in this case being in position preparatory to upward travel in clockwise direction.

As viewed in Fig. 16, the upper finger S of each pair as viewed in Fig. 15 moves further in clockwise direction to the position indicated, wherein its tip ceases temporarily to move or revolve, due to the peculiar conformation of the cam groove 98; in the meantime the lower finger S of Fig. 15 has rotated in clockwise direction to the position indicated in Fig. 16, in which its tip has slipped into the fold H of the web unfolding from the truck. In this connection it will be noted that slight variation in distance between folds H and I does not prevent proper engagement and register, since the lower fingers S, Fig. 16, feel their way into and engage in the folds H of the web unfolding from the truck prior to bringing such web into operative relation with the web group W.

As indicated in Fig. 17, the upper arms S of Fig. 16 continue to hesitate in their illustrated position for a considerable time while the lower fingers S of Fig. 16 continue clockwise rotation, elevating the webs from the trucks and approaching the position indicated in Fig. 14. This completes the cycle of operation, there being two complete cycles for each revolution of shaft 94, or one cycle for each revolution of the driving shafts 79 and 79^a.

As the fingers S of the extreme right hand pair rotate or fall away from the position indicated in Fig. 14, the weight of the web group W is transferred to the aforementioned trough 90, the slack thus occurring being taken up by the revolving feed rollers 87, 88 or their equivalent.

As the web unit W leaves the forward finger S of the right hand pair of registering and feed controlling fingers S, it passes downwardly in the trough 90, is longitudinally severed by the knife K, the two parts of the web group being then stitched in the margins or gutters between pages of a signature, and while undergoing stitching, the stitched sections in advance are cut off transversely by the knife L carried by the bar 135, the feed of the web group being controlled by the forward finger S of the last or right hand pair, Fig. 10, the feed rollers 87 and 88 keeping the web group taut and thereby accurately effecting a gauge for the proper positioning of the web group for the stitching and transverse cutting operations.

The parallel stitched sections of the web group are carried from left toward the right, Fig. 10, by the tapes 142, against any suitable stop and guided by guides at the sides and centre of a continuation of the trough structure, the tucker folding blades 144 then

pressing downwardly upon their top surfaces and feeding them through a guide slot to position between the rollers M, N, which produce a longitudinal fold coincident with the stitching, the folded units O and P falling on to the platform 162 and as they accumulate are pushed outwardly by the pushers 161.

The units O and P are then removed from the platforms 162 and then each is severed by any suitable cutting means into finished book units Q.

It will be understood that my invention is not limited to the order, number or nature of steps, or the apparatus for performing them, as regards the time after the web group leaves the last pair of fingers S, S, at which time the web group as such has been completed, and the mode of operation thereon after such completion is largely a matter of choice as affected by varying circumstances and conditions, such, for example, as quantities involved, presses available, etc.

It will be understood also that the web group W when completed need not immediately be further operated upon for partial or complete finishing of books, pamphlets or other product, but may be stored as such for any suitable or desired time and thereafter suitably cut, stitched, folded, etc., in any suitable sequence.

It will be understood that the term "signature" as herein employed, shall include not only the usual significance of the term, but shall be understood also as a mode for briefly describing or referring to other suitable unit common to the printing, lithographing, paper making, binding or other analogous arts.

What I claim is:

1. The method which consists in printing a web, creasing the web transversely at predetermined intervals, feeding and controlling the web by its transverse creases, and thereafter in desired sequence cutting, folding and binding the same.

2. The method which consists in printing a plurality of webs, separately transversely creasing the same at predetermined intervals, thereafter assembling the webs with their creases in register, and thereafter in desired sequence cutting, folding and binding the same.

3. The method which consists in separately printing a plurality of webs each having signatures repeated longitudinally thereof, the different webs containing different signatures, transversely creasing each web in opposite directions between signatures at predetermined intervals, thereafter bringing the webs into superposition with their creases in register, and thereafter in desired sequence cutting, folding and binding the same.

4. The method which consists in separately printing a plurality of webs each having signatures repeated longitudinally thereof, the different webs containing different signatures, transversely creasing each web in opposite directions between signatures at predetermined intervals, storing the folded webs, thereafter bringing the webs into superposition with their creases in register, and thereafter in desired sequence cutting, folding and binding the same.

5. The method which consists in separately printing a plurality of webs, transversely creasing each web at predetermined intervals, placing said creased webs in separate stacks, and withdrawing the webs from said stacks with the creases of each web in definite relation to the creases of an adjacent web.

6. The method which consists in separately printing a plurality of webs, transversely creasing each web at predetermined intervals, placing said creased webs in separate stacks, and withdrawing the webs from said stacks with the creases of one web interfitting with the creases of an adjacent web.

7. The method which consists in printing a plurality of webs, folding the webs and piling them into separate stacks, withdrawing the webs from their respective stacks in superposed relation, and forming the superposed webs into completed units.

8. The method which consists in printing a plurality of webs, separately creasing the same transversely, assembling the webs with their creases in predetermined relation, and thereafter forming the webs into completed units.

9. The method which consists in printing a plurality of webs, transversely creasing the webs separately at predetermined intervals, assembling the webs in superposed relation, and thereafter dividing the superposed webs and forming them into units.

10. The method which consists in printing a plurality of webs each divided into transverse sections and each transverse section being in turn divided into columns or pages, creasing the webs, assembling the webs in superposed relation and with their creases in predetermined relation, separating said sections, stitching between the columns, and cutting into longitudinal sections.

11. The method which consists in separately printing a plurality of webs each divided into transversely spaced columns or pages, creasing the webs and assembling them with their creases in predetermined relation, stitching between the columns, cutting into longitudinal sections, and folding along the stitches.

12. The method which consists in separately printing a plurality of webs each of which is divided into laterally spaced printed sections, creasing each web at predetermined intervals, transversely creasing each web at predetermined intervals, placing said creased webs in separate stacks, and withdrawing the webs from said stacks with the creases of each web in definite relation to the creases of an adjacent web.

mined intervals, superposing the webs with their creases in a definite relation, stitching the webs while so assembled, and folding along the stitches.

5 13. The method which consists in separately printing a plurality of webs each of which is divided into laterally spaced printed sections, creasing each web at predetermined intervals, superposing the webs with
10 their creases in a definite relation, stitching the webs in a longitudinal direction, folding along the stitches, and cutting into longitudinal sections.

14. The method which consists in printing
15 a web, thereafter transversely creasing the web in opposite directions at predetermined intervals, and thereafter feeding the web to signature-forming mechanism, the said creases being utilized to control the feeding
20 movement of the web.

15. The method which consists in printing a web, transversely creasing it in opposite directions, stacking the web fold upon fold, and withdrawing the web from the stack, the
25 withdrawal movement of the web being controlled through the creased portions thereof.

16. The method which consists in printing a plurality of webs, transversely creasing each web in opposite directions at predetermined intervals, stacking each web separately and in withdrawing the webs from the
30 stacks in predetermined relative arrangement.

17. The method which consists in printing
35 a plurality of webs, transversely creasing each web in opposite directions at predetermined intervals, stacking each web separately and in withdrawing the webs from the stacks in predetermined relative arrangement, the said oppositely creased portions of
40 one web being disposed in a definite manner relative to said creased portions of the other web.

18. The method which consists in providing a plurality of stacks of webs each transversely creased, and in withdrawing the

webs from the stacks and bringing them together with their respective creases in predetermined relative arrangement.

19. The method which consists in providing a plurality of stacks of folded webs each creased in opposite directions, and in withdrawing the webs from the stacks with the creases of one web lying within similarly
50 disposed creases of an adjacent web.

20. The method which consists in separately creasing a plurality of webs, and thereafter assembling the webs with the creases of one web lying within the creases
55 of an adjacent web.

21. The method which consists in creasing a plurality of webs in opposite directions at predetermined intervals, and thereafter assembling the webs with their creases in register.
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22. The method which consists in creasing a plurality of webs in opposite directions at predetermined intervals, and thereafter assembling said webs with their respective corresponding creases in register.
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23. The method which consists in creasing a plurality of the webs transversely, and thereafter assembling the webs with the creases of one web lying within the creases
70 of an adjacent web.

24. The method which consists in creasing a plurality of webs in opposite directions at predetermined intervals, and thereafter assembling the webs with the creases of each web in register with the creases of an adjacent web.
75

25. The method which consists in creasing a plurality of webs transversely in opposite directions at predetermined intervals, and thereafter assembling said webs with the
80 creases of each web in register with the creases of an adjacent web.

In testimony whereof I have hereunto affixed my signature this 27th day of December, 1919.

GEORGE M. KELLER.